

Source Water Assessment

A Hydrogeologic Susceptibility and
Vulnerability Assessment for
Chisana View Lodge,
Northway, Alaska
PWSID #381642

DRINKING WATER PROTECTION PROGRAM REPORT NO. 928

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 Chisana View Lodge, Northway, Alaska

Drinking Water Protection Program Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

The public water system for Chisana View Lodge is a Class B (transient/non-community) water system consisting of one well. The Chisana View Lodge is located at Mile 1264 of the Alaska Highway, near Northway, Alaska. 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 current sources of contaminants for Chisana View Lodge public drinking water source include large-capacity septic systems and aboveground heating oil tanks. 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 Chisana View Lodge received a vulnerability rating of **Medium** for bacteria and viruses and nitrates and nitrites; and **Low** for volatile organic chemicals.

CHISANA VIEW LODGE PUBLIC DRINKING WATER SYSTEM

Chisana View Lodge public water system is a Class B (transient/non-community) water system. The system consists of one well located at Mile 1264 of the Alaska Highway, near Northway, Alaska (See Map 1 of Appendix A). Northway presently consists of three settlements: Northway Junction, at Mile 1264, Northway, at the airport, and the Native village, 2 miles north. Northway lies within the Tetlin National Wildlife Refuge, 42 miles from the Canadian border. The population of Northway is approximately 350.

Northway averages about 10 inches of precipitation per year, snowfall is 30 inches annually. Over half of the households are not plumbed. Due to high groundwater and deep permafrost, individual water wells and septic systems often freeze. Many homes and businesses in the area rely on individual wells for their water supply.

The Northway area topography is characterized by a series of rugged mountains and plateaus separated by wide valleys and lowlands. The elevation of Northway is 1,710 feet. Drainages along the Alaska Highway in this area generally flow northwest.

According to a Sanitary Survey dated June 26, 1998, the existing well was installed in 1995 with 6-inch diameter casing to a depth of 225 feet below ground surface. It is assumed that the length of the well screen is 10 feet. The Survey indicates that the land surface is sloped away from the well, providing adequate surface water drainage. The well is not grouted according to ADEC regulations. Proper grouting provides added protection against contaminants traveling along the well casing and into source waters.

This system operates year round and serves approximately 25 non-residents through one service connection.

CHISANA VIEW 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 attributes of the aquifer in this calculation were estimated from information contained in the well logs and/or the Sanitary Survey. Additional methods were also used to take into account any uncertainties in groundwater flow and aquifer characteristics to arrive at a meaningful DWPA (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 Chisana View Lodge extends over 3,400 feet to the northwest of the well, and includes only Zone A. Because the upland groundwater system may include fractured bedrock, the TOT may be more rapid than predicted. For this reason, the zones related to TOT have been expanded at the upland base. Development in the vicinity of the well is limited to only Zone A (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 Chisana View 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 CHISANA VIEW 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 well for Chisana View Lodge is 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 Chisana View Lodge.

Table 2. Susceptibility

	Score	Rating
Susceptibility of the Wellhead	0	Low
Susceptibility of the Aquifer	9	Low
Natural Susceptibility	9	Low

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	40	Very High
Nitrates and/or Nitrites	50	Very High
Volatile Organic Chemicals	12	Low

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	50	Medium
Nitrates and Nitrites	55	Medium
Volatile Organic Chemicals	20	Low

Bacteria and Viruses

The contaminant risk for bacteria and viruses is **Very High** with large-capacity septic systems representing the risks 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. Recent sampling events indicated no recent positive results were detected for bacteria and viruses. 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 **Medium**.

Nitrates and Nitrites

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

Sampling history for Chisana View Lodge indicates that nitrates have been detected in the water, but only in very low concentrations (at 3.140 mg/L on 1/07/02) or 31% of the 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 **Medium**.

Volatile Organic Chemicals

The contaminant risk for volatile organic chemicals is **Low** with large-capacity septic systems and aboveground heating oil tanks the only known risks for volatile organic chemicals (See Chart 7 – Contaminant Risks for Volatile Organic Chemicals in Appendix D).

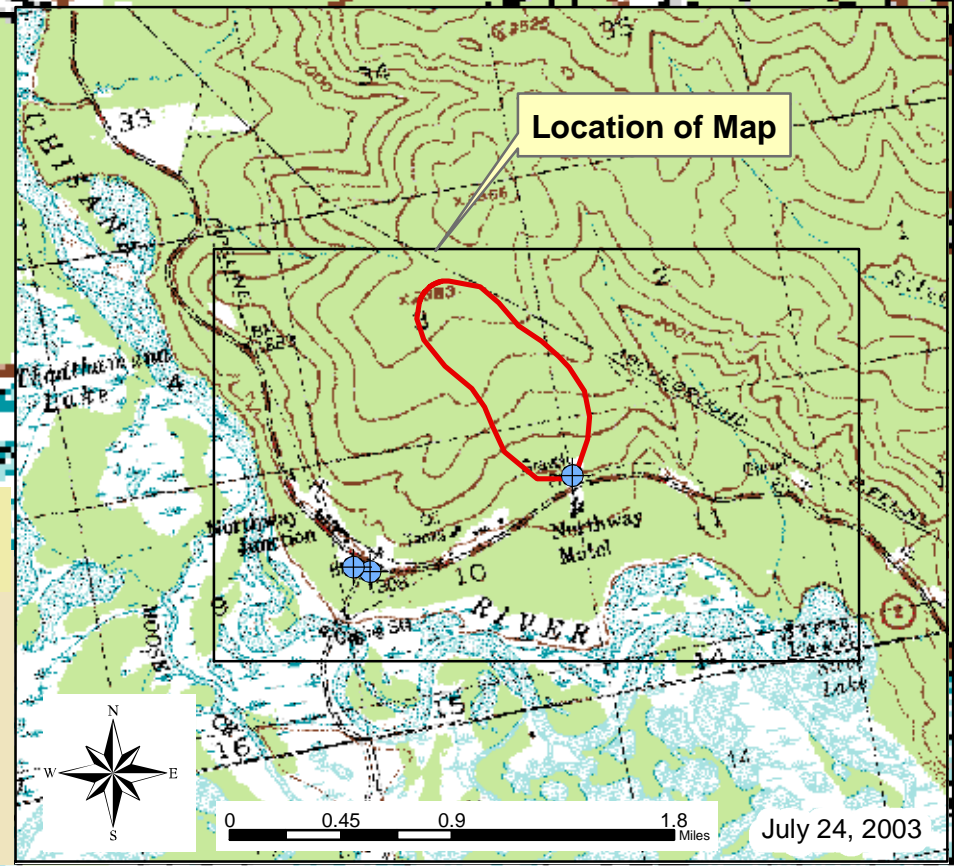
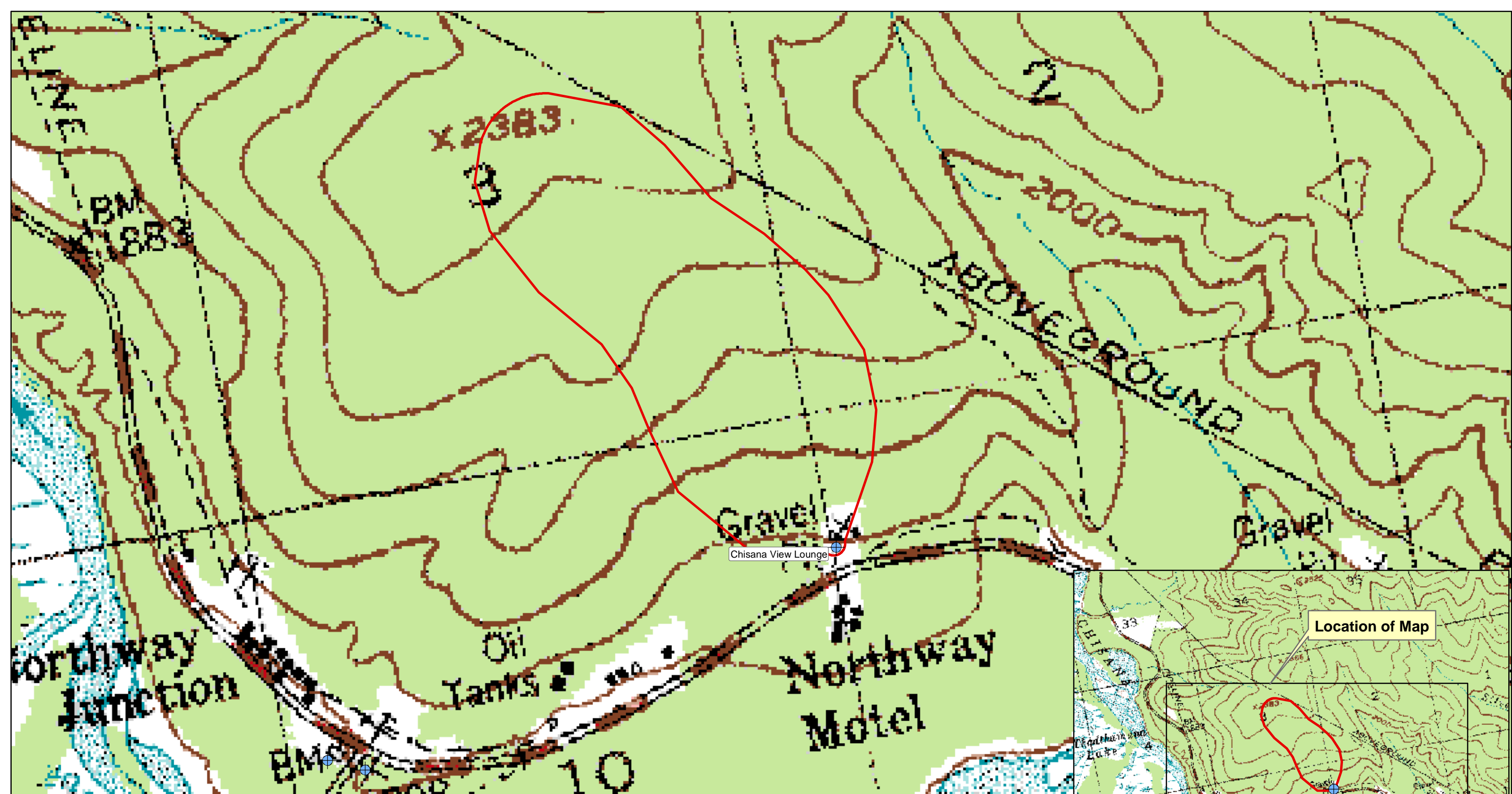
Recent sample data for the drinking water at Chisana View Lodge indicates that volatile organic chemicals have not been detected in the water. However, after combining the contaminant risk for volatile organic chemicals with the natural susceptibility of the well, the overall vulnerability of the well to contamination by volatile organic chemicals is **Low**.

