Source Water Assessment

A Hydrogeologic Susceptibility and Vulnerability Assessment for King Point Lodge Drinking Water System, Lake Creek, Alaska

King Point Lodge # 225008

DRINKING WATER PROTECTION PROGRAM REPORT # 262
Alaska Department of Environmental Conservation

AUGUST 2002

Source Water Assessment for King Point Lodge Drinking Water System, Lake Creek, Alaska King Point Lodge # 225008

By Shannon & Wilson, Inc.

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The Drinking Water Protection Program 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. 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 King Point Lodge Source of Public Drinking Water, Lake Creek, Alaska

By Shannon & Wilson, Inc.

Drinking Water Protection Program
Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

The King Point Lodge is a Class B (transient/non-community) water system consisting of one well, located near the confluence of Lake Creek and the Yentna River. Identified potential and current sources of contaminants for King Point Lodge public drinking water source include: aboveground heating oil tanks; large-capacity and single-family septic systems; abandoned wells; wastewater collection systems; and residential areas. 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 King Point Lodge received a vulnerability rating of **Very High** for volatile organic chemicals, **Very High** for bacteria and viruses, and **Very High** for nitrates and nitrites.

INTRODUCTION

The Alaska Department of Environmental Conservation (ADEC) is completing source water assessments for all public drinking water sources in the State of Alaska. The purpose of this assessment is to provide owners and/or operators, communities, and local governments with information they can use to preserve the quality of Alaska's public drinking water supplies. The results of this source water assessment can be used to decide where voluntary protection efforts are needed and feasible, and also what efforts will be most effective in reducing contaminant risks to your water system. Shannon & Wilson has been contracted to perform these assessments under the supervision of ADEC.

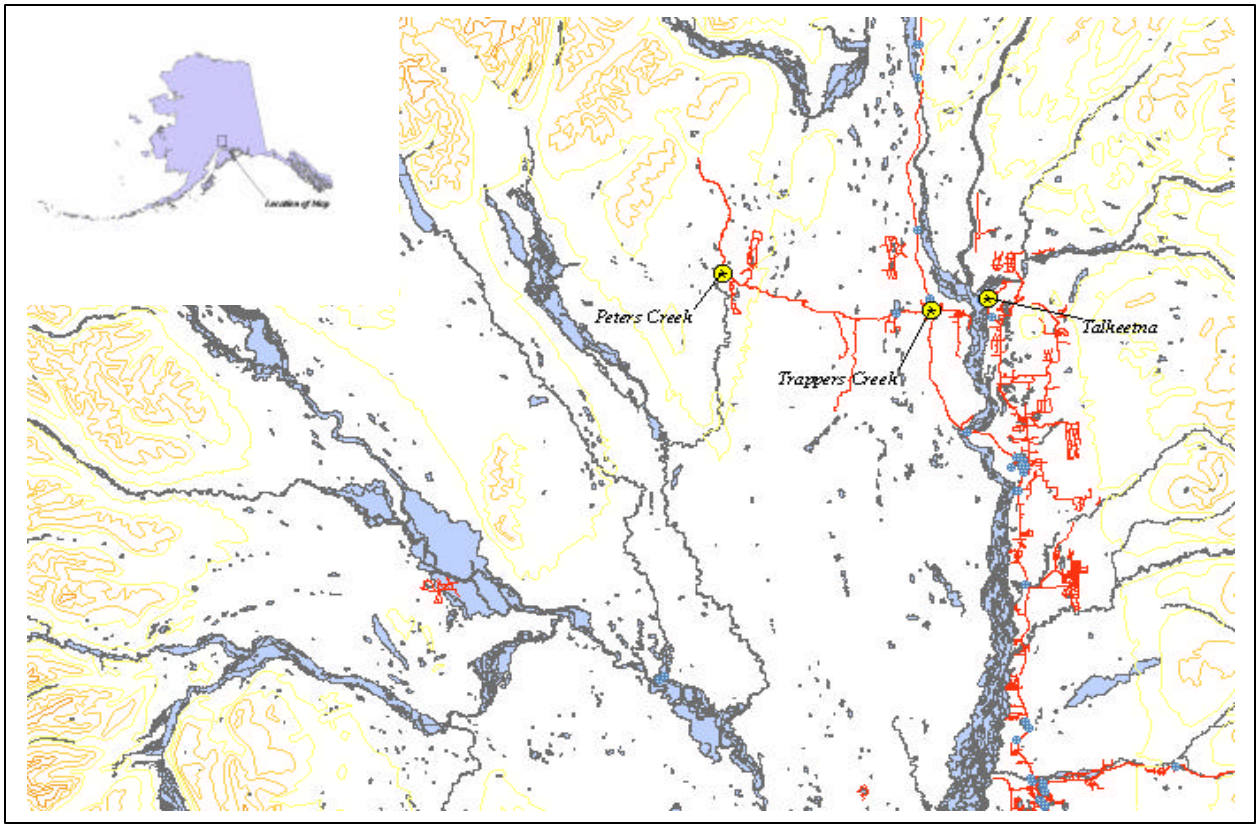


Figure 1. Index map showing the location of the Middle Susitna River Region.

This source water assessment combines a review of the natural conditions at the site and the potential and existing contaminant risks. These are combined to determine the overall vulnerability of the drinking water source to contamination.

DESCRIPTION OF THE MIDDLE SUSITNA RIVER REGION

Location

The Susitna River watershed is the largest watershed in Southcentral Alaska with the community of Talkeetna located at the confluence of the Chulitna, Talkeetna, and Susitna rivers. The area surrounding Talkeetna is shown in Figure 1. Talkeetna is located in the Matanuska-Susitna (Mat-Su) Borough.

Glacial and alluvial forces have shaped the Susitna River Region surrounding Talkeetna. These forces have resulted in the broad U-shaped river valleys, lakes, streams and undulating ridges and hills. Landforms in and around the Middle Susitna River Region are typified by the broad river floodplains, low ridges and lowlands.

Precipitation

Talkeetna averages about 30 inches of precipitation per year, including about 107 inches of snowfall.

Topography and Drainage

The area topography varies from about 300 feet to 400 feet within the river floodplains to several thousand feet on the surrounding ridges and mountain flanks.

Groundwater

Although the quality can vary significantly in a short distance, groundwater supplies are generally abundant in the area. Many homes and businesses in the area rely on individual wells for their water supply. Most of these wells are shallow with depths of less than 100 feet to 200 feet. Static water levels in many of these wells are less than 15 feet below the surface. The coarse, alluvial, sandy gravel in the floodplains of the areas streams and rivers provides a large aquifer even in the winter when infiltration is low.

Geology and Soils

Most of the soils in the area provide good sources of sand, gravel and topsoil. The deposition of silt, clay and organic muck in old lakes, oxbows and depressions means that some areas have soil conditions that vary over relatively short distances.

KING POINT LODGE PUBLIC DRINKING WATER SYSTEM

King Point Lodge is a Class B (transient/non-community) water system. The system consists of one well north of the confluence of Lake Creek and the Yentna River.

According to the well log completed for the water system, installation of the well occurred on July 1, 1990, to a total depth of approximately 30 feet below ground surface and was completed with 6-inch well casing. The most recent Sanitary Survey (8/4/00) indicates the well was installed with a cap providing a sanitary seal. A properly installed sanitary seal may provide protection against contaminants from entering the source waters at the well casing. The land surface is also appropriately sloped away from the well providing adequate surface water drainage. The well log is unclear as to whether the well was grouted according to ADEC regulations. Proper grouting provides added protection against contaminants travelling along the well casing and into source waters.

This system operates seasonally and serves 11 residents and more than 18 non-residents through one service connection.

KING POINT 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 groundwater. Some areas are more likely to allow contamination to reach the well than others. 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 a release 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 adopted from the U.S. Geological Survey (*Patrick, Brabets, and Glass, 1989*), and State of Alaska Department of Water Resources. 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 King Point Lodge drinking water system has been classified as a system with groundwater under the direct influence of surface water (GWUDISW). The DWPAs established for wells that have GWUDISW by the ADEC are separated into seven zones. These zones correspond to differences in the time-of-travel (TOT) of the water moving through the aquifer to the well and distances to the surface water body that the well is under the influence of. The time of travel 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 DWPA zones and the calculated TOT or distances for each:

Table 1. Definition of Zones

Zone	Definition
A	¼ the distance for the 2 year TOT
B	Less than the 2 year TOT
C	Less Than the 5 year TOT
D	Less than the 10 year TOT
E	1000 Feet from Surface Water Body
F	1 Mile from Surface Water Body
G	Entire Watershed

As an example, water moving through the aquifer in Zone B will reach the well in less than 2 years from the time it crosses the outer limit of Zone B.

Zone A also incorporates the area downgradient from the well to take into account the area of the aquifer that is influenced by pumping of the well. Water within the aquifer in Zone A will reach the well in several hours to several months.

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 King Point 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 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; and
- Volatile organic chemicals.

Inventoried potential sources of contamination within Zones A through Zone G were associated with residential and light industrial type activities. The sources are summarized in the tables in Appendix B.

RANKING OF CONTAMINANT RISKS

Once the potential and existing sources of contamination have been identified, they are sorted and ranked 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. Further, contaminant risks are a function of the number and density of those types of contaminant sources as well as the proximity of those sources to the well.

VULNERABILITY OF KING POINT LODGE DRINKING WATER SOURCE

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 0 to 100 is ultimately assigned:

Natural Susceptibility (0 – 50 points)

+

Contaminant Risks (0 – 50 points)

=

Vulnerability of the
Drinking Water Source to Contamination (0 – 100).

