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September 2, 1993

HDR

Michael E. Wolski
Department of Environmental Conservation
Village Safe Water (VSW)
3601 C Street, Suite 310
Anchorage, AK 99503

Subject: Community Water Sources for the City of Chefornak

Dear Mike:

In March 1993, HDR Engineering agreed to evaluate potential community water sources for the City of Chefornak through the Alaska Department of Environmental Conservation's (ADEC) Village Safe Water program (VSW). The goal of this project is to follow up on recommendations made in a December 1992 water resource study wherein HDR reviewed existing ground and surface water data to provide a reconnaissance evaluation of water resources and to focus data gathering efforts of future investigations. For the current effort, HDR provided guidance (on a limited budget) to VSW and the City to obtain information that would support selection of a water source for future development. Through these efforts, additional surface water quality information was obtained. However, attempts to acquire data for determination of aquifer characteristics were unsuccessful.

Despite the limited data regarding aquifer characteristics at Chefornak, existing information suggests that water of sufficient quantity and quality (according to source selection criteria) could be obtained at a peak pumping rate of 35 gallons per minute (gpm) and, possibly, 50 gpm through a carefully planned and executed exploratory ground water drilling program. The Kinia River, although able to provide sufficient quantity for a piped system, would likely be a more costly source than ground water would be. This is because of the need for treatment due the river's water quality problems and intake capital and operations and maintenance costs.

This letter report provides a discussion of findings from the current investigation, draws upon pertinent information from previous studies, and provides a recommendation for water resource development in Chefornak.

Source Selection Criteria

Future development of a community water source for Chefornak could occur at one of three different levels. The criteria for sufficient water quantity (in terms of a peak daily pumping rate) is 50 gpm for a fully piped system, 35 gpm for a washeteria system, and 21 gpm for a watering point system. Water quality is also an important criteria for selection, and a preferred

N:07078.005:4

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water source should have consistently good quality without the requirement of expensive treatment. The third criteria is that the source be located within 6,000 feet of the existing water treatment building.

Previous Investigation

In December 1992, HDR completed a water source study which was a reconnaissance effort to evaluate the water resources in Chefornak. No new data was developed for the study which drew largely on VSW file information, a 1985 summary by the Alaska Area Native Health Service, U.S. Public Health Service (PHS) for Chefornak, and regional data. HDR concluded that ground water yield could range from 5 to 50 gpm but that production should be carefully designed to avoid intrusion of saline or brackish waters. It was also recommended that aquifer tests be performed at existing wells to more reliably estimate long term yield and water quality characteristics. Surface water resources considered in this study included springs, tributary streams and lakes within the Kinia River watershed, and the Kinia River itself. Calculations of estimated mean monthly flows from the tributary watersheds and measurements indicate the small streams would not provide adequate yield in winter. A study of four lakes near town discovered that the lakes freeze to the bottom in most cases and could not provide a year-round source of water. It was recommended that additional data including water quality and flow data for the Kinia River and East Creek be collected to assess the viability of these sources in meeting community water demand.

Current Investigation

In April 1993, Scott Wheaton of HDR traveled to Chefornak to assist VSW in training a local field crew to collect surface water quality samples. The site map (Attachment 1) indicates the sampling stations. Forms and instruction sheets developed by HDR were used for training and to guide data collection during sampling rounds. These training materials are included in Attachment 2. The field crew was trained to collect samples for laboratory analysis and to obtain field measurements of temperature, conductivity, iron, chloride, hardness, bacteria, pH, and stream flow. VSW was thus equipped with materials and crew to direct sampling according to VSW's schedule and needs. Field forms and laboratory test results from three sampling rounds are included in Attachment 3.

On April 7, two sites on the Kinia River (sites 1 and 2) and one on East Creek (site 3) were accessed by drilling a hole through the ice with an ice auger. The field work (as described above) was performed during an incoming high tide, however, flow measurements were not taken. The East Creek site was drilled in two locations—the upstream site was dry (frozen), and the downstream site had some water below the ice but was not flowing. A sample of the downstream site was collected for laboratory testing. Since East Creek does not flow under typical winter conditions, no further testing was scheduled for this source.

The second round of sampling was performed on April 19, after the ice had melted in the river and snow had melted from the surrounding landscape, except in low areas. Samples were collected and field data was recorded for site 1 and two additional sites—one 200 feet (site 5) and the second ¼ mile (site 6) upstream from the mouth of East Creek in the Kinia River. This sampling round was performed from a boat on an incoming high tide. The East Creek site was not sampled since flow was not observed during the first visit.

The third sampling round was performed on June 7 at which time snow and ice were absent from the surrounding landscape. Sites 1, 5 and 6 were visited, again on an incoming high tide and following the same sampling regimen as for the previous visits.

Several attempts were made by VSW to prepare pumping equipment for the city well to perform well pump tests. To estimate aquifer characteristics, long-term yield, and ground water quality, the aquifer's response to stress applied by pumping at a rate of 30 to 50 gpm was to be measured as drawdown and change in water quality with time. Existing information on the city well, BIA well, church well, and high school wells (Attachment 4) provide some information on aquifer geometry, however, only limited data on aquifer hydraulics could be found in historical records.

VSW encountered difficulty achieving a pumping rate of 30 gpm from the city well which is old (drilled in 1965) and likely to have high well losses. A submersible pump capable of producing 50 gpm could not be used on the city well because of alignment problems. The pump could not be lowered deeper than about five feet below the top of the casing. A two-stage surface pump capable of up to 132 gpm (without lift) was installed and the well tested on July 8. The maximum rate the pump would sustain was about 18 gpm and a steady flow could not be maintained. To obtain the information needed for analysis, the goal was to perform either a high rate constant discharge or a controlled step drawdown test. It was concluded that the surface pump would not provide adequate information. In a final attempt to acquire meaningful data, an air compressor was connected to an adductor pipe to pump water using the air-lift method. The air compressor used was rated at 20 cubic feet per minute (cfm) at a pressure of 100 psi. Calculations of air flow and working pressure with drawdown suggested that the compressor would be operating at its design limits. Indeed, once the system was installed, well losses proved to be great enough that the best pumping rate the installation would support was about 23 gpm resulting in approximately 25 feet of drawdown. Again, the inability to maintain a steady high rate of flow or controlled moderate flow led to the decision to abort the pump test effort.

Kinia River Surface Water Resource

Kinia River Water Quantity

Stream flow measurements have not been recorded for the Kinia River, but the river flows year-round and reportedly does not exhibit a significant drop in level during winter. Sufficient quantity of water should be available from the Kinia River for all development alternatives considered. Average annual flow characteristics were the basis of regional observations (Parks and Madison, 1985). These calculations suggest a low month flow of 30 cfs, an annual peak flow of 3,400 cfs and a mean annual flow of 220 cfs for the Kinia River. A high percentage of the drainage basin is occupied by lakes, ponds, and swamps. This characteristic will likely alternate the high flows and sustain higher low flows than predicted by the regional calculations. This is supported by observations.

Kinia River Water Quality Issues

Chlorides. Kinia River water at Chefornak is influenced by ocean tides. Water quality results from the current sampling effort are summarized in Attachment 4 and indicate chloride concentrations ranging from 5,770 mg/L to 21 mg/L at site 1, with slightly lower levels at both sites 5 and 6 (upstream from site 1). It should also be noted that all samples were acquired near the river surface where density stratification would create lower chloride levels.

Alaska Drinking Water Regulations (18 ACC 80) set forth a secondary maximum contaminant concentration for chlorides of 250 mg/L as a goal for drinking water quality. Since all sampling was performed at approximately high tide, seasonal variations can probably be inferred from the data. Without freshwater flows from Kinia River's headwaters in winter, it appears that high tide (brackish water) flows originating in Etolin Strait may push farther upstream to the vicinity of Chefornak. Conversely, during ice breakup and during summer, freshwater outflow from the lake and drainage basin moves downstream and serves to both block tidal surges from Etolin Strait and to dilute the tidal waters that do reach as far upstream as Chefornak. Onshore winds would compound the effect of tidal surges up Kinia River. Based on wind data for Bethel presented in the December 1992 report, westerly winds occur primarily in the summer. A combination of low summer flows from the Kinia River along with onshore winds at high tide could create periods of high chloride concentration at Chefornak similar to or higher than winter levels. Based on available data, it is apparent that treatment of total dissolved solids (TDS) including chlorides would be required, at a minimum, for water pumped at high tide. Seasonal impacts and strong on-shore winds may create the need for treatment during all portions of the tidal cycle. An alternative to TDS treatment would be to carefully monitor water quality and to only pump water during favorable conditions. Storage would be needed to carry through unfavorable water quality conditions. Low tide water quality has not been monitored seasonally and it is possible that water would have to be collected in fall during low tide and stored in tanks for winter use.

Trihalomethanes. Trihalomethanes (THMs) are toxic byproducts formed during chlorination of water containing organic compounds. Organic compounds give color to the water and are commonly found in swamps and shallow lakes such as those at headwaters of Kinia River. Since chlorination would be required of surface water used for human consumption, it is important to test for the potential level at which THMs may be produced. Laboratory testing found THM components such as bromoform and chloroform in greatest concentrations for the April 1 sampling event and lowest levels on April 7. Total potential trihalomethane (TPT) levels were found to be 830 to 5,700 micrograms per liter (ug/L). Federal regulatory limits set forth in the Safe Drinking Water Act (SDWA) for total trihalomethanes (TTHM) are 100 ug/L for larger communities and are likely to become more stringent in the future. While there is no hard and fast conversion of TPT to TTHM levels, the TPT test is designed to portray a worst case, but feasible, scenario for TTHM levels. The results suggest that chlorination will almost surely lead to TTHM levels in excess of regulatory limits. Kinia River water would probably require year-round treatment to remove organics and reduce levels of THMs.

Surface Water Treatment Rule. The SWTR was developed on the basis that all surface waters are at risk from contamination by *Giardia lamblia* and other protozoa, viruses, and pathogenic bacteria. The regulation essentially provides that public water supplies influenced by surface sources be filtered and disinfected. Although the rule, and ADEC's interpretation of it, provide some latitude, HDR does not believe that Chefornak would qualify for an exclusion.

Microbiological Contaminants. Test results for numbers of coliform and streptococci bacteria ranged from less than 2 per 100 ml to 100 per 100 ml. Any coliform bacteria in raw water is an indication of contamination by animals and disinfection would be necessary.

Iron. Levels of total iron measured by the laboratory ranged from 3.1 to 12.5 mg/L, with the highest readings occurring during the June 7 sampling round. Alaska Drinking Water Regulations suggest a level of 0.3 mg/L as a goal for maximum iron concentration. Treatment would be required to remove iron from Kinia River water for use by the community.

Other Surface Water Resources

Other surface water resources available to Chefornak include springs, small tributary streams and lakes. The December 1992 report discussed these sources in some detail. Following is a brief summary of these sources relative to the source selection criteria.

Springs. Natural springs currently provide water for some residents of Chefornak. Anecdotal accounts suggest the water has good taste, however, available information suggests the springs could not provide a sufficient quantity of water for year-round demand. The water quality of these springs has not been tested, although it is likely to be fairly good. During the April 7 field visit, a trip to sample one such spring was aborted when it could not be located due to snow covering the marker poles. In winter, flow from the springs is generally lost to icing a short

distance from the source. The springs are typically found near the base of Tern Mountain, about 4 miles from the city, and therefore should not be considered a potential water source.

Lakes. Four lakes near the city have been studied as a possible water source for the community. The lakes have been found to be generally small and shallow. They freeze to the bottom in winter and therefore production would be limited to a fill and draw system wherein storage tanks would be filled in the fall for winter use until breakup. Water quality for these lakes is likely to vary seasonally and at a minimum, treatment would be required to satisfy SWTR regulations. Historical activities such as refuse and honeybucket disposal in the lakes have not been investigated but are a concern due to the lakes' proximity to town.

Small Tributary Streams. Small tributaries of the Kinia River and within a 6,000 foot radius of the city were investigated for the December 1992 report. Estimates of mean monthly flows indicated that these small streams are likely to cease flowing by late winter. These streams would not provide sufficient quantity of water for any of the design alternatives on a year-round basis. East Creek, however, appeared to be significantly larger than other streams near the city and was considered for further investigation. During the April 7 field trip to Chefornak, East Creek was drilled until water was found below the ice at a location downstream of the original sampling site. Water was not observed to flow below the ice and the creek was frozen to near the bottom. Water samples were collected for laboratory analysis and were reported to have chlorides at a level of 500 mg/L and TTHM at 490 ug/L. These results suggest that water from the Kinia River backflows into the East Creek channel at high tide, or it seasonally invades the channel due to freeze up of East Creek's fresh water source. In any case, low flow and low water quality in East Creek would create the need for seasonal storage and water treatment if that creek were used as a water source. Although East Creek is close, less than a mile from the city, lack of winter flow should eliminate this creek as a viable water source.

Ground Water Resources

Chefornak is located in an area having both regional and local ground water recharge and discharge zones. Local recharge likely takes place along the upper slopes of Tern Mountain, with ground water discharging locally in the form of springs along the base of the mountain or into upper strata in the regional aquifer. The thick unconsolidated silts and sands underlying the community are believed to be recharged regionally, however, by the larger lakes covering the delta lowlands at some distance to the northeast of the community. All existing village wells are believed to tap the regional aquifer. The city well and the BIA well are both 4-inch diameter cased wells that produce water from the fine sand aquifer below permafrost at a depth of about 100 feet. The church well was abandoned, and the high school well reportedly produces salty water. It was completed directly below the permafrost at a depth of 200 feet. The city well is currently pumped intermittently at a maximum rate of about 8 gpm. It has maintained fairly consistent water quality with time at this low production rate.

Ground Water Quantity

To determine the quantity of water available from the confined aquifer at Chefornak, aquifer geometry and hydraulic properties must be estimated. Minimally, the thickness of the aquifer and its hydraulic conductivity (K) and storativity (S) must be known or estimated from well logs and pumping tests. At Chefornak, the shallow production zone of the aquifer is at least 20 feet thick, and based on the high school well logs, it could extend to 120 feet or more. The hydraulic conductivity depends primarily on the type of aquifer material. Well drillers have described the aquifer as being a fine sand with pea gravel, shells, mica, and wood. Freeze and Cherry have listed the range of K values for a silty sand as 0-5,000 gpd/ft^2. Aquifer test results for similar locations in the Yukon/Kuskokwim delta (Kongiganak) suggests the K value should be about 10 to 150 gpd/ft^2. Values for storativity in a confined aquifer range from 10^{-5} to 10^{-3}. Assuming the drawdown available during pumping is about 60 feet, the maximum pumping rate could range from 6 to 34 gpm for a 20 foot thick aquifer or from 73 to 400 gpm were it 120 feet thick. These values assume continuous pumping for three years and no recharge. At higher pumping rates, recharge could be expected to occur from the river, leakage from deeper parts of the aquifer from regional ground water or from combinations of all of these sources. At the maximum design pumping rate of 50 gpm, the drawdown could fall within the range of 10 to 60 feet, which is less than the maximum available drawdown (see Attachment 5 for aquifer characteristic calculations).

Limitations of water production due to well screening of the aquifer, have been considered, and appear not to be an issue of concern at Chefornak. The existing wells have been completed with a 0.008 inch slot size screen (Johnson No. 8 screen) for a length of 10 feet. Manufacturer's information gives the amount of open area for 0.010 inch slot screen (No. 10 screen), 10 feet of which is calculated to potentially yield up to 93 gpm from a 6-inch diameter well.

Ground Water Quality

Ground water quality information has been collected in the past for both the city well and the BIA well (Attachment 6). Although test reports are not available for the high school well, it has been reported that water quality for this well is poor. The high school well produces from a zone in the aquifer about 100 feet deeper than the city and BIA wells.

