Source Water Assessment

A Hydrogeologic Susceptibility and Vulnerability Assessment for the Eklutna Utilities Twin Peaks Eklutna area, Alaska PWSID 227539

June 2004

DRINKING WATER PROTECTION PROGRAM REPORT Report 1533
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 Eklutna Utilities Twin Peaks
Eklutna area, Alaska

Drinking Water Protection Program
Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

This source water assessment provides an evaluation of the vulnerability to potential contamination of the public water system serving Eklutna Utilities Twin Peaks. This Class A (community) water system consists of one well along the Old Glenn Highway about 6 ½ miles east of the town of Eklutna, Alaska. The well received a natural susceptibility rating of **Low**. This rating is a combination of a susceptibility rating of **Low** for the actual wellhead and a **Low** rating for the aquifer in which the well is drawing water from. There were no identified potential sources of contamination for the Eklutna Utilities Twin Peaks public water system. Six groups of potential contaminants are considered in this assessment: 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 system for Eklutna Utilities Twin Peaks received an overall vulnerability rating of **Low** for all six contaminant categories.

EKLUTNA UTILITIES TWIN PEAKS PUBLIC DRINKING WATER SYSTEM

The Eklutna Utilities Twin Peaks public water system is a Class A (community) water system. The system consists of one well along the Old Glenn Highway about 6 ½ miles east of the town of Eklutna, Alaska (Seward Meridian, T16N, R2E, Section 18) (See Map 1 of Appendix A). Eklutna is located within the Municipality of Anchorage 25 miles northeast of the town of Anchorage.

Homes in the Twin Peaks Subdivision probably use septic systems for their wastewater. Electricity is provided by Matanuska Electric Association. Refuse for the residents of Eklutna is collected by Freedom Refuse for deposit at the Anchorage landfill on Hiland Road in Eagle River (ACDED, 2002).

The Eklutna Utilities Twin Peaks public water system lies at the base of the Chugach Mountains in the Knik River glacier valley at an elevation of approximately 350 feet above sea level.

The depth of the well is 103 feet below the ground surface and is screened in sand with pebbles, cobbles and boulders. The ground above the aquifer consists of sand silty clay with some pebbles, cobbles and boulders. The static water level in the well is 23.5 feet below land surface. This water level may be influenced by pressure of the clay confining level above the aquifer. Both the Knik River as well as surface infiltration from the Chugach Mountains contribute water to this alluvial aquifer.

The Eklutna Utilities Twin Peaks public drinking water system serves approximately 36 residents through twelve service connections.

EKLUTNA UTILITIES TWIN PEAKS DRINKING WATER PROTECTION AREA

The pathways most likely for surface contamination to reach the groundwater are identified as the first step in determining a drinking water system's risk. 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 wells is the area that contributes water to the well, the groundwater capture zone. The groundwater capture zone is located in the area circling the well (the area influenced by pumping) and also the area of the water table upgradient of the well, usually forming a parabola shape.

There are many different ways of calculating the size of capture zones. This assessment uses a combination of two simple groundwater flow equations, the Thiem and uniform flow equations for all groundwater wells screened in unconsolidated material. The orientation of the capture zone is then drawn using a water table elevation map (if available) or a land surface elevation map of the area. The capture zone calculated in this assessment is only a best guess using the information and resources available to us, and may differ slightly from the actual capture zone.

The parameters used to calculate the shape of this capture zone are general for the whole alluvial plain and were obtained from area well logs in the area and the Groundwater textbook by Freeze and Cherry (Freeze and Cherry, 1979).

Only limited information is available for the aquifer Eklutna Utilities Twin Peaks's public water system well draws its water from. The orientation of the capture

zone was drawn based on the assumption that groundwater flow direction is generally the same direction as the topography.

Because of uncertainties and changing site conditions, a factor of safety is added to the groundwater capture zone to form the drinking water protection area for the well.

The protection areas established for wells are usually separated into four zones, limited by the watershed. These zones correspond to times-of-travel (TOT) of the water moving through the aquifer to the well (plus the factor of safety).

The following is a summary of the four 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 2 years time-of-travel
C	Less than 5 years time-of-travel
D	Less than 10 years time-of-travel

The time of travel for *contaminants* within the water varies with their unique physical and chemical characteristics.

The drinking water protection area outlined for the Eklutna Utilities Twin Peaks on Map 1 of Appendix A will serve as the focus for voluntary protection efforts.

INVENTORY OF POTENTIAL AND EXISTING CONTAMINANT SOURCES

The Drinking Water Protection Program (DWPP) has completed an inventory of potential and existing sources of contamination within the Eklutna Utilities Twin Peaks protection area. This inventory was completed through a search of agency records and other publicly available information. 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 inorganic chemicals.

There were no identified sources of contamination for this public water system.

RANKING OF CONTAMINANT RISKS

Once the potential and existing sources of contamination have been identified, they are each 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 combination of toxicity and volume associated with that source. Rankings include:

- Low;
- Medium;
- High; and
- Very High.

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.

VULNERABILITY OF EKLUTNA UTILITIES TWIN PEAKS 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 properties of the aquifer and the presence of other wells or boreholes in the area. 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 the water system's contaminant sample results. Lastly, Chart 4 combines the results of the first three charts to produce 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.

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 wellhead for the Eklutna Utilities Twin Peaks received a Low Susceptibility rating. The 11/29/02 Sanitary Survey indicates both the well is capped with a sanitary seal, and the land surface is sloped away from each of the wells; however, the well is not grouted. A sanitary seal prevents potential contaminants from entering the well from the inside while sloping the land surface away from the well and grouting help to prevent potential contaminants from traveling down the outside of the well casing.

The aquifer the Eklutna Utilities Twin Peaks well is completed in received a Low Susceptibility rating. The low permeability of the material above the aquifer (sandy silty clay) in the area prevents contaminants from traveling down through it. Table 2 summarizes the Susceptibility scores and ratings for Eklutna Utilities Twin Peaks.

Table 2. Susceptibility

	Score	Rating
Susceptibility of the Wellhead	5	Low
Susceptibility of the Aquifer	1	Low
Natural Susceptibility	6	Low

The Contaminant Risk has been derived from an evaluation of the routine sampling results of the water system and the presence of potential sources of contamination. Contaminant risks to a drinking water source depend on the type and distribution of contaminant sources. 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	0	Low
Nitrates and/or Nitrites	8	Low
Volatile Organic Chemicals	0	Low
Heavy Metals, Cyanide, and Other Inorganic Chemicals	0	Low
Synthetic Organic Chemicals	0	Low
Other Organic Chemicals	0	Low

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	5	Low
Nitrates and/or Nitrites	15	Low
Volatile Organic Chemicals	5	Low
Heavy Metals, Cyanide, and Other Inorganic Chemicals	5	Low
Synthetic Organic Chemicals	5	Low
Other Organic Chemicals	5	Low

Bacteria and Viruses

Only a small amount of bacteria and viruses are required to endanger public health. Coliforms (a bacteria) are found naturally in the environment and although they aren't necessarily a health threat, it is 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 (EPA, 2002). Harmful bacteria can cause diarrhea, cramps, nausea, headaches, or other symptoms (EPA, 2002). Routine sampling has not detected coliforms in the water.

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 low.

Nitrates and Nitrites

Nitrates are very mobile, moving at approximately the same rate as water. Nitrates have been not detected in significant concentrations in recent sampling history for the Eklutna Utilities Twin Peaks well.

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 low.

Volatile Organic Chemicals

Volatile Organic Chemicals have not been detected during routine sampling of this water system.

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 low.

Heavy Metals, Cyanide, and Other Inorganic Chemicals

Heavy metals have not been detected during routine sampling of this water system.

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

Synthetic Organic Chemicals have not been sampled for in this water system.

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

Other Organic Chemicals have not been sampled for in this water system.

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 low.

REFERENCES

Alaska Department of Community and Economic Development (ADCED), 2002 [WWW document]. URL http://www.dced.state.ak.us/mra/CF_BLOCK.cfm.

Freeze, R.A. and Cherry, J.A., 1979. Groundwater. Prentice-Hall, Englewood Cliffs, NJ.

United States Environmental Protection Agency (EPA), 2002 [WWW document]. URL http://www.epa.gov/safewater/mcl.html.

APPENDIX A

Eklutna Utilities Twin Peaks
Drinking Water Protection Area Location Map
(Map 1)

OLD GLENN

Zone A

Zone B

Zone C

Zone D

MUSKA-SUSITNA BOROUGH

ANCHORAGE AREA BOROUGH

East Twin Peak

Map 1: Eklutna Utilities Twin Peaks Drinking Water Protection Area

PWSID: 227539

Alaska Department of Environmental Conservation

Alaska Drinking Water Protection Program

0 650 1,300 2,600 Feet

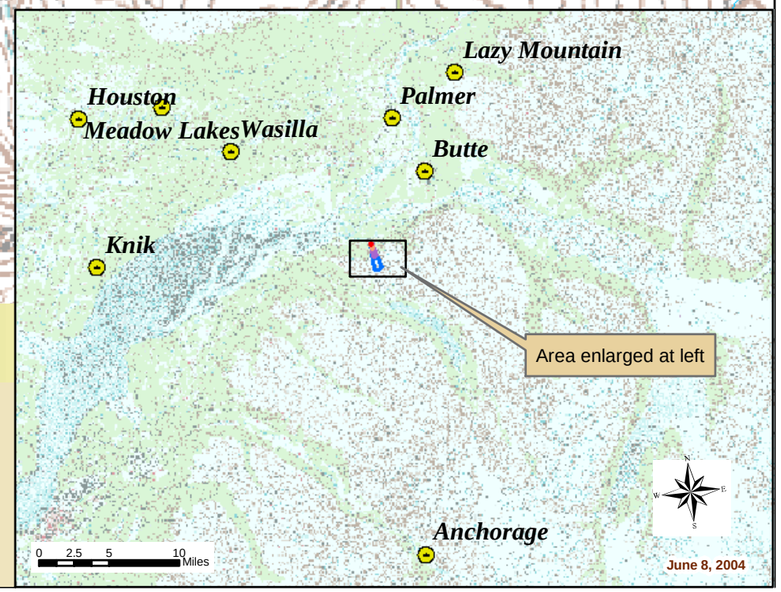
1:15,600

Data Sources:

Parcels, roads - Municipality of Anchorage
Background - USGS 63K mapping

Legend

- Zone A
- Zone B
- Zone C
- Zone D
- Parcels
- Roads
- Streams



APPENDIX B

Contaminant Source Inventory and Risk Ranking for Eklutna Utilities Twin Peaks (Table 1)

Table 1

Contaminant Source Inventory for

Eklutna Utilities Twin Peaks

PWSID 227539.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Map Number*	*Comments*
No identified sources					

APPENDIX C

Eklutna Utilities Twin Peaks
Potential Contaminant Sources
(Map 2)

OLD GLENN

Zone A

Zone B

Map 2: Eklutna Utilities Twin Peaks Potential Contaminant Sources

PWSID: 227539

Alaska Department of Environmental Conservation

Alaska Drinking Water Protection Program

0 150 300 600 Feet

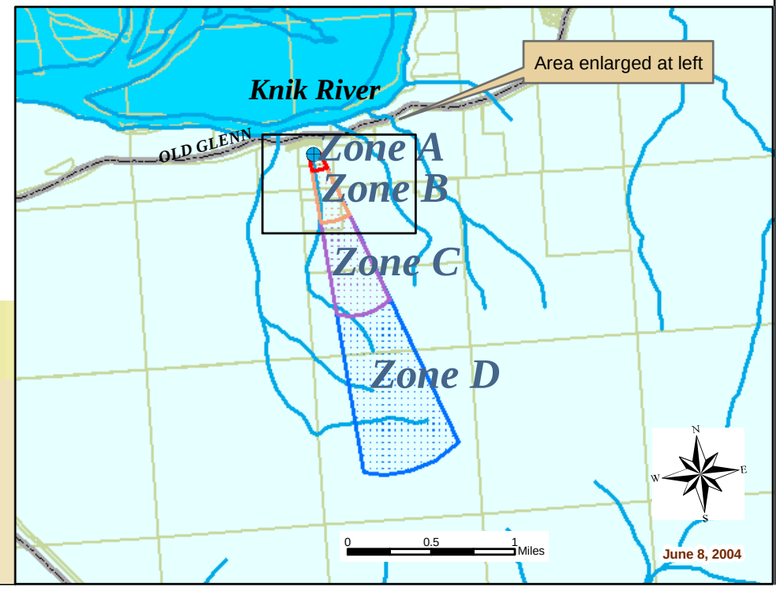
1:3,600

Data Sources:

