Source Water Assessment

A Hydrogeologic Susceptibility and Vulnerability Assessment for Katmai Lodge Water System

Katmai Lodge, Alaska

PWSID #262107.001

January 2004

Drinking Water Protection Program Report #1193

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 (EPA), the 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 that 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 the Katmai Lodge Water System, Katmai Lodge, Alaska

Drinking Water Protection Program
Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

The water system for Katmai Lodge, Alaska, is a Class B surface water system that obtains water from the Alagnak River. The river water is piped to the pump house/water treatment building where it is chlorinated, filtered, and stored in a 4,000-gallon water tank. Treated water is piped to the separate guest buildings and lodge.

The Katmai Lodge protection area is approximately 1,000 square miles in size and has received a susceptibility rating of **Very High**. *A rating of High to Very High is typical for all systems with surface water intakes*. Potential and existing sources of the following contaminants were evaluated for the Source Water Assessment: bacteria and viruses, nitrates and/or nitrites, and volatile organic chemicals.

Known potential contaminant sources are located within the surface water protection area and include parks and municipal landfills. These sources may affect drinking water at the source and could potentially influence sampling results. Samples were collected from post-treated water. Contaminant sources identified within the surface water protection area for this public water system have been considered in order to provide the most conservative evaluation.

This evaluation included all available water sampling data submitted to the Alaska Department of Environmental Conservation (ADEC) by the system operator. As stated previously, the samples were collected from post-treated water. Vulnerability ratings for the water system have been determined by combining the susceptibility of the surface water source with the contaminant risks. The system received a vulnerability rating of **Very High** in two of the three source water assessment categories: bacteria and viruses and nitrates and nitrites. Volatile organic chemicals received a vulnerability rating of **Medium**.

This assessment can be used as a foundation for local voluntary protection efforts as well as a basis for the continuous efforts on the part of Katmai Lodge to protect public health.

DRINKING WATER SYSTEM AND AREA OVERVIEW

Katmai Lodge is located on the Alagnak River, which is a National Wild and Scenic River. The lodge is about 15 air miles from Levelock and the Kvichak River. The lodge specializes in fly fishing in the Bristol Bay area and is open seasonally from June 1st to September 20th, with a non-resident seasonal population of about 95. In the lodge area, temperatures range from 25 to 63°F in the summer season, with about 11 inches of rainfall.

The water system is a Class B surface water system that operates seasonally from June 1st to September 20th and obtains water from Alagnak River. Water is piped from the river to the nearby pump house and water treatment building where is treated with chlorine and filtered. The treated water is piped to the separate guest buildings and lodge. The lodge operates its own septic system for sewage disposal.

Information acquired from a June 1999 sanitary survey for the public water system indicated that the surface water intake is adequately constructed. The average production of the system is 3,000 gallons per day.

The entire Bristol Bay area was formerly covered by glaciers and the topography is representative of a postglacial area. Soils information is limited. Generally, the soils consist of silty sand overlying relatively clean sand. The silty soils are slightly frost-susceptible. Isolated pockets of permafrost are scattered throughout the area (DOWL, 1982).

KATMAI LODGE DRINKING WATER PROTECTION AREA

Identifying the pathways most likely for surface contamination to reach water intake areas is the first step in determining the water system's risk. These pathways are initially determined by looking at the drainage area contributing overland water flow to a surface water source intake. The entire drainage area is also known as the "drinking water protection area." Please refer to pages 10-11 of the "Guidance Manual

for Class B Public Water Systems" for additional information.

The protection area established for surface water sources by the ADEC is usually separated into three zones. These zones correspond to the overland-flow distance that water travels to get to the source. The ADEC Drinking Water Protection Program's Technical Advisory Committee developed guidelines for derivation of these zones in 1998. The following is a summary of the three protection area zones:

Table 1. Definition of Zones

Zone	Definition
A	Areas within 1000-ft of lakes or streams
B	Areas within 1-mile of lakes or streams
C	The watershed boundary

The protection area for the Katmai Lodge water intake includes each of these Zones (See Map A 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 Katmai Lodge surface water protection area. This inventory was completed through a search of agency records and other publicly available information. There is a wide array of potential contamination sources to surface water. These contaminants are found within agricultural, residential, commercial, and industrial areas, but can also occur within areas that have little or no development.

For Class B public water system assessments, three categories of drinking water contaminants were inventoried. They include:

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

Several contaminant sources were identified in the Katmai Lodge protection area as displayed on Map C of Appendix C and in Table 1 of Appendix B.

RANKING OF CONTAMINANT RISKS

Once potential and existing sources of contamination have been identified, they are assigned a ranking according to what category and level of risk they represent. Ranking of contaminant risks for "potential" or "existing" sources of contamination is a function of the toxicity and the volume of specific contaminants associated with that source. Rankings include:

- Low;
- Medium;
- High; and
- Very High.

The time-of-travel for contaminants within the water is dependent on the physical and chemical characteristics of each contaminant. Bacteria and Viruses are only inventoried in Zone A because of their short life span. Only "Very High" and "High" rankings are inventoried within Zones B and C due to the probability of contaminant dilution by the time the contaminants reach the water intake.

The remaining tables 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 THE DRINKING WATER SYSTEM

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

- Surface Water Susceptibility and
- Contaminant risks.

Appendix D contains 7 charts, which together form the 'Vulnerability Analysis' for the public drinking water Source Water Assessment. Chart 1 analyzes the 'Susceptibility of the Surface Water Source' to contamination by looking at the climate, terrain, and intake location. Chart 2 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 intake area. Chart 3 contains the 'Vulnerability Analysis for Bacteria and Viruses,' which is a composite score of the Vulnerability Analysis and the overall Susceptibility. Charts 4 through 7 repeat the Contaminant Risks and Vulnerability Analyses for nitrates and nitrites and volatile organic chemicals.

A score for the Surface Water Susceptibility of the source is reached by considering the properties of the water intake and the surrounding area. The derivation of this information is presented below and the data for this source is shown in Chart 1 of Appendix D.

Susceptibility of the Surface Water Source – always considered to be "high" (30 points)

+

Adequate Construction of the Intake (0 – 5 Points)

+

Runoff Potential Within Zone B (0 – 5 Points)

+

Dilution Capacity of the Surface Water (0 – 10 Points)

=

Natural Susceptibility
(0 – 50 Points)

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

Surface Water Source Susceptibility Ratings	
40 to 50 pts	Very High
30 to < 40 pts	High

Table 2. Susceptibility of the Water Source

	Score	Rating
Minimum Allowable Susceptibility	30	
Intake Construction Adequate	0	
Runoff Potential	2	
Dilution Capacity	10	
Overall Susceptibility	***42***	***Very High***

For contaminants, risks to a drinking water source depend on the type, number or density, and distribution of the contaminant sources. The Contaminant Risk score has been derived from an examination of existing, and historical contamination sources that have been detected in the protection area 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 the 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. Katmai Lodge 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 contaminant type by combining each of the contaminant risk scores with the susceptibility score:

Susceptibility of the Surface Water Source

(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 and ratings for each of the six categories of drinking water contaminants. Note: scores are rounded off to the nearest five.

Table 4. Katmai Lodge Water System Overall Vulnerability

Category	Score	Rating
Bacteria and Viruses	80	Very High
Nitrates and Nitrites	90	Very High
Volatile Organic Chemicals	55	Medium

Bacteria and Viruses

The contaminant risk for bacteria and viruses is **Very High**. The contaminant risk for bacteria and viruses is primarily attributed to the presence of the landfill in Zone A.

