Source Water Assessment

A Hydrogeologic Susceptibility and Vulnerability Assessment for Chena Village Public Drinking Water System, Fairbanks, Alaska PWSID # 314679.001

DRINKING WATER PROTECTION REPORT 1792

Alaska Department of Environmental Conservation

January, 2009

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Chena Village
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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 (DEC), 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 DWP staff at the following number: 1-866-956-7656.

January, 2009

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Source Water Assessment for Chena Village Source of Public Drinking Water, Fairbanks, Alaska

Drinking Water Protection
Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

The public water system for Chena Village is a Class B (transient/non-community) water system consisting of one well at the end of Tall Spruce Road in Fairbanks, Alaska. The wellhead received a susceptibility rating of **Very High** and the aquifer received a susceptibility rating of **Very High**. Combining these two ratings produces a **Very High** rating for the natural susceptibility of the well. Identified potential and current sources of contaminants for the Chena Village public drinking water source include: construction areas, septic systems, heating oil tanks, Open Leaking Underground Fuel Storage Tank (LUST) sites, gasoline stations, diesel and gasoline tanks, an airport, and others (see Appendix B, Table 1). These identified potential and existing sources of contamination are considered as sources of bacteria and viruses, nitrates and/or nitrites, and volatile organic chemicals. Overall, the public water sources for Chena Village received a vulnerability rating of **Very High** for all three contaminant categories. 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 Chena Village to protect public health.

CHENA VILLAGE PUBLIC DRINKING WATER SYSTEM

The Chena Village public water system is a Class B (transient/non-community) water system. The system consists of one well at the end of Tall Spruce Road, west of Fairbanks International Airport, in Fairbanks, Alaska (see Map A of Appendix A). Fairbanks and its surrounding communities are located in the Fairbanks North Star Borough which is near the center of Alaska. The Borough's current population is 96,888 making it the second-largest population center in the state. Communities located within the Borough include: College, Eielson Air Force Base, Ester, Fairbanks, Fox, Harding Lake, Moose Creek, North Pole, Pleasant Valley, Salcha, and Two Rivers (ADCCED, 2009).

Sewage and treated water facilities are provided by a private company within Fairbanks. Fifteen circulating pump stations distribute treated water. Wells and septic systems are also used within and outside Fairbanks. Heating oil (stored in both above- and below-ground tanks) is used for heating homes and buildings. Refuse is transported to the Fairbanks North Star Borough landfill (ADCCED, 2009).

According to the well log, the well extends 40 feet below the ground surface and is completed in an unconfined aquifer of sand and gravel. This system operates from May to September and serves approximately 1000 non-residents through one service connection.

CHENA VILLAGE DRINKING WATER PROTECTION AREA

In order to evaluate whether a drinking water source is at risk, we must first evaluate what are the most likely pathways for surface contamination to reach the groundwater. 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 drinking water protection area. The drinking water protection area is the area circling the well (the area influenced by pumping) and also the area upgradient of the well, usually forming a parabola shape. Because releases of contaminants within the protection area are most likely to impact the well, this area will serve as the focus for voluntary protection efforts.

There are many different methods for calculating the size of protection areas. 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 protection zone is then drawn using a water table elevation map (if available) or a land surface elevation map of the area. The protection zone calculated by the DWP is an estimate using the available information and resources, and may differ slightly from the actual capture zone. Because of uncertainties and changing site conditions, a factor of safety is added to the protection zone to form the drinking water protection area for the well.

The parameters used to calculate the shape of this protection zone are general for the whole alluvial plain 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).

The protection areas established for wells by the DEC are usually separated into two zones, limited by the watershed. These zones correspond to differences in the time-of-travel (TOT) of the water moving through the aquifer to the well. An analytical calculation was used to determine the size and shape of the protection area.

The time-of-travel for contaminants within the water varies and is dependent on the physical and chemical characteristics of each contaminant. The following is a summary of the two protection area zones for wells and the calculated time-of-travel for each:

Table 1. Definition of Zones

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

The drinking water protection area for Chena Village was determined using an analytical calculation and includes Zones A and B (See Map A of Appendix A).

INVENTORY OF POTENTIAL AND EXISTING CONTAMINANT SOURCES

DWP has completed an inventory of potential and existing sources of contamination within the Chena Village drinking water protection area. This inventory was completed through a search of agency records and other publicly available information. Potential sources of contamination to the drinking water aquifer include a wide range of categories and types. 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 B public water system assessments, the following three categories of drinking water contaminants were inventoried:

- Bacteria and viruses;
- Nitrates and/or nitrites;
- Volatile organic chemicals

The sources are displayed on Map C 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 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 function of toxicity and volumes of specific contaminants associated with that source. Rankings include:

- Low;
- Medium;
- High; and
- Very High.

