

Source Water Assessment

A Hydrogeologic Susceptibility and
Vulnerability Assessment for
Alutiiq Manufacturing Drinking Water
System,

Pt. McKenzie, Alaska

PWSID 220132

February 2006

DRINKING WATER PROTECTION REPORT Report 1569
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 Alutiiq Manufacturing Source of Public Drinking Water, Fairbanks Area, Alaska

Drinking Water Protection Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

This source water assessment provides an evaluation of the vulnerability of the public water system serving the Alutiiq Manufacturing to potential contamination. This Class A (community) water system consists of one well on Reeve Ave. just off of Point MacKenzie Road. The well received a natural susceptibility rating of **Low**. This rating is a combination of a susceptibility rating of **Low** for the actual wellhead and a **Medium** rating for the aquifer in which the well is drawing water from. Identified potential and current sources of contamination for the Alutiiq Manufacturing public water system include: residential and non-residential heating oil storage tanks, a residential septic system, roads, an above ground diesel tank, wildlife habitat, a welding shop, and a water supply well. These are considered as sources of bacteria and viruses, nitrates and/or nitrites, volatile organic chemicals (VOCs), heavy metals, cyanide, and other inorganic chemicals, synthetic organic chemicals (SOCs), and other organic chemicals (OOCs). Combining the natural susceptibility of the well with the contaminant risk, the public water system for Alutiiq Manufacturing received an overall vulnerability rating of **Low** for VOCs, OOCs, bacteria and viruses, nitrates/nitrites, and SOCs; and, a **High** for heavy metals, cyanide, and other inorganic chemicals.

ALUTIIQ MANUFACTURING PUBLIC DRINKING WATER SYSTEM

Alutiiq Manufacturing public water system is a Class A (NTNC) water system. The system consists of one well on Reeve Ave. just off of Point MacKenzie Road (T14N, R4W, Section 23, Seward Meridian) (See Map 1 of Appendix A). Point MacKenzie is located southwest of Wasilla in the Matanuska Susitna Borough (Please see the inset of Map 1 in Appendix A for location). The Borough's current population is 70,148 making it one of the largest population centers in the state (ADCED, 2006). Communities located within the Borough include: Wasilla, Houston, Sutton, and Willow.

The majority of residents located in the area use individual water wells or hauled water, and septic

systems (ADCED, 2006). Refuse is transported to the Palmer landfill, or is collected by private firms. According to the most recent sanitary survey (6/8/05) for this water system, the depth of the well is estimated at 300 feet below the ground surface. Mostly glacial moraine and outwash deposits mantle the surface of the Mat-Su Valley; not surprisingly most wells are located in unconsolidated layers comprised of well sorted sands and gravels. These layers vary substantially in size and distribution throughout the Valley (*Jokela, Munter and Evans, 1991*).

In the Mat-Su Valley, the groundwater is recharged mainly by snowmelt and precipitation infiltrating into the foothill slopes of the Talkeetna or Chugach Mountains, and by direct precipitation and snowmelt throughout the area. The direction of groundwater flow in the upper unconfined aquifers is more variable because of the influence of surficial topography and close connection of those aquifers with surface water bodies (*Jokela, Munter, and Evans, 1991*).

The Alutiiq Manufacturing public water system serves 3 residents and 47 non-residents through 4 service connections.

ALUTIIQ MANUFACTURING DRINKING WATER PROTECTION AREA

The pathways most likely for surface contamination to reach the groundwater are identified as the first step in determining a drinking water system's risk. These areas are determined by looking at the characteristics of the soil, groundwater, aquifer, and well.

The most probable area for contamination to reach the drinking water well is the area that contributes water to the well, the groundwater capture zone. The groundwater capture zone is located in the area circling the well (the area influenced by pumping) and also the area of the water table upgradient of the well, usually forming a parabola shape.

There are many different methods for calculating the size of capture zones. Drinking Water Protection (DWP) uses a combination of two simple groundwater flow equations, the Thiem and uniform flow equations for all groundwater wells screened in unconsolidated material. The orientation of the capture zone is then drawn using a water table elevation map (if available) or a land surface elevation map of the area. The capture

zone calculated by the DWP is an estimate using the available information and resources, and may differ slightly from the actual capture zone.

The parameters used to calculate the shape of this capture zone are general for the area and were obtained from various United States Geological Survey (USGS) reports, area well logs, and the Groundwater textbook by Freeze and Cherry (Freeze and Cherry, 1979).

