Source Water Assessment

A Hydrogeologic Susceptibility and Vulnerability Assessment for Whitestone Logging Camp

Hoonah, Alaska

PWSID # 130562.001

September 2004

Drinking Water Protection Program Report #1239

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 Whitestone Logging Camp Water System, Hoonah

Drinking Water Protection Program
Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

The Whitestone Logging water system is a Class A (community) water system that obtains water from Game Creek. The intake is located approximately 3-miles south of Hoonah and is accessible via a gravel access road. Access to the upper watershed area is restricted from public use. The overall protection area is approximately 11.5 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. Gravel roads and potential logging areas 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 all contaminants, except volatile organic chemicals, which received a rating of **"high"**. This assessment can be used as a foundation for local voluntary protection efforts as well as a basis for the continuous efforts on the part of Whitestone Logging to protect public health.

DRINKING WATER SYSTEM AND AREA OVERVIEW

The City of Hoonah (Sec. 28, T043S, R061E, Copper River Meridian) is a Tlingit community located on the northeast shore of Chichagof Island, 40 air miles west of Juneau (Please see the inset of Map 1 in Appendix A for location). The current population of Hoonah is approximately 870 (ADCED, 2003). The Whitestone Logging water system is a Class A (community) water system that serves approximately 200 people. The system's intake is located approximately 3-miles south of Hoonah on Game Creek (See Map 1 of Appendix A). Access to the intake is available via gravel road.

98% of the households in Hoonah are fully plumbed. Piped sewage is processed in a sewage treatment plant and the City provides refuse collection (ADCED, 2003).

The geology of the watershed area is heavily composed of carbonate rocks. The majority of them being limestone and marble. Most areas are well drained because the water percolates through the underlying carbonate bedrock. Because of this, wetlands are not typically present, except on areas of glacial hardpans or non-carbonate intrusion. Alpine areas here have significant bare areas, where soils are too thin to support vegetation. Lower elevations support forests of western hemlock and Sitka spruce. Both surface and subsurface waters often have high pH levels (USDA, 2001).

Hoonah's maritime climate is characterized by cool summers and mild winters. Summer temperatures average 52 to 63; winter temperatures average 26 to 39. Temperature extremes have been recorded from -25 to 87. Precipitation averages 100 inches annually, with 71 inches of snowfall. (ADCED, 2003).

The most recent Sanitary Survey (1998) indicates that the intake screens are maintained and protected from ice buildup and siltation. The survey did not indicate the system's average daily output. The system operator provided documentation (for the Hoonah SWA report) showing that the mean annual flow of Ear Mountain Creek (upstream of the intake) is 11.4 cfs, with a mean monthly flow of 24.9 cfs in May and 3.1 cfs in January. Flow information for Game Creek was not provided.

WHITESTONE LOGGING 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 Whitestone Logging water intake 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 Whitestone Logging 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 Whitestone Logging 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	10	
Overall Susceptibility	45	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. Whitestone Logging Contaminant Risks

Category	Score	Rating
Bacteria and Viruses	12	Low
Nitrates and/or Nitrites	12	Low
Volatile Organic Chemicals	25	Medium
Heavy Metals, Cyanide, and Other Inorganic Chemicals	12	Low
Synthetic Organic Chemicals	0	Low
Other Organic Chemicals	12	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. Whitestone Logging Overall Vulnerability

Category	Score	Rating
Bacteria and Viruses	55	Medium
Nitrates and Nitrites	55	Medium
Volatile Organic Chemicals	70	High
Heavy Metals, Cyanide, and Other Inorganic Chemicals	55	Medium
Synthetic Organic Chemicals	45	Medium

Other Organic Chemicals	55	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 sampling collected since 1999.

A possible source of bacteria and viruses could be from human/animal activity along roads within the protection area.

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 is "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 have been detected at levels below the MCL in samples collected in 2000 and 2002. 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).

Possible sources of nitrates/nitrites could be from human/animal activity along roads or logging areas within the protection area.

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 "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 and trihalomethanes were detected at levels below the MCL during sampling in 2001-2002, 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 volatile organic chemicals could be from human/animal activity along roads or logging areas within the protection area.

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 1998-2002, although in levels below the MCL (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 and not from the source waters. Additional sources of heavy metals could be from activity along roads or logging areas within the protection area.

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

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 test results for dibromochloropropane and ethylene dibromide in 2002 were negative.

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).

A possible source of other organic chemicals could be from activity along roads within the protection area.

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

Using the Source Water Assessment

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 Whitestone Logging 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 the drinking water source.

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

Whitestone Logging
Drinking Water Protection Area Location Map
(Map 1)

Whitestone Logging -
Drinking Water Protection Area

Map 1: Whitestone Logging - Drinking Water Protection Area

PWSID: 130562.001

Alaska Department of Environmental Conservation

Alaska Drinking Water Protection Program

0 3,500 7,000 14,000 21,000 28,000 Feet

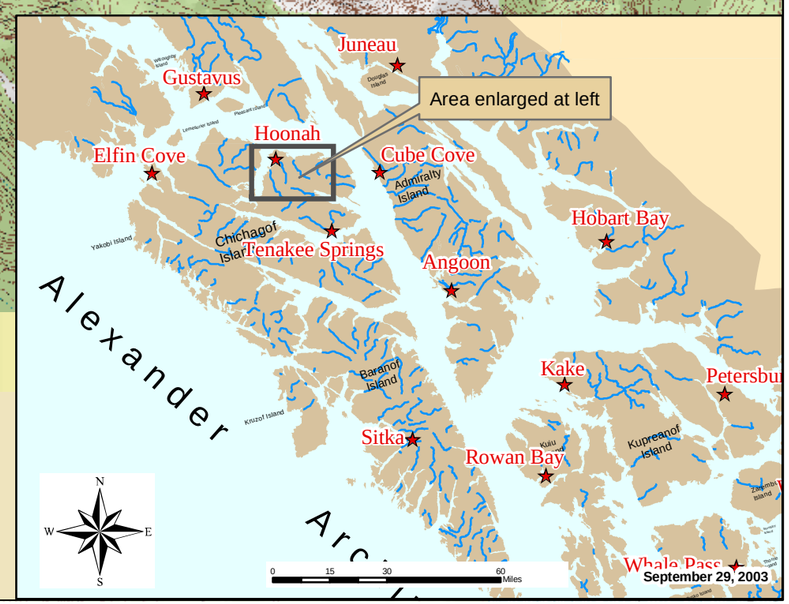
1:84,000

Data Sources:
Background image
- USGS 1:63,000 mapping
Lakes, streams, & roads
- U.S. Forest Service, Tongass

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

Legend

- Whitestone Logging 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 - 6)

Table 1

Contaminant Source Inventory for
Whitestone Logging

PWSID 130562.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Map Number*	*Comments*
Logging (potential)	E02	E02 1-5	A	2	U.S. Forest Service Data - Tongass
Highways and roads, dirt/gravel	X24	X24 1-4	A	2	U.S. Forest Service Data - Tongass
Logging (potential)	E02	E02 - 6	B	2	U.S. Forest Service Data - Tongass

Table 2

Contaminant Source Inventory and Risk Ranking for Whitestone Logging Sources of Bacteria and Viruses

PWSID 130562.001

Contaminant Source Type	***Contaminant Source ID***	***CS ID tag***	***Zone***	***Risk Ranking for Analysis***	***Map Number***	***Comments***
Highways and roads, dirt/gravel	X24	X24 1-4	A	Low	2	U.S. Forest Service Data - Tongass

Table 3

Contaminant Source Inventory and Risk Ranking for Whitestone Logging Sources of Nitrates/Nitrites

PWSID 130562.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Logging (potential)	E02	E02 1-5	A	Low	2	U.S. Forest Service Data - Tongass
Highways and roads, dirt/gravel	X24	X24 1-4	A	Low	2	U.S. Forest Service Data - Tongass
Logging (potential)	E02	E02 - 6	B	Low	2	U.S. Forest Service Data - Tongass

Table 4

Contaminant Source Inventory and Risk Ranking for Whitestone Logging
Sources of Volatile Organic Chemicals

PWSID 130562.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Logging (potential)	E02	E02 1-5	A	Medium	2	U.S. Forest Service Data - Tongass
Highways and roads, dirt/gravel	X24	X24 1-4	A	Low	2	U.S. Forest Service Data - Tongass
Logging (potential)	E02	E02 - 6	B	Medium	2	U.S. Forest Service Data - Tongass

Table 5

Contaminant Source Inventory and Risk Ranking for Whitestone Logging

Sources of Heavy Metals, Cyanide and Other Inorganic Chemicals

PWSID 130562.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Logging (potential)	E02	E02 1-5	A	Low	2	U.S. Forest Service Data - Tongass
Highways and roads, dirt/gravel	X24	X24 1-4	A	Low	2	U.S. Forest Service Data - Tongass
Logging (potential)	E02	E02 - 6	B	Low	2	U.S. Forest Service Data - Tongass

Table 6

Contaminant Source Inventory and Risk Ranking for Whitestone Logging
Sources of Other Organic Chemicals

PWSID 130562.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Highways and roads, dirt/gravel	X24	X24 1-4	A	Low	2	U.S. Forest Service Data - Tongass

APPENDIX C

Whitestone Logging
Drinking Water Protection Area
and Potential and Existing Contaminant Sources
(Map 2)

Whitestone Logging - Water System Intake

E02 - 3 & 4 (Potential Logging)

E02 - 5 & 6 (Potential Logging)

City of Hoonah - Water System Intake

X24 - 1 through 4 (Gravel/dirt roads)

E02 - 1 & 2 (Potential Logging)

Ear Mountain

Hoonah

Area enlarged at left

Map 2: Potential and Existing Contaminant Sources

PWSID: 130562.001

Alaska Department of Environmental Conservation

Alaska Drinking Water Protection Program

0 1,750 3,500 7,000 10,500 Feet

1:42,000

Data Sources:

Background image
- USGS 1:63,000 mapping
Lakes, streams, & roads
- U.S. Forest Service

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

Legend

- Whitestone Logging - PWS Intake
- City of Hoonah - PWS Intake
- Potential Logging Area
- Zone A Protection Area
- Zone B Protection Area
- Zone C Protection Area
- Lake
- Stream
- Roads

N W E S

0 1.5 3 6 Miles

September 20, 2003

APPENDIX D

Vulnerability Analysis and Contaminant Risks
(Charts 1-13)

