

Source Water Assessment

A Hydrogeologic Susceptibility and
Vulnerability Assessment for
Glacier Bear Lodge,
Yakutat, Alaska
PWSID #130164

DRINKING WATER PROTECTION PROGRAM REPORT NO. 720

Alaska Department of Environmental Conservation

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The Drinking Water Protection Program (DWPP) 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 DWPP, (907) 269-7521.

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Source Water Assessment for Glacier Bear Lodge, Yakutat, Alaska

Drinking Water Protection Program Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

The public water system for Glacier Bear Lodge is a Class B (transient/non-community) water system consisting of five wells with 14 service connections. The Glacier Bear Lodge is located in Yakutat, Alaska. The wellhead received a susceptibility rating of **Low** and the aquifer a susceptibility rating of **Very High**. Combining these two ratings produces a **High** rating for the natural susceptibility of the wells. Identified potential and current sources of contaminants for Glacier Bear Lodge public drinking water source includes: septic systems; aboveground heating oil tanks; dirt/gravel highways and roads; and a landfill. These identified potential and existing sources of contamination are considered sources of bacteria and viruses, nitrates and/or nitrites, and volatile organic chemicals. Overall, the public water sources for Glacier Bear Lodge received a vulnerability rating of **Very High** for bacteria and viruses, and nitrates and nitrites, and **High** for volatile organic chemicals.

GLACIER BEAR LODGE PUBLIC DRINKING WATER SYSTEM

Glacier Bear Lodge public water system is a Class B (transient/non-community) water system. The system consists of the main lodge well and backup well that are currently in service at the Glacier Bear Lodge in Yakutat, Alaska. Yakutat is located on the Gulf of Alaska coast, where southeastern Alaska joins the major body to Alaska to the west. Yakutat is 225 miles northwest of Juneau. The population of Yakutat is approximately 800.

Yakutat averages about 150 inches of precipitation per year; and approximately 200 inches of snow. The groundwater aquifers underlying the area are recharged through the infiltration of precipitation and surface water. Groundwater aquifers in the region generally occur in the fractured bedrock and unconsolidated sediments deposited by glaciers and/or rivers. The elevation for Yakutat is near sea level.

According to a Sanitary Survey dated June 10, 1999, the current water system initially began operation in 1972. The well assessed for this Sanitary Survey was installed to a depth of 90 feet below ground surface, with 4-inch well casing and screening at 60 feet below ground surface. The survey indicates that the land

surface is appropriately sloped away from the wells, providing adequate surface water drainage. The well does not include a concrete pad at the surface and, based on the date in which the well was drilled, is not grouted. Proper grouting provides added protection against contaminants traveling along the well casing and into source waters.

This system operates year round and serves approximately 60 non-residents.

GLACIER BEAR LODGE 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 area that contributes water to the well, the groundwater recharge area. This area is designated as the Drinking Water Protection Area (DWPA). Because releases of contaminants within the DWPA are most likely to impact the drinking water well, this area will serve as the focus for voluntary protection efforts.

An analytical calculation was used to determine the size and shape of the DWPA. The input parameters describing the attribute of the aquifer in this calculation were adopted from the U.S. Geological Survey (Patrick, Brabets, and Glass, 1989), and State of Alaska Department of Water Resources (Jokela, et. al., 1991). Additional methods were also used to take into account any uncertainties in groundwater flow and aquifer characteristics to arrive at a meaningful DPWA (Please refer to the Guidance Manual for Class B Public Water Systems for additional information).

The DWPAs established for wells by the ADEC are usually separated into four zones. These zones correspond to differences in the time-of-travel (TOT) of the water moving through the aquifer to the well.

The TOT 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 four protection area zones for wells and the calculated time-of-travel for each:

Table 1. Definition of Zones

Zone	Definition
A	¼ the distance for the 2-yr. time-of-travel
B	Less than the 2 year time-of-travel
C	Less Than the 5 year time-of-travel
D	Less than the 10 year time-of-travel

The DWPA for Glacier Bear Lodge extends 1.3 miles north of Glacier Bay Lodge. Development in the vicinity of the well occurs in Zones A, B, C, and D (See Map 1 of Appendix A).

INVENTORY OF POTENTIAL AND EXISTING CONTAMINANT SOURCES

The Drinking Water Protection Program has completed an inventory of potential and existing sources of contamination within the Glacier Bear Lodge 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 Class B public water system assessments, three categories of drinking water contaminants were inventoried. They include:

- Bacteria and viruses;
- Nitrates and/or nitrites;
- Volatile 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 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.

The TOT for contaminants within the water varies and is dependent on the physical and chemical characteristics of each contaminant. Bacteria and Viruses are only inventoried in Zones A and B because of their short life span. Only “Very High” and “High” rankings are inventoried within the outer Zone D due to the probability of contaminant dilution by the time the contaminants get to the well.

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 GLACIER BEAR LODGE DRINKING WATER SYSTEM

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

- Natural susceptibility; and
- Contaminant risks.

Appendix D contains eight charts, which together form the ‘Vulnerability Analysis’ for a source water assessment for a public drinking water source. Chart 1 analyzes the ‘Susceptibility of the Wellhead’ to contamination by looking at the construction of the well and its surrounding area. Chart 2 analyzes the ‘Susceptibility of the Aquifer’ to contamination by looking at the naturally occurring attributes of the water source and influences on the groundwater system that might lead to contamination. Chart 3 analyzes ‘Contaminant Risks’ for the drinking water source with respect to bacteria and viruses. The ‘Contaminant Risks’ portion of the analysis considers potential sources of contaminants as well as a review of contamination that has or may have occurred, but has not arrived or been detected at the well. Lastly, Chart 4 contains the ‘Vulnerability Analysis for Bacteria and Viruses’. Charts 5 through 8 contain the Contaminant Risks and Vulnerability Analyses for nitrates and nitrites and volatile organic chemicals, respectively.

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

Susceptibility of the Wellhead (0 – 25 Points)
(Chart 1 of Appendix D)

+

Susceptibility of the Aquifer (0 – 25 Points)
(Chart 2 of Appendix D)

=

Natural Susceptibility (Susceptibility of the Well)
(0 – 50 Points)

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

Natural Susceptibility Ratings

40 to 50 pts	Very High
30 to < 40 pts	High
20 to < 30 pts	Medium
< 20 pts	Low

The wells for the Glacier Bear Lodge are completed in an unconfined aquifer. Because unconfined aquifers are recharged by surface water and precipitation that migrates downward from the surface, contaminants at the surface have the potential to adversely impact this aquifer. Table 2 shows the Susceptibility scores and ratings for Glacier Bear Lodge

Table 2. Susceptibility

	Score	Rating
Susceptibility of the Wellhead	5	Low
Susceptibility of the Aquifer	25	Very High
Natural Susceptibility	30	High

Contaminant risks to a drinking water source depend on the type, number or density, and distribution of contaminant sources. This score has been derived from an examination of existing and historical contamination that has been detected at the drinking water source through routine sampling. It also evaluates potential sources of contamination. 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 to 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.

Table 3. Contaminant Risks

Category	Score	Rating
Bacteria and Viruses	50	Very High
Nitrates and/or Nitrites	50	Very High
Volatile Organic Chemicals	40	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).

Again, rankings are assigned according to a point score:

Overall Vulnerability Ratings

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

Table 4. Overall Vulnerability

Category	Score	Rating
Bacteria and Viruses	80	Very High
Nitrates and Nitrites	80	Very High
Volatile Organic Chemicals	70	High

Bacteria and Viruses

The contaminant risk for bacteria and viruses is **Very High** with the septic systems; dirt/gravel highways and roads; and a landfill located within Zone A representing the risk to the drinking water well (See Chart 3 – Contaminant Risks for Bacteria and Viruses in Appendix D).

Only a small amount of bacteria and viruses are required to endanger public health. Bacteria and viruses sampling data were not detected in recent water sampling of the system at the Glacier Bear Lodge. However, after combining the contaminant risks with the overall natural susceptibility of the well, the vulnerability of the well to contamination by bacteria and viruses is **Very High**.

Nitrates and Nitrites

The contaminant risk for nitrates and nitrites is **Very High** with the septic systems; landfill; and dirt/gravel highways and roads representing the risk to this source of public drinking water (See Chart 5 - Contaminant Risks for Nitrates and/or Nitrites in Appendix D).

Sampling history for Glacier Bear Lodge indicates that nitrates have been detected in the water, but only in very low concentrations (most recently at 0.798 mg/L on 7/6/99) or 8% Maximum Contaminant Level (MCL). The MCL is the maximum level of contaminant that is allowed to exist in drinking water and still be consumed by humans without harmful health effects. Due to the high solubility and weak retention by soil, nitrates are very mobile, moving at approximately the same rate as water.

After combining the contaminant risk for nitrates and nitrites with the natural susceptibility of the well, the overall vulnerability of the well to contamination by nitrates and nitrites is **Very High**.

Volatile Organic Chemicals

The contaminant risk for volatile organic chemicals is **Very High** with the septic systems; aboveground non-residential heating oil tanks, landfill; and paved highways and roads creating the only known risk for volatile organic chemicals (See Chart 7 – Contaminant Risks for Volatile Organic Chemicals in Appendix D).

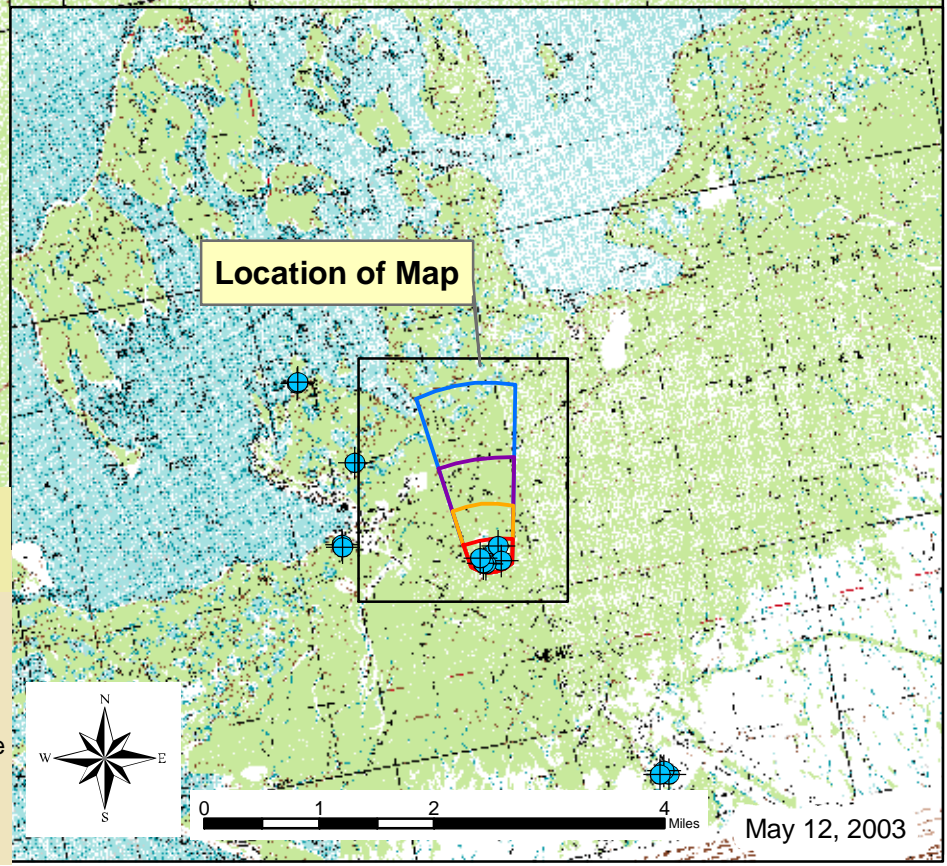
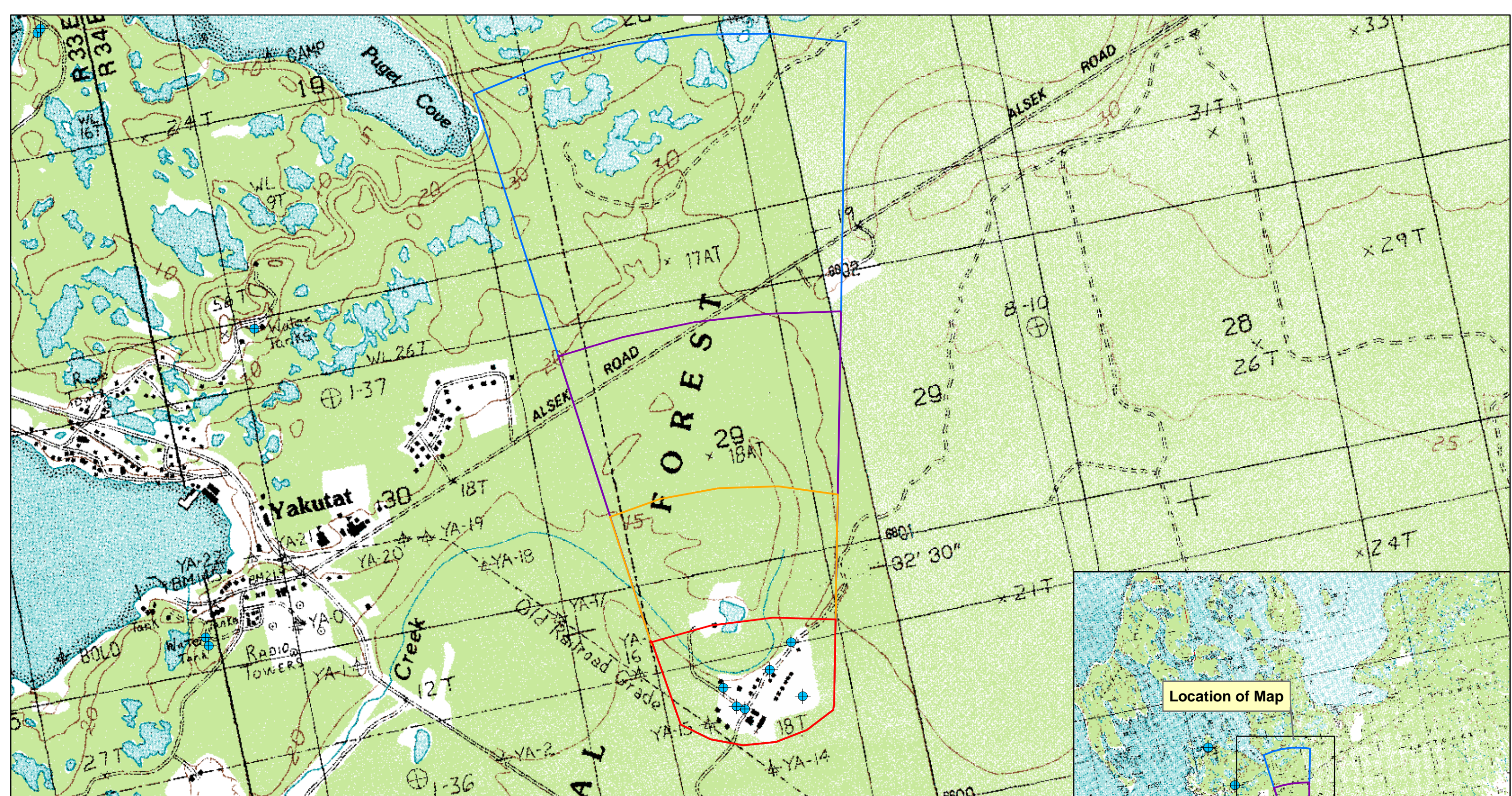
Volatile Organic Chemicals were not available for the drinking water at Glacier Bear Lodge. However, after combining the contaminant risk for volatile organic chemicals with the natural susceptibility of the well, the overall vulnerability of the well to contamination by volatile organic chemicals is **High**.

