Source Water Assessment

A Hydrogeologic Susceptibility and Vulnerability Assessment for NPS Copper Center Visitor Center Drinking Water System, Copper Center, Alaska PWSID 299025

February 2006

DRINKING WATER PROTECTION REPORT Report 1572
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 NPS Copper Center Visitor Center Source of Public Drinking Water,
Copper Center, 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 NPS Copper Center Visitor Center to potential contamination. This Class A (NTNC) water system consists of one well on the visitor center compound just outside of Copper Center, Alaska. 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 **Low** rating for the aquifer in which the well is drawing water from. Identified potential and current sources of contamination for the NPS Copper Center Visitor Center public water system include: non-residential heating oil storage tanks, large septic systems, roads, landscaped areas, a parking lot. 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 NPS Copper Center Visitor Center received an overall vulnerability rating a **Medium** for bacteria and viruses, and nitrates and/or nitrites, a **Low** for SOCs, OOCs, VOCs, and Heavy metals, cyanide, and other inorganic chemicals.

NPS COPPER CENTER VISITOR CENTER PUBLIC DRINKING WATER SYSTEM

NPS Copper Center Visitor Center public water system is a Class A (NTNC) water system. The system consists of one well on one well on the visitor center compound just outside of Copper Center, Alaska (Sec. 18, T002N, R001E, Copper River Meridian) (See Map 1 of Appendix A). Copper Center is located along the Richardson Highway between Mileposts 101 and 105. It is on the west bank of the Copper River at the confluence of the Klutina River. It lies just west of the Wrangell-St. Elias National Park (ADCED, 2006).

The majority of homes use individual water wells and septic tanks 75% of homes are fully plumbed. Refuse collection services are available from Copper Basin Sanitation. There is a local landfill, and an incinerator at mile 102 Richardson Hwy Electricity is provided by Copper Valley Electric Assoc. (ADCED, 2006)

This is a new system so As-Built drawings were used as the most recent sanitary survey. According to this information the depth of the well is over 500 feet below the ground surface. Two aquifer zones were developed at 471 feet and 552 feet. The upper zone is screened in gravel, sand, and cobbles. The other zone is screened in rock and consolidated gravels.

The Copper Center area is in the southeastern portion of the Copper River basin, in southeastern Interior Alaska. The Copper River basin, ranging from 500 to over 4,000 feet above sea level, is an intermontane basin rimmed by peaks of the Chugach, Alaska, Talkeetna, and Wrangell mountains. The terrain of the basin can be divided into two physiographic subunits: the rolling, hummocky Copper River basin piedmont surface, and the Copper River basin trough. The Copper River basin trough is generally flat and lacks the hummocky, rolling character of the piedmont surface.

The terrain, geology of the unconsolidated deposits, and foundation materials of the Copper River basin are related to Pliestocene and recent events. Glaciers from the Chugach, Wrangell, Talkeetna, and Alaska Ranges repeatedly invaded the basin, perhaps at times filling it and flowing across the divides to the north, west, east, and south. Such extensive glaciation has resulted in the deposition of large thicknesses of coarse glacial boulder clays (till) and coarse outwash gravel and sand on the piedmont surface, with finer till and outwash interbedded with lake deposits in the basin trough.

The Glennallen area is within the discontinuous permafrost zone. Surface soils in the area generally consist of silt and clay with pebbles underlain by boulder clay with till, underlain by glacial outwash sand and gravel, underlain by boulder clay or till (Nichols, 1956).

NPS COPPER CENTER VISITOR CENTER 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 whole area and were obtained from various United States Geological Survey (USGS) reports, as-built documents, 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 NPS Copper Center Visitor Center 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 NPS Copper Center Visitor Center 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 NPS COPPER CENTER VISITOR CENTER 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 NPS Copper Center Visitor Center received a **Low** susceptibility rating. The as-built documents indicate 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 NPS Copper Center Visitor Center well is completed in received a **Low** susceptibility rating. The depth of the well and confinement of the aquifer helps to prevent contaminants from reaching the water supply. Table 2 summarizes the Susceptibility scores and ratings for NPS Copper Center Visitor Center.

