Source Water Assessment

A Hydrogeologic Susceptibility and Vulnerability Assessment for KPBSD Moose Pass School Drinking Water System, Moose Pass, Alaska PWSID # 240561

May 2003

DRINKING WATER PROTECTION PROGRAM REPORT Report 851
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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APPENDICES

Source Water Assessment for KPBSD Moose Pass School Source of Public Drinking Water, Moose Pass, Alaska

Drinking Water Protection Program
Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

The public water system for KPBSD Moose Pass School is a Class A water system (nontransient/noncommunity), consisting of one well along Depot Drive off of the Seward Highway Drive. The wellhead received a susceptibility rating of **Very High** and the aquifer received a susceptibility rating of **High**. Combining these two ratings produces a **Very High** rating for the natural susceptibility of the well. Identified potential and current sources of contaminants for KPBSD Moose Pass School public drinking water source include: residential septic systems, large capacity septic systems, residential heating oil tanks, logging, tar/asphalt storage and residential area. 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. Combining the natural susceptibility of the well with the contaminant risk, the public water source for KPBSD Moose Pass School received a vulnerability rating of **Very High** for nitrates and/or nitrites, bacteria and viruses, volatile organic chemicals and other organic chemicals and **Medium** for heavy metals and synthetic organic chemicals. 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 KPBSD Moose Pass School to protect public health

KENAI PENINSULA BOROUGH SCHOOL DISTRICT-MOOSE PASS SCHOOL PUBLIC DRINKING WATER SYSTEM

The Moose Pass School public water system is a Class A (community) water system. The system consists of one well along Depot Drive off of the Seward Highway Drive, approximately 200 feet from Trail Lake. Moose Pass is located in the Kenai Peninsula Borough. The Borough encompasses 25,600 square miles, which only 15,700 square miles are land. The Kenai Peninsula is broken into two distinct geographic areas; the Kenai Mountains and the Kenai Lowland. The Kenai Mountains include Moose Pass, Cooper Landing, Crown Point, Trail Lake, and Seward. The Kenai Lowlands are located in the west and compromise about 2900 square miles and include the towns of Sterling, Soldotna, Kenai, Clam Gulch, Ninilchik and Homer.

Although the quality can vary significantly in a short distance, groundwater supplies are abundant in the area. Several areas on the Kenai Peninsula have a central water system, and several subdivisions have private water systems. Many homes and businesses in the area, however, rely on individual wells for their water supply. Most of these wells are shallow with depths of less than 70 feet. Static water levels in many of these wells are around 30 feet below the surface.

According to the most recent Sanitary Survey (9/7/01) the depth of the well is 44 feet below the surface. The well log indicates that the well is completed in coarse sand. The well log indicates a small clay layer from 23-25 feet and silt from 25-32 feet below surface level. The static water level was approximately 12 feet below surface level at the time of drilling (8/7/1964). The land surface is sloped away from the well providing surface water drainage. However, the survey indicates that the well casing is not the required 12 inches above the ground surface. Since the well is located in a flood plain and flooding has occurred in the past, increasing the height of the well casing to at least the required 12 inches would provide added protection. The Sanitary Survey recommends that the well casing be extended to 30 inches in order to provide protection from local flooding. It is unknown whether the well is properly grouted. Typically, wells constructed prior to 1993 are not grouted. Proper grouting provides added protection against contaminants traveling along the well casing and into source waters. The well was installed with a cap providing a sanitary seal. A properly installed sanitary seal may provide protection against contaminant from entering the source waters at the casing.

The system operates year-round and serves 54 non-residents through 1 service connections.

KPBSD MOOSE PASS SCHOOL DRINKING WATER PROTECTION AREA

In order to evaluate whether a drinking water source is at risk, we must first evaluate what are the most likely pathways for surface contamination to reach the

groundwater. 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. 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.

The protection areas established for wells by 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.

An outline of the immediate watershed and an analytical calculation was used to determine the size and shape of the protection area for KPBSD Moose Pass School. The input parameters describing the attributes of the aquifer for the analytical calculation were adopted from Groundwater (Freeze and Cherry 1979). Available geology was also considered to take into account any uncertainties in groundwater flow and aquifer characteristics to arrive at a meaningful protection area (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 of the water 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 protection area for KPBSD Moose Pass School is limited by its immediate watershed and includes only Zone A (See Map 1 of Appendix A).

INVENTORY OF POTENTIAL AND EXISTING CONTAMINANT SOURCES

The Drinking Water Protection Program has completed an inventory of potential and existing sources of contamination within the KPBSD Moose Pass School protection area. 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; and
- Other Organic Chemicals.

The sources are displayed on Map 2 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 7 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/other inorganic chemicals synthetic organic chemicals and other organic chemicals.

VULNERABILITY OF KPBSD MOOSE PASS SCHOOL DRINKING WATER SYSTEM

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. Lastly, 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.

Vulnerability of a drinking water source to contamination is a combination of two factors:

- Natural susceptibility; and
- Contaminant risks.

A score for the Natural Susceptibility is reached by considering the properties of the well and the aquifer.

Susceptibility of the Wellhead (0 – 25 Points)
(Chart 1 of Appendix D)

+

Susceptibility of the Aquifer (0 – 25 Points)
(Chart 2 of Appendix D)

=

Natural Susceptibility (Susceptibility of the Well)
(0 – 50 Points)

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 well for KPBSD Moose Pass School appears to be completed in an unconfined aquifer. Because an unconfined aquifer is recharged by surface water and precipitation that migrates downward from the surface, contaminants at the surface have the potential to adversely impact this aquifer. The vulnerability of KPBSD Moose Pass Schools water source is significantly increased due to being located on a flood plain.

Table 2 shows the Susceptibility scores and ratings for KPBSD Moose Pass School .

Table 2. Susceptibility

	Score	Rating
Susceptibility of the Wellhead	25	Very High
Susceptibility of the Aquifer	18	High
Natural Susceptibility	43	Very High

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	44	Very High
Volatile Organic Chemicals	38	High
Heavy Metals, Cyanide, and Other Inorganic Chemicals	16	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:

Natural Susceptibility (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 (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	*85*	*Very High*
Nitrates and Nitrites	*85*	*Very High*
Volatile Organic Chemicals	*80*	*Very High*
Heavy Metals, Cyanide, and Other Inorganic Chemicals	*55*	*Medium*
Synthetic Organic Chemicals	*55*	*Medium*
Other Organic Chemicals	*85*	*Very High*

Bacteria and Viruses

The contaminant risk for bacteria and viruses is very high with a large capacity septic system and residential septic systems presenting the most significant risk to the drinking water well (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. Bacteria and viruses have not been detected during recent water sampling of the system. 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 very high..

Nitrates and Nitrites

The contaminant risk for nitrates and nitrites is very high with large capacity septic systems and residential septic systems, posing the most significant contaminant risk to this source of public drinking water (See Chart 5 - 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 KPBSD Moose Pass School well indicates that low concentrations of nitrate have been detected. Existing nitrate concentration is approximately 0.83 mg/L or 8% of the Maximum Contaminant Level (MCL) of 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. Nitrate concentrations have varying from 0.62 to 1.31 mg/L within the past five years.

It is unknown how much of the existing nitrate concentration can be attributed to natural or human-made sources. Nitrate concentrations in uncontaminated groundwater are typically less than 2 mg/L, or 20% of the MCL, and are derived primarily from the decomposition of organic matter in soils (Wang, Strelakos, Jokela, 2000).

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

Volatile Organic Chemicals

The contaminant risk for volatile organic chemicals is high with asphalt and tar storage, residential and nonresidential heating oil tank and roads presenting the most significant risk for volatile organic chemicals (See Chart 7 – Contaminant Risks for Volatile Organic Chemicals in Appendix D). Moose Pass and the surrounding area heat there homes with various types of on-site fuel sources. For purposes of this report, it is assumed that above ground oil tanks are used for heating home. The most common causes of fuel leaks of these heating oil systems are overfilling the tank, ruptured fuel lines, leaking storage tanks, damaged or faulty valves and vandalism. Secondary containment around the tank and regular system maintenance can help prevent many of these harmful fuel leaks.

Volatile organic chemicals have not been detected during recent sampling of the well. 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 very high.

Heavy Metals, Cyanide, and Other Inorganic Chemicals

The contaminant risk for heavy metals is low with asphalt/ tar storage, large capacity septic systems and residential activities in the protection area creating risk (See Chart 9 – Contaminant Risks for Heavy Metals, Cyanide, and Other Inorganic Chemicals in Appendix D).

Heavy metals, cyanide and other inorganic sampling has detected very low concentrations of barium. The most recent detection of barium was 0.015 mg/l or 7% of the MCL of 2 mg/l. The barium levels detected are considered safe for human consumption. After combining the contaminant risk for heavy metals with the natural susceptibility of the well, the overall vulnerability of the well to contamination is medium.

Synthetic Organic Chemicals

The contaminant risk for synthetic organic chemicals is low with the residential activities a large capacity septic system creating risk. After combining the contaminant risk with the natural susceptibility of the well, the overall vulnerability to synthetic organic chemicals of the well is medium. (See Chart 11 – Contaminant Risks for Synthetic Organic Chemicals in Appendix D).

Other Organic Chemicals

The contaminant risk for other organic chemicals is very high with asphalt/tar storage and residential activities within the protection area creating the risk. After combining the contaminant risk with the natural susceptibility of the well, the overall vulnerability to other organic chemicals of the well is very high. (See Chart 13 – Contaminant Risks for Other Organic Chemicals in Appendix D).

Review of the historical sampling data indicates that no synthetic organic chemicals or other organic chemicals have been sampled for within the past 5 years.

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 KPBSD Moose Pass School 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 KPBSD Moose Pass School drinking water source.

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ACKNOWLEDGMENT

Source Water Assessments in the Moose Pass area were jointly prepared by ADEC-Drinking Water Protection Program and URS Corporation. The Drinking Water Protection Program would like to thank URS Corporation for their efforts in researching the area.

APPENDIX A

KPBSD Moose Pass School
Drinking Water Protection Area Location Map
(Map 1)

Map 1- KPBSD Moose Pass School Drinking Water Protection Area

Alaska Department of Environmental Conservation

Alaska Drinking Water Protection Program

0 800 1,600 3,200 Feet

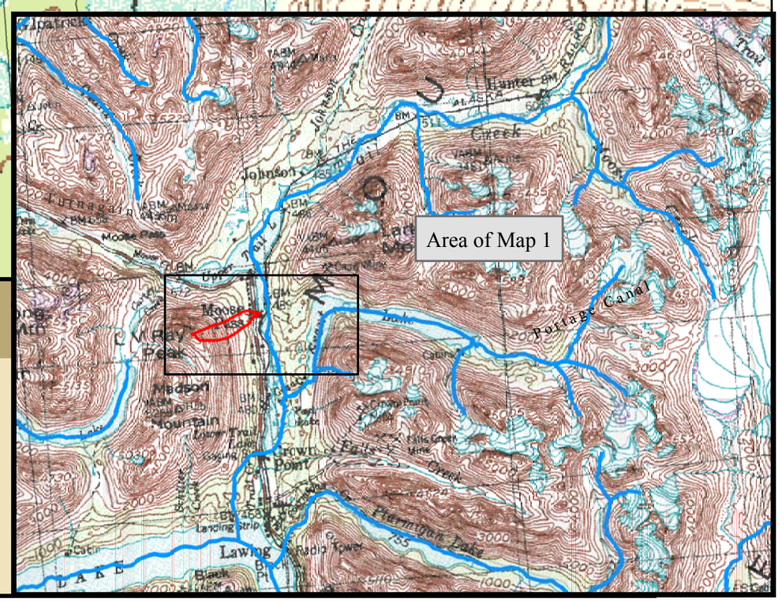
1:18,810

N W E S

Data Sources:
USGS- 1:63,000 and 250,000 background
Kenai Borough: Parcels
DOT:Roads
RDI: Railroad and rivers.

Legend

- Moos Pass School Well
- Zone A Protection Area
- Railroads
- Roads
- Rivers
- Lakes



APPENDIX B

Contaminant Source Inventory and Risk Ranking for KPBSD Moose Pass School (Tables 1-7)

Table 1

Contaminant Source Inventory for
KPBSD Moose Pass School

PWSID 240561.001

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	2	
Logging	E02	E02	A	2	
Asphalt and tar processing/storage	I03	I03	A	2	Mile 29 Seward Highway
Septic systems (serves one single-family home)	R02	R02-1	A	2	
Septic systems (serves one single-family home)	R02	R02-2	A	2	
Septic systems (serves one single-family home)	R02	R02-3	A	2	Location obtained from Sanitary Survey
Tanks, heating oil, residential (above ground)	R08	R08	A	2	
Tanks, heating oil, residential (above ground)	R08	R08	A	2	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-01	A	2	
Highways and roads, paved (cement or asphalt)	X20	X20-1	A	2	
Highways and roads, paved (cement or asphalt)	X20	X20-2	A	2	
Highways and roads, paved (cement or asphalt)	X20	X20-3	A	2	

Table 2

Contaminant Source Inventory and Risk Ranking for KPBSD Moose Pass School Sources of Bacteria and Viruses

PWSID 240561.001

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	2	
Septic systems (serves one single-family home)	R02	R02-1	A	Low	2	
Septic systems (serves one single-family home)	R02	R02-2	A	Low	2	
Septic systems (serves one single-family home)	R02	R02-3	A	Low	2	Location obtained from Sanitary Survey
Highways and roads, paved (cement or asphalt)	X20	X20-1	A	Low	2	
Highways and roads, paved (cement or asphalt)	X20	X20-2	A	Low	2	
Highways and roads, paved (cement or asphalt)	X20	X20-3	A	Low	2	

Table 3

Contaminant Source Inventory and Risk Ranking for KPBSD Moose Pass School Sources of Nitrates/Nitrites

PWSID 240561.001

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	2	
Logging	E02	E02	A	Low	2	
Septic systems (serves one single-family home)	R02	R02-1	A	Low	2	
Septic systems (serves one single-family home)	R02	R02-2	A	Low	2	
Septic systems (serves one single-family home)	R02	R02-3	A	Low	2	Location obtained from Sanitary Survey
Highways and roads, paved (cement or asphalt)	X20	X20-1	A	Low	2	
Highways and roads, paved (cement or asphalt)	X20	X20-2	A	Low	2	
Highways and roads, paved (cement or asphalt)	X20	X20-3	A	Low	2	

Table 4

Contaminant Source Inventory and Risk Ranking for KPBSD Moose Pass School Sources of Volatile Organic Chemicals

