Source Water Assessment

A Hydrogeologic Susceptibility and Vulnerability Assessment for Gold Rush Trail Camp, Skagway, Alaska PWSID #111465

DRINKING WATER PROTECTION PROGRAM REPORT NO. 722

Alaska Department of Environmental Conservation

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Gold Rush Trail Camp
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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 Gold Rush Trail Camp, Skagway, Alaska

Drinking Water Protection Program
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EXECUTIVE SUMMARY

The public water system for Gold Rush Trail Camp is a Class B (transient/non-community) water system consisting of one well. The Gold Rush Trail Camp is located at Mile 3 Klondike Highway, Skagway, Alaska. The wellhead received a susceptibility rating of **Very High** and the aquifer a susceptibility rating of **High**. Combining these two ratings produces a **High** rating for the natural susceptibility of the well. Identified potential and current sources of contaminants for Gold Rush Trail Camp public drinking water source includes: large capacity and residential septic systems; water supply wells; open-pit metals mining; and underground metals mining. 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 Gold Rush Trail Camp received a vulnerability rating of **High** for bacteria and viruses; **Very High** for nitrates and nitrites, and **Medium** for volatile organic chemicals.

GOLD RUSH TRAIL CAMP PUBLIC DRINKING WATER SYSTEM

Gold Rush Trail Camp public water system is a Class B (transient/non-community) water system. The system consists of one well at Mile 3 Klondike Highway, Skagway, Alaska (See Map 1 of Appendix A). Skagway is located on the north end of Taiya Inlet on Lynn Canal, approximately 90 air miles northeast of Juneau, or 108 road miles south of Whitehorse (please see the inset of Map 1 in Appendix A for location). The population of Skagway is approximately 850.

Shadowed by the surrounding mountains, Skagway receives less rain than is typical of Southeast Alaska, averaging 26 inches of precipitation per year, and 39 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 Gold Rush Trail Camp well is at an elevation of about 60 feet above mean sea level.

According to a Well Report dated October 15, 1995, there is one well that was installed October 15, 1995. The depth of this well is 45 feet below the ground surface. It is assumed that the length of the well screen for this well is 10 feet.

The Report for the water system does not indicate if the land surface is appropriately sloped away from the well, providing adequate surface water drainage. The Report does indicate that the well is not grouted. Proper grouting provides added protection against contaminants traveling along the well casing and into source waters.

This system operates from May 1 to September 30 and serves approximately 6 residents and 250 non-residents through the service connection.

GOLD RUSH TRAIL CAMP 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 Gold Rush Trail Camp is limited by its immediate watershed. Development in the vicinity of the well is generally limited to only Zone A, although there are reportedly mining claims along the adjacent river and its tributaries (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 Gold Rush Trail Camp 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 GOLD RUSH TRAIL CAMP 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 Gold Rush Trail Camp 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 Gold Rush Trail Camp

Table 2. Susceptibility

	Score	Rating
Susceptibility of the Wellhead	20	Very High
Susceptibility of the Aquifer	18	Very High
Natural Susceptibility	38	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	40	Very High
Nitrates and/or Nitrites	43	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	75	High
Nitrates and Nitrites	80	Very High
Volatile Organic Chemicals	50	Medium

Bacteria and Viruses

The contaminant risk for bacteria and viruses is **Very High** with septic systems 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 is not available for recent water sampling of the system at the Gold Rush Trail Camp. However, after combining the contaminant risks from the municipal parks and dirt/gravel roads with the overall natural susceptibility of the well, the vulnerability of the well to contamination by bacteria and viruses is **High**.

Nitrates and Nitrites

The contaminant risk for nitrates and nitrites is **Very High** with septic systems representing the risk to this source of public drinking water (See Chart 5 - Contaminant Risks for Nitrates and/or Nitrites in Appendix D). Nitrates are very mobile, moving at approximately the same rate as water.

Sampling history for Gold Rush Trail Camp well indicates that nitrates have been detected in the water, but only in very low concentrations (most recently at 0.561 mg/L on 6/28/2002) or 6% 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 **Very High**.

Volatile Organic Chemicals

The contaminant risk for volatile organic chemicals is **Low** with septic systems creating the only known risk for volatile organic chemicals (See Chart 7 – Contaminant Risks for Volatile Organic Chemicals in Appendix D).

There are no recent sample data available for the drinking water at Gold Rush Trail Camp for volatile organic chemicals. 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**.

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APPENDIX A

Gold Rush Trail Camp
Drinking Water Protection Area Location Map
(Map 1)

Gold Rush Trail Camp

City of Skagway City of Skagway
City of Skagway

Map 1: Gold Rush Trail Camp Drinking Water Protection Areas

PWSID: 111465.001

Alaska Department of Environmental Conservation

Alaska Drinking Water Protection Program

0 4,450 8,900 17,800 26,700 35,600 Feet

1:123,086

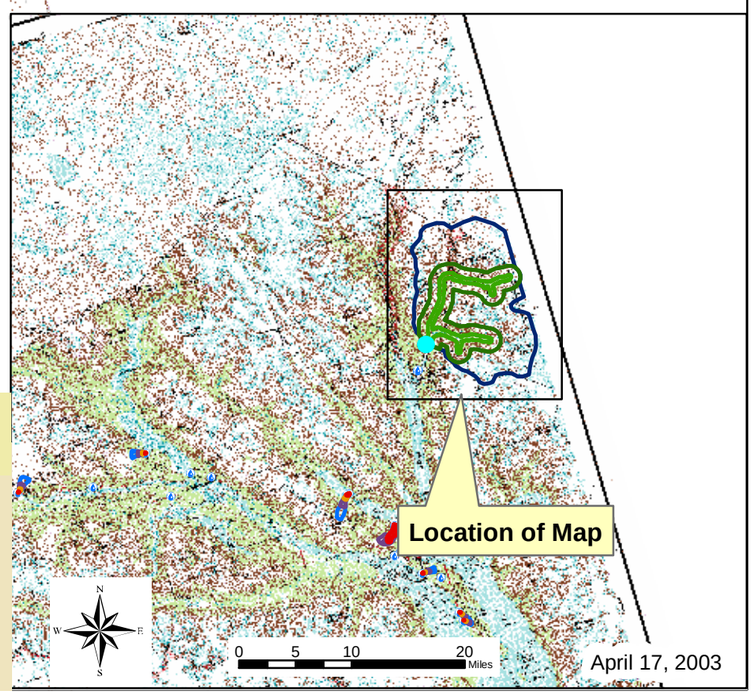
Data Sources:

Background image - USGS 1:250,000 mapping

Protection zones were delineated based upon streams noted on USGS 1:250,000 mapping.

