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# Source Water Assessment

A Hydrogeologic Susceptibility and  
Vulnerability Assessment for  
Karluk, Alaska

Karluk Community Water System

PWSID # 250087.001

February 2006

Drinking Water Protection Report #1570

Alaska Department of Environmental Conservation

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The Drinking Water Protection (DWP) section of the Drinking Water Program is producing Source Water Assessments in compliance with the Safe Drinking Water Act Amendments of 1996. Each assessment includes a delineation of the source water area, an inventory of potential and existing contaminant sources that may impact the water, a risk ranking for each of these contaminants, and an evaluation of the potential vulnerability of these drinking water sources.

These assessments are intended to provide public water systems owners/operators, communities, and local governments with the best available information that may be used to protect the quality of their drinking water. The assessments combine information obtained from various sources, including the U.S. Environmental Protection Agency, Alaska Department of Environmental Conservation (ADEC), public water system owners/operators, and other public information sources. The results of this assessment are subject to change if additional data becomes available. It is anticipated this assessment will be updated every five years to reflect any changes in the vulnerability and/or susceptibility of public drinking water source. If you have any additional information that may affect the results of this assessment, please contact the Program Coordinator of DWP, (907) 269-7521.

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# Source Water Assessment for the Karluk Drinking Water System, Karluk

## Drinking Water Protection Alaska Department of Environmental Conservation

### EXECUTIVE SUMMARY

The public water system for Karluk, Alaska is a Class A water system that obtains water from a small seepage, directly south of the community. The Karluk protection area received a susceptibility rating of “very high”. *A rating of high to very high is typical for all systems with surface water intakes.* Potential and existing sources of the following contaminants were evaluated for the Source Water Assessment: bacteria and viruses, nitrates and/or nitrites, heavy metals, cyanide, and other inorganic chemicals, synthetic organic chemicals, volatile organic chemicals, and other organic chemicals. No potential sources of contaminants were identified for the drinking water source. This evaluation included all available water sampling data submitted to ADEC by the system operator. The samples may have been collected from either raw water or post-treated water. Combining the susceptibility of the surface water source with the contaminant risks, this water system has received a vulnerability rating of “medium” for each of the six contaminant categories. This assessment can be used as a foundation for local voluntary protection efforts as well as a basis for the continuous efforts on the part of the Karluk Community to protect public health.

### DRINKING WATER SYSTEM AND AREA OVERVIEW

Karluk (Sec. 17, T030S, R032W, Seward Meridian), is located on the west coast of Kodiak Island, on the Karluk River, 88 air miles southwest of Kodiak and 301 miles southwest of Anchorage. The current population is approximately 27 (ADCED, 2006).

The Karluk public water system is a Class A water system that operates year-round and obtains water from Nunulik Creek, directly south of the community.

The Indian Health Service constructed a piped water and community septic system in 1978. Water is supplied by a creek, is treated and stored in a 50,000-gallon tank. All occupied homes are fully plumbed. A feasibility study is needed to examine alternatives for water treatment, sewage disposal and solid waste. There is no refuse collection service, and the landfill is a temporary, unpermitted site. The school organizes

aluminum recycling. Electricity is provided by Alutiiq Power Company (ADCED, 2006).

The climate of the Kodiak Islands is dominated by a strong marine influence. There is little or no freezing weather, moderate precipitation, and frequent cloud cover and fog. Severe storms and winds are common from December through February. Annual precipitation is 23 inches. Temperatures remain within a narrow range, from 31 to 54 (ADCED, 2006).

The 1998 sanitary survey indicates that the water intake is screened but not protected from ice buildup and siltation. However, the intake is inspected on a monthly basis. The survey also states that the average daily production of the system is approximately 12,000 gallons per day.

### KARLUK DRINKING WATER PROTECTION AREA

Identifying the pathways most likely for surface contamination to reach water intake areas is the first step in determining the water system’s risk. These are initially determined by looking at the drainage area contributing overland water flow to a surface water source intake. The entire drainage area is also known as the “drinking water protection area”. Please refer to pages 10-11 of the “Guidance Manual for Class A Public Water Systems” for additional information.