Table 2: Susceptibility

	Rating
Susceptibility of the Wellhead	Low
Susceptibility of the Aquifer	Low
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	Very High
Nitrates and/or Nitrites	Very High
Volatile Organic Chemicals	Low
Heavy Metals, Cyanide, and Other Inorganic Chemicals	Low
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:

Natural Susceptibility
+
Contaminant Risks
=
Vulnerability of the
Drinking Water Source to Contamination

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	Medium
Nitrates and Nitrites	Medium
Volatile Organic Chemicals	Low
Heavy Metals, Cyanide, and Other Inorganic Chemicals	Low
Synthetic Organic Chemicals	Low
Other Organic Chemicals	Low

Bacteria and Viruses

The septic systems, roads, and natural landscape in the protection area represent the greatest risks 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). No samples have detected coliforms in the water.

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 medium.

Nitrates and Nitrites

The roads, natural landscape, and septic systems in the protection area also represent the greatest risk 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 been detected in amounts well below the Maximum Contaminant Level (MCL=10 mg/L) sampling from 9/17/2003 for the NPS Copper Center Visitor Center 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 medium.

Volatile Organic Chemicals

The roads, septics, heating oil tanks, and parking lots 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 septics, heating oil tanks, natural landscape, and roads represent the greatest risk for inorganic chemicals to the well.

Inorganic chemicals have not been detected within the source waters. 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 low.

Synthetic Organic Chemicals

The septic systems and natural landscape 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 snythetic organic chemicals with the natural susceptibility of the well, the overall vulnerability of the well to contamination is low.

Other Organic Chemicals

The roads, parking lots, and septic systems represent 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 snythetic organic chemicals with the natural susceptibility of the well, the overall vulnerability of the well to contamination is low.

REFERENCES

Alaska Department of Community and Economic Development (ADCED), 2002 [WWW document]. URL http://www.dced.state.ak.us/mra/CF_BLOCK.cfm.

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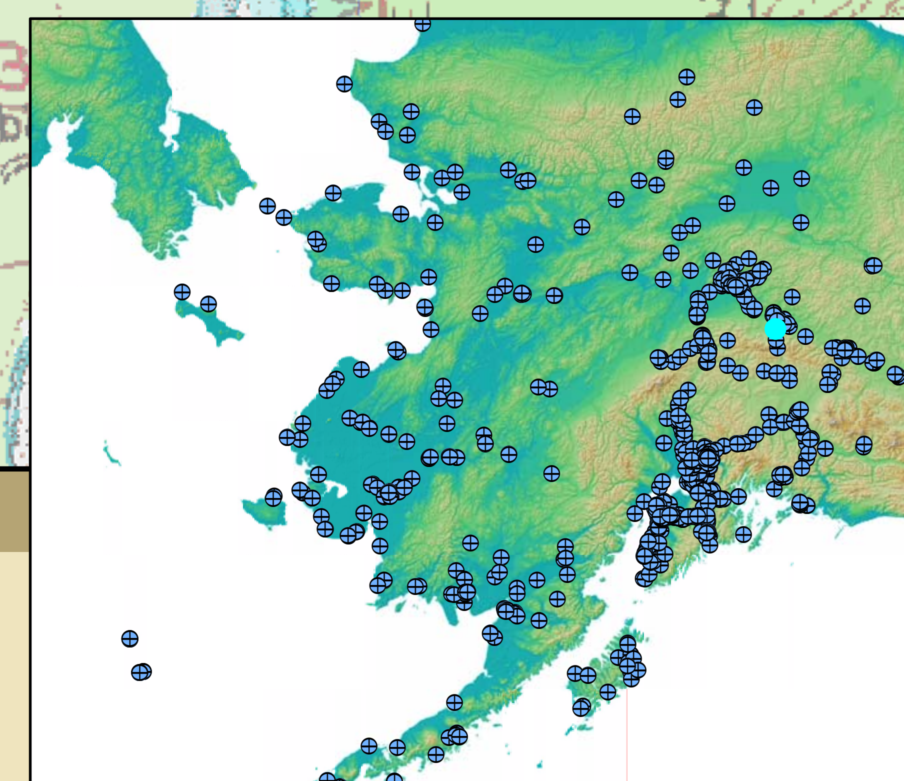
Freeze, R.A. and Cherry, J.A., 1979. Groundwater. Prentice-Hall, Englewood Cliffs, NJ.

