



Source Water Assessment

A Hydrogeologic Susceptibility and
Vulnerability Assessment for the
City of Hydaburg, Alaska

PWSID # 120224.001

September 2003

Drinking Water Protection Program Report #859

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

	Page
SECTION	
Executive Summary	1
Drinking Water System And Area Overview	1
City of Hydaburg Drinking Water Protection Area	1
Inventory of Potential and Existing Contaminant Sources	2
Ranking of Contaminant Risks	2
Vulnerability of the Drinking Water System	2
References	6

TABLES

TABLE		
1.	Definition of Zones	2
2.	Susceptibility of the Water Source	3
3.	City of Hydaburg Contaminant Risks	3
4.	City of Hydaburg Overall Vulnerability	3

APPENDICES

APPENDIX	
A.	City of Hydaburg Drinking Water Protection Area (Map 1)
B.	Contaminant Source Inventory and Risk Rankings (Tables 1 - 6)
C.	City of Hydaburg Drinking Water Protection Area and Potential and Existing Contaminant Sources (Map 2)
D.	Vulnerability Analysis and Contaminant Risks (Charts 1 – 13)

Source Water Assessment for the City of Hydaburg Public Water System

Drinking Water Protection Program Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

The Hydaburg public water system is a Class A (community) water system that obtains water from the Hydaburg River. The intake is located approximately 1.5-miles north of Hydaburg Bay and is accessible via gravel road. The overall protection area is approximately 9.8 square miles in size and 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, heavy metals, cyanide, and other inorganic chemicals, synthetic organic chemicals, volatile organic chemicals, and other organic chemicals. A timber waste landfill, gravel roads, beaver activity, logging areas, swimming at the source, and an underground heating oil tank were identified as potential sources of contaminants for the drinking water source. This evaluation included all available water sampling data submitted to ADEC by the system operator. The samples may have been collected from either raw water or post-treated water. Combining the susceptibility of the surface water source with the contaminant risks, this water system has received a vulnerability rating of **“medium”** for synthetic organic chemicals; **“high”** for heavy metals, cyanide, and other inorganic chemicals, and volatile organic chemicals; and **“very high”** for bacteria and viruses, nitrates and/or nitrites, and other organic chemicals.

DRINKING WATER SYSTEM AND AREA OVERVIEW

Hydaburg (Sec. 12, T077S, R083E, Copper River Meridian) is located on the southwest coast of Prince of Wales Island, 45 air miles northwest of Ketchikan. It lies 36 road miles west of Hollis, site of the State Ferry landing. (Please see the inset of Map 1 in Appendix A for location). The current population is approximately 360 (ADCED, 2003). The Hydaburg water system is a Class A (community) water system that operates year round. The system’s intake is located approximately 1.5-miles north of Hydaburg on Hydaburg River and is accessible via gravel road (See Map 1 of Appendix A).

Piped gravity sewage is treated at a secondary treatment plant, with an 800' outfall to Sukkwaw Strait. Over 95% of all homes are plumbed. (ADCED, 2003).

The geology of the watershed area is heavily composed of sediments deposited by glacial ice. The soils typically have low permeability and are frequently marked by wetland complexes. Due to the abundance of precipitation and meltwaters, water accumulates on low to gently sloped areas, which causes soil saturation. Organic soils form in these areas and support wetland plants (USDA, 2001).

Prince of Wales Island is dominated by a cool, moist, maritime climate. Summer temperatures range from 49 to 63; winter temperatures range from 32 to 42. Average annual precipitation is 120 inches, including 40 inches of snow. (ADCED, 2003).

The most recent sanitary survey (2000) states that the intake area is screened and properly protected against ice buildup and siltation. The survey also indicates there is beaver activity and human swimming that occurs around the intake area. The average daily production of the system is 125,000 gallons. No information on flow rates of the Hydaburg River was provided.

CITY OF HYDABURG 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 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 A Public Water Systems” for additional information.

The protection area established for surface water sources by the ADEC is usually separated into three zones, limited by the watershed boundary. 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 Hydaburg includes each of these Zones (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 City of Hydaburg 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 A public water system assessments, six categories of drinking water contaminants were inventoried. They include:

- Bacteria and viruses;
- Nitrates and/or nitrites;
- Volatile organic chemicals;
- Heavy metals, cyanide, and other inorganic chemicals;
- Synthetic Organic Chemicals; and
- Other Organic Chemicals.

Sources identified in the City of Hydaburg protection area are displayed on Map 2 of Appendix C and summarized 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 (if necessary) contain the ranking of potential and existing sources of contamination with respect to bacteria and viruses, nitrates and/or nitrites, volatile organic chemicals, heavy metals, cyanide, and other inorganic chemicals, synthetic organic chemicals, and other 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 13 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 13 repeat the Contaminant Risks and Vulnerability Analyses for nitrates and nitrites, volatile organic chemicals, heavy metals, cyanide, and other inorganic chemicals, synthetic organic chemicals, and other organic chemicals, respectively.

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	5	
Dilution Capacity	15	
Overall Susceptibility	50	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. City of Hydaburg Contaminant Risks

Category	Score	Rating
Bacteria and Viruses	40	Very High
Nitrates and/or Nitrites	42	Very High
Volatile Organic Chemicals	25	Medium
Heavy Metals, Cyanide, and Other Inorganic Chemicals	12	Low
Synthetic Organic Chemicals	0	Low
Other Organic Chemicals	42	Very High

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. City of Hydaburg Overall Vulnerability

Category	Score	Rating
Bacteria and Viruses	90	Very High
Nitrates and Nitrites	90	Very High
Volatile Organic Chemicals	75	High
Heavy Metals, Cyanide, and Other Inorganic Chemicals	60	High
Synthetic Organic Chemicals	50	Medium
Other Organic Chemicals	90	Very High

Bacteria and Viruses

The contaminant risk for bacteria and viruses is “very high”. 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).

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.

No two consecutive positive bacteria counts have been detected in sampling collected since January 1999. A possible source of bacteria could be from beaver activity, gravel roads, or human activity (swimming/hiking) at the source.

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 becomes “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). Nitrates are very mobile, moving at approximately the same rate as water.

Sampling history for the water source indicates that nitrates were last detected in small amounts in March 2000. 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).

A possible source of nitrate/nitrites is the presence of gravel roadways, beaver activity, logging, or human activity (hiking/swimming) at the source.

After combining the contaminant risk for nitrates and nitrites with the natural susceptibility of the source, the overall vulnerability of the source to contamination is “very high”.

Volatile Organic Chemicals

The contaminant risk for volatile organic chemicals is “medium” (See Chart 6 – Contaminant Risks for Volatile Organic Chemicals in Appendix D).

Chloroform and trihalomethanes were detected at levels below the MCL during sampling in 2000-2001, although both of these chemicals typically originate during the process of water treatment and not from the source waters. The MCL for chloroform is 0.2 milligrams per liter (mg/L) and the MCL for total trihalomethanes is 0.1 mg/L.

Possible sources of these chemicals in the watershed are logging, underground storage tanks containing oil, or gravel roads.

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 “high”.

Heavy Metals, Cyanide, and Other Inorganic Chemicals

The contaminant risk for heavy metals is “low”. Copper and lead were detected in samples collected during 1993 and 1996 (See Chart 8 – Contaminant Risks for Heavy Metals, Cyanide, and Other Inorganic Chemicals in Appendix D). The MCL for copper is 1.3 mg/l. and the MCL for lead is 0.015 mg/l.

The most common source of these chemicals is the infrastructure of the distribution system following the treatment process. Logging activity or gravel roads can also contribute heavy metals to source waters.

After combining the contaminant risk for heavy metals with the natural susceptibility of the source, the overall vulnerability of the source to contamination is “high”.

Synthetic Organic Chemicals

The contaminant risk for synthetic organic chemicals is “low”. After combining the contaminant risk with the natural susceptibility of the source, the overall vulnerability to synthetic organic chemicals of the source is “medium” (See Chart 11 – Contaminant Risks for Synthetic Organic Chemicals in Appendix D).

Review of the historical sampling data indicates that no sampling for these chemicals has been performed recently.

Other Organic Chemicals

The contaminant risk for other organic chemicals is “very high”. After combining the contaminant risk with the natural susceptibility of the source, the overall vulnerability to other organic chemicals of the source is “very high” (See Chart 13 – Contaminant Risks for Other Organic Chemicals in Appendix D).

A potential source of these chemicals is gravel roads or logging waste landfills.

Review of the historical sampling data indicates that no other organic chemicals have been sampled recently.

REFERENCES

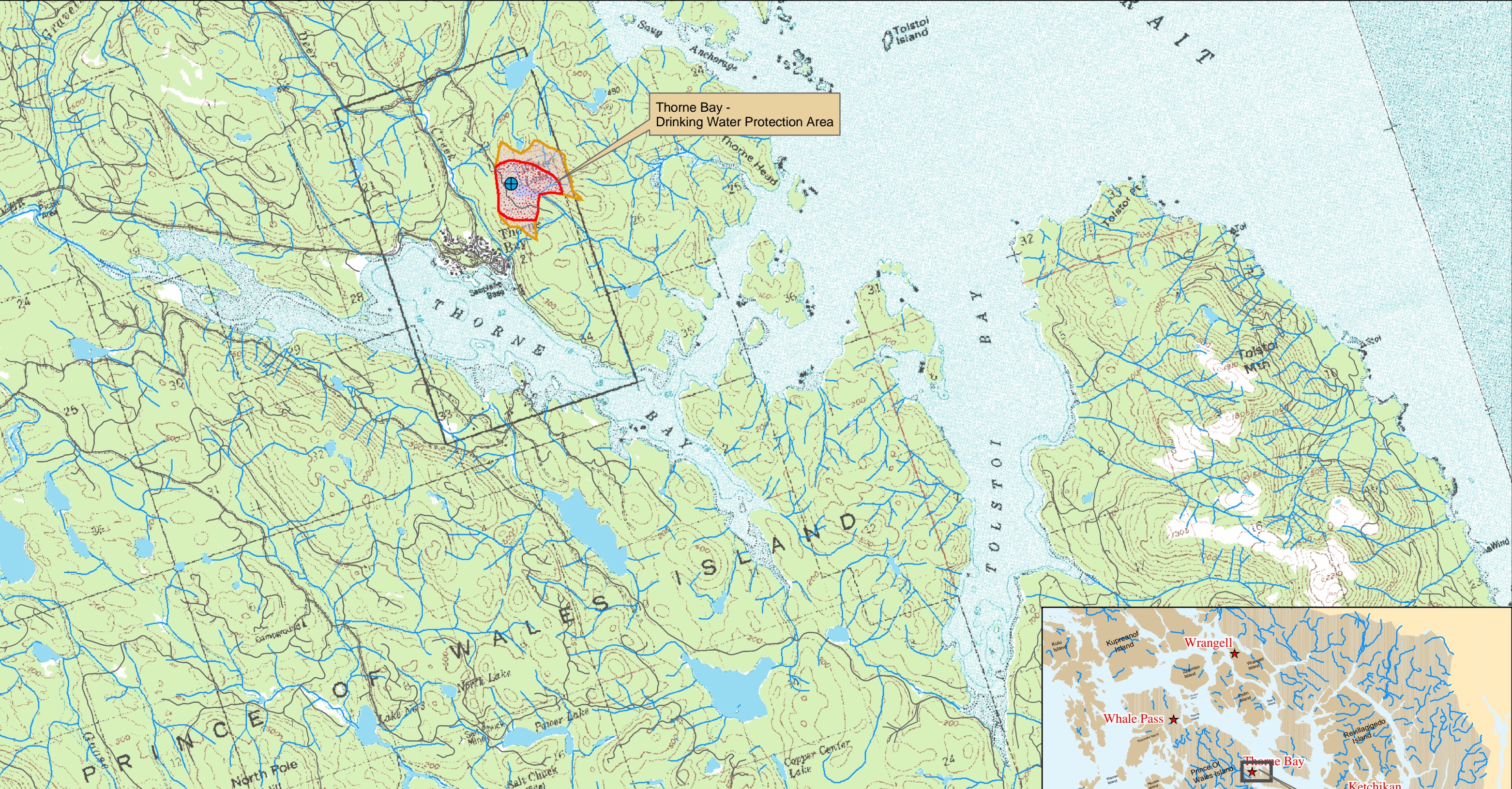
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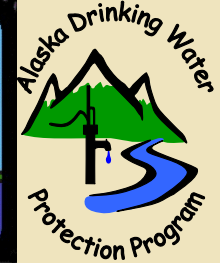
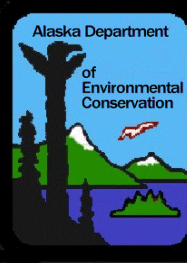
APPENDIX A

City of Hydaburg Drinking Water Protection Area Location Map (Map 1)



Map 1: Thorne Bay Drinking Water Protection Area

PWSID: 120216.001



Data Sources:

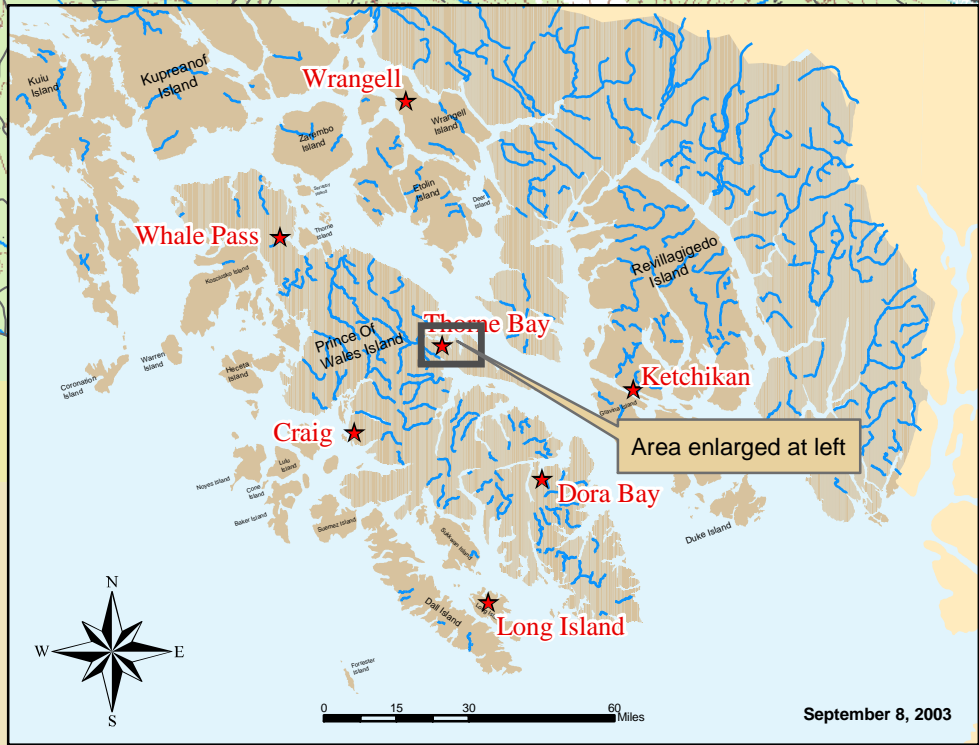
Background image - USGS 1:63,000 mapping
Lakes & streams - U.S. Forest Service, Tongass
Roads, Contours - Shannon & Wilson, Inc.