The protection area established for surface water sources by the ADEC is usually separated into three zones, limited by the watershed boundary. These zones correspond to the overland-flow distance that water travels to get to the source. The ADEC Drinking Water Protection Technical Advisory Committee developed guidelines for derivation of these zones in 1998. The following is a summary of the three protection area zones:

**Table 1. Definition of Zones**

Zone	Definition
A	Areas within 1000-ft of lakes or streams
B	Areas within 1-mile of lakes or streams
C	The watershed boundary

The protection area for the Karluk water intake includes only Zones A and B. Due to the small size of the overall protection area, Zones B and C cover the same region (See Map 1 of Appendix A).

## INVENTORY OF POTENTIAL AND EXISTING CONTAMINANT SOURCES

Drinking Water Protection has completed an inventory of potential and existing sources of contamination within Karluk protection area. This inventory was completed through a search of agency records and other publicly available information. There is a wide array of potential contamination sources to surface water. These contaminants are found within agricultural, residential, commercial, and industrial areas, but *can also occur within areas that have little or no development.*

For Class A public water system assessments, six categories of drinking water contaminants were inventoried. They include:

- Bacteria and viruses;
- Nitrates and/or nitrites;
- Volatile organic chemicals;
- Heavy metals, cyanide, and other inorganic chemicals;
- Synthetic Organic Chemicals; and
- Other Organic Chemicals.

Sources identified in the Karluk protection area are displayed on Map 2 of Appendix C and summarized in Table 1 of Appendix B.

## RANKING OF CONTAMINANT RISKS

Once potential and existing sources of contamination have been identified, they are assigned a ranking according to what category and level of risk they represent. Ranking of contaminant risks for “potential” or “existing” sources of contamination is a function of the toxicity and the volume of specific contaminants associated with that source. Rankings include:

- Low
- Medium
- High
- Very High.

The time-of-travel for contaminants within the water is dependent on the physical and chemical characteristics of each contaminant. Bacteria and Viruses are only inventoried in Zone A because of their short life span. Only “Very High” and “High” rankings are inventoried within Zones B and C due to the probability of

contaminant dilution by the time the contaminants reach the water intake.

The remaining tables in Appendix B (if necessary) contain the ranking of potential and existing sources of contamination with respect to bacteria and viruses, nitrates and/or nitrites, volatile organic chemicals, heavy metals, cyanide, and other inorganic chemicals, synthetic organic chemicals, and other organic chemicals.

## VULNERABILITY OF THE DRINKING WATER SYSTEM

Vulnerability of a drinking water source to contamination is a combination of two factors:

- Surface Water Susceptibility; and
- Contaminant risks.

The Surface Water Susceptibility of the source is reached by considering the properties of the water intake and the surrounding area.

Susceptibility of the Surface Water Source (always considered “high”).

+

Adequate Construction of the Intake

+

Runoff Potential Within Zone B

+

Dilution Capacity of the Surface Water

=

Natural Susceptibility

**Table 2. Susceptibility of the Water Source**

<b>Overall Susceptibility</b>	<b>45</b>	<b>Rating Very High</b>
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For contaminants, risks to a drinking water source depend on the type, number or density, and distribution of the contaminant sources. The Contaminant Risk score has been derived from an examination of existing, and historical contamination sources that have been detected in the protection area through routine sampling. It also evaluates potential sources of contamination. Flow charts are used to assign a point score, and ratings are assigned in the same way as the susceptibility:

Table 3 summarizes the Contaminant Risks for each category of drinking water contaminants.

**Table 3. Karluk Contaminant Risks**

Category	Rating
Bacteria and Viruses	Low
Nitrates and/or Nitrites	Low
Volatile Organic Chemicals	Low
Heavy Metals, Cyanide, and Other Inorganic Chemicals	Low
Synthetic Organic Chemicals	Low
Other Organic Chemicals	Low

Finally, an overall vulnerability assigned for each contaminant type by combining each of the contaminant risk with the overall susceptibility:

$$\begin{array}{c} \text{Susceptibility of the Surface Water Source} \\ + \\ \text{Contaminant Risks} = \\ \text{Vulnerability of the} \\ \text{Drinking Water Source to Contamination} \end{array}$$

Table 4 contains the overall vulnerability scores and ratings for each of the six categories of drinking water contaminants. Note: scores are rounded off to the nearest five.