Chlorides. From 1975 to 1985, water quality from the city well has remained fairly steady at low production rates with chlorides ranging from 102 mg/L to 168 mg/L. The BIA well, however, experienced increased chloride concentrations from 112 mg/L to 400 mg/L from 1966 to 1979. The city well has been pumped at a rate of about 8 gpm without significant degradation of water quality. The BIA well was pumped at an unknown rate until construction of the new school in 1980. Without information about aquifer geometry and long-term pumping tests to evaluate aquifer characteristics, it is difficult to assess the nature of ground water flow and the source of the chlorides. At Chefornak, ground water recharge is likely to occur from a

combination of infiltration from the Kinia River, leakage from below the aquifer, and from regional ground water flow. The water quality of these sources will impact the ground water produced. Based on gross estimates of aquifer characteristics, it is reasonable to assume that long-term, sustained drawdown in wells near the river at levels below the Kinia River elevation could eventually lead to degradation of water quality from a pumped well. The critical component for prevention of river water infiltration is drawdown. At any pumping level, the drawdown should be kept above the river level to maintain flow to the river rather than from the river.

The fact that ground water currently discharges to the river is supported by the higher static water level in the wells compared to the average river level and by the differing water quality results for ground water compared to the river water. Sufficient water level measurements collected concurrently for the river and wells have not been made to verify this issue. The likelihood of drawing river water through the ground to a well is decreased by the square of the distance away from the river. However, with increased distance away from the river, the permafrost layer is likely to become thicker. This means the aquifer is likely to occur at greater depths which appears to increase the risk of upconing or leakage of more brackish water from below the aquifer.

With sufficient elevation data, ground water geometry, and hydraulic data, the various source water contributions can be estimated through analytical techniques.

Iron. It should also be noted that iron levels, typically a bane to Yukon-Kuskokwim delta ground water sources, have been tested at levels from 0.18 to 0.5 mg/L. The Alaska Drinking Water Regulation goal for iron is 0.3 mg/L. It is possible that treatment would be required to remove low levels of iron from a ground water source.

Source Development Considerations

Kinia River

Design considerations for a Kinia River water source include the need to have an intake structure suitable for varying seasonal conditions. In winter, a line across the ice would enable water to be pumped from a hole in the ice. Consideration must be made for tidal fluctuations at Chefornak which cause the ice to move vertically by 2 or 3 feet. The ice has been observed to remain relatively smooth with some fractures throughout winter. In the summer, a float could be used to support a pump in the river. The alternative system would involve a permanent buried line to an intake. However, concern of stratified water quality could limit this option to periodic pumping with storage. It should be considered that in winter, ice cover potentially leads to mixing of otherwise stratified waters. Before a water treatment plant could be designed to improve water quality, a pilot study would have to be performed to determine which treatment method best removes the organics and bacteria. Capital costs for a sand/carbon filter system

DAILY REPORT

Date	Tuesday June 9, 2009	Report Number	23
Project:	SELDOVIA		
Project Number:	81301		
Location:	Seldovia		
Completed By:	Jeff Lindquist		
Superintendent	Jeff Lindquist		
Construction Managers:	Pete Bellezza/Jeff Beatty		

Weather

Precipitat		HIGH	LOW
Wind Speed	Temperature	60	40

Effect of Weather on Crew and Production N/A

Recorded Rain Fall: 0 (In the last 24 hours)

FORCE ACCOUNT EMPLOYEES

Name	Skill	HRS WORKED	WC CODE
Jeff Lindquist	Superintendent	12	5606
Curtis Dickson	Laborer/Water	10	W 6319
	Sewer		S 6306
Jonathan Geagel	Laborer/Water	10	W 6319
	Sewer		S 6306
Randy Bond	Operator/water	10	W 6319
	Sewer		S 6306
Steven Bond	Foreman/Water	10	W 6319
	Sewer		S 6306
Thor Burt	Yard Man	10	8227
Rance Zeien	Operator/Water	10	W 6319
	Sewer		S 6306
Cassidi Little	Office Assist/Safety	3.5	8810
TOTAL HOURS F/A		75.5	

SUBCONTRACTORS

Name	SKILL	Crew	HRS

ACCIDENT / MEDICAL

Name	TIME	MEDICAL REQUIRE		

SAFETY MEETING / Item discussed

COMMENTS of INJURY

TASK INFORMATION

	% Complet
Worked on new water service at Fitzgeralds, had to remove	
fencing and dog kennels in back to continue.	
Continued going through work area and locating valves and	
services in question.	
Received freight from KAR A VAN that came in on ferry, we	
brought 420 to yard and unloaded some of our materials, Russ	
brought down the rest when he finished unloading, went	
through and did count on what was received.	
Cleaned out the ash we could get to that was in the air intake	
for blower on the Chevy Colorado truck. Cleaned ash out of cab.	
Worked on Req. form and materials needed, talked with Jeff,	
and Macki about materials.	
Had two meetings with Tim Dillon to discuss project issues.	
Tim will talk with HEA about slow service	

EQUIPMENT

Equipment	GPH	OIL	Hr Work	Fuel
Hopkins Equip.				
304 Mini hoe	1.5		5	7.5
320CLU Exca W/ Plate	3			
Pile Driver/Vib attach.				
420 Back hoe/loader	2		7.5	15
84 In drum roller	3			
966D LoaderW8ft fks	7.5			
Dump Truck	3			
Cat Skid-Steer	1		4.5	4.5
320 Hammer attach.				
320 Compactor attach.				
320 Impact Hammer att.				
Bomag Compactor	1			
450 CFM air comp.	1.5			
Jack Hammer				

TASK INSPECTED						
Task Inspected		Plate Compacter	0.5			
		Hitachi 150 Excavator	2			
		Project Equipment				
		2" Trash Pump	0.5			
		2" Diaphragm Pump	0.5			
		3" Diaphragm Pump	0.5			
		Jumping Jack Comp.	0.5			
		Hydrostatic Test Pump	0.5			
		Dewalt Generator #1	0.5			
		Dewalt Generator #2	0.5			
		Pressure Washer	0.5			
		Chevy Colorado Truck	2		1	2
		Chevy Flat Bed	2		2	4
		Mack Box Truck	2		1	2
		Other Rentals				
		Jeep	2		1	2
		Honda 4 Wheeler	0.5			
				Total Fuel Used	37	

Comments:

Manfred brought over water test results from Mondays samples and all was good. Went out to collect water samples for second test, Manfred went with to get the chlorine residual reading and take samples to lab. Had meeting with the whole crew to discuss local politics and what is being said, also what we can do to have a good season and positive attitude in the community. Cut steel plate and installed on floor over bad spot in office entry. Worked on paper work in office, updated forms and logs. Called in material orders.

SIGNATURE: Jeff Lindquist	Superintendent: Jeff Lindquist	

Service to Fitzgerald's

Service to Fitzgerald's

would be on the order of $100,000, with operation and maintenance (O&M) costs at around $80,000 per year. Treatment for chlorides could entail installation of a distillation or reverse osmosis (RO) system. O&M costs for a RO unit treating water at only 10 gpm could be in the vicinity of $20,000 per year. Volume limitations of storage tanks and their cost must also be considered if periodic, selective pumping is used to obtain better quality water.

Ground Water

It is likely that development of ground water for a community water source at Chefornak would entail construction of multiple wells. Two to five wells are likely to be required and should be spaced within town such that interference between wells is avoided. Wells should be targeted to produce water from the shallowest depth possible and thus minimize the risk of salt water intrusion from below. Wells should also be placed far enough away from the Kinia River to avoid infiltration over time to the wells. Final well construction design and development for the aquifer should be planned on the basis of an initial exploratory well drilling program. Depending on the actual number of wells drilled and the total depth, ground water exploration and well construction costs could be in the vicinity of $300,000 to $400,000

Conclusions

Most surface water resources available to Chefornak would provide inadequate yield in winter. The Kinia River could provide a sufficient quantity of water throughout the year for any level of system development, however, serious water quality concerns limit this resource. The water quality appears to vary both seasonally and diurnally with potential unpredictable changes during periods of strong onshore winds. Treatment would be required of all surface water sources to meet SWTR regulations and to reduce levels of TTHM. Treatment may be necessary on a seasonal and/or diurnal basis for removal of TDS.

Ground water is currently being obtained, at low flows with relatively minor water quality problems, from the city well. Water quantity may be available for all levels of system development. Water quality is poor in the high school well and to a lesser extent the BIA well. Low levels of production from shallow depths within the aquifer appear to result in better water quality. Water treatment may be required to remove TDS including chlorides if drawdown is maintained at too great a depth.

Recommendations

Successful development of ground water for Chefornak appears to be obtainable and have the greatest chance for success. Exploratory drilling needs to be performed and production limited to multiple low yield wells. The wells must be spaced far enough apart to prevent interference between their cones of influence. The wells should be located close enough to the Kinia River to allow production from the shallow, thawed sands but far enough away to avoid river

Attachment 1

1993 Water Quality Sampling Locations

infiltration. The well drilling should be performed as an exploratory effort with on-site monitoring by a hydrogeologist. Information about the aquifer should be carefully collected and analyzed during drilling to refine initial plans for well field construction. Analytical techniques or computer modeling should be performed to assess the influence of brackish waters from deeper levels of the aquifer or from the Kinia River once the aquifer geometry and hydraulic characteristics have been determined.

We have appreciated this opportunity to provide assistance to you in your data gathering efforts and to analyze the existing data on Chefornak water resources. We hope that our combined efforts will result in development of an adequate community water source for the city. Please let me know when we can provide further assistance.

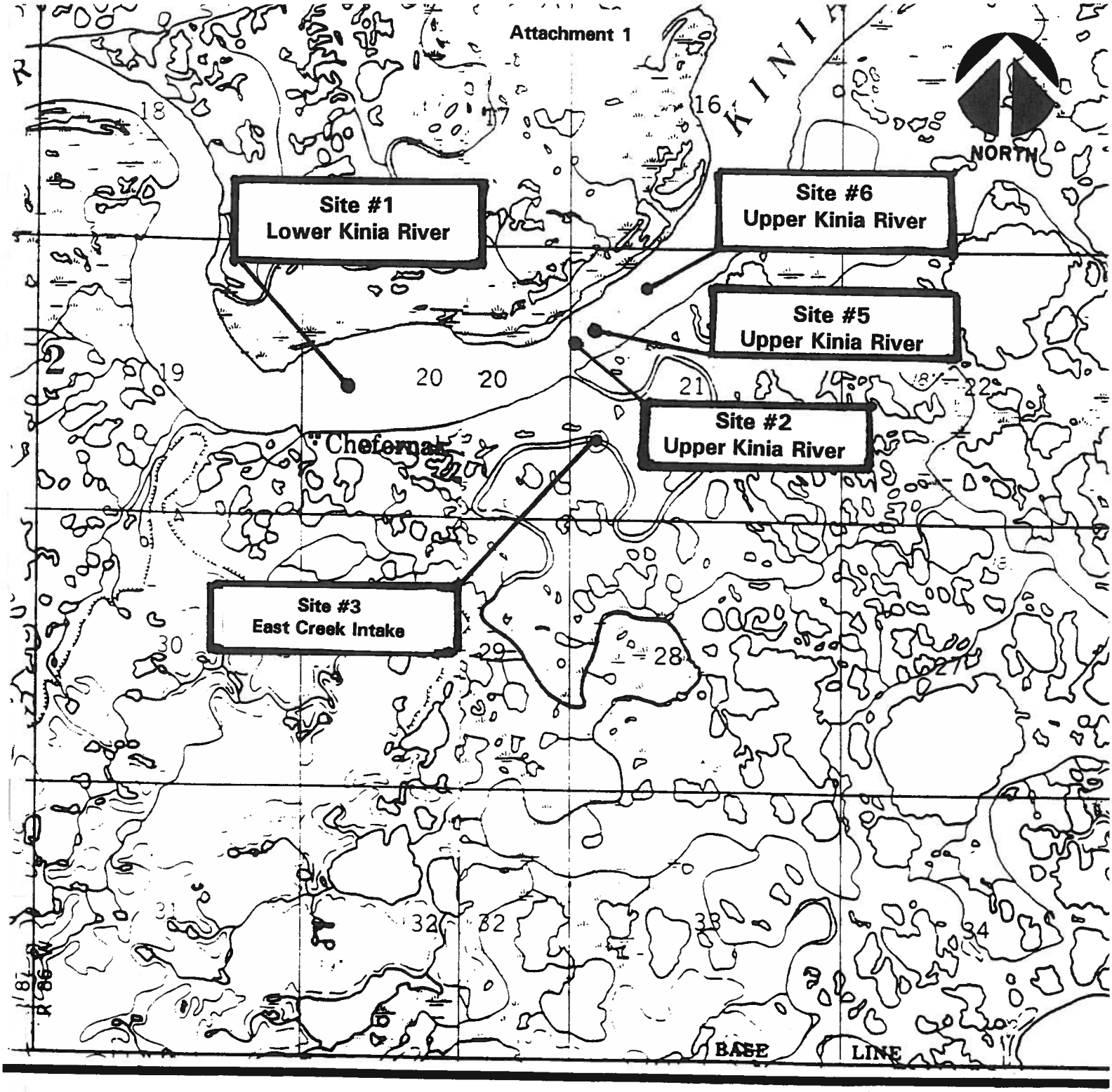
Sincerely,

HDR ENGINEERING, INC.

Elizabeth J. Shen
Staff Hydrogeologist

cn

Attachments



City of Chefornak
1993 Water Quality Sampling Locations:

1. Lower Kinia River
2. Upper Kinia River
3. East Creek Intake
4. Upper East Creek
- Other (springs, ponds or other surface source)

5. Upper Kinia River
6. Upper Kinia River

Approx. Scale

0 0.5 mi.

Attachment 2

Field Forms and Instruction Sheets

Water Quality Sampling and Testing Checklist

Prepare equipment and gear before leaving for sampling sites:

- Calibrate Conductivity and Temperature Meters (see Instruction Sheet #2).
- Check that you have all field equipment (see Equipment Checklist).
- Check that you have enough copies of all field forms and instruction sheets.

Proceed to the Lower Kinia River Site - Site #1

- Collect water samples (see Instruction Sheet #1)
- Measure conductivity, temperature and pH (see Instruction Sheet #2) and record the results on the field form.
- Decontaminate conductivity, temperature and pH probes.
- Measure Chloride, total iron, dissolved iron, nitrate-N, nitrite-N, total hardness and total bacteria (see Instruction Sheet #3) and record the results on the field form.
- Measure stream flow parameters - velocity, depth and stream width (see Instruction Sheet #4-1) and record data on the discharge data form.

Proceed to the Upper Kinia River Site - Site #2

- Collect water samples (see Instruction Sheet #1)
- Measure conductivity, temperature and pH (see Instruction Sheet #2) and record the results on the field form.
- Decontaminate conductivity, temperature and pH probes.
- Measure Chloride, total iron, dissolved iron, nitrate-N, nitrite-N, total hardness and total bacteria (see Instruction Sheet #3) and record the results on the field form.
- Measure stream flow parameters - velocity, depth and stream width (see Instruction Sheet #4-1) and record the data on the discharge data form.

