Source Water Assessment

A Hydrogeologic Susceptibility and Vulnerability Assessment for George Inlet Lodge, Ketchikan, Alaska PWSID #121474

DRINKING WATER PROTECTION PROGRAM REPORT NO. 719

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.

CONTENTS

TABLES

APPENDICES

Source Water Assessment for George Inlet Lodge, Ketchikan, Alaska

Drinking Water Protection Program
Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

The public water system for George Inlet Lodge is a Class B (transient/non-community) water system consisting of one surface water intake from a small creek. George Inlet Lodge is at Mile 11 South Tongass Highway, Ketchikan, Alaska. The surface water intake received a susceptibility rating of **Very High**. A rating of High to Very High is typical for all surface water systems. Identified potential and current sources of contaminants for George Inlet Lodge public drinking water source include dirt/gravel highways and roads. Identified potential and existing sources of contamination include sources of bacteria and viruses, nitrates and/or nitrites, and volatile organic chemicals. Contaminant sources could potentially contribute bacteria and viruses, nitrates and/or nitrites, and volatile organic chemicals into the source waters. Overall, the public water sources for George Inlet Lodge received a vulnerability rating of **Medium** for bacteria and viruses; **High** for nitrates and nitrites; and **Medium** for volatile organic chemicals.

GEORGE INLET LODGE PUBLIC DRINKING WATER SYSTEM

George Inlet Lodge public water system is a Class B (transient/non-community) water system. The system consists of one surface water intake at Mile 11 South Tongass Highway, Ketchikan, Alaska (See Map 1 of Appendix A). Ketchikan Gateway Borough and City is located on Revillagigedo Island, on Tongass Narrows, 235 miles south of Juneau, Alaska (please see the inset of Map 1 in Appendix A for location). Ketchikan is Alaska's southern most major city, and the fourth largest. The population of Ketchikan is approximately 15,100.

Ketchikan averages about 160 inches of precipitation per year; and approximately 32 inches of snow. The groundwater sources underlying the area are recharged through the infiltration of precipitation and surface water. Groundwater sources in the region generally occur in the fractured bedrock and unconsolidated sediments deposited by glaciers and/or rivers. The elevation for Ketchikan is at sea level.

According to a System description the surface water intake is located upstream of the highway crossing and the raw water line routed through the culvert. The specific construction of the surface water intake is unknown. An adequately constructed intake may provide protection against debris and contaminants from entering the system. The raw water is treated by filtration and chlorination. The water is drawn out as needed from the storage tank, through the filters and pressure tank, to the points of use in the lodge. There is a potential for runoff within the area surrounding the surface water.

This system operates year round and serves approximately 2 residents and 24 non-residents through one connection.

GEORGE INLET LODGE DRINKING WATER PROTECTION AREA

In order to evaluate whether a drinking water source is at risk, we must first evaluate what are the most likely pathways for surface contamination to reach the creek. These areas are determined by looking at the characteristics of the creek, surrounding contaminant sources, and the intake.

The most probable area for contamination to reach the drinking water system is the area that contributes water to the surface water body that water is being drawn from. 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 system, this area will serve as the focus for voluntary protection efforts.

The size and shape of the DWPAs were established based on aerial distances from the surface water body, and the watershed that recharges the surface water body. Please refer to the Guidance Manual for Class B Public Water Systems for additional information.

The DWPAs established for surface water systems by the ADEC are separated into three zones. These zones correspond to different distances from the surface water body, and the entire watershed that recharges the surface water body. The following is a summary of the three DWPA zones and their definitions.

Table 1. Definition of Zones

Zone	Definition
A	1,000 feet from the Surface Water Body
B	1 mile from the Surface Water Body
C	Entire Watershed

The DWPA for George Inlet Lodge extends over the entire watershed. Development in the vicinity of the surface water intake 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 George Inlet Lodge DWPA. This inventory was completed through a search of agency records and other publicly-available information. Potential sources of contamination to the drinking water source 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

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.

VULNERABILITY OF GEORGE INLET LODGE DRINKING WATER SYSTEM

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

- Natural susceptibility; and
- Contaminant risks.

Each of the three categories of drinking water contaminants has been analyzed and an overall vulnerability score of 30 to 100 is ultimately assigned:

Natural Susceptibility (30 – 50 points)

+

Contaminant Risks (0 – 50 points)

=

Vulnerability of the
Drinking Water Source to Contamination (30 – 100).

A score for the Natural Susceptibility is achieved by analyzing the properties of the surface water source.

Natural Susceptibility
(Susceptibility of the Surface Water Source)
(30 – 50 Points)

The surface water intake for George Inlet Lodge is from a small creek. Because the creek is recharged by surface water runoff and precipitation, contaminants at or near the creek have the potential to adversely impact this drinking water source. Table 2 shows the Overall Susceptibility score and rating for George Inlet Lodge.

Table 2. Natural Susceptibility

	Score	Rating
Natural Susceptibility	50	Very High

Contaminant risks to a drinking water source depend on the type, number or density, and distribution of contaminant sources. This data has been derived from an examination of existing or historical contamination that has been detected at the drinking water source through routine sampling. It also evaluates potential sources of contamination. Table 3 summarizes the Contaminant Risks for each category of drinking water contaminants.

Table 3. Contaminant Risks

Category	Score	Rating
Bacteria and Viruses	5	Low
Nitrates and/or Nitrites	12	Low
Volatile Organic Chemicals	7	Low

Appendix D contains seven 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 Surface Water Source' to contamination by looking at the construction of the intake and its surrounding area and naturally-occurring attributes of the water source and influences on the groundwater system that might lead to contamination. 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 surface water. Chart 3 contains the 'Vulnerability Analysis for Bacteria and Viruses.' Charts 4 through 7 contain the Contaminant Risks and Vulnerability Analyses for nitrates and nitrites and volatile organic chemicals, respectively.

Table 4 contains the overall vulnerability scores (30 – 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	60	High
Volatile Organic Chemicals	55	Medium

Bacteria and Viruses

The contaminant risk for bacteria and viruses is **Low** with roads located within Zone A representing the risks to the drinking water (See Chart 2 – 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 have not been detected during recent water sampling of the system at the George Inlet Lodge. Combining the contaminant risks with the overall natural susceptibility of the surface water source, the vulnerability of the surface water source to contamination by bacteria and viruses is **Medium**.

Nitrates and Nitrites

The contaminant risk for nitrates and nitrites is **Low** with roads located within Zone A representing the risks to the drinking water (See Chart 4 - Contaminant Risks for Nitrates and/or Nitrites in Appendix D).