Chart 1. Susceptibility of the Surface Water Source - Whitestone Logging

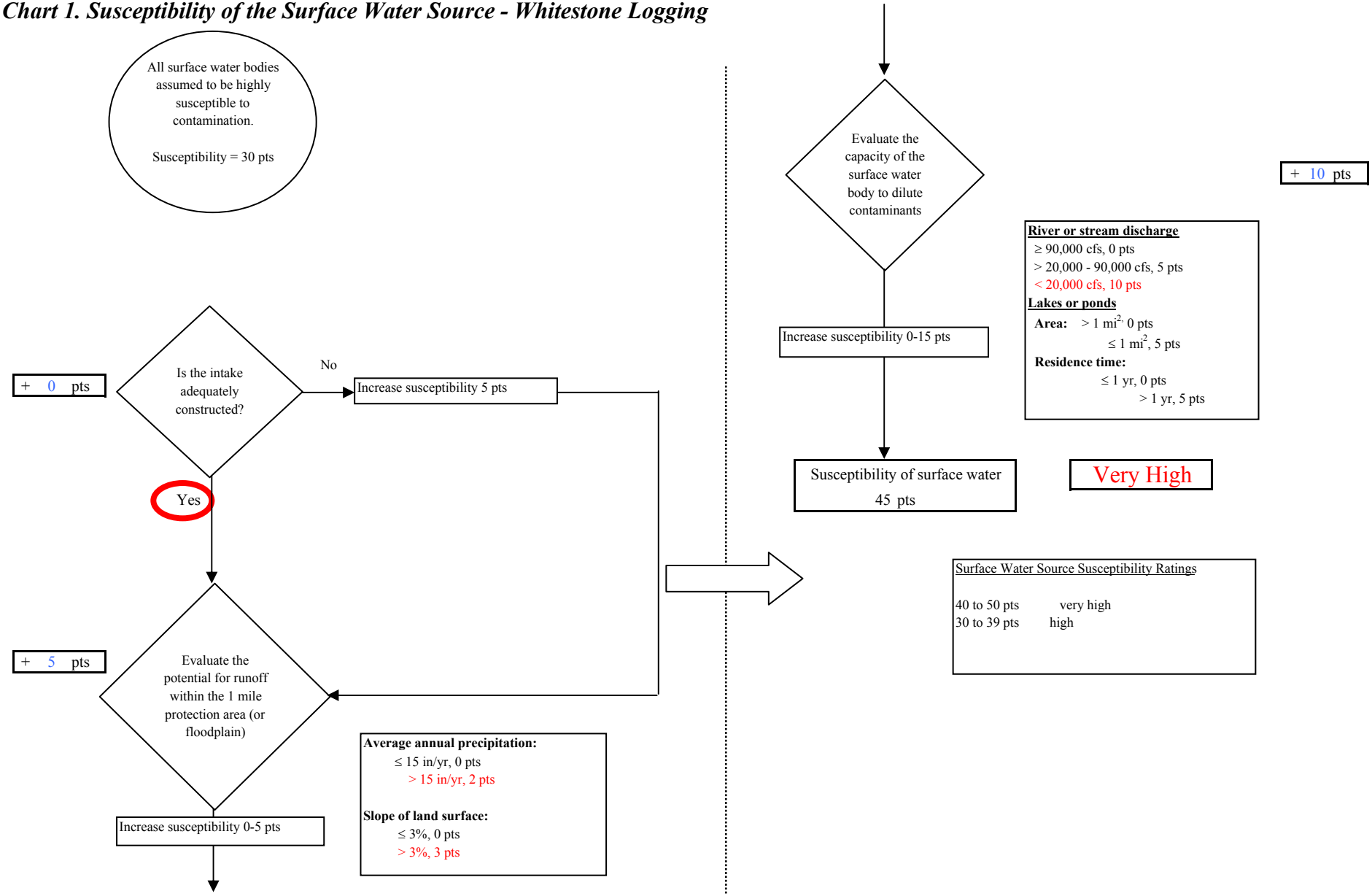
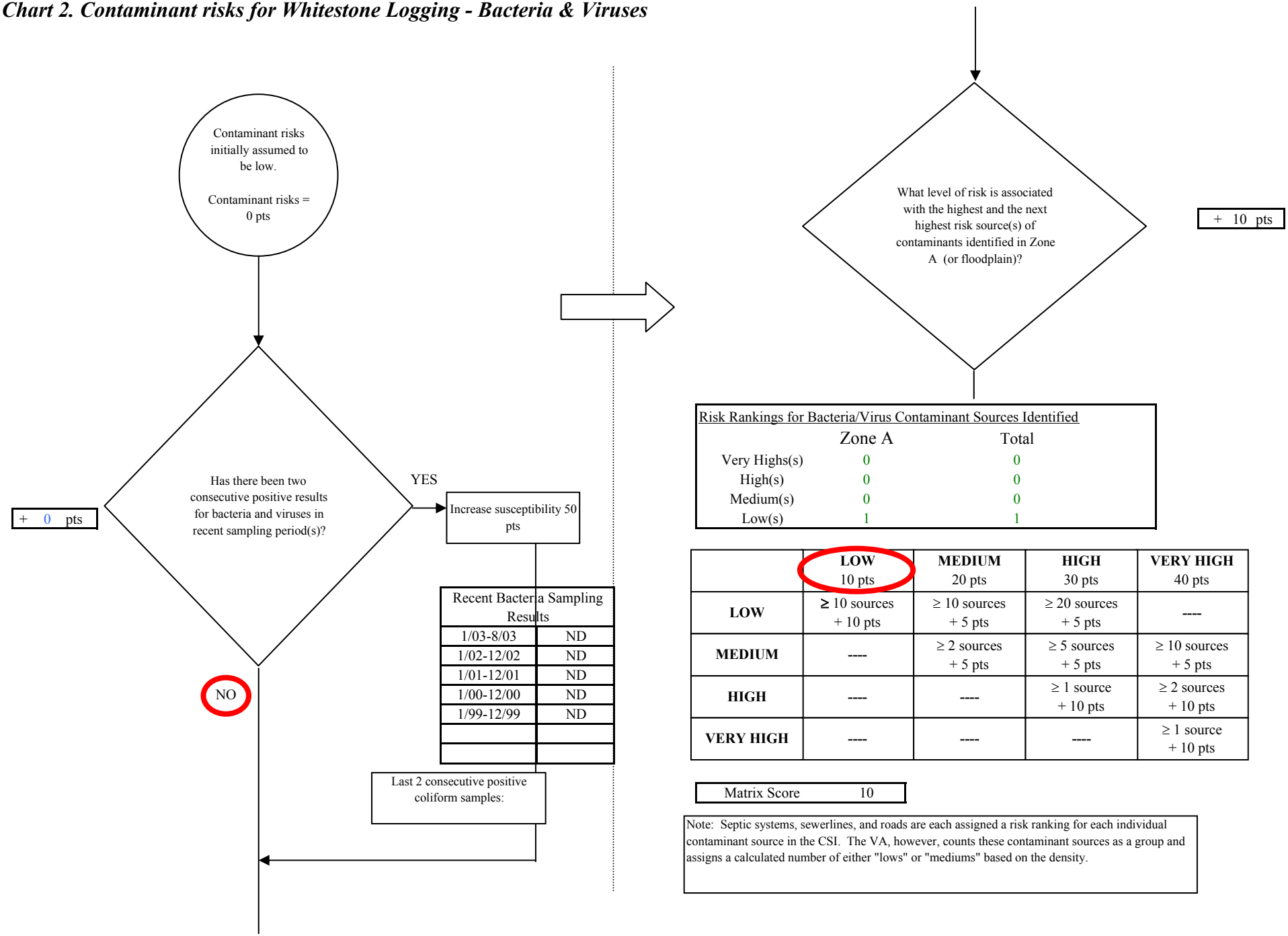


Chart 2. Contaminant risks for Whitestone Logging - Bacteria & Viruses



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)	1	1

	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 2. Contaminant risks for Whitestone Logging - Bacteria & Viruses