Because of uncertainties and changing site conditions, a factor of safety is added to the groundwater capture zone to form the drinking water protection area for the well.

The protection areas established for wells are usually separated into two zones, limited by the watershed. These zones correspond to times-of-travel (TOT) of the water moving through the aquifer to the well (plus the factor of safety).

The following is a summary of the two zones for wells and the calculated time-of-travel for each:

Table 1. Definition of Zones

Zone	Definition
A	Several months travel time
B	Less than 2 years time-of-travel

The time of travel for contaminants within the water varies with their unique physical and chemical characteristics.

The drinking water protection area outlined for the Alutiiq Manufacturing on Map 1 of Appendix A will serve as the focus for voluntary protection efforts.

INVENTORY OF POTENTIAL AND EXISTING CONTAMINANT SOURCES

Drinking Water Protection (DWP) has completed an inventory of potential and existing sources of contamination within the Alutiiq Manufacturing protection area. This inventory was completed through a search of agency records and other publicly available information. Potential drinking water contaminants are found within agricultural, residential, commercial, and industrial areas, but can also occur within areas that have little or no development.

For the basis of all 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.

The sources are displayed on Map 2 of Appendix C and summarized in Table 1 of Appendix B.

RANKING OF CONTAMINANT RISKS

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

- Low
- Medium
- High
- Very High

Tables 2 through 7 in Appendix B contain the ranking of inventoried 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 chemical

VULNERABILITY OF ALUTIIQ MANUFACTURING DRINKING WATER SYSTEM

The vulnerability of public drinking water systems to regulated contaminants is determined by assessing the susceptibility of the wellhead, the susceptibility of the aquifer and the potential contaminant sources identified within the protection area.

The Drinking Water Protection developed a vulnerability assessment tool that assigns a vulnerability risk ranking based upon various factors associated with the well, aquifer and potential and existing contaminants identified within the protection area.

Factors contributing to the susceptibility of the wellhead are: whether the sanitary seal in place, protection from flooding, and if the well casing is properly grouted.

The wellhead for the Alutiiq Manufacturing received a **Low** susceptibility rating. The most recent sanitary survey (6/8/2005) indicates the well is capped with a sanitary seal, the land surface is sloped away from the well, and the well is grouted. A sanitary seal prevents potential contaminant from entering the well while sloping of the land surface and grouting help to prevent potential contaminants from traveling down the outside of the well casing.

Factors contributing to the susceptibility of the aquifer are: whether the aquifer is confined or unconfined, whether the well is completed in unconsolidated or fractured bedrock, whether wells and bore holes are penetrating the aquifer and, if applicable, the confining layer.

The aquifer the Alutiiq Manufacturing well is completed in received a **Medium** susceptibility rating. Table 2 summarizes the Susceptibility scores and ratings for Alutiiq Manufacturing.

Table 2: Susceptibility

	Rating
Susceptibility of the Wellhead	Low
Susceptibility of the Aquifer	Medium
Natural Susceptibility	Low

The Contaminant Risk has been derived from an evaluation of the routine sampling results of the water system and the presence of potential sources of contamination. Contaminant risks to a drinking water source depend on the type and distribution of contaminant sources.

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

Table 3. Contaminant Risks

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

Finally, an overall vulnerability is determined for each water system by combining each of the contaminant risk scores with the natural susceptibility score:

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

Table 4 contains the overall ratings for each of the six categories of drinking water contaminants.

Table 4. Overall Vulnerability

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

Bacteria and Viruses

The wildlife habitat in the protection area represent the greatest risk for bacteria and viruses to the drinking water well.

Only a small amount of bacteria and viruses are required to endanger public health. Coliforms are found naturally in the environment and although they aren't necessarily a health threat, it is 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 (EPA, 2006). Harmful bacteria can cause diarrhea, cramps, nausea, headaches, or other symptoms (EPA, 2006).

After combining the contaminant risk for bacteria and viruses with the natural susceptibility of the well, the overall vulnerability of the well to contamination is low.

Nitrates and Nitrites

The roads in the protection area also represent the greatest risk to to nitrates and nitrites for this source of public drinking water.

Nitrates are very mobile, moving at approximately the same rate as water. Nitrates have not been detected in in recent sampling history for the Alutiiq Manufacturing well.

After combining the contaminant risk for nitrates and nitrites with the natural susceptibility of the well, the overall vulnerability of the well to contamination is low.

Volatile Organic Chemicals

The welding shops, and storage tanks represent the greatest identified risk for volatile organic chemical contamination to the well.