Sampling history for George Inlet Lodge indicates that nitrates have not been detected in the water. 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 surface water source, the overall vulnerability of the surface water source to contamination by nitrates and nitrites is **High**.

Volatile Organic Chemicals

The contaminant risk for volatile organic chemicals is **Low** with roads creating the only known risks for volatile organic chemicals (See Chart 6 – Contaminant Risks for Volatile Organic Chemicals in Appendix D).

Sampling history indicates that volatile organic chemicals have not been detected in the water. Combining the contaminant risk for volatile organic chemicals with the natural susceptibility of the surface water source, the overall vulnerability of the surface water source to contamination by volatile organic chemicals is **Medium**.

REFERENCES

Alaska Department of Community and Economic Development (ADCED), 2002 [WWW document]. URL http://www.dced.state.ak.us/mra/CF_BLOCK.cfm.

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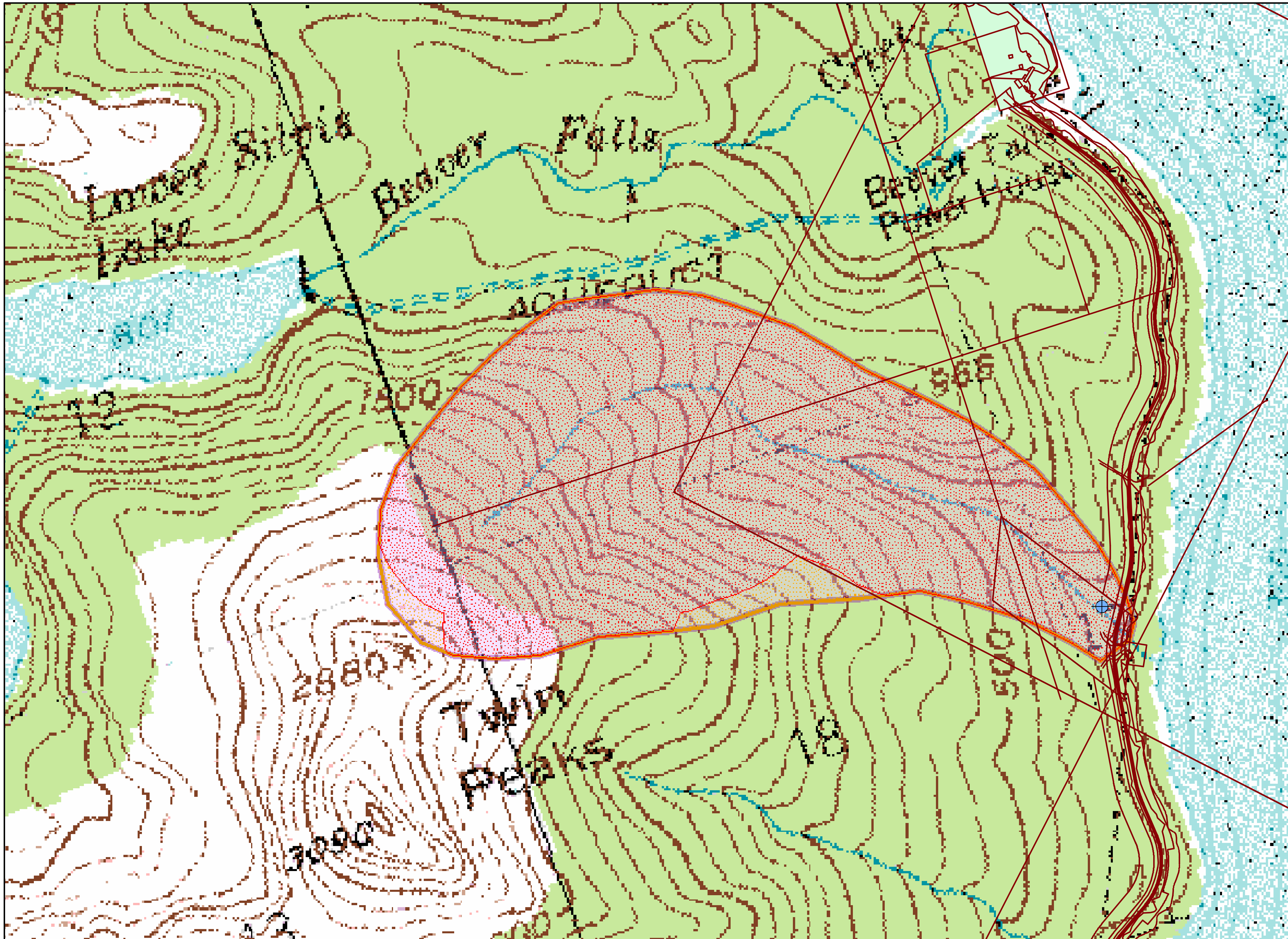
Gehrels, G.E., Berg, H.C., Geologic Map of Southeastern Alaska: U.S. Geological Survey Map (scale 1:600,000), Map I-1867, 1sheet.

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 (EPA), 2002 [WWW document]. URL: http://www.epa.gov/safewater/mcl.html.

APPENDIX A

George Inlet Lodge
Drinking Water Protection Area Location Map
(Map 1)



Map 1: George Inlet Lodge Drinking Water Protection Areas

PWSID: 121474.001

Alaska Department of Environmental Conservation

Alaska Drinking Water Protection Program

0 500 1,000 2,000 3,000 4,000 5,000 Feet

1:12,000

Data Sources:

Background image - USGS 1:63,000 mapping

Protection zones were delineated based upon streams noted on USFS Streams coverage.