Parcels, roads - Municipality of Anchorage
Inset background - USGS 63K mapping

Legend

- Zone A
- Zone B
- Zone C
- Zone D
- Eklutna Utilities Twin Peaks well
- Parcels
- Roads
- Rivers or Streams



APPENDIX D

Vulnerability Analysis for Eklutna Utilities Twin Peaks Public Drinking Water Source

(Charts 1-14)

Chart 1. Susceptibility of the wellhead - Eklutna Utilities Twin Peaks

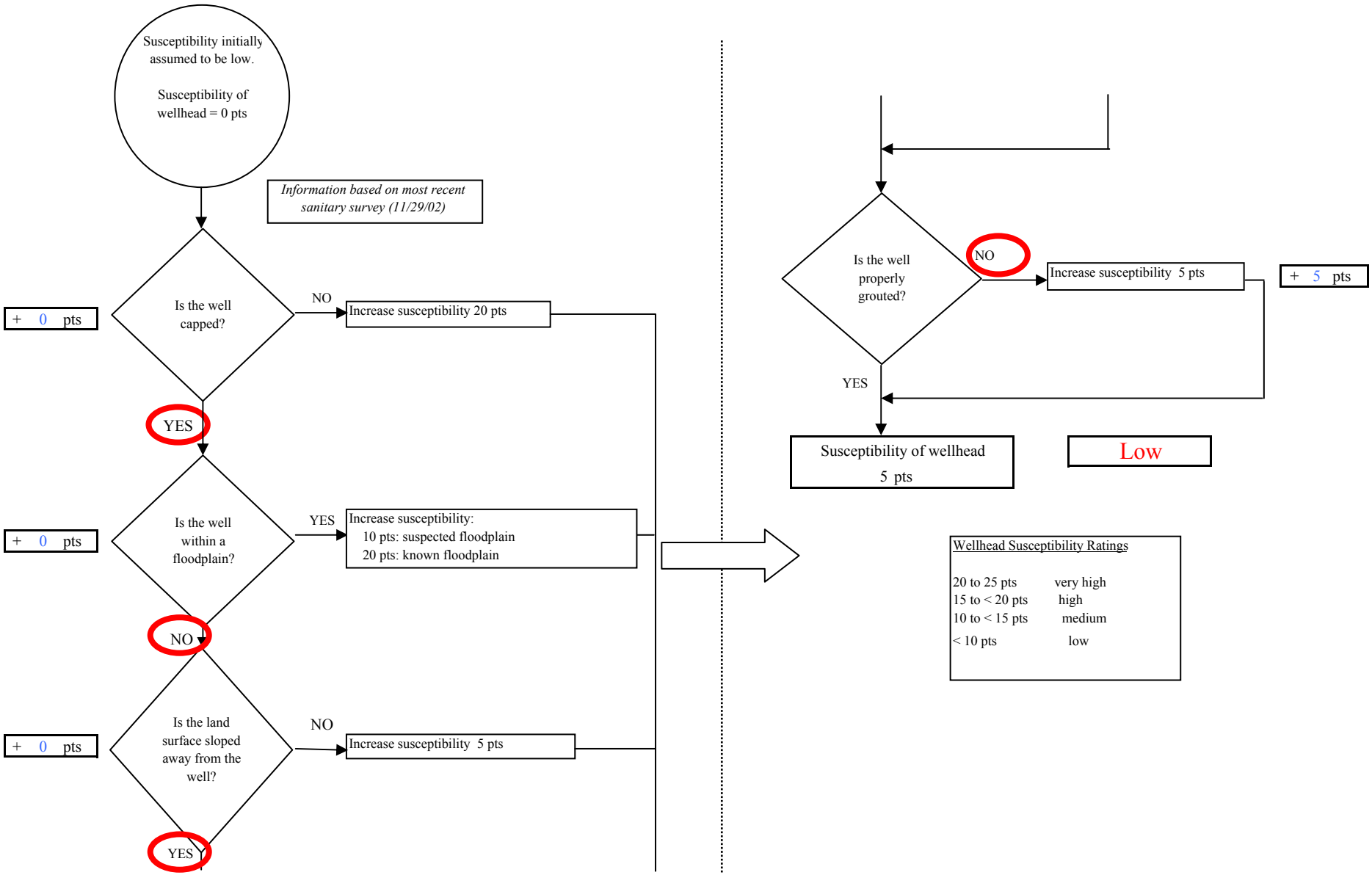


Chart 2. Susceptibility of the aquifer - Eklutna Utilities Twin Peaks

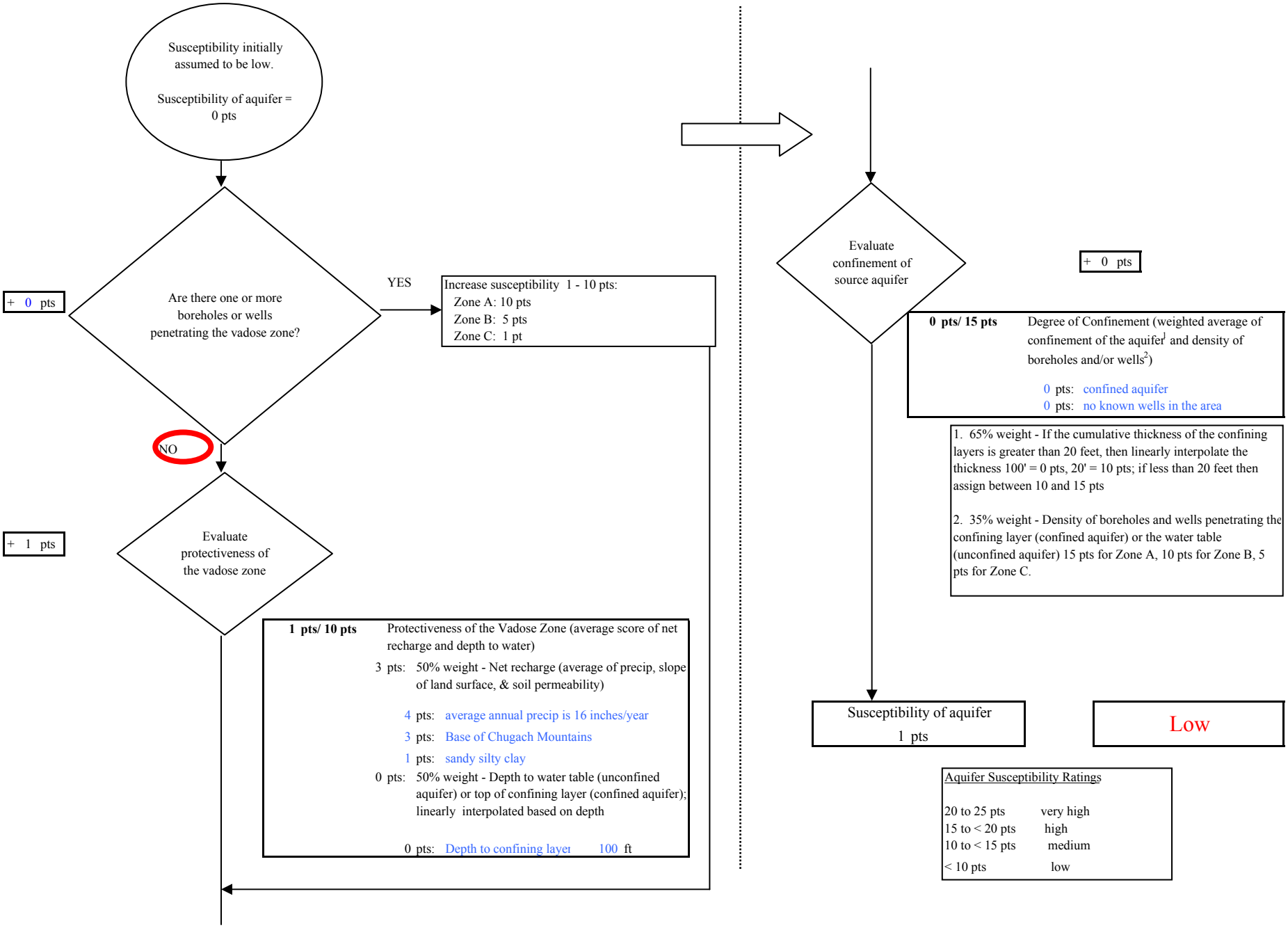
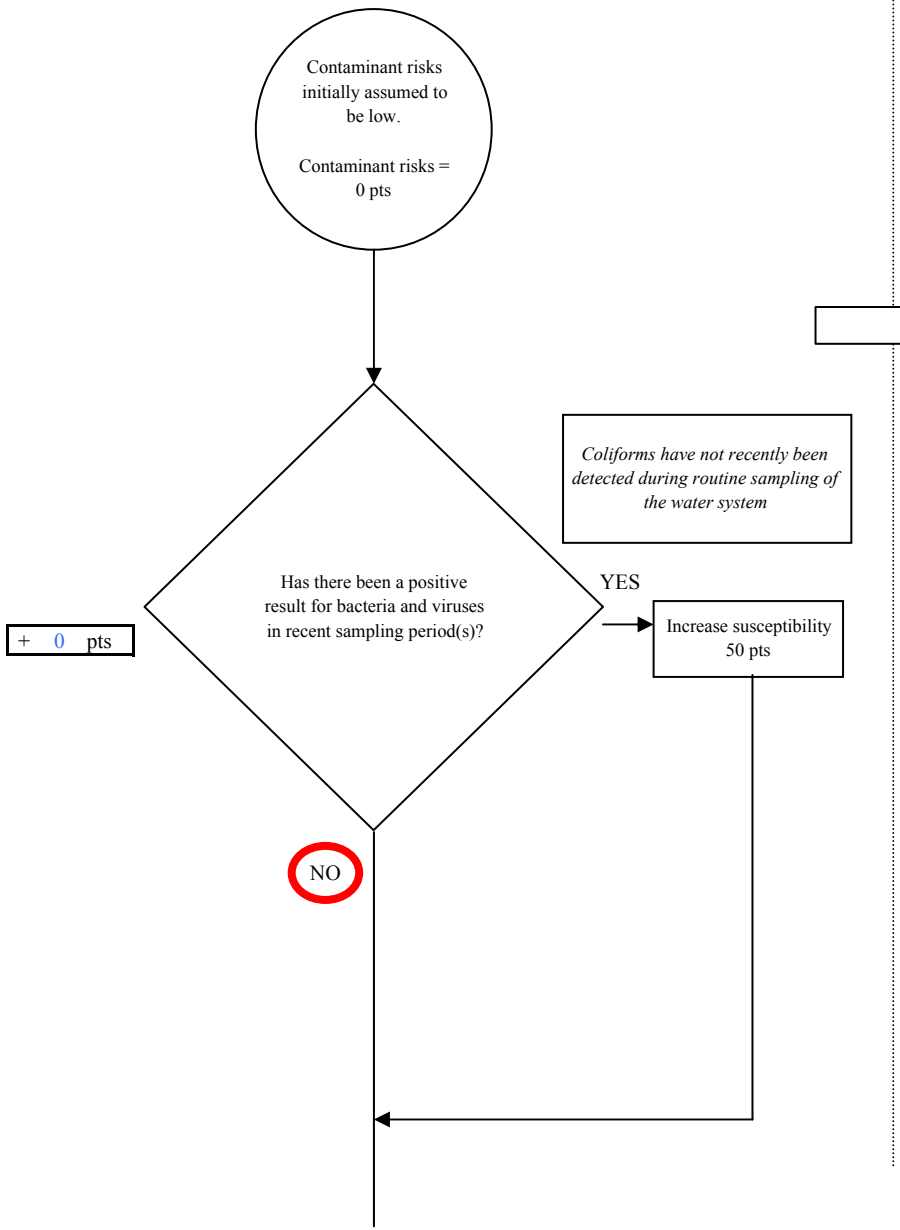
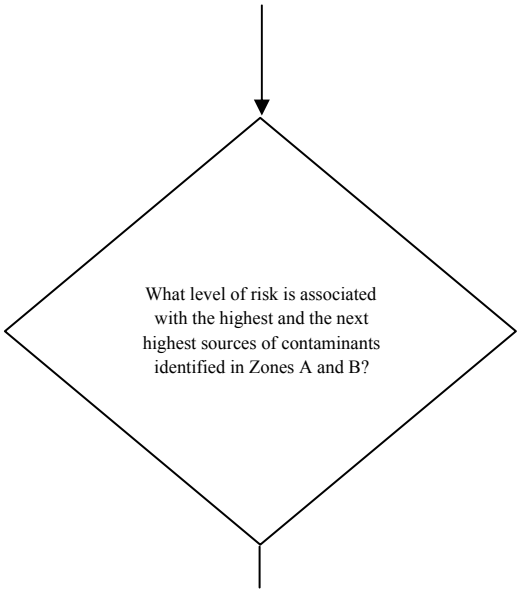