Volatile Organic Chemicals have not been detected within source waters. After combining the contaminant risk for volatile organic chemicals with the natural susceptibility of the well, the overall vulnerability of the well to contamination is low.

Heavy Metals, Cyanide, and Other Inorganic Chemicals

The electrical equipment manufacturing plant represents the greatest risk for inorganic chemicals to the well.

Inorganic chemicals were sampled on 8/18/05. Arsenic was detected well above the maximum contaminant levels (MCL = 0.005mg/L). In greater quantities, arsenic is known to cause skin damage, problems with circulatory systems, and may create an increased risk of developing cancer (EPA, 2006).

After combining the contaminant risk for heavy metals, cyanide and other inorganic chemicals with the natural susceptibility of the well, the overall vulnerability of the well to contamination is high.

Synthetic Organic Chemicals

The residential septic systems represent the greatest risk for synthetic organic chemicals to the well.

Synthetic organic chemicals have not been sampled for in this water system.

After combining the contaminant risk for synthetic organic chemicals with the natural susceptibility of the well, the overall vulnerability of the well to contamination is low.

Other Organic Chemicals

The machine shop, roads, and septic represents the greatest risk for other organic chemicals to the well.

Other organic chemicals have not been sampled for in this water system.

After combining the contaminant risk for synthetic organic chemicals with the natural susceptibility of the well, the overall vulnerability of the well to contamination is low.