**Table 4. Karluk Overall Vulnerability**

Category	Rating
Bacteria and Viruses	Medium
Nitrates and Nitrites	Medium
Volatile Organic Chemicals	Medium
Heavy Metals, Cyanide, and Other Inorganic Chemicals	Medium
Synthetic Organic Chemicals	Medium
Other Organic Chemicals	Medium

#### **Bacteria and Viruses**

The contaminant risk for bacteria and viruses is “low”.

Coliforms (a bacteria) are found naturally in the environment and although they aren’t necessarily a health threat, they are an indicator of other potentially harmful bacteria in the water, more specifically, fecal coliforms and E. coli which only come from human and animal fecal waste. Harmful bacteria can cause diarrhea, cramps, nausea, headaches, or other symptoms

(EPA, 2006). Positive samples increase the overall vulnerability of the drinking water source, indicating that the source is susceptible to bacteria and virus contamination. Typically, coliform detection in raw water samples collected from surface water sources is normal.

No positive bacteria counts have been detected during the 2005 sampling period.

After combining the contaminant risk for bacteria and viruses with the natural susceptibility of the source, the overall vulnerability of the source to bacteria and virus contamination is considered “medium”.

#### **Nitrates and Nitrites**

The contaminant risk for nitrates and nitrites is “low”. Nitrates are very mobile, moving at approximately the same rate as water.

The Maximum Contaminant Level (MCL) for nitrates is 10 milligrams per liter (mg/L). The MCL is the maximum level of contaminant that is allowed to exist in drinking water and still be consumed by humans without harmful health effects (EPA, 2006).

Sampling history for the water source indicates that low concentrations of nitrates (below MCL) were detected in sampling performed in 2004-2005.

Since there are no potential contaminant sources within the protection area, the nitrate/nitrites source is deemed natural.

After combining the contaminant risk for nitrates and nitrites with the natural susceptibility of the source, the overall vulnerability of the source to contamination is “medium”.

#### **Volatile Organic Chemicals**

The contaminant risk for volatile organic chemicals is “low”.

Trihalomethanes were detected at levels below the MCL during sampling in 2004, although this chemical typically originates during the process of water treatment and not from the source water. The MCL for total trihalomethanes is 0.1 mg/L.

After combining the contaminant risk for volatile organic chemicals with the natural susceptibility of the source, the overall vulnerability of the source to contamination remains “medium”.

### **Heavy Metals, Cyanide, and Other Inorganic Chemicals**

years to reflect any changes in the vulnerability and/or susceptibility of the drinking water source.

The contaminant risk for heavy metals is “low”. Low levels of nickel were detected in samples collected during 2004. The MCL for nickel is 0.1 mg/l.

The source of this chemical may be the infrastructure of the distribution system following the treatment process, or as naturally occurring in the environment.

After combining the contaminant risk for heavy metals with the natural susceptibility of the source, the overall vulnerability of the well to contamination is “medium”.

See Table 5 in Appendix C for a listing of the identified possible sources of heavy metals, cyanide, and other organic chemicals in the Protection Area.

### **Synthetic Organic Chemicals**

The contaminant risk for synthetic organic chemicals is “low”. After combining the contaminant risk with the natural susceptibility of the source, the overall vulnerability to synthetic organic chemicals of the source is “medium”.

Review of the historical sampling data indicates that test results for 2,4-D in 1992 were negative.

See Table 6 in Appendix C for a listing of the identified possible sources of synthetic organic chemicals in the Protection Area.

### **Other Organic Chemicals**

The contaminant risk for other organic chemicals is “low”. After combining the contaminant risk with the natural susceptibility of the source, the overall vulnerability to other organic chemicals of the source is “medium”.

Review of the historical sampling data indicates that no other organic chemicals have been sampled recently.

