A Source Water Assessment (SWA) for

PWSID #226021 – Majestic Hills Subdivision – WL001 and WL002

What is an SWA?

The Drinking Water Protection group of the Drinking Water Program is producing Source Water Assessments (SWAs) in compliance with the Safe Drinking Water Act (SDWA) Amendments of 1996. Each SWA includes:

- A delineation of the drinking water source area;
- Inventory of potential and existing sources of contamination;
- Risk ranking for the identified contaminants;
- Evaluation of the overall vulnerability to the PWS source.

What is a Protection Area?

The most probable area for contamination to reach the drinking water well is within the drinking water protection area (DWPA). The DWPA for a groundwater source is the area around 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 DWPA are most likely to impact the well, this area will serve as the focus for voluntary protection efforts.

The DWPAs established for wells by DEC are separated into 2 zones, limited by the watershed. The following is a summary of the two zones for wells and the estimated time-of-travel for each:

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

Natural Susceptibility

Susceptibility of a groundwater source is a measure of a water supply's potential to become contaminated based on information gathered on the wellhead and the aquifer.

Table 1: Public Water System Source Information

PWS Name	**MAJESTIC HILLS SUBDIVISION**	
PWSID Number	226021	
Federal Designation	Community water system (CWS)	
State Assigned ID	WL001	WL002
Facility Name	Well	Majestic Hills Subd.
Source Type	Groundwater	Groundwater
Total Depth of Well (ft bls*)	141	141
Static Water Level (ft bls*)	72	72
Aquifer Type	Unconfined	Unconfined
Aquifer Formation	Gravel and sand	Sandy Gravel
Description and Cumulative Thickness of Barrier (ft)	N/A	N/A
Date Well Completed	3/4/2003	4/25/2003

*"*ft bls*" = feet below land surface

Executive Summary

The public water system (PWS) for MAJESTIC HILLS SUBDIVISION is a Community water system (CWS) consisting of two (2) wells, at the time of this report, located in Palmer, Alaska. This report is a combined assessment of wells WL001 and WL002. An assessment of the susceptibility of the wellheads and aquifer to contamination, and the vulnerability of the wells to potential and existing contamination were evaluated as of December 2014. Both WL001 and WL002 wellheads received a susceptibility rating of ***Low*** and the aquifer received a susceptibility rating of ***High***. Combining these two ratings produces a ***Low*** rating for the natural susceptibility of the wells and aquifer. Identified potential and existing sources of contamination for MAJESTIC HILLS SUBDIVISION WL001 and WL002 include residential areas, single family home septic systems, highways and roads (cement or asphalt), cropland, livestock stables/corrals, heavy equipment rental/storage, Contaminated Sites (DEC recognized, non-Superfund, non-RCRA), Open Leaking Underground Fuel Storage Tank (LUST) sites, Municipal or city parks (with green areas), bus maintenance facilities, and motor vehicle/general storage yards/facilities. These are considered sources one or more of the following six (6) contaminant risk categories: 1) bacteria and viruses; 2) nitrates and/or nitrites; 3) volatile organic chemicals (VOCs); 4) heavy metals, cyanide, and other inorganic chemicals (inorganic chemicals); 5) synthetic organic chemicals (SOCs); and 6) other organic chemicals (OOCs).

Combining the natural susceptibility of the wells and aquifer with the six (6) contaminant risk categories, MAJESTIC HILLS SUBDIVISION WL001 and WL002 received an overall vulnerability rating of ***Medium*** for bacteria and viruses; ***Medium*** for nitrates and/or nitrites; ***Medium*** for VOCs; ***Medium*** for inorganic chemicals; and a ***Medium*** for SOCs and ***Medium*** for OOCs.

Introduction

Source Water Assessments (SWAs) are intended to provide PWS operators, owners, communities, and local governments with the best available information that may be used to protect the quality of their drinking water. The SWA for the MAJESTIC HILLS SUBDIVISION WL001 and WL002 is a tool to be used as the foundation or "stepping stone" to comprehensive management and protection of its groundwater resource. Protecting the quality of your drinking water is a sensible investment.