Coliforms (a bacteria) are found naturally in the environment and although they aren't necessarily a health threat, they are an indicator of other potentially harmful bacteria in the water, more specifically, fecal coliforms and E. coli, which only come from human and animal fecal waste. Harmful bacteria can cause diarrhea, cramps, nausea, headaches, or other symptoms (EPA, 2003). Positive samples increase the overall vulnerability of the drinking water source, indicating that the source is susceptible to bacteria and virus contamination. Typically, coliform detection in raw water samples collected from surface water sources is normal. (See Chart 2 – Contaminant Risks for Bacteria and Viruses in Appendix D).

One positive bacteria count was reported in recent (previous five years) sampling events. However, the follow-up sample was negative, therefore no risk points were retained.

After combining the contaminant risk for bacteria and viruses with the natural susceptibility of the source, the overall vulnerability of the source to bacteria and virus contamination remains **Very High**.

Nitrates and Nitrites

The contaminant risk for nitrates and nitrites is **Very High** (See Chart 4 - Contaminant Risks for Nitrates and/or Nitrites in Appendix D). Three potential contaminant risk sources for nitrates were identified in the protection area for this public water system. The contaminant risk is primarily attributed to the presence of the landfills in Zones A and C and partially attributed to the presence of a municipal park in Zone B. Nitrates are very mobile, moving at approximately the same rate as water. The Maximum Contaminant Level (MCL) for nitrates is 10 milligrams per liter (mg/L). 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 (EPA, 2003).

Although low concentrations of nitrates have been reported in recent sampling history, none of the concentrations exceed the MCL of 10 mg/L.

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

Volatile Organic Chemicals

The contaminant risk for volatile organic chemicals is **Low** (see Chart 6 – Contaminant Risks for Volatile Organic Chemicals in Appendix D). One potential contaminant source for volatile organic chemicals was identified in the protection area for this public water system. A low contaminant risk is primarily attributed to the presence of a landfill in Zone A.

Review of the historical sampling data found no recent sampling results for volatile organic chemicals.

After combining the contaminant risk for volatile organic chemicals with the natural susceptibility of the source, the overall vulnerability of the source to contamination is **Medium**.

Using the Source Water Assessment

This assessment of contaminant risks can be used as a foundation for local voluntary protection efforts as well as a basis for the continuous efforts on the part of Katmai Lodge to protect public health. It is anticipated that Source Water Assessments will be updated every five years to reflect any changes in the vulnerability and/or susceptibility of the drinking water source.

REFERENCES

Alaska Department of Community and Economic Development (ADCED), 2003 [WWW document]. URL: http://www.dced.state.ak.us/cbd/commdb/CF_COMDB.htm

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R&M Consultants, Inc., 1979b, Lower Kuskokwim School District School Site Investigation for Tununak, Alaska.

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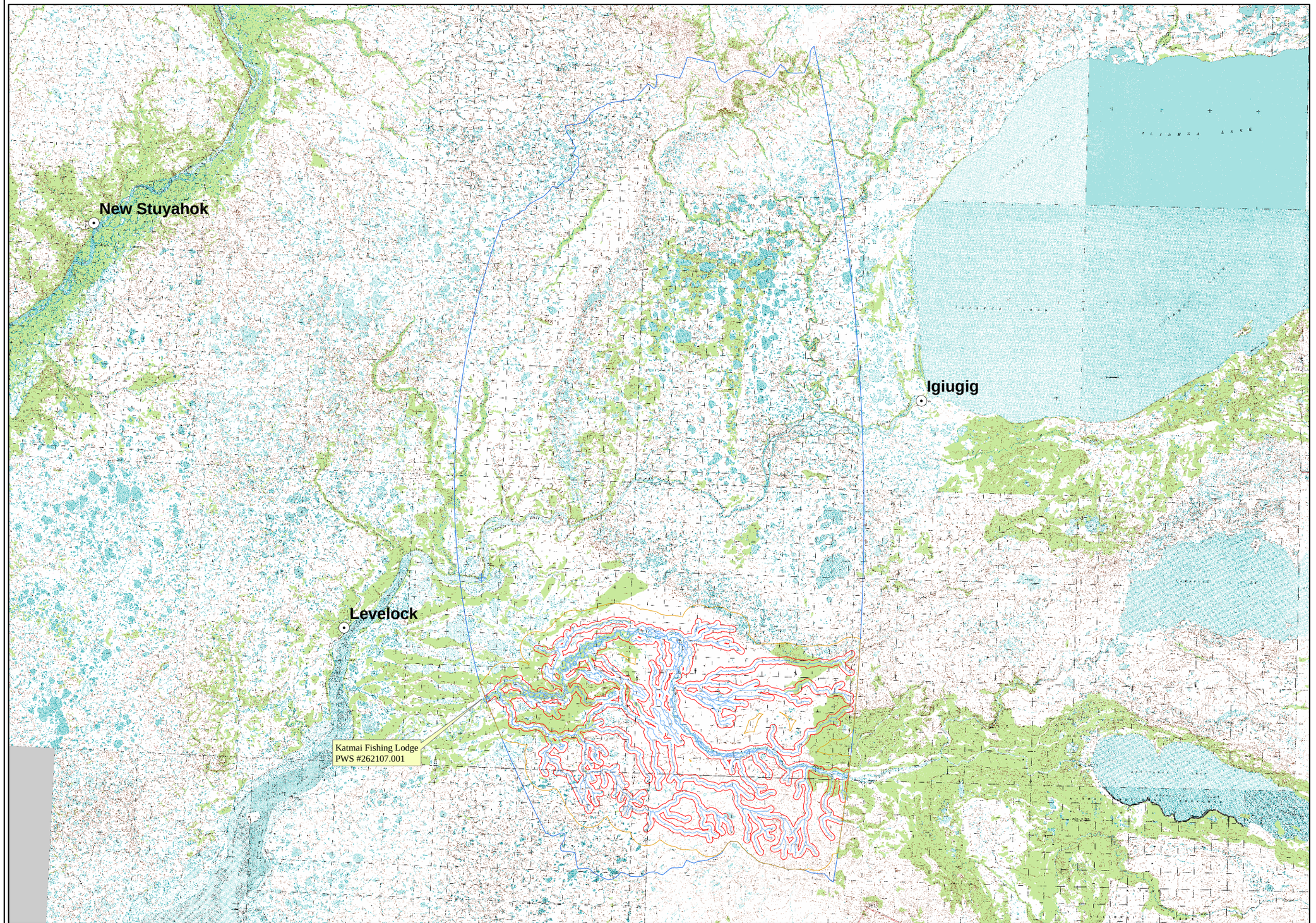
APPENDIX A

Drinking Water Protection Area Location Map
(Map A)

Public Water System for PWS #262107.001 Katmai Fishing Lodge



LEGEND

- Public Water System

Surface Water Protection Zones

- Zone A – 1000 Feet from Surface Water
- Zone B – 1 Mile from Surface Water
- Zone C – Entire Watershed

Hydrography/Physical

- Parcels
- Stream
- Lake or Pond
- Contours (approx. 50 ft. or as indicated)

Transportation

- Primary Route (Class 1)
- Secondary Route (Class 2)
- Road (Class 3)
- Road (Class 4)
- Road (Class 5, Four-wheel drive)
- Road Ferry Crossing

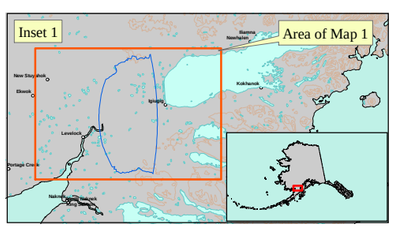
Data Sources:
Contaminant Sources, Public Water System Wells, Contours
Alaska Department of Environmental Conservation (ADEC)

