

Source Water Assessment

A Hydrogeologic Susceptibility and
Vulnerability Assessment for
Whitestone Farms
(Formerly Living Word Tabernacle)
Drinking Water System,
Delta Junction, Alaska

PWSID # 372075.001

June 2004

DRINKING WATER PROTECTION PROGRAM REPORT 1386
Alaska Department of Environmental Conservation

Source Water Assessment for
Whitestone Farms
(Formerly Living Word Tabernacle)
Drinking Water System
Delta Junction, Alaska

PWSID # 372075.001

DRINKING WATER PROTECTION PROGRAM REPORT 1386

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

EXECUTIVE SUMMARY	1	INVENTORY OF POTENTIAL AND EXISTING	
PUBLIC DRINKING WATER SYSTEM	1	CONTAMINANT SOURCES	2
DRINKING WATER PROTECTION AREA	2	RANKING OF CONTAMINANT RISKS	2
		VULNERABILITY OF DRINKING WATER	
		SYSTEM	3

TABLES

Table 1. Definition of Zones	2
Table 2. Susceptibility	3
Table 3. Contaminant Risks	3
Table 4. Overall Vulnerability	4

APPENDICES

APPENDIX	A. Whitestone Farms Drinking Water Protection Area (Map A)
	B. Contaminant Source Inventory for Whitestone Farms (Table 1)
	Contaminant Source Inventory and Risk Ranking for Whitestone Farms
	– Bacteria and Viruses (Table 2)
	Contaminant Source Inventory and Risk Ranking for Whitestone Farms
	– Nitrates/Nitrites (Table 3)
	Contaminant Source Inventory and Risk Ranking for Whitestone Farms
	– Volatile Organic Chemicals (Table 4)
	Contaminant Source Inventory and Risk Ranking for Whitestone Farms
	– Heavy Metals, Cyanide and Other Inorganic Chemicals (Table 5)
	Contaminant Source Inventory and Risk Ranking for Whitestone Farms
	– Synthetic Organic Chemicals (Table 6)
	Contaminant Source Inventory and Risk Ranking for Whitestone Farms
	– Other Organic Chemicals (Table 7)
	C. Whitestone Farms Drinking Water Protection Area and Potential
	and Existing Contaminant Sources (Map C)
	D. Vulnerability Analysis for Contaminant Source Inventory and Risk Ranking for
	Whitestone Farms Public Drinking Water Source (Charts 1 – 14)

Source Water Assessment for Whitestone Farms Source of Public Drinking Water, Delta Junction, Alaska

Drinking Water Protection Program Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

Whitestone Farms has one Public Water System (PWS) well. The current well (PWS No. 372075.001) has been used as a drinking water source since it was drilled in 1987.

The well is a Class A (community and non-transient/non-community) water system located at Mile Post 275 of the Richardson Highway in Delta Junction, Alaska. The 1999 sanitary survey indicates that there is 120-gallon storage capacity, with two 60-gallon hydro pneumatic tanks. It is unknown how the drinking water source is treated. This system operates year round and serves approximately 10 residents and 150 nonresidents through 15 service connections. The wellhead received a susceptibility rating of **Low** and the aquifer received a susceptibility rating of **High**. Combining these two ratings produce a **Low** rating for the natural susceptibility of the well.

Identified potential and current sources of contaminants for the public drinking water source include: a large-capacity septic system, underground diesel tanks, and a petroleum product bulk station/terminal. These identified potential and existing sources of contamination are considered as sources of bacteria and viruses, nitrates and/or nitrites, volatile organic chemicals, heavy metals, cyanide and other inorganic chemicals, synthetic organic chemicals, and other organic chemicals contaminant categories.

Overall, the water well received a vulnerability rating of **High** for volatile organic chemicals, a vulnerability rating of **Medium** for bacteria and viruses, nitrates and nitrites, and other organic chemicals and a vulnerability rating of **Low** for heavy metals, cyanide and other inorganic chemicals, and synthetic organic chemicals.

PUBLIC DRINKING WATER SYSTEM

The Whitestone Farm's well is a Class A (community/non-transient/non-community) public

water system. The system is located at Mile Post 275 of the Richardson Highway in Delta Junction, Alaska (Sec. 23, T010S, R010E, Fairbanks Meridian; see Map A of Appendix A). Delta Junction is located at the convergence of the Richardson and Alaska Highways, approximately 95 miles southeast of Fairbanks. The community has a population of 984 (ADCED, 2003). Average annual precipitation for Delta Junction is 12 inches, including approximately 37 inches of snowfall. Temperatures can be as extreme as -63 to 92°F.

Households in Delta Junction have individual wells and septic systems. Almost all homes are fully plumbed, and refuse is collected by a private firm, Delta Sanitation, and is transported to the City landfill (ADCED, 2003). The city provides electricity with a generating plant with a 450 kW capacity. A new bulk fuel facility is planned for 2005-2006.

According to information supplied by ADEC for the Whitestone Farms PWS, the depth of the primary water well is 53 feet below the ground surface. Based on available well construction details, it appears that the well is screened and it is assumed to be in an unconfined aquifer. The well is not located within a floodplain.

Information acquired from an August 1999 sanitary survey for the public water system indicated that the land surface was sloped away from the well. Generally, land surfaces that slope away from the wellhead promote surface water drainage, which reduces the potential of contaminant migration down the well casing annulus. The sanitary survey indicates that the well is grouted according to ADEC regulations. Proper grouting provides added protection against contaminants traveling along the well casing annulus and into source waters.

Delta Junction lies in the Tanana-Kuskokwim Lowland, a broad depression bordering the Alaska Range on the north. The principal surficial deposits in the surrounding area are composed of moderately well sorted silt, sand, and gravel. It is likely that deep sediments in the area are poorly sorted

lacustrine, glacial, or marine sediments of low permeability. There are five major soil types in the area: Salchaket, Jarvis, Nenana, Chena, and Tanana (Nelson, 1995).

DRINKING WATER PROTECTION AREA

In order to evaluate whether a drinking water source is at risk, we must first evaluate what the most likely pathways for surface contamination to reach the groundwater are. These areas are determined by looking at the characteristics of the soil, groundwater, aquifer, and well.

The most probable area for contamination to reach the drinking water well is the area that contributes water to the well, the groundwater recharge area. This area is designated as the drinking water protection area (DWPA). Because releases of contaminants within the protection area are most likely to impact the drinking water well, this area will serve as the focus for voluntary protection efforts. An analytical calculation was used to determine the size and shape of the DWPA for the Whitestone Farms PWS. The input parameters describing the attributes of the aquifer in this calculation were adopted from Groundwater (Freeze and Cherry, 1979). Available geology and groundwater contours were also considered to take into account any uncertainties in groundwater flow and aquifer characteristics to arrive at a meaningful protection area.

The protection areas established for wells by the ADEC are usually separated into four zones, limited by the watershed. These zones correspond to differences in the time-of-travel (TOT) of the water moving through the aquifer to the well (Please refer to the Guidance Manual for Class A Public Water Systems for additional information).

The time of travel for contaminants within the water varies and is dependent on the physical and chemical characteristics of each contaminant. The following is a summary of the four protection area zones for wells and the calculated time-of-travel for each:

Table 1. Definition of Zones

Zone	Definition
A	¼ the distance for the 2-yr. time-of-travel
B	Less than the 2 year time-of-travel
C	Less Than the 5 year time-of-travel
D	Less than the 10 year time-of-travel

The DWPA for the Whitestone Farm PWS was determined using an analytical calculation and includes Zones A, B, C, and D (See Map A 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 Farms DWPA. This inventory was completed through a search of agency records and other publicly available information. Potential sources of contamination to the drinking water aquifer include a wide range of categories and types. Potential drinking water contaminants are found within agricultural, residential, commercial, and industrial areas, but can also occur within areas that have little or no development.

For the basis of all Class 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,
- Other organic chemicals.

The sources are displayed on Map C of Appendix C and summarized in Table 1 of Appendix B.

RANKING OF CONTAMINANT RISKS

Once the potential and existing sources of contamination have been identified, they are assigned a ranking according to what type and level of risk they represent. Ranking of contaminant risks for a “potential” or “existing” source of contamination is a function of toxicity and volumes of specific contaminants associated with that source. Rankings include:

- Low,
- Medium,
- High, and
- Very High.

The time-of-travel for contaminants within the water varies and is dependent on the physical and chemical characteristics of each contaminant. Bacteria and Viruses are only inventoried in Zones A and B because of their short life span. Only “Very High” and “High” rankings are inventoried within the outer

Zone D due to the probability of contaminant dilution by the time the contaminants get to the well. Tables 2 through 4 in Appendix B contain the ranking of potential and existing sources of contamination with respect to bacteria and viruses, nitrates and/or nitrites, 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:

- Natural susceptibility, and
- Contaminant risks.

Appendix D contains fourteen charts, which together form the ‘Vulnerability Analysis’ for a source water assessment for a public drinking water source. Chart 1 analyzes the ‘Susceptibility of the Wellhead’ to contamination by looking at the construction of the well and its surrounding area. Chart 2 analyzes the ‘Susceptibility of the Aquifer’ to contamination by looking at the naturally occurring attributes of the water source and influences on the groundwater system that might lead to contamination. Chart 3 analyzes ‘Contaminant Risks’ for the drinking water source with respect to bacteria and viruses. The ‘Contaminant Risks’ portion of the analysis considers potential sources of contaminants as well as a review of contamination that has or may have occurred, but has not arrived or been detected at the well. Chart 4 contains the ‘Vulnerability Analysis for Bacteria and Viruses’. Charts 5 through 14 contain 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 Natural Susceptibility is reached by considering the properties of the well and the aquifer.

$$\begin{aligned}
 & \text{Susceptibility of the Wellhead (0 – 25 Points)} \\
 & \quad \text{(Chart 1 of Appendix D)} \\
 & \quad + \\
 & \text{Susceptibility of the Aquifer (0 – 25 Points)} \\
 & \quad \text{(Chart 2 of Appendix D)} \\
 & \quad = \\
 & \text{Natural Susceptibility (Susceptibility of the Well)} \\
 & \quad \text{(0 – 50 Points)}
 \end{aligned}$$

A ranking is assigned for the Natural Susceptibility according to the point score:

Natural Susceptibility Ratings	
40 to 50 pts	Very High
30 to < 40 pts	High
20 to < 30 pts	Medium
< 20 pts	Low

The Whitestone Farms water well is assumed to be in an unconfined aquifer. Unconfined aquifers are more susceptible to potential groundwater quality impacts posed by the migration of surface water contaminants downward from the surface. Table 2 shows the susceptibility scores and ratings for this PWS.

Table 2. Susceptibility

	Score	Rating
Susceptibility of the Wellhead	0	Low
Susceptibility of the Aquifer	16	High
Natural Susceptibility	16	Low

Contaminant risks to a drinking water source depend on the type, number or density, and distribution of contaminant sources. This score has been derived from an examination of existing and historical contamination that has been detected at the drinking water source 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 for the natural 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. Contaminant Risks

Category	Score	Rating
Bacteria and Viruses	40	Very High
Nitrates and/or Nitrites	42	Very High
Volatile Organic Chemicals	50	Very High
Heavy Metals, Cyanide and Other Inorganic Chemicals	12	Low
Synthetic Organic Chemicals	12	Low
Other Organic Chemicals	40	Very High

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

$$\begin{aligned}
 &\text{Natural Susceptibility (0 – 50 points)} \\
 &\quad + \\
 &\text{Contaminant Risks (0 – 50 points)} \\
 &\quad = \\
 &\text{Vulnerability of the} \\
 &\text{Drinking Water Source to Contamination (0 – 100).}
 \end{aligned}$$

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 (0 – 100) and ratings for each of the six categories of drinking water contaminants. Note: scores are rounded off to the nearest five.

Table 4. Overall Vulnerability

Category	Score	Rating
Bacteria and Viruses	55	Medium
Nitrates and Nitrites	55	Medium
Volatile Organic Chemicals	65	High
Heavy Metals, Cyanide and Other Inorganic Chemicals	30	Low
Synthetic Organic Chemicals	30	Low
Other Organic Chemicals	55	Medium

Bacteria and Viruses

The contaminant risk for bacteria and viruses is **Very High**. The risk is primarily attributed to the presence of a large-capacity septic system in Zone A (see Table 2 – Appendix B).

Coliform (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 coliform 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).

No positive bacteria counts have been reported in recent (within five years) sampling events (See Chart 3 – Contaminant Risks for Bacteria and Viruses in Appendix D). Only a small amount of bacteria and viruses are required to endanger public health.

After combining the contaminant risk for bacteria and viruses with the natural susceptibility of the well, the overall vulnerability of the well to contamination is **Medium**.

Nitrates and Nitrites

The contaminant risk for nitrates and nitrites is **Very High**. The risk to this source of public drinking water is primarily attributed to the presence of large-capacity septic system in Zone A (see Table 3 – Appendix B).

Nitrates are very mobile, moving at approximately the same rate as water. The sampling history for this well indicates that low levels of nitrates have been detected in recent sampling events. However, the reported concentrations of nitrates do not exceed the maximum contaminant level (MCL) of 10 mg/L.

Nitrate concentrations in uncontaminated groundwater are typically less than 2 mg/L; therefore, nitrate concentrations above 2 mg/L may be indicative of man-made sources (See Chart 5 - Contaminant Risks for Nitrates and/or Nitrites in Appendix D).

After combining the contaminant risk for nitrates and nitrites with the natural susceptibility of the well, the overall vulnerability of the well to nitrate and nitrite contamination is **Medium**.

Volatile Organic Chemicals

The contaminant risk for volatile organic chemicals is **Very High**. The risk is primarily attributed to the presence of a petroleum product bulk station/terminal

located in Zone A. Other potential contaminant sources are also found within the protection area (see Table 4 – Appendix B).

All recent sampling data for VOCs were below the detection levels for Whitestone Farms (See Chart 7 – Contaminant Risks for Volatile Organic Chemicals in Appendix D).

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

Heavy Metals, Cyanide and Other Inorganic Chemicals

The contaminant risk for heavy metals, cyanide and other inorganic chemicals is **Low**. The risk is primarily attributed to the presence of a large-capacity septic system and a petroleum product bulk station/terminal located in Zone A (see Table 5 – Appendix B).

Based on review of recent sampling records for this public water system, low levels of lead and copper have been detected in recent sampling history. Neither analyte exceeded their respective MCL's of 0.015 mg/L and 1.3mg/L (see Chart 9 – Contaminant Risks for Heavy Metals, Cyanide, and Other Inorganic Chemicals in Appendix D). The reported concentrations of lead and copper are likely attributed to the water treatment/conveyance system and no risk points were assigned.

After combining the contaminant risk for heavy metals, cyanide and other inorganic chemicals with the natural susceptibility of the well, the overall vulnerability of the well to contamination is **Low**.

Synthetic Organic Chemicals

The contaminant risk for synthetic organic chemicals is **Low**. The risk is primarily attributed to the presence of a large-capacity septic system and a petroleum product bulk station/terminal in Zone A. (see Table 6 – Appendix B).

No recent sampling data was available in ADEC records for Whitestone Farms (See Chart 11 – Contaminant Risks for Synthetic Organic Chemicals in Appendix D).

After combining the contaminant risk for synthetic organic chemicals with the natural susceptibility of the well, the overall vulnerability of the well to contamination is **Low**.

Other Organic Chemicals

The contaminant risk for other organic chemicals is **Very High**. The risk is primarily attributed to the presence of a petroleum product bulk station/terminal in Zone A. Other potential contaminant sources are also found within the protection area (see Table 7 – Appendix B).

No recent sampling data was available in ADEC records for Whitestone Farms (See Chart 13 – Contaminant Risks for Other Organic Chemicals in Appendix D).

After combining the contaminant risk for other organic chemicals with the natural susceptibility of the well, the overall vulnerability of the well to contamination is **Medium**.

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 Farms and the community of Delta Junction 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.

