Source Water Assessment

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

(Halfmile Creek)

PWSID # 120169.001

September 2003

Drinking Water Protection Program Report #848

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 the City of Klawock Public Water System

Drinking Water Protection Program
Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

The City of Klawock water system is a Class A (community) water system that obtains water from Halfmile Creek. The intake is located approximately 3-miles east of Klawock and is accessible via gravel road. The Halfmile Creek protection area is approximately 5.3 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 catchment areas*. 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 small area of timber harvest located on aerial photography was identified as a potential source of contaminants for the drinking water source. This evaluation included all available water sampling data submitted by the system operator. The samples may have been collected from either raw water samples or post-treatment samples. Combining the susceptibility of the surface water source with the contaminant risk, this water system has received a vulnerability rating of **"medium"** for bacteria and viruses, nitrates and/or nitrites, synthetic organic chemicals, and other organic chemicals; and **"high"** for volatile organic compounds, heavy metals, cyanide and other inorganic chemicals.

DRINKING WATER SYSTEM AND AREA OVERVIEW

The City of Klawock (Sec. 09, T073S, R081E, Copper River Meridian) is located on the west coast of Prince of Wales Island, on Klawock Inlet, across from Klawock Island in the Southeast Panhandle of Alaska; 56 miles west of Ketchikan and 7 miles north of Craig (Please see the inset of Map 1 in Appendix A for location). The current population is approximately 850 (ADCED, 2003). The City of Klawock water system is a Class A (community) water system that operates year round. The system's intake is located 3-miles east of Klawock on Halfmile Creek (See Map 1 of Appendix A). Access to the intake is available via gravel road.

90% of the households in Klawock are fully plumbed and most homes have piped sewage collection. The City provides refuse collection, which is hauled to a permitted landfill shared with Craig and other island residents. Funds have been requested to develop a permitted site with incinerator. (ADCED, 2003).

The geology of the watershed area consists of rounded mountains composed primarily of volcanic rock. At the higher elevations, soils are shallow over bedrock, often organic, and less productive. Well drained glacial till soils predominate at the lower elevations. Hemlock and hemlock-spruce forests are present on the well-drained areas, while mixed conifers and lodgepole pines dominate on the wetter areas. Shrubby bogs and fens occur on the wettest spots (USDA, 2001).

The climate here is moist and cool. Average temperatures in the summer range from 49 to 63; winter temperatures range from 32 to 42. Annual precipitation is approximately 120-inches, with 40-inches of snow. (ADCED, 2003).

The most recent Sanitary Survey (2001) indicates that the Halfmile Creek intake is screened, protected from ice buildup and siltation, and inspected regularly. The survey also indicated that the system has a pump capacity of 1000gpm with an average daily production of 300,000 gallons.

CITY OF KLAWOCK 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 10-11of 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 the City of Klawock includes each of these Zones (See Map 1 of Appendix A). It should be noted here that, because of the small watershed size, Zones C and B are identical.

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 Klawock 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 Klawock 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 Klawock Contaminant Risks

Category	Score	Rating
Bacteria and Viruses	0	Low
Nitrates and/or Nitrites	2	Low
Volatile Organic Chemicals	21	Medium
Heavy Metals, Cyanide, and Other Inorganic Chemicals	26	Medium
Synthetic Organic Chemicals	0	Low
Other Organic Chemicals	0	Low

Finally, an overall vulnerability score is assigned for each contaminant type by combining each of the contaminant risk scores with the susceptibility score:

Susceptibility of the Surface Water Source

(0 – 50 points)

+

Contaminant Risks (0 – 50 points)

=

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

Again, rankings are assigned according to a point score:

Overall Vulnerability Ratings	
80 to 100 pts	Very High
60 to < 80 pts	High
40 to < 60 pts	Medium
< 40 pts	Low

Table 4 contains the overall vulnerability scores and ratings for each of the six categories of drinking water contaminants. Note: scores are rounded off to the nearest five.

Table 4. City of Klawock Overall Vulnerability

Category	Score	Rating
Bacteria and Viruses	50	Medium
Nitrates and Nitrites	50	Medium
Volatile Organic Chemicals	70	High
Heavy Metals, Cyanide, and Other Inorganic Chemicals	75	Very High
Synthetic Organic Chemicals	50	Medium
Other Organic Chemicals	50	Medium

Bacteria and Viruses

The contaminant risk for bacteria and viruses is "low". 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 positive bacteria counts have been detected in the sampling period 1999 – 2003.

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 "medium".

Nitrates and Nitrites

The contaminant risk for nitrates and nitrites is "low" (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 detected in very small quantities in samples collected in May 2000 and May 1998. 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).

After combining the contaminant risk for nitrates and nitrites with the natural susceptibility of the source, the overall vulnerability of the well to contamination is "medium".

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, trihalomethanes, and tolulene were detected during sampling in 2000-2003. The MCL for chloroform is 0.2 milligrams per liter (mg/L) and the MCL for total trihalomethanes is 0.1 mg/L. All three of these chemicals originate during the process of water treatment.

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

Heavy Metals, Cyanide, and Other Inorganic Chemicals

The contaminant risk for heavy metals is "medium". Copper and lead were detected in samples collected during 1997 – 2001 (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.

A possible source of these chemicals is through the distribution system following the treatment process.

After combining the contaminant risk for heavy metals with the natural susceptibility of the source, the overall vulnerability of the well to contamination is "very 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 well is "medium" (See Chart 11 – Contaminant Risks for Synthetic Organic Chemicals in Appendix D).

Review of the historical sampling data indicates that no recent testing for synthetic organic chemicals has occurred other than a negative test for dibromochloropropane that occurred in 2002.

Other Organic Chemicals

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

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

REFERENCES

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

United States Forest Service – Alaska Region (USDA), 2001. Technical Publication No. R10-TP-75. Ecological Subsections of Southeast Alaska and Neighboring Areas of Canada.

United States Environmental Protection Agency (EPA), 2003 [WWW document]. URL http://www.epa.gov/safewater/mcl.html.

APPENDIX A

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

City of Klawock -
Drinking Water Protection Area

Map 1: City of Klawock Drinking Water Protection Area

PWSID: 120169.001

Alaska Department of Environmental Conservation

Alaska Drinking Water Protection Program

0 2,000 4,000 8,000 12,000 16,000 20,000 Feet

1:60,000

Data Sources:

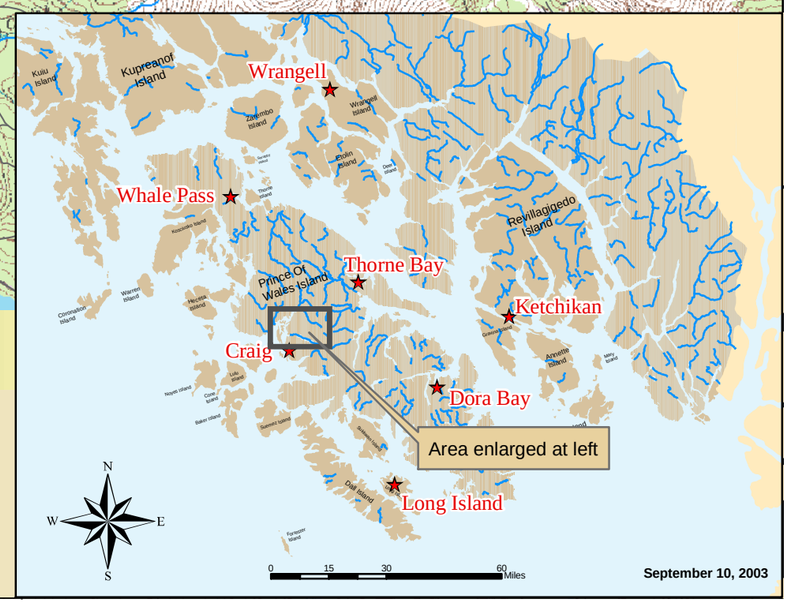
Background image - USGS 1:63,000 mapping
Lakes & streams - U.S. Forest Service, Tongass
Roads, Contours - Shannon & Wilson, Inc.

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

- City of Klawock PWS
- Zone A Protection Area
- Zone B Protection Area
- Zone C Protection Area
- Stream
- Roads
- Lake



APPENDIX B

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

Table 1

Contaminant Source Inventory for
City of Klawock

PWSID 120169.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Map Number*	*Comments*
Logging	E02	E02 -1	B	2	Harvest area spotted on aerial photo from Shannon and Wilson, Inc.

Table 2

Contaminant Source Inventory and Risk Ranking for City of Klawock Sources of Nitrates/Nitrites

PWSID 120169.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Logging	E02	E02 -1	B	Low	2	Harvest area spotted on aerial photo from Shannon and Wilson, Inc.

Table 3

Contaminant Source Inventory and Risk Ranking for City of Klawock Sources of Volatile Organic Chemicals

PWSID 120169.001

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Risk Ranking for Analysis	Map Number	Comments
Logging	E02	E02 -1	B	Medium	2	Harvest area spotted on aerial photo from Shannon and Wilson, Inc.

Table 4

Contaminant Source Inventory and Risk Ranking for City of Klawock

Sources of Heavy Metals, Cyanide and Other Inorganic Chemicals

PWSID 120169.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Logging	E02	E02 -1	B	Low	2	Harvest area spotted on aerial photo from Shannon and Wilson, Inc.

APPENDIX C

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

E02 - 1
(Timber Harvest)

PWS Intake

Halfmile Creek

Airport

Klawock

Klawock River

Klawock Lake

Being studied as a
possible new water source.

Threemile Creek

Area enlarged at left

Map 2: Potential and Existing Contaminant Sources

PWSID: 120169.001

Alaska Department of Environmental Conservation

Alaska Drinking Water Protection Program

0 1,500 3,000 6,000 9,000 Feet

1:36,000

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

- City of Klawock PWS
- Zone A Protection Area
- Zone B Protection Area
- Zone C Protection Area
- Lake
- Potential Logging Area
- Roads
- 100-ft Contours

N W E S

0 0.5 1 2 3 4 Miles

September 10, 2003

APPENDIX D

Vulnerability Analysis and Contaminant Risks
(Charts 1-13)

