



Source Water Assessment

A Hydrogeologic Susceptibility and
Vulnerability Assessment for
Sourdough Campground,
Tok, Alaska
PWSID #380387

DRINKING WATER PROTECTION PROGRAM REPORT NO. 899

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 Sourdough Campground, Tok, Alaska

Drinking Water Protection Program Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

The public water system for Sourdough Campground is a Class B (transient/non-community) water system consisting of one well. The Sourdough Campground is located at Mile 122.8 of the Glenn Highway, Tok, Alaska. The wellhead received a susceptibility rating of **Low** and the aquifer received a susceptibility rating of **Medium**. Combining these two ratings produces a **Low** rating for the natural susceptibility of the well. Identified potential and current sources of contaminants for Sourdough Campground public drinking water source include laundromats (without drycleaning); large-capacity septic systems; RV dump stations; single-family septic systems; aboveground heating oil tanks; campgrounds and RV parks; and paved highways and roads. 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 Sourdough Campground received a vulnerability rating of **Medium** for bacteria and viruses; nitrates and nitrites; and volatile organic chemicals.

SOURDOUGH CAMPGROUND PUBLIC DRINKING WATER SYSTEM

Sourdough Campground public water system is a Class B (transient/non-community) water system. The system consists of one well at Mile 122.8 of the Glenn Highway, Tok, Alaska (See Map 1 of Appendix A). Tok is located at the junction of the Alaska Highway and the Tok cutoff to the Glenn Highway, 200 miles southeast of Fairbanks. Tok is called the “Gateway to Alaska” as it is the first major community upon entering Alaska, 93 miles from the Canadian border. The population of Tok is approximately 1,400.

Tok averages about 15 inches of precipitation per year, including 33 inches of snow. Although the quality of the groundwater can vary significantly in a short distance, groundwater supplies are generally abundant in the area. Many homes and businesses in the area rely on individual wells for the water supply. Most of these wells are shallow with depths of less than 50 to 125 feet. Static water levels in these wells are generally 50 to 80 feet below the surface. The coarse, alluvial, sandy gravel aquifer generally provides sufficient water, even in the winter when infiltration is low.

The elevation for the Sourdough Campground is approximately 1,650 feet above sea level. Drainages along the Glenn Highway in this area generally flow north.

According to a Sanitary Survey dated June 27, 2000, the well was installed in 1978 with 6-inch diameter casing to a depth of 132 feet below ground surface. The Survey indicates that the land surface is sloped away from the well, providing adequate surface water drainage. Because the well was installed prior to 1992, we are assuming that it is not grouted according to ADEC standards. Proper grouting provides added protection against contaminants traveling along the well casing and into source waters.

This system operates seasonally from May to September and serves approximately 1 resident and 110 non-residents through one service connection.

SOURDOUGH CAMPGROUND DRINKING WATER PROTECTION AREA

In order to evaluate whether a drinking water source is at risk, we must first evaluate what are the most likely pathways for surface contamination to reach the groundwater. These areas are determined by looking at the characteristics of the soil, groundwater, aquifer, and well.

The most probable area for contamination to reach the drinking water well is the 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 Sourdough Campground extends over 2 miles feet southwest of the well. 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 Sourdough Campground 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

There are no sources of contamination for the Sourdough Campground.

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 SOURDOUGH CAMPGROUND 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 the Sourdough Campground 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 the Sourdough Campground.

Table 2. Susceptibility

	Score	Rating
Susceptibility of the Wellhead	5	Low
Susceptibility of the Aquifer	12	Medium
Natural Susceptibility	17	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	41	Very High
Volatile Organic Chemicals	25	Medium

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	55	Medium
Nitrates and Nitrites	55	Medium
Volatile Organic Chemicals	40	Medium

Bacteria and Viruses

The contaminant risk for bacteria and viruses is **Very High** with with laundromats (without drycleaning); large-capacity septic systems; RV dump stations; single-family septic systems; aboveground heating oil tanks; and campgrounds and RV parks representing the risks to this source of public drinking water (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 laundromats (without drycleaning); large-capacity septic systems; RV dump stations; single-family septic systems; campgrounds and RV parks 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 The Sourdough Campground indicates that nitrates have been detected in the water, but only in very low concentrations (most recently at .270 mg/L on 8/29/02) or 3% 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 **Medium** with laundromats (without drycleaning); large-capacity septic systems; RV dump stations; single-family septic systems; aboveground heating oil tanks; and campgrounds and RV parks the only known risks for volatile organic chemicals (See Chart 7 – Contaminant Risks for Volatile Organic Chemicals in Appendix D).

Sample data for volatile organic chemicals was not available. 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 **Medium**.

REFERENCES

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- King, P.B., compiler, 1969, Tectonic map of North America: US Geological Survey Map (Scale 1:5,000,000) 2 sheets.
- United States Environmental Protection Agency (2002). <<http://www.epa.gov/safewater/mcl.html#mcls>> (2003, September 1)

APPENDIX A

Sourdough Campground Drinking Water Protection Area Location Map (Map 1)

APPENDIX B

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

Table 1**Contaminant Source Inventory for
Sourdough Campground****PWSID 380387.001**

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Map Number	Comments
Laundromats without dry cleaning	C22	C22-1	A	2	Sourdough Campground Laundromat
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A	2	Sourdough Campground Septic System
RV dump stations	D18	D18-1	A	2	Sourdough Campground RV Dump Station
Septic systems (serves one single-family home)	R02	R02-1	A	2	Residence South of Sourdough Campground
Tanks, heating oil, residential (above ground)	R08	R08-1	A	2	Residence South of Sourdough Campground
Campgrounds and RV Parks	X35	X35-1	A	2	Sourdough Campground
Highways and roads, paved (cement or asphalt)	X20	X20-1	D	2	Glenn Highway

Table 2

**Contaminant Source Inventory and Risk Ranking for
Sourdough Campground
Sources of Bacteria and Viruses**

PWSID 380387.001

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Risk Ranking for Analysis	Map Number	Comments
Laundromats without dry cleaning	C22	C22-1	A	Low	2	Sourdough Campground Laundromat
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A	High	2	Sourdough Campground Septic System
RV dump stations	D18	D18-1	A	Low	2	Sourdough Campground RV Dump Station
Septic systems (serves one single-family home)	R02	R02-1	A	Low	2	Residence South of Sourdough Campground
Campgrounds and RV Parks	X35	X35-1	A	Low	2	Sourdough Campground

Table 3

**Contaminant Source Inventory and Risk Ranking for
Sourdough Campground
Sources of Nitrates/Nitrites**

PWSID 380387.001

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Risk Ranking for Analysis	Map Number	Comments
Laundromats without dry cleaning	C22	C22-1	A	Low	2	Sourdough Campground Laundromat
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A	High	2	Sourdough Campground Septic System
RV dump stations	D18	D18-1	A	Low	2	Sourdough Campground RV Dump Station
Septic systems (serves one single-family home)	R02	R02-1	A	Low	2	Residence South of Sourdough Campground
Campgrounds and RV Parks	X35	X35-1	A	Low	2	Sourdough Campground