Protection zones were delineated based upon streams noted on USGS 1:63,000 mapping.

For this PWS, Zone C (the entire watershed) covers the same area as Zone B (areas within 1-mile of the stream).

Legend

- Thorne Bay PWS
- Zone A Protection Area
- Zone B Protection Area
- Zone C Protection Area
- Stream
- Lake



September 8, 2003

APPENDIX B

Contaminant Source Inventory and Risk Rankings (Tables 1 - 6)

Table 1**Contaminant Source Inventory for
Thorne Bay****PWSID 120216.001**

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Map Number	Comments
Beaver/muskrat/otter habitat	B01	B01 - 1	A	2	From operator information , March 2003, Ralph Groshong
Logging areas	E02	E02 1-3	A	2	2 Areas on Tongass GIS data. 1 area visible on aerial photo, operator reports that logging is inactive in the area, March 2003
Highways and roads, dirt/gravel	X24	X24 1-3	A	2	From Tongass GIS data

Table 2

*Contaminant Source Inventory and Risk Ranking for
Thorne Bay
Sources of Bacteria and Viruses*

PWSID 120216.001

<i>Contaminant Source Type</i>	<i>Contaminant Source ID</i>	<i>CS ID tag</i>	<i>Zone</i>	<i>Risk Ranking for Analysis</i>	<i>Map Number</i>	<i>Comments</i>
Beaver/muskrat/otter habitat	B01	B01 - 1	A	High	2	From operator information , March 2003, Ralph Groshong
Highways and roads, dirt/gravel	X24	X24 1-3	A	Low	2	From Tongass GIS data

Table 3

*Contaminant Source Inventory and Risk Ranking for
Thorne Bay
Sources of Nitrates/Nitrites*

PWSID 120216.001

<i>Contaminant Source Type</i>	<i>Contaminant Source ID</i>	<i>CS ID tag</i>	<i>Zone</i>	<i>Risk Ranking for Analysis</i>	<i>Map Number</i>	<i>Comments</i>
Beaver/muskrat/otter habitat	B01	B01 - 1	A	High	2	From operator information , March 2003, Ralph Groshong
Logging areas	E02	E02 1-3	A	Low	2	2 Areas on Tongass GIS data. 1 area visible on aerial photo, operator reports that logging is inactive in the area, March 2003
Highways and roads, dirt/gravel	X24	X24 1-3	A	Low	2	From Tongass GIS data

Table 4

*Contaminant Source Inventory and Risk Ranking for
Thorne Bay
Sources of Volatile Organic Chemicals*

PWSID 120216.001

<i>Contaminant Source Type</i>	<i>Contaminant Source ID</i>	<i>CS ID tag</i>	<i>Zone</i>	<i>Risk Ranking for Analysis</i>	<i>Map Number</i>	<i>Comments</i>
Logging areas	E02	E02 1-3	A	Medium	2	2 Areas on Tongass GIS data. 1 area visible on aerial photo, operator reports that logging is inactive in the area, March 2003
Highways and roads, dirt/gravel	X24	X24 1-3	A	Low	2	From Tongass GIS data

Table 5

*Contaminant Source Inventory and Risk Ranking for
Thorne Bay
Sources of Heavy Metals, Cyanide and Other Inorganic Chemicals*

PWSID 120216.001

<i>Contaminant Source Type</i>	<i>Contaminant Source ID</i>	<i>CS ID tag</i>	<i>Zone</i>	<i>Risk Ranking for Analysis</i>	<i>Map Number</i>	<i>Comments</i>
Logging areas	E02	E02 1-3	A	Low	2	2 Areas on Tongass GIS data. 1 area visible on aerial photo, operator reports that logging is inactive in the area, March 2003
Highways and roads, dirt/gravel	X24	X24 1-3	A	Low	2	From Tongass GIS data

Table 6

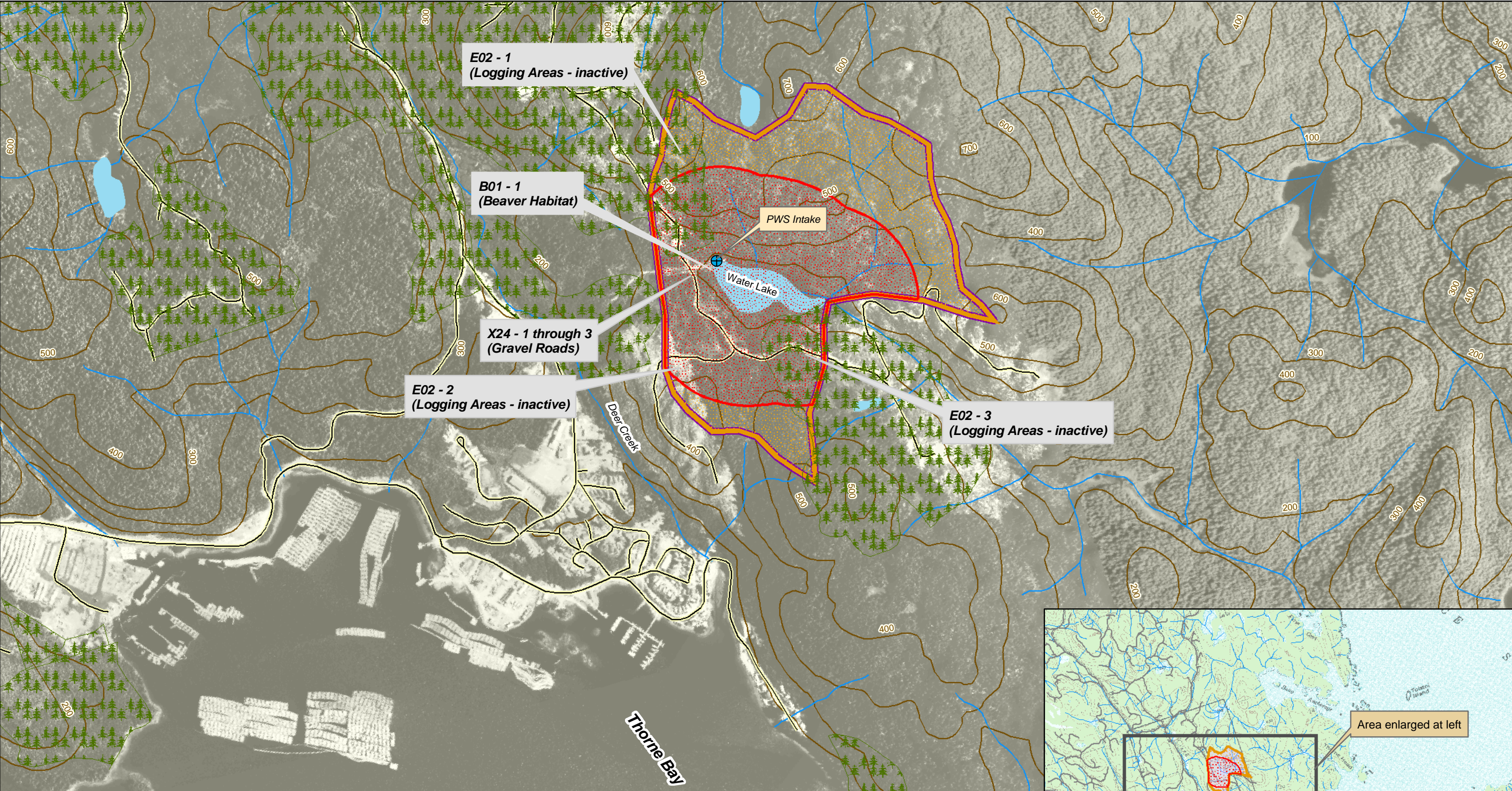
*Contaminant Source Inventory and Risk Ranking for
Thorne Bay
Sources of Other Organic Chemicals*

PWSID 120216.001

<i>Contaminant Source Type</i>	<i>Contaminant Source ID</i>	<i>CS ID tag</i>	<i>Zone</i>	<i>Risk Ranking for Analysis</i>	<i>Map Number</i>	<i>Comments</i>
Highways and roads, dirt/gravel	X24	X24 1-3	A	Low	2	From Tongass GIS data

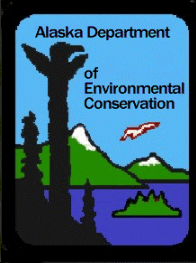
APPENDIX C

City of Hydaburg Drinking Water Protection Area and Potential and Existing Contaminant Sources (Map 2)



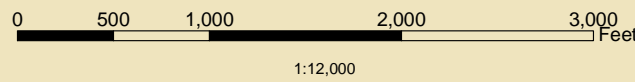
Map 2: Potential and Existing Contaminant Sources

PWSID: 120216.001



Data Sources:

Background image - Shannon & Wilson, Inc.
Lakes, streams, & roads - U.S. Forest Service
Roads, contours - Shannon & Wilson, Inc.

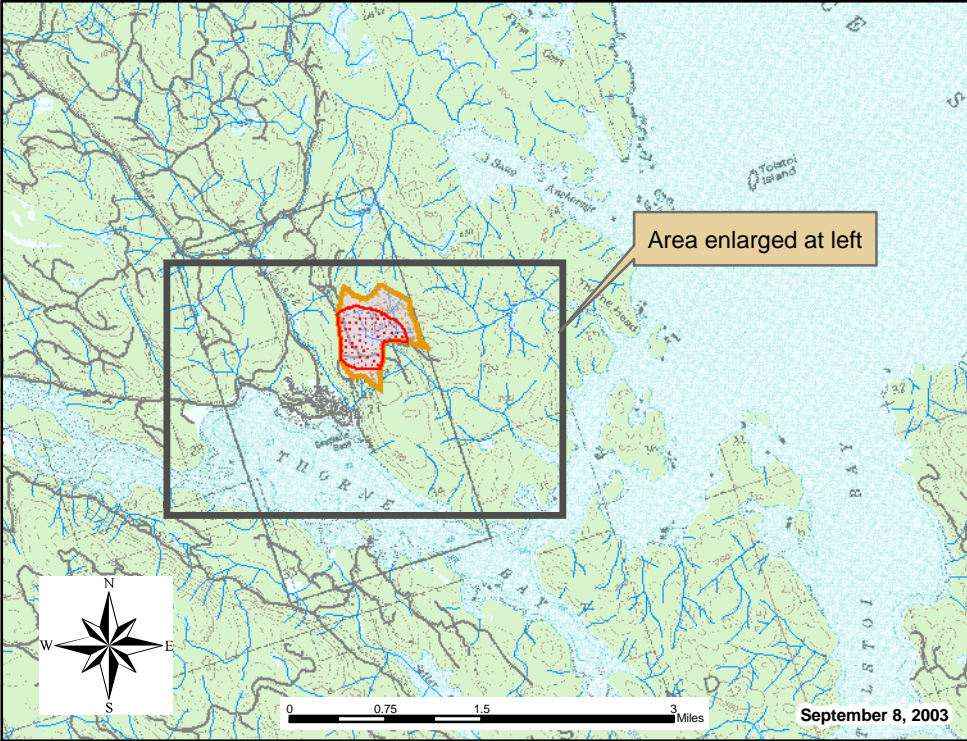


Protection zones were delineated based upon streams noted on USGS 1:63,000 mapping.

For this PWS, Zone C (the entire watershed) covers the same area as Zone B (areas within 1-mile of the stream).

Legend

- Thorne Bay PWS
- Zone A Protection Area
- Zone B Protection Area
- Zone C Protection Area
- Lake
- Streams
- Roads
- 100-ft Contours



APPENDIX D

Vulnerability Analysis and Contaminant Risks (Charts 1-13)