See Table 7 in Appendix C for a listing of the identified possible sources of other organic chemicals in the Protection Area.

### **Using the Source Water Assessment**

This assessment of contaminant risks can be used as a foundation for local voluntary protection efforts as well as a basis for the continuous efforts on the part of Karluk to protect public health. It is anticipated that Source Water Assessments will be updated every five

## **REFERENCES**

Alaska Department of Community and Economic Development (ADCED), 2006 [WWW document]. URL: [http://www.dced.state.ak.us/cbd/commdb/CF\\_COMDB.htm](http://www.dced.state.ak.us/cbd/commdb/CF_COMDB.htm)

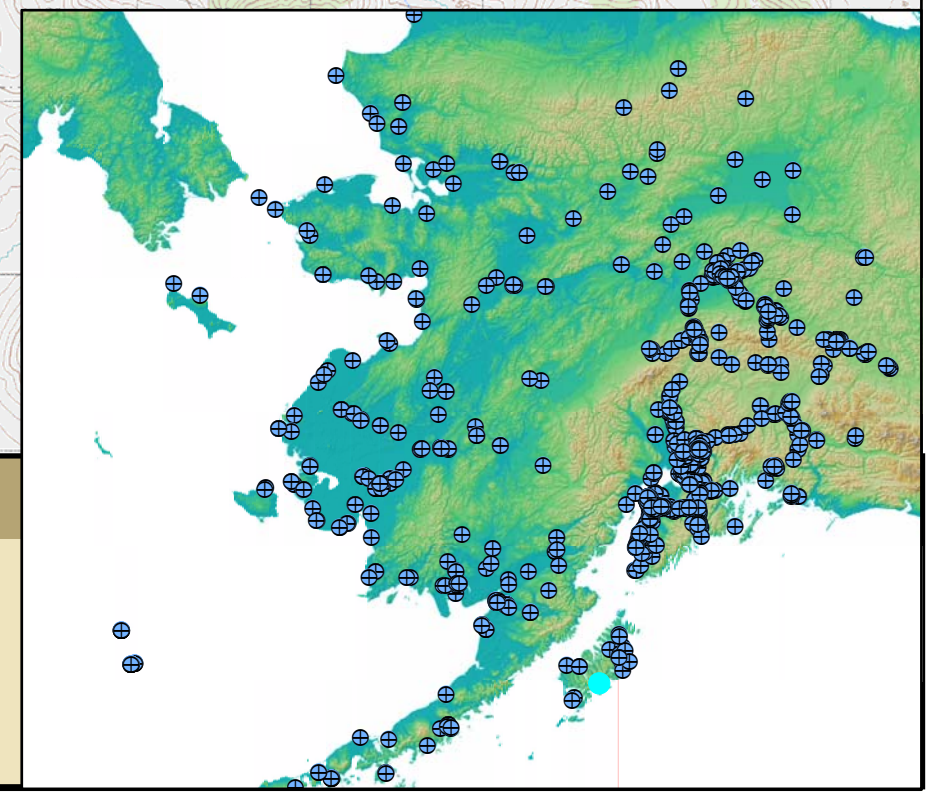
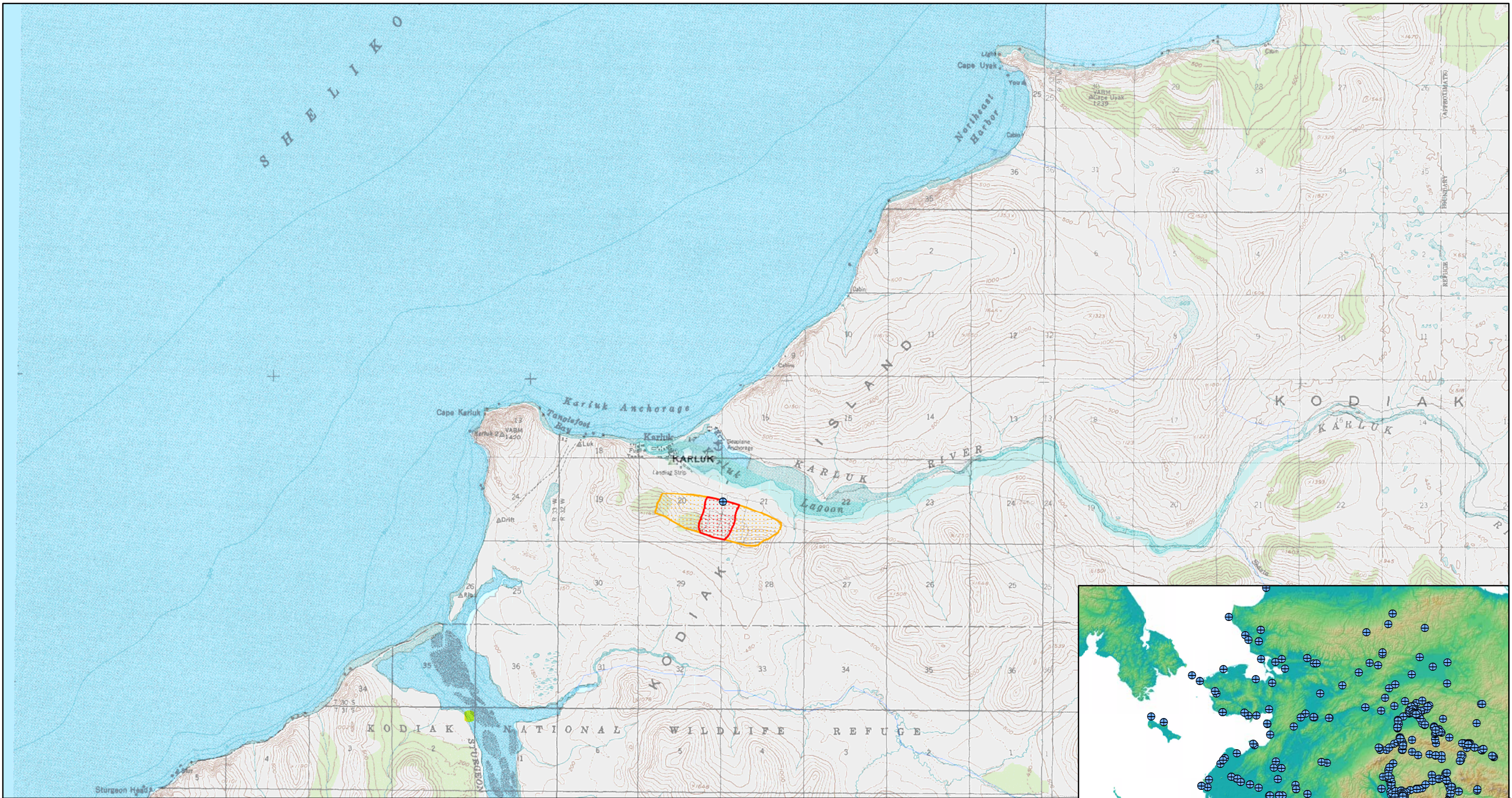
United States Environmental Protection Agency (EPA), 2006 [WWW document]. URL: <http://www.epa.gov/safewater/mcl.html>