Tables 2 through 4 in Appendix B contain the ranking of potential and existing sources of contamination with respect to bacteria and viruses, nitrates and/or nitrites, and volatile organic chemicals.

VULNERABILITY OF CHENA VILLAGE DRINKING WATER SYSTEM

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

- Natural Susceptibility; and
- Contaminant Risks.

A score for the Natural Susceptibility of the well is reached by considering the properties of the well and the aquifer.

Susceptibility of the Wellhead (0-25 Points)
+
Susceptibility of the Aquifer (0-25 Points)
=
Natural Susceptibility of the Well (0-50 Points)

A ranking is assigned for the Natural Susceptibility according to the point score:

Natural Susceptibility Ratings	
40-50 pts	Very High
30 to < 40 pts	High
20 to < 30 pts	Medium
< 20 pts	Low

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

The wellhead for the Chena Village received a **Very High** susceptibility rating. The sanitary survey (05/18/2001) indicates the well is capped and the land surface is appropriately sloped away from the well. However, the well is not grouted according to DEC regulations and lies within a floodplain. Sanitary seals prevent potential contaminants from entering the well, while sloping of the land surface away from the wellhead provides adequate surface water drainage, and

concrete or grouting around the wellhead helps 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 Chena Village system draws water from an unconfined aquifer. The aquifer received a **Very High** susceptibility rating because its unconfined nature and the presence of other wells penetrating the vadose zone of the protection area. Because an unconfined aquifer is recharged by surface water and precipitation that migrates downward from the surface, it is susceptible to contamination from outside sources. Furthermore, the presence of other wells penetrating the vadose zone of the protection area can allow contaminants to travel into the shared aquifer with precipitation and runoff.

Table 2 summarizes the Susceptibility scores and ratings for the Chena Village system.

Table 2. Susceptibility

	Score	Rating
Susceptibility of the Wellhead	25	Very High
Susceptibility of the Aquifer	25	Very High
Natural Susceptibility	50	Very High

Contaminant risks are 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. Flow charts are used to assign a point score, and ratings are assigned in the same way as for the natural susceptibility:

Contaminant Risk Ratings	
40-50 pts	Very High
30 to < 40 pts	High
20 to < 30 pts	Medium
< 20 pts	Low

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

Table 3. Contaminant Risks

Category	Score	Rating
Bacteria and Viruses	45	Very High
Nitrates and/or Nitrites	45	Very High
Volatile Organic Chemicals	50	Very High

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

Natural Susceptibility (0-50 Points)
+
Contaminant Risks (0-50 Points)
=
Vulnerability of the Drinking Water Source to Contamination (0-100 Points)

Again, rankings are assigned according to a point score:

Overall Vulnerability Ratings	
80-100 pts	Very High
60 to < 80 pts	High
40 to < 60 pts	Medium
< 40 pts	Low

Table 4 contains the overall vulnerability scores (0-100) and ratings for each of the three categories of drinking water contaminants for the Chena Village system. Note: scores are rounded off to the nearest five.

Table 4. Overall Vulnerability

Category	Score	Rating
Bacteria and Viruses	95	Very High
Nitrates and/or Nitrites	95	Very High
Volatile Organic Chemicals	100	Very High

Bacteria and Viruses

The contaminant risk for bacteria and viruses is **Very High** with septic systems, roads, a campground, a kennel, a boat engine repair shop, domestic wastewater collection systems, large-capacity septic systems, a motor vehicle waste disposal well, and a beverage industry site contributing to the risk to the drinking water well.

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, 2008).

Only a small amount of bacteria and viruses are required to endanger public health. Positive samples increase the overall vulnerability of the drinking water source, indicating that the source is susceptible to bacteria and virus contamination. Bacteria and viruses have not been detected during recent water sampling of the system at Chena Village (data reviewed in April, 2008).

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 **Very High**.

Nitrates and Nitrites

The contaminant risk for nitrates and nitrites is **Very High** with septic systems, an airport, roads, a campground, a kennel, domestic wastewater collection systems, large-capacity septic systems, and a quarry contributing to the risk to this source of public drinking water.

The sampling history for Chena Village well indicates that nitrates have not been detected in the water in the past five years (data reviewed in April, 2008).

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 **Very High**.

Volatile Organic Chemicals

The contaminant risk for volatile organic chemicals is **Very High** with an aircraft maintenance shop, a construction trade area, a furniture manufacturer, septic systems, heating oil tanks, an airport, roads, a campground, boat engine repair shop, gasoline stations, heavy equipment rental/storage, laboratory, domestic wastewater collection systems, large-capacity septic systems, motor vehicle waste disposal well, and other sites (see Appendix B, Table 4) contributing to the risk to the drinking water well.

The drinking water at Chena Village has not been recently sampled for volatile organic chemicals (data reviewed in April, 2008).

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 **Very High**.