Legend

Public Drinking Water Systems

Zone A Protection Area

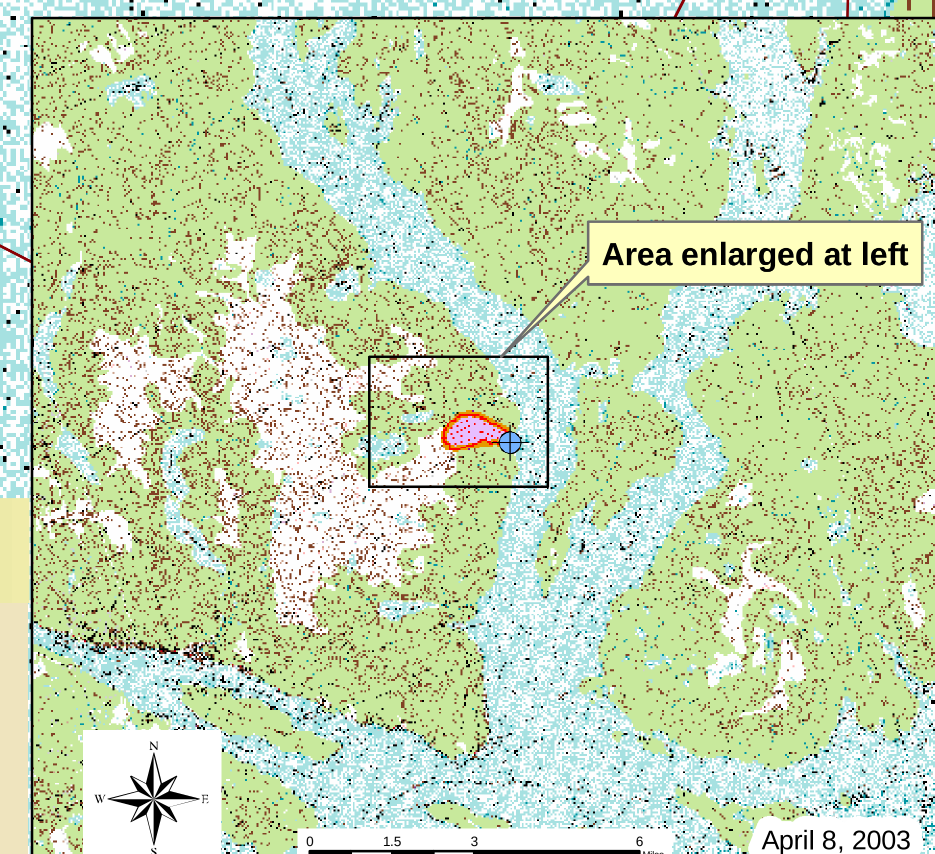
1000 Feet from Surface Water Body

Zone B Protection Area

1 Mile from Surface Water Body

Zone C Protection Area 2

Entire Watershed



April 8, 2003

APPENDIX B

Contaminant Source Inventory and Risk Ranking for George Inlet Lodge (Tables 1-4)

Table 1 *Contaminant Source Inventory for* ***PWSID 121474.001***

George Inlet Lodge

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Map Number*	*Comments*
Highways and roads, dirt/gravel	X24	X24-1	A	2	South Tongass Highway
Highways and roads, dirt/gravel	X24	X24-2	A	2	Driveway

Contaminant Source Inventory and Risk Ranking for

Table 2 ***PWSID 121474.001***

George Inlet Lodge

Sources of Bacteria and Viruses

Contaminant Source Type	***Contaminant Source ID***	***CS ID tag***	***Zone***	***Risk Ranking for Analysis***	***Map Number***	***Comments***
Highways and roads, dirt/gravel	X24	X24-1	A	Low	2	South Tongass Highway
Highways and roads, dirt/gravel	X24	X24-2	A	Low	2	Driveway

Contaminant Source Inventory and Risk Ranking for

Table 3 ***PWSID 121474.001***

George Inlet Lodge

Sources of Nitrates/Nitrites

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Highways and roads, dirt/gravel	X24	X24-1	A	Low	2	South Tongass Highway
Highways and roads, dirt/gravel	X24	X24-2	A	Low	2	Driveway

Contaminant Source Inventory and Risk Ranking for

Table 4 ***PWSID 121474.001***

George Inlet Lodge

Sources of Volatile Organic Chemicals

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Highways and roads, dirt/gravel	X24	X24-1	A	Low	2	South Tongass Highway
Highways and roads, dirt/gravel	X24	X24-2	A	Low	2	Driveway

APPENDIX C

George Inlet Lodge
Drinking Water Protection Area
and Potential and Existing Contaminant Sources
(Map 2)

X24-2

X24-1

Area Enlarged at Left

Map 2: George Inlet Lodge - Potential and Existing Sources of Contamination

PWSID: 121474.001

Alaska Department of Environmental Conservation

Alaska Drinking Water Protection Program

0 350 700 1,400 2,100 Feet

1:8,000

Data Sources:

Background image - USGS 1:63,000 mapping

Protection zones were delineated based upon streams noted on USFS Streams coverage.

Legend

George Inlet Lodge Intake

Zone A Protection Area
1000 Feet from Surface Water Body

Zone B Protection Area
1 Mile from Surface Water Body

Zone C Protection Area 2
Entire Watershed

N W E S

0 0.4 0.8 1.6 Miles

April 8, 2003

APPENDIX D

Vulnerability Analysis for George Inlet Lodge Public Drinking Water Source

(Charts 1-7)

Chart 1. Susceptibility of the Surface Water Source - George Inlet Lodge

All surface water bodies assumed to be highly susceptible to contamination.

Susceptibility = 30 pts

+ 5 pts

Is the intake adequately constructed?

No

Increase susceptibility 5 pts

No, there is not a record of the intake being screened.

Yes

+ 5 pts

Evaluate the potential for runoff within the 1 mile protection area (or floodplain)

Average annual rainfall = 160 inches Slope of land surface = 36% (from topography of stream up the mountain)

Average annual precipitation:
≤ 15 in/yr, 0 pts
> 15 in/yr, 2 pts

Slope of land surface:
≤ 3%, 0 pts
> 3%, 3 pts

Increase susceptibility 0-5 pts

Evaluate the capacity of the surface water body to dilute contaminants

Assumed <20,000 cfs

+ 10 pts

River or stream discharge
≥ 90,000 cfs, 0 pts
> 20,000 - 90,000 cfs, 5 pts
< 20,000, 10 pts

Lakes or ponds
Area: > 1 mi2, 0 pts
≤ 1 mi^2, 5 pts
Residence time:
≤ 1 yr, 0 pts
> 1 yr, 5 pts

