Source Water Assessment

A Hydrogeologic Susceptibility and Vulnerability Assessment for Matanuska Telephone Association Public Drinking Water System, Wasilla, Alaska PWSID# 220025.001

DRINKING WATER PROTECTION REPORT 1844

Alaska Department of Environmental Conservation

September, 2008

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The Drinking Water Protection (DWP) team 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 DWP staff at #1-866/956-7656.

September, 2008

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Drinking Water Protection

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EXECUTIVE SUMMARY

The public water system for Matanuska Telephone Association is a Non-Transient, Non-Community (NTNC) water system consisting of one well at 4401 E. Palmer-Wasilla Highway, Wasilla, Alaska. An assessment of the susceptibility of the wellhead and aquifer to contamination, and the vulnerability of the public water system to potential and existing contamination were evaluated as of February 2008. The wellhead received a susceptibility rating of **Low** and the aquifer received a susceptibility rating of **Low**. Combining these two ratings produces a **Low** rating for the natural susceptibility of the well. Identified potential and existing sources of contamination for the Matanuska Telephone Association public drinking water system are residential septic systems, roads, and residential areas. These are considered 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). Additionally, a presumably natural source of arsenic is also present.

Combining the natural susceptibility of the well with the six (6) contaminant risk categories, the public water system for Matanuska Telephone Association received an overall vulnerability rating of **Very High** for bacteria and viruses, and VOCs; and a **Low** for nitrates and/or nitrites, heavy metals, cyanide, and other inorganic chemicals, OOCs, and SOCs.

MATANUSKA TELEPHONE ASSOCIATION PUBLIC DRINKING WATER SYSTEM

Matanuska Telephone Association public water system is a NTNC water system. The system consists of one well at 4401 E. Palmer-Wasilla Highway, Wasilla, Alaska (T17N, R01E, Section 6) (See Map 1 of Appendix A). Wasilla is located north of Anchorage in the Matanuska-Susitna Borough which is in Southcentral Alaska (Please see the inset of Map 1 in Appendix A for location). The Borough's current population is approximately 80,088, and Wasilla's current population is approximately 7,028 (ADCCED 2008). Communities located within the Borough include: Big Lake, Buffalo Soapstone, Butte, Chase, Chickaloon, Farm Loop, Fishhook, Gateway, Glacier View, Houston, Knik River, Knik-Fairview, Lake Louise, Lakes, Lazy Mountain, Meadow Lakes, Palmer, Petersville, Point MacKenzie, Skwentna, Susitna, Sutton-Alpine, Talkeetna, Tanaina, Trapper Creek, Wasilla, Willow and Y (ADCCED 2008. The majority of homes use individual water wells and septic systems, although the City operates a piped water and sewer system (ADCCED 2008). Refuse collection is provided by a private company for disposal in the Mat-Su Borough landfill. Residents also drop refuse at the Borough landfill in Palmer (ADCCED 2008).

A lake covered the Susitna River valley lowland during glacial times. The deposition of glacial silts and clays played an important part in the makeup of the soils of the area.

Most of the soils in the area provide good sources of sand, gravel and topsoil. The deposition of silt, clay and organic "muck" in old lakes and depressions means that some areas have soil conditions that vary over relatively short distances. The U.S. Soil Conservation Service has mapped seven soil associations in and around Wasilla.

The Homestead and Knik soil types predominate the Wasilla area, with smaller areas of Coal Creek, Jacobsen, Salamatof, and Slikok soil types. The soil type at this well is the Knik silt loam.

According to the most recent sanitary survey (7/25/2007) for this water system, the depth of the well is estimated at 229 feet below the ground surface. Other wells in this area are screened in a combination of sand and gravel and the well log indicates that this well is also. Along with other wells in this area, this well penetrated relatively impermeable beds of hardpan and clay of a cumulative thickness of approximately 152 feet. Based on this, the well is assumed to be completed in a confined aquifer, or an aquifer under hydrostatic pressure.