Chart 1. Susceptibility of the Surface Water Source - City of Klawock

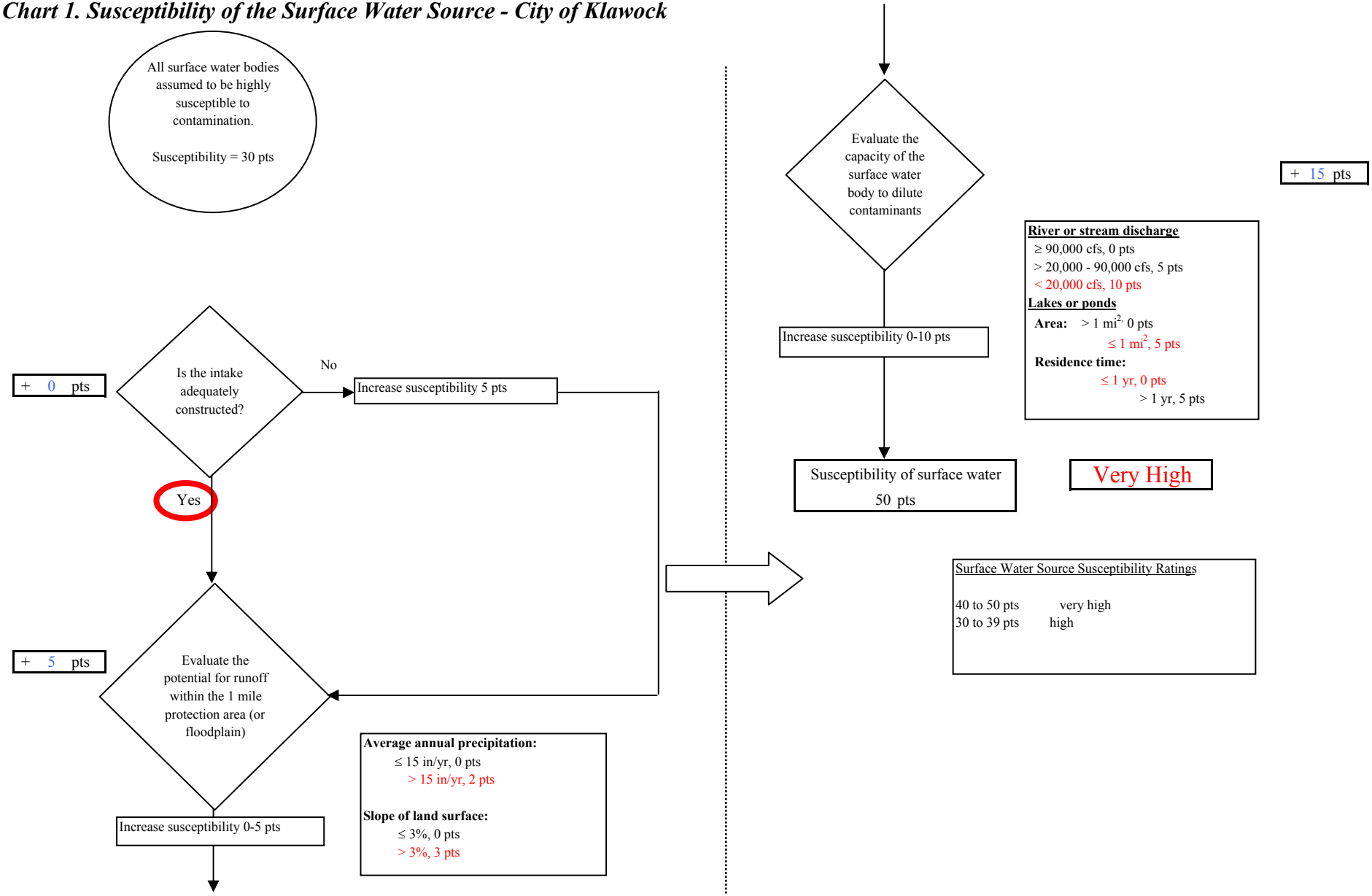
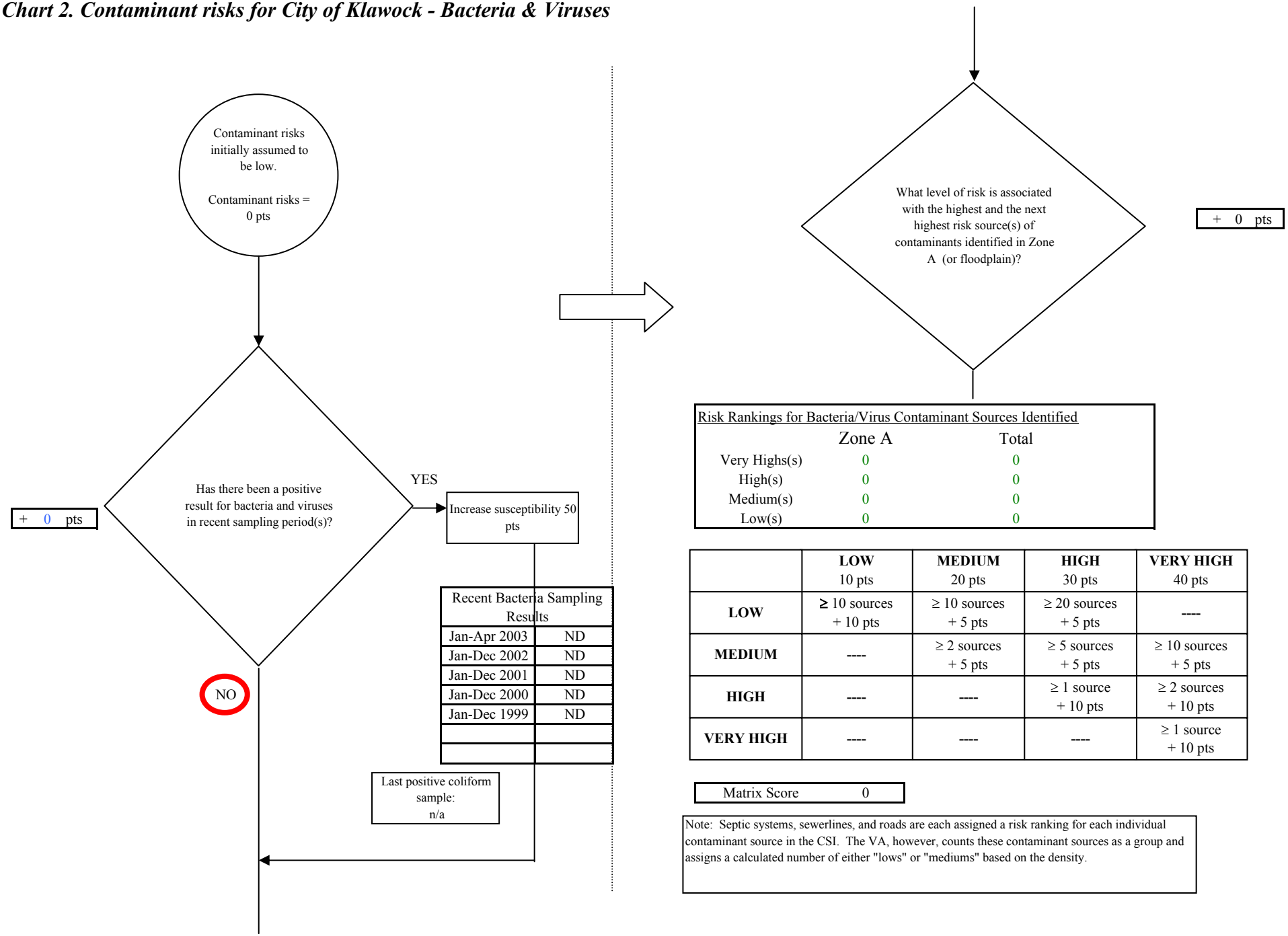


Chart 2. Contaminant risks for City of Klawock - Bacteria & Viruses



Risk Rankings for Bacteria/Virus Contaminant Sources Identified	Zone A	Total
Very Highs(s)	0	0
High(s)	0	0
Medium(s)	0	0
Low(s)	0	0

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

Matrix Score	0

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 City of Klawock - Bacteria & Viruses

