

Source Water Assessment

A Hydrogeologic Susceptibility and
Vulnerability Assessment for
Esther Hatchery,
Esther Island, Alaska
PWSID #293124

DRINKING WATER PROTECTION PROGRAM REPORT NO. 881

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.

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Source Water Assessment for Esther Hatchery, Esther Island, Alaska

Drinking Water Protection Program Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

The public water system for Esther Hatchery is a Class B (transient/non-community) water system consisting of one surface water intake taken from the southern end of Esther Lake, Esther Island, Alaska. The surface water intake received a susceptibility rating of **High**. A rating of High to Very High is typical for all surface water systems. Identified potential and current sources of contaminants for Esther Hatchery's public drinking water source include large-capacity septic systems; aboveground heating oil tanks; and fish hatcheries. These identified potential and existing source 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 Esther Hatchery received a vulnerability rating of **High** for bacteria and viruses, and nitrates and nitrites; and **Medium** for volatile organic chemicals.

ESTHER HATCHERY PUBLIC DRINKING WATER SYSTEM

Esther Hatchery public water system is a Class B (transient/non-community) water system. The water system consists of one surface water intake from the southern end of Esther Lake on Esther Island. Esther Island is at the south end of Port Wells in northwest Prince William Sound. The population of Esther Island is approximately 20.

Esther Island's average annual precipitation includes 66 inches of rain and 80 inches of snowfall. 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 Esther Island is about 100 feet above sea level.

According to a Sanitary Survey dated June 25, 1992, the surface water intake was adequately constructed. An adequately constructed intake may provide protection against debris and contaminants from

entering the system. The raw water is treated by filtration and disinfection. There is a potential for runoff within the area surrounding the surface water.

This system operates seasonally from May through September and serves approximately 20 residents and 35 non-residents through 9 service connections.

ESTHER HATCHERY 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 lake. These areas are determined by looking at the characteristics of the lake, 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 Esther Hatchery extends throughout the entire watershed area. Due to the small size of this watershed, Zones B and C for this area cover the same area. 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 Esther Hatchery 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 ESTHER HATCHERY 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 Esther Hatchery is Esther Lake. Because the lake is recharged by surface water runoff and precipitation, contaminants at or near the lake have the potential to adversely impact this drinking water source. Table 2 shows the Overall Susceptibility score and rating for Esther Hatchery.

Table 2. Natural Susceptibility

	Score	Rating
Natural Susceptibility	35	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	30	High
Nitrates and/or Nitrites	41	Very High
Volatile Organic Chemicals	12	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 source. 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	65	High
Nitrates and Nitrites	75	High
Volatile Organic Chemicals	45	Medium

Bacteria and Viruses

The contaminant risk for bacteria and viruses is **High** with the large-capacity septic system representing the risk to this source of public 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 Esther Hatchery. 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 **High**.

Nitrates and Nitrites

The contaminant risk for nitrates and nitrites is **Very High** with the large-capacity septic systems representing the risk to this source of public drinking water (See Chart 4 - Contaminant Risks for Nitrates and/or Nitrites in Appendix D).

Sampling history for Esther Hatchery indicates that nitrates have been detected in the water, but only in very low concentrations (at 0.586 mg/L on 05/09/00) or 6% of the Maximum Contaminant Level (MCL). The MCL is the maximum level of contaminant that is allowed to exist in drinking water and still be consumed by humans without harmful health effects. Due to the high solubility and weak retention by soil, nitrates are very mobile, moving at approximately the same rate as water.

After combining the contaminant risk for nitrates and nitrites with the natural susceptibility of the 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 the large-capacity septic systems; and aboveground heating oil tanks creating the only known risks for volatile organic chemicals (See Chart 6 – Contaminant Risks for Volatile Organic Chemicals in Appendix D).

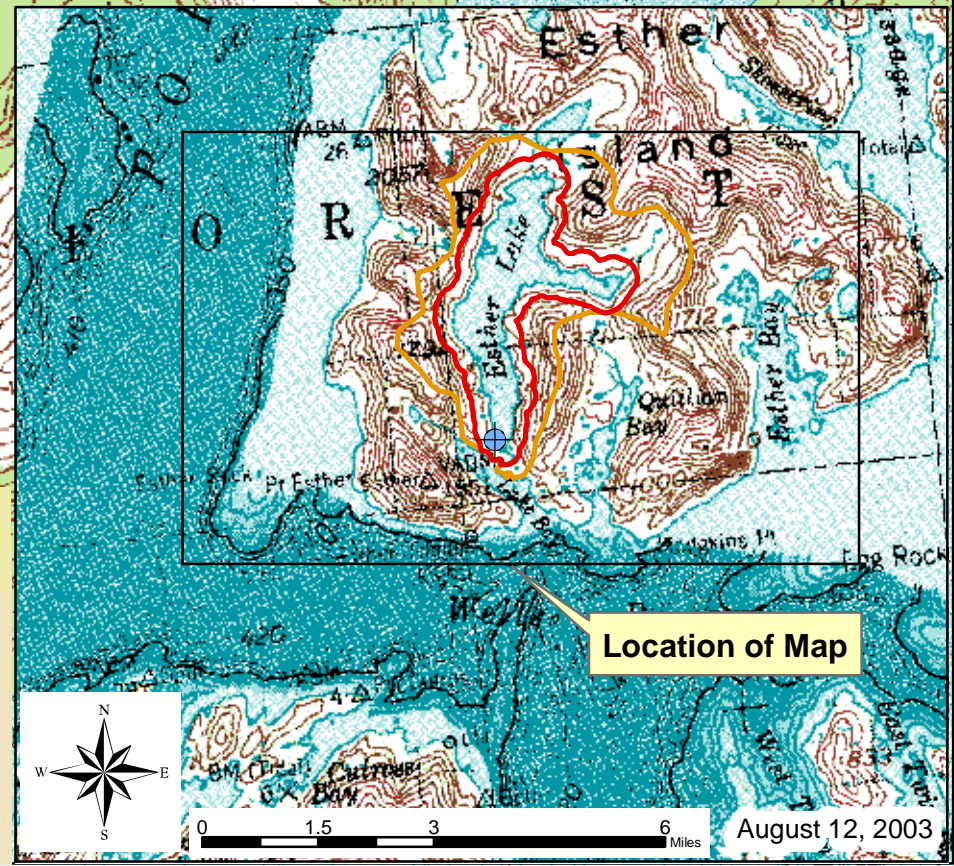
Sampling history indicates that volatile organic chemicals have not been detected in the water. Combining the contaminant risk for volatile organic chemicals with the natural susceptibility of the surface water source, the overall vulnerability of the surface water source to contamination by volatile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

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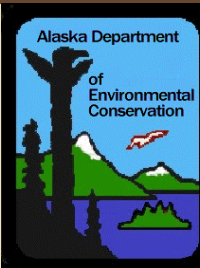
APPENDIX A

Esther Hatchery Drinking Water Protection Area Location Map (Map 1)



Map 1: PWSAC - Esther Hatchery Drinking Water Protection Areas

PWSID: 293124.001



1:33,269

Data Sources:

Background image - USGS 1:63,000 mapping

Legend

- ⊕ Public Drinking Water Systems
- DWPA Zone A
▭ 1000 Feet from Surface Water Body
- DWPA Zone B
▭ Entire Watershed

August 12, 2003

APPENDIX B

Contaminant Source Inventory and Risk Ranking for Esther Hatchery (Tables 1-4)

Table 1**Contaminant Source Inventory for
PWSAC - Esther Hatchery****PWSID 293124.001**

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Map Number	Comments
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A	2	Septic System for Esther Fish Hatchery
Tanks, heating oil, nonresidential (aboveground)	T14	T14-1	A	2	Heating Oil Tank for Esther Fish Hatchery
Fish hatcheries	X47	X47-1	A	2	Esther Fish Hatchery

**Contaminant Source Inventory and Risk Ranking for
PWSAC - Esther Hatchery
Sources of Bacteria and Viruses**

PWSID 293124.001

Table 2

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Risk Ranking for Analysis	Map Number	Comments
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A	High	2	Septic System for Esther Fish Hatchery