Table 4

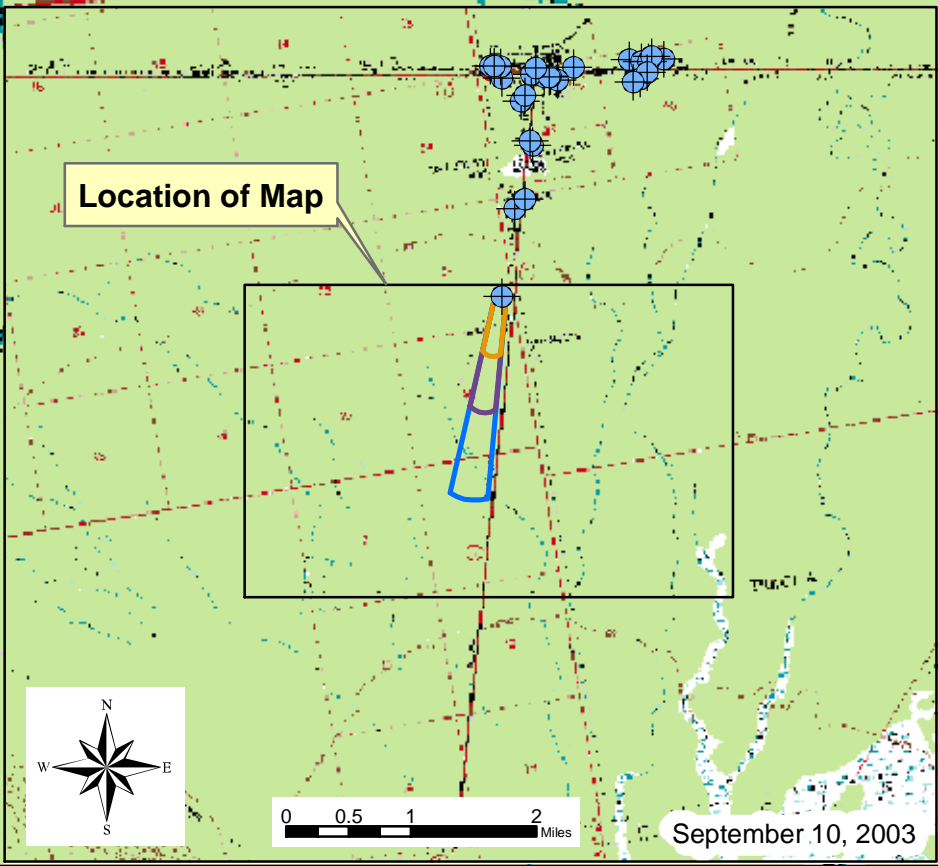
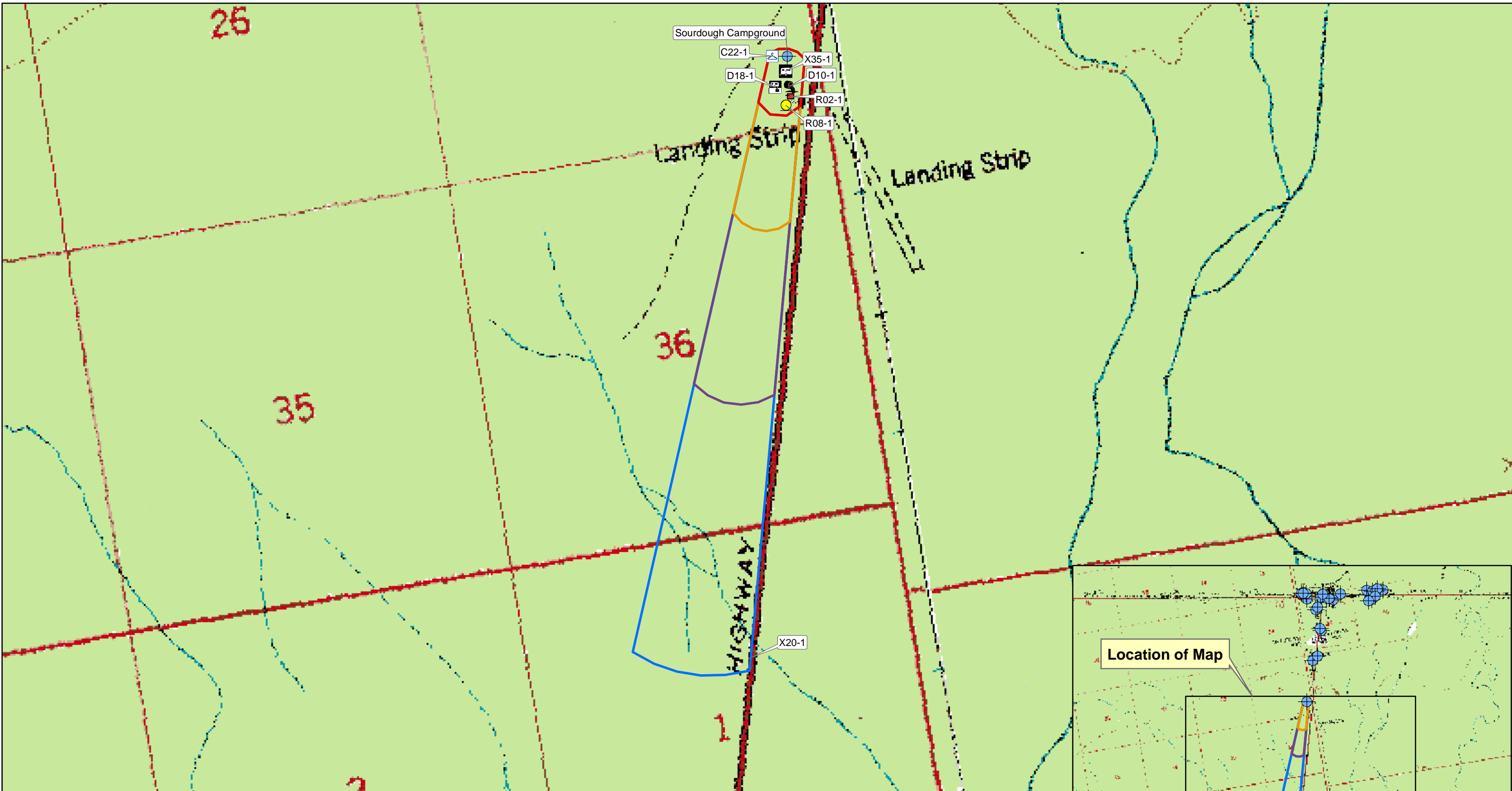
**Contaminant Source Inventory and Risk Ranking for
Sourdough Campground
Sources of Volatile Organic Chemicals**

PWSID 380387.001

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Risk Ranking for Analysis	Map Number	Comments
Laundromats without dry cleaning	C22	C22-1	A	Low	2	Sourdough Campground Laundromat
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A	Low	2	Sourdough Campground Septic System
RV dump stations	D18	D18-1	A	Low	2	Sourdough Campground RV Dump Station
Septic systems (serves one single-family home)	R02	R02-1	A	Low	2	Residence South of Sourdough Campground
Tanks, heating oil, residential (above ground)	R08	R08-1	A	Medium	2	Residence South of Sourdough Campground
Campgrounds and RV Parks	X35	X35-1	A	Low	2	Sourdough Campground

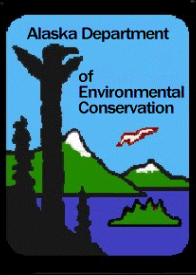
APPENDIX C

Sourdough Campground Drinking Water Protection Area and Potential and Existing Contaminant Sources (Map 2)



Map 2: Drinking Water Protection Areas for Sourdough Campground and Potential and Existing Sources of Contamination

PWSID: 380387.001



0 480 960 1,920 2,880 3,840 Feet

1:14,782

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

Legend

- Public Drinking Water Systems
- Single Family Septic System (R02)
- Laundromat (C22)
- Residential Heating Oil Tank (R08)
- RV Dump Station (D18)
- Campground/RV Park (X35)
- Large Capacity Septic System (D10)

- 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

APPENDIX D

Vulnerability Analysis for Sourdough Campground Public Drinking Water Source (Charts 1-8)