REFERENCES

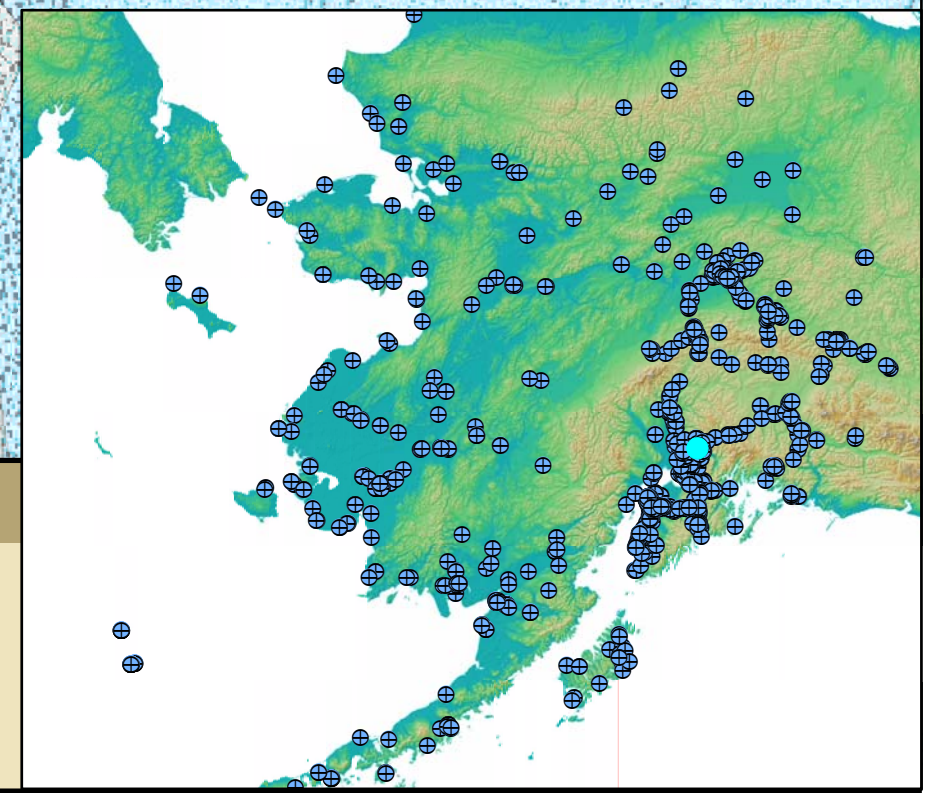
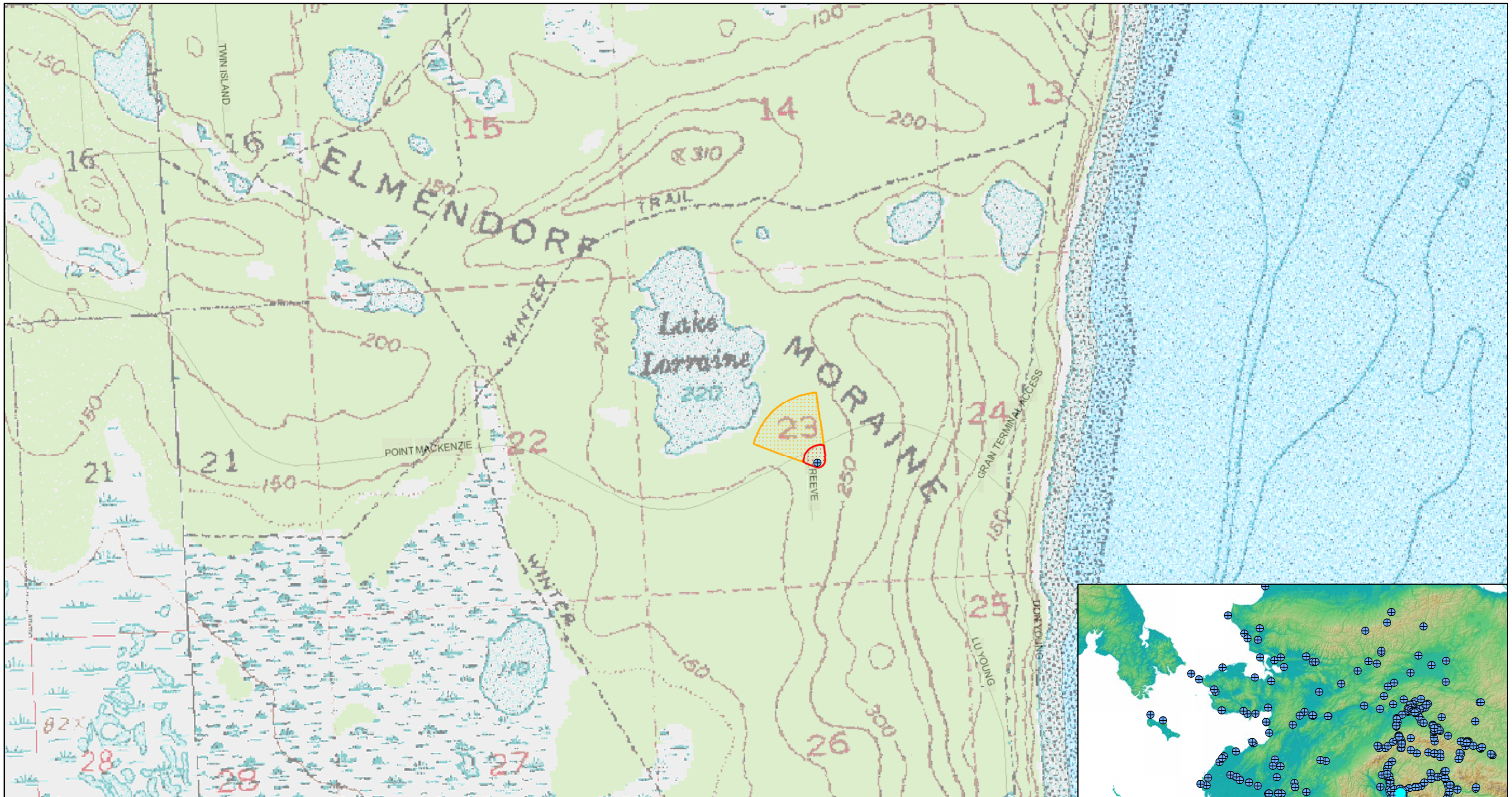
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APPENDIX A

Alutiiq Manufacturing Drinking Water Protection Area Location Map (Map 1)



Map 1- Alutiiq Manufacturing and Surrounding Systems

PWSID: 220132.001

Alaska Department of Environmental Conservation

Alaska Drinking Water Protection Program

0 1:18,354 4,600 Feet

Data Sources:
 Mat-Su Borough: Roads and parcels
 Aerial Photo: USGS and Microsoft Terraserver
 Potential Sources of Contamination: ADEC

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

APPENDIX B

Contaminant Source Inventory and Risk Ranking for Alutiiq Manufacturing (Tables 1-7)

Table 1

***Contaminant Source Inventory for
Alutiiq Manufacturing Contractors, LLC***

PWSID 220132.001

<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>
Highways and roads, paved (cement or asphalt)	X20	X20-1-2	A		
Wildlife habitat, densely populated (other than birds, salmon, beavers, etc.)	B11	B11-1	B		
Welding shops	C43	C43-1	B		
Septic systems (serves one single-family home)	R02	R02-1	B		
Tanks, heating oil, residential (above ground)	R08	R08-1	B		
Tanks, diesel (above ground)	T06	T06-1	B		
Closed tanks, heating oil, nonresidential (aboveground)	T15	T15-1	B		
Water supply wells	W09	W09-1	B		Possibly primary drinking water well.

