Source Water Assessment

A Hydrogeologic Susceptibility and Vulnerability Assessment for the Rock Creek Water System Denali National Park and Preserve, Alaska PWSID 390586

June 2004

DRINKING WATER PROTECTION PROGRAM REPORT Report 1549
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.

CONTENTS

TABLES

APPENDICES

Source Water Assessment for the Rock Creek Water System
Denali National Park and Preserve, 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 Rock Creek Water System. This Class A (community) water system consists one well along Park Road in Denali National Park and Preserve, Alaska. The well received a natural susceptibility rating of **Medium**. This rating is a combination of a susceptibility rating of **Low** for the actual wellhead and a **High** rating for the aquifer in which the well is drawing water from. Identified potential and current sources of contamination for the Rock Creek Water System public water system include: a parking lot. This is considered as a source 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 system for Rock Creek Water System received an overall vulnerability rating of **Low** for all six contaminant categories.

ROCK CREEK WATER SYSTEM PUBLIC DRINKING WATER SYSTEM

The Rock Creek Water System public water system is a Class A (community) water system. The system consists of one well located on the north side of Park Road in Denali National Park and Preserve, Alaska (Fairbanks Meridian, T14S, R7W, Section 5) (See Map 1 of Appendix A). Denali National Park and Preserve is located along the George Parks Highway.

The Rock Creek Water System serves the residents of the "Headquarters Housing Area", the seasonal residents of "C-Camp Housing Area", and the employees working in the Headquarters Area and the Maintenance Area. Heat for this area is provided through a fuel oil-fired steam boiler and its underground steam pipe system. UST propane and some heating oil tanks supplement this system. This area is also served by a piped sewer system (ADCED, 2002). Electricity is provided by Golden Valley Electric Association (ADCED, 2002). Refuse is hauled to the new Denali Borough regional landfill, located south of Anderson.

The Rock Creek Water System public water system lays at the base of Mount Healy of the Alaska Range at an elevation of approximately 2300 feet above sea level.

The water system consists of three horizontal 65-foot wells drilled into the side of the mountain. The wells receive their water from a fractured bedrock aquifer. Primarily surface infiltration contributes water to this fractured bedrock aquifer.

The Rock Creek Water System public drinking water system serves between 80 to 100 residents and nonresidents.

ROCK CREEK WATER SYSTEM 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. Because this water system is gravity fed and doesn't use a water pump, only the area up gradient of the wells contributes water to the system. The outline of the immediate watershed was delineated as the capture zone for the Rock Creek Water System.

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). Because time-of-travel is difficult to calculate in fractured bedrock aquifers, the protection area for Rock Creek Water System is divided into only two zones. Zone B incorporates the immediate watershed, and Zone A is a 1000-foot radius surrounding the well but within the immediate watershed.

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 Rock Creek Water System 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 Rock Creek Water System 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.

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 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.

Tables 2 through 3 in Appendix B contain the ranking of inventoried potential and existing sources of contamination with respect to the six contaminant categories.

VULNERABILITY OF ROCK CREEK WATER SYSTEM 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 wellheads for the Rock Creek Water System received a Low Susceptibility rating. The design of the water system does not allow for sanitary seals on the actual wellheads, however the clear well the three infiltration wells drain into is sealed preventing surface waters from entering. The infiltration wells were also designed to slope down to drain water into the clear well without the use of a pump. This design also prevents surface water from traveling along the casing into the aquifer. The wells are not grouted. Grouting along the outside of the well casing would prevent water from the aquifer to travel down along the outside of the well casing and into the clear well.

The aquifer the Rock Creek Water System well is completed in received a High Susceptibility rating. The highly transmissive aquifer material (fractured bedrock) in the area allows contaminants to travel quickly through it with very little natural filtering. Table 2 summarizes the Susceptibility scores and ratings for Rock Creek Water System.

Table 1. Susceptibility

	Score	Rating
Susceptibility of the Wellhead	5	Low
Susceptibility of the Aquifer	16	High
Natural Susceptibility	21	Medium

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 2. Contaminant Risks

Category	Score	Rating
Bacteria and Viruses	0	Low
Nitrates and/or Nitrites	3	Low
Volatile Organic Chemicals	12	Low
Heavy Metals, Cyanide, and Other Inorganic Chemicals	0	Low
Synthetic Organic Chemicals	0	Low
Other Organic Chemicals	12	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 3. Overall Vulnerability

Category	Score	Rating
Bacteria and Viruses	20	Low
Nitrates and/or Nitrites	25	Low
Volatile Organic Chemicals	35	Low
Heavy Metals, Cyanide, and Other Inorganic Chemicals	20	Low
Synthetic Organic Chemicals	20	Low
Other Organic Chemicals	35	Low

Bacteria and Viruses

No risks of bacteria and viruses were identified for this water system.

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

There were also no risks of nitrates and nitrites identified for this water system.

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 Rock Creek Water System 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

The parking lot located directly over the wells represents the only identified risk of volatile organic chemical contamination to the well.

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

No risks of heavy metals, cyanide, and other inorganic chemicals were identified for this water system.

Barium, Chromium, and Fluoride have all been detected but in concentrations well below their respective Maximum Contaminant Levels (MCLs). A MCL is the concentration of a contaminant allowed in the drinking water by the Environmental Protection Area (EPA).

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

Again, there are no identified risks of synthetic organic chemicals to this public water system.

Synthetic Organic Chemicals have not been detected during routine sampling of 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

The parking lot is the only identified risk of other organic chemicals for this source of public drinking water.

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

Rock Creek Water System
Drinking Water Protection Area Location Map
(Map 1)

Denali Rock Creek HQ wells

Map 1: Rock Creek Water System Drinking Water Protection Area

PWSID: 390586.001

Alaska Department of Environmental Conservation

Alaska Drinking Water Protection Program

0 1,150 2,300 4,600 6,900 Feet

1:27,600

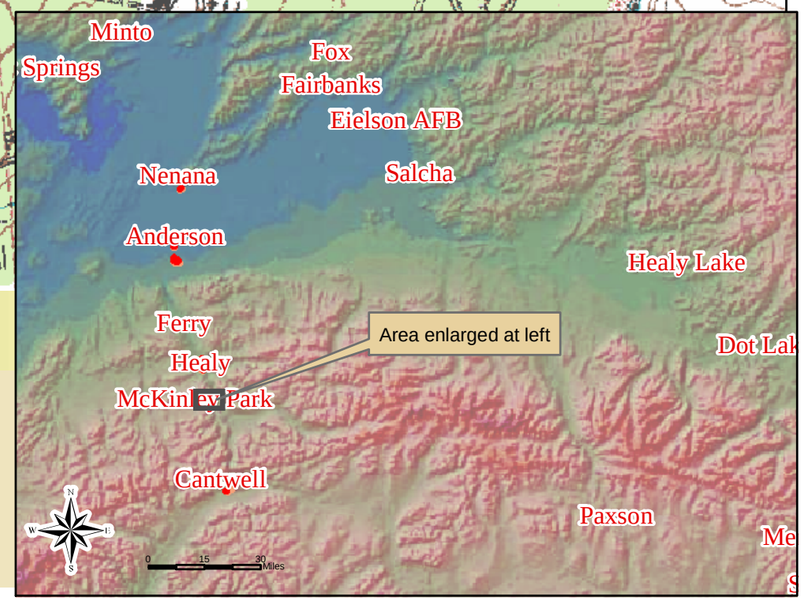
Data Sources:

Background image
- USGS 1:63,000 mapping

Zone B was delineated based upon surface contours of USGS 1:63,000 mapping.

Legend

- Denali - Rock Creek HQ wells
- Zone A
- Zone B



APPENDIX B

Contaminant Source Inventory and Risk Ranking for Rock Creek Water System (Tables 1-7)

Table 1

Contaminant Source Inventory for ***Rock Creek Water System***

PWSID 390586.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Map Number*	*Comments*
Motor vehicle/general storage yards/facilities	X27	X27-1	A	2	Parking lot located directly over the water supply wells as noted on the 7/15/02 Sanitary Survey

Table 2

Contaminant Source Inventory and Risk Ranking for Rock Creek Water System Sources of Volatile Organic Chemicals

PWSID 390586.001

Contaminant Source Type	***Contaminant Source ID***	***CS ID tag***	***Zone***	***Risk Ranking for Analysis***	***Map Number***	***Comments***
Motor vehicle/general storage yards/facilities	X27	X27-1	A	Low	2	Parking lot located directly over the water supply wells as noted on the 7/15/02 Sanitary Survey

Table 3

Contaminant Source Inventory and Risk Ranking for Rock Creek Water System
Sources of Other Organic Chemicals

PWSID 390586.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Motor vehicle/general storage yards/facilities	X27	X27-1	A	Low	2	Parking lot located directly over the water supply wells as noted on the 7/15/02 Sanitary Survey

APPENDIX C

Rock Creek Water System
Potential Contaminant Sources
(Map 2)

Zone B

Zone A

X27-1

MCKINLEY

Mt McKinley National Park Headquarters

Map 2: Rock Creek Water System Potential Contaminant Sources

PWSID: 390586.001

Alaska Department of Environmental Conservation

Alaska Drinking Water Protection Program

0 300 600 1,200 Feet

1:7,200

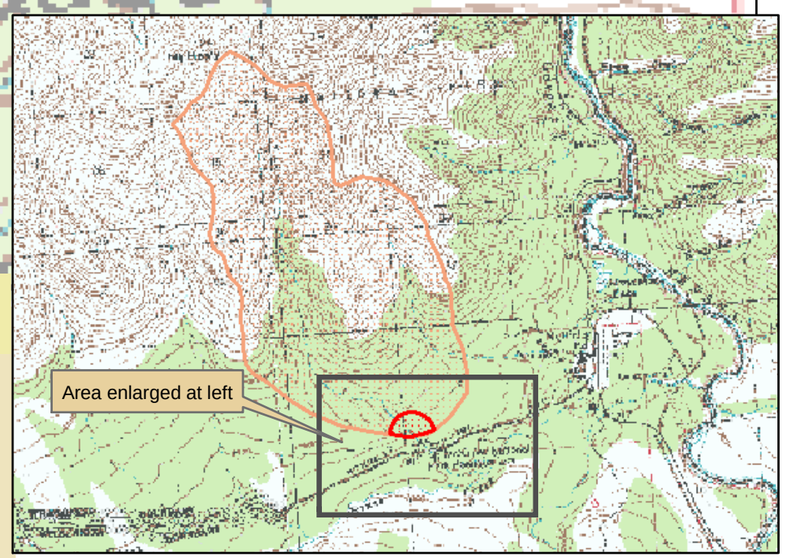
Data Sources:

Background image
- USGS 1:63,000 mapping

Zone B was delineated based upon surface contours of USGS 1:63,000 mapping.