Chart 3. Contaminant risks for Eklutna Utilities Twin Peaks - Bacteria & Viruses





+ 0 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)	0	0	0
Medium(s)	0	0	0
Low(s)	0	0	0

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

Matrix Score 0

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

Chart 3. Contaminant risks for Eklutna Utilities Twin Peaks - Bacteria & Viruses

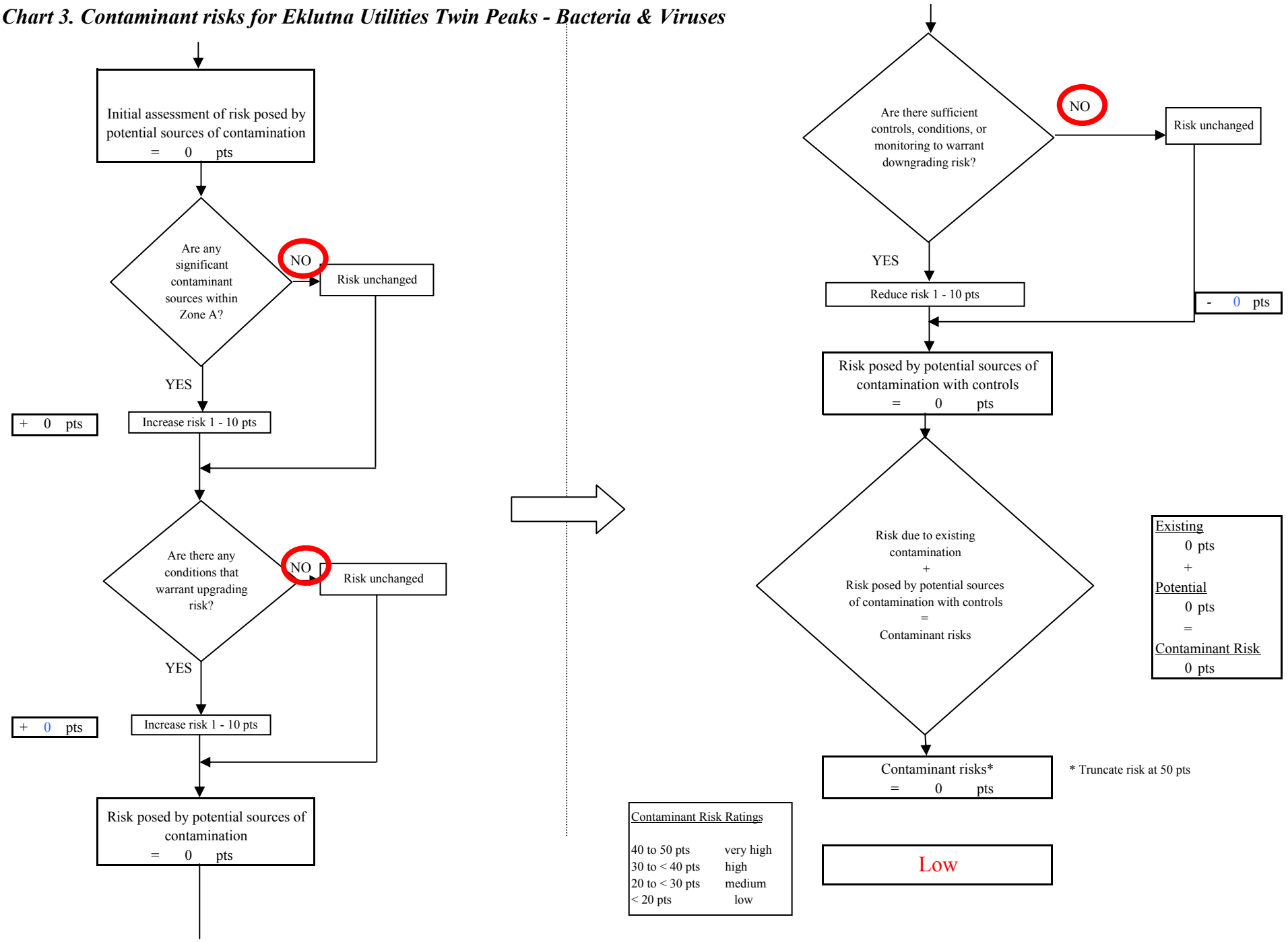


Chart 4. Vulnerability analysis for Eklutna Utilities Twin Peaks - Bacteria & Viruses

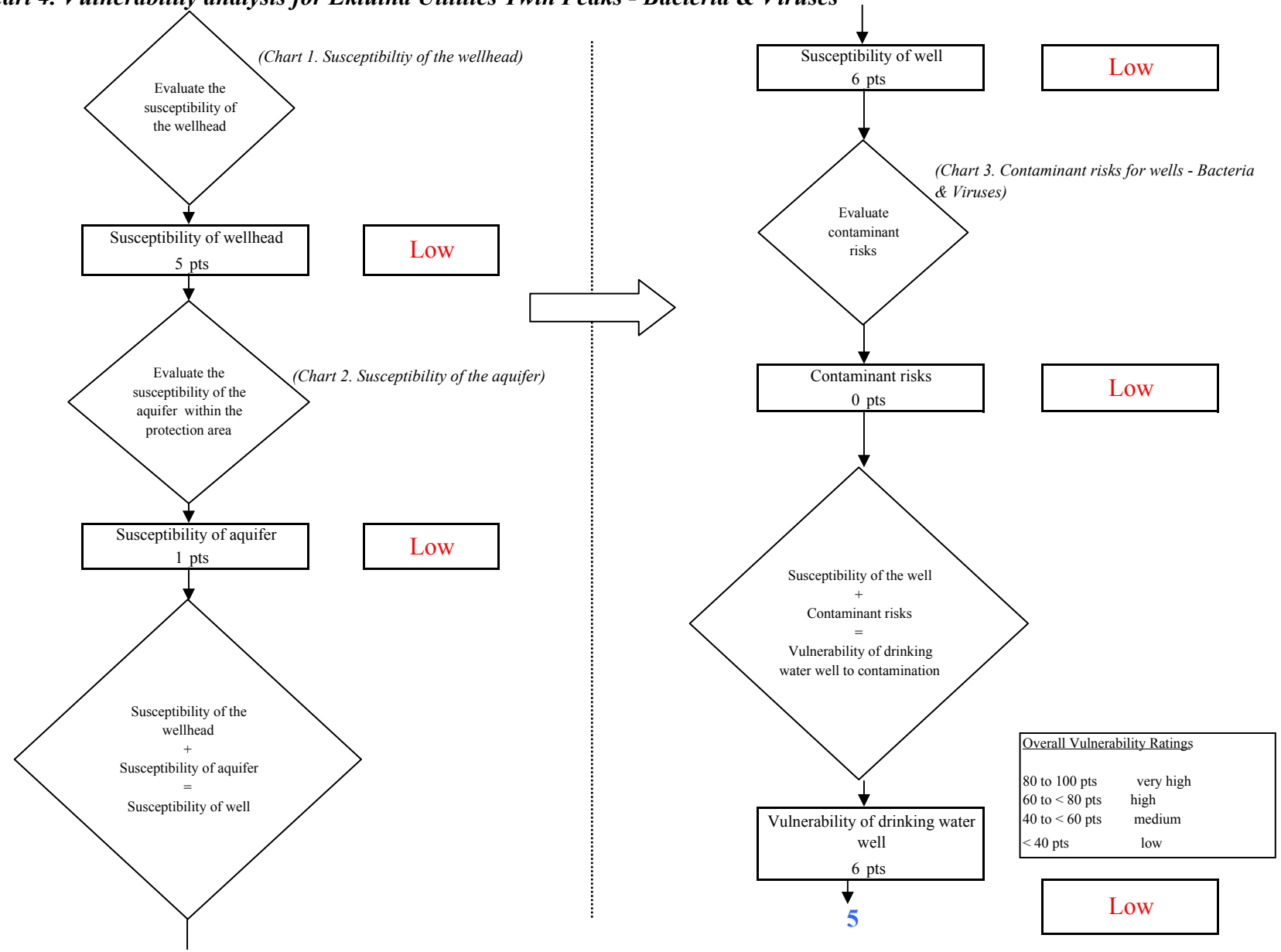


Chart 5. Contaminant risks for Eklutna Utilities Twin Peaks - Nitrates and Nitrites

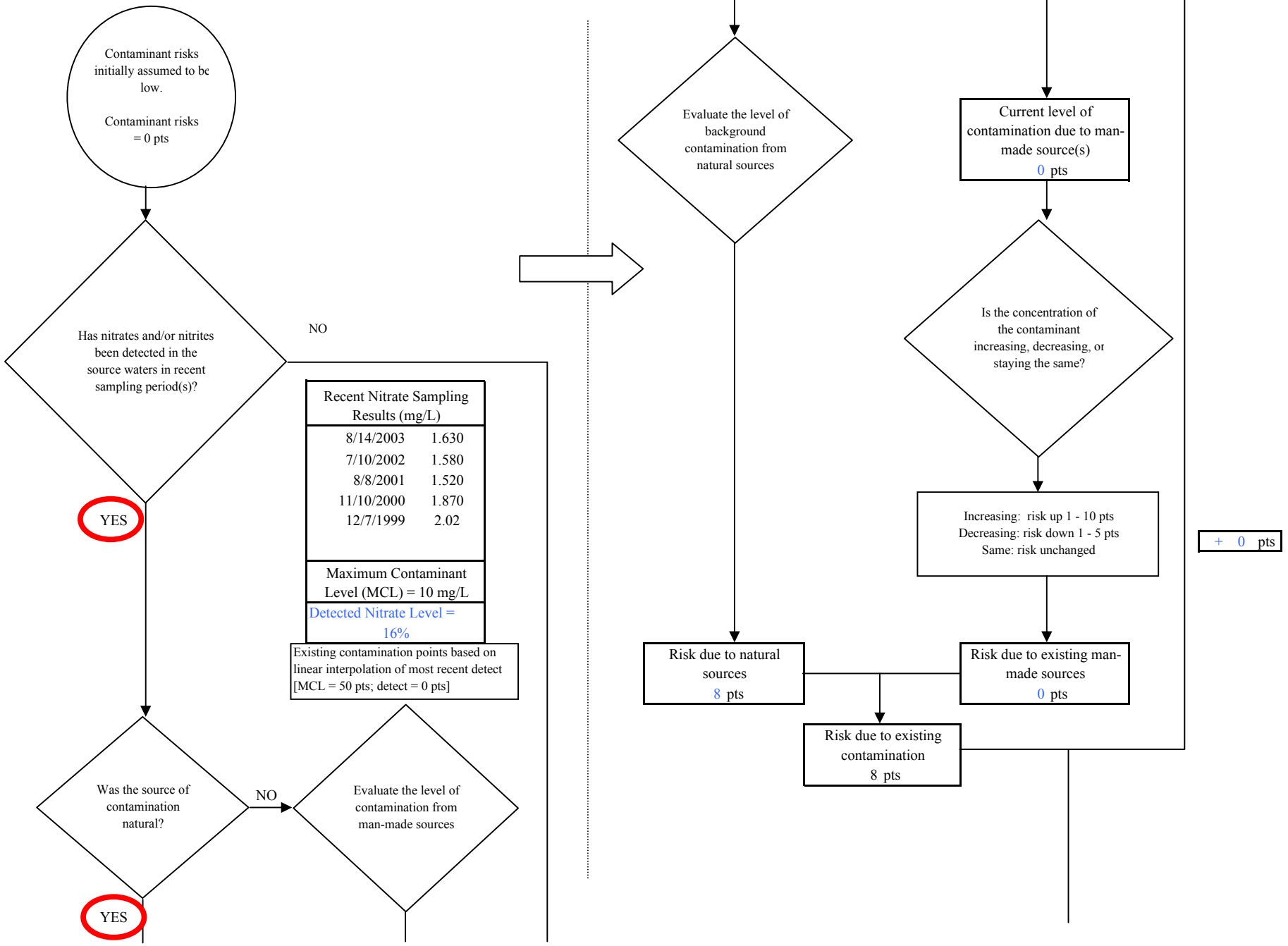


Chart 5. Contaminant risks for Eklutna Utilities Twin Peaks - Nitrates and Nitrites