Chart 1. Susceptibility of the Surface Water Source - Thorne Bay

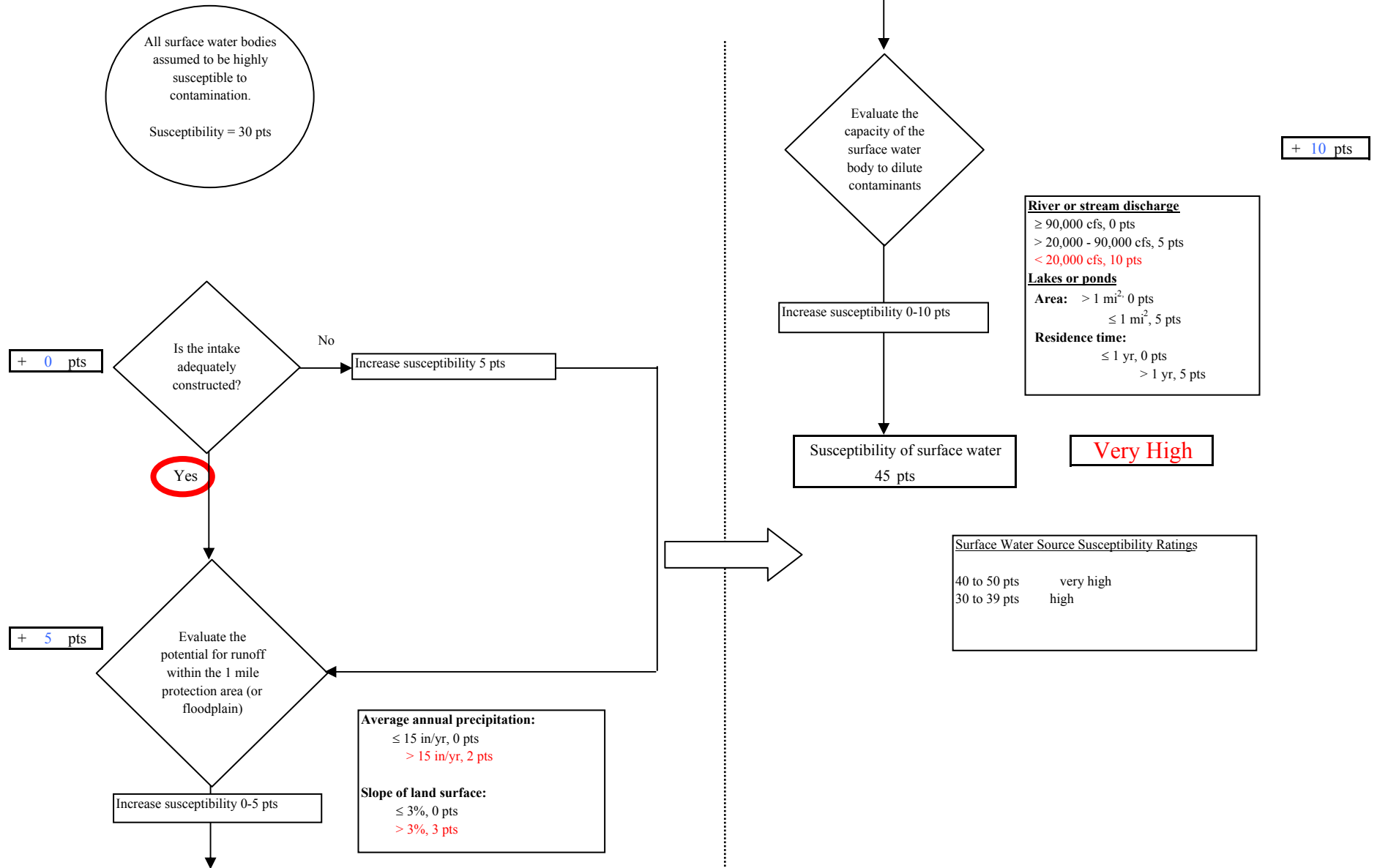


Chart 2. Contaminant risks for Thorne Bay - Bacteria & Viruses

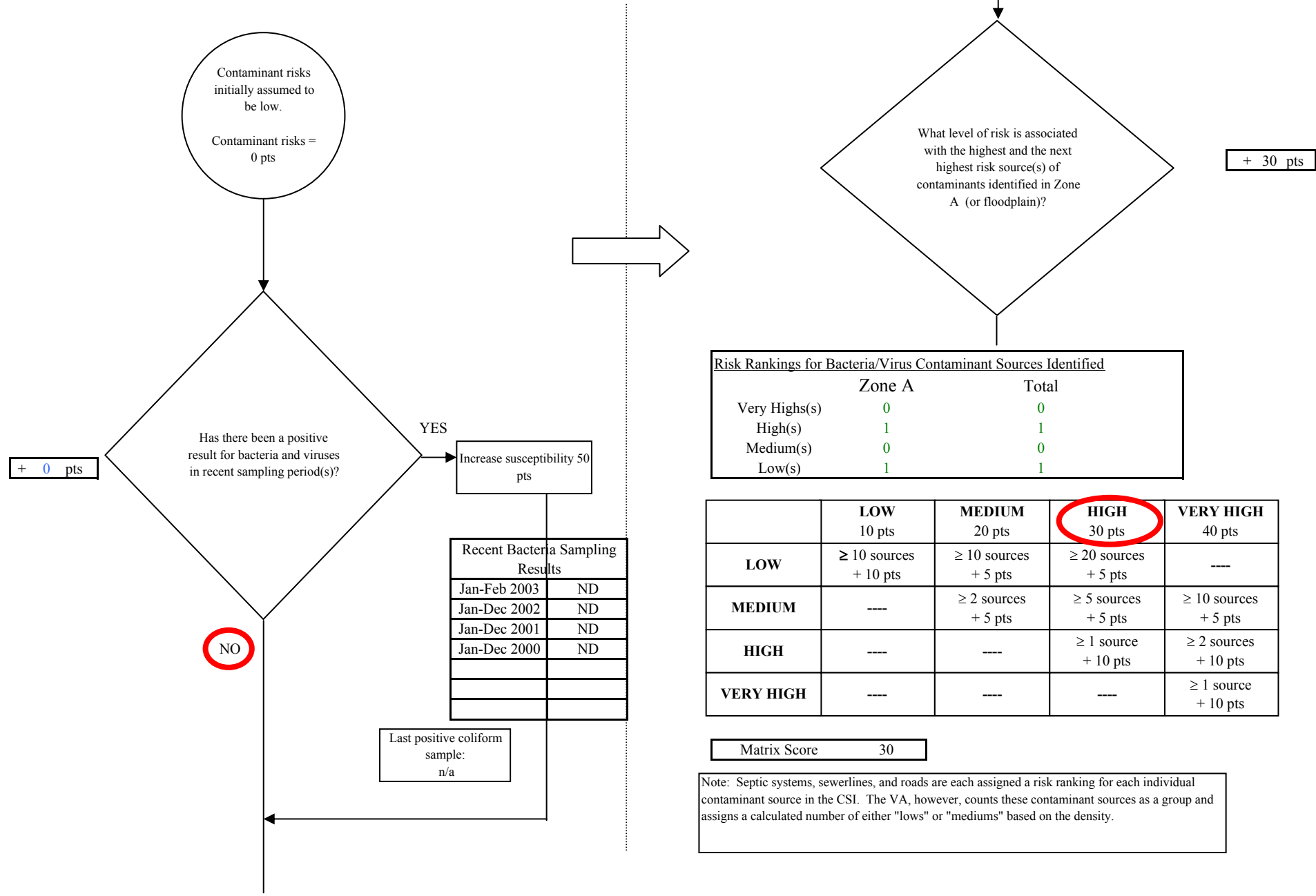


Chart 2. Contaminant risks for Thorne Bay - Bacteria & Viruses

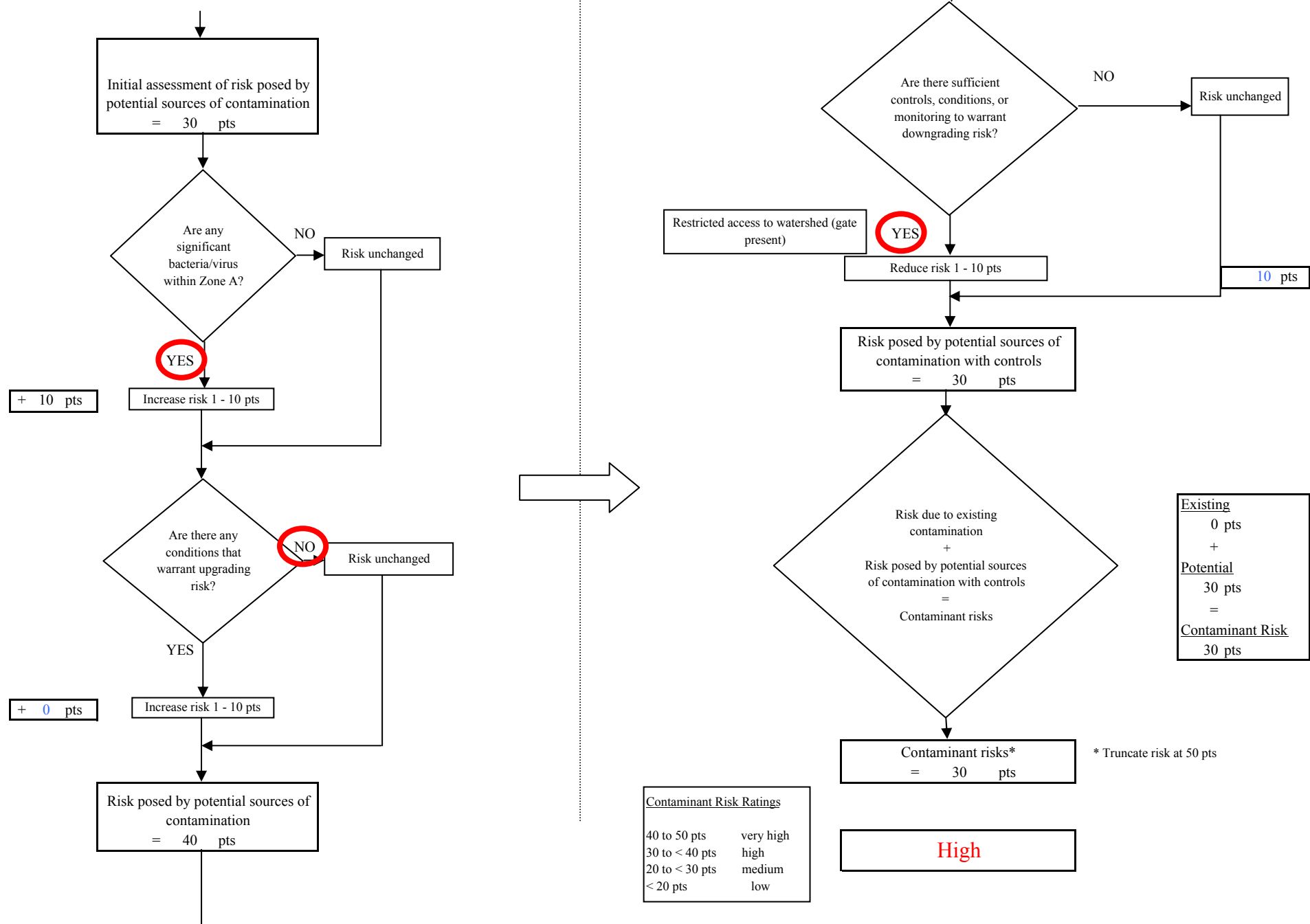


Chart 3. Vulnerability analysis for Thorne Bay - Bacteria & Viruses

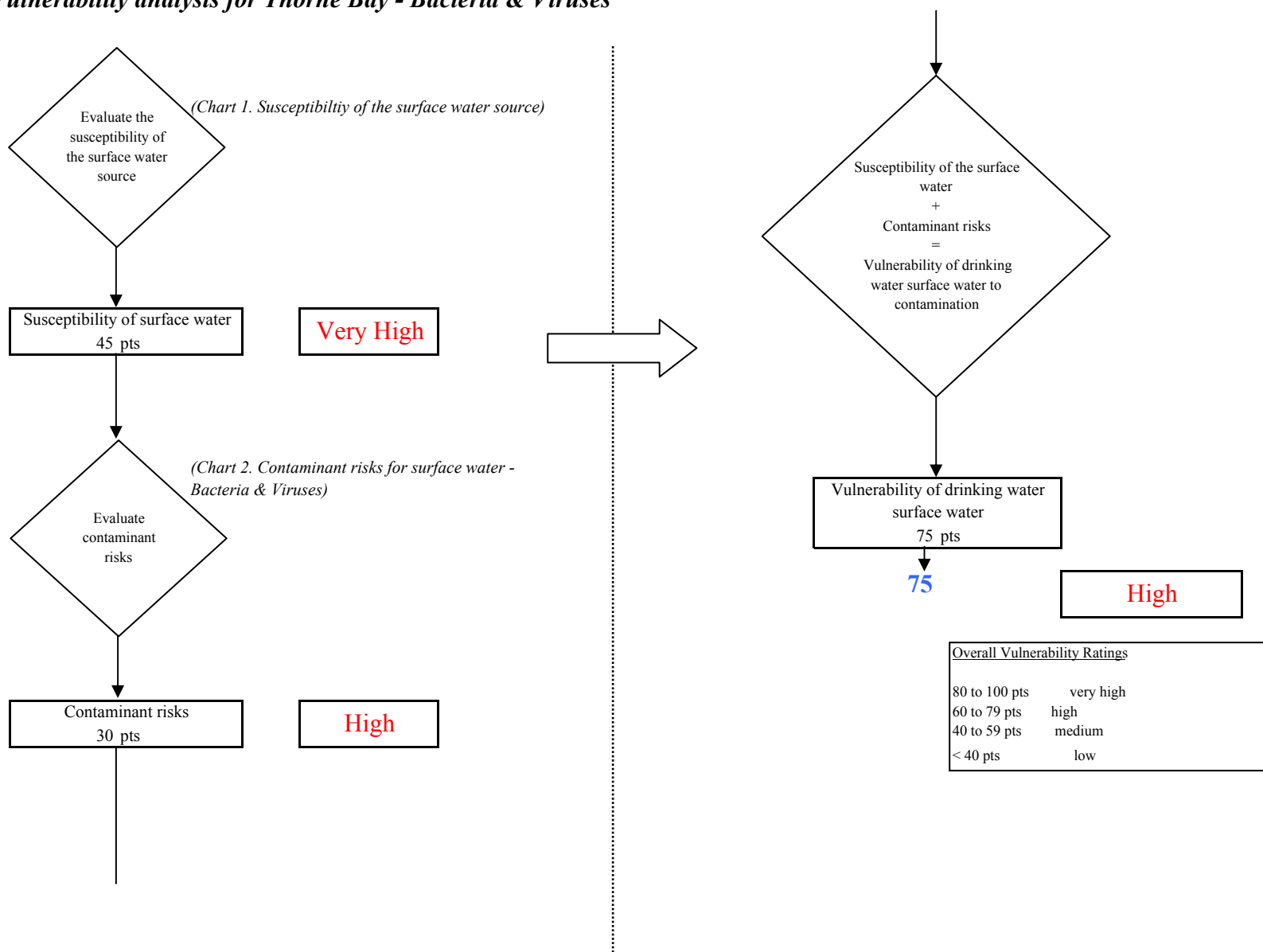


