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# Source Water Assessment

A Hydrogeologic Susceptibility and  
Vulnerability Assessment for  
Porcupine Creek State Recreation Site,  
Slana, Alaska  
PWSID #380515

DRINKING WATER PROTECTION PROGRAM REPORT NO. 903

Alaska Department of Environmental Conservation

# Source Water Assessment for Porcupine Creek State Recreation Site, Slana, Alaska PWSID #380515

DRINKING WATER PROTECTION PROGRAM REPORT NO. 903

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 Porcupine Creek State Recreation Site, Slana, Alaska

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## Drinking Water Protection Program Alaska Department of Environmental Conservation

### EXECUTIVE SUMMARY

The public water system for Porcupine Creek State Recreation Site (Porcupine Creek) is a Class B (transient/non-community) water system consisting of one well. Porcupine Creek is located at Mile 64.3 of the Glenn Highway, near Slana, Alaska. The wellhead received a susceptibility rating of **High** and the aquifer received 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 Porcupine Creek public drinking water source include pit toilets; paved highways and roads; and campgrounds and RV parks. 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 Porcupine Creek received a vulnerability rating of **Medium** for bacteria and viruses, nitrates and nitrites, and volatile organic chemicals.

### PORCUPINE CREEK PUBLIC DRINKING WATER SYSTEM

Porcupine Creek public water system is a Class B (transient/non-community) water system. The system consists of one well at Mile 64.3 of the Glenn Highway, near Slana, Alaska (See Map 1 of Appendix A). Slana stretches along the first 2.5 miles of Nabesna Road, which runs south of the Tok Cutoff at mile 63. It lies at the junction of the Slana and Copper Rivers, 53 miles southwest of Tok. The population of Slana is approximately 60.

Slana averages about 13 inches of precipitation per year, and an annual average of approximately 61 inches of snow. Individual wells are the primary source of water in Slana; others draw water from Rufus Creek. Outhouses, honeybuckets and septic systems are used for sewage disposal. Approximately one third of the homes have complete plumbing. The elevation for Slana is approximately 2,420 feet above sea level.

According to a Sanitary Survey dated June 25, 2002, the existing well was installed prior to 1959 with 6-inch diameter casing to a depth of 35 feet below the ground surface. The length of the well screen is assumed to be 10 feet.

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, it is assumed 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. The well is suspected to be within the floodplain of Porcupine Creek.

It is assumed that this system operates seasonally, from May to September, and serves approximately 35 non-residents through one service connection.

### PORCUPINE CREEK 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**

<b>Zone</b>	<b>Definition</b>
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 Porcupine Creek State Recreation Site extends over 2 miles feet north 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 Porcupine Creek 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 PORCUPINE CREEK 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

We assume the well for the Porcupine Creek 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 Porcupine Creek.

**Table 2. Susceptibility**

	Score	Rating
Susceptibility of the Wellhead	15	High
Susceptibility of the Aquifer	16	High
Natural Susceptibility	31	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	25	Medium
Nitrates and/or Nitrites	27	Medium
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	55	Medium
Nitrates and Nitrites	55	Medium
Volatile Organic Chemicals	45	Medium

### **Bacteria and Viruses**

The contaminant risk for bacteria and viruses is **Medium** with pit toilets; paved highways and roads; and campgrounds and RV parks located within Zone A 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 consecutive 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 **Medium** with pit toilets; paved highways and roads; and 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). Due to the high solubility and weak retention by soil, nitrates are very mobile, moving at approximately the same rate as water.

Sampling history for Porcupine Creek indicates that nitrates have been detected in the water, but only in very low concentrations (at .310 mg/L on 6/17/01) 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.

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 pit toilets; paved highways and roads; and campgrounds and RV parks creating the known risks 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 Porcupine Creek 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**.

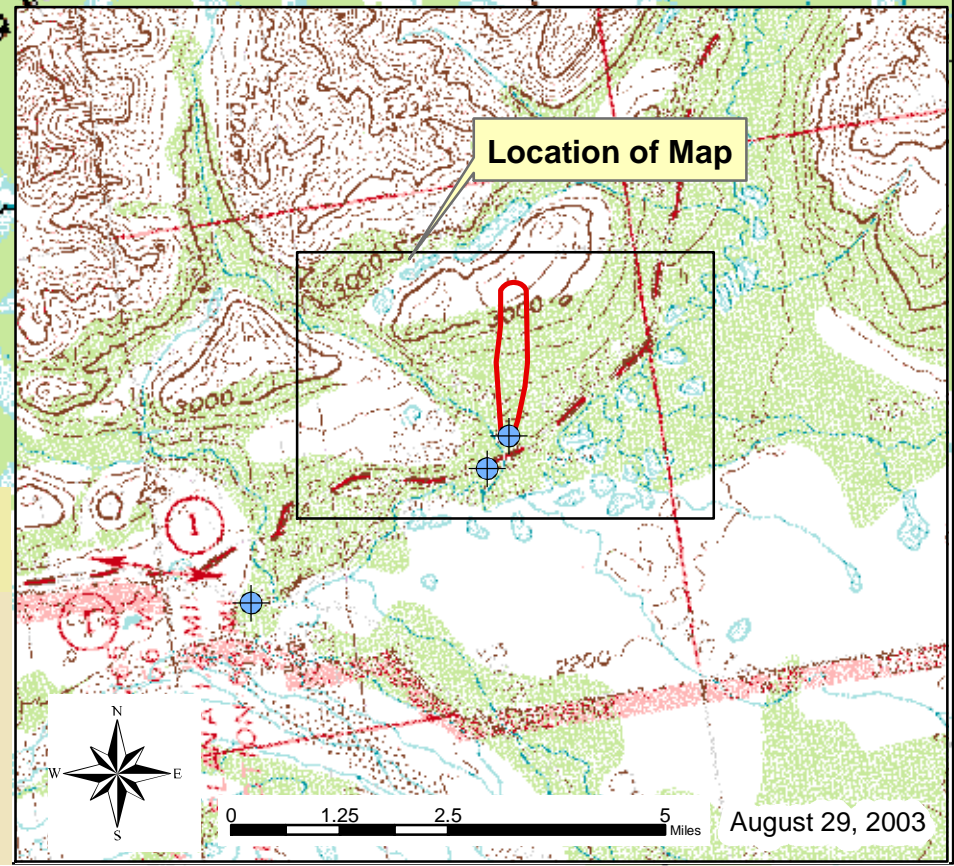
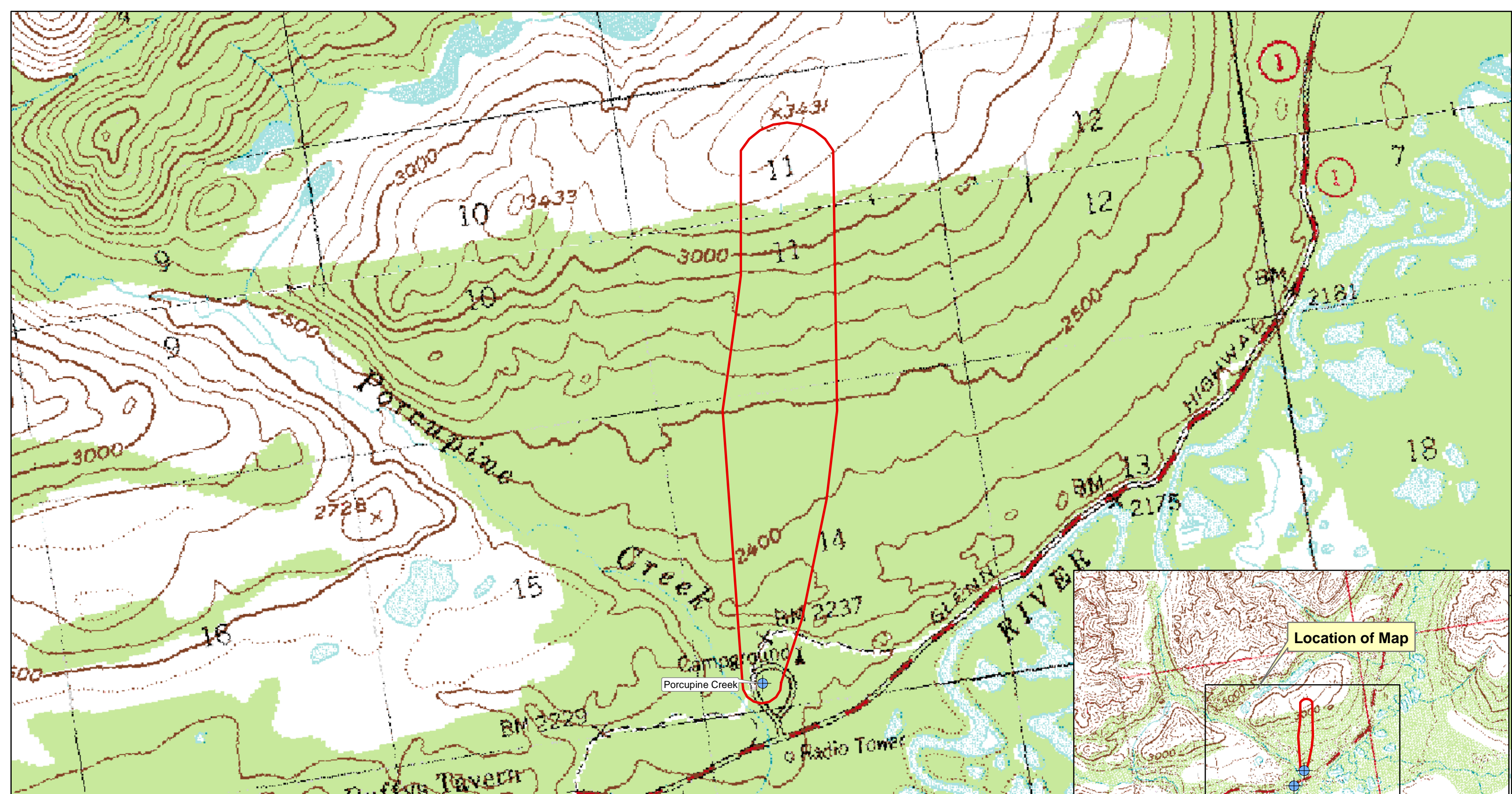
## REFERENCES