+ 0 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)	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

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

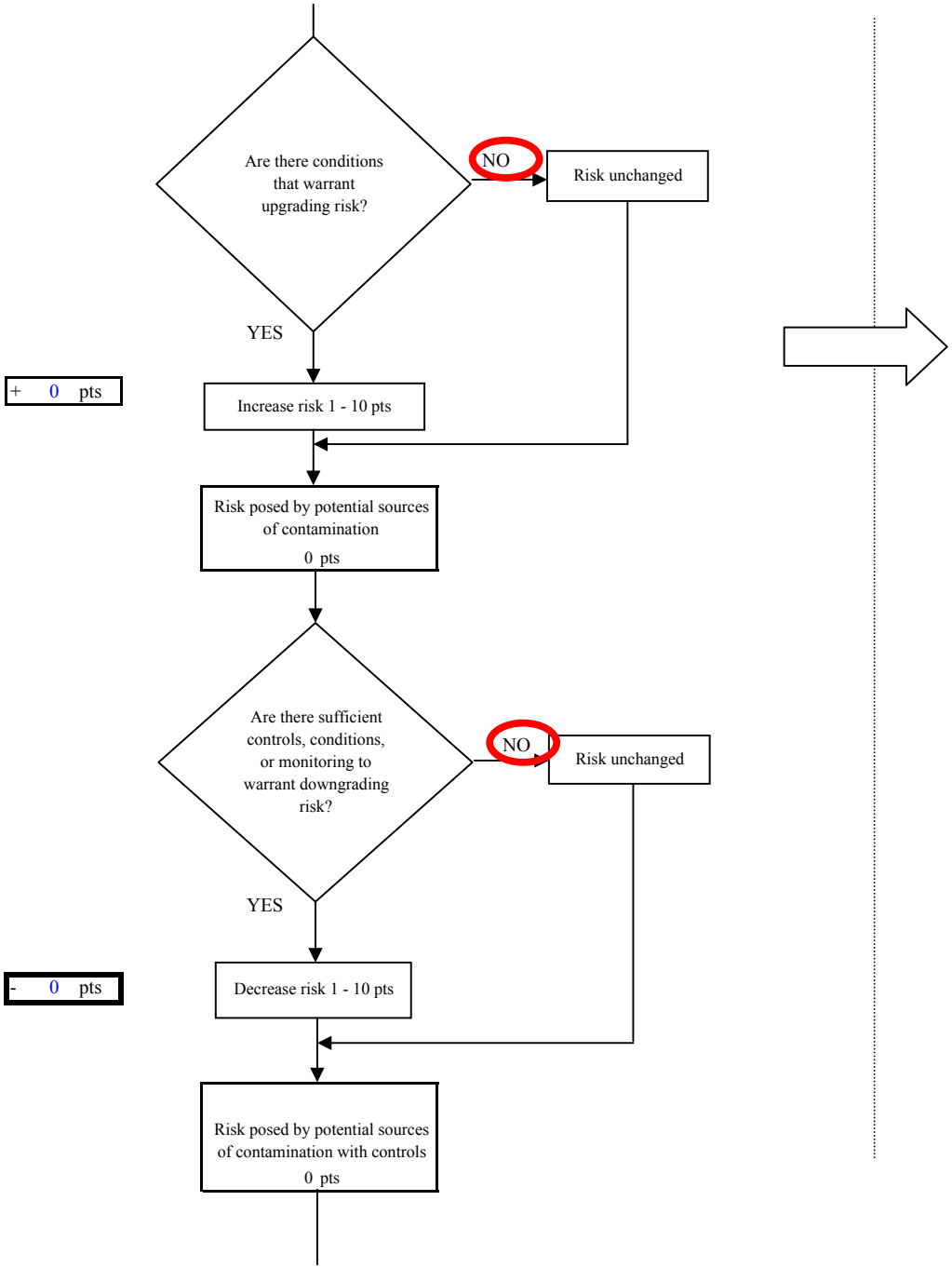
Risk unchanged

YES

Increase risk 1 - 10 pts

+ 0 pts

Chart 5. Contaminant risks for Eklutna Utilities Twin Peaks - Nitrates and Nitrites



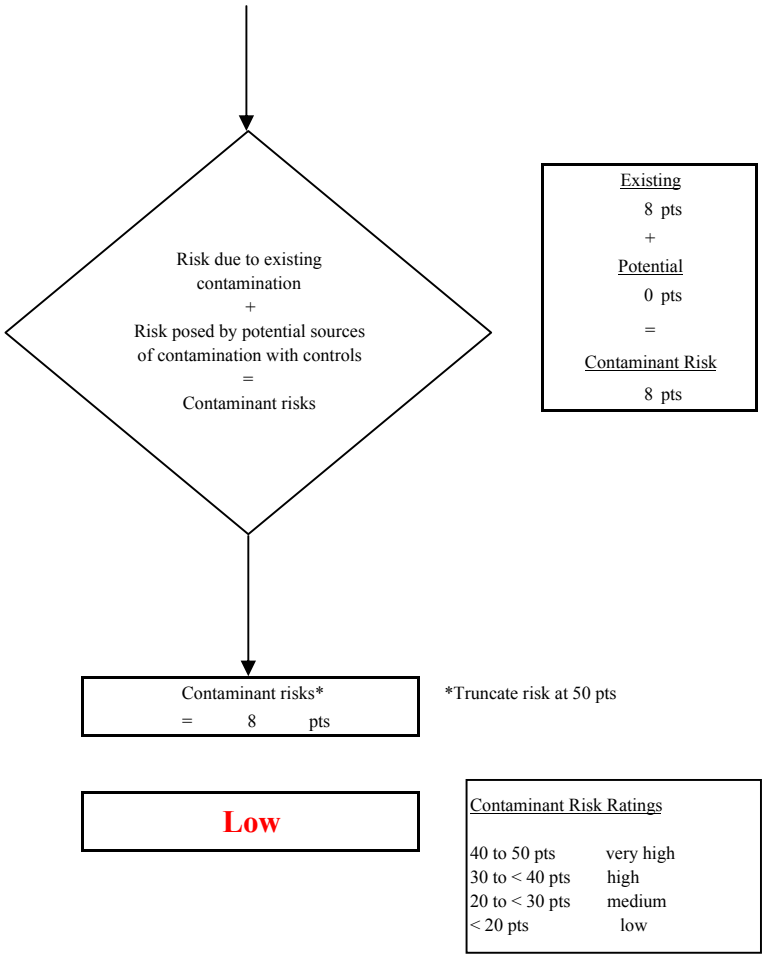


Chart 6. Vulnerability analysis for Eklutna Utilities Twin Peaks - Nitrates and Nitrites

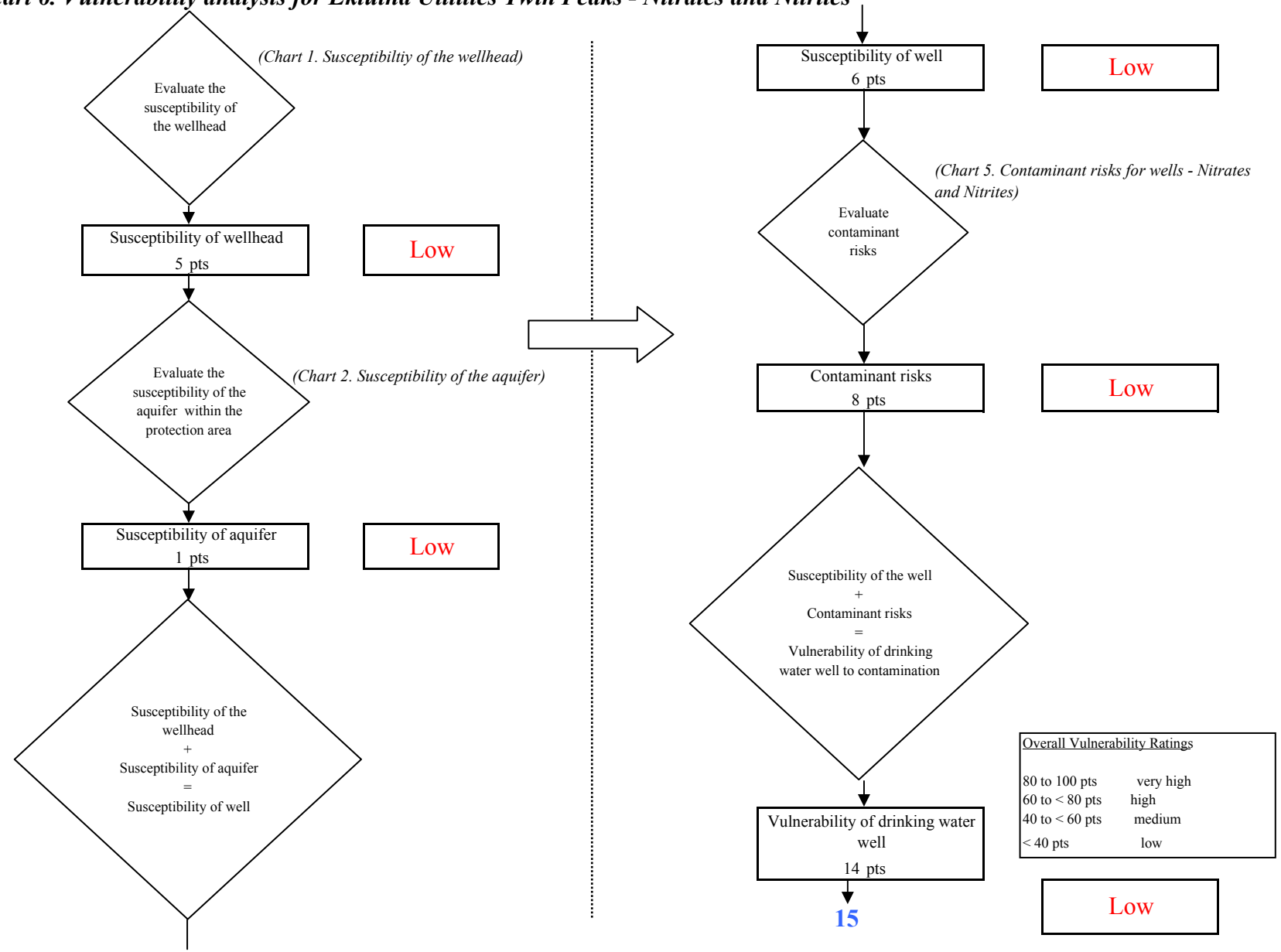


Chart 7. Contaminant risks for Eklutna Utilities Twin Peaks - Volatile Organic Chemicals