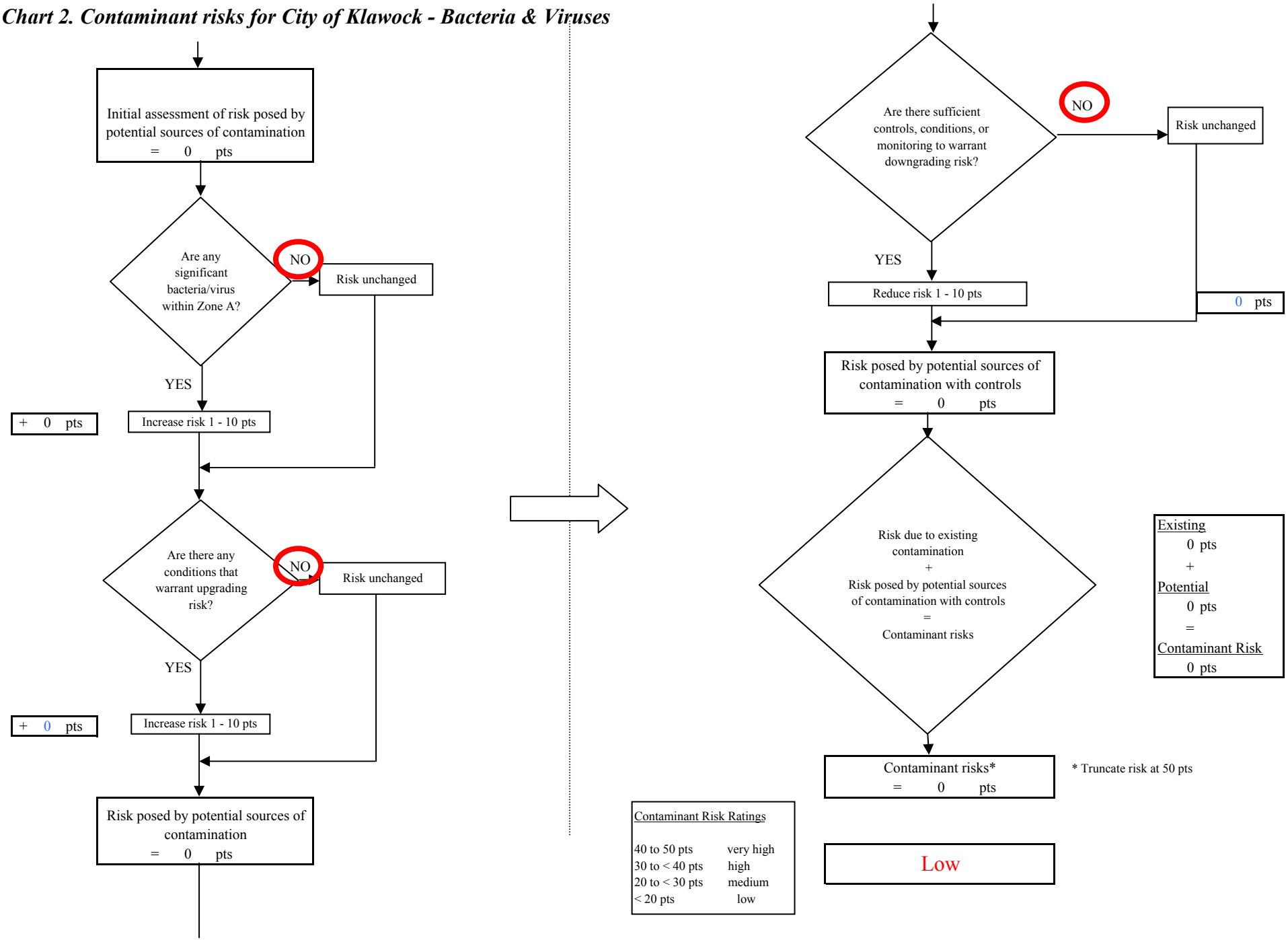


Chart 3. Vulnerability analysis for City of Klawock - Bacteria & Viruses

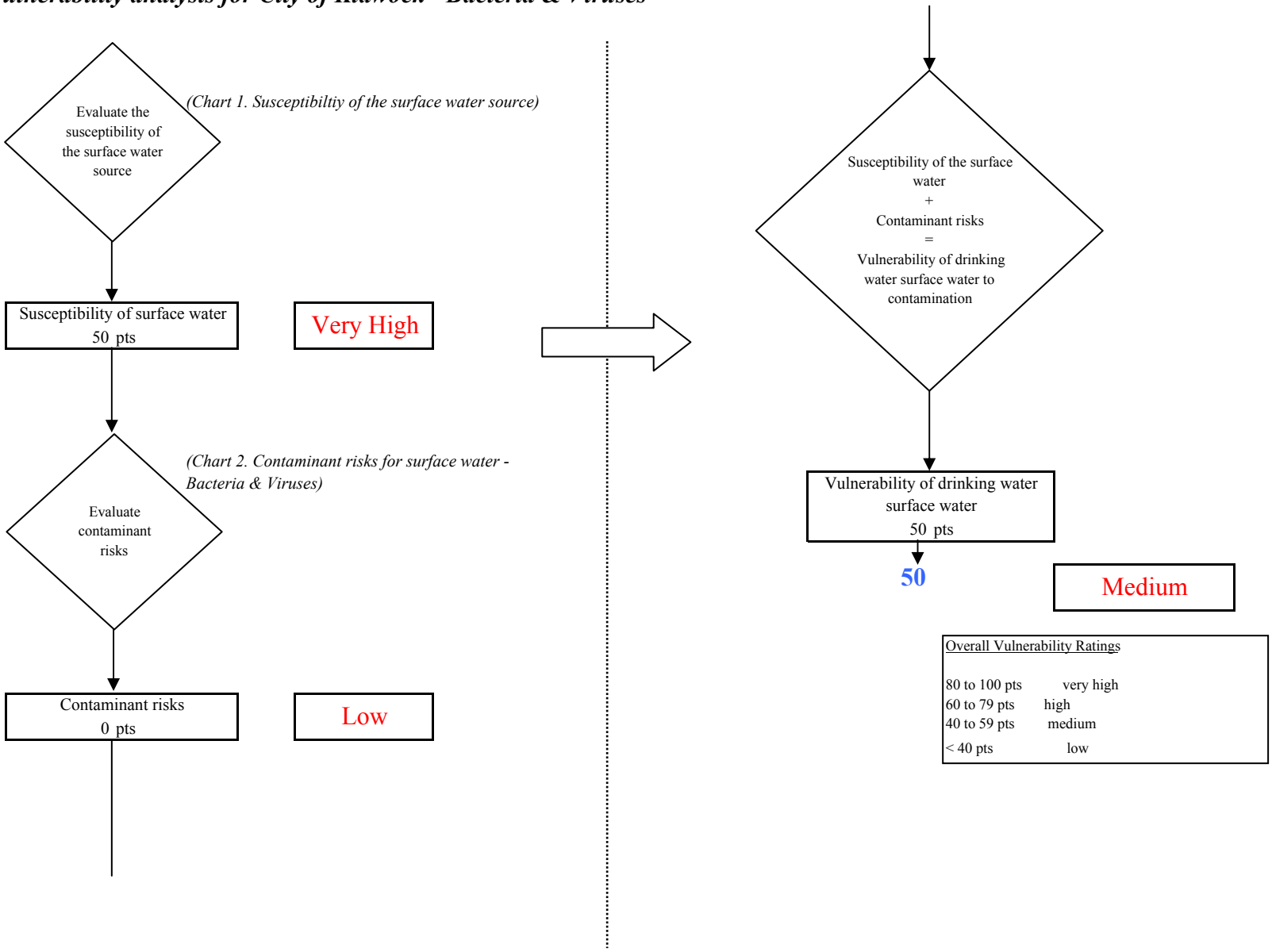


Chart 4. Contaminant risks for City of Klawock - Nitrates and Nitrites

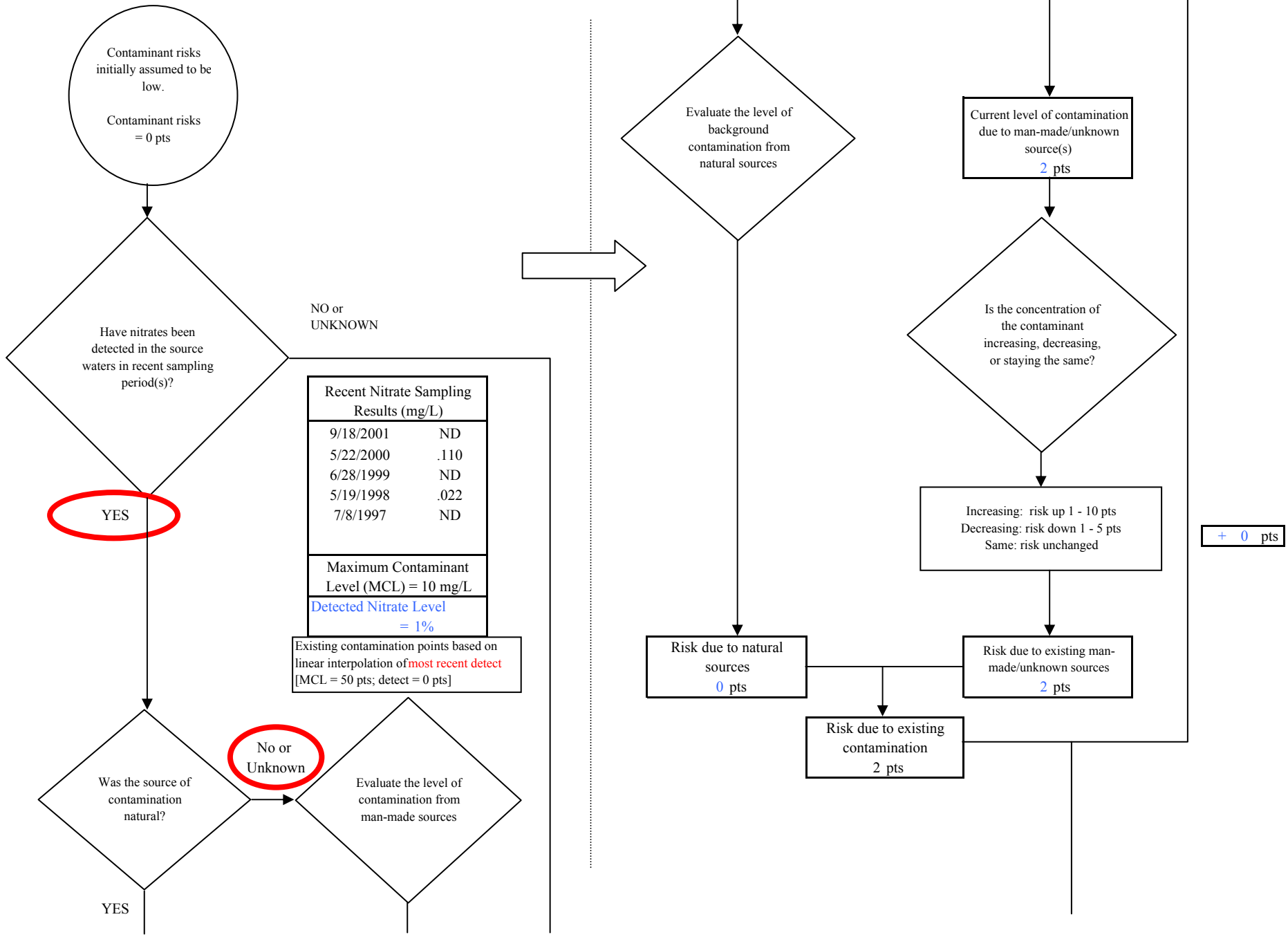
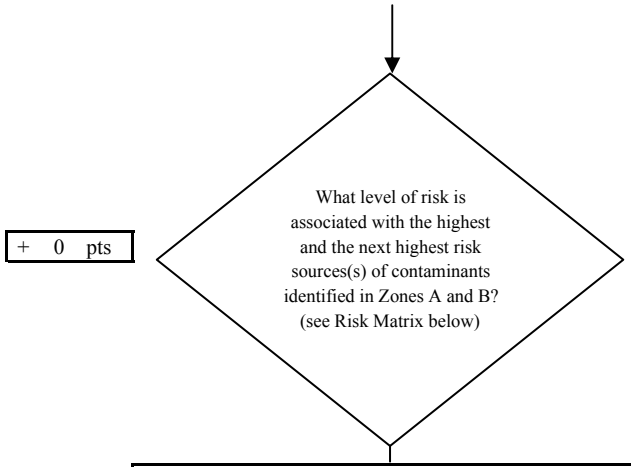


Chart 4. Contaminant risks for City of Klawock - Nitrates and Nitrites



Risk Levels for Nitrate/Nitrite 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)	0		0

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

Matrix Score 0

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.