A score for the Natural Susceptibility is achieved by analyzing the properties of the well and the aquifer.

Susceptibility of the Wellhead (0 – 25 Points)

+

Susceptibility of the Aquifer (0 – 25 Points)

=

Natural Susceptibility (Susceptibility of the Well)
(0 – 50 Points)

The well for King Point Lodge is completed in an unconfined aquifer setting. Because an unconfined aquifer is 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 Overall Susceptibility score and rating for King Point Lodge.

Table 2. Natural Susceptibility - Susceptibility of the Wellhead and Aquifer to Contamination

	Score	Rating
Susceptibility of the Wellhead	25	Very High
Susceptibility of the Aquifer	25	Very High
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	50	Very High
Nitrates and/or Nitrites	50	Very High
Volatile Organic Chemicals	50	Very High

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.

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 of King Point Lodge to Contamination by Category

Category	Score	Rating
Bacteria and Viruses	100	Very High
Nitrates and Nitrites	100	Very High
Volatile Organic Chemicals	100	Very High

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.

The large-capacity septic systems and two abandoned wells create a risk increase for the bacteria and viruses, nitrates and nitrites, and volatile organic compounds.

Only a small amount of bacteria and viruses are required to endanger public health. Bacteria and viruses were detected during water sampling in August 2000 at King Point Lodge.

Nitrates and/or nitrites are found in natural background concentration at this site, as elsewhere throughout Alaska. Nitrate concentrations in uncontaminated groundwater are typically less than 2 milligrams per liter (mg/L) and are derived primarily from the decomposition of organic matter in soils, adopted from the U.S. Geological Survey (Wang, et al., 2000).

Sampling history for King Point Lodge well indicates that low concentrations of nitrate have been detected (see Chart 5 - Contaminant Risks for Nitrates and/or Nitrites in Appendix D). Existing nitrate concentration is approximately 0.70 mg/L or 7% of the Maximum Contaminant Level (MCL) of 10 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. Due to the high solubility and weak retention by soil, nitrates are very mobile, moving at approximately the same rate as water. Though existing nitrate contamination was detected at the site, concentrations remain at very safe levels with respect to human health.

SUMMARY

A *Source Water Assessment* has been completed for the sources of public drinking water serving King Point Lodge. The overall vulnerability of this source to contamination is **Very High** for volatile organic chemicals, **Very High** for bacteria and viruses, and **Very High** for nitrates and nitrites. 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 King Point 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 King Point Lodge public drinking water source.

REFERENCES CITED

Patrick, L.D., Brabets, T.P., and Glass, R.L., 1989, Simulation of ground-water flow at Anchorage, Alaska: US Geological Survey Water-Resources Investigations Report 88-4139, 41p.

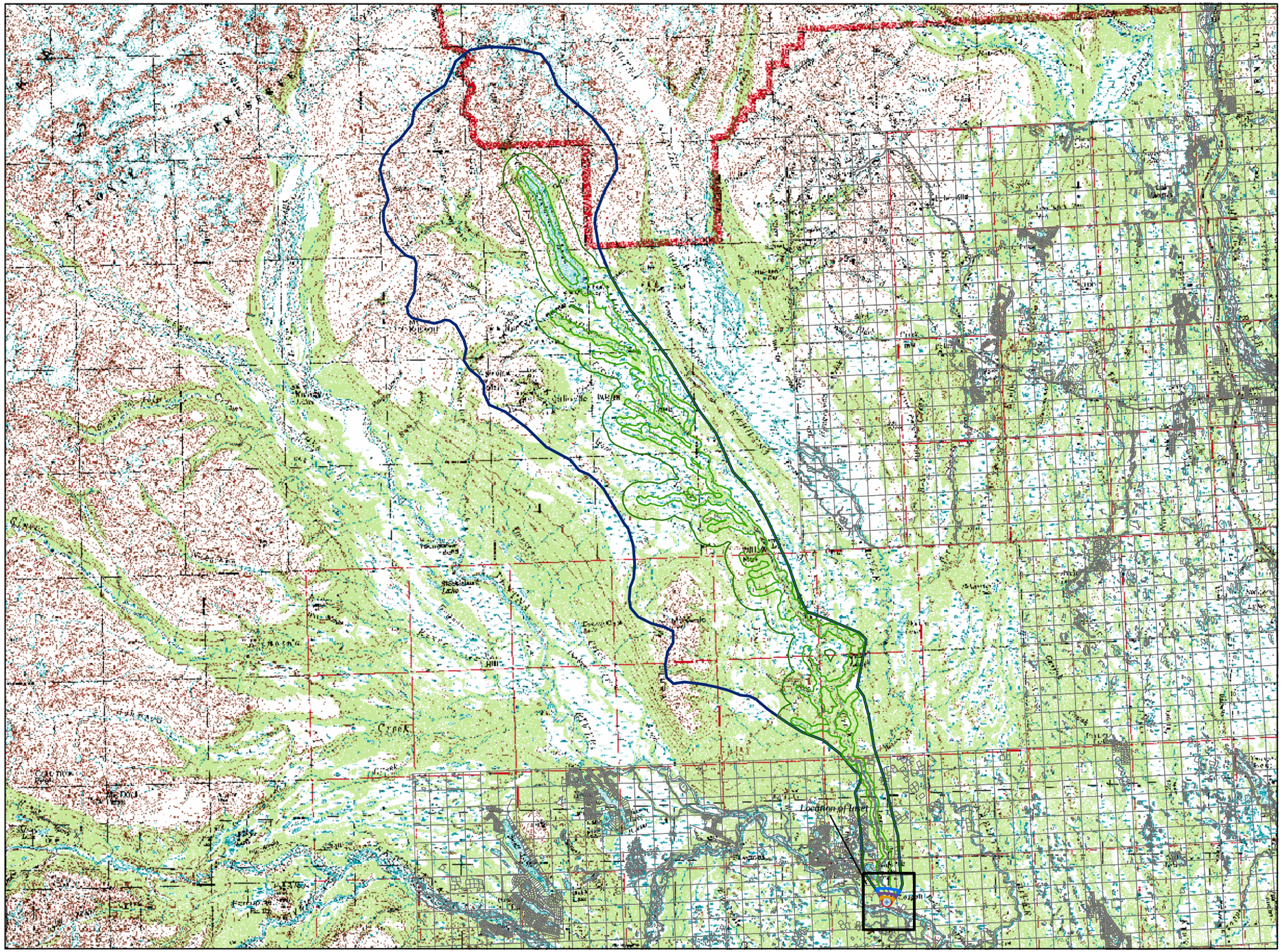
Wang, B., Strelakos, P.M., and Jokela, J.B., 2000, Nitrate source indicators in ground water of the scimitar subdivision, Peters Creek Area, Anchorage, Alaska: US Geological Survey Water-Resources Investigations Report 00-4137.

Weather Underground, June 18, 2002, Web extension to the *Western Regional Climate Center* [WWW document]. URL http://www.wunderground.com

APPENDIX A

King Point Lodge
Drinking Water Protection Area
(Map 1)

Drinking Water Protection Areas for King Point Lodge



King Point Lodge

Zone A Protection Area
Several Months Travel Time

Zone B Protection Area
Less than 2-Years Travel Time

Zone C Protection Area
Less than 5-Years Travel Time

Zone D Protection Area
Less than 10-Years Travel Time

Zone E Protection Area
1000 Feet from Surface Water

Zone F Protection Area
1 Mile from Surface Water

Zone G Protection Area
Entire Watershed

10 5 0 10 Miles

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N
W E
S

Map 1

APPENDIX B

Contaminant Source Inventory and Risk Ranking for King Point Lodge (Tables 1-4)

Table 1

Contaminant Source Inventory for ***King Point Lodge***

PWSID 225008.001

Contaminant Source Type	***Contaminant Source ID***	***CS ID tag***	***Zone***	***Location***	***Map Number***	***Comments***
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-1	A	East of King Point Lodge Well	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-2	A	East of King Point Lodge Well	3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A	NE of King Point Lodge Well	3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-2	A	NE of King Point Lodge Well	3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-3	A	S of King Point Lodge Well	3	
Residential Areas	R01	R1-1	A	Residences S and SW of King Point Lodge Well	2	18 acres of residential area in Zone A
Septic systems (serves one single-family home)	R02	R2-1	A	SW of King Point Lodge Well	3	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-1	A	East of King Point Lodge Well	3	
Abandoned wells	W01	W1-1	A	East of King Point Lodge Well	3	
Abandoned wells	W01	W1-2	A	East of King Point Lodge Well	3	
Electric power generation (fossil fuels)	X36	X36-1	A	East of King Point Lodge Well	3	
Residential Areas	R01	R1-2	B	Residences NE of King Point Lodge Well	2	2 acres of residential area in Zone B
Residential Areas	R01	R1-3	C	Residences N of King Point Lodge	3	4 acres of residential area in Zone C
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-4	E	North of King Point Lodge Well	3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-5	E	North of King Point Lodge Well	3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-6	E	North of King Point Lodge Well	3	