The Matanuska Telephone Association public water system serves ninety (90) non-transient residents through two (2) service connections.

MATANUSKA TELEPHONE ASSOCIATION 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 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 area are general for the Matanuska-Susitna lowlands and were obtained from various United States Geological Survey (USGS) reports, area well logs, and the Groundwater textbook by Freeze and Cherry (1979).

The drinking water protection areas (DWPAs) 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 input parameters describing the attributes of the aquifer in this calculation were adopted from the State of Alaska Department of Water Resources (*Jokela et. al., 1991*).

The confined aquifer levels in the area of the Matanuska Telephone Association water system are not well-understood, but are likely primarily influenced by regional recharge from the Talkeetna Mountains and the Matanuska River valley. The protection areas were drawn based on the regional topography. Groundwater in the confined aquifer of this area likely generally flows west to south.

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

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 DWPA for the Matanuska Telephone Association found 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 Matanuska Telephone Association DWPA. 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 NTNC public water system assessments, the following six categories of drinking water contaminants were inventoried:

- 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

The time-of-travel for contaminants within the water varies and is dependent on the physical and chemical characteristics of each contaminant.

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 MATANUSKA TELEPHONE ASSOCIATION PUBLIC 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 DWPA.

Drinking Water Protection staff 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 DWPA.

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 Matanuska Telephone Association received a **Low** susceptibility rating. The most recent sanitary survey (completed 7/25/07) indicates the well is capped with a sanitary seal, the land surface is sloped away from the well, but it is not clear if the well is properly grouted. A sanitary seal prevents potential contaminants 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 other wells and bore holes are penetrating the aquifer and, if applicable, and the characteristics of the confining layer.

The aquifer that the Matanuska Telephone Association well is completed in received a **Low** susceptibility rating. The aquifer is confined by 152 cumulative feet of confining layers. Confining layers can help inhibit transport of contaminants to the aquifer.

Table 2 summarizes the susceptibility scores and ratings for Matanuska Telephone Association.

Table 2. Susceptibility

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

The Contaminant Risk was 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	Low
Volatile Organic Chemicals	Low
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:

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	High
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 residential septic systems, roads, and residential areas in the protection area represent the greatest risk for bacteria and viruses to the drinking water well. Historically, bacteria and viruses were detected based on mechanical operations issues, but these have since been corrected and the land use has changed. The system was credited for these changes.

Only a small amount of bacteria and viruses are required to endanger public health. Coliform bacteria 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 coliform bacteria and E. coli which only come from human and animal fecal waste (EPA, 2002). Harmful bacteria can cause diarrhea, cramps, nausea, headaches, or other symptoms (EPA, 2002). Within the last five years, samples collected on 2/25/05 and 12/16/04 tested positive more than once for total coliform and fecal coliform. All other samples did not detect coliform bacteria 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 **High**.

Nitrates and Nitrites

The residential septic systems, roads, and residential areas 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. Nitrate was detected once on 2/10/03, but has not since been detected for the Matanuska Telephone Association well. The history of the use of the site has changed and the source of nitrate that was detected has presumably been removed.

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 residential septic systems, roads, and residential areas 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 residential septic systems, roads, and residential areas in the protection area and natural sources represent the greatest risk for inorganic chemicals to the well.

Heavy metals and other inorganic chemicals were sampled for on 1/29/07. Barium, chromium, and nickel were all detected well below their respective maximum contaminant levels (MCLs). Selenium was detected above the MCL. Arsenic was sampled for and detected 9/27/07 and 6/28/07; the greatest detection (more recent sample) was 0.021 mg/L or 213% with respect to its MCL. In greater quantities, arsenic is known to cause skin damage, problems with circulatory systems, and may create an increased risk of developing cancer (EPA, 2002). There is no identified man-made source of arsenic and it is commonly found in other wells in the area, which suggests a natural source.

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 and residential areas 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 residential septic systems, roads, and residential areas 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 other organic chemicals with the natural susceptibility of the well, the

overall vulnerability of the well to contamination is **Low**.