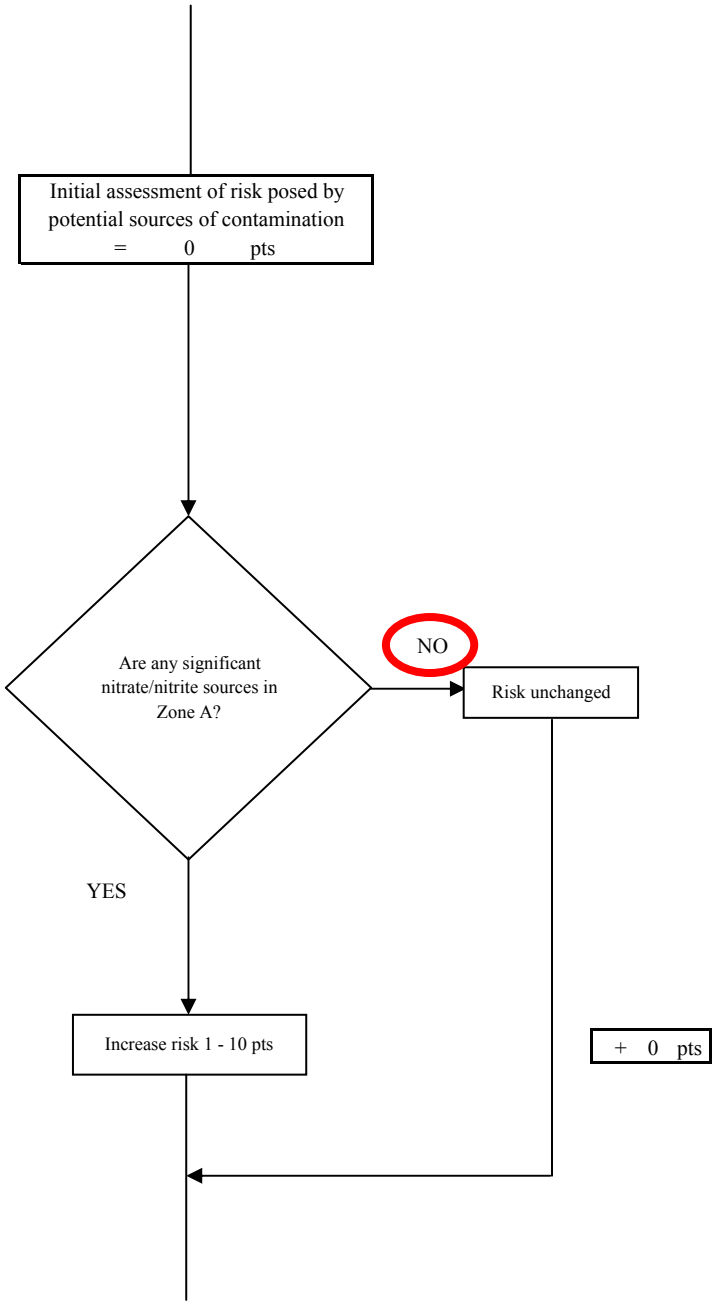


Chart 4. Contaminant risks for City of Klawock - Nitrates and Nitrites

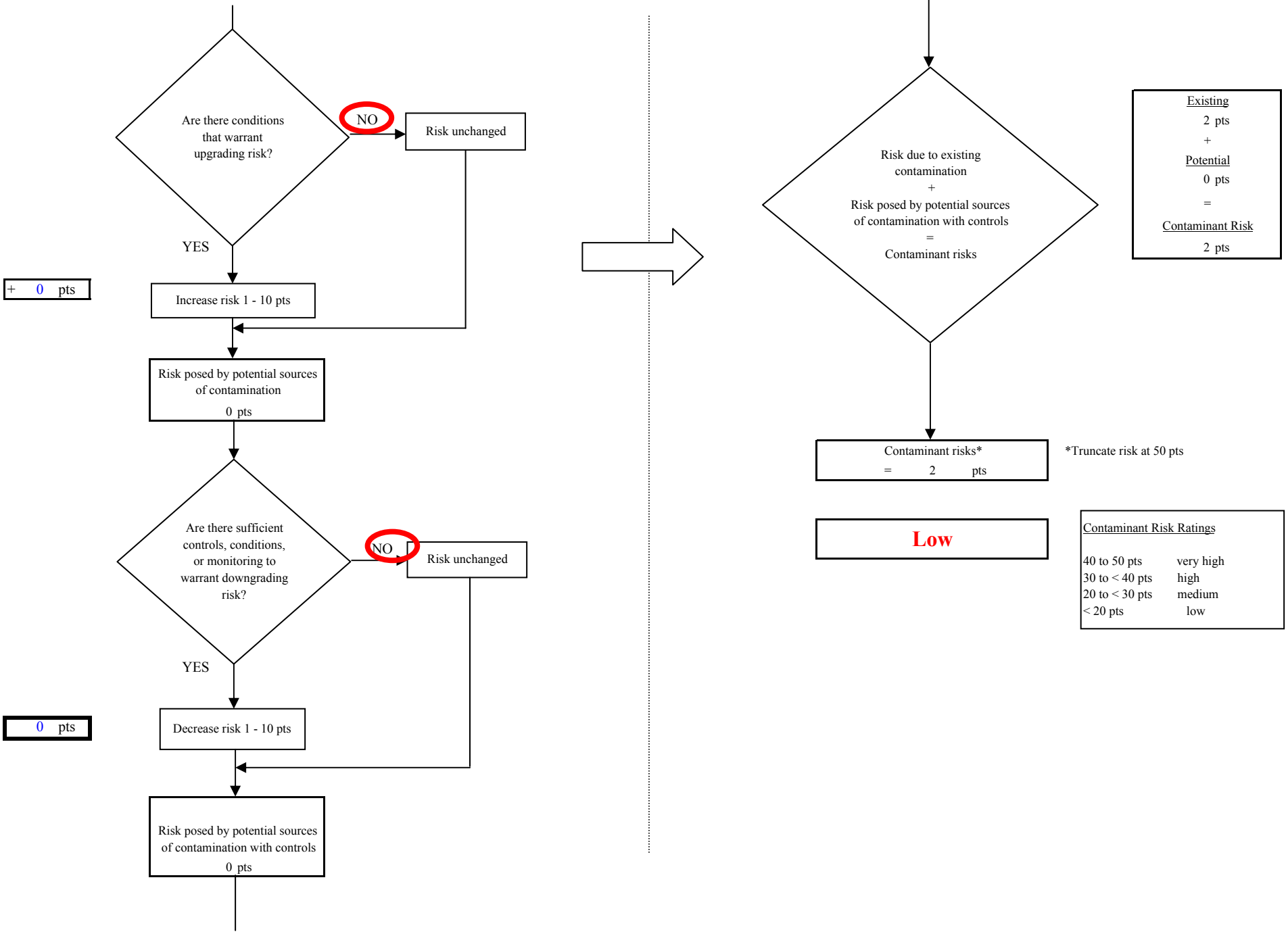


Chart 5. Vulnerability analysis for City of Klawock - Nitrates and Nitrites

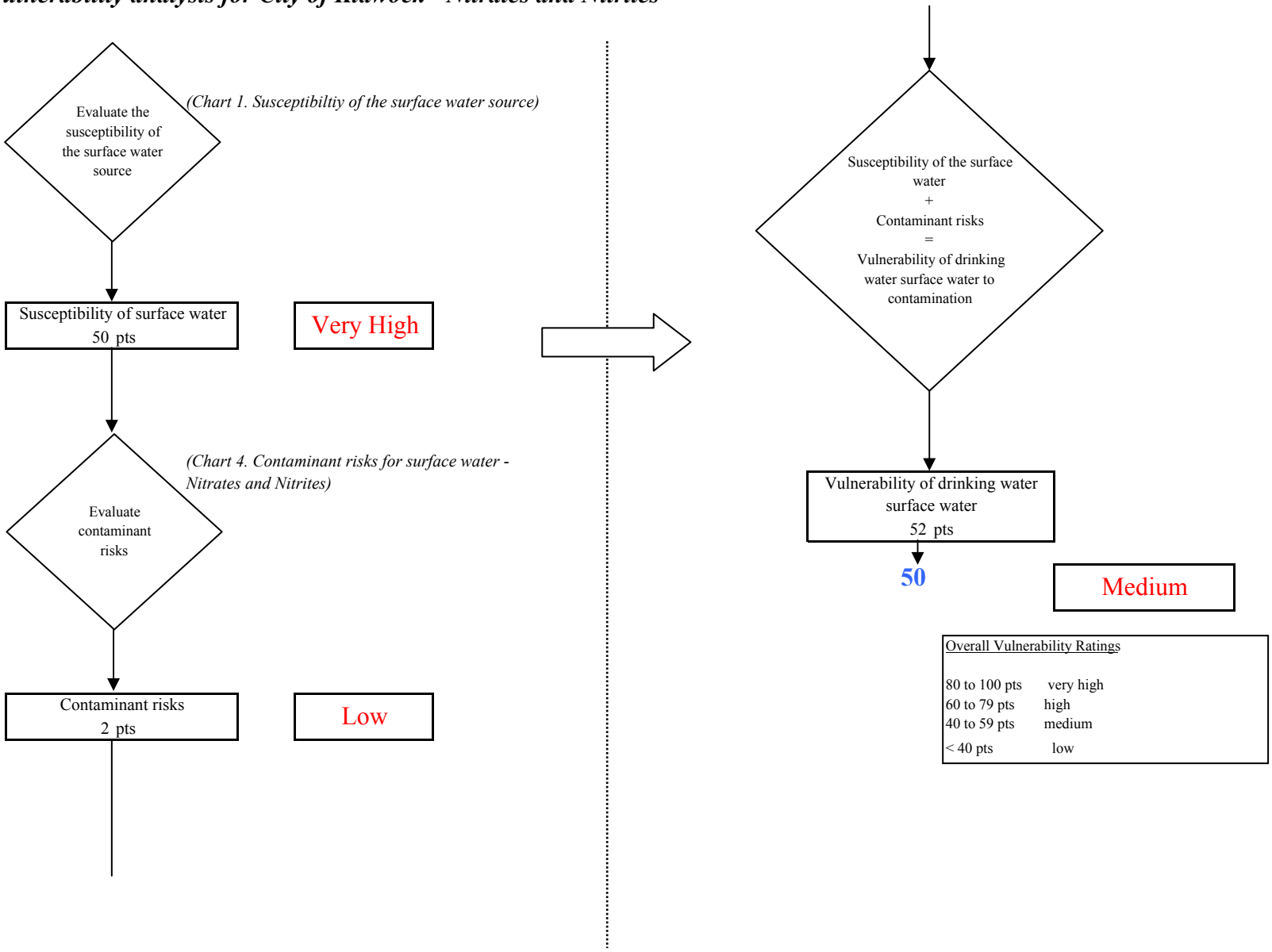


Chart 6. Contaminant risks for City of Klawock - Volatile Organic Chemicals

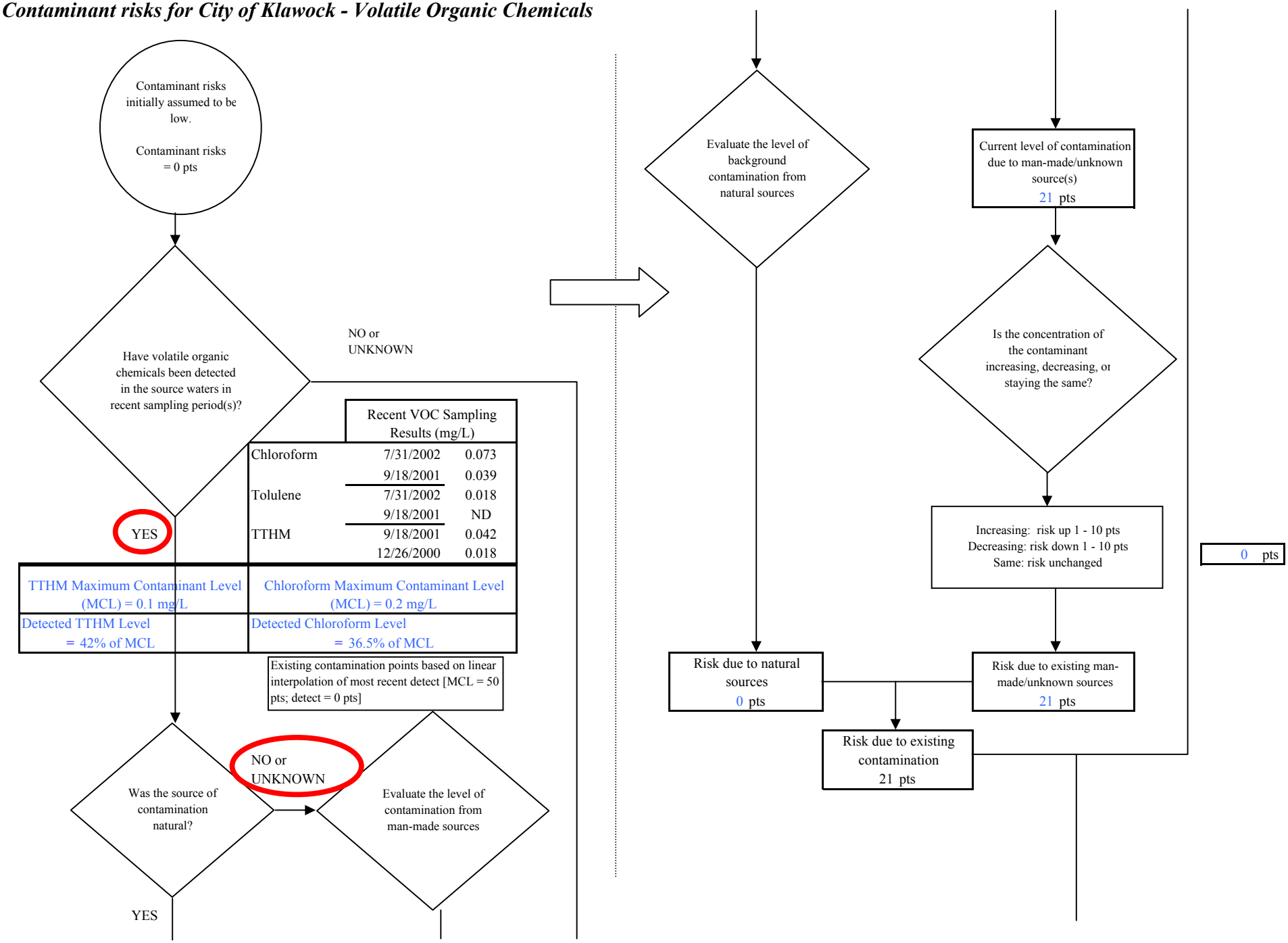
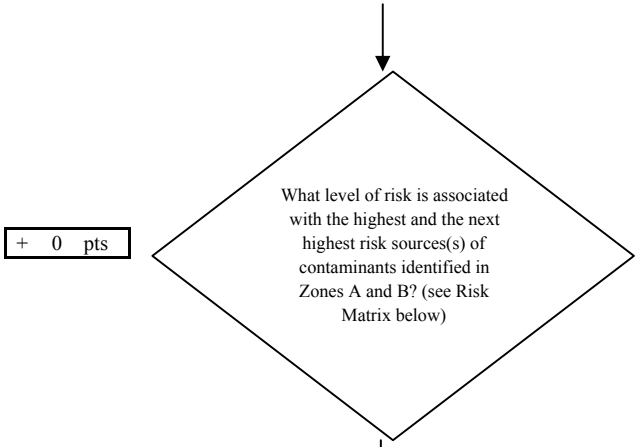


Chart 6. Contaminant risks for City of Klawock - Volatile Organic Chemicals



+ 0 pts

Risk Levels for VOC Sources identified in Zones A and B

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

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

Matrix Score 0

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.

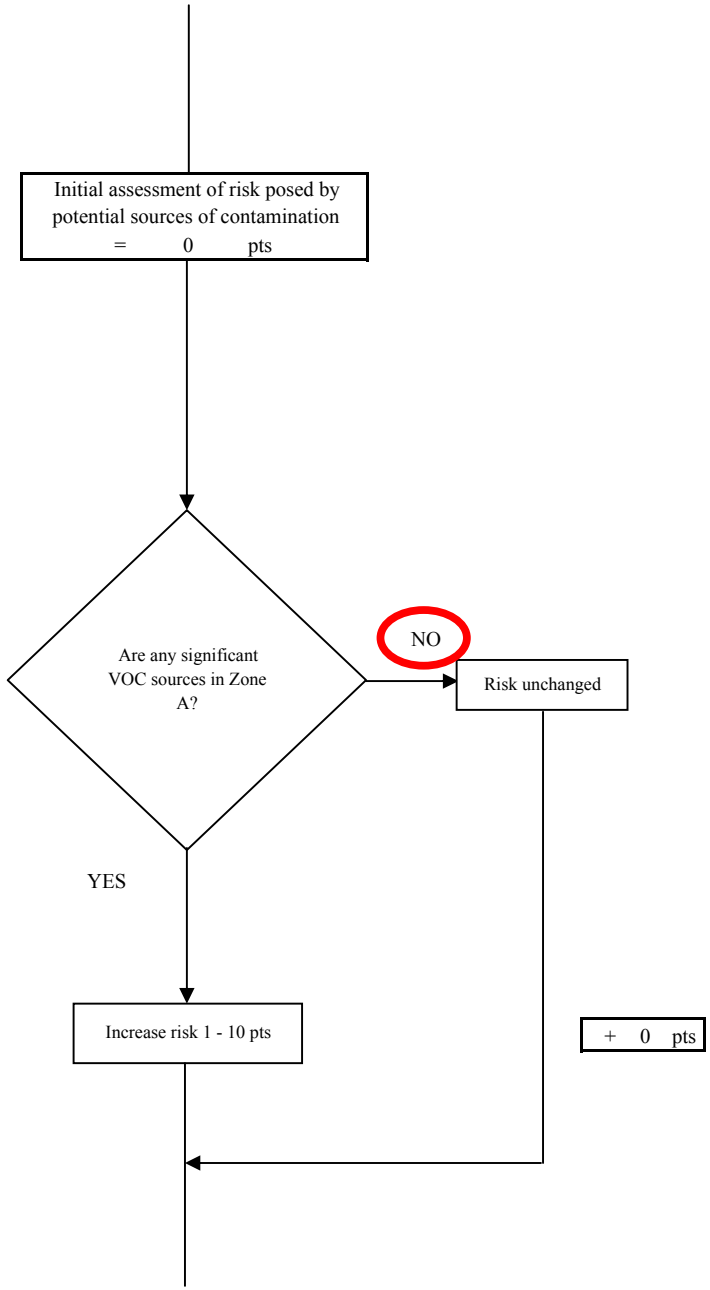
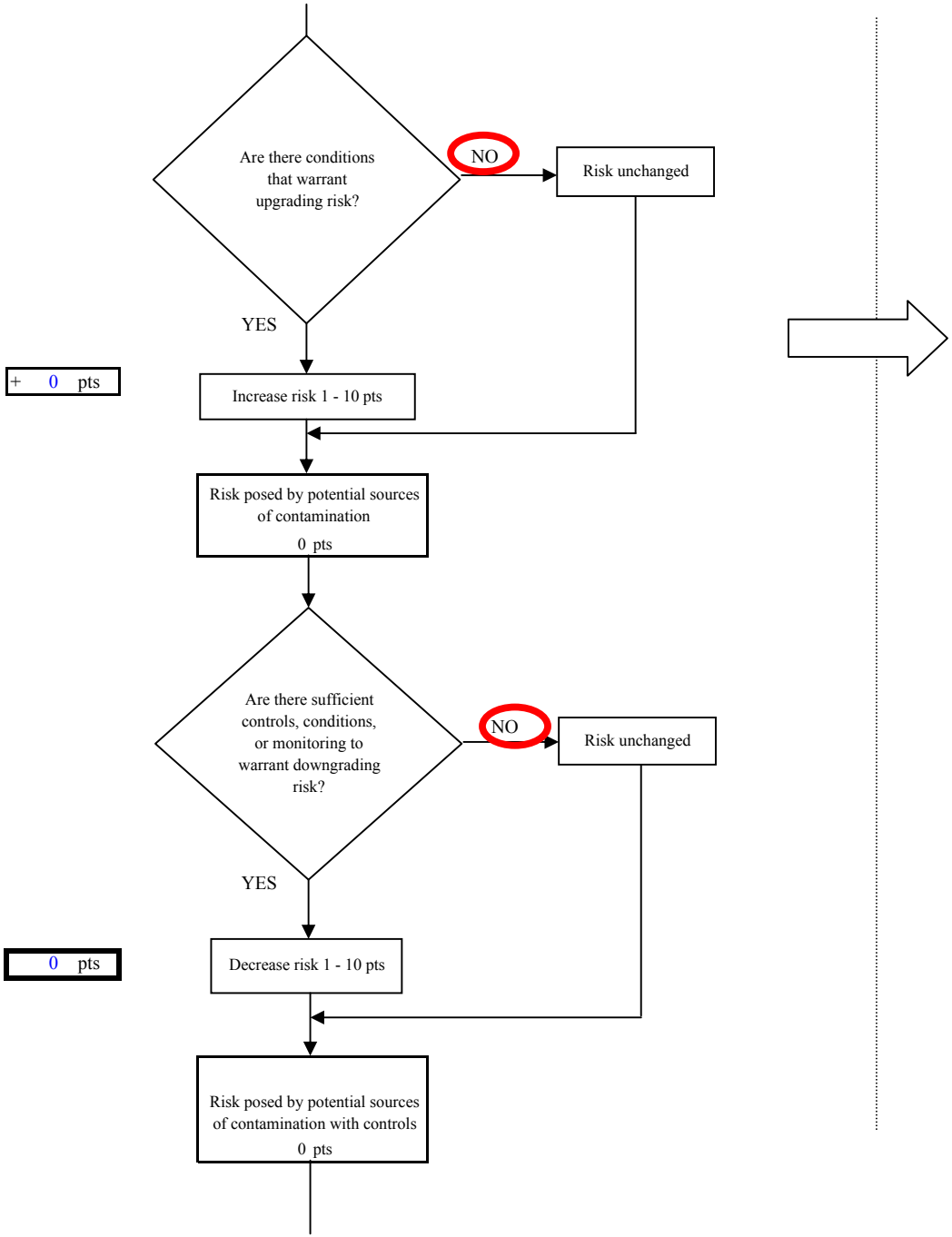
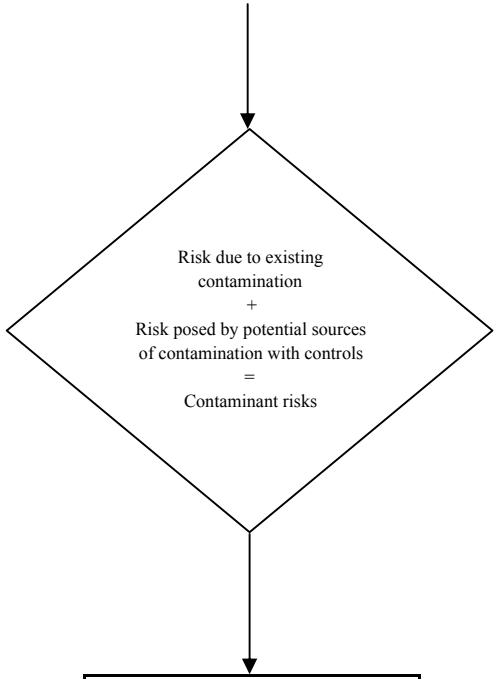