Chart 4. Contaminant risks for Thorne Bay - Nitrates and Nitrites

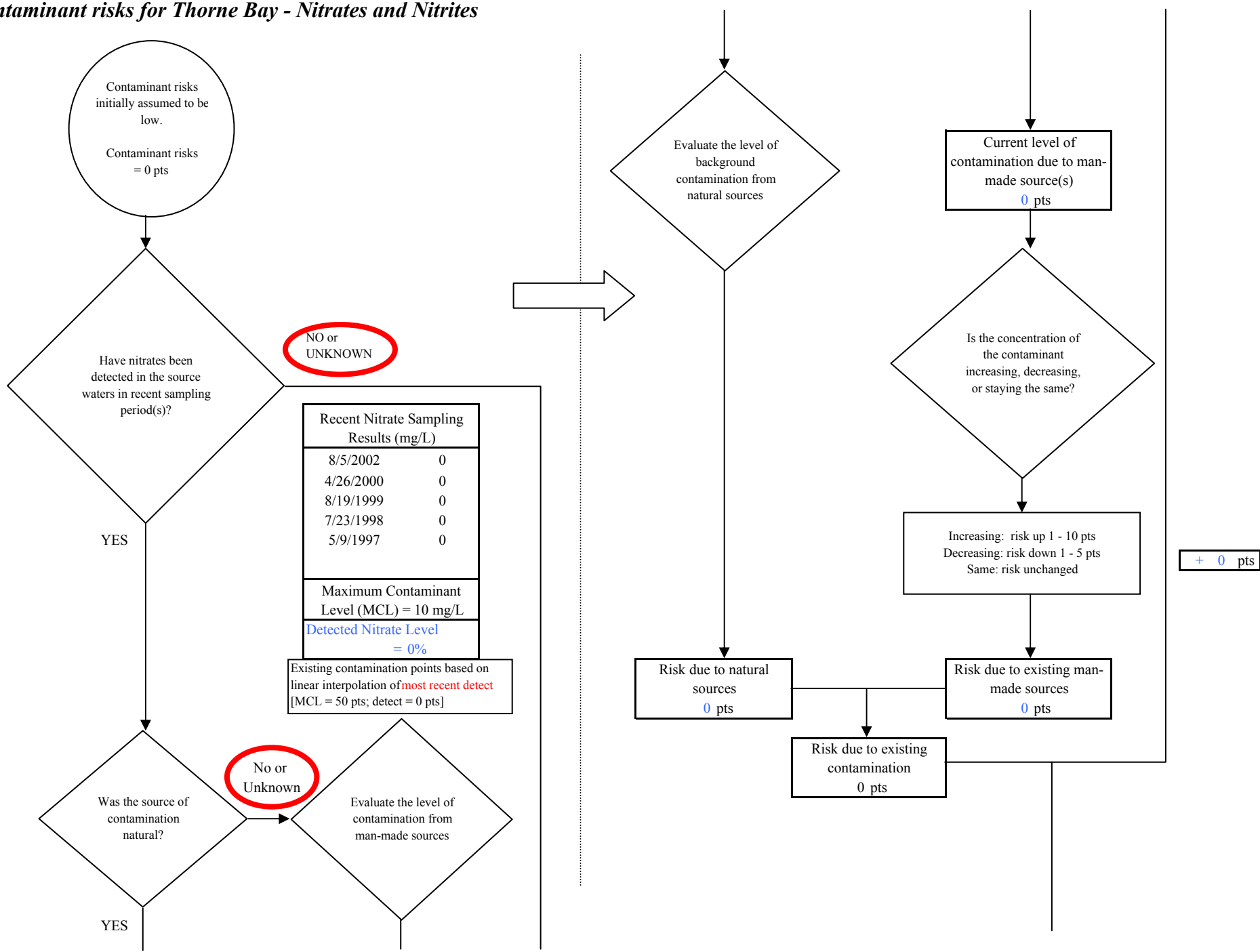


Chart 4. Contaminant risks for Thorne Bay - Nitrates and Nitrites

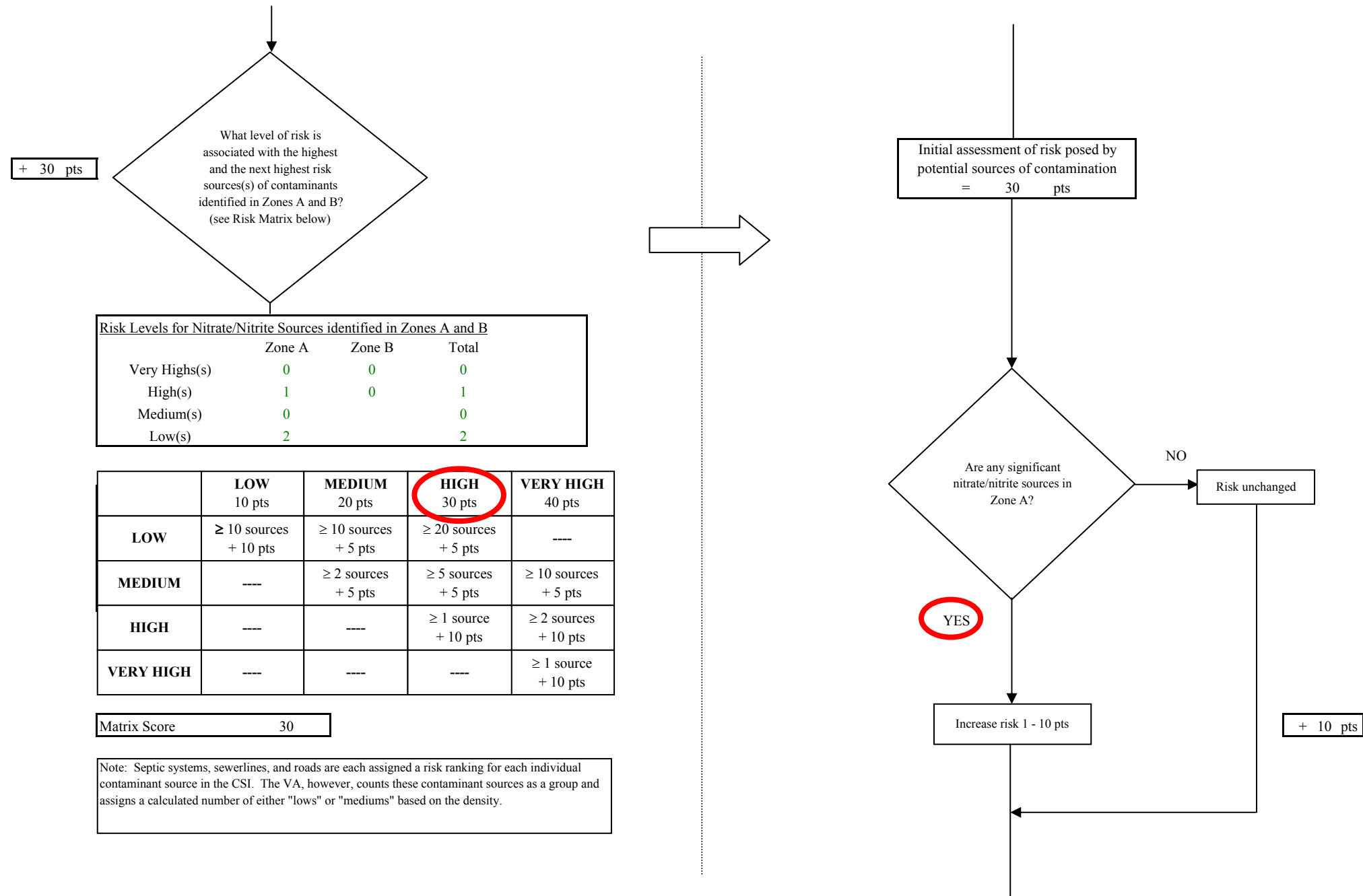


Chart 4. Contaminant risks for Thorne Bay - Nitrates and Nitrites

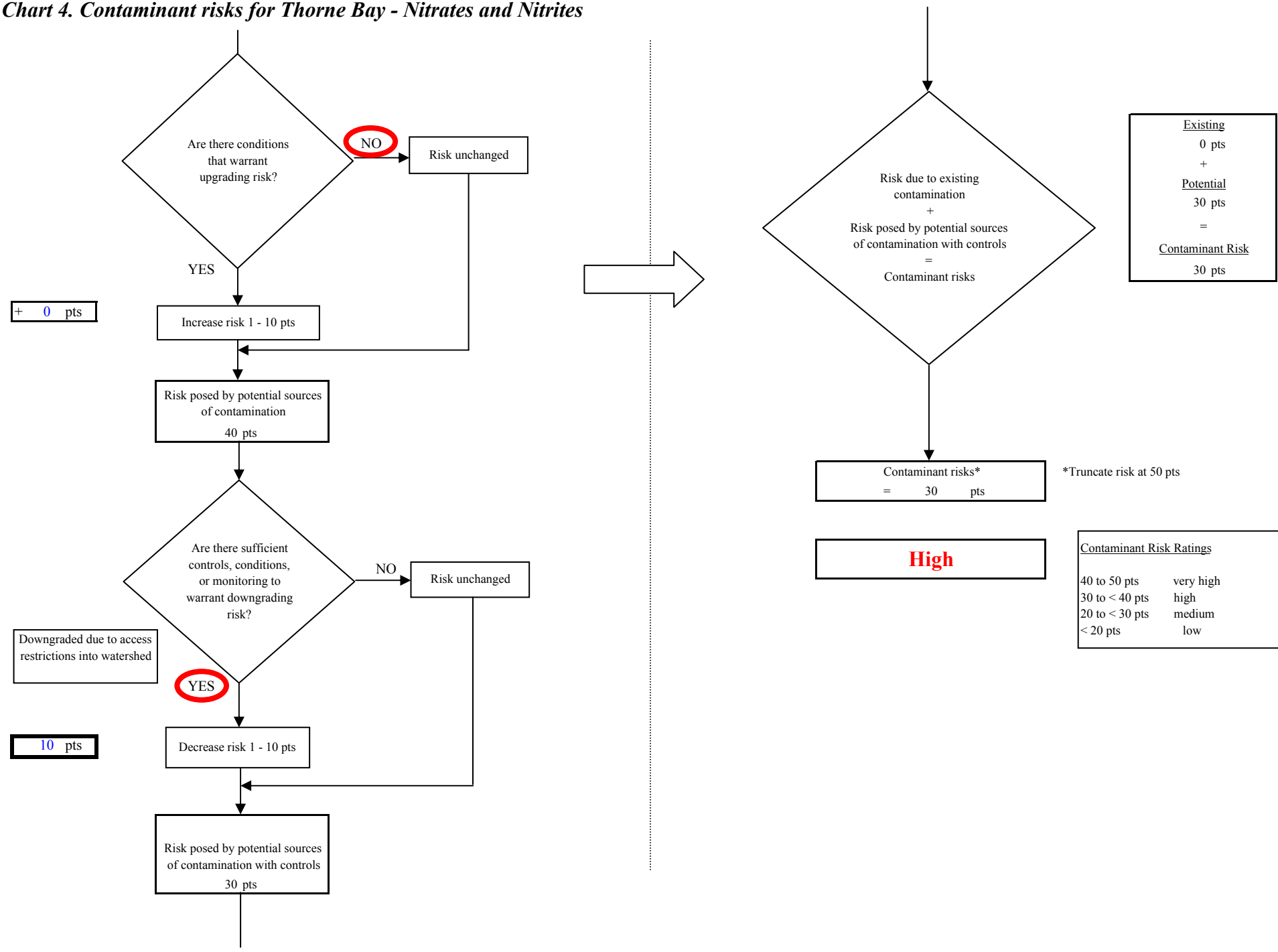


Chart 5. Vulnerability analysis for Thorne Bay - Nitrates and Nitrites

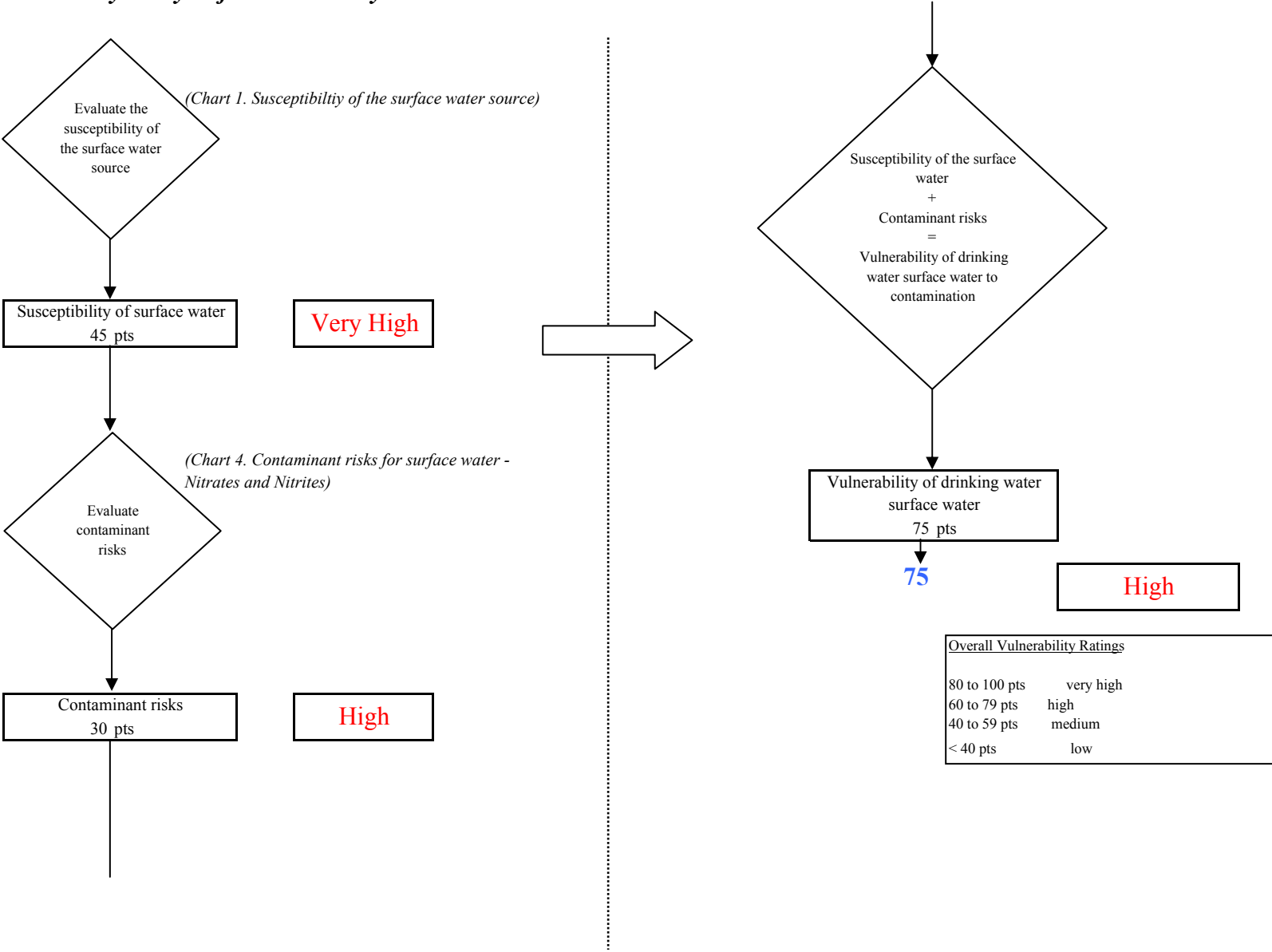


Chart 6. Contaminant risks for Thorne Bay - Volatile Organic Chemicals