Critical Facilities
Federal Emergency Management Agency (FEMA)

All other data
United States Geological Survey (USGS)

Drinking Water Protection Areas based on ADEC published document:
"Alaska Drinking Water Protection Progarm - Guidance Manual for Class A Public Water Systems"

URS Corporation does not guarantee the accuracy or validity of the data provided



0 3 6 12 18 24 Miles

Katmai Fishing Lodge PWS 262107.001
Appendix A Map A

APPENDIX B

Contaminant Source Inventory and Risk Rankings (Tables 1-4)

Table 1

Contaminant Source Inventory for

Katmai Fishing Lodge

PWSID 262107.00

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Map Number*	*Comments*
Landfills (municipal; Class III)	D51	D51-01	A	C	
Municipal or city parks (with green areas)	X04	X04-01	A	C	
Municipal or city parks (with green areas)	X04	X04-02	B	C	
Landfills (municipal; Class III)	D51	D51-02	C	C	

Table 2

Contaminant Source Inventory and Risk Ranking for Katmai Fishing Lodge
Sources of Bacteria and Viruses

PWSID 262107.001

Contaminant Source Type	***Contaminant Source ID***	***CS ID tag***	***Zone***	***Risk Ranking for Analysis***	***Map Number***	***Comments***
Landfills (municipal; Class III)	D51	D51-01	A	High	C	
Municipal or city parks (with green areas)	X04	X04-02	B	Medium	C	
Landfills (municipal; Class III)	D51	D51-02	C	High	C	

Table 3

Contaminant Source Inventory and Risk Ranking for Katmai Fishing Lodge
Sources of Nitrates/Nitrites

PWSID 262107.001

Contaminant Source Type	***Contaminant Source ID***	***CS ID tag***	***Zone***	***Risk Ranking for Analysis***	***Map Number***	***Comments***
Landfills (municipal; Class III)	D51	D51-01	A	Very High	C	
Municipal or city parks (with green areas)	X04	X04-02	B	Medium	C	
Landfills (municipal; Class III)	D51	D51-02	C	Very High	C	

Table 4

Contaminant Source Inventory and Risk Ranking for Katmai Fishing Lodge
Sources of Volatile Organic Chemicals

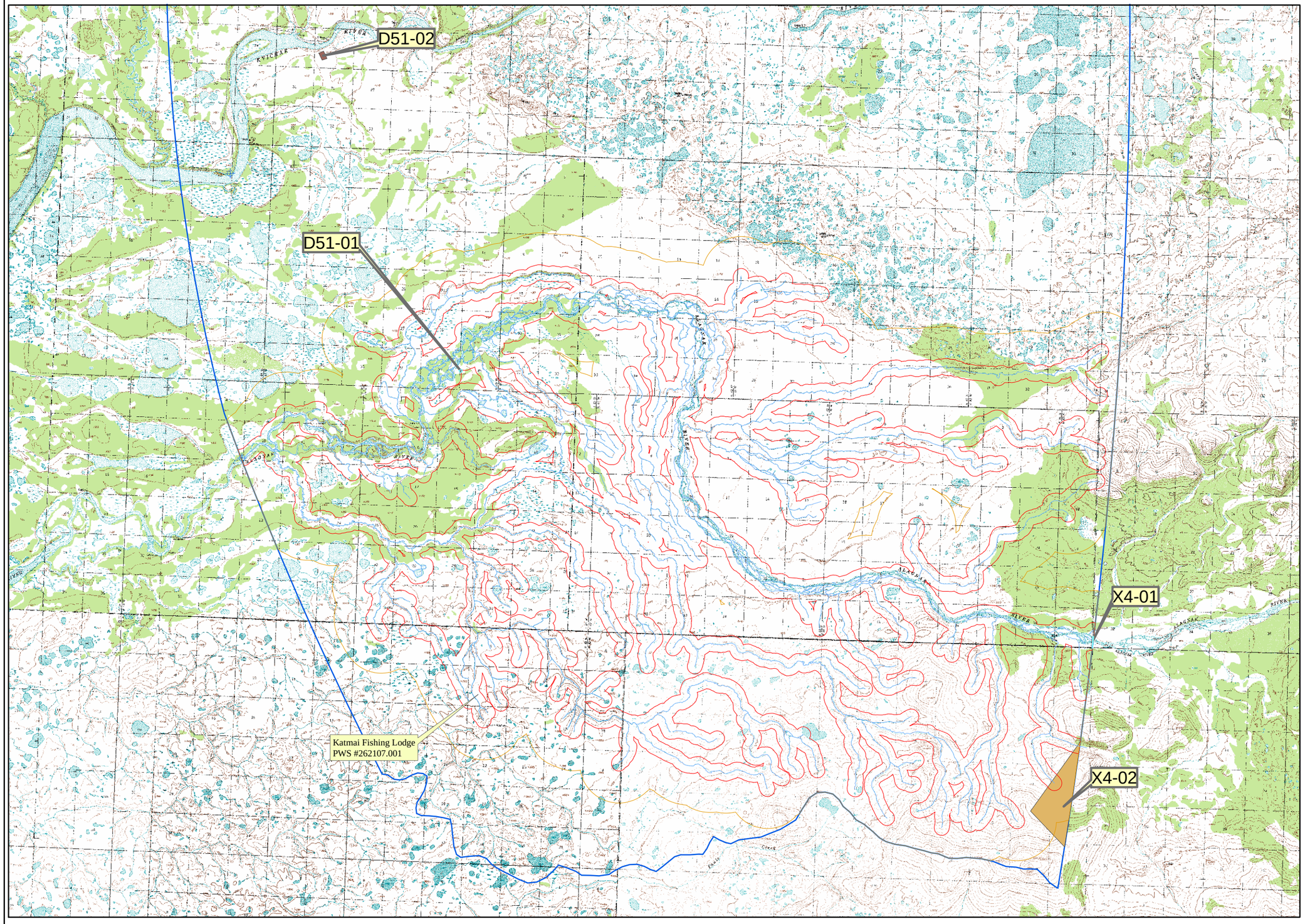
PWSID 262107.001

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Risk Ranking for Analysis	Map Number	Comments
Landfills (municipal; Class III)	D51	D51-01	A	Low	C	

APPENDIX C

Drinking Water Protection Area
and Potential and Existing Contaminant Sources
(Maps C and D)

Public Water System for PWS #262107.001 Katmai Fishing Lodge
Showing Potential and Existing Sources of Contamination



LEGEND

- Public Water System

Surface Water Protection Zones

- Zone A – 1000 Feet from Surface Water
- Zone B – 1 Mile from Surface Water
- Zone C – Entire Watershed

Hydrography/Physical

- Parcels
- Stream
- Lake or Pond
- Contours (approx. 50 ft. or as indicated)

Transportation

- Primary Route (Class 1)
- Secondary Route (Class 2)
- Road (Class 3)
- Road (Class 4)
- Road (Class 5, Four-wheel drive)
- Road Ferry Crossing

Potential Contaminant Sources

- Municipal Landfill, Class III (D51)
- Parks (with green areas) (X04)

Data Sources:
Contaminant Sources, Public Water System Wells, Contours
Alaska Department of Environmental Conservation (ADEC)

Critical Facilities
Federal Emergency Management Agency (FEMA)

All other data
United States Geological Survey (USGS)

Drinking Water Protection Areas based on ADEC published document:
"Alaska Drinking Water Protection Progarm - Guidance Manual for
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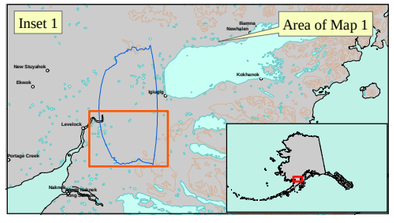