Legend

- Public Drinking Water Systems
- **Zone A Protection Area** — Several Months Travel Time
- **Zone B Protection Area** — Less than 2 Years Travel Time
- **Zone E Protection Area** — 1000 Feet from Surface Water Body
- **Zone F Protection Area** — 1 Mile from Surface Water Body
- **Zone G Protection Area** — Entire Watershed



April 17, 2003

APPENDIX B

Contaminant Source Inventory and Risk Ranking for Gold Rush Trail Camp (Tables 1-4)

Table 1 *Contaminant Source Inventory for* ***PWSID 111465.001***

Gold Rush Trail Camp

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	Gold Rush Trail Camp	
Septic systems (serves one single-family home)	R02	R02-1	A	2	Residence North of Gold Rush Trail Camp	
Highways and roads, dirt/gravel	X24	X24-2	A	2	Road East of Gold Rush Trail Camp Road	
Water supply wells	W09	W09-1	B	2	Residence North of Gold Rush Trail Camp	
Highways and roads, dirt/gravel	X24	X24-1	B	2	Road East of Gold Rush Trail Camp	
Metals mining, open pit (active or inactive?)	E03	E03-1	E	2	East Fork Mine	
Metals mining, open pit (active or inactive?)	E03	E03-2	E	2	Clifton Mine	
Metals mining, open pit (active or inactive?)	E03	E03-3	E	2	Hope Mine	
Metals mining, open pit (active or inactive?)	E03	E03-4	G	2	Nevada Mine	
Metals mining, underground (active or inactive?)	E05	E05-1	G	2	Inspiration Point Mine	

Sources of Bacteria and Viruses

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	Gold Rush Trail Camp
Septic systems (serves one single-family home)	R02	R02-1	A	Low	2	Residence North of Gold Rush Trail Camp
Highways and roads, dirt/gravel	X24	X24-2	A	Low	2	Road East of Gold Rush Trail Camp Road
Highways and roads, dirt/gravel	X24	X24-1	B	Low	2	Road East of Gold Rush Trail Camp

Sources of Nitrates/Nitrites

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	Gold Rush Trail Camp
Septic systems (serves one single-family home)	R02	R02-1	A	Low	2	Residence North of Gold Rush Trail Camp
Highways and roads, dirt/gravel	X24	X24-2	A	Low	2	Road East of Gold Rush Trail Camp Road
Highways and roads, dirt/gravel	X24	X24-1	B	Low	2	Road East of Gold Rush Trail Camp

Table 4 *Contaminant Source Inventory and Risk Ranking for Gold Rush Trail Camp* ***PWSID 111465.001***

Sources of Volatile Organic Chemicals

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	Gold Rush Trail Camp
Septic systems (serves one single-family home)	R02	R02-1	A	Low	2	Residence North of Gold Rush Trail Camp
Highways and roads, dirt/gravel	X24	X24-2	A	Low	2	Road East of Gold Rush Trail Camp Road
Highways and roads, dirt/gravel	X24	X24-1	B	Low	2	Road East of Gold Rush Trail Camp

APPENDIX C

Gold Rush Trail Camp
Drinking Water Protection Area
and Potential and Existing Contaminant Sources
(Map 2)

Map 2: Drinking Water Protection Areas for Gold Rush Trail Camp and Potential and Existing Contaminate Sources

PWSID: 111465.001

Alaska Department of Environmental Conservation

Alaska Drinking Water Protection Program

0 3,200 6,400 12,800 19,200 25,600 Feet

1:83,381

Data Sources:

Background image - USGS 1:250,000 mapping

Protection zones were delineated based upon streams noted on USGS 1:250,000 mapping.

Legend

- Public Drinking Water Systems
- Large Capacity Septic System (D10)
- Private Water Supply Well (W09)
- Other Mining Claim

Zone A Protection Area
Several Months Travel Time

Zone B Protection Area
Less than 2 Years Travel Time

Zone E Protection Area
1000 Feet from Surface Water Body

Zone F Protection Area
1 Mile from Surface Water Body

Zone G Protection Area
Entire Watershed

E05-1
E03-2
E03-1
E03-3
E03-4
Gold Rush Trail Camp
City of Skagway
City of Skagway
City of Skagway
Location of Map

R02-1
X24-1
W09-1
D10-1
X24-2

0 0.05 0.1 0.2 Miles

May 8, 2003

APPENDIX D

Vulnerability Analysis for Gold Rush Trail Camp Public Drinking Water Source

(Charts 1-8)