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 Matanuska Telephone Association 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 the Matanuska Telephone Association drinking water source.

REFERENCES

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Jokela, J.B., Munter, J.A., and Evans, J.G., 1991, Ground-water resources of the Palmer-Big Lake area, Alaska: a conceptual model. Division of Geological and Geophysical Surveys Report of Investigations 90-4, State of Alaska Department of Natural Resources, Fairbanks, AK.

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

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APPENDIX A

Matanuska Telephone Association
Drinking Water Protection Area Location Map
(Map 1)

220025.001

Map 1- Matanuska Telephone Association (formerly: Landscape Supply)

PWSID: 220025.001

Alaska DEC

0 — 1 inch equals 333 feet — 1,160 Feet

Data Sources:
Boroughs: Roads and parcels
Public Water Systems: DEC
Potential Sources of Contamination: DEC

N W E S

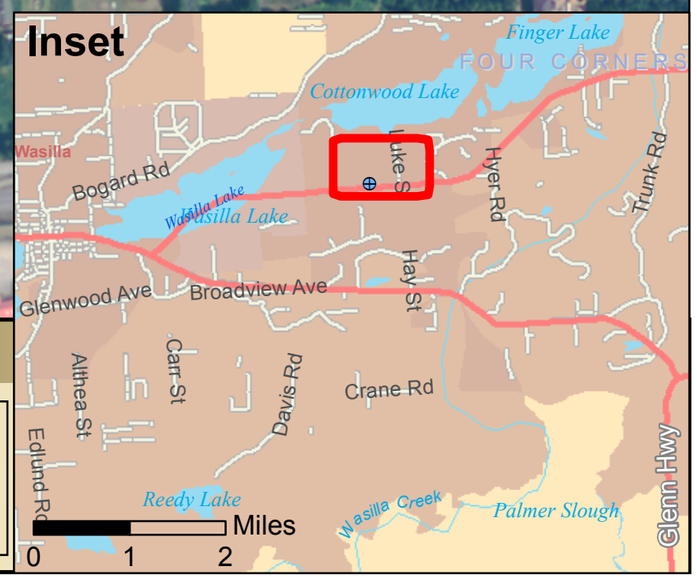
Identified PWS Locations

State Classification

- Class A (Federal Classification: Community (C), or Non-Transient Non-Community (NTNC))
- Class B (Federal Classification: Non-Community (NC), or Transient Non-Community (TNC))

- Zone A (Several Months Time of Travel)
- Zone B (2 Year Time of Travel)

Inset



APPENDIX B

Contaminant Source Inventory and Risk Ranking for Matanuska Telephone Association (Tables 1-7)

Table 1 *Contaminant Source Inventory for* ***PWSID 220025.001***

MATANUSKA TELEPHONE ASSOCIATION (MTA)

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Map Number*	*Comments*
Residential Areas	R01	R01-1	A	2	6 acres.
Septic systems (serves one single-family home)	R02	R02-1	A	2	
Highways and roads, paved (cement or asphalt)	X20	X20-1	A	2	1 road.
Residential Areas	R01	R01-2	B	2	58 acres.
Septic systems (serves one single-family home)	R02	R02-2-10	B	2	
Highways and roads, paved (cement or asphalt)	X20	X20-2-4	B	2	

Table 2

Contaminant Source Inventory and Risk Ranking for MATANUSKA TELEPHONE ASSOCIATION (MTA) Sources of Bacteria and Viruses

PWSID 220025.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Residential Areas	R01	R01-1	A	Low	2	6 acres.
Septic systems (serves one single-family home)	R02	R02-1	A	Low	2	
Highways and roads, paved (cement or asphalt)	X20	X20-1	A	Low	2	1 road.
Residential Areas	R01	R01-2	B	Low	2	58 acres.
Septic systems (serves one single-family home)	R02	R02-2-10	B	Low	2	
Highways and roads, paved (cement or asphalt)	X20	X20-2-4	B	Low	2	