PWSID 240561.001

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	2	
Logging	E02	E02	A	Low	2	
Asphalt and tar processing/storage	I03	I03	A	Medium	2	Mile 29 Seward Highway
Septic systems (serves one single-family home)	R02	R02-1	A	Low	2	
Septic systems (serves one single-family home)	R02	R02-2	A	Low	2	
Septic systems (serves one single-family home)	R02	R02-3	A	Low	2	Location obtained from Sanitary Survey
Tanks, heating oil, residential (above ground)	R08	R08	A	Medium	2	
Tanks, heating oil, residential (above ground)	R08	R08	A	Medium	2	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-01	A	Low	2	
Highways and roads, paved (cement or asphalt)	X20	X20-1	A	Low	2	
Highways and roads, paved (cement or asphalt)	X20	X20-2	A	Low	2	
Highways and roads, paved (cement or asphalt)	X20	X20-3	A	Low	2	

Table 5

Contaminant Source Inventory and Risk Ranking for KPBSD Moose Pass School

Sources of Heavy Metals, Cyanide and Other Inorganic Chemicals

PWSID 240561.001

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	2	
Logging	E02	E02	A	Low	2	
Asphalt and tar processing/storage	I03	I03	A	Low	2	Mile 29 Seward Highway
Asphalt and tar processing/storage	I03	I03	A	Low	2	Mile 29 Seward Highway
Septic systems (serves one single-family home)	R02	R02-1	A	Low	2	
Septic systems (serves one single-family home)	R02	R02-2	A	Low	2	
Septic systems (serves one single-family home)	R02	R02-3	A	Low	2	Location obtained from Sanitary Survey
Tanks, heating oil, nonresidential (aboveground)	T14	T14-01	A	Low	2	
Highways and roads, paved (cement or asphalt)	X20	X20-1	A	Low	2	
Highways and roads, paved (cement or asphalt)	X20	X20-2	A	Low	2	
Highways and roads, paved (cement or asphalt)	X20	X20-3	A	Low	2	

Table 6

Contaminant Source Inventory and Risk Ranking for KPBSD Moose Pass School Sources of Synthetic Organic Chemicals

PWSID 240561.001

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	2	
Septic systems (serves one single-family home)	R02	R02-1	A	Low	2	
Septic systems (serves one single-family home)	R02	R02-2	A	Low	2	
Septic systems (serves one single-family home)	R02	R02-3	A	Low	2	Location obtained from Sanitary Survey

Table 7

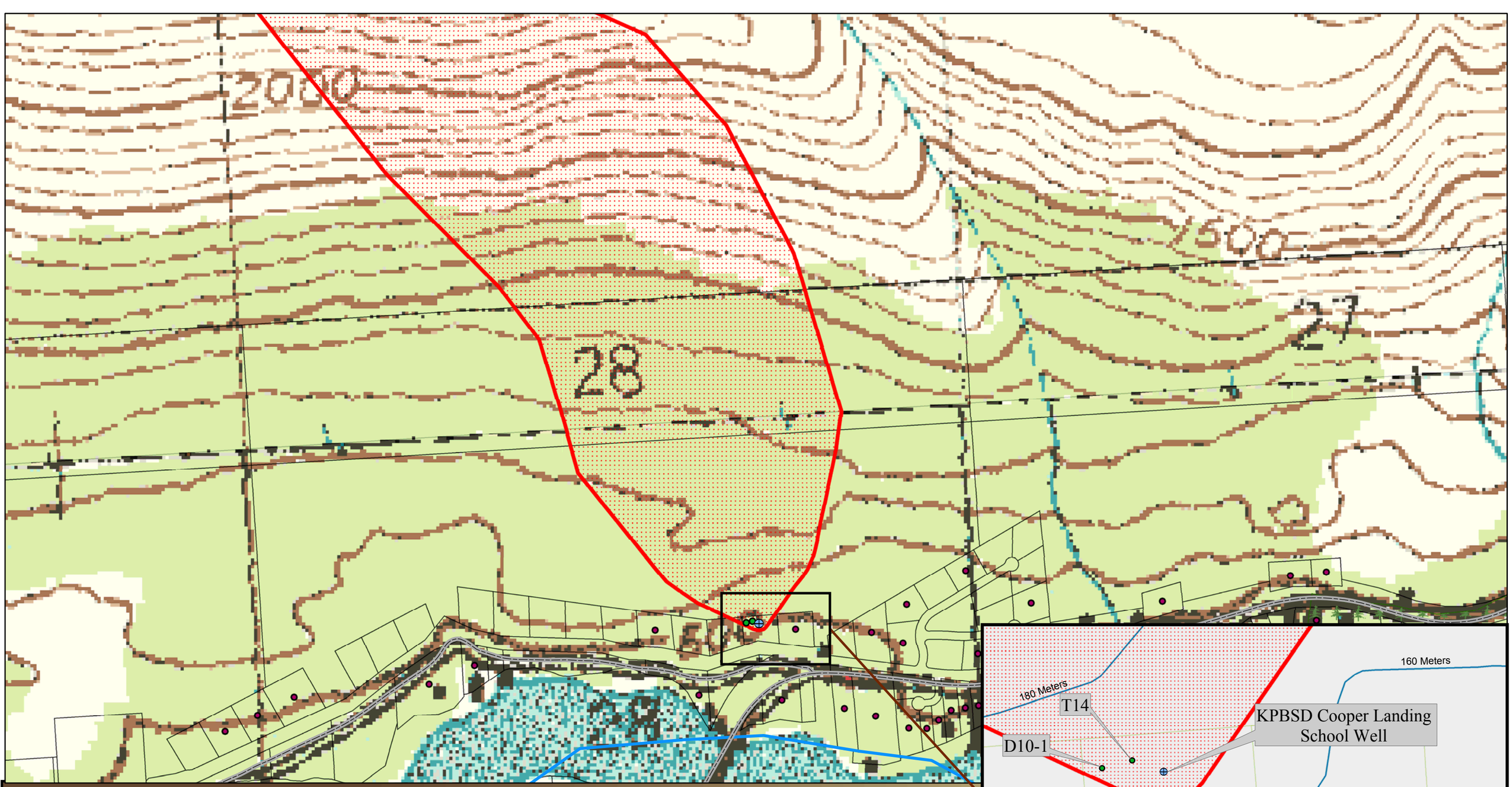
Contaminant Source Inventory and Risk Ranking for KPBSD Moose Pass School Sources of Other Organic Chemicals

PWSID 240561.001

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	2	
Asphalt and tar processing/storage	I03	I03	A	High	2	Mile 29 Seward Highway
Septic systems (serves one single-family home)	R02	R02-1	A	Low	2	
Septic systems (serves one single-family home)	R02	R02-2	A	Low	2	
Septic systems (serves one single-family home)	R02	R02-3	A	Low	2	Location obtained from Sanitary Survey
Highways and roads, paved (cement or asphalt)	X20	X20-1	A	Low	2	
Highways and roads, paved (cement or asphalt)	X20	X20-2	A	Low	2	
Highways and roads, paved (cement or asphalt)	X20	X20-3	A	Low	2	

APPENDIX C

KPBSD Moose Pass School
Drinking Water Protection Area
and Potential and Existing Contaminant Sources
(Map 2)



Map 2- KPBSD Cooper Landing School Potential and Existing Source of Contamination

Alaska Department of Environmental Conservation

Alaska Drinking Water Protection Program

0 333 666 1,332 Feet

1:7,865

Data Sources:
USGS- 1:63,000 Background
Kenai Borough: Parcels
URS Corp.: Septics
DOT:Roads
GDT: Railroad and rivers.

Legend

- KPBSD Cooper Landing School
- Zone A Protection Area
- Parcels
- Lakes
- Rivers
- Railroads
- Roads

APPENDIX D

Vulnerability Analysis for KPBSD Moose Pass School Public Drinking Water Source

(Charts 1-14)