- Alaska Department of Community and Economic Development, Alaska Community Database, Detailed Community Information (2002). <[http://www.dced.state.ak.us/mra/CF\\_BLOCK.cfm](http://www.dced.state.ak.us/mra/CF_BLOCK.cfm)> (2003, September 1).
- Alaska Department of Natural Resources, Well Log Tracking System (2002). <<http://info.dec.state.ak.us/welts/Default.asp>> (2003, September 1)
- Alaska Geospatial Data Clearinghouse (2003). <<http://agdc.usgs.gov/data/datasets.html>> (2003, September 1)
- Freeze, R. Allen, and John A. Cherry, Groundwater. Englewood Cliffs: Prentice-Hall 1979.
- 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**

### **Porcupine Creek State Recreation Site Drinking Water Protection Area Location Map (Map 1)**



Map 1: Alaska Division of Parks - Porcupine Creek Drinking Water Protection Areas

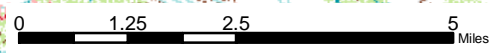
PWSID: 380515.001



1:18,186

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



August 29, 2003

## **APPENDIX B**

### **Contaminant Source Inventory and Risk Ranking for Porcupine Creek State Recreation Site (Tables 1-4)**

**Table 1****Contaminant Source Inventory for  
Alaska Division of Parks - Porcupine Creek****PWSID 380515.001**

<b>Contaminant Source Type</b>	<b>Contaminant Source ID</b>	<b>CS ID tag</b>	<b>Zone</b>	<b>Map Number</b>	<b>Comments</b>
Pit toilets (open hole), nonresidential (one or more)	D16	D16-1	A	2	Porcupine Creek Campground Pit Toilets
Highways and roads, paved (cement or asphalt)	X20	X20-1	A	2	Road to Porcupine Creek Campground
Campgrounds and RV Parks	X35	X35-1	A	2	Porcupine Creek Campground

**Contaminant Source Inventory and Risk Ranking for  
Alaska Division of Parks - Porcupine Creek  
Sources of Bacteria and Viruses**

**PWSID 380515.001**

**Table 2**

<b>Contaminant Source Type</b>	<b>Contaminant Source ID</b>	<b>CS ID tag</b>	<b>Zone</b>	<b>Risk Ranking for Analysis</b>	<b>Map Number</b>	<b>Comments</b>
Pit toilets (open hole), nonresidential (one or more)	D16	D16-1	A	Medium	2	Porcupine Creek Campground Pit Toilets
Highways and roads, paved (cement or asphalt)	X20	X20-1	A	Low	2	Road to Porcupine Creek Campground
Campgrounds and RV Parks	X35	X35-1	A	Low	2	Porcupine Creek Campground

**Contaminant Source Inventory and Risk Ranking for  
Alaska Division of Parks - Porcupine Creek  
Sources of Nitrates/Nitrites**

**PWSID 380515.001**

**Table 3**

<b>Contaminant Source Type</b>	<b>Contaminant Source ID</b>	<b>CS ID tag</b>	<b>Zone</b>	<b>Risk Ranking for Analysis</b>	<b>Map Number</b>	<b>Comments</b>
Pit toilets (open hole), nonresidential (one or more)	D16	D16-1	A	Medium	2	Porcupine Creek Campground Pit Toilets
Highways and roads, paved (cement or asphalt)	X20	X20-1	A	Low	2	Road to Porcupine Creek Campground
Campgrounds and RV Parks	X35	X35-1	A	Low	2	Porcupine Creek Campground

**Contaminant Source Inventory and Risk Ranking for  
Alaska Division of Parks - Porcupine Creek  
Sources of Volatile Organic Chemicals**

**PWSID 380515.001**

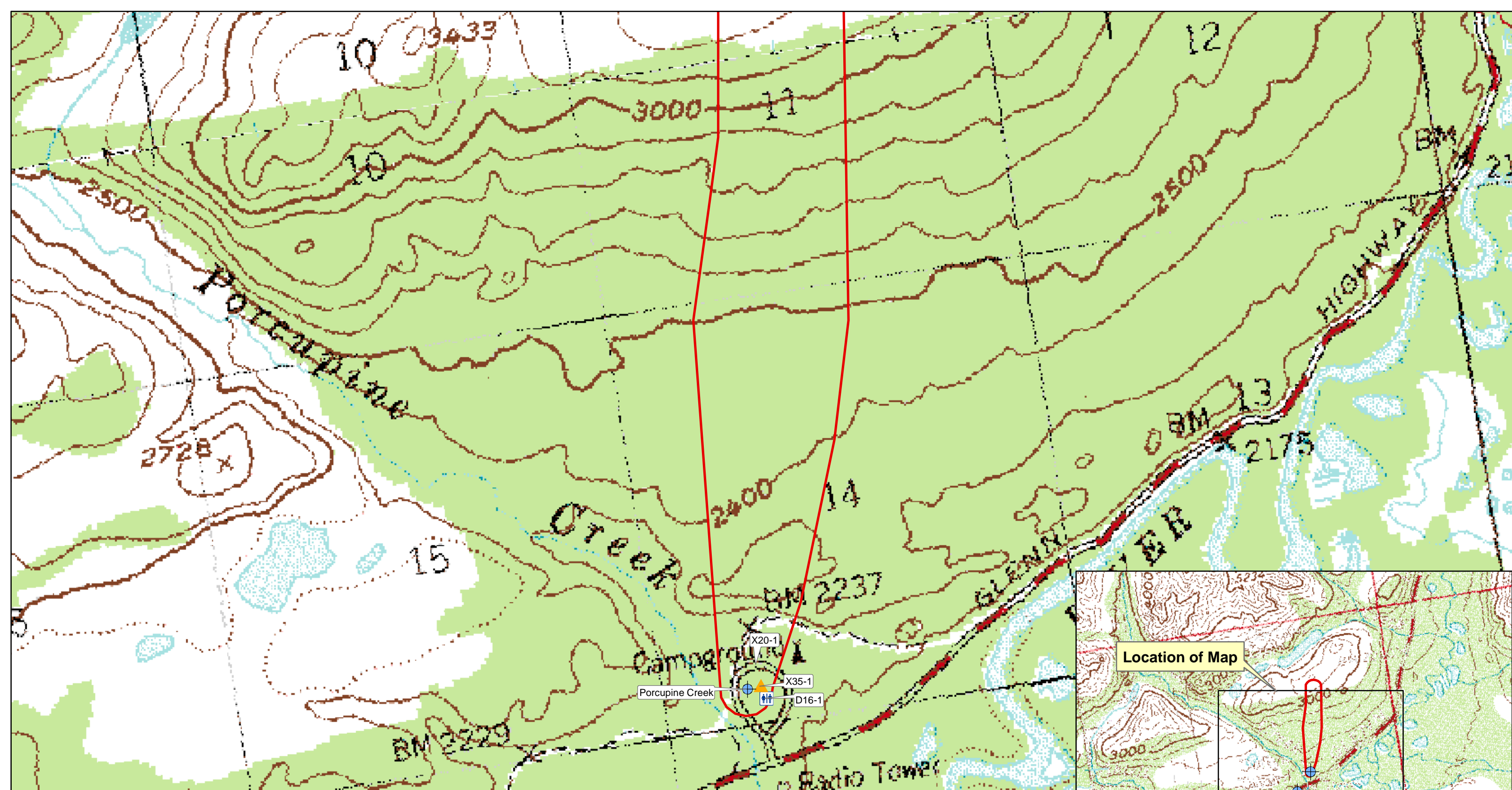
**Table 4**

<b>Contaminant Source Type</b>	<b>Contaminant Source ID</b>	<b>CS ID tag</b>	<b>Zone</b>	<b>Risk Ranking for Analysis</b>	<b>Map Number</b>	<b>Comments</b>
Pit toilets (open hole), nonresidential (one or more)	D16	D16-1	A	Low	2	Porcupine Creek Campground Pit Toilets
Highways and roads, paved (cement or asphalt)	X20	X20-1	A	Low	2	Road to Porcupine Creek Campground
Campgrounds and RV Parks	X35	X35-1	A	Low	2	Porcupine Creek Campground

## **APPENDIX C**

### **Porcupine Creek State Recreation Site Drinking Water Protection Area and Potential and Existing Contaminant Sources (Map 2)**





**Map 2: Drinking Water Protection Areas for Alaska Division of Parks - Porcupine Creek and Potential and Existing Sources of Contamination**