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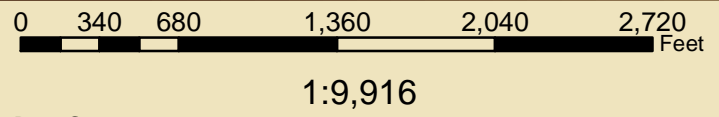
APPENDIX A

Chisana View Lodge Drinking Water Protection Area Location Map (Map 1)



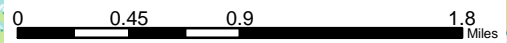
Map 1: Chisana View Lounge Drinking Water Protection Areas

PWSID: 381642.001



Data Sources:
Background image - USGS 1:63,000 mapping

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



July 24, 2003

APPENDIX B

Contaminant Source Inventory and Risk Ranking for Chisana View Lodge (Tables 1-4)

Table 1**Contaminant Source Inventory for
Chisana View Lounge****PWSID 381642.001**

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Map Number	Comments
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A	2	Septic System for Chisana View Lounge
Tanks, heating oil, nonresidential (aboveground)	T14	T14-1	A	2	Heating Oil Tank for Chisana View Lounge

**Contaminant Source Inventory and Risk Ranking for
Chisana View Lounge
Sources of Bacteria and Viruses**

PWSID 381642.001

Table 2

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Risk Ranking for Analysis	Map Number	Comments
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A	High	2	Septic System for Chisana View Lounge

**Contaminant Source Inventory and Risk Ranking for
Chisana View Lounge
Sources of Nitrates/Nitrites**

PWSID 381642.001

Table 3

Contaminant Source Type	Contaminant Source ID	Risk Ranking CS ID tag	Map Zone	for Analysis	Number	Comments
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A	High	2	Septic System for Chisana View Lounge

**Contaminant Source Inventory and Risk Ranking for
Chisana View Lounge
Sources of Volatile Organic Chemicals**

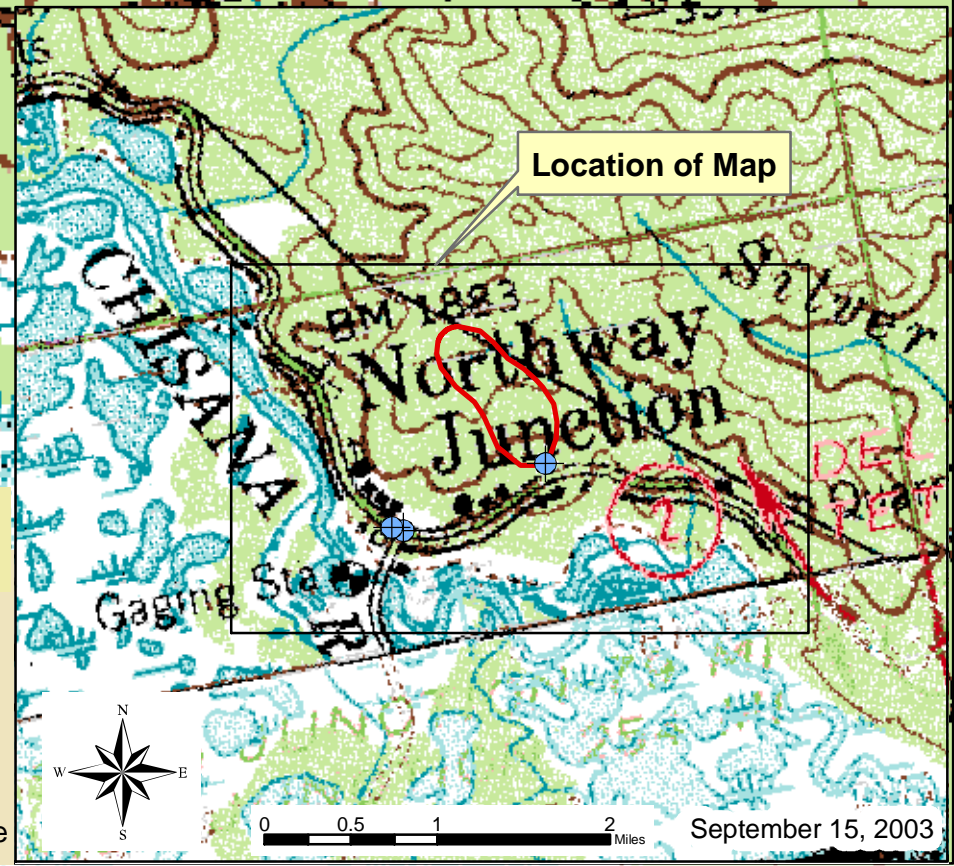
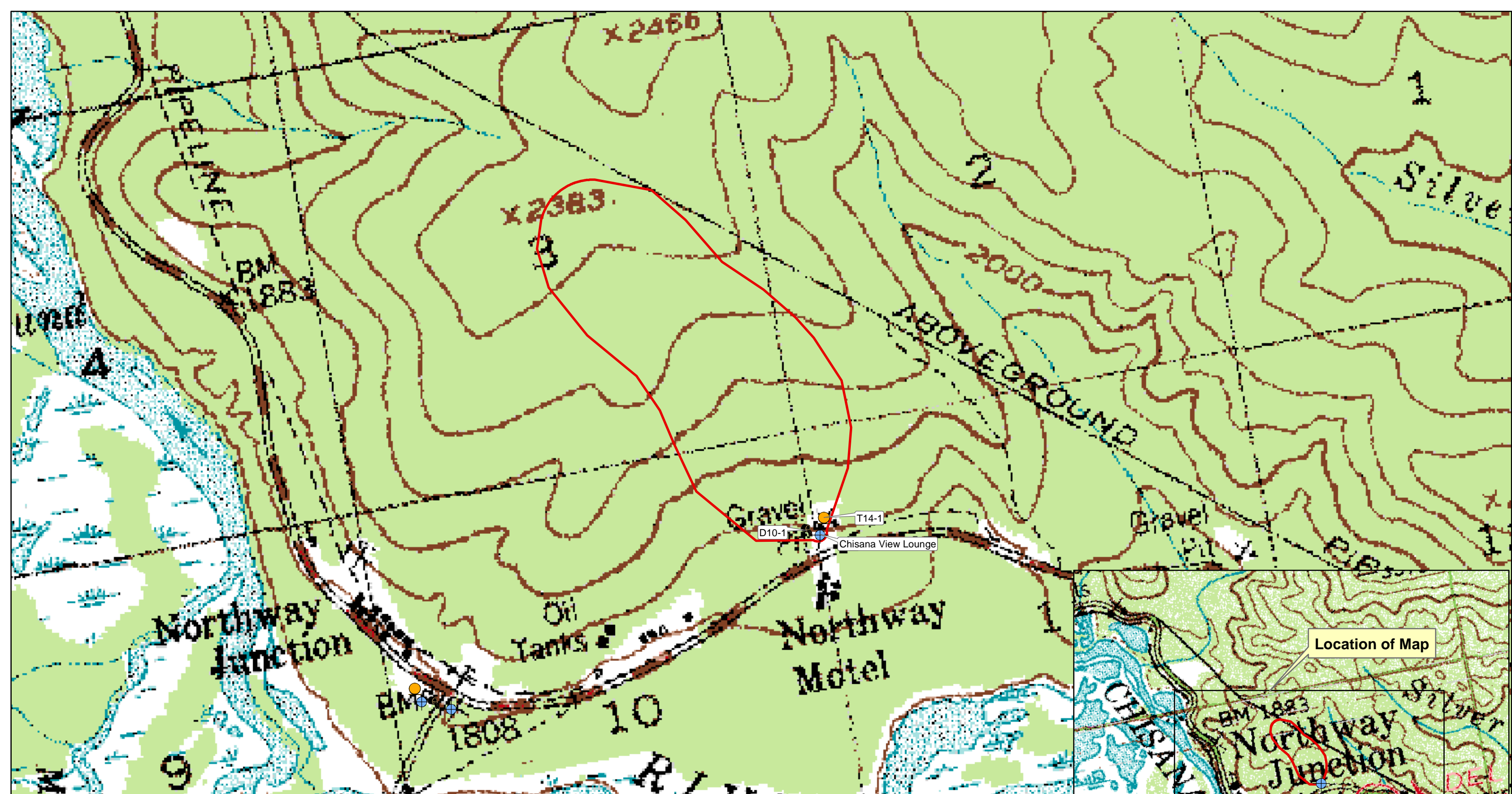
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Table 4