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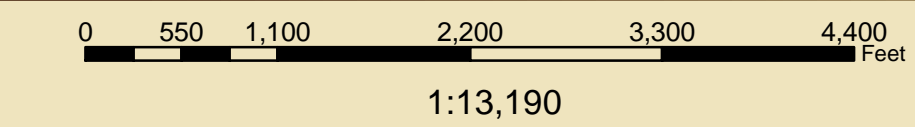
APPENDIX A

Glacier Bear Lodge Drinking Water Protection Area Location Map (Map 1)



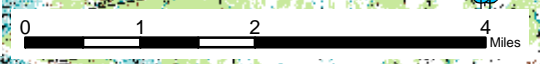
Map 1: Glacier Bear Lodge Drinking Water Protection Area

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Data Source:
Background images - USGS 1:25,000 Topos

- Legend
- Public Drinking Water Systems
 - Zone A Protection Area
Several Months Travel Time
 - Zone B Protection Area
Less than 2 Years Travel Time
 - Zone C Protection Area
Less than 5 Years Travel Time
 - Zone D Protection Area
Less than 10 Years Travel Time



May 12, 2003

APPENDIX B

Contaminant Source Inventory and Risk Ranking for Glacier Bear Lodge (Tables 1-4)

Table 1

**Contaminant Source Inventory for
Glacier Bear Lodge**

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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	A	2	Glacier Bear Lodge
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-2	A	2	Glacier Bear Lodge
Septic systems (serves one single-family home)	R02	R02-1	A	2	Residence West of Glacier Bear Lodge
Septic systems (serves one single-family home)	R02	R02-2	A	2	Residence East of Glacier Bear Lodge
Septic systems (serves one single-family home)	R02	R02-3	A	2	Residence North of Glacier Bear Lodge
Septic systems (serves one single-family home)	R02	R02-4	A	2	Residence Northwest of Glacier Bear Lodge
Tanks, heating oil, residential (above ground)	R08	R08-1	A	2	Residence West of Glacier Bear Lodge
Tanks, heating oil, residential (above ground)	R08	R08-2	A	2	Residence East of Glacier Bear Lodge
Tanks, heating oil, residential (above ground)	R08	R08-3	A	2	Residence North of Glacier Bear Lodge
Tanks, heating oil, residential (above ground)	R08	R08-4	A	2	Residence Northwest of Glacier Bear Lodge
Tanks, heating oil, nonresidential (aboveground)	T14	T14-1	A	2	Glacier Bear Lodge
Tanks, heating oil, nonresidential (aboveground)	T14	T14-10	A	2	Glacier Bear Lodge
Tanks, heating oil, nonresidential (aboveground)	T14	T14-2	A	2	Glacier Bear Lodge
Tanks, heating oil, nonresidential (aboveground)	T14	T14-3	A	2	Glacier Bear Lodge
Tanks, heating oil, nonresidential (aboveground)	T14	T14-4	A	2	Glacier Bear Lodge
Tanks, heating oil, nonresidential (aboveground)	T14	T14-5	A	2	Glacier Bear Lodge
Tanks, heating oil, nonresidential (aboveground)	T14	T14-6	A	2	Glacier Bear Lodge
Tanks, heating oil, nonresidential (aboveground)	T14	T14-7	A	2	Glacier Bear Lodge
Tanks, heating oil, nonresidential (aboveground)	T14	T14-8	A	2	Glacier Bear Lodge
Tanks, heating oil, nonresidential (aboveground)	T14	T14-9	A	2	Glacier Bear Lodge

Contaminant Source Inventory for
Glacier Bear Lodge

<i>Contaminant Source Type</i>	<i>Contaminant Source ID</i>	<i>CS ID tag</i>	<i>Zone</i>	<i>Map Number</i>	<i>Comments</i>
Water supply wells	W09	W09-2	A	2	Glacier Bear Lodge
Water supply wells	W09	W09-3	A	2	Glacier Bear Lodge
Water supply wells	W09	W09-4	A	2	Glacier Bear Lodge
Water supply wells	W09	W09-5	A	2	Glacier Bear Lodge
Water supply wells	W09	W9-1	A	2	Glacier Bear Lodge
Highways and roads, dirt/gravel	X24	X24-1	A	2	Road Northeast of Glacier Bear Lodge
Highways and roads, dirt/gravel	X24	X24-2	A	2	Road Northwest of Glacier Bear Lodge
Landfills (municipal; Class III)	D51	D51-1	C	2	City of Yakutat Landfill
Highways and roads, dirt/gravel	X24	X24-3	C	2	Alsek Road
Highways and roads, dirt/gravel	X24	X24-4	D	2	Road South of Alsek Road
Highways and roads, dirt/gravel	X24	X24-5	D	2	Road Northwest of Alsek Road

Contaminant Source Inventory and Risk Ranking for

PWSID 130164.001

Table 2

*Glacier Bear Lodge
Sources of Bacteria and Viruses*

<i>Contaminant Source Type</i>	<i>Contaminant Source ID</i>	<i>CS ID tag</i>	<i>Zone</i>	<i>Risk Ranking for Analysis</i>	<i>Map Number</i>	<i>Comments</i>
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A	High	2	Glacier Bear Lodge
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-2	A	High	2	Glacier Bear Lodge
Septic systems (serves one single-family home)	R02	R02-1	A	Low	2	Residence West of Glacier Bear Lodge
Septic systems (serves one single-family home)	R02	R02-2	A	Low	2	Residence East of Glacier Bear Lodge
Septic systems (serves one single-family home)	R02	R02-3	A	Low	2	Residence North of Glacier Bear Lodge
Septic systems (serves one single-family home)	R02	R02-4	A	Low	2	Residence Northwest of Glacier Bear Lodge
Highways and roads, dirt/gravel	X24	X24-1	A	Low	2	Road Northeast of Glacier Bear Lodge
Highways and roads, dirt/gravel	X24	X24-2	A	Low	2	Road Northwest of Glacier Bear Lodge
Landfills (municipal; Class III)	D51	D51-1	C	High	2	City of Yakutat Landfill

Contaminant Source Inventory and Risk Ranking for

PWSID 130164.001

Table 3

*Glacier Bear Lodge
Sources of Nitrates/Nitrites*

<i>Contaminant Source Type</i>	<i>Contaminant Source ID</i>	<i>CS ID tag</i>	<i>Zone</i>	<i>Risk Ranking for Analysis</i>	<i>Map Number</i>	<i>Comments</i>
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A	High	2	Glacier Bear Lodge
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-2	A	High	2	Glacier Bear Lodge
Septic systems (serves one single-family home)	R02	R02-1	A	Low	2	Residence West of Glacier Bear Lodge
Septic systems (serves one single-family home)	R02	R02-2	A	Low	2	Residence East of Glacier Bear Lodge
Septic systems (serves one single-family home)	R02	R02-3	A	Low	2	Residence North of Glacier Bear Lodge
Septic systems (serves one single-family home)	R02	R02-4	A	Low	2	Residence Northwest of Glacier Bear Lodge
Highways and roads, dirt/gravel	X24	X24-1	A	Low	2	Road Northeast of Glacier Bear Lodge
Highways and roads, dirt/gravel	X24	X24-2	A	Low	2	Road Northwest of Glacier Bear Lodge
Landfills (municipal; Class III)	D51	D51-1	C	Very High	2	City of Yakutat Landfill
Highways and roads, dirt/gravel	X24	X24-3	C	Low	2	Alsek Road

Contaminant Source Inventory and Risk Ranking for

PWSID 130164.001

Table 4

*Glacier Bear Lodge
Sources of Volatile Organic Chemicals*

<i>Contaminant Source Type</i>	<i>Contaminant Source ID</i>	<i>CS ID tag</i>	<i>Zone</i>	<i>Risk Ranking for Analysis</i>	<i>Map Number</i>	<i>Comments</i>
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A	Low	2	Glacier Bear Lodge
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-2	A	Low	2	Glacier Bear Lodge
Septic systems (serves one single-family home)	R02	R02-1	A	Low	2	Residence West of Glacier Bear Lodge
Septic systems (serves one single-family home)	R02	R02-2	A	Low	2	Residence East of Glacier Bear Lodge
Septic systems (serves one single-family home)	R02	R02-3	A	Low	2	Residence North of Glacier Bear Lodge
Septic systems (serves one single-family home)	R02	R02-4	A	Low	2	Residence Northwest of Glacier Bear Lodge
Tanks, heating oil, residential (above ground)	R08	R08-1	A	Medium	2	Residence West of Glacier Bear Lodge
Tanks, heating oil, residential (above ground)	R08	R08-2	A	Medium	2	Residence East of Glacier Bear Lodge
Tanks, heating oil, residential (above ground)	R08	R08-3	A	Medium	2	Residence North of Glacier Bear Lodge
Tanks, heating oil, residential (above ground)	R08	R08-4	A	Medium	2	Residence Northwest of Glacier Bear Lodge
Tanks, heating oil, nonresidential (aboveground)	T14	T14-1	A	Low	2	Glacier Bear Lodge
Tanks, heating oil, nonresidential (aboveground)	T14	T14-10	A	Low	2	Glacier Bear Lodge
Tanks, heating oil, nonresidential (aboveground)	T14	T14-2	A	Low	2	Glacier Bear Lodge
Tanks, heating oil, nonresidential (aboveground)	T14	T14-3	A	Low	2	Glacier Bear Lodge
Tanks, heating oil, nonresidential (aboveground)	T14	T14-4	A	Low	2	Glacier Bear Lodge
Tanks, heating oil, nonresidential (aboveground)	T14	T14-5	A	Low	2	Glacier Bear Lodge
Tanks, heating oil, nonresidential (aboveground)	T14	T14-6	A	Low	2	Glacier Bear Lodge