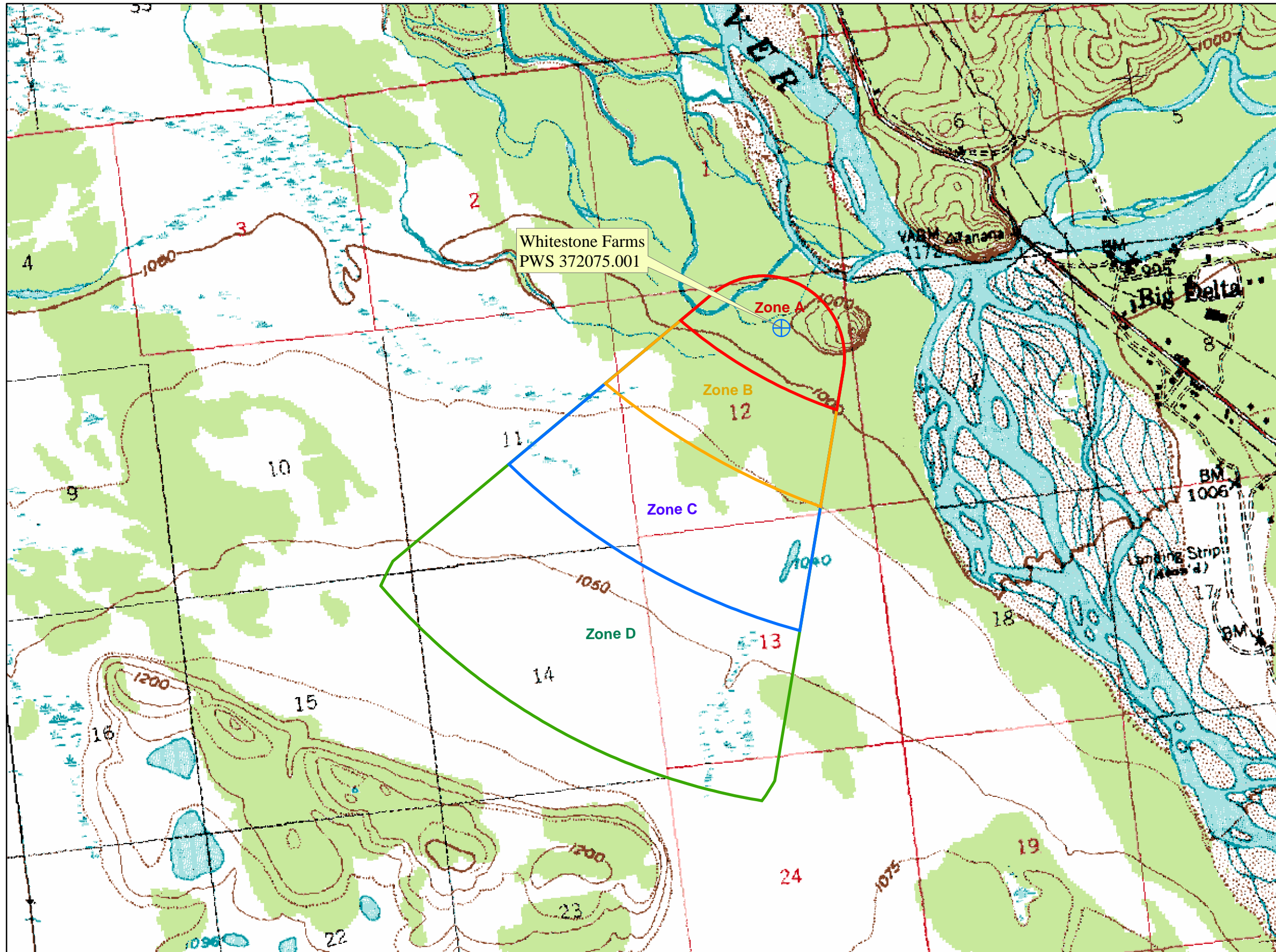
REFERENCES

- Alaska Department of Community and Economic Development (ADCED), 2003 [WWW document]. URL: http://www.dced.state.ak.us/cbd/commdb/CF_COMDB.htm
- Alaska Department of Environmental Conservation, Contaminated Sites Database, 2003 [WWW database], URL http://www.state.ak.us/dec/dspar/csites/cs_search.htm
- Alaska Department of Environmental Conservation, Leaking Underground Storage Tank Database, 2003 [WWW database], URL http://www.dec.state.ak.us/spar/stp/ust/search/fac_search.asp
- Freeze, R. A., and Cherry, J.A. 1979, Groundwater, Prentice-Hall, Englewood Cliffs, New Jersey
- Nelson, G.L., 1995, Overview of Environmental and Hydrogeologic Conditions near Big Delta, Alaska, U.S. Geological Survey Open File Report 95-180, prepared in cooperation with the FAA.
- United States Environmental Protection Agency (EPA), 2002 [WWW document]. URL <http://www.epa.gov/safewater/mcl.html>.

APPENDIX A

Drinking Water Protection Area Location Map (Map A)

Public Water Well System for PWS #372075.001 Whitestone Farms



LEGEND

⊕ Public Water System Well

Groundwater Protection Zones

- Zone A Protection Area- Several Months Travel Time
- Zone B Protection Area- 2 Years Travel Time
- Zone C Protection Area- 5 Years Travel Time
- Zone D Protection Area- 10 Years Travel Time or Watershed Boundary

Hydrography/Physical

- Parcels
- Stream
- Lake or Pond
- Contours

Transportation

- Primary Route (Class 1)
- Secondary Route (Class 2)
- Road (Class 3)
- Road (Class 4)
- Road (Class 5, Four-wheel drive)

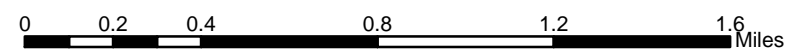
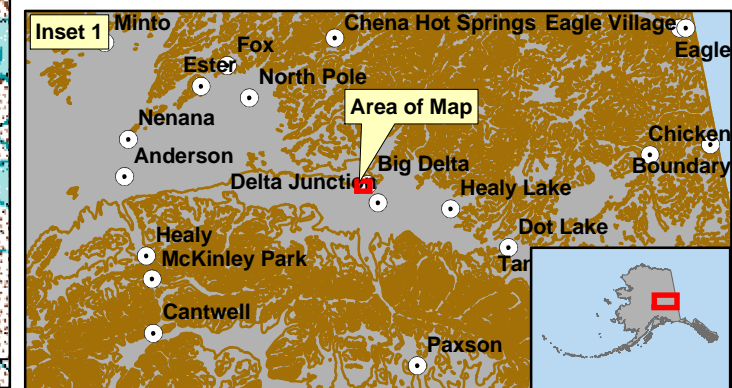
Data Sources:

- Contaminant Sources, Public Water System Wells, Contours
Alaska Department of Environmental Conservation (ADEC)
- Critical Facilities, Federal Emergency Management Agency (FEMA)

All other data:

- United States Geological Survey (USGS)
- Drinking Water Protection Areas based on "Alaska Drinking Water Protection Program - Guidance Manual for Class A Public Water Systems" published by ADEC

URS Corporation does not guarantee the accuracy or validity of the data provided.



APPENDIX B

Contaminant Source Inventory and Risk Ranking (Tables 1-7)

Table 1**Contaminant Source Inventory for
Whitestone Farms****PWSID 372075.001**

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Map Number	Comments
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-01	A	C	
Tanks, diesel (underground)	T08	T08-01	A	C	
Petroleum product bulk station/terminals	X11	X11-01	A	C	

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

PWSID 372075.001

Table 2

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Risk Ranking for Analysis	Map Number	Comments
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-01	A	High	C	

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

PWSID 372075.001

Table 3

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Risk Ranking for Analysis	Map Number	Comments
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-01	A	High	C	

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

PWSID 372075.001

Table 4

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Risk Ranking for Analysis	Map Number	Comments
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-01	A	Low	C	
Tanks, diesel (underground)	T08	T08-01	A	High	C	
Petroleum product bulk station/terminals	X11	X11-01	A	Very High	C	

*Contaminant Source Inventory and Risk Ranking for
Whitestone Farms*

PWSID 372075.001

Table 5

Sources of Heavy Metals, Cyanide and Other Inorganic Chemicals

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Risk Ranking for Analysis	Map Number	Comments
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-01	A	Low	C	
Petroleum product bulk station/terminals	X11	X11-01	A	Low	C	

*Contaminant Source Inventory and Risk Ranking for
Whitestone Farms
Sources of Synthetic Organic Chemicals*

PWSID 372075.001

Table 6

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Risk Ranking for Analysis	Map Number	Comments
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-01	A	Low	C	
Petroleum product bulk station/terminals	X11	X11-01	A	Low	C	

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

PWSID 372075.001

Table 7

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Risk Ranking for Analysis	Map Number	Comments
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-01	A	Low	C	
Petroleum product bulk station/terminals	X11	X11-01	A	High	C	

APPENDIX C

Drinking Water Protection Area and Potential and Existing Contaminant Sources (Map C)

Public Water Well System for PWS #372075.001 Whitestone Farms
Showing Potential and Existing Sources of Contamination



LEGEND

- Public Water System Well

- Groundwater Protection Zones**
- Zone A Protection Area- Several Months Travel Time
- Zone B Protection Area- 2 Years Travel Time
- Zone C Protection Area- 5 Years Travel Time
- Zone D Protection Area- 10 Years Travel Time or Watershed Boundary

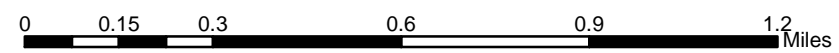
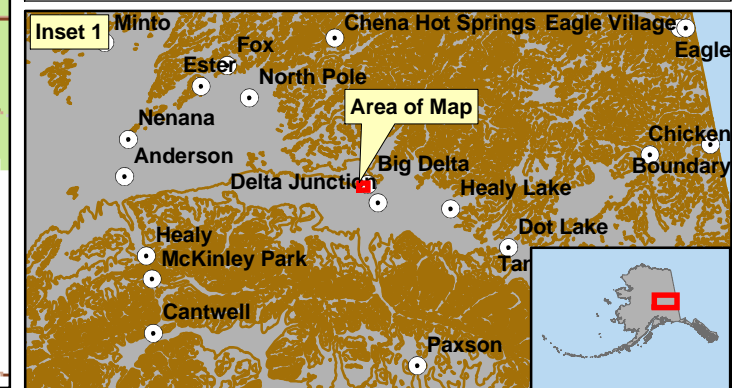
- Hydrography/Physical**
- Parcels
- Stream
- Lake or Pond
- Contours

- Transportation**
- Primary Route (Class 1)
- Secondary Route (Class 2)
- Road (Class 3)
- Road (Class 4)
- Road (Class 5, Four-wheel drive)

- Existing or Potential Contaminant Sources**
- Injection wells (Class V) Large-Capacity Septic System (D10)
- Tanks, diesel (underground) (T08)
- Petroleum product bulk station/terminals (X11)

Data Sources:
 - Contaminant Sources, Public Water System Wells, Contours
 Alaska Department of Environmental Conservation (ADEC)
 - Critical Facilities, Federal Emergency Management Agency (FEMA)
 All other data:
 - United States Geological Survey (USGS)
 - Drinking Water Protection Areas based on "Alaska Drinking Water Protection Program - Guidance Manual for Class A Public Water Systems" published by ADEC

URS Corporation does not guarantee the accuracy or validity of the data provided.



APPENDIX D

Vulnerability Analysis for Public Drinking Water Source (Charts 1-14)

Chart 1. Susceptibility of the wellhead - Whitestone Farms (PWS No. 372075.001)

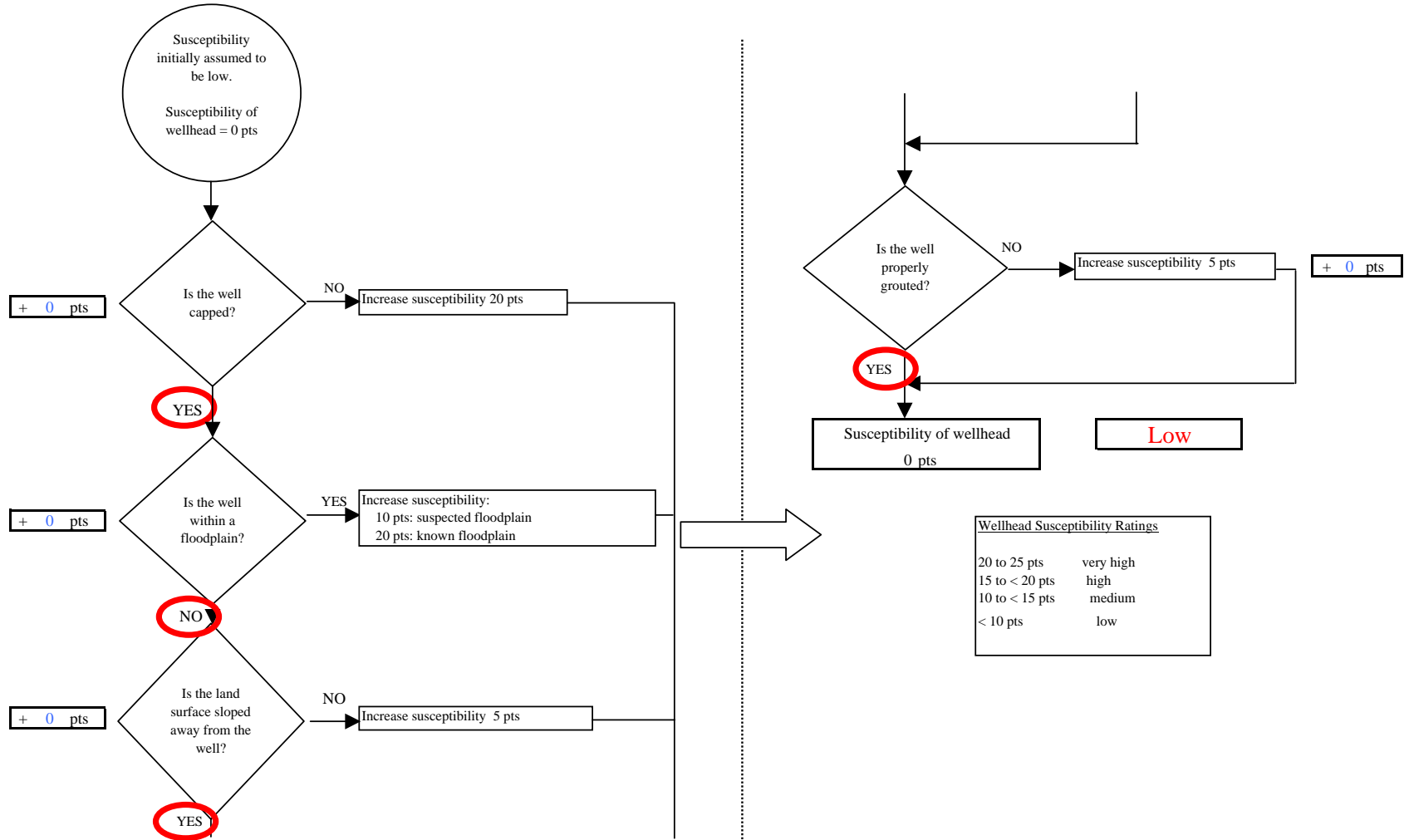


Chart 2. Susceptibility of the aquifer Whitestone Farms (PWS No. 372075.001)