Drinking Water Protection Area

For groundwater sources, a combination of a numerical flow model and natural factors such as drainage divides, subsurface barriers, and manmade structures are used to determine the size and shape of the Drinking Water Protection Area (DWPA). The orientation of the DWPA is typically drawn using a groundwater surface, or a land surface, elevation map. Because of uncertainties and changing site conditions, a factor of safety is added in calculating the size of the DWPA. (See Map1 of the Appendices)

Natural Susceptibility (Wellhead and Aquifer)

The susceptibility of a wellhead to the introduction of contaminants to the drinking water is determined by, but not limited to, the following risk factors: presence of a sanitary seal, protection from flooding, drainage, and presence of adequate grouting.

The wellheads for the MAJESTIC HILLS SUBDIVISION WL001 and WL002 received a ***Low*** susceptibility rating. The most recent sanitary survey (completed May 30, 2012) indicates that the wells are capped with a sanitary seal, the wells are not in a floodplain, the land surface is sloped to drain away from the wellheads, and that a subsurface grout seal was installed to the required depth. 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, or through casing seams/cracks to the inside of the well casing, and into the well and/or aquifer.

The susceptibility of an aquifer to the introduction of contaminants is determined by, but not limited to, the following risk factors: whether the aquifer is confined or unconfined, whether the well is completed in unconsolidated or fractured bedrock, whether other nearby wells and bore holes are penetrating the aquifer and if applicable the characteristics of the confining layer(s).

The MAJESTIC HILLS SUBDIVISION WL001 and WL002 draw water from an unconfined aquifer completed in varying proportions of mainly sand and gravel. It received a ***High*** susceptibility rating primarily because of the many water wells located within the DWPA. A confined aquifer is generally more protected than an unconfined aquifer from the infiltration of surface water potentially carrying contaminants by migrating downward from the surface to the aquifer. However, other wells that penetrate the confining layers create a potential pathway for surface water and contaminants to the aquifer.

The Natural Susceptibility of the wells and aquifer to contamination is ***Low***. Table 2 summarizes the susceptibility ratings for the MAJESTIC HILLS SUBDIVISION WL001 and WL002.

Table 2: Susceptibility Ratings

Susceptibility of the wellheads	***Low***
+	
Susceptibility of the aquifer	***High***
=	
Natural susceptibility	***Low***

Inventory of Potential and Existing Sources Contamination

The Drinking Water Protection (DWP) group has completed an inventory of potential and existing sources of contamination within the DWPA for the MAJESTIC HILLS SUBDIVISION WL001 and WL002. This inventory was completed through a search of agency records and other publicly available information. Potential sources of contamination 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. The identified potential sources of contamination are summarized in Table 3 and are portrayed in Map 2 of the Appendices.

Table 3: Contaminant Source Inventory

Contaminant Source Type	Contaminant Source ID	Zone	Comments
Residential Areas	R01-01-90	A	Identified approximately 90 acres of residential areas within Zone A
Septic systems (serves one single-family home)	R02-01-54	A	Identified 54 residential septic systems within Zone A
Highways and roads, paved (cement or asphalt)	X20-01-06	A	Brooks Rd, Inner Springer Loop, King Mountain Ln, Mt. Gannett Cir, Outer Springer Loop and Pinnacle Mountain Dr
Cropland	A02-01	B	Geo. Crowther Farm
Livestock stables/corrals	A09-01	B	Doogan Arabian Horses
Livestock stables/corrals	A09-02	B	Windsong Stables
Heavy equipment rental/storage	C18-01	B	Alaska Demolition
Residential Areas	R01-91-164	B	Identified approximately 74 acres of residential areas within Zone B
Septic systems (serves one single-family home)	R02-55-94	B	Identified 40 residential septic systems within Zone B
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04-01	B	Alaska State Fairgrounds (Hazard ID# 2420); Status - Cleanup Complete as of 09/30/1996; Contaminant - Total Petroleum Hydrocarbons
Open Leaking Underground Fuel Storage Tank (LUST) Sites	U07-01	B	Tundra Tours - Palmer Bus Barn (Hazard ID# 23618); Status - Cleanup Complete as of 11/03/2005

Municipal or city parks (with green areas)	X04-01	B	Hermon Brothers Field
Bus maintenance facilities	X16-01	B	Tundra Tours, Inc
Highways and roads, paved (cement or asphalt)	X20-07-11	B	Caulkins St, Crowther Rd, Idaho Peak Cir, Rebarchek Ave, Verda Dr
Motor vehicle/general storage yards/facilities	X27-01	B	Truck transportation business on Caulkins St