Contaminant Source Inventory and Risk Ranking for

PWSID 130164.001

Glacier Bear Lodge

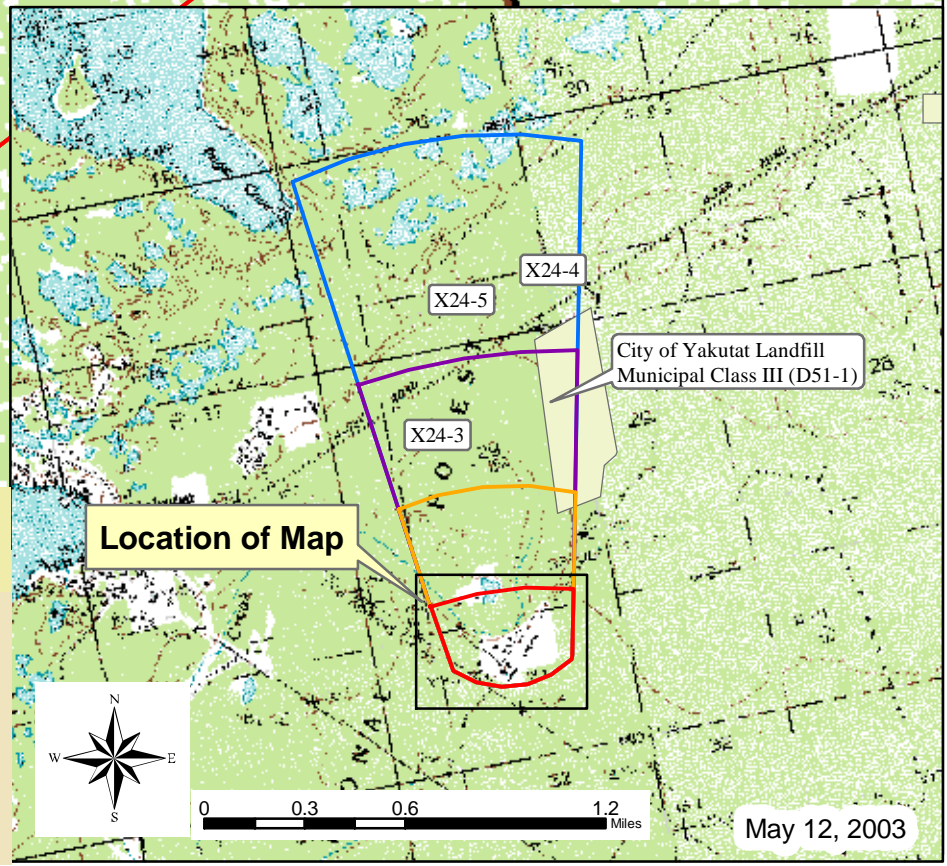
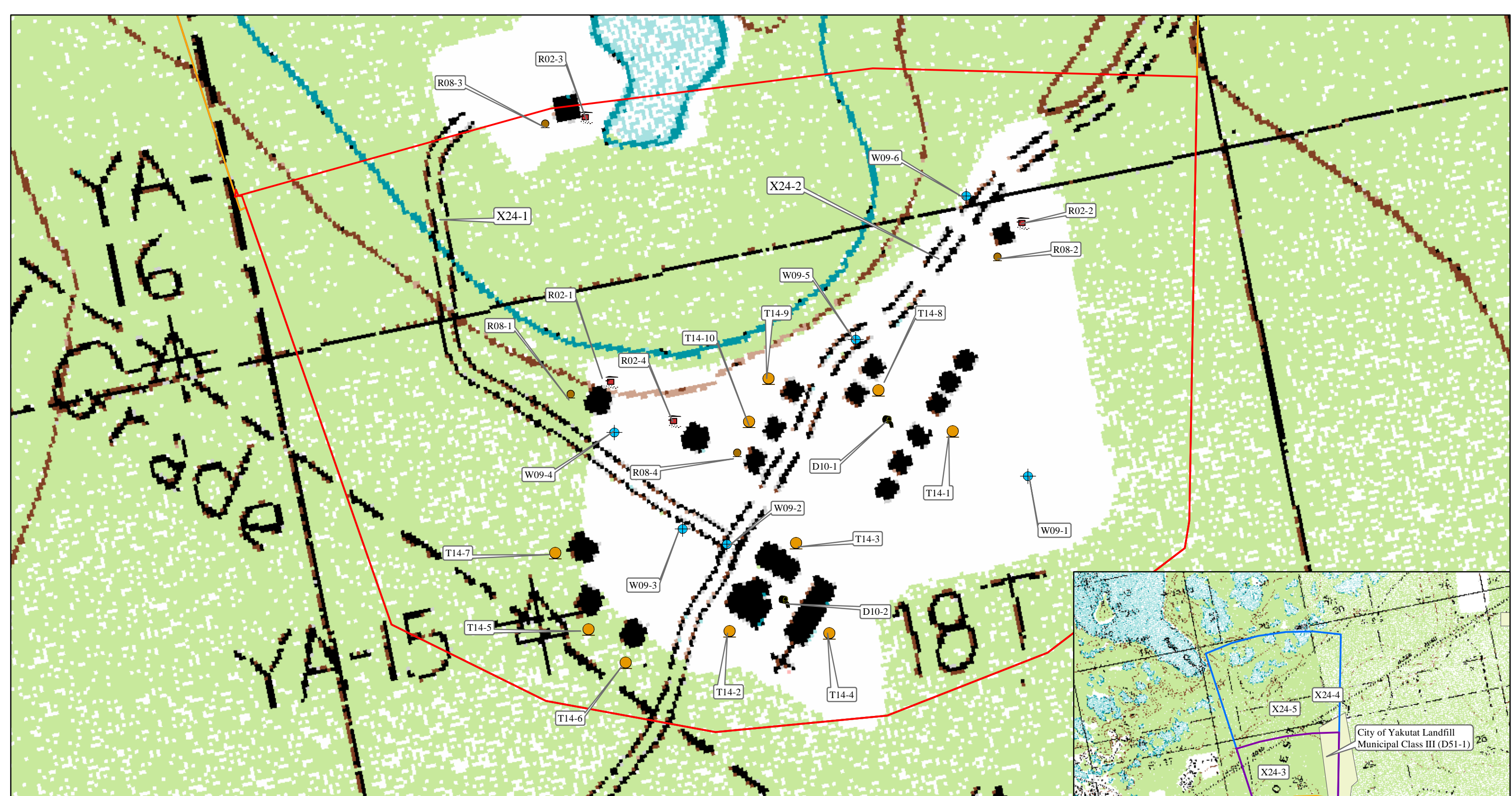
Sources of Volatile Organic Chemicals

Table 4 (continued)

<i>Contaminant Source Type</i>	<i>Contaminant Source ID</i>	<i>Risk Ranking CS ID tag</i>	<i>Map Zone</i>	<i>for Analysis</i>	<i>Number</i>	<i>Comments</i>
Tanks, heating oil, nonresidential (aboveground)	T14	T14-7	A	Low	2	Glacier Bear Lodge
Tanks, heating oil, nonresidential (aboveground)	T14	T14-8	A	Low	2	Glacier Bear Lodge
Tanks, heating oil, nonresidential (aboveground)	T14	T14-9	A	Low	2	Glacier Bear Lodge
Highways and roads, dirt/gravel	X24	X24-1	A	Low	2	Road Northeast of Glacier Bear Lodge
Highways and roads, dirt/gravel	X24	X24-2	A	Low	2	Road Northwest of Glacier Bear Lodge
Landfills (municipal; Class III)	D51	D51-1	C	High	2	City of Yakutat Landfill
Highways and roads, dirt/gravel	X24	X24-3	C	Low	2	Alsek Road

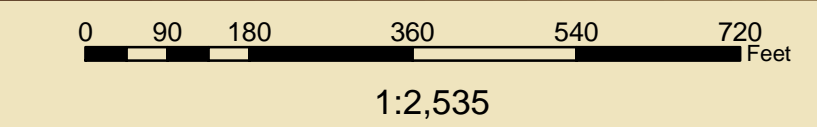
APPENDIX C

Glacier Bear Lodge Drinking Water Protection Area and Potential and Existing Contaminant Sources (Map 2)



Map 2: Drinking Water Protection Areas for Glacier Bear Lodge and Potential and Existing Sources of Contamination

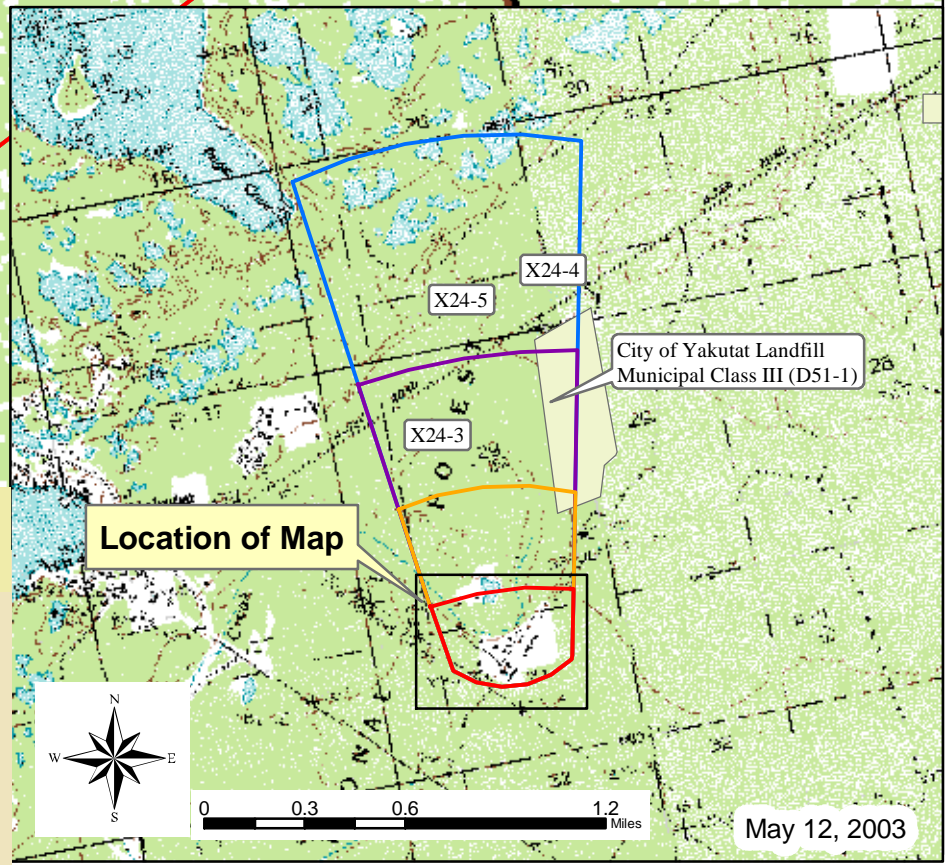
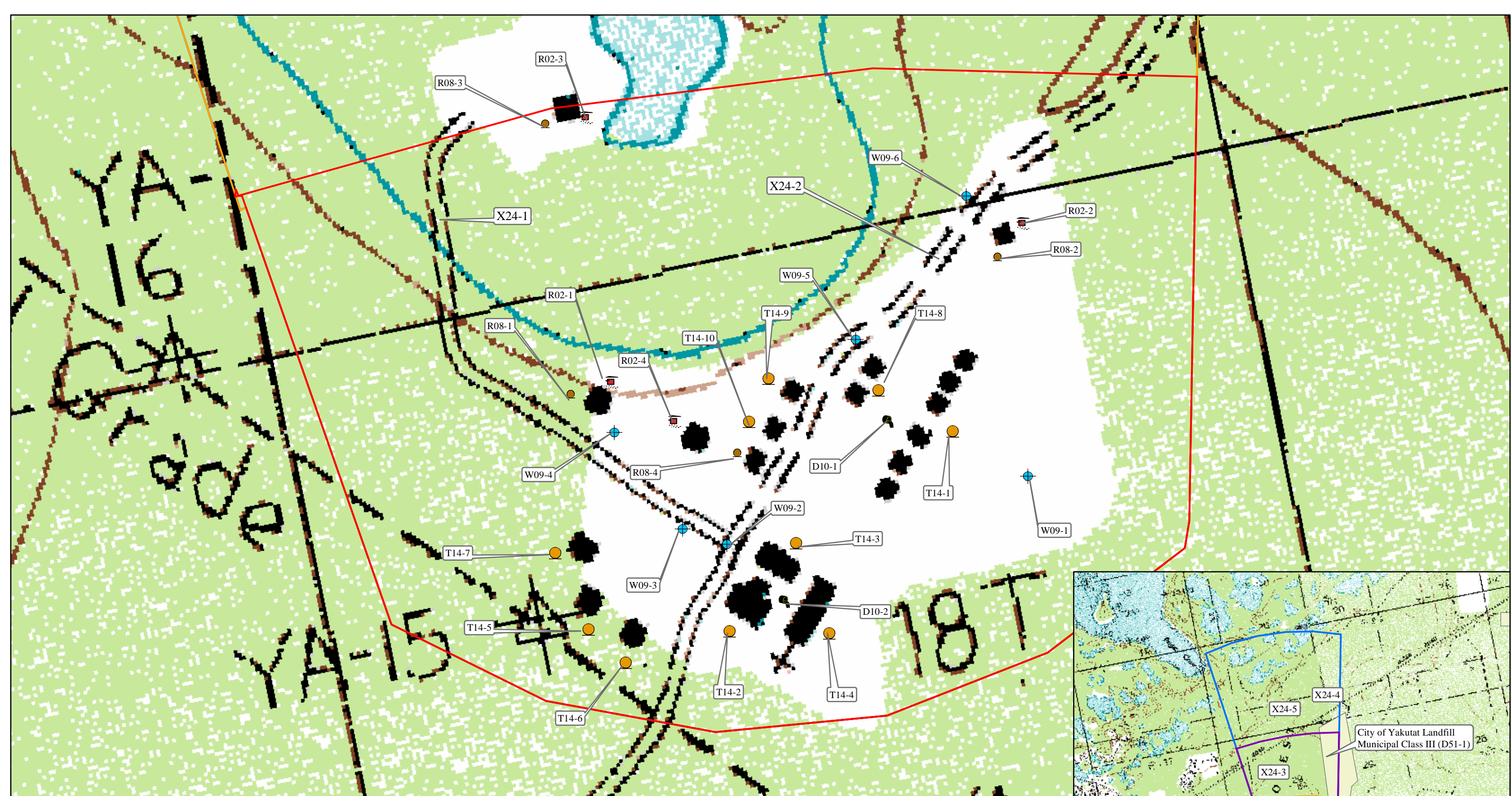
PWSID: 130164.001