Legend

- Denali - Rock Creek HQ
- Zone A
- Zone B
- X27, Parking lot



APPENDIX D

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

Chart 1. Susceptibility of the wellhead - Rock Creek Water System

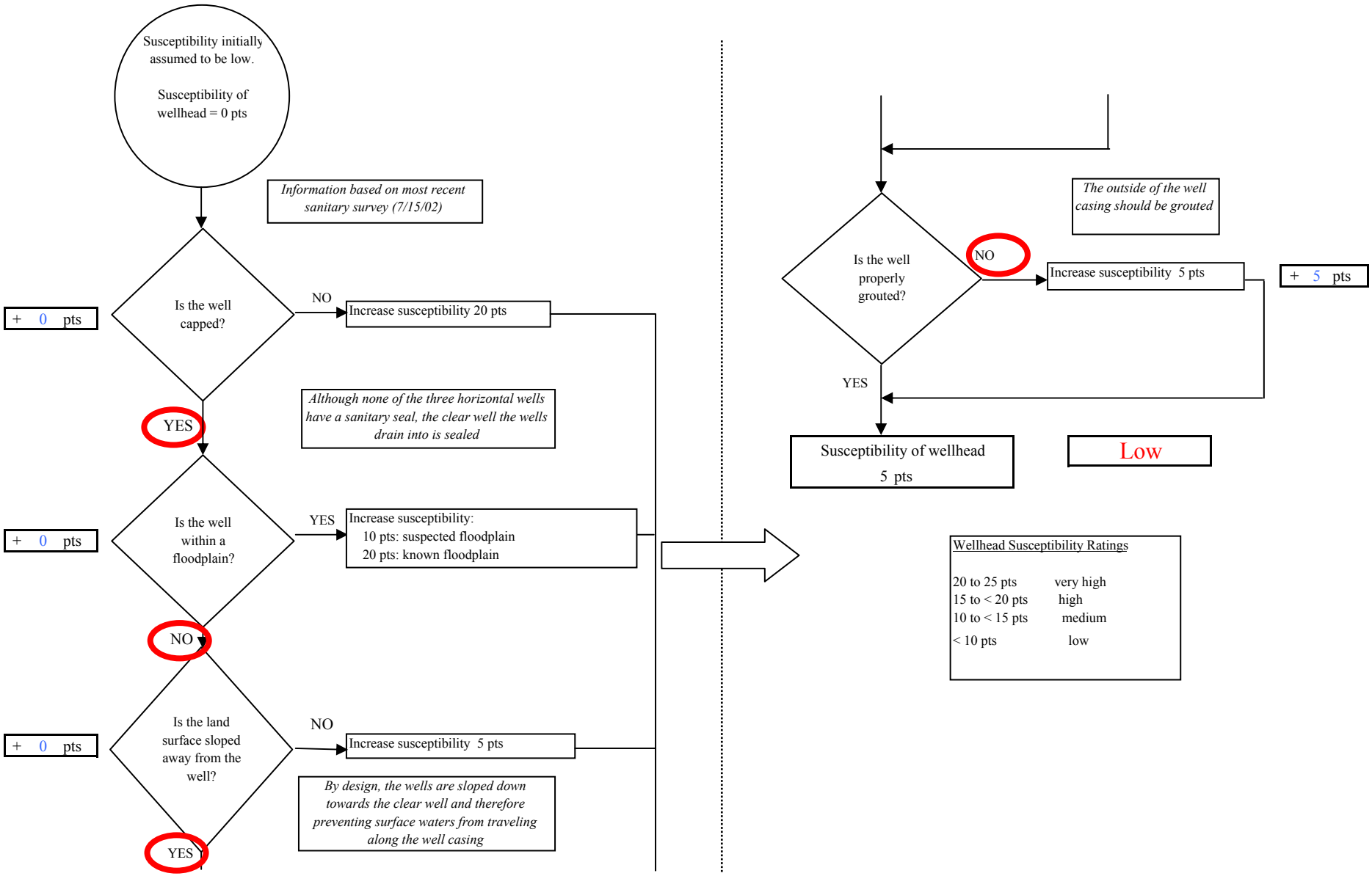


Chart 2. Susceptibility of the aquifer - Rock Creek Water System

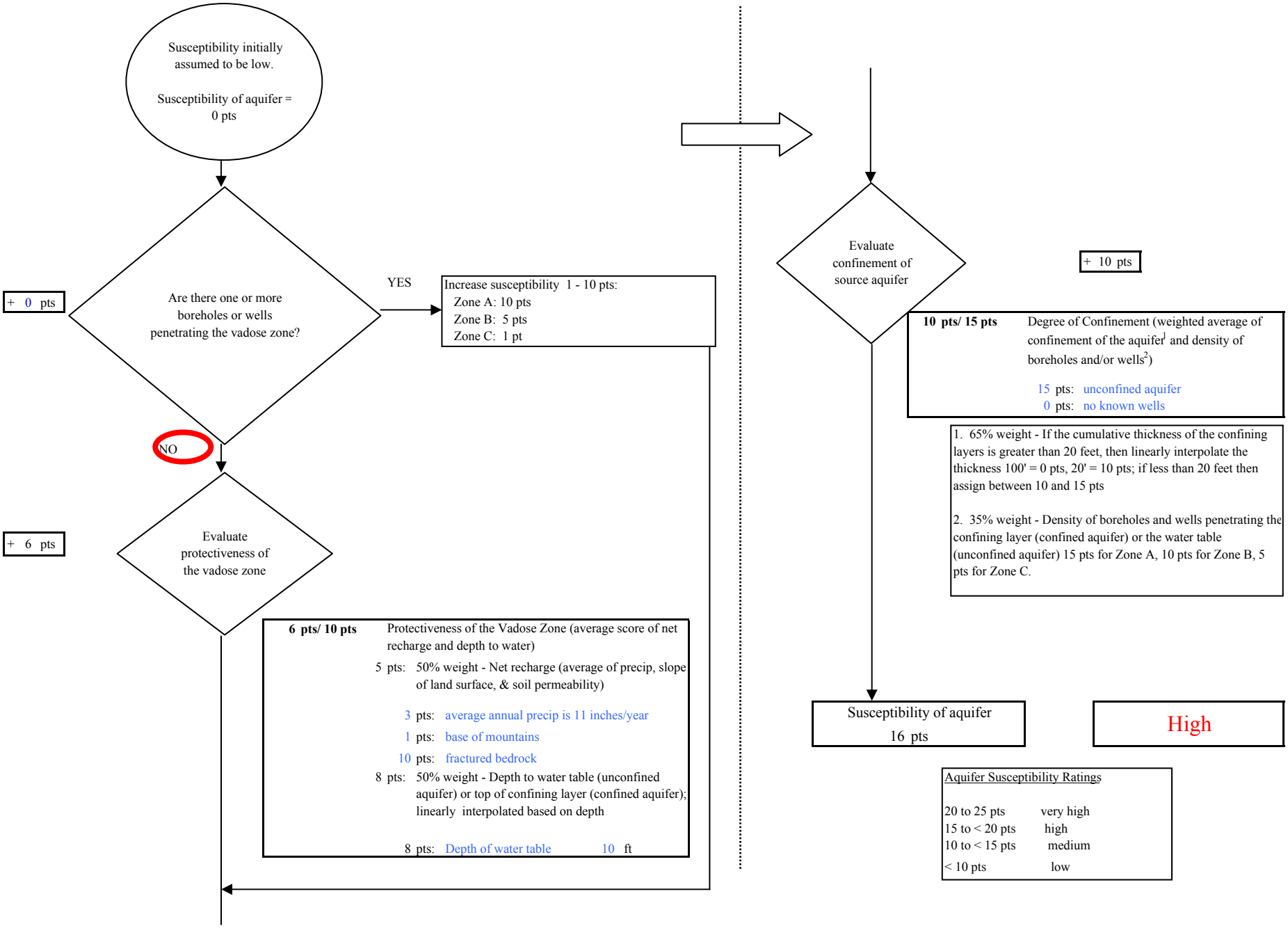
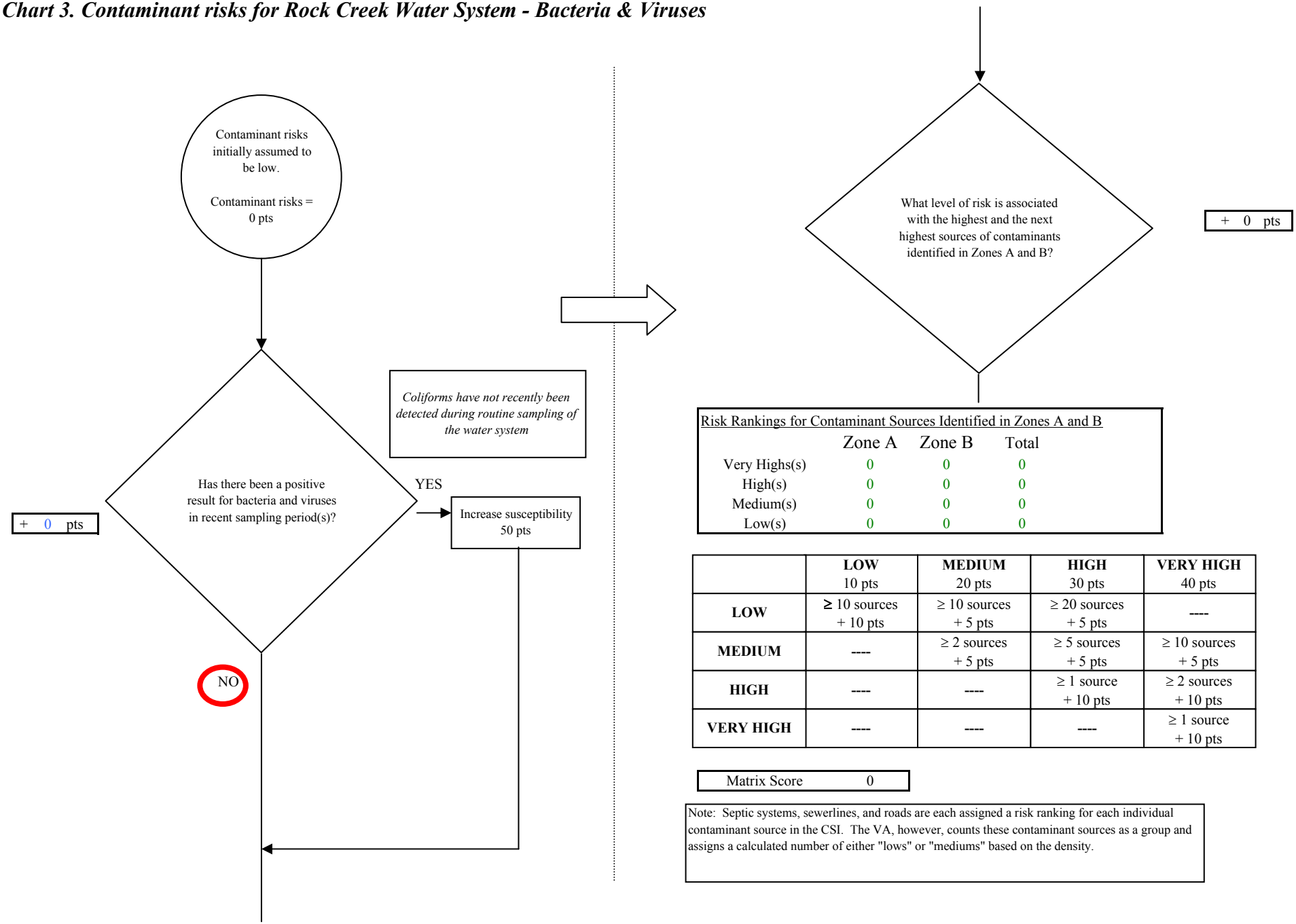


Chart 3. Contaminant risks for Rock Creek Water System - Bacteria & Viruses



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 Rock Creek Water System - Bacteria & Viruses