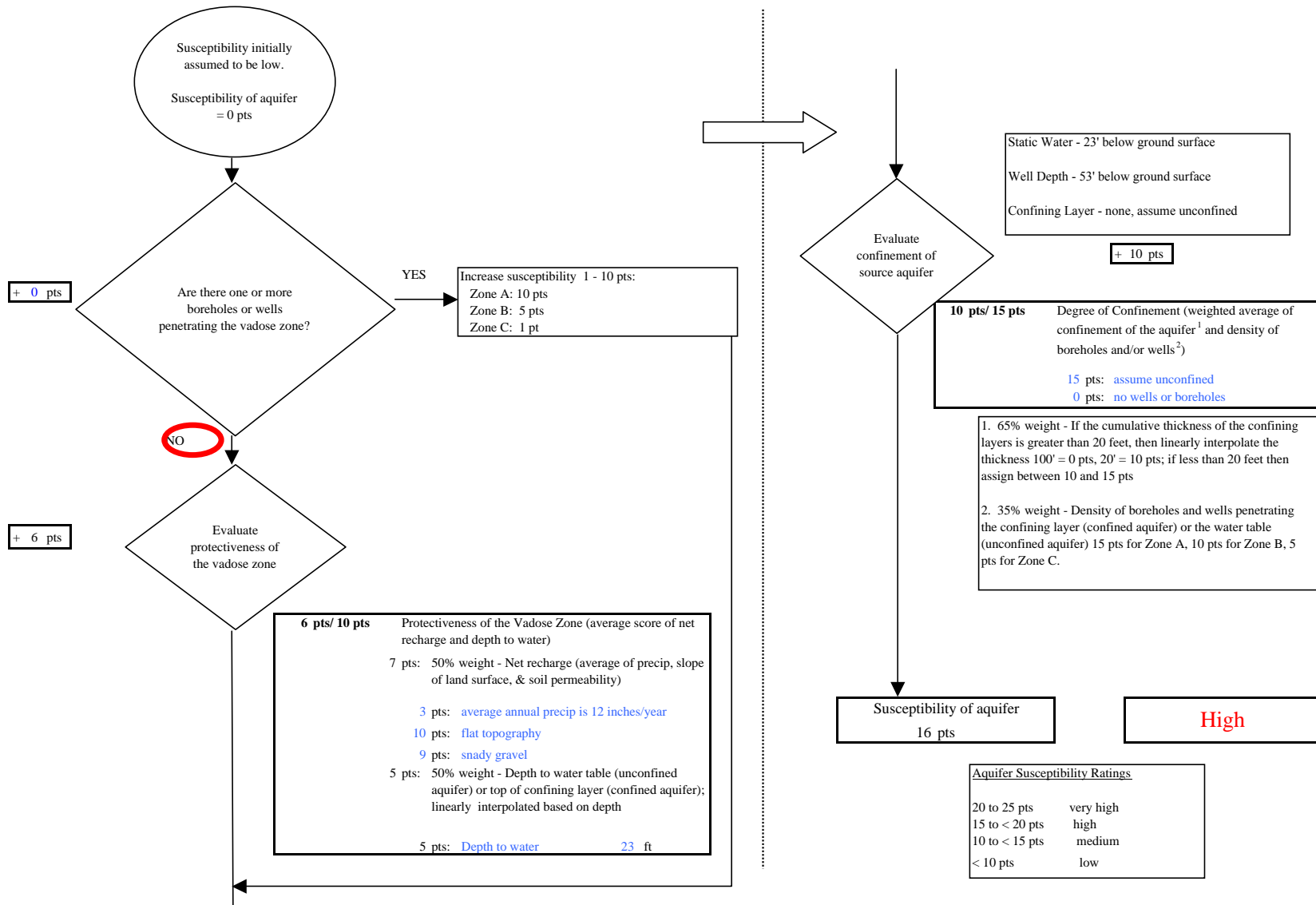


Chart 3. Contaminant risks for Whitestone Farms (PWS No. 372075.001) - Bacteria & Viruses

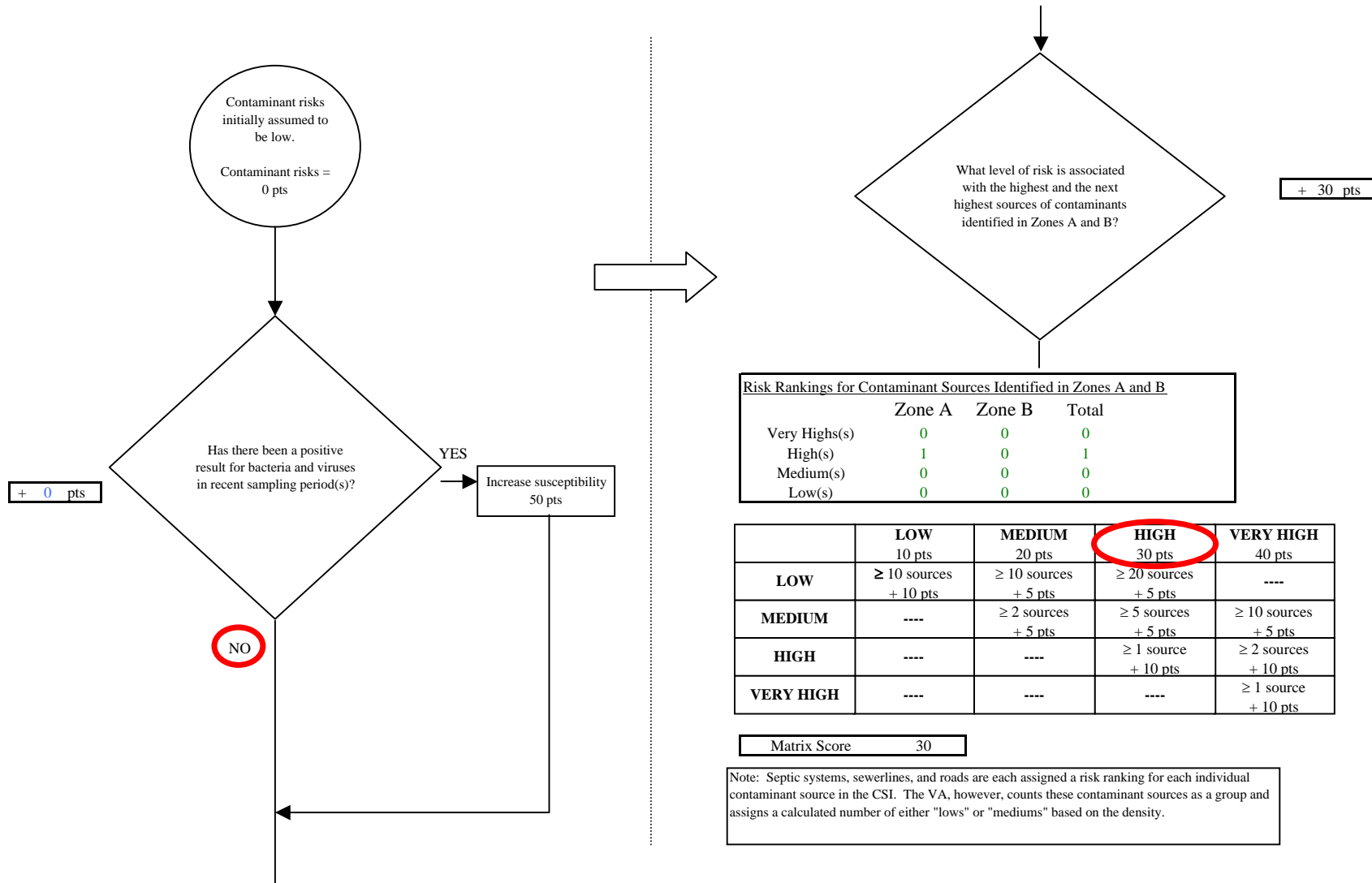


Chart 3. Contaminant risks for Whitestone Farms (PWS No. 372075.001) - Bacteria & Viruses

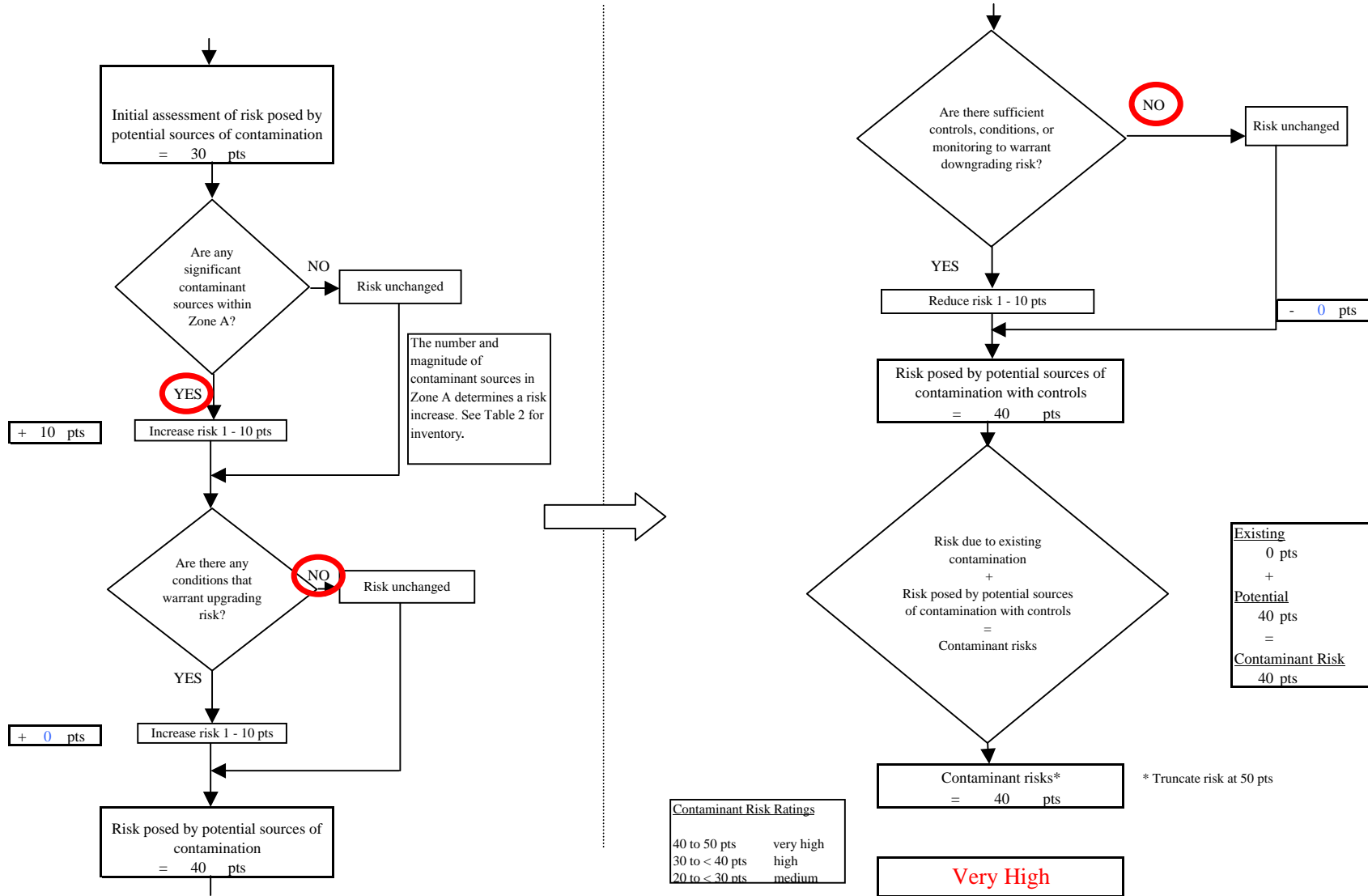


Chart 4. Vulnerability analysis for Whitestone Farms (PWS No. 372075.001) - Bacteria & Viruses

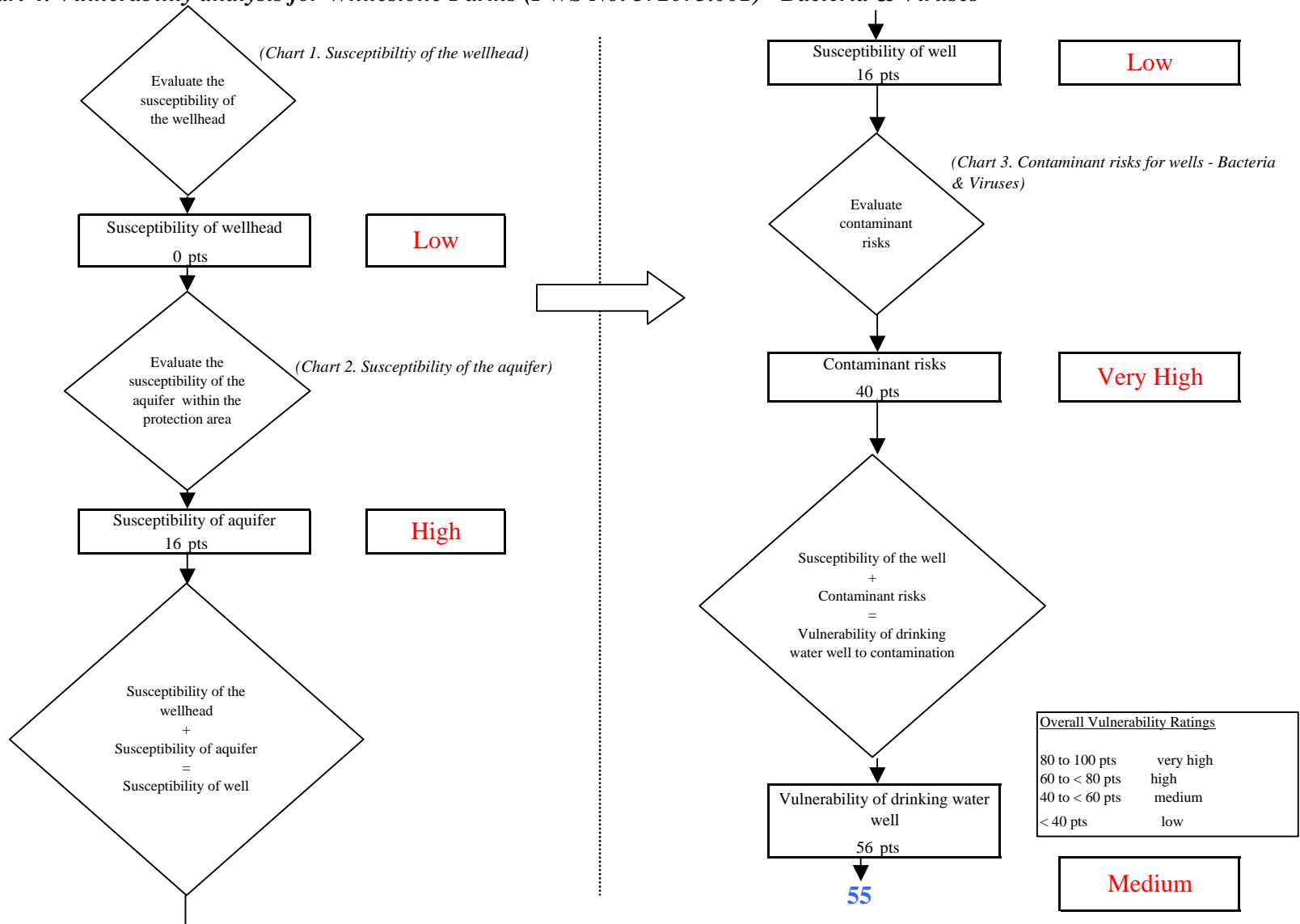


Chart 5. Contaminant risks for Whitestone Farms (PWS No. 372075.001) - Nitrates and Nitrites