Chart 1. Susceptibility of the wellhead - KPBSD- Moose Pass School

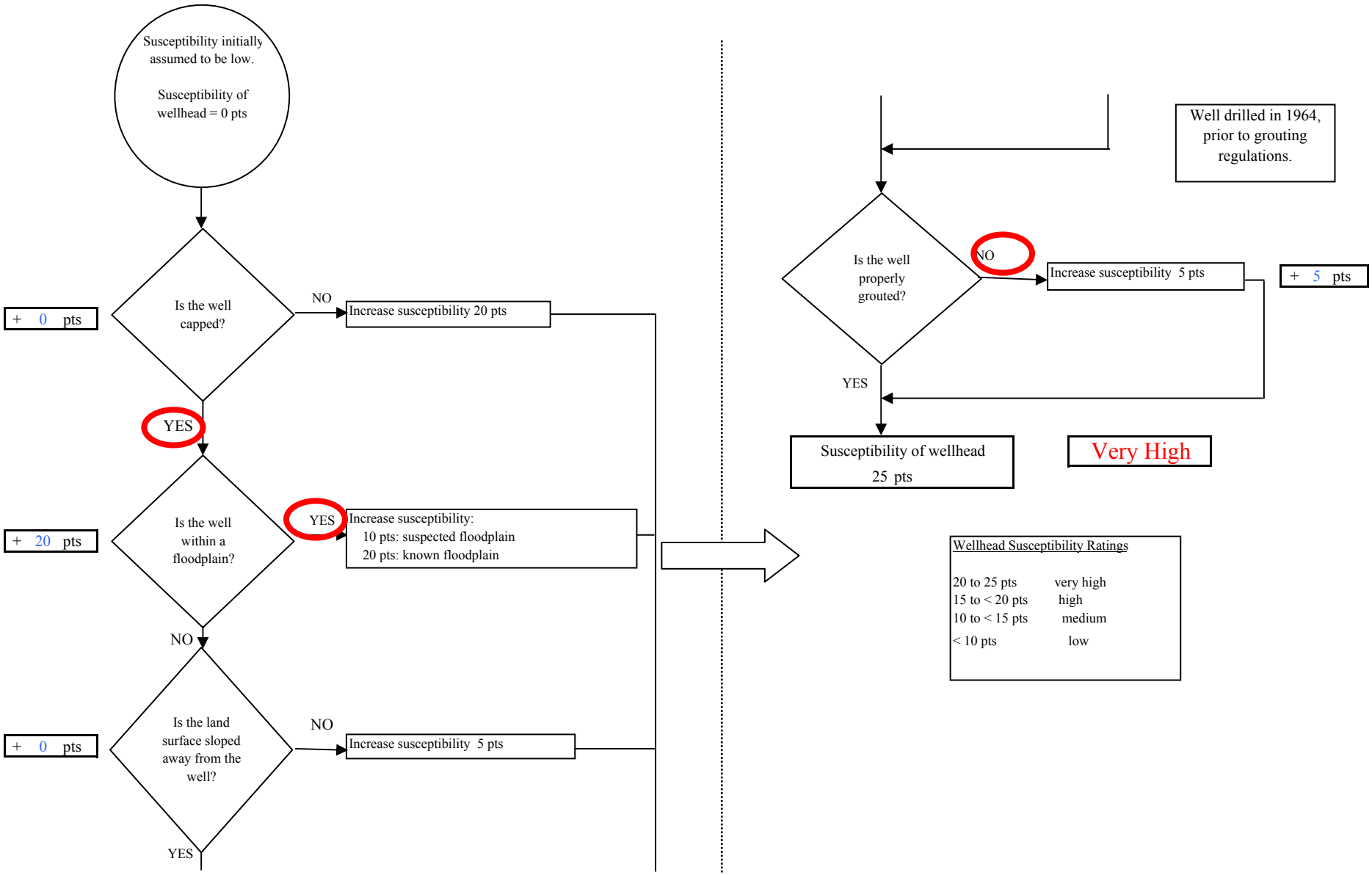


Chart 2. Susceptibility of the aquifer - KPBSD- Moose Pass School

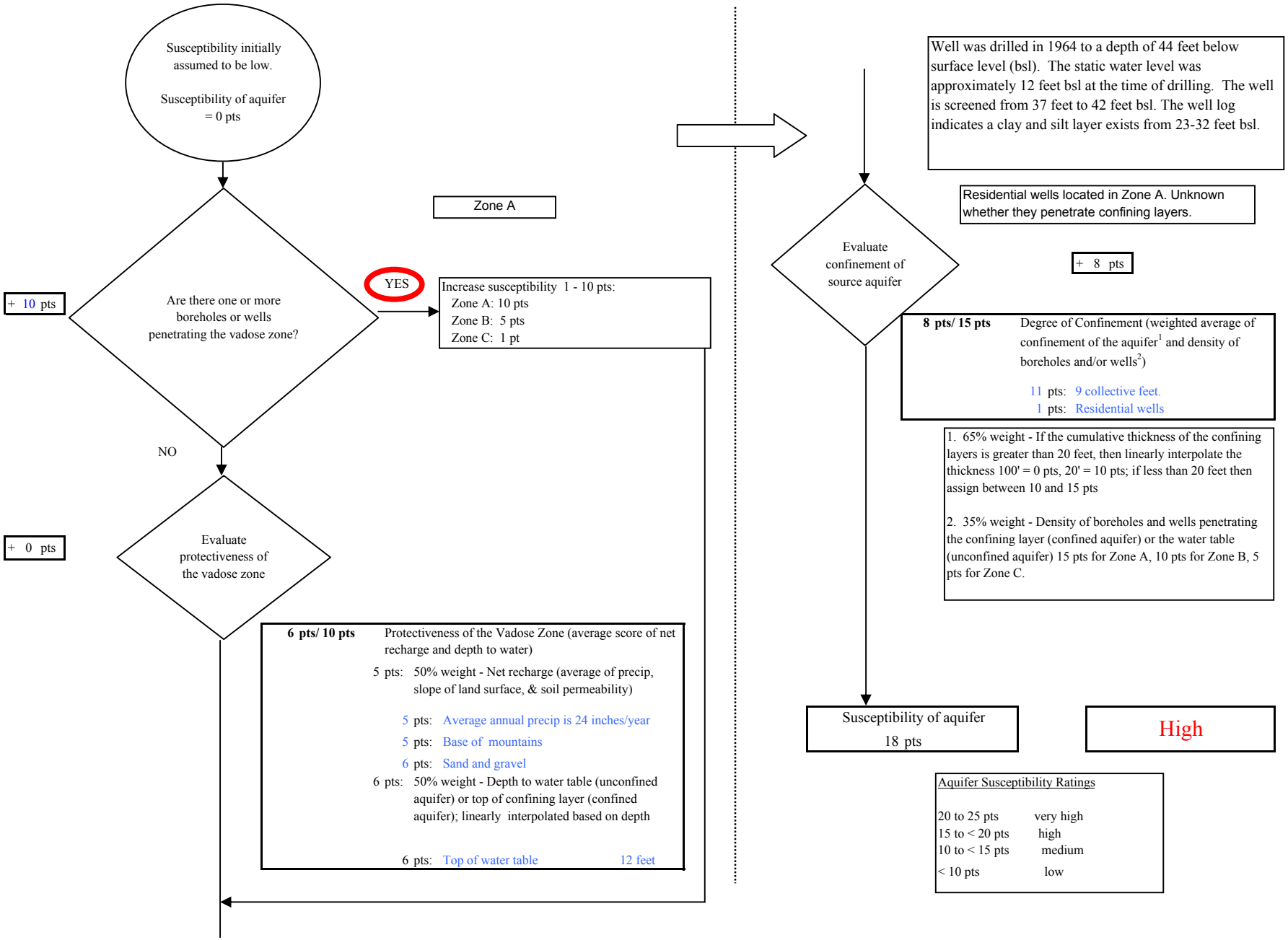
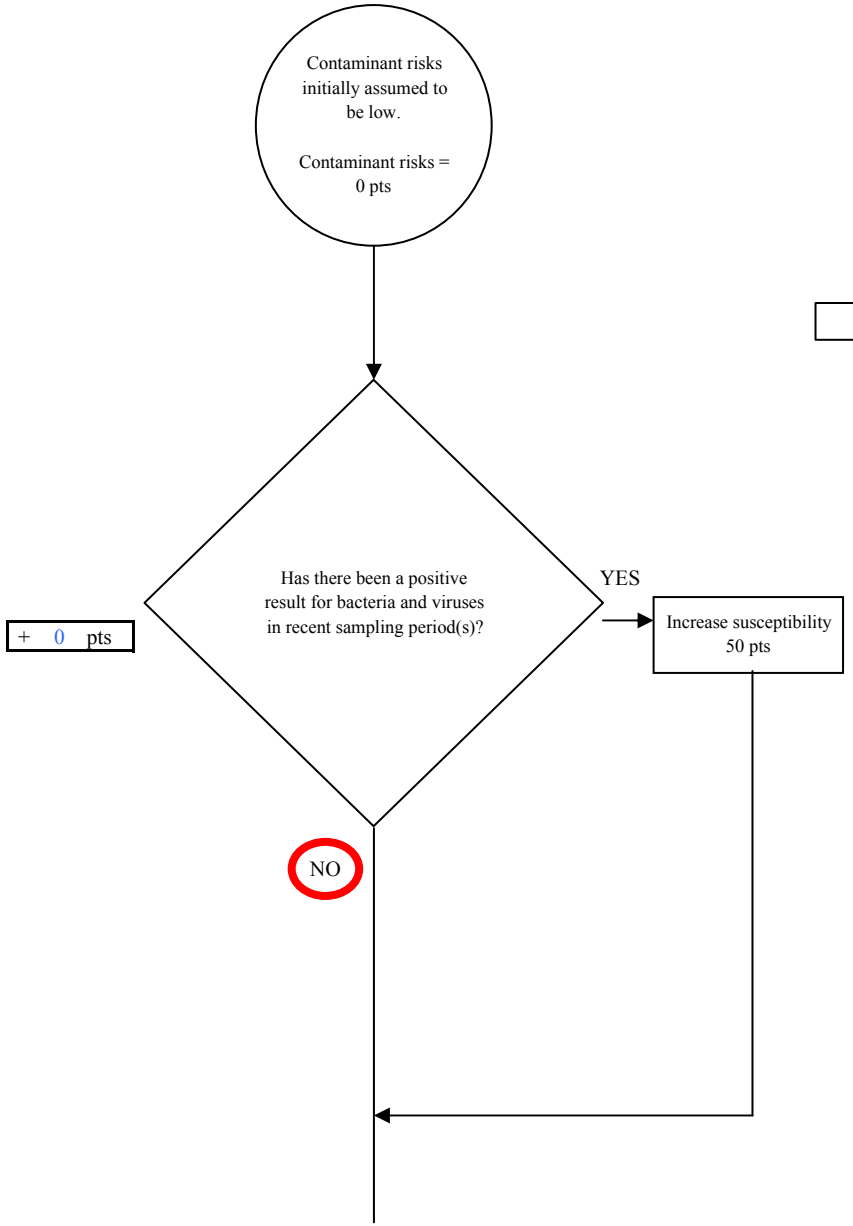
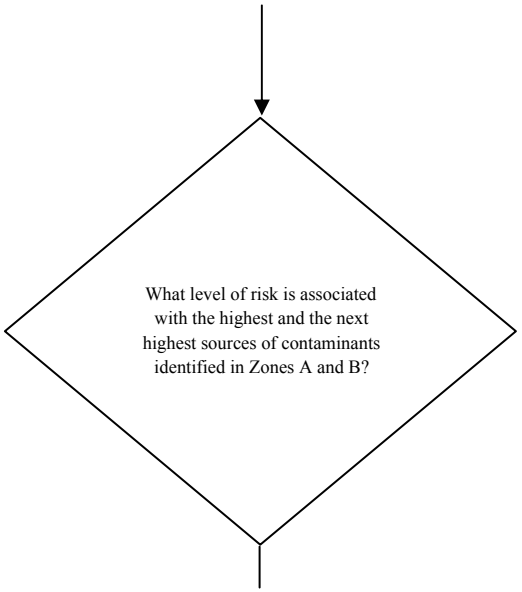


Chart 3. Contaminant risks for KPBSD- Moose Pass School - Bacteria & Viruses





+ 30 pts

Risk Rankings for Contaminant Sources Identified in Zones A and B

	Zone A	Zone B	Total
Very Highs(s)	0	0	0
High(s)	1	0	1
Medium(s)	0	0	0
Low(s)	4	0	4

	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 30

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 3. Contaminant risks for KPBSD- Moose Pass School - Bacteria & Viruses

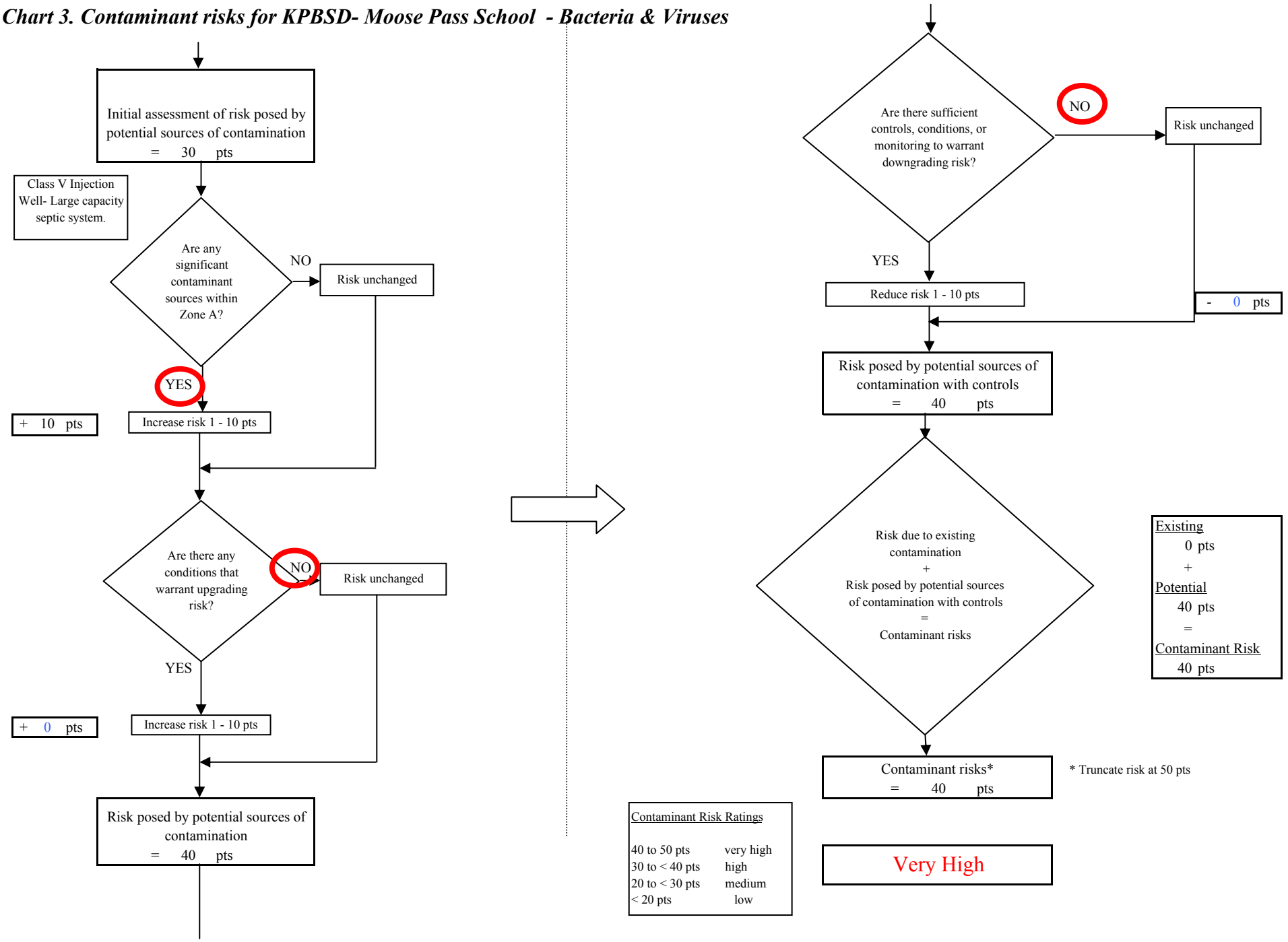


Chart 4. Vulnerability analysis for KPBSD- Moose Pass School - Bacteria & Viruses