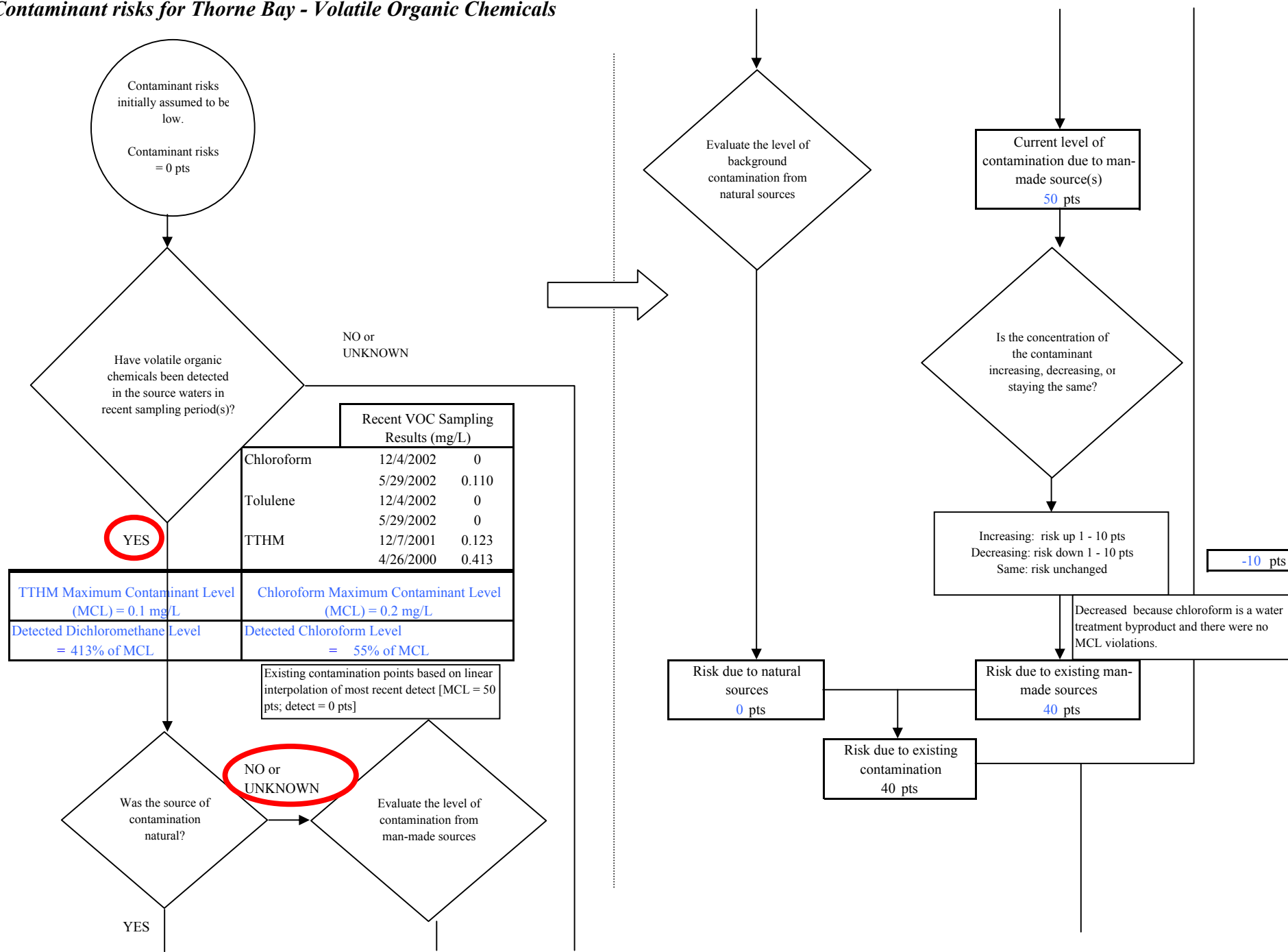


Chart 6. Contaminant risks for Thorne Bay - Volatile Organic Chemicals

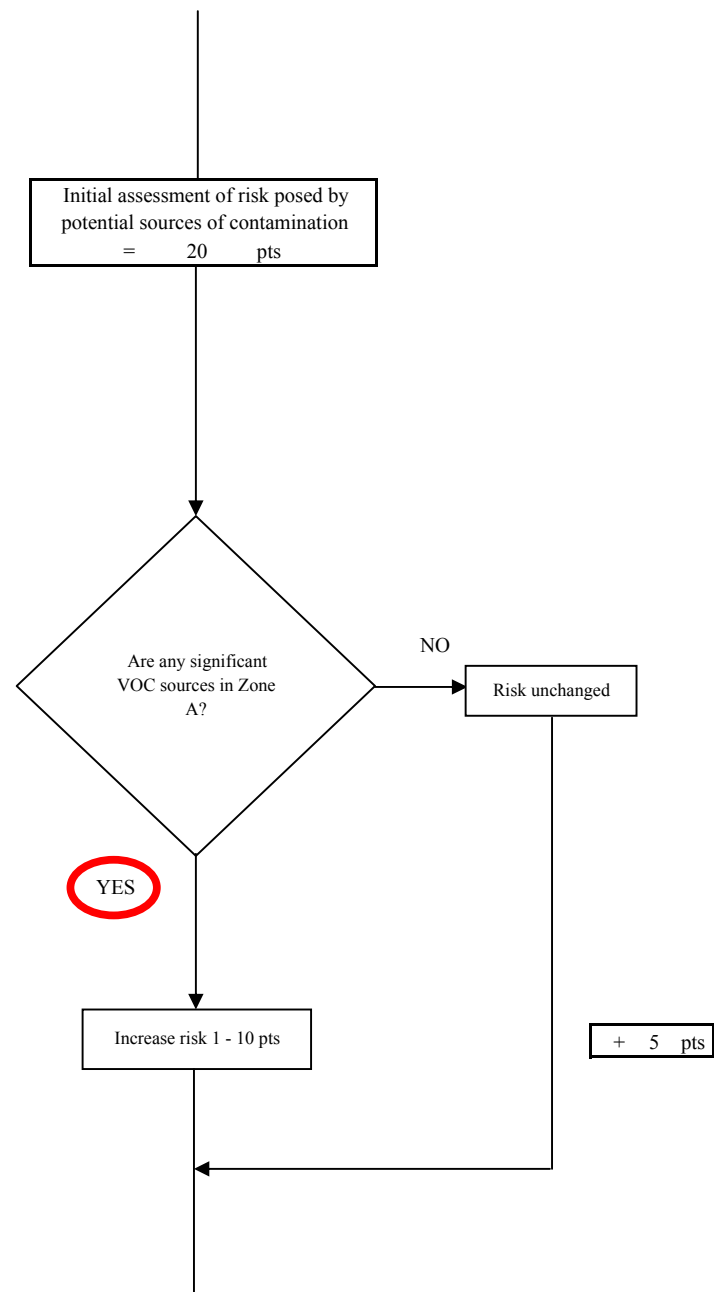
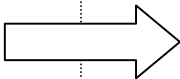
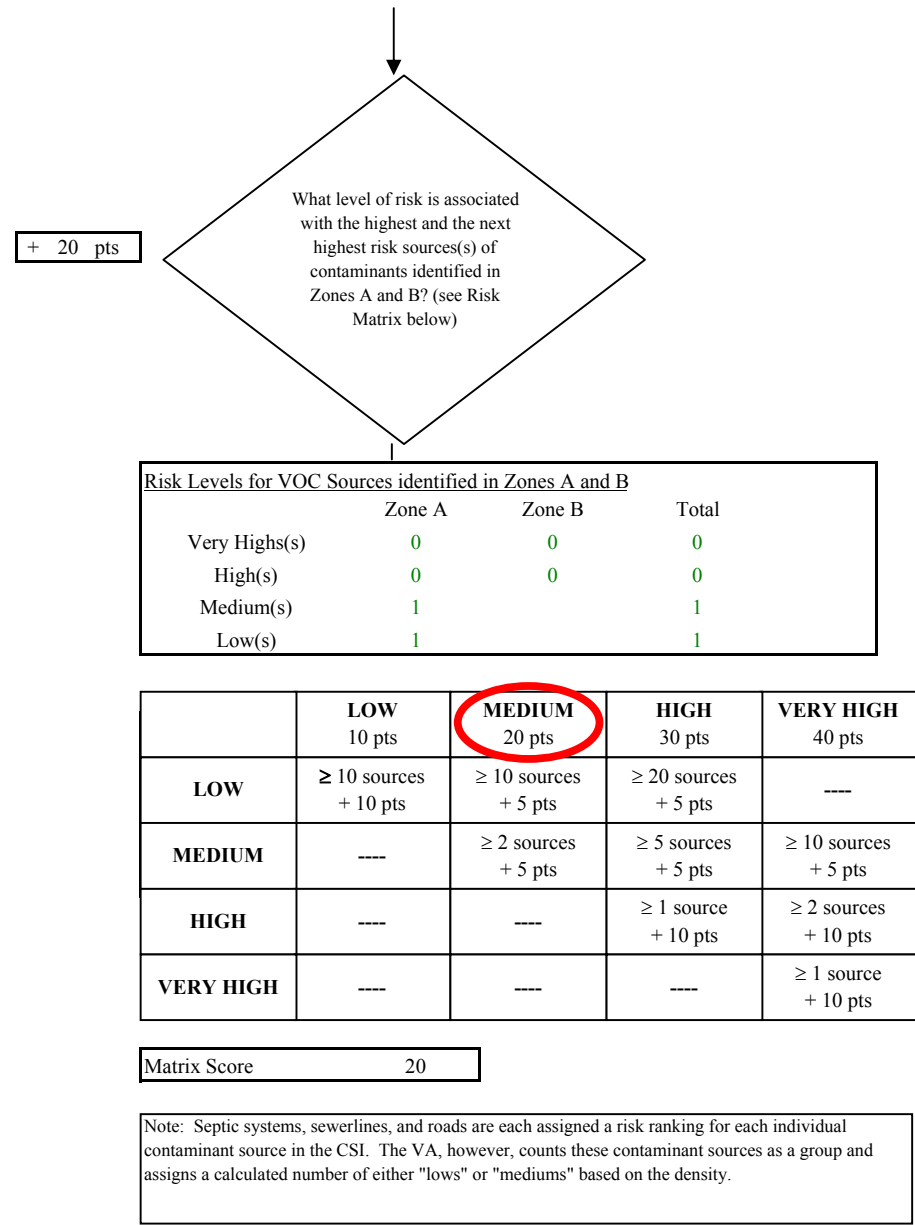


Chart 6. Contaminant risks for Thorne Bay - Volatile Organic Chemicals

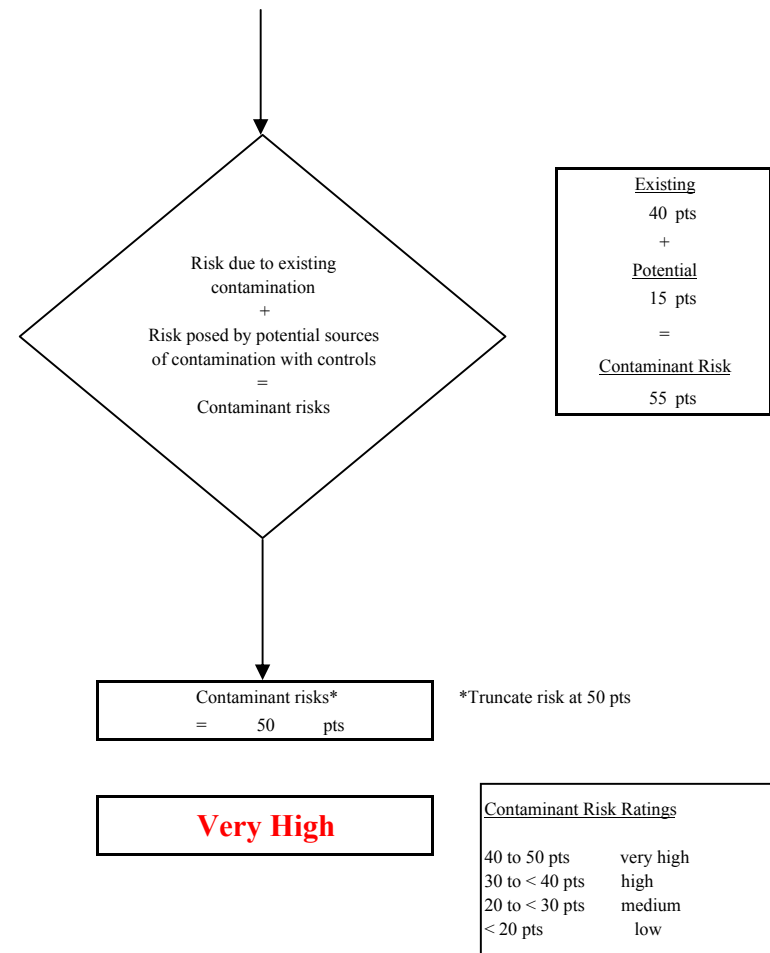
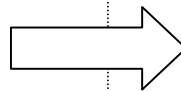
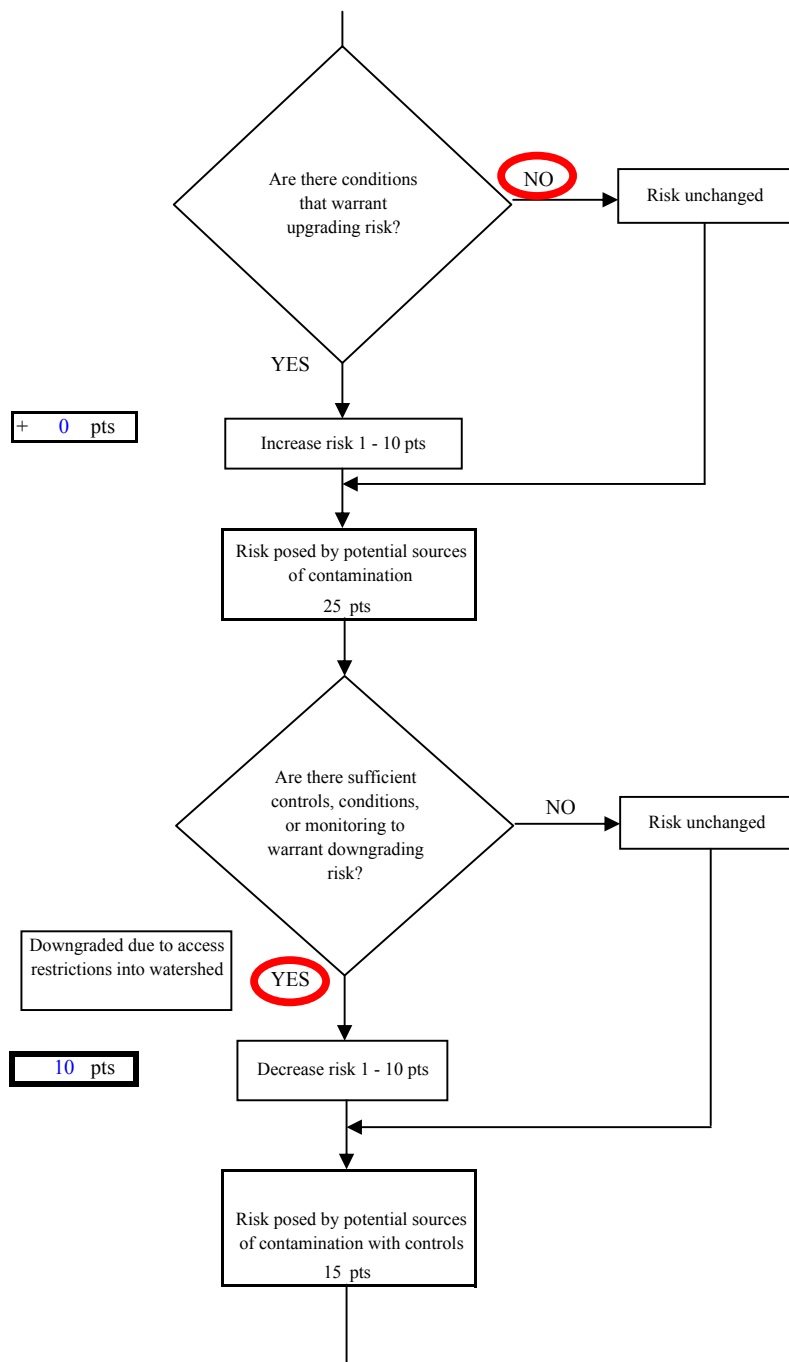


