Source Water Assessment

A Hydrogeologic Susceptibility and Vulnerability Assessment for Country Boy Campground Public Drinking Water System, Ninilchik, Alaska PWSID # 249977.001

DRINKING WATER PROTECTION REPORT 1740

Alaska Department of Environmental Conservation

January, 2009

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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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Drinking Water Protection
Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

The public water system for Country Boy Campground is a Class B (transient/non-community) water system consisting of one well at 63960 Oilwell Road, in Ninilchik, Alaska. The wellhead received a susceptibility rating of **Low** and the aquifer received a susceptibility rating of **Medium**. Combining these two ratings produces a **Low** rating for the natural susceptibility of the well. Identified potential and current sources of contaminants for Country Boy Campground public drinking water source include: coal mines, logging activities, septic systems, heating oil tanks, airports, and roads. 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 Country Boy Campground received a vulnerability rating of **Low** for bacteria and viruses, **Low** for nitrates and nitrites, and **High** for volatile organic chemicals. 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 Country Boy Campground to protect public health.

COUNTRY BOY CAMPGROUND PUBLIC DRINKING WATER SYSTEM

Country Boy Campground public water system is a Class B (transient/non-community) water system. The system consists of one well at 63960 Oilwell Road Ninilchik, Alaska, approximately five miles southeast of the Sterling Highway (see Map A in Appendix A). Ninilchik is located on the west coast of the Kenai Peninsula, 188 road miles south of Anchorage. With a population of 778, Ninilchik is part of the Kenai Peninsula Borough and considered a highway village. Temperatures range from 14 degrees to 65 degrees Fahrenheit, and annual rainfall averages 24 inches (ADCCED, 2008).

The majority of homes use individual water wells or have water delivered. Two-thirds of the residences are fully plumbed and have individual septic systems. The remainder of homes use outhouses. Additional construction of piped sewer systems and a public water source is being considered. A refuse site is provided by the Borough and located in Ninilchik (ADCCED, 2008).

Ninilchik is situated at the base of the Caribou Hills, near the mouth of the Ninilchik River. The area's topography is gentle, with a few small hills. The drainage of the Ninilchik lowlands is spread out, lacking distinct channels of flow. The Caribou Hills are better defined with definite drainage channels (Savard & Scully, 1983).

A large majority of the exposed sediment along the western side of the Kenai Peninsula are Quaternary sediments (Magoon, Adkision, and Egbert, 1976). The origins of these sediments are former glacial streams, abandoned-channel deposits, glacial moraines, and deposits from existing streams (Glass, 1996). Aquifers in this area may be either confined or unconfined, based on the significant variation in composition of the sand, gravel, and silt layers of sediment (Glass, 1996).

According to the most recent sanitary survey for this system (12/29/04), the well extends 45 feet below the ground surface. As no well log is available, it is assumed to be completed in a confined aquifer based on information from nearby public water systems. The sanitary survey states that the land surface is appropriately sloped away from the well, the well is grouted according to DEC regulations, and a sanitary seal is installed.

This system operates year round and serves six residents and one hundred and thirty-six non-residents through sixty service connections.

COUNTRY BOY CAMPGROUND 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 Country Boy Campground 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 Country Boy Campground 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 COUNTRY BOY CAMPGROUND 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 Country Boy Campground received a **Low** susceptibility rating. The most recent sanitary survey (12/29/04) states that the land surface is appropriately sloped away from the well, the well is grouted according to DEC regulations, and a sanitary seal is installed. 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, the slope of the land surface and, if applicable, the confining layer.

As no well log is available for this system, the Country Boy Campground system is assumed to draw water from a confined aquifer overlain by 20 feet of clay, based on information from nearby public water systems. The aquifer received a **Medium** susceptibility rating because of its moderately shallow nature and relatively thin confining layer. Deeper aquifers are more protected from surface contaminants while thicker confining layers provide greater protection from any contamination that does manage to penetrate to that depth.

Table 2 summarizes the Susceptibility scores and ratings for the Country Boy Campground system.

Table 2. Susceptibility

	Score	Rating
Susceptibility of the Wellhead	0	Low
Susceptibility of the Aquifer	14	Medium
Natural Susceptibility	14	Low

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 Country Boy Campground system.

Table 3. Contaminant Risks

Category	Score	Rating
Bacteria and Viruses	12	Low
Nitrates and/or Nitrites	15	Low
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 Country Boy Campground

system. Note: scores are rounded off to the nearest five.

Table 4. Overall Vulnerability

Category	Score	Rating
Bacteria and Viruses	25	Low
Nitrates and/or Nitrites	30	Low
Volatile Organic Chemicals	65	High

Bacteria and Viruses

The contaminant risk for bacteria and viruses is **Low** with septic systems and roads 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 sampling at Country Boy Campground (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 **Low**.