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 Chena Village to protect public health. It is anticipated that Source Water Assessments will be updated every five years to reflect any changes in the vulnerability and/or susceptibility of Chena Village drinking water source.

REFERENCES

Alaska Department of Commerce, Community and Economic Development (ADCCED), Accessed 2009 [WWW document]. URL: http://www.commerce.state.ak.us/dca/commdb/CF_COMDB.htm

Freeze, R.A. and Cherry, J.A., 1979. Groundwater. Prentice-Hall, Englewood Cliffs, NJ.

United States Environmental Protection Agency (EPA), Accessed 2008 [WWW document]. URL: http://www.epa.gov/safewater/contaminants/index.html.

APPENDIX A

Chena Village
Drinking Water Protection Area Location Map
(Map A)

Public Water Well System for PWS #314679.001 Chena Village

Legend

Class B Public Water System

Groundwater Protection Zones

Zone A Protection Area - Several Months Travel Time

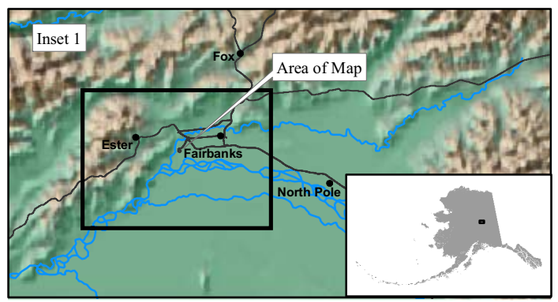
Zone B Protection Area - 2 Years Travel Time

Data Sources:
Contaminant Sources, Public Water System Wells, Alaska Department of Environmental Conservation (ADEC)

All other data:
Alaska Statewide Digital Mapping Initiative (SDMI)

Drinking Water Protection Areas based on "Alaska Drinking Water Protection Program - Guidance Manual for Class B Public Water Systems" published by ADEC

URS Corporation does not guarantee the accuracy or validity of the data provided.



N
W E
S

0 12,500 25,000 50,000 Feet

Chena Village
PWS 314679.001

Appendix A Map A

APPENDIX B

Contaminant Source Inventory and Risk Ranking for Chena Village (Tables 1-4)

Table 1

Contaminant Source Inventory for ***Chena Village***

PWSID 314679.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Map Number*	*Comments*
Aircraft maintenance shops	C01	C01	A	C	
Construction trade areas and materials	C09	C09	A	C	
Furniture manufacturing, repair, and finishing shops	C14	C14	A	C	
Septic systems (serves one single-family home)	R02	R02	A	C	52 assumed
Tanks, heating oil, residential (above ground)	R08	R08	A	C	52 inferred
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04	A	C	
Open Leaking Underground Fuel Storage Tank (LUST) Sites	U07	U07	A	C	
Airports	X14	X14	A	C	
Highways and roads, paved (cement or asphalt)	X20	X20	A	C	7 roads
Campgrounds and RV Parks	X35	X35	A	C	
Kennels	X49	X49	A	C	
Aircraft maintenance shops	C01	C01	B	C	
Aircraft maintenance shops	C01	C01	B	C	
Aircraft maintenance shops	C01	C01	B	C	
Boat engine/body repair shops	C04	C04	B	C	
Construction trade areas and materials	C09	C09	B	C	
Construction trade areas and materials	C09	C09	B	C	
Gasoline stations (without repair shop)	C15	C15	B	C	
Gasoline stations (without repair shop)	C15	C15	B	C	
Gasoline stations (with repair shop)	C16	C16	B	C	
Heavy equipment rental/storage	C18	C18	B	C	
Heavy equipment rental/storage	C18	C18	B	C	
Heavy equipment rental/storage	C18	C18	B	C	
Laboratories (chemical, soils, and research)	C20	C20	B	C	

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Map Number*	*Comments*
Motor vehicle dealerships - cars, trucks, motor cycles, ATV's, snow machines, boats (with service department)	C27	C27	B	C	
Motor vehicle rental facilities - cars, trucks, ATV's, snow machines (without service department)	C29	C29	B	C	
Motor vehicle rental facilities - cars, trucks, ATV's, snow machines (without service department)	C29	C29	B	C	
Motor vehicle rental facilities - cars, trucks, ATV's, snow machines (with service department)	C30	C30	B	C	
Motor vehicle rental facilities - cars, trucks, ATV's, snow machines (with service department)	C30	C30	B	C	
Motor vehicle rental facilities - cars, trucks, ATV's, snow machines (with service department)	C30	C30	B	C	
Motor /motor vehicle repair shops	C31	C31	B	C	
Motor /motor vehicle repair shops	C31	C31	B	C	
Paint sales /service	C32	C32	B	C	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D01	B	C	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10	B	C	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10	B	C	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10	B	C	
Injection wells (Class V) Motor Vehicle Waste Disposal Well	D42	D42	B	C	
Injection wells (Class V) Motor Vehicle Waste Disposal Well	D42	D42	B	C	
Metals mining, placer (active or inactive?)	E04	E04	B	C	
Quarries (sand, gravel, rock, other?)	E10	E10	B	C	
Beverage industry	I07	I07	B	C	
Septic systems (serves one single-family home)	R02	R02	B	C	235 assumed
Tanks, heating oil, residential (above ground)	R08	R08	B	C	235 inferred
Tanks, diesel (underground)	T08	T08	B	C	
Tanks, diesel (underground)	T08	T08	B	C	
Tanks, diesel (underground)	T08	T08	B	C	