Data Source:
Background images - USGS 1:25,000 Topos

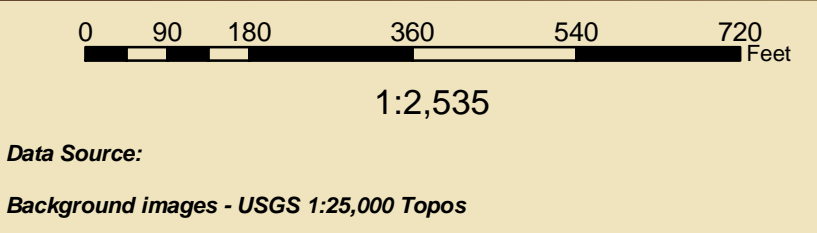
- | | |
|--|--|
| <ul style="list-style-type: none"> Public Drinking Water Systems <all other values> Large Capacity Septic System (D10) Single Family Septic System (R02) Residential Heating Oil Tank (R08) Non-residential Heating Oil Tanks (T14) City of Yakutat Landfill | <ul style="list-style-type: none"> Zone A Protection Area
 Several Months Travel Time Zone B Protection Area
 Less than 2 Years Travel Time Zone C Protection Area
 Less than 5 Years Travel Time Zone D Protection Area
 Less than 10 Years Travel Time |
|--|--|

May 12, 2003



Map 2: Drinking Water Protection Areas for Glacier Bear Lodge and Potential and Existing Sources of Contamination

PWSID: 130164.001



- Legend**
- Public Drinking Water Systems
 - <all other values>
 - Large Capacity Septic System (D10)
 - Single Family Septic System (R02)
 - Residential Heating Oil Tank (R08)
 - Non-residential Heating Oil Tanks (T14)
 - City of Yakutat Landfill
- Zone A Protection Area**
 Several Months Travel Time
 - Zone B Protection Area**
 Less than 2 Years Travel Time
 - Zone C Protection Area**
 Less than 5 Years Travel Time
 - Zone D Protection Area**
 Less than 10 Years Travel Time

May 12, 2003

APPENDIX D

Vulnerability Analysis for Glacier Bear Lodge Public Drinking Water Source (Charts 1-8)

Chart 1. Susceptibility of the wellhead - Glacier Bear Lodge

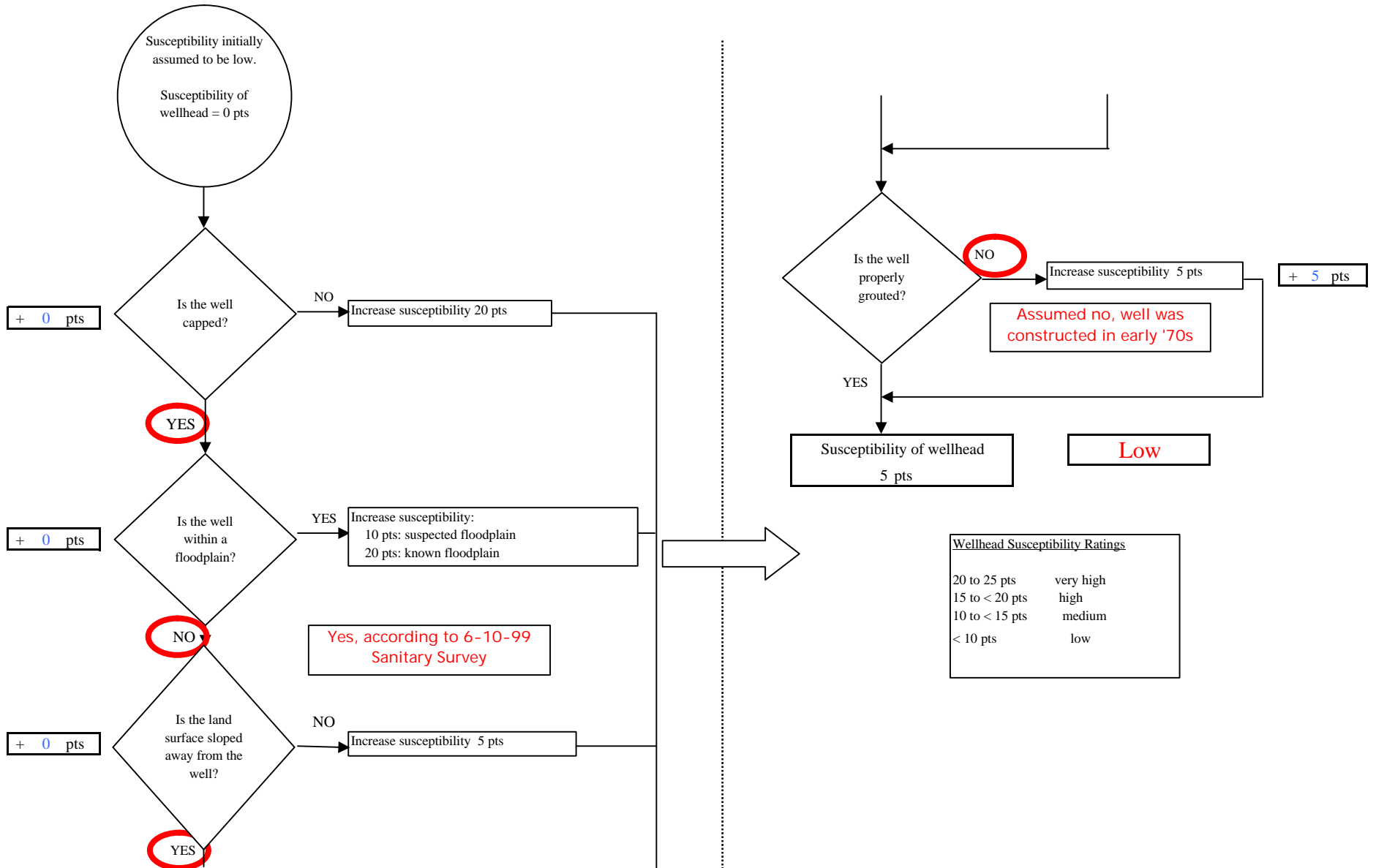


Chart 2. Susceptibility of the aquifer - Glacier Bear Lodge

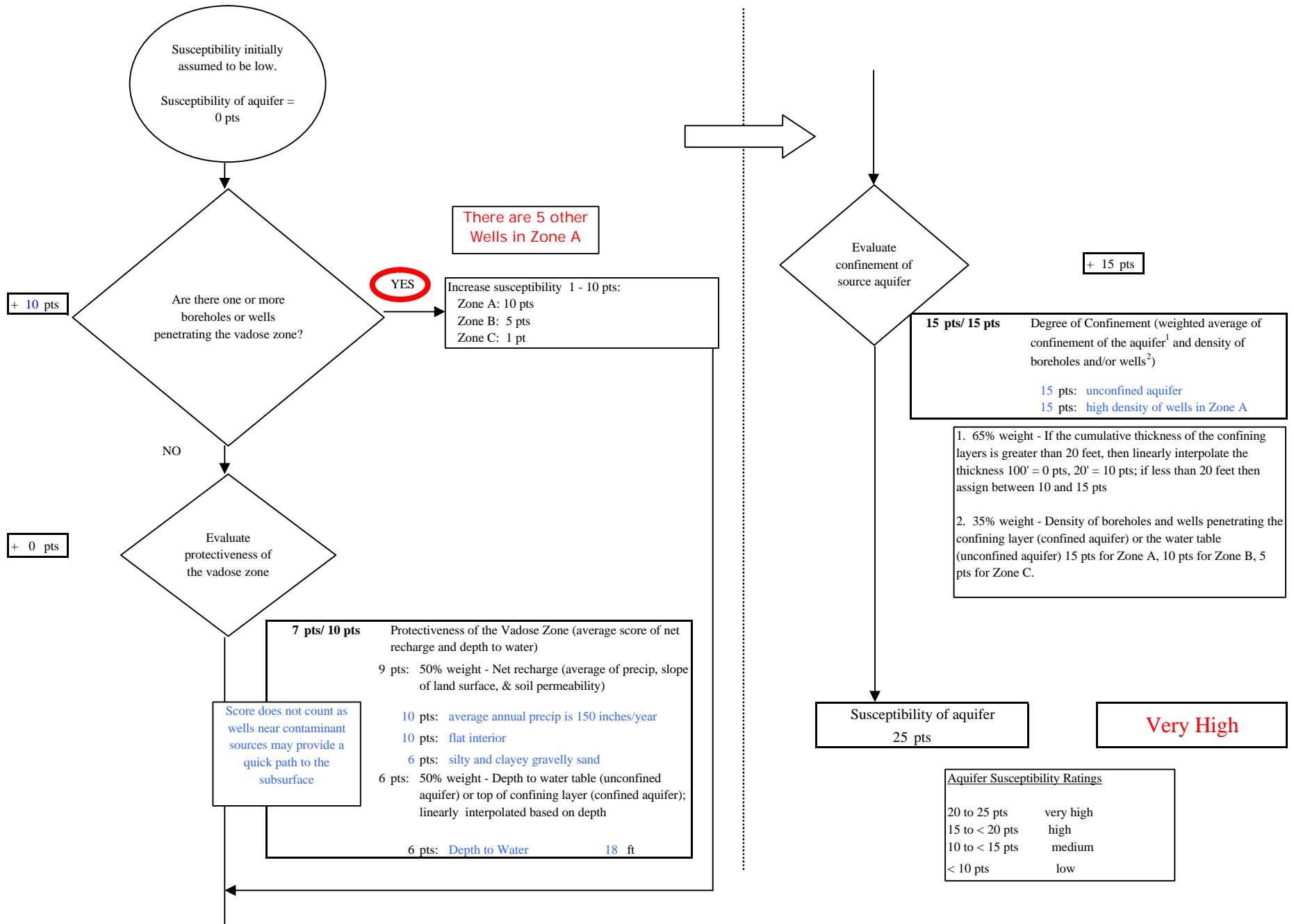
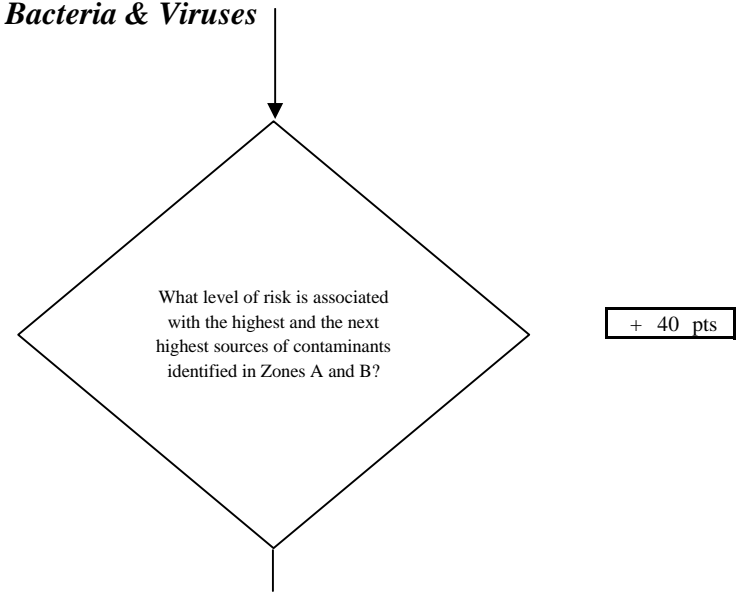
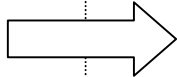
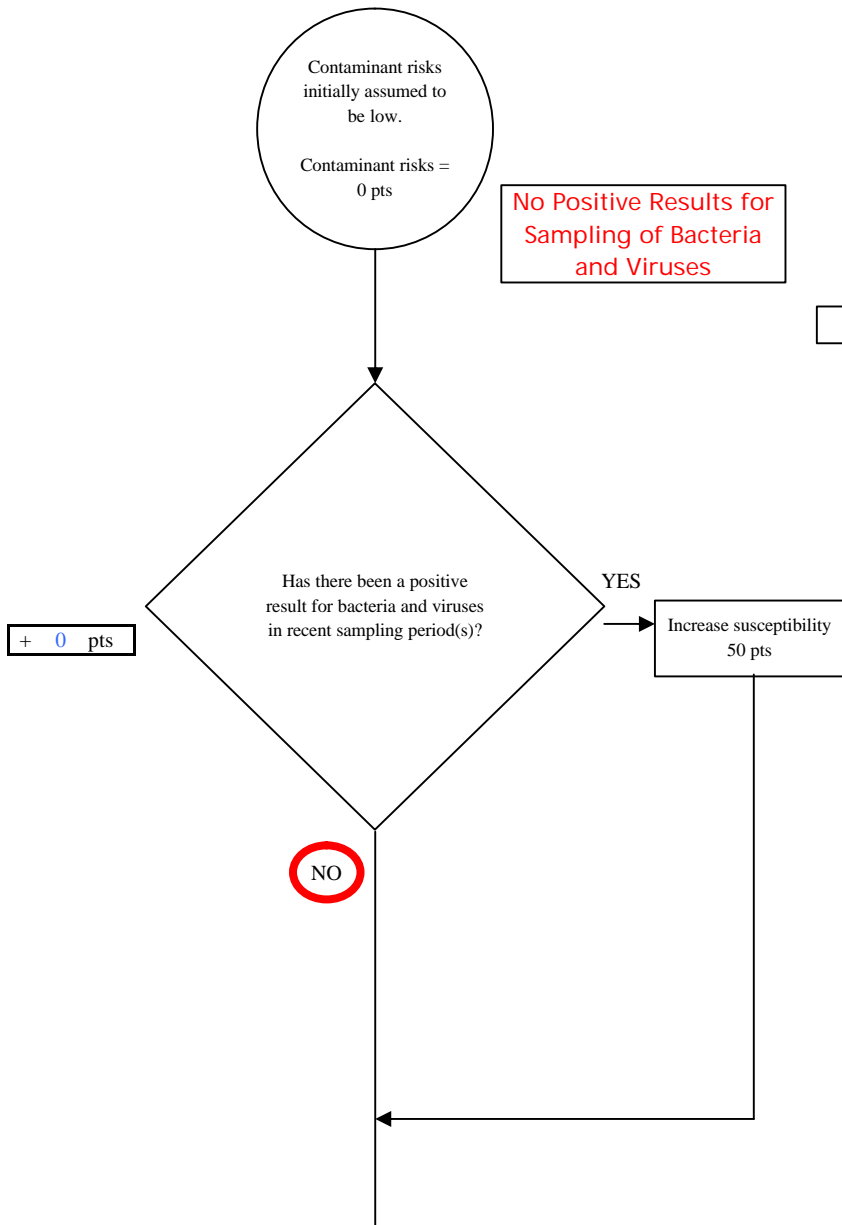