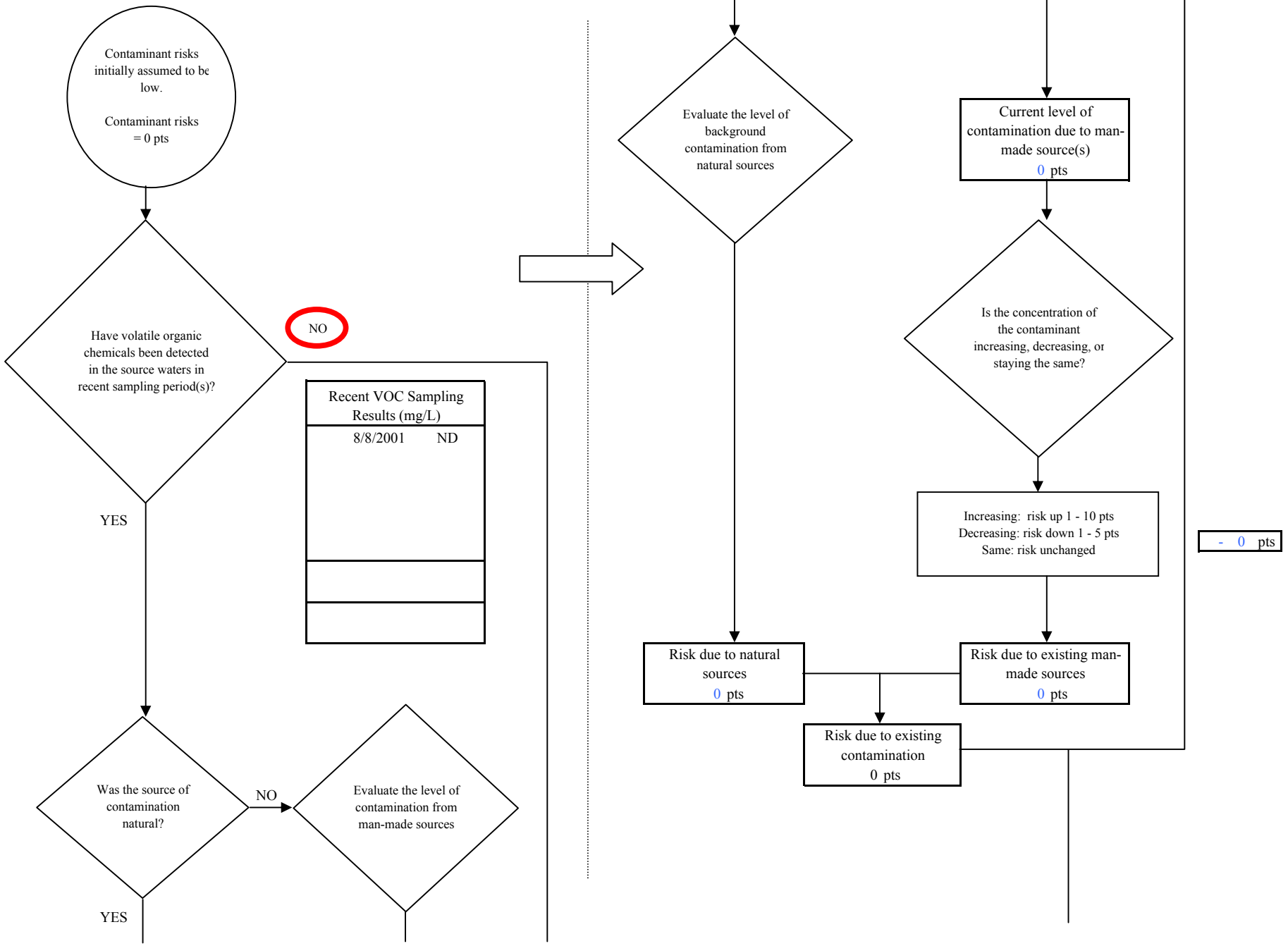


Chart 7. Contaminant risks for Eklutna Utilities Twin Peaks - Volatile Organic Chemicals

+ 0 pts

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

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

Increase risk 1 - 10 pts

+ 0 pts

Chart 7. Contaminant risks for Eklutna Utilities Twin Peaks - Volatile Organic Chemicals

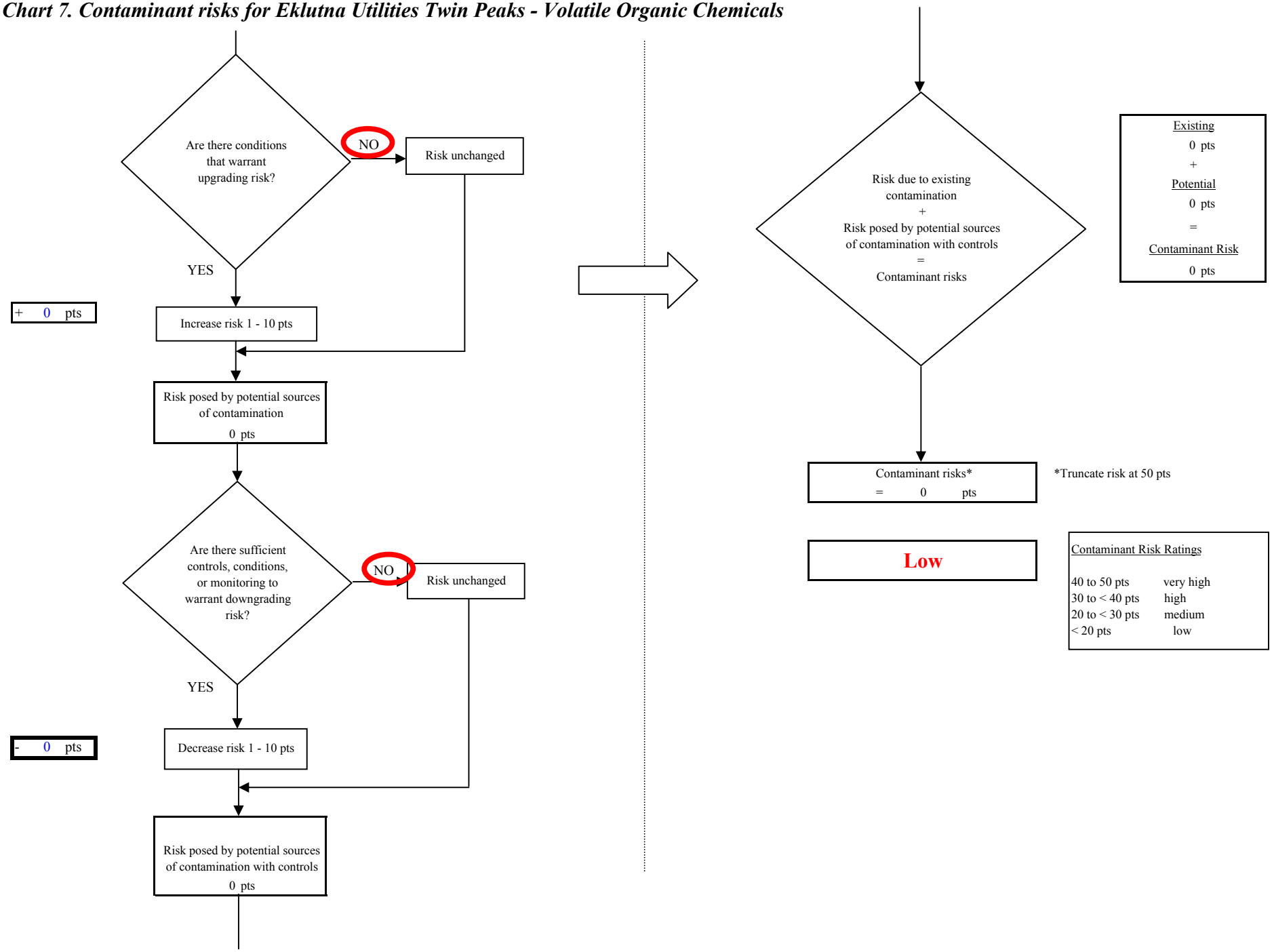


Chart 8. Vulnerability analysis for Eklutna Utilities Twin Peaks - Volatile Organic Chemicals

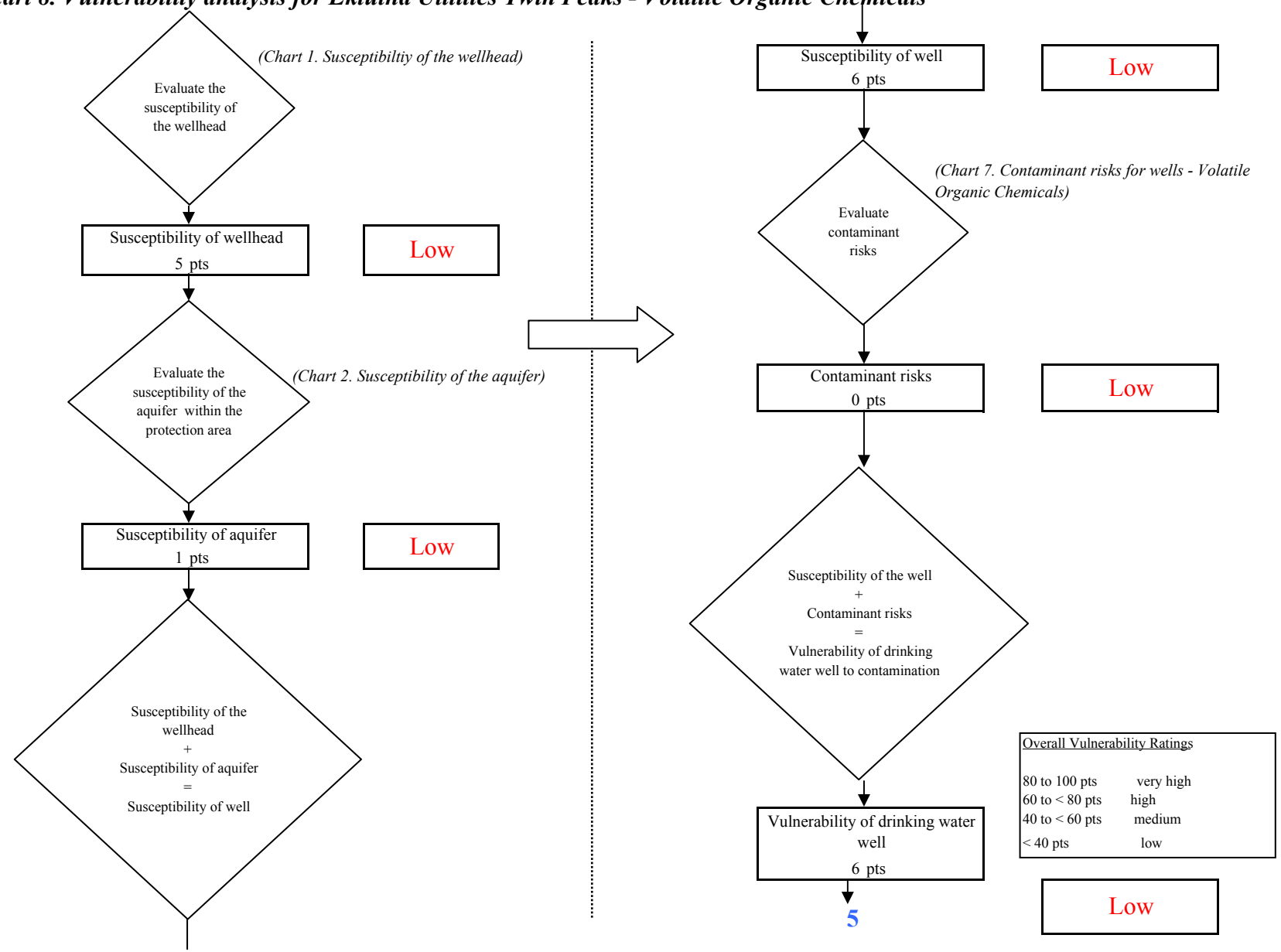


Chart 9. Contaminant risks for Eklutna Utilities Twin Peaks - Heavy Metals, Cyanide and Other Inorganic Chemicals