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Map Number*	*Comments*
Tanks, diesel (underground)	T08	T08	B	C	
Tanks, diesel (underground)	T08	T08	B	C	
Tanks, diesel (underground)	T08	T08	B	C	
Closed tanks, diesel (underground)	T09	T09	B	C	
Tanks, gasoline (underground)	T12	T12	B	C	
Tanks, gasoline (underground)	T12	T12	B	C	
Tanks, gasoline (underground)	T12	T12	B	C	
Tanks, gasoline (underground)	T12	T12	B	C	
Tanks, gasoline (underground)	T12	T12	B	C	
Tanks, gasoline (underground)	T12	T12	B	C	
Tanks, gasoline (underground)	T12	T12	B	C	
Tanks, gasoline (underground)	T12	T12	B	C	
Tanks, gasoline (underground)	T12	T12	B	C	
Tanks, gasoline (underground)	T12	T12	B	C	
Tanks, gasoline (underground)	T12	T12	B	C	
Tanks, gasoline (underground)	T12	T12	B	C	
Tanks, gasoline (underground)	T12	T12	B	C	
Tanks, gasoline (underground)	T12	T12	B	C	
Tanks, gasoline (underground)	T12	T12	B	C	
Tanks, gasoline (underground)	T12	T12	B	C	
Closed tanks, gasoline (underground)	T13	T13	B	C	
Closed tanks, gasoline (underground)	T13	T13	B	C	
Closed tanks, gasoline (underground)	T13	T13	B	C	
Closed tanks, gasoline (underground)	T13	T13	B	C	
Closed tanks, gasoline (underground)	T13	T13	B	C	
Closed tanks, gasoline (underground)	T13	T13	B	C	
Closed tanks, gasoline (underground)	T13	T13	B	C	
Closed tanks, gasoline (underground)	T13	T13	B	C	

Contaminant Source Type	***Contaminant Source ID***	***CS ID tag***	***Zone***	***Map Number***	***Comments***
Closed tanks, gasoline (underground)	T13	T13	B	C	
Closed tanks, gasoline (underground)	T13	T13	B	C	
Closed tanks, gasoline (underground)	T13	T13	B	C	
Closed tanks, gasoline (underground)	T13	T13	B	C	
Tanks, heating oil, nonresidential (underground)	T16	T16	B	C	
Tanks, heating oil, nonresidential (underground)	T16	T16	B	C	
Tanks, heating oil, nonresidential (underground)	T16	T16	B	C	
Tanks, heating oil, nonresidential (underground)	T16	T16	B	C	
Tanks, heating oil, nonresidential (underground)	T16	T16	B	C	
Tanks, heating oil, nonresidential (underground)	T16	T16	B	C	
Tanks, heating oil, nonresidential (underground)	T16	T16	B	C	
Closed tanks, heating oil, nonresidential (underground)	T17	T17	B	C	
Closed tanks, lubricants or other petroleum products (underground)	T21	T21	B	C	
Closed Wastewater Holding Tank	T23	T23	B	C	
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04	B	C	
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04	B	C	
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04	B	C	
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04	B	C	
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04	B	C	
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04	B	C	
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04	B	C	
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04	B	C	
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04	B	C	
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04	B	C	
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04	B	C	
Open Leaking Underground Fuel Storage Tank (LUST) Sites	U07	U07	B	C	
Open Leaking Underground Fuel Storage Tank (LUST) Sites	U07	U07	B	C	