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Risk Ranking for Analysis	Map Number	Comments
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A	Low	2	Septic System for Chisana View Lounge
Tanks, heating oil, nonresidential (aboveground)	T14	T14-1	A	Low	2	Heating Oil Tank for Chisana View Lounge

APPENDIX C

Chisana View Lodge Drinking Water Protection Area and Potential and Existing Contaminant Sources (Map 2)



Map 2: Drinking Water Protection Areas for Chisana View Lounge and Potential and Existing Sources of Contamination

PWSID: 381642.001



0 395 790 1,580 2,370 3,160 Feet
 1:12,666
 Data Sources:
 Background image - USGS 1:63,000 mapping

- Legend**
- Public Drinking Water Systems
 - Large Capacity Septic System (D10)
 - Nonresidential Heating Oil Tank (T14)
 - DWPA Zone A**
 - Several Months Travel Time
 - DWPA Zone B**
 - Less than 2 Years Travel Time
 - DWPA Zone C**
 - Less than 5 Years Travel Time
 - DWPA Zone D**
 - Less than 10 Years Travel Time

September 15, 2003

APPENDIX D

Vulnerability Analysis for Chisana View Lodge Public Drinking Water Source (Charts 1-8)

Chart 1. Susceptibility of the wellhead - Chisana View Lodge

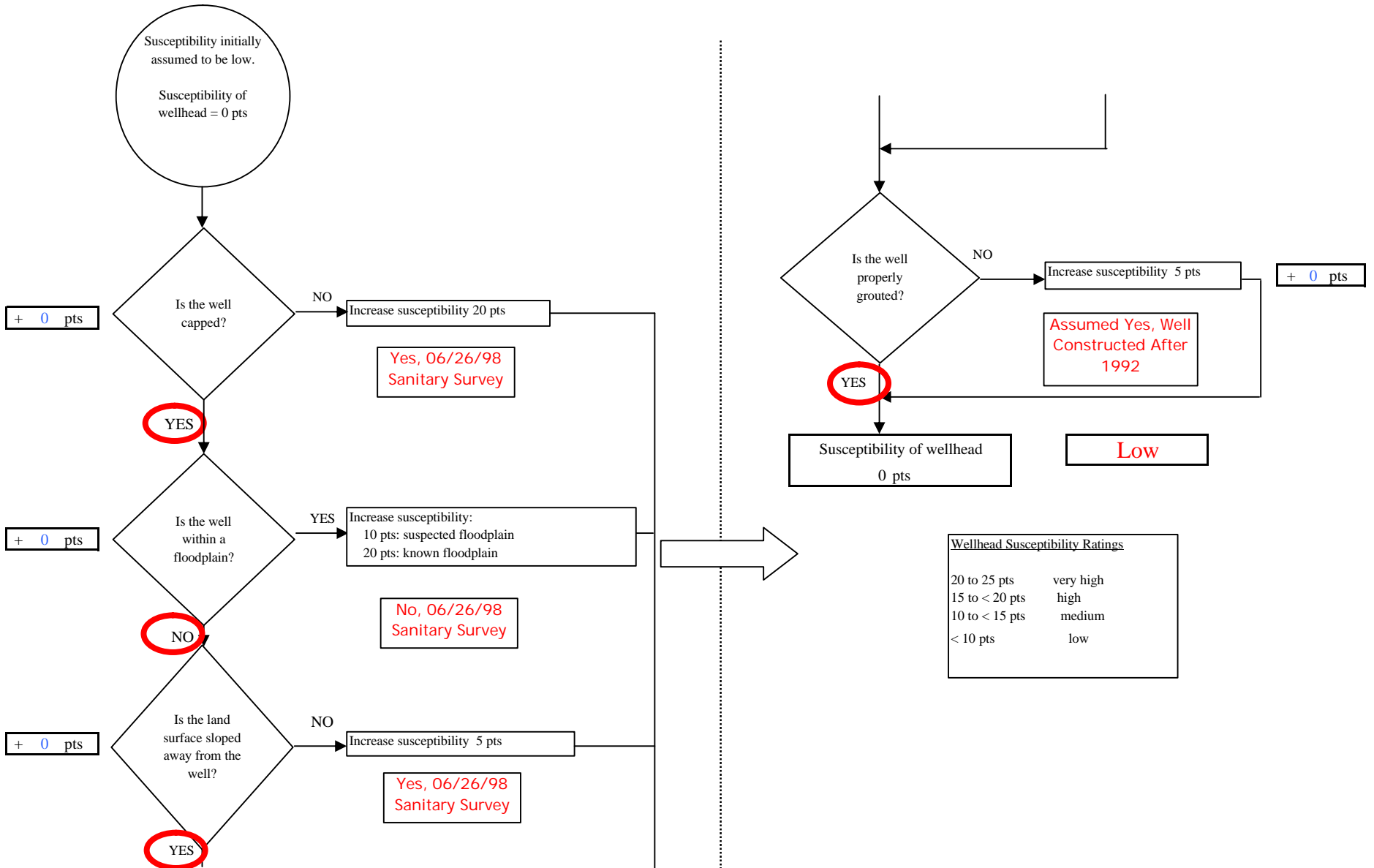


Chart 2. Susceptibility of the aquifer - Chisana View Lodge

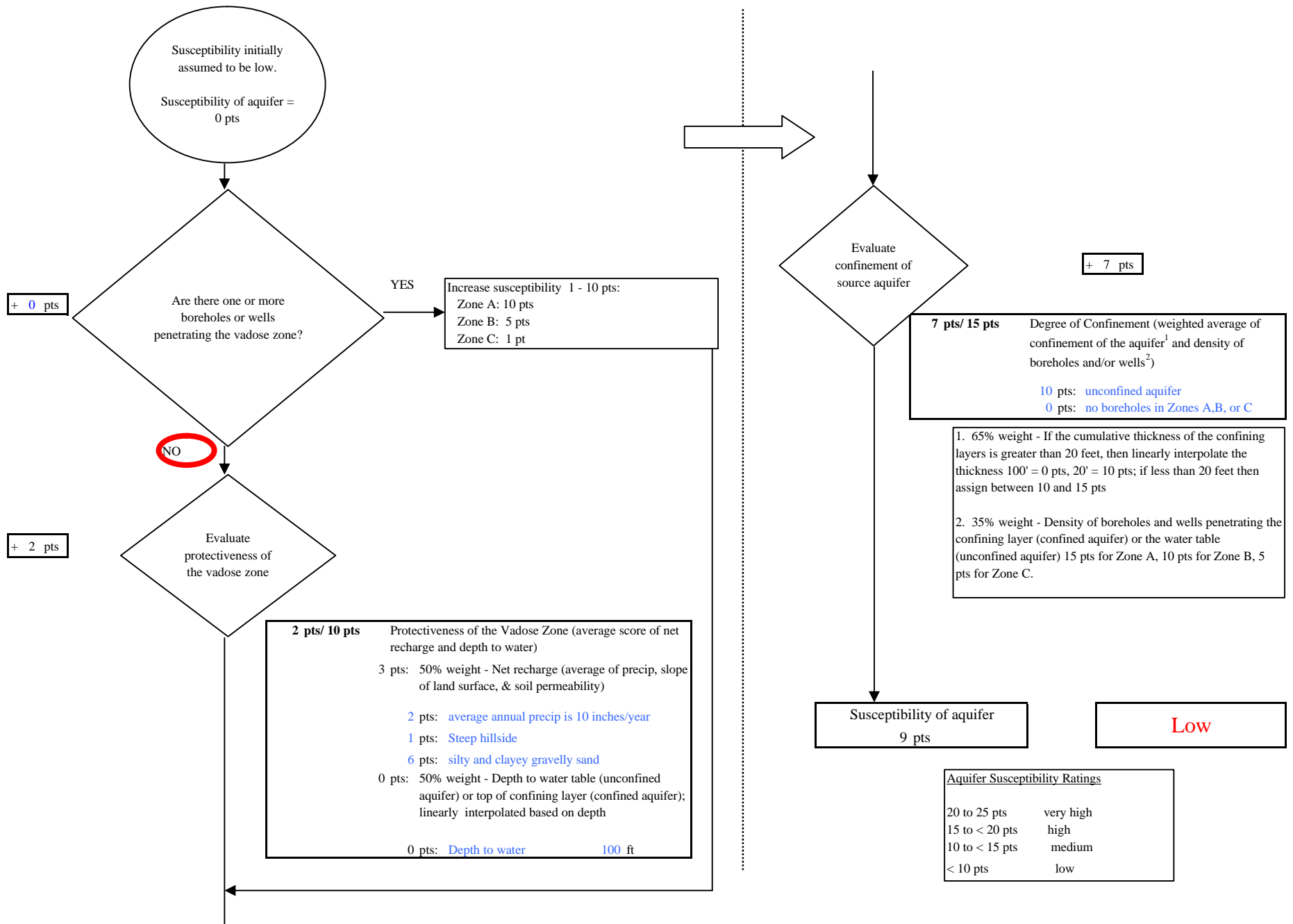


Chart 3. Contaminant risks for Chisana View Lodge - Bacteria & Viruses

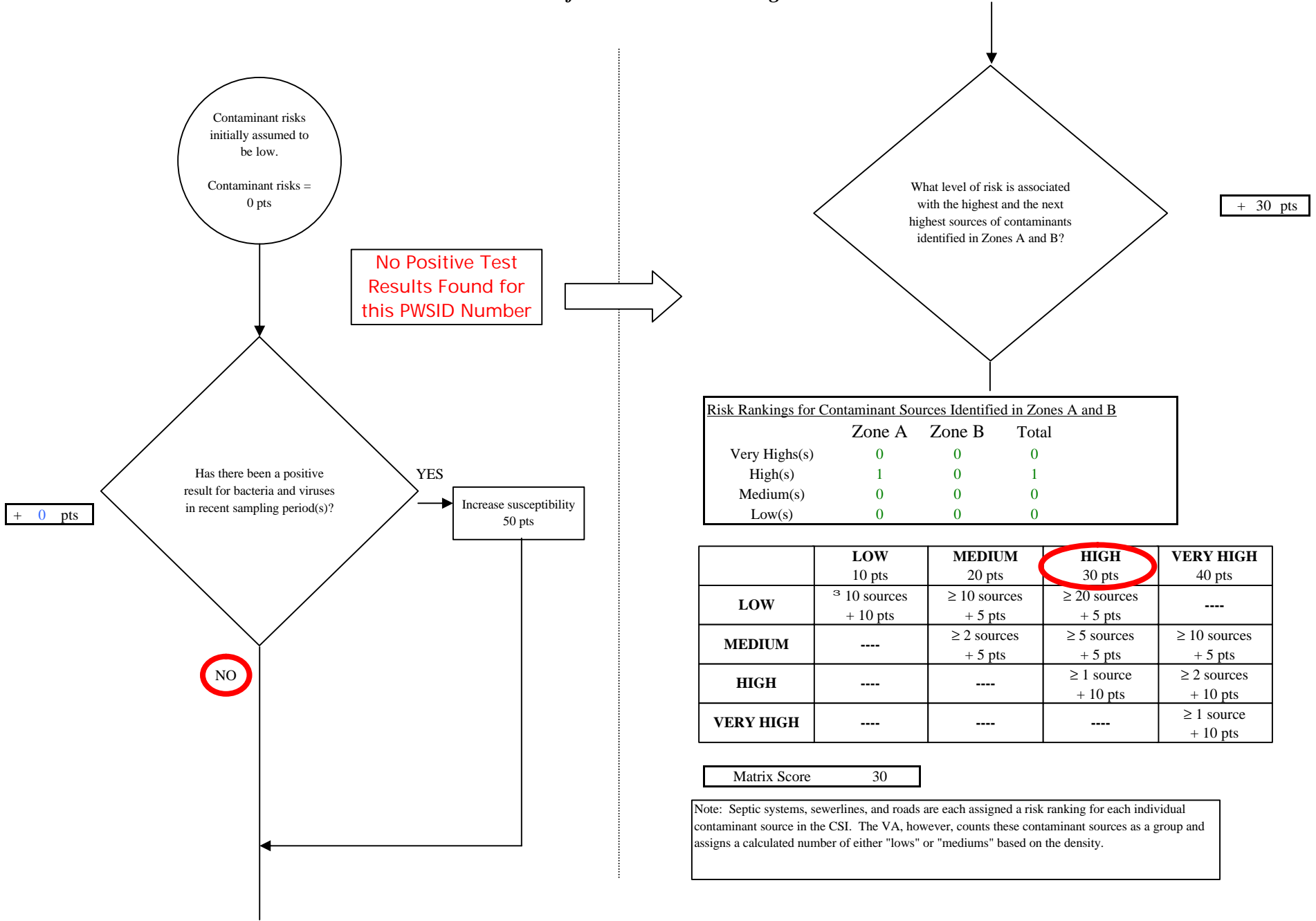
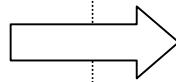
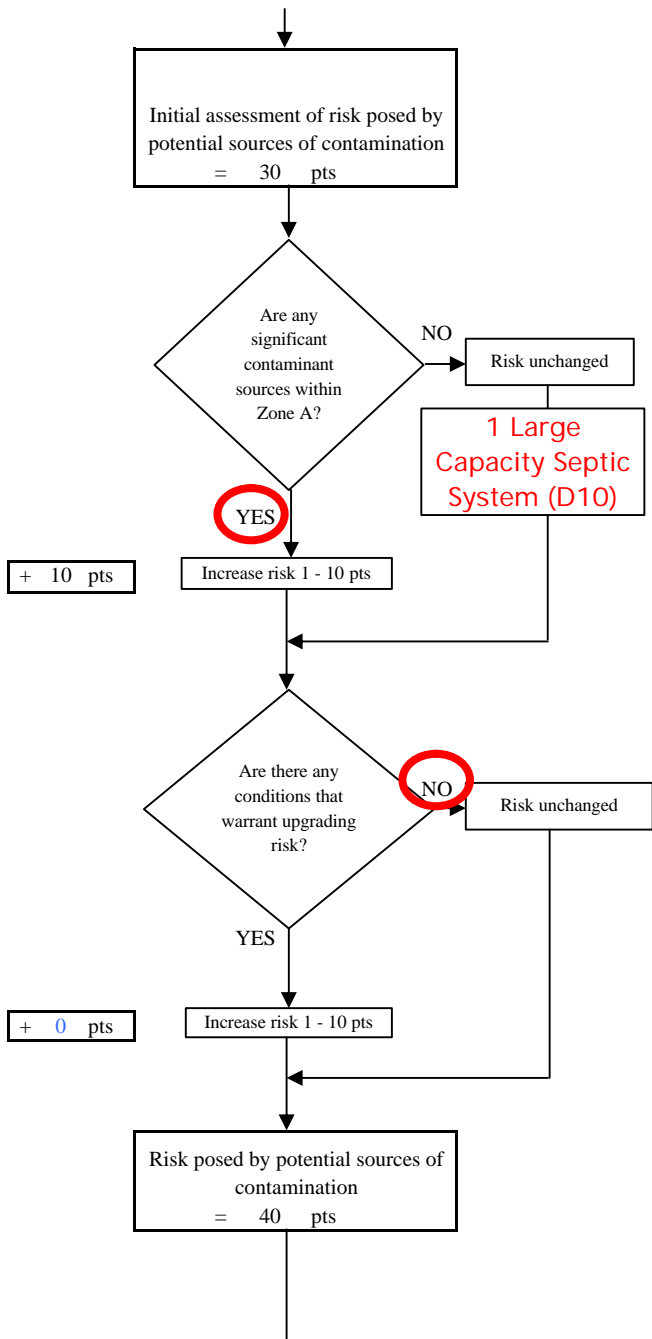
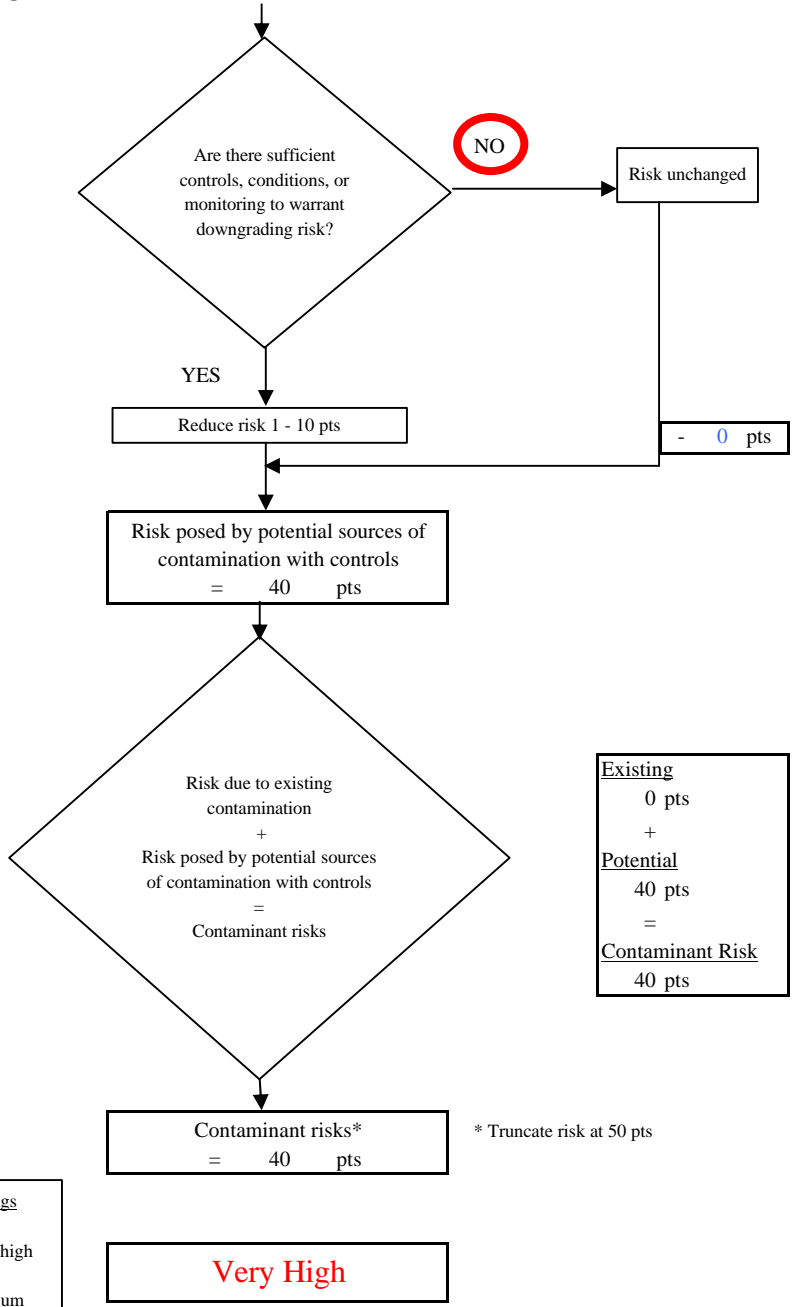


Chart 3. Contaminant risks for Chisana View Lodge - Bacteria & Viruses



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	40 pts
=	
Contaminant Risk	40 pts