Chart 1. Susceptibility of the wellhead - Sourdough Campground

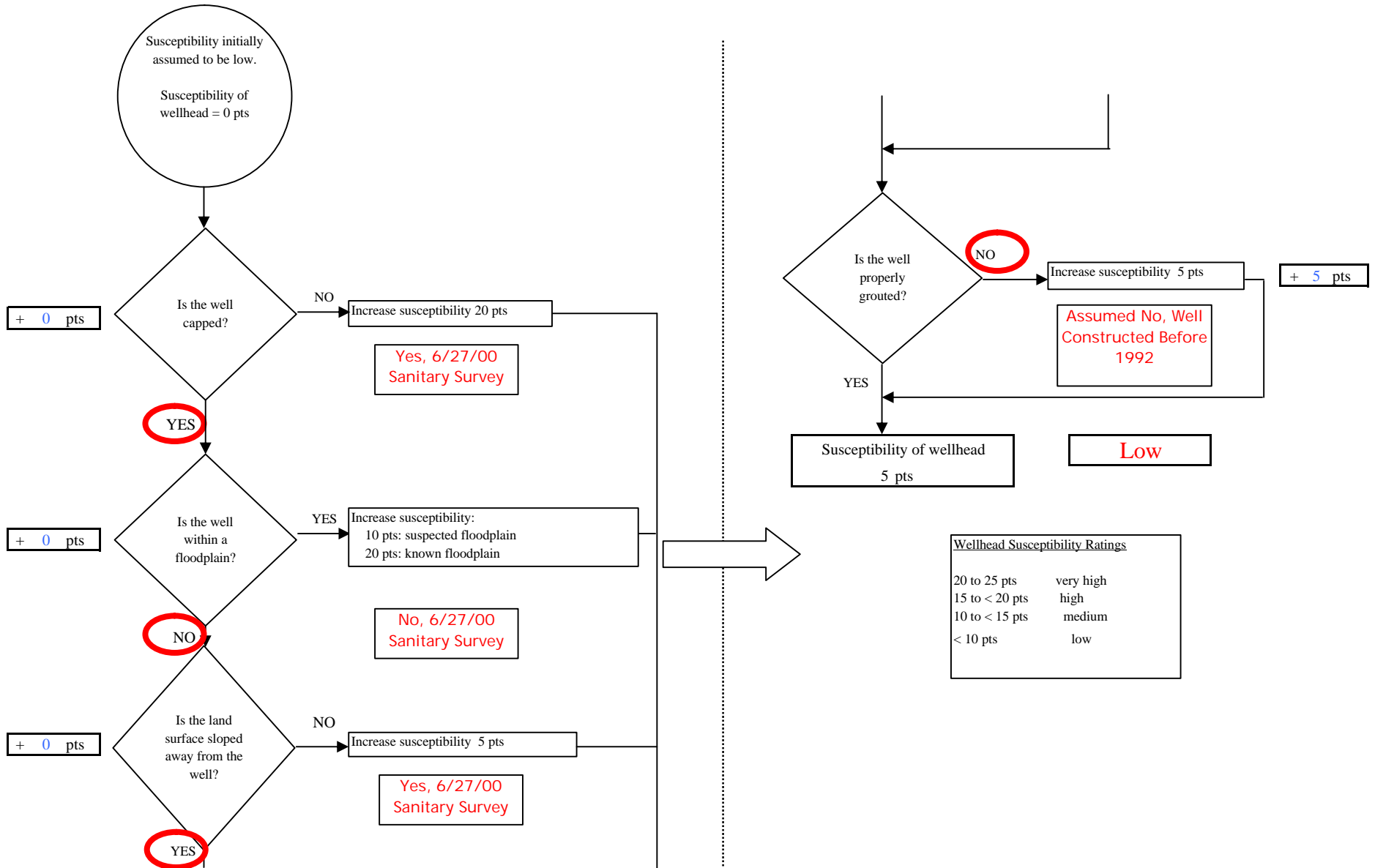


Chart 2. Susceptibility of the aquifer - Sourdough Campground

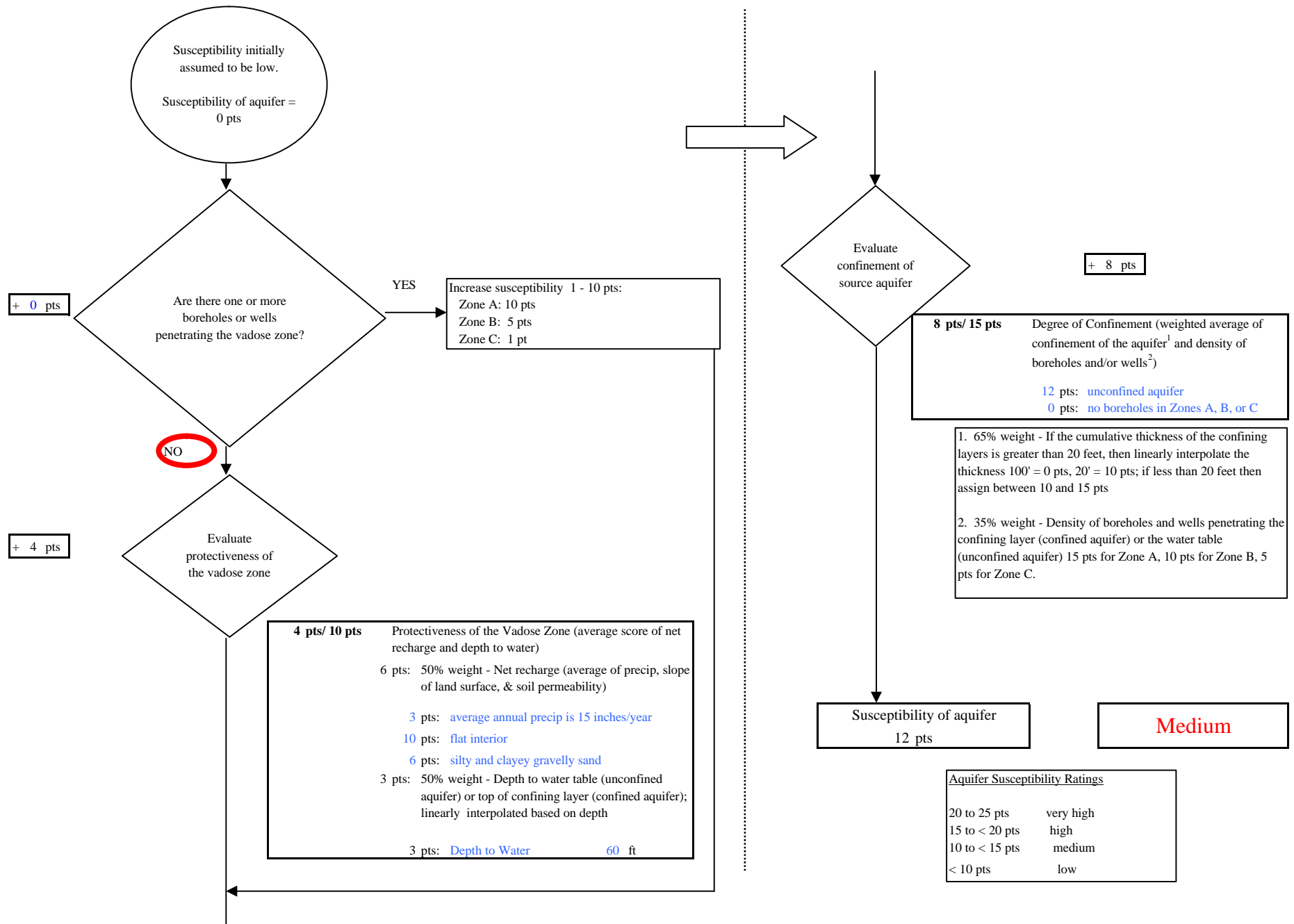


Chart 3. Contaminant risks for Sourdough Campground - Bacteria & Viruses