Chart 3. Contaminant risks for Glacier Bear Lodge - Bacteria & Viruses



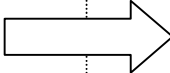
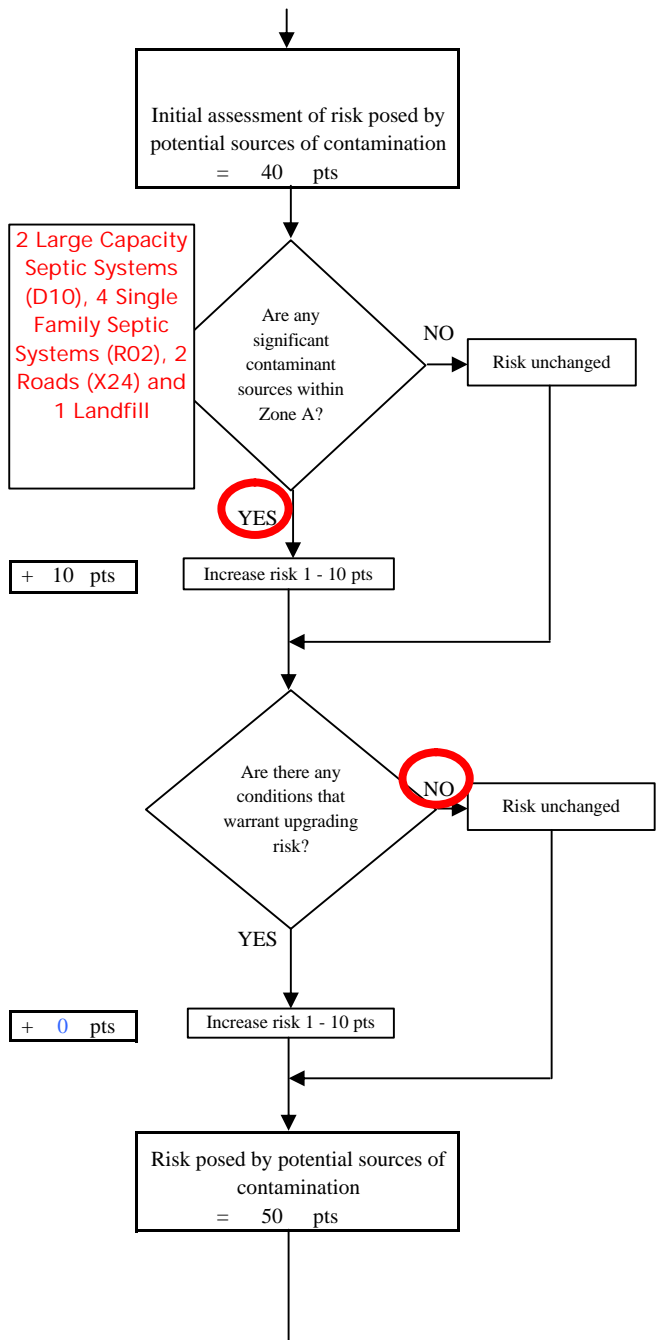
Risk Rankings for Contaminant Sources Identified in Zones A and B			
	Zone A	Zone B	Total
Very High(s)	0	0	0
High(s)	2	0	2
Medium(s)	0	0	0
Low(s)	5	0	5

	LOW 10 pts	MEDIUM 20 pts	HIGH 30 pts	VERY HIGH 40 pts
LOW	³ 10 sources + 10 pts	≥ 10 sources + 5 pts	≥ 20 sources + 5 pts	----
MEDIUM	----	≥ 2 sources + 5 pts	≥ 5 sources + 5 pts	≥ 10 sources + 5 pts
HIGH	----	----	≥ 1 source + 10 pts	≥ 2 sources + 10 pts
VERY HIGH	----	----	----	≥ 1 source + 10 pts

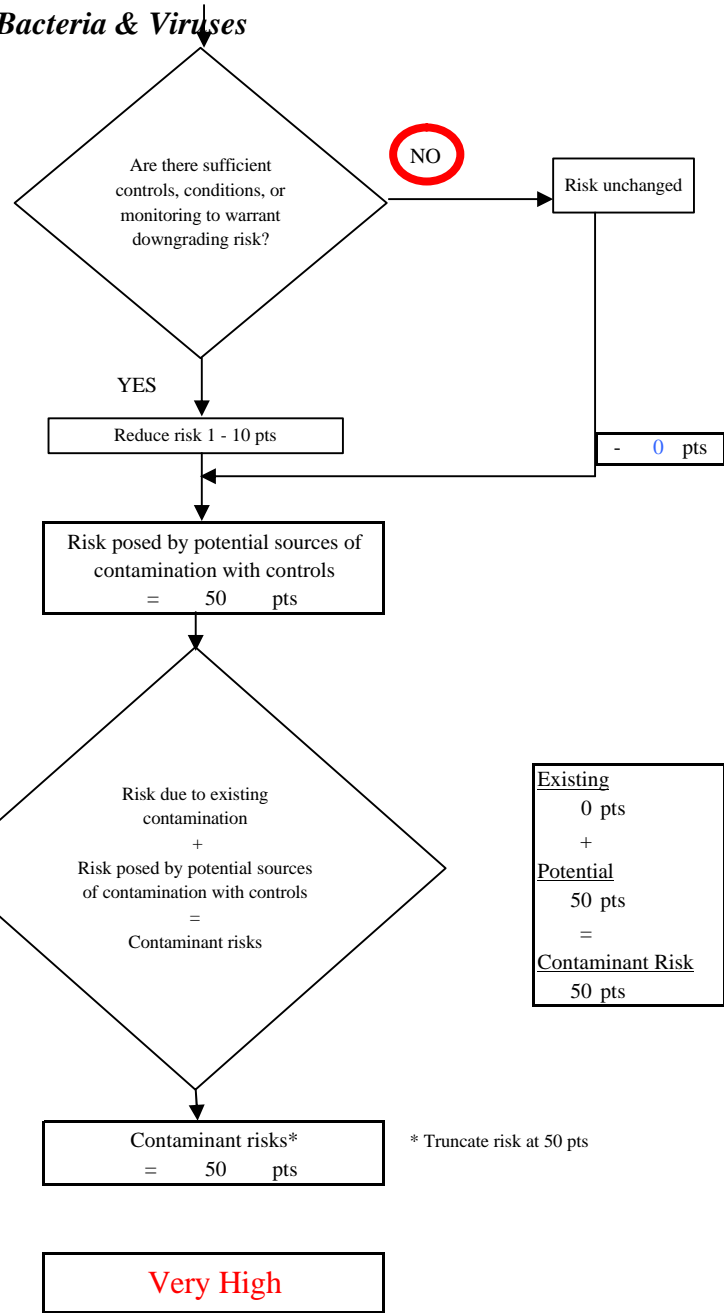
Matrix Score 40

Note: Septic systems, sewerlines, and roads are each assigned a risk ranking for each individual contaminant source in the CSI. The VA, however, counts these contaminant sources as a group and assigns a calculated number of either "lows" or "mediums" based on the density.

Chart 3. Contaminant risks for Glacier Bear Lodge - Bacteria & Viruses



Contaminant Risk Ratings	
40 to 50 pts	very high
30 to < 40 pts	high
20 to < 30 pts	medium
< 20 pts	low