Nitrates and Nitrites

The contaminant risk for nitrates and nitrites is **Low** with logging activity, septic systems, airports, and roads contributing to the risk to the drinking water well.

The sampling history for the Country Boy Campground well indicates that nitrates have been detected in the water within the last five years, with the highest concentration of 0.500 mg/l detected on 04/19/2007 (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 **Low**.

Volatile Organic Chemicals

The contaminant risk for volatile organic chemicals is **Very High** with coal mines, logging activity, septic systems, heating oil tanks, airports, and roads contributing to the risk to the drinking water well.

The drinking water at Country Boy Campground 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 **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 Country Boy Campground 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 Country Boy Campground drinking water source.

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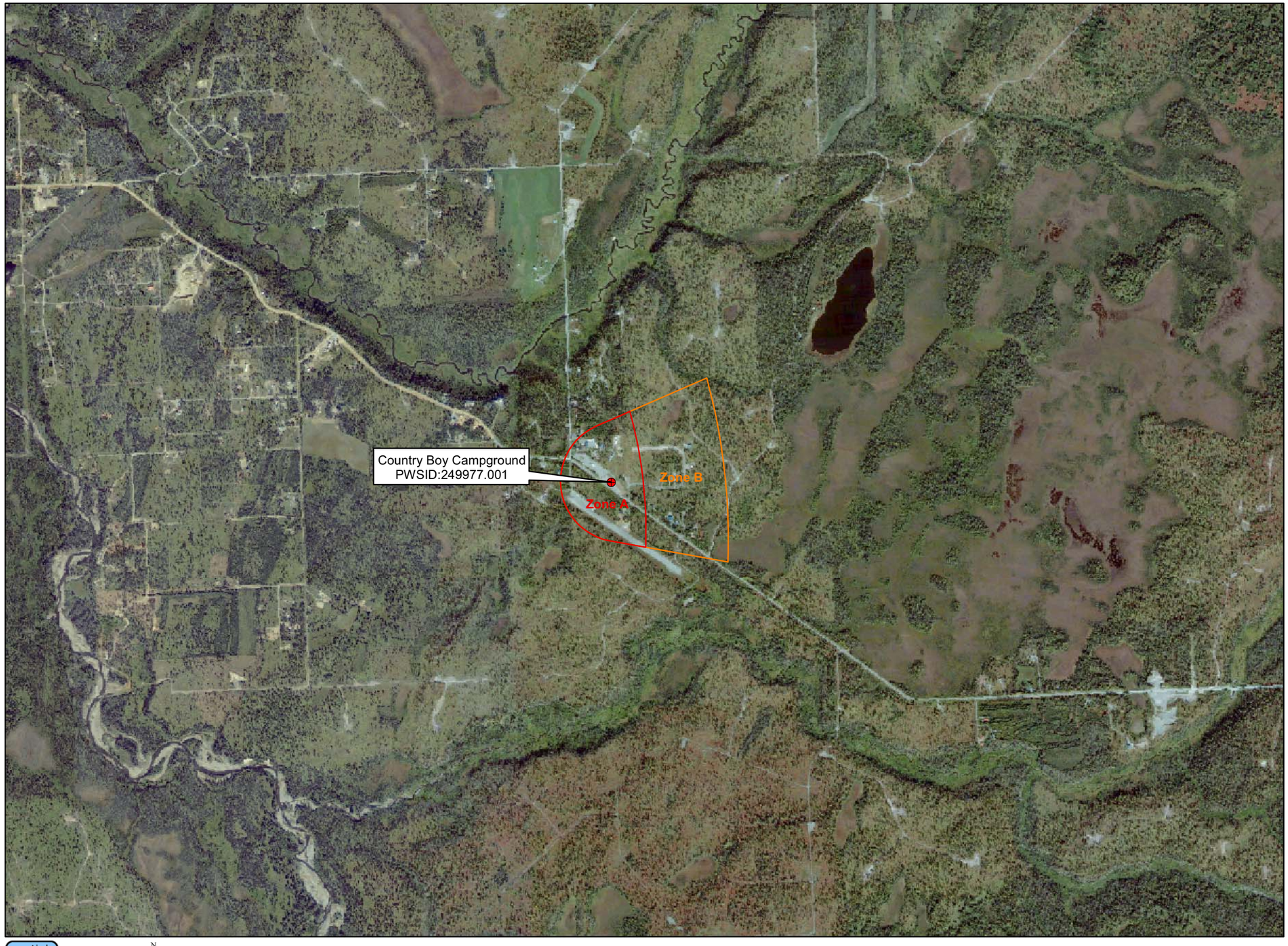
APPENDIX A