Chart 1. Susceptibility of the wellhead - Gold Rush Trail Camp

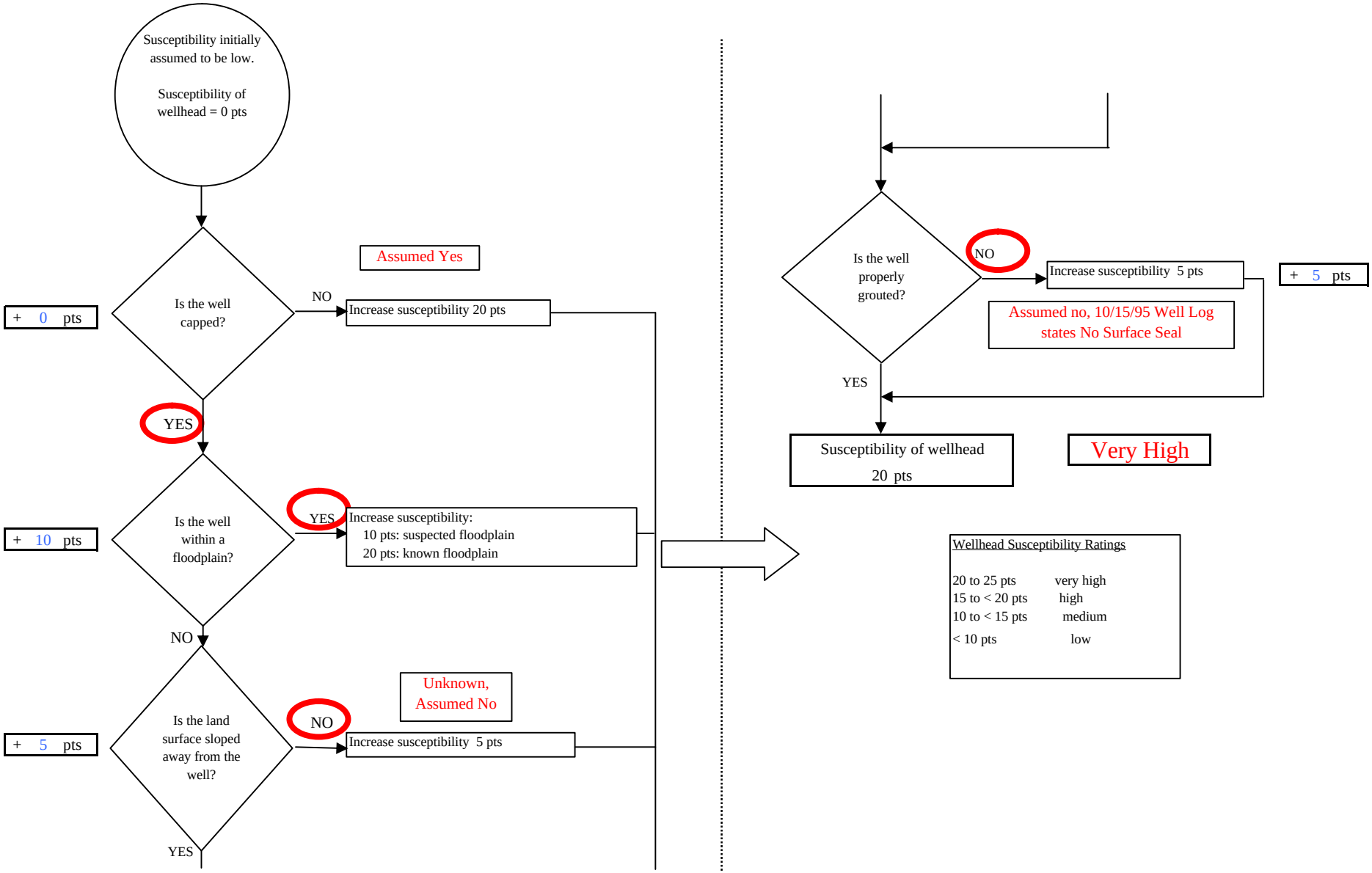


Chart 2. Susceptibility of the aquifer - Gold Rush Trail Camp

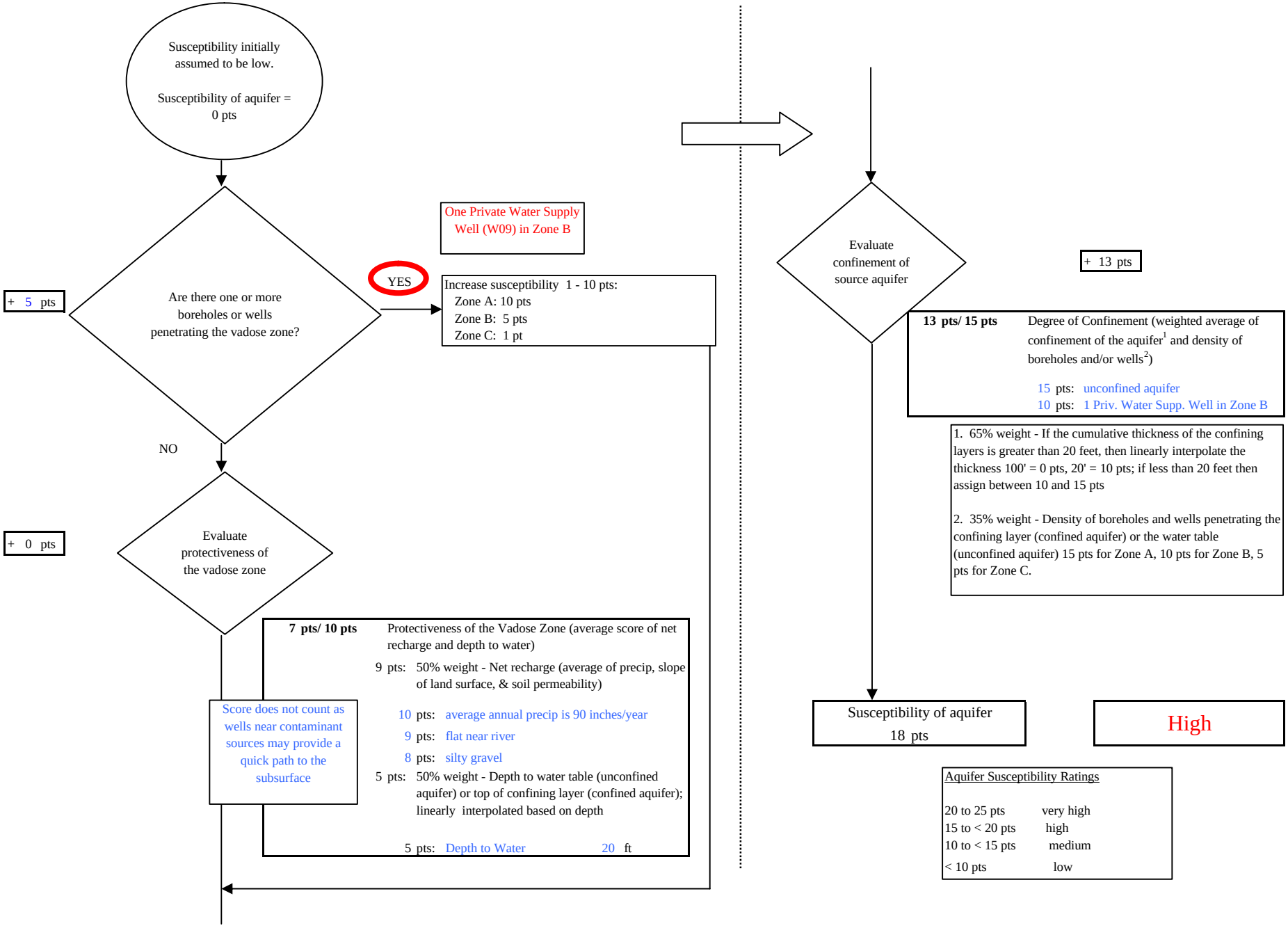
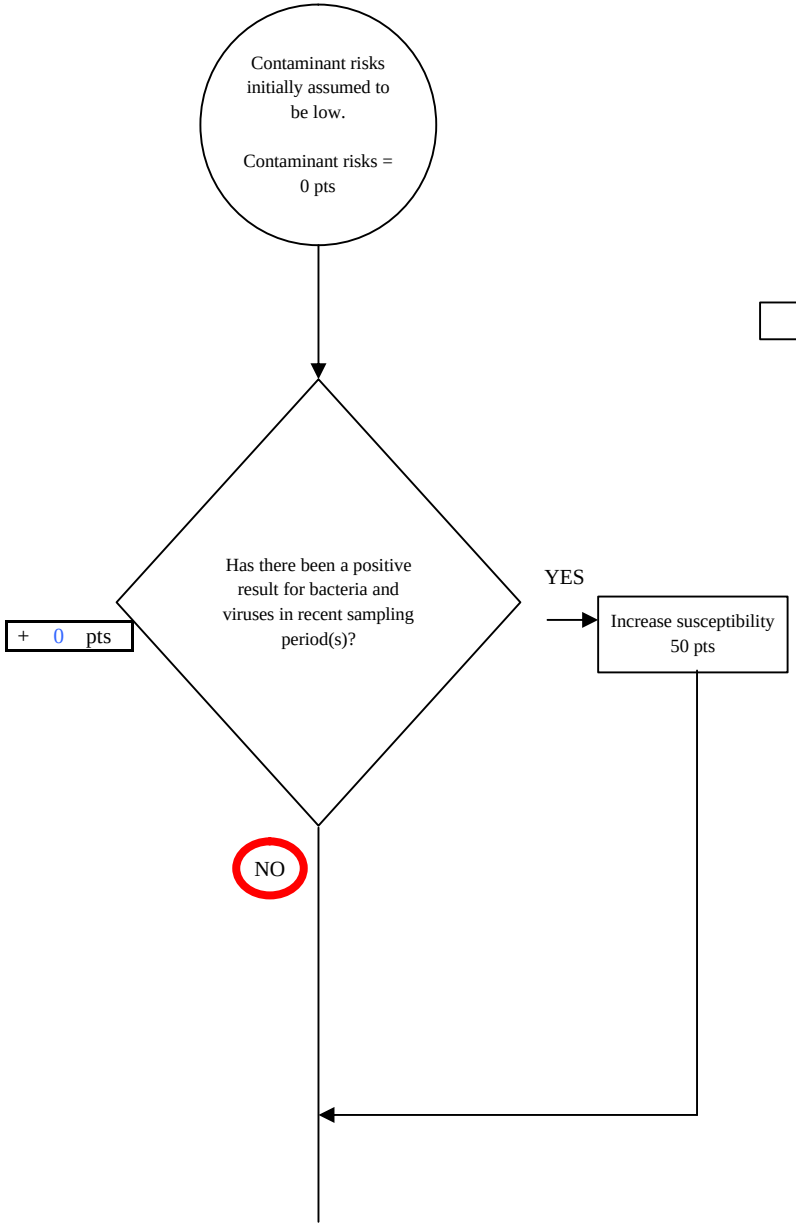
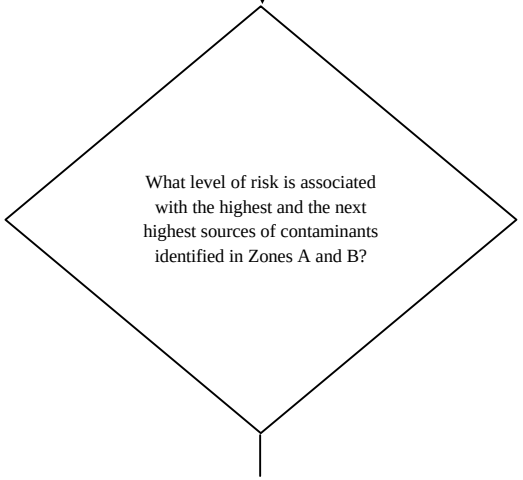