Increase susceptibility 0-10 pts

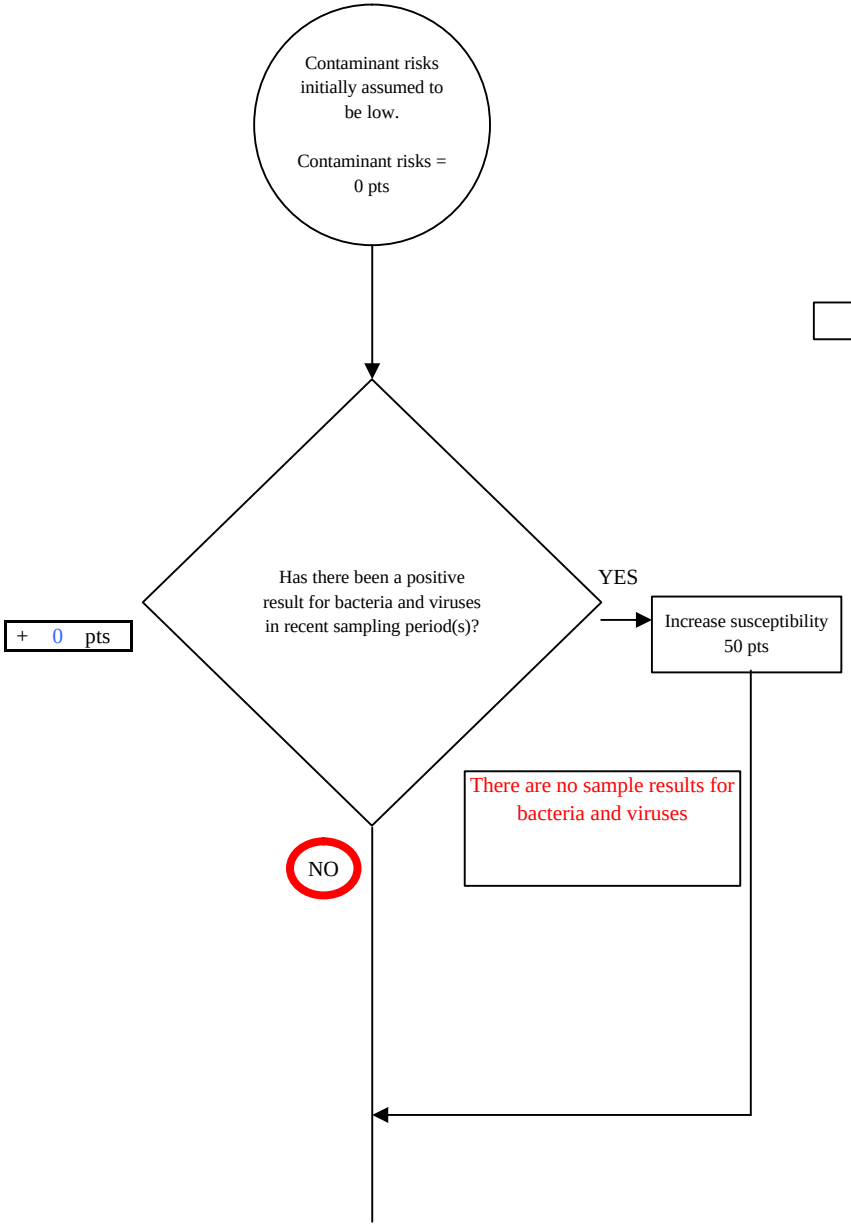
Susceptibility of surface water 50 pts

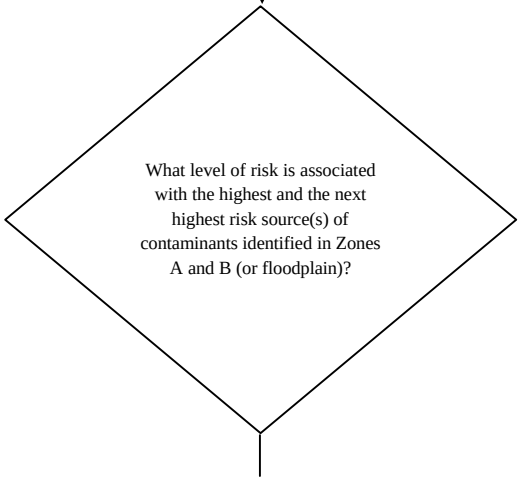
Very High

Surface Water Source Susceptibility Ratings

40 to 50 pts very high
30 to < 40 pts high

Chart 2. Contaminant Risks for George Inlet Lodge - Bacteria & Viruses





+ 10 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)	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	[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, 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 George Inlet Lodge - Bacteria & Viruses