Proceed to the East Creek Intake Site - Site #3

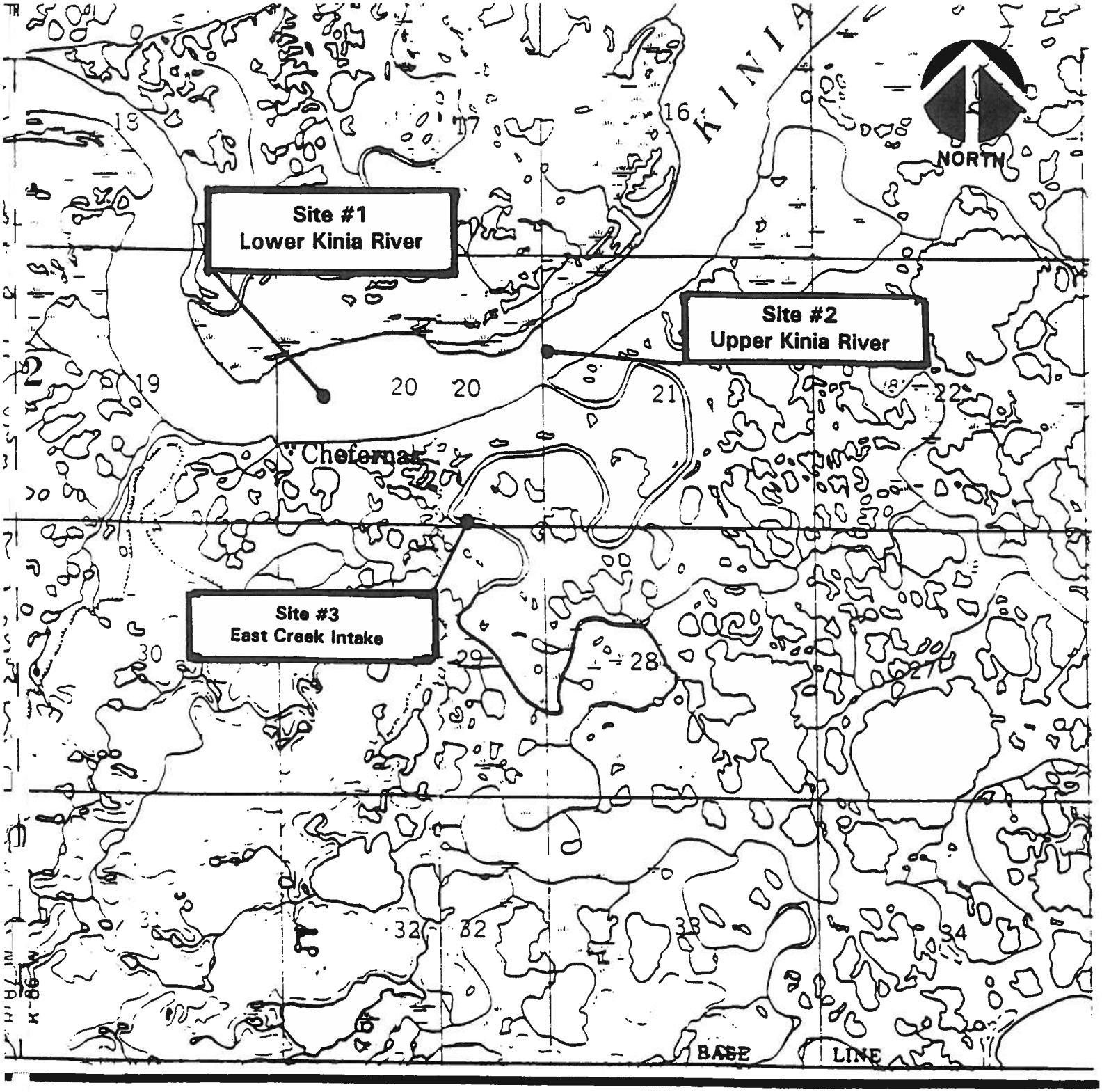
- Collect water samples (see Instruction Sheet #1)
- Measure conductivity, temperature and pH (see Instruction Sheet #2) and record the results on the field form.
- Decontaminate conductivity, temperature and pH probes.
- Measure Chloride, total iron, dissolved iron, nitrate-N, nitrite-N, total hardness and total bacteria (see Instruction Sheet #3) and record the results on the field form.
- Measure stream flow parameters - velocity, depth and stream width (see Instruction Sheet #4-2) and record the data on the discharge data form.

Proceed to the Upper East Creek Site - Site #4

- Collect water samples (see Instruction Sheet #1)
- Measure conductivity, temperature and pH (see Instruction Sheet #2) and record the results on the field form.
- Decontaminate conductivity, temperature and pH probes.
- Measure Chloride, total iron, dissolved iron, nitrate-N, nitrite-N, total hardness and total bacteria (see Instruction Sheet #3) and record the results on the field form.
- Measure stream flow parameters - velocity, depth and stream width (see Instruction Sheet #4-2) and record the data on the discharge data form.

Make sure all sample containers are tightly capped and placed in a cooler with ice.

Follow chain of custody procedures before relinquishing the samples to another party.



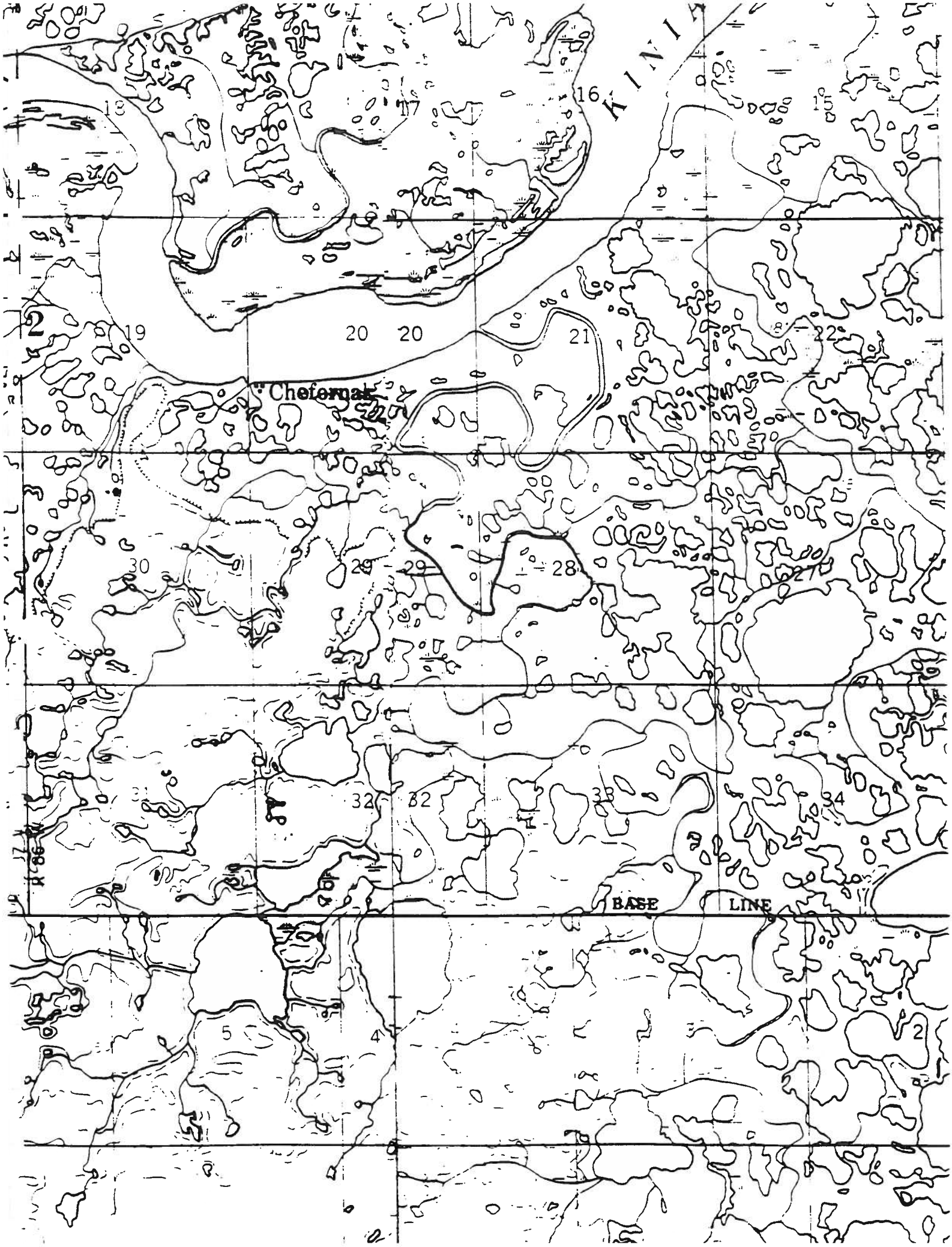
City of Chefornak
1993 Water Quality Sampling Locations:

1. Lower Kinia River
2. Upper Kinia River
3. East Creek Intake
4. Upper East Creek

▸ Other (springs, ponds or other surface source)

Approx. Scale

0 — 0.5 mi.



KINIA
Chefornak
BASE LINE
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Instruction Sheet #1
April 1993

Collecting Stream Water Samples

General Instructions:
The acquisition of stream water samples for laboratory analysis involves preparation, sample collection and sample accounting. Samples should be collected from approximately the middle or deepest part of the stream. Try to avoid collecting any debris, ice or sediment in the samples and note site conditions on the field form. Retrieve samples from ice covered streams through an augered hole at least 20 feet offshore of the Kinia River (Sites 1 and 2) and near the outside bank of a bend in East Creek (Sites 3 and 4) where flowing water is typically the deepest.

Preparation:

- Mark the sampling date, initials of the sampling crew, and site location number on the label attached to each container using a permanent marker or pen.
- Group sample containers in plastic bags - one bag for each sampling site with the site number marked on the outside of the bag.
- Also mark the site number on the outside of a "transfer bottle" for each site. (A "transfer bottle" is a clean, preservative-free plastic bottle that is used to fill the sample containers.)

Sample Collection:

- At the site, use a permanent marker and note the sampling time on all bottles.
- Use a clean transfer bottle and fresh rubber gloves at each collection site.
- Since most of the sample bottles contain preservative acid, they should not be filled directly from the water body being sampled. The labeled transfer bottle should be used to obtain all sample water placed in the sample containers except for any coliform samples. All coliform samples should be collected directly from the stream using the lab-supplied sample container.

- Put on clean surgical gloves to reduce the chance of sample contamination and to protect your skin, then remove the lid from the transfer bottle.

- Invert the bottle and plunge about halfway to the channel bottom at its deepest point (or as deep as you can reach). Turn it upright and raise at a rate such that the container becomes full as it approaches the water surface. This technique is used to collect a water sample that includes water representative of most of the stream flow from all depths but that is clear of any floating particles or bottom sediment. In cases where the depth of flow is very shallow, hold the container at such an angle that it fills with water without disturbing any bottom sediment. If the water is too deep to reach near the bottom, fill the bottle below the surface.

- Remove the lid from a labeled sample container. Keep the inside of the lid and the mouth of the bottle clean. Fill the container from the transfer bottle until it is nearly full, leaving a little airspace at the top. (Fill all coliform samples using only the sample bottle to collect the water.)

- Fill the remaining sample containers in the same manner except for the small glass vials which are used to sample for "volatile" fuel contaminants. These must be carefully handled. The lid has a removable rubber seal with a special teflon coating (the teflon side is the side that bulges downward). The vial must be filled to overflowing so that a mound of water forms. The rubber seal is then placed teflon side down, on top of the water and then capped with the black plastic cap. If properly done, the bottle should not have any air bubbles when turned upside-down.

- The attached figure provides a more detailed description of this procedure. We advise keeping extra glass vials on hand because it is very easy to drop the rubber seal or to trap air in the sample. If any of these events occur, the sample must be re-collected in a new vial until a bubble-free sample is collected.

- Keep samples tightly capped in a cooler with ice at all times after collection and prior to analysis.

<u>Sample Accounting:</u>

Chain of custody procedures are to be followed for all samples sent to the laboratory for analysis. These are provided by the laboratory and should be filled out and signed before samples are relinquished to another party. Keep a copy of the signed custody form and pass the original on to the person receiving the samples.

NORTHERN TESTING LABORATORIES, INC.

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6957 OLD SEWARD HWY., SUITE 101

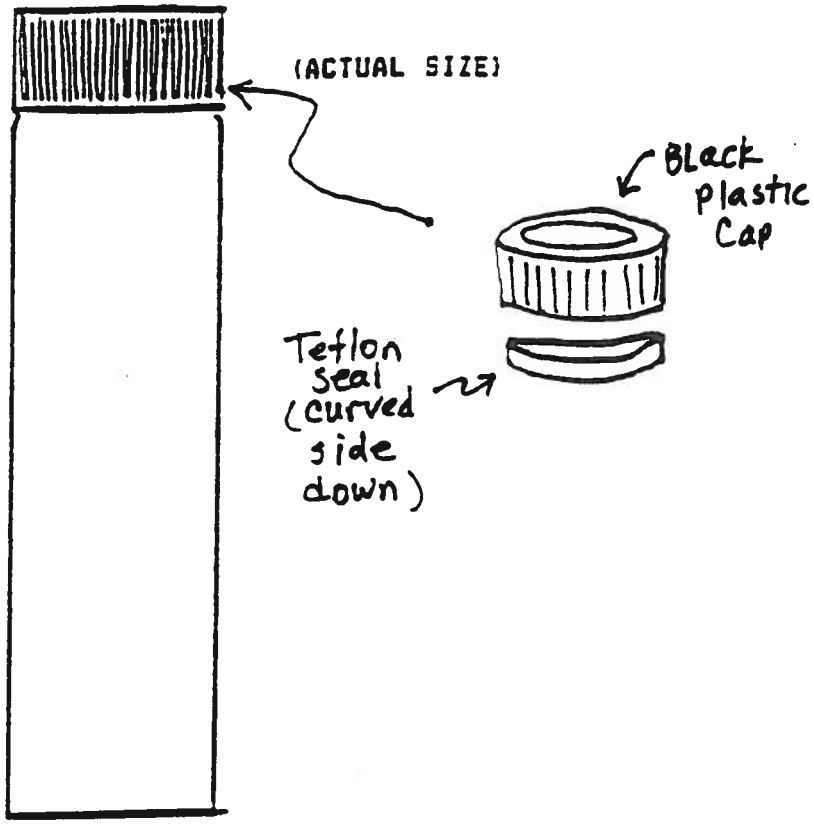
FAIRBANKS, ALASKA 99709
ANCHORAGE, ALASKA 99518

907-479-3115
907-349-6823

SAMPLING INTRUCTIONS FOR VOLATILE PARAMETERS

(Trihalomethanes, Purgeable Aromatics and Halocarbons)

1. The sample is to be collected in the small glass vial. The vial will arrive to you with the rubber seal in the correct position. Please note that there are two layers on the seal; a teflon layer and a rubber layer. The teflon layer is the smaller layer.



2. Slowly fill the vial so that a mound of water is formed. Place the rubber seal with the teflon side touching the mound of water, being careful not to tip the sample.

3. Place the black screw cap carefully over the rubber seal and tighten securely. (Do not place the seal in the cap and try to close the bottle. You must place the seal on the mound first)! There must not be any air or air bubbles in the closed vial when finished. If there is an air bubble, remove cap, add a few more drops of water to form a mound, and try again. Do not dump out the sample as there is a preservative in the bottle.

TURN UPSIDE-DOWN, TAP
LOOK FOR Bubble

Measuring Field pH, Conductivity and Temperature

General Instructions:
Perform a calibration of the conductivity meter and temperature meter at the start of each sampling day. Be sure that reference solutions have not been open beyond the expiration date. Review the instructions for meter calibration and operation provided by the manufacturer. The following is a brief set of instructions for calibration and field measurement of conductivity and temperature using meter devices and measurement of pH using paper indicator strips. Forms are provided for use in guiding and recording calibration.

Conductivity Meter Calibration:

- Immerse the probe in a reference solution, agitate the solution and let the reading stabilize for a few seconds.
- Record the reading on the calibration form.
- If the meter does not indicate the conductivity of the reference solution, turn the adjustment knob or trimpot (a small screw on the meter) until the display reads the correct value of the reference solution. (Note: This assumes the meter is automatically temperature corrected.)
- Rinse the probe with distilled water.