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Map Number*	*Comments*
Open Leaking Underground Fuel Storage Tank (LUST) Sites	U07	U07	B	C	
Open Leaking Underground Fuel Storage Tank (LUST) Sites	U07	U07	B	C	
Open Leaking Underground Fuel Storage Tank (LUST) Sites	U07	U07	B	C	
Open Leaking Underground Fuel Storage Tank (LUST) Sites	U07	U07	B	C	
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Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Map Number*	*Comments*
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Open Leaking Underground Fuel Storage Tank (LUST) Sites	U07	U07	B	C	
Open Leaking Underground Fuel Storage Tank (LUST) Sites	U07	U07	B	C	
Open Leaking Underground Fuel Storage Tank (LUST) Sites	U07	U07	B	C	
Open Leaking Underground Fuel Storage Tank (LUST) Sites	U07	U07	B	C	
Open Leaking Underground Fuel Storage Tank (LUST) Sites	U07	U07	B	C	
Open Leaking Underground Fuel Storage Tank (LUST) Sites	U07	U07	B	C	
Open Leaking Underground Fuel Storage Tank (LUST) Sites	U07	U07	B	C	
Open Leaking Underground Fuel Storage Tank (LUST) Sites	U07	U07	B	C	
Open Leaking Underground Fuel Storage Tank (LUST) Sites	U07	U07	B	C	
Open Leaking Underground Fuel Storage Tank (LUST) Sites	U07	U07	B	C	
Open Leaking Underground Fuel Storage Tank (LUST) Sites	U07	U07	B	C	
Closed Leaking Underground Fuel Storage Tank (LUST) Sites	U08	U08	B	C	
Closed Leaking Underground Fuel Storage Tank (LUST) Sites	U08	U08	B	C	
Closed Leaking Underground Fuel Storage Tank (LUST) Sites	U08	U08	B	C	
Closed Leaking Underground Fuel Storage Tank (LUST) Sites	U08	U08	B	C	
Closed Leaking Underground Fuel Storage Tank (LUST) Sites	U08	U08	B	C	
Closed Leaking Underground Fuel Storage Tank (LUST) Sites	U08	U08	B	C	
Closed Leaking Underground Fuel Storage Tank (LUST) Sites	U08	U08	B	C	
Closed Leaking Underground Fuel Storage Tank (LUST) Sites	U08	U08	B	C	
Closed Leaking Underground Fuel Storage Tank (LUST) Sites	U08	U08	B	C	
Closed Leaking Underground Fuel Storage Tank (LUST) Sites	U08	U08	B	C	
Closed Leaking Underground Fuel Storage Tank (LUST) Sites	U08	U08	B	C	
Airports	X14	X14	B	C	
Airports	X14	X14	B	C	
Boat yards and marinas	X15	X15	B	C	

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Map Number*	*Comments*
Highways and roads, paved (cement or asphalt)	X20	X20	B	C	15 roads
Motor vehicle/general storage yards/facilities	X27	X27	B	C	
Motor vehicle/general storage yards/facilities	X27	X27	B	C	
Fire training facilities	X39	X39	B	C	

Table 2

Contaminant Source Inventory and Risk Ranking for Chena Village

Sources of Bacteria and Viruses

PWSID 314679.001

Contaminant Source Type	***Contaminant Source ID***	***CS ID tag***	***Zone***	***Risk Ranking for Analysis***	***Map Number***	***Comments***
Septic systems (serves one single-family home)	R02	R02	A	Low	C	52 assumed
Highways and roads, paved (cement or asphalt)	X20	X20	A	Low	C	7 roads
Campgrounds and RV Parks	X35	X35	A	Low	C	
Kennels	X49	X49	A	Medium	C	
Boat engine/body repair shops	C04	C04	B	Medium	C	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D01	B	Medium	C	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10	B	High	C	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10	B	High	C	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10	B	High	C	
Injection wells (Class V) Motor Vehicle Waste Disposal Well	D42	D42	B	Low	C	
Injection wells (Class V) Motor Vehicle Waste Disposal Well	D42	D42	B	Low	C	
Beverage industry	I07	I07	B	Low	C	
Septic systems (serves one single-family home)	R02	R02	B	Low	C	235 assumed
Highways and roads, paved (cement or asphalt)	X20	X20	B	Low	C	15 roads

Table 3

Contaminant Source Inventory and Risk Ranking for Chena Village
Sources of Nitrates/Nitrites

PWSID 314679.001

Contaminant Source Type	***Contaminant Source ID***	***CS ID tag***	***Zone***	***Risk Ranking for Analysis***	***Map Number***	***Comments***
Septic systems (serves one single-family home)	R02	R02	A	Low	C	52 assumed
Airports	X14	X14	A	Low	C	
Highways and roads, paved (cement or asphalt)	X20	X20	A	Low	C	7 roads
Campgrounds and RV Parks	X35	X35	A	Low	C	
Kennels	X49	X49	A	Medium	C	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D01	B	Medium	C	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10	B	High	C	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10	B	High	C	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10	B	High	C	
Quarries (sand, gravel, rock, other?)	E10	E10	B	Low	C	
Septic systems (serves one single-family home)	R02	R02	B	Low	C	235 assumed
Airports	X14	X14	B	Low	C	
Airports	X14	X14	B	Low	C	
Highways and roads, paved (cement or asphalt)	X20	X20	B	Low	C	15 roads

Table 4

Contaminant Source Inventory and Risk Ranking for Chena Village
Sources of Volatile Organic Chemicals