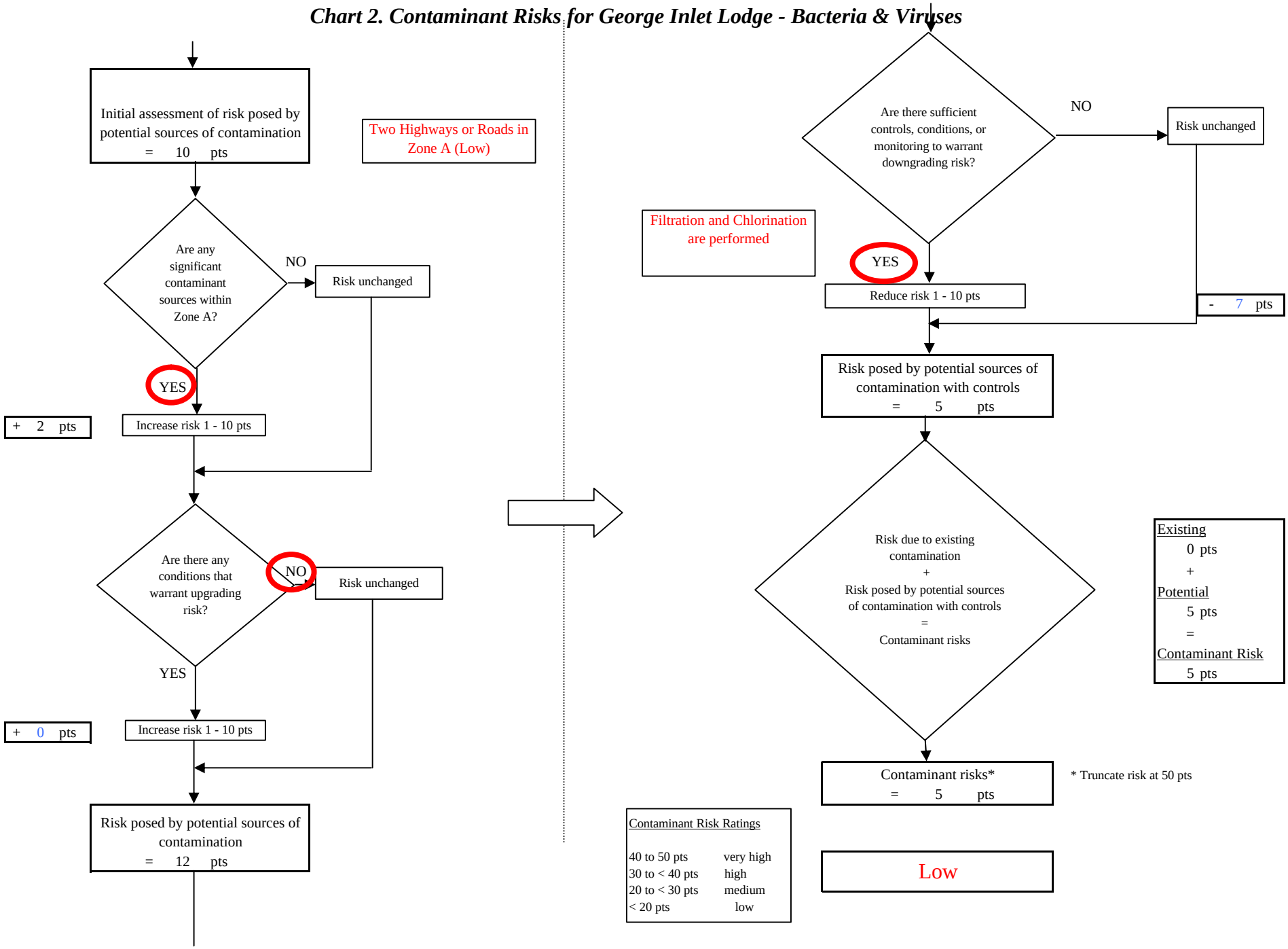


Chart 3. Vulnerability Analysis for George Inlet Lodge - Bacteria & Viruses

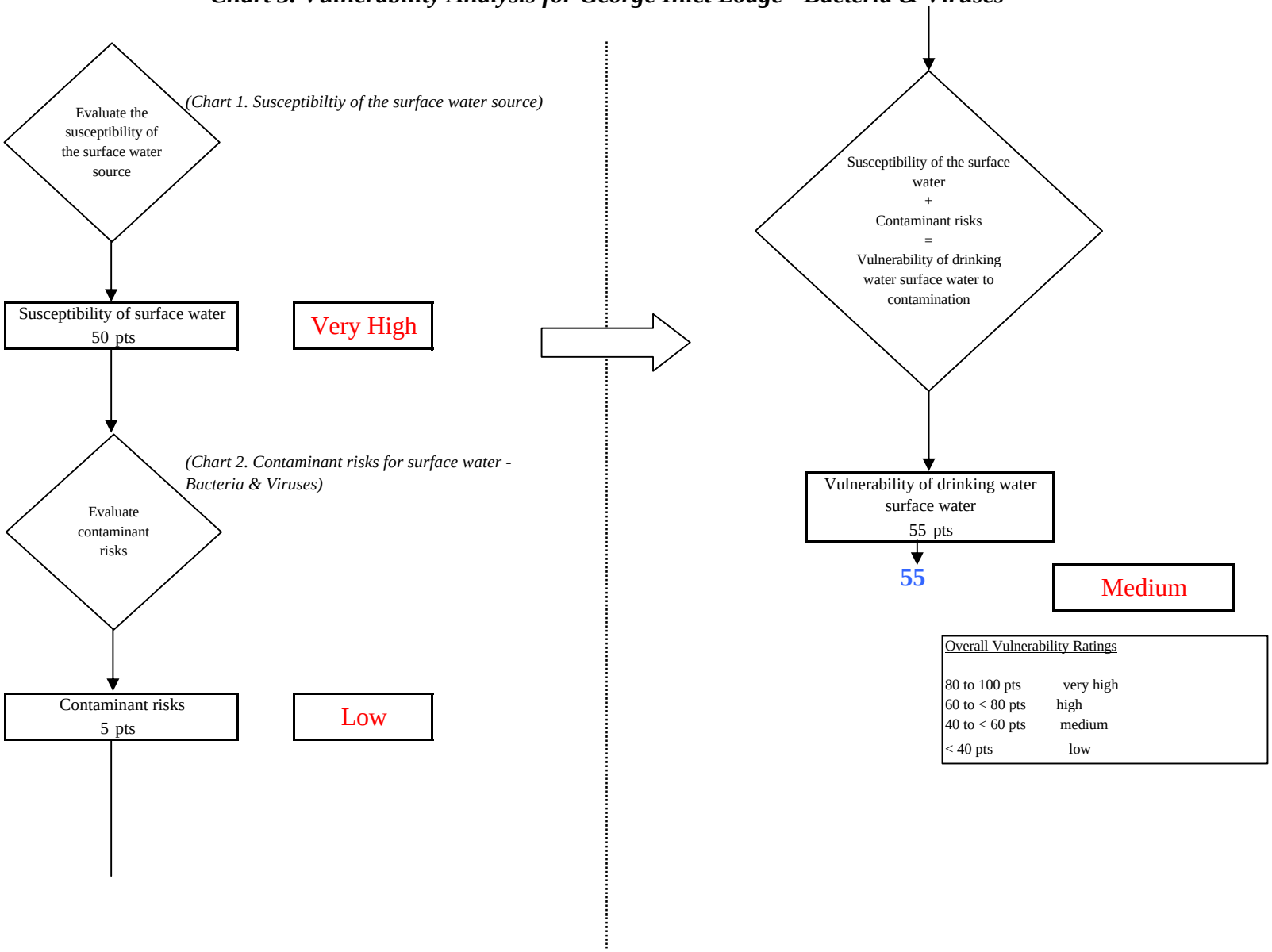


Chart 4. Contaminant Risks for George Inlet Lodge - Nitrates and Nitrites

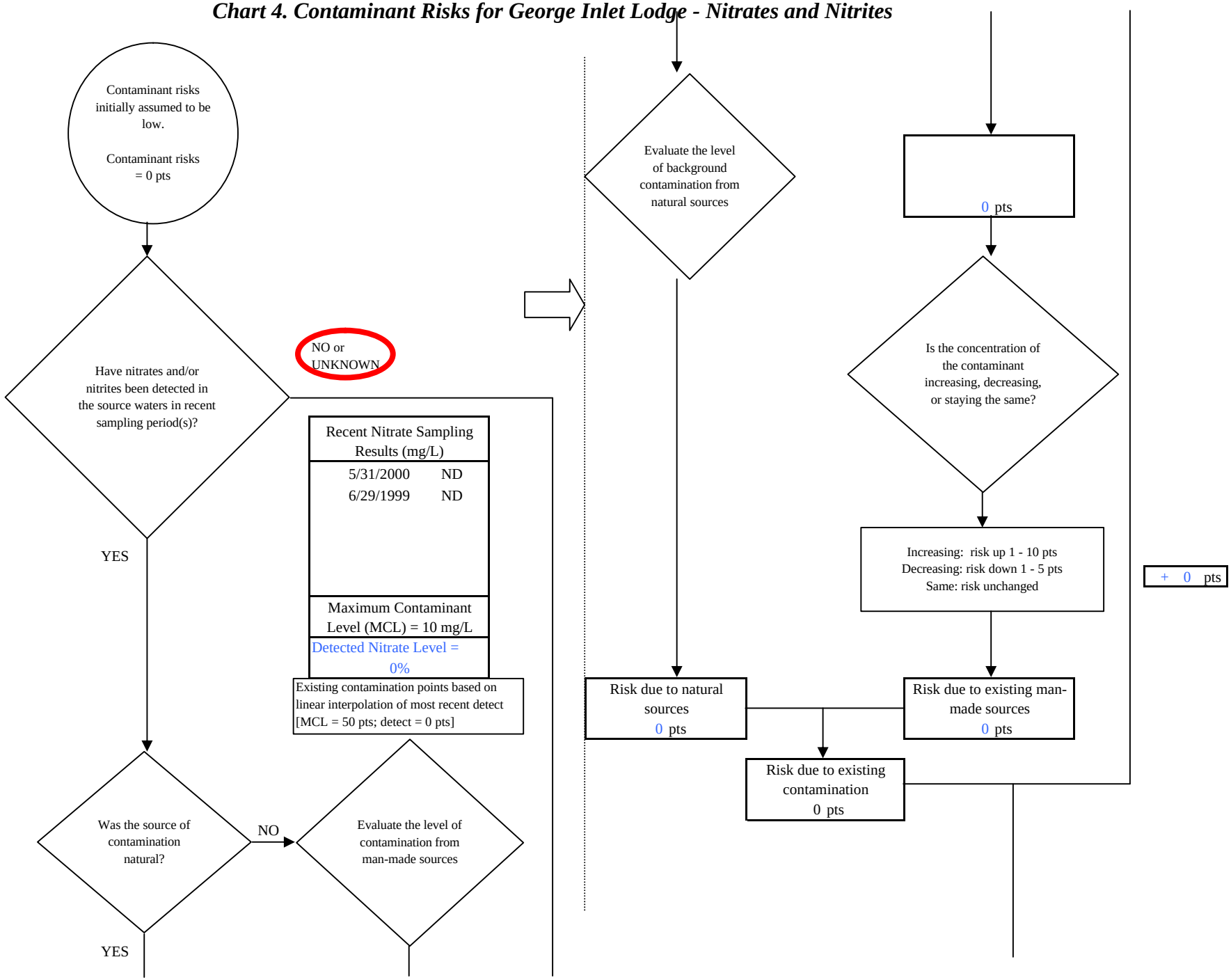


Chart 4. Contaminant Risks for George Inlet Lodge - Nitrates and Nitrites

+ 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)

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

Are any significant sources in Zone A?

NO → Risk unchanged

YES

Two Highways or Roads in Zone A

Increase risk 1 - 10 pts

+ 2 pts

Risk Levels for Contaminant 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	[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, 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 George Inlet Lodge - Nitrates and Nitrites