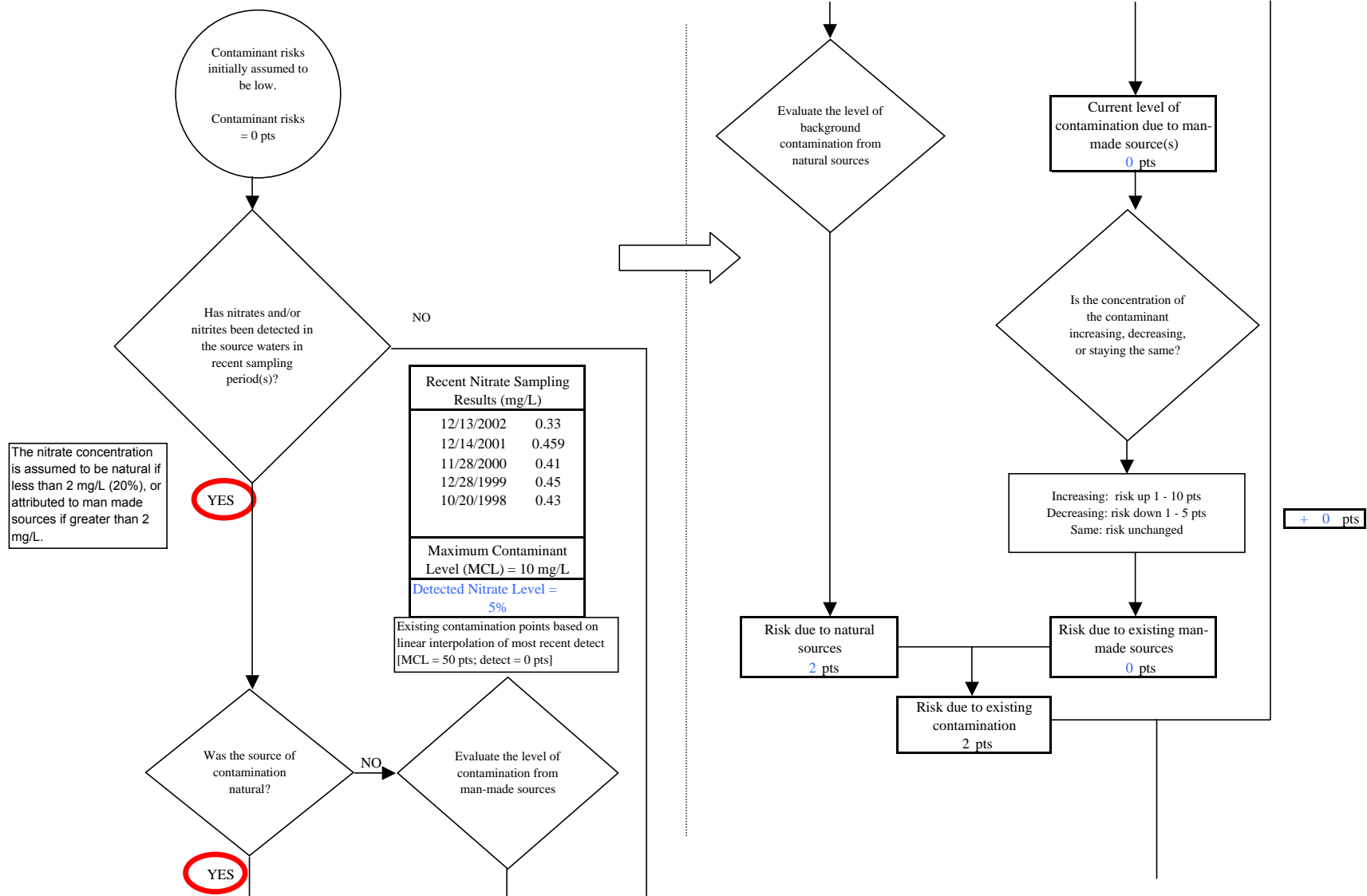


Chart 5. Contaminant risks for Whitestone Farms (PWS No. 372075.001) - Nitrates and Nitrites

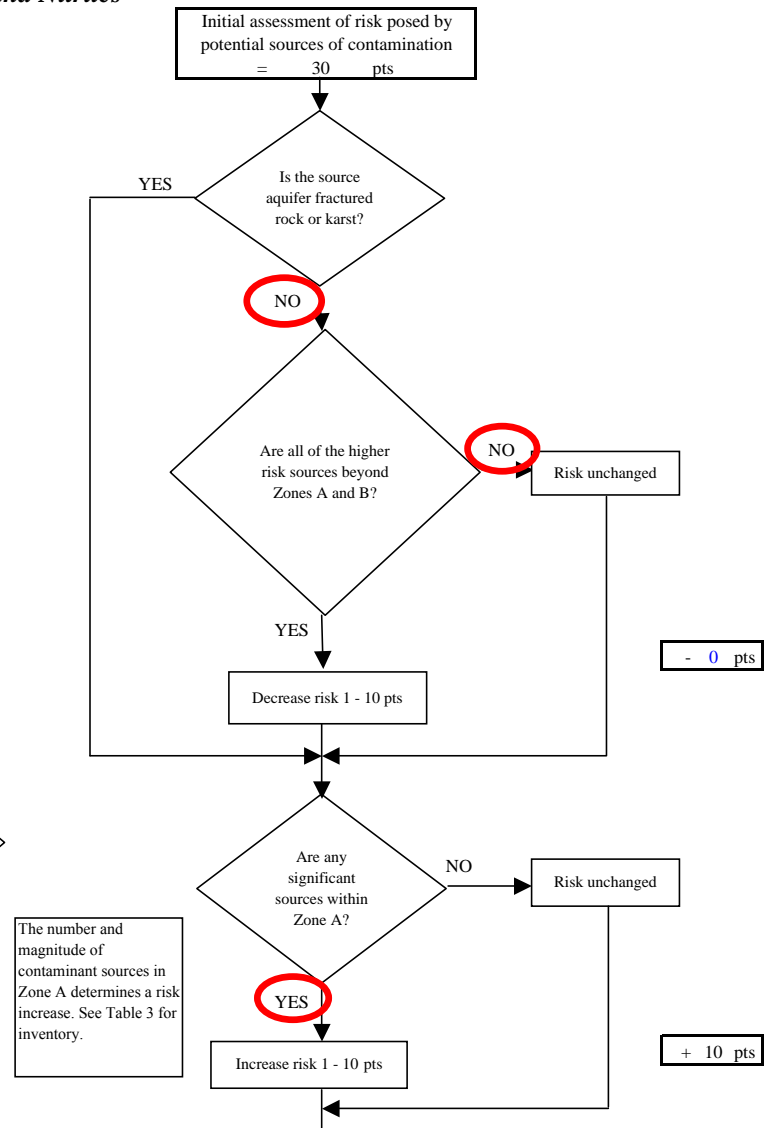
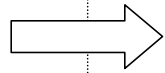
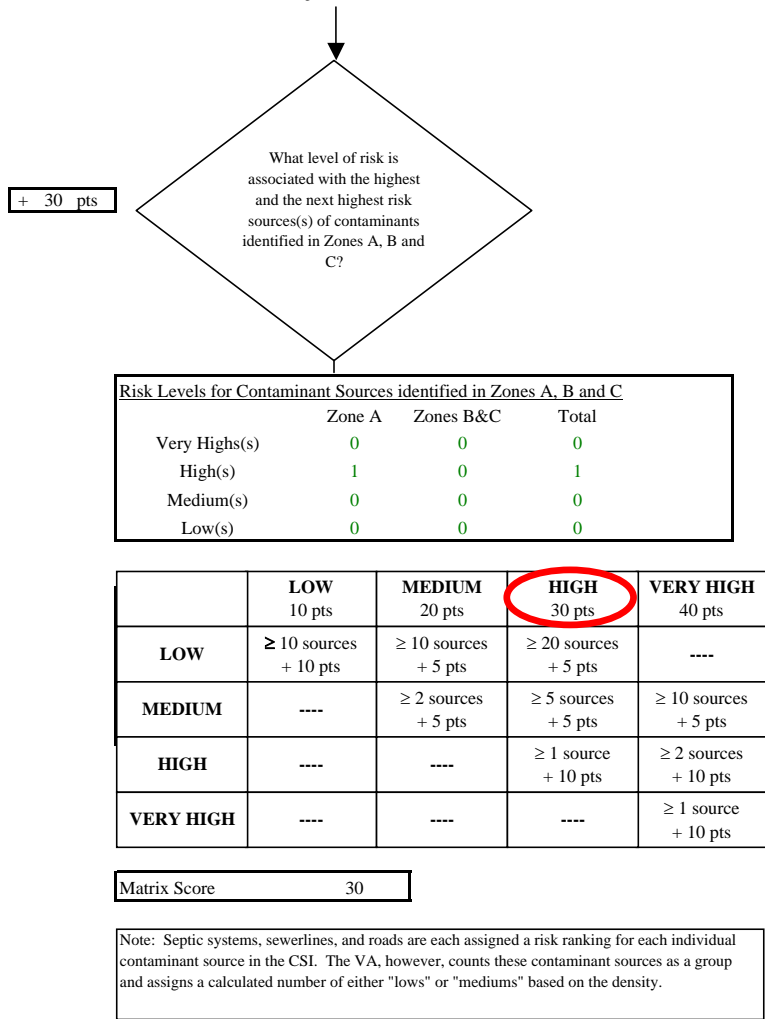


Chart 5. Contaminant risks for Whitestone Farms (PWS No. 372075.001) - Nitrates and Nitrites

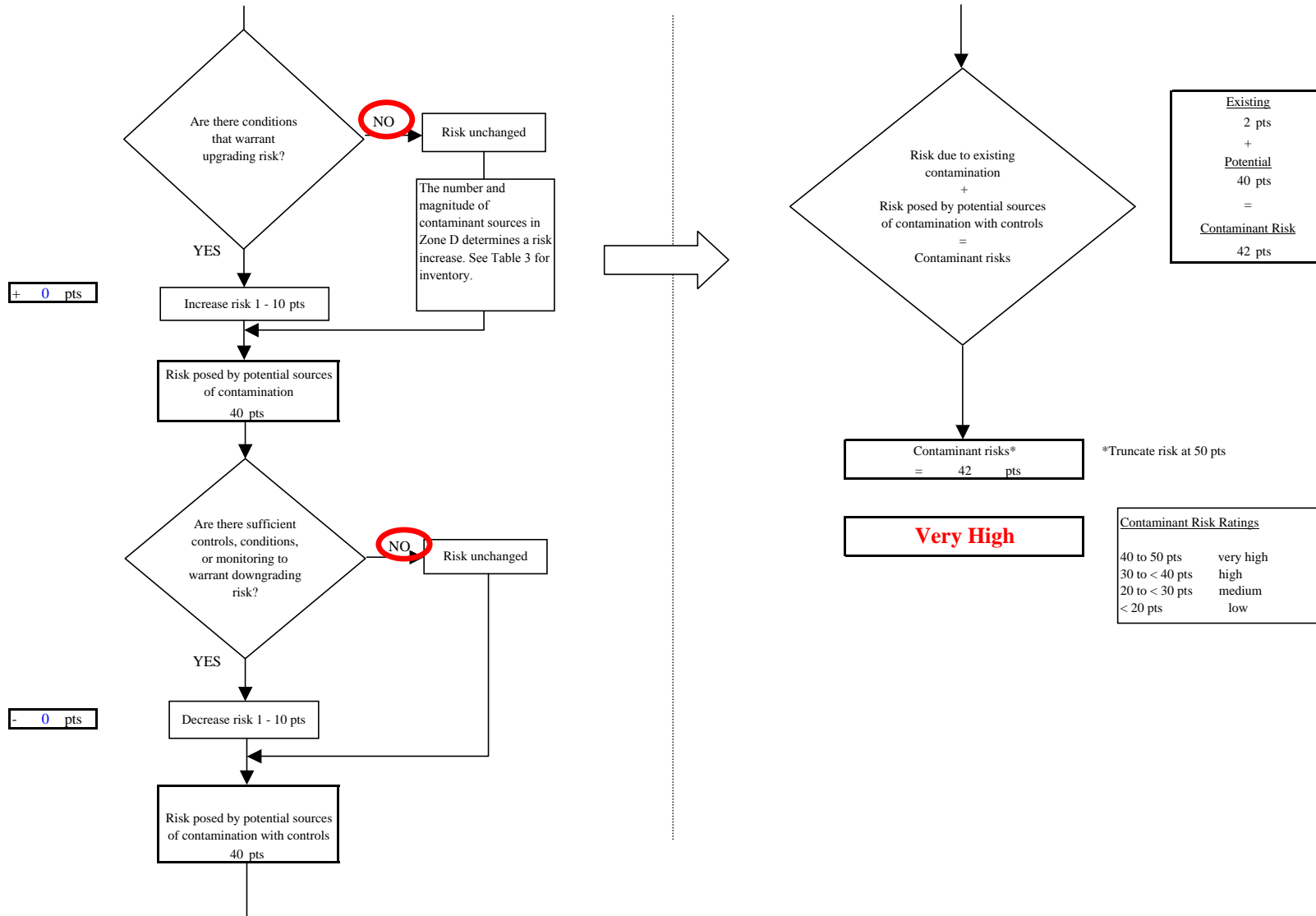


Chart 6. Vulnerability analysis for Whitestone Farms (PWS No. 372075.001) - Nitrates and Nitrites

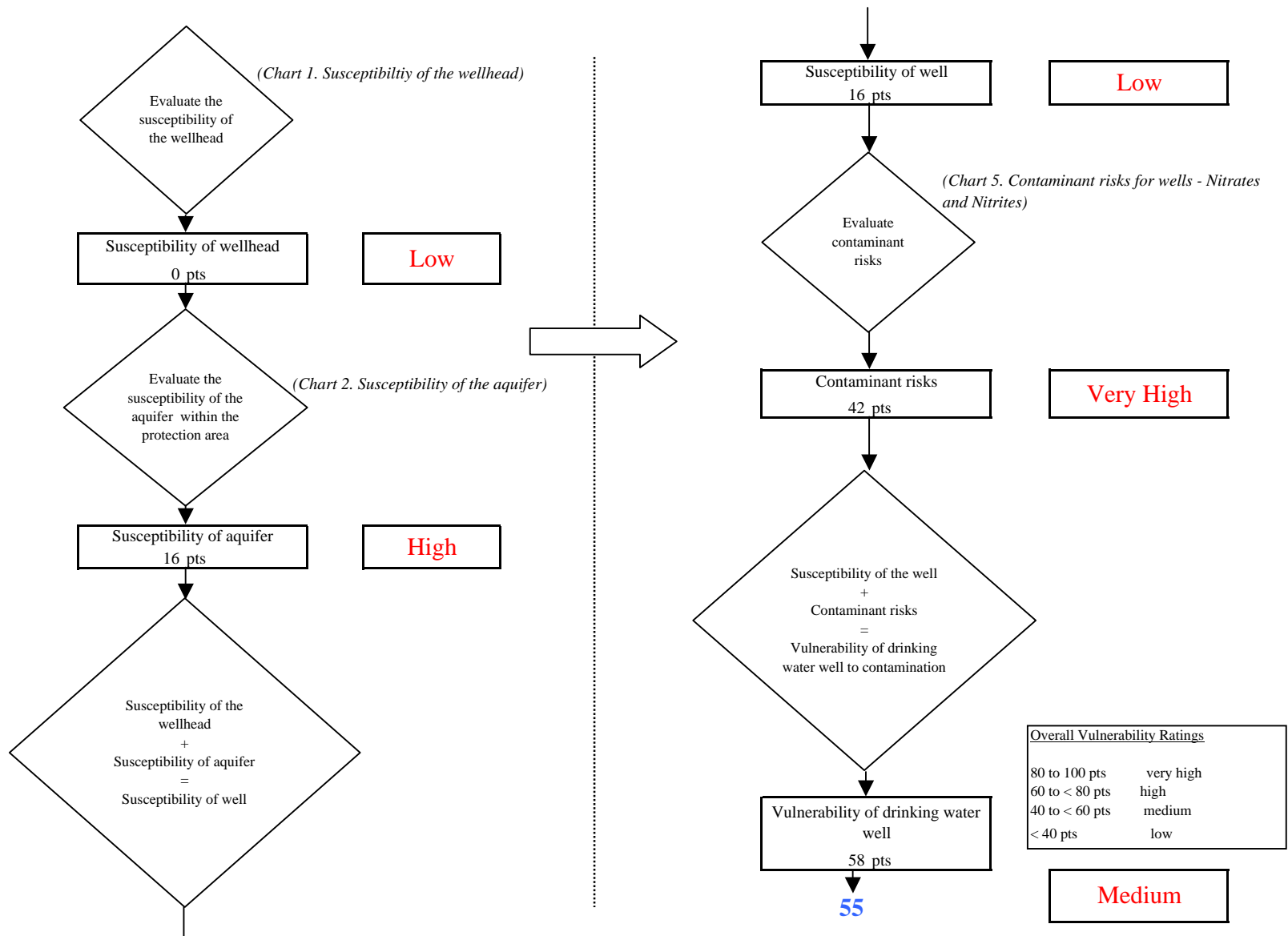


Chart 7. Contaminant risks for Whitestone Farms (PWS No. 372075.001) - Volatile Organic Chemicals