**Contaminant Source Inventory and Risk Ranking for
PWSAC - Esther Hatchery
Sources of Nitrates/Nitrites**

PWSID 293124.001

Table 3

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Risk Ranking for Analysis	Map Number	Comments
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A	High	2	Septic System for Esther Fish Hatchery

**Contaminant Source Inventory and Risk Ranking for
PWSAC - Esther Hatchery
Sources of Volatile Organic Chemicals**

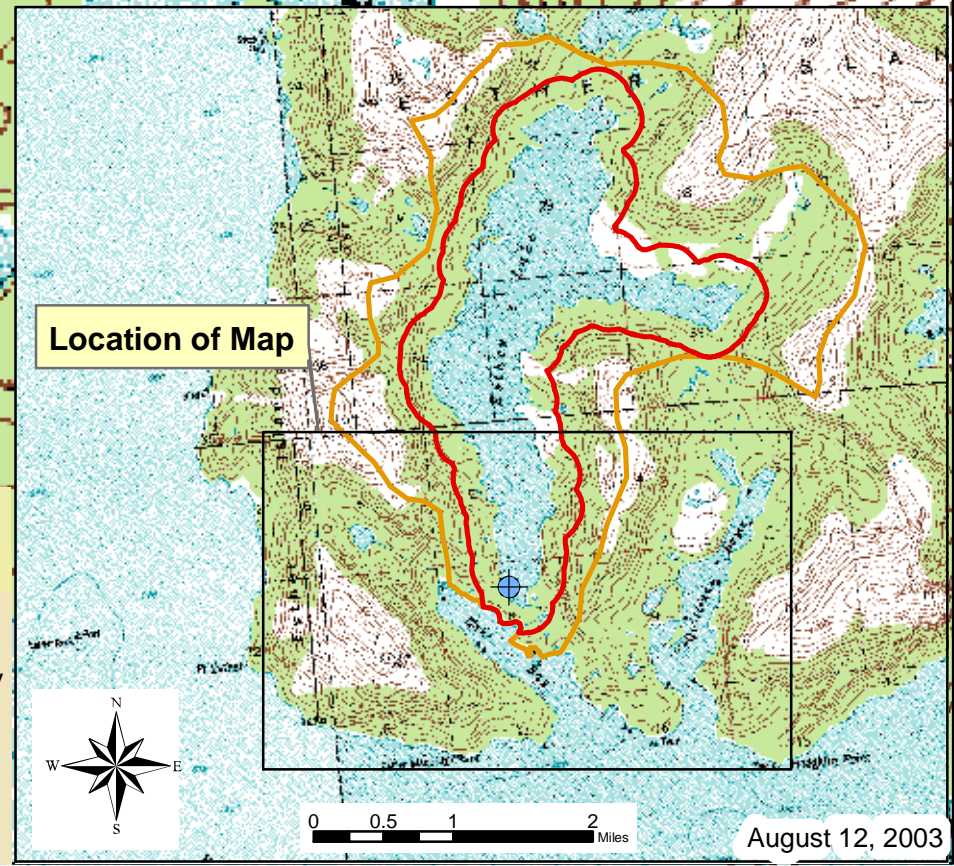
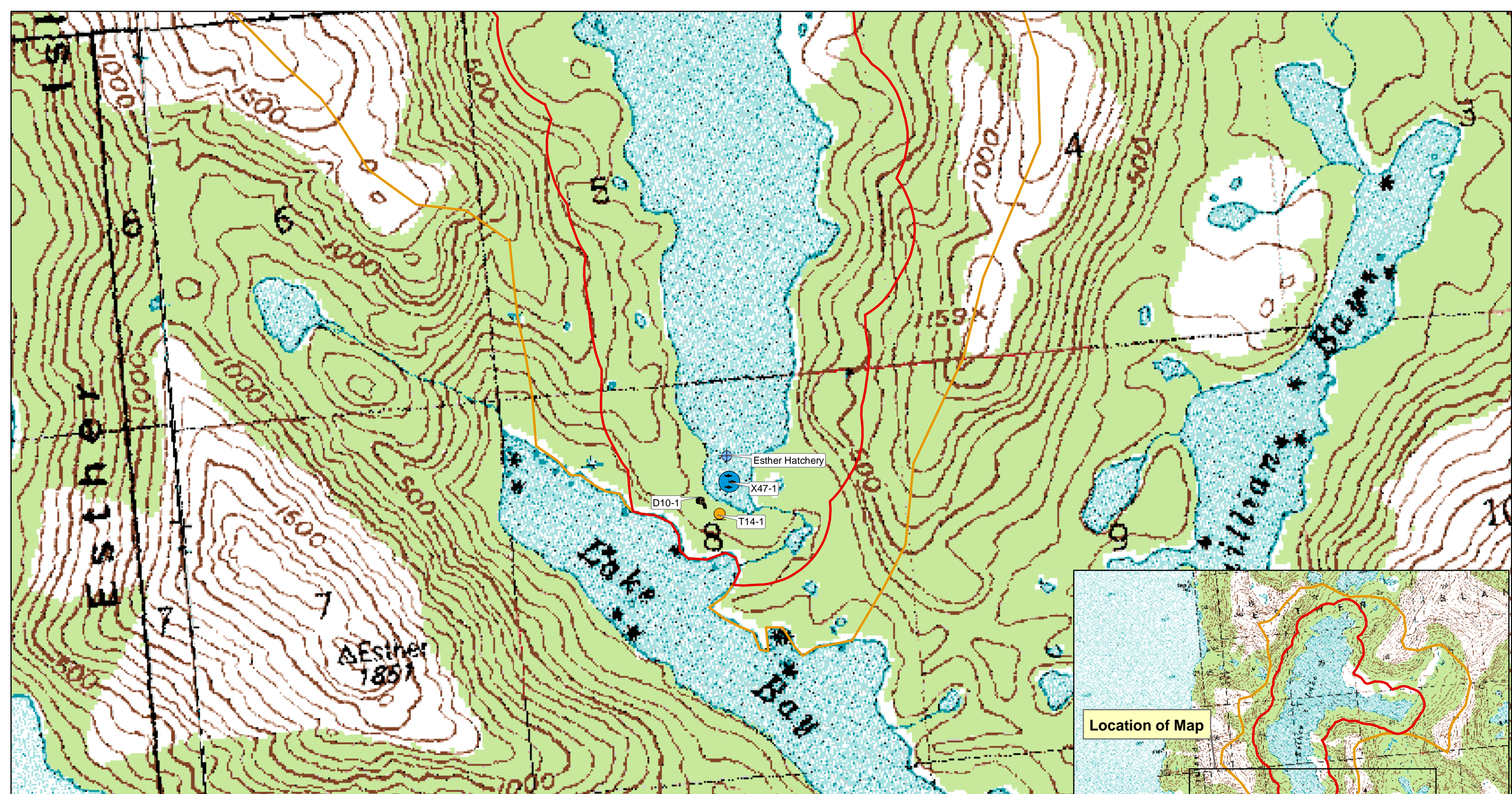
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Table 4

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Risk Ranking for Analysis	Map Number	Comments
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A	Low	2	Septic System for Esther Fish Hatchery
Tanks, heating oil, nonresidential (aboveground)	T14	T14-1	A	Low	2	Heating Oil Tank for Esther Fish Hatchery

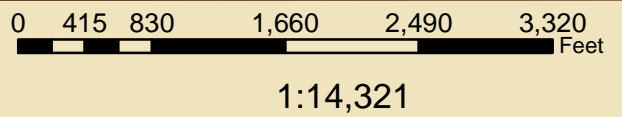
APPENDIX C

Esther Hatchery Drinking Water Protection Area and Potential and Existing Contaminant Sources (Map 2)



Map 2: Drinking Water Protection Areas for PWSAC - Esther Hatchery and Potential and Existing Sources of Contamination

PWSID: 293124.001



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

- Legend**
- Public Drinking Water Systems
 - Large Capacity Septic System (D10)
 - Nonresidential Heating Oil Tank (T14)
 - Fish Hatchery (X47)
 - DWPA Zone A: 1000 Feet from Surface Water Body
 - DWPA Zone B: Entire Watershed

APPENDIX D

Vulnerability Analysis for Esther Hatchery Public Drinking Water Source (Charts 1-7)