* Truncate risk at 50 pts

Chart 4. Vulnerability analysis for Chisana View Lodge - Bacteria & Viruses

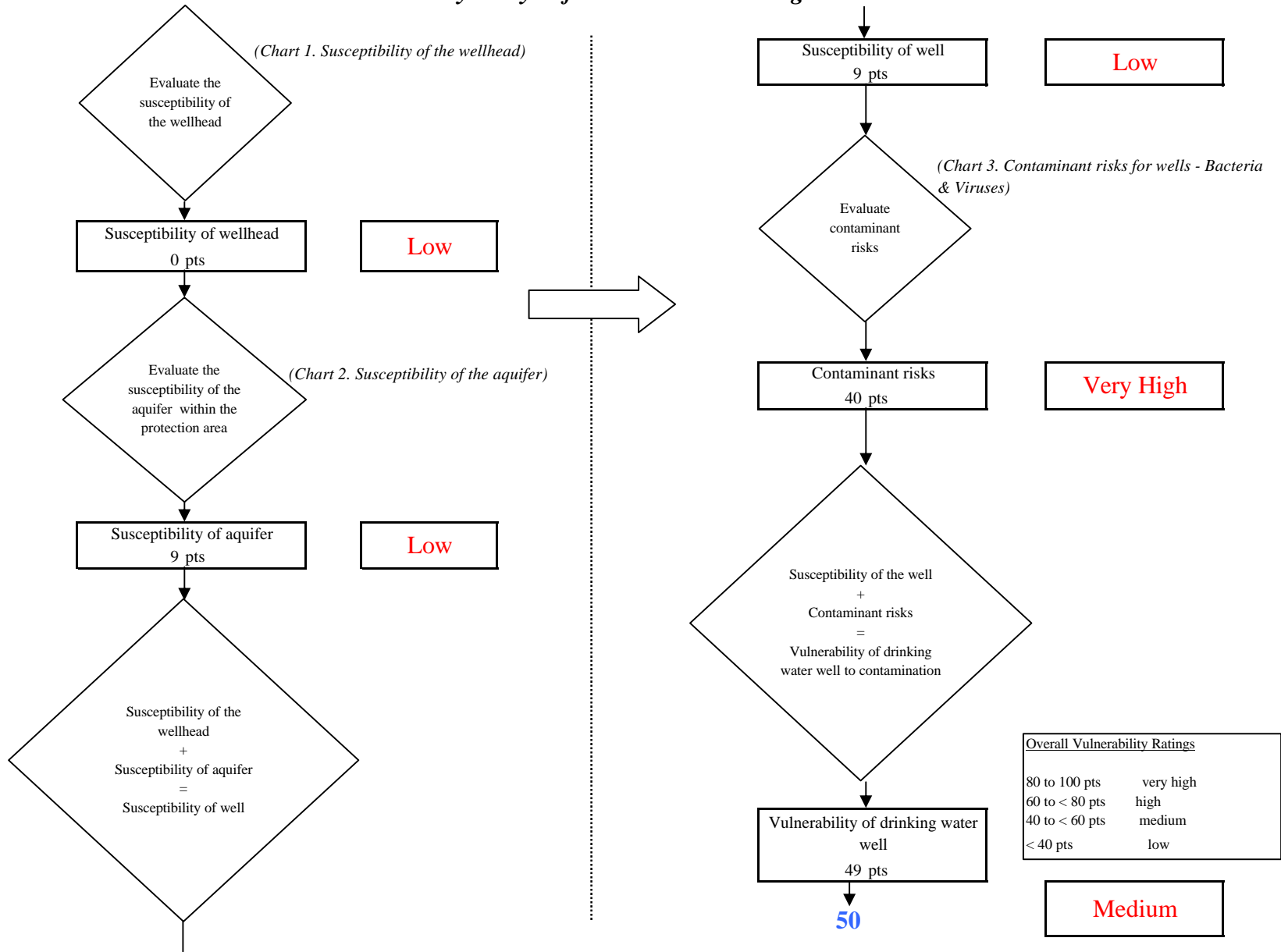


Chart 5. Contaminant risks for Chisana View Lodge - Nitrates and Nitrites