PWSID 314679.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Aircraft maintenance shops	C01	C01	A	Low	C	
Construction trade areas and materials	C09	C09	A	Low	C	
Furniture manufacturing, repair, and finishing shops	C14	C14	A	Medium	C	
Septic systems (serves one single-family home)	R02	R02	A	Low	C	52 assumed
Tanks, heating oil, residential (above ground)	R08	R08	A	Medium	C	52 inferred
Airports	X14	X14	A	High	C	
Highways and roads, paved (cement or asphalt)	X20	X20	A	Low	C	7 roads
Campgrounds and RV Parks	X35	X35	A	Low	C	
Aircraft maintenance shops	C01	C01	B	Low	C	
Aircraft maintenance shops	C01	C01	B	Low	C	
Aircraft maintenance shops	C01	C01	B	Low	C	
Boat engine/body repair shops	C04	C04	B	Medium	C	
Construction trade areas and materials	C09	C09	B	Low	C	
Construction trade areas and materials	C09	C09	B	Low	C	
Gasoline stations (without repair shop)	C15	C15	B	High	C	
Gasoline stations (without repair shop)	C15	C15	B	High	C	
Gasoline stations (with repair shop)	C16	C16	B	High	C	
Heavy equipment rental/storage	C18	C18	B	Medium	C	
Heavy equipment rental/storage	C18	C18	B	Medium	C	
Heavy equipment rental/storage	C18	C18	B	Medium	C	

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Laboratories (chemical, soils, and research)	C20	C20	B	Low	C	
Motor vehicle dealerships - cars, trucks, motor cycles, ATV's, snow machines, boats (with service department)	C27	C27	B	Medium	C	
Motor vehicle rental facilities - cars, trucks, ATV's, snow machines (without service department)	C29	C29	B	Low	C	
Motor vehicle rental facilities - cars, trucks, ATV's, snow machines (without service department)	C29	C29	B	Low	C	
Motor vehicle rental facilities - cars, trucks, ATV's, snow machines (with service department)	C30	C30	B	Medium	C	
Motor vehicle rental facilities - cars, trucks, ATV's, snow machines (with service department)	C30	C30	B	Medium	C	
Motor vehicle rental facilities - cars, trucks, ATV's, snow machines (with service department)	C30	C30	B	Medium	C	
Motor /motor vehicle repair shops	C31	C31	B	Medium	C	
Motor /motor vehicle repair shops	C31	C31	B	Medium	C	
Paint sales /service	C32	C32	B	Medium	C	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D01	B	Low	C	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10	B	Low	C	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10	B	Low	C	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10	B	Low	C	
Injection wells (Class V) Motor Vehicle Waste Disposal Well	D42	D42	B	High	C	

Table 4 (continued)

Contaminant Source Inventory and Risk Ranking for Chena Village

Sources of Volatile Organic Chemicals

PWSID 314679.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Injection wells (Class V) Motor Vehicle Waste Disposal Well	D42	D42	B	High	C	
Quarries (sand, gravel, rock, other?)	E10	E10	B	Low	C	
Septic systems (serves one single-family home)	R02	R02	B	Low	C	235 assumed
Tanks, heating oil, residential (above ground)	R08	R08	B	Medium	C	235 inferred
Tanks, diesel (underground)	T08	T08	B	High	C	
Tanks, diesel (underground)	T08	T08	B	High	C	
Tanks, diesel (underground)	T08	T08	B	High	C	
Tanks, diesel (underground)	T08	T08	B	High	C	
Tanks, diesel (underground)	T08	T08	B	High	C	
Tanks, diesel (underground)	T08	T08	B	High	C	
Closed tanks, diesel (underground)	T09	T09	B	Medi	C	
Tanks, gasoline (underground)	T12	T12	B	High	C	
Tanks, gasoline (underground)	T12	T12	B	High	C	
Tanks, gasoline (underground)	T12	T12	B	High	C	
Tanks, gasoline (underground)	T12	T12	B	High	C	
Tanks, gasoline (underground)	T12	T12	B	High	C	
Tanks, gasoline (underground)	T12	T12	B	High	C	
Tanks, gasoline (underground)	T12	T12	B	High	C	
Tanks, gasoline (underground)	T12	T12	B	High	C	
Tanks, gasoline (underground)	T12	T12	B	High	C	

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Contaminant Source Inventory and Risk Ranking for Chena Village
Sources of Volatile Organic Chemicals