Table 2

*Contaminant Source Inventory and Risk Ranking for
Alutiiq Manufacturing Contractors, LLC
Sources of Bacteria and Viruses*

PWSID 220132.001

<i>Contaminant Source Type</i>	<i>Contaminant Source ID</i>	<i>CS ID tag</i>	<i>Zone</i>	<i>Risk Ranking for Analysis</i>	<i>Map Number</i>	<i>Comments</i>
Highways and roads, paved (cement or asphalt)	X20	X20-1-2	A	Low		
Wildlife habitat, densely populated (other than birds, salmon, beavers, etc.)	B11	B11-1	B	Medium		
Septic systems (serves one single-family home)	R02	R02-1	B	Low		

Table 3

*Contaminant Source Inventory and Risk Ranking for
Alutiiq Manufacturing Contractors, LLC
Sources of Nitrates/Nitrites*

PWSID 220132.001

<i>Contaminant Source Type</i>	<i>Contaminant Source ID</i>	<i>CS ID tag</i>	<i>Zone</i>	<i>Risk Ranking for Analysis</i>	<i>Map Number</i>	<i>Comments</i>
Highways and roads, paved (cement or asphalt)	X20	X20-1-2	A	Low		
Wildlife habitat, densely populated (other than birds, salmon, beavers, etc.)	B11	B11-1	B	Low		
Septic systems (serves one single-family home)	R02	R02-1	B	Low		

Table 4

*Contaminant Source Inventory and Risk Ranking for
Alutiiq Manufacturing Contractors, LLC
Sources of Volatile Organic Chemicals*

PWSID 220132.001

<i>Contaminant Source Type</i>	<i>Contaminant Source ID</i>	<i>CS ID tag</i>	<i>Zone</i>	<i>Risk Ranking for Analysis</i>	<i>Map Number</i>	<i>Comments</i>
Highways and roads, paved (cement or asphalt)	X20	X20-1-2	A	Low		
Welding shops	C43	C43-1	B	Medium		
Septic systems (serves one single-family home)	R02	R02-1	B	Low		
Tanks, heating oil, residential (above ground)	R08	R08-1	B	Medium		
Tanks, diesel (above ground)	T06	T06-1	B	Medium		
Closed tanks, heating oil, nonresidential (aboveground)	T15	T15-1	B	Low		

Table 5

*Contaminant Source Inventory and Risk Ranking for
Alutiiq Manufacturing Contractors, LLC
Sources of Heavy Metals, Cyanide and Other Inorganic Chemicals*

PWSID 220132.001

<i>Contaminant Source Type</i>	<i>Contaminant Source ID</i>	<i>CS ID tag</i>	<i>Zone</i>	<i>Risk Ranking for Analysis</i>	<i>Map Number</i>	<i>Comments</i>
Highways and roads, paved (cement or asphalt)	X20	X20-1-2	A	Low		
Welding shops	C43	C43-1	B	Low		
Septic systems (serves one single-family home)	R02	R02-1	B	Low		

Table 6

*Contaminant Source Inventory and Risk Ranking for
Alutiiq Manufacturing Contractors, LLC
Sources of Synthetic Organic Chemicals*

PWSID 220132.001

<i>Contaminant Source Type</i>	<i>Contaminant Source ID</i>	<i>CS ID tag</i>	<i>Zone</i>	<i>Risk Ranking for Analysis</i>	<i>Map Number</i>	<i>Comments</i>
Septic systems (serves one single-family home)	R02	R02-1	B	Low		