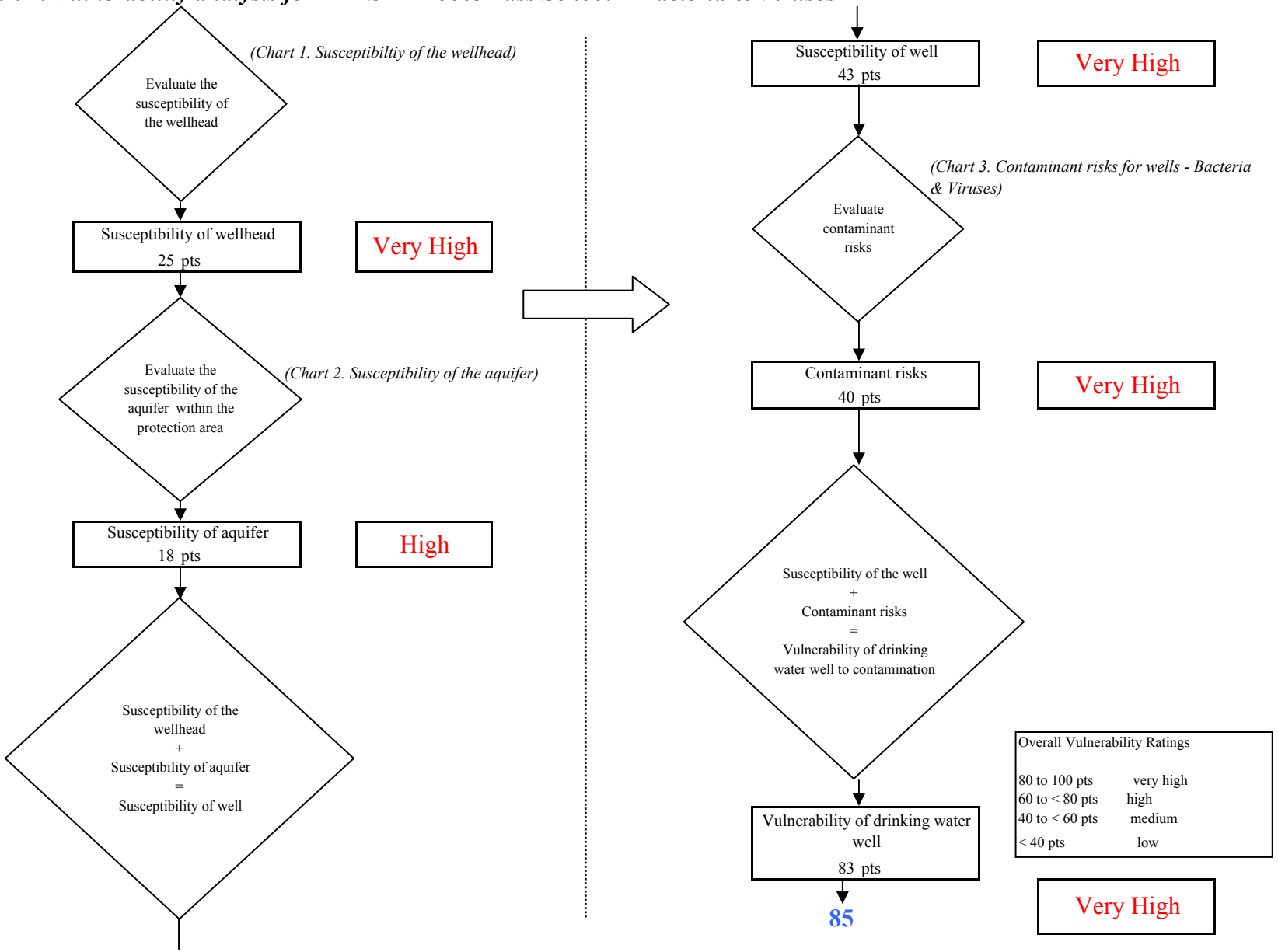


Chart 5. Contaminant risks for KPBSD- Moose Pass School - Nitrates and Nitrites

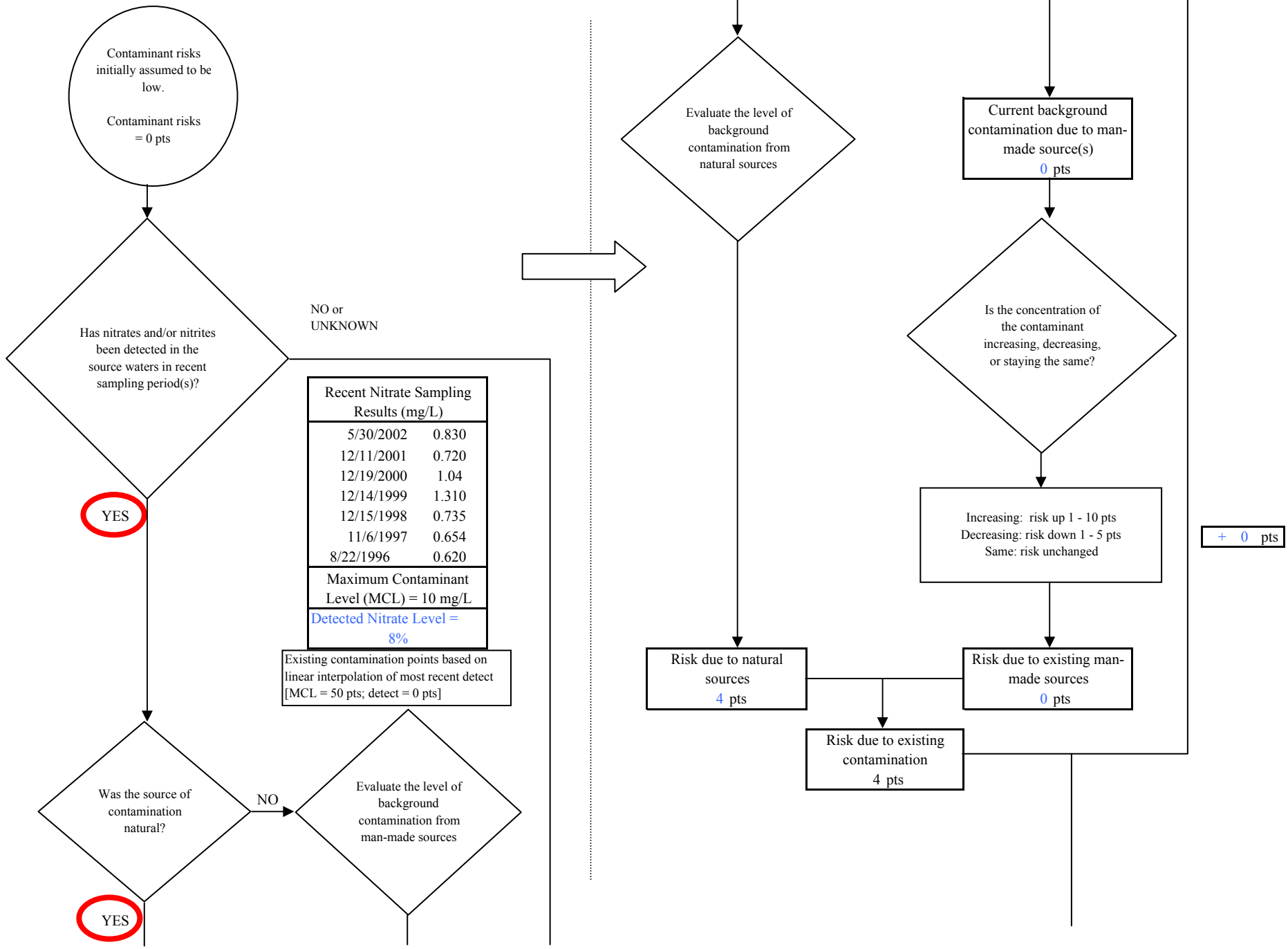


Chart 5. Contaminant risks for KPBSD- Moose Pass School - Nitrates and Nitrites

+ 30 pts

What level of risk is associated with the highest and the next highest risk sources(s) of contaminants identified in Zones A, B and C?

Risk Levels for Contaminant Sources identified in Zones A, B and C

	Zone A	Zones B&C	Total
Very Highs(s)	0	0	0
High(s)	1	0	1
Medium(s)	0	0	0
Low(s)	5	4	9

	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 30

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.

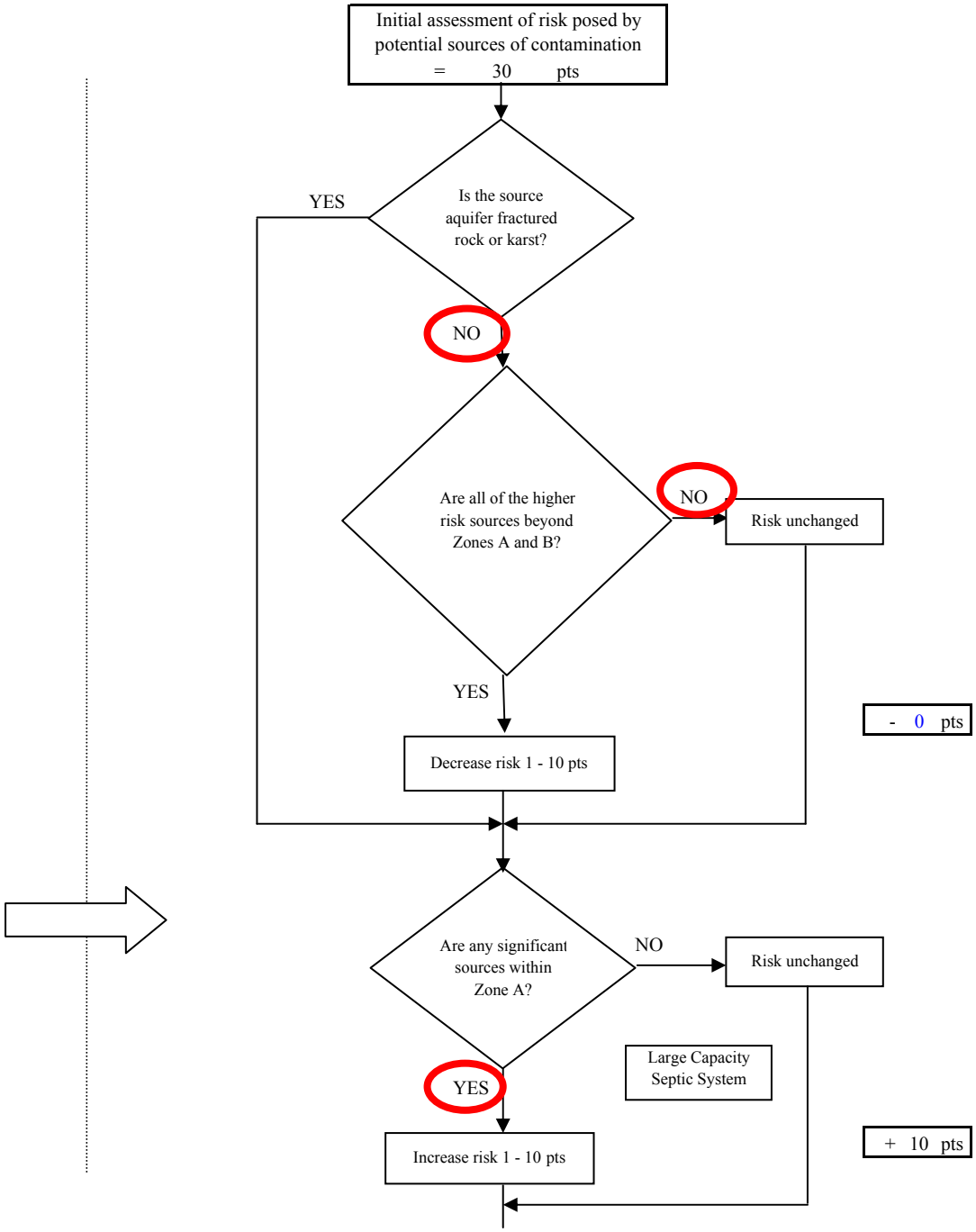
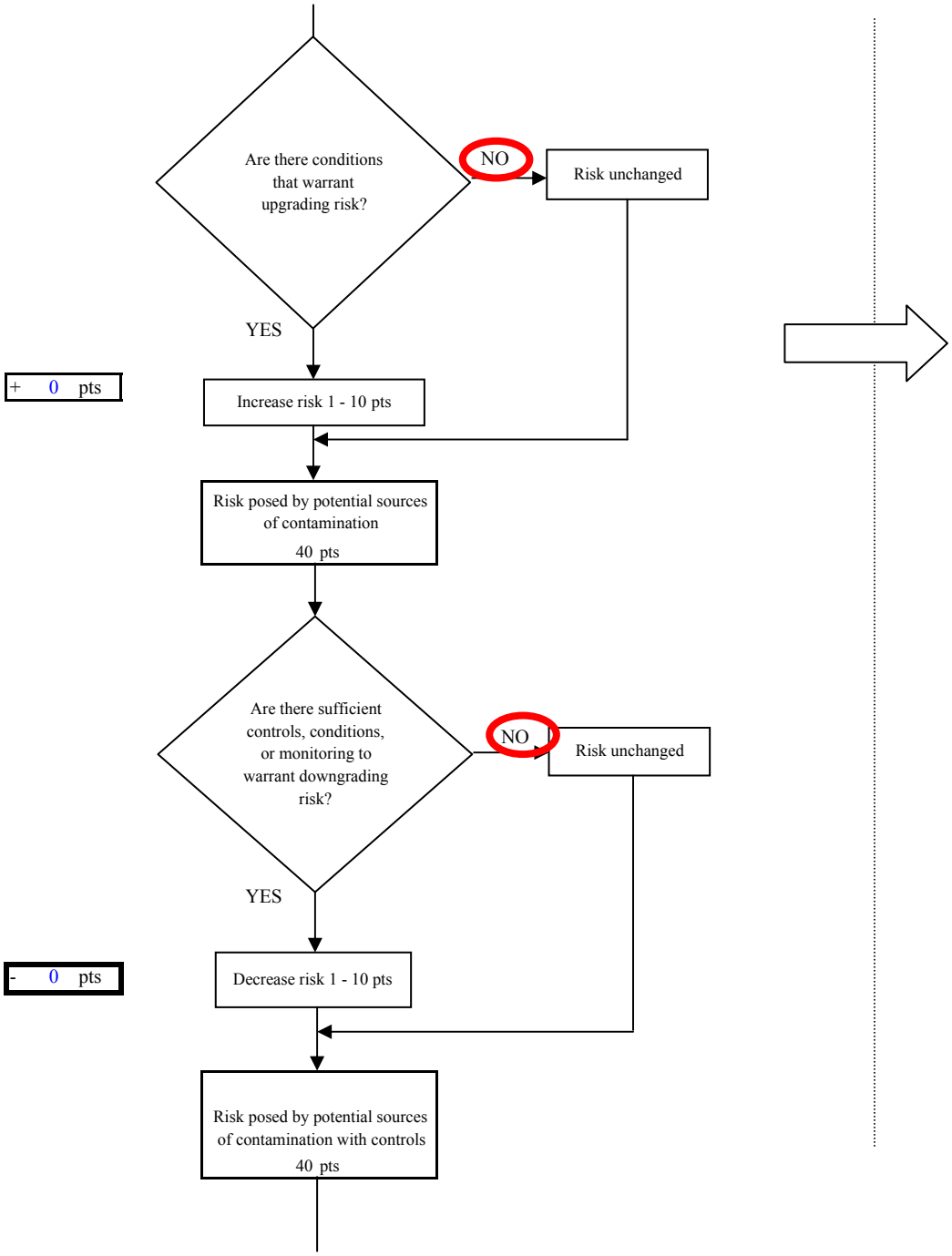
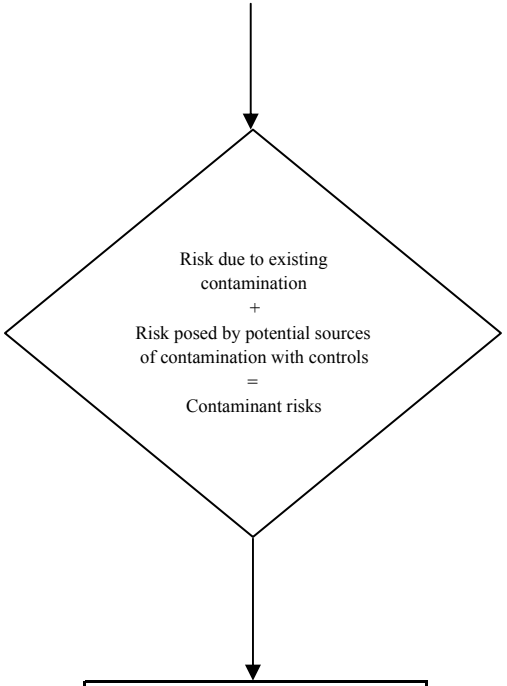


Chart 5. Contaminant risks for KPBSD- Moose Pass School - Nitrates and Nitrites





Existing
4 pts
+
Potential
40 pts
=
Contaminant Risk
44 pts

Contaminant risks*
= 44 pts

*Truncate risk at 50 pts

Very High

Contaminant Risk Ratings

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

Chart 6. Vulnerability analysis for KPBSD- Moose Pass School - Nitrates and Nitrites

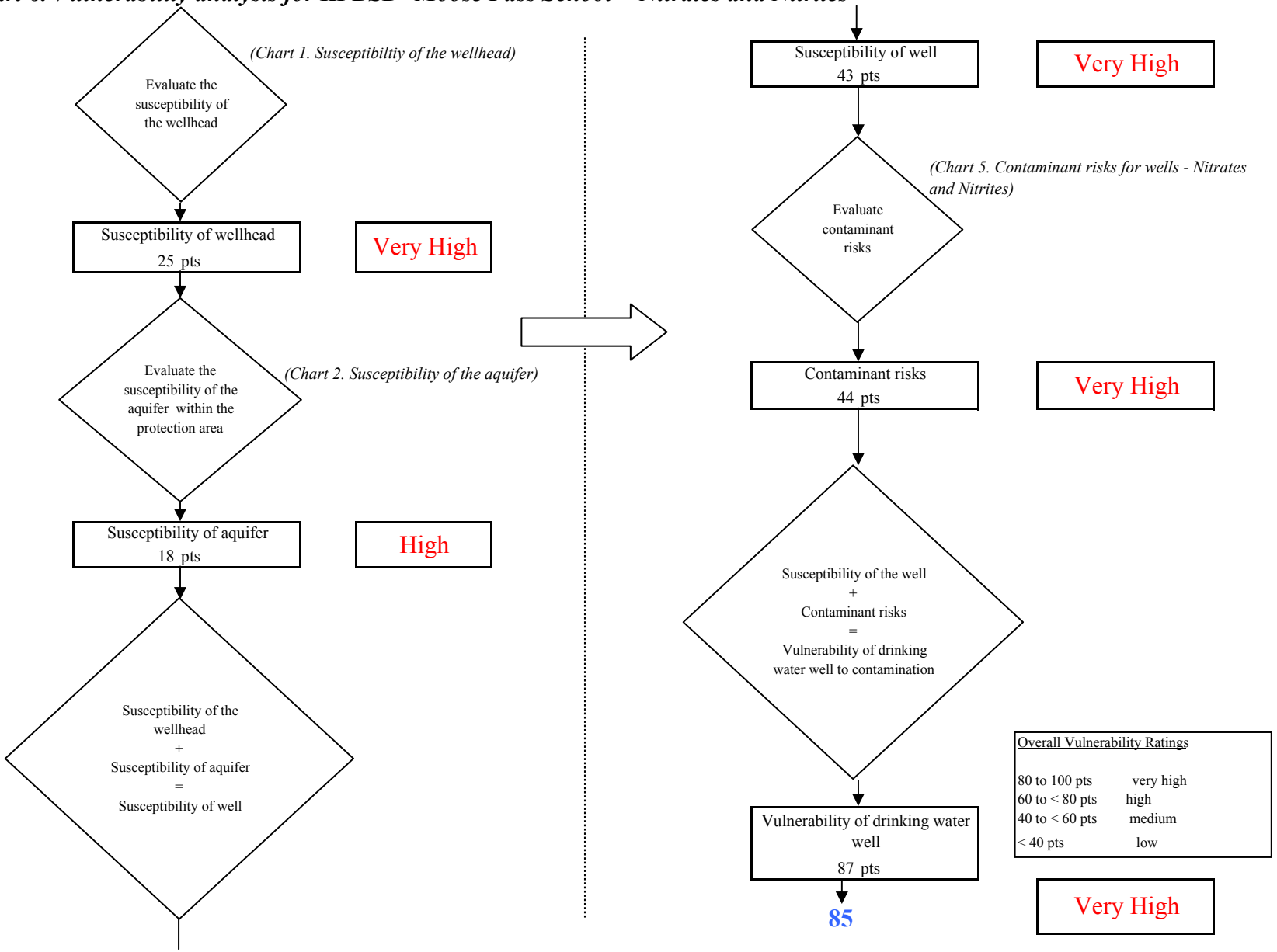


Chart 7. Contaminant risks for KPBSD- Moose Pass School - Volatile Organic Chemicals