Chart 3. Contaminant risks for Gold Rush Trail Camp - Bacteria & Viruses





+ 30 pts

Risk Rankings for Contaminant Sources Identified in Zones A and B

	Zone A	Zone B	Total
Very Highs(s)	0	0	0
High(s)	1	0	1
Medium(s)	0	0	0
Low(s)	2	1	3

	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 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.

Chart 3. Contaminant risks for Gold Rush Trail Camp - Bacteria & Viruses

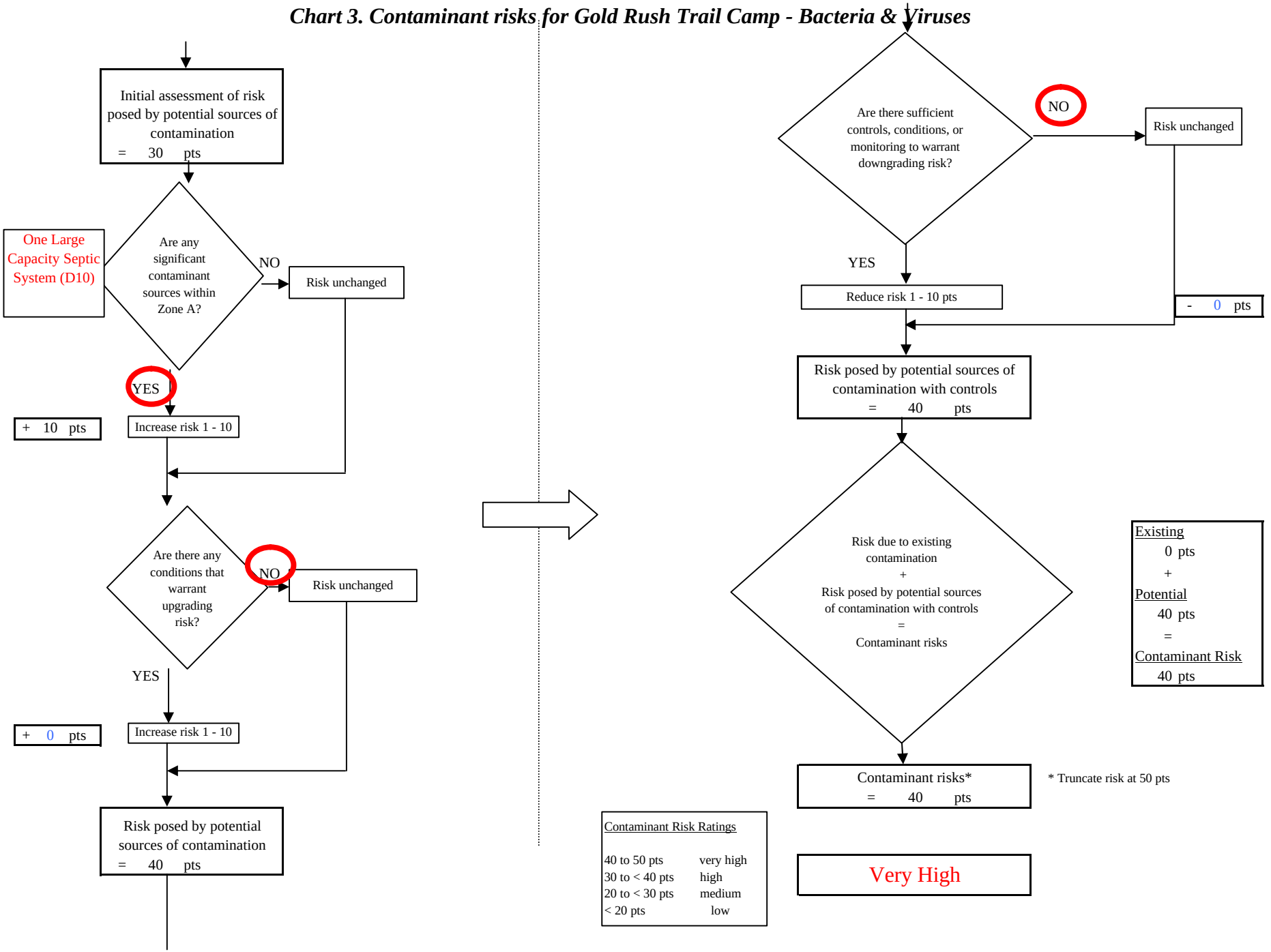


Chart 4. Vulnerability analysis for Gold Rush Trail Camp - Bacteria & Viruses

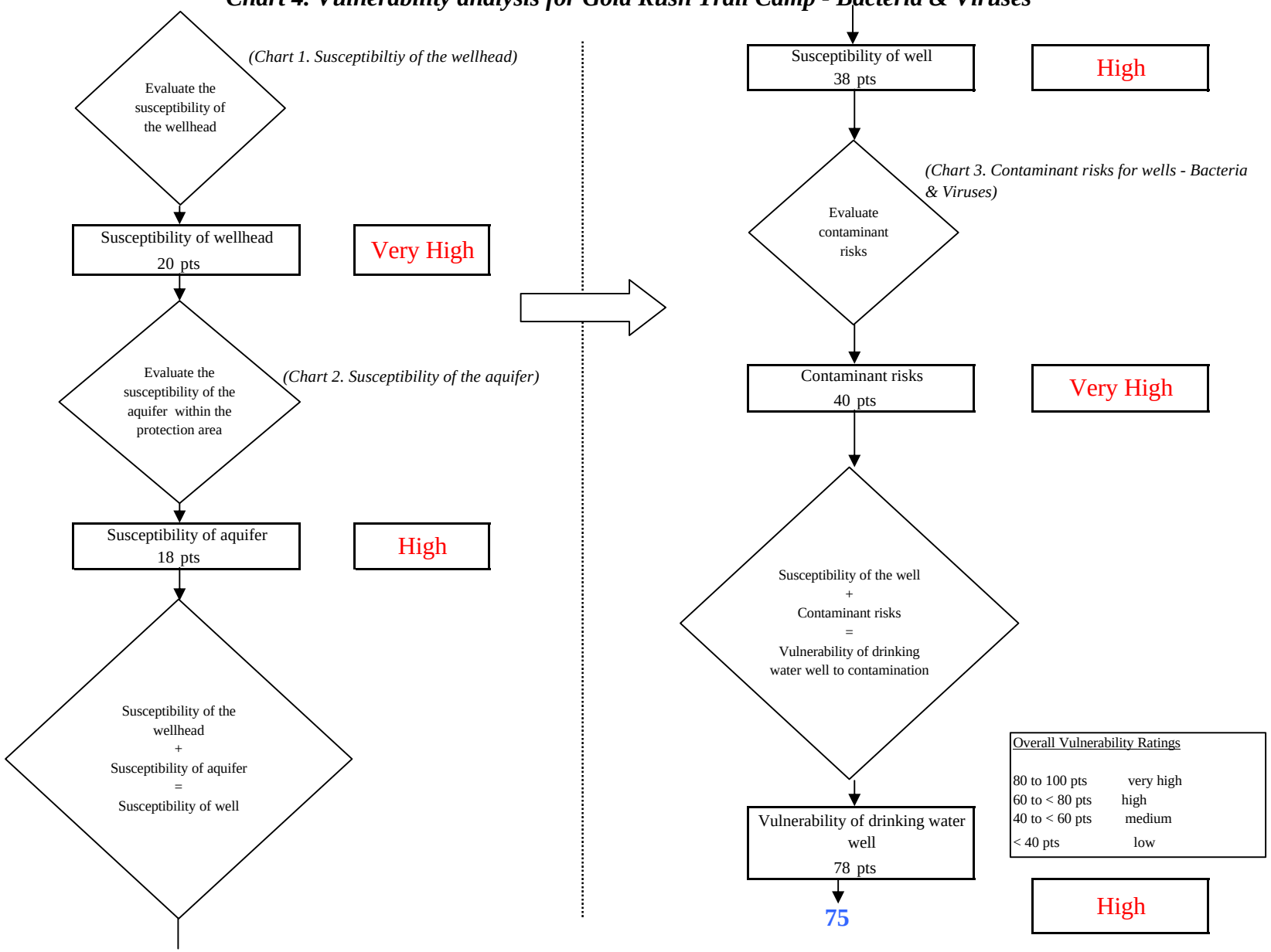


Chart 5. Contaminant risks for Gold Rush Trail Camp - Nitrates and Nitrites

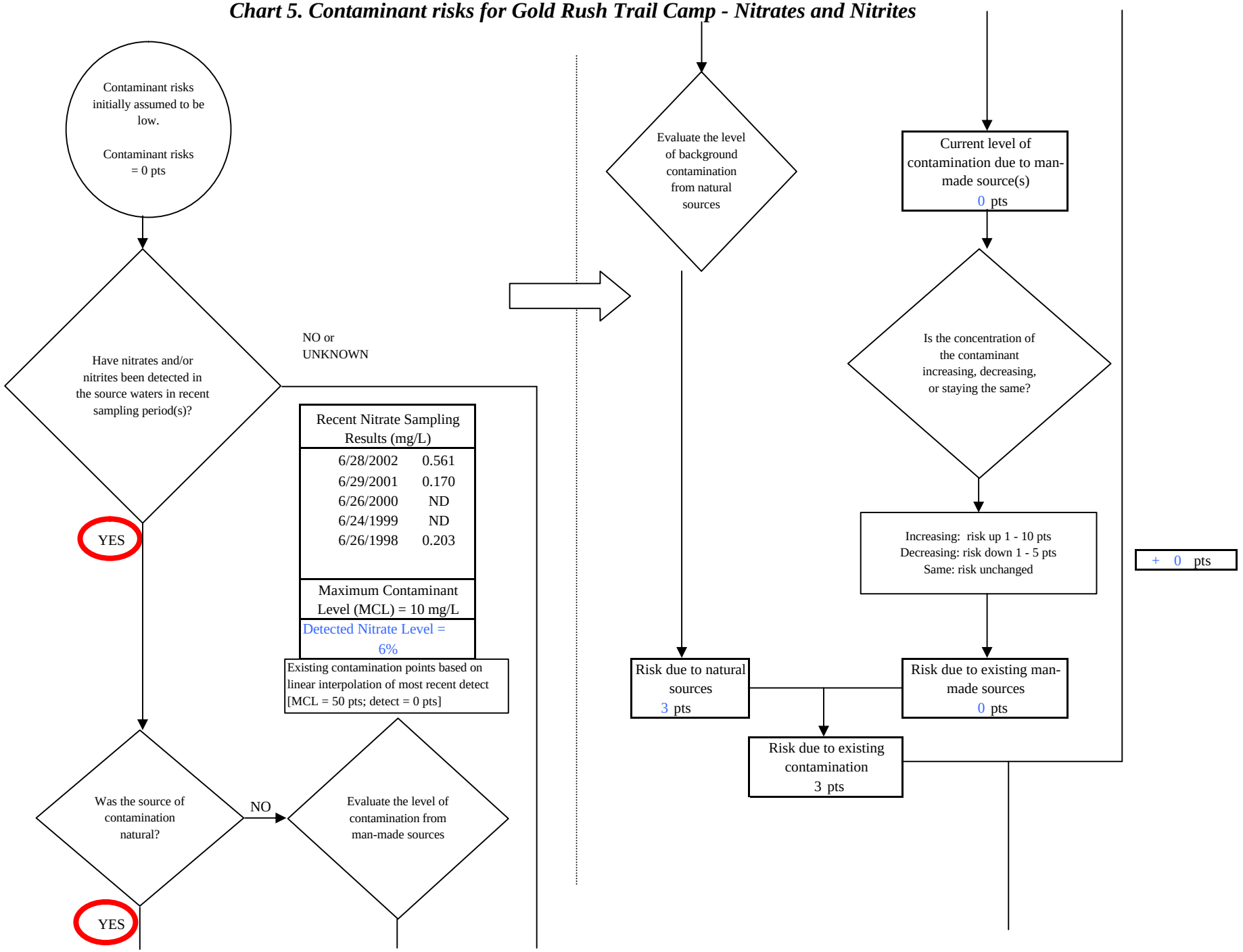


Chart 5. Contaminant risks for Gold Rush Trail Camp - Nitrates and Nitrites

+ 30 pts

What level of risk is associated with the highest and the next highest risk sources(s) of contaminants identified in Zones A, B and C?

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)	1	0	1
Medium(s)	0	0	0
Low(s)	2	1	3

	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 30

Note: Septic systems, sewerline, 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.

Initial assessment of risk posed by potential sources of contamination = 30 pts

Is the source aquifer fractured rock or karst?

YES

NO

Are all of the higher risk sources beyond Zones A and B?

NO

Risk unchanged

YES

Decrease risk 1 - 10 pts

- 0 pts

Are any significant sources within Zone A?

NO

Risk unchanged

One Large Capacity Septic System (D10)