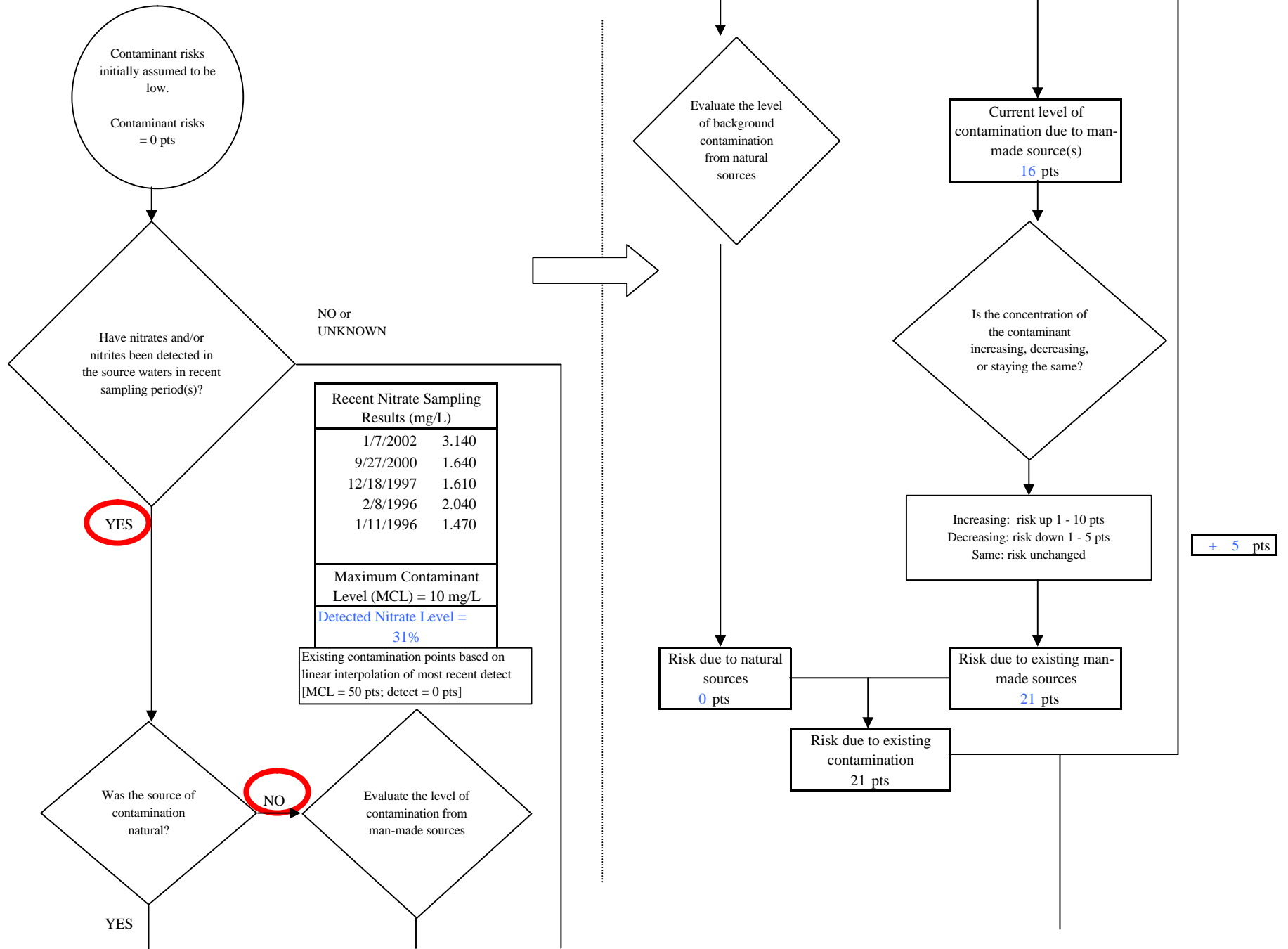


Chart 5. Contaminant risks for Chisana View Lodge - Nitrates and Nitrites

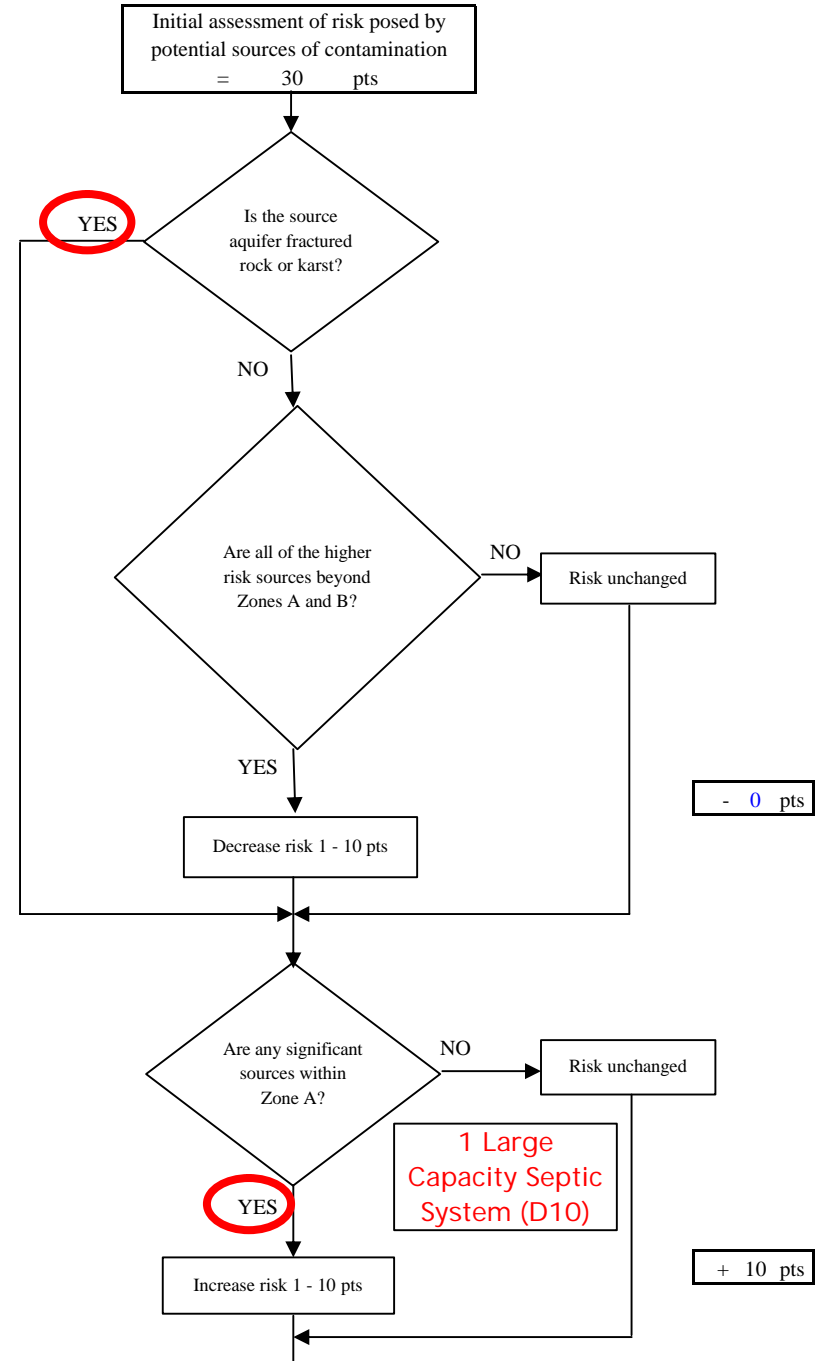
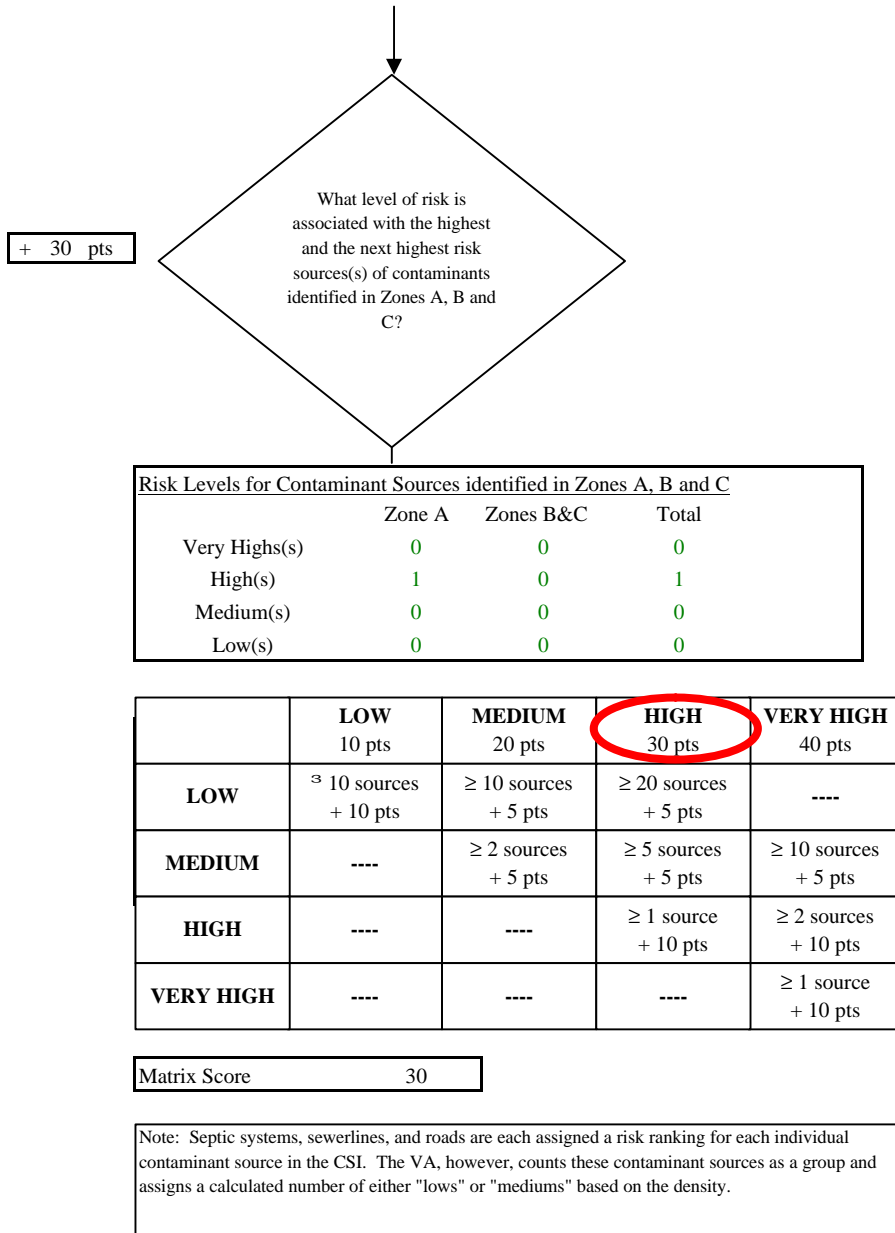