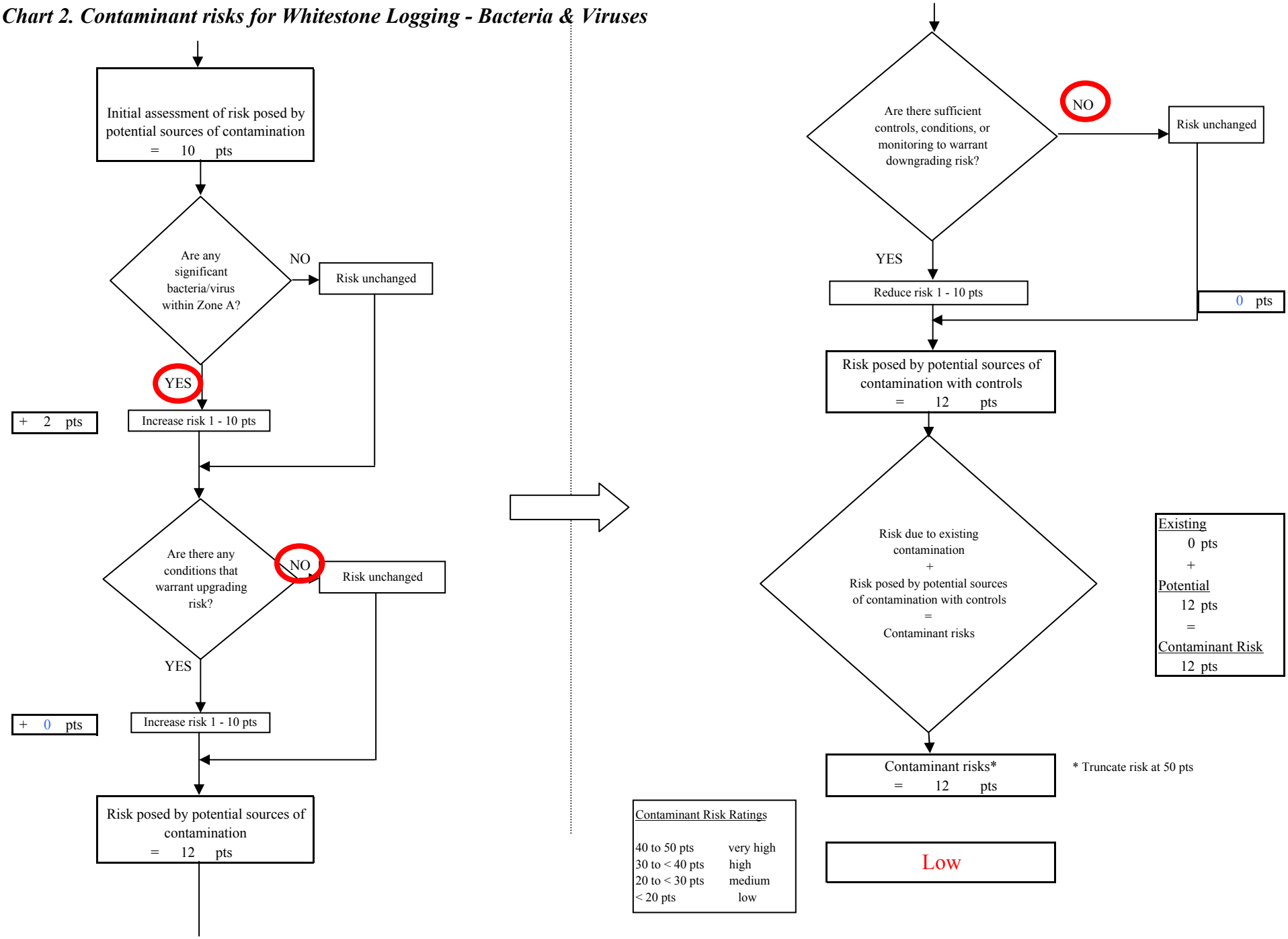


Chart 3. Vulnerability analysis for Whitestone Logging - Bacteria & Viruses

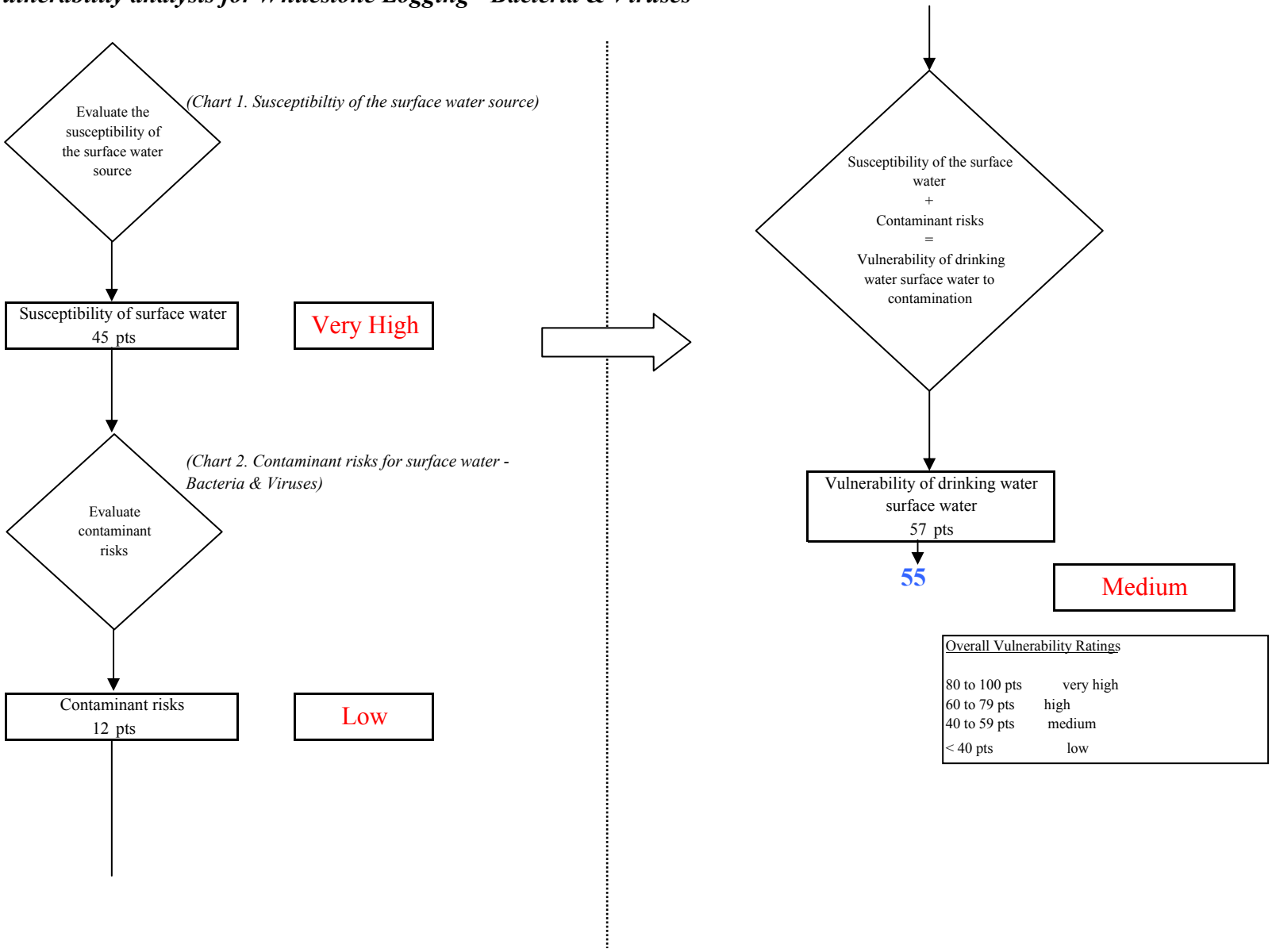


Chart 4. Contaminant risks for Whitestone Logging - Nitrates and Nitrites

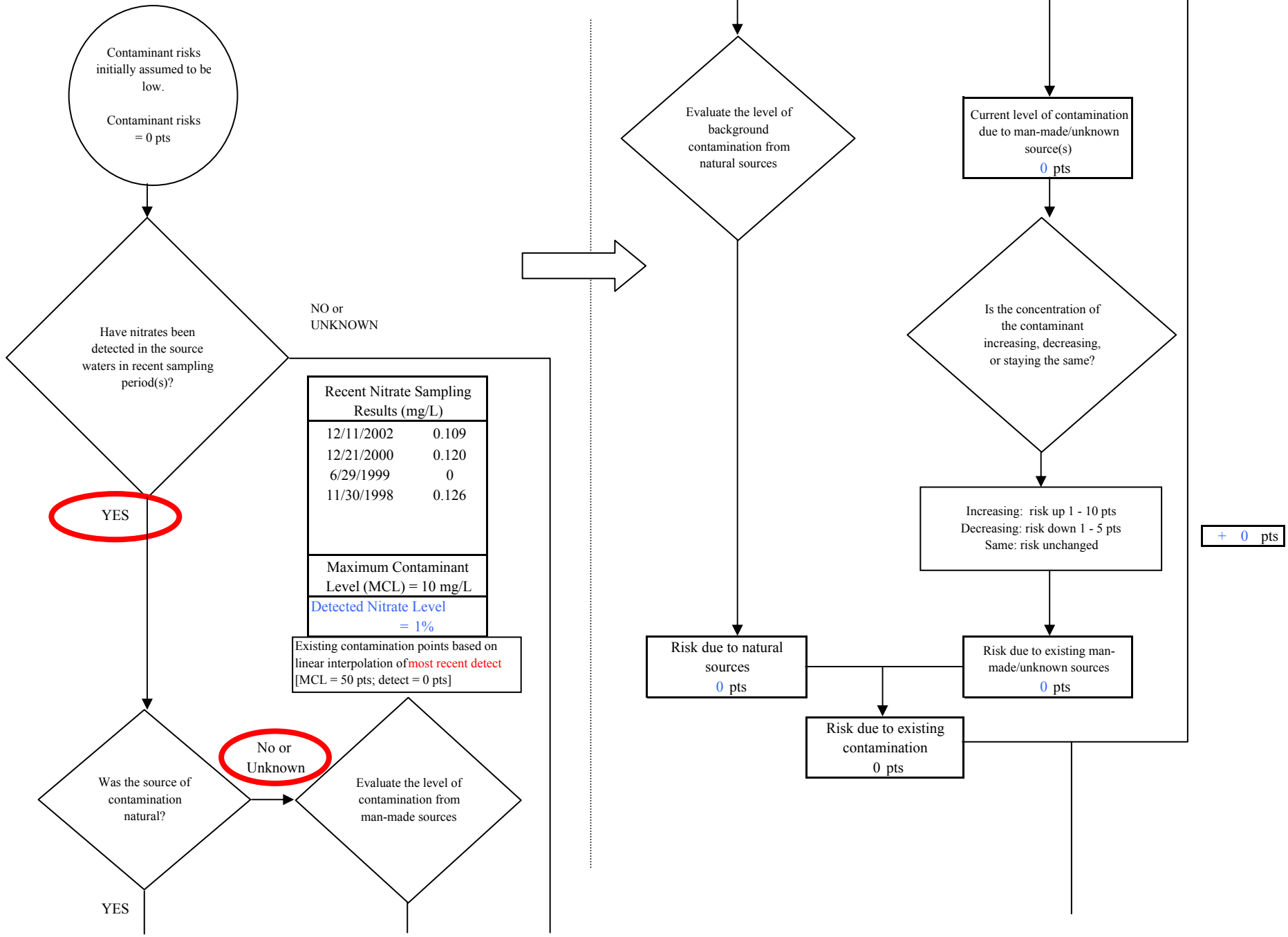
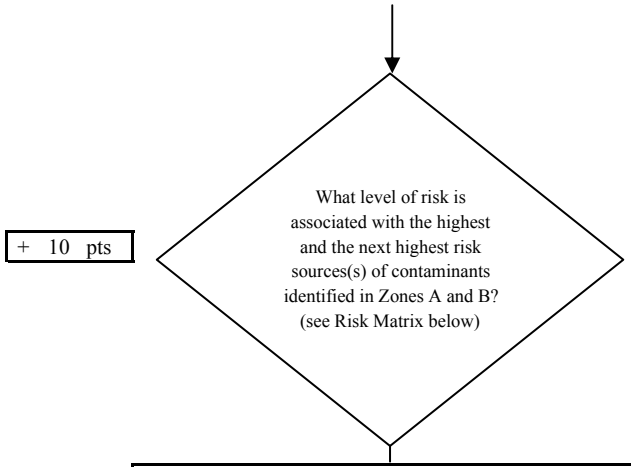


Chart 4. Contaminant risks for Whitestone Logging - Nitrates and Nitrites



+ 10 pts

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)	2		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.

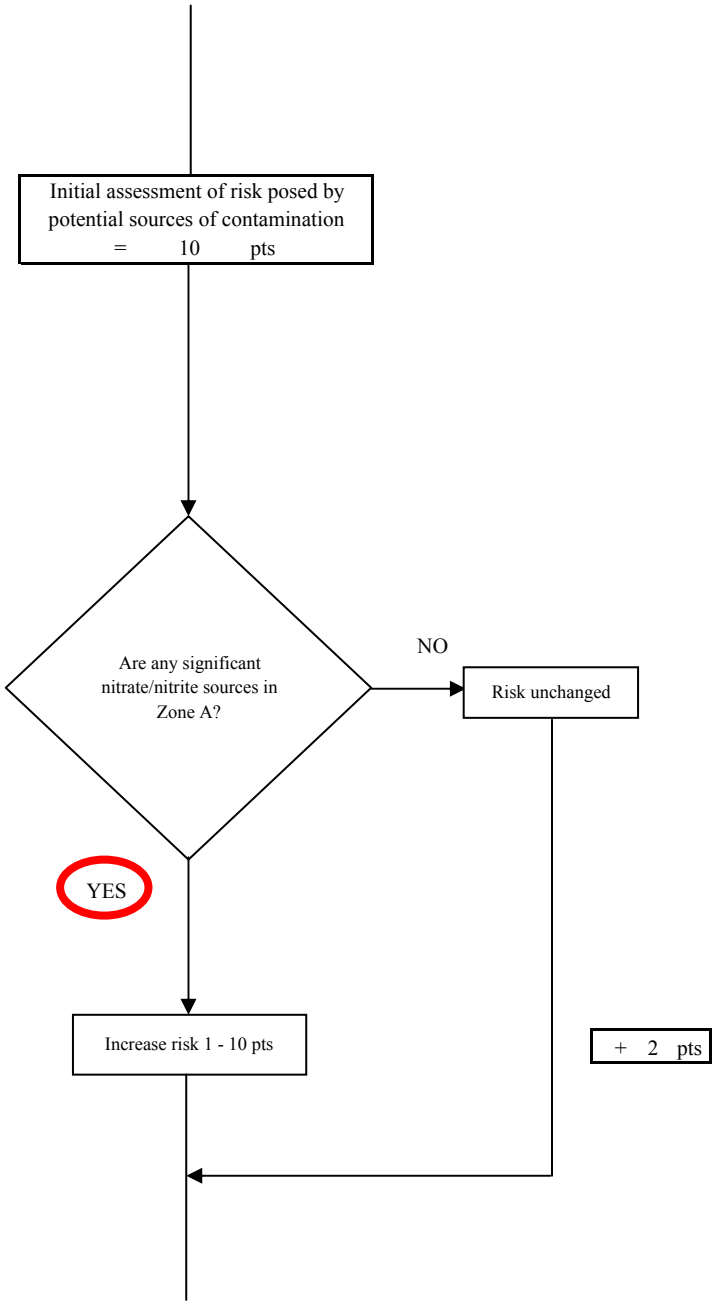
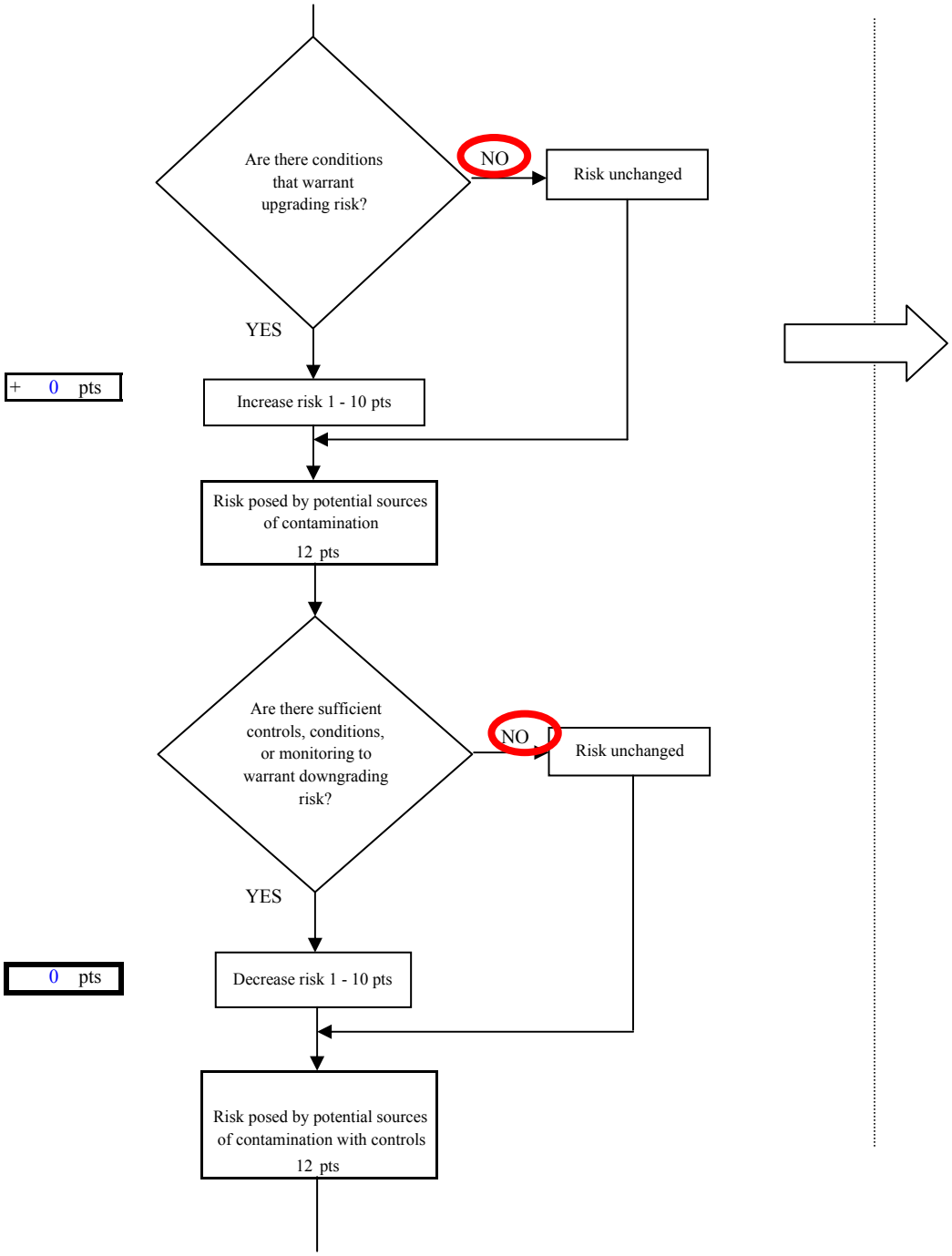
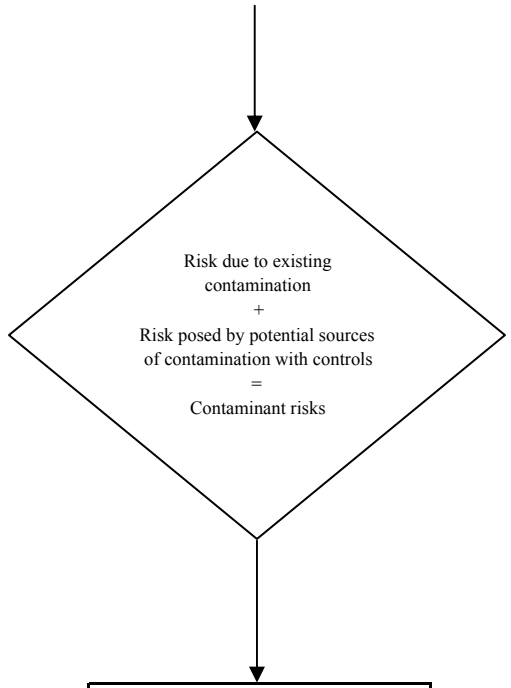