0 1.25 2.5 5 7.5 10 Miles

APPENDIX D

Vulnerability Analysis and Contaminant Risks
(Charts 1-7)

Chart 1. Susceptibility of the Surface Water Source - Katmai Fishing Lodge Water System (PWS No. 262107.001)

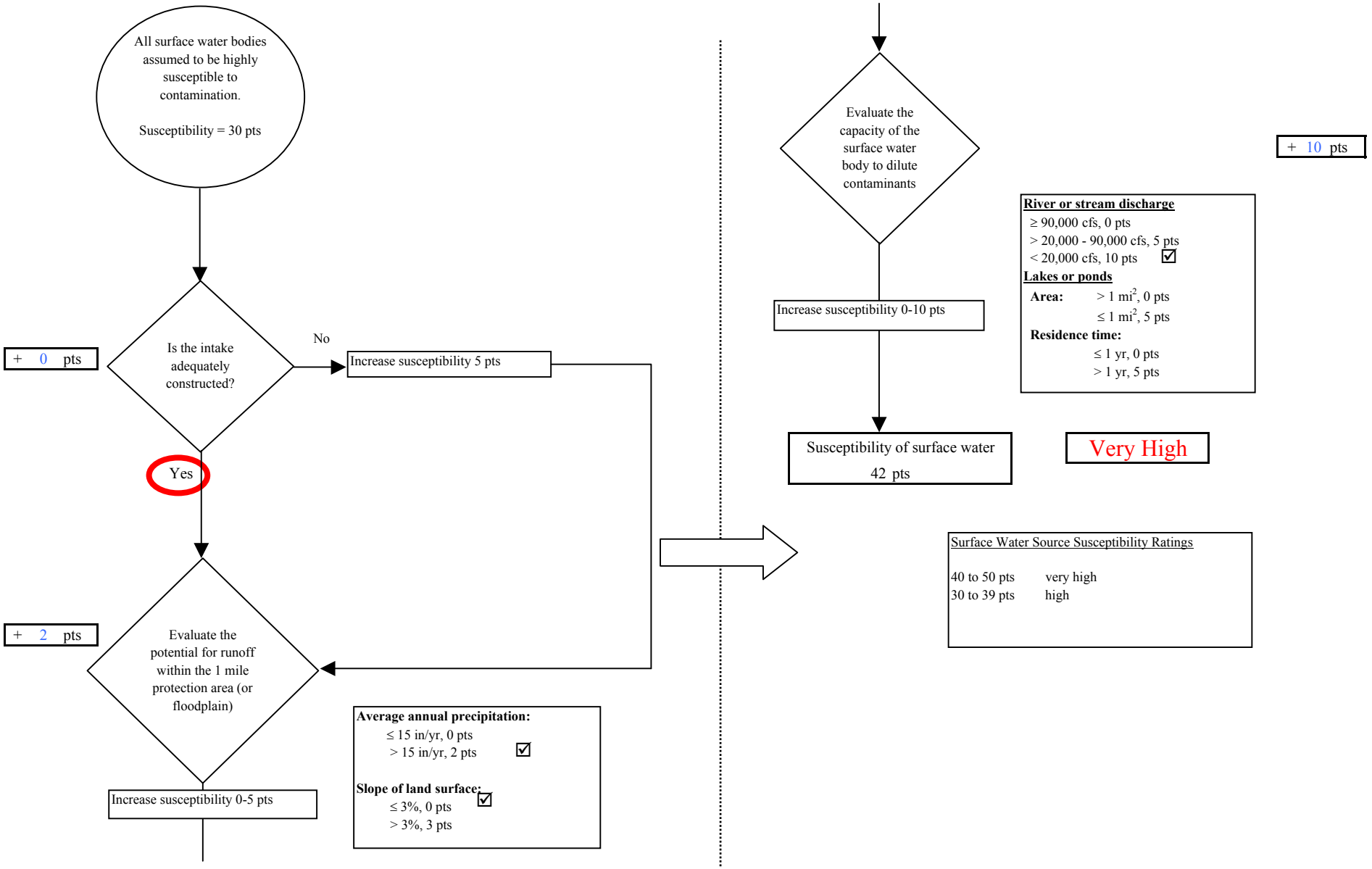
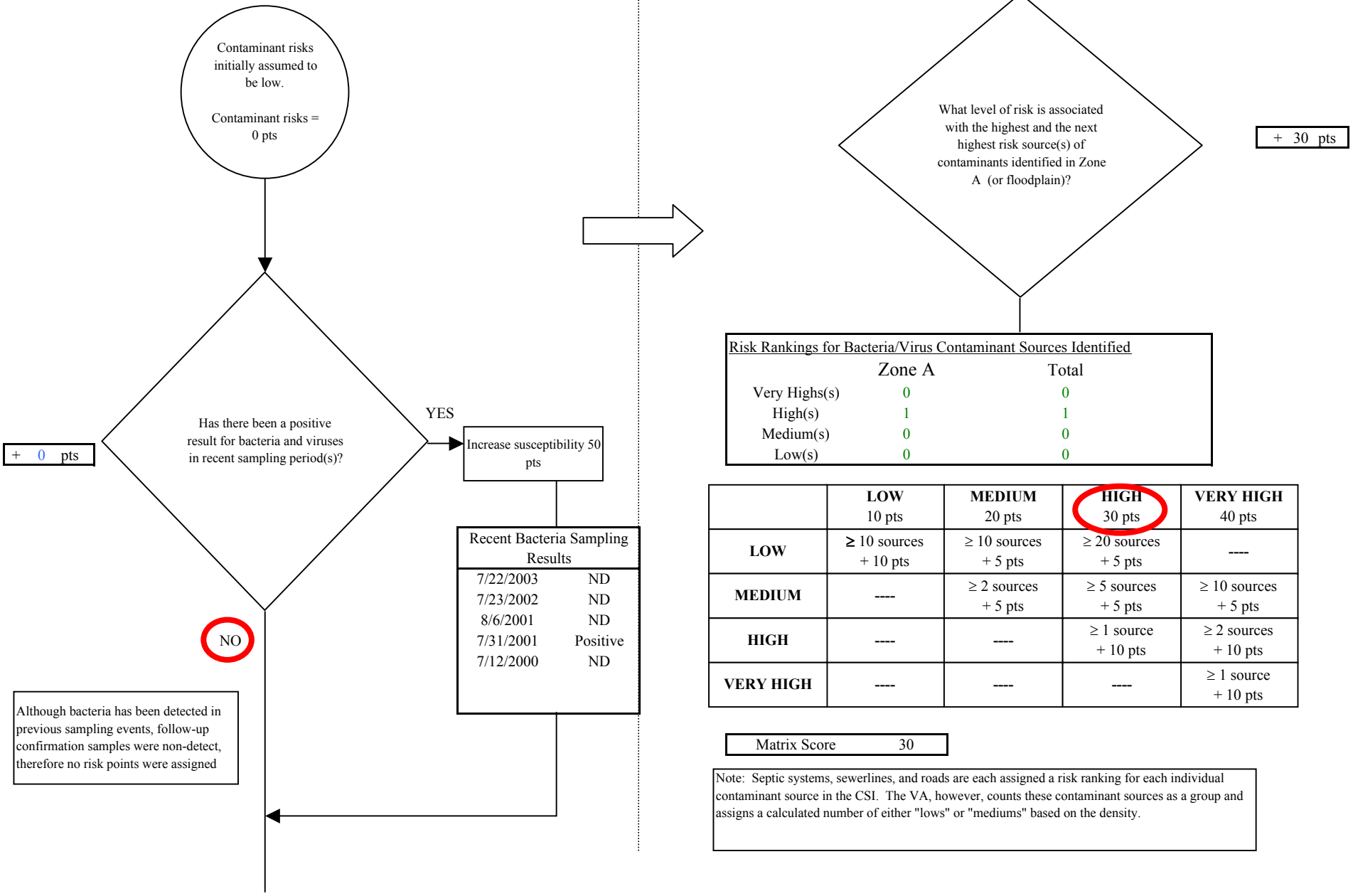