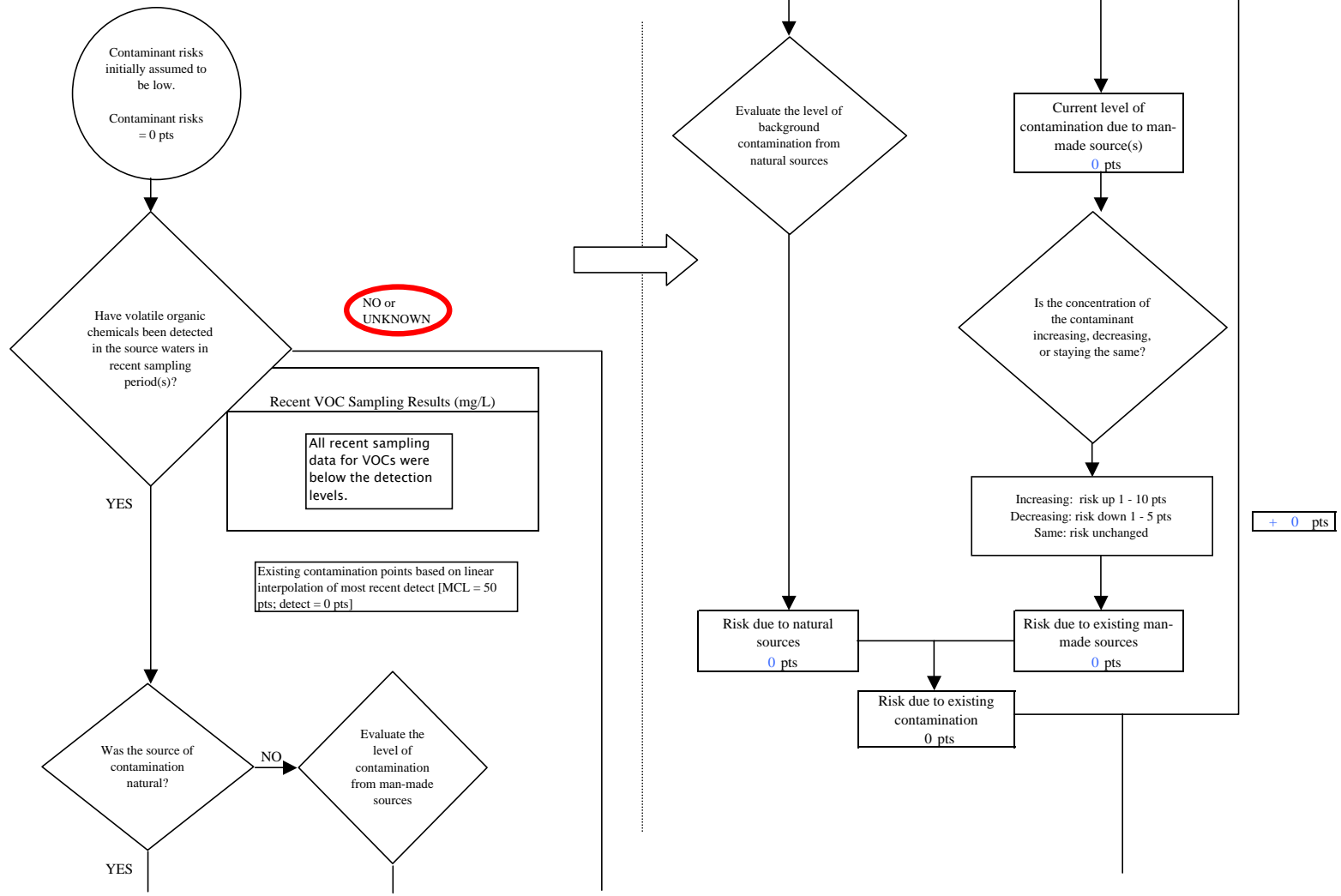


Chart 7. Contaminant risks for Whitestone Farms (PWS No. 372075.001) - Volatile Organic Chemicals

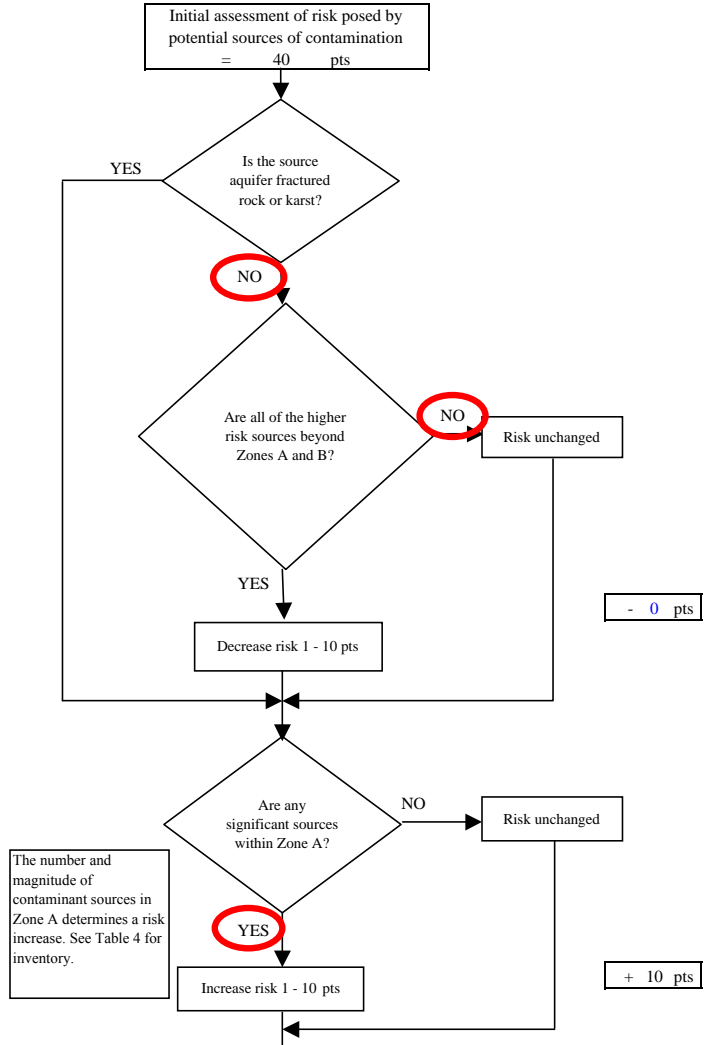
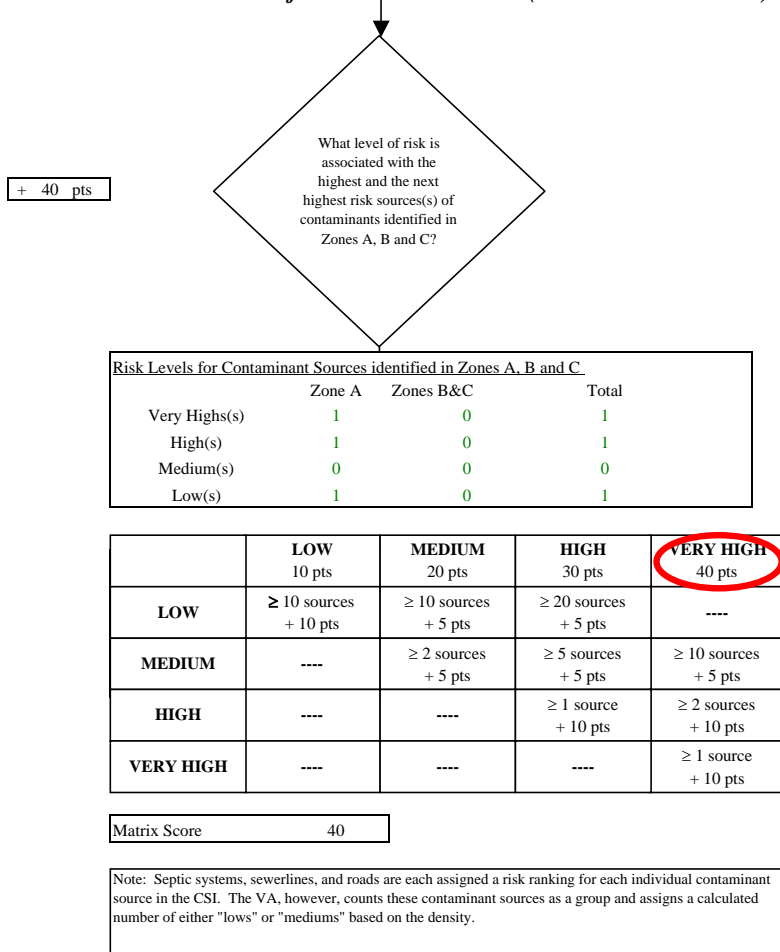


Chart 7. Contaminant risks for Whitestone Farms (PWS No. 372075.001) - Volatile Organic Chemicals

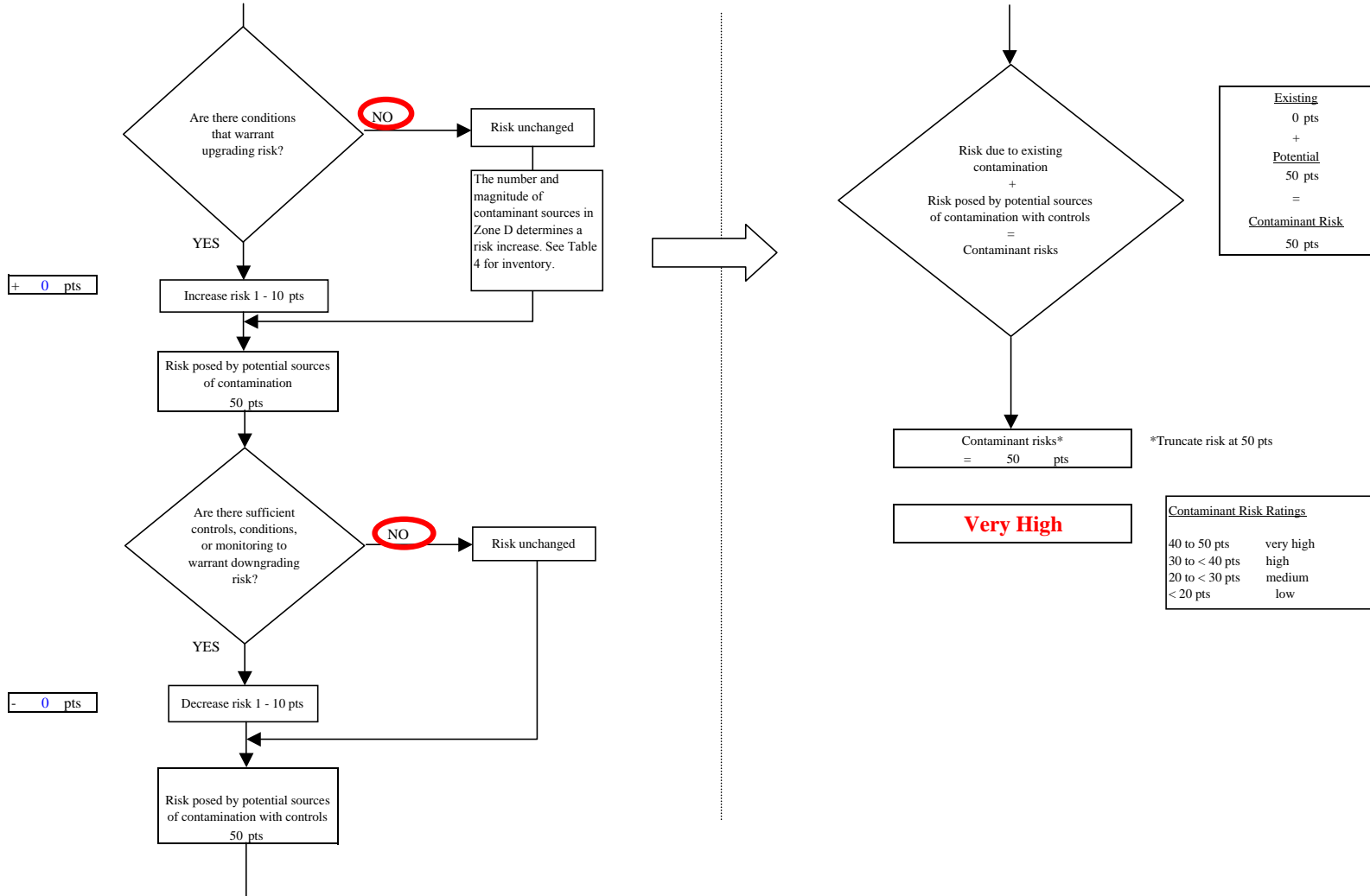


Chart 8. Vulnerability analysis for Whitestone Farms (PWS No. 372075.001) - Volatile Organic Chemicals

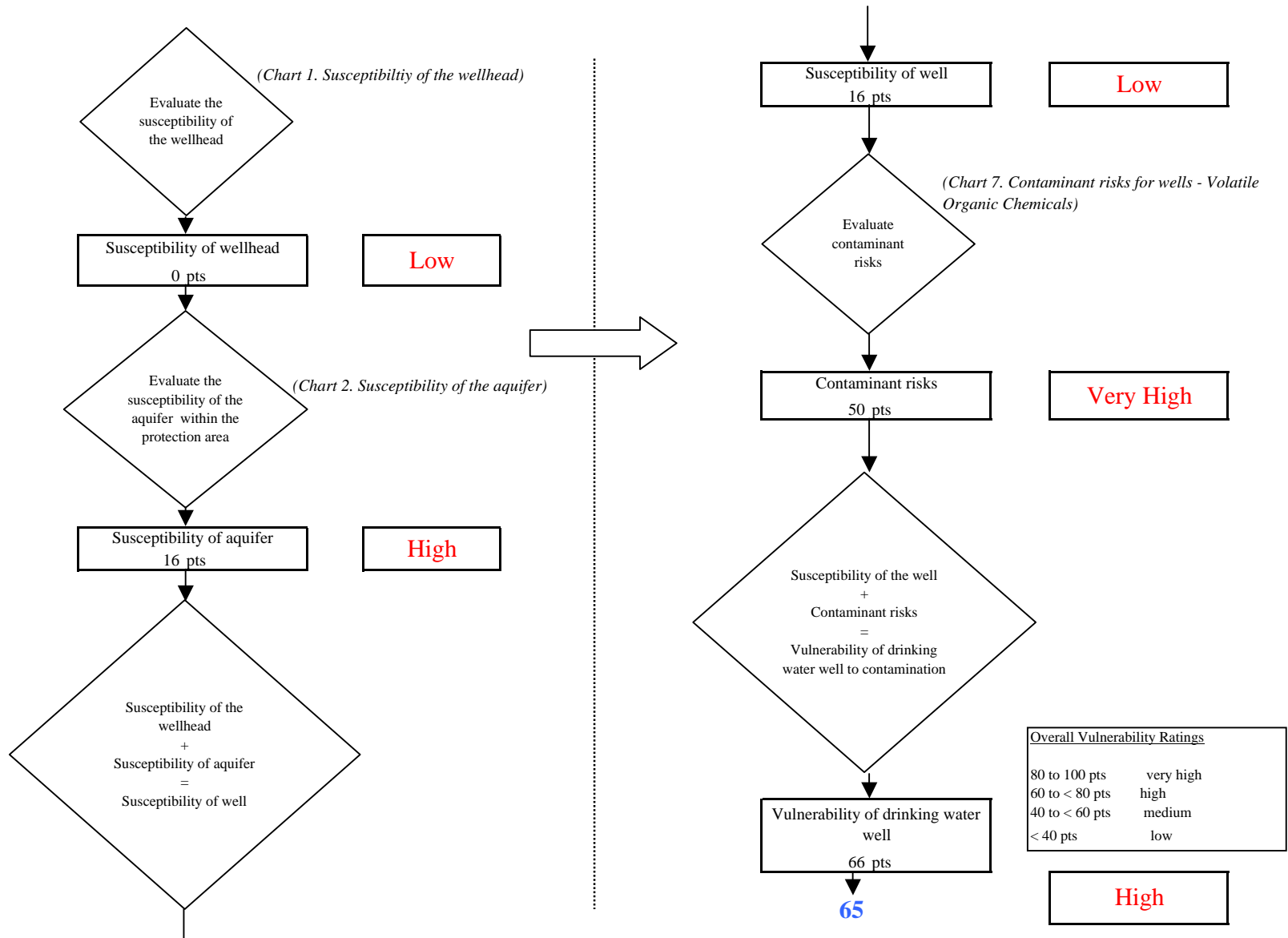


Chart 9. Contaminant risks for Whitestone Farms (PWS No. 372075.001) - Heavy Metals, Cyanide and Other Inorganic Chemicals