Chart 7. Vulnerability analysis for Thorne Bay - Volatile Organic Chemicals

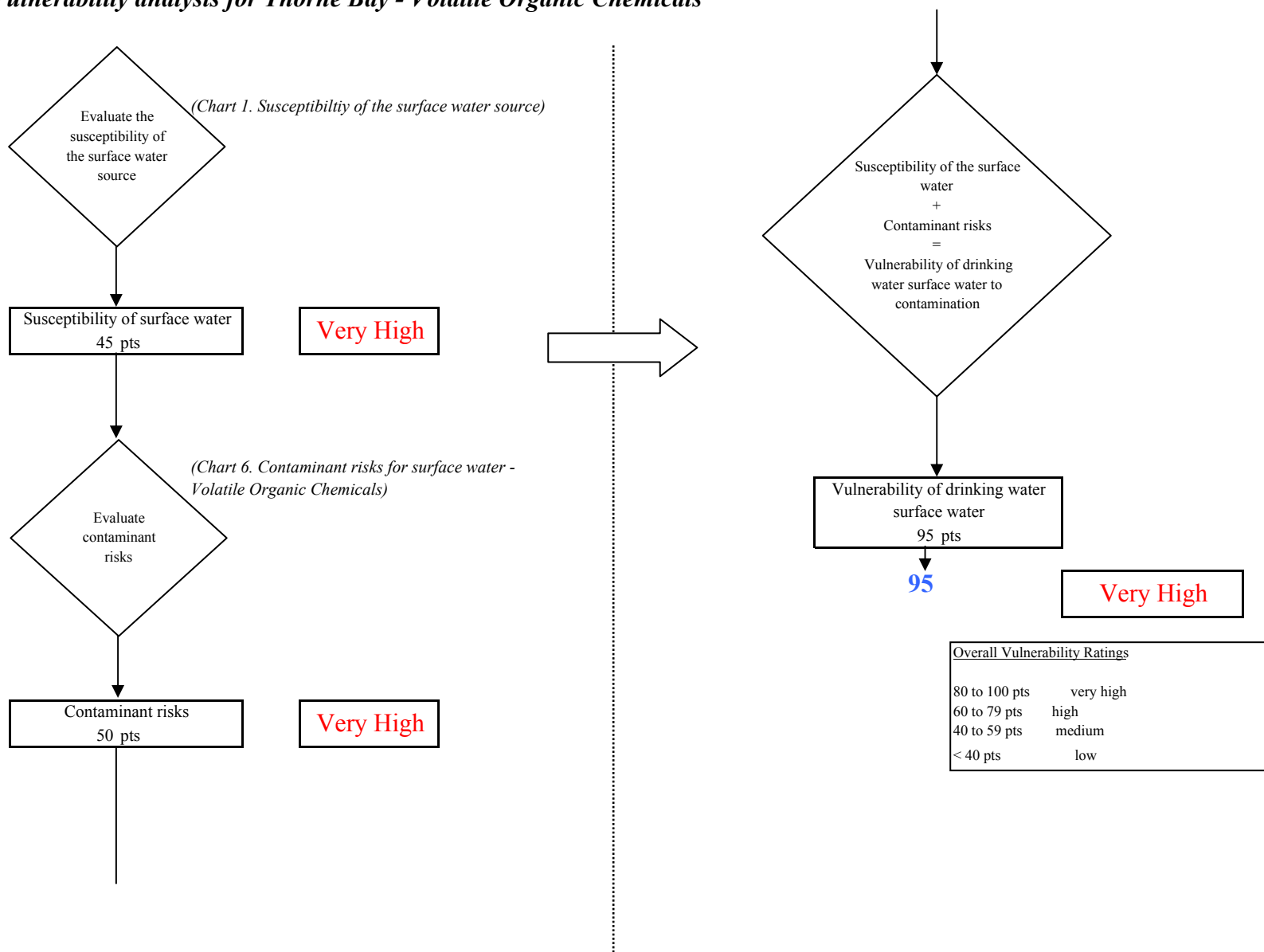


Chart 8. Contaminant risks for Thorne Bay - Heavy Metals, Cyanide and Other Inorganic Chemicals

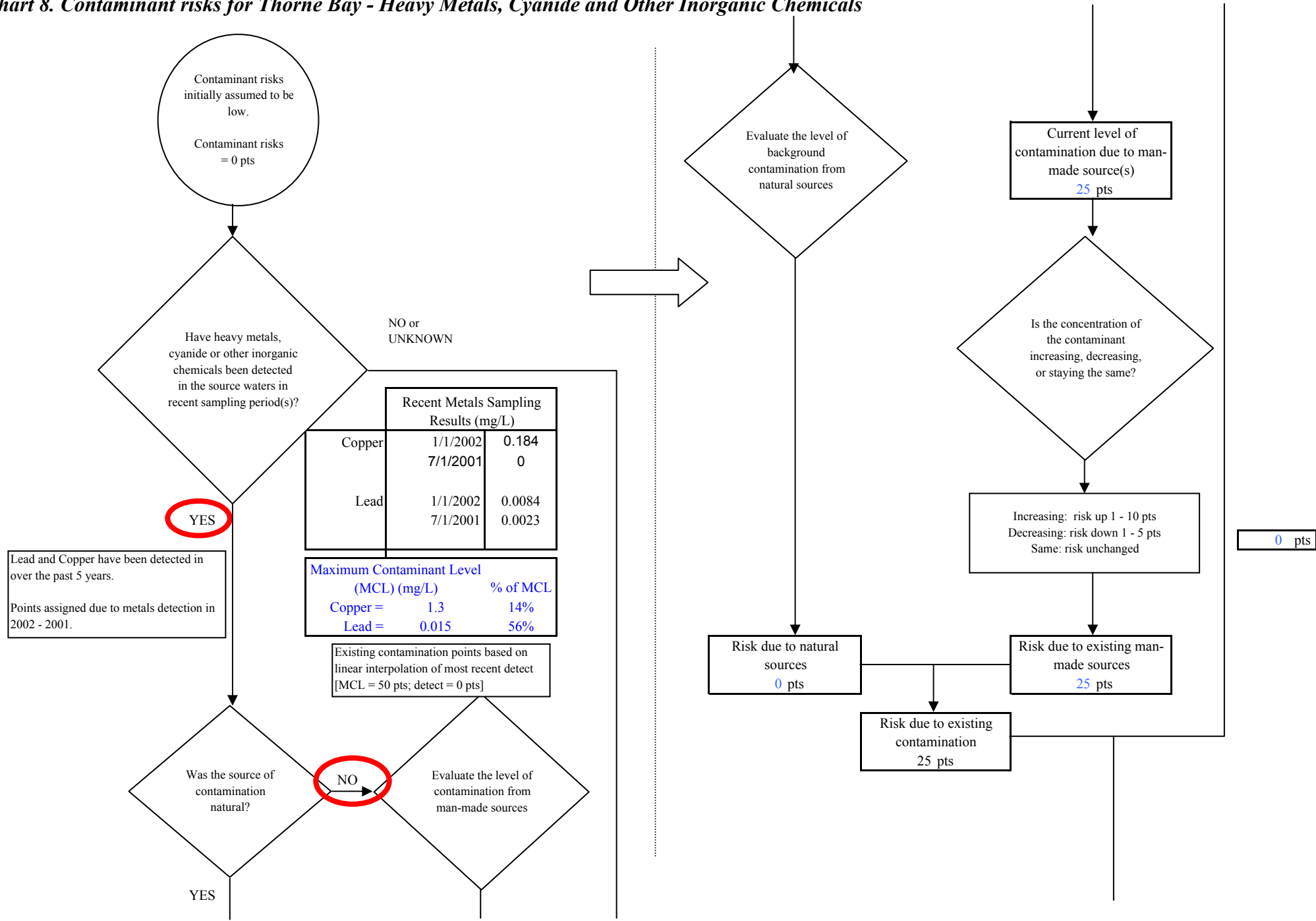


Chart 8. Contaminant risks for Thorne Bay - Heavy Metals, Cyanide and Other Inorganic Chemicals

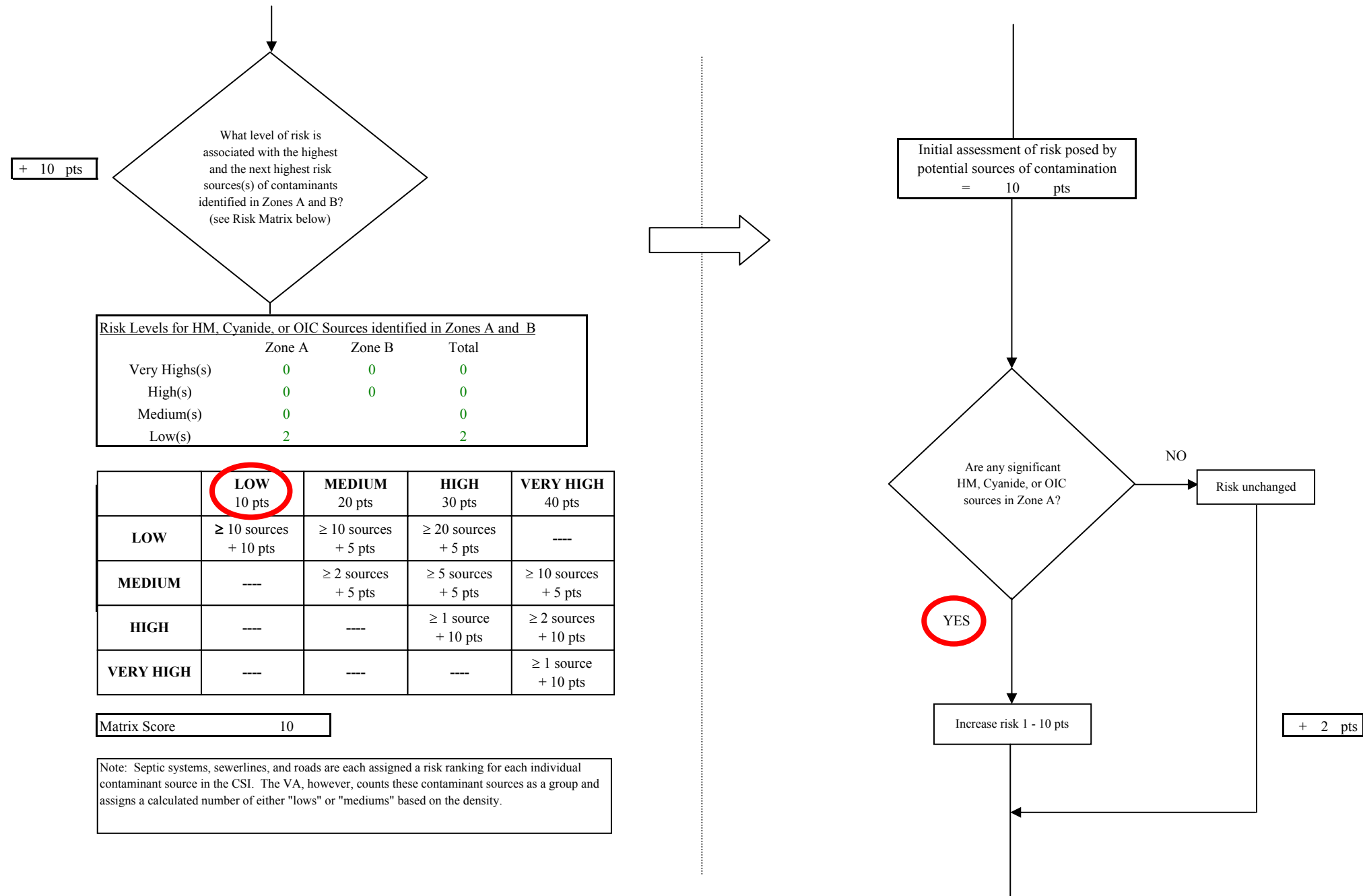


Chart 8. Contaminant risks for Thorne Bay - Heavy Metals, Cyanide and Other Inorganic Chemicals

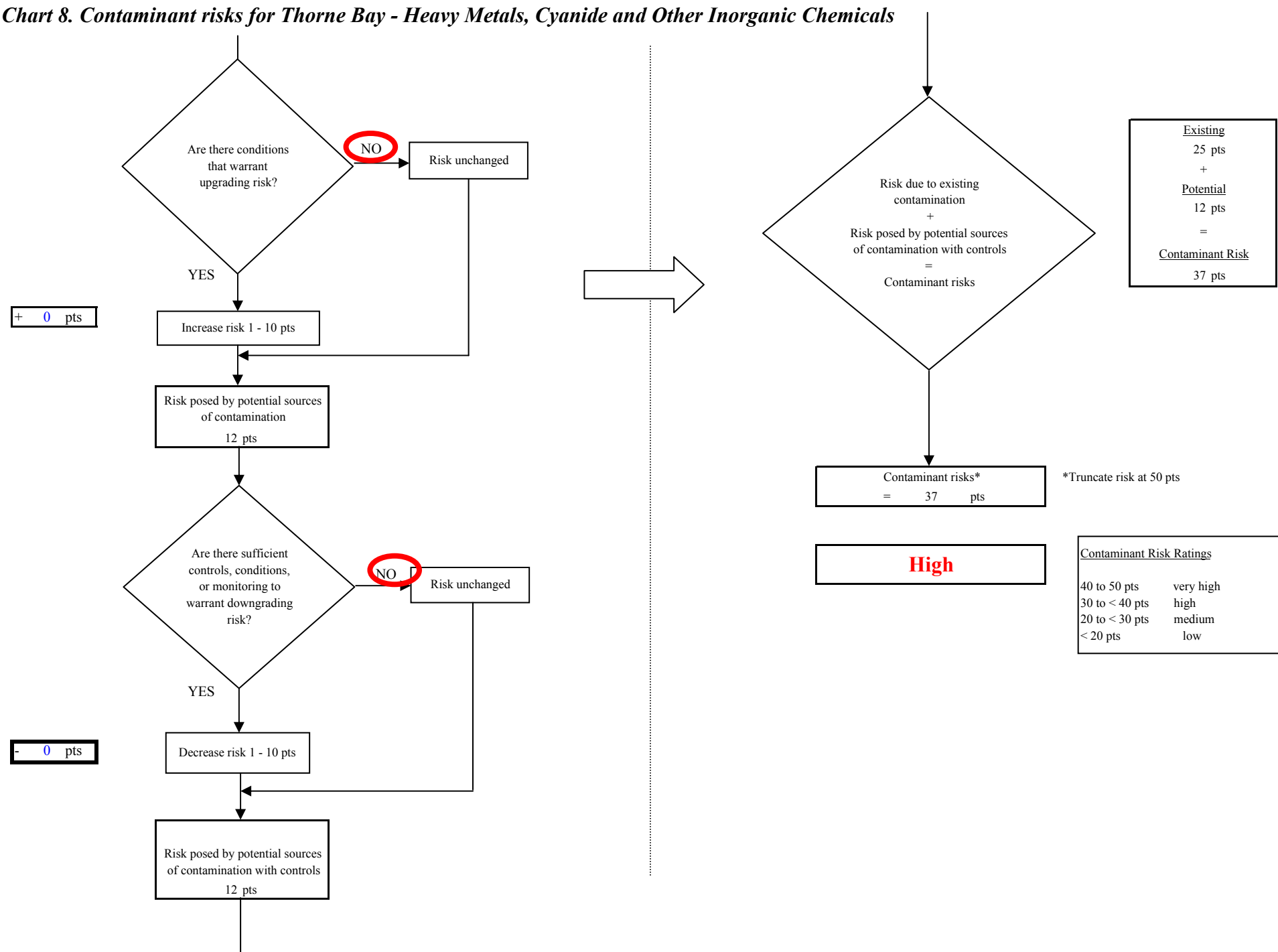


Chart 9. Vulnerability analysis for Thorne Bay - Heavy Metals, Cyanide and Other Inorganic Chemicals