Chart 1. Susceptibility of the surface water source - PWSAC Esther Hatchery

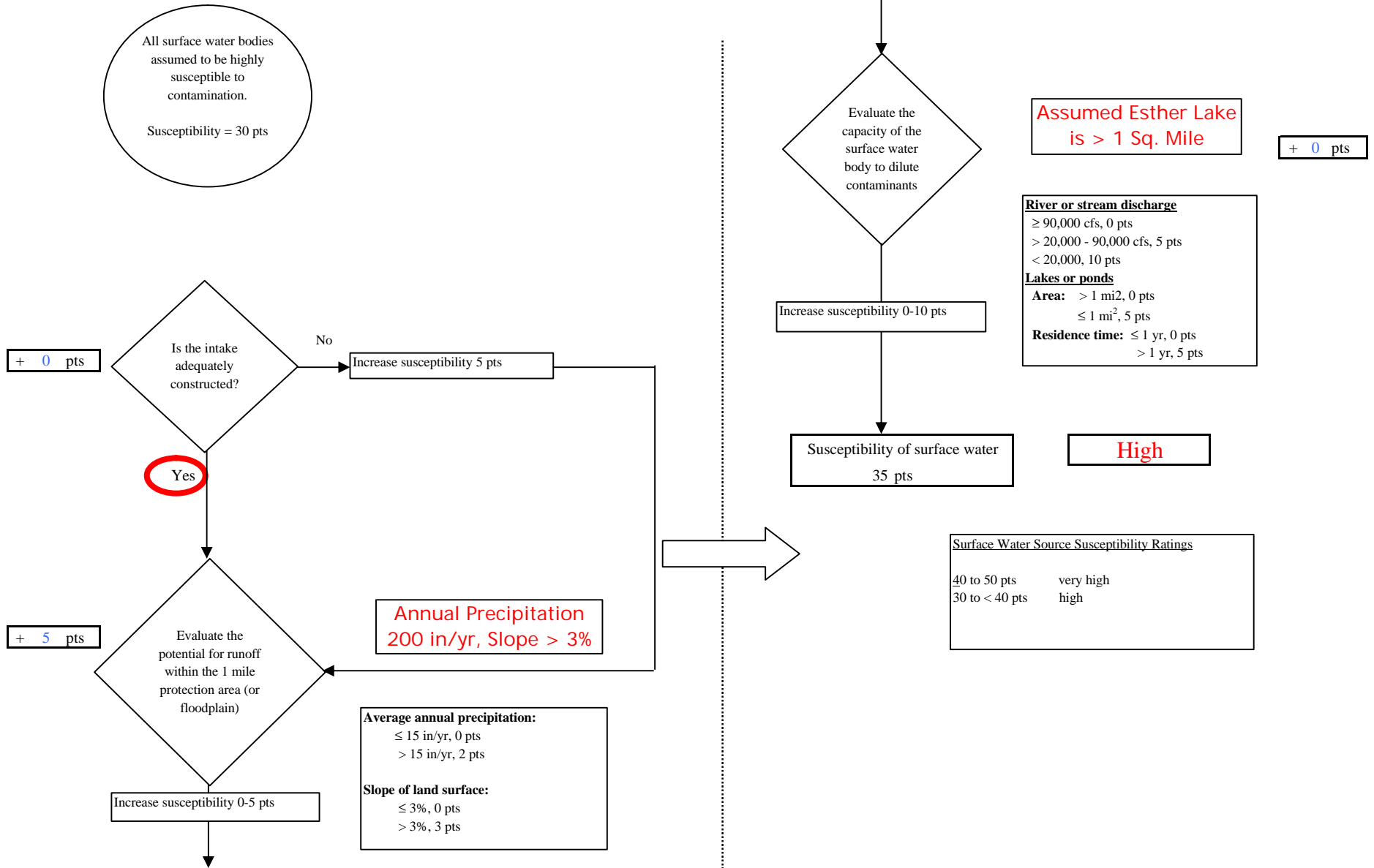


Chart 2. Contaminant risks for PWSAC Esther Hatchery - Bacteria & Viruses

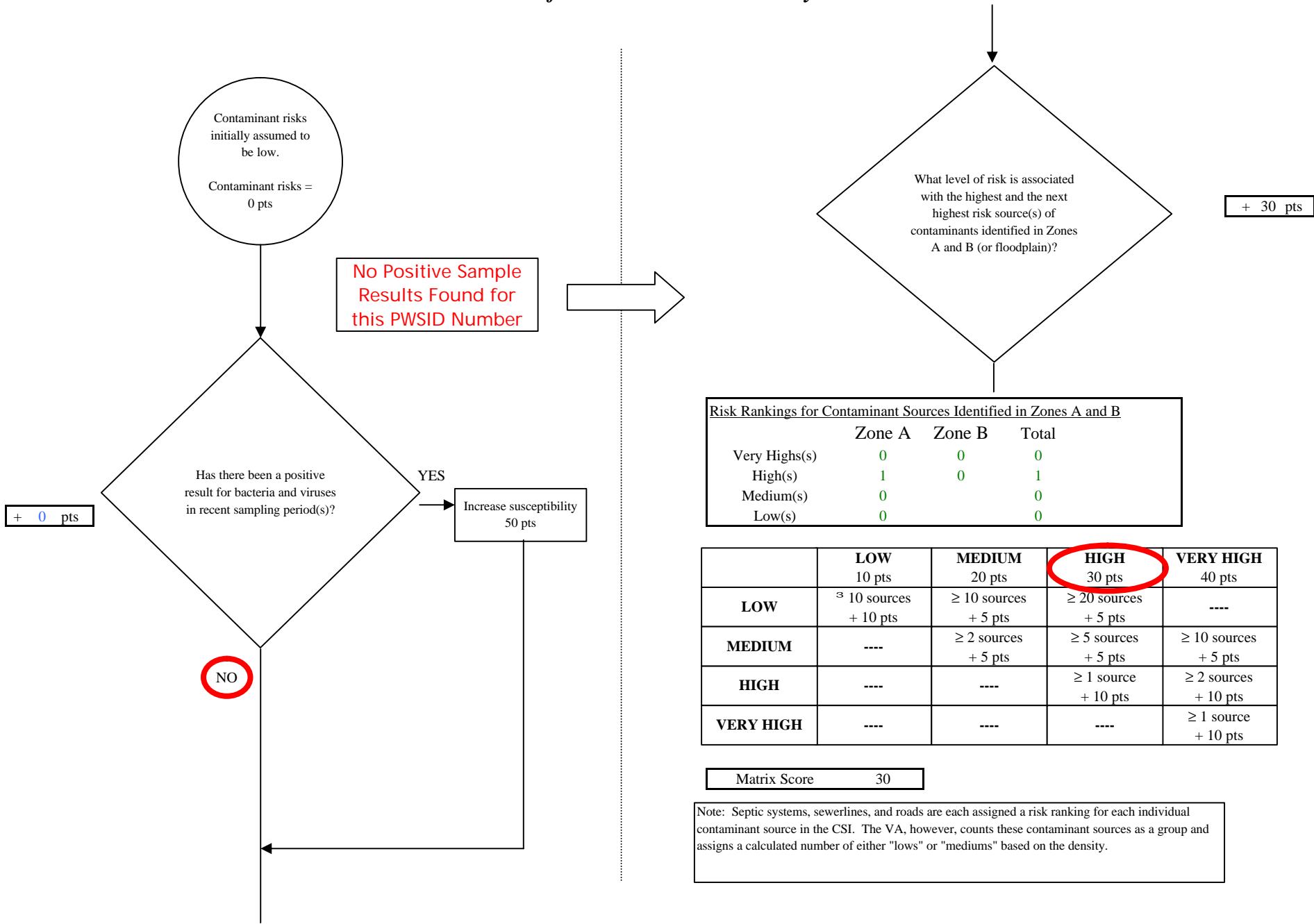
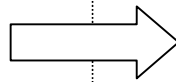