Table 2

Contaminant Source Inventory and Risk Ranking for King Point Lodge

PWSID 225008.001

Sources of Bacteria and Viruses

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Overall Rank after Analysis*	*Location*	*Map Number*	*Comments*
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A	High	1	NE of King Point Lodge Well	3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-2	A	High	2	NE of King Point Lodge Well	3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-3	A	High	3	S of King Point Lodge Well	3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-4	E	High	4	North of King Point Lodge Well	3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-5	E	High	5	North of King Point Lodge Well	3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-6	E	High	6	North of King Point Lodge Well	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-1	A	Medium	7	East of King Point Lodge Well	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-2	A	Medium	8	East of King Point Lodge Well	3	
Abandoned wells	W01	W1-1	A	Medium	9	East of King Point Lodge Well	3	
Abandoned wells	W01	W1-2	A	Medium	10	East of King Point Lodge Well	3	
Residential Areas	R01	R1-1	A	Low		Residences S and SW of King Point Lodge Well	2	18 acres of residential area in Zone A
Septic systems (serves one single-family home)	R02	R2-1	A	Low		SW of King Point Lodge Well	3	
Residential Areas	R01	R1-2	B	Low		Residences NE of King Point Lodge Well	2	2 acres of residential area in Zone B

Table 3

Contaminant Source Inventory and Risk Ranking for King Point Lodge

PWSID 225008.001

Sources of Nitrates/Nitrites

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Risk Ranking for Analysis	Overall Rank after Analysis	Location	Map Number	Comments
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A	High	1	NE of King Point Lodge Well	3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-2	A	High	2	NE of King Point Lodge Well	3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-3	A	High	3	S of King Point Lodge Well	3	
Abandoned wells	W01	W1-1	A	High	4	East of King Point Lodge Well	3	
Abandoned wells	W01	W1-2	A	High	5	East of King Point Lodge Well	3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-4	E	High	6	North of King Point Lodge Well	3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-5	E	High	7	North of King Point Lodge Well	3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-6	E	High	8	North of King Point Lodge Well	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-1	A	Medium	9	East of King Point Lodge Well	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-2	A	Medium	10	East of King Point Lodge Well	3	
Residential Areas	R01	R1-1	A	Low		Residences S and SW of King Point Lodge Well	2	18 acres of residential area in Zone A
Septic systems (serves one single-family home)	R02	R2-1	A	Low		SW of King Point Lodge Well	3	
Residential Areas	R01	R1-2	B	Low		Residences NE of King Point Lodge Well	2	2 acres of residential area in Zone B
Residential Areas	R01	R1-3	C	Low		Residences N of King Point Lodge Well	3	4 acres of residential area in Zone C

Table 4

Contaminant Source Inventory and Risk Ranking for King Point Lodge

PWSID 225008.001

Sources of Volatile Organic Chemicals

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Overall Rank after Analysis*	*Location*	*Map Number*	*Comments*
Abandoned wells	W01	W1-1	A	High	1	East of King Point Lodge Well	3	
Abandoned wells	W01	W1-2	A	High	2	East of King Point Lodge Well	3	
Electric power generation (fossil fuels)	X36	X36-1	A	Medium	3	East of King Point Lodge Well	3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A	Low	4	NE of King Point Lodge Well	3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-2	A	Low	5	NE of King Point Lodge Well	3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-3	A	Low	6	S of King Point Lodge Well	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-1	A	Low	7	East of King Point Lodge Well	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-2	A	Low	8	East of King Point Lodge Well	3	
Residential Areas	R01	R1-1	A	Low	9	Residences S and SW of King Point Lodge Well	2	18 acres of residential area in Zone A
Residential Areas	R01	R1-2	B	Low	10	Residences NE of King Point Lodge Well	2	2 acres of residential area in Zone B
Septic systems (serves one single-family home)	R02	R2-1	A	Low		SW of King Point Lodge Well	3	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-1	A	Low		East of King Point Lodge Well	3	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-1	A	Low		East of King Point Lodge Well	3	
Residential Areas	R01	R1-3	C	Low		Residences N of King Point Lodge Well	3	4 acres of residential area in Zone C

APPENDIX C

King Point Lodge
Drinking Water Protection Area
and Potential and Existing Contaminant Sources
(Maps 2-3)

Drinking Water Protection Areas for King Point Lodge and Potential and Existing Sources of Contamination

King Point Lodge

Residential Areas (R1)

Zone A Protection Area
Several Months Travel Time

Zone B Protection Area
Less than 2-Years Travel Time

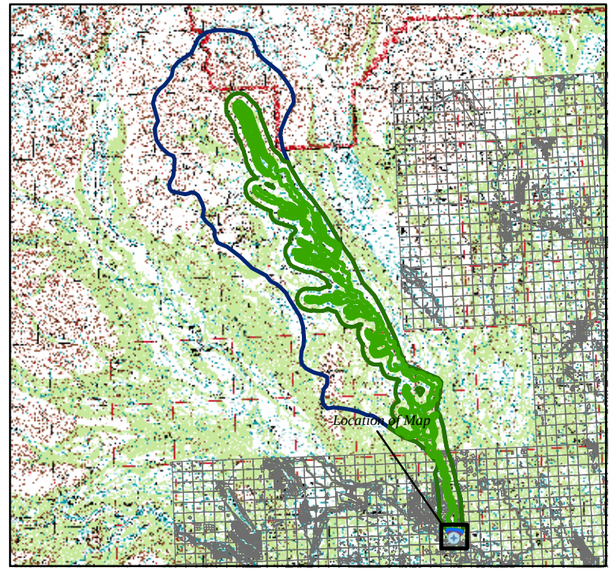
Zone C Protection Area
Less than 5-Years Travel Time

Zone D Protection Area
Less than 10-Years Travel Time

Zone E Protection Area
1000 Feet from Surface Water

Zone F Protection Area
1 Mile from Surface Water

Zone G Protection Area
Entire Watershed



0.3 0.15 0 0.3 Miles

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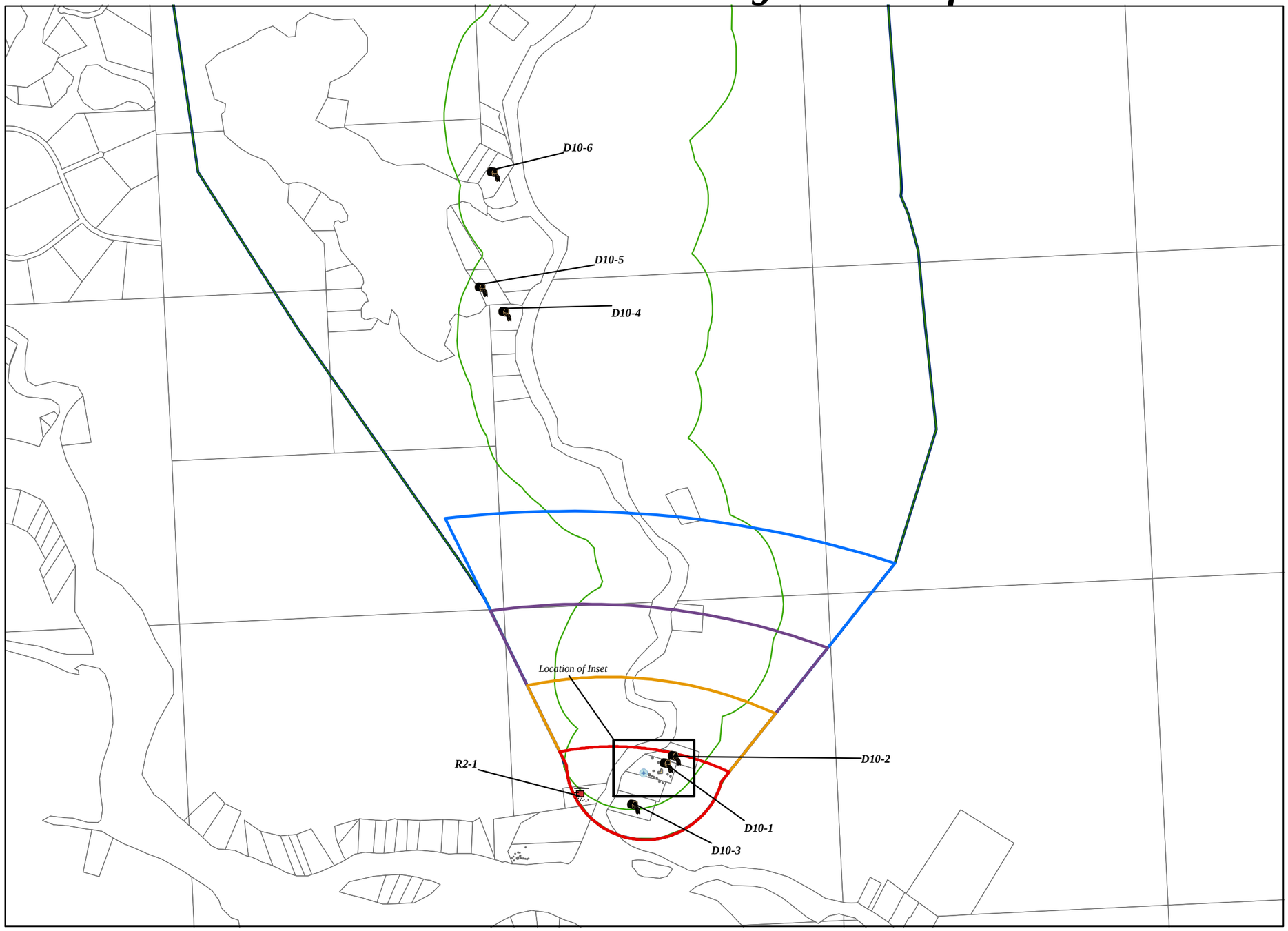
N W E S