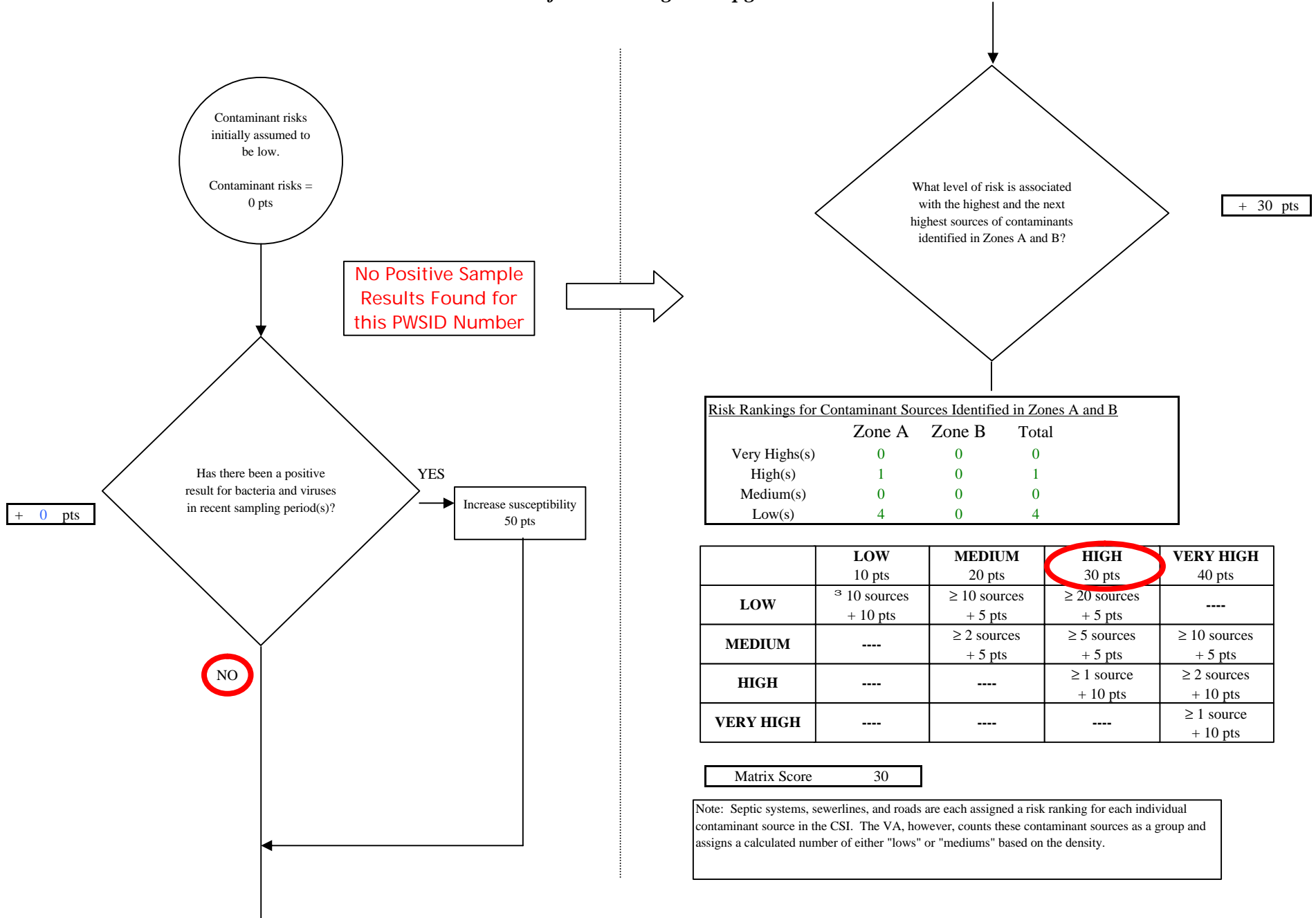


Chart 3. Contaminant risks for Sourdough Campground - Bacteria & Viruses

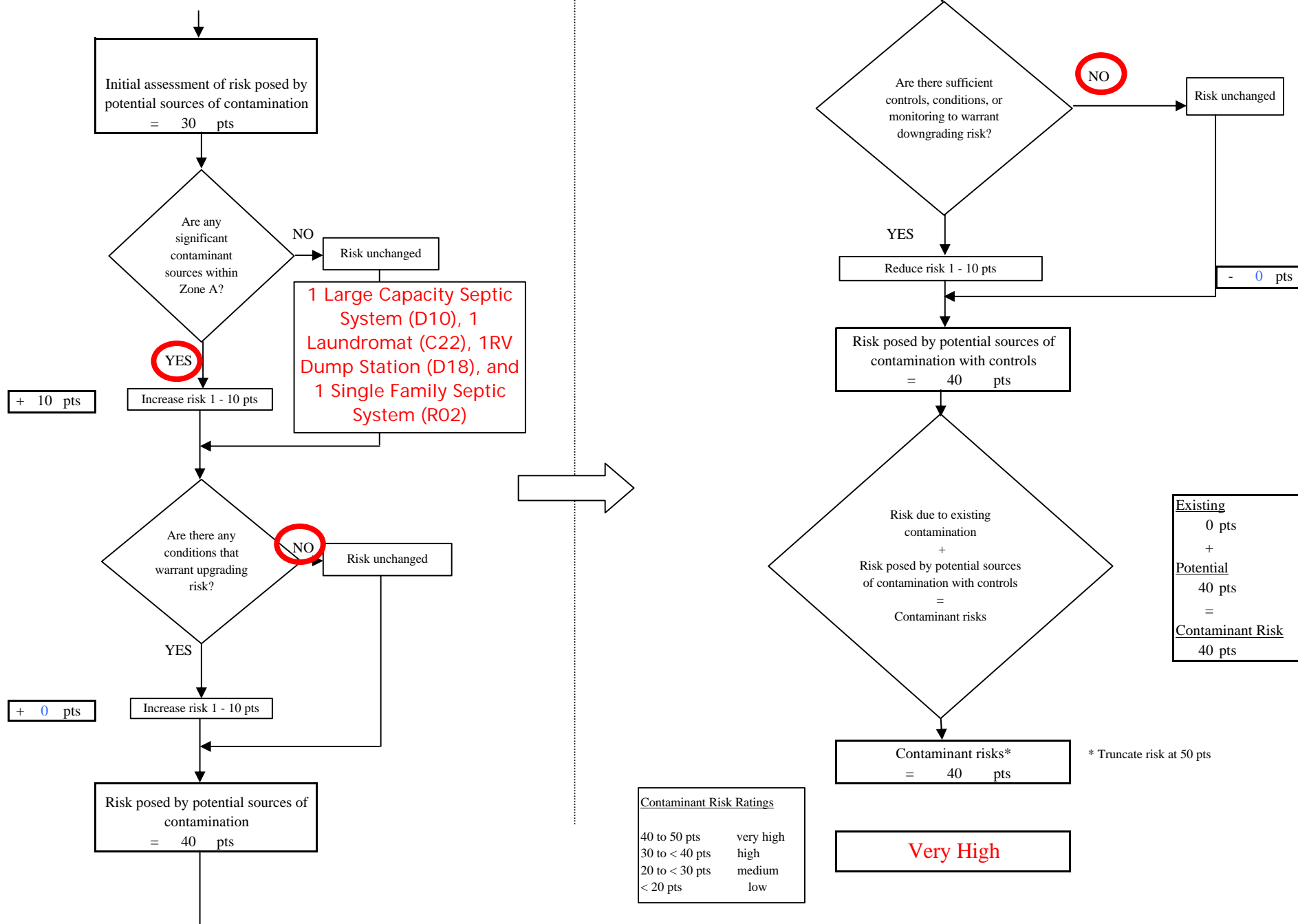


Chart 4. Vulnerability analysis for Sourdough Campground - Bacteria & Viruses

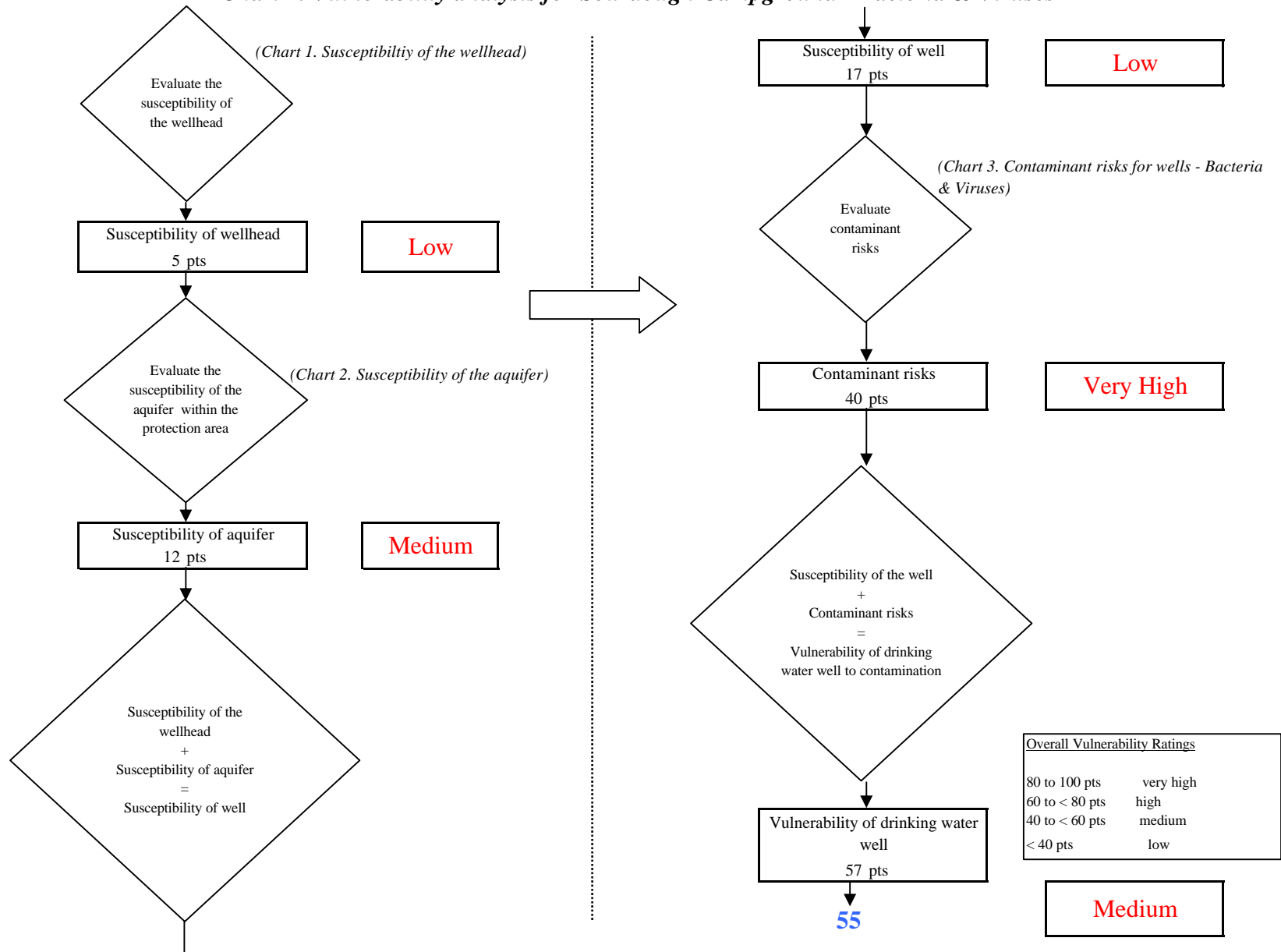