Existing	0 pts
+	
Potential	50 pts
=	
Contaminant Risk	50 pts

Chart 4. Vulnerability analysis for Glacier Bear Lodge - Bacteria & Viruses

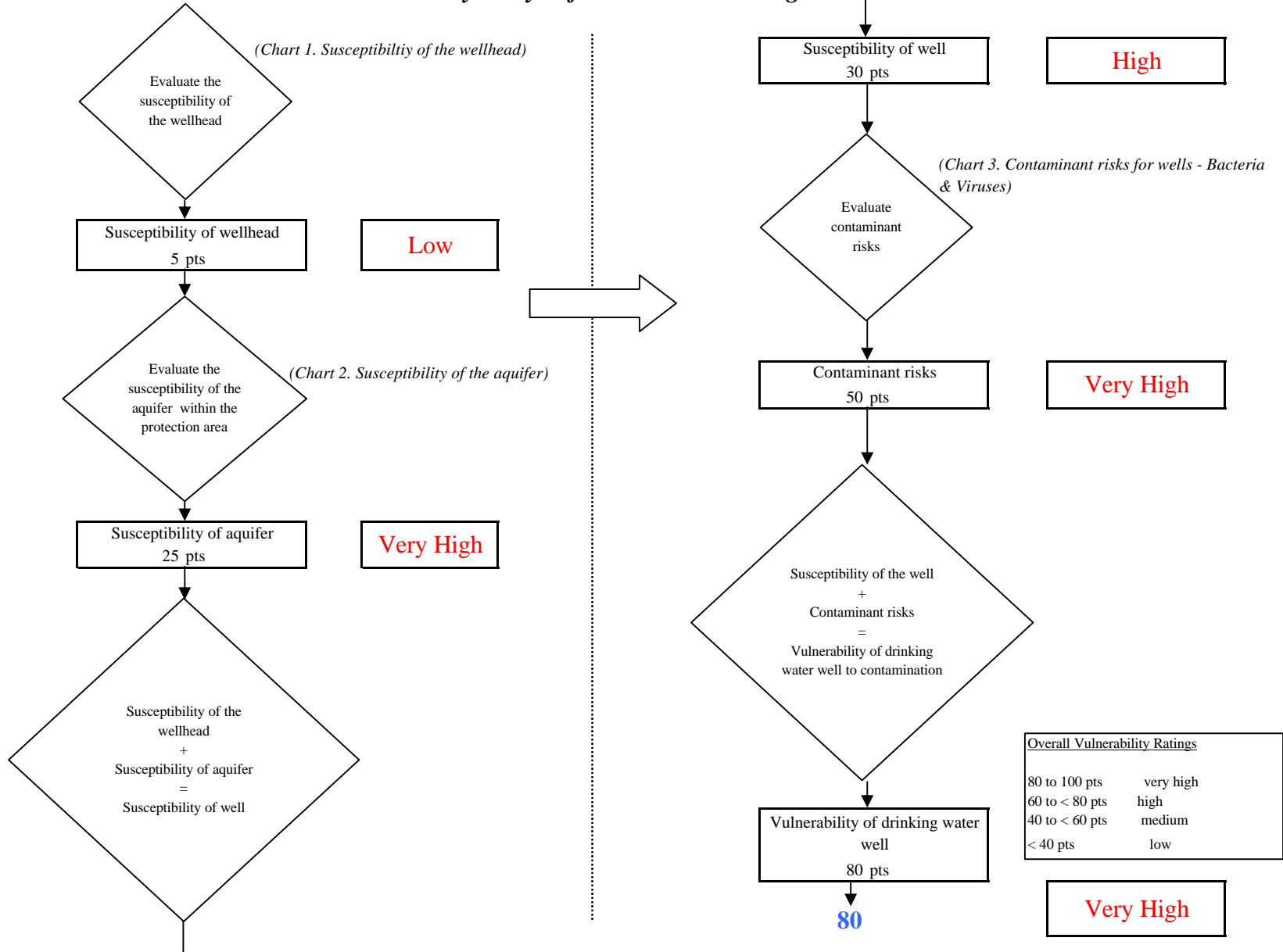


Chart 5. Contaminant risks for Glacier Bear Lodge - Nitrates and Nitrites

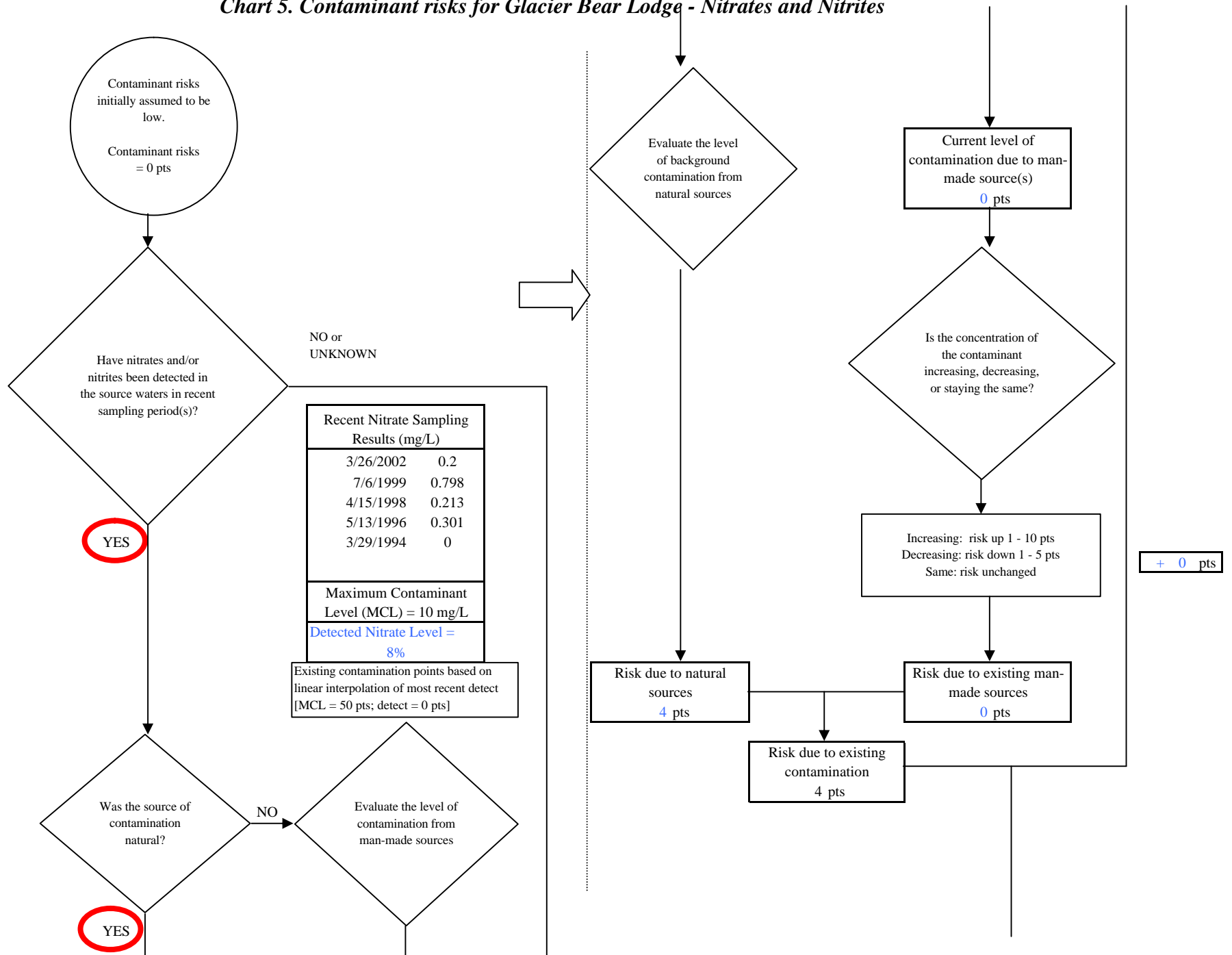


Chart 5. Contaminant risks for Glacier Bear Lodge - Nitrates and Nitrites

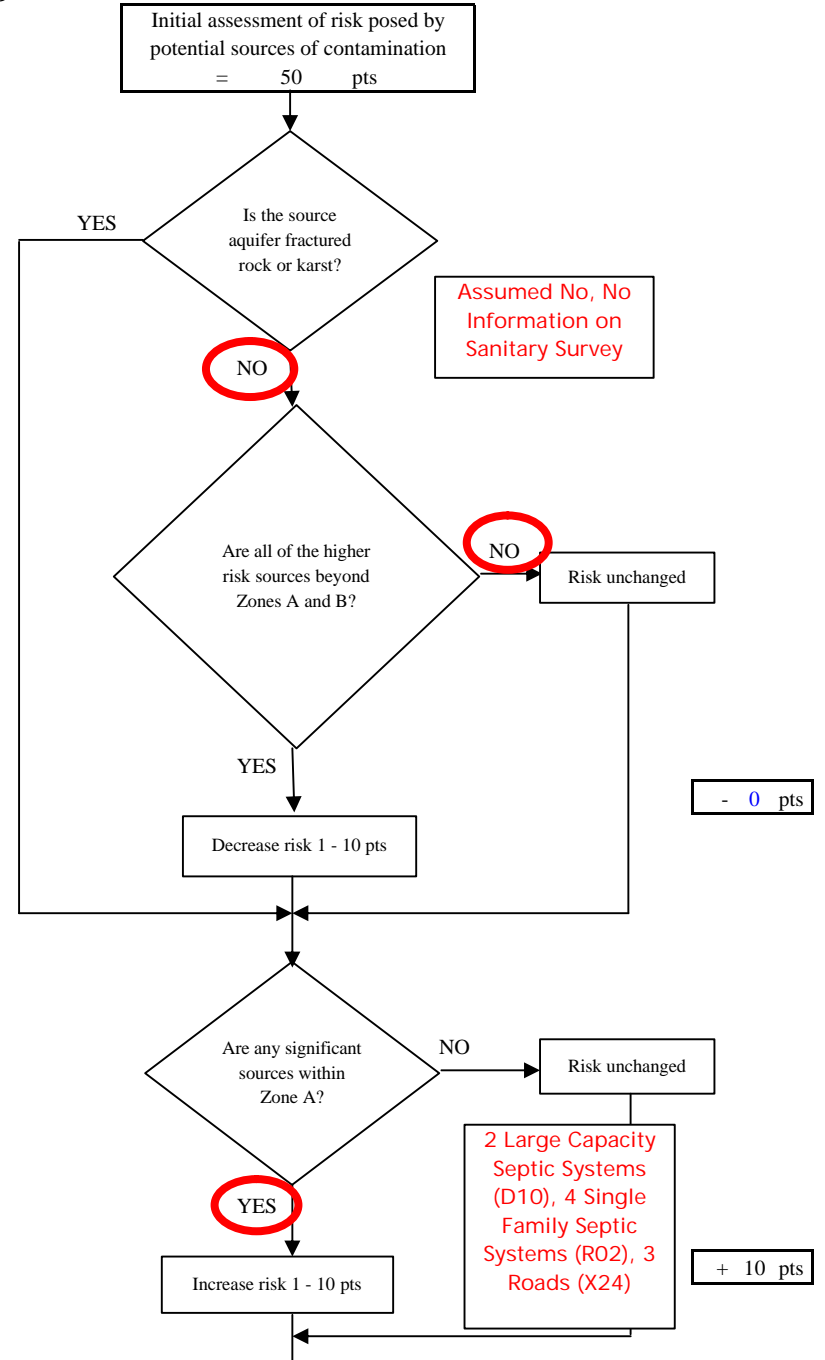
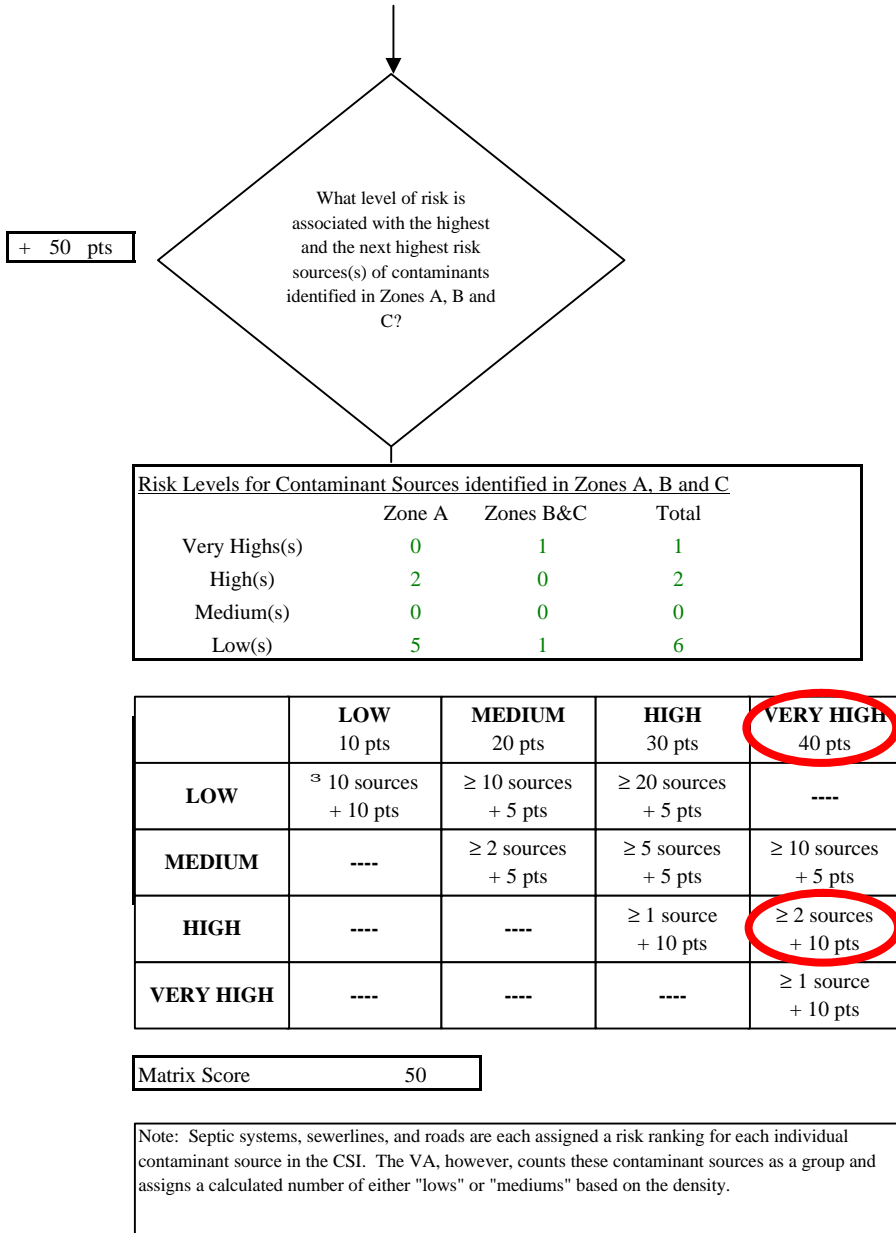