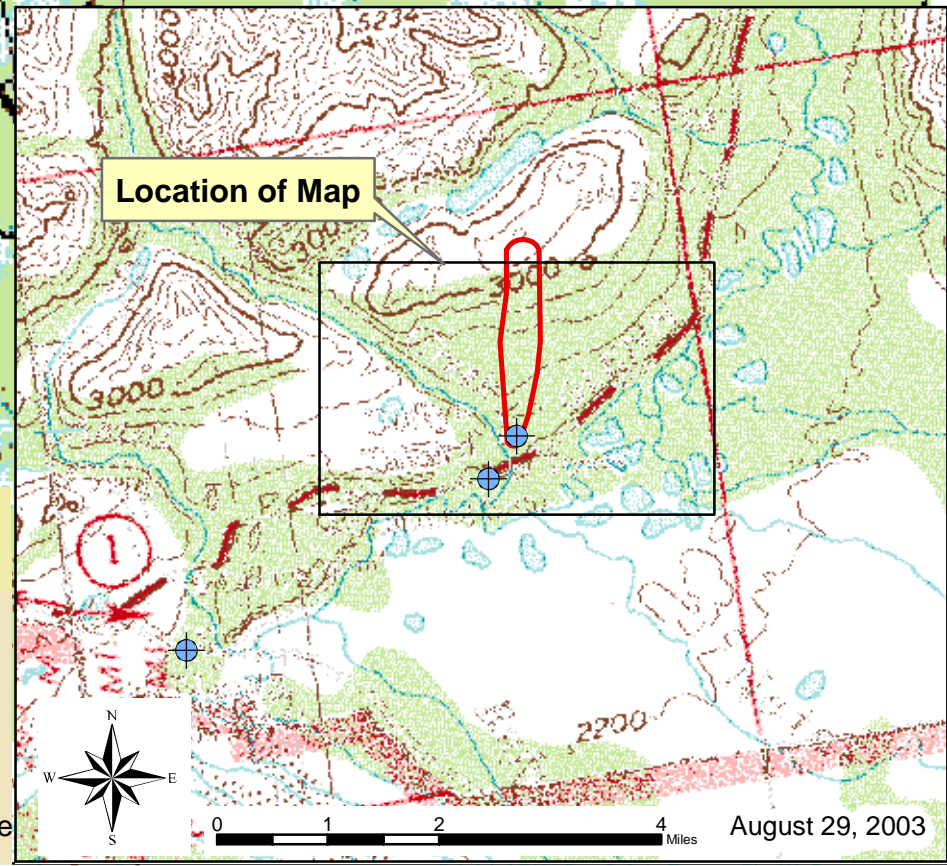
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1:13,462

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

- Legend**
- Public Drinking Water Systems
  - Campground (X35)
  - Pit Toilets (D16)
  - 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