Table 3

Contaminant Source Inventory and Risk Ranking for MATANUSKA TELEPHONE ASSOCIATION (MTA) Sources of Nitrates/Nitrites

PWSID 220025.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Residential Areas	R01	R01-1	A	Low	2	6 acres.
Septic systems (serves one single-family home)	R02	R02-1	A	Low	2	
Highways and roads, paved (cement or asphalt)	X20	X20-1	A	Low	2	1 road.
Residential Areas	R01	R01-2	B	Low	2	58 acres.
Septic systems (serves one single-family home)	R02	R02-2-10	B	Low	2	
Highways and roads, paved (cement or asphalt)	X20	X20-2-4	B	Low	2	

Table 4

Contaminant Source Inventory and Risk Ranking for MATANUSKA TELEPHONE ASSOCIATION (MTA) Sources of Volatile Organic Chemicals

PWSID 220025.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Residential Areas	R01	R01-1	A	Low	2	6 acres.
Septic systems (serves one single-family home)	R02	R02-1	A	Low	2	
Highways and roads, paved (cement or asphalt)	X20	X20-1	A	Low	2	1 road.
Residential Areas	R01	R01-2	B	Low	2	58 acres.
Septic systems (serves one single-family home)	R02	R02-2-10	B	Low	2	
Highways and roads, paved (cement or asphalt)	X20	X20-2-4	B	Low	2	

Table 5

Contaminant Source Inventory and Risk Ranking for MATANUSKA TELEPHONE ASSOCIATION (MTA) Sources of Heavy Metals, Cyanide and Other Inorganic Chemicals

PWSID 220025.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Residential Areas	R01	R01-1	A	Low	2	6 acres.
Septic systems (serves one single-family home)	R02	R02-1	A	Low	2	
Highways and roads, paved (cement or asphalt)	X20	X20-1	A	Low	2	1 road.
Residential Areas	R01	R01-2	B	Low	2	58 acres.
Septic systems (serves one single-family home)	R02	R02-2-10	B	Low	2	
Highways and roads, paved (cement or asphalt)	X20	X20-2-4	B	Low	2	

Table 6

Contaminant Source Inventory and Risk Ranking for MATANUSKA TELEPHONE ASSOCIATION (MTA) Sources of Synthetic Organic Chemicals

PWSID 220025.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Residential Areas	R01	R01-1	A	Low	2	6 acres.
Septic systems (serves one single-family home)	R02	R02-1	A	Low	2	
Residential Areas	R01	R01-2	B	Low	2	58 acres.
Septic systems (serves one single-family home)	R02	R02-2-10	B	Low	2	

Table 7

Contaminant Source Inventory and Risk Ranking for MATANUSKA TELEPHONE ASSOCIATION (MTA) Sources of Other Organic Chemicals

PWSID 220025.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Residential Areas	R01	R01-1	A	Low	2	6 acres.
Septic systems (serves one single-family home)	R02	R02-1	A	Low	2	
Highways and roads, paved (cement or asphalt)	X20	X20-1	A	Low	2	1 road.
Residential Areas	R01	R01-2	B	Low	2	58 acres.
Septic systems (serves one single-family home)	R02	R02-2-10	B	Low	2	
Highways and roads, paved (cement or asphalt)	X20	X20-2-4	B	Low	2	

APPENDIX C

Matanuska Telephone Association
Drinking Water Protection Area
and Potential and Existing Contaminant Sources
(Map 2)

Map 1- Matanuska Telephone Association (formerly: Landscape Supply)

PWSID: 220025.001

Alaska DEC

0 — 1,380 Feet

1 inch equals 400 feet

Data Sources:
Boroughs: Roads and parcels
Public Water Systems: DEC
Potential Sources of Contamination: DEC

N W E S

Identified PWS Locations

System Class

- **Class A (Federal Classification: Community (C), or Non-Transient Non-Community (NTNC))**
- **Class B (Federal Classification: Non-Community (NC), or Transient Non-Community (TNC))**
- Zone A (Several Months Time of Travel)
- Zone B (2 Year Time of Travel)