Chart 4. Contaminant risks for Whitestone Logging - Nitrates and Nitrites





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

Contaminant risks*
= 12 pts

*Truncate risk at 50 pts

Low

Contaminant Risk Ratings

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

Chart 5. Vulnerability analysis for Whitestone Logging - Nitrates and Nitrites

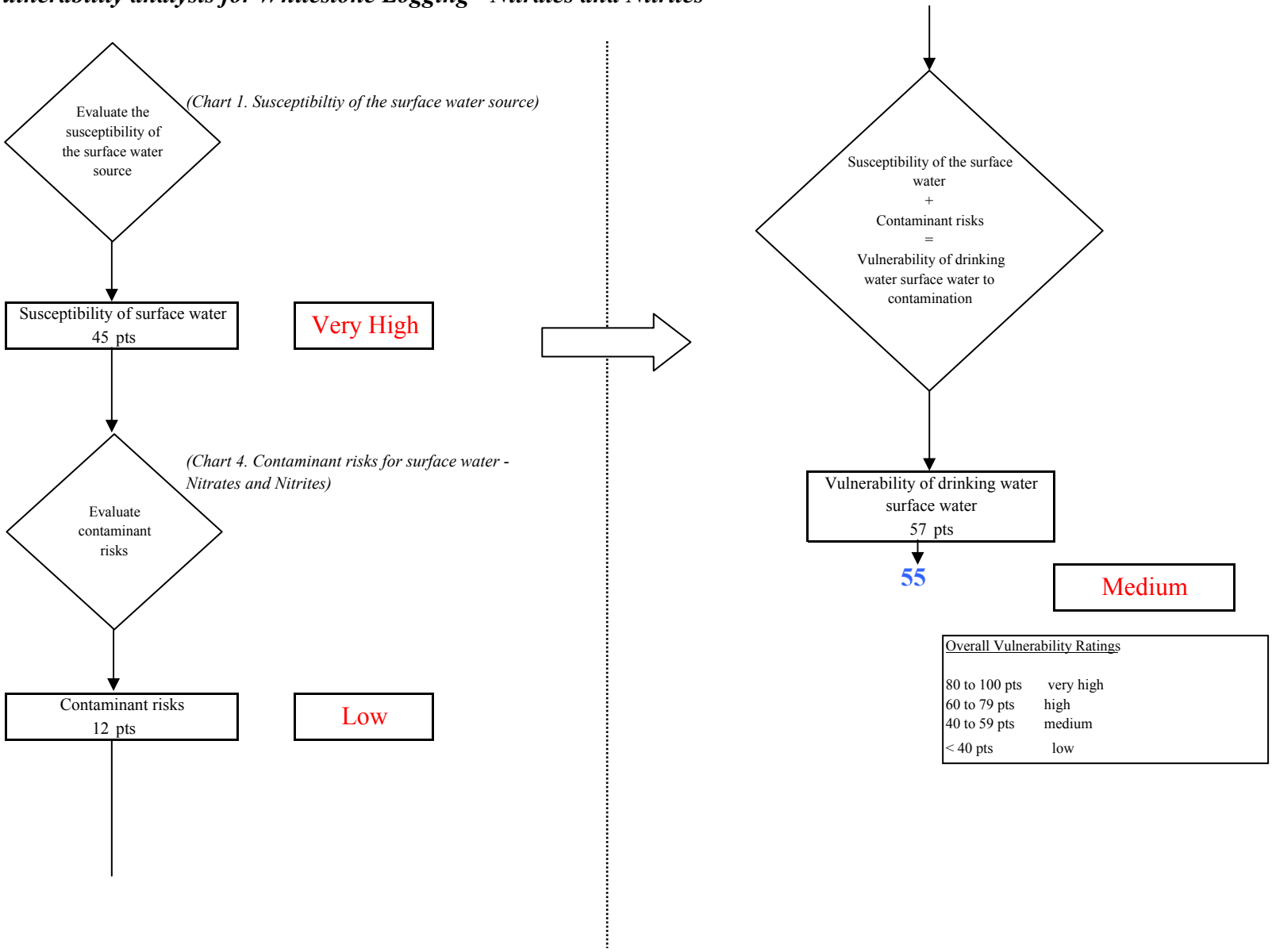


Chart 6. Contaminant risks for Whitestone Logging - Volatile Organic Chemicals

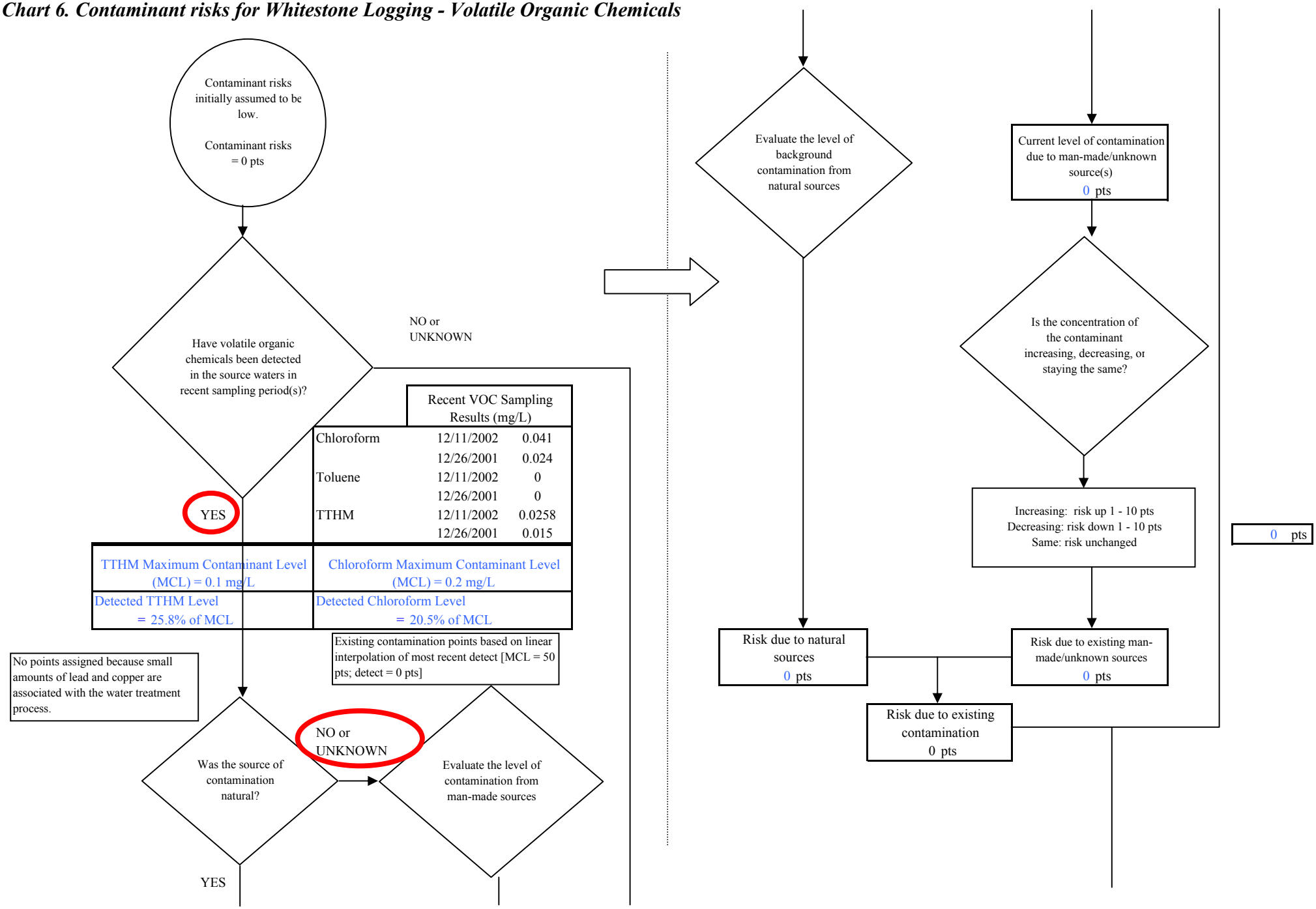


Chart 6. Contaminant risks for Whitestone Logging - Volatile Organic Chemicals

+ 20 pts

What level of risk is associated with the highest and the next highest risk sources(s) of contaminants identified in Zones A and B? (see Risk Matrix below)

Initial assessment of risk posed by potential sources of contamination = 20 pts

Are any significant VOC sources in Zone A?