Map 2

Drinking Water Protection Areas for King Point Lodge and Potential and Existing Sources of Contamination



- King Point Lodge
- Abandoned Wells (W1)
- Electric Power generation (fossil fuels) (X36)
- Sewer System Lift Station (D1)
- Tanks, heating oil, nonresidential, (aboveground) (T14)
- Large Capacity Septic System (D10)
- Single Family Septic System (R2)

Zone A Protection Area
Several Months Travel Time

Zone B Protection Area
Less than 2-Years Travel Time

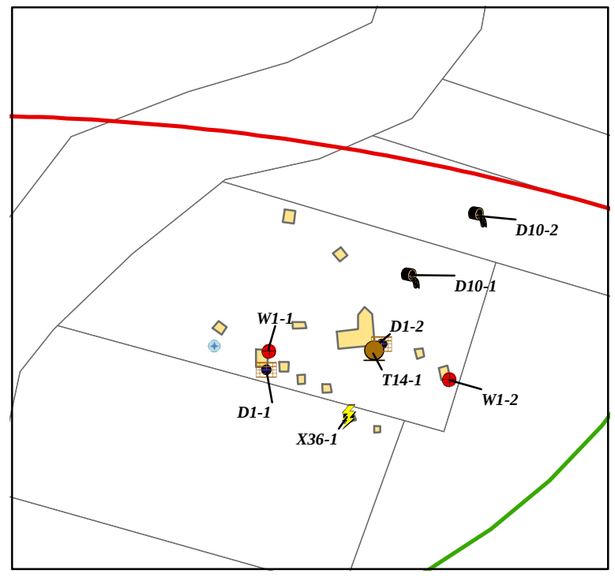
Zone C Protection Area
Less than 5-Years Travel Time

Zone D Protection Area
Less than 10-Years Travel Time

Zone E Protection Area
1000 Feet from Surface Water

Zone F Protection Area
1 Mile from Surface Water

Zone G Protection Area
Entire Watershed



0.5 0.25 0 0.5 Miles

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N W E S

Map 3

APPENDIX D

Vulnerability Analysis for King Point Lodge Public Drinking Water Source

(Charts 1-8)