Chart 6. Contaminant risks for City of Klawock - Volatile Organic Chemicals





Existing
21 pts
+
Potential
0 pts
=
Contaminant Risk
21 pts

Contaminant risks*
= 21 pts

*Truncate risk at 50 pts

Medium

Contaminant Risk Ratings

40 to 50 pts	very high
30 to < 40 pts	high
20 to < 30 pts	medium
< 20 pts	low

Chart 7. Vulnerability analysis for City of Klawock - Volatile Organic Chemicals

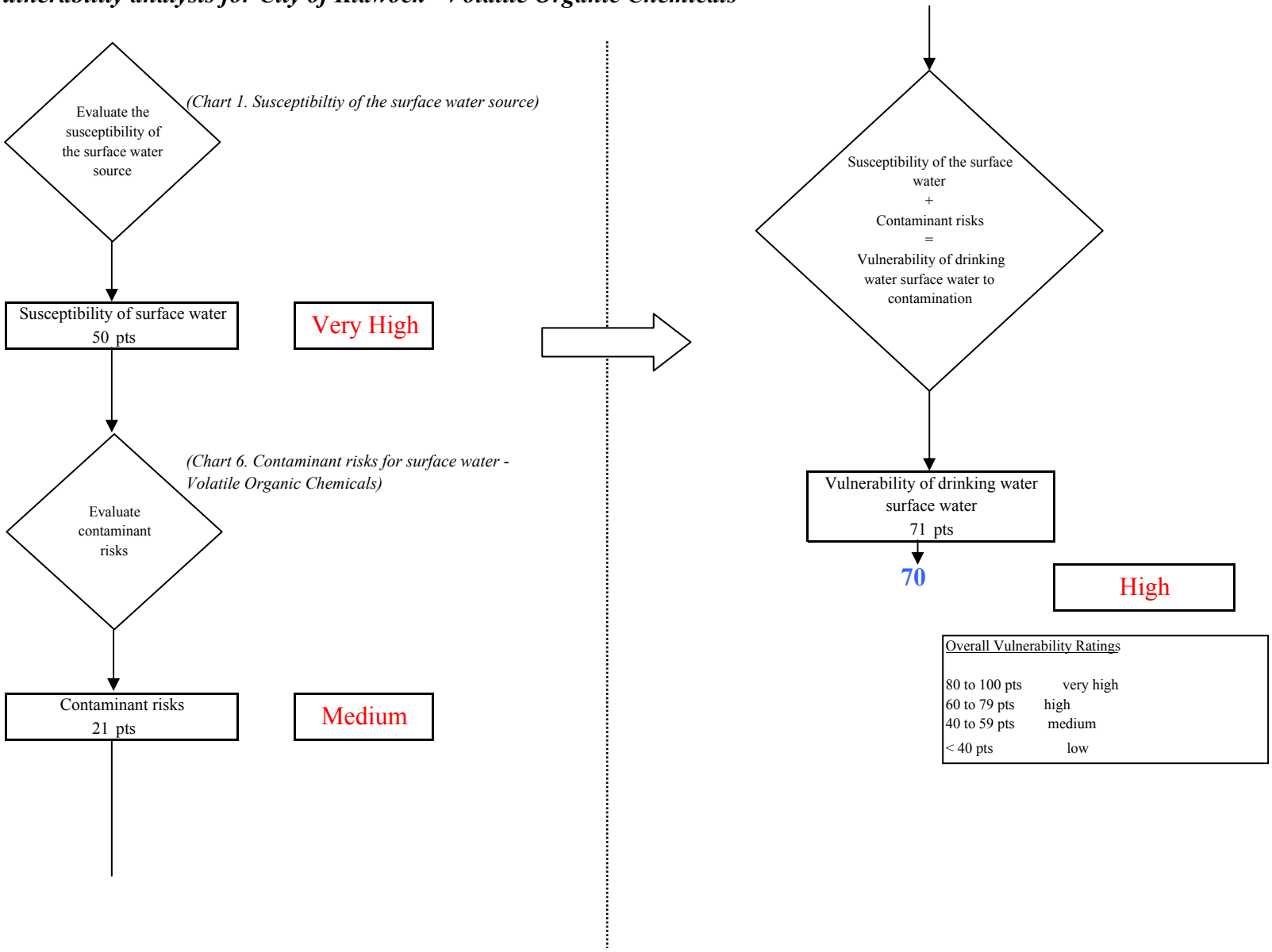


Chart 8. Contaminant risks for City of Klawock - Heavy Metals, Cyanide and Other Inorganic Chemicals

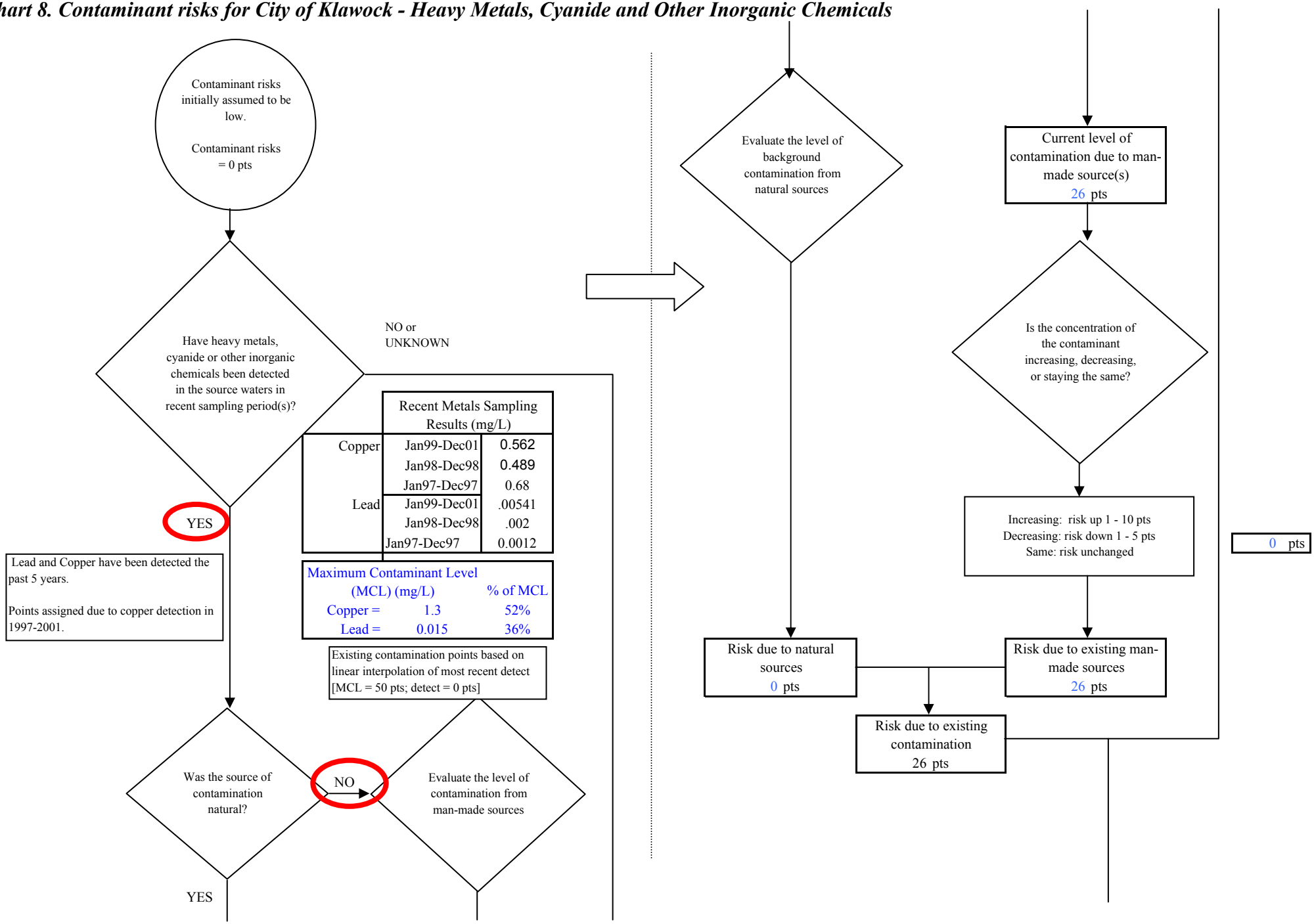
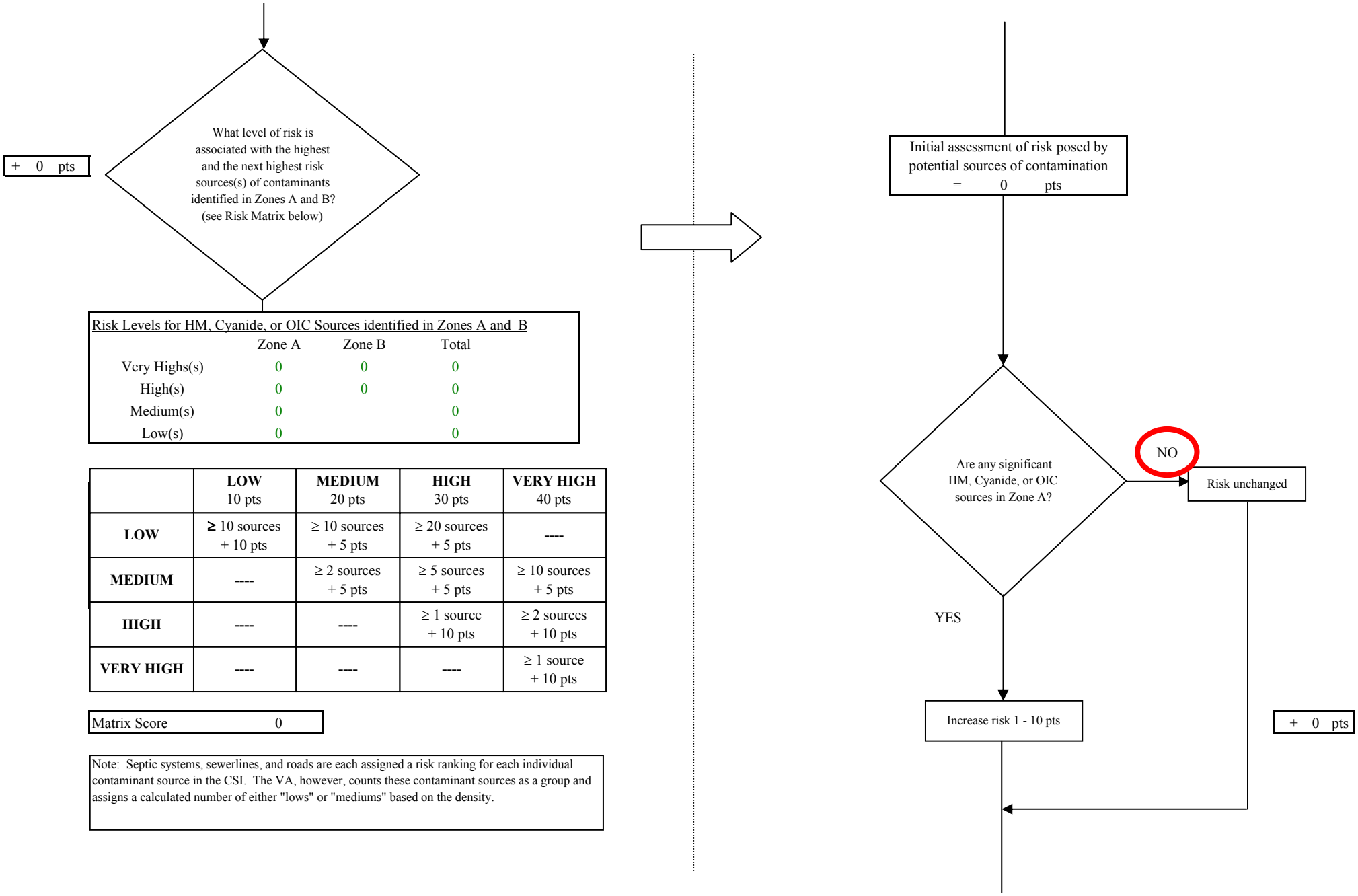