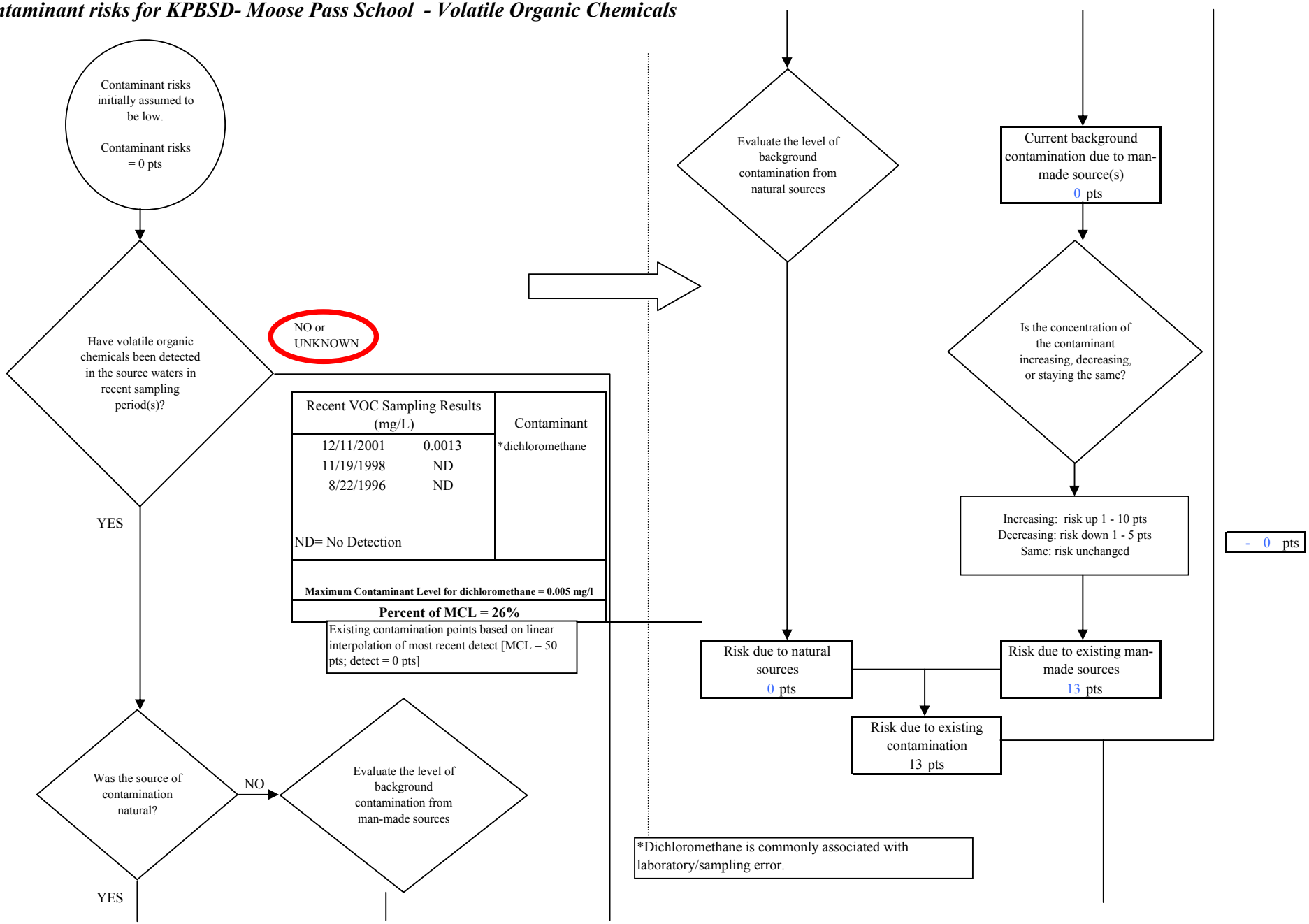


Chart 7. Contaminant risks for KPBSD- Moose Pass School - Volatile Organic Chemicals

+ 25 pts

What level of risk is associated with the highest and the next highest risk sources(s) of contaminants identified in Zones A, B and C?

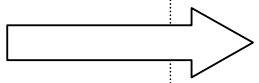
Risk Levels for Contaminant Sources identified in Zones A, B and C

	Zone A	Zones B&C	Total
Very Highs(s)	0	0	0
High(s)	0	0	0
Medium(s)	3	0	3
Low(s)	5	2	7

	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 25

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.



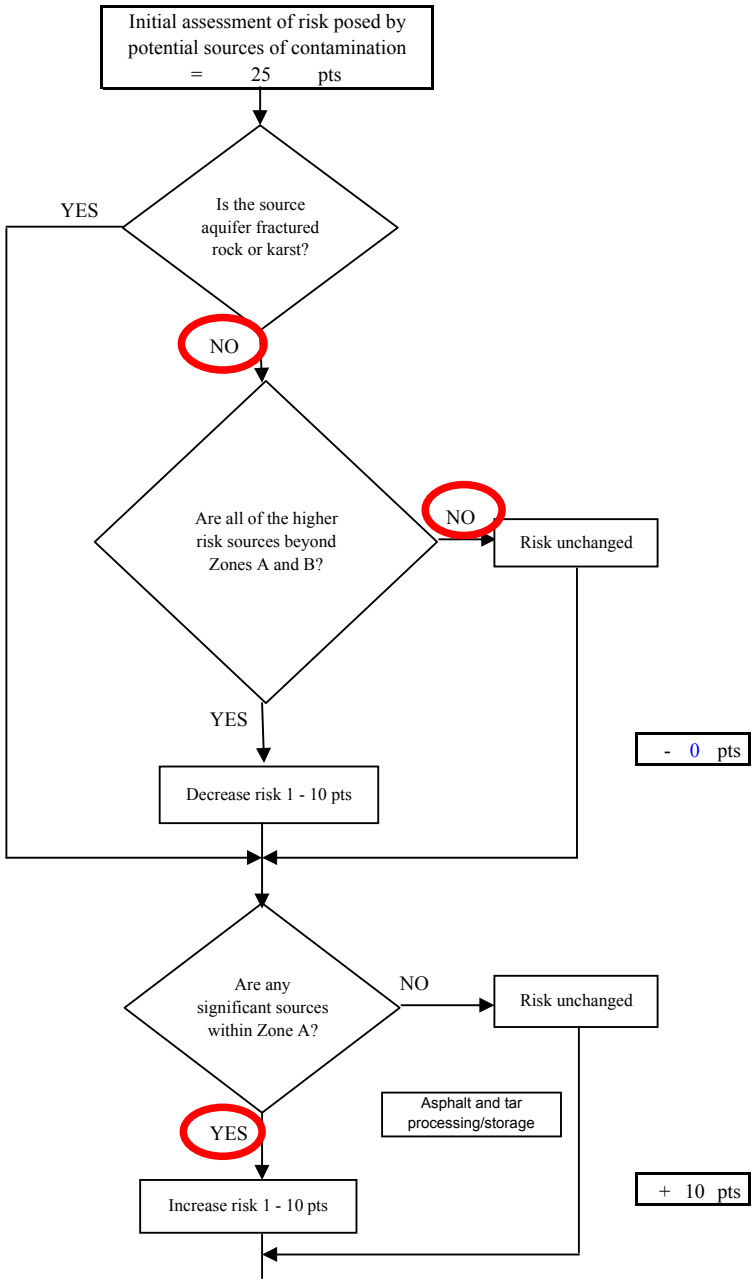


Chart 7. Contaminant risks for KPBSD- Moose Pass School - Volatile Organic Chemicals

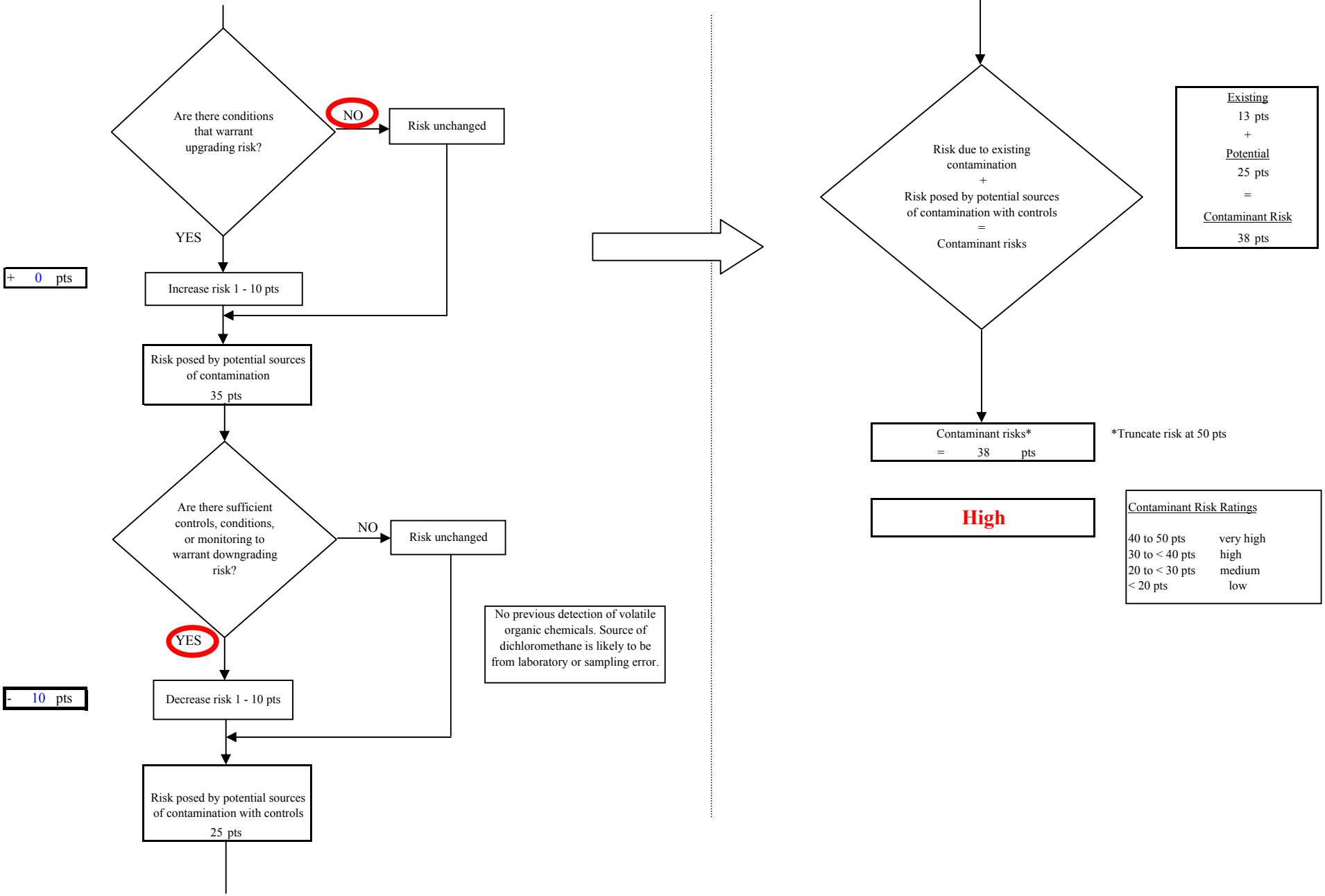


Chart 8. Vulnerability analysis for KPBSD- Moose Pass School - Volatile Organic Chemicals