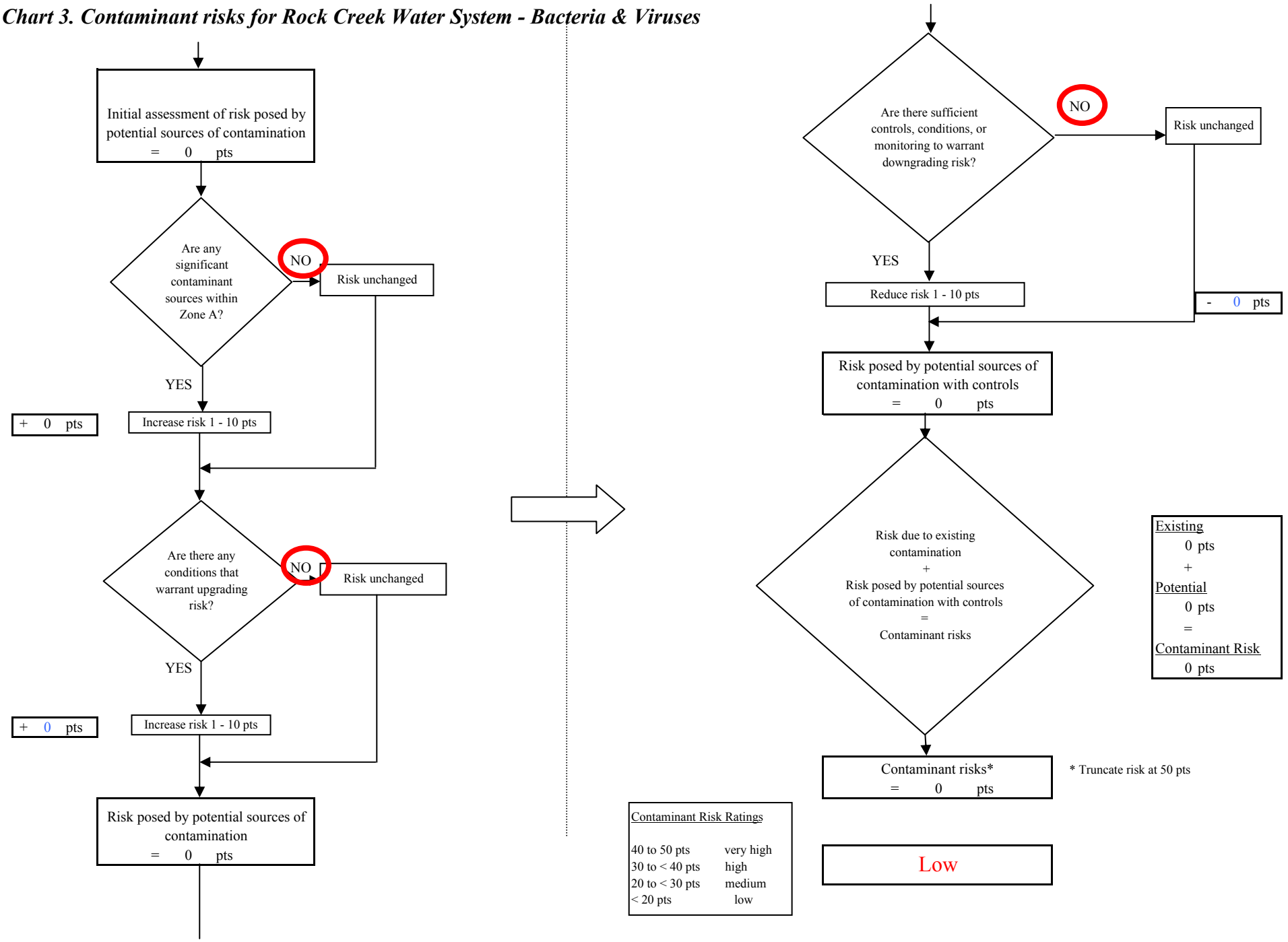


Chart 4. Vulnerability analysis for Rock Creek Water System - Bacteria & Viruses

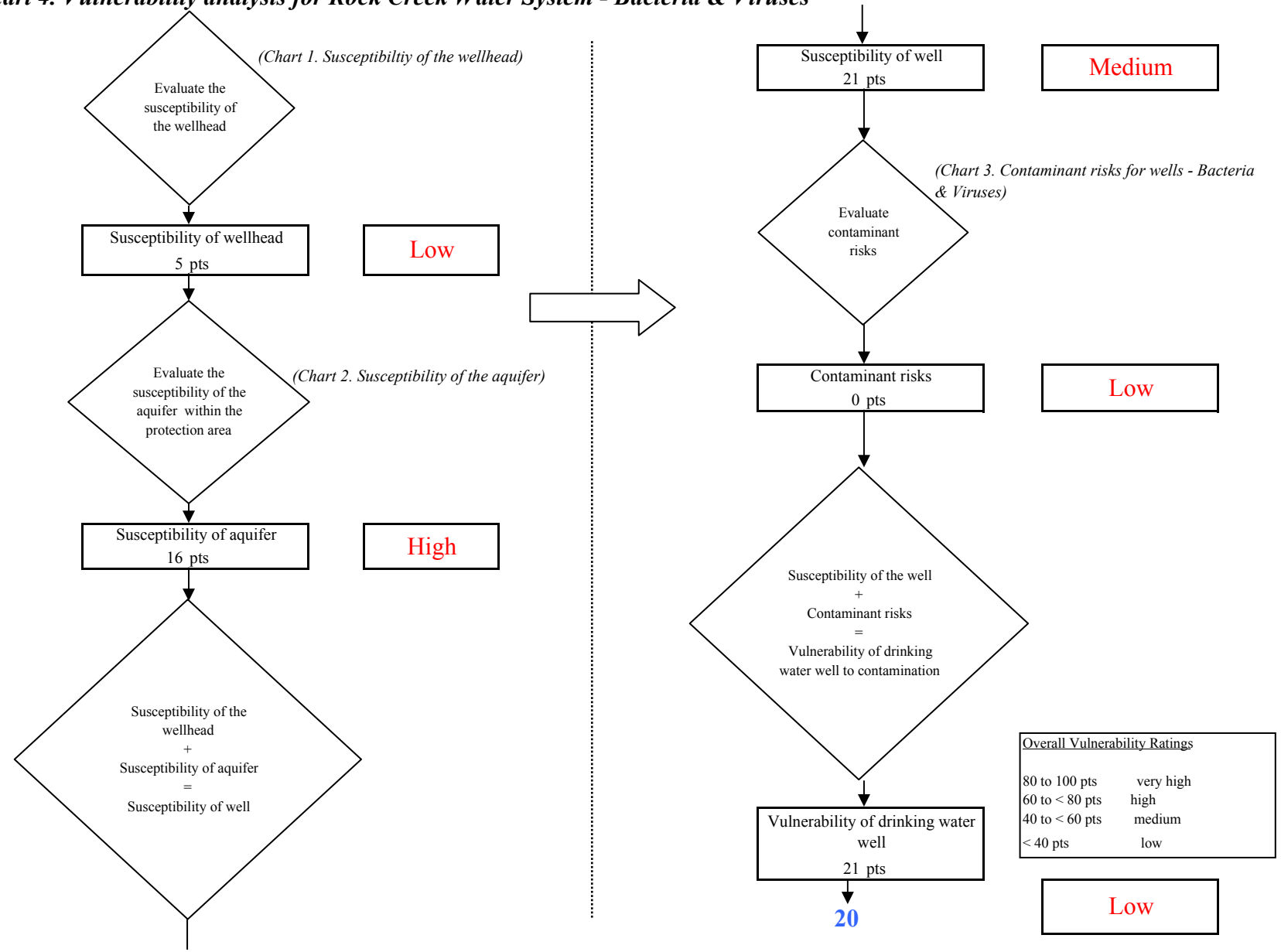


Chart 5. Contaminant risks for Rock Creek Water System - Nitrates and Nitrites

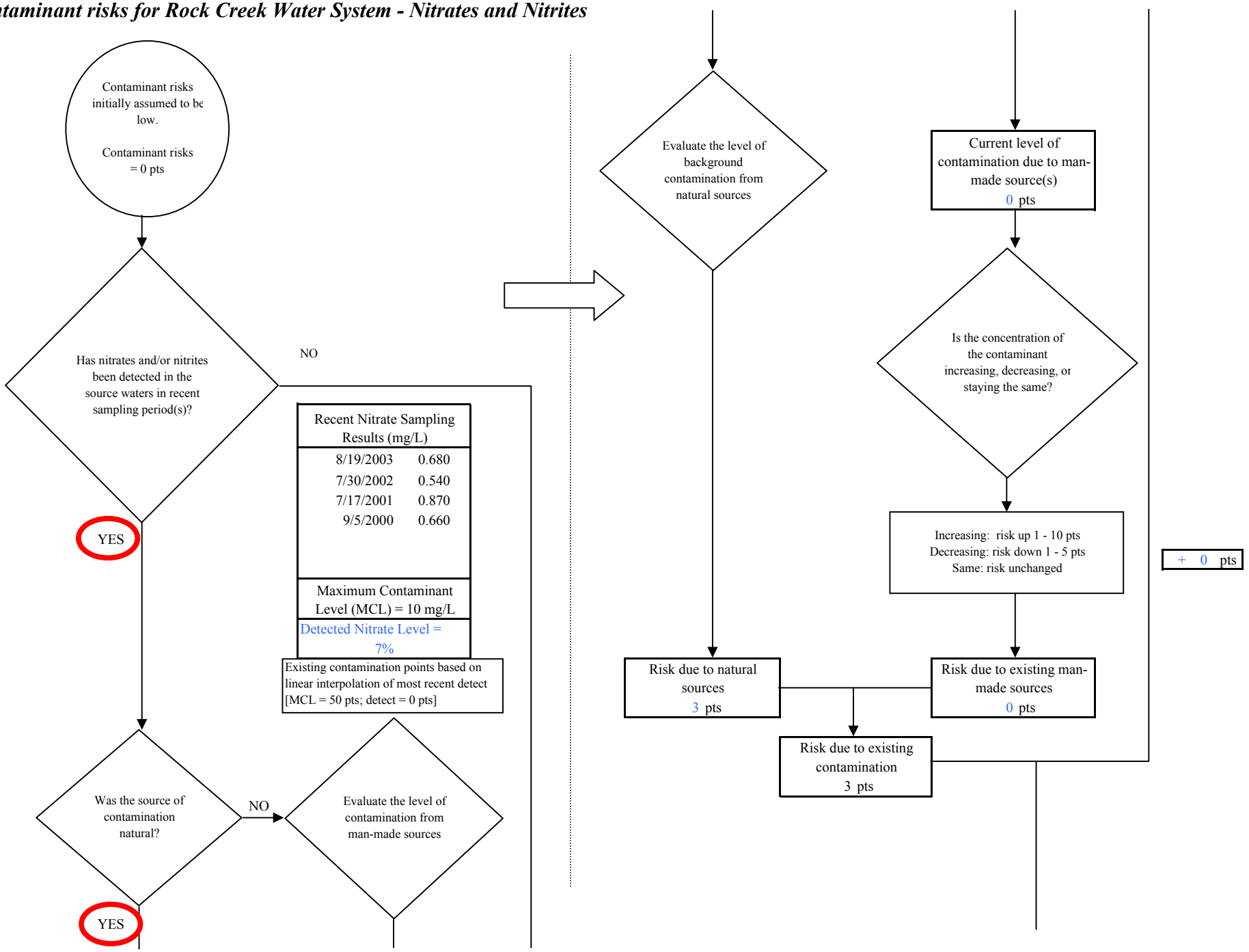


Chart 5. Contaminant risks for Rock Creek Water System - Nitrates and Nitrites

+ 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.