Chart 5. Contaminant risks for Chisana View Lodge - Nitrates and Nitrites

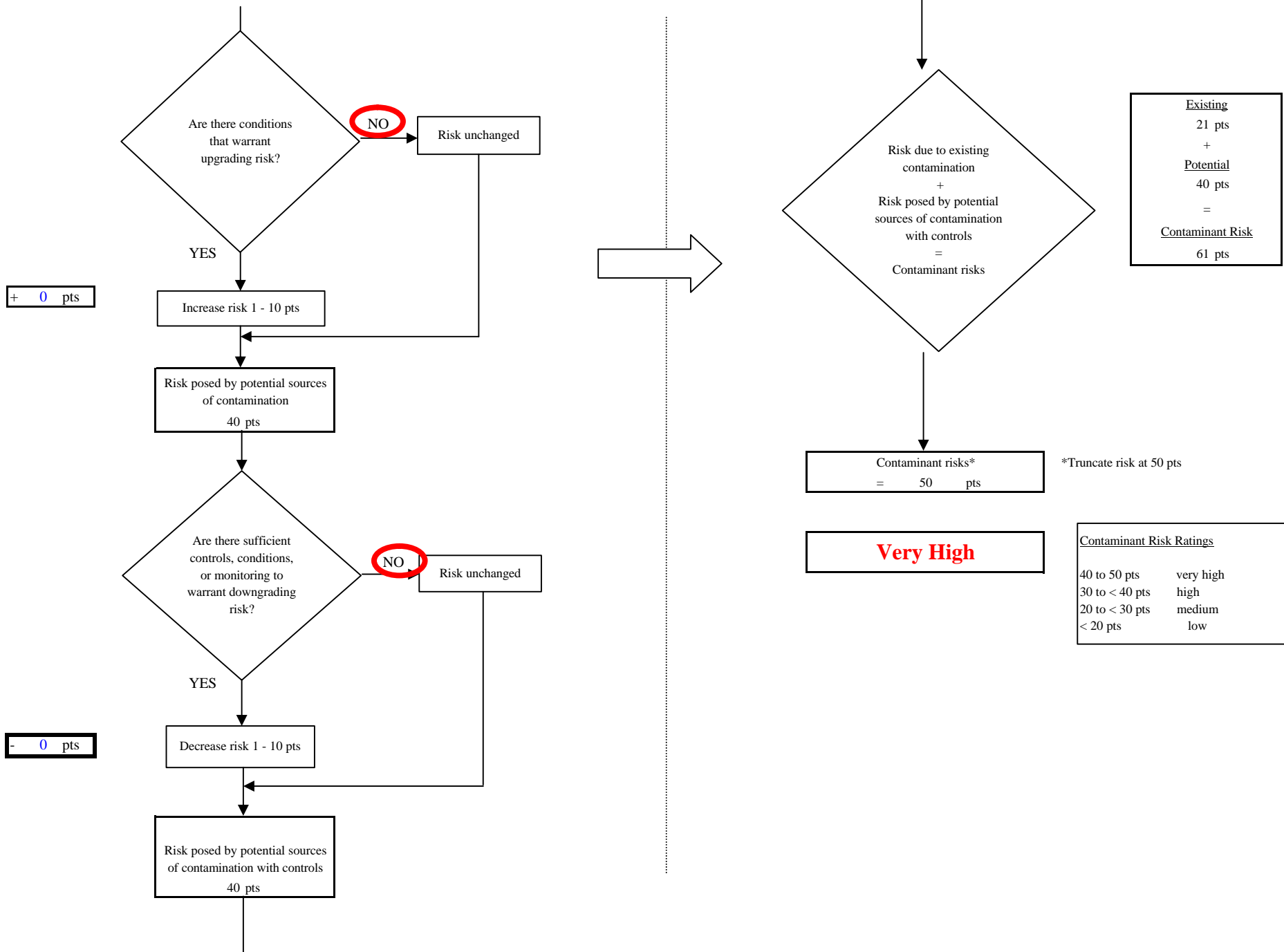


Chart 6. Vulnerability analysis for Chisana View Lodge - Nitrates and Nitrites

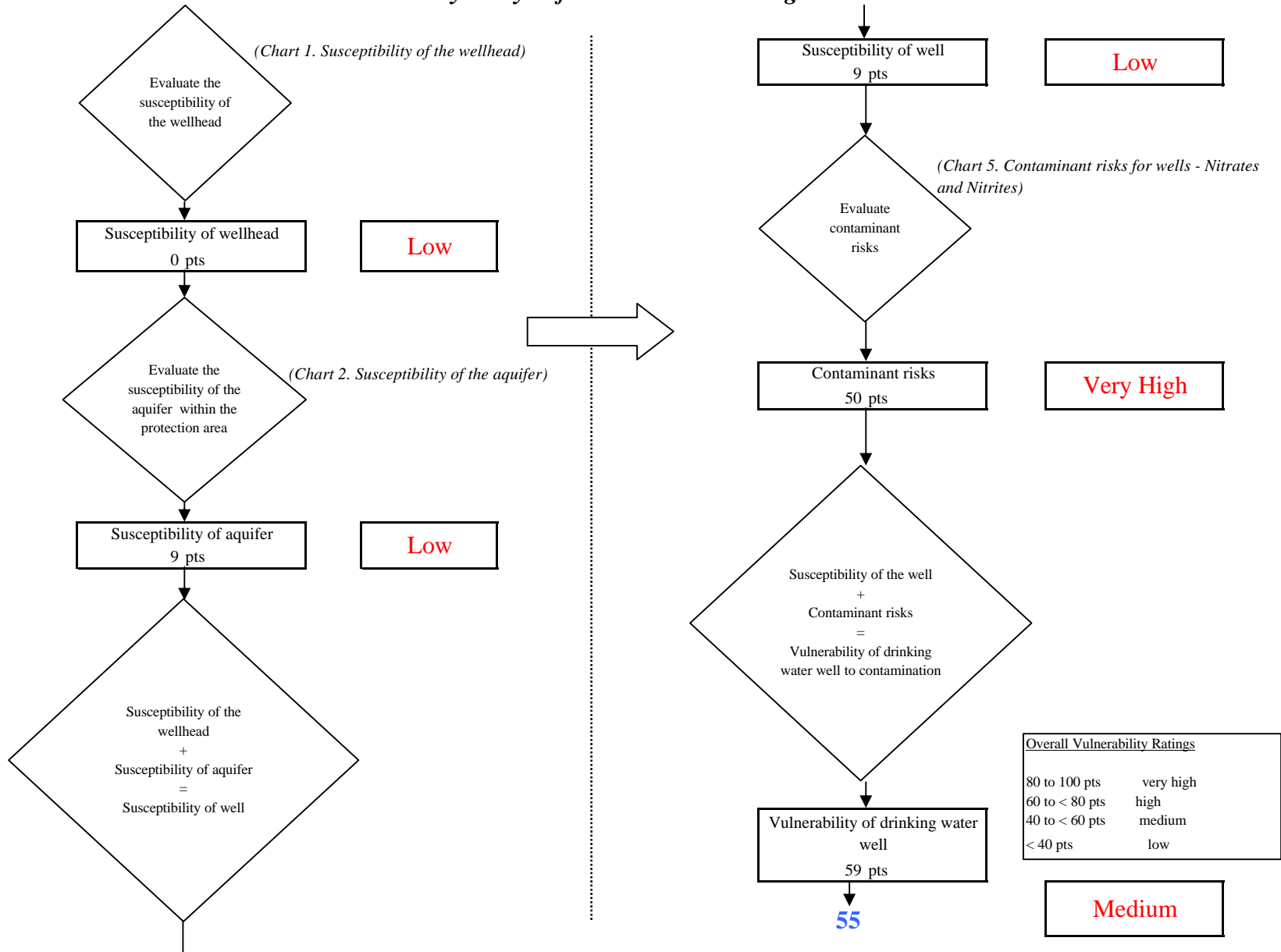


Chart 7. Contaminant risks for Chisana View Lodge - Volatile Organic Chemicals

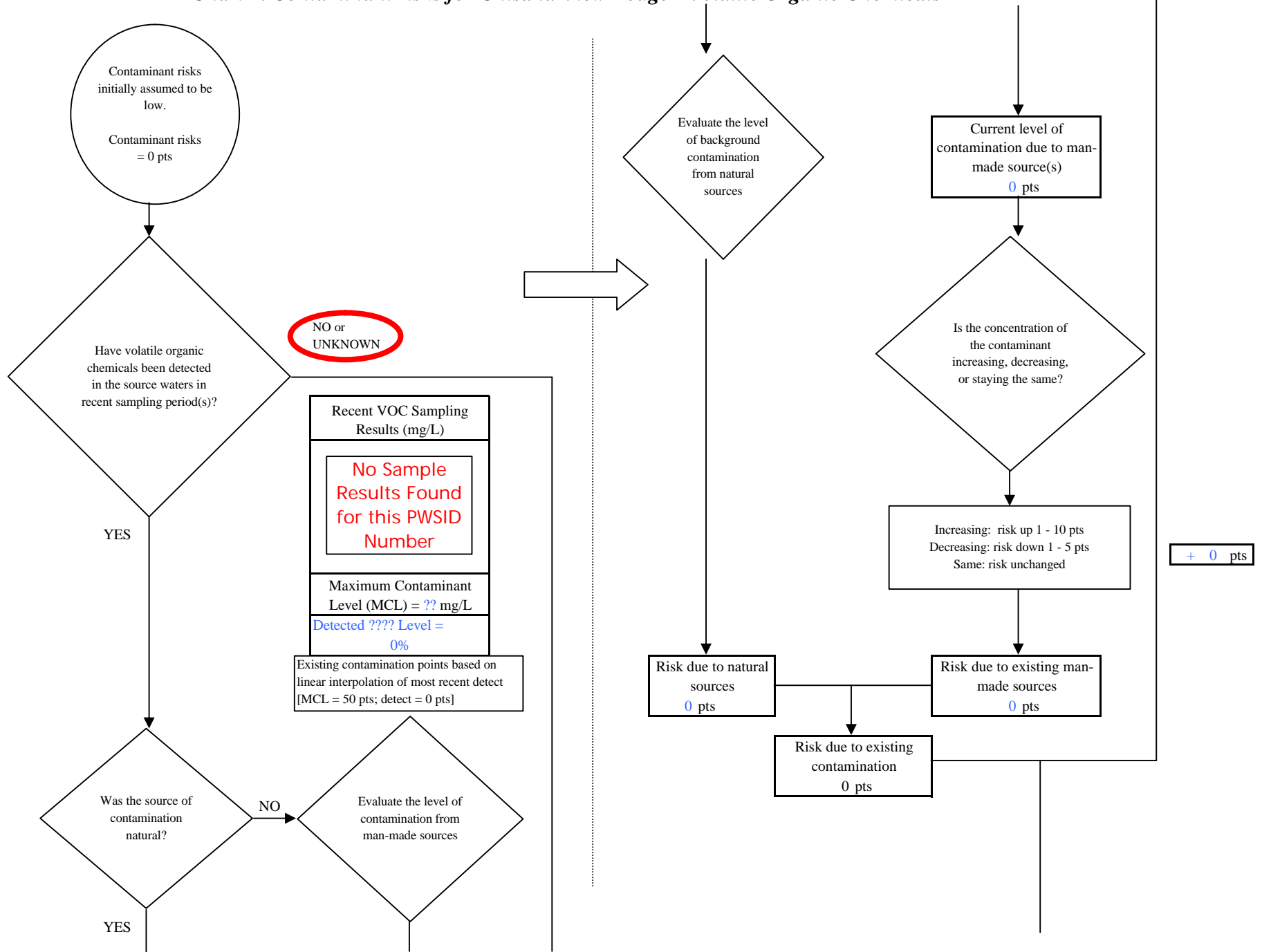