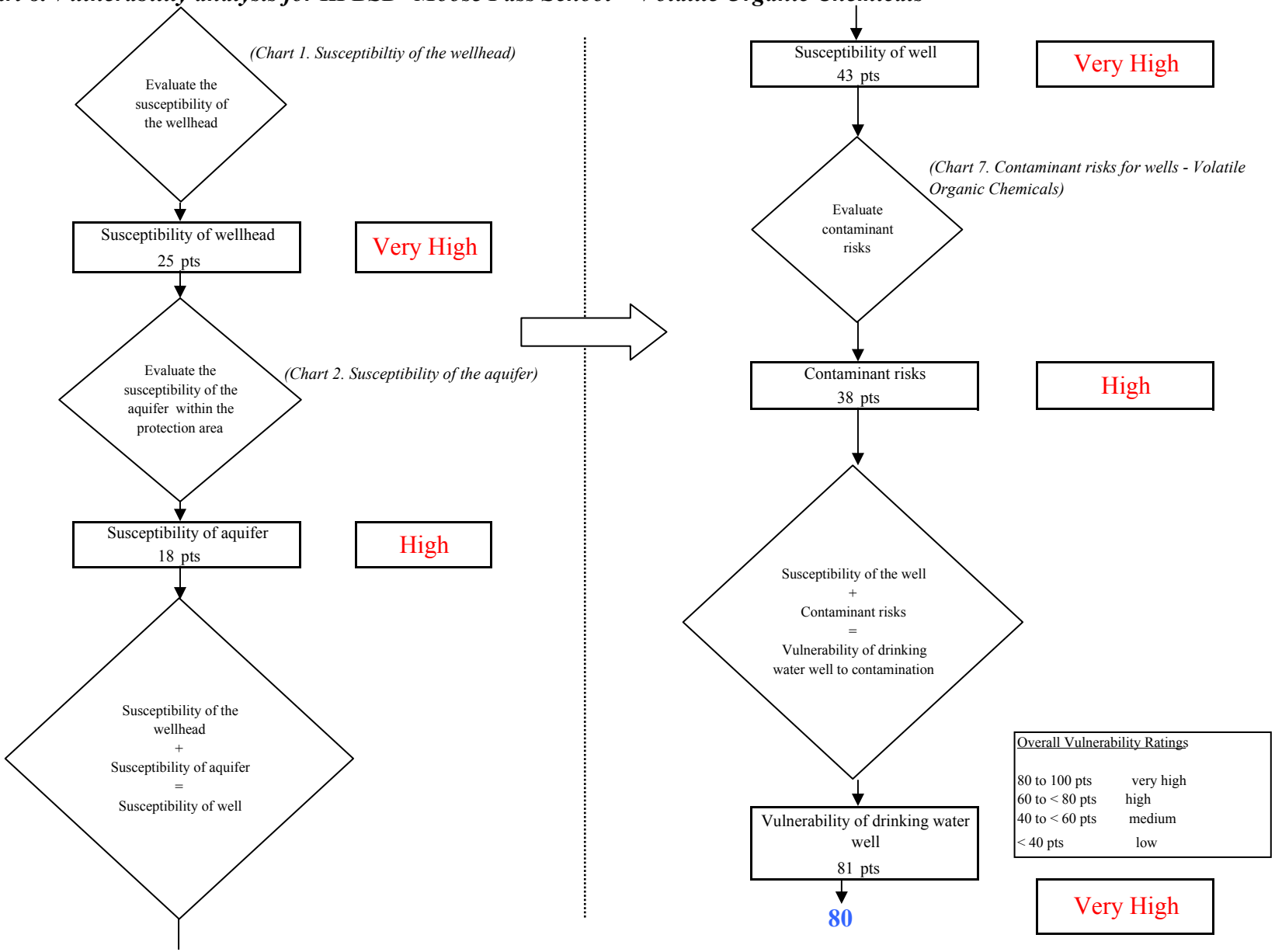


Chart 9. Contaminant risks for KPBSD- Moose Pass School - Heavy Metals, Cyanide and Other Inorganic Chemicals

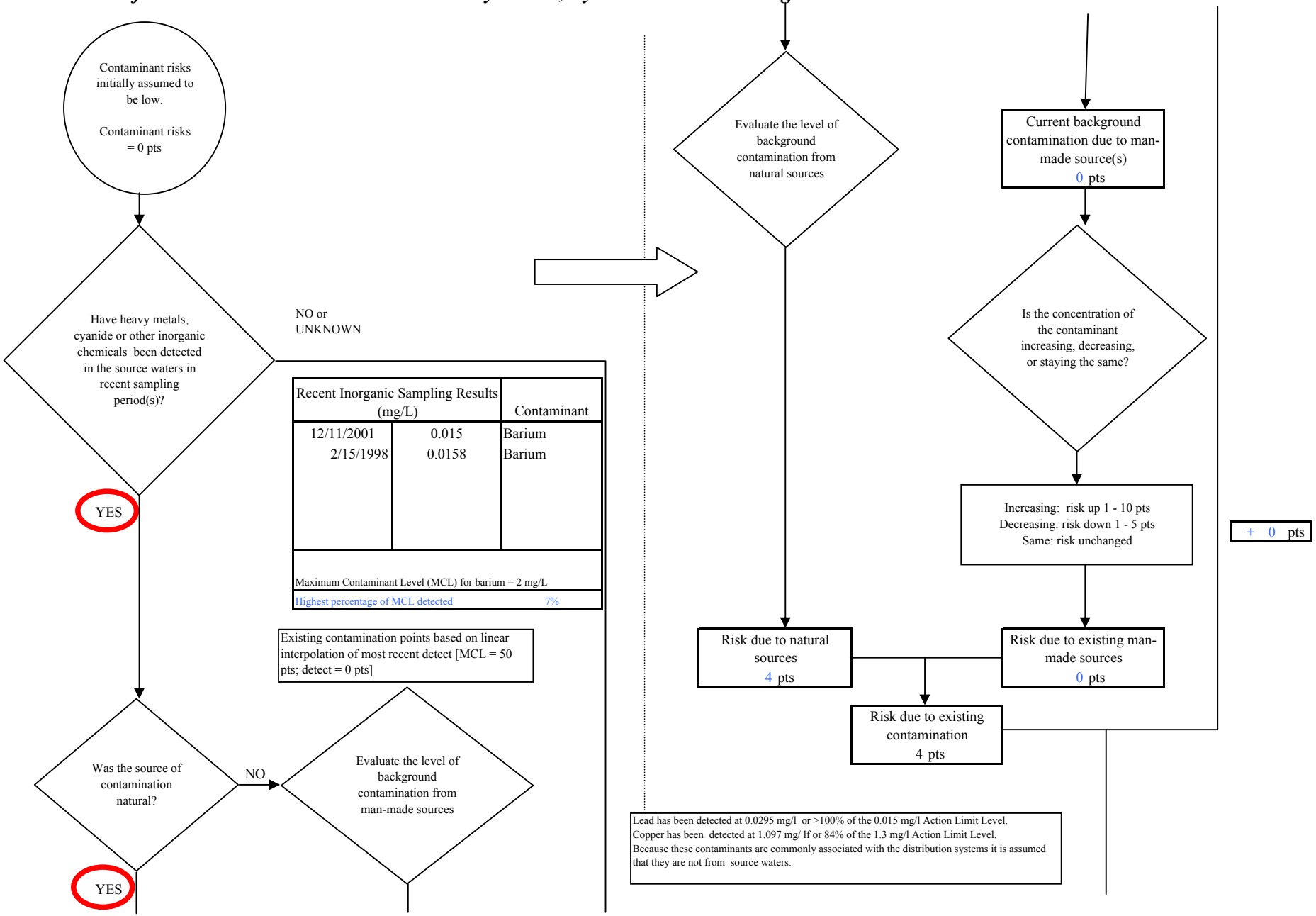


Chart 9. Contaminant risks for KPBSD- Moose Pass School - Heavy Metals, Cyanide and Other Inorganic Chemicals

+ 10 pts

What level of risk is associated with the highest and the next highest risk sources(s) of contaminants identified in Zones A, B and C?

Risk Levels for Contaminant Sources identified in Zones A, B and C			
	Zone A	Zones B&C	Total
Very Highs(s)	0	0	0
High(s)	0	0	0
Medium(s)	0	0	0
Low(s)	7	2	9

	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.

Initial assessment of risk posed by potential sources of contamination = 10 pts

Is the source aquifer fractured rock or karst?

YES

NO

Are all of the higher risk sources beyond Zones A and B?

NO → Risk unchanged

YES → Decrease risk 1 - 10 pts

- 0 pts

Are any significant sources within Zone A?

NO → Risk unchanged

Septics, residential areas and roads.

YES → Increase risk 1 - 10 pts

+ 2 pts

Chart 9. Contaminant risks for KPBSD- Moose Pass School - Heavy Metals, Cyanide and Other Inorganic Chemicals

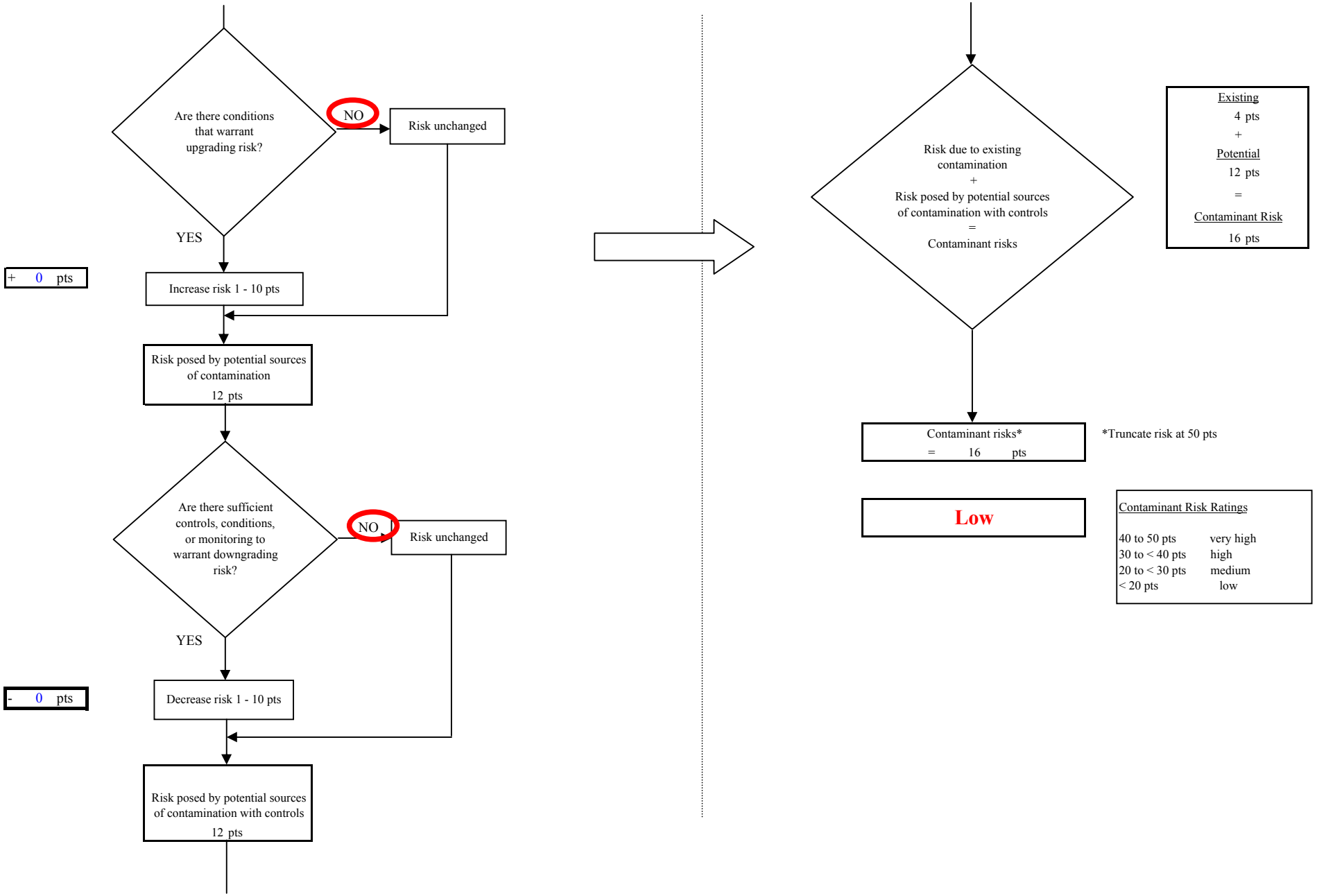


Chart 10. Vulnerability analysis for KPBSD- Moose Pass School - Heavy Metals, Cyanide and Other Inorganic Chemicals

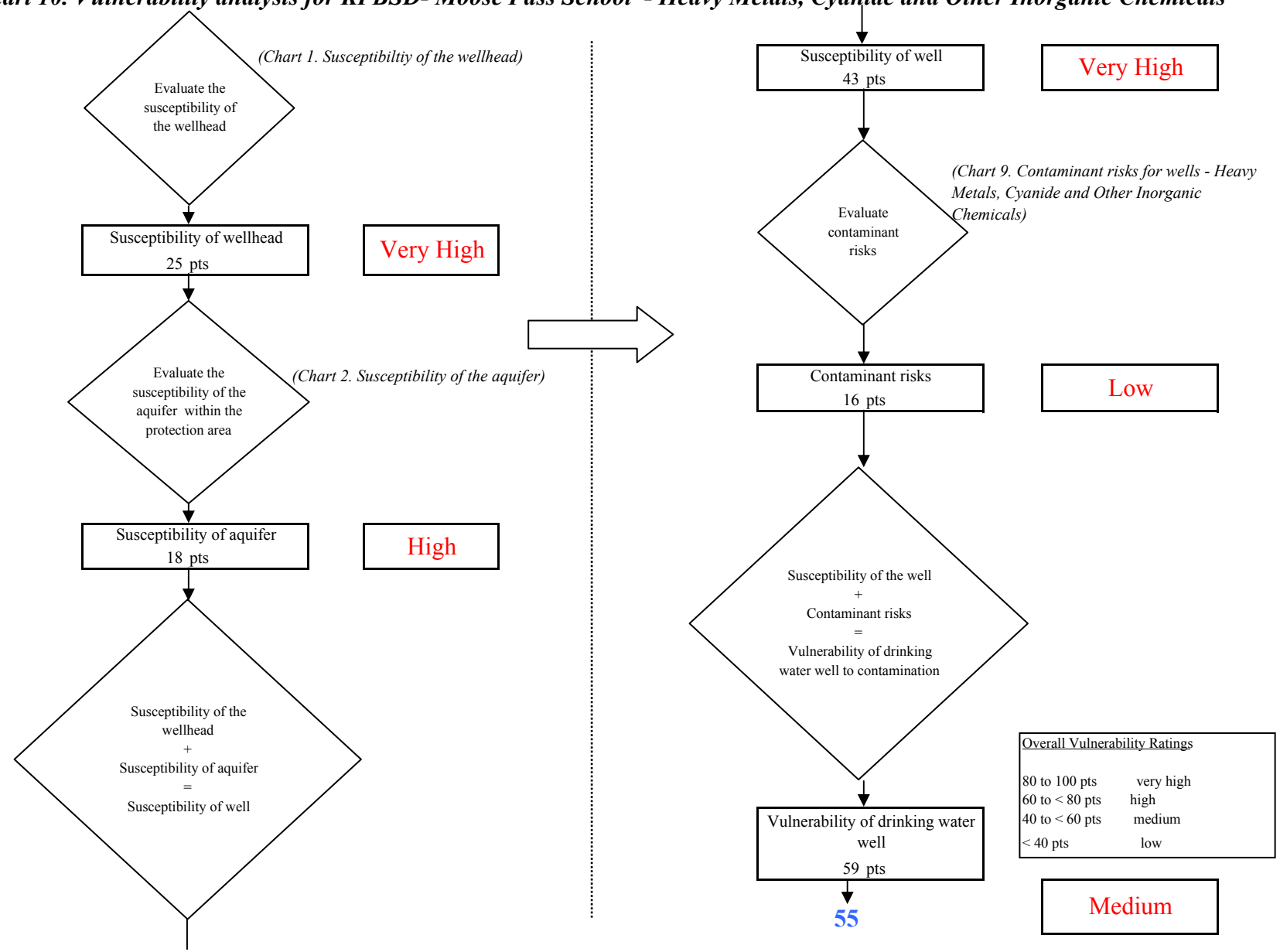


Chart 11. Contaminant risks for KPBSD- Moose Pass School - Synthetic Organic Chemicals