NO → Risk unchanged

YES → Increase risk 1 - 10 pts

+ 5 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)	1		1
Low(s)	1		1

	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 20

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 Whitestone Logging - Volatile Organic Chemicals

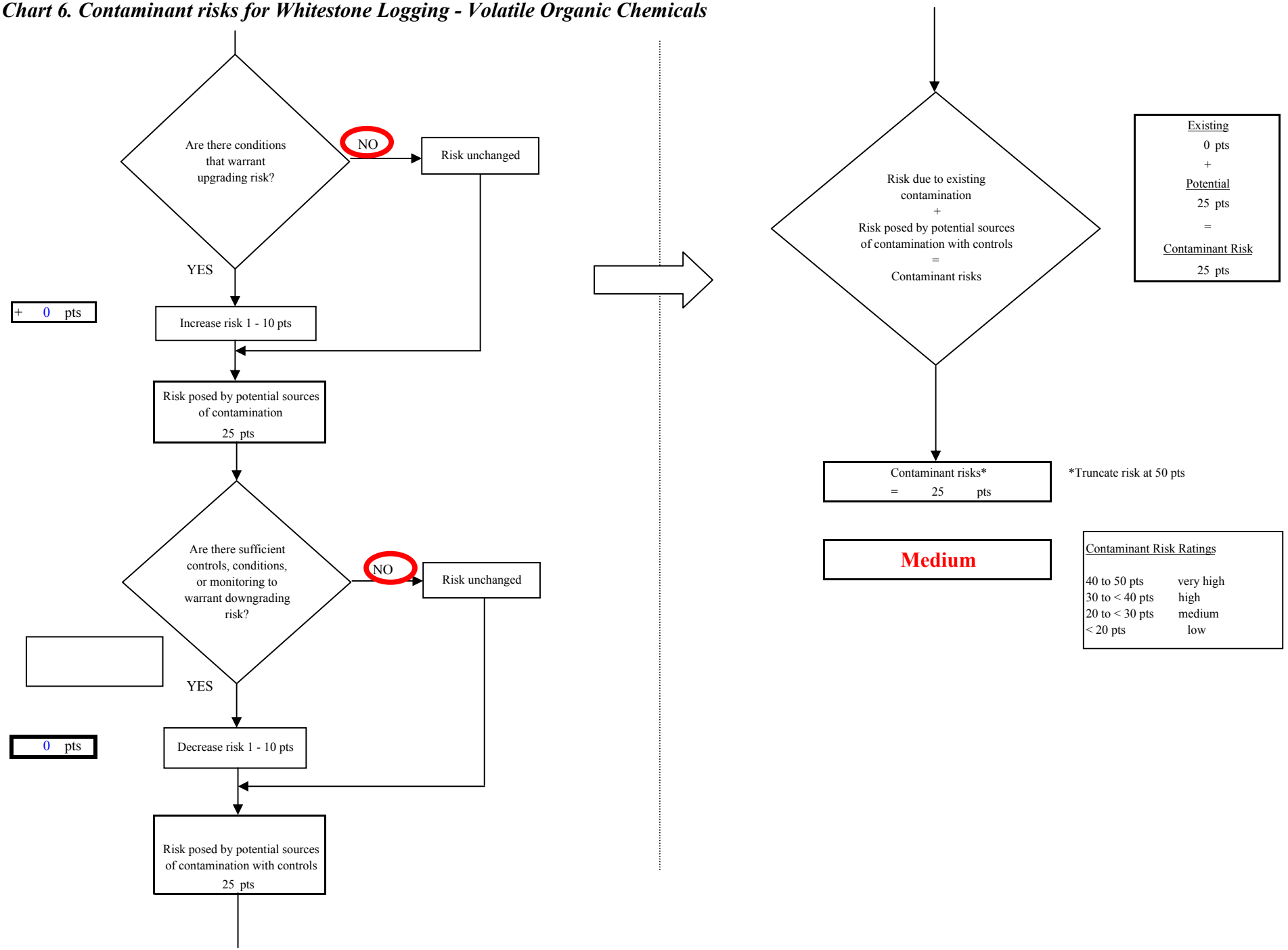


Chart 7. Vulnerability analysis for Whitestone Logging - Volatile Organic Chemicals

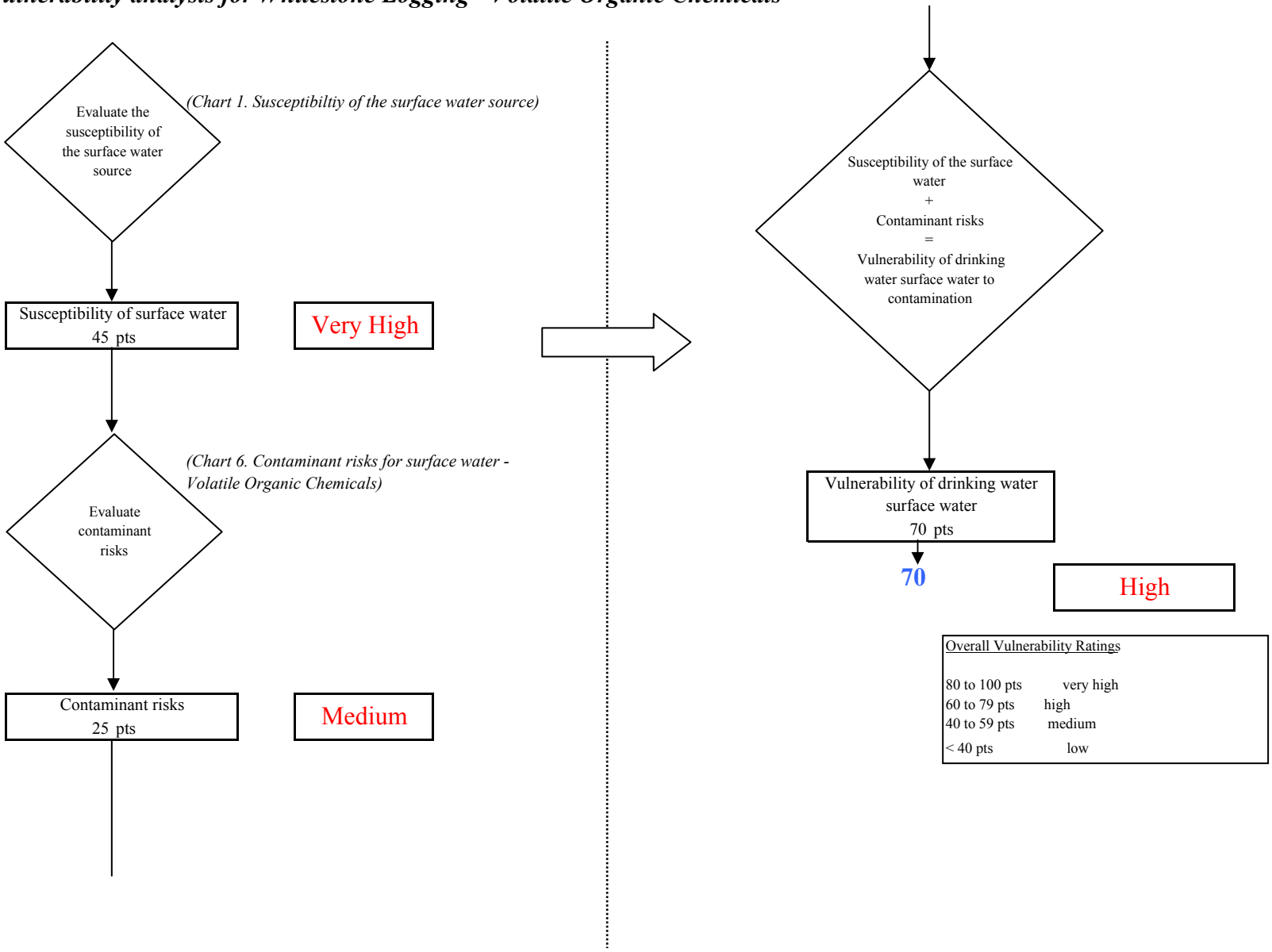


Chart 8. Contaminant risks for Whitestone Logging - Heavy Metals, Cyanide and Other Inorganic Chemicals

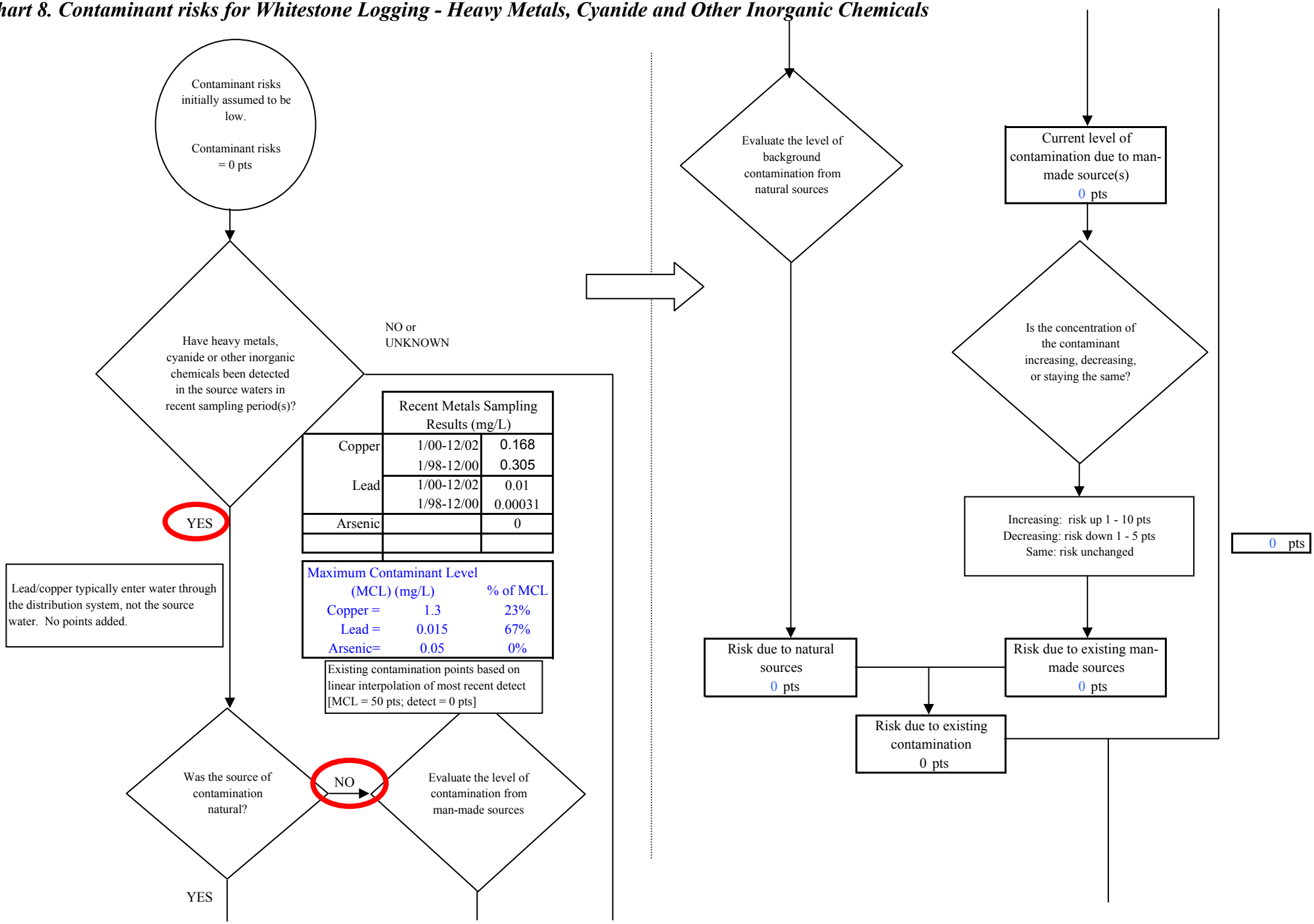
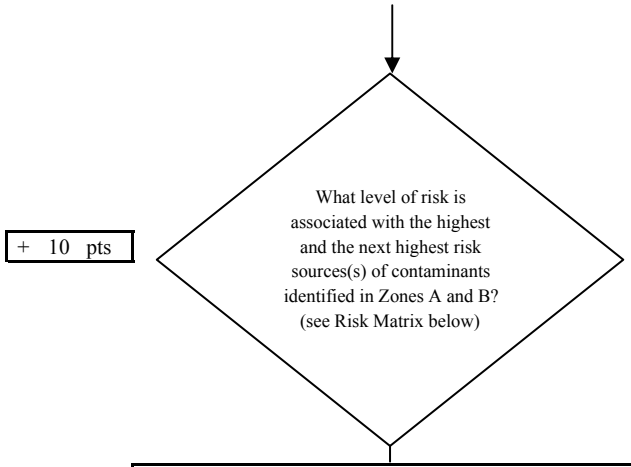


Chart 8. Contaminant risks for Whitestone Logging - Heavy Metals, Cyanide and Other Inorganic Chemicals



+ 10 pts

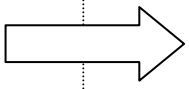
Risk Levels for HM, Cyanide, or OIC Sources identified in Zones A and B

	Zone A	Zone B	Total
Very Highs(s)	0	0	0
High(s)	0	0	0
Medium(s)	0		0
Low(s)	2		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.