Chart 7. Contaminant risks for Chisana View Lodge - Volatile Organic Chemicals

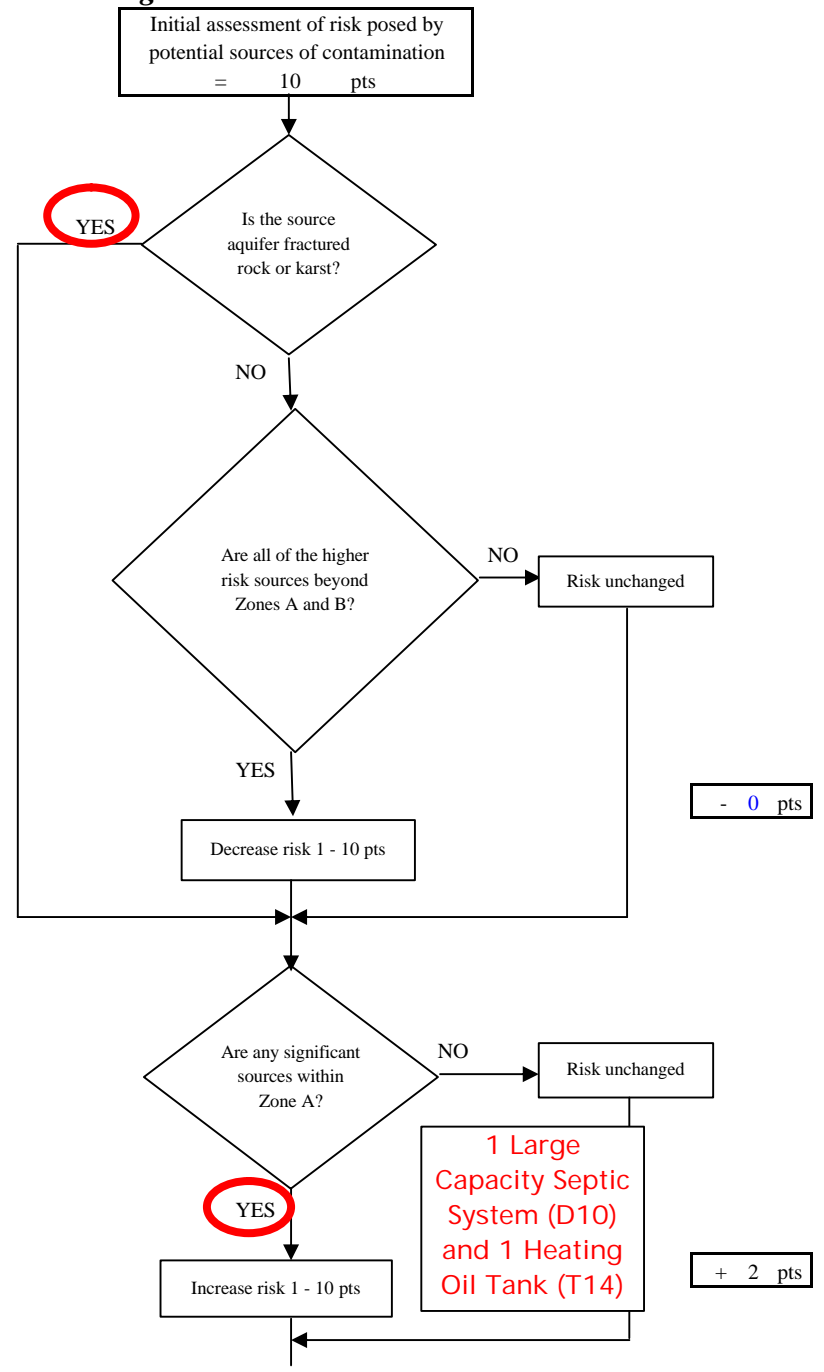
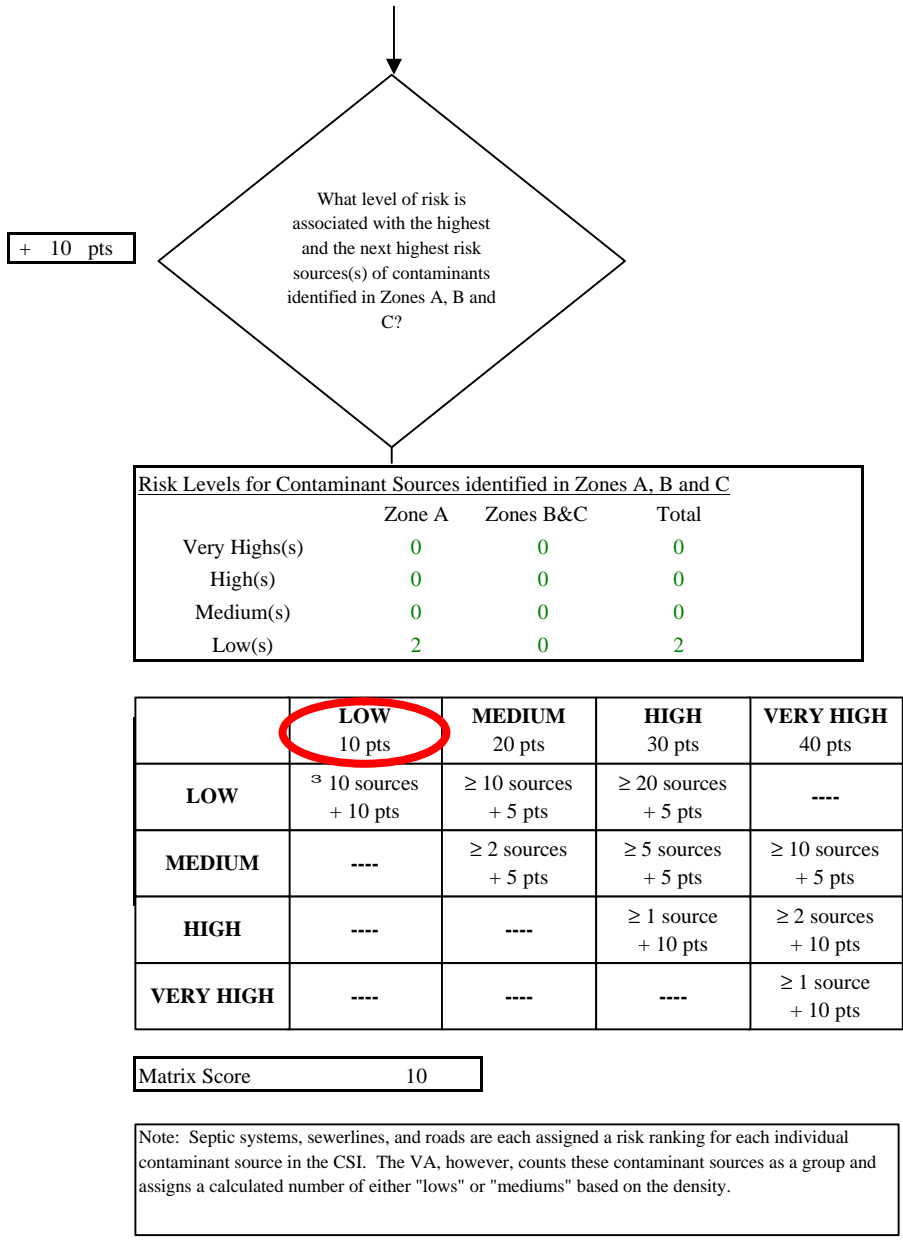


Chart 7. Contaminant risks for Chisana View Lodge - Volatile Organic Chemicals

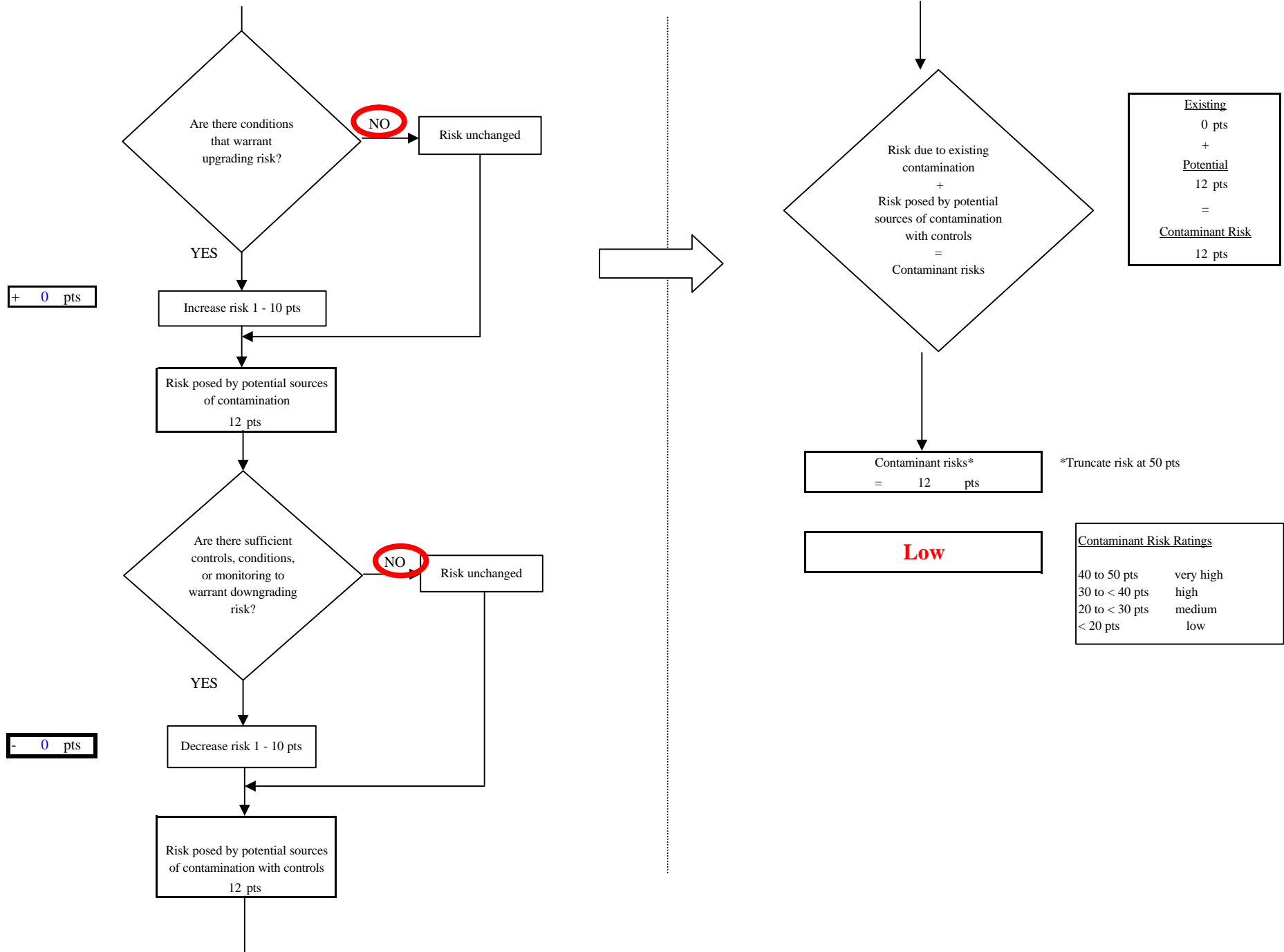


Chart 8. Vulnerability analysis for Chisana View Lodge - Volatile Organic Chemicals