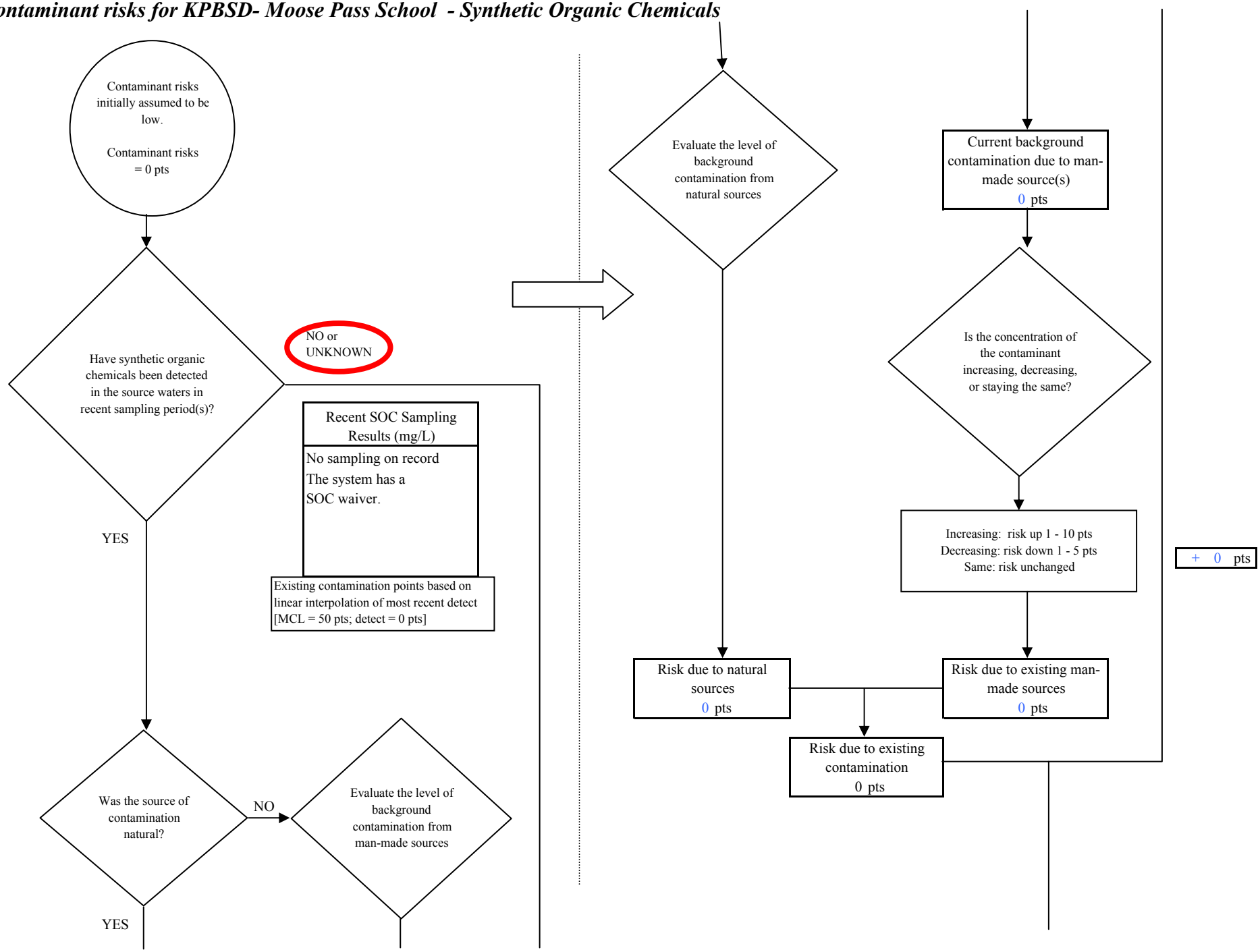
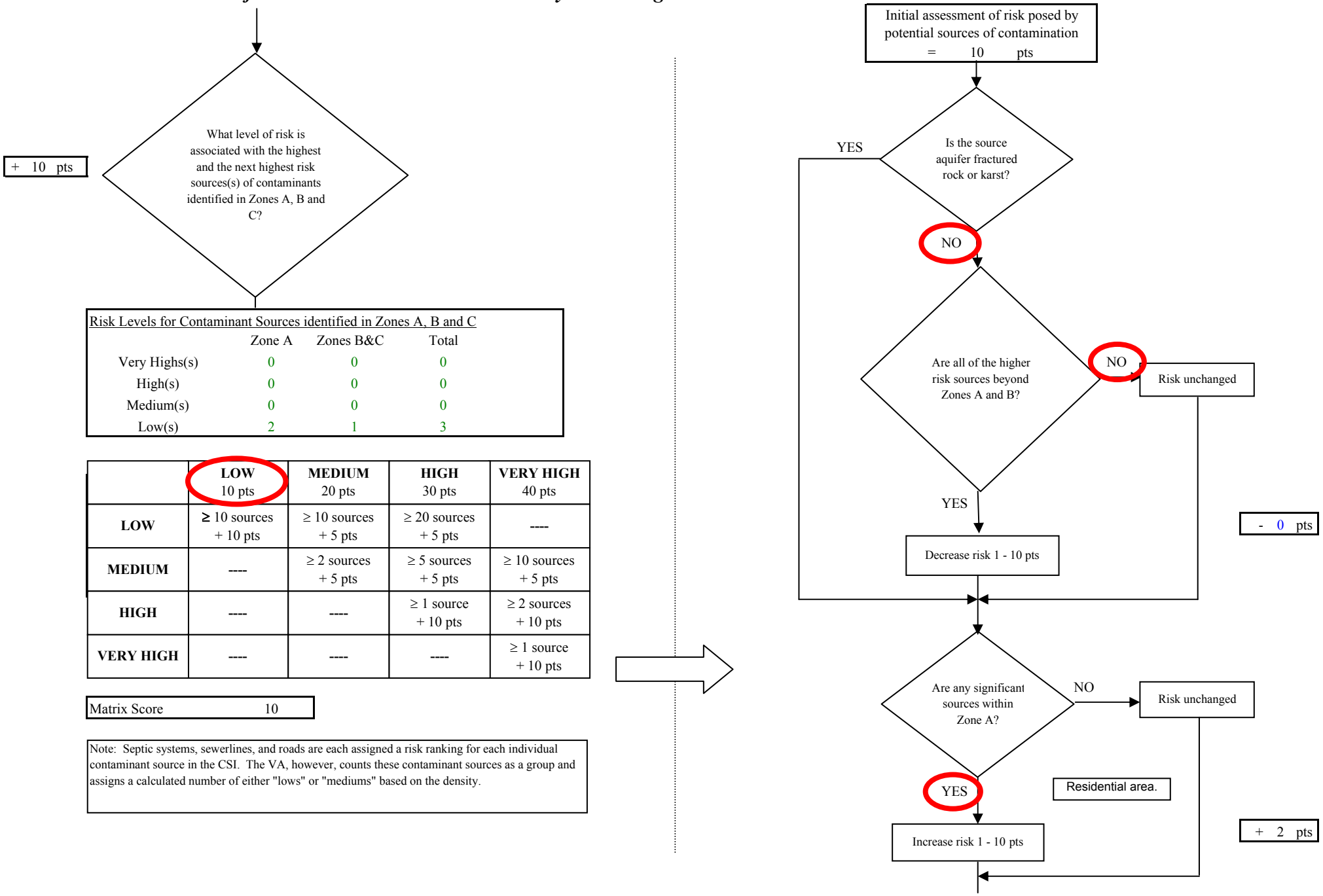


Chart 11. Contaminant risks for KPBSD- Moose Pass School - Synthetic Organic Chemicals



Risk Levels for Contaminant Sources identified in Zones A, B and C

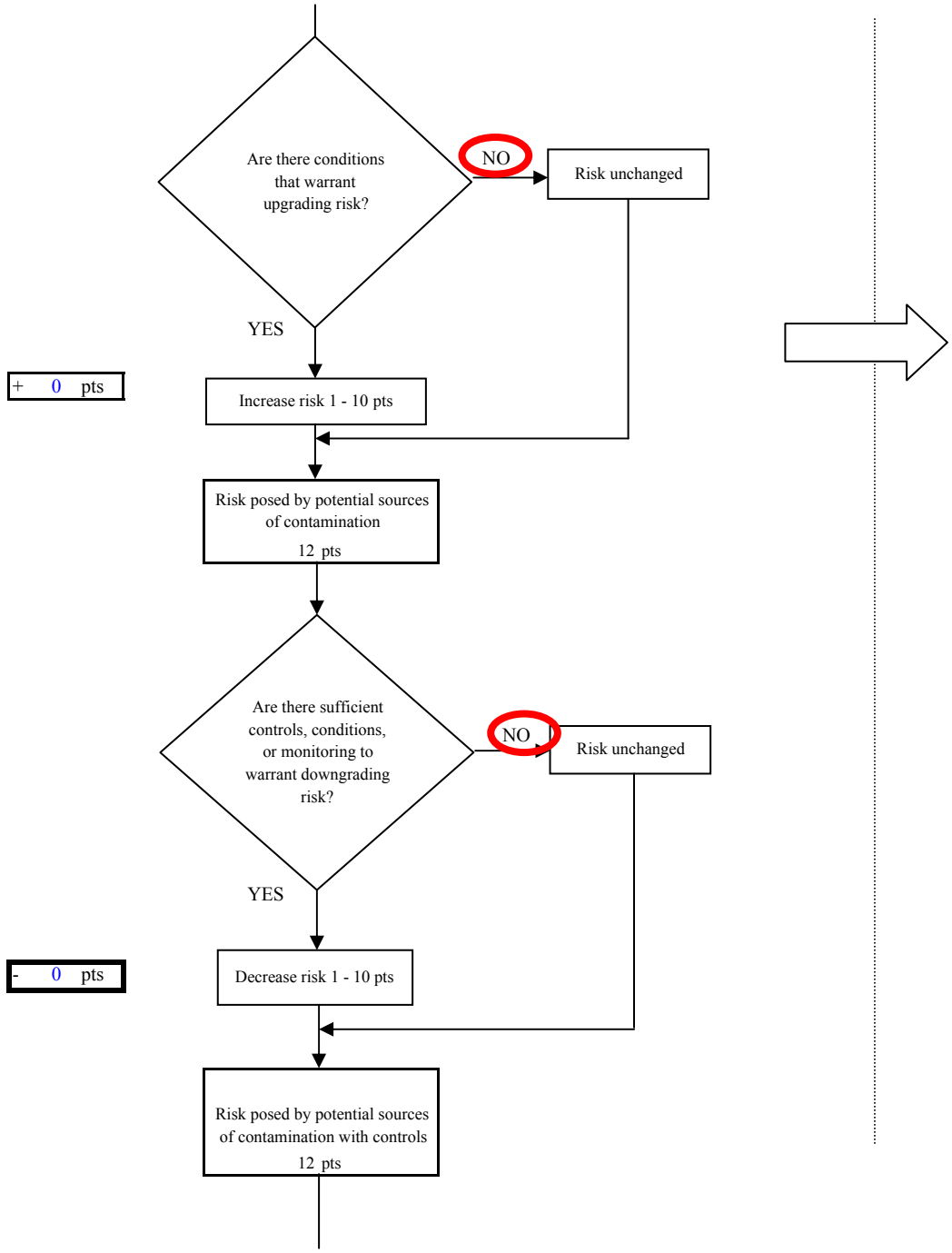
	Zone A	Zones B&C	Total
Very Highs(s)	0	0	0
High(s)	0	0	0
Medium(s)	0	0	0
Low(s)	2	1	3

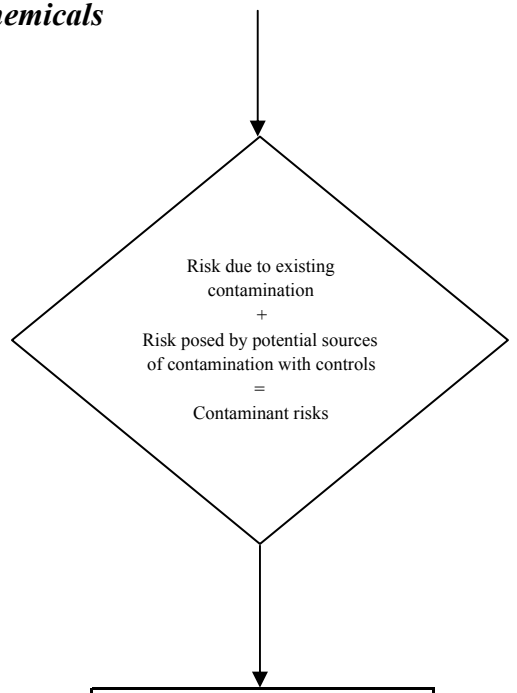
	LOW 10 pts	**MEDIUM** 20 pts	**HIGH** 30 pts	**VERY HIGH** 40 pts
LOW	≥ 10 sources + 10 pts	≥ 10 sources + 5 pts	≥ 20 sources + 5 pts	----
MEDIUM	----	≥ 2 sources + 5 pts	≥ 5 sources + 5 pts	≥ 10 sources + 5 pts
HIGH	----	----	≥ 1 source + 10 pts	≥ 2 sources + 10 pts
VERY HIGH	----	----	----	≥ 1 source + 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 11. Contaminant risks for KPBSD- Moose Pass School - Synthetic Organic Chemicals





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 12. Vulnerability analysis for KPBSD- Moose Pass School - Synthetic Organic Chemicals