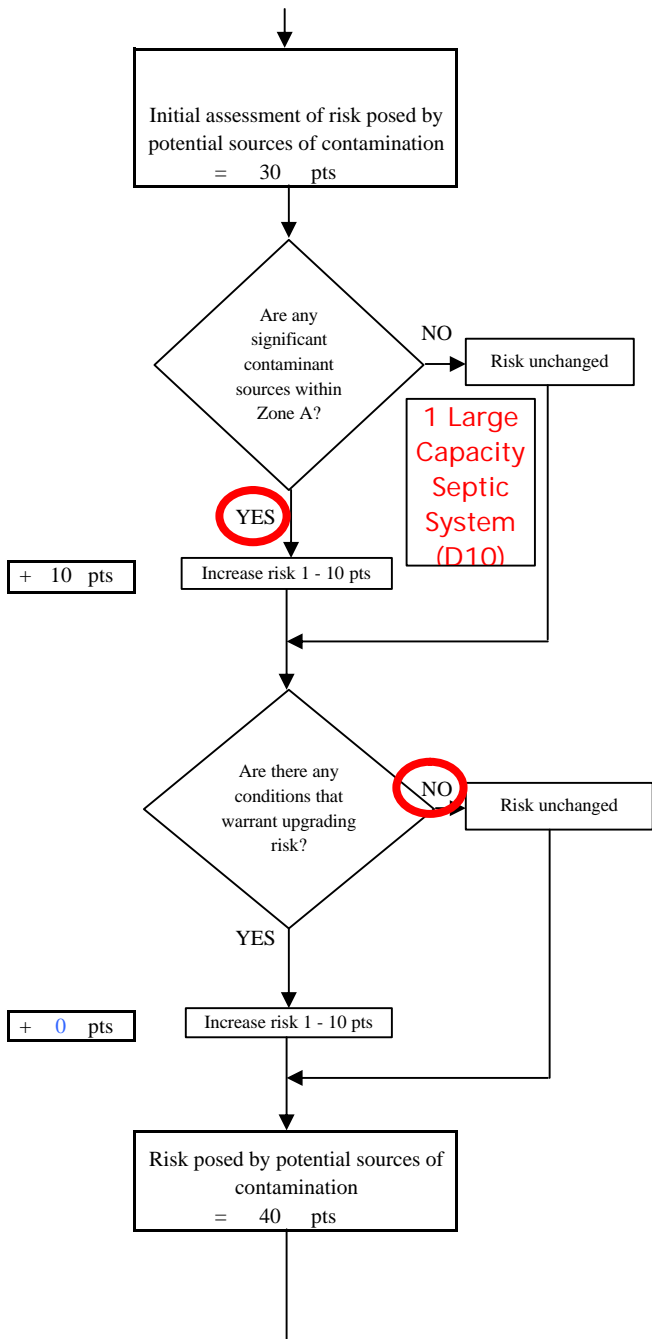
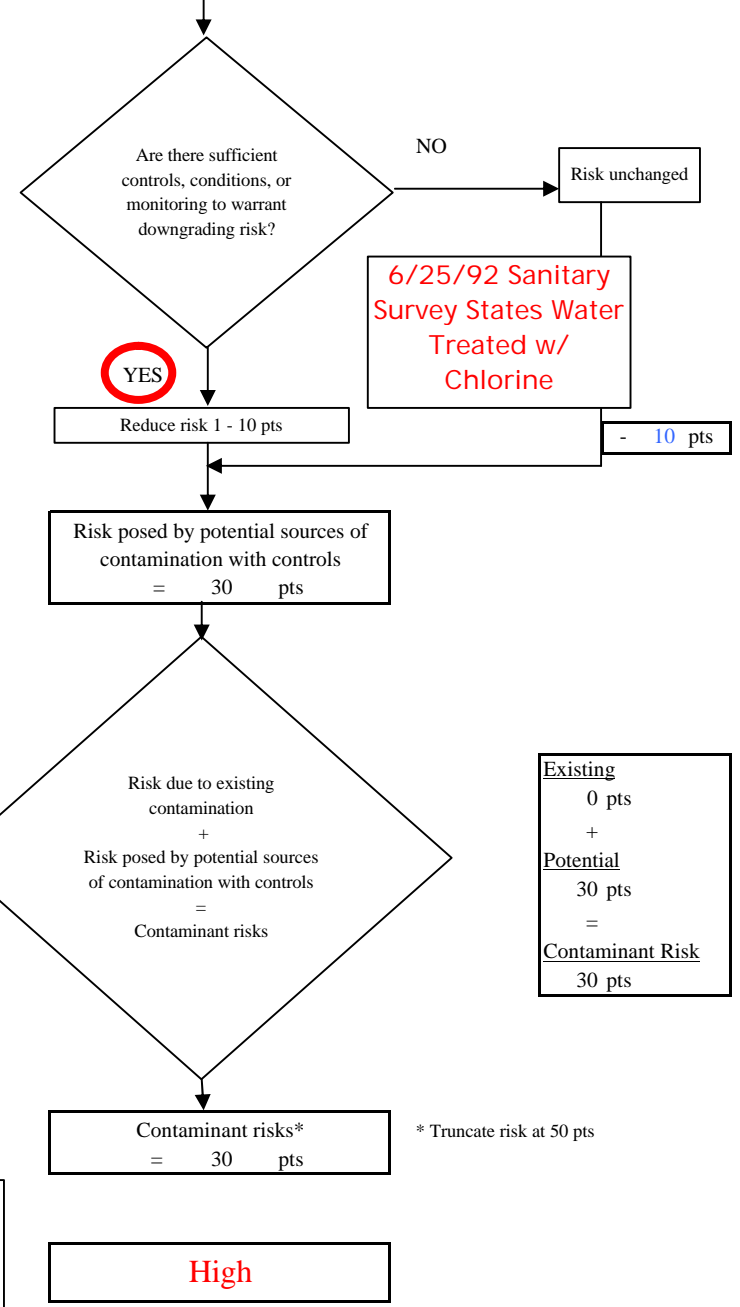


Chart 2. Contaminant risks for PWSAC Esther Hatchery - Bacteria & Viruses



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	30 pts
=	
Contaminant Risk	30 pts