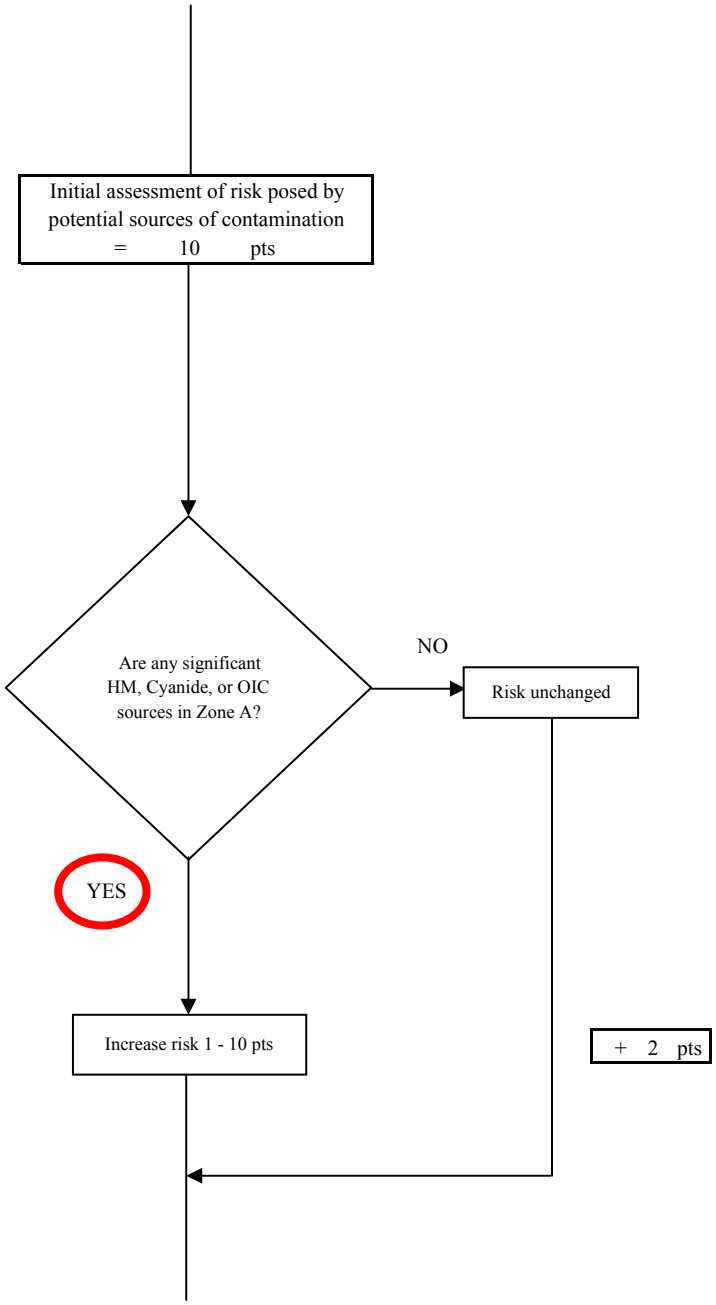


Chart 8. Contaminant risks for Whitestone Logging - Heavy Metals, Cyanide and Other Inorganic Chemicals

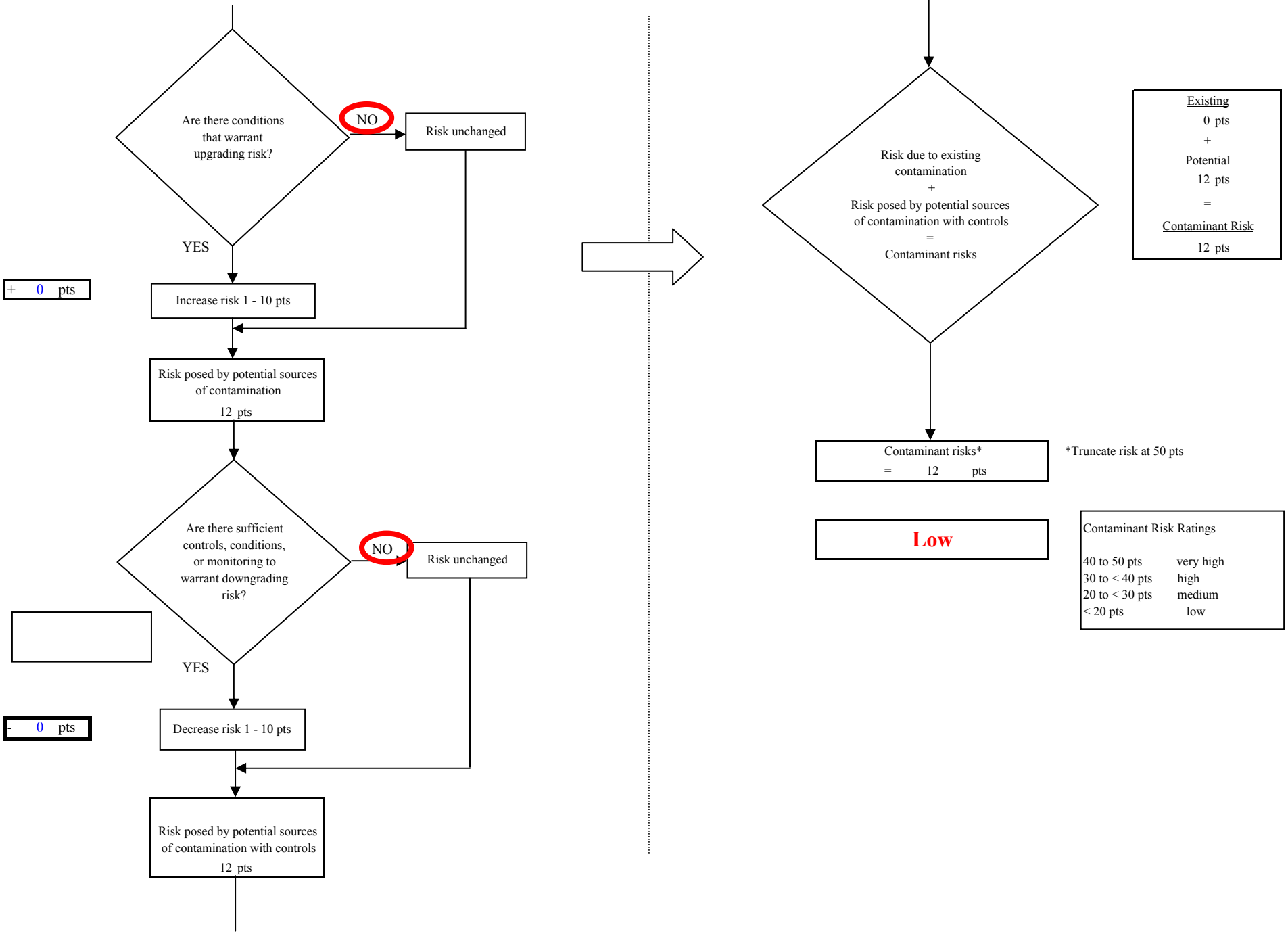


Chart 9. Vulnerability analysis for Whitestone Logging - Heavy Metals, Cyanide and Other Inorganic Chemicals