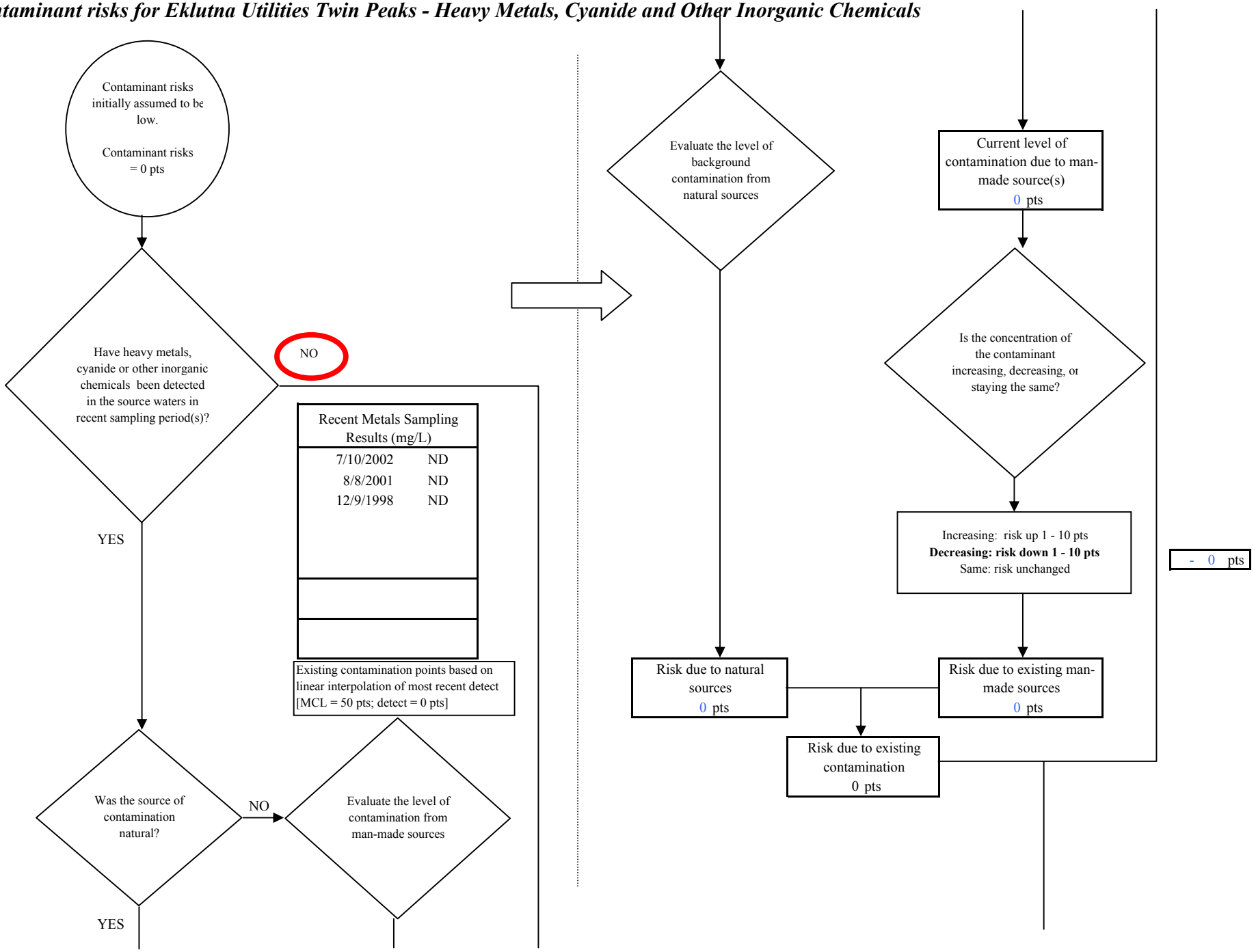


Chart 9. Contaminant risks for Eklutna Utilities Twin Peaks - Heavy Metals, Cyanide and Other Inorganic Chemicals

+ 0 pts

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

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 → Increase risk 1 - 10 pts

+ 0 pts

Chart 9. Contaminant risks for Eklutna Utilities Twin Peaks - Heavy Metals, Cyanide and Other Inorganic Chemicals

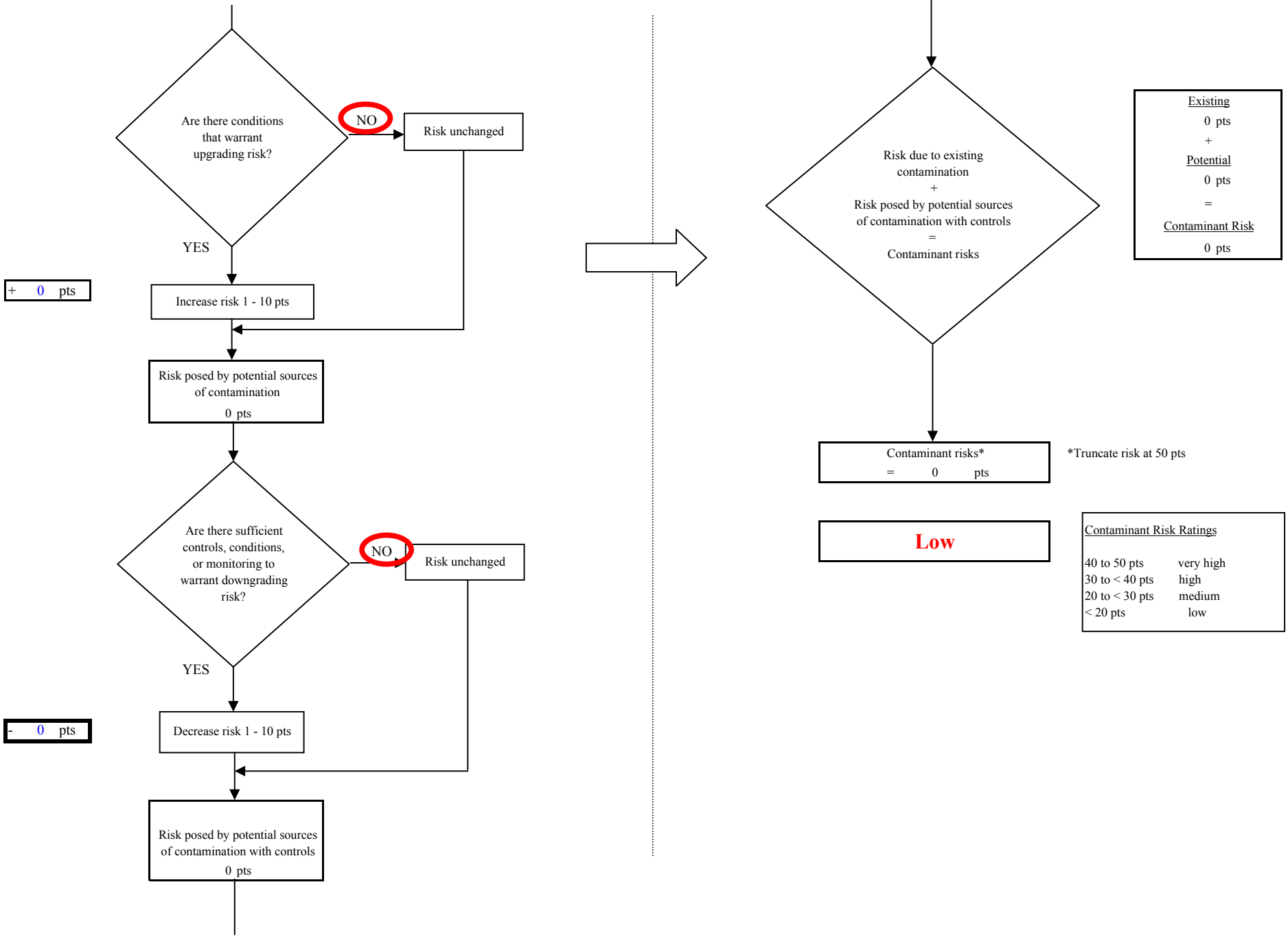


Chart 10. Vulnerability analysis for Eklutna Utilities Twin Peaks - Heavy Metals, Cyanide and Other Inorganic Chemicals

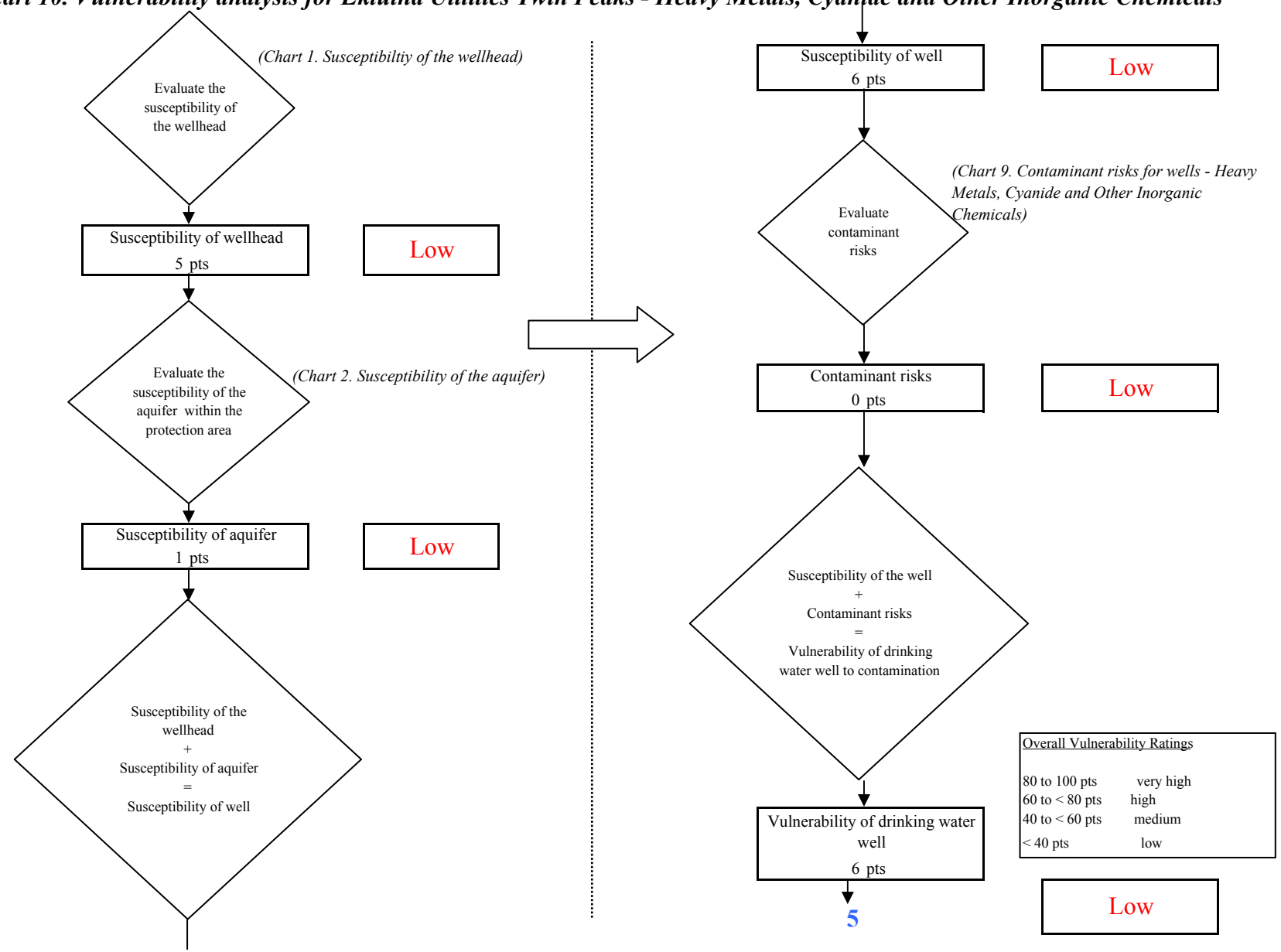


Chart 11. Contaminant risks for Eklutna Utilities Twin Peaks - Synthetic Organic Chemicals