United States Environmental Protection Agency (EPA), 2002 [WWW document]. URL http://www.epa.gov/safewater/mcl.html.

APPENDIX A

NPS Copper Center Visitor Center
Drinking Water Protection Area Location Map
(Map 1)



Map 1- NPS Copper River Visitor Center and Surrounding Water Systems

PWSID: 299025.001

Alaska Department of Environmental Conservation

Alaska Drinking Water Protection Program

Feet

0 1:17,309 4,000

Data Sources:
NPS: CAD drawing
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 NPS Copper Center Visitor Center (Tables 1-7)

Table 1

Contaminant Source Inventory for

NPS Copper Center Visitor Center

PWSID 299025.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Map Number*	*Comments*
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1-2	A		
Tanks, heating oil, nonresidential (aboveground)	T14	T14-1-5	A		
Landscaping around commercial, industrial, or government buildings	X03	X03-1	A		
Highways and roads, paved (cement or asphalt)	X20	X20-1-2	A		
Motor vehicle/general storage yards/facilities	X27	X27-1	A		
Highways and roads, paved (cement or asphalt)	X20	X20-3	B		

Table 2

Contaminant Source Inventory and Risk Ranking for NPS Copper Center Visitor Center Sources of Bacteria and Viruses

PWSID 299025.001

Contaminant Source Type	***Contaminant Source ID***	***CS ID tag***	***Zone***	***Risk Ranking for Analysis***	***Map Number***	***Comments***
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1-2	A	High		
Landscaping around commercial, industrial, or government buildings	X03	X03-1	A	Medium		
Highways and roads, paved (cement or asphalt)	X20	X20-1-2	A	Low		
Highways and roads, paved (cement or asphalt)	X20	X20-3	B	Low		

Table 3

Contaminant Source Inventory and Risk Ranking for NPS Copper Center Visitor Center Sources of Nitrates/Nitrites

PWSID 299025.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1-2	A	High		
Landscaping around commercial, industrial, or government buildings	X03	X03-1	A	Medium		
Highways and roads, paved (cement or asphalt)	X20	X20-1-2	A	Low		
Highways and roads, paved (cement or asphalt)	X20	X20-3	B	Low		

Table 4

Contaminant Source Inventory and Risk Ranking for NPS Copper Center Visitor Center Sources of Volatile Organic Chemicals

PWSID 299025.001

Contaminant Source Type	***Contaminant Source ID***	***CS ID tag***	***Zone***	***Risk Ranking for Analysis***	***Map Number***	***Comments***
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1-2	A	Low		
Tanks, heating oil, nonresidential (aboveground)	T14	T14-1-5	A	Low		
Highways and roads, paved (cement or asphalt)	X20	X20-1-2	A	Low		
Motor vehicle/general storage yards/facilities	X27	X27-1	A	Low		
Highways and roads, paved (cement or asphalt)	X20	X20-3	B	Low		

Table 5

Contaminant Source Inventory and Risk Ranking for NPS Copper Center Visitor Center Sources of Heavy Metals, Cyanide and Other Inorganic Chemicals

PWSID 299025.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1-2	A	Low		
Tanks, heating oil, nonresidential (aboveground)	T14	T14-1-5	A	Low		
Landscaping around commercial, industrial, or government buildings	X03	X03-1	A	Low		
Highways and roads, paved (cement or asphalt)	X20	X20-1-2	A	Low		
Highways and roads, paved (cement or asphalt)	X20	X20-3	B	Low		

Table 6

Contaminant Source Inventory and Risk Ranking for NPS Copper Center Visitor Center Sources of Synthetic Organic Chemicals

PWSID 299025.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1-2	A	Low		
Landscaping around commercial, industrial, or government buildings	X03	X03-1	A	Low		