Chart 3. Vulnerability analysis for PWSAC Esther Hatchery - Bacteria & Viruses

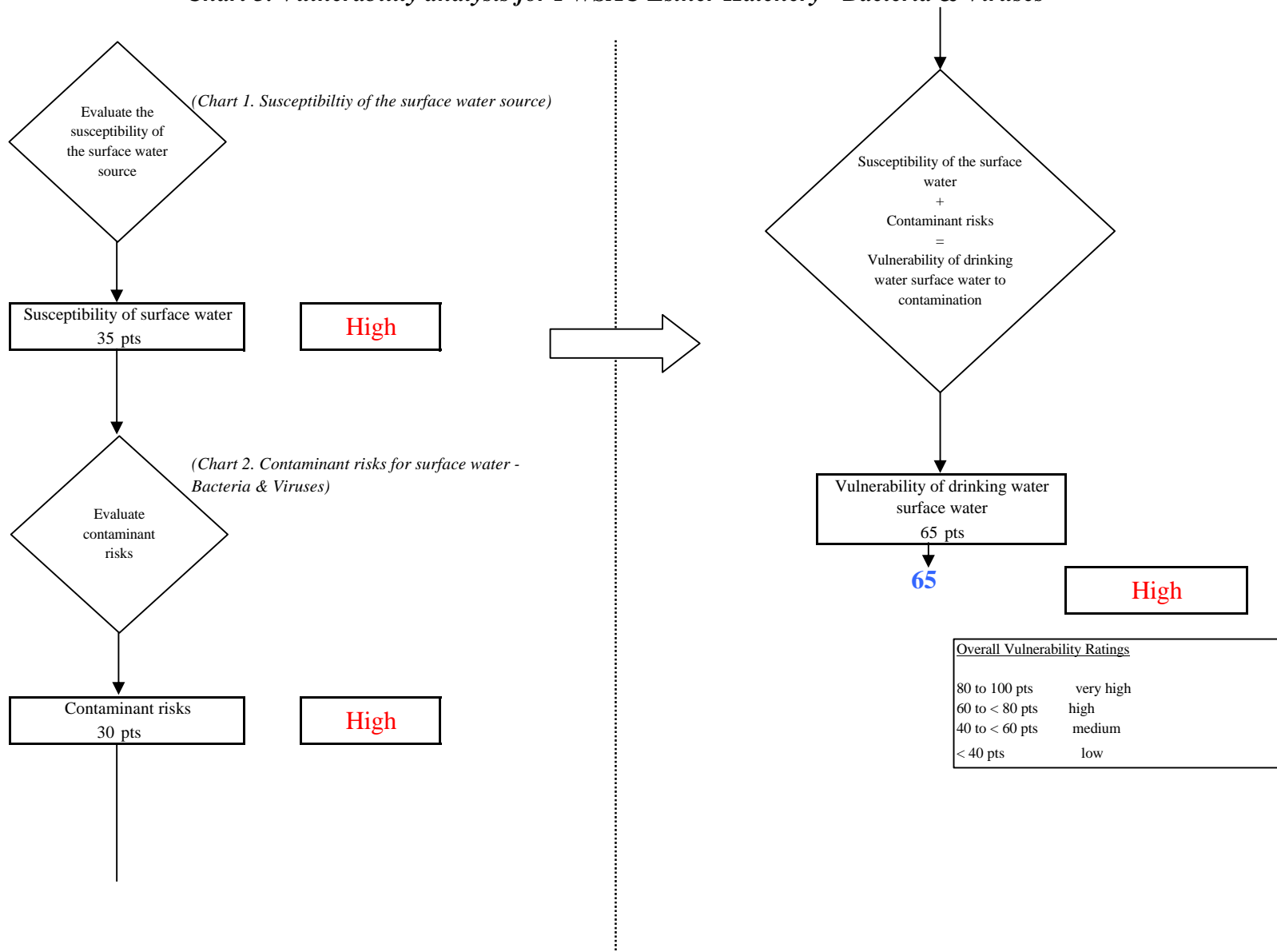


Chart 4. Contaminant risks for PWSAC Esther Hatchery - Nitrates and Nitrites

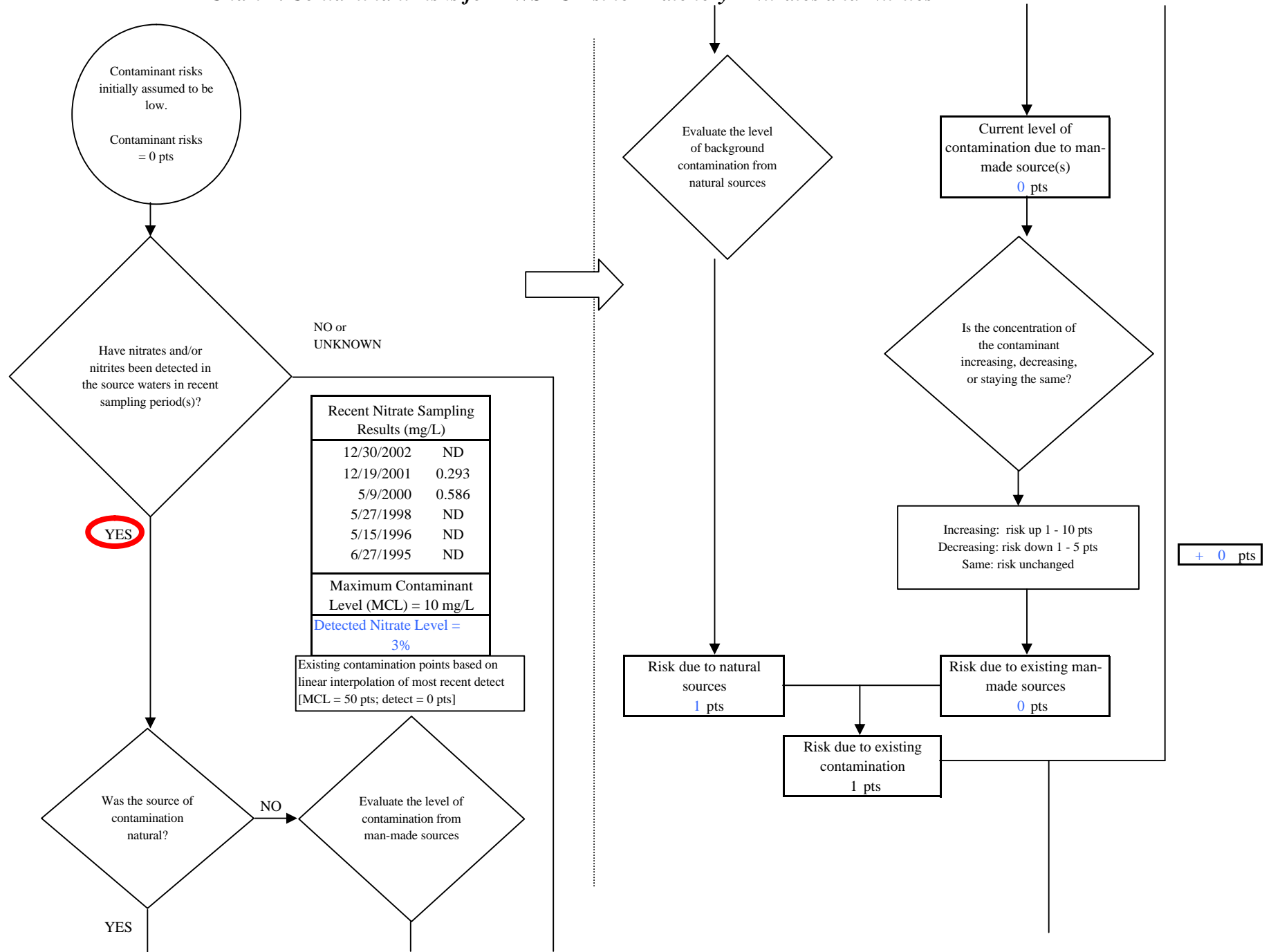


Chart 4. Contaminant risks for PWSAC Esther Hatchery - Nitrates and Nitrites