Chart 8. Contaminant risks for City of Klawock - Heavy Metals, Cyanide and Other Inorganic Chemicals



Risk Levels for HM, Cyanide, or OIC 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)	0		0

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

Matrix Score 0

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 8. Contaminant risks for City of Klawock - Heavy Metals, Cyanide and Other Inorganic Chemicals

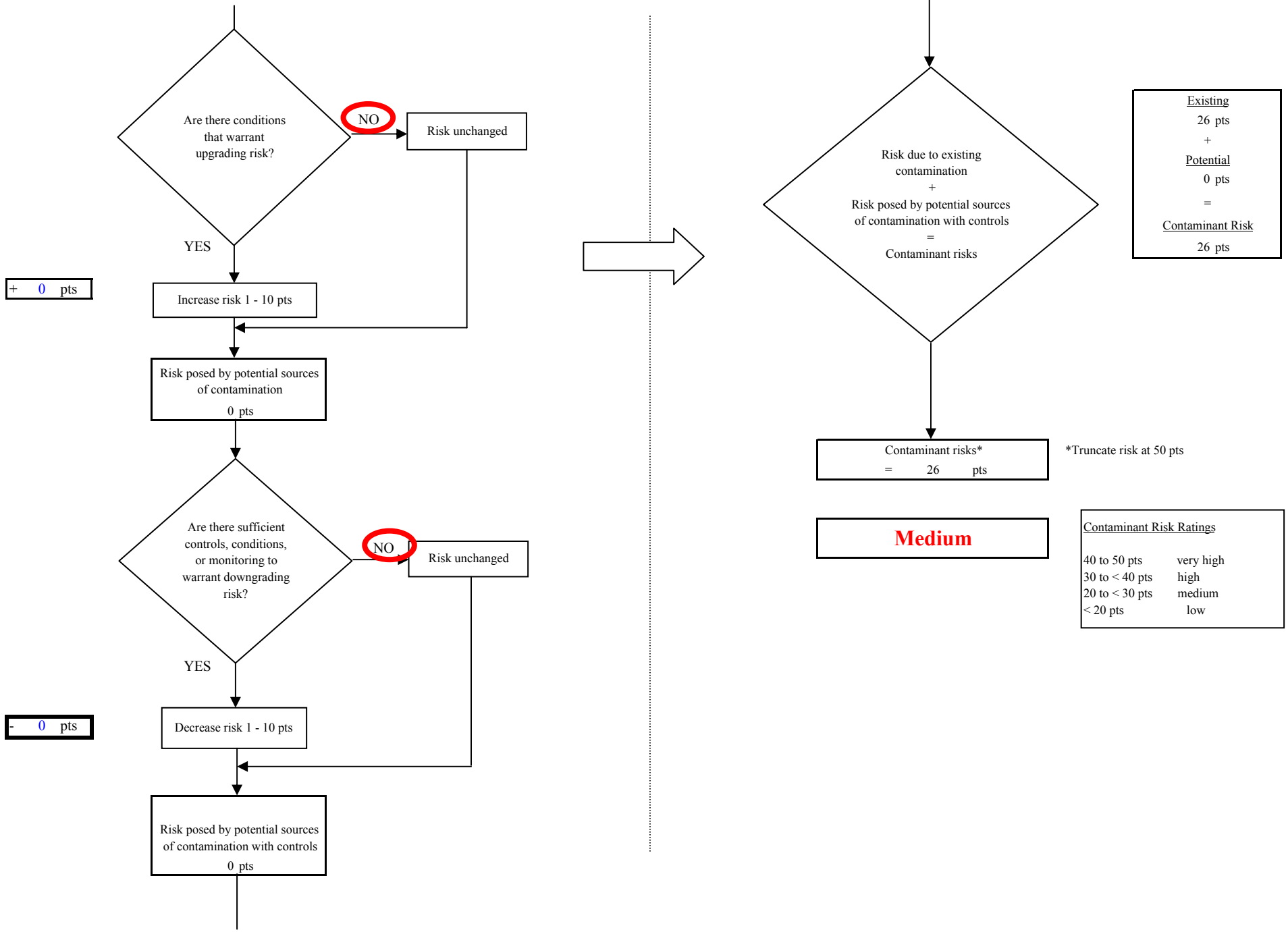


Chart 9. Vulnerability analysis for City of Klawock - Heavy Metals, Cyanide and Other Inorganic Chemicals