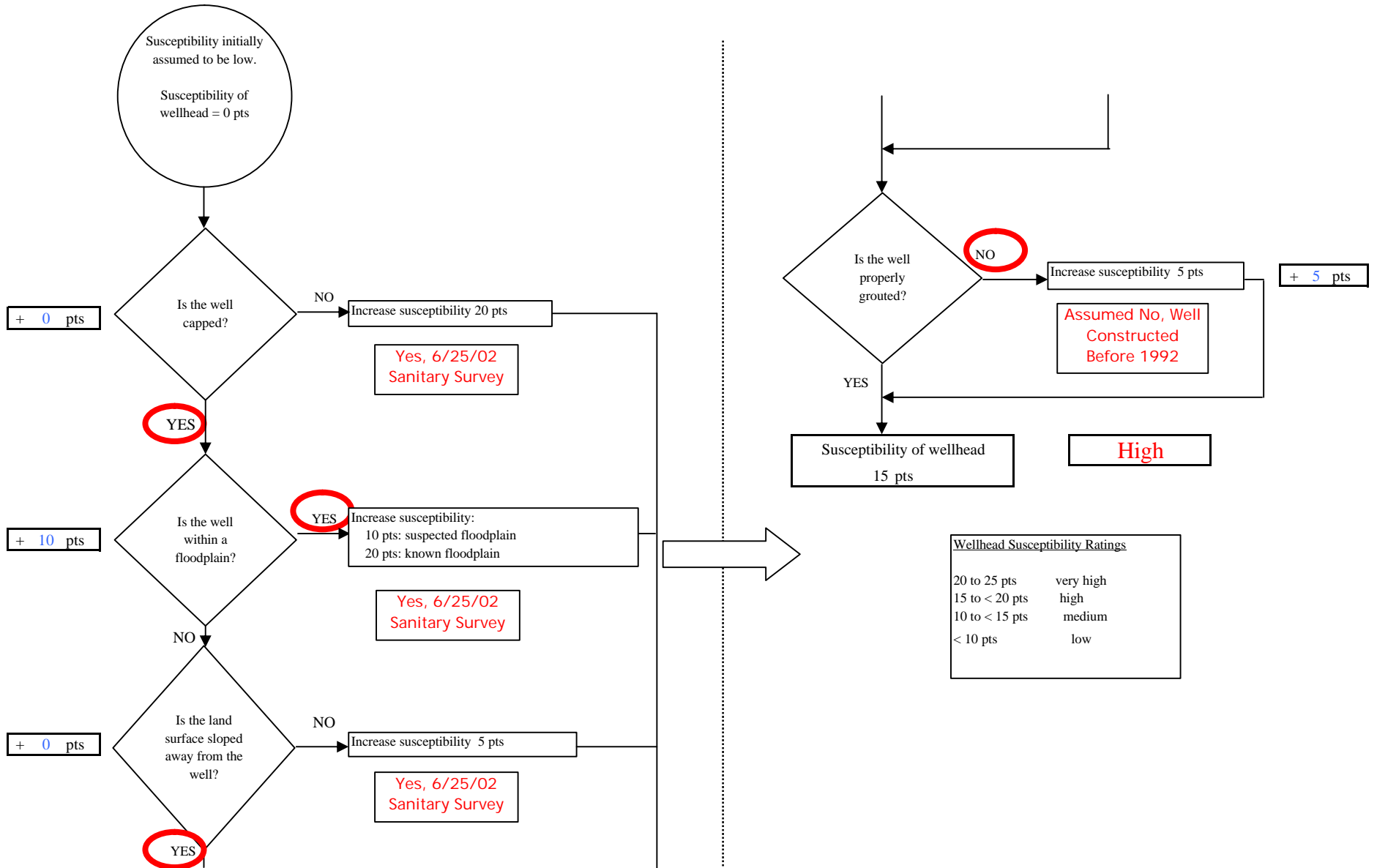


August 29, 2003

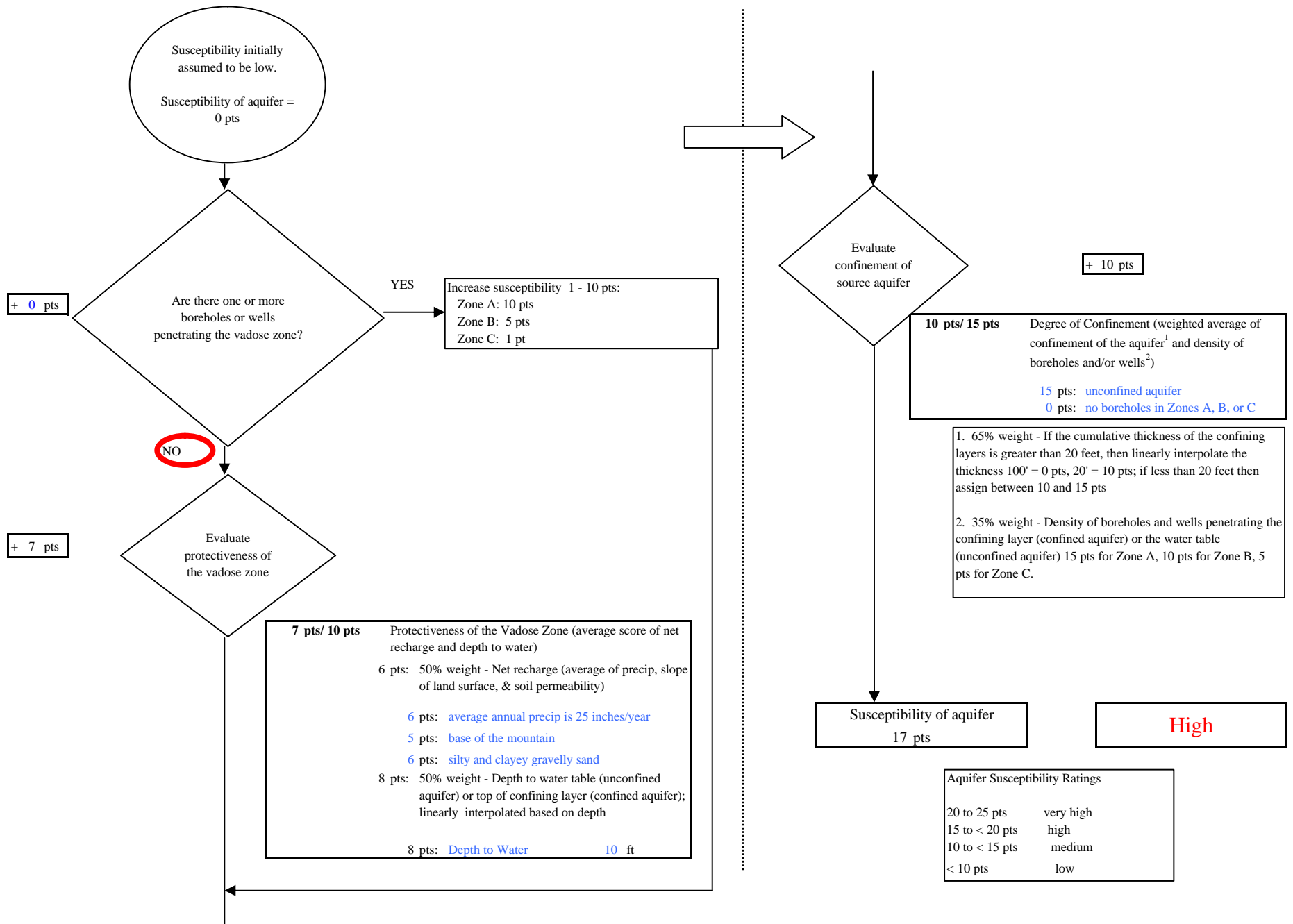
## **APPENDIX D**

### **Vulnerability Analysis for Porcupine Creek State Recreation Site Public Drinking Water Source (Charts 1-8)**

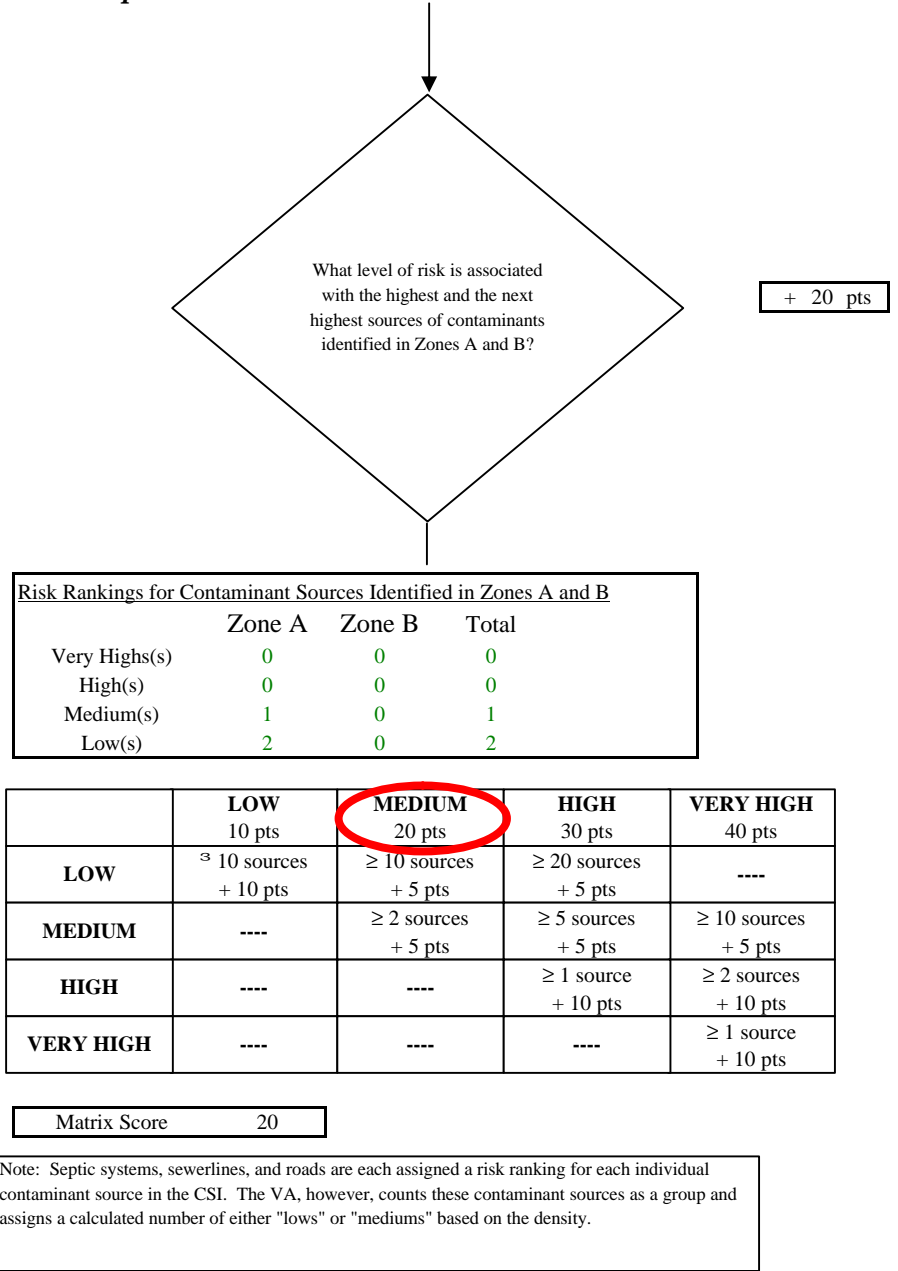
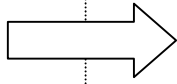
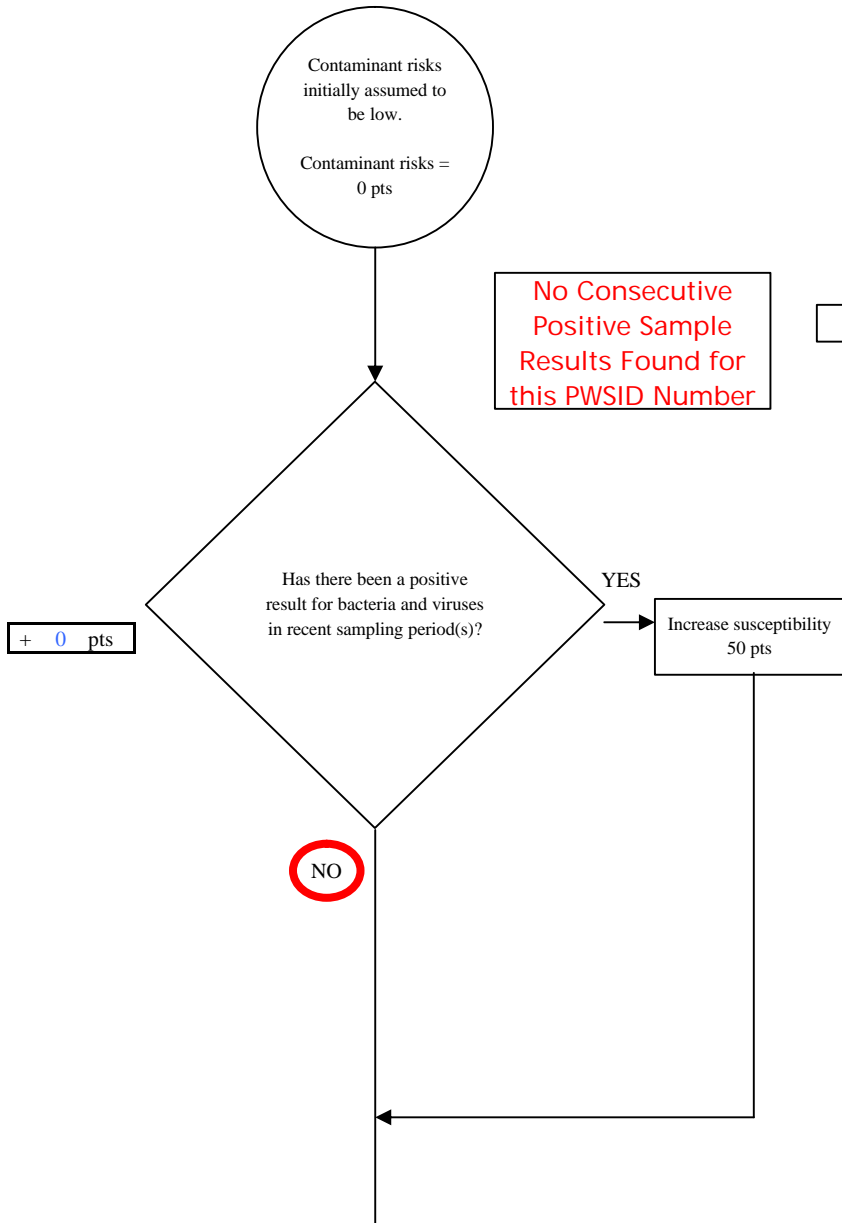
**Chart 1. Susceptibility of the wellhead - AK Division of Parks - Porcupine Creek**



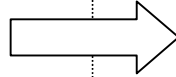
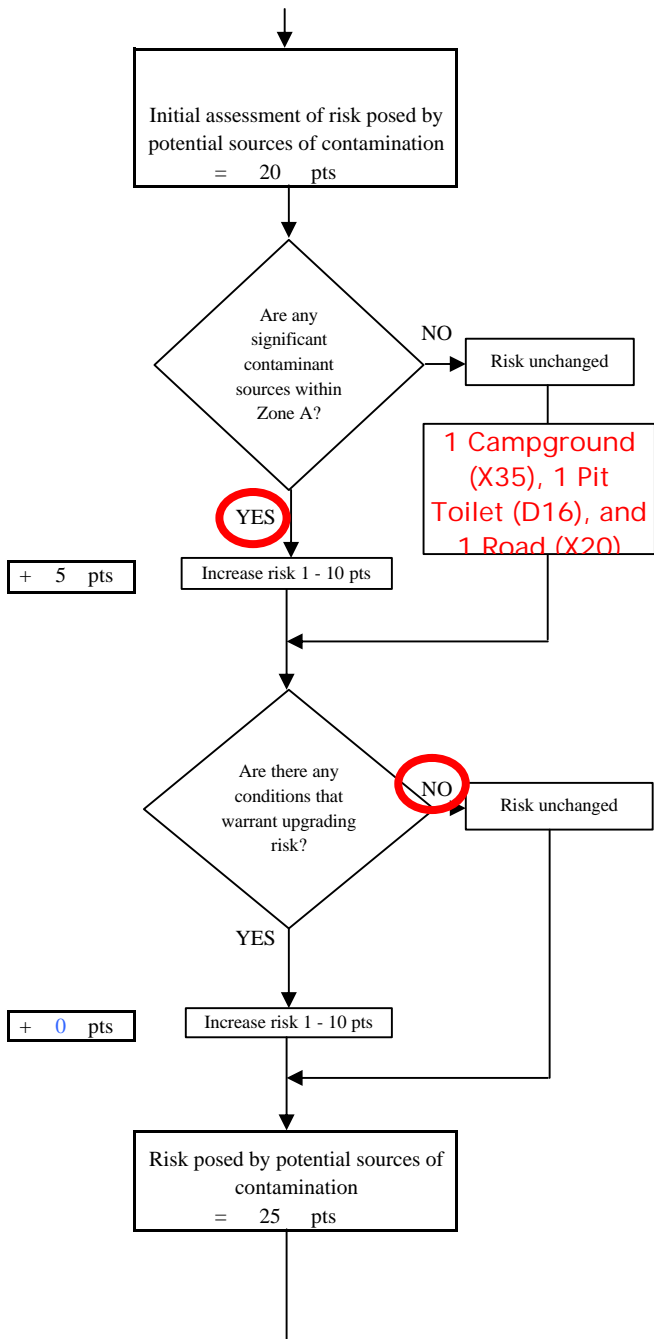
**Chart 2. Susceptibility of the aquifer - AK Division of Parks - Porcupine Creek**