Chart 2. Contaminant risks for Katmai Fishing Lodge Water System (PWS No. 262107.001) - Bacteria & Viruses



Recent Bacteria Sampling Results	
7/22/2003	ND
7/23/2002	ND
8/6/2001	ND
7/31/2001	Positive
7/12/2000	ND

Risk Rankings for Bacteria/Virus Contaminant Sources Identified

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

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

Matrix Score 30

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

Chart 2. Contaminant risks for Katmai Fishing Lodge Water System (PWS No. 262107.001) - Bacteria & Viruses

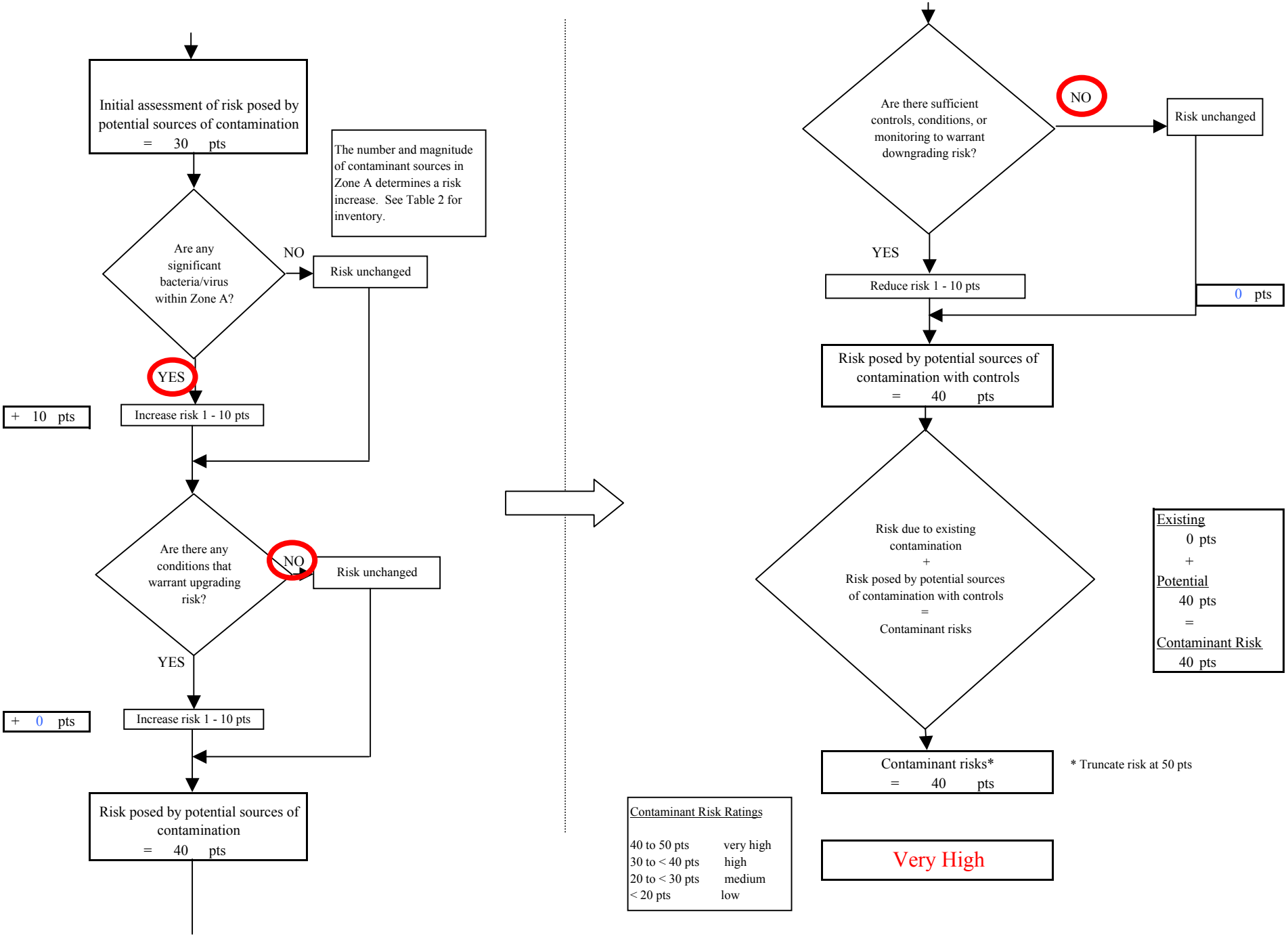


Chart 3. Vulnerability analysis for Katmai Fishing Lodge Water System (PWS No. 262107.001) - Bacteria & Viruses