Chart 5. Contaminant risks for Sourdough Campground - Nitrates and Nitrites

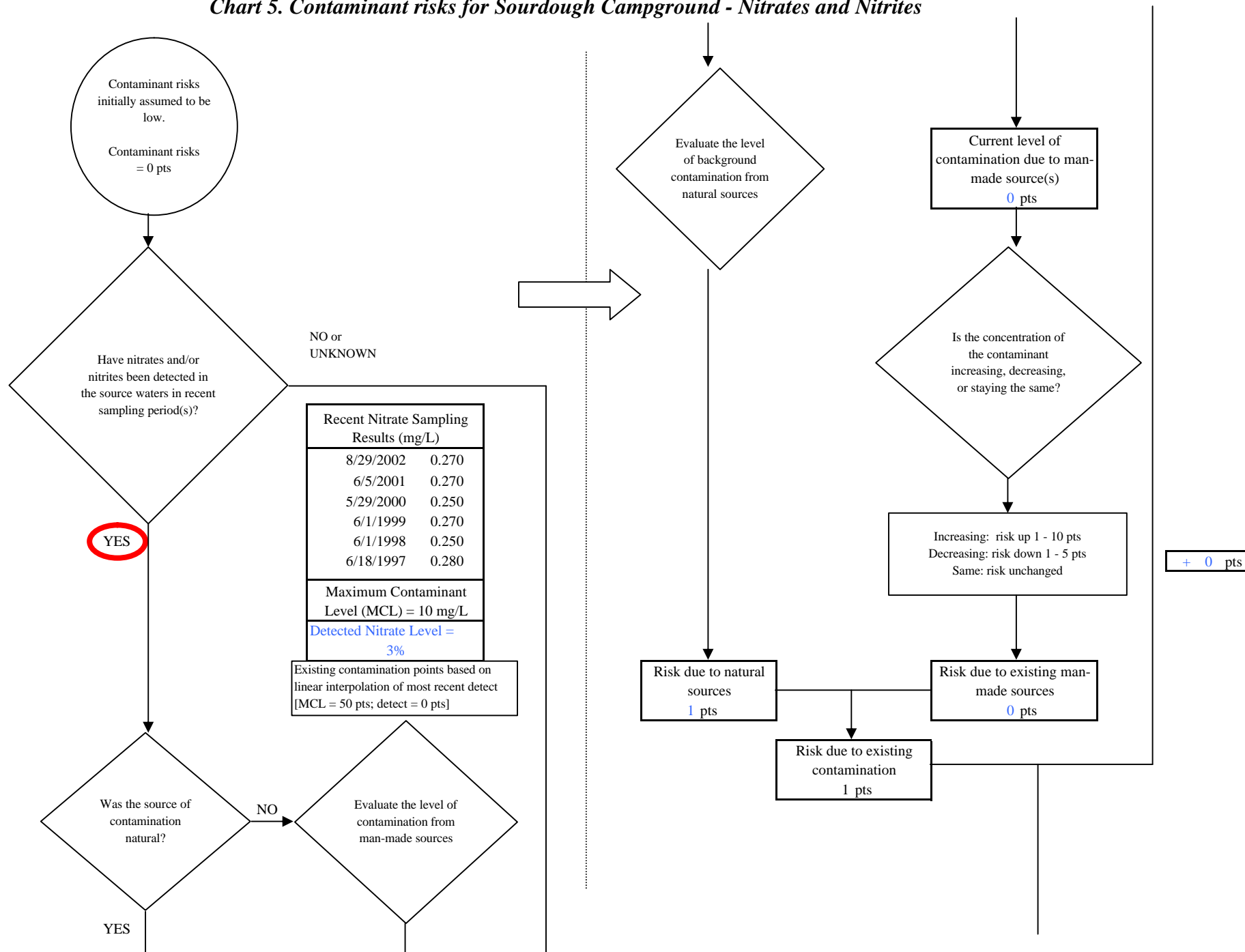


Chart 5. Contaminant risks for Sourdough Campground - Nitrates and Nitrites

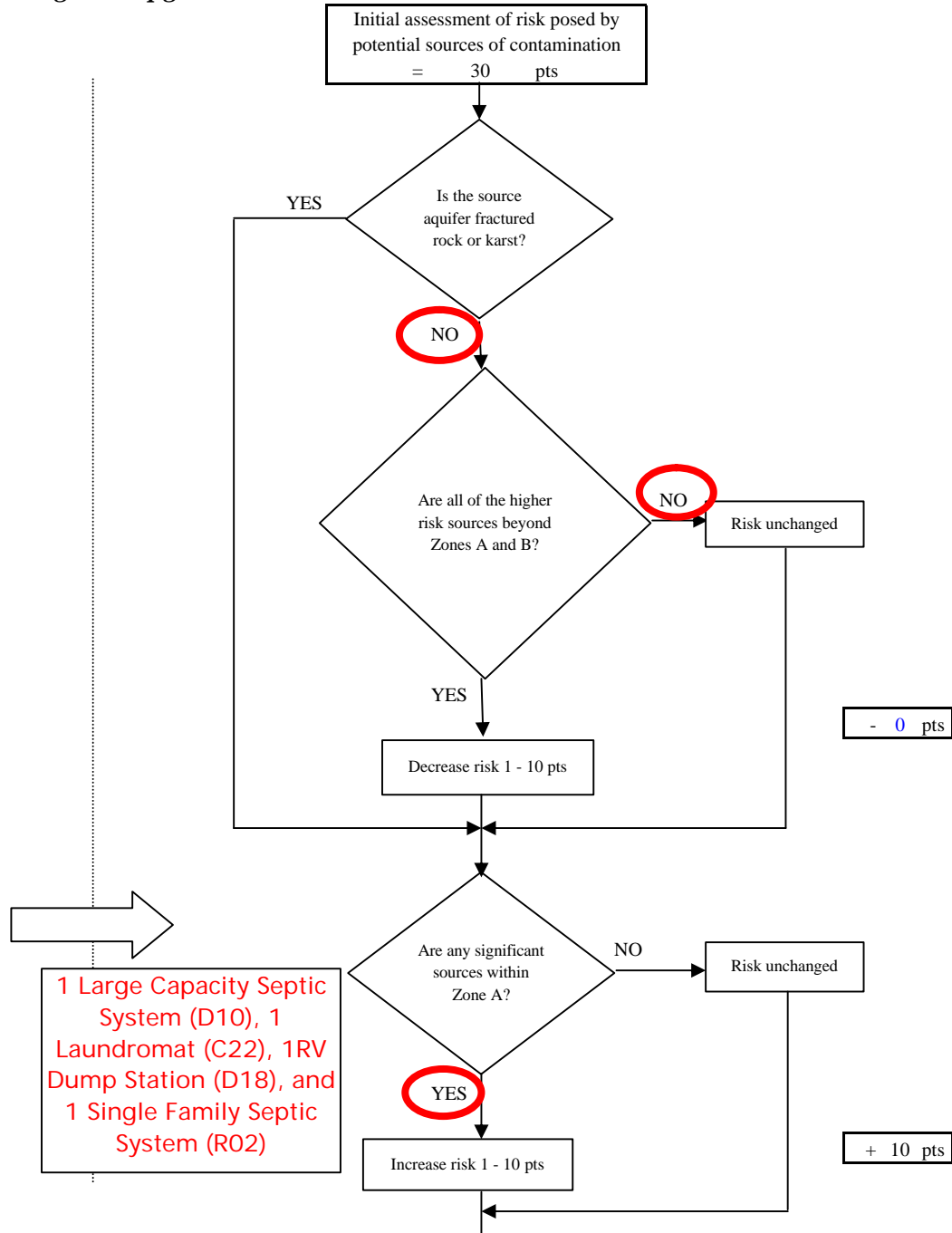
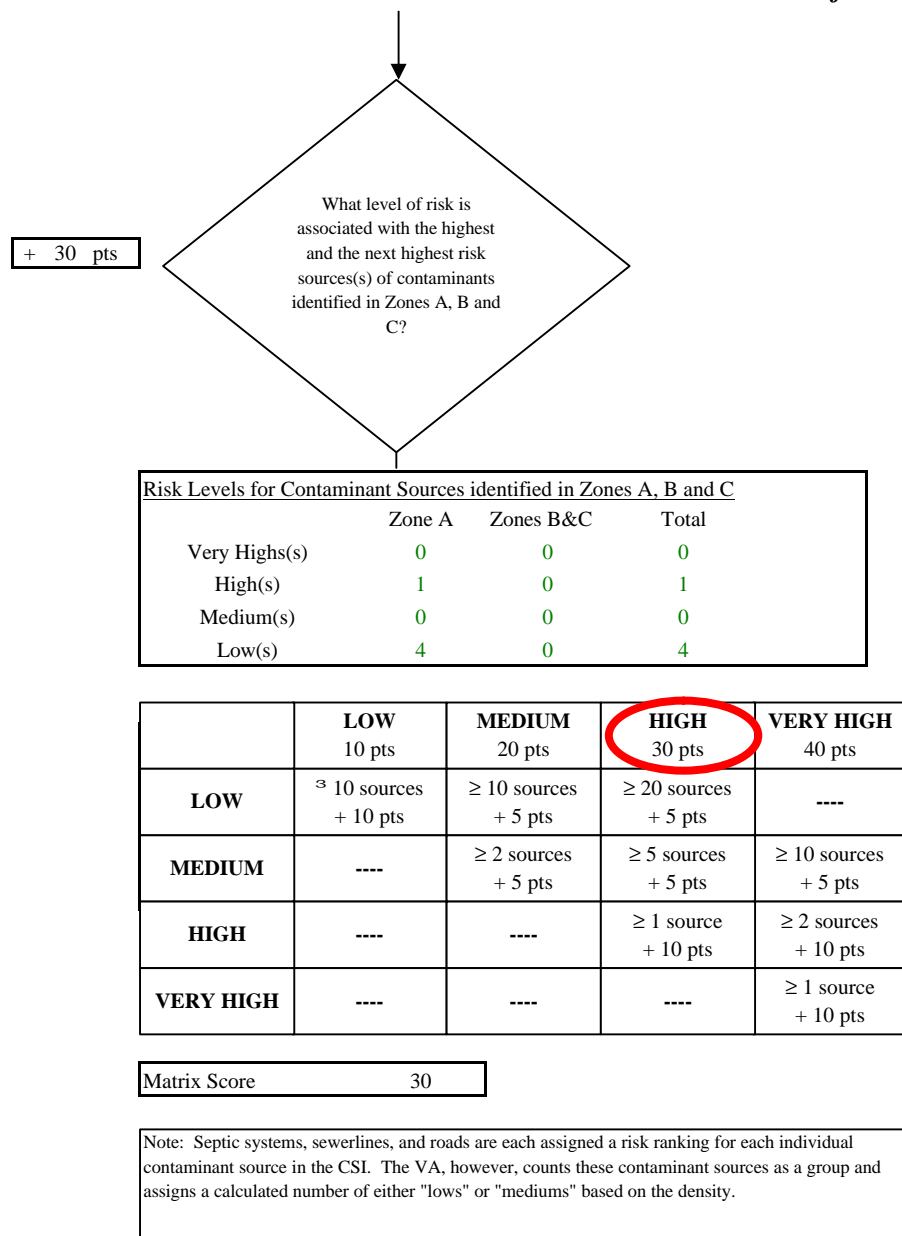