Temperature Calibration:

- Immerse the temperature meter probe and a reference thermometer in a container or glass beaker filled with crushed ice and water.
- Allow them to remain in the water for five minutes and then compare readings while they are still immersed in the bath.
- Record the readings on the calibration form.
- If there is a discrepancy between the two readings, adjust the meter according to

Instruction Sheet #3
April 1993

Using Field Water Quality Test Kits

- Follow the instructions provided by the manufacturer of the test kit.
- It is a good idea to do a trial run of each of the tests using ordinary tap water before taking the kit out into the field.
- Put on a pair of surgical gloves to prevent possible sample contamination and for protection from chemicals used in some test procedures.
- Pour water samples from the transfer bottle into the graduated sample cup provided with the test kit (CHEMetrics kits).
- If the test result is greater than the highest reading for a particular test, try to dilute the sample in order to gauge the correct reading.
- Fill a graduated cylinder to some level with distilled water and add an equal portion of the sample to be tested.
- Gently swirl the cylinder to mix the diluted sample and perform the test again. If the reading now falls within the test kit range, remember to multiply the result by 2 for the actual test result.
- Record all test results on the field form and indicate if a test result is from a diluted sample in the comments section.
- Always rinse the sample cup 2 to 3 times with deionized or distilled water after a test is performed.

Stream Flow Measurements - Method I
(streams too deep to wade)

General Instructions:
The following describes a method for estimating stream flow for a stream that cannot be safely waded from bank to bank. This method employs use of the Marsh McBirney flow meter with top-setting wading rod to measure the flow at a single location in the stream. It is assumed that a boat is used to retrieve data from the middle of the stream or that a single hole is augered through the ice during winter (ice covered) conditions. Use the field form provided to record measurements for this method (and Methods II and III). Note that the form includes places to record data in three different flow measurement sites.

- Estimate the width of the stream and record the value on the "Discharge Data" form.
- Calibrate the flow meter by turning the top meter knob to "CAL". The needle should fall within the black "CAL" zone, indicating that the meter is calibrated and has adequate battery power. If the needle does not point to "CAL", replace the batteries and recheck.
- Maneuver the boat or auger a hole through the ice approximately in the center of the stream.
- The boat operator should try to keep the boat approximately midway between the stream banks while the meter operator measures stream depth and flow velocity.
- The black bulb or velocity sensor on the rod should be pointed upstream, parallel to the flow and away from any turbulence created by the boat or motor.
- Turn the meter dial to one of the 3 meter ranges and read the flow velocity in feet per second on the corresponding needle scale. Record the flow velocity on the discharge data form.
- Measure the depth of the stream at the same location as the velocity reading. Use a weighted tape measure or other sounding device and record the depth on the field form.

Stream Flow Measurements - Method II
(stream shallow enough to wade, single velocity data point)

General Instructions:
The following instructions are for acquiring limited flow data for a stream that can be safely waded from bank to bank. This method employs use of the Marsh McBirney flow meter with top-setting wading rod and requires a single velocity measurement. This method should be used for winter (ice covered) stream conditions.

- Measure the width of the stream using a tape measure and record the value on the "Discharge Data" form.

- Calibrate the flow meter by turning the top meter knob to "CAL". The needle should fall within the black "CAL" zone, indicating that the meter is calibrated and has adequate battery power. If the needle does not point to "CAL", replace the batteries and recheck the calibration.

- Record the flow at a station approximately in the center of the stream or in the area where the deepest water is likely to be found. For ice covered, shallow streams, drill a hole through the ice with an ice auger where deeper, flowing water is most likely to be found at the outside bank of a stream bend.

- The "rodman" (meter reader) should stand downstream of the flow rod, setting it firmly on the bottom, perpendicular to the water surface. The black bulb or velocity sensor should be pointed upstream, parallel to the flow (see figure 1).

- Record the water depth as read from the thick, stationary part of the flow rod. It is marked off in tenths of a foot.

- The stream velocity is to be measured six tenths of the way down from the surface of the water. The rod is designed to set the sensor bulb at this position by sliding the skinny part of the flow rod up while depressing the lever on the handle. Align the number on the skinny rod with the numbers on the handle so that the two combined indicate the depth of the water. For example, if the depth is measured as 1.6 ft., match the "1" on the skinny rod with the "6" on the handle (see figure 2).

- The rodman should turn the meter dial to one of the 3 meter ranges and read the flow velocity in feet per second on the corresponding needle scale.

Flow Measurements - Method III

(stream shallow enough to wade, multiple velocity data points)

General Instructions:

The following instructions are for acquiring detailed flow data from a stream that can be safely waded from bank to bank. This method employs use of the Marsh McBirney flow meter with top-setting wading rod and requires measurement of a velocity "profile" across the stream.

- Measure and record the width of the stream with a tape measure and record the value on the discharge data form. Since this will be the location of the flow profile, try to find a straight stretch that is clear of obstructions.

- Secure the tape measure on each bank so that the tape measure is just above the water, straight and perpendicular to the stream banks (see figure 2).

- Record the bank locations along the tape measure approximately at the edges of the stream.

- Determine the positions along the tape for 10 stations in order to measure a "flow profile" across the stream. Divide the total distance across the stream by 10 and add this increment to the tape reading on the bank (zero point). Continue to add this increment on the form so that the position of ten equally spaced stations from bank to bank can be read by the recorder to the "rodman" who will read the flow indicated by the meter at each station.

- Calibrate the flow meter by turning the top meter knob to "CAL". The needle should fall within the black "CAL" zone, indicating that the meter is calibrated and has adequate battery power. If the needle does not point to "CAL", replace the batteries and recheck.

- The data recorder should read off the station distances, starting with the bank and then record the velocity and depth information when called out by the rodman at each station.

- The rodman should stand downstream of the flow rod, setting it firmly on the

bottom, perpendicular to the water. The black bulb or velocity sensor should be pointed upstream, parallel to the flow (see figure 1).

- Read the depth from the thick, stationary part of the flow rod. It is marked off in tenths of a foot.

- The stream velocity is to be measured six tenths of the way down from the surface of the water. The rod is designed to set the sensor bulb at this position by sliding the skinny part of the flow rod up while depressing the lever on the handle. Align the number on the skinny rod with the numbers on the handle so that the two combined indicate the depth of the water. For example, if the depth is measured as 1.6 feet, match the "1" on the skinny rod with the "6" on the handle (see figure 2).

- The rodman should turn the meter dial to one of the 3 meter ranges and read the flow velocity in feet per second on the corresponding needle scale.

- Continue to read the depth, adjust the height of the sensor and read the velocity of each station along the profile.

Job No. | No.

Computation

HDR

Project	CHEFORNAK WATER RESOURCES	Computed	Date
Subject	MARSH McBirney Flow Meter	Checked	Date
Task		Sheet	Of

FIGURE 1

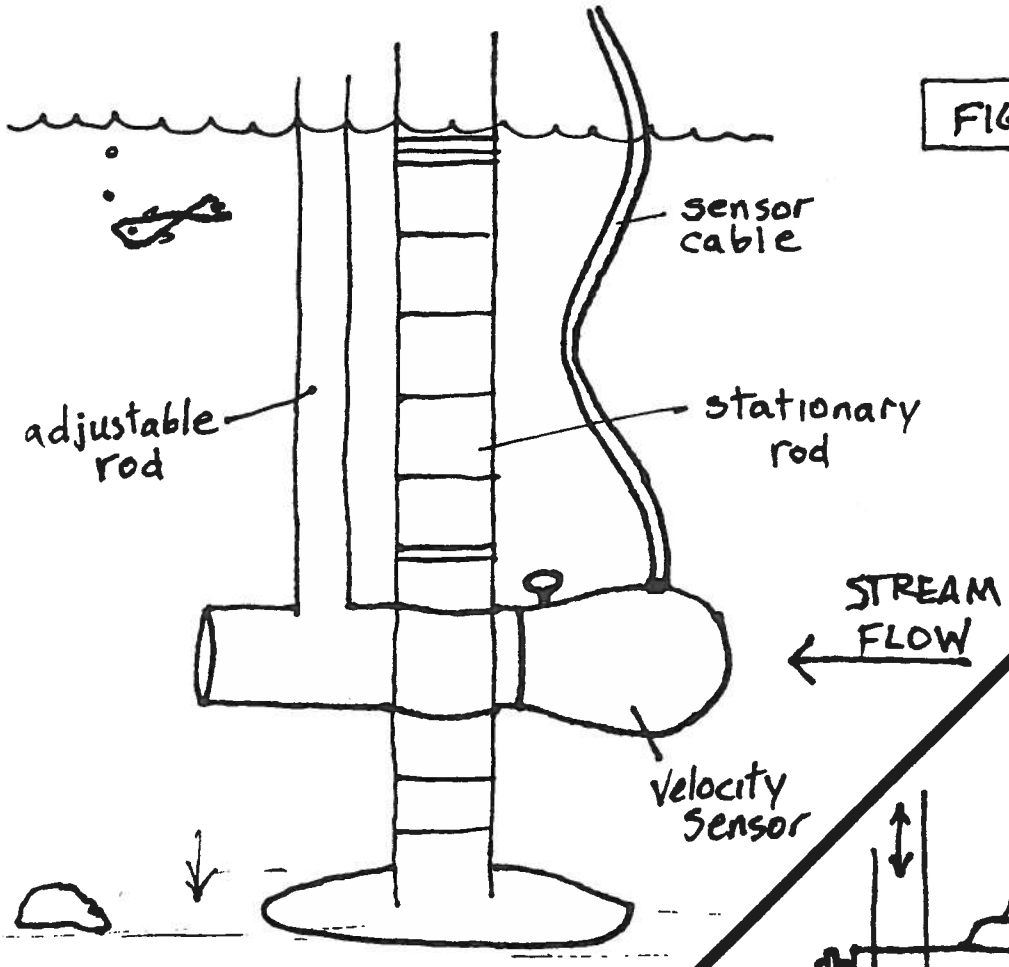
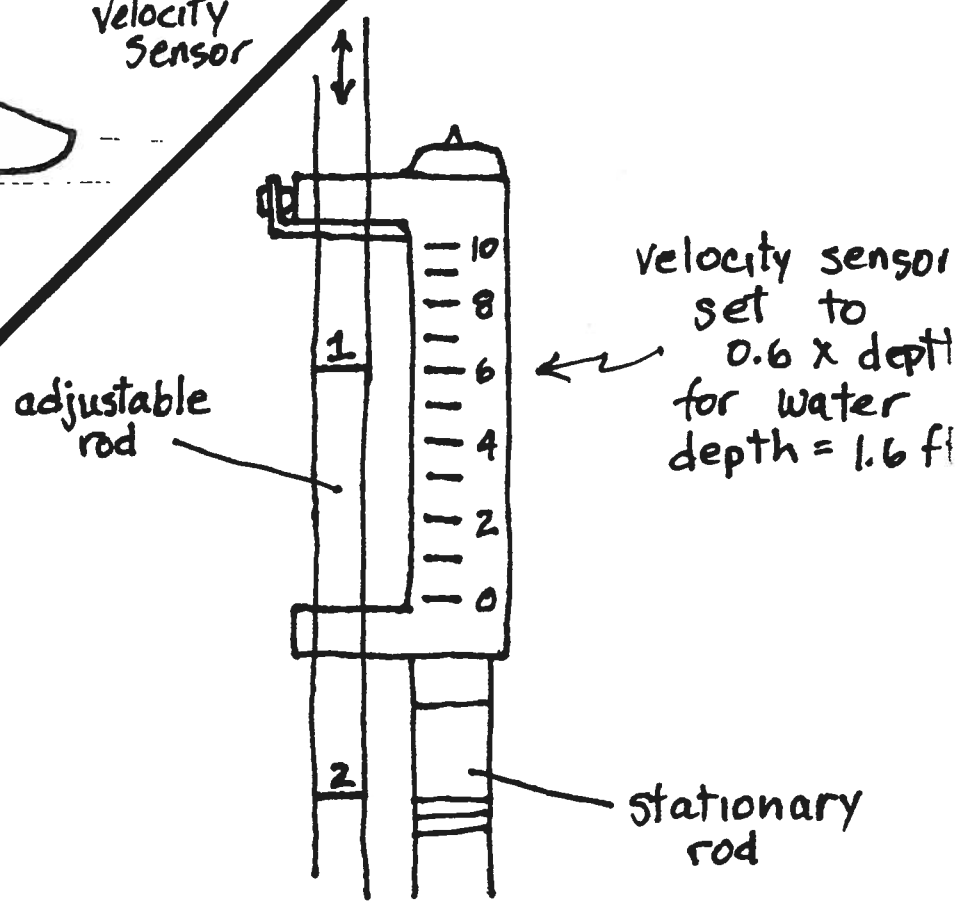


FIGURE 2



Job No. | No.

Computation

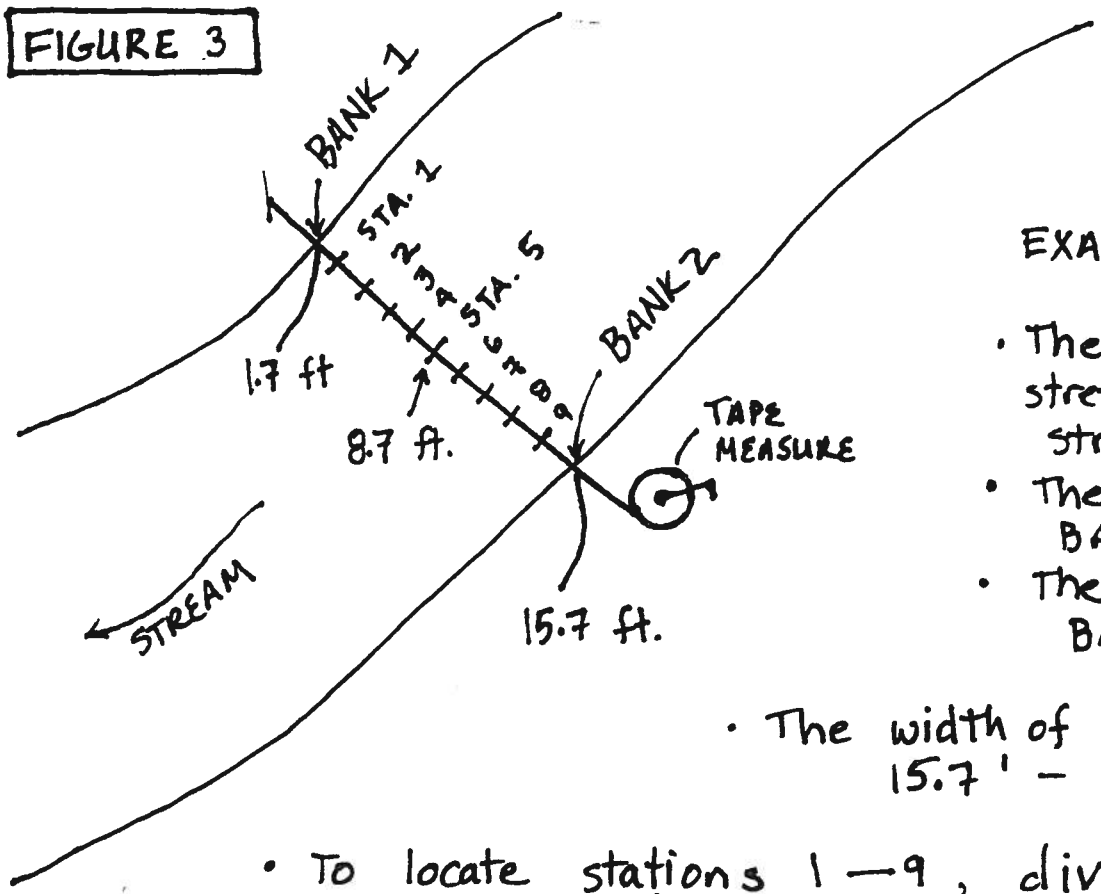
HDR

Project: CHEFORNAK WATER RESOURCES | Computed | Date

Subject: FLOW PROFILE (METHOD III) | Checked | Date

Task | Sheet | Of

FIGURE 3



EXAMPLE :

- The tape measure is stretched across the stream and secured.
- The tape reading at BANK 1 is 1.7 ft.
- The tape reading at BANK 2 is 15.7 ft.