Country Boy Campground
Drinking Water Protection Area Location Map
(Map A)

Public Water Well System for PWS #249977.001 Country Boy Campground



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

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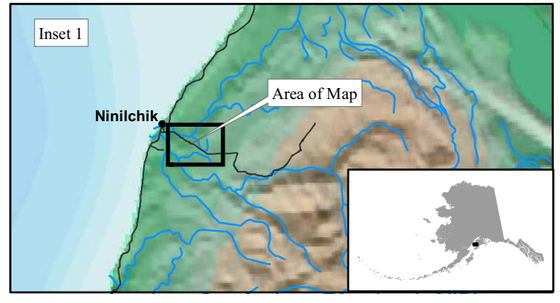

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Country Boy Campground
PWS 249977.001

Appendix A Map A

APPENDIX B

Contaminant Source Inventory and Risk Ranking for Country Boy Campground (Tables 1-4)

Table 1

Contaminant Source Inventory for ***Country Boy Campground***

PWSID 249977.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Map Number*	*Comments*
Coal mining (active or inactive?)	E01	E01	A	C	
Logging (active or inactive?)	E02	E02	A	C	
Septic systems (serves one single-family home)	R02	R02	A	C	5 inferred
Tanks, heating oil, residential (above ground)	R08	R08	A	C	5 assumed
Airports	X14	X14	A	C	
Highways and roads, paved (cement or asphalt)	X20	X20	A	C	1 road
Coal mining (active or inactive?)	E01	E01	B	C	
Logging (active or inactive?)	E02	E02	B	C	
Septic systems (serves one single-family home)	R02	R02	B	C	4 inferred
Tanks, heating oil, residential (above ground)	R08	R08	B	C	4 assumed
Highways and roads, paved (cement or asphalt)	X20	X20	B	C	1 road

Table 2

Contaminant Source Inventory and Risk Ranking for Country Boy Campground Sources of Bacteria and Viruses

PWSID 249977.001

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	5 inferred
Highways and roads, paved (cement or asphalt)	X20	X20	A	Low	C	1 road
Septic systems (serves one single-family home)	R02	R02	B	Low	C	4 inferred
Highways and roads, paved (cement or asphalt)	X20	X20	B	Low	C	1 road

Table 3

Contaminant Source Inventory and Risk Ranking for Country Boy Campground Sources of Nitrates/Nitrites

PWSID 249977.001

Contaminant Source Type	***Contaminant Source ID***	***CS ID tag***	***Zone***	***Risk Ranking for Analysis***	***Map Number***	***Comments***
Logging (active or inactive?)	E02	E02	A	Low	C	
Septic systems (serves one single-family home)	R02	R02	A	Low	C	5 inferred
Airports	X14	X14	A	Low	C	
Highways and roads, paved (cement or asphalt)	X20	X20	A	Low	C	1 road
Logging (active or inactive?)	E02	E02	B	Low	C	
Septic systems (serves one single-family home)	R02	R02	B	Low	C	4 inferred
Highways and roads, paved (cement or asphalt)	X20	X20	B	Low	C	1 road

Table 4

Contaminant Source Inventory and Risk Ranking for Country Boy Campground Sources of Volatile Organic Chemicals