Chart 5. Contaminant risks for Sourdough Campground - Nitrates and Nitrites

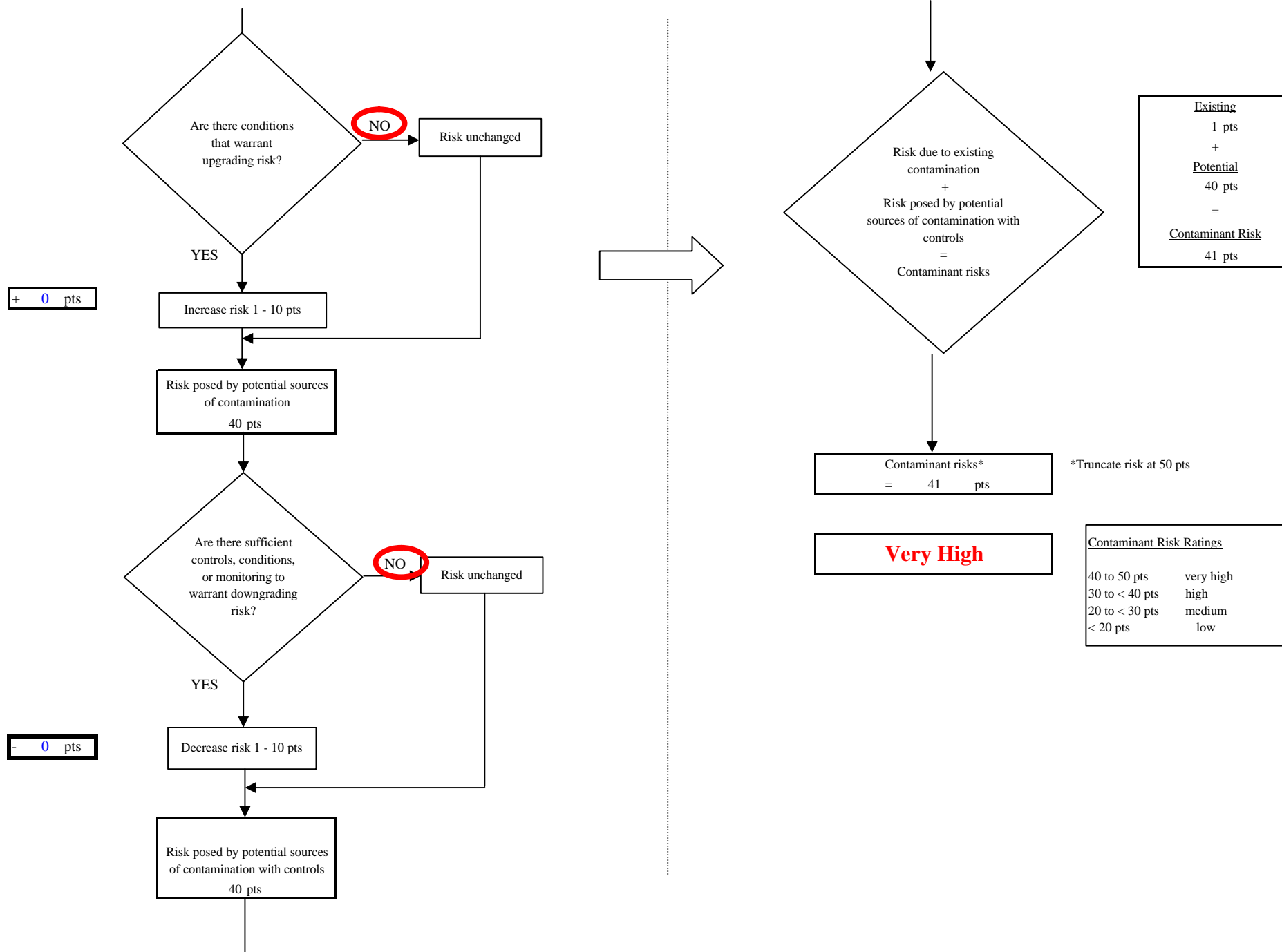


Chart 6. Vulnerability analysis for Sourdough Campground - Nitrates and Nitrites

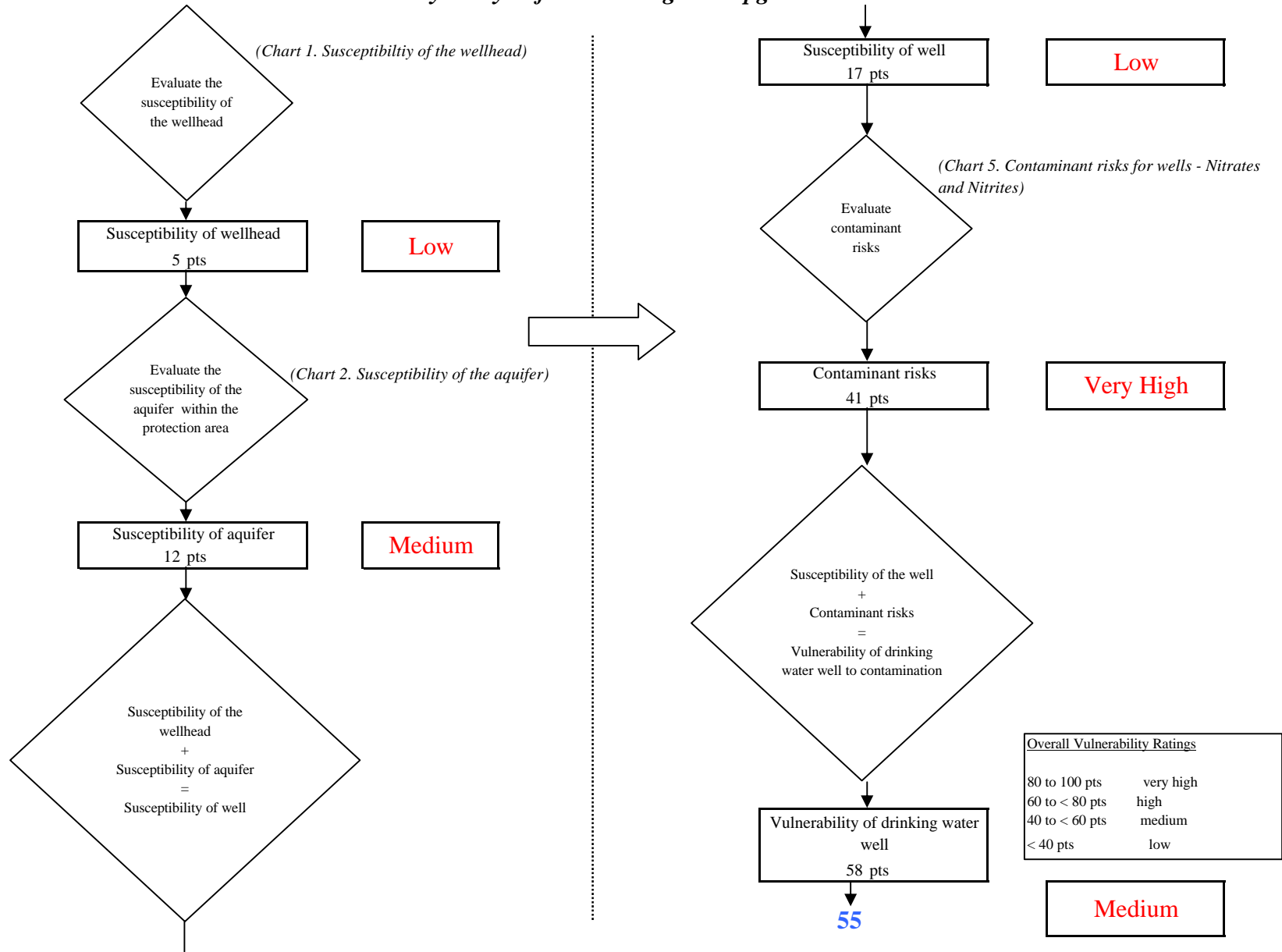