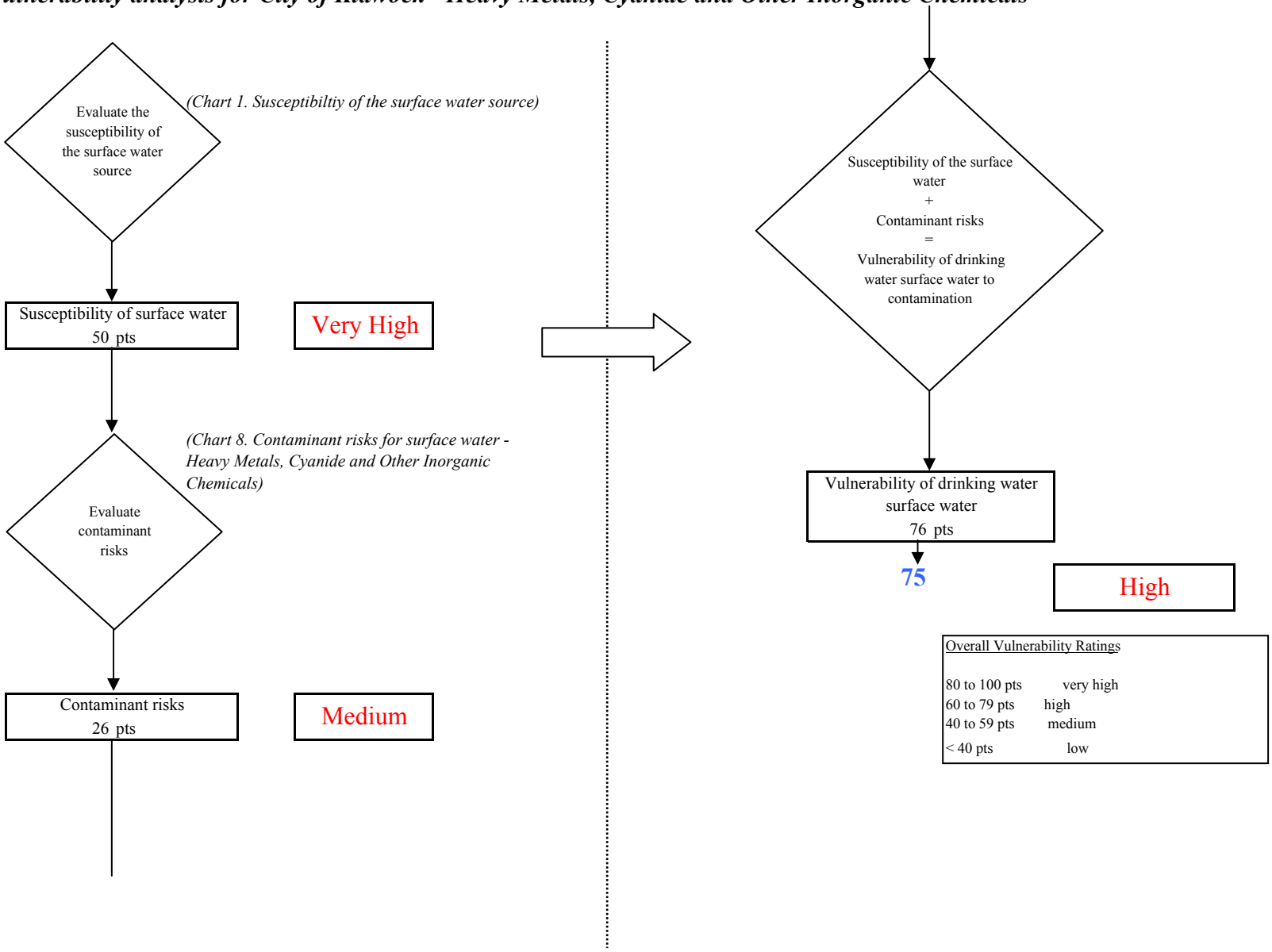


Chart 10. Contaminant risks for City of Klawock - Synthetic Organic Chemicals

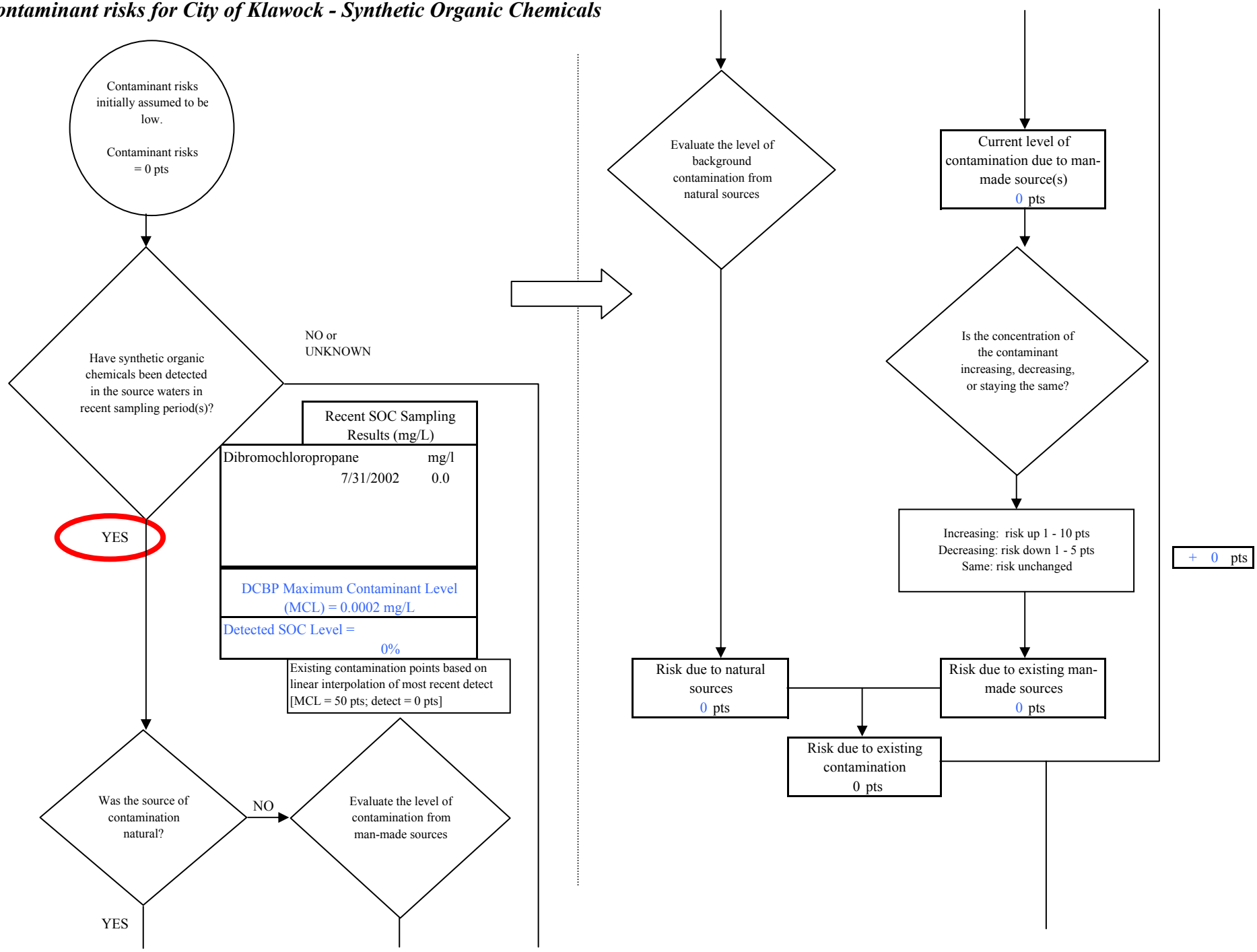
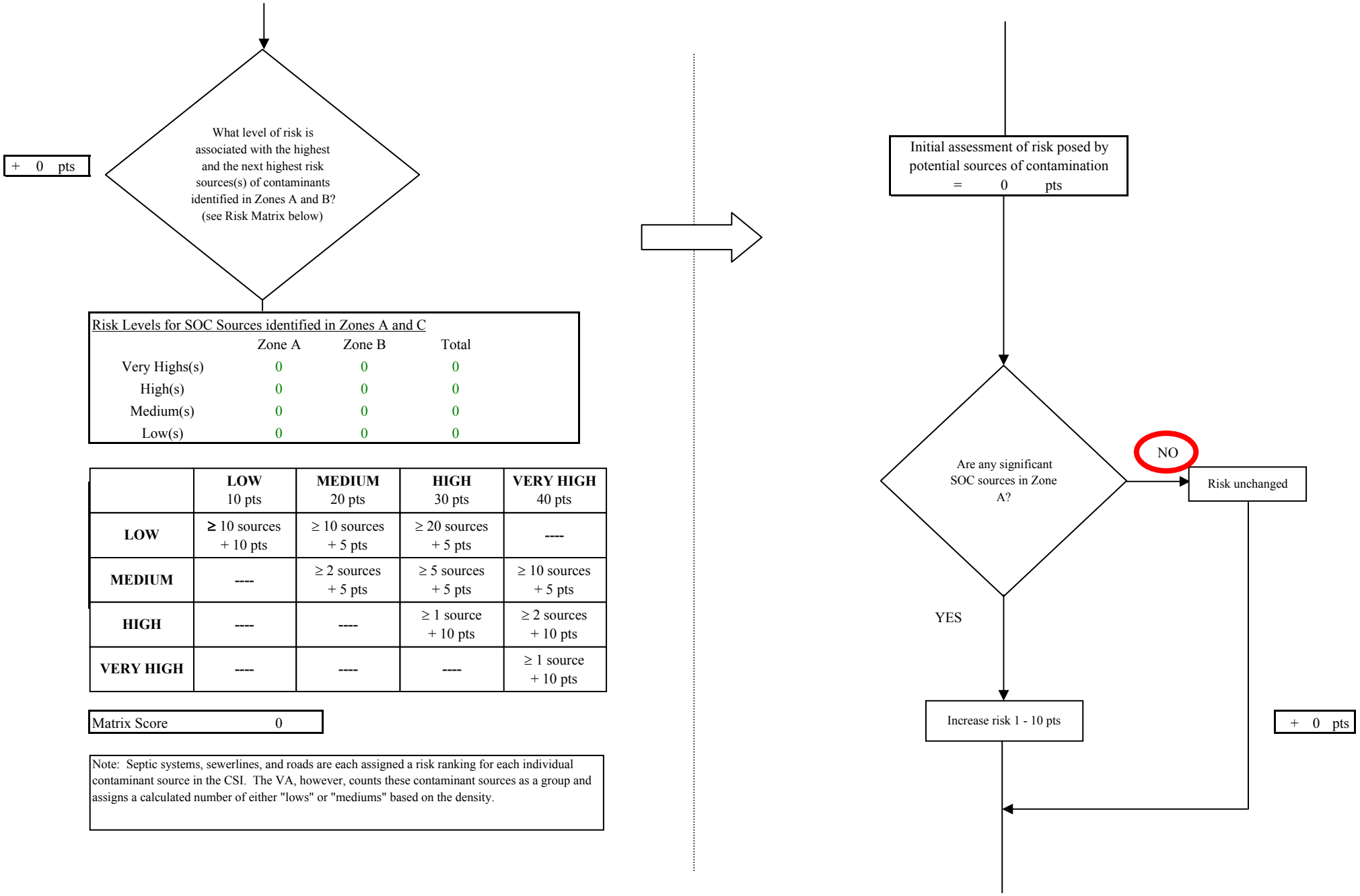


Chart 10. Contaminant risks for City of Klawock - Synthetic Organic Chemicals



Risk Levels for SOC Sources identified in Zones A and C

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

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

Matrix Score 0

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 10. Contaminant risks for City of Klawock - Synthetic Organic Chemicals

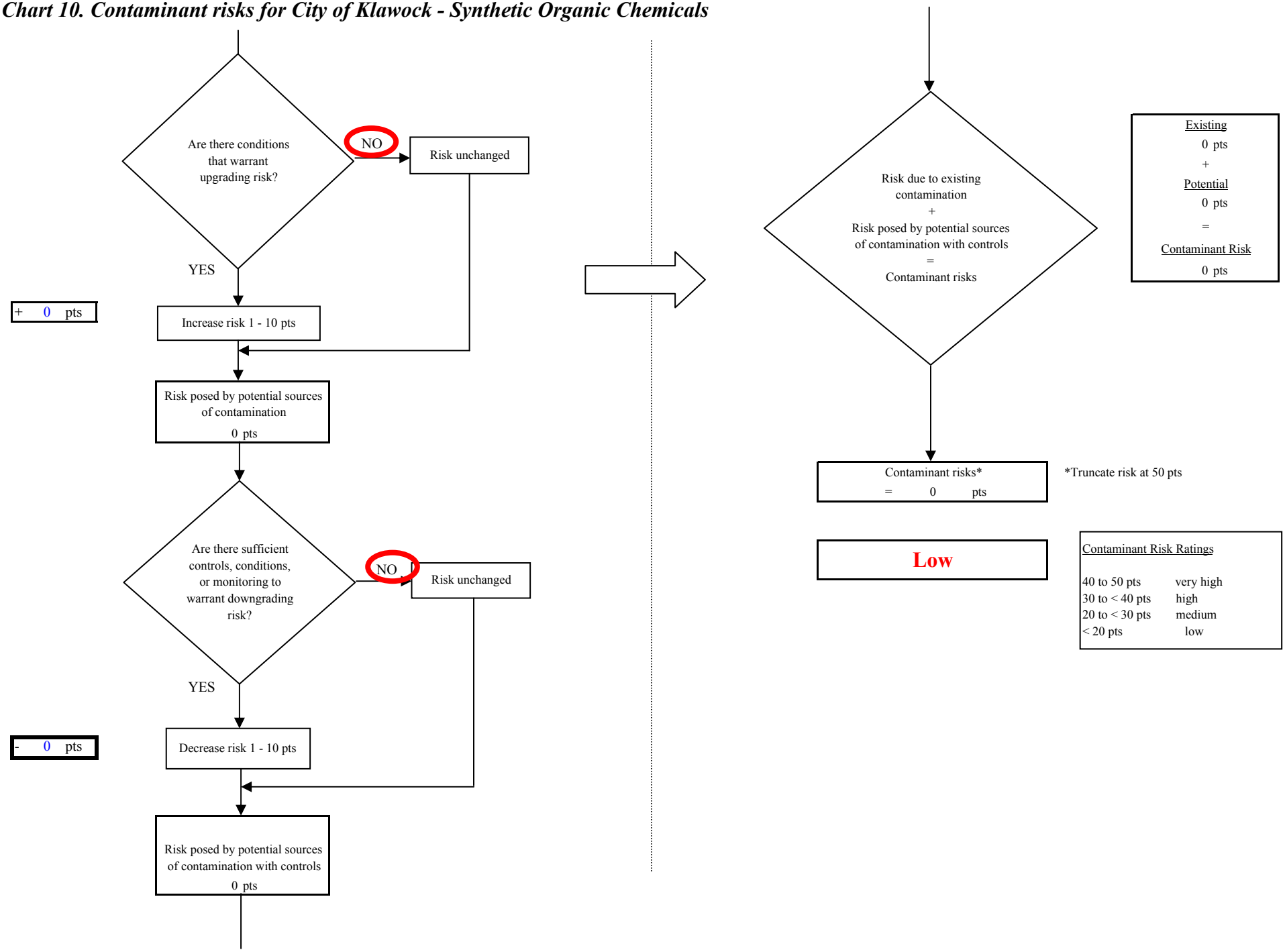


Chart 11. Vulnerability analysis for City of Klawock - Synthetic Organic Chemicals