## **APPENDIX A**

### **Karluk Utilities Drinking Water Protection Area Location Map (Map 1)**





Map 1- Karluk Community and Surrounding Water Systems

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0 1:70,020 13,800 Feet

Data Sources:  
Potential Sources of Contamination: ADEC

- ⊕ Public Water Sources
- Zone A Protection Area
- Zone B Protection Area



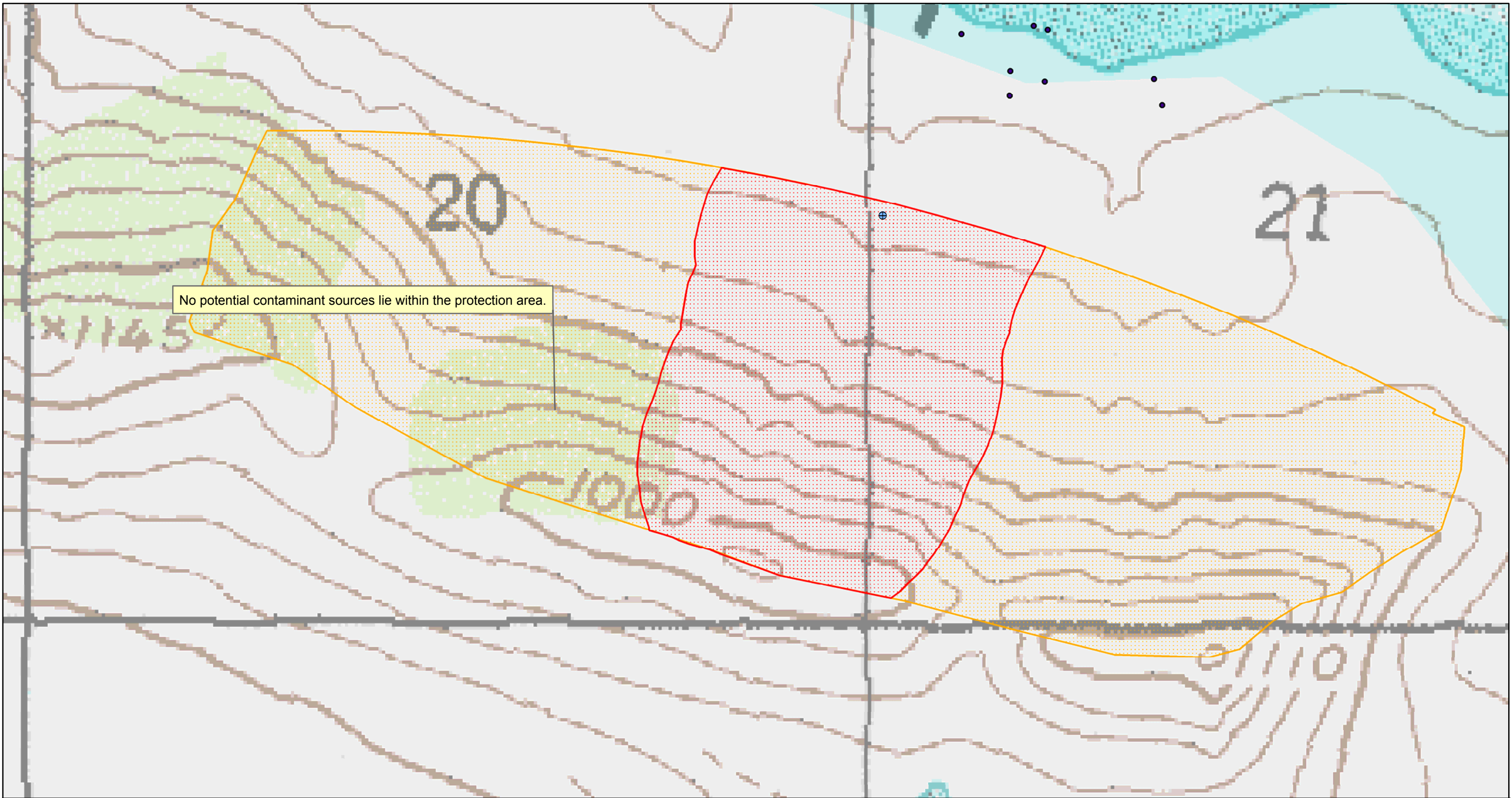
## **APPENDIX B**

### **Contaminant Source Inventory and Risk Rankings (Tables 1 - 7)**

<i>Contaminant Source Type</i>	<i>Contaminant Source ID</i>	<i>CS ID tag</i>	<i>Zone</i>	<i>Map Number</i>	<i>Comments</i>
					According to our data there are no potenial contaminant sources that have been identified within the protection area.

## **APPENDIX C**

### **Karluk Utilities Drinking Water Protection Area and Potential and Existing Contaminant Sources (Map 2)**



Map 1- Karluk Water System Potential Contaminants

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0 1:6,898 1,440 Feet

Data Sources:  
Potential Sources of Contamination: ADEC