Chart 1. Susceptibility of the Wellhead - King Point Lodge

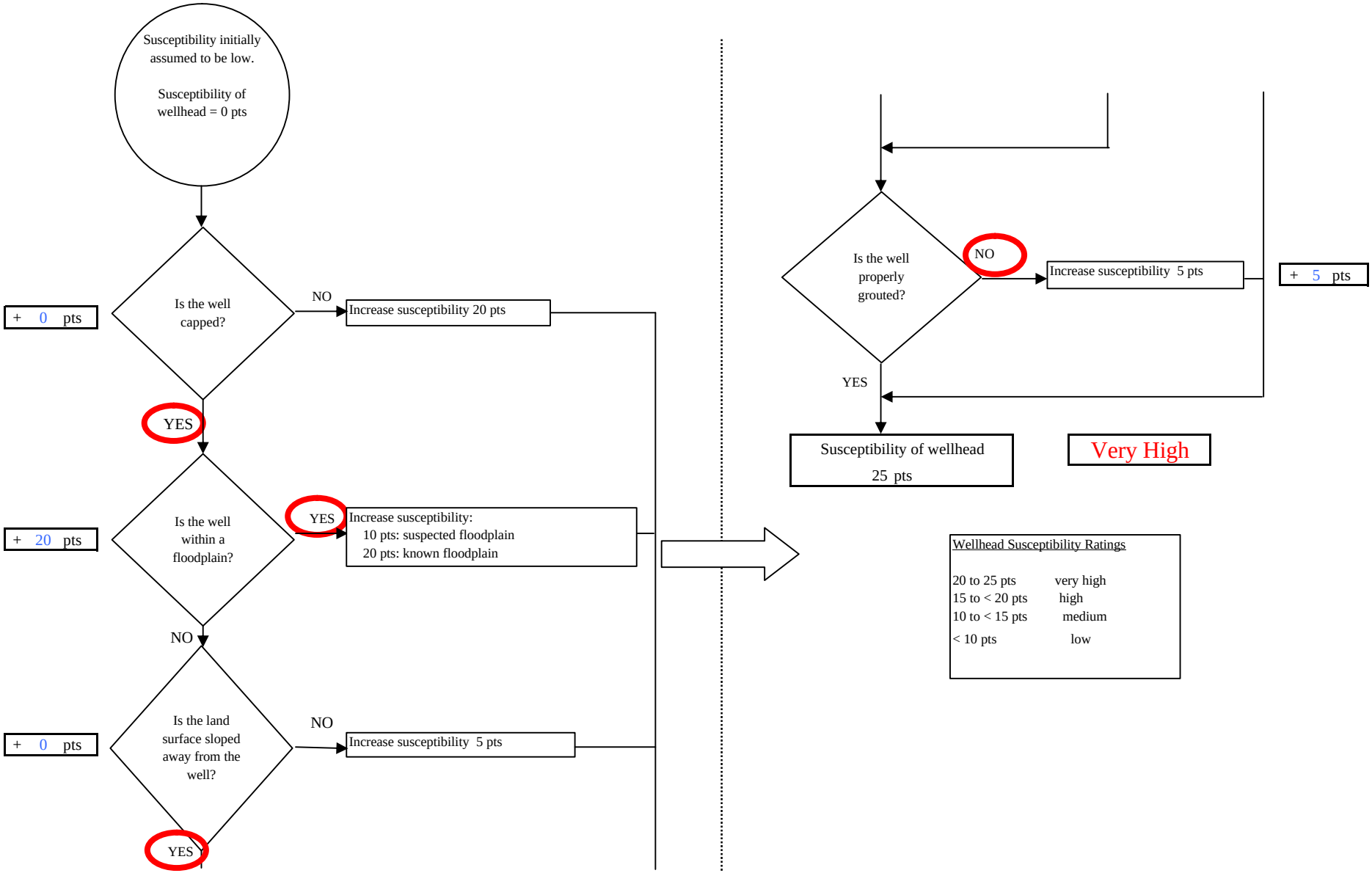


Chart 2. Susceptibility of the Aquifer - King Point Lodge

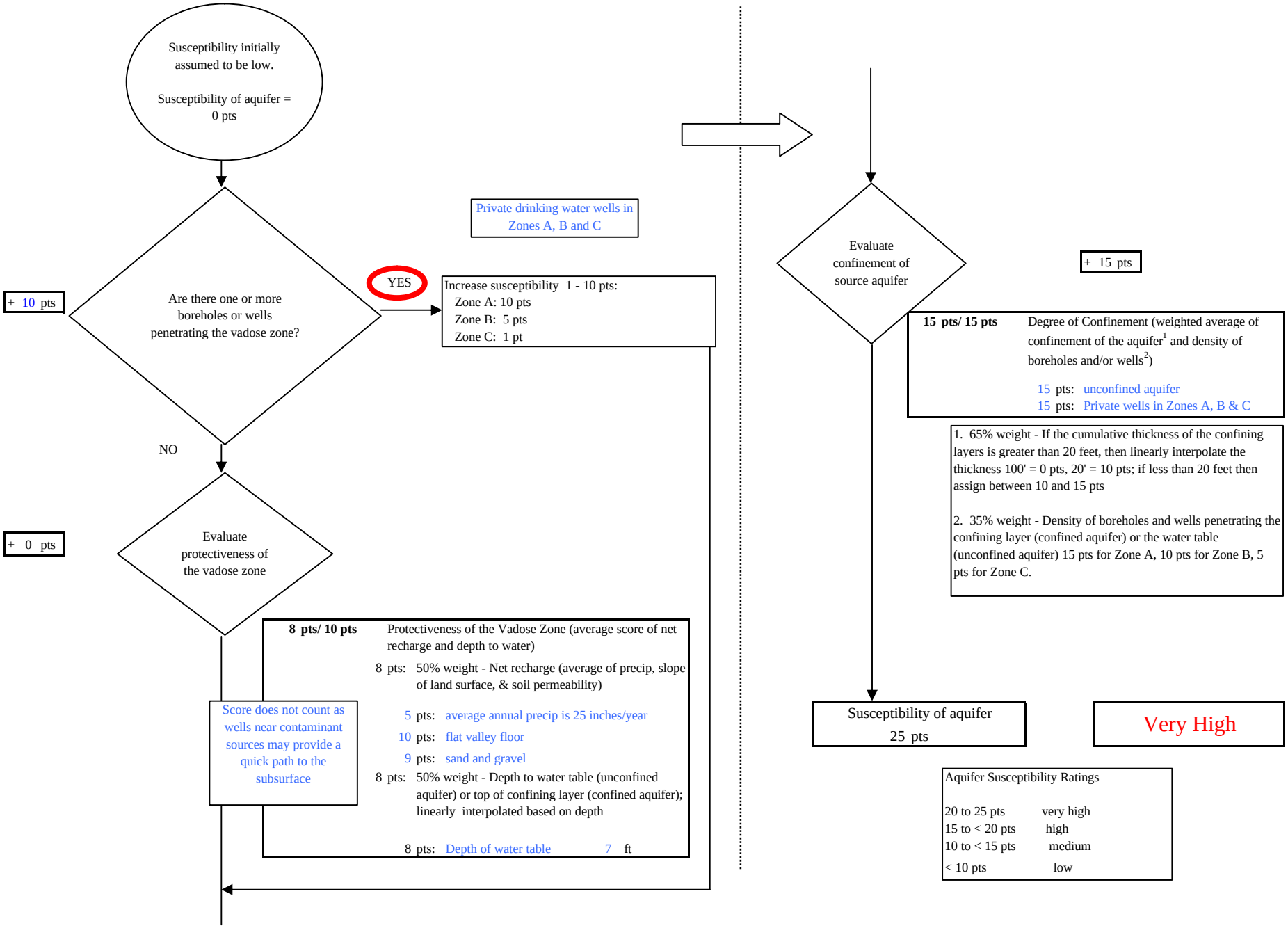
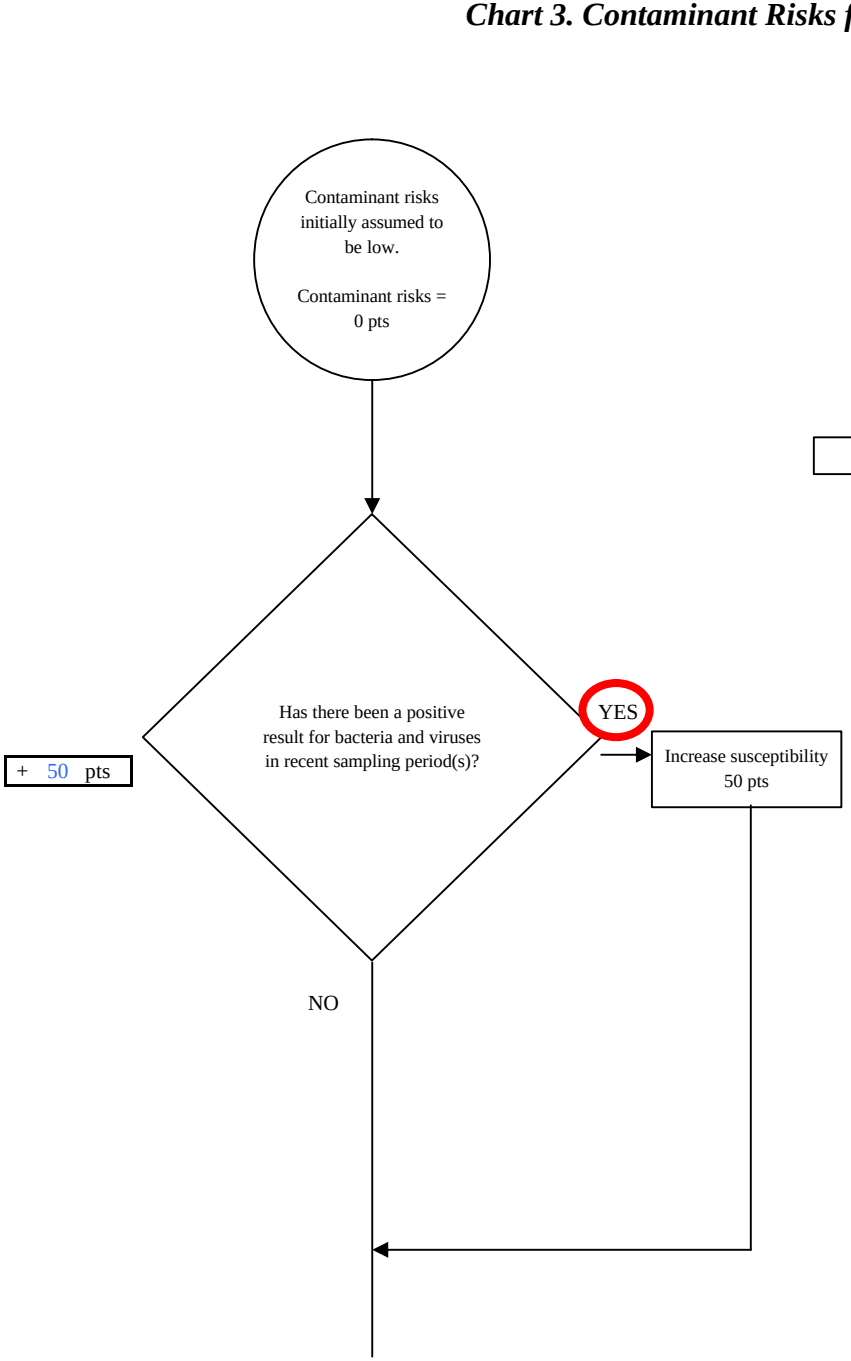
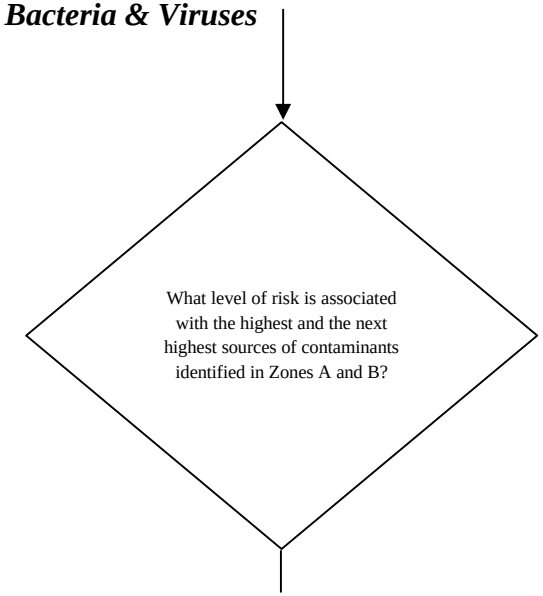


Chart 3. Contaminant Risks for King Point Lodge - Bacteria & Viruses





+ 40 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)	3	0	3
Medium(s)	3	0	3
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 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 3. Contaminant Risks for King Point Lodge - Bacteria & Viruses