Chart 7. Contaminant risks for Sourdough Campground - Volatile Organic Chemicals

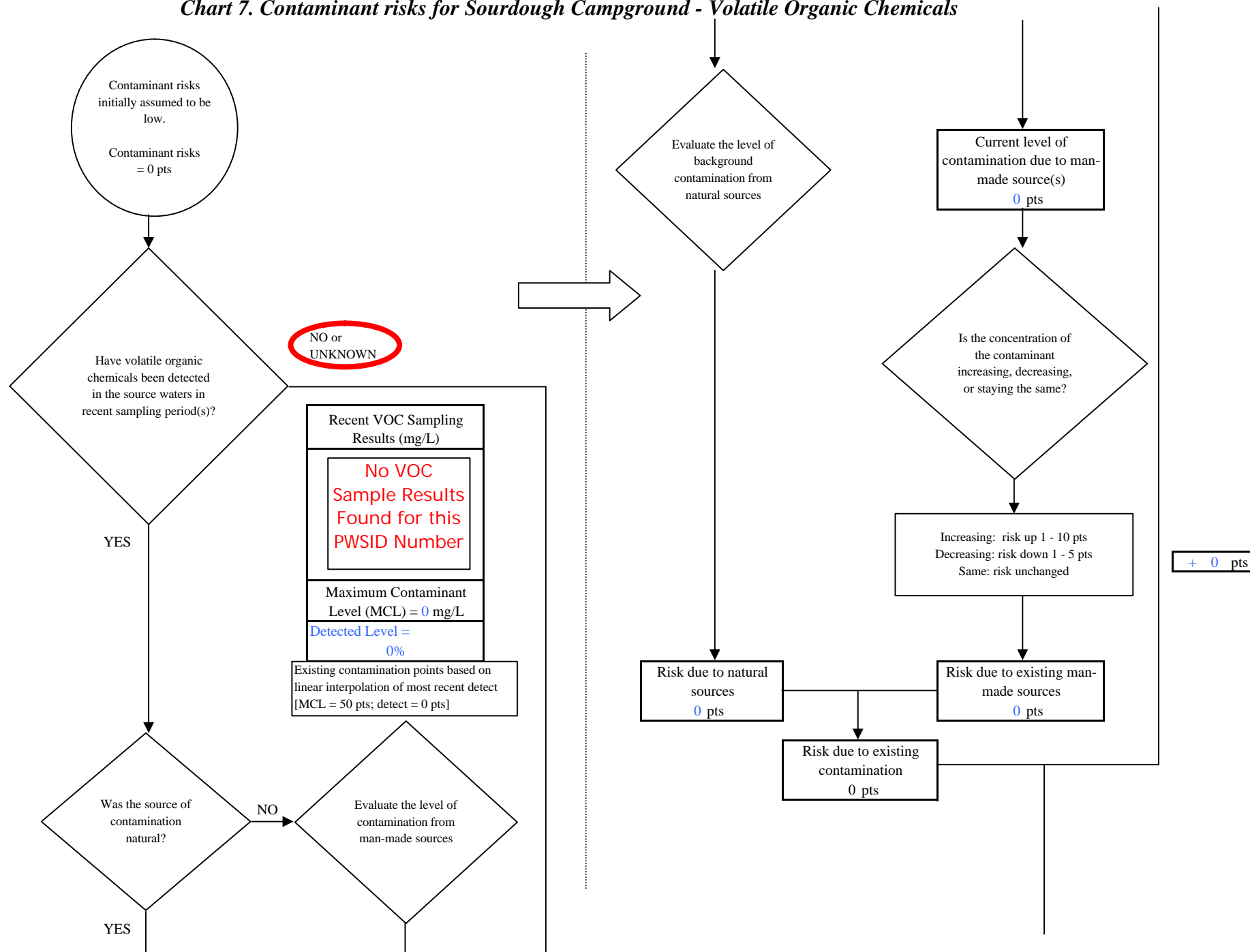


Chart 7. Contaminant risks for Sourdough Campground - Volatile Organic Chemicals

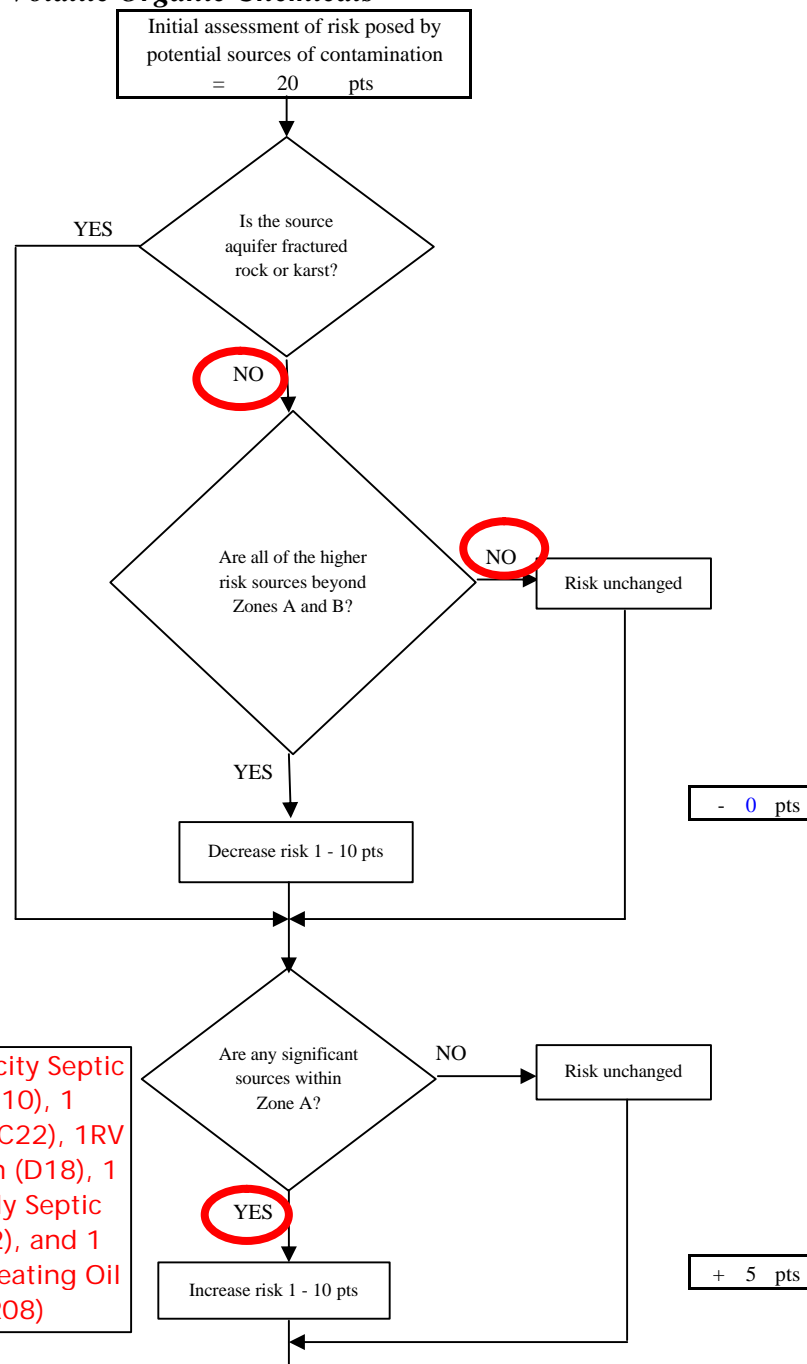