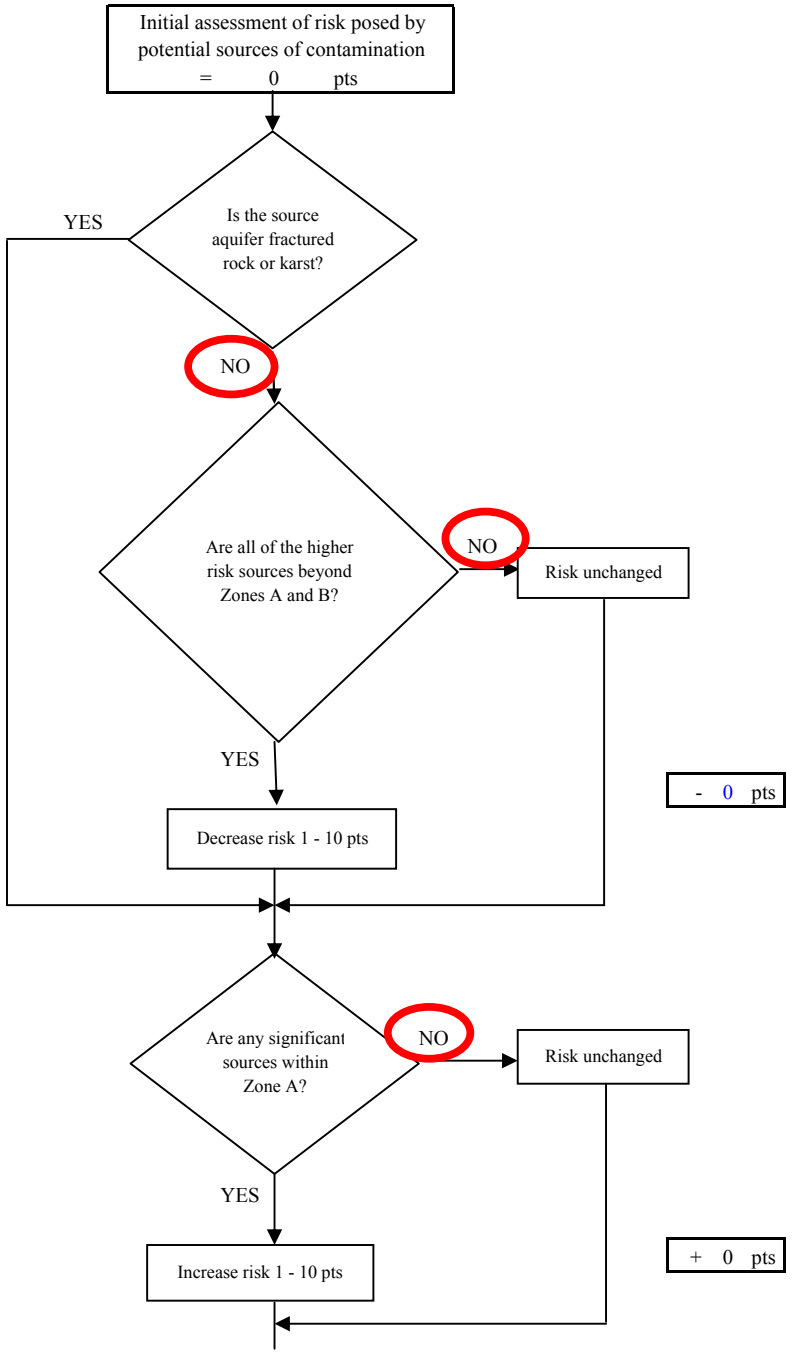
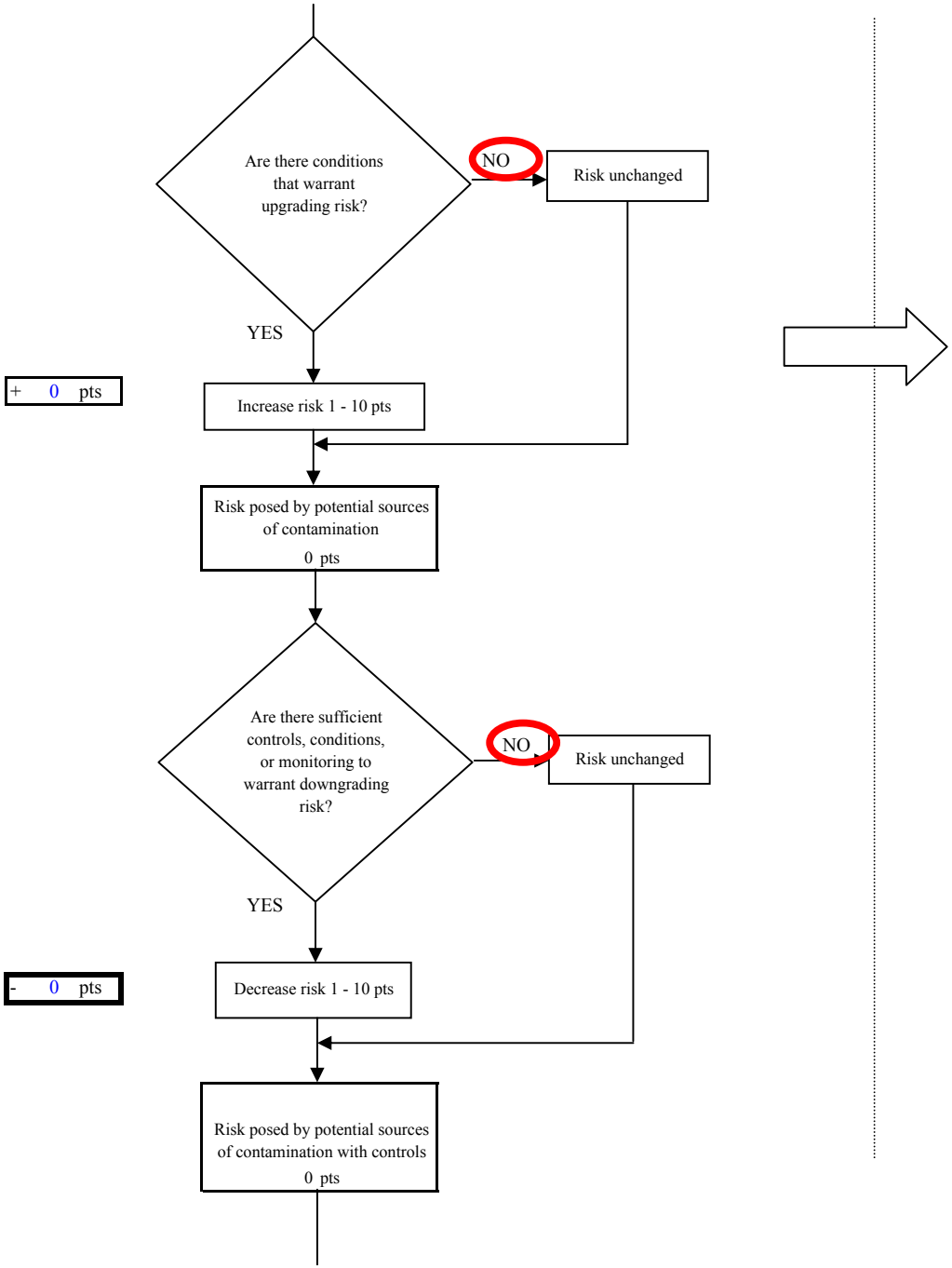


Chart 5. Contaminant risks for Rock Creek Water System - Nitrates and Nitrites



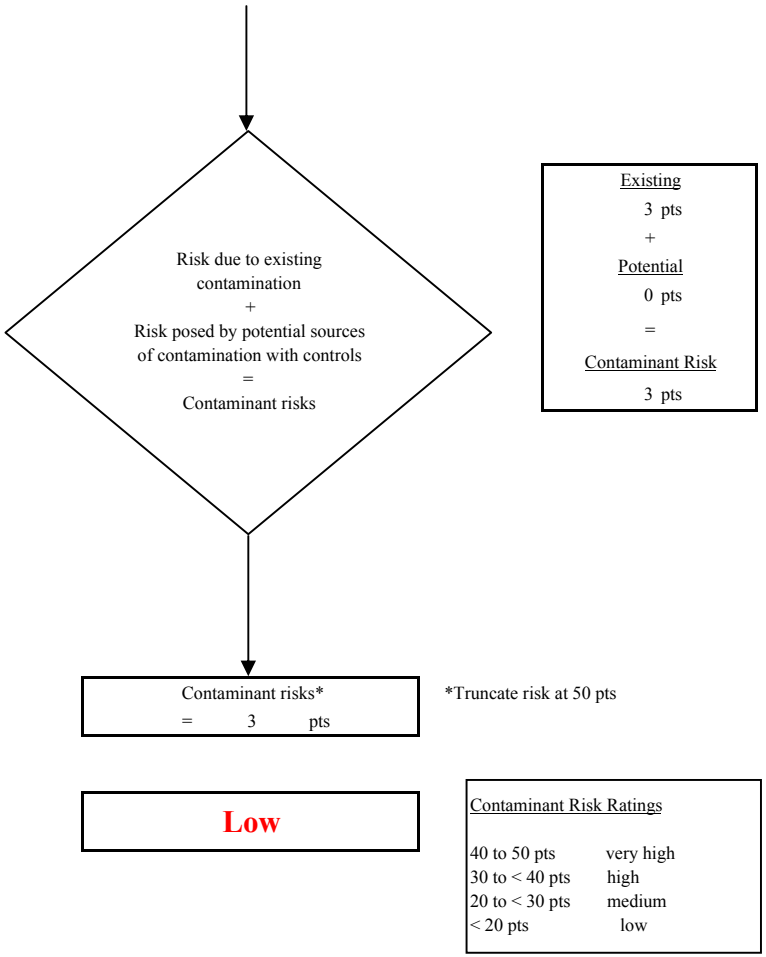


Chart 6. Vulnerability analysis for Rock Creek Water System - Nitrates and Nitrites

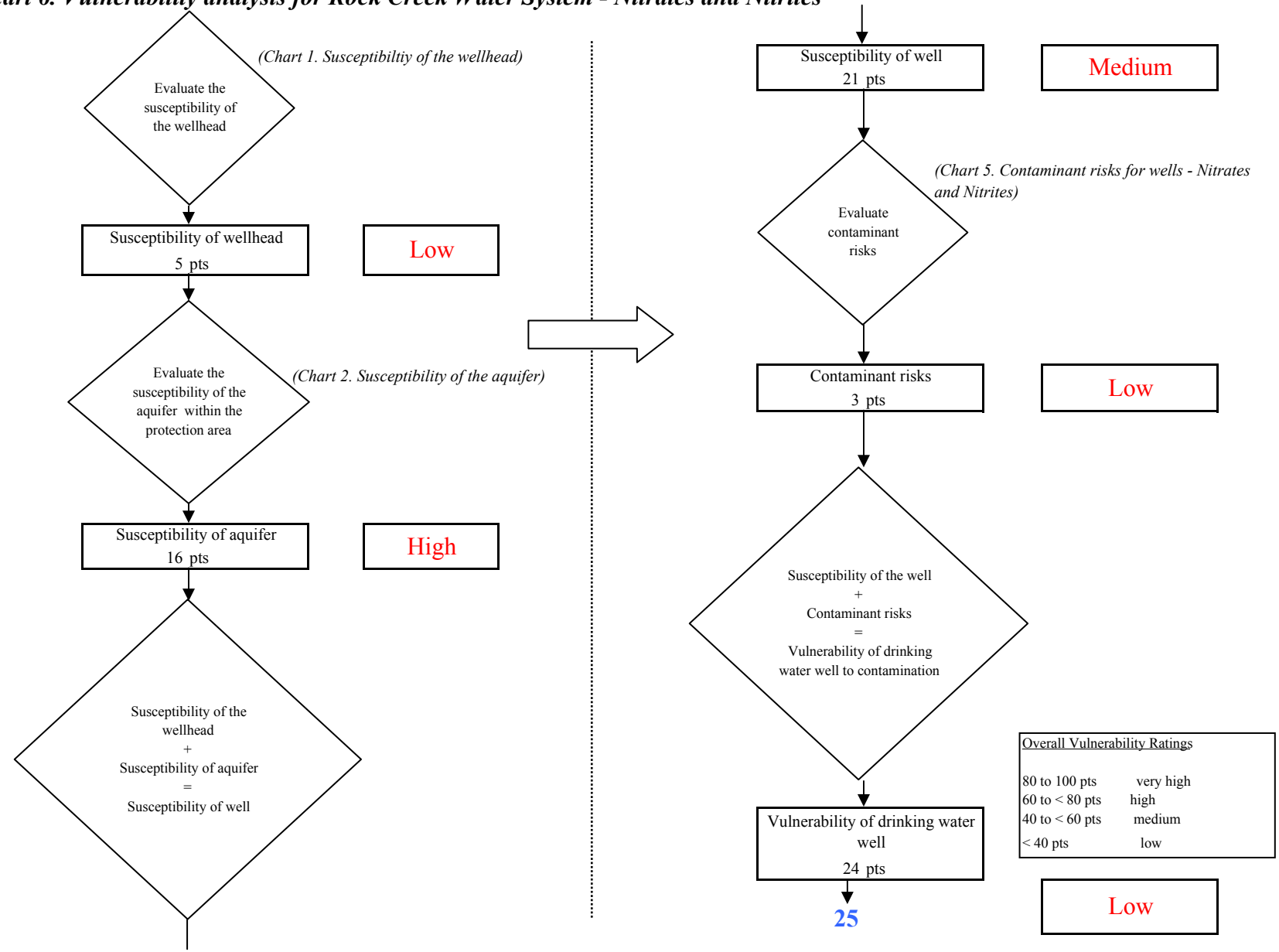


Chart 7. Contaminant risks for Rock Creek Water System - Volatile Organic Chemicals