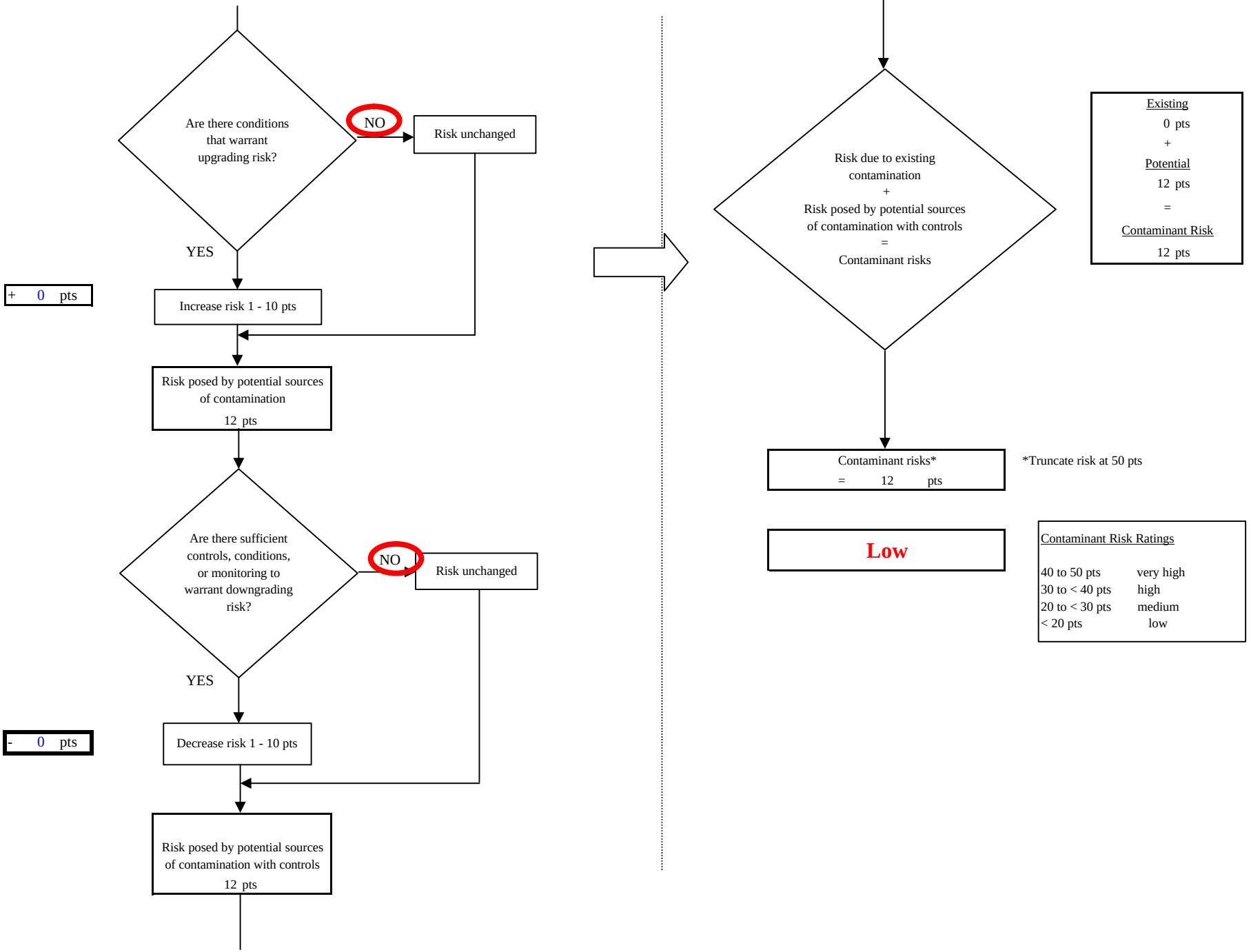


Chart 5. Vulnerability Analysis for George Inlet Lodge - Nitrates and Nitrites

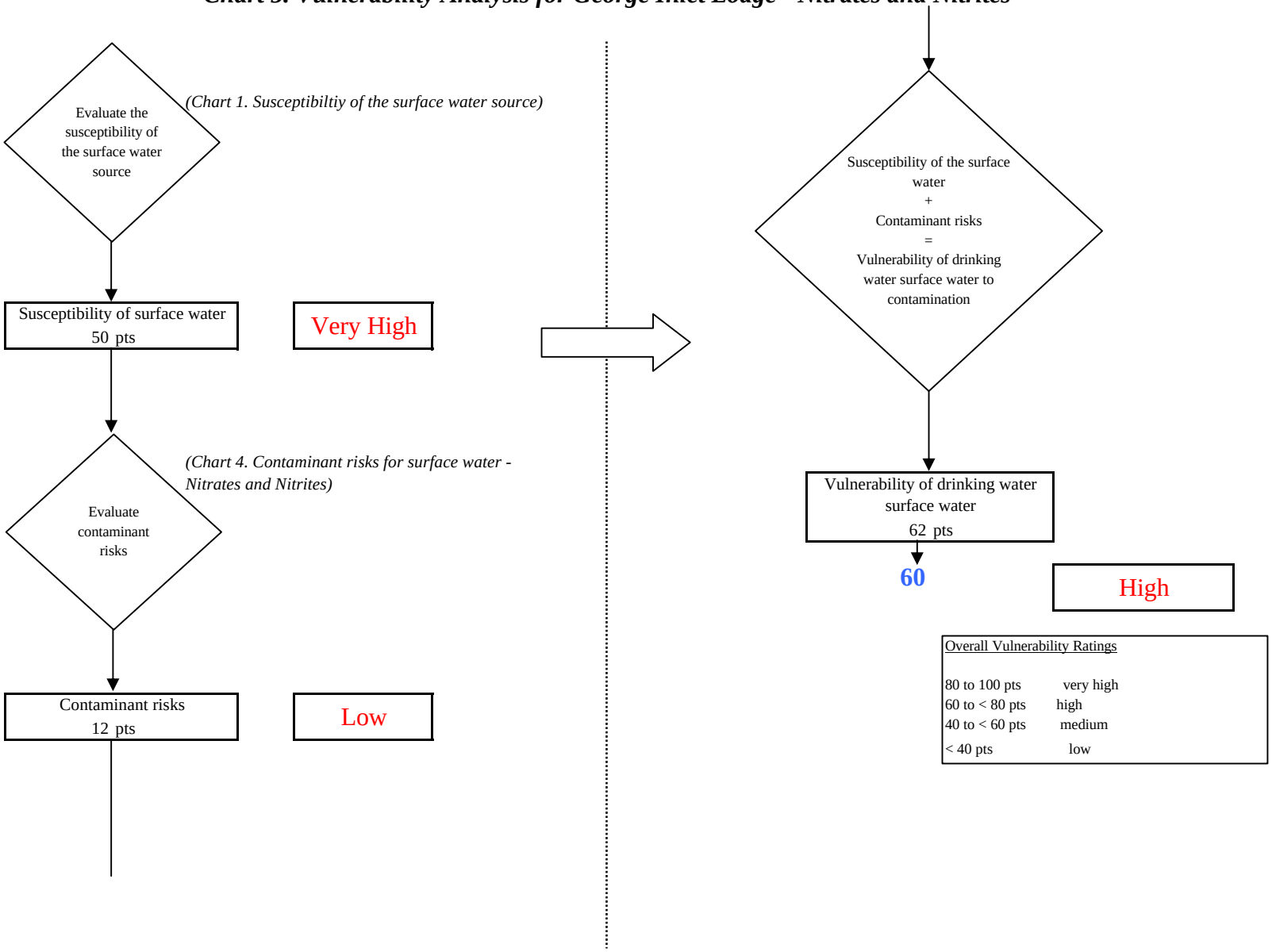


Chart 6. Contaminant Risks for George Inlet Lodge - Volatile Organic Chemicals

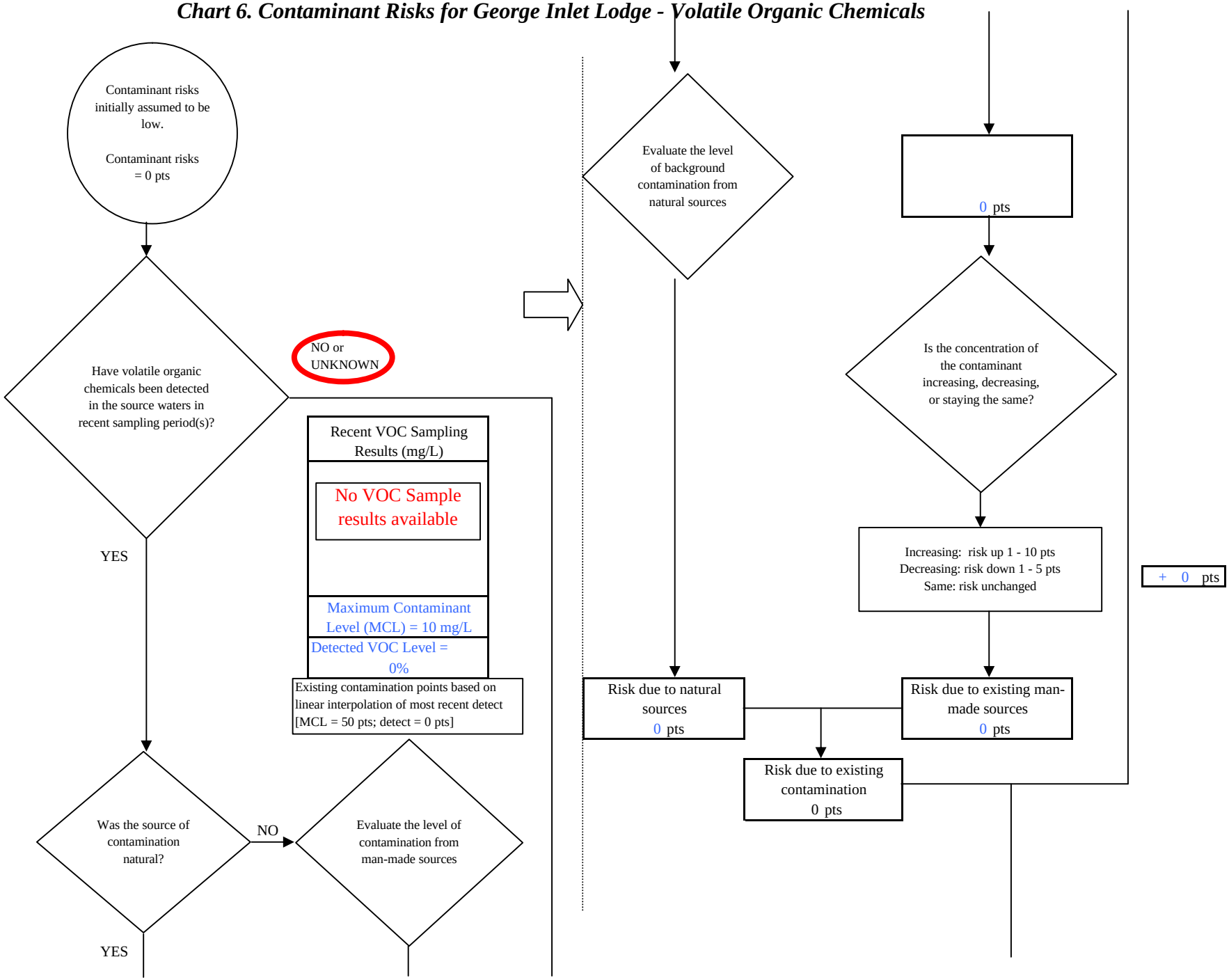


Chart 6. Contaminant Risks for George Inlet Lodge - Volatile Organic Chemicals

+ 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)

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

Are any significant sources in Zone A?