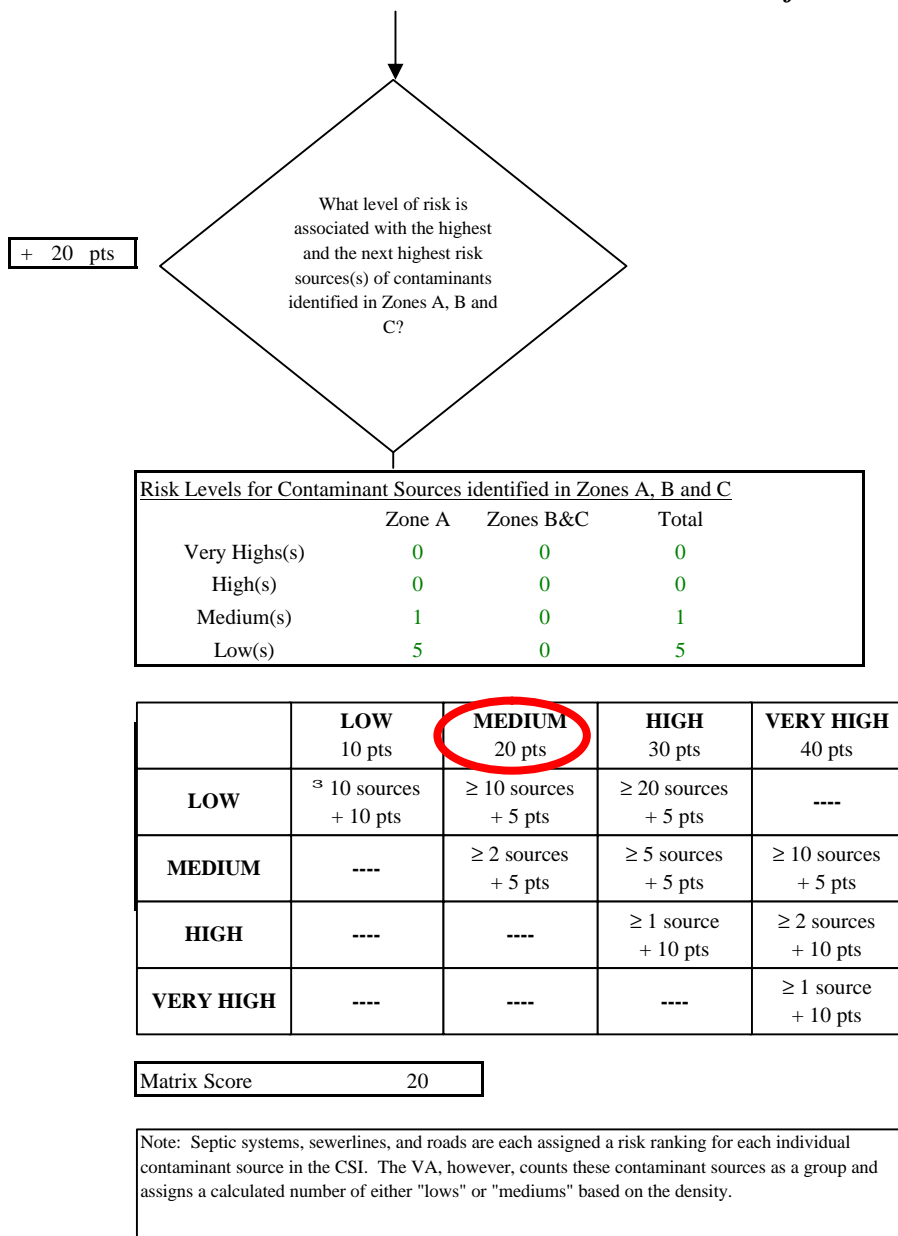


Chart 7. Contaminant risks for Sourdough Campground - Volatile Organic Chemicals

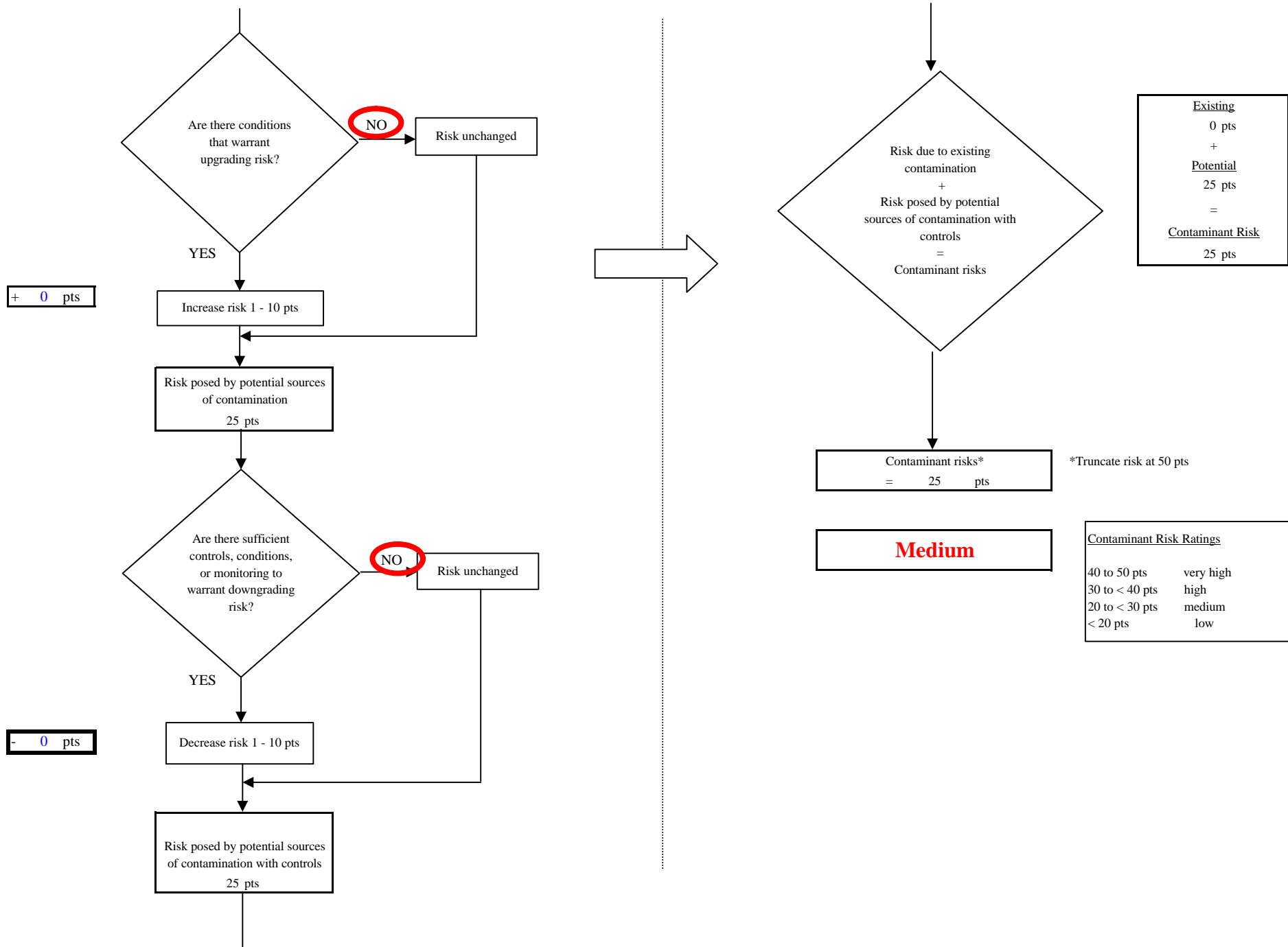


Chart 8. Vulnerability analysis for Sourdough Campground - Volatile Organic Chemicals