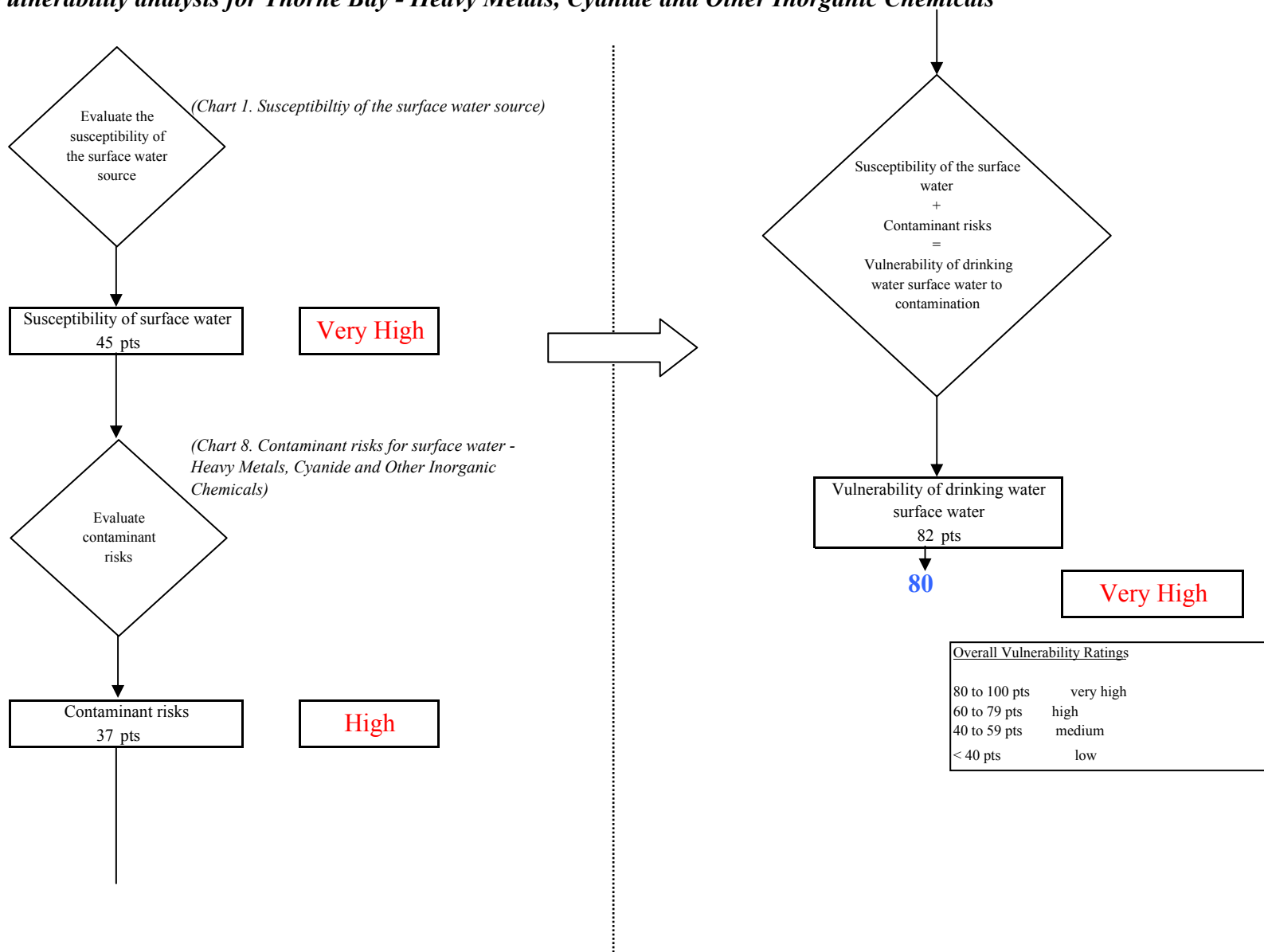


Chart 10. Contaminant risks for Thorne Bay - Synthetic Organic Chemicals

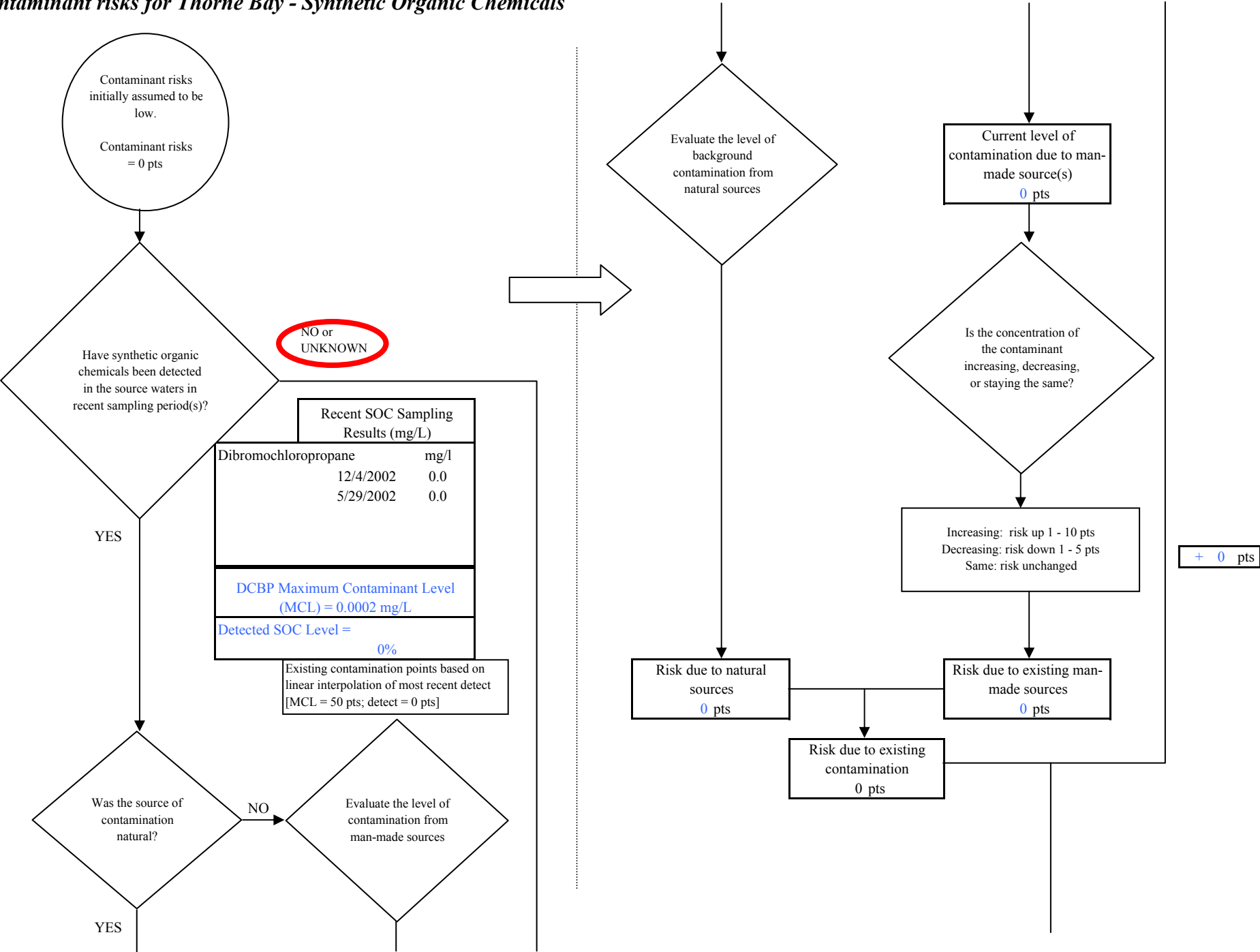


Chart 10. Contaminant risks for Thorne Bay - Synthetic Organic Chemicals

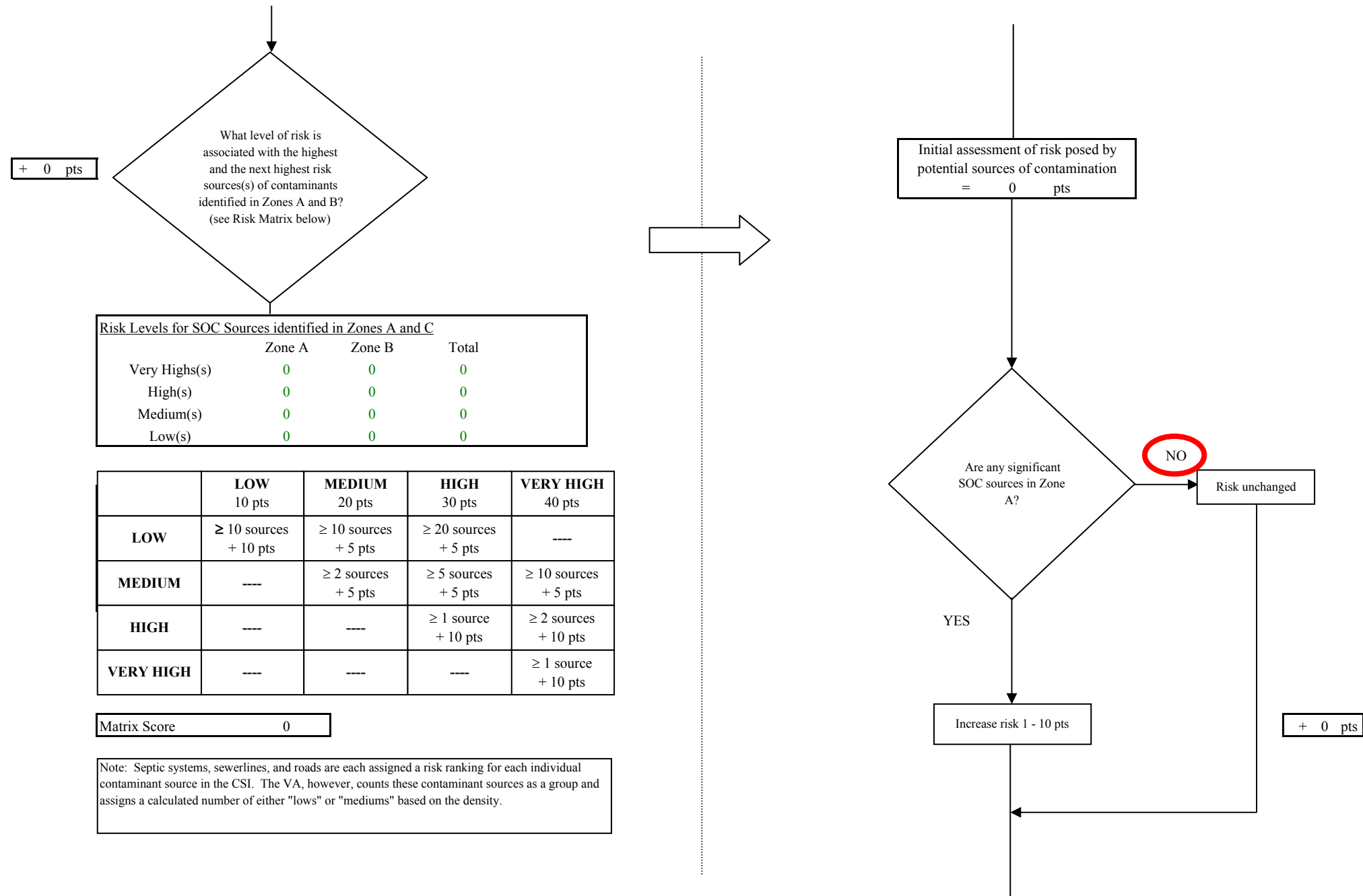


Chart 10. Contaminant risks for Thorne Bay - Synthetic Organic Chemicals

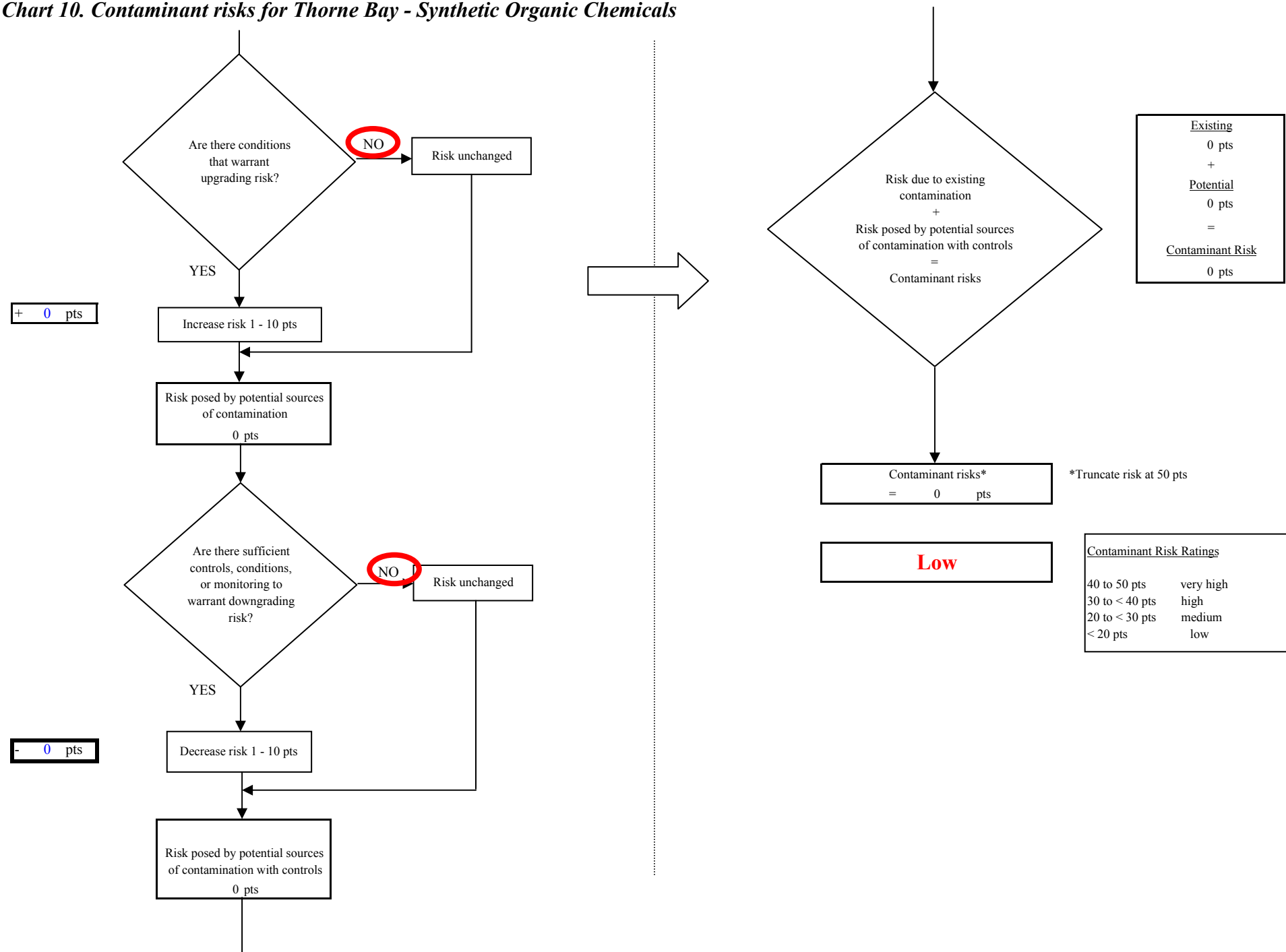


Chart 11. Vulnerability analysis for Thorne Bay - Synthetic Organic Chemicals