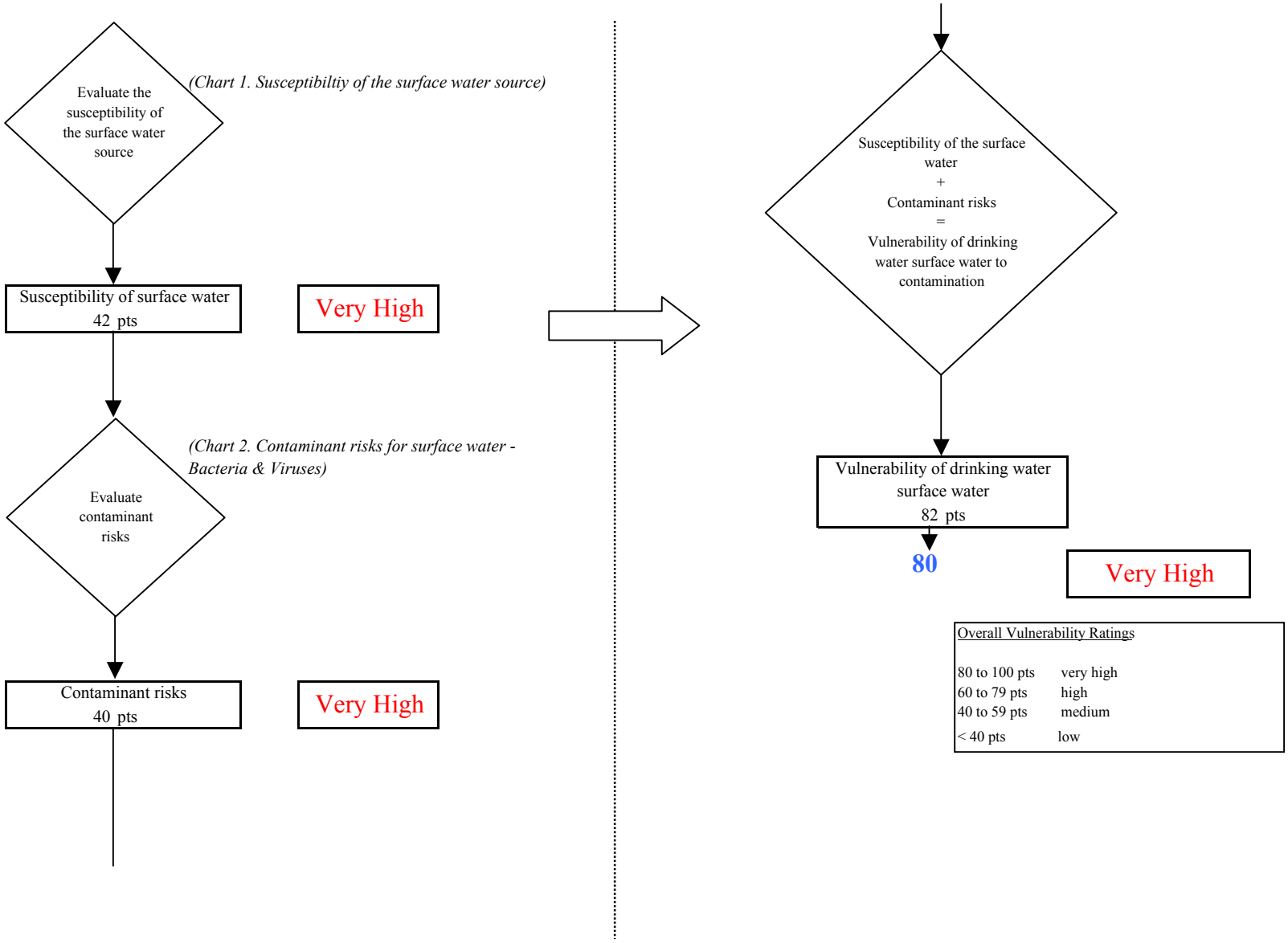


Chart 4. Contaminant risks for Katmai Fishing Lodge Water System (PWS No. 262107.001) - Nitrates and Nitrites

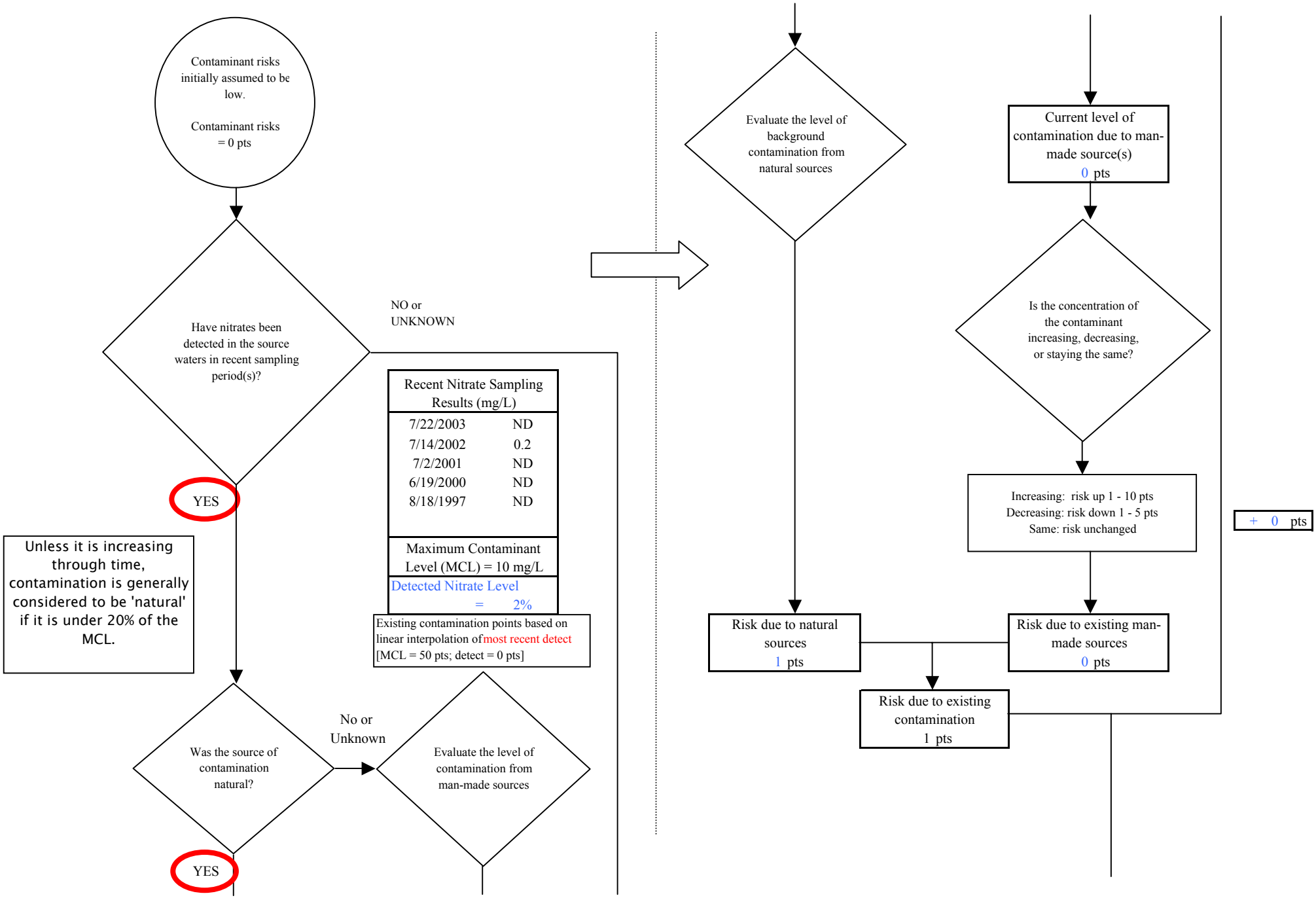


Chart 4. Contaminant risks for Katmai Fishing Lodge Water System (PWS No. 262107.001) - Nitrates and Nitrites

+ 40 pts

What level of risk is associated with the highest and the next highest risk sources(s) of contaminants identified in Zones A and B? (see Risk Matrix below)

Initial assessment of risk posed by potential sources of contamination = 40 pts

Are any significant nitrate/nitrite sources in Zone A?

NO → Risk unchanged → + 10 pts

YES → Increase risk 1 - 10 pts

The number and magnitude of contaminant sources in Zone A determines a risk increase. See Table 3 for inventory.

Risk Levels for Nitrate/Nitrite Sources identified in Zones A and B

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

	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 40

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

Chart 4. Contaminant risks for Katmai Fishing Lodge Water System (PWS No. 262107.001) - Nitrates and Nitrites