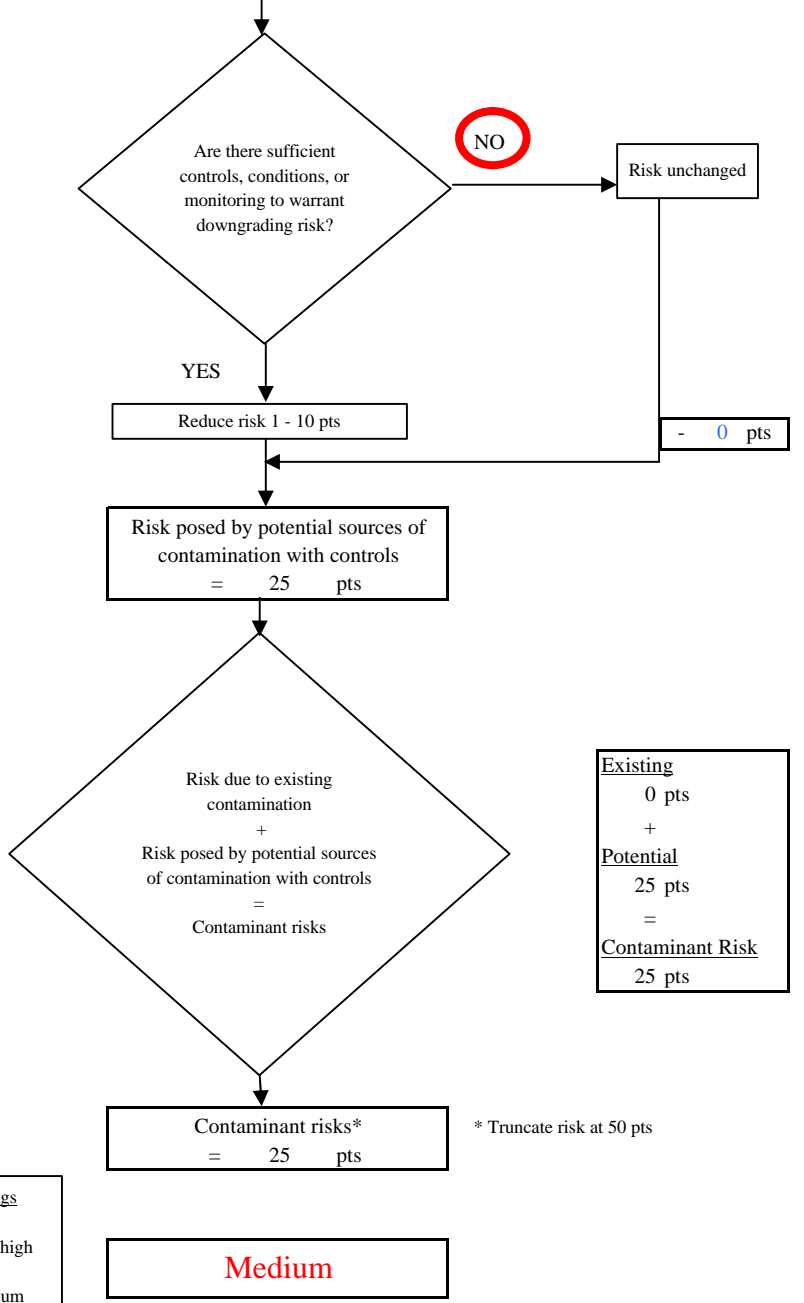
**Chart 3. Contaminant risks for AK Division of Parks - Porcupine Creek - Bacteria & Viruses**



**Chart 3. Contaminant risks for AK Division of Parks - Porcupine Creek - Bacteria & Viruses**



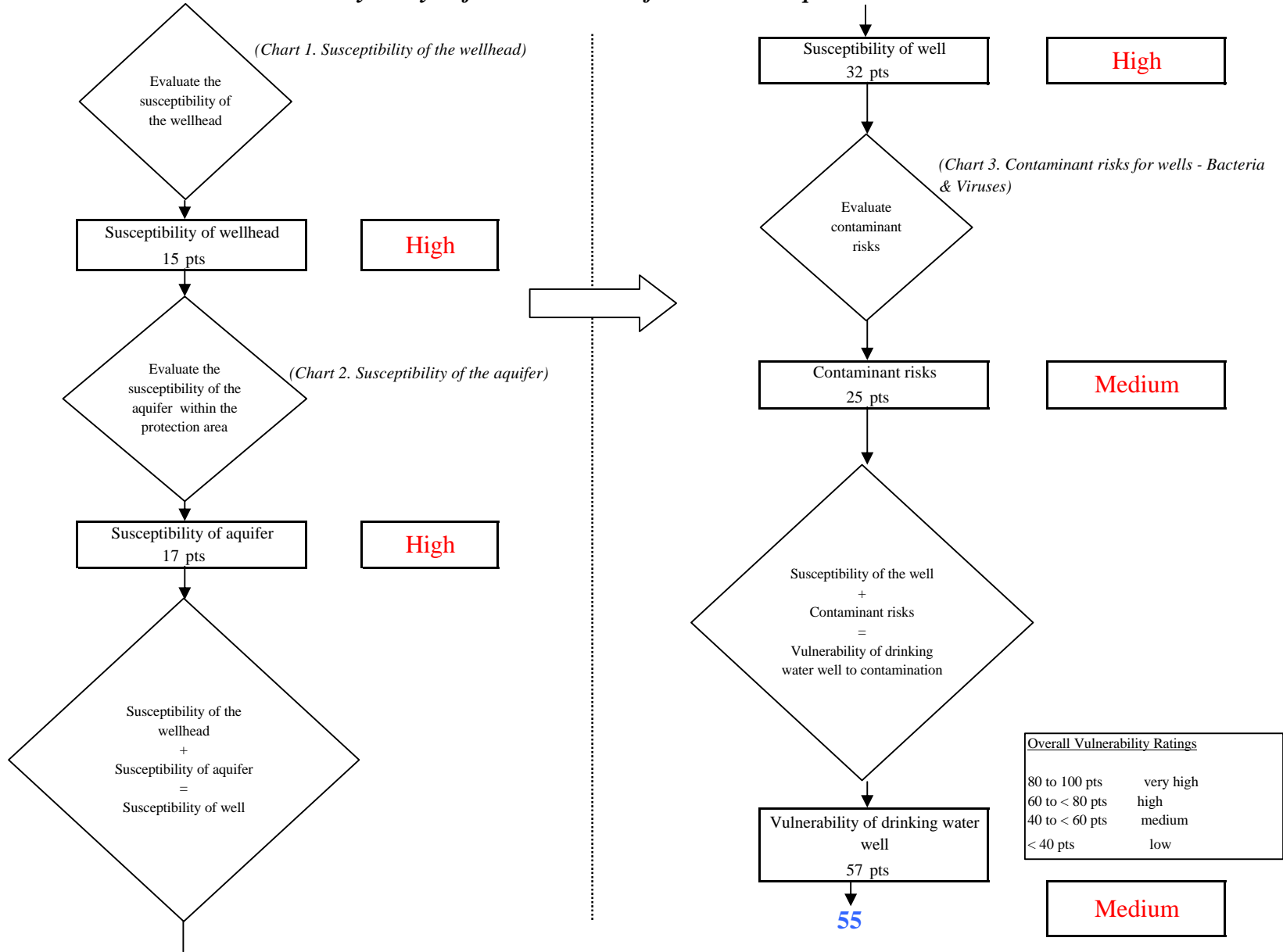
Contaminant Risk Ratings	
40 to 50 pts	very high
30 to < 40 pts	high
20 to < 30 pts	medium
< 20 pts	low



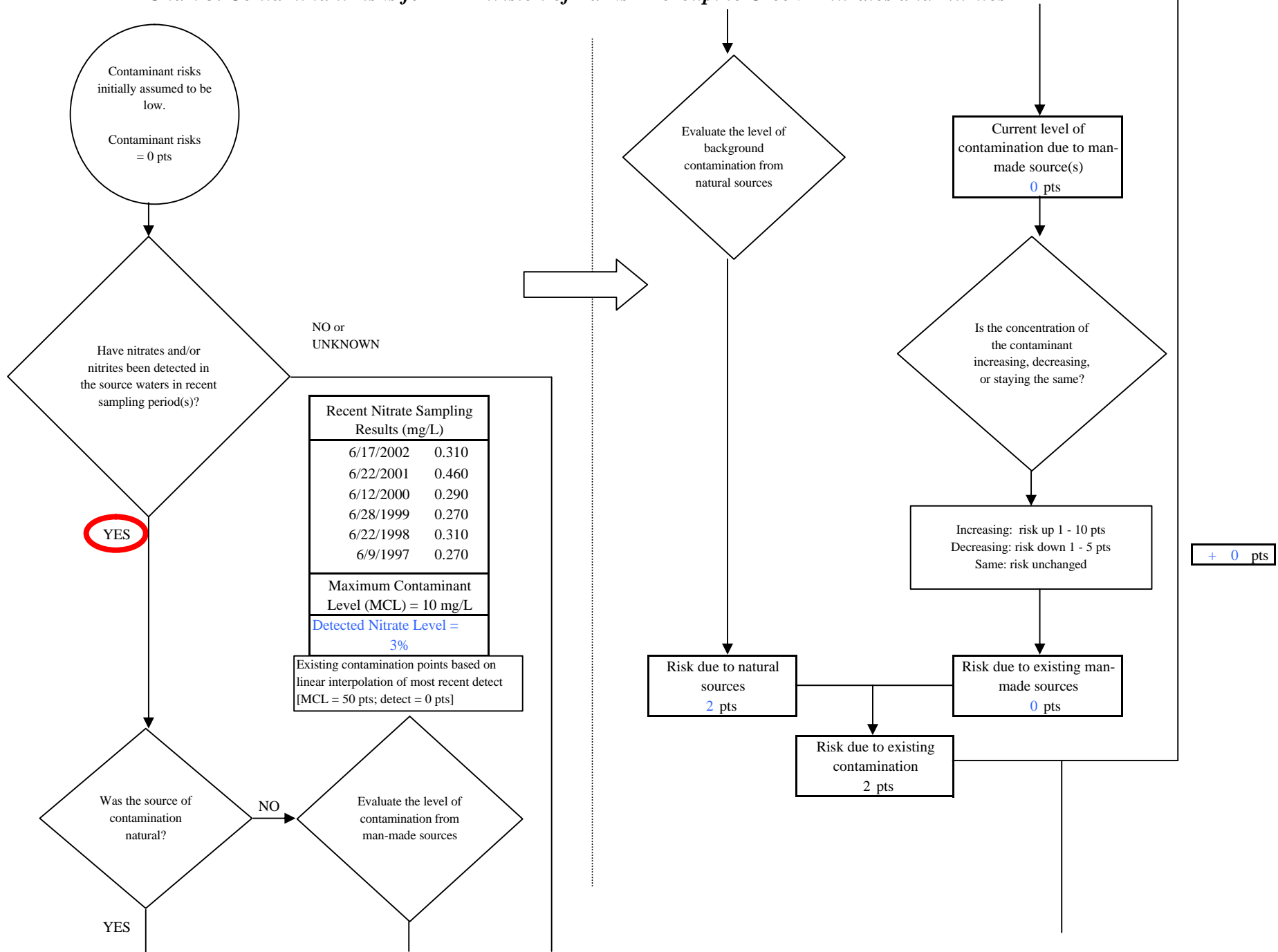
Existing	0 pts
+	
Potential	25 pts
=	
Contaminant Risk	25 pts