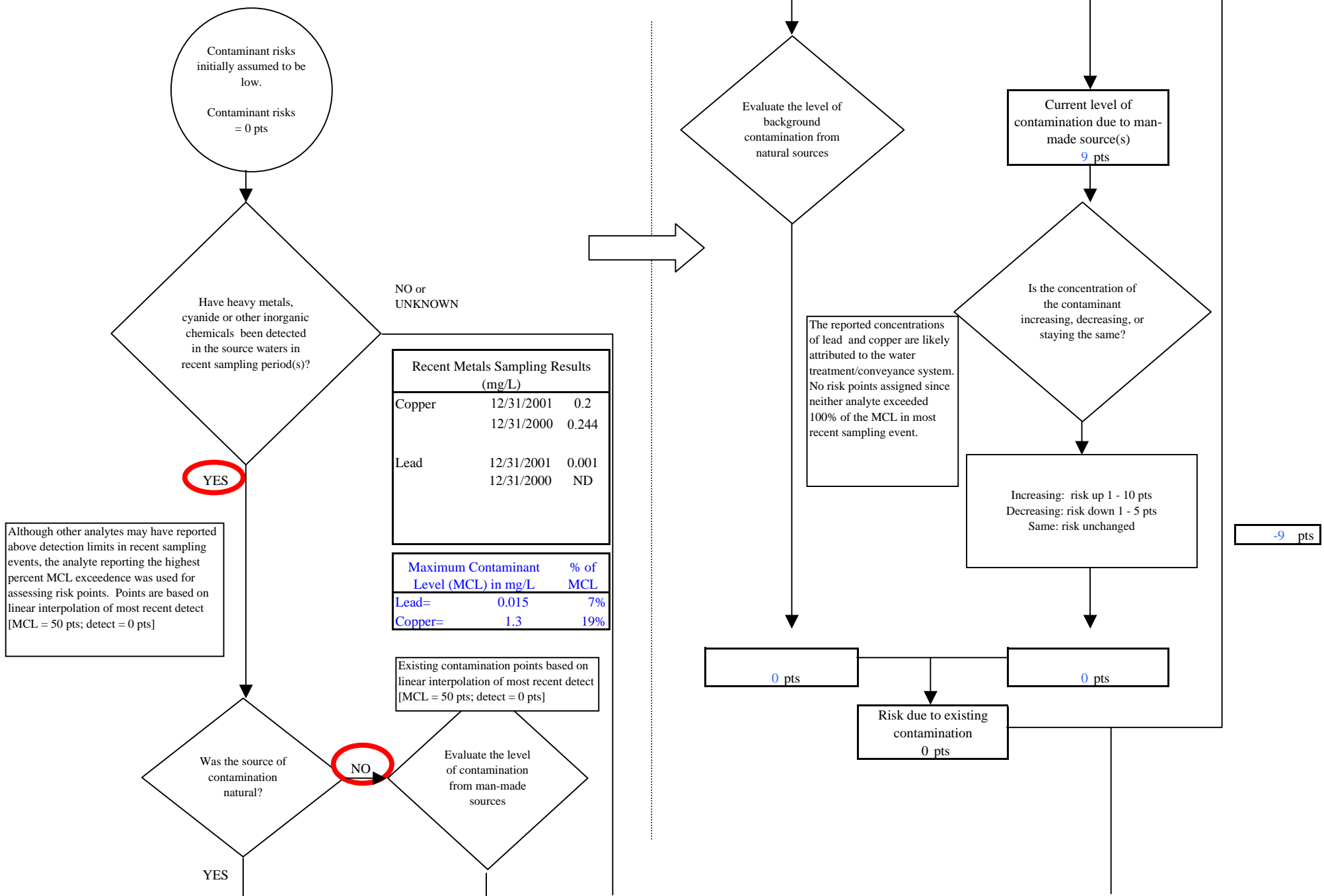
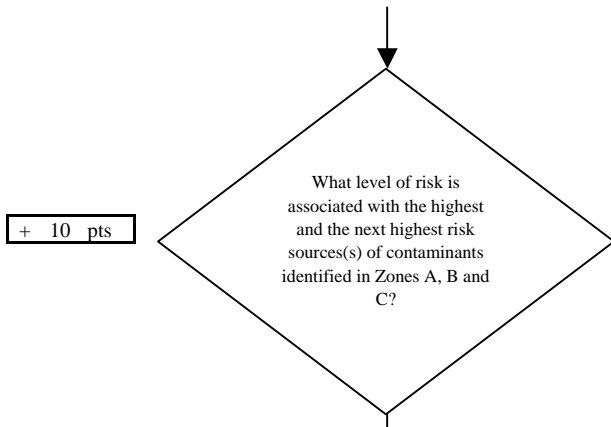


Chart 9. Contaminant risks for Whitestone Farms (PWS No. 372075.001) - Heavy Metals, Cyanide and Other Inorganic Chemicals



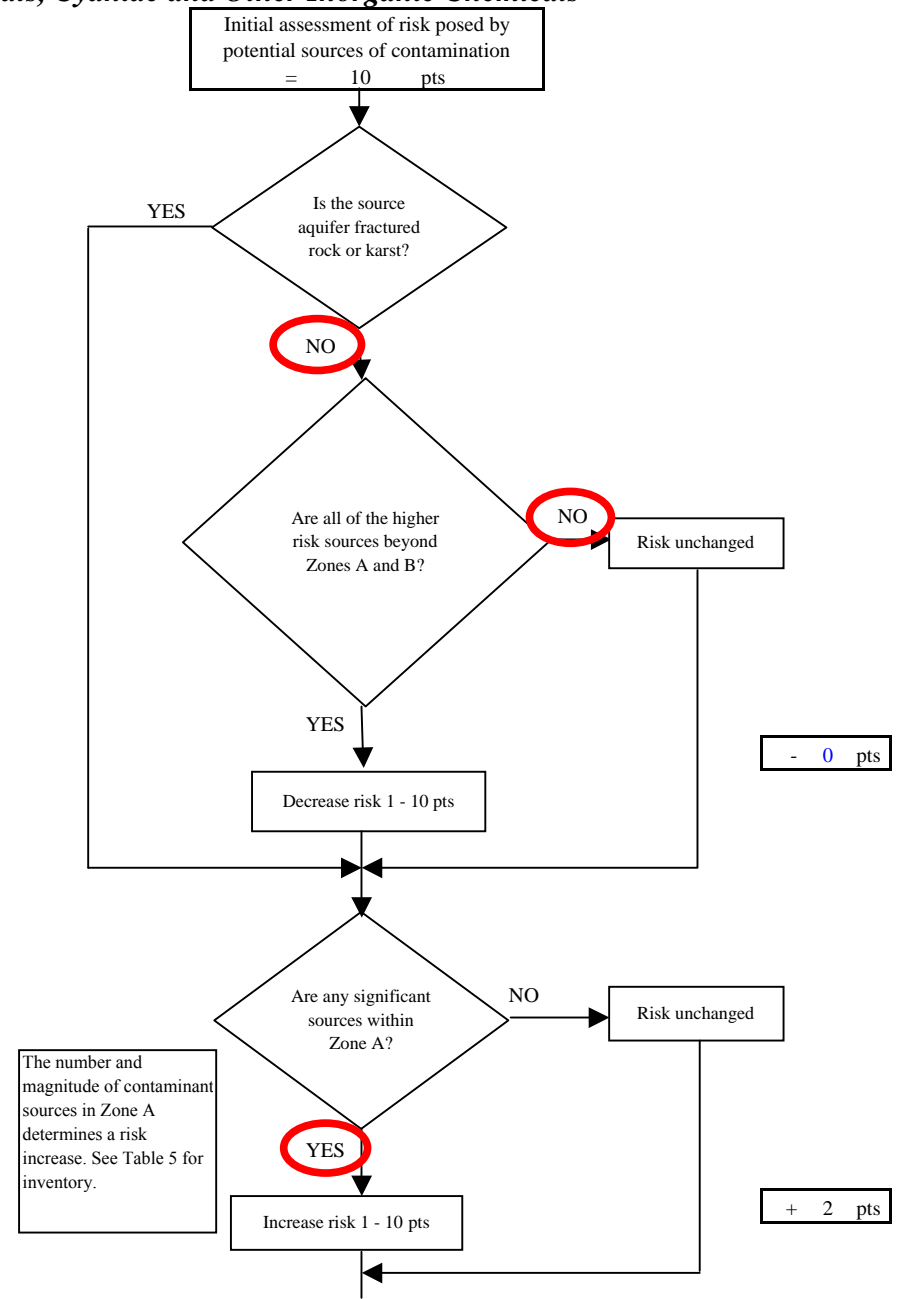
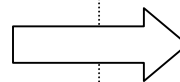
+ 10 pts

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

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

Matrix Score 10

Note: Septic systems, sewerlines, and roads are each assigned a risk ranking for each individual contaminant source in the CSI. The VA, however, counts these contaminant sources as a group and assigns a calculated number of either "lows" or "mediums" based on the density.



- 0 pts

+ 2 pts

Chart 9. Contaminant risks for Whitestone Farms (PWS No. 372075.001) - Heavy Metals, Cyanide and Other Inorganic Chemicals

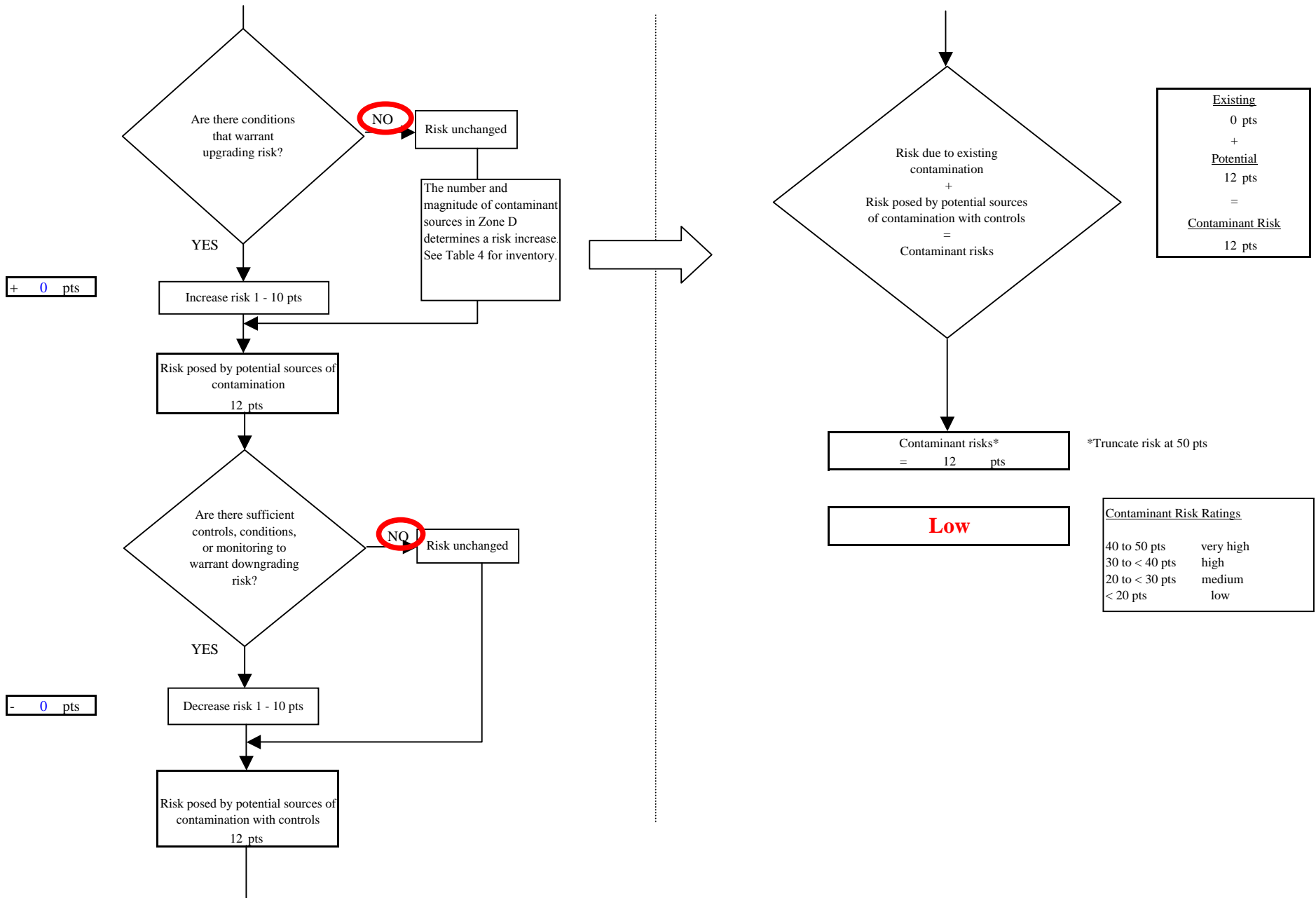


Chart 10. Vulnerability analysis for Whitestone Farms (PWS No. 372075.001) - Heavy Metals, Cyanide and Other Inorganic Chemicals

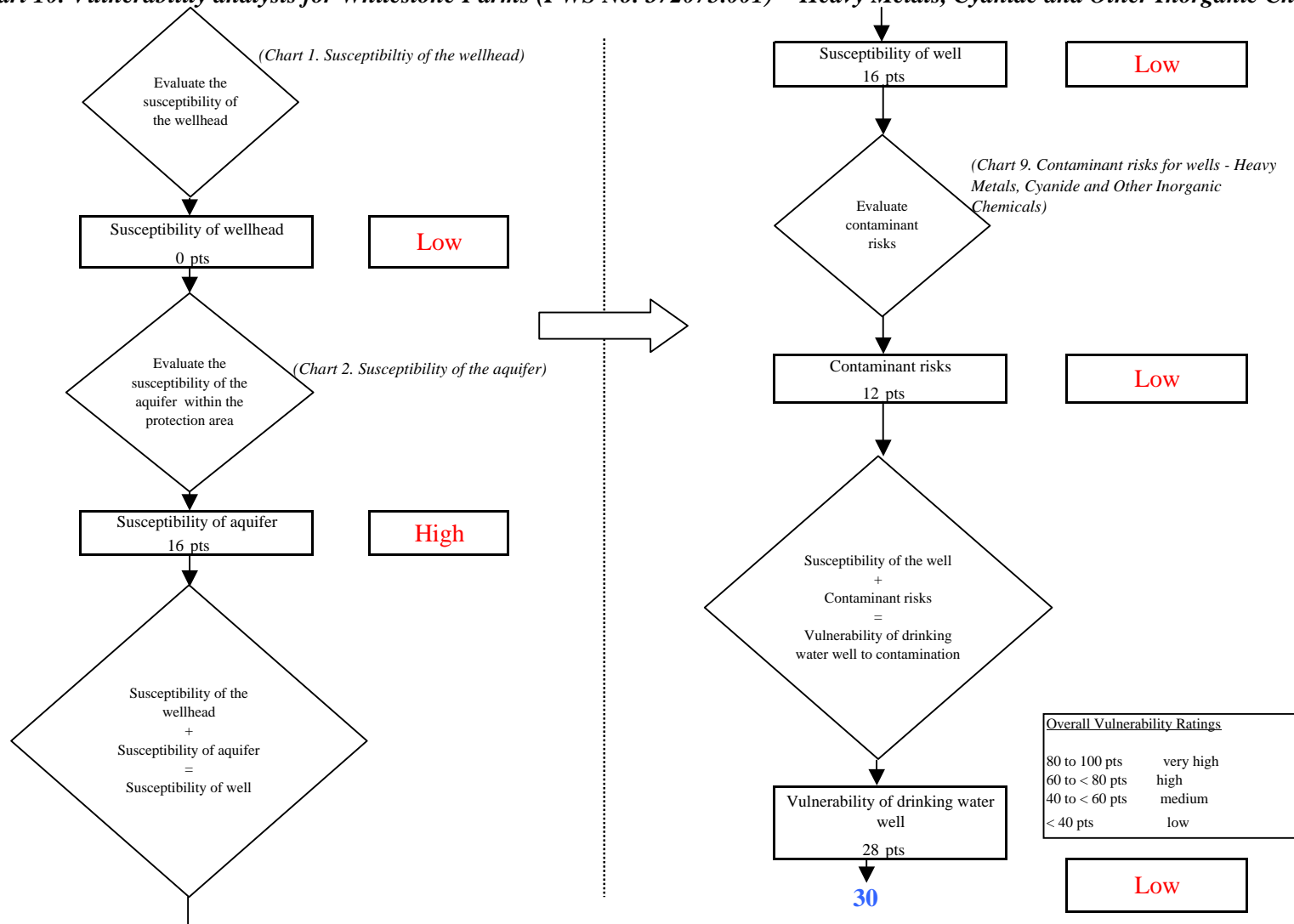


Chart 11. Contaminant risks for Whitestone Farms (PWS No. 372075.001) - Synthetic Organic Chemicals