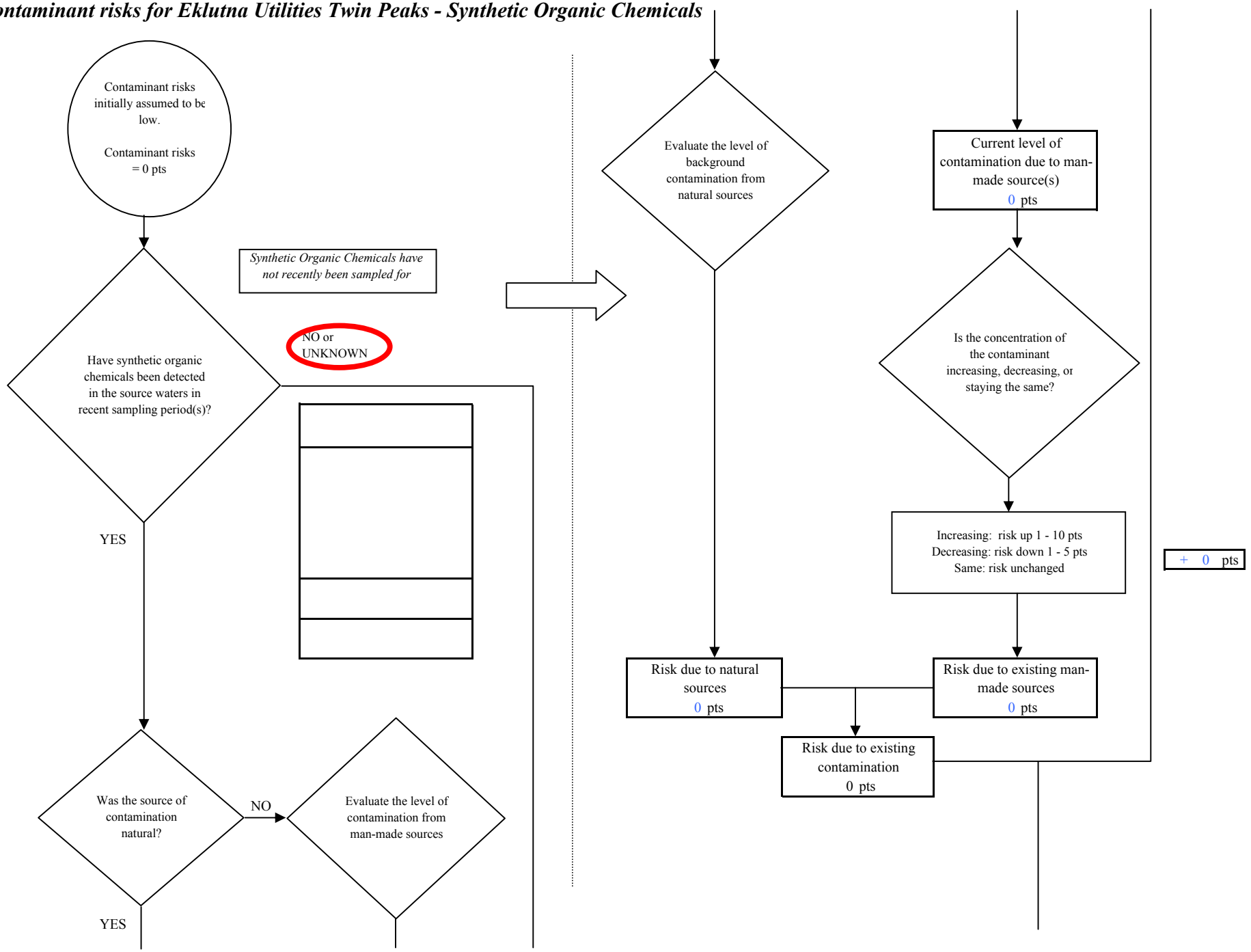


Chart 11. Contaminant risks for Eklutna Utilities Twin Peaks - Synthetic Organic Chemicals

+ 0 pts

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

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

Increase risk 1 - 10 pts

+ 0 pts

Chart 11. Contaminant risks for Eklutna Utilities Twin Peaks - Synthetic Organic Chemicals

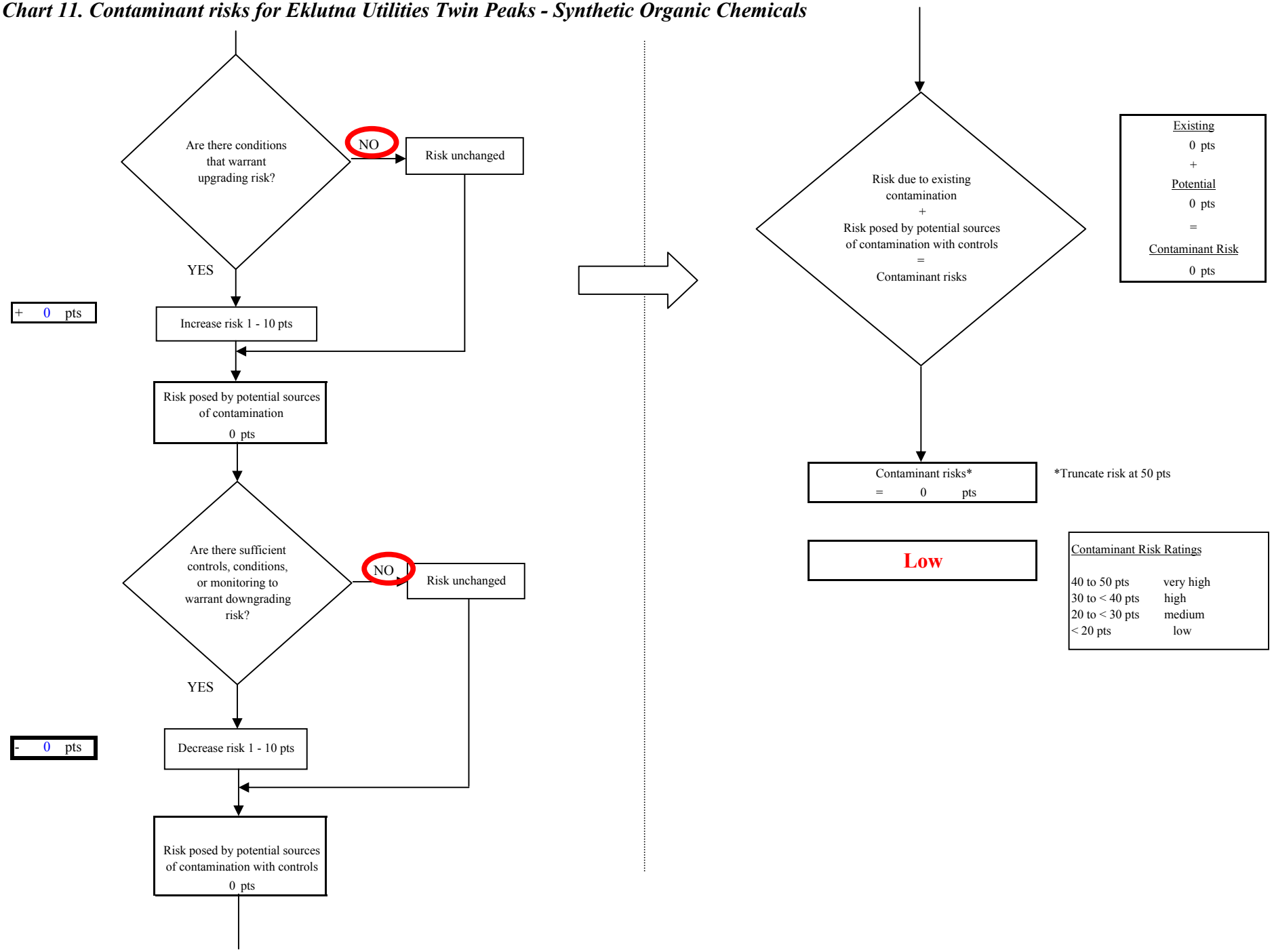


Chart 12. Vulnerability analysis for Eklutna Utilities Twin Peaks - Synthetic Organic Chemicals

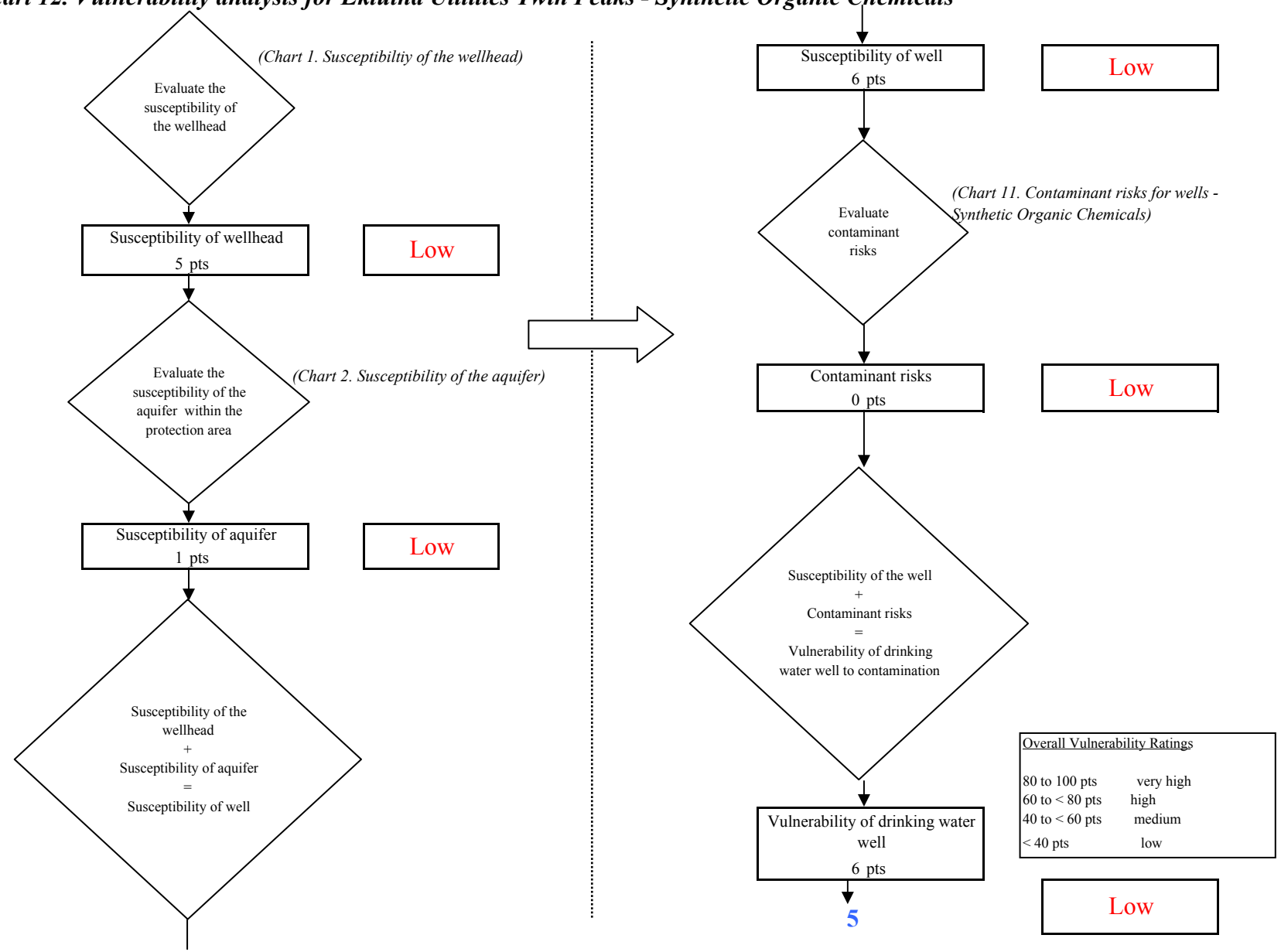


Chart 13. Contaminant risks for Eklutna Utilities Twin Peaks - Other Organic Chemicals