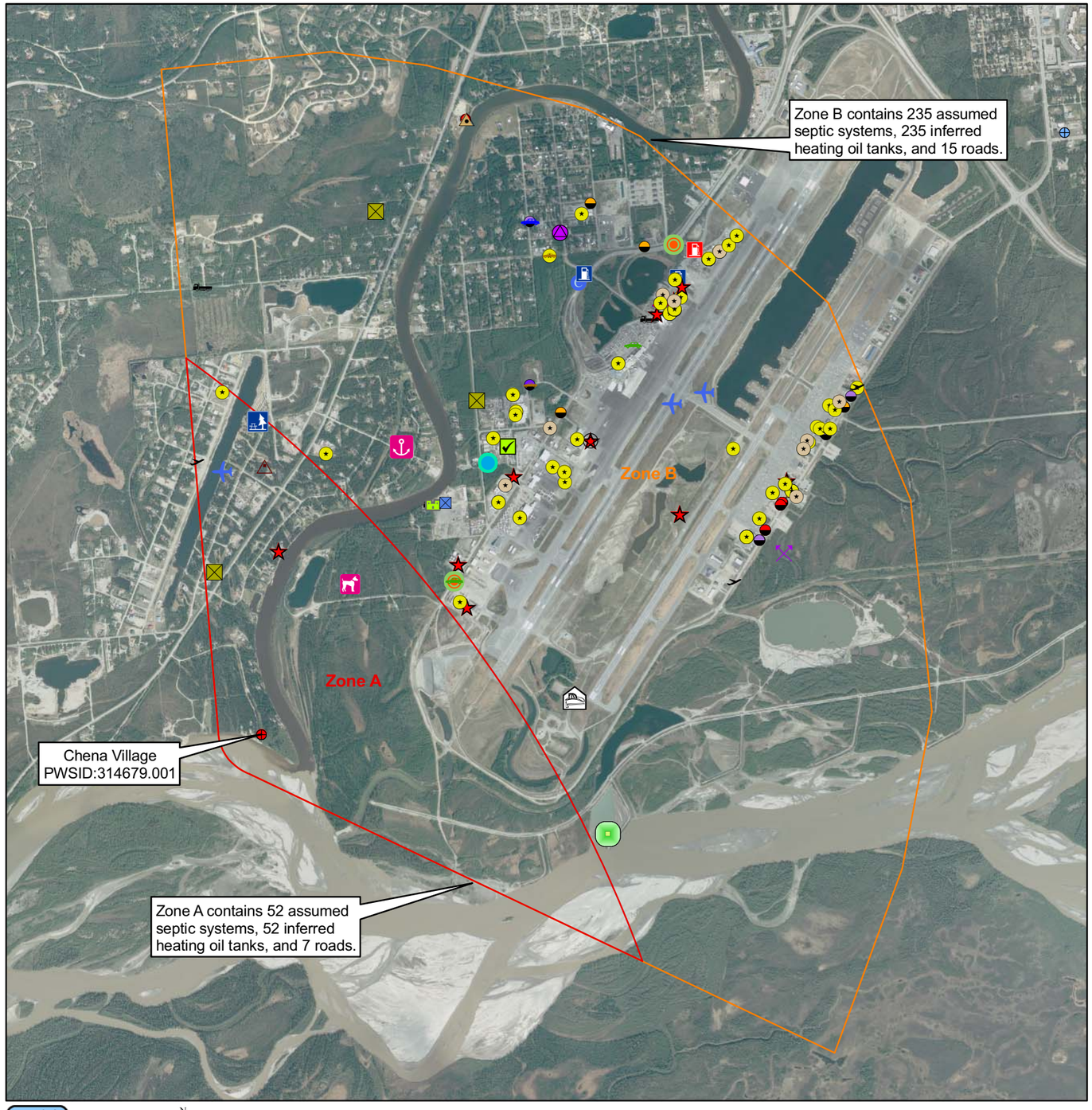
Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Tanks, gasoline (underground)	T12	T12	B	High	C	
Tanks, gasoline (underground)	T12	T12	B	High	C	
Tanks, gasoline (underground)	T12	T12	B	High	C	
Tanks, gasoline (underground)	T12	T12	B	High	C	
Tanks, gasoline (underground)	T12	T12	B	High	C	
Tanks, gasoline (underground)	T12	T12	B	High	C	
Closed tanks, gasoline (underground)	T13	T13	B	Medium	C	
Closed tanks, gasoline (underground)	T13	T13	B	Medium	C	
Closed tanks, gasoline (underground)	T13	T13	B	Medium	C	
Closed tanks, gasoline (underground)	T13	T13	B	Medium	C	
Closed tanks, gasoline (underground)	T13	T13	B	Medium	C	
Closed tanks, gasoline (underground)	T13	T13	B	Medium	C	
Closed tanks, gasoline (underground)	T13	T13	B	Medium	C	
Closed tanks, gasoline (underground)	T13	T13	B	Medium	C	
Closed tanks, gasoline (underground)	T13	T13	B	Medium	C	
Closed tanks, gasoline (underground)	T13	T13	B	Medium	C	
Closed tanks, gasoline (underground)	T13	T13	B	Medium	C	
Closed tanks, gasoline (underground)	T13	T13	B	Medium	C	
Tanks, heating oil, nonresidential (underground)	T16	T16	B	Low	C	
Tanks, heating oil, nonresidential (underground)	T16	T16	B	Low	C	