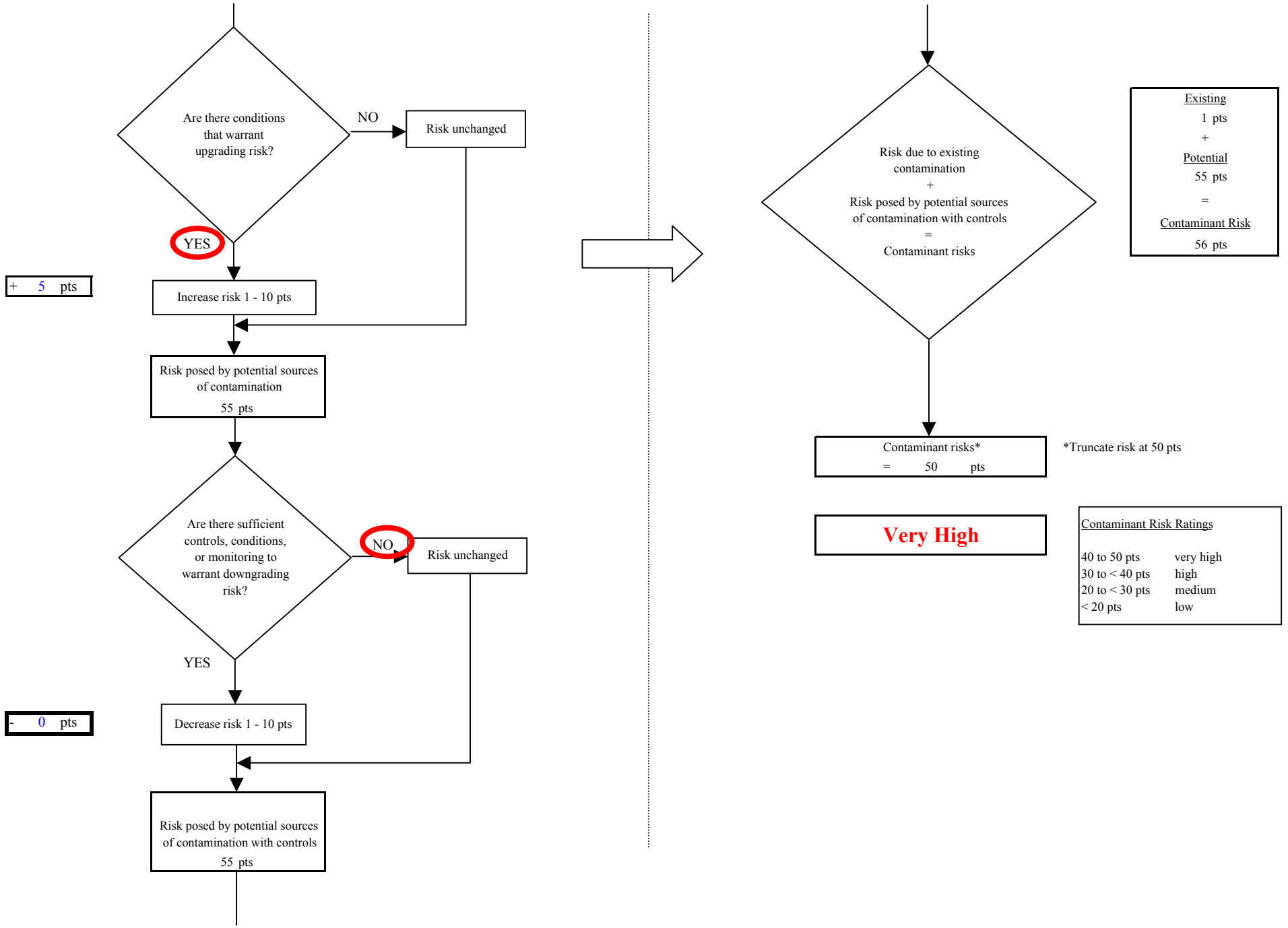


Chart 5. Vulnerability analysis for Katmai Fishing Lodge Water System (PWS No. 262107.001) - Nitrates and Nitrites

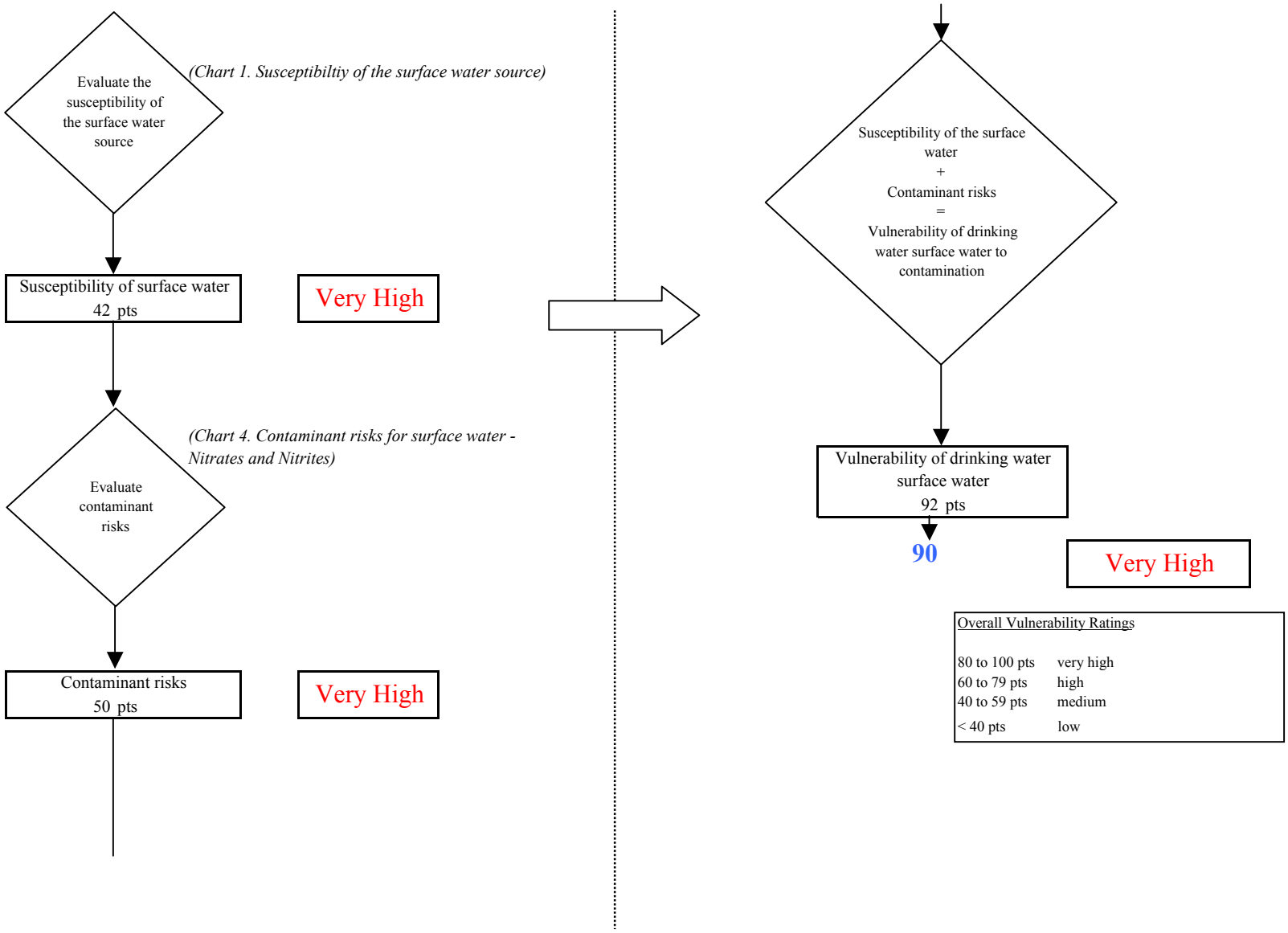


Chart 6. Contaminant risks for Katmai Fishing Lodge Water System (PWS No. 262107.001) - Volatile Organic Chemicals