Contaminant Risks

Inventoried contaminant sources are sorted by the Drinking Water Protection (DWP) group according to the six (6) major categories of contaminants regulated for drinking water: 1) bacteria and viruses; 2) nitrates and/or nitrites; 3) volatile organic chemicals (VOCs); 4) heavy metals, cyanide, and other inorganic chemicals (inorganic chemicals); 5) synthetic organic chemicals (SOCs); and 6) other organic chemicals (OOCs). The contaminant sources are then given a ranking (within each category) according to the density of sources within the DWPA, the PWS sampling history, as well as the degree of risk posed to human health based on the volume, toxicity, persistence, and the mobility of the contaminants involved. The contaminant risk rankings are summarized in Table 4.

Table 4: Contaminant Risk Rankings

Contaminant Source Type	Contaminant	Zone	Bacteria	Nitrates	VOC	Metals	SOC	OOC
Septic systems (serves one single-family home)	R02-01-54	A	Low	Low	Low	Low	Low	Low
Highways and roads, paved (cement or asphalt)	X20-01-06	A	Low	Low	Low	Low	N/A	Low
Cropland	A02-01	B	N/A	High	N/A	Medium	High	N/A
Livestock stables/corrals	A09-01	B	Medium	Medium	N/A	N/A	Low	N/A
Livestock stables/corrals	A09-02	B	Medium	Medium	N/A	N/A	Low	N/A
Heavy equipment rental/storage	C18-01	B	N/A	N/A	Medium	Low	N/A	Medium
Residential Areas	R01-91-164	B	Low	Low	Low	Low	Low	Low
Septic systems (serves one single-family home)	R02-55-94	B	Low	Low	Low	Low	Low	Low
Municipal or city parks (with green areas)	X04-01	B	Medium	Medium	N/A	Low	Low	N/A
Bus maintenance facilities	X16-01	B	N/A	N/A	Medium	Low	N/A	Medium
Highways and roads, paved (cement or asphalt)	X20-07-11	B	Low	Low	Low	Low	N/A	Low

Motor vehicle/general storage yards/facilities	X27-01	B	N/A	N/A	Low	N/A	N/A	Low
Contaminant Category Risk Ranking*			***High***	***High***	***Medium***	***Medium***	***High***	***Medium***

** Includes heavy metals, cyanide, and other inorganic chemicals.*
*** Scores based on additional factors, such as sampling history, and number/density of sources.*

The contaminant category risk ranking for Bacteria & Viruses is ***High***. This ranking is driven primarily by livestock stables/corrals, municipal or city parks (with green areas), and the density of residential septic systems, roads, and residential areas located within the DWPA. A positive Total Coliform (which may include fecal coliform and *E. Coli*, but not a confirmation of the presence of either) has not been detected in recent years. Coliforms are naturally present in the environment, as well as feces; fecal coliforms and *E. Coli* only come from human and animal fecal waste. Total Coliforms is not a health threat in itself; it is used to indicate whether other potentially harmful bacteria may be present.

The contaminant category risk ranking for Nitrates and/or Nitrites is ***High***. This ranking is driven primarily by cropland, livestock stables/corrals, municipal or city parks (with green areas), and the density of residential septic systems, roads, and residential areas located within the DWPA. Nitrates and/or nitrites have been detected in samples collected in recent years, but an increasing or decreasing trend is not apparent; the most recent sample collected April 2013, showed a total nitrate-nitrite concentration of 0.769 milligrams per liter (mg/L), which is .8% of the maximum contaminant level (MCL) of 10 mg/L for nitrate. Sources of nitrate and/or nitrite may include runoff from fertilizer use, leaking from septic tanks, sewage, and/or erosion from natural deposits. A relatively low concentration and absence of a clear trend implies that the source is natural, rather than anthropogenic. Potential health effects include serious illness and, if untreated, death for infants below the age of six months; symptoms include a shortness of breath and blue-baby syndrome.

The contaminant category risk ranking for VOCs is ***Medium***. This ranking is driven primarily by heavy equipment rental/storage, bus maintenance facilities, motor vehicle/general storage yards/facilities, and the density of residential septic systems, roads, and residential areas located within the DWPA. VOCs have not been detected in samples collected in recent years. Sources of VOCs may be either natural or anthropogenic. Potential health effects are typically compounding long-term, and not acute.