NO

Risk unchanged

YES

Two Highways or Roads in Zone A

Increase risk 1 - 10 pts

+ 2 pts

Risk Levels for Contaminant 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	[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, 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 6. Contaminant Risks for George Inlet Lodge - Volatile Organic Chemicals

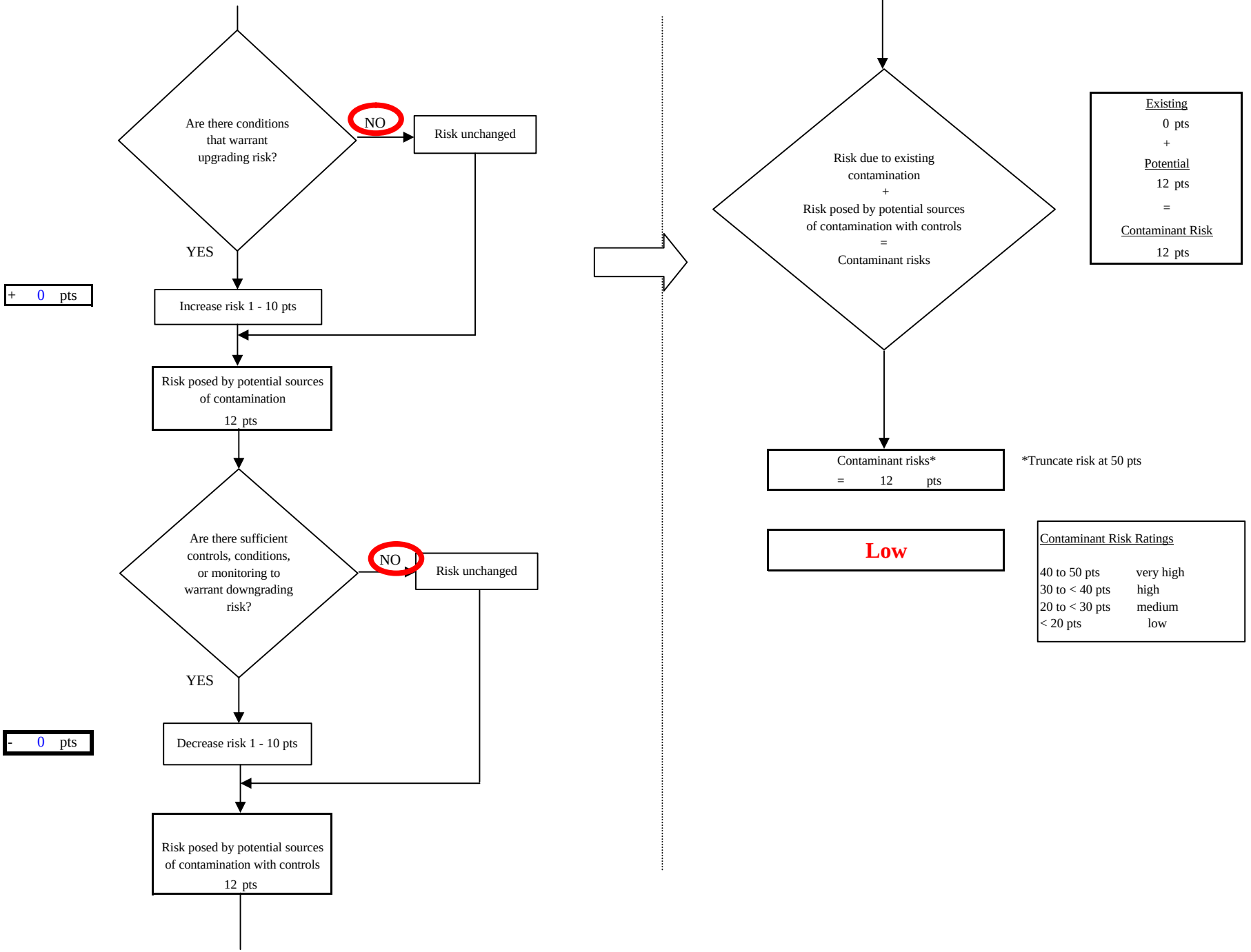


Chart 7. Vulnerability Analysis for George Inlet Lodge - Volatile Organic Chemicals