\* Truncate risk at 50 pts

**Chart 4. Vulnerability analysis for AK Division of Parks - Porcupine Creek - Bacteria & Viruses**

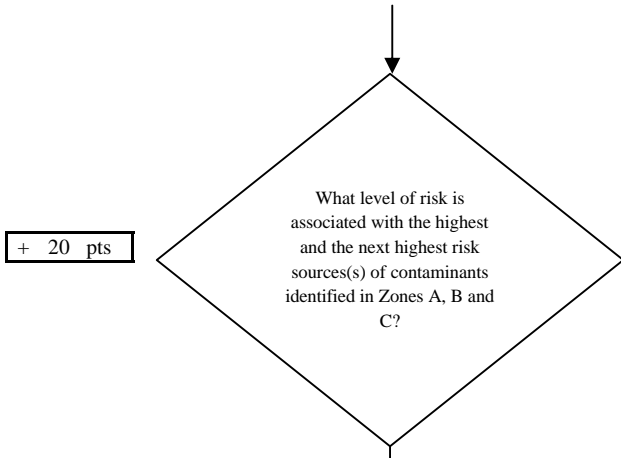


**Chart 5. Contaminant risks for AK Division of Parks - Porcupine Creek - Nitrates and Nitrites**





**Chart 5. Contaminant risks for AK Division of Parks - Porcupine Creek - Nitrates and Nitrites**

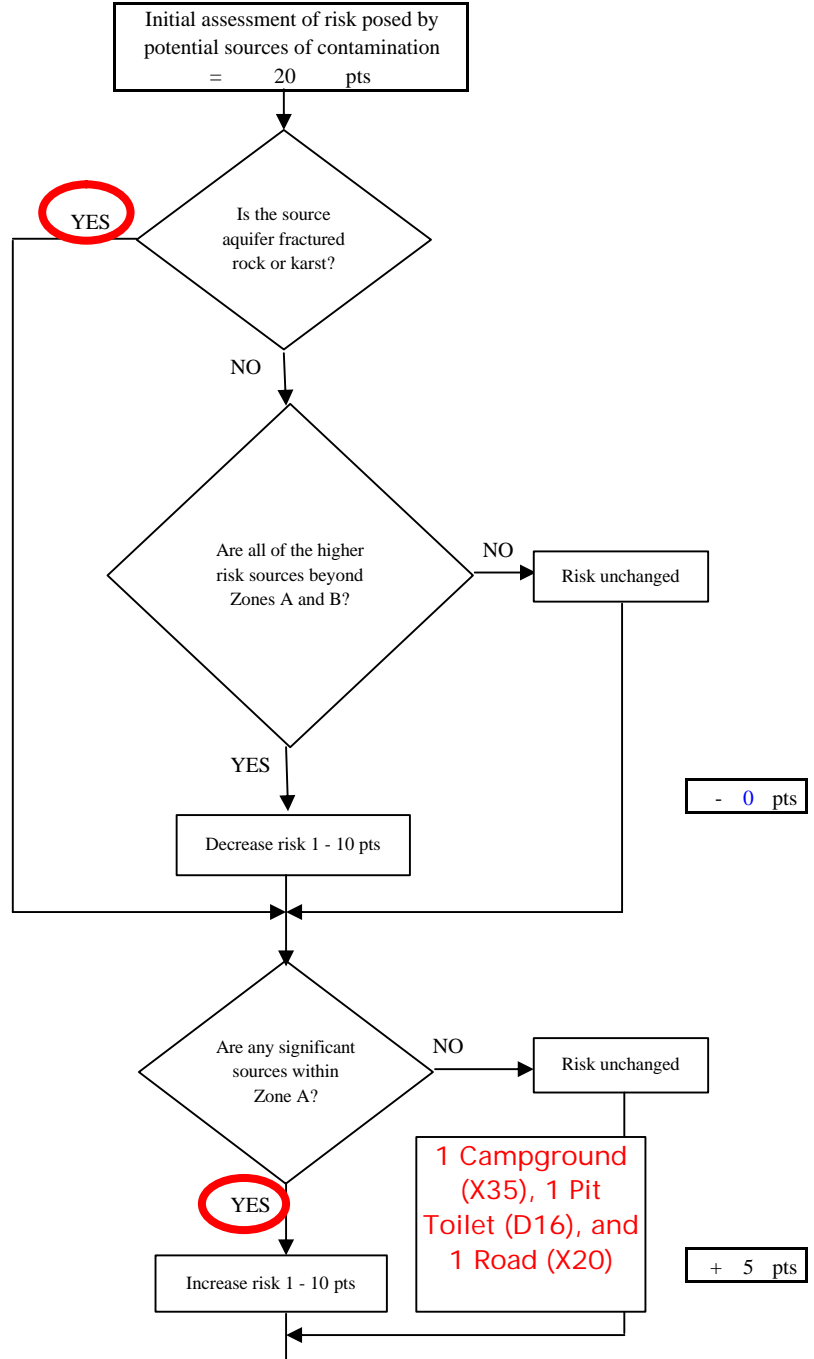
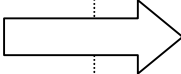


Risk Levels for Contaminant Sources identified in Zones A, B and C			
	Zone A	Zones B&C	Total
Very High(s)	0	0	0
High(s)	0	0	0
Medium(s)	1	0	1
Low(s)	2	0	2

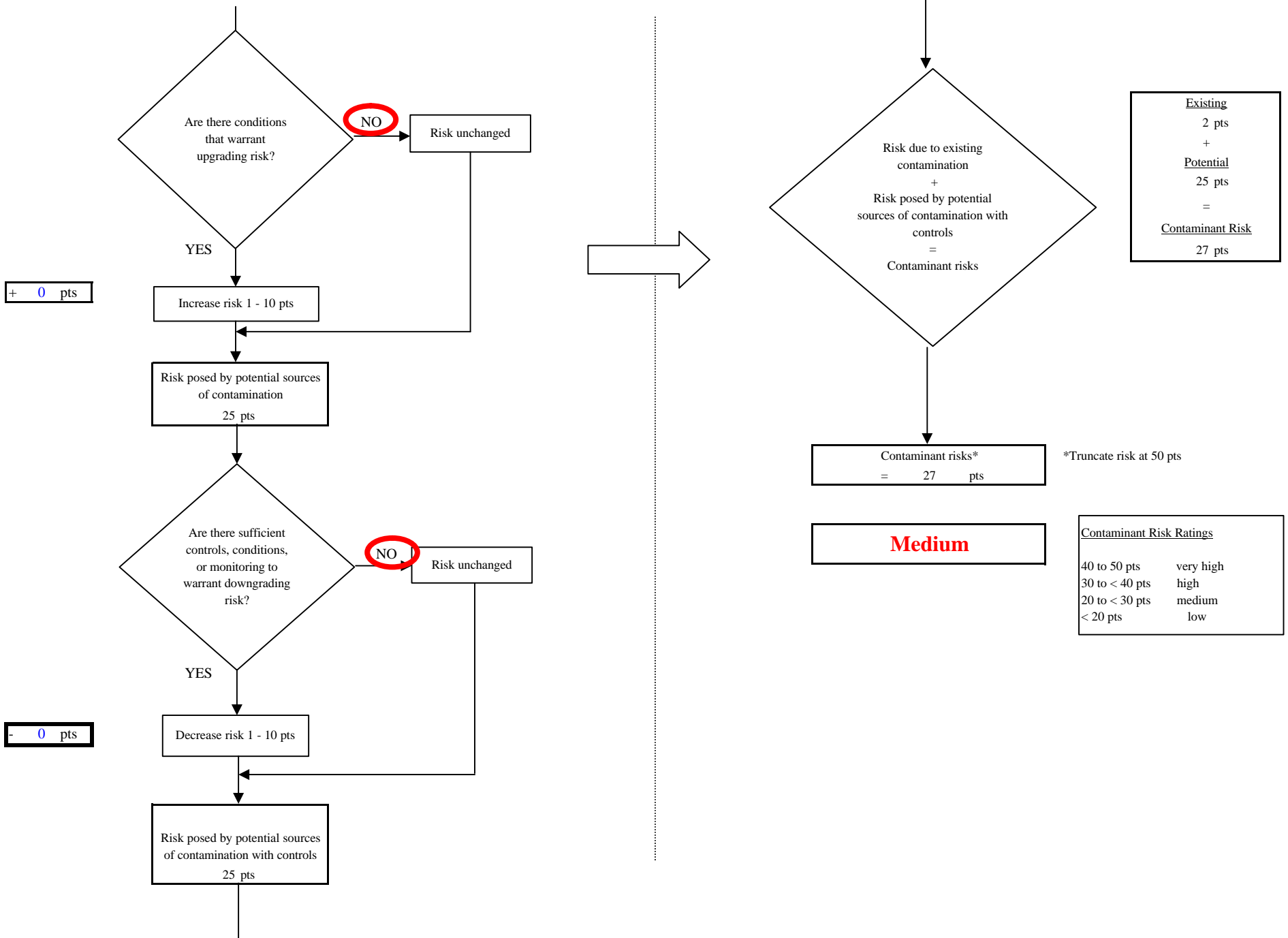
	LOW 10 pts	MEDIUM 20 pts	HIGH 30 pts	VERY HIGH 40 pts
<b>LOW</b>	≥ 10 sources + 10 pts	≥ 10 sources + 5 pts	≥ 20 sources + 5 pts	----
<b>MEDIUM</b>	----	≥ 2 sources + 5 pts	≥ 5 sources + 5 pts	≥ 10 sources + 5 pts
<b>HIGH</b>	----	----	≥ 1 source + 10 pts	≥ 2 sources + 10 pts
<b>VERY HIGH</b>	----	----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