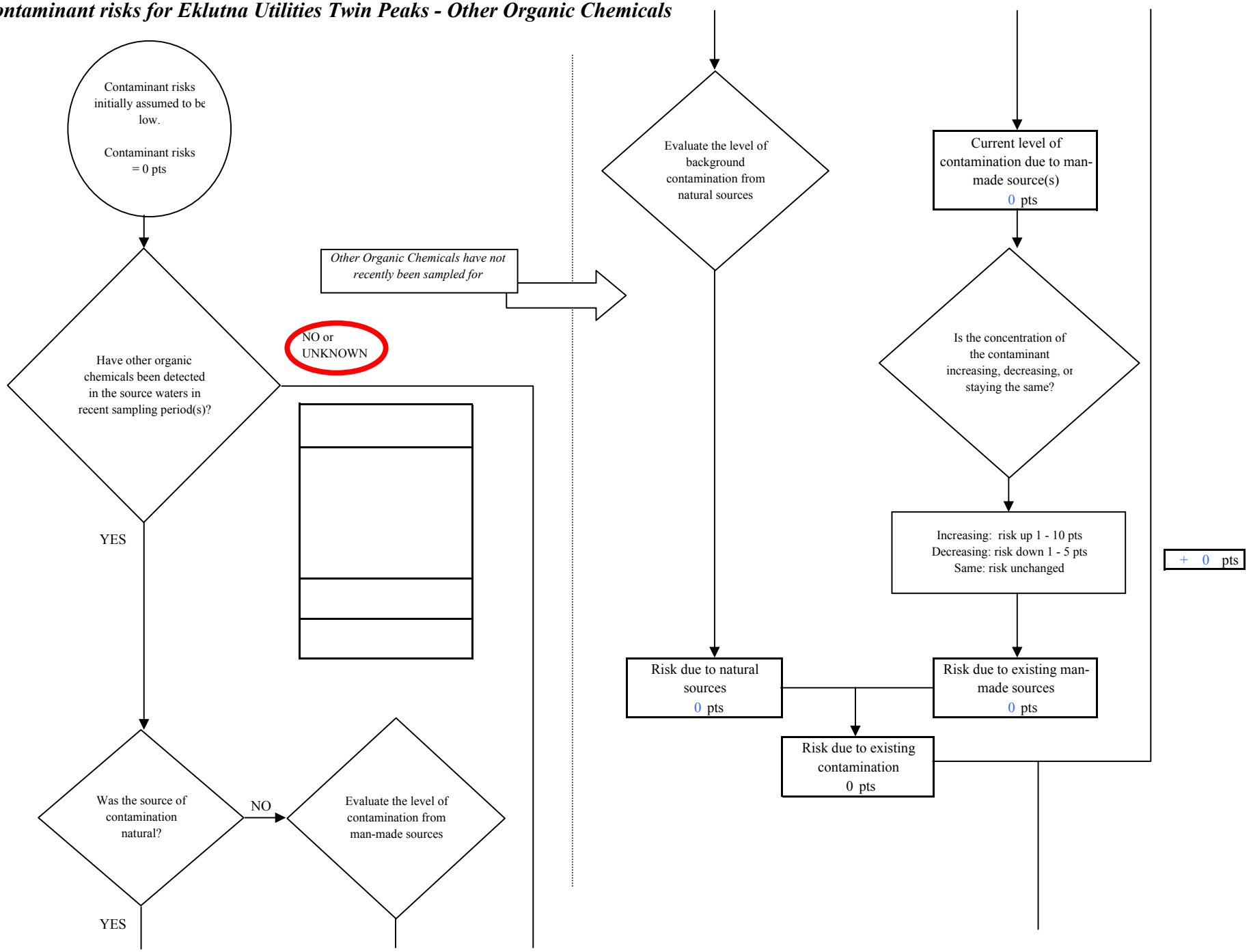


Chart 13. Contaminant risks for Eklutna Utilities Twin Peaks - Other Organic Chemicals

+ 0 pts

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

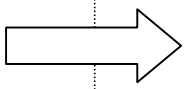
Risk Levels for Contaminant Sources identified in Zones A, B and C

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

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

Matrix Score 0

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



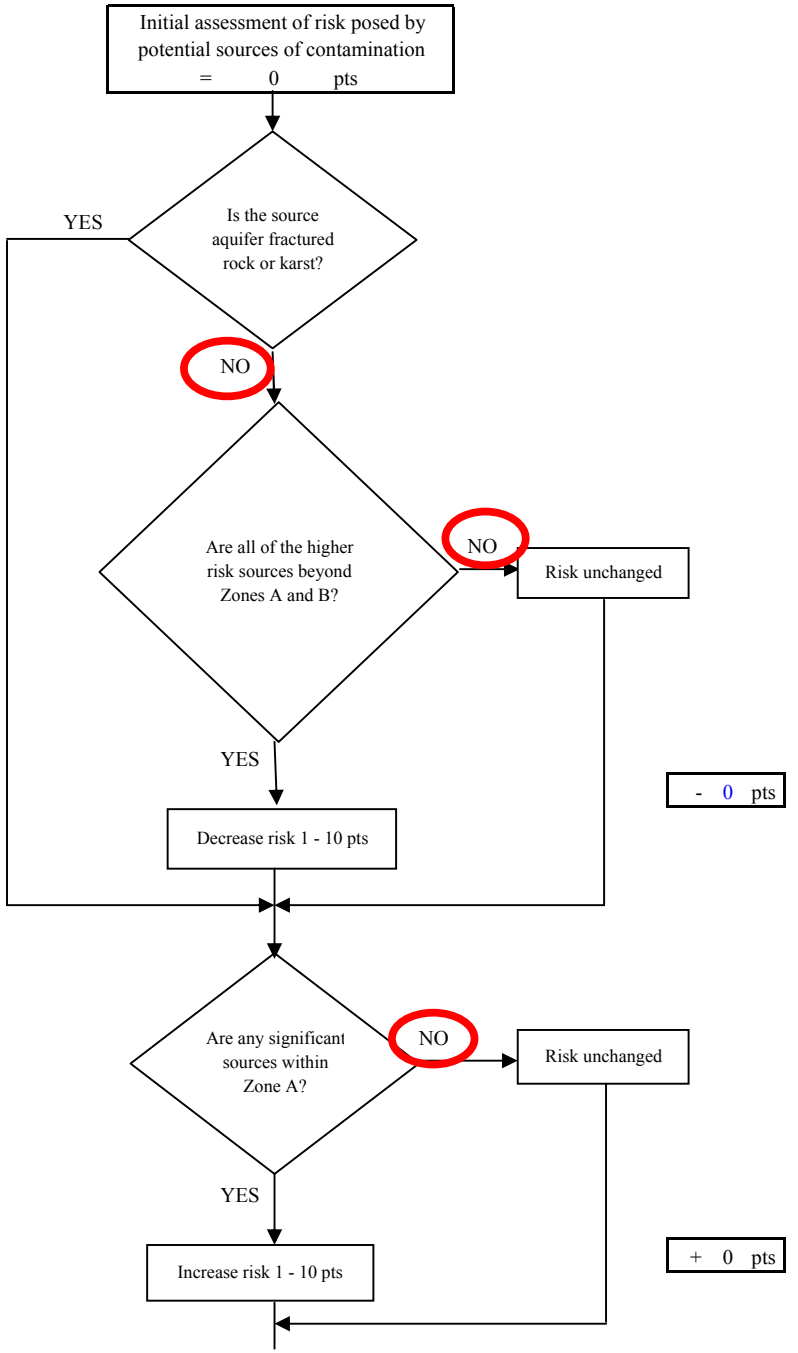


Chart 13. Contaminant risks for Eklutna Utilities Twin Peaks - Other Organic Chemicals

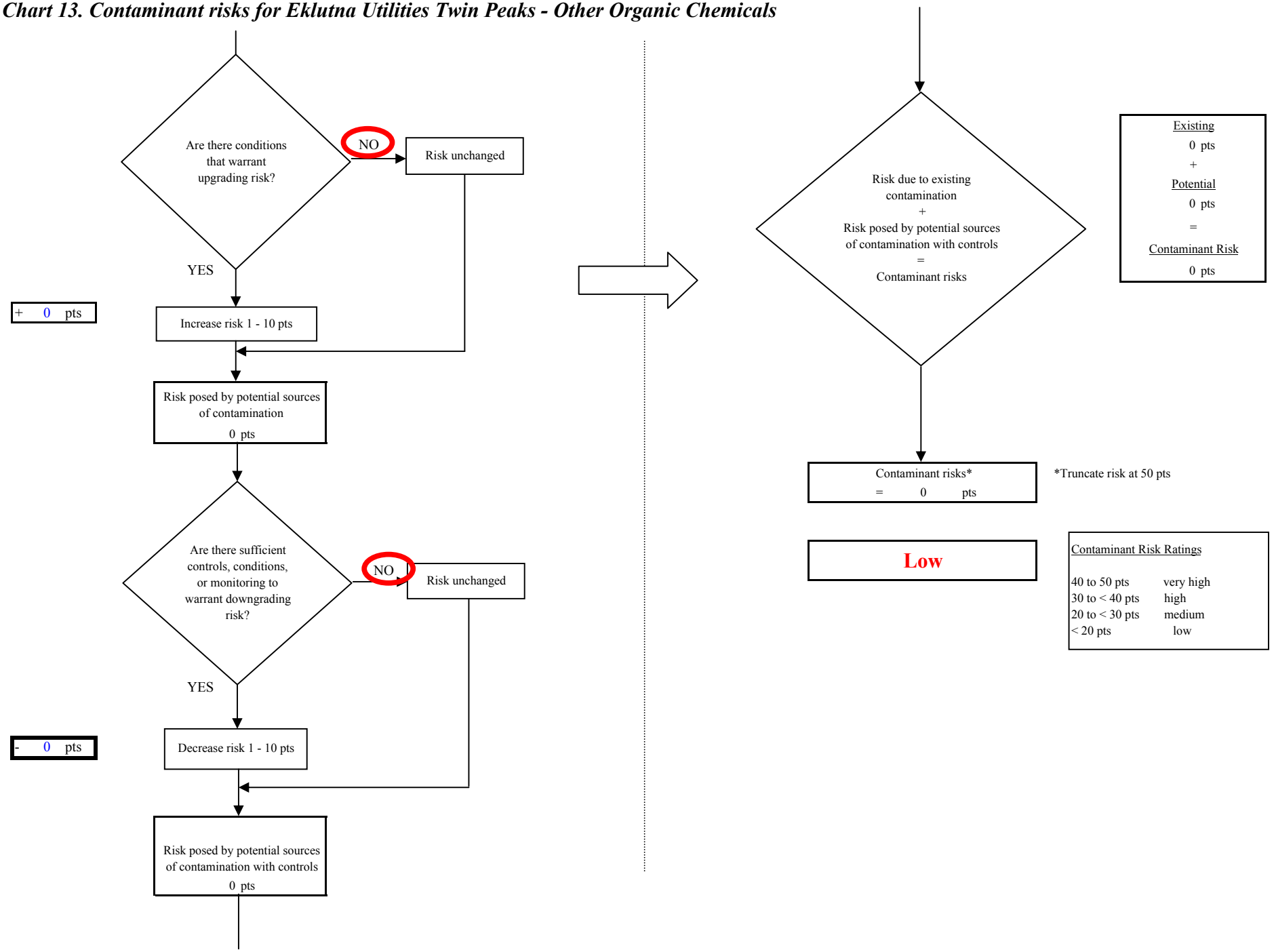


Chart 14. Vulnerability analysis for Eklutna Utilities Twin Peaks - Other Organic Chemicals