- The width of the stream is 15.7' − 1.7' = 14 ft.

- To locate stations 1 — 9, divide the stream width by 10: 14 ft. ÷ 10 = 1.4 ft
- DETERMINE the stations on the field form as follows:

BANK 1	=	1.7 ft	
STA. 1	=	3.1 ft	(1.7 ft + 1.4 ft.)
2	=	4.5	(3.1 + 1.4)
3	=	5.9	(4.5 + 1.4)
4	=	7.3	(5.9 + 1.4)
5	=	8.7	(7.3 + 1.4)
6	=	10.1	(8.7 + 1.4)
7	=	11.5	(10.1 + 1.4)
8	=	12.9	(11.5 + 1.4)
9	=	14.3	(12.9 + 1.4)
(BANK 2) 10	=	15.7	(14.3 + 1.4)

FIELD WATER QUALITY FORM
Chefornak Water Resources Program

Sample Type
- ☐ Lake Samples
- ☐ Stream Samples
- ☐ Groundwater Samples

Sample Date_____
Field Crew_____
_____
_____

SITE > PARAMETER						
Conductivity						
pH						
Temperature						
Chloride						
Iron - total						
Iron - dissolved						
Nitrate nitrogen						
Nitrite nitrogen						
Hardness - total						
Bacteria - total						
Sample time						
Water color						
Debris, scum or sheen on water?						
# of laboratory sample bottles filled						

Comments:

DAI[illegible] INSTRUMENT CALIBRATION, MAINTENANCE, AN[illegible] MEASUREMENTS FORM

HDR Engineering, [illegible]2

COMPLETE THIS FORM AT THE BEGINNING OF EACH SAMPLING DAY

Date:	Name:	Time:
TEMPERATURE		
Thermometer #:	Calibrated successfully? yes no comments:	
Ice bath temperature, field thermometer: °C	Ice bath temperature, SAMA precision thermometer: °C	
Ice bath temperature, 2nd reading, field thermometer: °C	Ice bath temperature, 2nd reading, SAMA precision thermometer: °C	
pH		
Meter #:		
Calibration completed successfully? yes no comments:		
Date buffer solutions opened - pH 4: pH 7:	Temperature of buffer solutions (SAMA) - pH 4: pH 7:	
Observed pH of pH 4 solution:	Observed pH of pH 4 solution, second reading:	
CONDUCTIVITY		
Meter #:	Date calibration solution opened:	
Meter calibrated successfully? yes no comments:		
Observed conductivity of 1000µS solution: µS	Observed conductivity, second reading: µS	
EQUIPMENT BLANK		
Batch #:	Total chlorine mg/l	Total copper mg/l
Total phenol mg/l	Detergents mg/l	

COMPLETE THIS FORM AT THE END OF EACH SAMPLING DAY

Date:	Name:	Time:
TEMPERATURE		
Ice bath temperature, field thermometer: °C	SAMA Precision Thermometer: °C	
Thermometer cleaned, checked in, and put away? yes no comments:		
pH		
Observed pH of pH 4 buffer:	Temperature of pH 4 buffer solution (SAMA):	
Meter cleaned, checked in, and put away? yes no comments:		
CONDUCTIVITY		
Observed conductivity of 1000µS solution: µS	Meter cleaned, checked in, and put away? yes no comments:	

Attachment 3

Field and Laboratory Test Results

NORTHERN TESTING LABORATORIES, INC.

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ANCHORAGE, ALASKA 99503

(907) 456-3116 • FAX 456-3125
(907) 277-8378 • FAX 274-9645

Village Safewater
3601 C. Street, Suite 1318
Anchorage AK 99503

Attn: Mike W.

Report Date: 04/30/93

Date Arrived: 04/08/93
Date Sampled: 04/07/93
Time Sampled: 1700
Collected By: MW

* Definitions *
B = Below Regulatory Min.
H = Above Regulatory Max.
E = Estimated Value
M = Matrix Interference
D = Lost to Dilution
MDL = Method Detection Limit

Our Lab #: A122964
Location/Project: Chefornak
Your Sample ID: # 1
Sample Matrix: Water
Comments: Cl2 value after incubation < 0.2 ug/L, TPTHM results may be higher.

Lab Number	Method	Parameter	Units	Result	*	MDL	Date Prepared	Date Analyzed
A122964	EPA 353.3	Nitrate-N	mg/l	<MDL		0.1		04/08/93
A122964	EPA 510.1	Bromoform	ug/l	60		10.0		04/30/93
		Bromodichloromethane	ug/l	9.5		2.0		
		Chloroform	ug/l	10		2.0		
		Dibromochloromethane	ug/l	22		4.0		
		Surrogate Spike (Recovery)	%	118				
		Total Trihalomethane	ug/l	100	H	20.0		
A122964	SM 909C	Fecal Coliform	#/100 ml	24		4.0		04/08/93
A122964	SM 9230C	Fecal Streptococcus	#/100 ml	100		4		04/08/93

Reported By: Anthony J. Dange
Senior Chemist

NORTHERN TESTING LABORATORIES, INC.

3330 INDUSTRIAL AVENUE FAIRBANKS, ALASKA 99701 907-456-3116
2505 FAIRBANKS ST. ANCHORAGE, ALASKA 99503 907-277-8378

Village Safewater
3601 C Street
Anchorage AK 99503

Attn: Mike Wolski

Report Date: 04/22/93

Date Arrived: 04/09/93
Date Sampled: 04/07/93
Time Sampled: 1700
Collected By: DJ

MDL = Method Detection Limit

Our Lab #: F123539
Location/Project: Chefornak
Your Sample ID: #1/A122964
Sample Matrix: Water
Comments:

* Flag Definitions
B = Below Regulatory Min.
H = Above Regulatory Max.

Method	Parameter	Units	Results *	MDL	Date Prepared	Date Analyzed
EPA 200.7	Aluminum	mg/l	0.183	0.050	04/16/93	04/21/93
	Iron	mg/l	3.88	0.008	04/16/93	04/21/93
	Manganese	mg/l	0.355	0.002	04/16/93	04/21/93
EPA 300.0	Chloride	mg/l	5770	1000.0		04/13/93

Reported By: James H. Johnson
Vice President

NORTHERN TESTING LABORATORIES, INC.

3330 INDUSTRIAL AVENUE FAIRBANKS, ALASKA 99701 907-456-3116
2505 FAIRBANKS ST. ANCHORAGE, ALASKA 99503 907-277-8378

Village Safewater
3601 C Street; Suite 1318
Anchorage AK 99503

Attn: Mike Wolski

Report Date: 04/22/93

Date Arrived: 04/09/93
Date Sampled: 04/07/93
Time Sampled: 1700
Collected By: DJ

MDL = Method Detection Limit

Our Lab #: F123542
Location/Project: Chefornak
Your Sample ID: #1 Dissolved
Sample Matrix: Water
Comments:

* Flag Definitions
B = Below Regulatory Min.
H = Above Regulatory Max.

Method	Parameter	Units	Results *	MDL	Date Prepared	Date Analyzed
EPA 200.7	Iron	mg/l	0.052	0.008	04/16/93	04/21/93

Reported By: James H. Johnson
Vice-President

NORTHERN TESTING LABORATORIES, INC.

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ANCHORAGE, ALASKA 99503

(907) 456-3116 • FAX 456-3125
(907) 277-8378 • FAX 274-9645

Village Safewater
3601 C. Street, Suite 310
Anchorage AK 99503

Attn: Mike Wolski

Report Date: 05/18/93

Date Arrived: 04/20/93
Date Sampled: 04/19/93
Time Sampled: 1300
Collected By: DJ

* Definitions *
B = Below Regulatory Min.
H = Above Regulatory Max.
E = Estimated Value
M = Matrix Interference
D = Lost to Dilution
MDL = Method Detection Limit

Our Lab #: A123091
Location/Project: Chefornak/P.O. #7852
Your Sample ID: Chefornak Site #1
Sample Matrix: Water
Comments:

Lab Number	Method	Parameter	Units	Result	*	MDL	Date Prepared	Date Analyzed
A123091	EPA 510.1	Bromoform	ug/l	2800		100.0		05/10/9
		Bromodichloromethane	ug/l	720		20.0		
		Chloroform	ug/l	160		2.0		
		Dibromochloromethane	ug/l	2100		40.0		
		Surrogate Spike (Recovery)	%	101				
		Total Potential Trihalomethane	ug/l	5700	H	200.0		
A123091	SM 909C	Fecal Coliform	#/100 ml	80		2.0		04/20/9
A123091	SM 9230C	Fecal Streptococcus	#/100 ml	40		2		04/20/9

Reported By: Anthony J. Lange
Senior Chemist

NORTHERN TESTING LABORATORIES, INC.

3330 INDUSTRIAL AVENUE FAIRBANKS, ALASKA 99701 907-456-3116
2505 FAIRBANKS ST. ANCHORAGE, ALASKA 99503 907-277-8378

Village Safewater
3601 C Street; Suite 310
Anchorage AK 99503

Attn: Michael Wolski

Report Date: 04/30/93

Date Arrived: 04/21/93
Date Sampled: 04/19/93
Time Sampled: 1300
Collected By: -

MDL = Method Detection Limit

Our Lab #: F123773
Location/Project: Chefornak
Your Sample ID: Chefornak Site #1/A123091
Sample Matrix: Water
Comments: 7852

* Flag Definitions
B = Below Regulatory Min.
H = Above Regulatory Max.

Method	Parameter	Units	Results *	MDL	Date Prepared	Date Analyzed
EPA 200.7	Aluminum	mg/l	0.697	0.050	04/22/93	04/22/93
	Iron	mg/l	6.16	0.008	04/22/93	04/22/93
	Manganese	mg/l	0.361	0.002	04/22/93	04/22/93
EPA 300.0	Chloride	mg/l	3270	200.0		04/28/93
	Nitrate-N	mg/l	<MDL	0.5		04/26/93

Reported By: James H. Johnson
Vice President

NORTHERN TESTING LABORATORIES, INC.

3330 INDUSTRIAL AVENUE
2505 FAIRBANKS STREET

FAIRBANKS, ALASKA 99701
ANCHORAGE, ALASKA 99503

907-456-3116
907-277-8378

Drinking Water Analysis Report for Total Coliform Bacteria

TO BE COMPLETED BY CLIENT

☐ PUBLIC WATER SYSTEM I.D. # ☐☐☐☐☐☐

☐ PRIVATE WATER SYSTEM

NAME: Village Safe Water

Mailing Address

City, State, Zip Code

SAMPLE DATE: 4 (Mo.) 23 (Day) 93 (Year) Phone

Purchase Order No.

SAMPLE TYPE:

☐ Routine ☐ Treated Water

☐ Special Purpose ☒ Untreated Water

☐ Check Sample (for original contaminated sample with lab reference no. _____)

METHOD OF ANALYSIS:

☒ MF Membrane Filter ☐ MPN — Most Probable Number

Sample No.	Location	Time Collected	Collected by	Laboratory Ref. No.
1	chefornak #1		NC DJ	AA14912
2				
3				
4				
5				
6				
7				
8				

Signature of Representative

FOR LABORATORY USE ONLY

CASH	CHARGE	PREPAID	TRANSMITTAL	SPECIAL INSTRUCTIONS	MAIL / HOLD FOR PICKUP

TO BE COMPLETED BY LABORATORY

Received at: ☒ Anch. ☐ Fbks.

Date Received 20 April 93

Time Received 1145

Date Analyzed 4-20-93

Time Analyzed 1600

Next Sample Due

COMMENTS:

SATISFACTORY	S
UNSATISFACTORY	U
RESAMPLE	R
OTHER BACTERIA	OB
TOO NUMEROUS TO COUNT	TNTC

Direct Count	Verification LSB	BGB	EC	Final Result*	Comments
132+111OB	1/1	1/1	1/1	132+111OB	U

*No. of Total Coliform Colonies per 100 mls.

Reported by

Date 4-23-93

Time 1330

NORTHERN TESTING LABORATORIES, INC.

3330 INDUSTRIAL AVENUE
2505 FAIRBANKS STREET

FAIRBANKS, ALASKA 99701
ANCHORAGE, ALASKA 99503

(907) 456-3116 • FAX 456-3125
(907) 277-8378 • FAX 274-9645

Village Safewater
3601 C. Street, Suite 1318
Anchorage AK 99503

Attn: Mike Wolski

Report Date: 06/30/93

Date Arrived: 06/09/93
Date Sampled: 06/07/93
Time Sampled: 1600
Collected By: NC/MW

* Definitions *
B = Below Regulatory Min.
H = Above Regulatory Max.
E = Estimated Value
M = Matrix Interference
D = Lost to Dilution
MDL = Method Detection Limit

Our Lab #: A124019
Location/Project: Chefornak
Your Sample ID: Site #1
Sample Matrix: Water
Comments:

Lab Number	Method	Parameter	Units	Result	*	MDL	Date Prepared	Date Analyzed
A124019	EPA 325.0	Chloride	mg/l	21		0.1		06/18/9[illegible]
A[illegible]19	EPA 353.3	Nitrate-N	mg/l	<MDL		0.1		06/15/9[illegible]
A1[illegible]019	EPA 510.1	Bromoform	ug/l	<MDL		50		06/25/9[illegible]
		Bromodichloromethane	ug/l	77		10		
		Chloroform	ug/l	1200		10		
		Dibromochloromethane	ug/l	<MDL		20		
		Surrogate Spike (Recovery)	%	100				
		Total Potential Trihalomethane	ug/l	1300	H	100		
A124019	SM 909C	Fecal Coliform	#/100 ml	2		2		06/09/93
A124019	SM 9230C	Fecal Streptococcus	#/100 ml	2		2		06/09/93

Reported By: Anthony J. Lange
Senior Chemist

NORTHERN TESTING LABORATORIES, INC.

3330 INDUSTRIAL AVENUE FAIRBANKS, ALASKA 99701 907-456-3116
2505 FAIRBANKS ST. ANCHORAGE, ALASKA 99503 907-277-8378

Village Safewater (Anchorage)
3601 C Street; Suite 1318
Anchorage AK 99503

Attn: -

Report Date: 06/17/93

Date Arrived: 06/10/93
Date Sampled: 06/07/93
Time Sampled: 1600
Collected By: NC/MW

MDL = Method Detection Limit

Our Lab #: F125042
Location/Project: -
Your Sample ID: Site #1/A124019
Sample Matrix: Water
Comments:

* Flag Definitions
B = Below Regulatory Min.
H = Above Regulatory Max.

Method	Parameter	Units	Results *	MDL	Date Prepared	Date Analyzed
EPA 200.7	Aluminum	mg/l	3.01	0.033	06/11/93	06/16/93
	Iron	mg/l	4.84	0.003	06/11/93	06/16/93
	Manganese	mg/l	0.076	0.002	06/11/93	06/16/93

Reported By: James H. Johnson
Vice-President

NORTHERN TESTING LABORATORIES, INC.

3330 INDUSTRIAL AVENUE
2505 FAIRBANKS STREET

FAIRBANKS, ALASKA 99701
ANCHORAGE, ALASKA 99503

(907) 456-3116 • FAX 456-3125
(907) 277-8378 • FAX 274-9645

Village Safewater
3601 C. Street, Suite 1318
Anchorage AK 99503

Attn: Mike W.