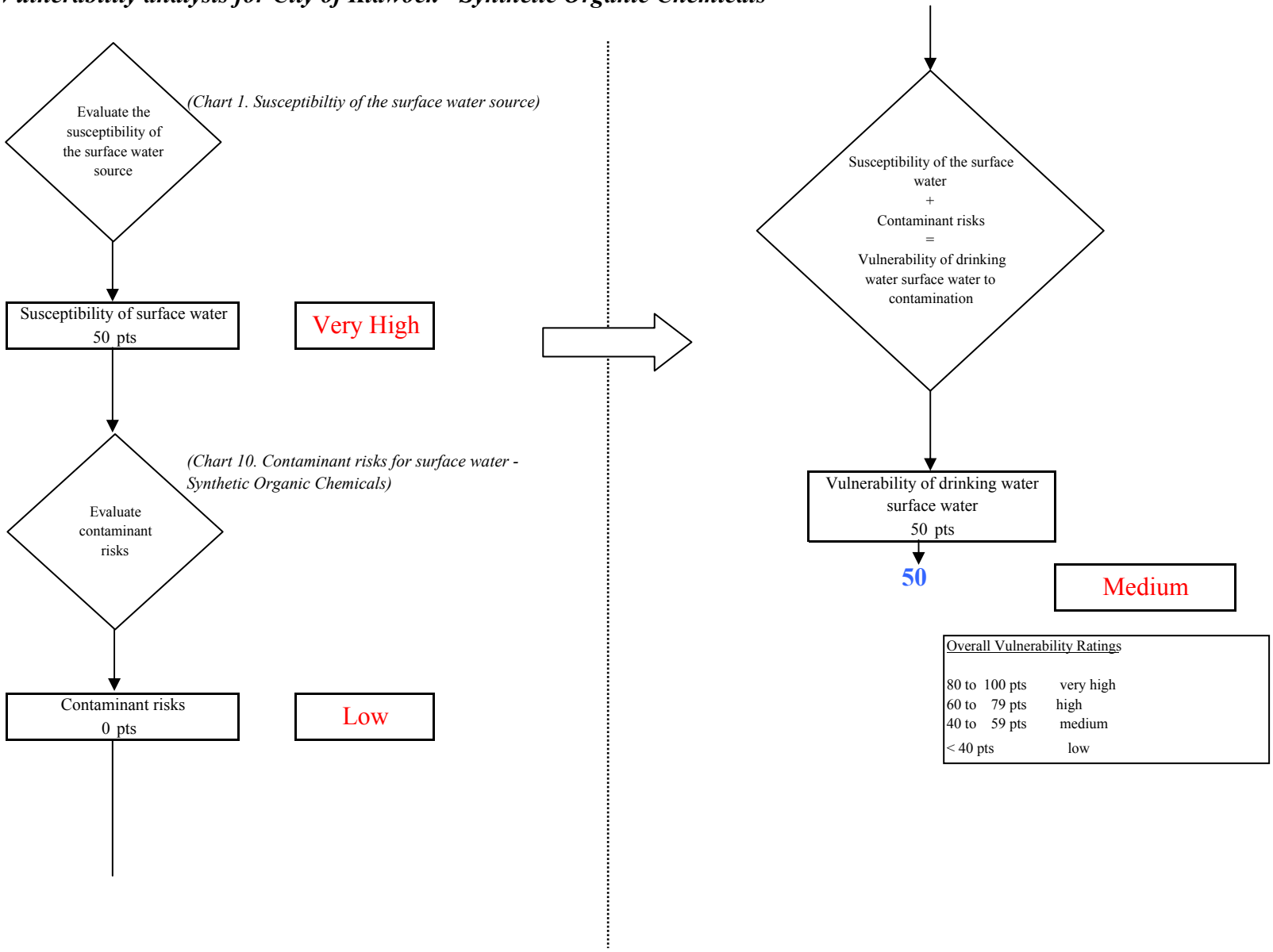


Chart 12. Contaminant risks for City of Klawock - Other Organic Chemicals

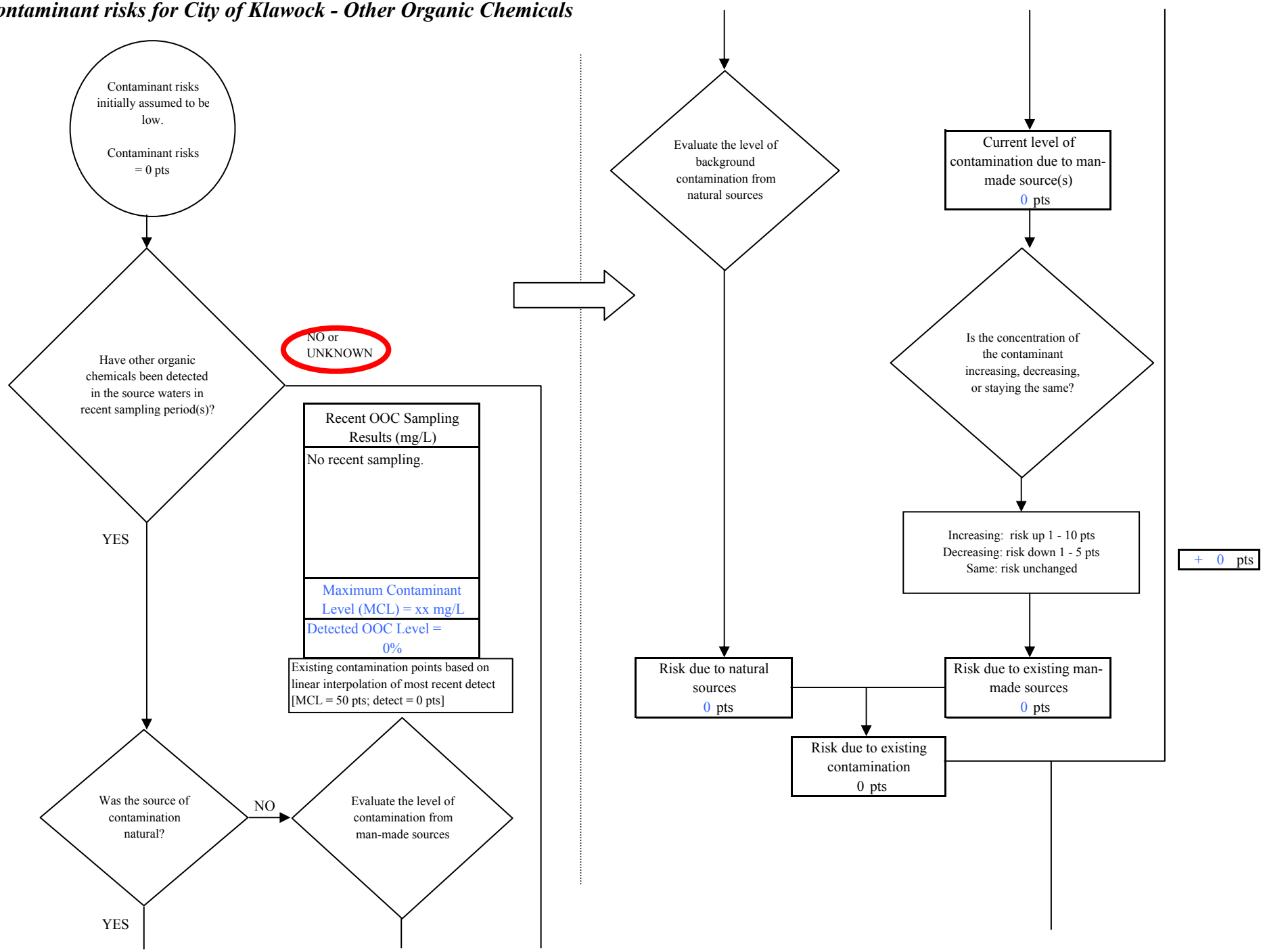
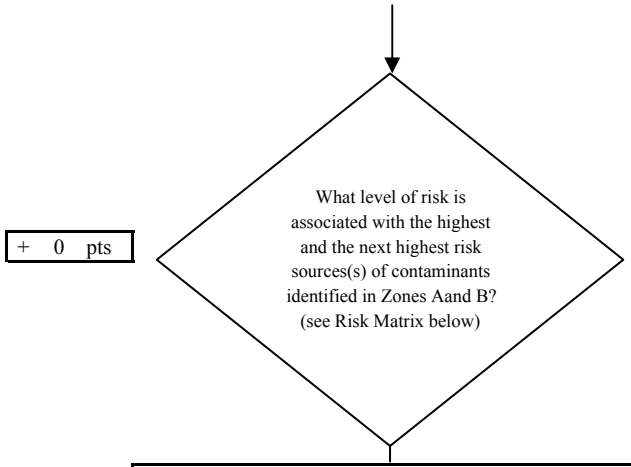


Chart 12. Contaminant risks for City of Klawock - Other Organic Chemicals



Risk Levels for OOC 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	0
Low(s)	0	0	0

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

Matrix Score 0

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.

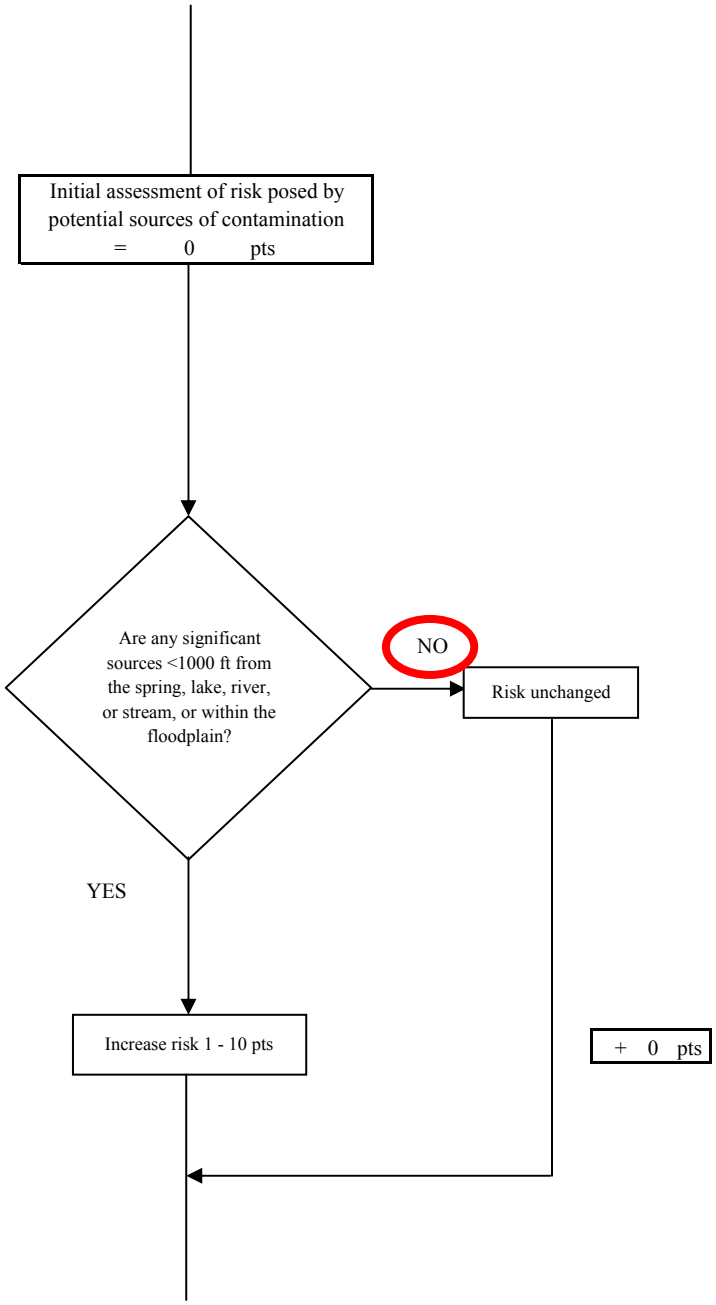


Chart 12. Contaminant risks for City of Klawock - Other Organic Chemicals

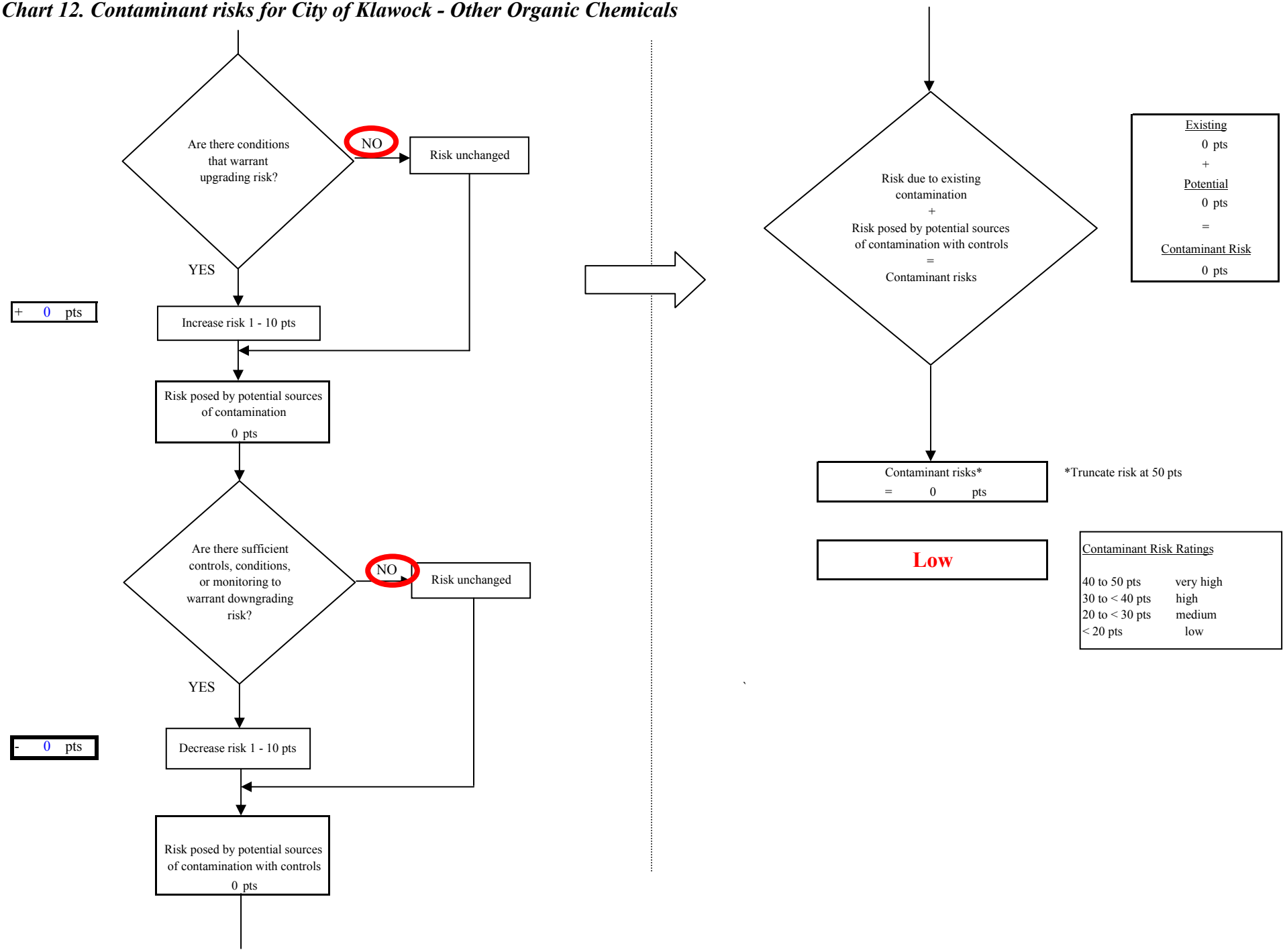


Chart 13. Vulnerability analysis for City of Klawock - Other Organic Chemicals