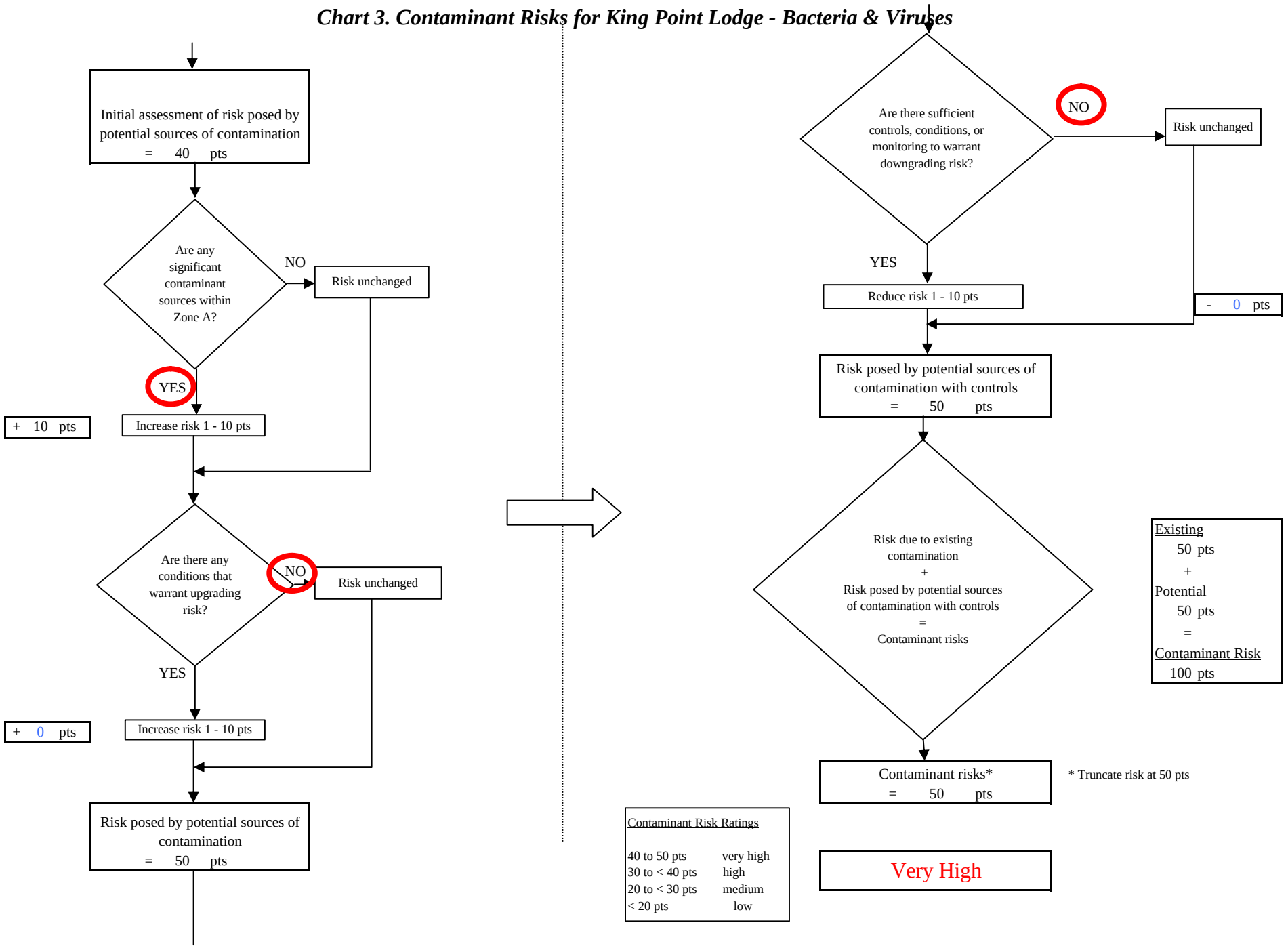


Chart 4. Vulnerability Analysis for King Point Lodge - Bacteria & Viruses

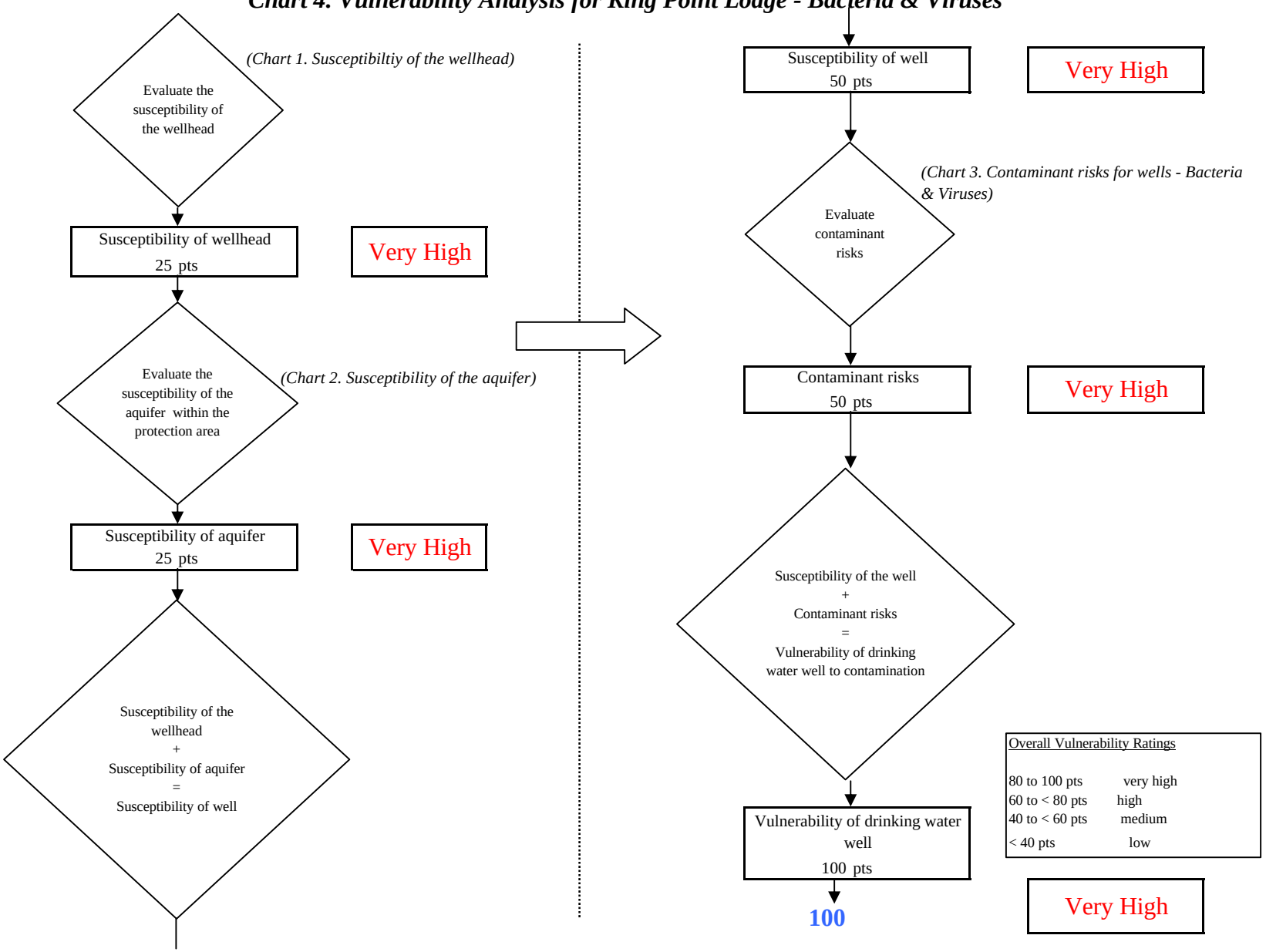


Chart 5. Contaminant Risks for King Point Lodge - Nitrates and Nitrites

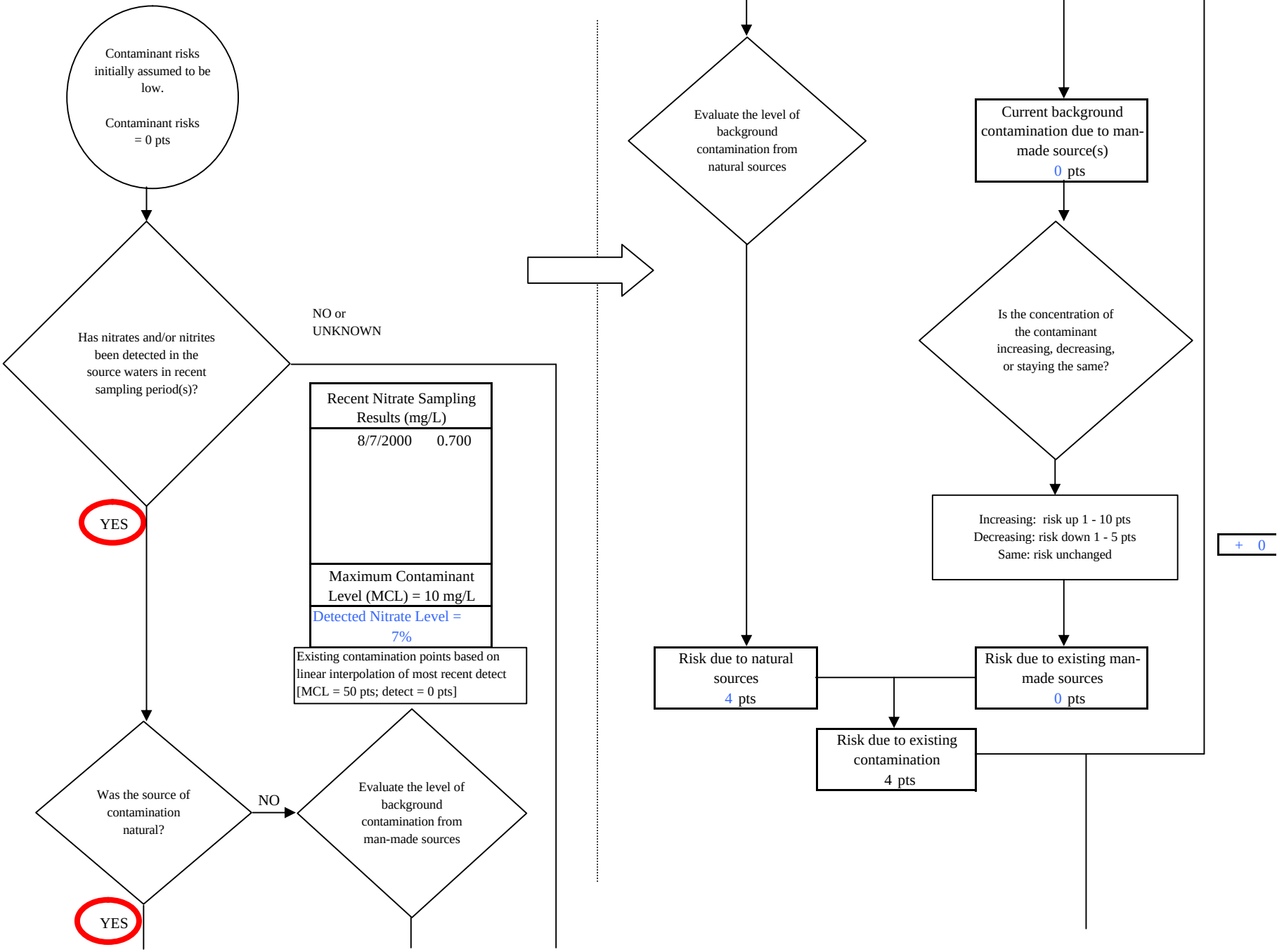


Chart 5. Contaminant Risks for King Point Lodge - Nitrates and Nitrites

+ 40 pts

What level of risk is associated with the highest and the next highest risk sources(s) of contaminants identified in Zones A, 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)	5	0	5
Medium(s)	1	0	1
Low(s)	1	1	2

	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 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.

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

Are any significant sources within Zone A?