Table 7

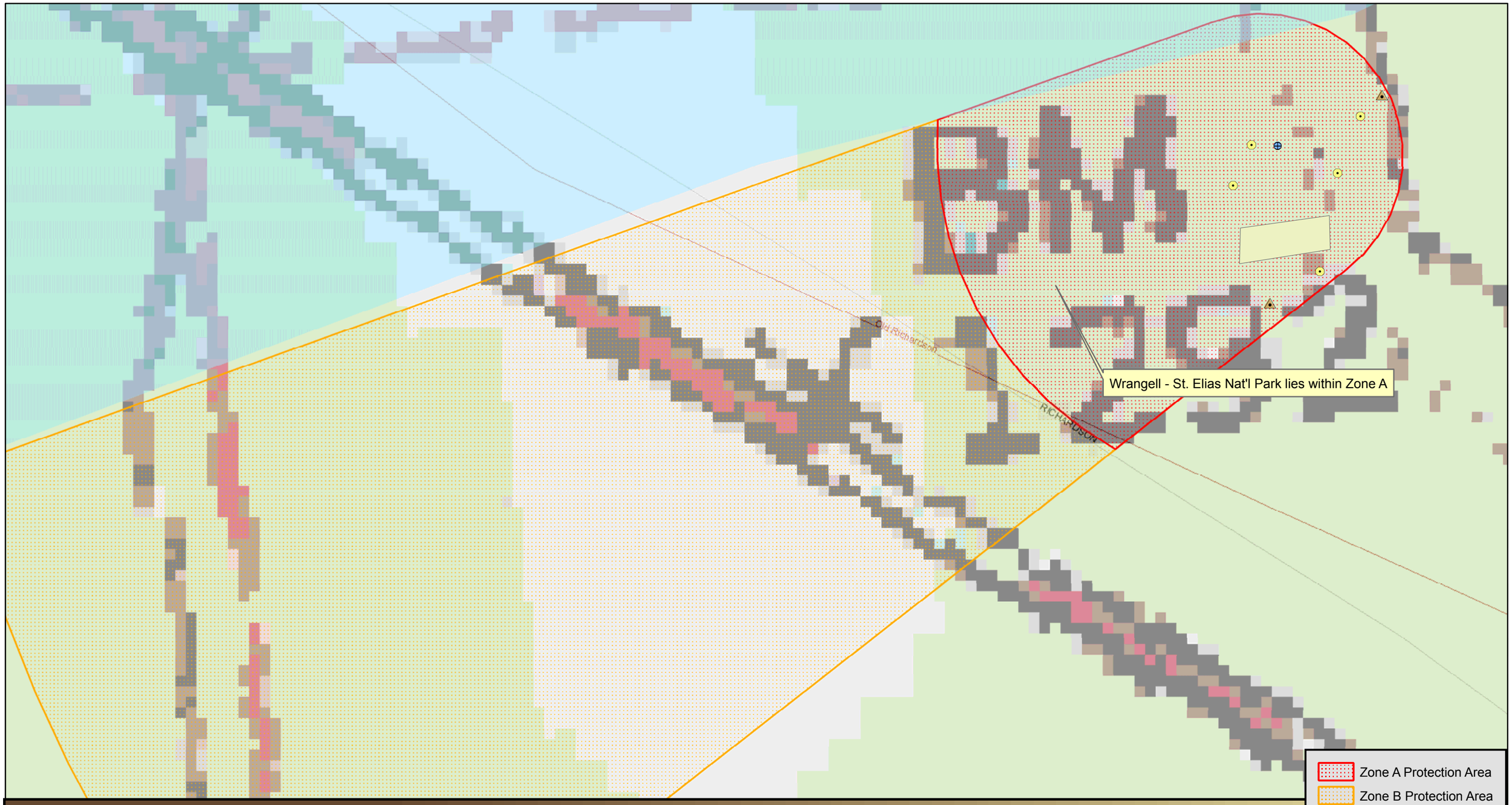
Contaminant Source Inventory and Risk Ranking for NPS Copper Center Visitor Center Sources of Other Organic Chemicals

PWSID 299025.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1-2	A	Low		
Highways and roads, paved (cement or asphalt)	X20	X20-1-2	A	Low		
Motor vehicle/general storage yards/facilities	X27	X27-1	A	Low		
Highways and roads, paved (cement or asphalt)	X20	X20-3	B	Low		

APPENDIX C

NPS Copper Center Visitor Center
Drinking Water Protection Area
and Potential and Existing Contaminant Sources
(Map 2)



Map 2- NPS Copper River Visitor Center Potential Contaminants

PWSID: 299025.001

Alaska Department of Environmental Conservation

Alaska Drinking Water Protection Program

0 1:2,203 Feet 600

Data Sources:
NPS: CAD drawing
Potential Sources of Contamination: ADEC