The contaminant category risk ranking for Inorganic Chemicals is ***Medium***. This ranking is driven primarily by cropland, heavy equipment rental/storage, bus maintenance facilities, municipal or city parks (with green areas), and the density of residential septic systems, roads, and residential areas located within the DWPA. Barium was detected at a concentration of 16 micrograms per liter (μg/L) (.8% of the MCL of 2000μg/L) December 2010. Sources of arsenic may include erosion of natural deposits, runoff from orchards, and/or runoff from glass & electronics production wastes. A potential health effect from long-term exposure above the MCL may include skin damage or problems with circulatory systems, and an increased risk of cancer.

The contaminant category risk ranking for SOCs is ***High***. This ranking is driven primarily by cropland, livestock stables/corrals, municipal or city parks (with green areas), and the density of residential septic systems, and residential areas located within the DWPA. This PWS has received an SOC Monitoring Waiver for compliance periods 2011-2013, 2008-2010, and 2005-2007.

The contaminant category risk ranking for OOCs is ***Medium***. This ranking is driven primarily by heavy equipment rental/storage, bus maintenance facilities, motor vehicle/general storage yards/facilities, and the density of residential septic systems, roads, and residential areas located within the DWPA. This PWS has received an SOC Monitoring Waiver for compliance periods 2011-2013, 2008-2010, and 2005-2007.

Overall Vulnerability of the Drinking Water Source to Contamination

An overall vulnerability is determined by combining each of the contaminant category risk rankings with the natural susceptibility score:

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

Table 5 summarizes the overall vulnerability ratings for each of the six (6) contaminant categories.

Table 5: Overall Vulnerability

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

Using the Source Water Assessment

This assessment of contaminant risks and source vulnerability can be used as a foundation for local voluntary protection efforts as well as a basis for the continuous efforts on the part of the MAJESTIC HILLS SUBDIVISION PWS to protect public health. Communities can use the Source Water Assessment (SWA) to create a drinking water protection plan to manage the identified potential and existing sources of regulated drinking water contaminants and to prevent or minimize new contaminant threats in the drinking water protection area.

The MAJESTIC HILLS SUBDIVISION PWS can use a number of different drinking water protection methods to limit or prevent contamination of its drinking water source.

- *Non-Regulatory Options include:*
    - Public education about where drinking water comes from and the effects of contaminants is probably the most effective and least costly method of protection;
    - Household hazardous waste collection - household hazardous wastes are usually generated in small amounts but can have a big impact on the environment;
    - The source water assessment report is a tool that can be used to prioritize protection strategies identified in a drinking water protection plan;
    - Taking proactive measures towards proper waste storage and disposal can help eliminate the need to find an alternative drinking water source by preventing source water contamination;
    - Conservation easements - easements can assist in protecting the area by limiting development;
    - Make a written plan on what you will do if an accidental spill happens that could contaminate your source of drinking water; and
    - Local drinking water protection plan (an example or template is available from DEC).

- *Regulatory Options include:*

- Source protection regulations prohibiting the presence or use of all or specific chemicals within the drinking water protection area;
- Zoning ordinances to control development within the different protection areas around the source;
- Subdivision ordinance; and
- Operating standards for industrial and other activities within the different protection areas around the source.

Source Water Assessments can be updated to reflect any changes in the vulnerability and/or susceptibility of the MAJESTIC HILLS SUBDIVISION WL004 and WL005. The data that is used to generate the SWA is updated on an on-going basis as identified in the field or if changes are identified and brought to the attention of the Drinking Water Program.

Where to go from here?

The SWA is a comprehensive evaluation of the potential risk of contamination to the PWS and the source(s) of drinking water used by the system. Identifying potential sources of contamination and the vulnerability of the PWS is an important first step in protecting the drinking water source from contamination. However, in order to prevent contamination from occurring, action must be taken by the PWS owner and/or operator. The SWA can be used by the PWS to educate the local community and to prioritize community-driven protection strategies. Inviting community members, council members, and local government officials to help develop a drinking water protection plan is one essential component towards successful drinking water protection efforts. For questions regarding, or assistance to begin, the process of developing a drinking water protection plan, please contact the Drinking Water Protection group toll-free at #1-866-956-7656 (within Alaska only), or direct at #907-269-7656.