YES

Increase risk 1 - 10 pts

+ 10 pts

Chart 5. Contaminant risks for Gold Rush Trail Camp - Nitrates and Nitrites

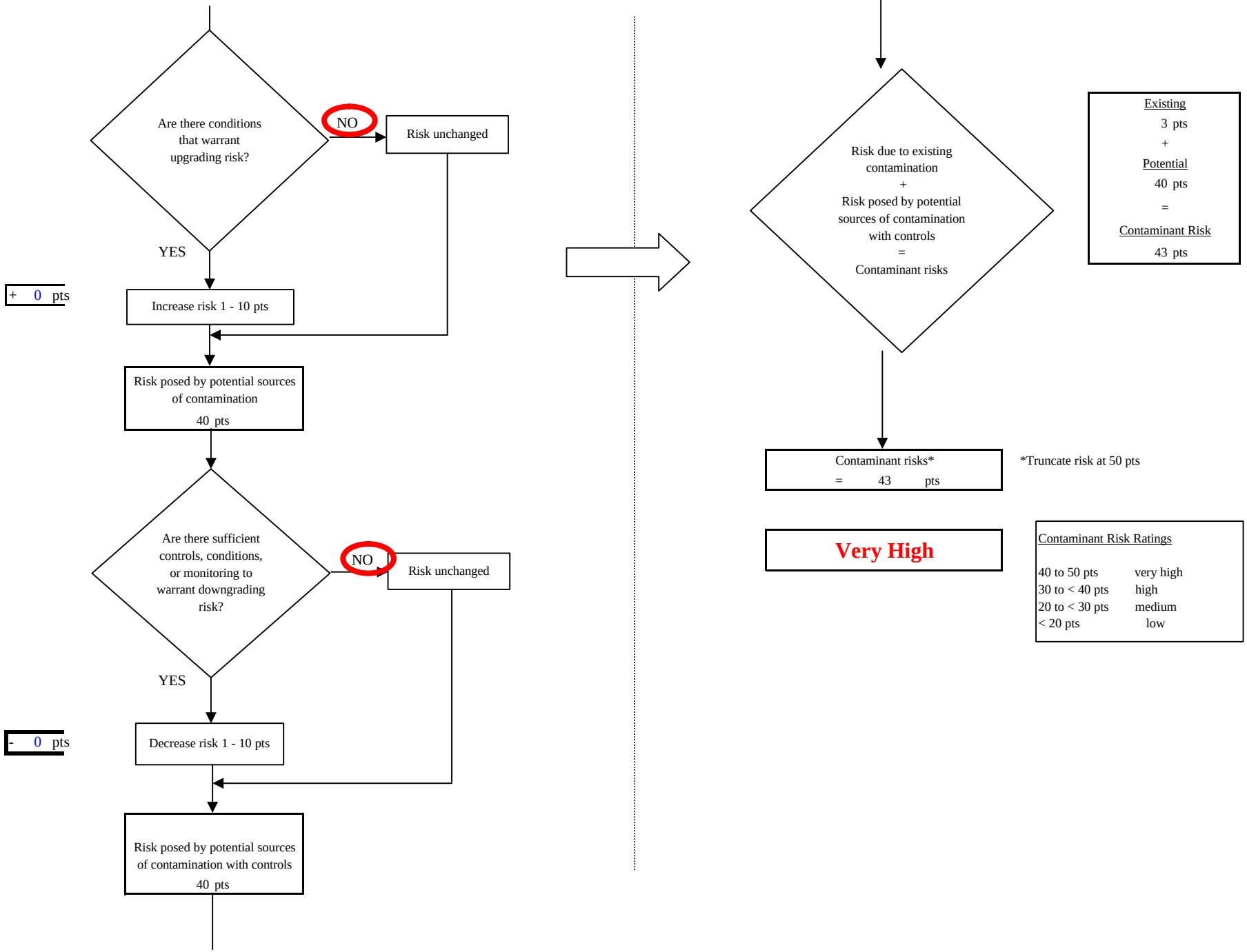


Chart 6. Vulnerability analysis for Gold Rush Trail Camp - Nitrates and Nitrites

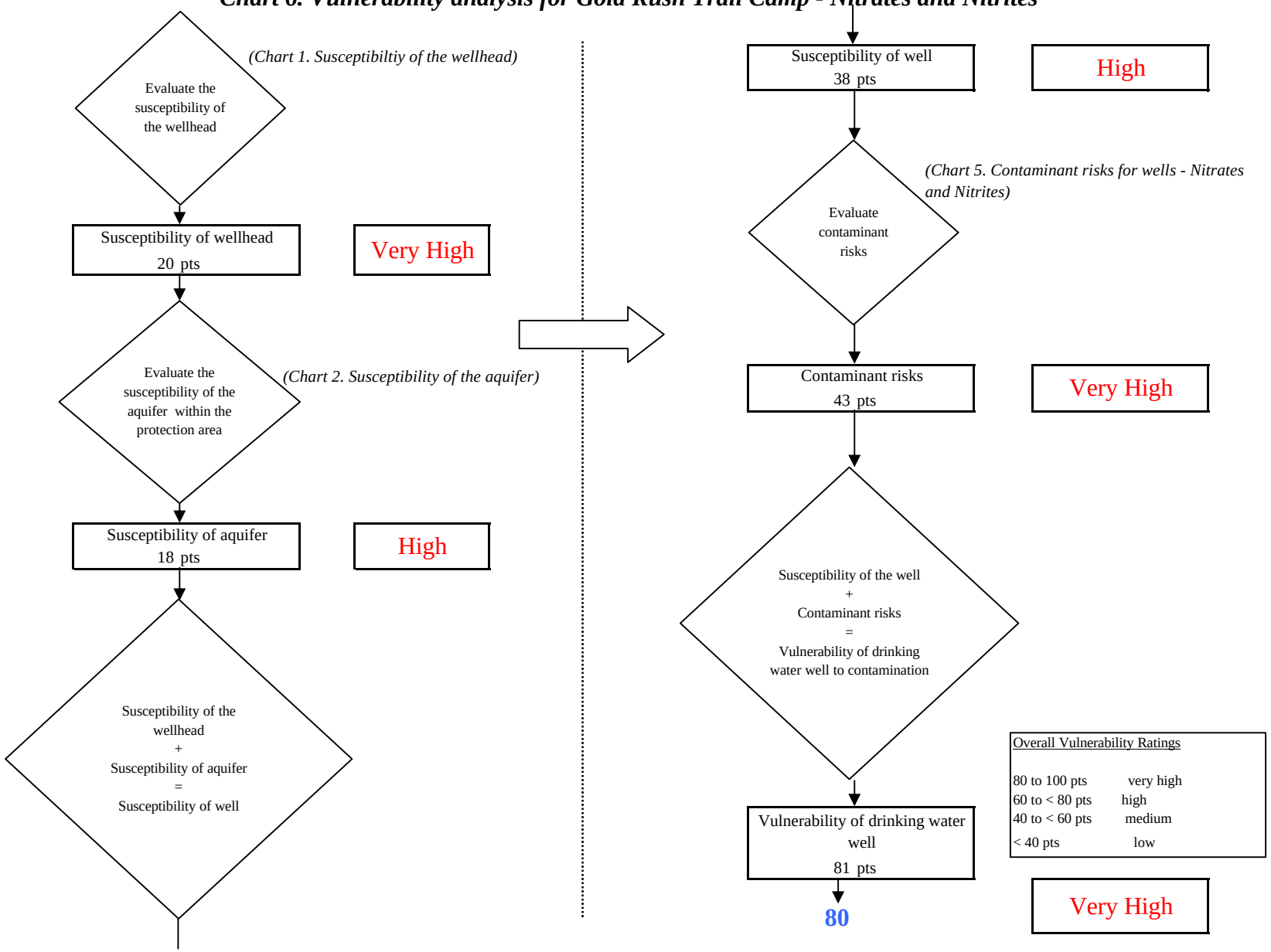


Chart 7. Contaminant risks for Gold Rush Trail Camp - Volatile Organic Chemicals

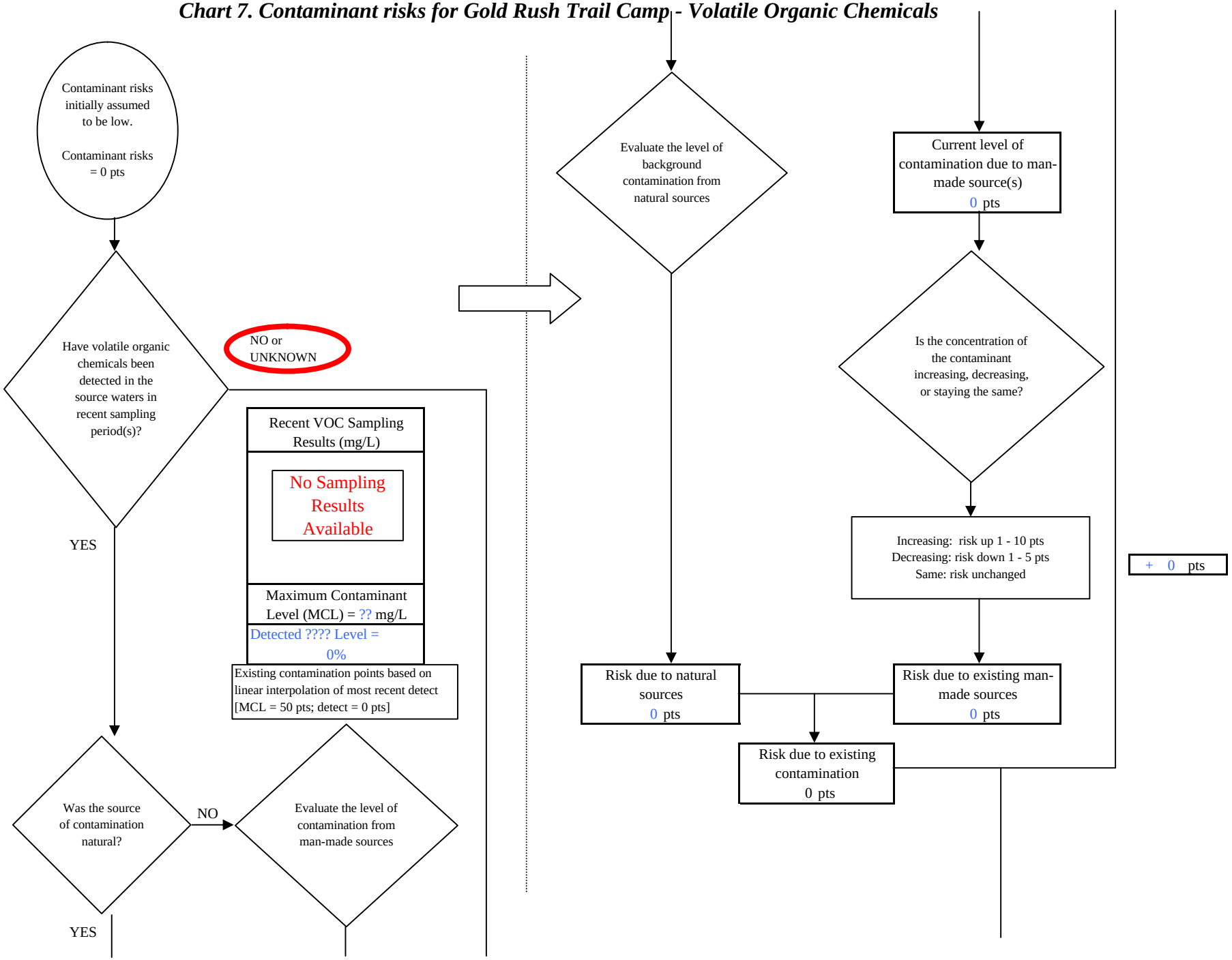


Chart 7. Contaminant risks for Gold Rush Trail Camp - Volatile Organic Chemicals

+ 10 pts

What level of risk is associated with the highest and the next highest risk sources(s) of contaminants identified in Zones A, B and C?

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	0	0
Medium(s)	0	0	0
Low(s)	3	1	4

	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 10

Note: Septic systems, sewerline, 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.