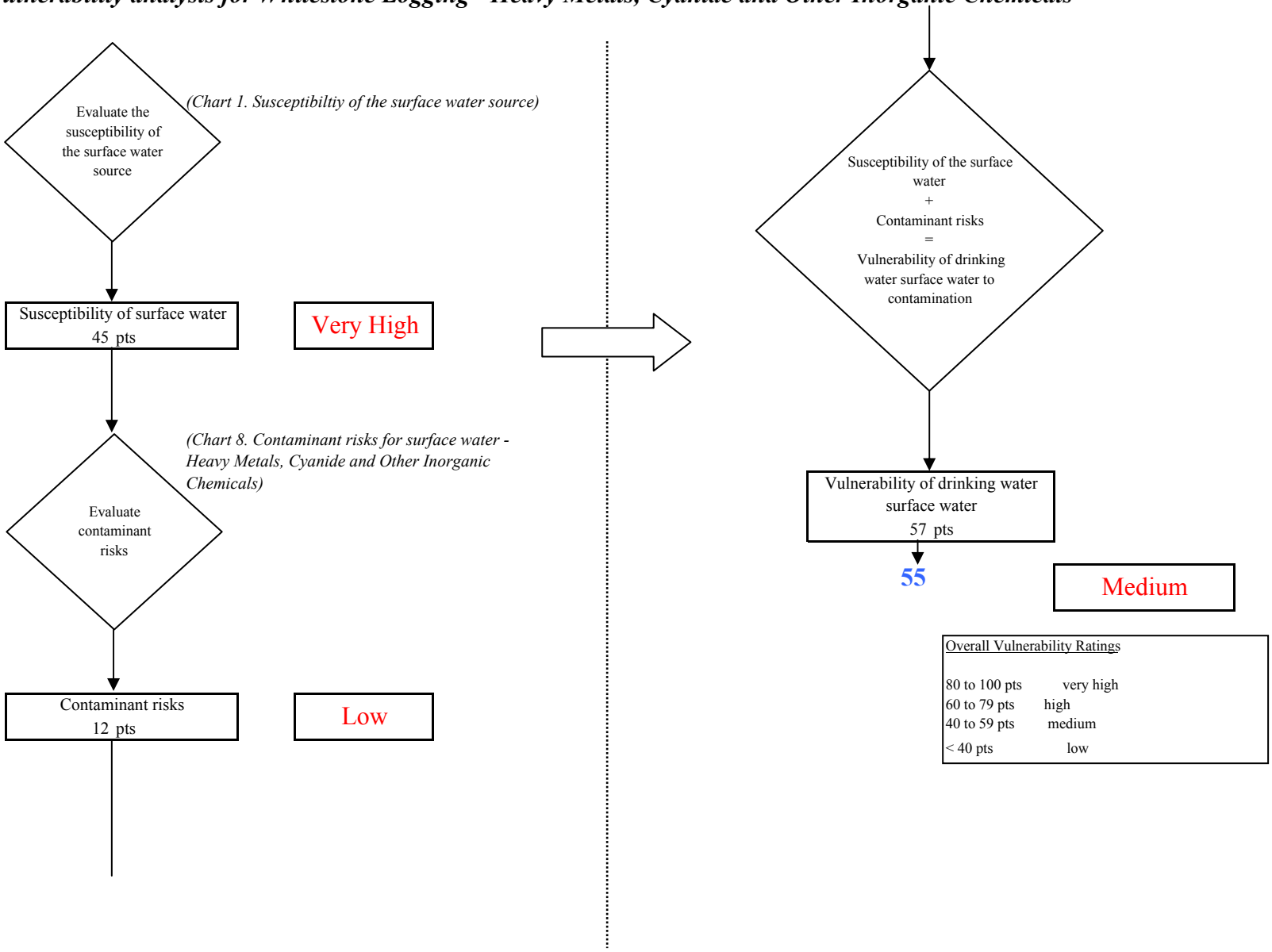


Chart 10. Contaminant risks for Whitestone Logging - Synthetic Organic Chemicals

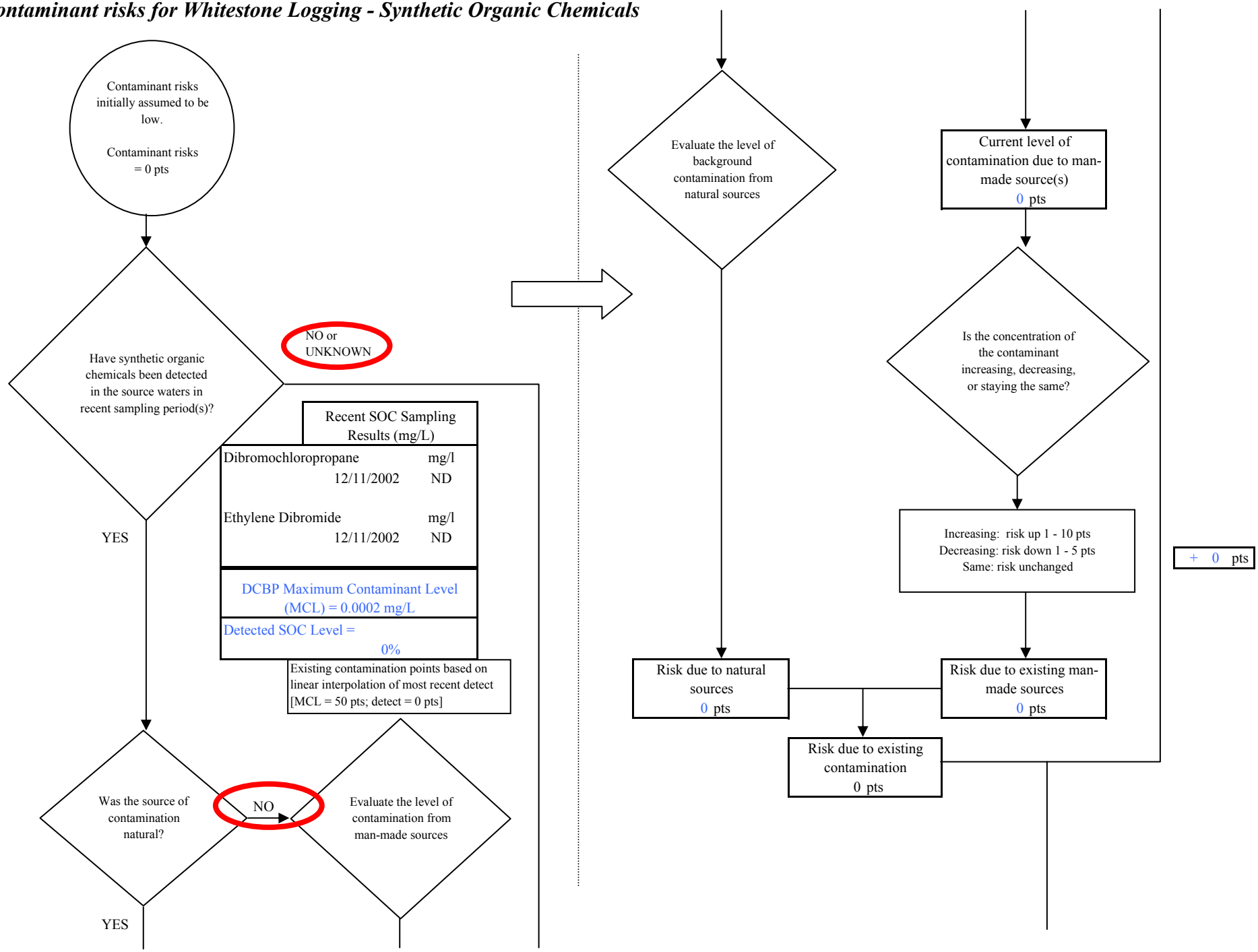


Chart 10. Contaminant risks for Whitestone Logging - Synthetic Organic Chemicals

+ 0 pts

What level of risk is associated with the highest and the next highest risk sources(s) of contaminants identified in Zones A and B? (see Risk Matrix below)

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.

Initial assessment of risk posed by potential sources of contamination = 0 pts

Are any significant SOC sources in Zone A?

NO

Risk unchanged

YES

Increase risk 1 - 10 pts

+ 0 pts

Chart 10. Contaminant risks for Whitestone Logging - Synthetic Organic Chemicals

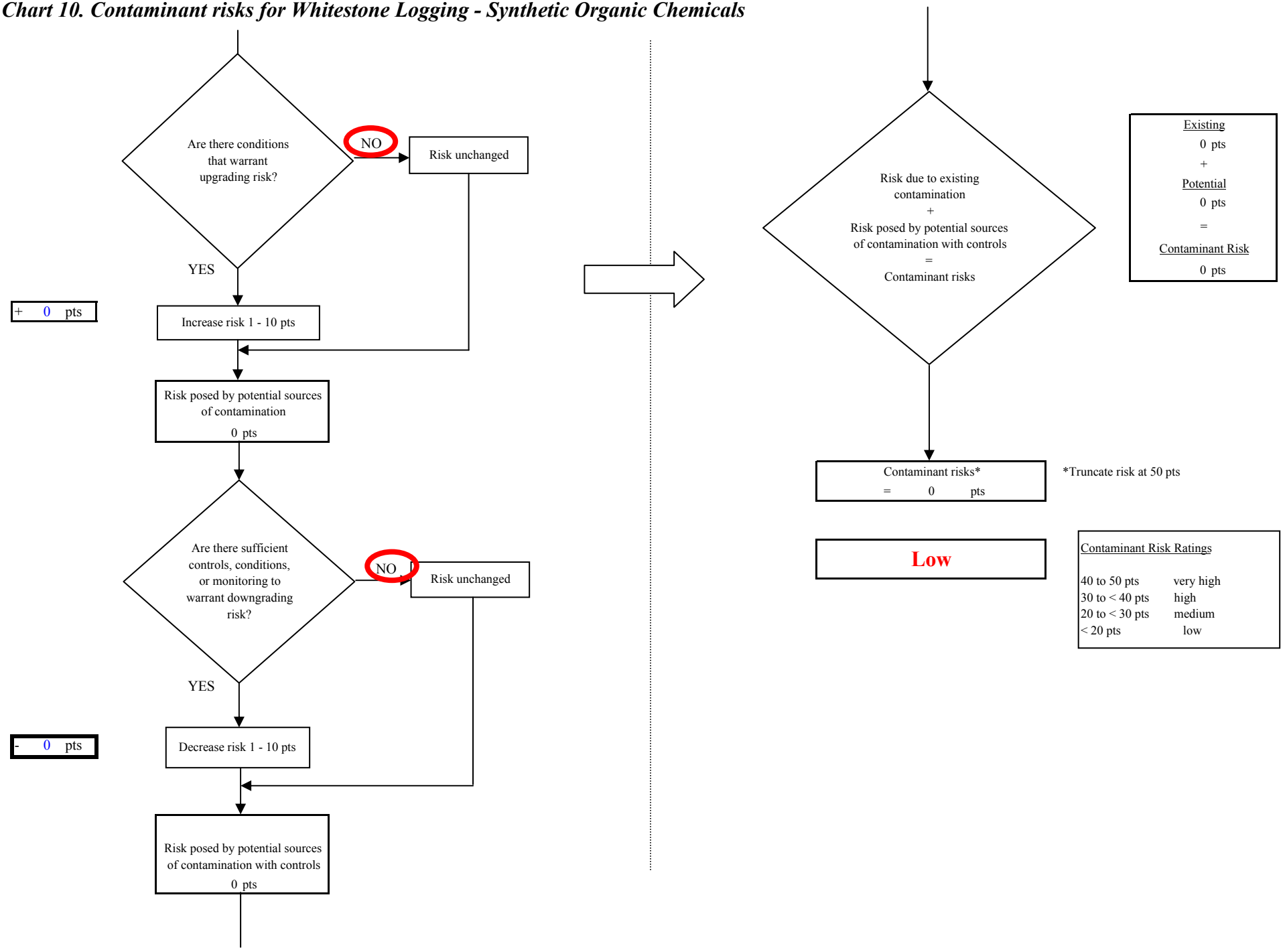


Chart 11. Vulnerability analysis for Whitestone Logging - Synthetic Organic Chemicals