Matrix Score 20

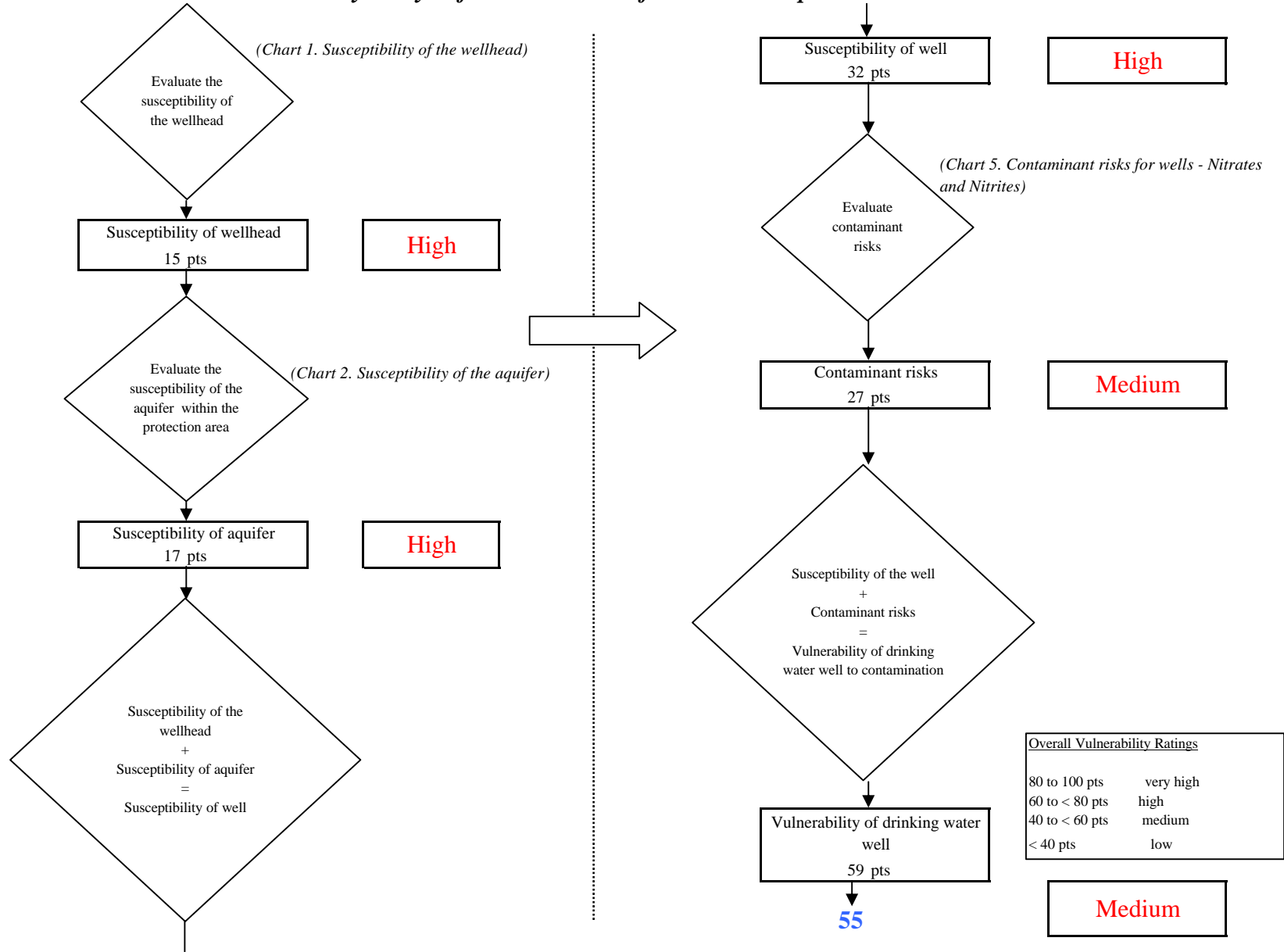
Note: Septic systems, sewerlines, and roads are each assigned a risk ranking for each individual contaminant source in the CSI. The VA, however, counts these contaminant sources as a group and assigns a calculated number of either "lows" or "mediums" based on the density.



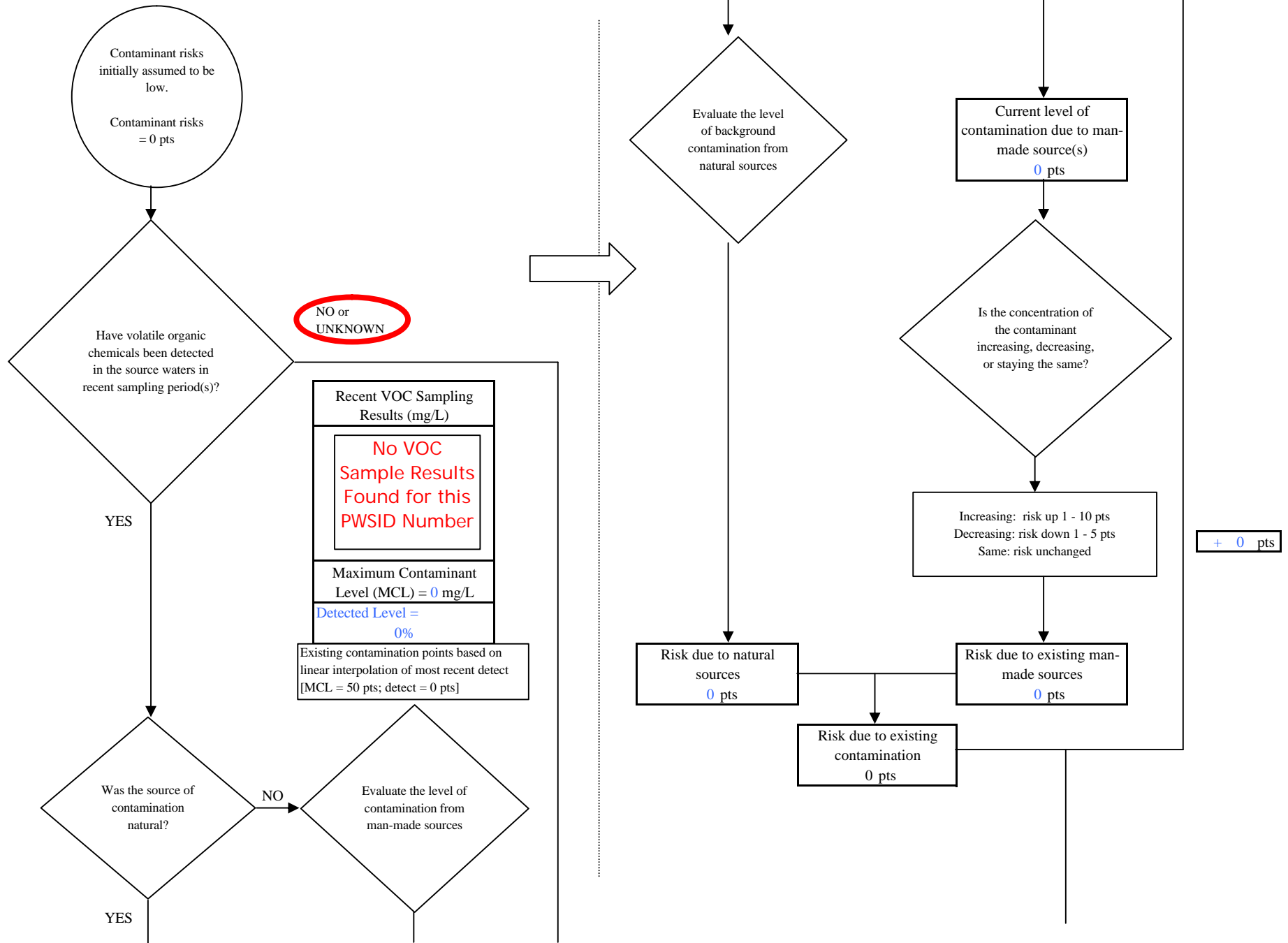
**Chart 5. Contaminant risks for AK Division of Parks - Porcupine Creek - Nitrates and Nitrites**