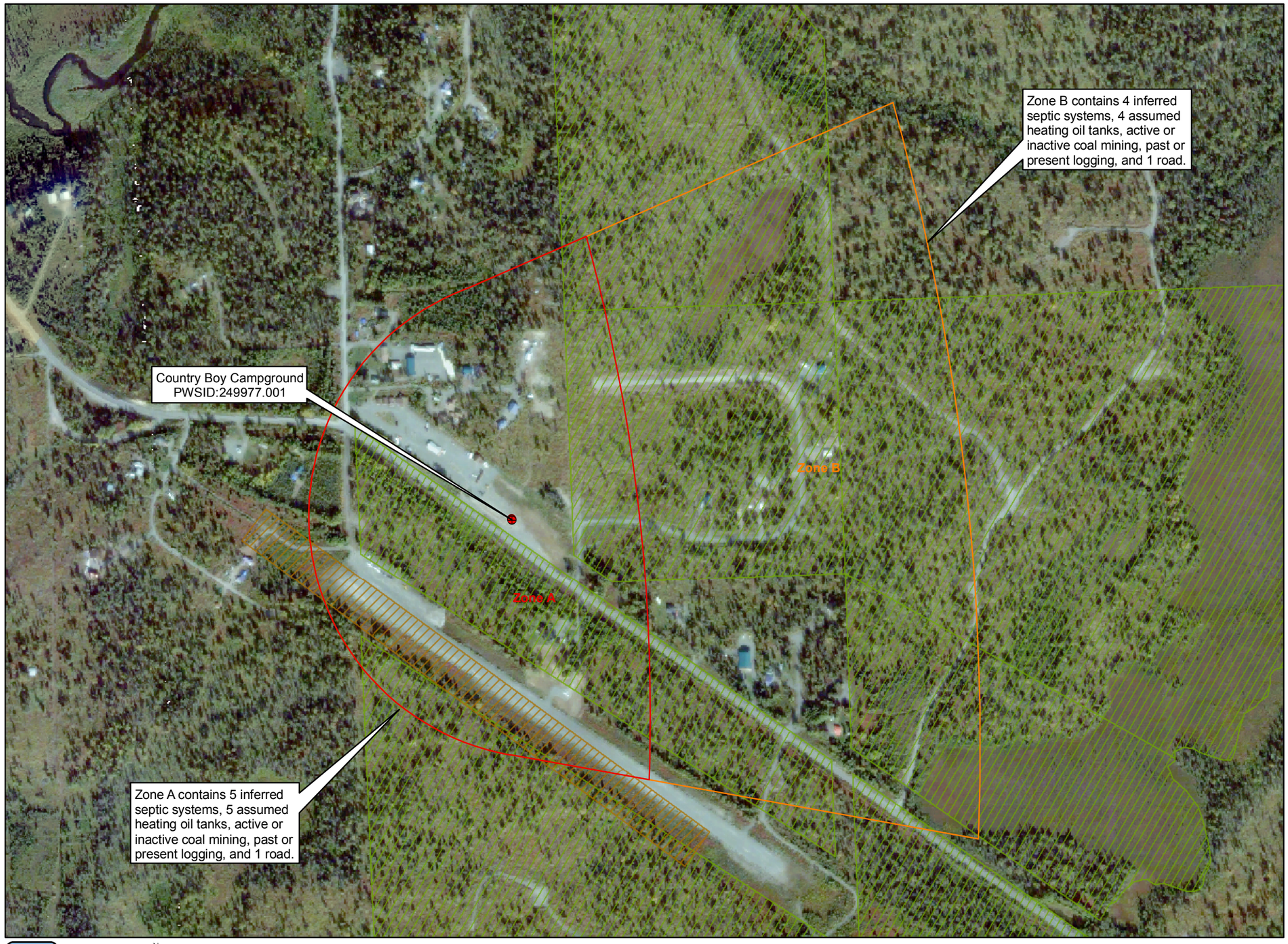
PWSID 249977.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Coal mining (active or inactive?)	E01	E01	A	High	C	
Logging (active or inactive?)	E02	E02	A	Low	C	
Septic systems (serves one single-family home)	R02	R02	A	Low	C	5 inferred
Tanks, heating oil, residential (above ground)	R08	R08	A	Medium	C	5 assumed
Airports	X14	X14	A	High	C	
Highways and roads, paved (cement or asphalt)	X20	X20	A	Low	C	1 road
Coal mining (active or inactive?)	E01	E01	B	High	C	
Logging (active or inactive?)	E02	E02	B	Low	C	
Septic systems (serves one single-family home)	R02	R02	B	Low	C	4 inferred
Tanks, heating oil, residential (above ground)	R08	R08	B	Medium	C	4 assumed
Highways and roads, paved (cement or asphalt)	X20	X20	B	Low	C	1 road

APPENDIX C

Country Boy Campground
Drinking Water Protection Area
and Potential and Existing Contaminant Sources
(Map C)

Public Water Well System for PWS #249977.001 Country Boy Campground
Showing Potential and Existing Sources of Contamination



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

Existing or Potential Contaminant Sources

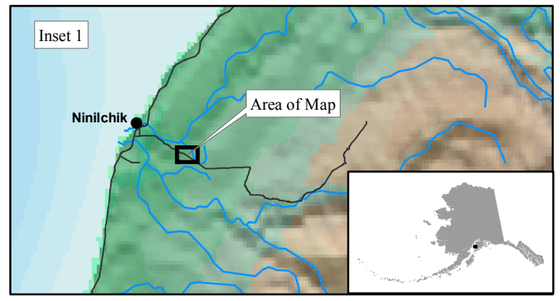
- Logging (past or present) (E02)
- Airports/Airstrips (X14)

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

Apparent misalignment between geographic features and aerial imagery may be present due to differences in source data. URS Corporation does not guarantee the accuracy or validity of the data provided.



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Country Boy Campground
PWS 249977.001

Appendix C Map C