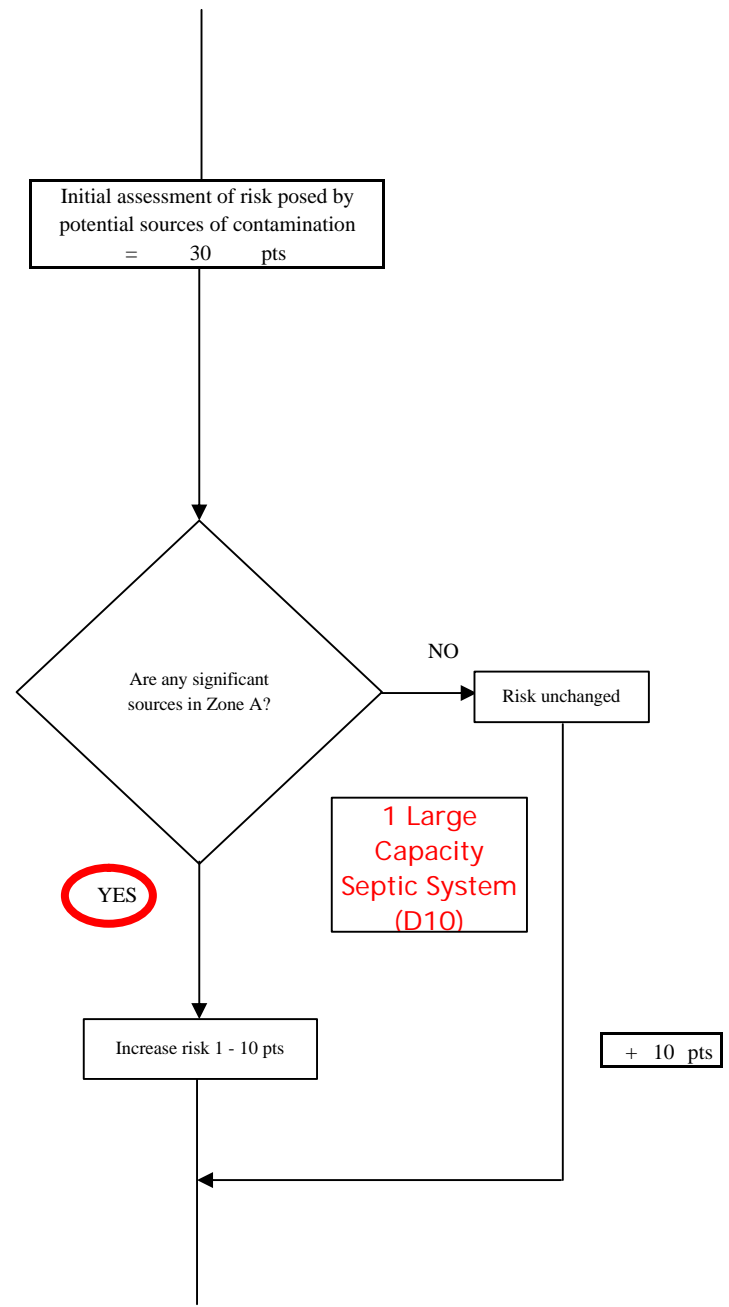
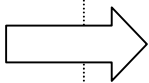
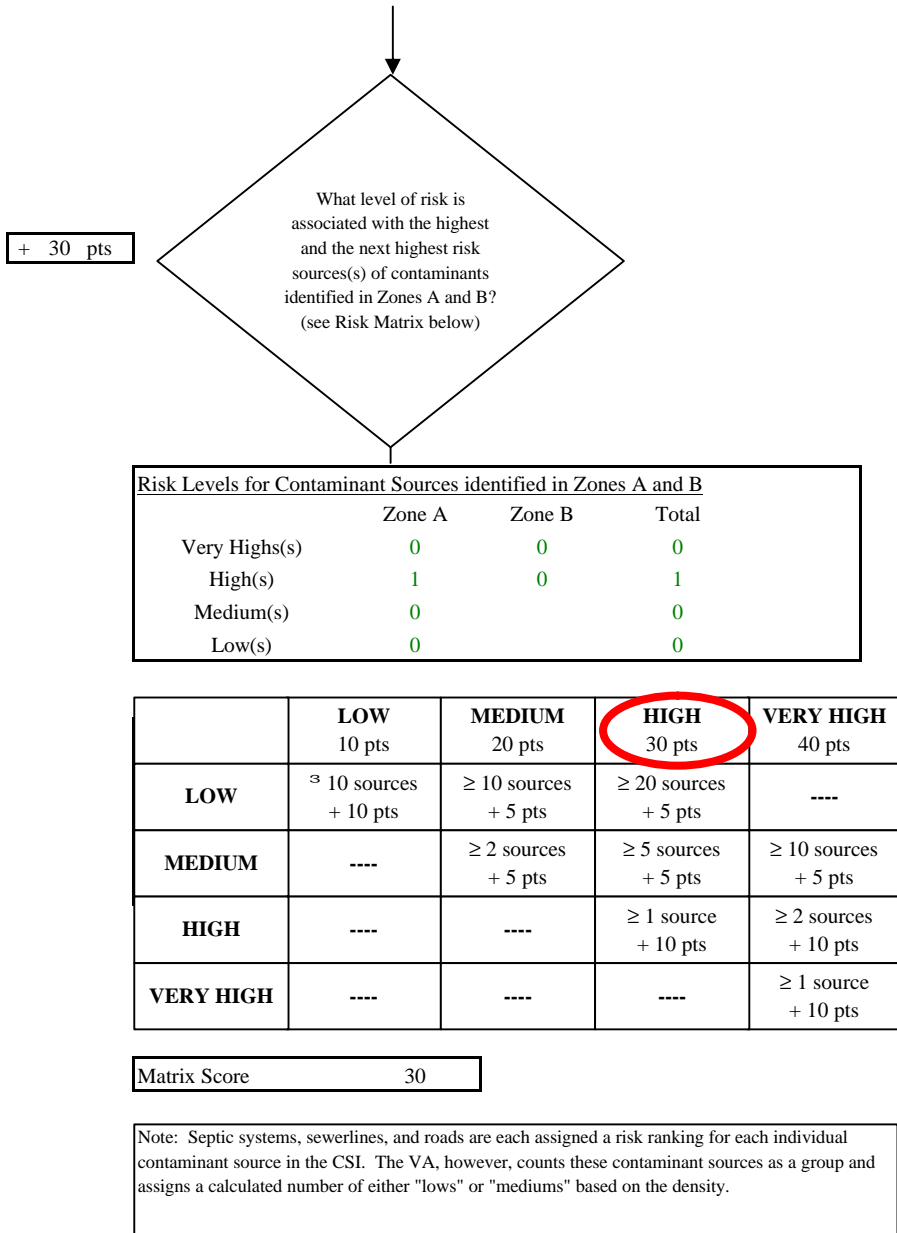


Chart 4. Contaminant risks for PWSAC Esther Hatchery - Nitrates and Nitrites

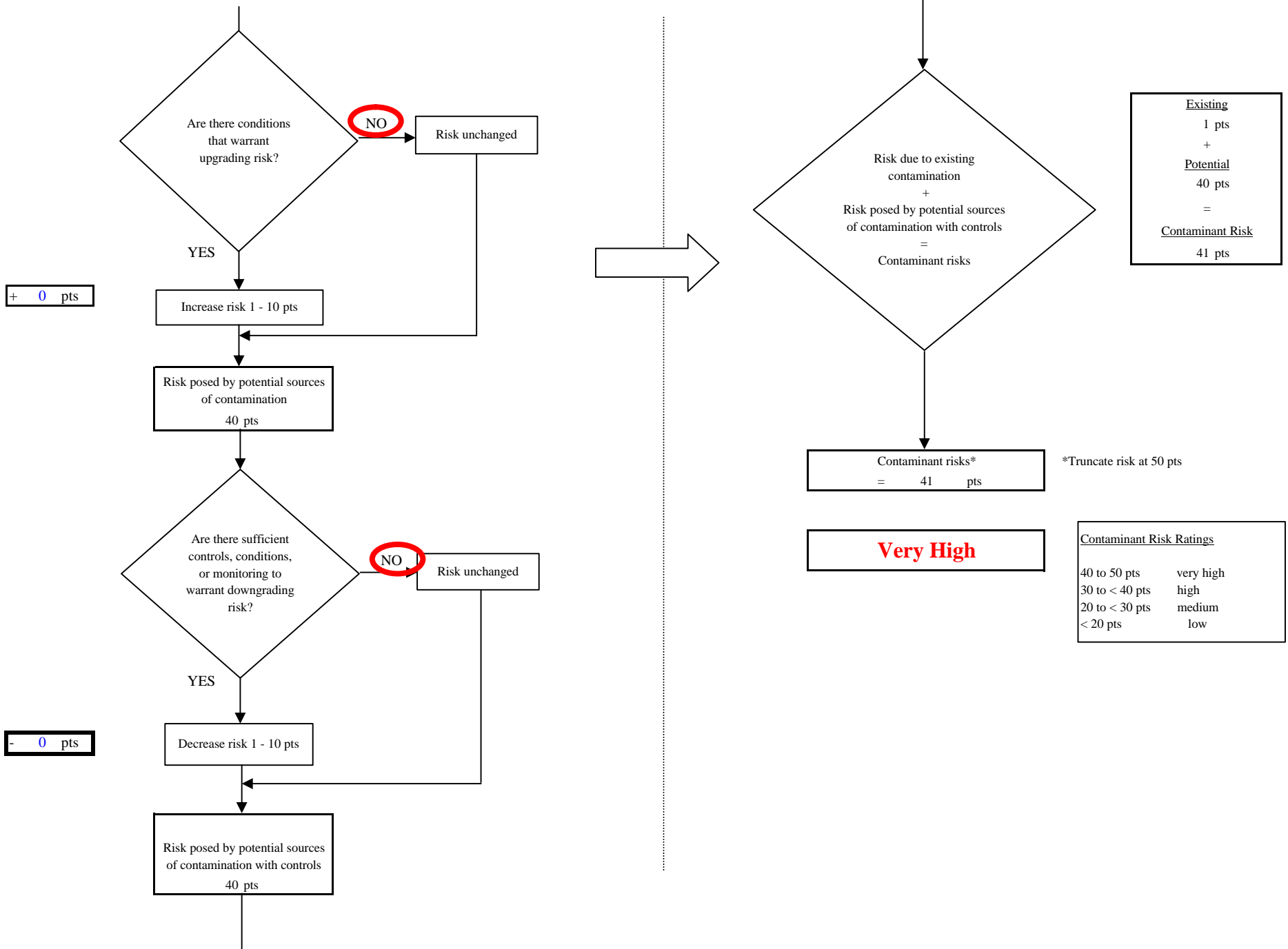


Chart 5. Vulnerability analysis for PWSAC Esther Hatchery - Nitrates and Nitrites