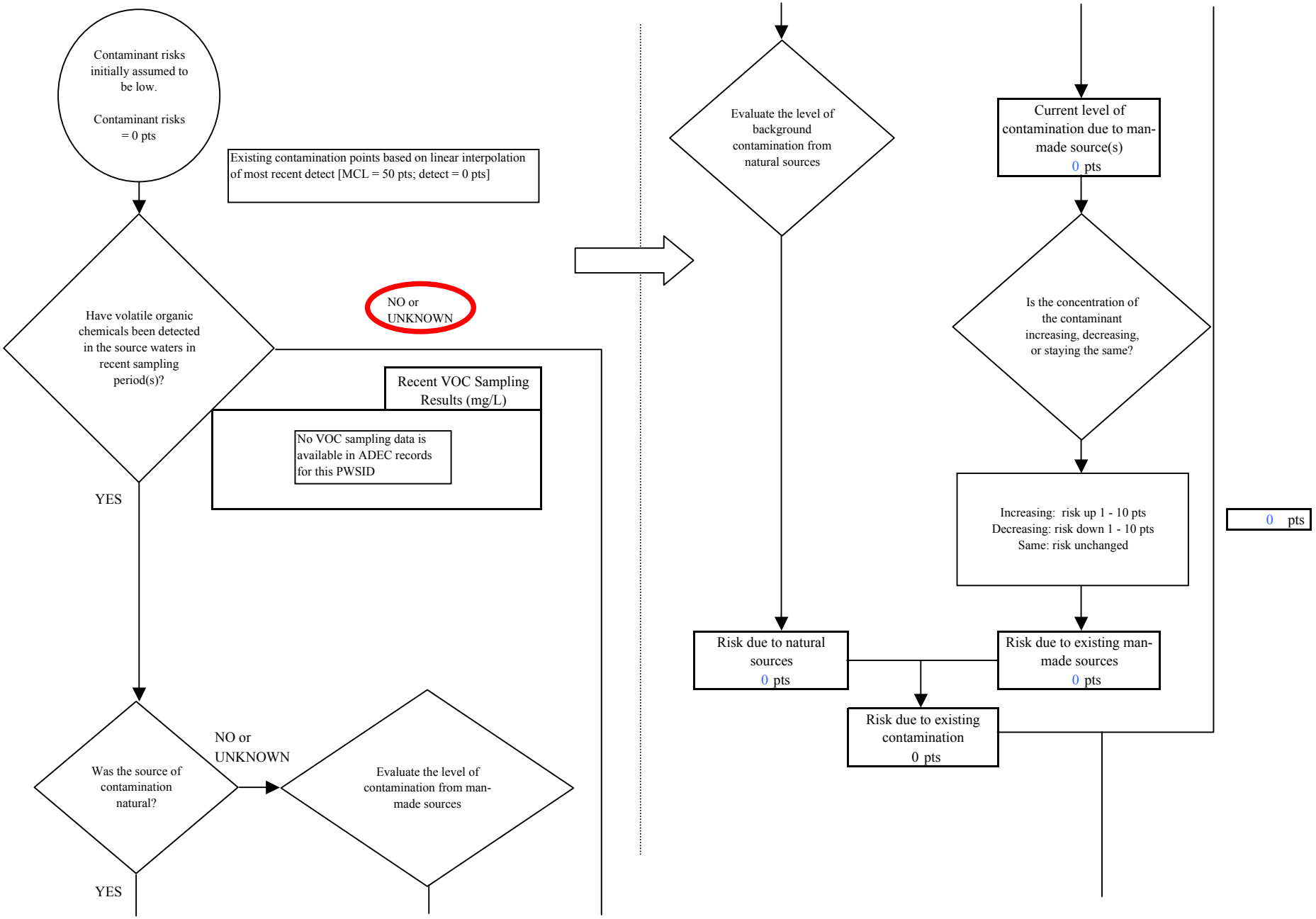


Chart 6. Contaminant risks for Katmai Fishing Lodge Water System (PWS No. 262107.001) - Volatile Organic Chemicals

+ 10 pts

What level of risk is associated with the highest and the next highest risk sources(s) of contaminants identified in Zones A and B? (see Risk Matrix below)

Risk Levels for VOC Sources identified in Zones A and B

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

	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.

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

Are any significant VOC sources in Zone A?

NO → Risk unchanged

The number and magnitude of contaminant sources in Zone A determines a risk increase. See Table 4 for inventory.

YES

Increase risk 1 - 10 pts

+ 2 pts

Chart 6. Contaminant risks for Katmai Fishing Lodge Water System (PWS No. 262107.001) - Volatile Organic Chemicals

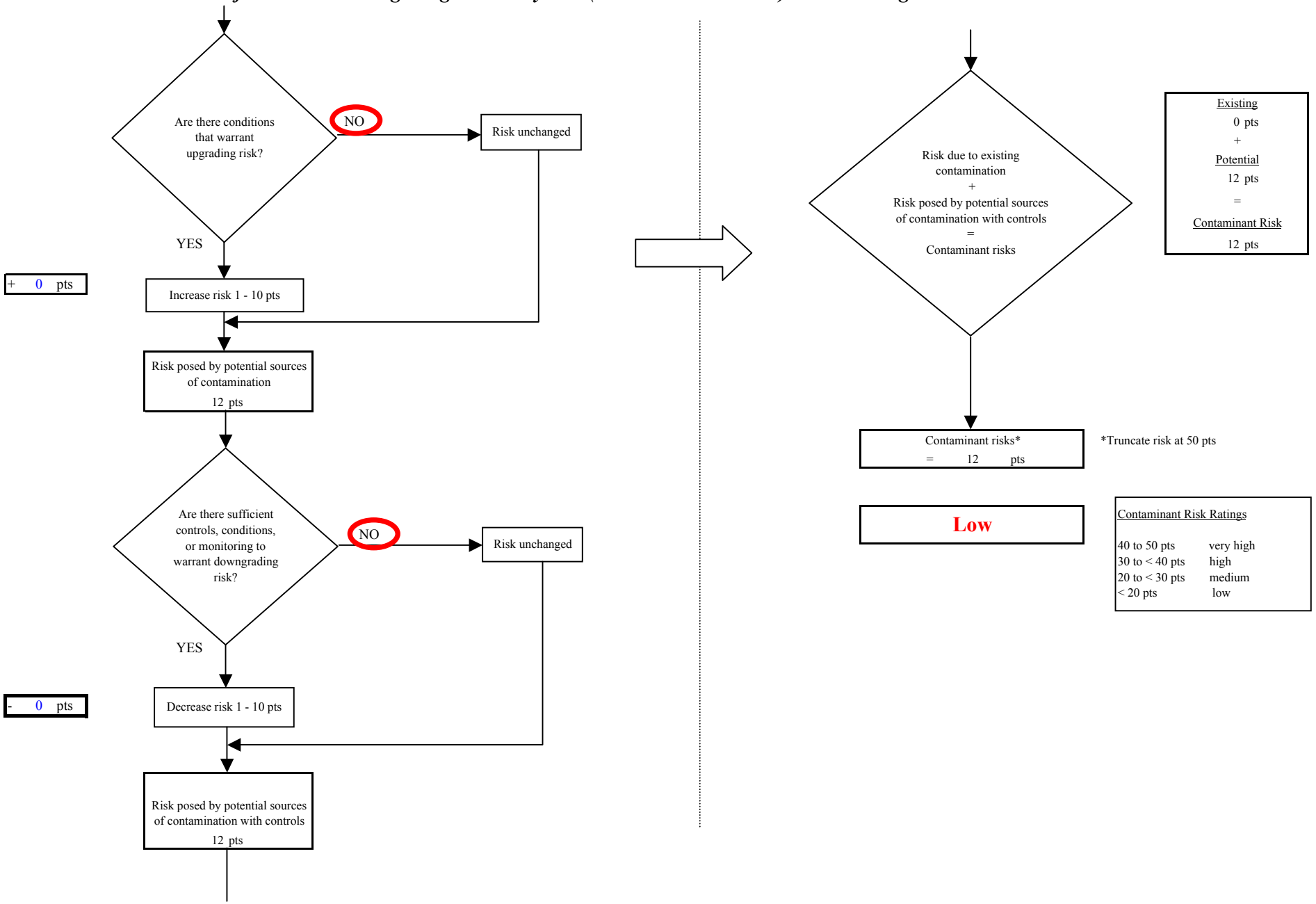


Chart 7. Vulnerability analysis for Katmai Fishing Lodge Water System (PWS No. 262107.001) - Volatile Organic Chemicals