Chart 5. Contaminant risks for Glacier Bear Lodge - Nitrates and Nitrites

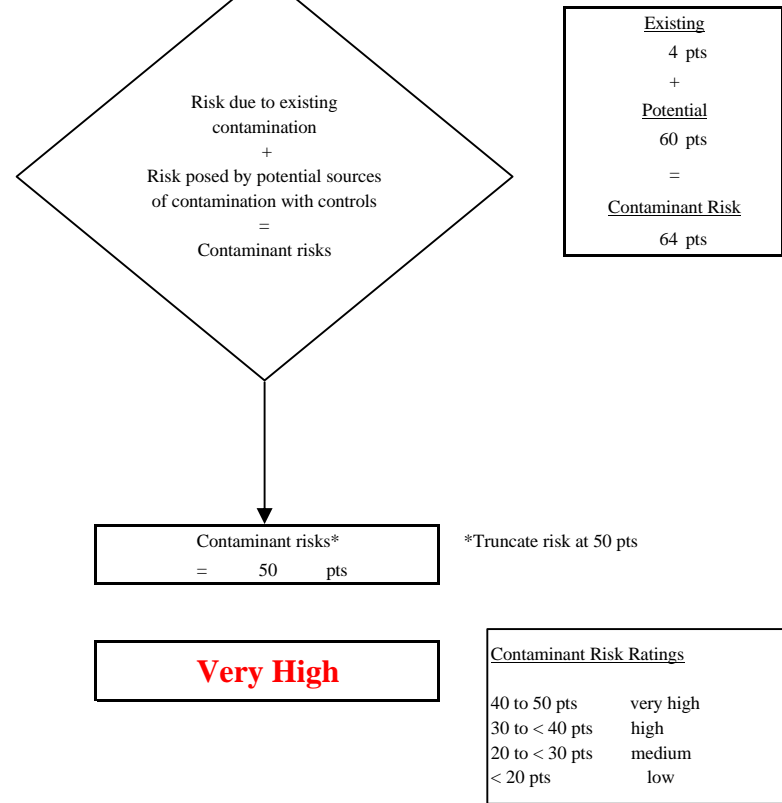
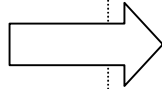
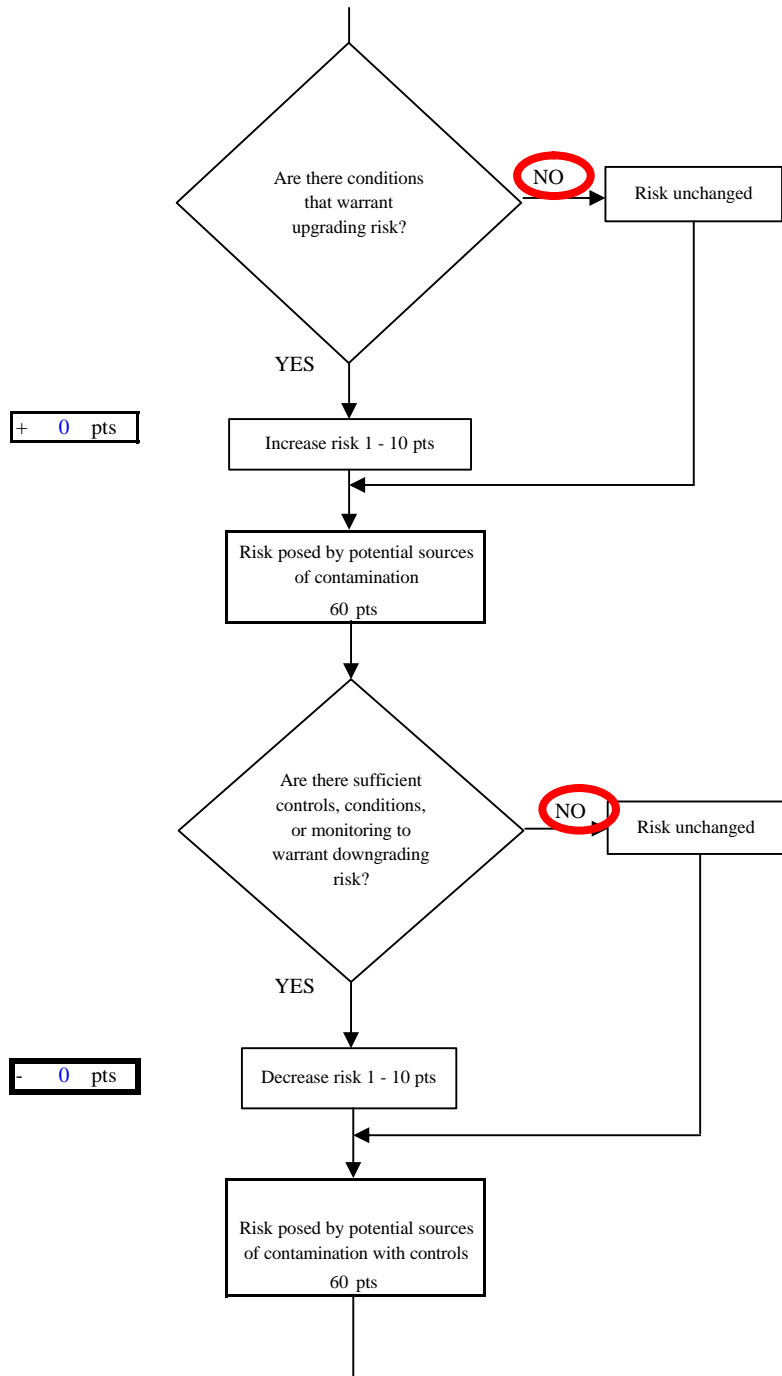


Chart 6. Vulnerability analysis for Glacier Bear Lodge - Nitrates and Nitrites

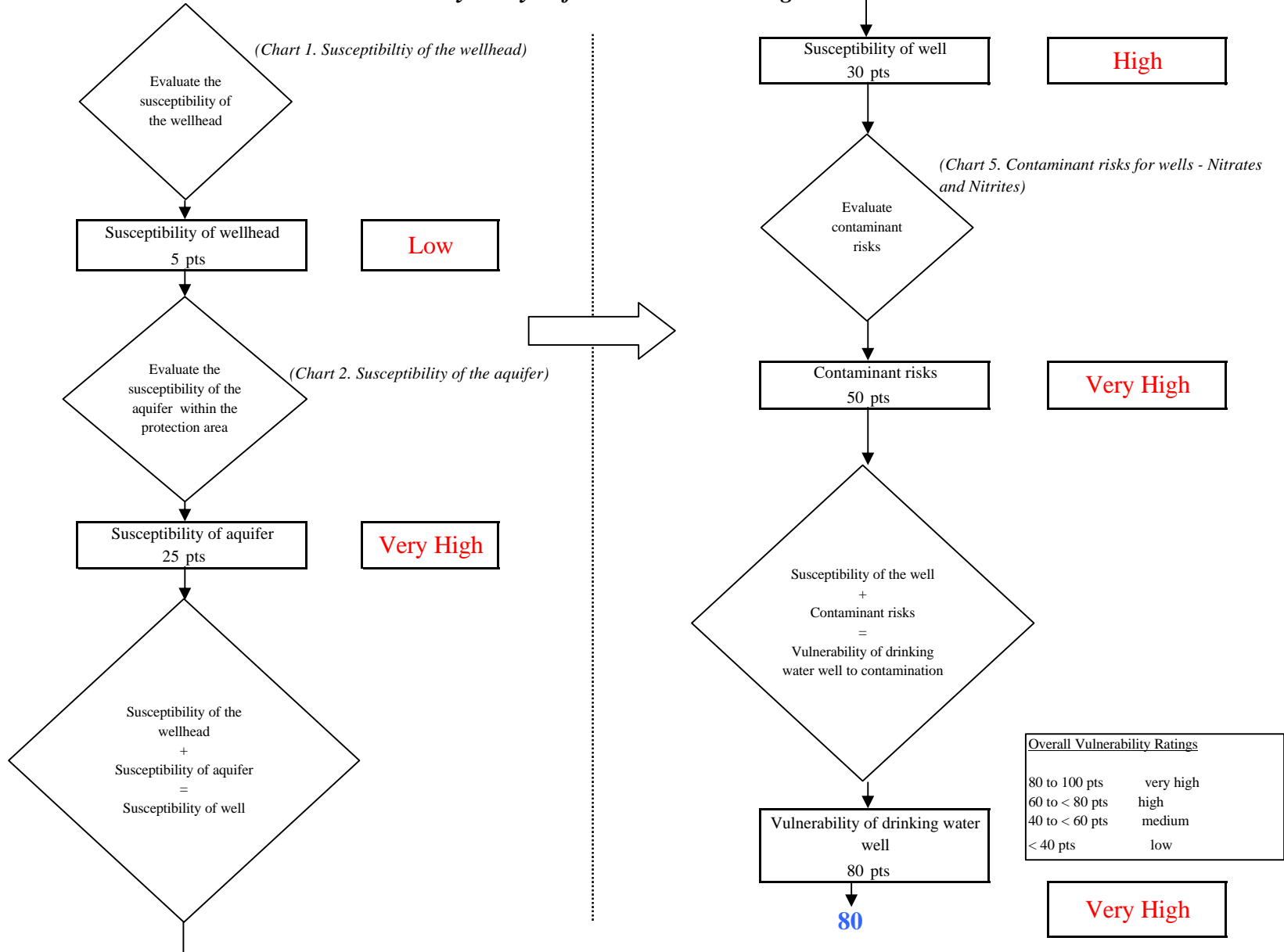


Chart 7. Contaminant risks for Glacier Bear Lodge - Volatile Organic Chemicals

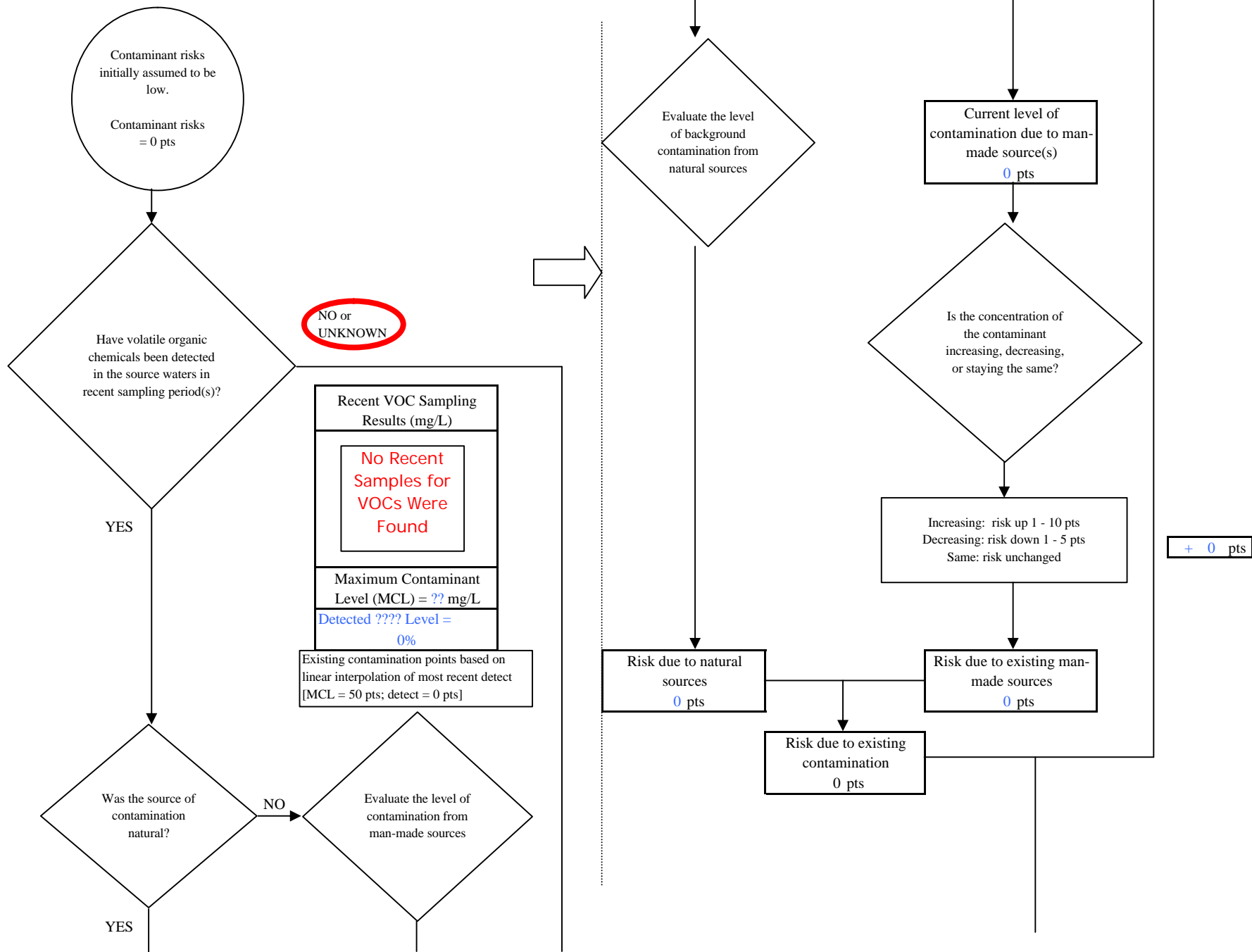
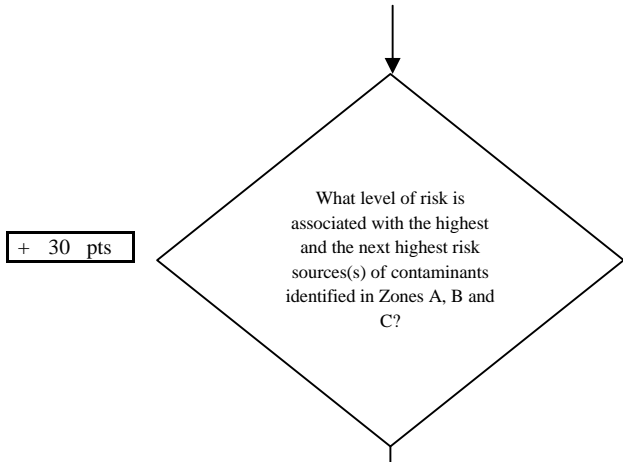