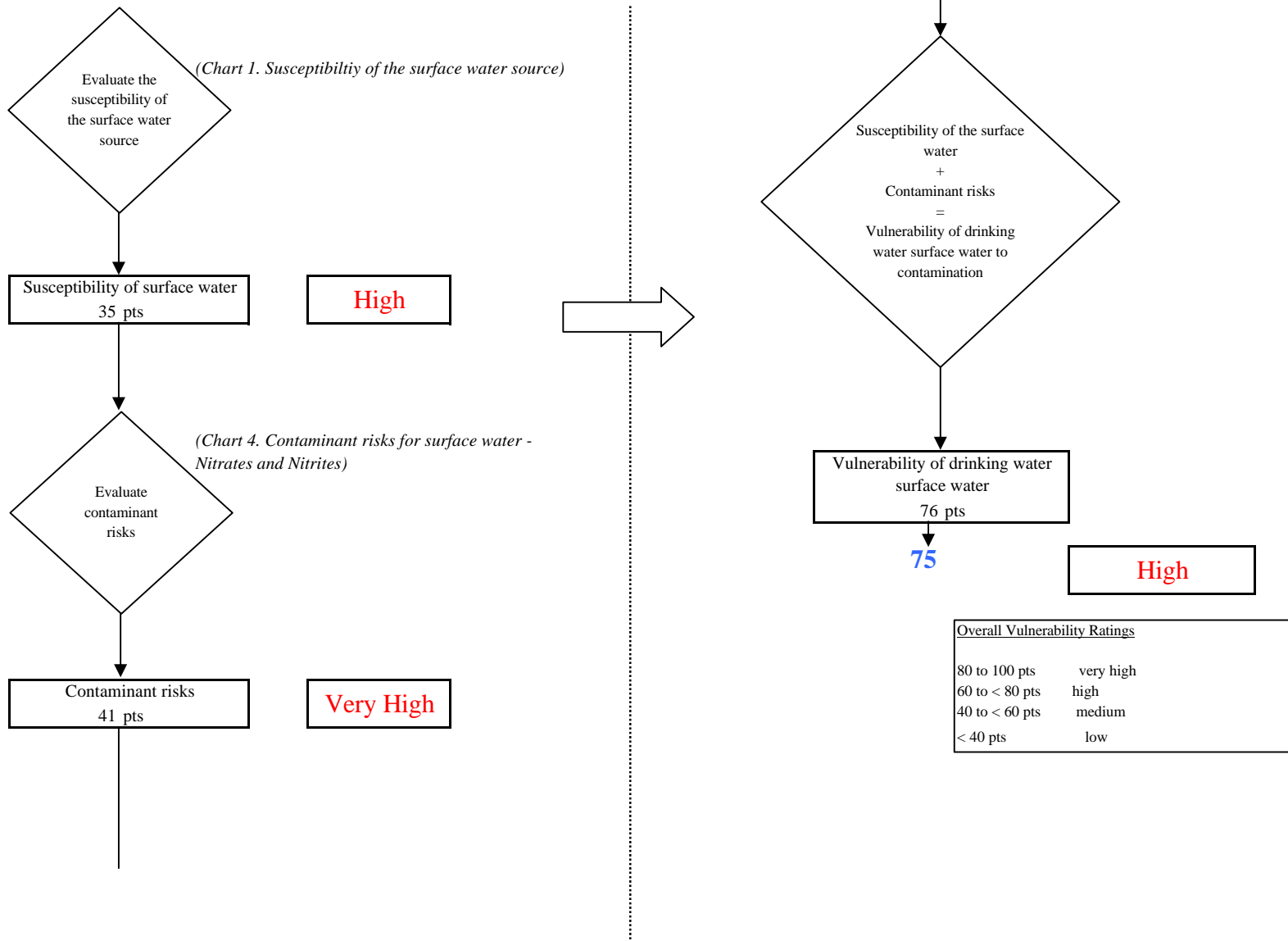


Chart 6. Contaminant risks for PWSAC Esther Hatchery - Volatile Organic Chemicals

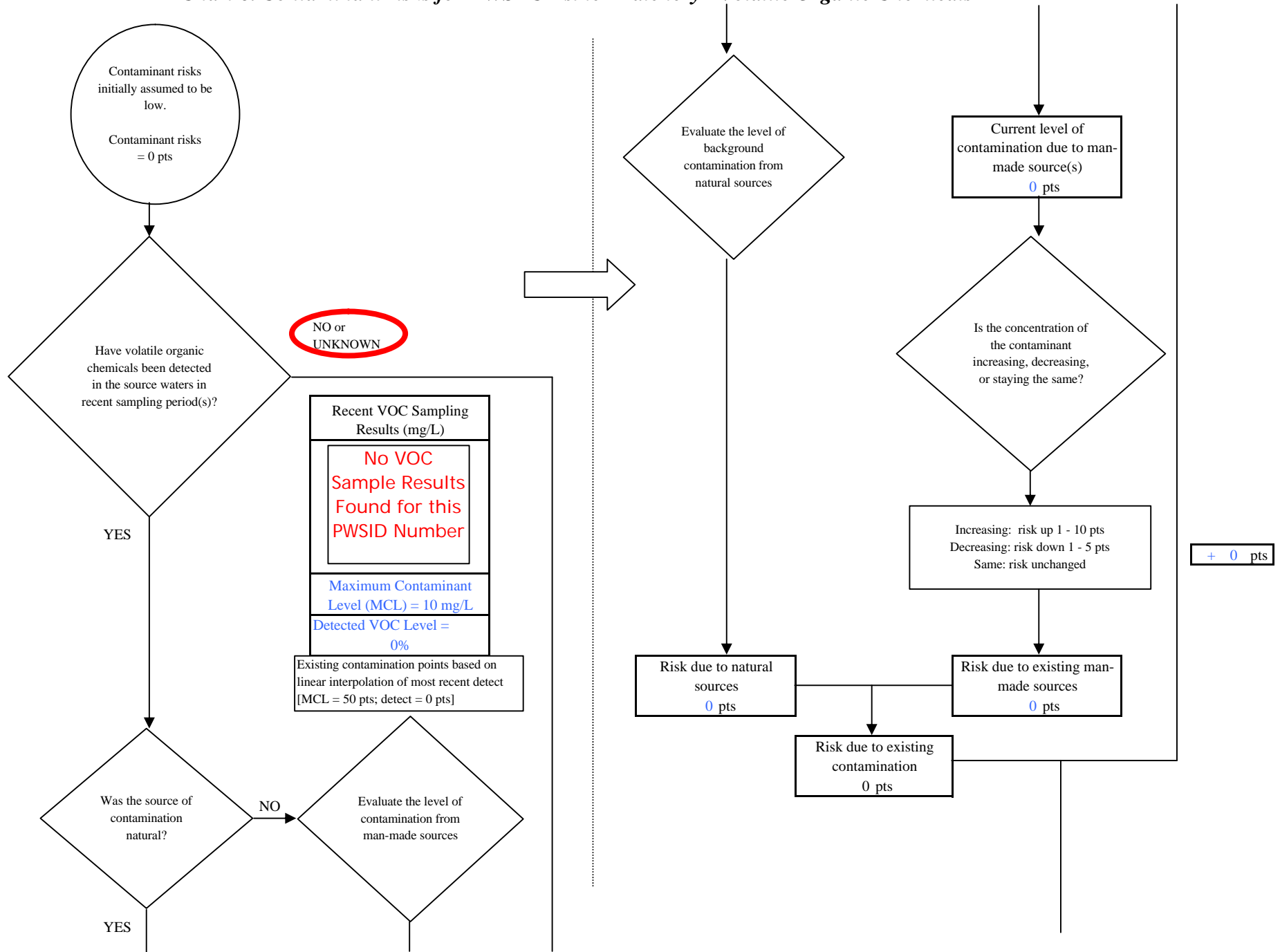
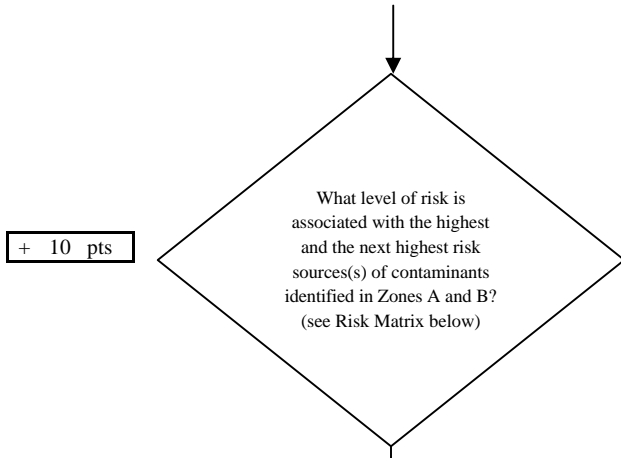


Chart 6. Contaminant risks for PWSAC Esther Hatchery - Volatile Organic Chemicals



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

	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.