Initial assessment of risk posed by potential sources of contamination = 10 pts

Is the source aquifer fractured rock or karst?

YES

NO

Are all of the higher risk sources beyond Zones A and B?

NO

Risk unchanged

YES

Decrease risk 1 - 10 pts

- 0 pts

Are any significant sources within Zone A?

NO

Risk unchanged

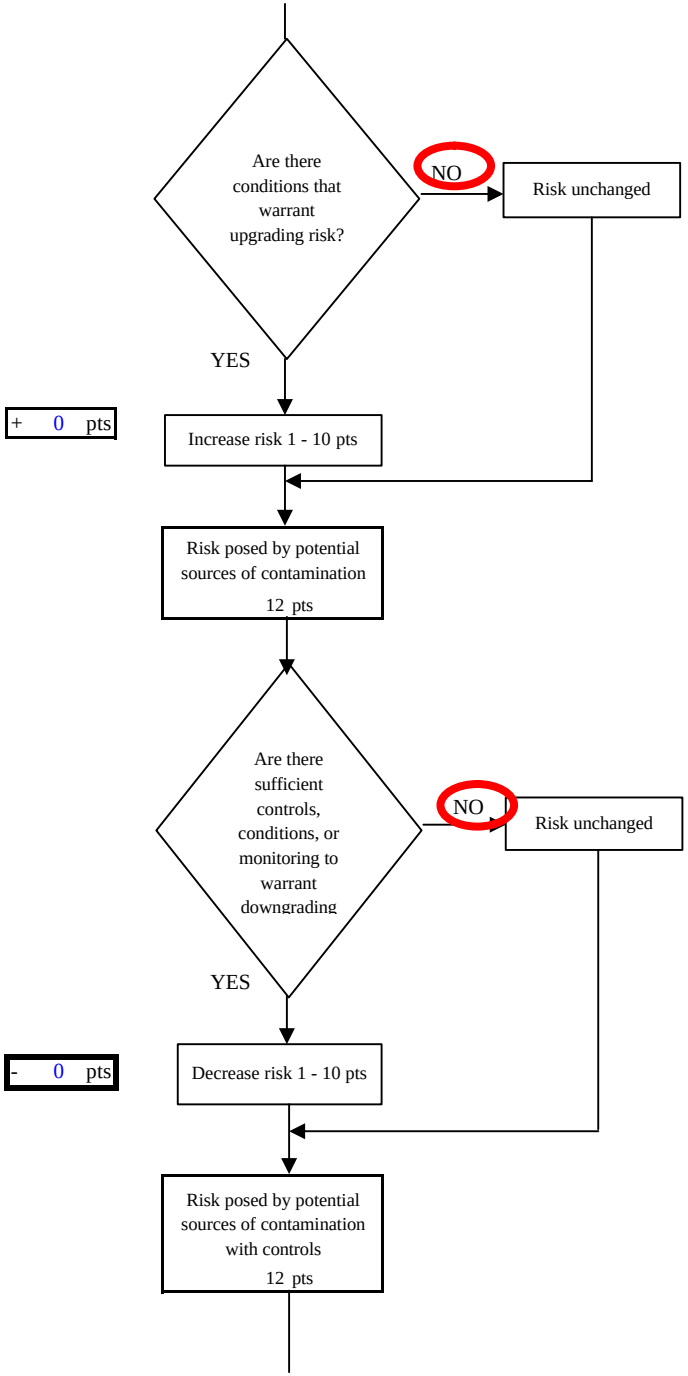
One Large Capacity Septic System (D10)

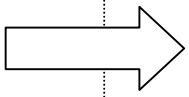
YES

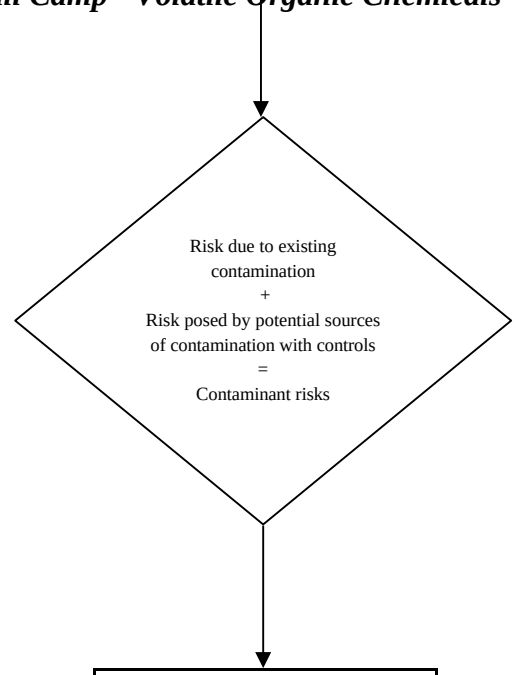
Increase risk 1 - 10 pts

+ 2 pts

Chart 7. Contaminant risks for Gold Rush Trail Camp - Volatile Organic Chemicals







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

Contaminant risks*
= 12 pts

*Truncate risk at 50 pts

Low

Contaminant Risk Ratings

40 to 50 pts	very high
30 to < 40 pts	high
20 to < 30 pts	medium
< 20 pts	low

Chart 8. Vulnerability analysis for Gold Rush Trail Camp - Volatile Organic Chemicals