Other Resources

The Drinking Water Protection group, the Environmental Protection Agency (EPA), and local organizations are available to help you build on this SWA report as you continue to improve drinking water protection in your community.

- DEC, Drinking Water Protection - http://dec.alaska.gov/eh/dw/DWP/DWP_main.html
- EPA, Drinking Water Protection - http://cfpub.epa.gov/safewater/sourcewater/index.cfm
- Groundwater Foundation - http://www.groundwater.org
- Groundwater Protection Council- http://www.gwpc.org
- National Ground Water Association: http://www.ngwa.org/Pages/default.aspx

Appendices

- MAJESTIC HILLS SUBDIVISION WL001 and WL002 Drinking Water Protection Area Location Map (Map 1);
- MAJESTIC HILLS SUBDIVISION WL001 and WL002 Drinking Water Protection Area with Potential and Existing Contaminant Sources (Map 2);
- Example Best Management Strategies for Potential Contaminants Identified within a Drinking Water Protection Area.

Map 1 - Majestic Hills Subdivision WL001 and WL002
PWS ID#s 226021.001 and 226021.002

Public Water Systems

- Community Water System (Formerly Class A)
- NonTransient/NonCommunity (Formerly Class A)
- NonCommunity (Formerly Class B)
- NonPublic (Class C-State Regulated)

Drinking Water Protection Areas

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

N W E S

DATA SOURCES:

Shaded Map Relief: A WMS-compliant map server provided by the Alaska Mapped program (http://www.alaskamapped.org) and UAF-GINA (http://www.gina.alaska.edu) and Microsoft Virtual Earth Aerial with labels (c)2009 Microsoft Corporation.
Public Drinking Water Sources, Drinking Water Protection Areas: Alaska Department of Environmental Conservation

Prepared by: Anne Gleason on 11/28/2012.

Potential/Existing Sources of Contamination (Zone B):
- 1 cropland, A02
- 2 livestock stables/corrals, A09
- 1 heavy equipment storage, C18
- approximately 74 acres of residential areas, R01
- 40 residential septi systems, R02
- 1 ADEC contaminated site, U04
- 1 LUST site, U07
- 1 park (green area), X04
- 1 bus maintenance facility, X16
- 5 roads, X20
- 1 motor vehicle/storage yard, X27

Potential/Exsiting Sources of Contamination (Zone A):
- approximately 90 acres of residential areas, R01
- 54 residential septic systems, R02
- 6 roads, X20

Majestic Hills SD Well #1 (WL001) and Well #2 (WL002)
PWS ID#s 226021.001 and 226021.002

Map 2 - Majestic Hills Subdivision Well #1 (WL001) and Well #2 (WL002) PWS ID#s 226021.001 and 226021.002

Public Water Systems
- Community Water System (Formerly Class A)
- NonTransient/NonCommunity (Formerly Class A)
- NonCommunity (Formerly Class B)
- NonPublic (Class C-State Regulated)

Drinking Water Protection Areas
- Zone A (GW-Several Months Time of Travel)
- Zone B (GW-2 Yr Time of Travel)

Potential/Existing Sources of Contamination
- A09, Livestock stables/corrals
- C18, Heavy equipment rental/storage
- U04, Contaminated sites, DEC recognized, non-Superfund, non-RCRA
- U07, Open Leaking Underground Fuel Storage Tank (LUST) Sites
- X16, Bus maintenance facilities
- X27, Motor vehicle/general storage yards/facilities
- R02, Residential Septic Systems
- R01, Residential Areas
- A02, Cropland
- X04, Parks (with green areas)

N W E S

1:8,400

0 0.125 0.25 0.5 Miles

DATA SOURCES:

Shaded Map Relief: A WMS-compliant map server provided by the Alaska Mapped program (http://www.alaskamapped.org) and UAF-GINA (http://www.gina.alaska.edu) and Microsoft Virtual Earth Aerial with labels (c)2009 Microsoft Corporation.
Public Drinking Water Sources, Drinking Water Protection Areas and Potential/Existing Sources of Contamination: Alaska Department of Environmental Conservation

Prepared by: Anne Gleason on 12/4/2012.