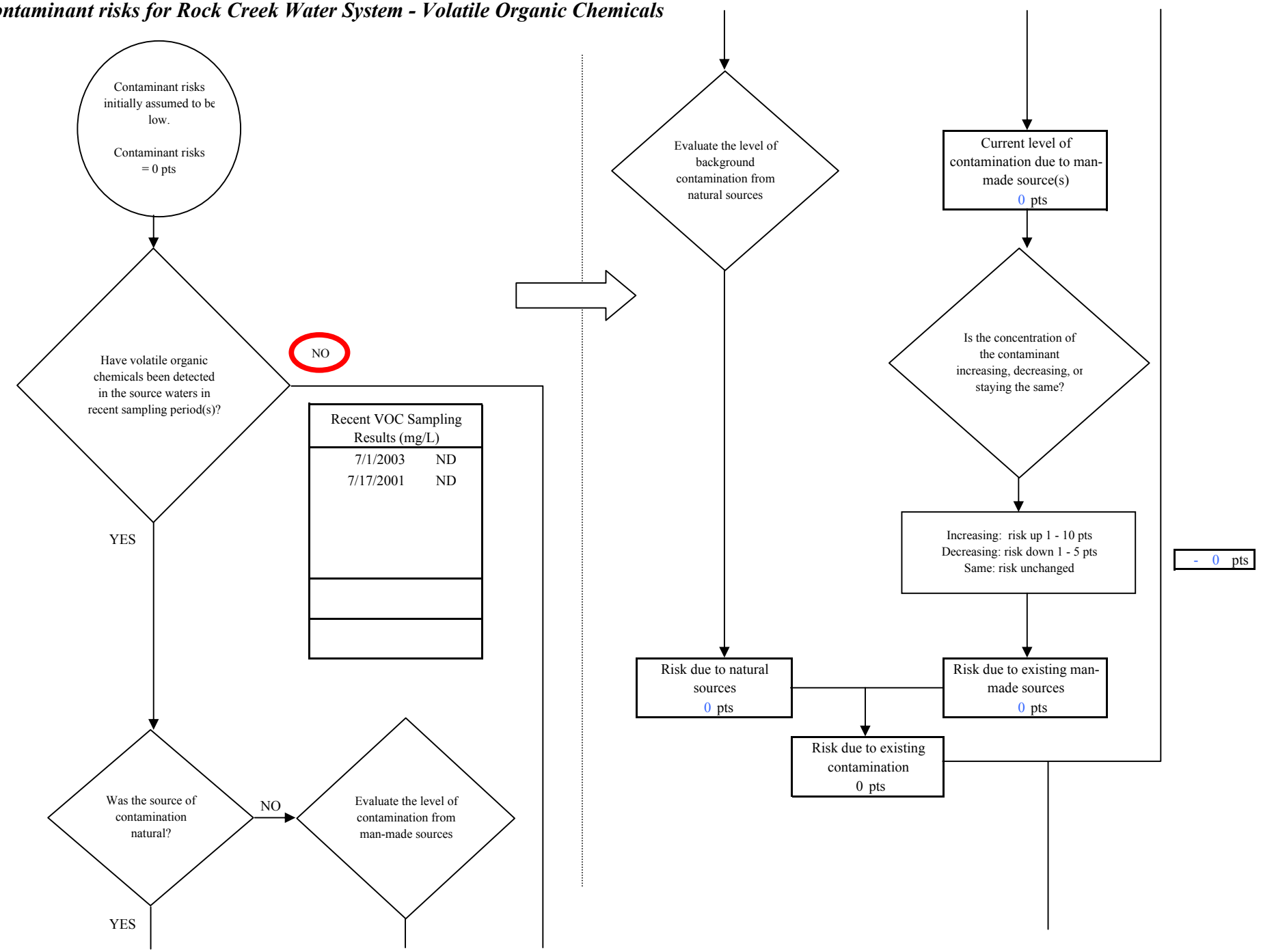


Chart 7. Contaminant risks for Rock Creek Water System - Volatile Organic Chemicals

+ 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)	1	0	1

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

Matrix Score 10

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

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

The parking lot directly above the wells increases the risk

YES

Increase risk 1 - 10 pts

+ 2 pts

Chart 7. Contaminant risks for Rock Creek Water System - Volatile Organic Chemicals

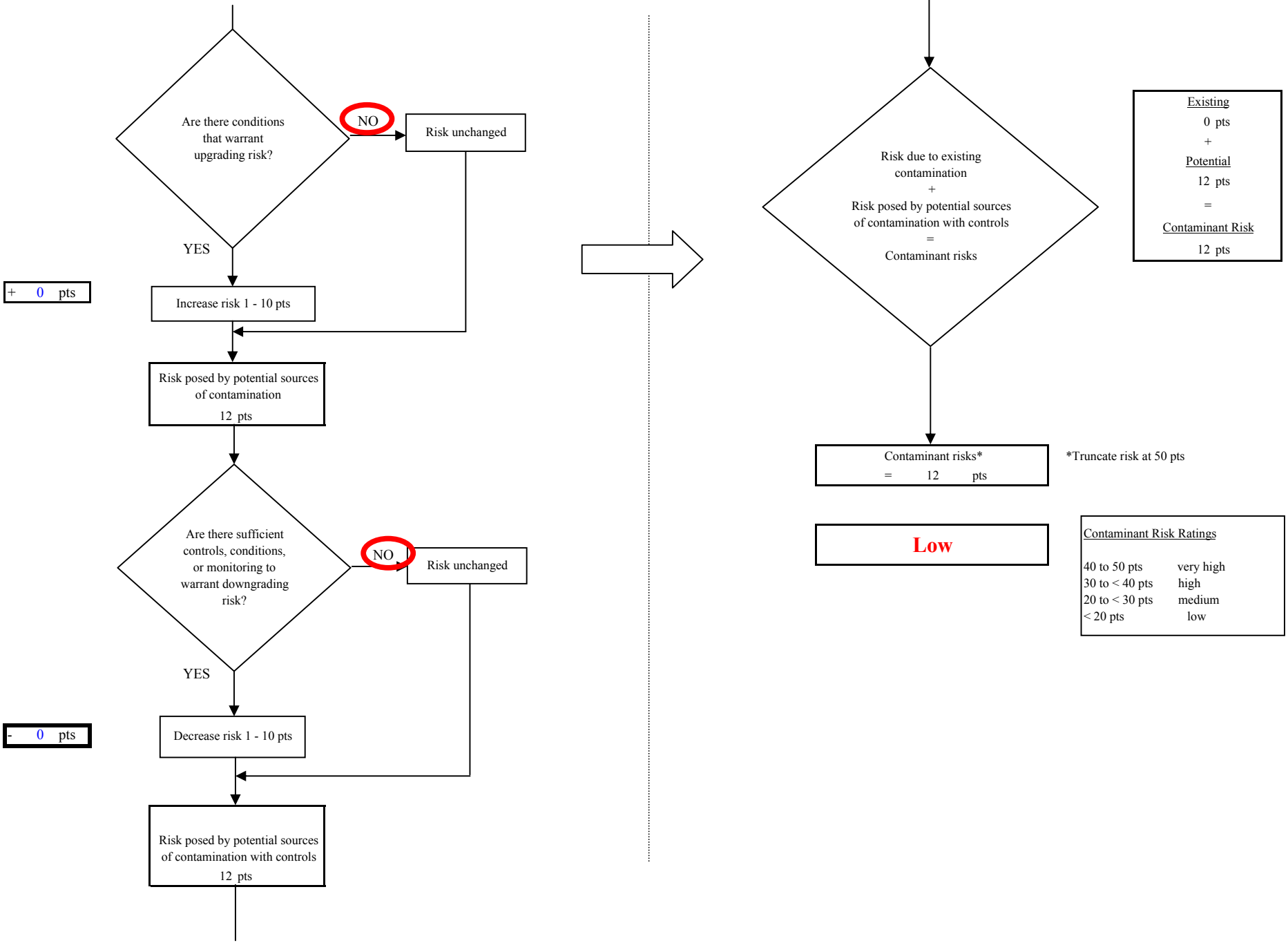


Chart 8. Vulnerability analysis for Rock Creek Water System - Volatile Organic Chemicals

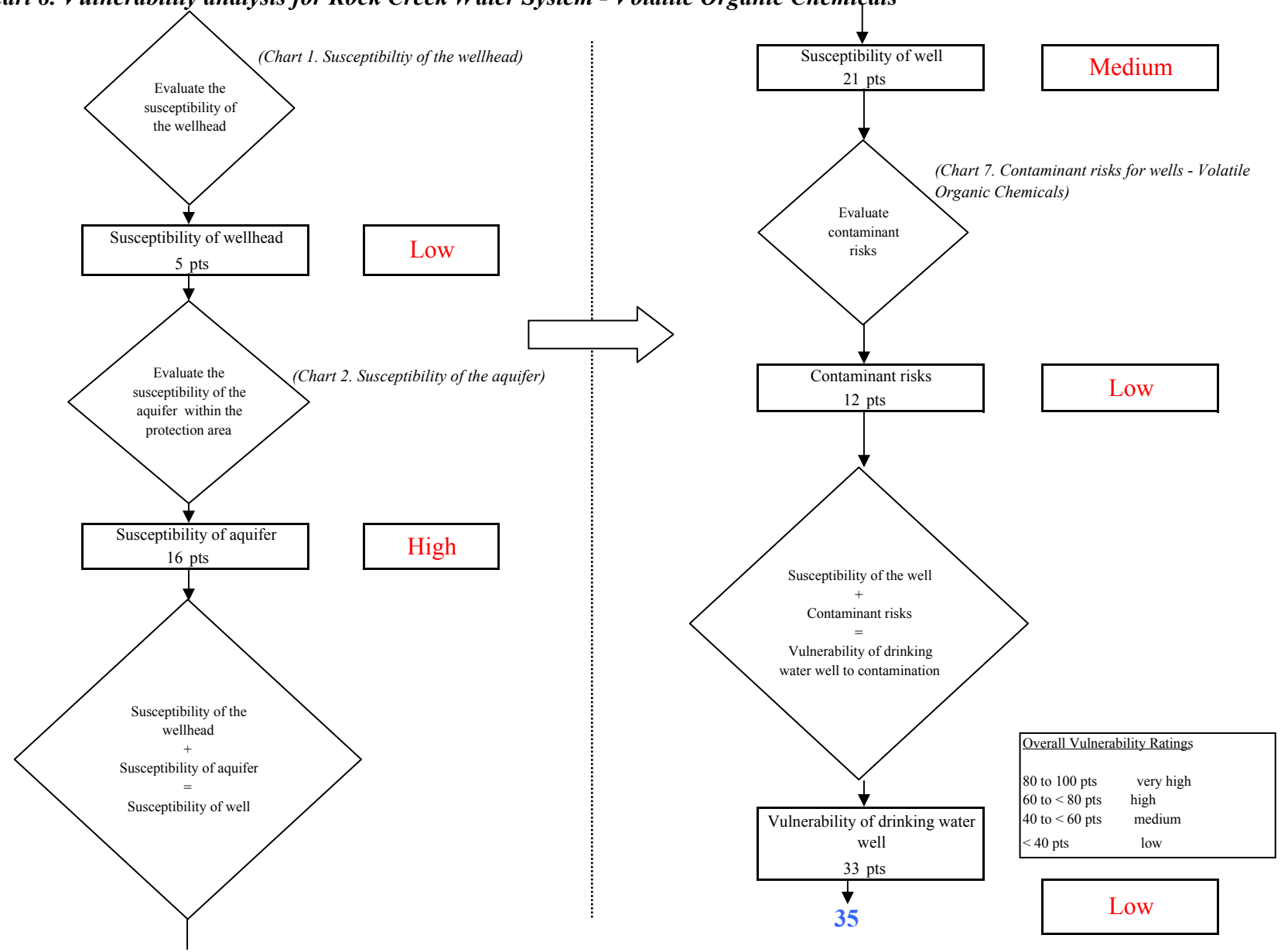


Chart 9. Contaminant risks for Rock Creek Water System - Heavy Metals, Cyanide and Other Inorganic Chemicals