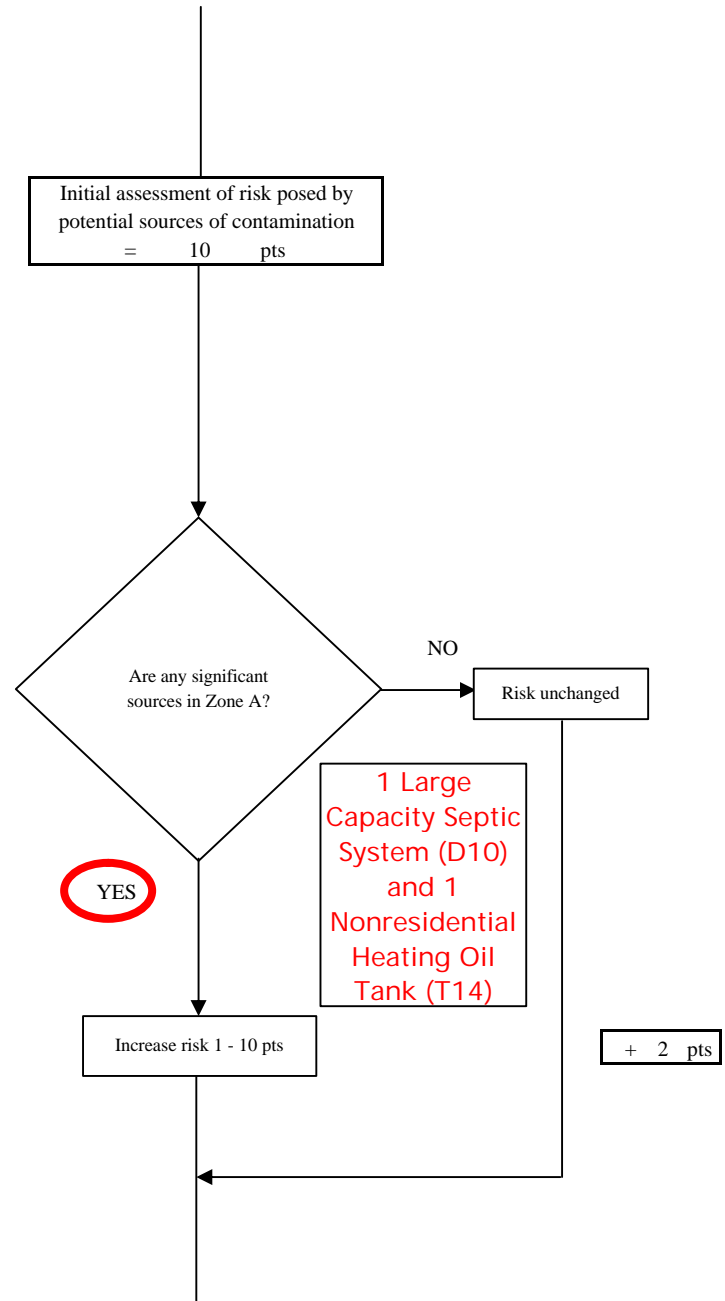
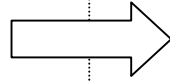


Chart 6. Contaminant risks for PWSAC Esther Hatchery - Volatile Organic Chemicals

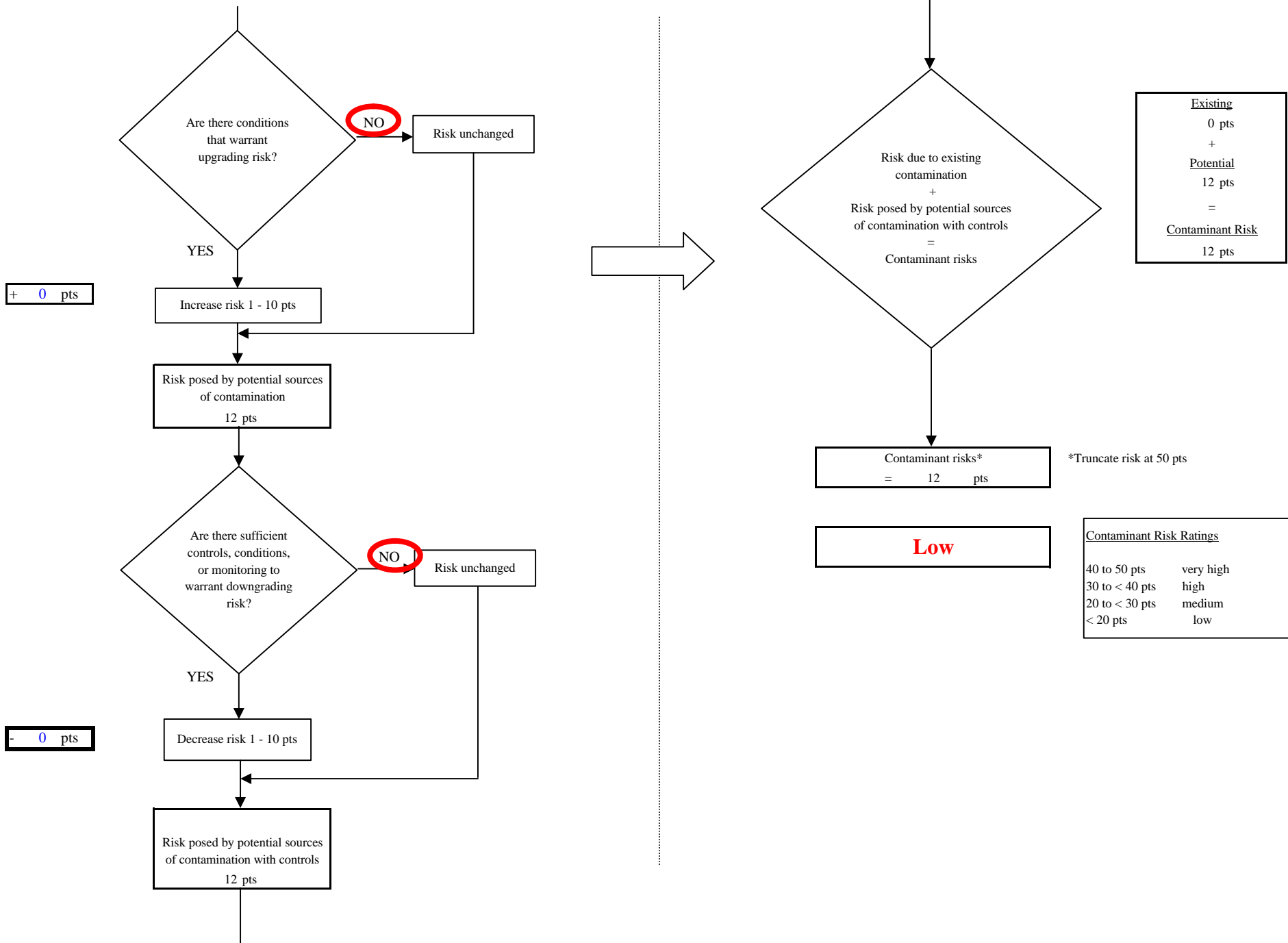


Chart 7. Vulnerability analysis for PWSAC Esther Hatchery - Volatile Organic Chemicals