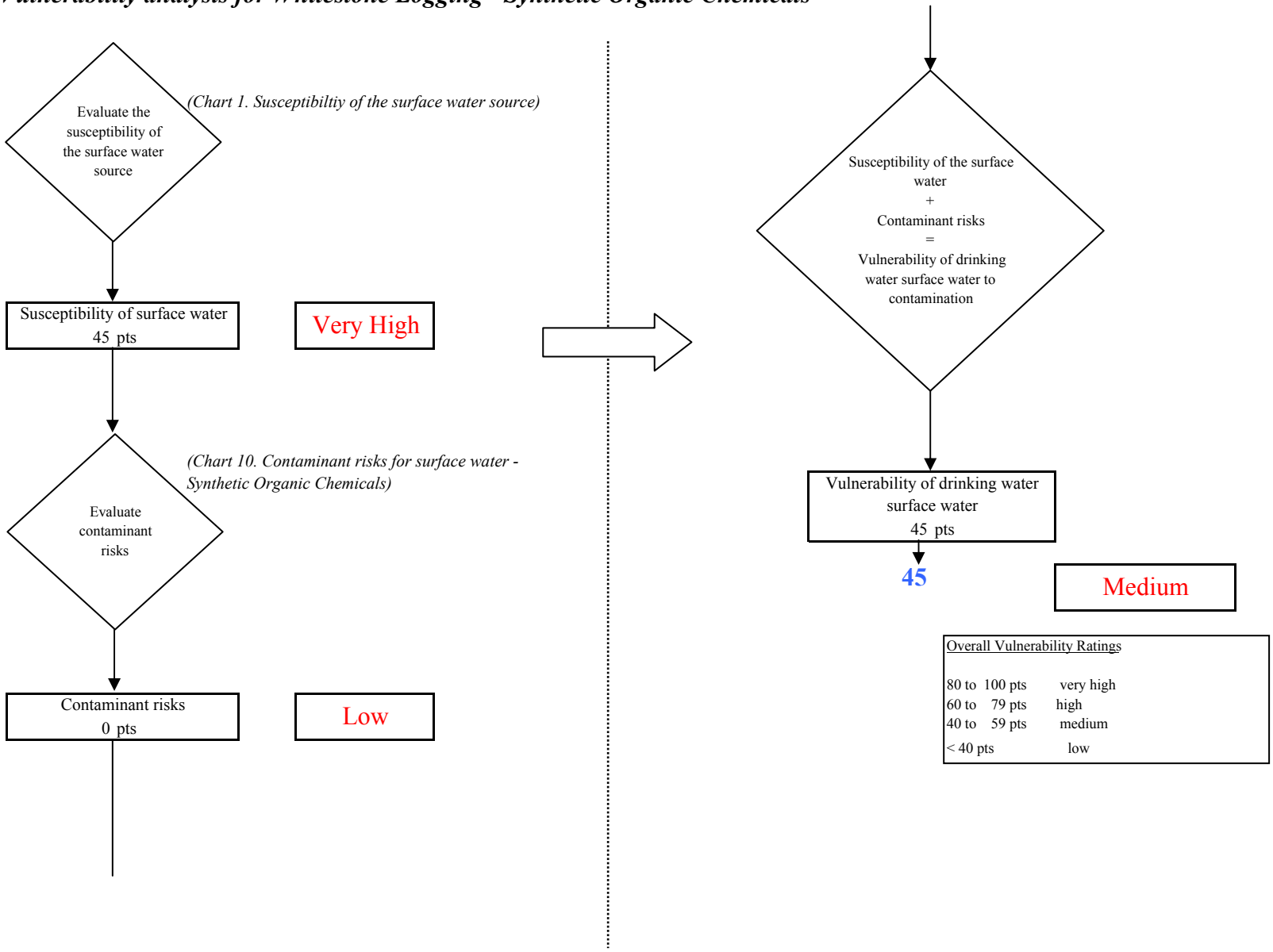


Chart 12. Contaminant risks for Whitestone Logging - Other Organic Chemicals

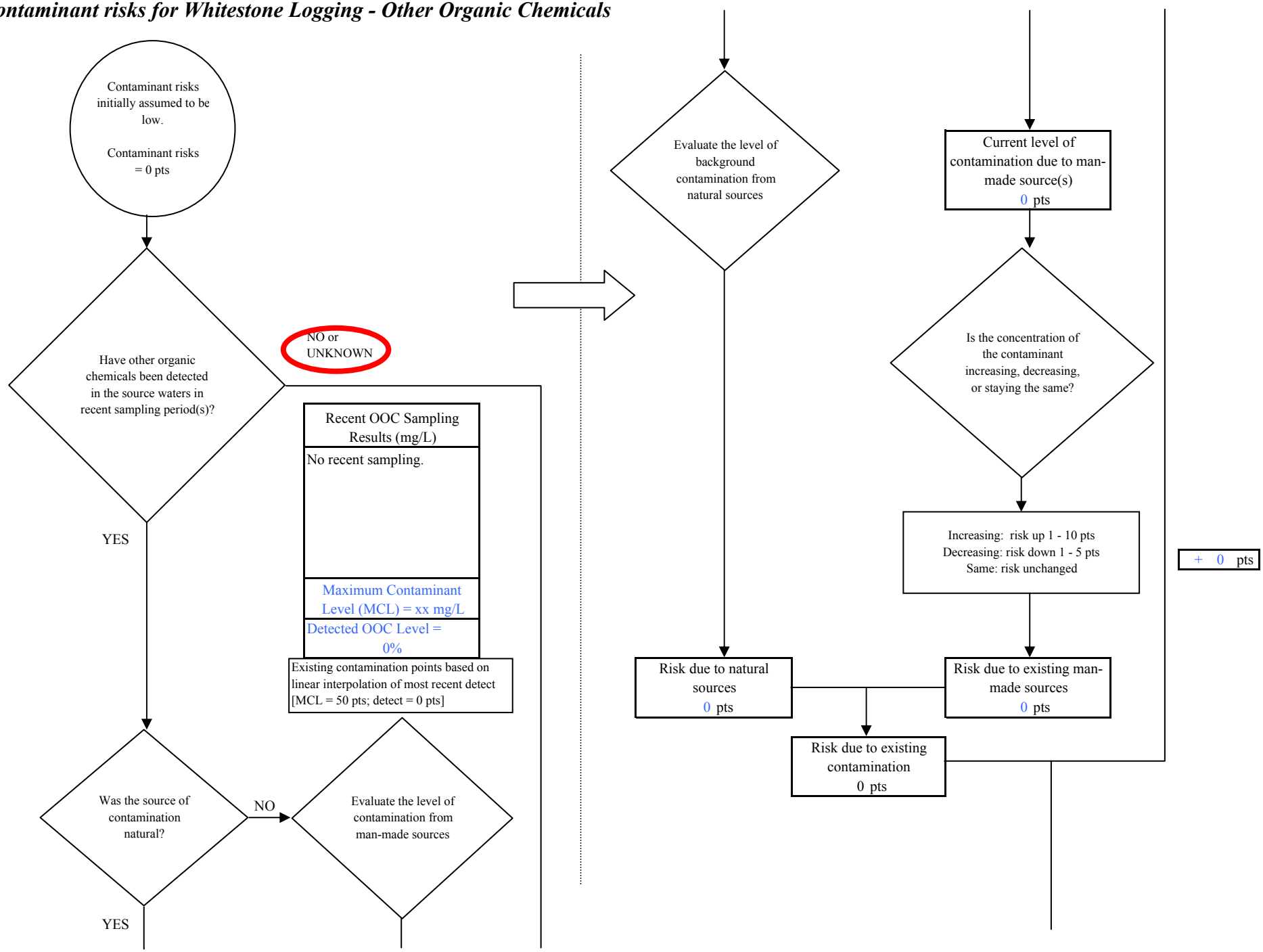
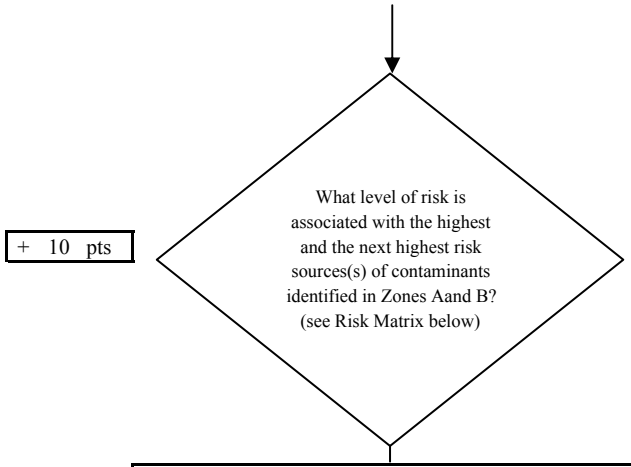


Chart 12. Contaminant risks for Whitestone Logging - Other Organic Chemicals



+ 10 pts

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)	1	0	1

	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.

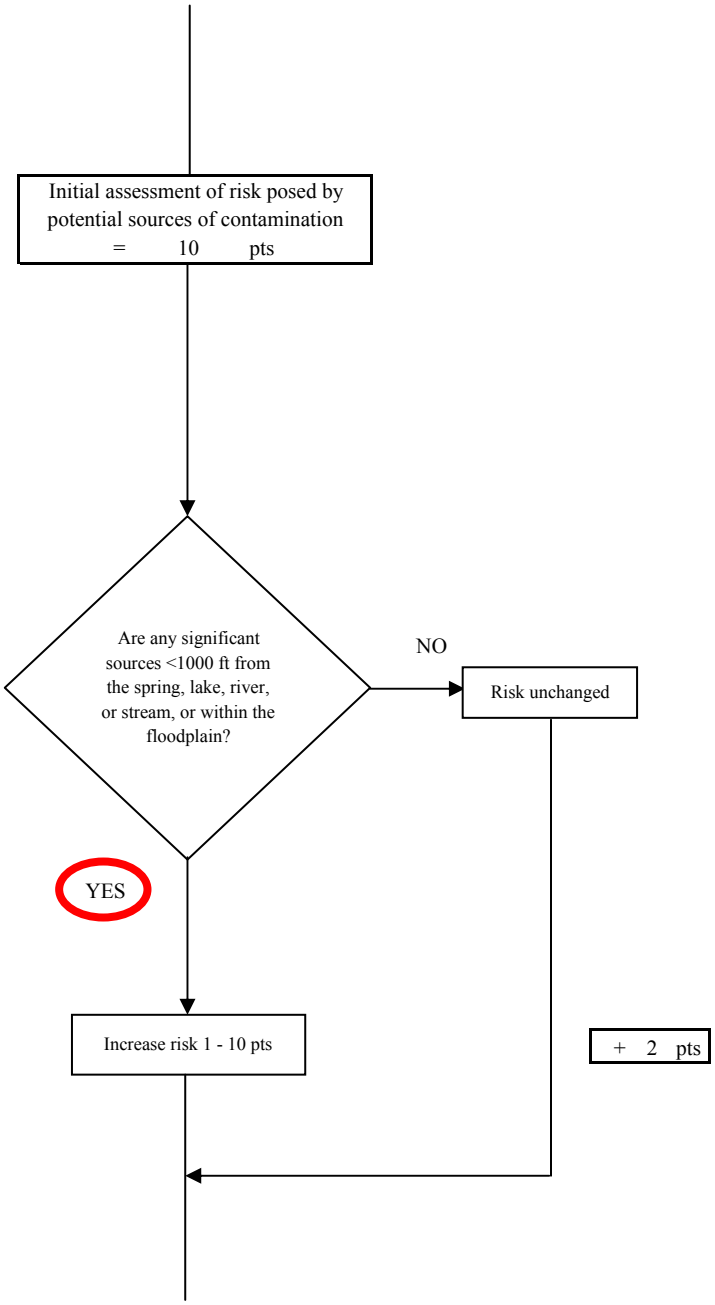
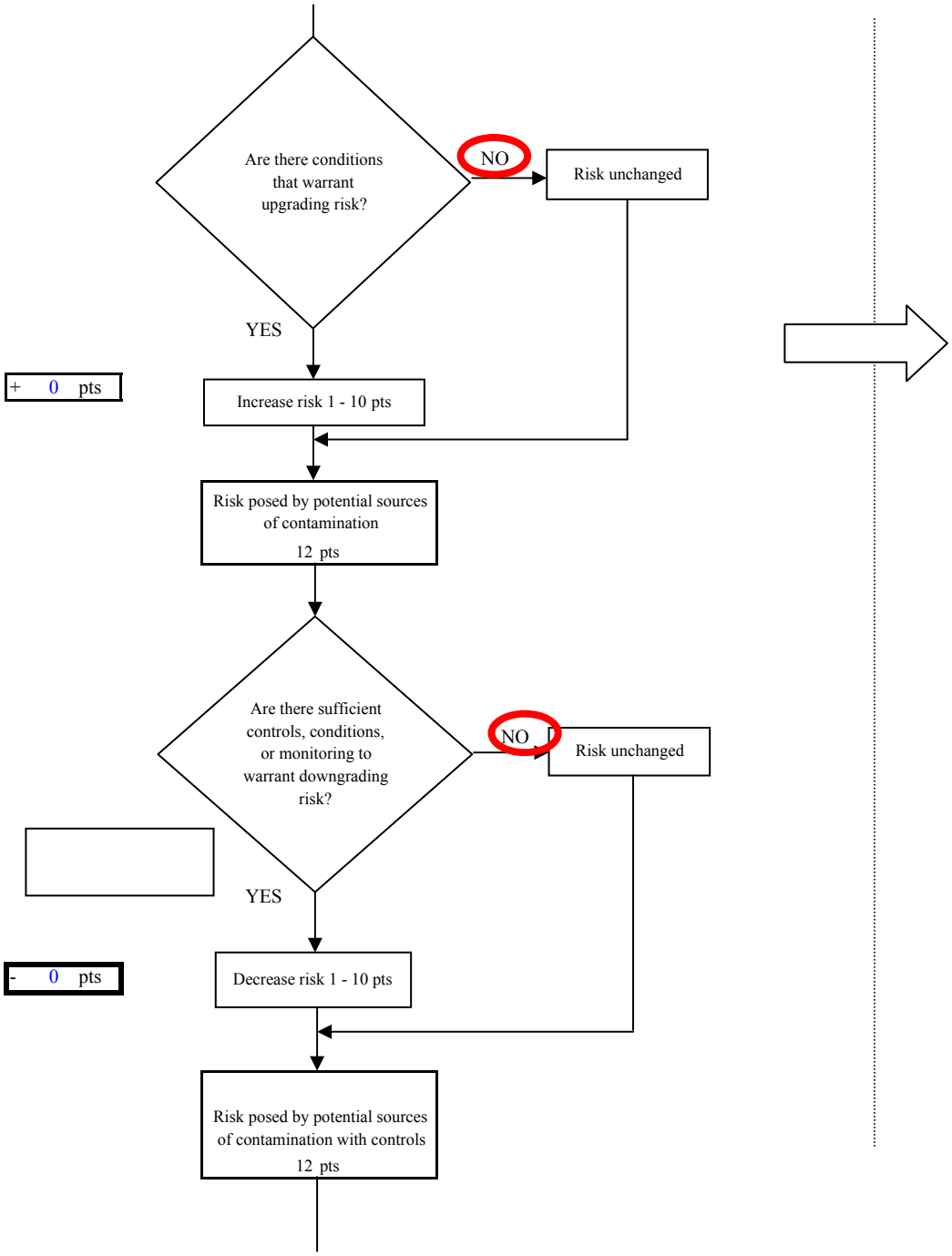


Chart 12. Contaminant risks for Whitestone Logging - Other Organic Chemicals



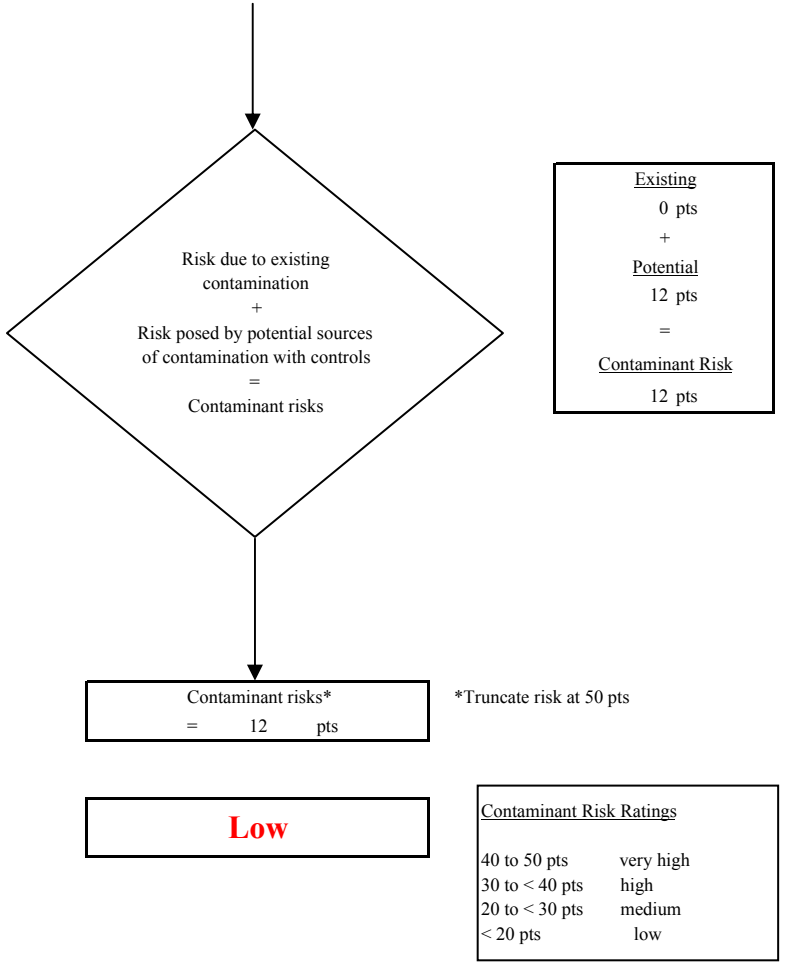


Chart 13. Vulnerability analysis for Whitestone Logging - Other Organic Chemicals