Report Date: 04/30/93

Date Arrived: 04/08/93
Date Sampled: 04/07/93
Time Sampled: 1600
Collected By: MW

* Definitions *
B = Below Regulatory Min.
H = Above Regulatory Max.
E = Estimated Value
M = Matrix Interference
D = Lost to Dilution
MDL = Method Detection Limit

Our Lab #: A122965
Location/Project: Chefornak
Your Sample ID: # 2
Sample Matrix: Water
Comments: Cl2 value after incubation < 0.2 ug/L, TPTHM results may be higher.

Lab Number	Method	Parameter	Units	Result	*	MDL	Date Prepared	Date Analyzed
A122965	EPA 353.3	Nitrate-N	mg/l	<MDL		0.1		04/08/93
A122965	EPA 510.1	Bromoform	ug/l	92		10.0		04/30/93
		Bromodichloromethane	ug/l	34		2.0		
		Chloroform	ug/l	21		2.0		
		Dibromochloromethane	ug/l	71		4.0		
		Surrogate Spike (Recovery)	%	105				
		Total Trihalomethane	ug/l	220	H	20.0		
A122965	SM 909C	Fecal Coliform	#/100 ml	<MDL		4.0		04/08/93
A122965	SM 9230C	Fecal Streptococcus	#/100 ml	6		4		04/08/93

Reported By: Anthony J. Lange
Senior Chemist

NORTHERN TESTING LABORATORIES, INC.

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2505 FAIRBANKS ST. ANCHORAGE, ALASKA 99503 907-277-8378

Village Safewater
3601 C Street
Anchorage AK 99503

Attn: Mike Wolski

Report Date: 04/22/93

Date Arrived: 04/09/93
Date Sampled: 04/07/93
Time Sampled: 1600
Collected By: DJ

MDL = Method Detection Limit

Our Lab #: F123540
Location/Project: Chefornak
Your Sample ID: #2/A122965
Sample Matrix: Water
Comments:

* Flag Definitions
B = Below Regulatory Min.
H = Above Regulatory Max.

Method	Parameter	Units	Results *	MDL	Date Prepared	Date Analyzed
EPA 200.7	Aluminum	mg/l	0.259	0.050	04/16/93	04/21/93
	Iron	mg/l	3.1	0.008	04/16/93	04/21/93
	Manganese	mg/l	0.272	0.002	04/16/93	04/21/93
EPA 300.0	Chloride	mg/l	2400	500.0		04/13/93

Reported By: James H. Johnson
Vice-President

NORTHERN TESTING LABORATORIES, INC.

3330 INDUSTRIAL AVENUE FAIRBANKS, ALASKA 99701 907-456-3116
2505 FAIRBANKS ST. ANCHORAGE, ALASKA 99503 907-277-8378

Village Safewater
3601 C Street; Suite 1318
Anchorage AK 99503

Attn: Mike Wolski

Report Date: 04/22/93

Date Arrived: 04/09/93
Date Sampled: 04/07/93
Time Sampled: 1600
Collected By: DJ

MDL = Method Detection Limit

Our Lab #: F123543
Location/Project: Chefornak
Your Sample ID: #2 Dissolved
Sample Matrix: Water
Comments:

* Flag Definitions
B = Below Regulatory Min.
H = Above Regulatory Max.

Method	Parameter	Units	Results *	MDL	Date Prepared	Date Analyzed
EPA 200.7	Iron	mg/l	0.113	0.008	04/16/93	04/21/93

Reported By: James H. Johnson
Vice-President

NORTHERN TESTING LABORATORIES, INC.

3330 INDUSTRIAL AVENUE — FAIRBANKS, ALASKA 99701 — 907-456-3116
2505 FAIRBANKS STREET — ANCHORAGE, ALASKA 99503 — 907-277-8378

Drinking Water Analysis Report for Total Coliform Bacteria

TO BE COMPLETED BY CLIENT

☐ PUBLIC WATER SYSTEM I.D. # ☐☐☐☐☐☐

☐ PRIVATE WATER SYSTEM

VSW
ME

Mailing Address

, State, Zip Code

SAMPLE DATE: 4 (Mo.) 7 (Day) 93 (Year) Phone

Purchase Order No.

SAMPLE TYPE:

☐ Routine ☐ Treated Water

☐ Special Purpose ☒ Untreated Water

Check Sample (for original contaminated
e with lab reference no.)

ETHOD OF ANALYSIS:

☒ MF Membrane Filter ☐ MPN — Most Probable Number

mple No.	Location	Time Collected	Collected by	Laboratory Ref. No.
1	site #2		NC OT	AA14914
2				
3				
4				
5				
6				
7				
8				

Sig of Representative

FOR LABORATORY USE ONLY						
CASH	CHARGE	PREPAID	TRANSMITTAL	SPECIAL INSTRUCTIONS	MAIL	
			Called 4/14/93		HOLD FOR PICKUP	

TO BE COMPLETED BY LABORATORY

Received at: ☒ Anch. ☐ Fbks.

Date Received 4-8-93

Time Received 0930

Date Analyzed 4/8/93

Time Analyzed 1600

Next Sample Due ASAP

COMMENTS:

SATISFACTORY S

UNSATISFACTORY U

RESAMPLE R

OTHER BACTERIA OB

TOO NUMEROUS TO COUNT TNTC

Direct Count	Verification LSB	Verification BGB	Verification EC	Final Result*	Comments
29 T.C. +700.B.	1/1	1/1	1/1	29 T.C. +700.B.	U

*No. of Total Coliform Colonies per 100 mls.

Reported by Julie Schafer

Date 4/13/93 1400

NORTHERN TESTING LABORATORIES, INC.

3330 INDUSTRIAL AVENUE
2505 FAIRBANKS STREET

FAIRBANKS, ALASKA 99701
ANCHORAGE, ALASKA 99503

(907) 456-3116 • FAX 456-3125
(907) 277-8378 • FAX 274-9645

Village Safewater
3601 C. Street, Suite 1318
Anchorage AK 99503

Attn: Sam Mills

Report Date: 04/30/93

Date Arrived: 04/08/93
Date Sampled: 04/07/93
Time Sampled: 1400
Collected By: MW

* Definitions *
B = Below Regulatory Min.
H = Above Regulatory Max.
E = Estimated Value
M = Matrix Interference
D = Lost to Dilution
MDL = Method Detection Limit

Our Lab #: A122966
Location/Project: Chefornak
Your Sample ID: # 3
Sample Matrix: Water
Comments: Cl2 value after incubation < 0.2 ug/L, TPTHM results may be higher.

Lab Number	Method	Parameter	Units	Result	*	MDL	Date Prepared	Date Analyzed
A122966	EPA 353.3	Nitrate-N	mg/l	<MDL		0.1		04/08/93
A122966	EPA 510.1	Bromoform	ug/l	<MDL		10.0		04/30/93
		Bromodichloromethane	ug/l	62		2.0		
		Chloroform	ug/l	410		2.0		
		Dibromochloromethane	ug/l	12		4.0		
		Surrogate Spike (Recovery)	%	105				
		Total Trihalomethane	ug/l	490	H	20.0		
A122966	SM 909C	Fecal Coliform	#/100 ml	<MDL		4.0		04/08/93
A122966	SM 9230C	Fecal Streptococcus	#/100 ml	24		4		04/08/93

Reported By: Anthony J. Lange
Senior Chemist

NORTHERN TESTING LABORATORIES, INC.

3330 INDUSTRIAL AVENUE FAIRBANKS, ALASKA 99701 907-456-3116
2505 FAIRBANKS ST. ANCHORAGE, ALASKA 99503 907-277-8378

Village Safewater
3601 C Street
Anchorage AK 99503

Attn: Mike Wolski

Report Date: 04/22/93

Date Arrived: 04/09/93
Date Sampled: 04/07/93
Time Sampled: 1400
Collected By: DJ

MDL = Method Detection Limit

Our Lab #: F123541
Location/Project: Chefornak
Your Sample ID: #3/A122966
Sample Matrix: Water
Comments:

* Flag Definitions
B = Below Regulatory Min.
H = Above Regulatory Max.

Method	Parameter	Units	Results *	MDL	Date Prepared	Date Analyzed
EPA 200.7	Aluminum	mg/l	0.494	0.050	04/16/93	04/21/93
	Iron	mg/l	3.2	0.008	04/16/93	04/21/93
	Manganese	mg/l	0.116	0.002	04/16/93	04/21/93
EPA 300.0	Chloride	mg/l	500	250.0		04/13/93

Reported By: James H. Johnson
Vice-President

NORTHERN TESTING LABORATORIES, INC.

3330 INDUSTRIAL AVENUE FAIRBANKS, ALASKA 99701 907-456-3116
2505 FAIRBANKS ST. ANCHORAGE, ALASKA 99503 907-277-8378

Village Safewater
3601 C Street; Suite 1318
Anchorage AK 99503

Attn: Mike Wolski

Report Date: 04/22/93

Date Arrived: 04/09/93
Date Sampled: 04/07/93
Time Sampled: 1400
Collected By: DJ

MDL = Method Detection Limit

Our Lab #: F123544
Location/Project: Chefornak
Your Sample ID: #3 Dissolved
Sample Matrix: Water
Comments:

* Flag Definitions
B = Below Regulatory Min.
H = Above Regulatory Max.

Method	Parameter	Units	Results *	MDL	Date Prepared	Date Analyzed
EPA 200.7	Iron	mg/l	2.05	0.008	04/16/93	04/21/93

Reported By: James H. Johnson
Vice-President

NORTHERN TESTING LABORATORIES, INC.

3330 INDUSTRIAL AVENUE
2505 FAIRBANKS STREET

FAIRBANKS, ALASKA 99701
ANCHORAGE, ALASKA 99503

907-456-3116
907-277-8378

Drinking Water Analysis Report for Total Coliform Bacteria

TO BE COMPLETED BY CLIENT

☐ PUBLIC WATER SYSTEM I.D. # ☐☐☐☐☐☐

☐ PRIVATE WATER SYSTEM

NAME: VSW

Mailing Address:

City, State, Zip Code:

SAMPLE DATE: 4 (Mo.) 7 (Day) 93 (Year) Phone:

Purchase Order No.:

SAMPLE TYPE:

☐ Routine ☐ Treated Water

☐ Special Purpose ☒ Untreated Water

☐ Check Sample (for original contaminated sample with lab reference no. _____)

METHOD OF ANALYSIS:

☒ MF Membrane Filter ☐ MPN — Most Probable Number

Sample No.	Location	Time Collected	Collected by	Laboratory Ref. No.
1	SITE 3	2PM	D.J.	AA14913
2				
3				
4				
5				
6				
7				
8				

Signature of Representative

FOR LABORATORY USE ONLY						
CASH	CHARGE	PREPAID	TRANSPORTAL	SPECIAL INSTRUCTIONS	MAIL	
					HOLD FOR PICKUP	

TO BE COMPLETED BY LABORATORY

Received at: ☒ Anch. ☐ Fbks.

Date Received: 4-8-93

Time Received: 0930

Date Analyzed: 4/8/93

Time Analyzed: 1600

Next Sample Due: ASAP

COMMENTS:

SATISFACTORY — S

UNSATISFACTORY — U

RESAMPLE — R

OTHER BACTERIA — OB

TOO NUMEROUS TO COUNT — TNTC

Direct Count	Verification LSB	Verification BGB	Verification EC	Final Result*	Comments
33T.C. + 2000 O.B.	1/1	1/1	9/1	33T.C. + 2000 O.B.	U

*No. of Total Coliform Colonies per 100 mls.

Reported by: Julie Shaefer

Date: 4/13/93

Time: 1400

NORTHERN TESTING LABORATORIES, INC.

3330 INDUSTRIAL AVENUE
2505 FAIRBANKS STREET

FAIRBANKS, ALASKA 99701
ANCHORAGE, ALASKA 99503

(907) 456-3116 • FAX 456-3125
(907) 277-8378 • FAX 274-9645

Village Safewater
3601 C. Street, Suite 310
Anchorage AK 99503

Attn: Mike Wolski

Report Date: 05/18/93

Date Arrived: 04/20/93
Date Sampled: 04/19/93
Time Sampled: 1030
Collected By: DJ

* Definitions *
B = Below Regulatory Min.
H = Above Regulatory Max.
E = Estimated Value
M = Matrix Interference
D = Lost to Dilution
MDL = Method Detection Limit

Our Lab #: A123092
Location/Project: Chefornak/P.O. #7852
Your Sample ID: Chefornak Site #5
Sample Matrix: Water
Comments:

Lab Number	Method	Parameter	Units	Result	*	MDL	Date Prepared	Date Analyzed
A123092	EPA 510.1	Bromoform	ug/l	240		10.0		05/10/93
		Bromodichloromethane	ug/l	1200		20.0		
		Chloroform	ug/l	1900		20.0		
		Dibromochloromethane	ug/l	910		40.0		
		Surrogate Spike (Recovery)	%	105				
		Total Potential Trihalomethane	ug/l	4300	H	200.0		
A123092	SM 909C	Fecal Coliform	#/100 ml	40		2.0		04/20/93
A123092	SM 9230C	Fecal Streptococcus	#/100 ml	10		2		04/20/93

Reported By: Anthony J. Lange
Senior Chemist

NORTHERN TESTING LABORATORIES, INC.

3330 INDUSTRIAL AVENUE FAIRBANKS, ALASKA 99701 907-456-3116
2505 FAIRBANKS ST. ANCHORAGE, ALASKA 99503 907-277-8378

Village Safewater
3601 C Street; Suite 310
Anchorage AK 99503

Attn: Michael Wolski

Report Date: 04/30/93

Date Arrived: 04/21/93
Date Sampled: 04/19/93
Time Sampled: 1030
Collected By: -

MDL = Method Detection Limit

Our Lab #: F123774
Location/Project: Chefornak
Your Sample ID: Chefornak Site #5/A123092
Sample Matrix: Water
Comments: 7852

* Flag Definitions
B = Below Regulatory Min.
H = Above Regulatory Max.

Method	Parameter	Units	Results *	MDL	Date Prepared	Date Analyzed
EPA 200.7	Aluminum	mg/l	0.438	0.050	04/22/93	04/22/93
	Iron	mg/l	11.4	0.008	04/22/93	04/22/93
	Manganese	mg/l	0.384	0.002	04/22/93	04/22/93
EPA 300.0	Chloride	mg/l	1040	200.0		04/28/93
	Nitrate-N	mg/l	<MDL	0.5		04/26/93

Reported By: James H. Johnson
Vice-President

NORTHERN TESTING LABORATORIES, INC.

3330 INDUSTRIAL AVENUE
2505 FAIRBANKS STREET

FAIRBANKS, ALASKA 99701
ANCHORAGE, ALASKA 99503

907-456-3116
907-277-8378

Drinking Water Analysis Report for Total Coliform Bacteria

TO BE COMPLETED BY CLIENT

☐ PUBLIC WATER SYSTEM I.D. # ☐☐☐☐☐☐

☐ PRIVATE WATER SYSTEM

MICHAEL WOLSKI - S.O.A - VILLAGE SAFE WATER
ME

3601 C st #310
Mailing Address

ANCHORAGE AK 99503
y, State, Zip Code

SAMPLE DATE: ___ ___ ___ (Mo. Day Year) Phone 563-0239

Purchase Order No. 7852

SAMPLE TYPE:

Routine ☐ Treated Water

☒ Special Purpose ☒ Untreated Water

Check Sample (for original contaminated sample with lab reference no. _____)

ETHOD OF ANALYSIS:

MF Membrane Filter

PN — Most Probable Number

mple No.	Location	Time Collected	Collected by	Laboratory Ref. No.
1	CHEFORNAK SITES			AB 1081
2				
3				
4				
5				
6				
7				
8				

Si ure of Representative _____

FOR LABORATORY USE ONLY						
CASH	CHARGE	PREPAID	TRANSMITTAL	SPECIAL INSTRUCTIONS	MAIL	
					HOLD FOR PICKUP	

TO BE COMPLETED BY LABORATORY

Received at: ☒ Anch. ☐ Fbks.