Chart 7. Contaminant risks for Glacier Bear Lodge - Volatile Organic Chemicals



+ 30 pts

Risk Levels for Contaminant Sources identified in Zones A, B and C			
	Zone A	Zones B&C	Total
Very Highs(s)	0	0	0
High(s)	0	1	1
Medium(s)	4	0	4
Low(s)	14	1	15

	LOW 10 pts	MEDIUM 20 pts	HIGH 30 pts	VERY HIGH 40 pts
LOW	≥ 10 sources + 10 pts	≥ 10 sources + 5 pts	≥ 20 sources + 5 pts	----
MEDIUM	----	≥ 2 sources + 5 pts	≥ 5 sources + 5 pts	≥ 10 sources + 5 pts
HIGH	----	----	≥ 1 source + 10 pts	≥ 2 sources + 10 pts
VERY HIGH	----	----	----	≥ 1 source + 10 pts

Matrix Score 30

Note: Septic systems, sewerlines, and roads are each assigned a risk ranking for each individual contaminant source in the CSI. The VA, however, counts these contaminant sources as a group and assigns a calculated number of either "lows" or "mediums" based on the density.

2 Large Capacity Septic Systems (D10), 4 Single Family Septic Systems (R02), 4 Residential Heating Oil Tanks (R08), 10 Non Residential Heating Oil Tanks (T14), 3 Roads (X24)

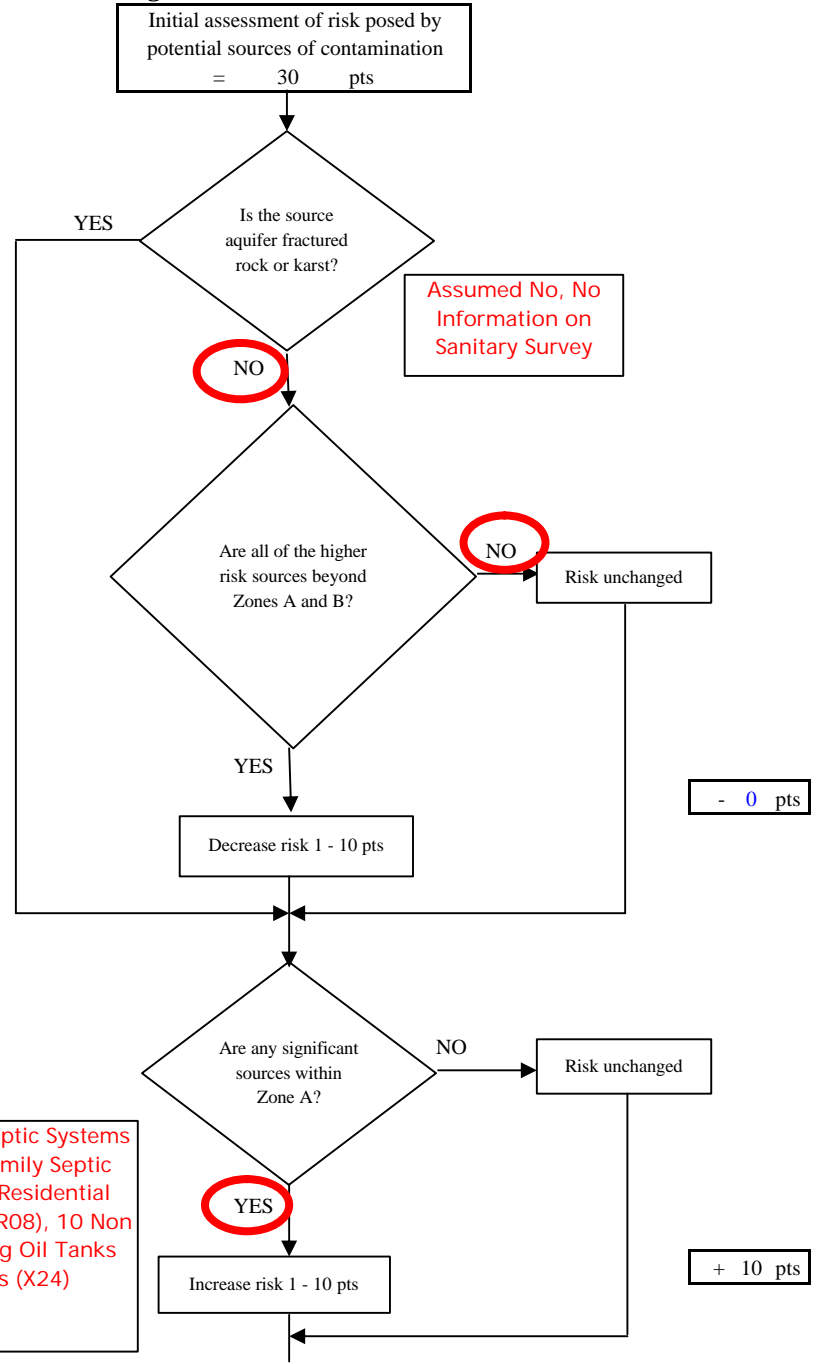


Chart 7. Contaminant risks for Glacier Bear Lodge - Volatile Organic Chemicals

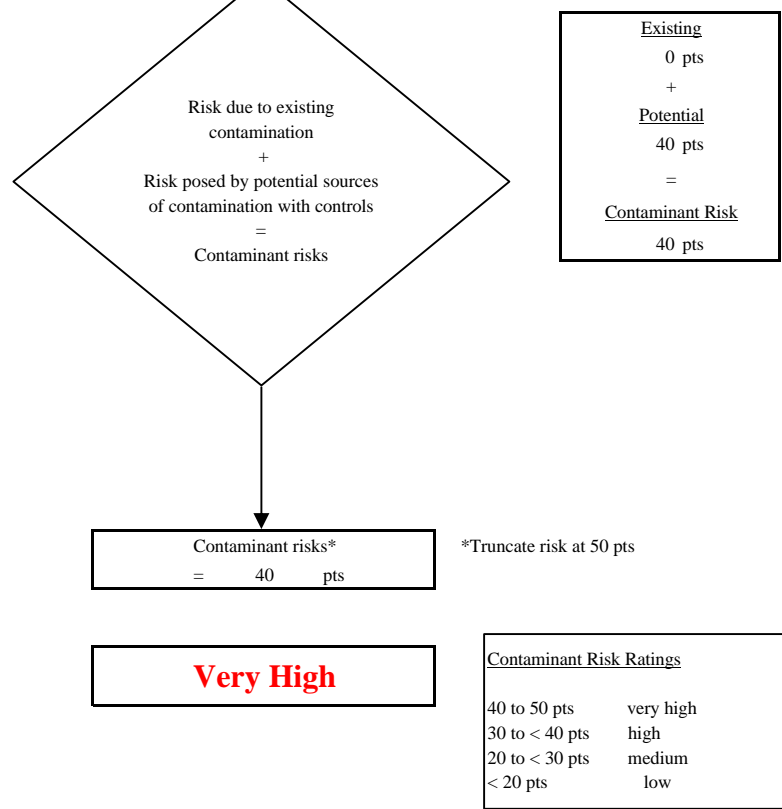
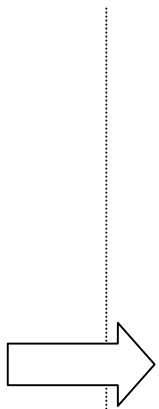
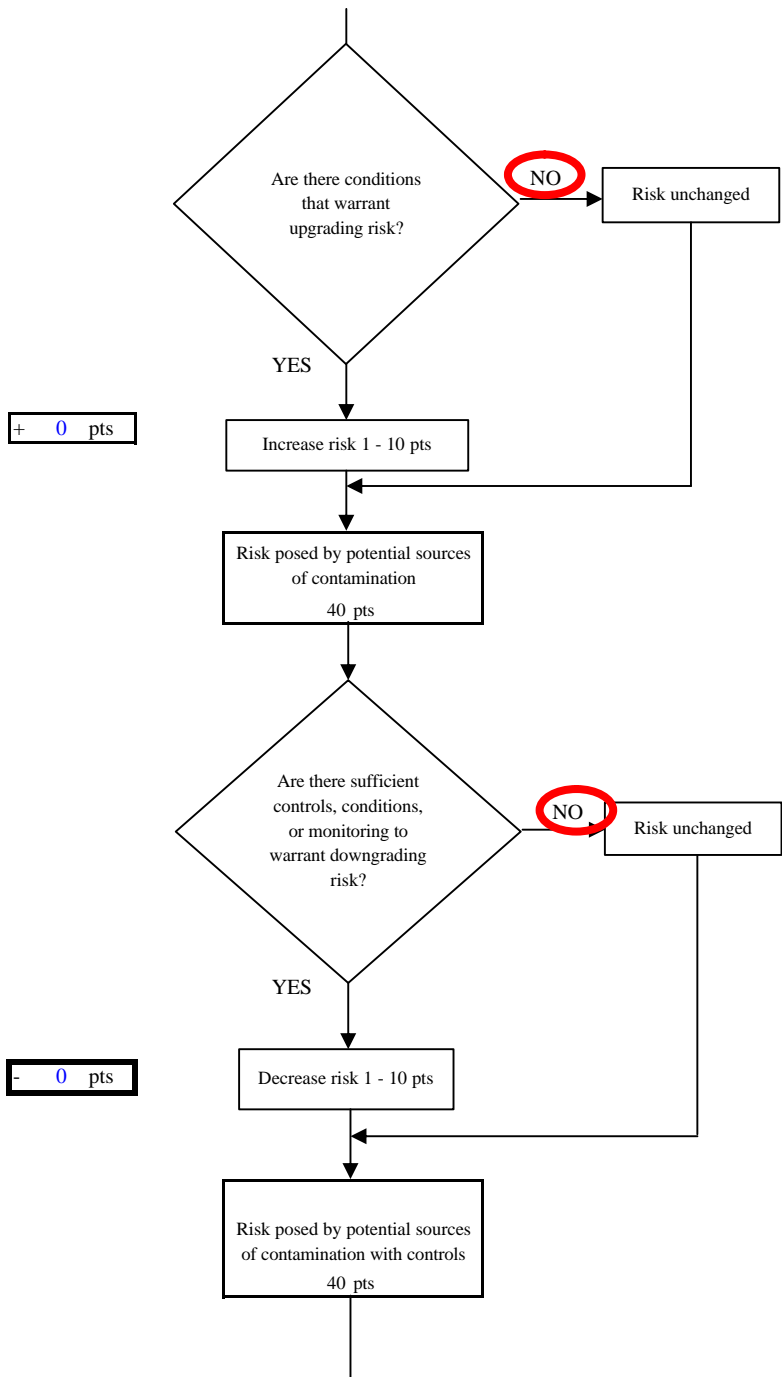


Chart 8. Vulnerability analysis for Glacier Bear Lodge - Volatile Organic Chemicals