Table 7

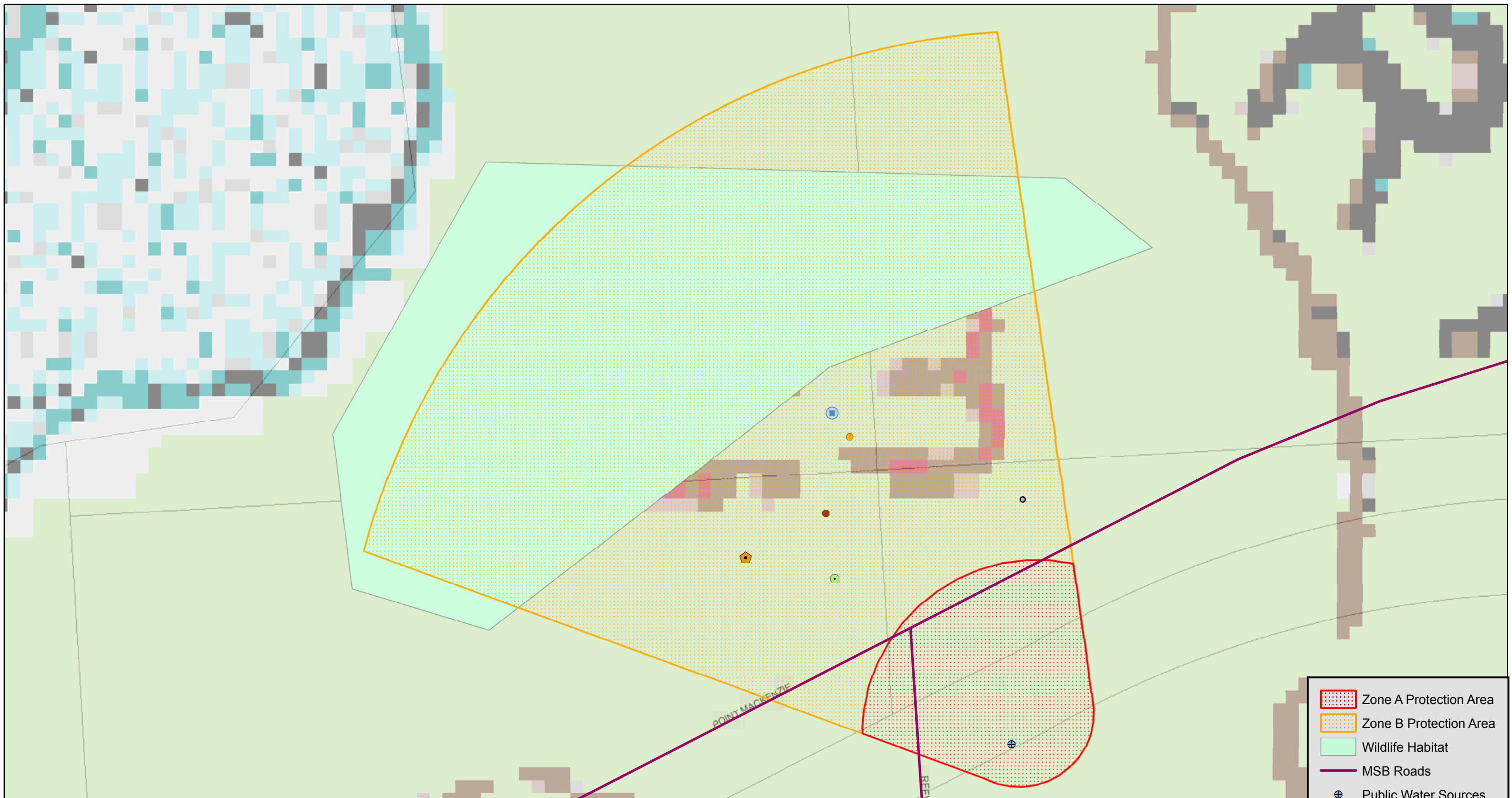
*Contaminant Source Inventory and Risk Ranking for
Alutiiq Manufacturing Contractors, LLC
Sources of Other Organic Chemicals*

PWSID 220132.001

<i>Contaminant Source Type</i>	<i>Contaminant Source ID</i>	<i>CS ID tag</i>	<i>Zone</i>	<i>Risk Ranking for Analysis</i>	<i>Map Number</i>	<i>Comments</i>
Highways and roads, paved (cement or asphalt)	X20	X20-1-2	A	Low		
Welding shops	C43	C43-1	B	Low		
Septic systems (serves one single-family home)	R02	R02-1	B	Low		

APPENDIX C

Alutiiq Manufacturing Drinking Water Protection Area and Potential and Existing Contaminant Sources (Map 2)



	Zone A Protection Area
	Zone B Protection Area
	Wildlife Habitat
	MSB Roads
	Public Water Sources
	C43
	R02
	R08
	T06
	T15
	W09

Map 2- Alutiiq Manufacturing Potential Contaminants

PWSID: 220132.001

0 1,181 480 Feet

Data Sources:
 Mat-Su Borough: Roads and Parcels
 Potential Sources of Contamination: ADEC