NO

Risk unchanged

YES

Increase risk 1 - 10 pts

+ 10

Chart 5. Contaminant Risks for King Point Lodge - Nitrates and Nitrites

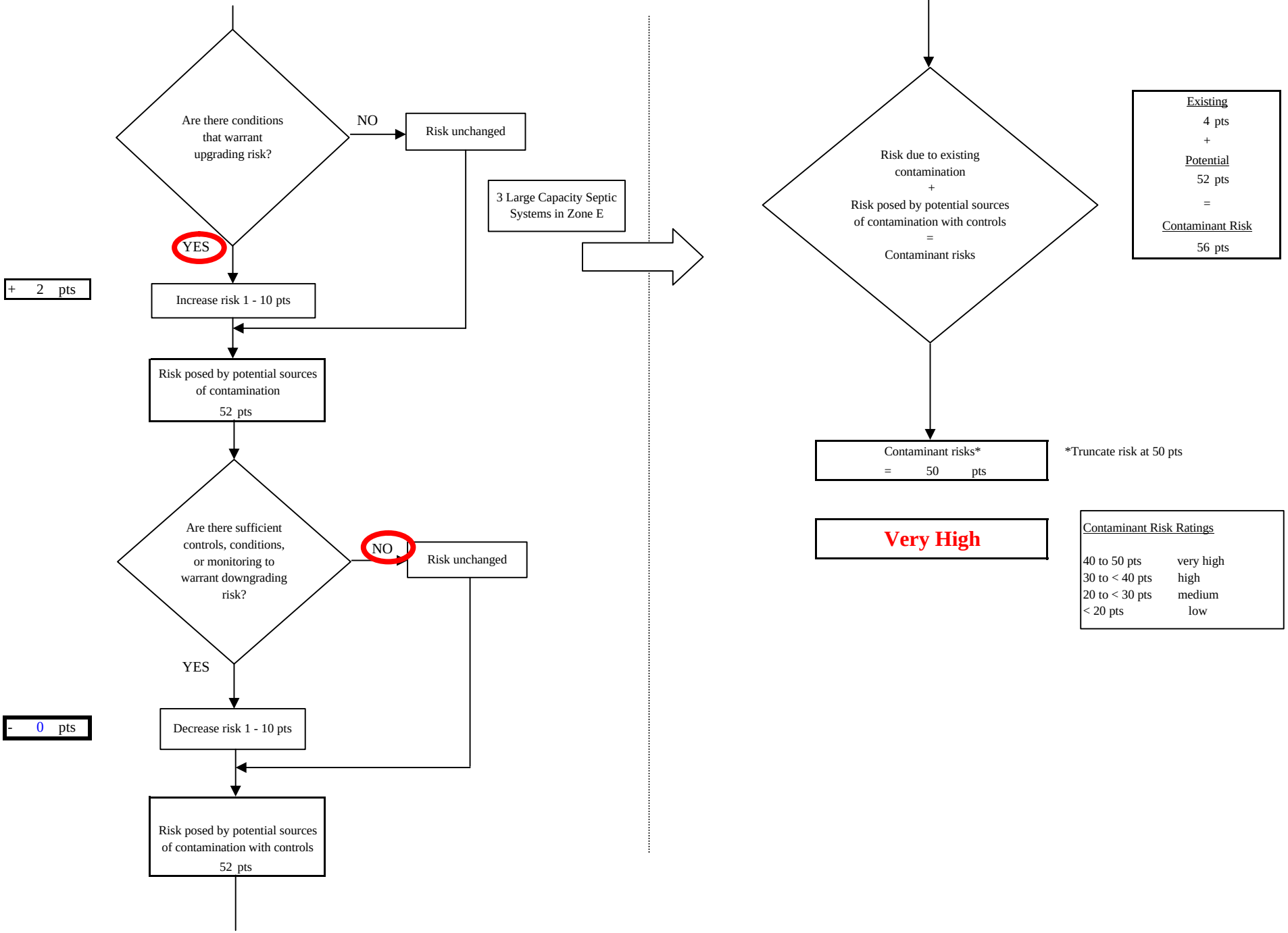


Chart 6. Vulnerability Analysis for King Point Lodge - Nitrates and Nitrites

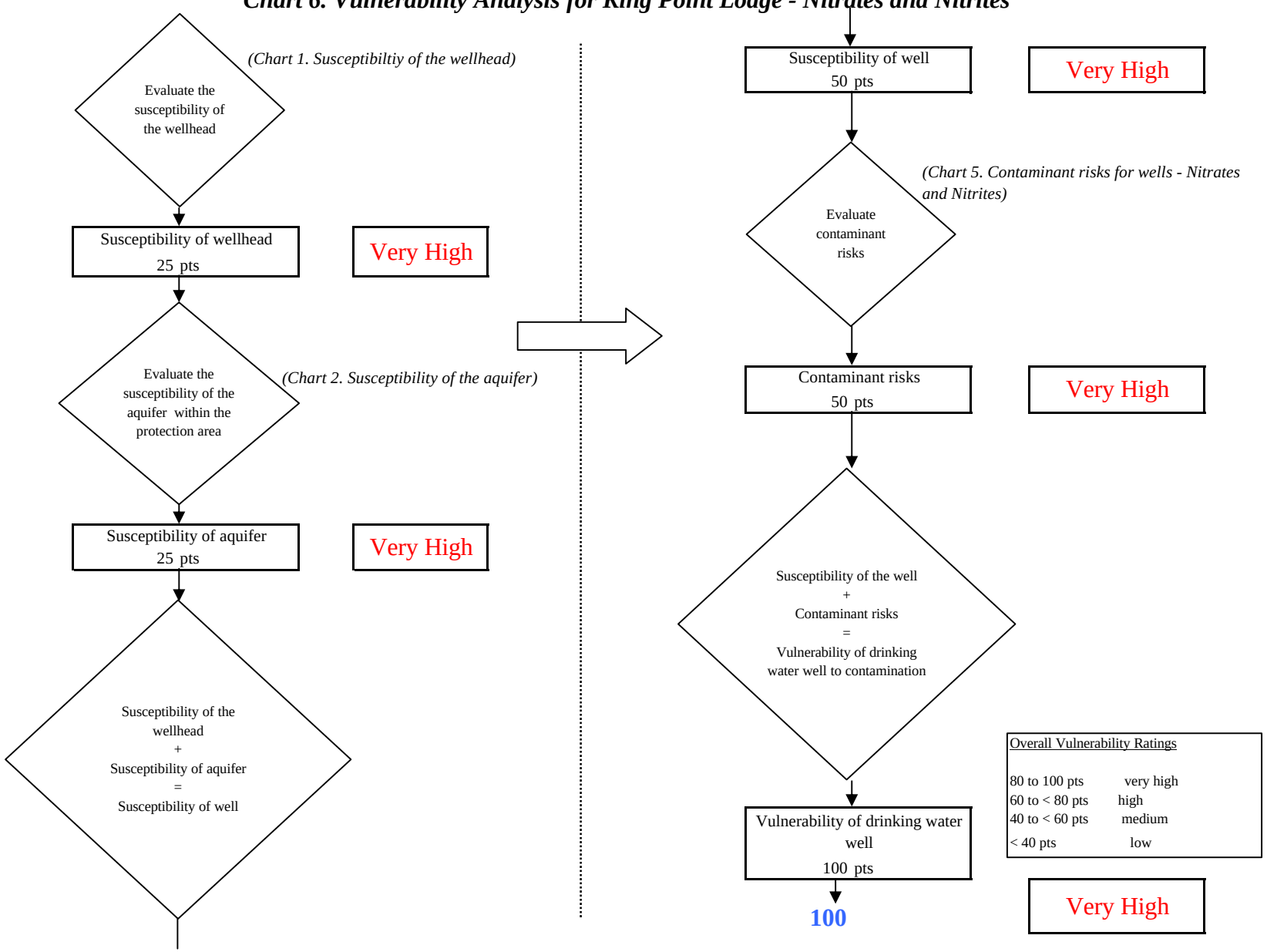


Chart 7. Contaminant Risks for King Point Lodge - Volatile Organic Chemicals

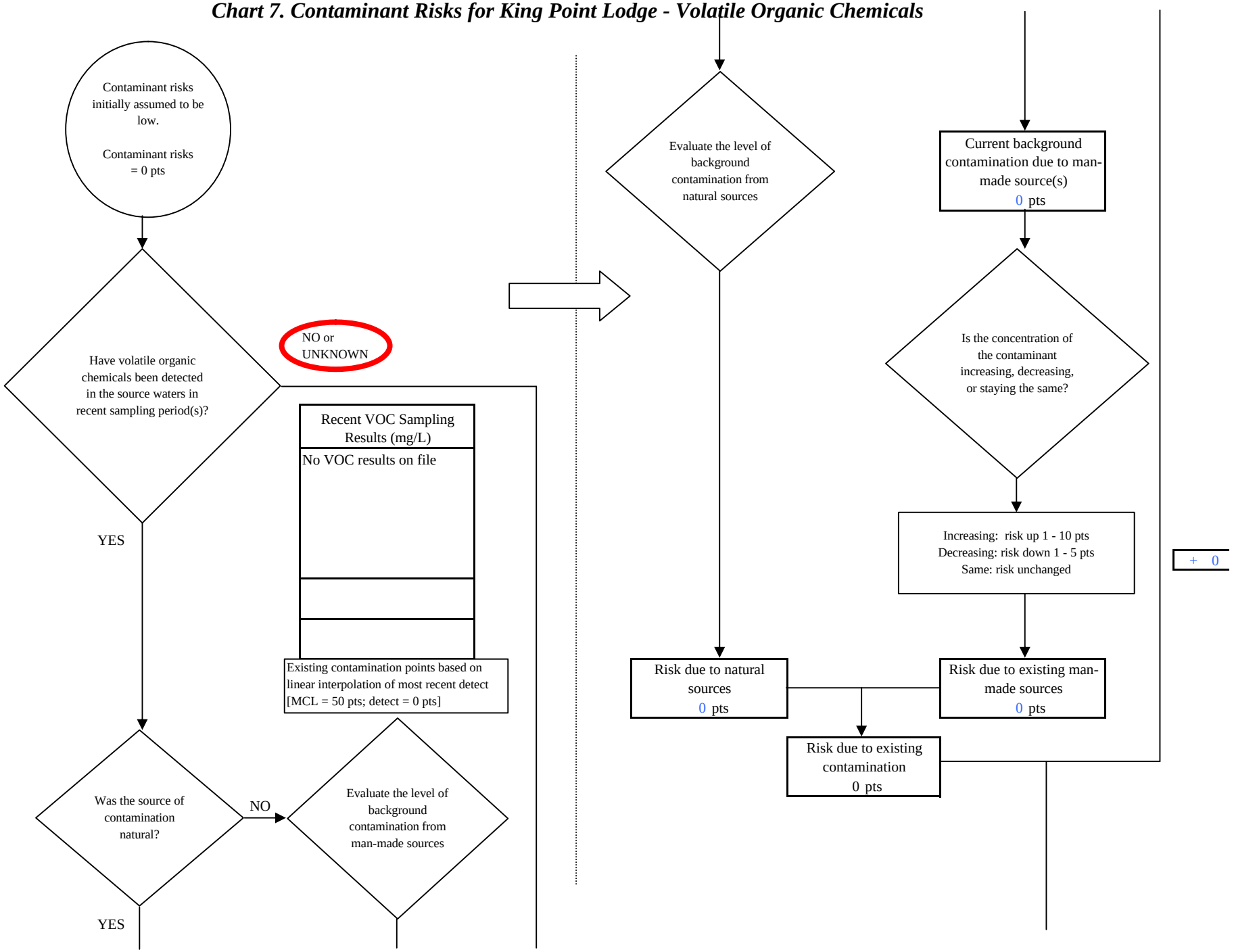
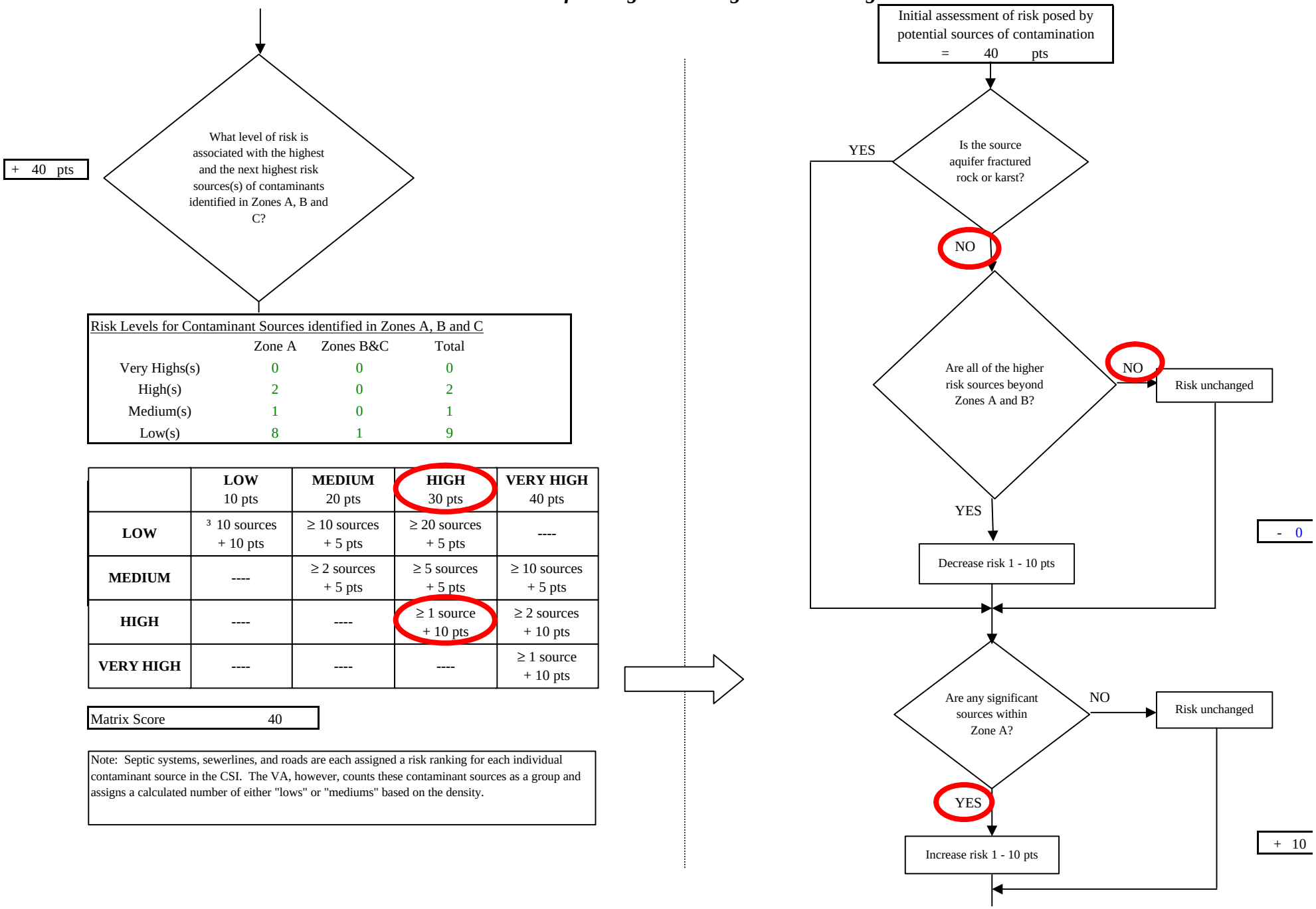