Date Received 20 April 93

Time Received 1145 (AM)

Date Analyzed 4-20-93

Time Analyzed 1600

Next Sample Due _____

COMMENTS:

SATISFACTORY	S
UNSATISFACTORY	U
RESAMPLE	R
OTHER BACTERIA	OB
TOO NUMEROUS TO COUNT	TNTC

Fecal +

Direct Count	Verification LSB	Verification BGB	EC	Final Result*	Comments
28+50OB	1/1	1/1	1/1	28+50OB	U

*No. of Total Coliform Colonies per 100 mls.

Reported by _____

Date 4-23-93

1330

NORTHERN TESTING LABORATORIES, INC.

3330 INDUSTRIAL AVENUE
2505 FAIRBANKS STREET

FAIRBANKS, ALASKA 99701
ANCHORAGE, ALASKA 99503

(907) 456-3116 • FAX 456-3125
(907) 277-8378 • FAX 274-9645

Village Safewater
3601 C. Street, Suite 1318
Anchorage AK 99503

Attn: Mike Wolski

Report Date: 06/30/93

Date Arrived: 06/09/93
Date Sampled: 06/07/93
Time Sampled: 1400
Collected By: NC/MW

* Definitions *
B = Below Regulatory Min.
H = Above Regulatory Max.
E = Estimated Value
M = Matrix Interference
D = Lost to Dilution
MDL = Method Detection Limit

Our Lab #: A124020
Location/Project: Chefornak
Your Sample ID: Site #5
Sample Matrix: Water
Comments:

Lab Number	Method	Parameter	Units	Result	*	MDL	Date Prepared	Date Analyzed
A124020	EPA 325.0	Chloride	mg/l	15		0.1		06/18/93
A[illegible]20	EPA 353.3	Nitrate-N	mg/l	<MDL		0.1		06/15/93
A1[illegible]020	EPA 510.1	Bromoform	ug/l	<MDL		50		06/25/93
		Bromodichloromethane	ug/l	63		10		
		Chloroform	ug/l	1300		10		
		Dibromochloromethane	ug/l	<MDL		20		
		Surrogate Spike (Recovery)	%	95				
		Total Potential Trihalomethane	ug/l	1200	H	100		
A124020	SM 909C	Fecal Coliform	#/100 ml	<MDL		2		06/09/93
A124020	SM 9230C	Fecal Streptococcus	#/100 ml	<MDL		2		06/09/93

Reported By: Anthony J. Lange
Senior Chemist

NORTHERN TESTING LABORATORIES, INC.

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2505 FAIRBANKS ST. ANCHORAGE, ALASKA 99503 907-277-8378

Village Safewater (Anchorage)
3601 C Street; Suite 1318
Anchorage AK 99503

Attn: -

Report Date: 06/17/93

Date Arrived: 06/10/93
Date Sampled: 06/07/93
Time Sampled: 1400
Collected By: NC/MW

MDL = Method Detection Limit

Our Lab #: F125043
Location/Project: -
Your Sample ID: Site #5/A124020
Sample Matrix: Water
Comments:

* Flag Definitions
B = Below Regulatory Min.
H = Above Regulatory Max.

Method	Parameter	Units	Results *	MDL	Date Prepared	Date Analyzed
EPA 200.7	Aluminum	mg/l	2.78	0.033	06/11/93	06/16/93
	Iron	mg/l	4.74	0.003	06/11/93	06/16/93
	Manganese	mg/l	0.065	0.002	06/11/93	06/16/93

Reported By: James H. Johnson
Vice President

NORTHERN TESTING LABORATORIES, INC.

3330 INDUSTRIAL AVENUE FAIRBANKS, ALASKA 99701 907-456-3116
2505 FAIRBANKS ST. ANCHORAGE, ALASKA 99503 907-277-8378

Village Safewater (Anchorage)
3601 C Street; Suite 1318
Anchorage AK 99503

Attn: -

Report Date: 06/18/93

Date Arrived: 06/11/93
Date Sampled: 06/07/93
Time Sampled: 1400
Collected By: NC/MW

MDL = Method Detection Limit

Our Lab #: F125111
Location/Project: -
Your Sample ID: Site #5/A124020
Sample Matrix: Water
Comments:

* Flag Definitions
B = Below Regulatory Min.
H = Above Regulatory Max.

Method	Parameter	Units	Results *	MDL	Date Prepared	Date Analyzed
EPA 325.0	Chloride	mg/l	15	0.10		06/18/93

Reported By: James H. Johnson
Vice-President

NORTHERN TESTING LABORATORIES, INC.

3330 INDUSTRIAL AVENUE
2505 FAIRBANKS STREET

FAIRBANKS, ALASKA 99701
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(907) 277-8378 • FAX 274-9645

Village Safewater
3601 C. Street, Suite 310
Anchorage AK 99503

Attn: Mike Wolski

Report Date: 05/18/93

Date Arrived: 04/20/93
Date Sampled: 04/19/93
Time Sampled: 1300
Collected By: DJ

* Definitions *
B = Below Regulatory Min.
H = Above Regulatory Max.
E = Estimated Value
M = Matrix Interference
D = Lost to Dilution
MDL = Method Detection Limit

Our Lab #: A123093
Location/Project: Chefornak/P.O. #7852
Your Sample ID: Chefornak Site #6
Sample Matrix: Water
Comments:

Lab Number	Method	Parameter	Units	Result	*	MDL	Date Prepared	Date Analyzed
A123093	EPA 510.1	Bromoform	ug/l	380		10.0		05/10/93
		Bromodichloromethane	ug/l	1600		20.0		
		Chloroform	ug/l	2000		20.0		
		Dibromochloromethane	ug/l	1400		40.0		
		Surrogate Spike (Recovery)	%	104				
		Total Potential Trihalomethane	ug/l	5400	H	200.0		
A123093	SM 909C	Fecal Coliform	#/100 ml	70		2.0		04/20/93
A123093	SM 9230C	Fecal Streptococcus	#/100 ml	40		2		04/20/93

Reported By: Anthony J. Lange
Senior Chemist

NORTHERN TESTING LABORATORIES, INC.

3330 INDUSTRIAL AVENUE FAIRBANKS, ALASKA 99701 907-456-3116
2505 FAIRBANKS ST. ANCHORAGE, ALASKA 99503 907-277-8378

Village Safewater
3601 C Street; Suite 310
Anchorage AK 99503

Attn: Michael Wolski

Report Date: 04/30/93

Date Arrived: 04/21/93
Date Sampled: 04/19/93
Time Sampled: -
Collected By: -

MDL = Method Detection Limit

Our Lab #: F123775
Location/Project: Chefornak
Your Sample ID: Chefornak Site #6/A123093
Sample Matrix: Water
Comments: 7852

* Flag Definitions
B = Below Regulatory Min.
H = Above Regulatory Max.

Method	Parameter	Units	Results *	MDL	Date Prepared	Date Analyzed
EPA 200.7	Aluminum	mg/l	1.77	0.050	04/22/93	04/22/93
	Iron	mg/l	12.5	0.008	04/22/93	04/22/93
	Manganese	mg/l	0.43	0.002	04/22/93	04/22/93
EPA 300.0	Chloride	mg/l	1310	100.0		04/28/93
	Nitrate-N	mg/l	<MDL	0.5		04/26/93

Reported By: James H. Johnson
Vice-President

NORTHERN TESTING LABORATORIES, INC.

3330 INDUSTRIAL AVENUE — FAIRBANKS, ALASKA 99701 — 907-456-3116
2505 FAIRBANKS STREET — ANCHORAGE, ALASKA 99503 — 907-277-8378

Drinking Water Analysis Report for Total Coliform Bacteria

TO BE COMPLETED BY CLIENT

PUBLIC WATER SYSTEM I.D. # [ ][ ][ ][ ][ ][ ]

PRIVATE WATER SYSTEM

MICHAEL WOLSKI - SOA - VILLAGE SAFE WATER

3601 C St. Suite 310

Address

Anchorage AK 99503

City, State, Zip Code

SAMPLE DATE: ___ Mo. ___ Day ___ Year

Phone 563-0239

Purchase Order No. 7852

SAMPLE TYPE:

Routine

Special Purpose

☐ Treated Water

☒ Untreated Water

Check Sample (for original contaminated sample with lab reference no. _____)

METHOD OF ANALYSIS:

MF Membrane Filter

MPN — Most Probable Number

#	Location	Time Collected	Collected by	Laboratory Ref. No.
1	CHEFORNAK SITE 6			AB1082
2				
3				
4				
5				
6				
7				
8				

Signature of Representative _____

FOR LABORATORY USE ONLY

CASH	CHARGE	PREPAID	TRANSMITTAL	SPECIAL INSTRUCTIONS	MAIL / HOLD FOR PICKUP

TO BE COMPLETED BY LABORATORY

Received at: ☒ Anch. ☐ Fbks.

Date Received 20 April 93

Time Received 1145

Date Analyzed 4-20-93

Time Analyzed 1600

Next Sample Due _____

COMMENTS:

SATISFACTORY	S
UNSATISFACTORY	U
RESAMPLE	R
OTHER BACTERIA	OB
TOO NUMEROUS TO COUNT	TNTC

Fecal +

Direct Count	Verification LSB	BGB	EC	Final Result*	Comments
70+71 OB.	1/1	1/1	1/1	70+71 OB	SL

*No. of Total Coliform Colonies per 100 mls.

Reported by [signature]

Date 4-23-93

Time 1330

NORTHERN TESTING LABORATORIES, INC.

3330 INDUSTRIAL AVENUE
2505 FAIRBANKS STREET

FAIRBANKS, ALASKA 99701
ANCHORAGE, ALASKA 99503

(907) 456-3116 • FAX 456-3125
(907) 277-8378 • FAX 274-9645

Village Safewater
3601 C. Street, Suite 1318
Anchorage AK 99503

Attn: Mike Wolski

Report Date: 06/30/93

Date Arrived: 06/09/93
Date Sampled: 06/07/93
Time Sampled: 1535
Collected By: NC/MW

* Definitions *
B = Below Regulatory Min.
H = Above Regulatory Max.
E = Estimated Value
M = Matrix Interference
D = Lost to Dilution
MDL = Method Detection Limit

Our Lab #: A124021
Location/Project: Chefornak
Your Sample ID: Site #6
Sample Matrix: Water
Comments:

Lab Number	Method	Parameter	Units	Result	*	MDL	Date Prepared	Date Analyzed
A124021	EPA 325.0	Chloride	mg/l	17		0.1		06/18/9
A1[illegible]21	EPA 353.3	Nitrate-N	mg/l	<MDL		0.1		06/15/9
A1[illegible]21	EPA 510.1	Bromoform	ug/l	<MDL		50		06/25/9
		Bromodichloromethane	ug/l	68		10		
		Chloroform	ug/l	760		10		
		Dibromochloromethane	ug/l	<MDL		20		
		Surrogate Spike (Recovery)	%	103				
		Total Potential Trihalomethane	ug/l	830	H	100		
A124021	SM 909C	Fecal Coliform	#/100 ml	4		2		06/09/9
A124021	SM 9230C	Fecal Streptococcus	#/100 ml	<MDL		2		06/09/9

Reported By: Anthony J. Lange
Senior Chemist

NORTHERN TESTING LABORATORIES, INC.

3330 INDUSTRIAL AVENUE FAIRBANKS, ALASKA 99701 907-456-3116
2505 FAIRBANKS ST. ANCHORAGE, ALASKA 99503 907-277-8378

Village Safewater (Anchorage)
3601 C Street; Suite 1318
Anchorage AK 99503

Attn: -

Report Date: 06/17/93

Date Arrived: 06/10/93
Date Sampled: 06/07/93
Time Sampled: 1535
Collected By: NC/MW

MDL = Method Detection Limit

Our Lab #: F125044
Location/Project: -
Your Sample ID: Site #6/A124021
Sample Matrix: Water
Comments:

* Flag Definitions
B = Below Regulatory Min.
H = Above Regulatory Max.

Method	Parameter	Units	Results *	MDL	Date Prepared	Date Analyzed
EPA 200.7	Aluminum	mg/l	2.45	0.033	06/11/93	06/16/93
	Iron	mg/l	3.87	0.003	06/11/93	06/16/93
	Manganese	mg/l	0.061	0.002	06/11/93	06/16/93

Reported By: James H. Johnson
Vice-President

NORTHERN TESTING LABORATORIES, INC.

3330 INDUSTRIAL AVENUE FAIRBANKS, ALASKA 99701 907-456-3116
2505 FAIRBANKS ST. ANCHORAGE, ALASKA 99503 907-277-8378

Village Safewater (Anchorage)
3601 C Street; Suite 1318
Anchorage AK 99503

Attn: -

Report Date: 06/18/93

Date Arrived: 06/11/93
Date Sampled: 06/07/93
Time Sampled: 1535
Collected By: NC/MW

MDL = Method Detection Limit

Our Lab #: F125112
Location/Project: -
Your Sample ID: Site #6/A124021
Sample Matrix: Water
Comments:

* Flag Definitions
B = Below Regulatory Min.
H = Above Regulatory Max.