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Tanks, heating oil, nonresidential (underground)	T16	T16	B	Low	C	
Tanks, heating oil, nonresidential (underground)	T16	T16	B	Low	C	
Tanks, heating oil, nonresidential (underground)	T16	T16	B	Low	C	
Tanks, heating oil, nonresidential (underground)	T16	T16	B	Low	C	
Tanks, heating oil, nonresidential (underground)	T16	T16	B	Low	C	
Closed tanks, heating oil, nonresidential (underground)	T17	T17	B	Medium	C	
Closed Wastewater Holding Tank	T23	T23	B	Low	C	
Airports	X14	X14	B	High	C	
Airports	X14	X14	B	High	C	
Boat yards and marinas	X15	X15	B	Low	C	
Highways and roads, paved (cement or asphalt)	X20	X20	B	Low	C	15 roads
Motor vehicle/general storage yards/facilities	X27	X27	B	Low	C	
Motor vehicle/general storage yards/facilities	X27	X27	B	Low	C	
Fire training facilities	X39	X39	B	Low	C	

APPENDIX C

Chena Village
Drinking Water Protection Area
and Potential and Existing Contaminant Sources
(Map C)

Public Water Well System for PWS #314679.001 Chena Village
Showing Potential and Existing Sources of Contamination



Legend

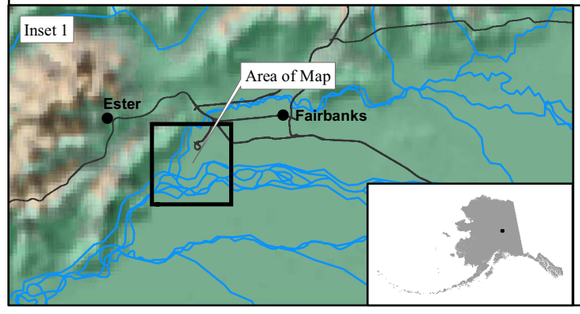
- Class A Public Water System
- Class B Public Water System

Groundwater Protection Zones

- Zone A Protection Area - Several Months Travel Time
- Zone B Protection Area - 2 Years Travel Time

Existing or Potential Contaminant Sources

- Aircraft maintenance shops (C01)
- Boat engine/body repair shop (C04)
- Construction trade areas and materials (C09)
- Furniture manufacturing, repair, and finishing shops (C14)
- Gasoline stations (without repair shop) (C15)
- Gasoline stations (with repair shop) (C16)
- Heavy equipment rental/storage (C18)
- Laboratories (chemical, soils, and research) (C20)
- Motor vehicle dealerships (with service department) (C27)
- Motor vehicle rental facilities (without service department) (C29)
- Motor vehicle rental facilities (with service department) (C30)
- Motor /motor vehicle repair shops (C31)
- Paint sales /service (C32)
- Domestic wastewater collection systems (sewer lines or lift stations) (D01)
- Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method) (D10)
- Injection wells (Class V) Motor Vehicle Waste Disposal Well (D42)
- Metals mning, placer (active/inactive) (E04)
- Quarries (sand, gravel, rock, other) (E10)
- Beverage Industry (I07)
- Tanks, diesel (underground) (T08)
- Closed tanks, diesel (underground) (T09)
- Tanks, gasoline (underground) (T12)
- Closed tanks, gasoline (underground) (T13)
- Tanks, heating oil, nonresidential (underground) (T16)
- Closed tanks, heating oil, nonresidential (underground) (T17)
- Closed tanks, lubricants or other petroleum products (underground) (T21)
- Closed Wastewater Holding Tank (T23)
- Contaminated sites, DEC recognized, non-Superfund, non-RCRA (U04)
- Open Leaking Underground Fuel Storage Tank (LUST) Sites (U07)
- Closed Leaking Underground Fuel Storage Tank (LUST) Sites (U08)
- Airports (X14)
- Boat yards and marinas (X15)
- Motor vehicle/general storage yards/facilities (X27)
- Campgrounds and RV Parks (X35)
- Fire training facilities (X39)
- Kennels (X49)



Data Sources:
Contaminant Sources, Public Water System Wells, Alaska Department of Environmental Conservation (ADEC)

All other data:
Alaska Statewide Digital Mapping Initiative (SDMI)

Drinking Water Protection Areas based on "Alaska Drinking Water Protection Program - Guidance Manual for Class B Public Water Systems" published by ADEC

URS Corporation does not guarantee the accuracy or validity of the data provided.

Alaska DEC

N W E S

0 3,500 7,000 14,000 Feet

Chena Village
PWS 314679.001
Appendix C Map C