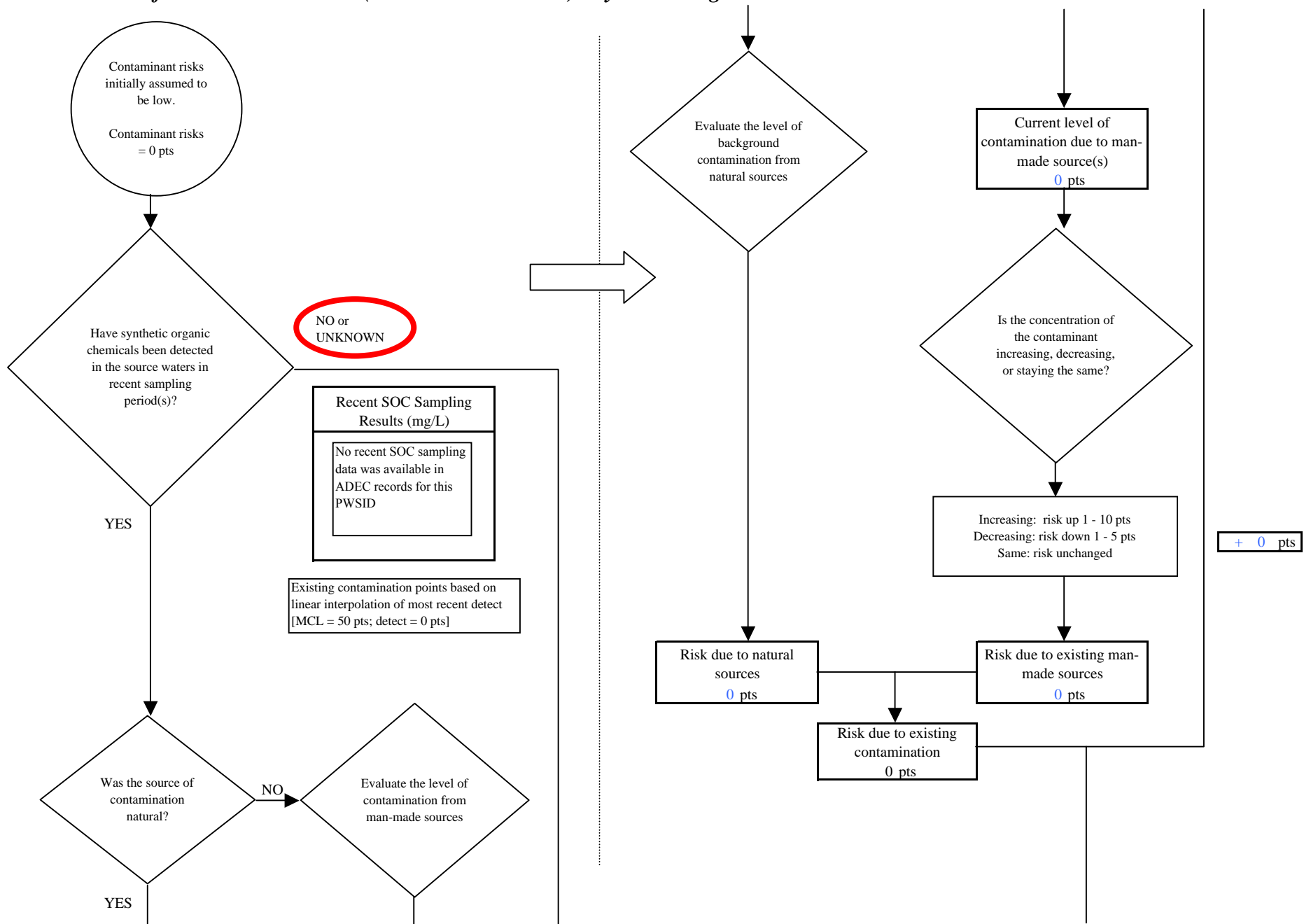
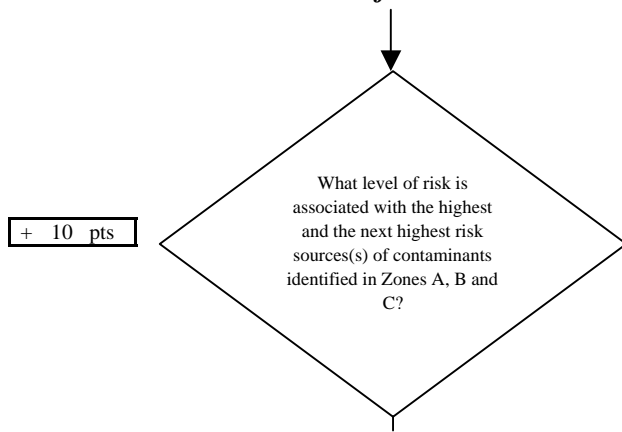


Chart 11. Contaminant risks for Whitestone Farms (PWS No. 372075.001) - Synthetic Organic Chemicals



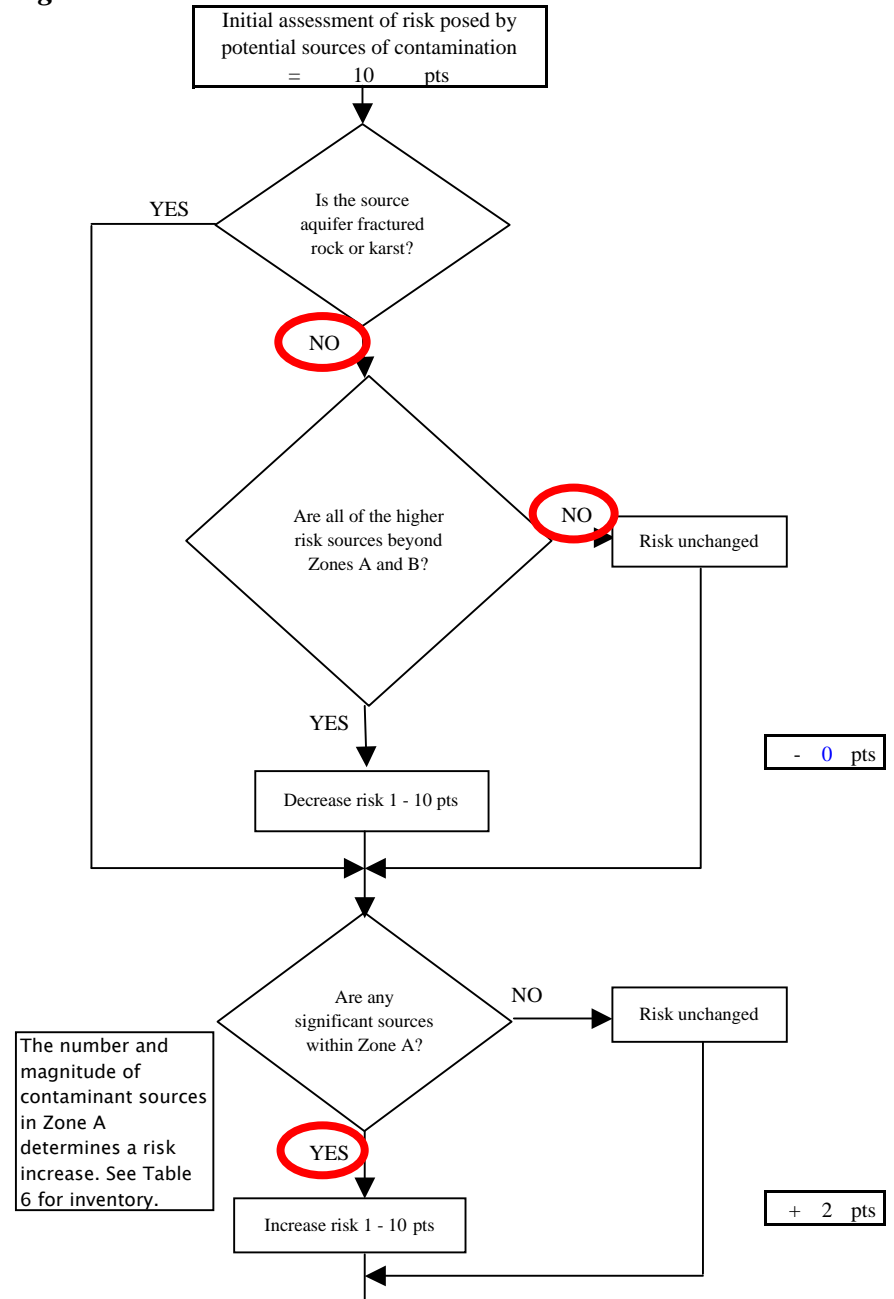
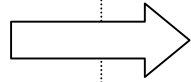
+ 10 pts

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

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

Matrix Score 10

Note: Septic systems, sewerlines, and roads are each assigned a risk ranking for each individual contaminant source in the CSI. The VA, however, counts these contaminant sources as a group and assigns a calculated number of either "lows" or "mediums" based on the density.



- 0 pts

+ 2 pts

Chart 11. Contaminant risks for Whitestone Farms (PWS No. 372075.001) - Synthetic Organic Chemicals

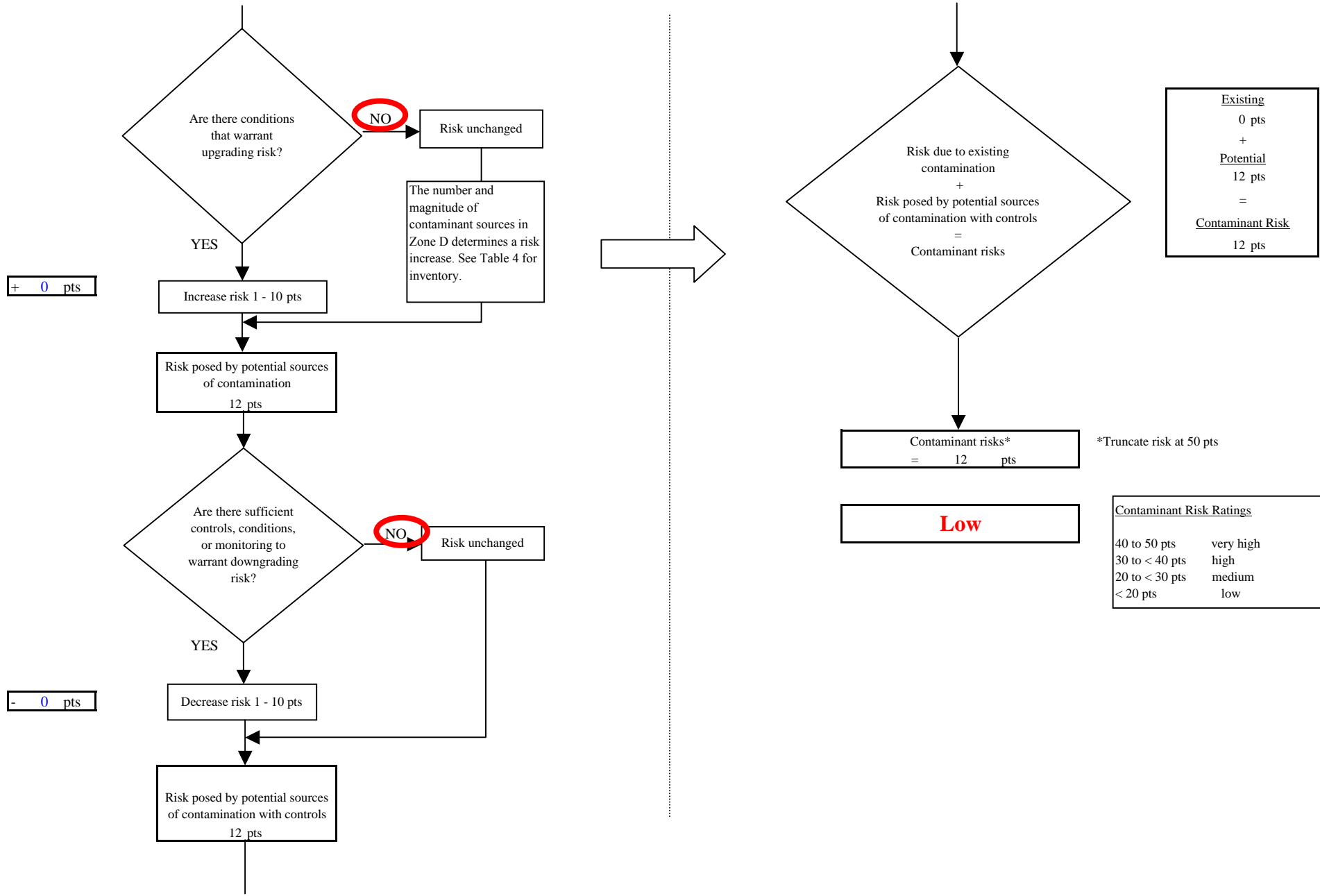


Chart 12. Vulnerability analysis for Whitestone Farms (PWS No. 372075.001) - Synthetic Organic Chemicals

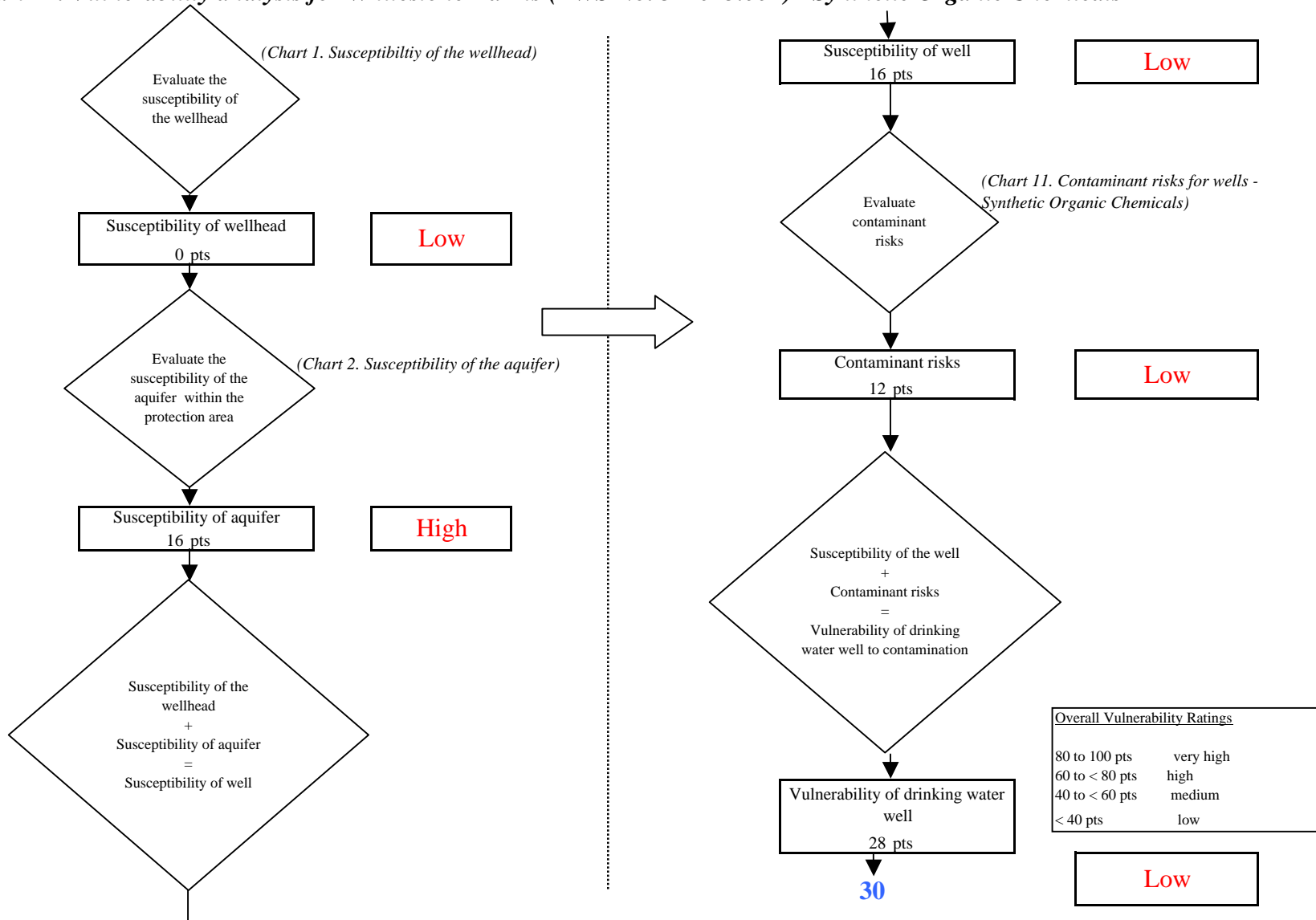


Chart 13. Contaminant risks for Whitestone Farms (PWS No. 372075.001) - Other Organic Chemicals