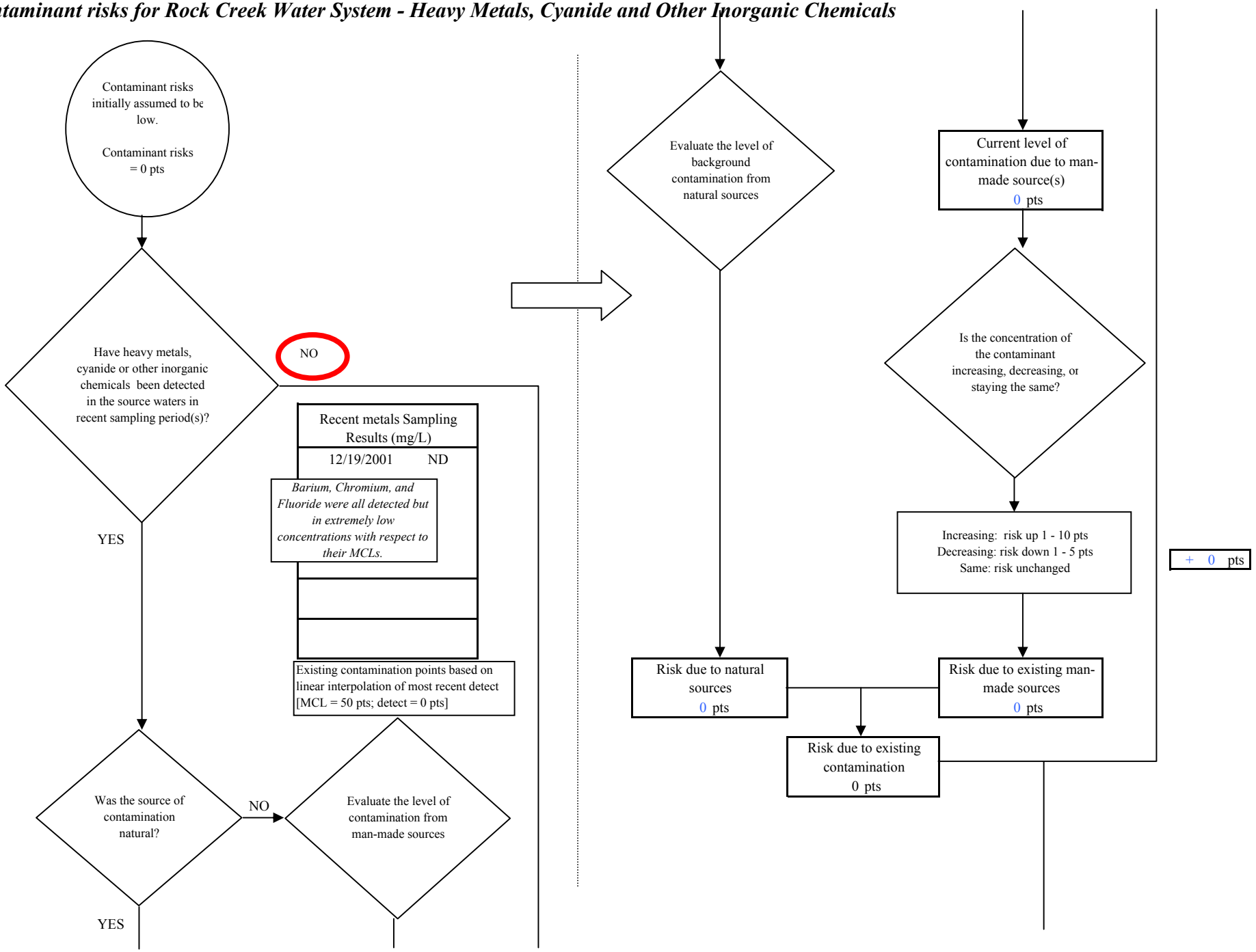


Chart 9. Contaminant risks for Rock Creek Water System - Heavy Metals, Cyanide and Other Inorganic Chemicals

+ 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 Rock Creek Water System - Heavy Metals, Cyanide and Other Inorganic Chemicals

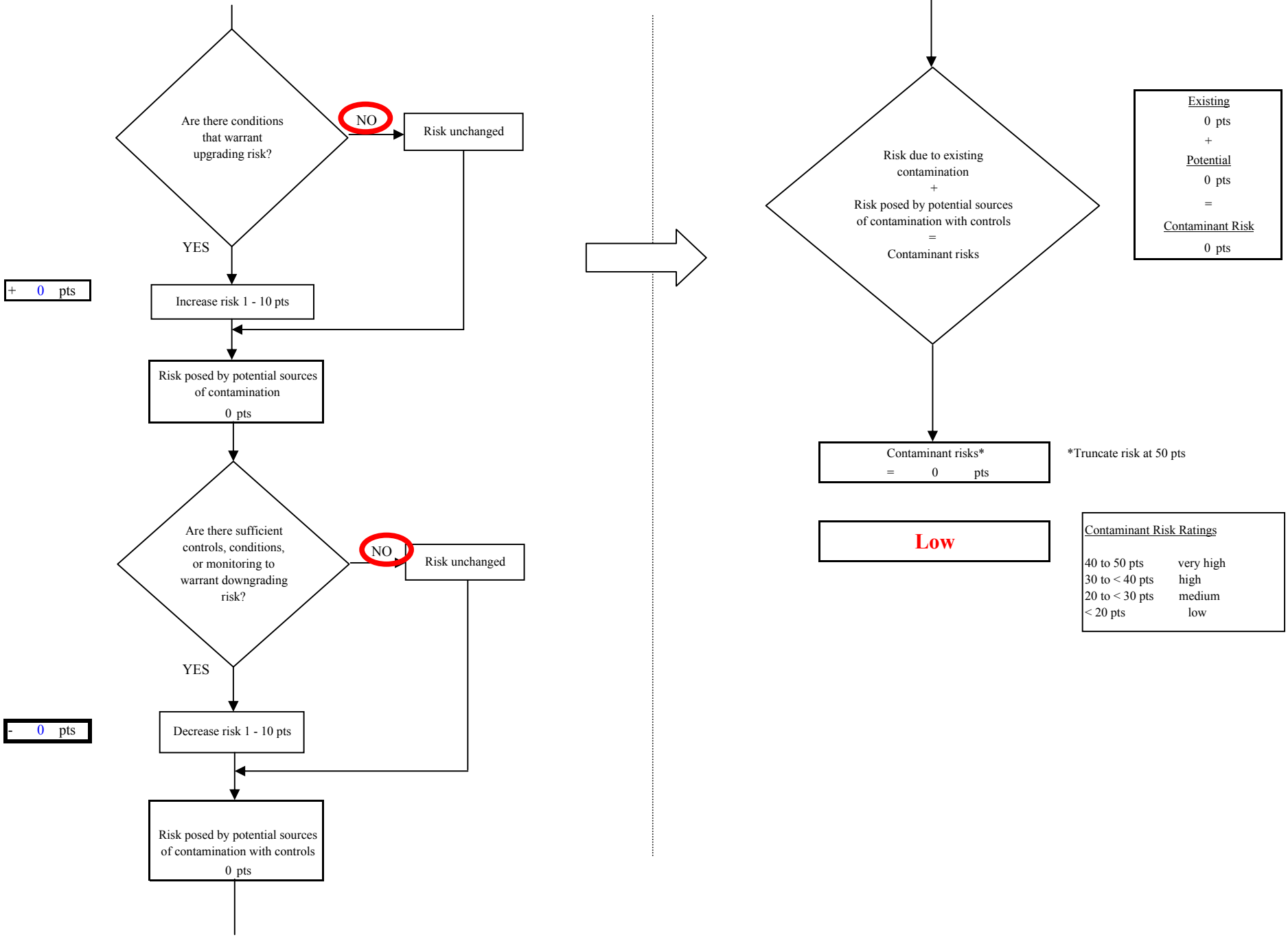


Chart 10. Vulnerability analysis for Rock Creek Water System - Heavy Metals, Cyanide and Other Inorganic Chemicals

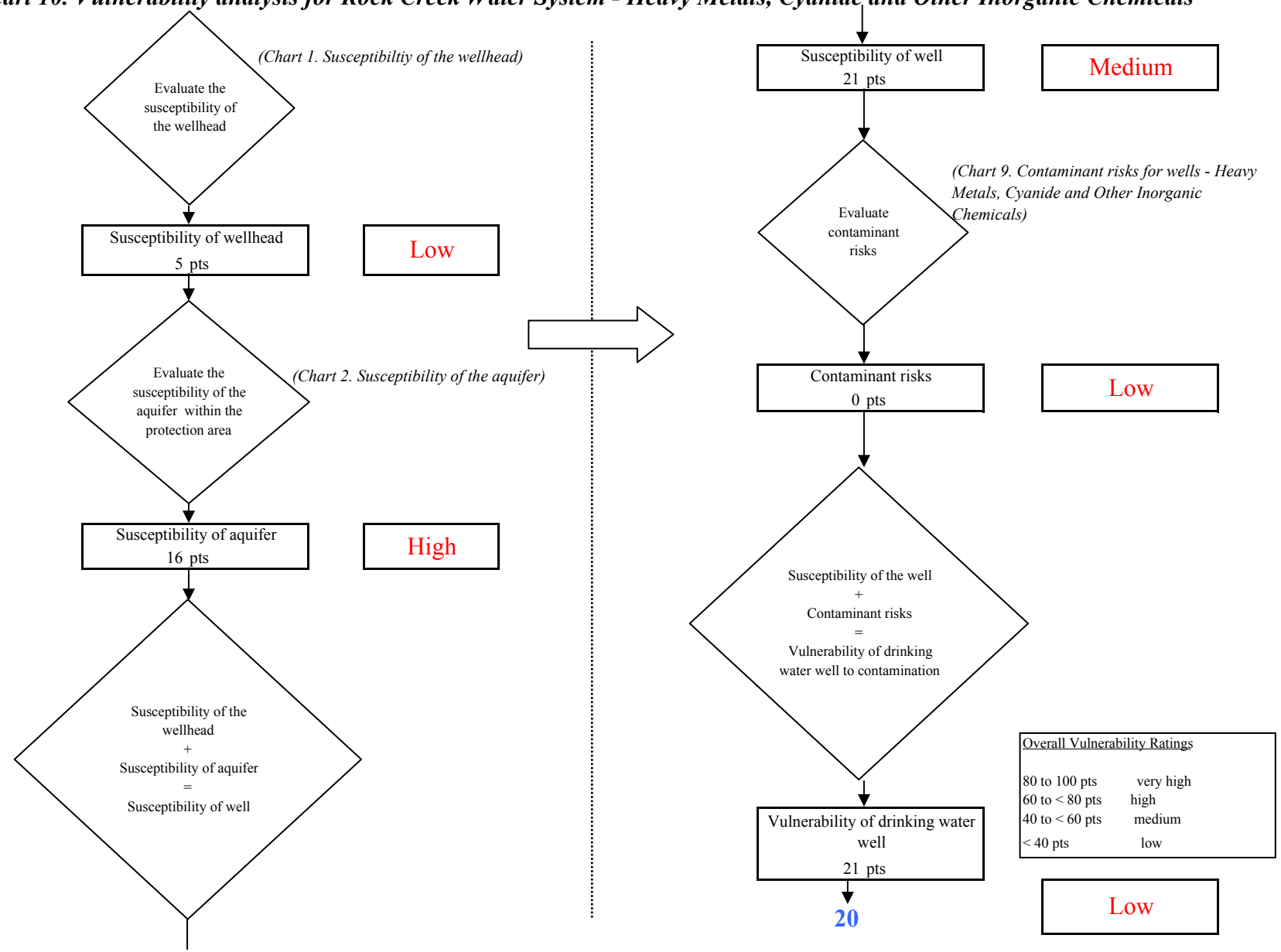


Chart 11. Contaminant risks for Rock Creek Water System - Synthetic Organic Chemicals