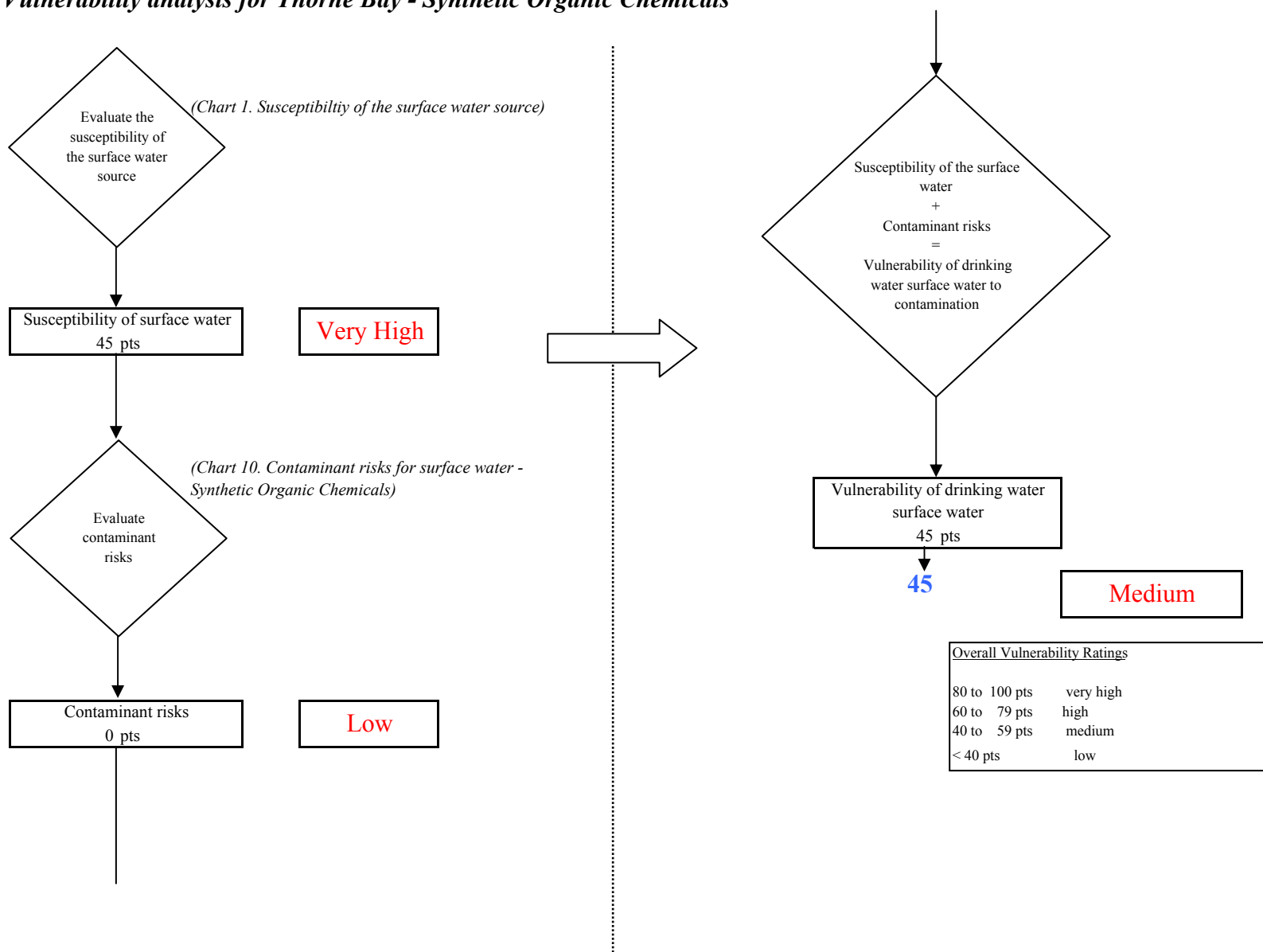


Chart 12. Contaminant risks for Thorne Bay - Other Organic Chemicals

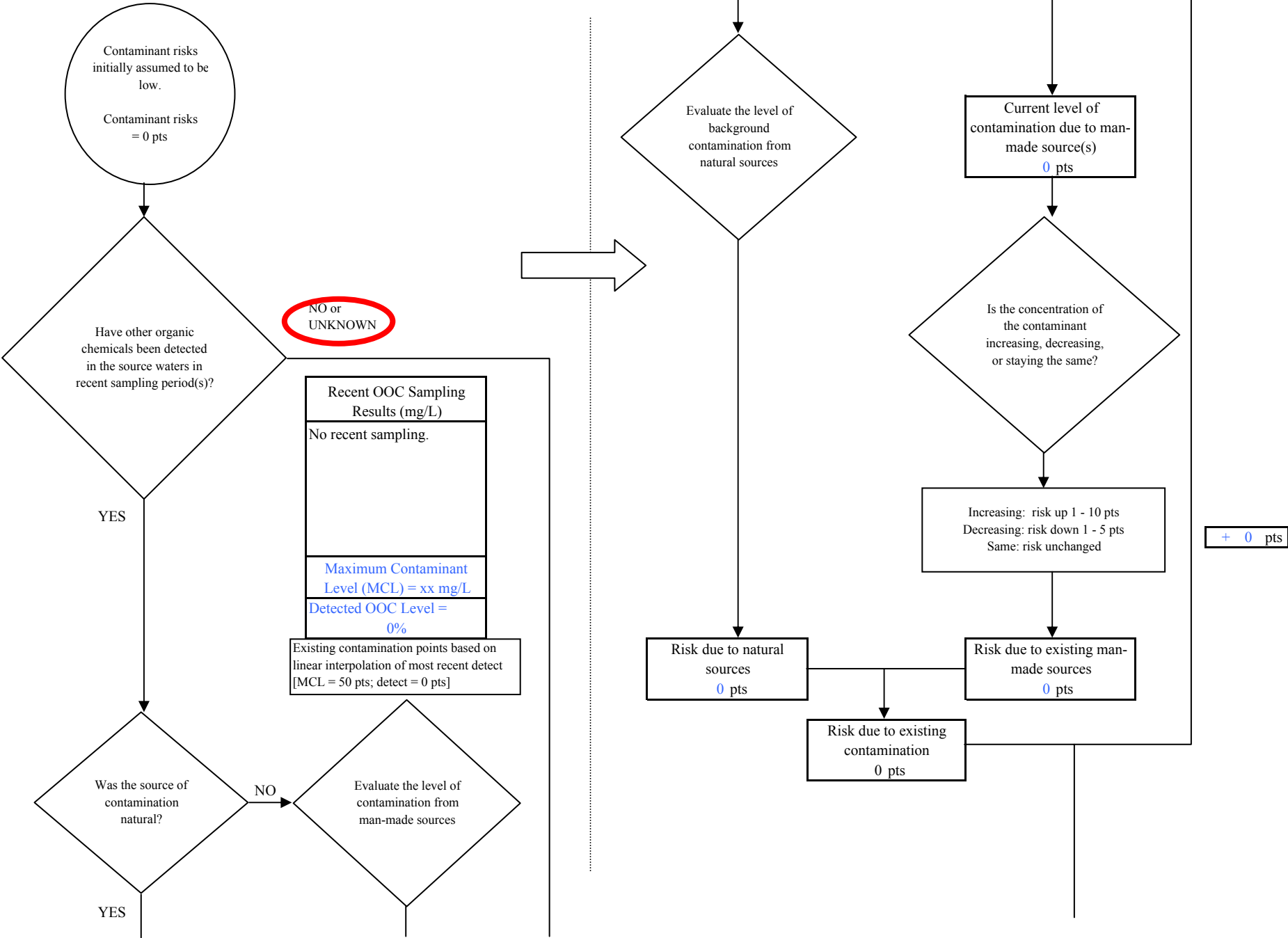


Chart 12. Contaminant risks for Thorne Bay - Other Organic Chemicals

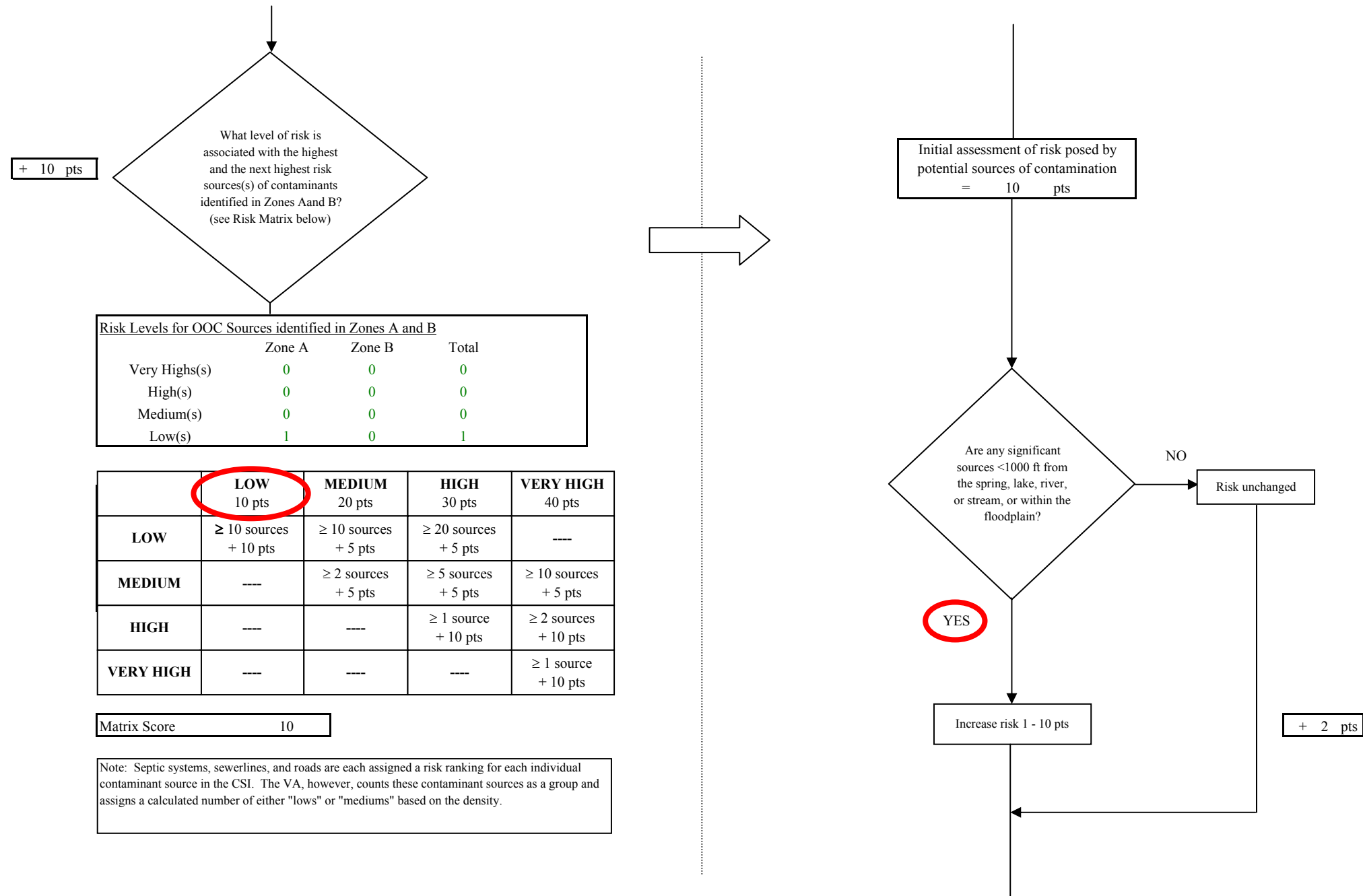


Chart 12. Contaminant risks for Thorne Bay - Other Organic Chemicals

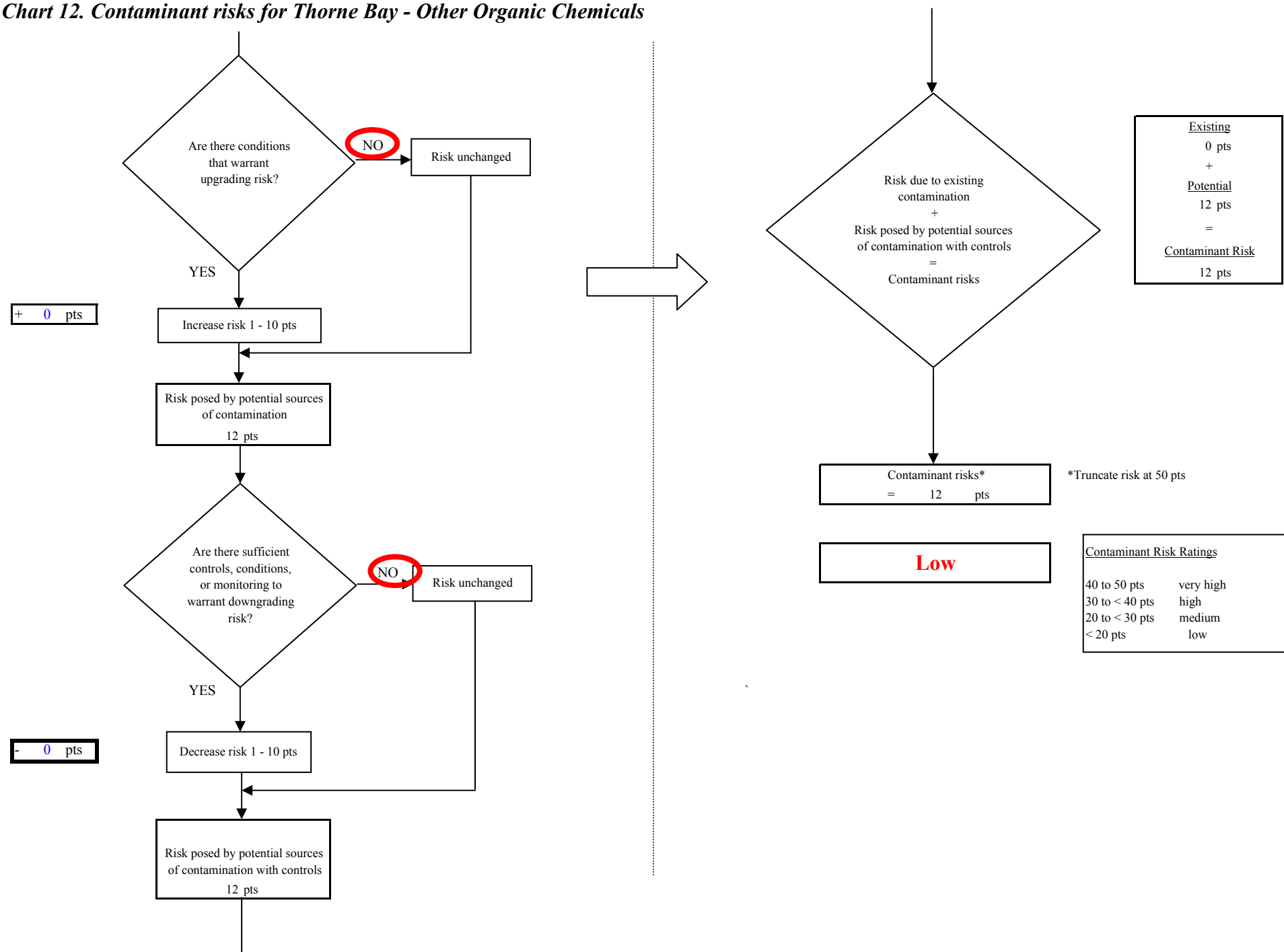


Chart 13. Vulnerability analysis for Thorne Bay - Other Organic Chemicals