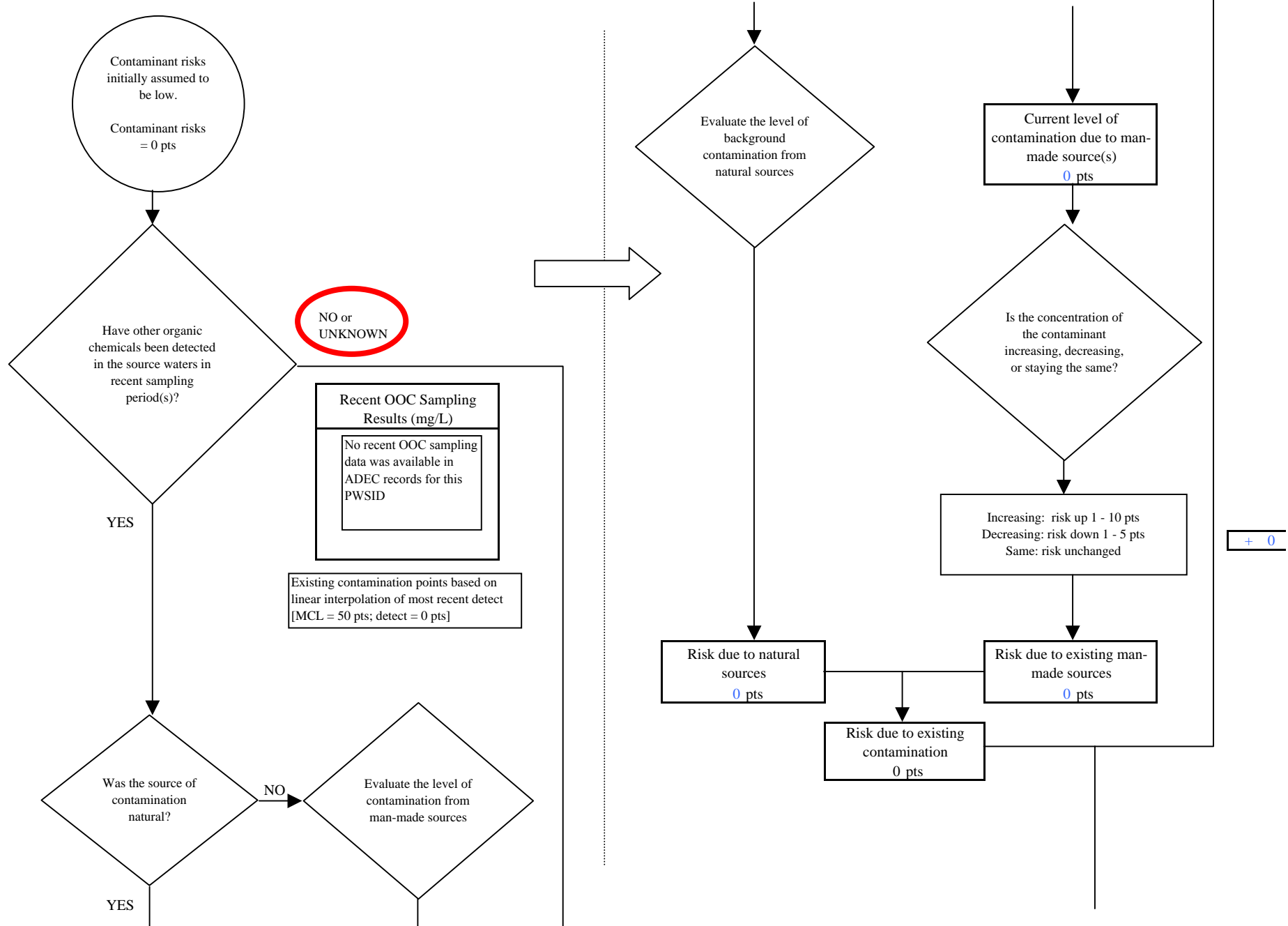


Chart 13. Contaminant risks for Whitestone Farms (PWS No. 372075.001) - Other Organic Chemicals

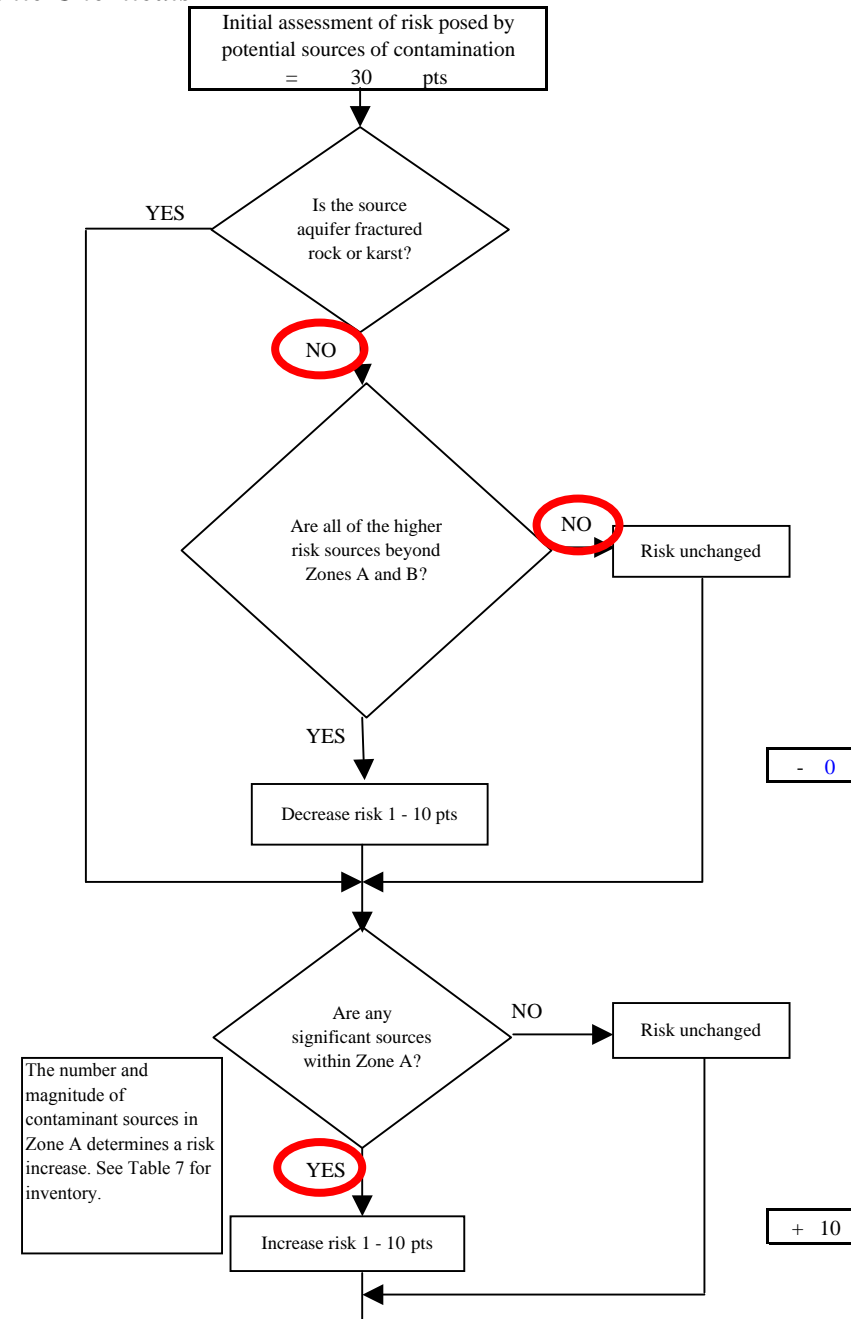
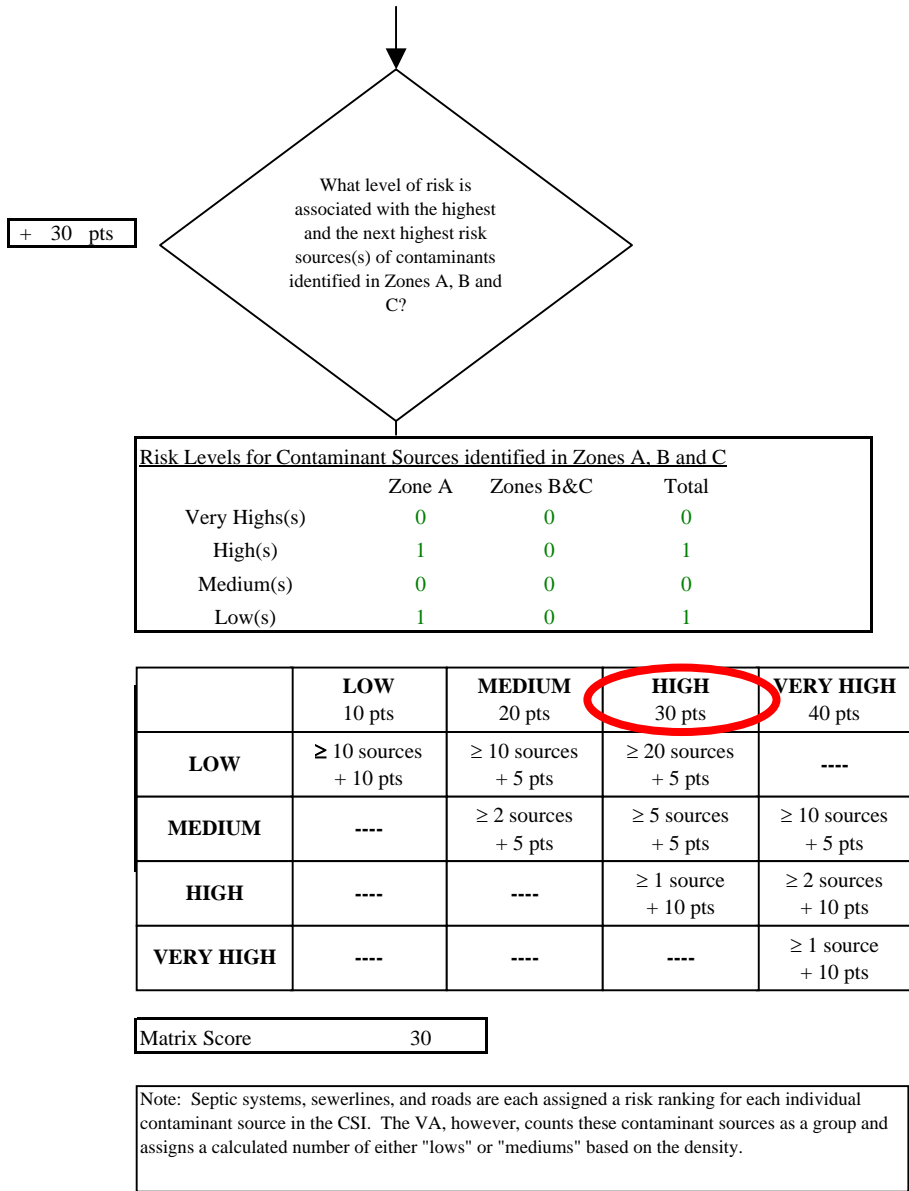


Chart 13. Contaminant risks for Whitestone Farms (PWS No. 372075.001) - Other Organic Chemicals

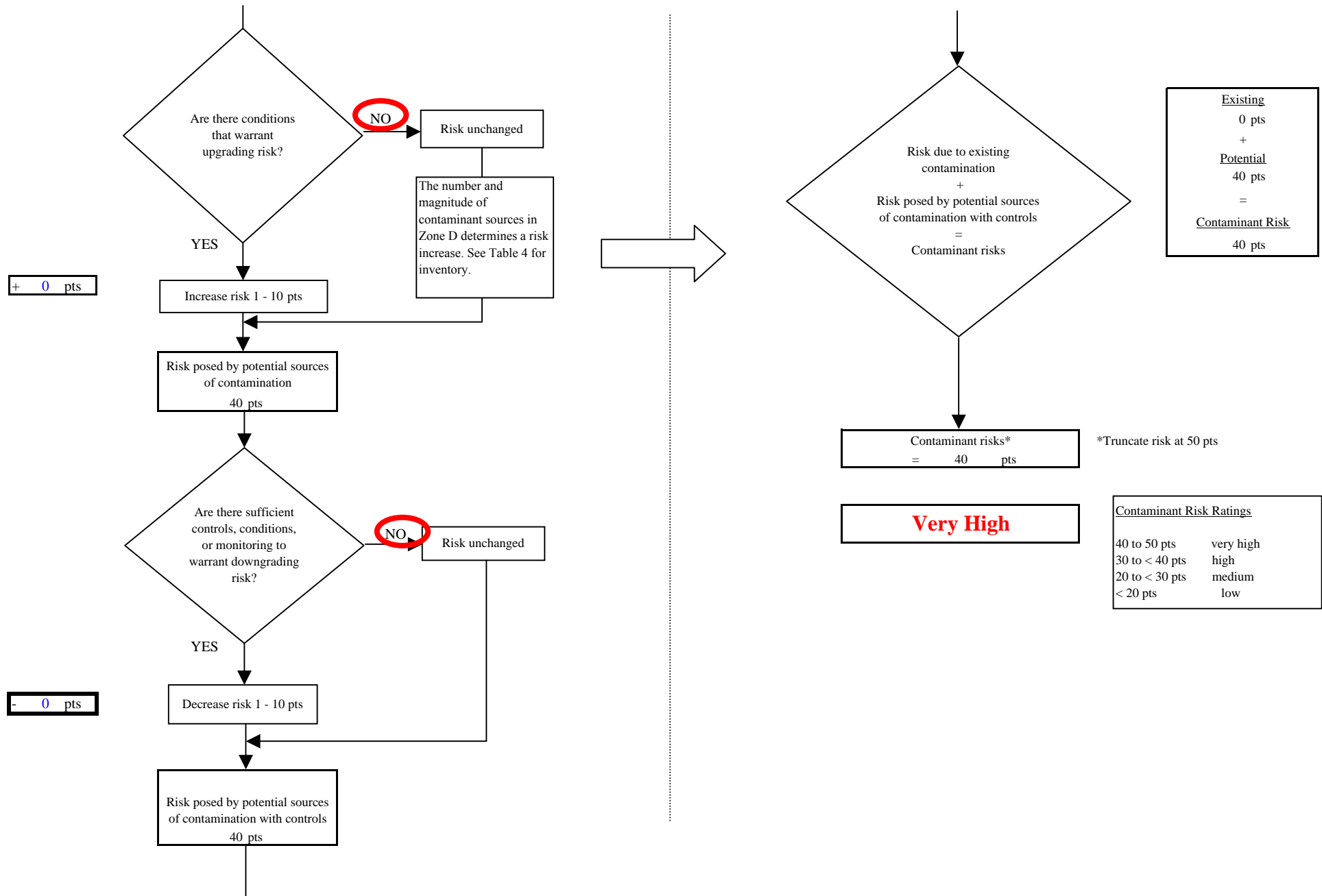


Chart 14. Vulnerability analysis for Whitestone Farms (PWS No. 372075.001) - Other Organic Chemicals