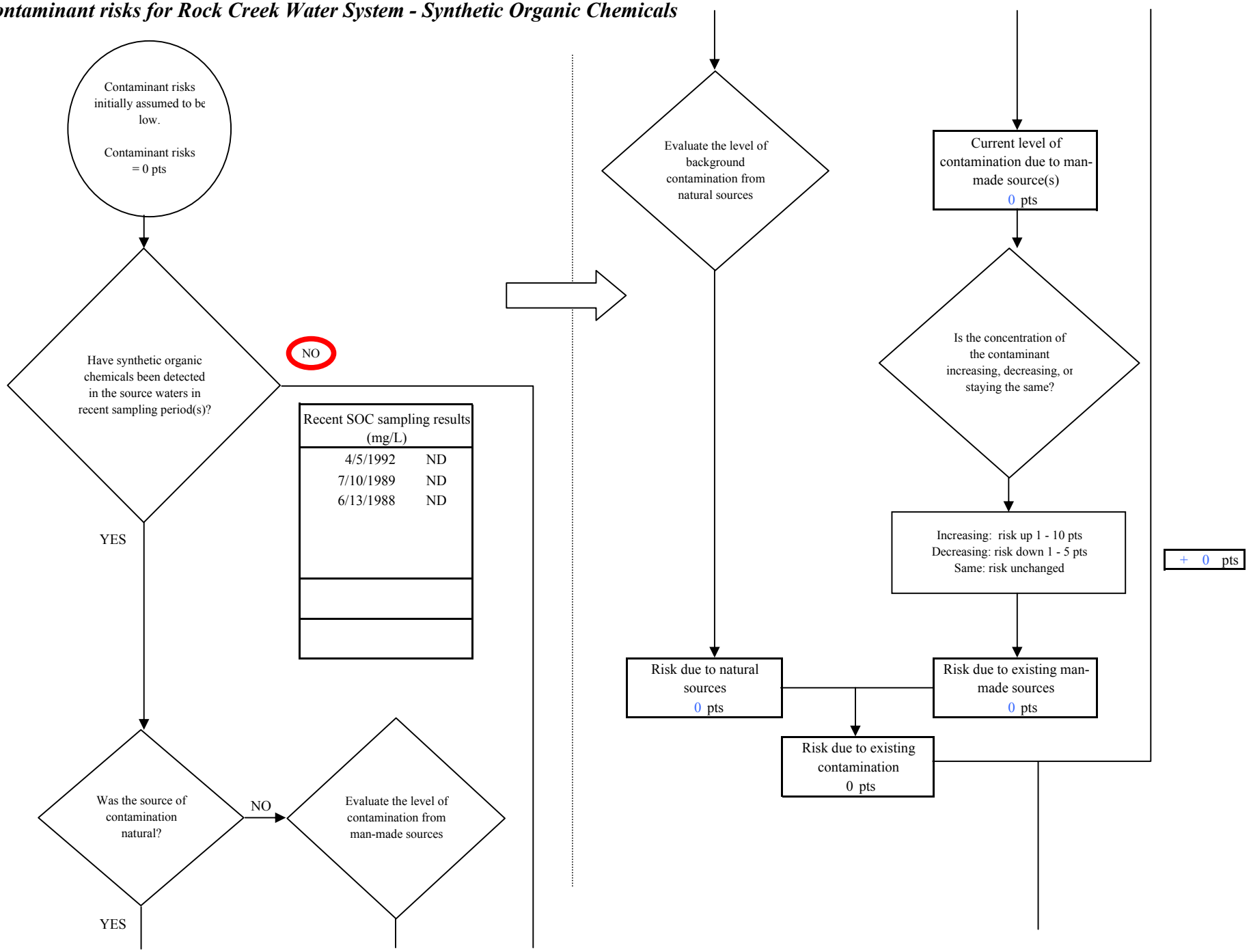


Chart 11. Contaminant risks for Rock Creek Water System - Synthetic Organic Chemicals

+ 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?

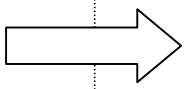
Risk Levels for Contaminant Sources identified in Zones A, B and C

	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.



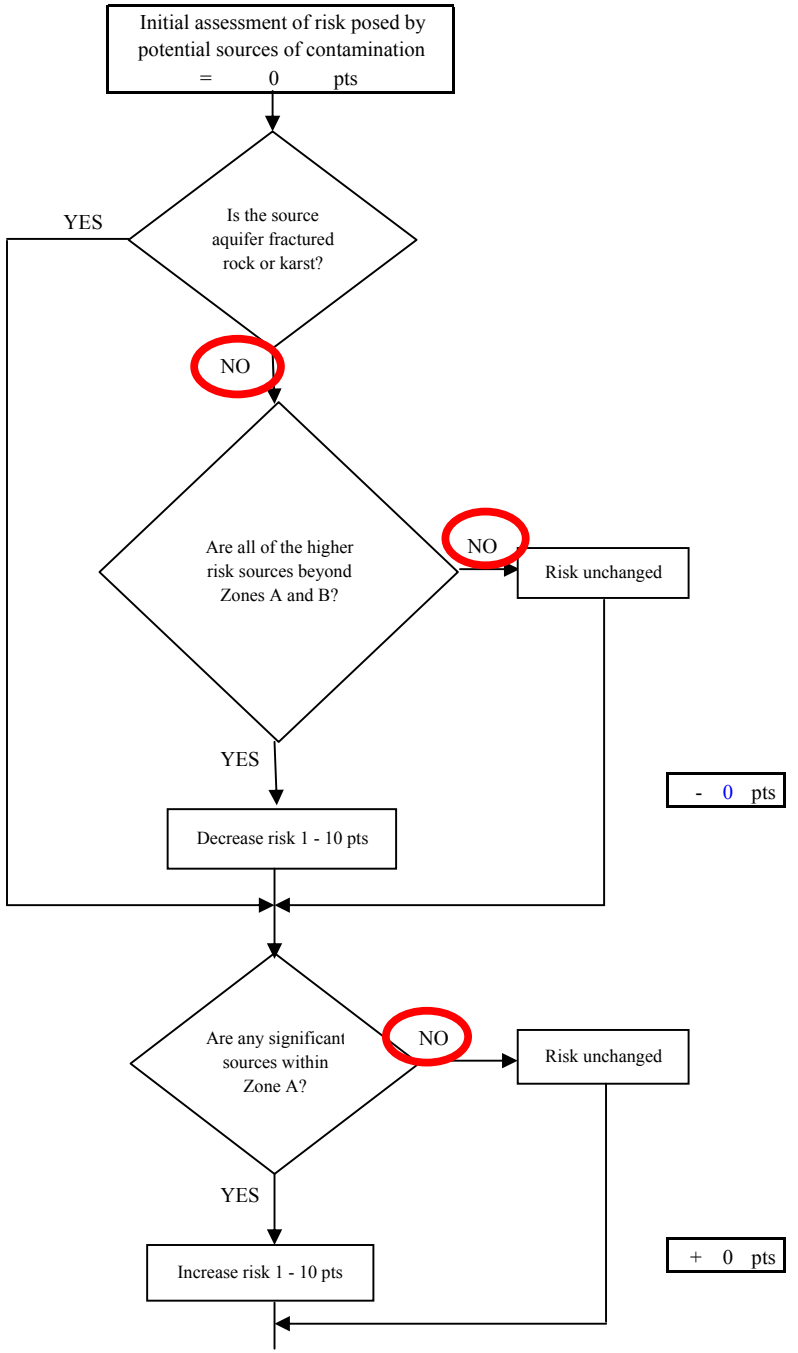


Chart 11. Contaminant risks for Rock Creek Water System - Synthetic Organic Chemicals

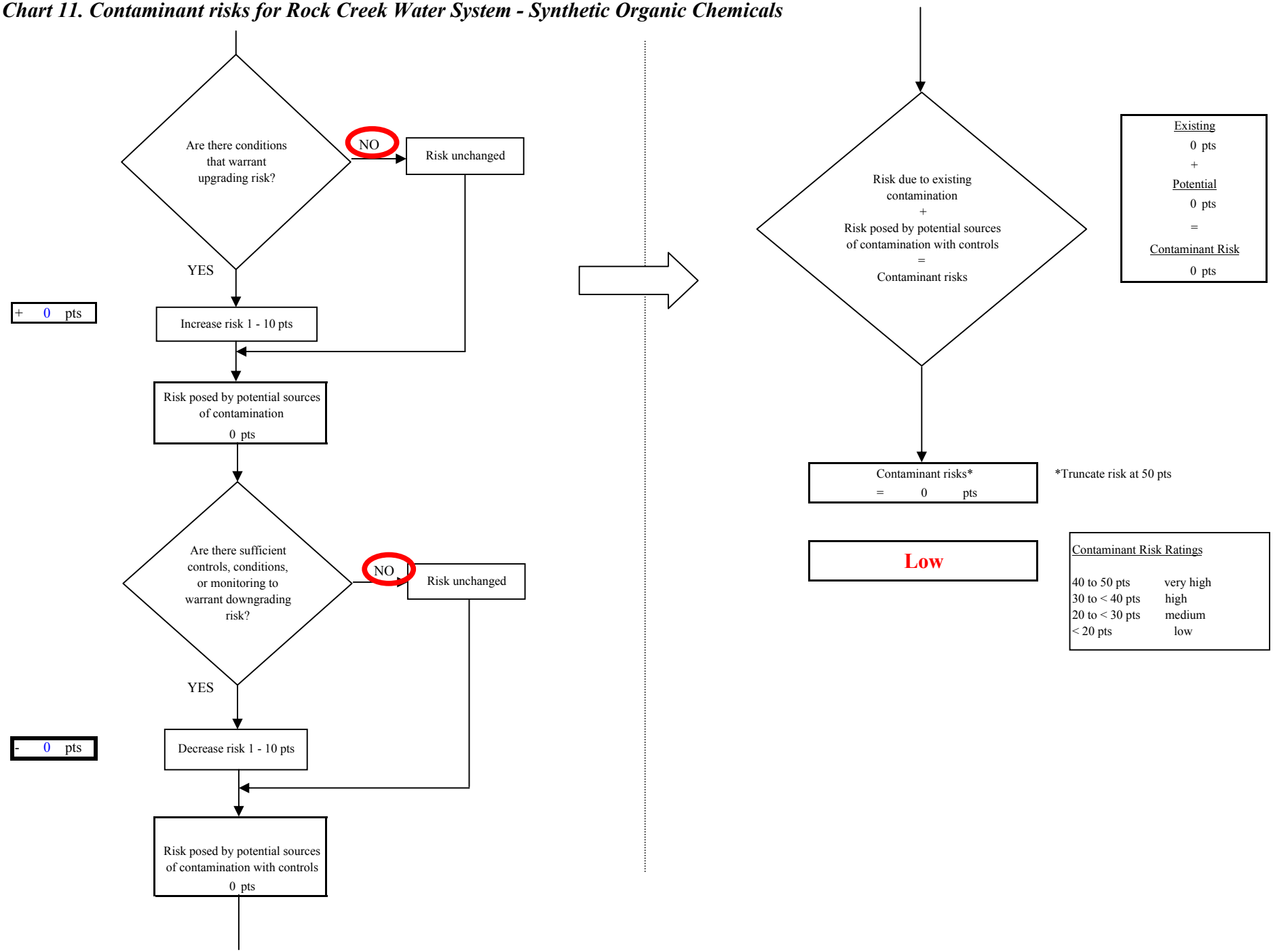


Chart 12. Vulnerability analysis for Rock Creek Water System - Synthetic Organic Chemicals