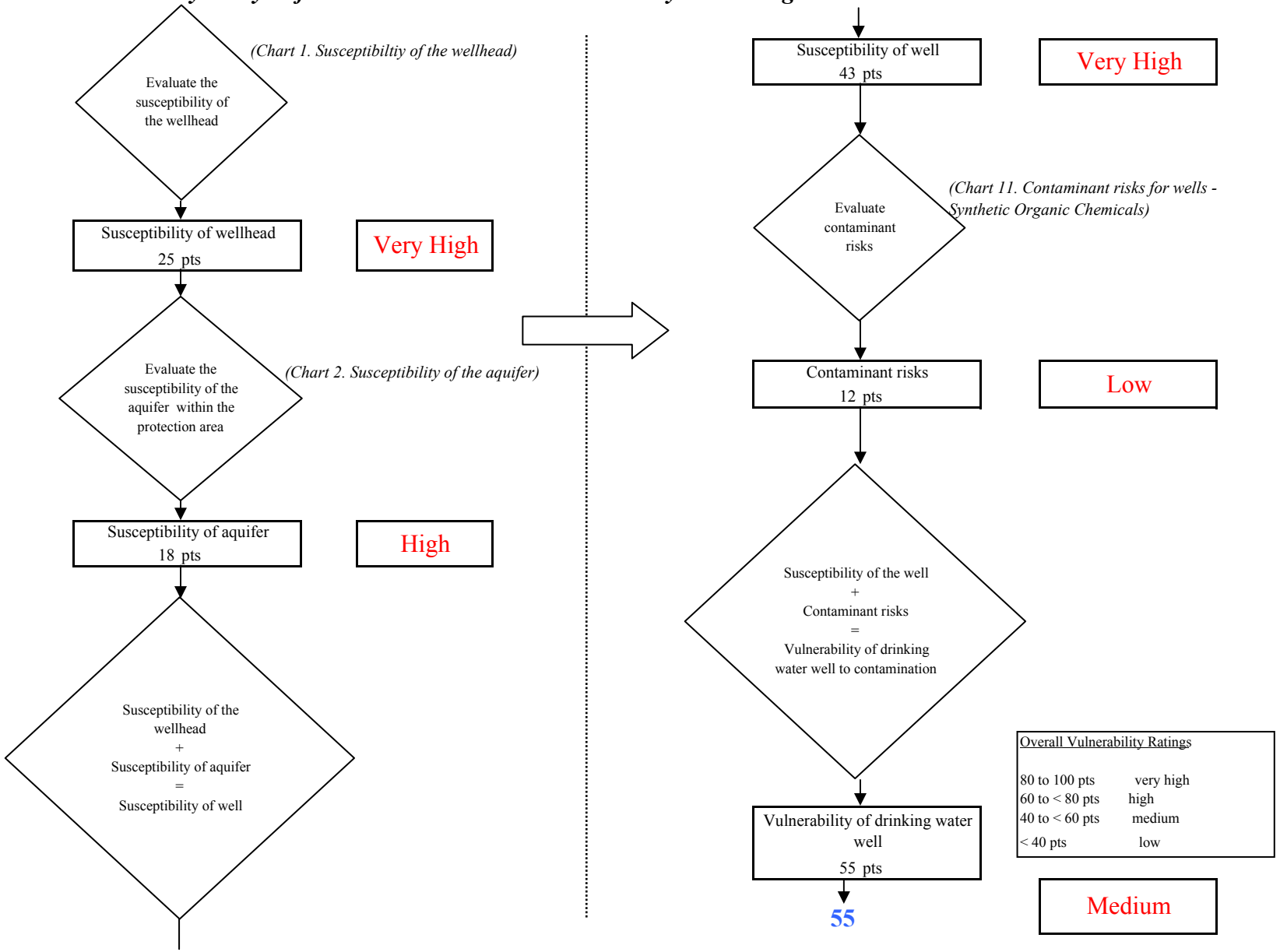


Chart 13. Contaminant risks for KPBSD- Moose Pass School - Other Organic Chemicals

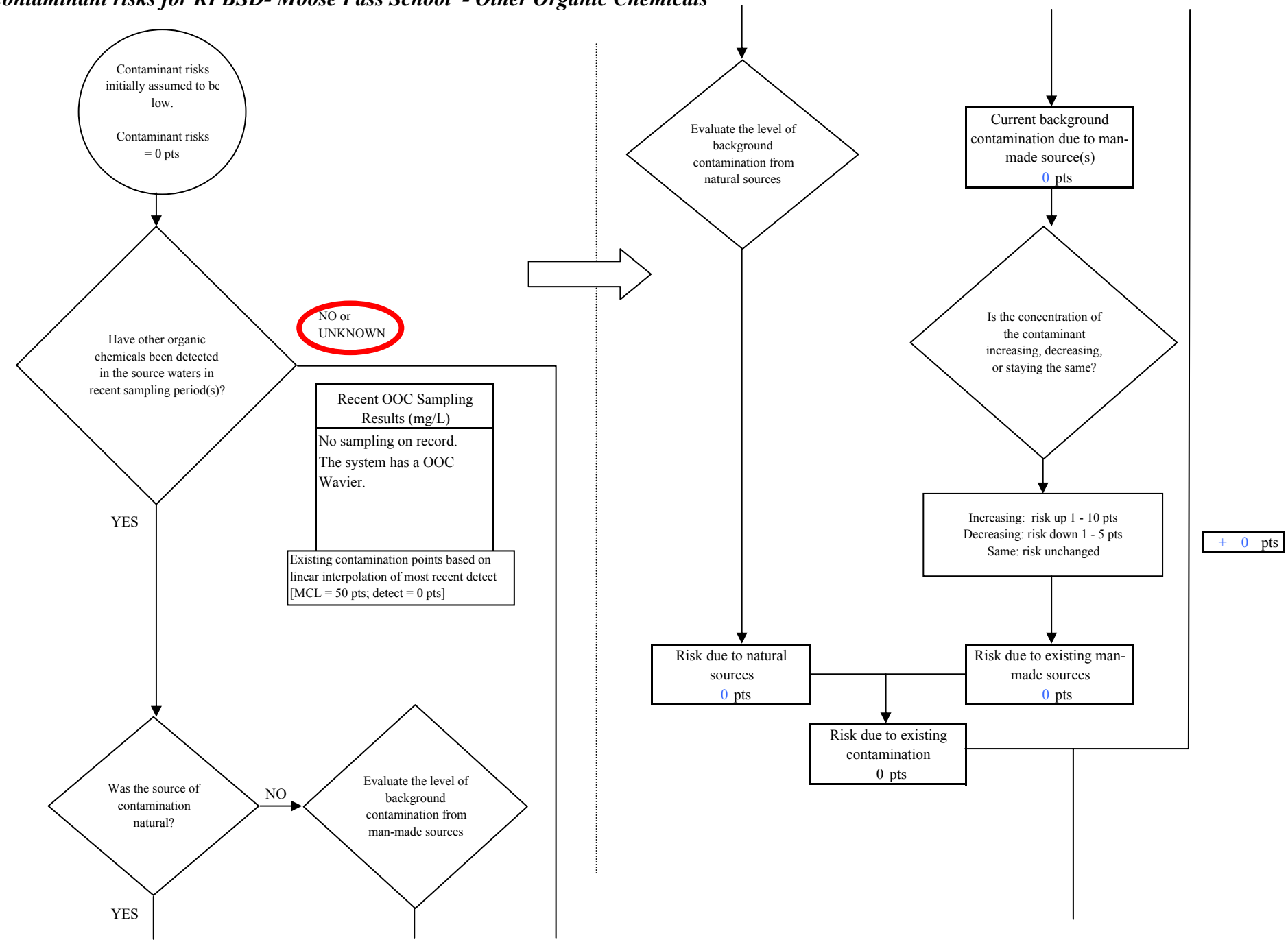


Chart 13. Contaminant risks for KPBSD- Moose Pass School - Other Organic Chemicals

+ 30 pts

What level of risk is associated with the highest and the next highest risk sources(s) of contaminants identified in Zones A, B and C?

Risk Levels for Contaminant Sources identified in Zones A, B and C

	Zone A	Zones B&C	Total
Very Highs(s)	0	0	0
High(s)	1	0	1
Medium(s)	0	0	0
Low(s)	3	2	5

	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 30

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 = 30 pts

Is the source aquifer fractured rock or karst?

YES

NO

Are all of the higher risk sources beyond Zones A and B?

NO

Risk unchanged

YES

Decrease risk 1 - 10 pts

- 0 pts

Are any significant sources within Zone A?

NO

Risk unchanged

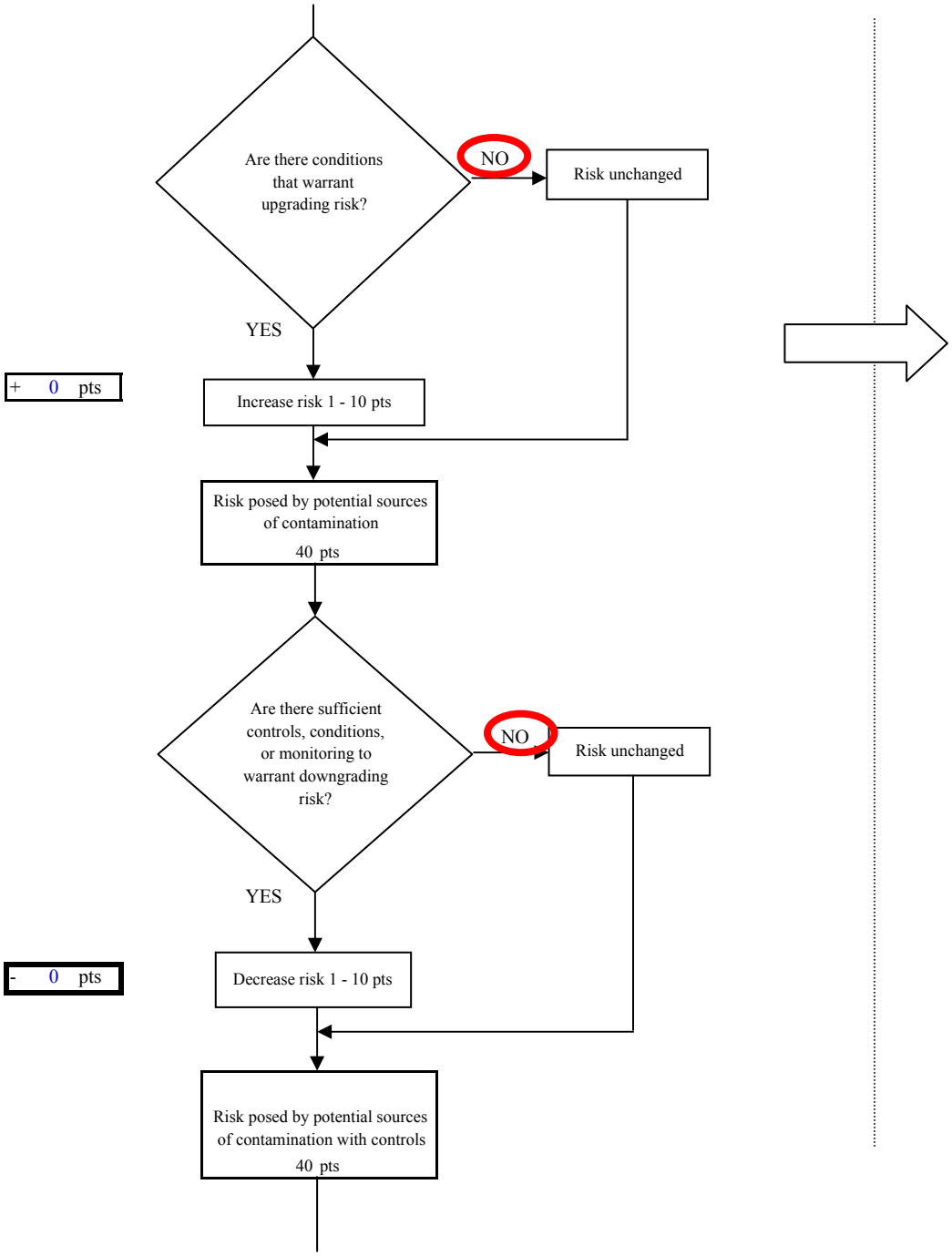
YES

Asphalt and tar processing/storage

Increase risk 1 - 10 pts

+ 10 pts

Chart 13. Contaminant risks for KPBSD- Moose Pass School - Other Organic Chemicals



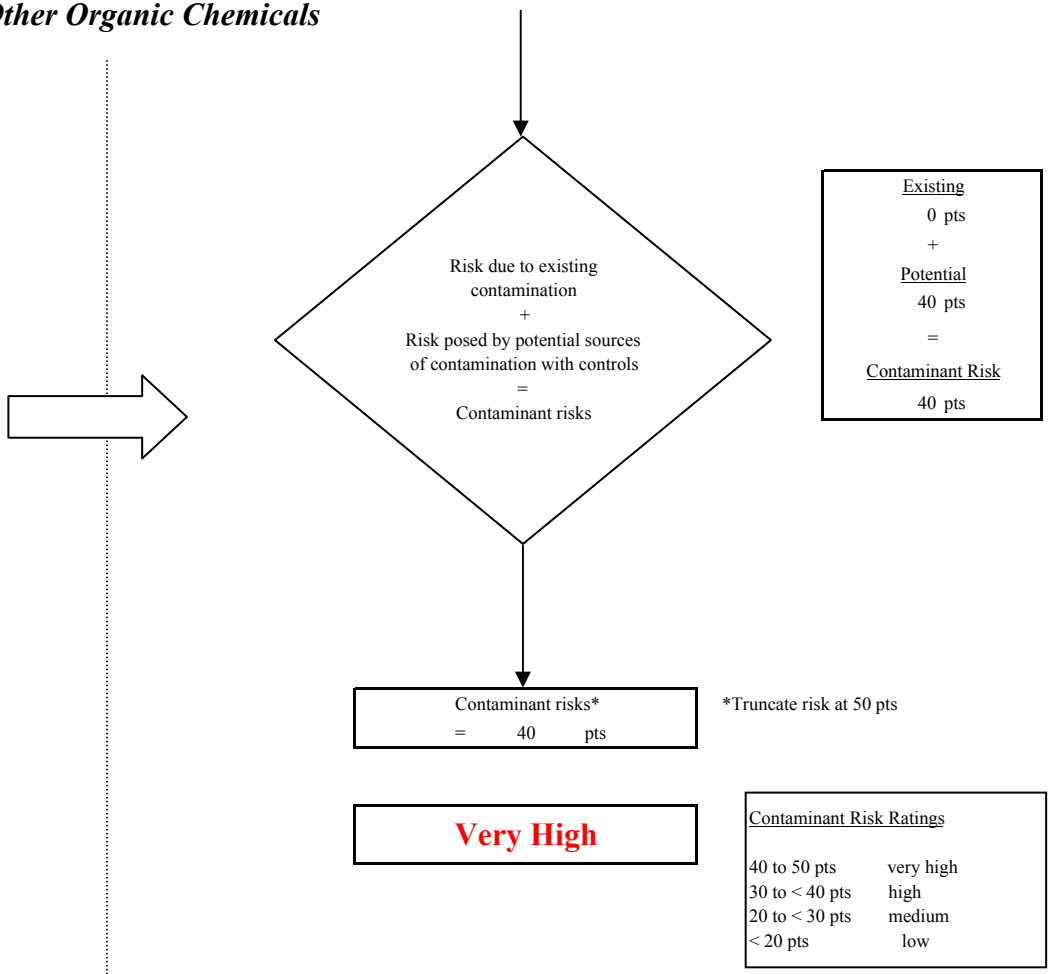


Chart 14. Vulnerability analysis for KPBSD- Moose Pass School - Other Organic Chemicals