Method	Parameter	Units	Results *	MDL	Date Prepared	Date Analyzed
EPA 325.0	Chloride	mg/l	16.6	0.10		06/18/93

Reported By: James H. Johnson
Vice President

1st set P.01

FIELD WATER QUALITY FORM
Chefornak Water Resources Program

Sample Type
- ☐ Lake Samples
- ☒ Stream Samples
- ☐ Groundwater Samples

Sample Date 4/7/93
Field Crew NC DJ

SITE > PARAMETER	#3 3PM	#2 4PM	#1			
Conductivity	2,500	5900	10,000+			
pH	5.0	5.5	5.5			
Temperature	34	34	34			
Chloride	0	32	100			
Iron - total	4	1.0	3.0			
Iron - dissolved	0.8	0.1	0.8			
Nitrate nitrogen	0.1	0.0	0			
Nitrite nitrogen	0	0	0			
Hardness - total	50	495	1200			
Bacteria - total	✓	✓	✓			
Sample time	3:PM	4:PM	5:PM			
Water color	Yes	Yes	Yes			
Debris, scum or sheen on water?						
# of laboratory sample bottles filled	++++ ✓	++++ ✓ Greater than 1,000	++++ ✓ Greater than 1,000			

Comments:

14.1
14.0 °C = 57.2 °F
15.0 °C = 59.0 °F

FIELD WATER QUALITY FORM
Chefornak Water Resources Program

Sample Type

- ☐ Lake Samples
- ☒ Stream Samples
- ☐ Groundwater Samples

Sample Date 6/7/93
Field Crew NC
MW

equalls 80 ≈90 ≈110

SITE > PARAMETER	5	#6	#1			
Conductivity	08	09	11			
pH	5.0	5.0	5.0			
Temperature	14.6 °C 59.6	14.1 57.4	14.4 58.8			
Chloride	~~80~~ ~~80~~	~~80~~	~~235~~ 000	<1.0	m.s. [illegible]	
Iron - total	~~3~~ 2.0	1.0	1.0			
Iron - dissolved	~~1.0~~ .3	0.2	0.2			
Nitrate nitrogen	0	0	0			
Nitrite nitrogen	0	0	0			
Hardness - total	0	25	25			
Bacteria - total	✓ ++--	✓ ++--	✓ +++-			
Sample time	2:00 p.m	3:35	4:00			
Water color	Brown	Brown	Brown			
Debris, scum or sheen on water?	white Foam on ~~NO~~ River	white foam on ~~NO~~ river	white foam on ~~NO~~ River			
# of laboratory sample bottles filled	6					

Comments:

2nd set

FIELD WATER QUALITY FORM
Chefornak Water Resources Program

Sample Type
- [ ] Lake Samples
- [x] Stream Samples
- [ ] Groundwater Samples

Sample Date 4/19/93
Field Crew W.C.
DJ

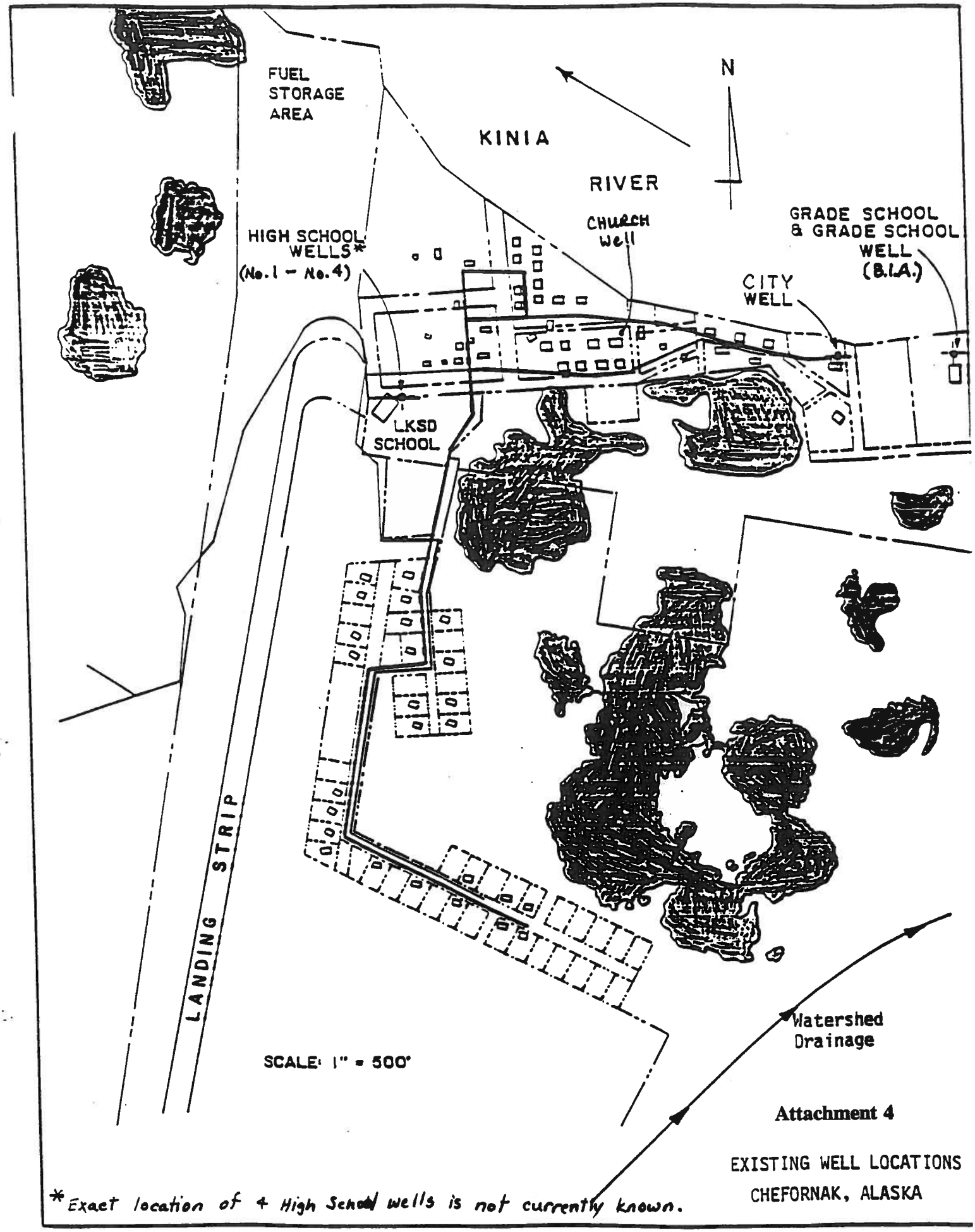
SITE > PARAMETER	4-19-93 5	6	1			
Conductivity	2000	3000	7000			
pH	5.5	5.5	5.5			
Temperature	34	33	33			
Chloride	7.5	4.0	7.0			
Iron - total	0.3	0.6	0.2			
Iron - dissolved	0.8	0.8	0.4			
Nitrate nitrogen	0	0	0			
Nitrite nitrogen	0	0	0			
Hardness - total	425	425	425			
Bacteria - total						
Sample time	12, AM		1 PM			
Water color						
Debris, scum or sheen on water?						
# of laboratory sample bottles filled	++ --	++ --	++ --			

Comments:

Arthur Mike

Attachment 4

Map of Ground Water Wells



Attachment 4

EXISTING WELL LOCATIONS
CHEFORNAK, ALASKA

*Exact location of 4 High School wells is not currently known.

Attachment 5

Surface Water Quality Laboratory Results

Surface Water Quality
Laboratory Results

ID	Sample Date	Time (hrs)	Nitrate N (mg/L)	B1 (ug/L)	B2 (ug/L)	C (ug/L)	D (ug/L)	TPT (ug/L)	Fecal Colif. (#/100 ml)	Fecal Strep. (#/100 ml)	Al (mg/L)	Total Fe (mg/L)	Diss. Fe (mg/L)	Mn (mg/L)	Cl (mg/L)
KINIA RIVER															
Site 1	4/7/93	1700	<0.1	60	9.5	10	22	100*	24	100	0.183	3.88	0.052	0.355	5770
	4/19/93	1300	<0.5	2800	720	160	2100	5700	80	40	0.697	6.16	-	0.361	3270
	6/7/93	1600	<0.1	<50	77	1200	<20	1300	2	2	3.01	4.84	-	0.076	21
Site 2	4/7/93	1600	<0.1	92	34	21	71	220*	<4.0	6	0.259	3.1	0.113	0.272	2400
Site 5	4/19/93	1030	<0.5	240	1200	1900	910	4300	40	10	0.438	11.4	-	0.384	1040
	6/7/93	1400	<0.1	<50	63	1300	<20	1200	<2	<2	2.78	4.74	-	0.065	15
Site 6	4/19/93	1300	<0.5	380	1600	2000	1400	5400	70	40	1.77	12.5	-	0.43	1310
	6/7/93	1535	<0.1	<50	68	760	<20	830	4	<2	2.45	3.87	-	0.061	16.6
EAST CREEK															
Site 3	4/7/93	1400	<0.1	<10.0	62	410	12	490*	<4.0	24	0.494	3.2	2.05	0.116	500

N = Nitrogen
B1 = Bromoform
B2 = Bromodichloromethane
C = Chloroform
D = Dibromochloromethane
T PT= Total Potential Trihalomethane

Colif. = Coliform
Strep. = Streptococcus
Al = Aluminum
Fe = Iron, Diss. = Dissolved
Mn = Manganese
* = Total Trihalomethane

Cl = Chloride

Surface Water Quality
Field Results

Attachment 5

ID	Sample Date	Time (hrs)	Conductivity us/cm	pH	Temp. (deg. F)	Hardness (mg/L)
KINIA RIVER						
Site1	4/7/93	1700	10,000	5.5	34	1200
	4/19/93	1300	1,000	5.5	33	425
	6/7/93	1600	110	5	58.8	25
Site 2	4/7/93	1600	5900	5.5	32	425
Site 5	4/19/93	1030	2000	5.5	34	425
	6/7/93	1400	80	5	59	0
Site 6	4/19/93	1300	3000	5.5	34	425
	6/7/93	1535	90	5	57.6	25
EAST CREEK						
Site 3	4/7/93	1400	2,500	5	34	50

Attachment 6

Aquifer Characteristic Calculations

Job No. | No.

Computation

HDR

Project	Chefornak	Computed	Date
Subject	Pumping rates, aquifer charac.	Checked	Date
Task		Sheet 1	Of 5

- aquifer Thickness, m :
  22' exposed at city well, sands from 125 – 243' at high school well. 243 - 125 = 118'

  Use range 20 - 120 ft.

- hydraulic conductivity, K :
  aquifer material = fine sand w/ some pea gvl & organics + shells. Probably equiv. to silty sand.
  from Freeze & Cherry, range of K = 0 - 5,000 gpd/ft²

  experience = lower .... about 150 gpd/ft²

  use expected = 150 gpd/ft²
  worst = 10 gpd/ft²

- storativity, S, for confined aquifer :

  from Driscoll, range = 10^{-5} to 10^{-3} (0.00001 - 0.001)

  based on material type, S ⇒ 0.00001
  due to proximity of river, try <u>0.0005</u>

T = Km

best T_a = (150 gpd/ft²)(120 ft) = 18,000 gpd/ft
mid. T_b = (150 gpd/ft²)(20 ft) = 3,000 " "
mid. T_c = (10 gpd/ft²)(120 ft) = 1,200 " "
worst T_d = (10 gpd/ft²)(20 ft) = 200 " "

Job No. | No.

Computation

HDR

Project	Chefornak	Computed	Date
Subject	Pumping rates, aquifer characs.	Checked	Date
Task		Sheet 2	Of 5

Use Non-equilibrium well formulas -

$$u = \frac{1.87\ r^2\ S}{T t}$$

Use r, dist. to obs. well = 1 ft.
t, time well pumped 1000 d (3 yrs)
Find $W(u)$ in Table (App. 9E), Driscoll

a.) $u = \frac{1.87\ (1)^2\ 0.0005}{18{,}000\ \text{gpd/ft}\ (1000\ \text{d})} = 5.19 \times 10^{-11}$ $\quad W(u) = 23.1$

b.) $= \frac{1.87\ (1)^2\ 0.0005}{3{,}000\ \text{gpd/ft}\ (1000\ \text{d})} = 3.1 \times 10^{-10}$ $\quad W(u) = 21.3$

c.) $\frac{1.87\ (1)^2\ 0.0005}{1200\ \text{gpd/ft}\ (1000\ \text{d})} = 7.8 \times 10^{-10}$ $\quad W(u) = 20.4$

d.) $\frac{1.87\ (1)^2\ 0.0005}{200\ \text{gpd/ft}\ (1000\ \text{d})} = 4.7 \times 10^{-9}$ $\quad W(u) = 18.6$

Job No. | No.

Computation

HDR

Project Chefornak		Computed	Date
Subject Pumping rates, aquifer characs.		Checked	Date
Task		Sheet 3	Of 5

A. Determine max pumping rate given available drawdown.

SWL ≈ 5 ft , Top of aquifer = base of permafrost = 95 ft.

avail. dd = 90 ft. Want to use max dd = 67% dd
= 60 ft. ↳ (90 % of yield)

$$\Delta s = \frac{114.6\ Q}{T} w(u) \qquad \Delta s = \text{drawdown, ft.}$$

a.) $60' = \frac{114.6\ Q}{18{,}000\ gpd/ft}\ 23.1 \qquad Q = 408\ gpm$

b) $60' = \frac{114.6\ Q}{3000\ gpd/ft}\ 21.3 \qquad Q = 73\ gpm$

c.) $60' = \frac{114.6\ Q}{1200\ gpd/ft}\ 20.4 \qquad Q = 31\ gpm$

d.) $60' = \frac{114.6\ Q}{200\ gpd/ft}\ 18.6 \qquad Q = 6\ gpm$

Job No. | No.

Computation

HDR

Project	Chefornak	Computed	Date
Subject	Pumping rates, aquifer characs.	Checked	Date
Task		Sheet 4	Of 5

6. What is drawdown if pumps at 50 gpm?

Assume 30 % well losses so 50 × 1.3 = 67 gpm

a) $\Delta s = \frac{114.6 \quad 67 \text{ gpm}}{18000 \text{ gpd/ft}} 23.1 = 9.8 \text{ ft.}$

b.) $\Delta s = \frac{114.6 \quad 67 \text{ gpm}}{3000 \text{ gpd/ft}} 21.3 = 54.5 \text{ ft.}$

c.) $\Delta s = \frac{114.6 \quad 67 \text{ gpm}}{1200 \text{ gpd/ft}} 20.4 = 130.5 \text{ ft.}$

d.) $\Delta s = \frac{114.6 \quad 67 \text{ gpm}}{200 \text{ gpd/ft}} 18.6 = 714. \text{ ft}$

Job No. | No.

Computation

HDR

Project Chefornak		Computed	Date
Subject Pumping rate, aquifer charac.		Checked	Date
Task		Sheet 5	Of 5

From previous pumping,

City Well, 12/21/82 dd = 16' @ 20 gpm. – 8 hrs? 8 min?

a.) $u = \frac{1.87\, r^2 S}{Tt} = \frac{1.87\ (1')^2\ 0.0005}{18000\ gpd/ft\ \ 1d} = 5.2 \times 10^{-}$

$W(u) = 16.2$

b.) $\frac{1.87\ (1')^2\ 0.0005}{3000\ gpd/ft\ \ 1d} = 3.1 \times 10^{-7}$

$W(u) = 14.4$

c.) $\frac{1.87\ (1')^2\ 0.0005}{1200\ gpd/ft\ \ 1d} = 7.8 \times 10^{-7}$

$W(u) = 13.5$

d.) $\frac{1.87\ (1')^2\ 0.0005}{200\ gpd/ft\ \ 1d} = 4.7 \times 10^{-6}$ $W(u) = 11.7$

a.) $\Delta s = \frac{114.6\ \ 20\ gpm}{18000\ gpd/ft} 16.2 = 2.06'$

b) $\Delta s = \frac{114.6\ \ 20\ gpm}{3000\ gpd/ft} 14.4 = 11.0'$

$> 16'$

c.) $\Delta s = \frac{114.6\ \ 20\ gpm}{1200\ gpd/ft} 13.5 = 25.8'$

d.) $\Delta s = \frac{114.6\ \ 20\ gpm}{200\ gpd/ft} 11.7 = 134'$

Job No. | No.

Computation

HDR

Project	Chefornak	Computed	Date
Subject	Limitations due to well screen	Checked	Date
Task	(Grain size – D_{50})	Sheet 1	Of 1

Transmitting capacity of well screen (p. 453 Driscoll)

Open area x 0.31 = gpm / ft.

Assume 6" telescoping well screen for fine sand.

Manufacturers info from AK Pump (Barry McCormack) smallest slot size screen for which he had info was No. 10 slot.

30 in^2/ft x 0.31 = 9.3 gpm / ft.

5' of screen = 46.5 gpm
10' of screen = 93 gpm

Attachment 7

Selected Well Water Quality Results

ATTACHMENT 7

SELECTED WELL WATER QUALITY RESULTS
CHEFORNAK, ALASKA

WELL	DATE	TDS (mg/l)	CHLORIDE (mg/l)	SPECIFIC CONDUCTANCE	TOTAL IRON (mg/l)	MAGNESIUM (mg/l)	HARD-NESS (mg/l)
BIA Well	10/5/66	541	112	924	0.78	14	100
BIA Well	2/4/71	634	175	1,070	0.5	23	127
BIA Well	3/8/78	1,060	---	1,310	0.62	35	149
BIA Well	9/5/79	---	400	1,400	0.6	31	---
City Well	9/5/75	486	102	738	0.23	16	70
City Well	1/20/78	445	130	750	0.3	14	87
City Well	9/5/79	---	168	800	0.3	15.9	---
City Well	5/22/81	415	111	840	0.22	12	62
City Well	12/21/82	500	130	840	0.18	12	63
City Well	9/1/85	457	122	750	0.5	13	67

Note: In 1983, "all-weather" watering points were connected to the city well.