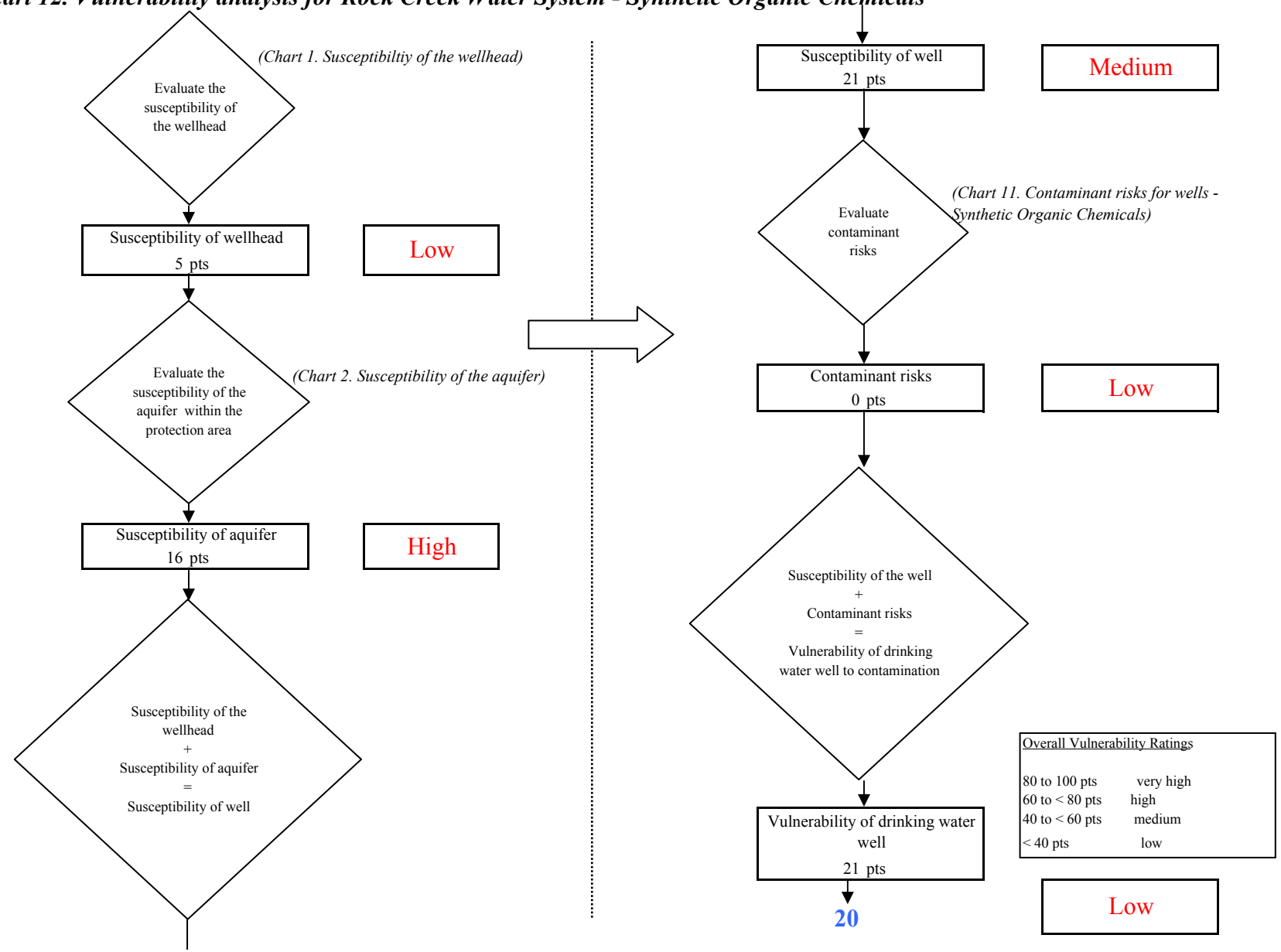


Chart 13. Contaminant risks for Rock Creek Water System - Other Organic Chemicals

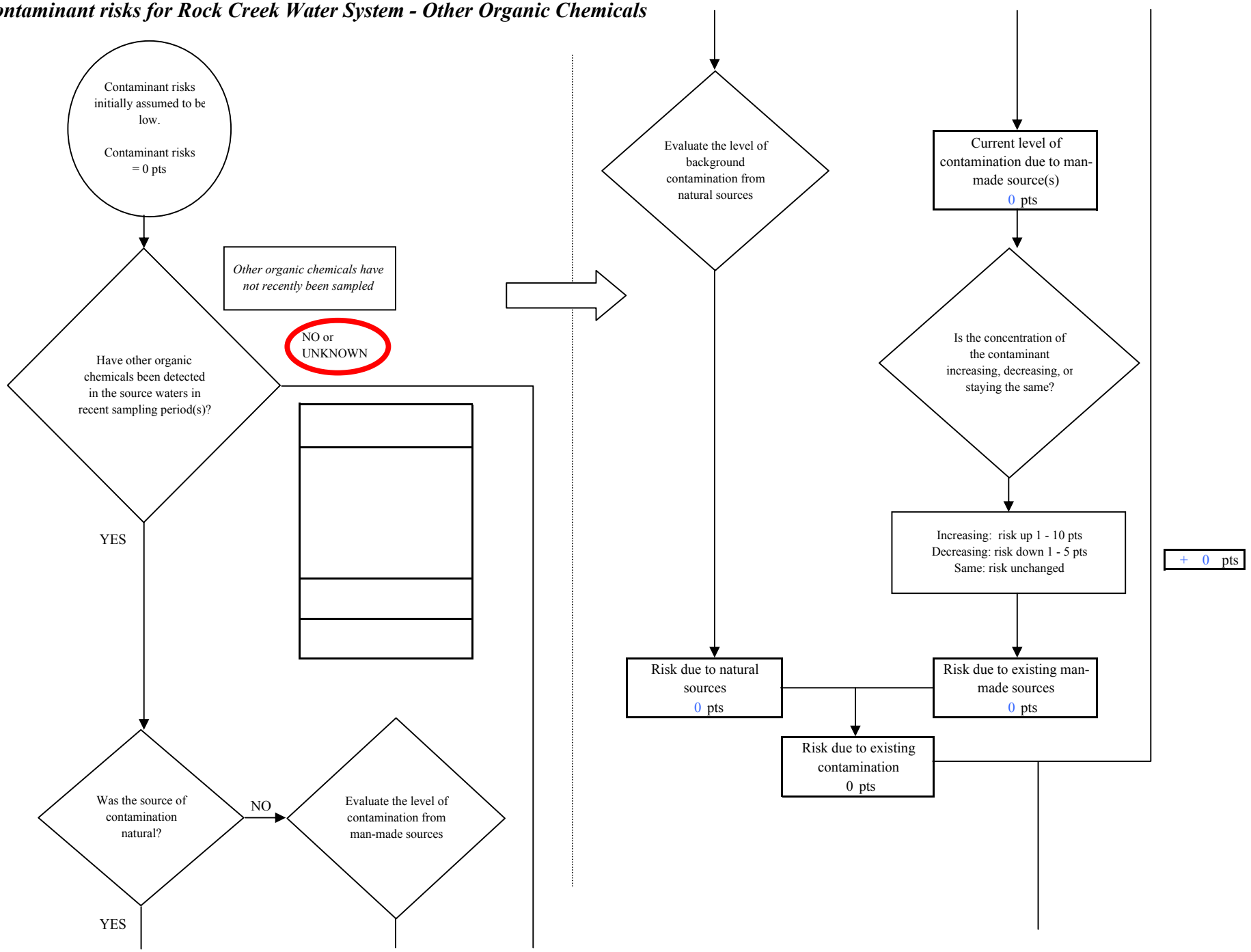


Chart 13. Contaminant risks for Rock Creek Water System - Other Organic Chemicals

+ 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)	1	0	1

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

Matrix Score 10

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

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

The parking lot located directly above the wells increases the risk

YES

Increase risk 1 - 10 pts

+ 2 pts

Chart 13. Contaminant risks for Rock Creek Water System - Other Organic Chemicals

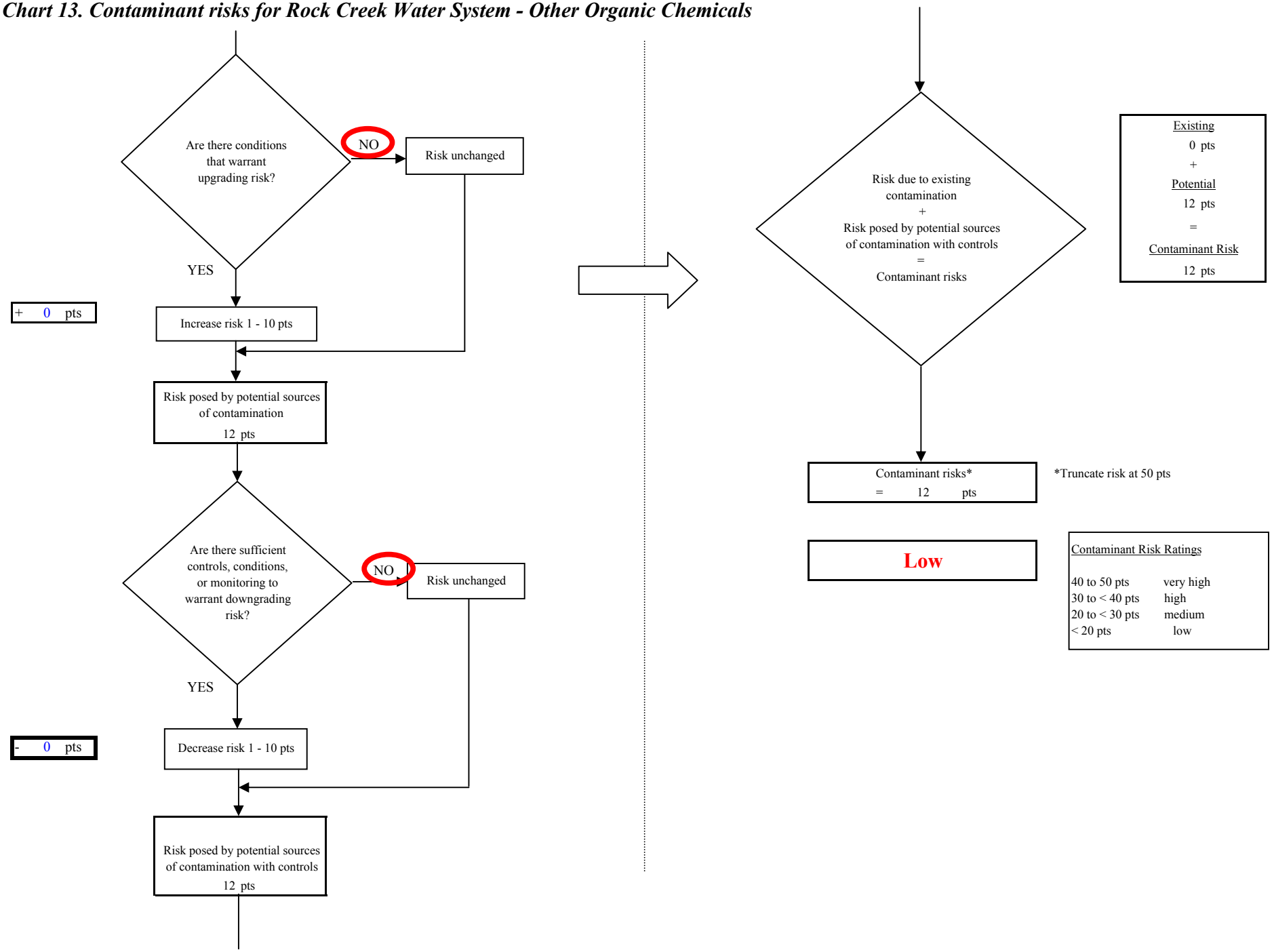


Chart 14. Vulnerability analysis for Rock Creek Water System - Other Organic Chemicals