Chart 7. Contaminant Risks for King Point Lodge - Volatile Organic Chemicals



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)	2	0	2
Medium(s)	1	0	1
Low(s)	8	1	9

	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 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 7. Contaminant Risks for King Point Lodge - Volatile Organic Chemicals

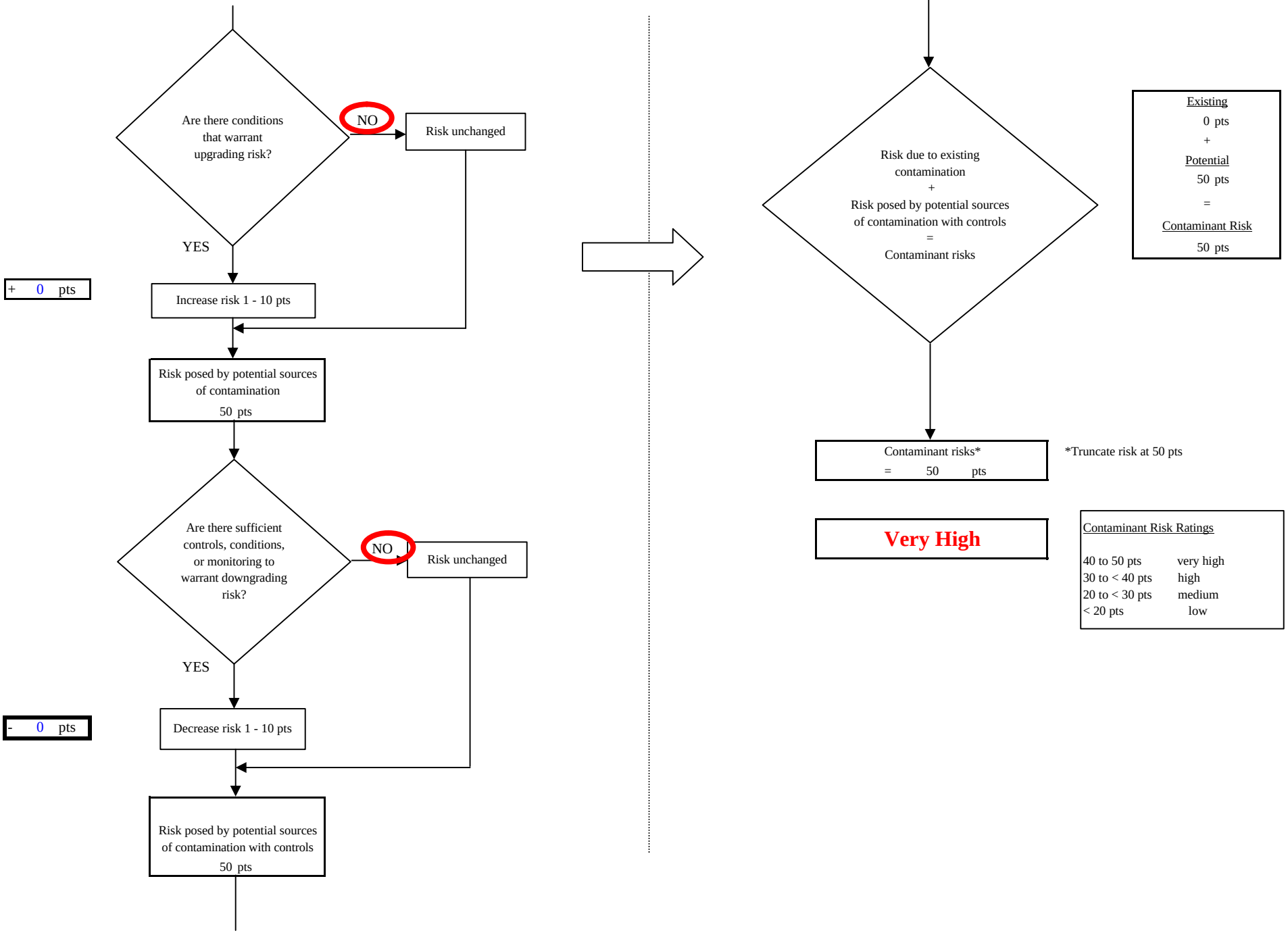


Chart 8. Vulnerability Analysis for King Point Lodge - Volatile Organic Chemicals