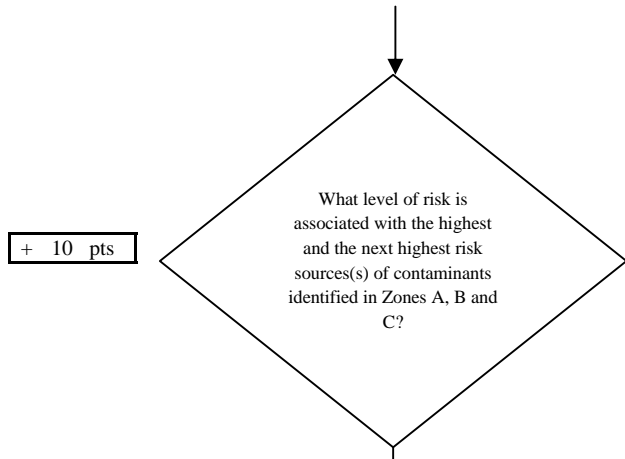
**Chart 6. Vulnerability analysis for AK Division of Parks - Porcupine Creek - Nitrates and Nitrites**



**Chart 7. Contaminant risks for AK Division of Parks - Porcupine Creek - Volatile Organic Chemicals**



**Chart 7. Contaminant risks for AK Division of Parks - Porcupine Creek - Volatile Organic Chemicals**



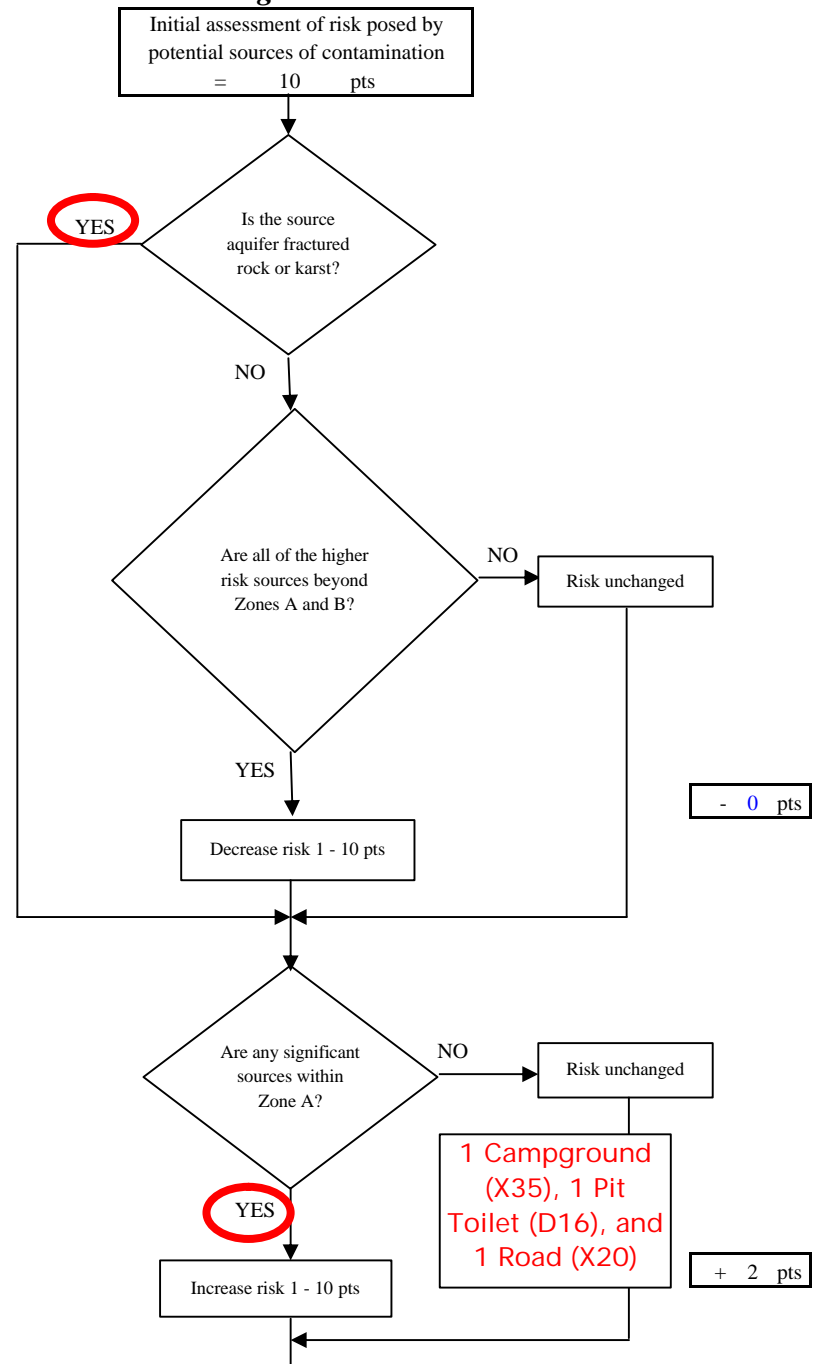
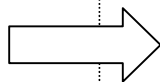
+ 10 pts

Risk Levels for Contaminant Sources identified in Zones A, B and C			
	Zone A	Zones B&C	Total
Very High(s)	0	0	0
High(s)	0	0	0
Medium(s)	0	0	0
Low(s)	3	0	3

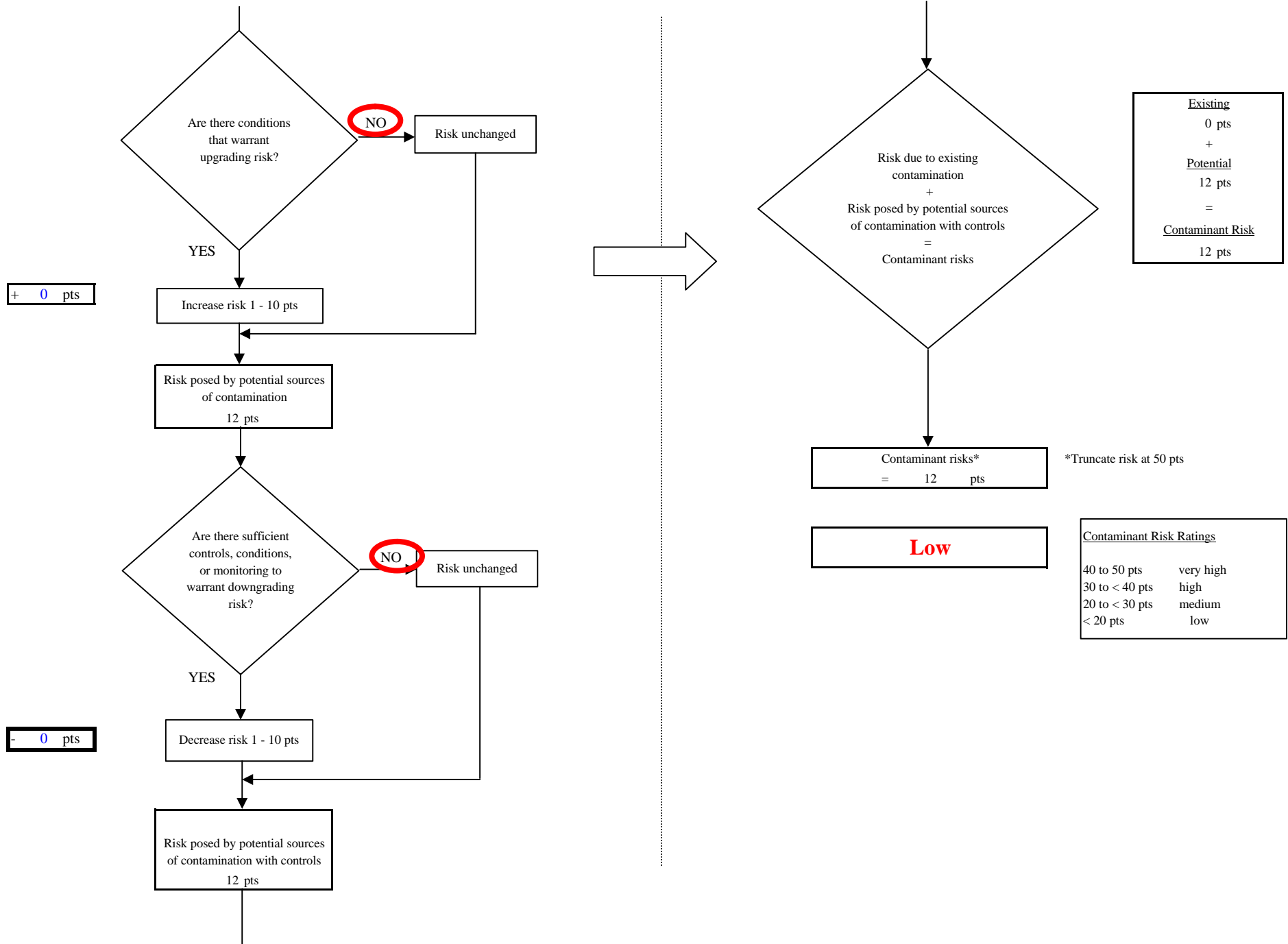
	LOW 10 pts	MEDIUM 20 pts	HIGH 30 pts	VERY HIGH 40 pts
LOW	≈ 10 sources + 10 pts	≥ 10 sources + 5 pts	≥ 20 sources + 5 pts	----
MEDIUM	----	≥ 2 sources + 5 pts	≥ 5 sources + 5 pts	≥ 10 sources + 5 pts
HIGH	----	----	≥ 1 source + 10 pts	≥ 2 sources + 10 pts
VERY HIGH	----	----	----	≥ 1 source + 10 pts

Matrix Score 10

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 7. Contaminant risks for AK Division of Parks - Porcupine Creek - Volatile Organic Chemicals**



**Chart 8. Vulnerability analysis for AK Division of Parks - Porcupine Creek - Volatile Organic Chemicals**

