Source Water Assessment

A Hydrogeologic Susceptibility and Vulnerability Assessment for Two Rivers Elementary Drinking Water System,
Two Rivers, Alaska
PWSID 310578

April 2004

DRINKING WATER PROTECTION PROGRAM REPORT Report 1491
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 Two Rivers Elementary Source of Public Drinking Water, Two Rivers, Alaska

Drinking Water Protection Program
Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

This source water assessment provides an evaluation of the vulnerability of the public water system serving the Two Rivers Elementary to potential contamination. This Class A (non-community) water system consists of one well at 400 Two Rivers Road off of Chena Hot Springs Road near Two Rivers, 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 **Medium** rating for the aquifer in which the well is drawing water from. Identified potential and current sources of contamination for the Two Rivers Elementary public water system include: residential areas, septic systems, fuel storage tanks, and roads. These are considered as sources of bacteria and viruses, nitrates and/or nitrites, volatile organic chemicals, heavy metals 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 Two Rivers Elementary received an overall vulnerability rating of **High** for bacteria and viruses, **Medium** for nitrates and nitrites, volatile organic chemicals, and heavy metals, and **Low** for synthetic organic chemicals and other organic chemicals.

TWO RIVERS ELEMENTARY PUBLIC DRINKING WATER SYSTEM

Two Rivers Elementary public water system is a Class A (non-community) water system. The system consists of one well at 400 Two Rivers Road off of Chena Hot Springs Road near Two Rivers, Alaska (T1N, R3E, Section 36). (See Map 1 of Appendix A). Two Rivers is located northeast of the town of Fairbanks which is located in the Fairbanks North Star Borough near the center of Alaska (Please see the inset of Map 1 in Appendix A for location). The Borough's current population is 82,840 making it the second-largest population center in the state (ADCED, 2002). Communities located within the Borough include : College, Eielson Air Force Base, Ester, Fairbanks, Fox, Harding Lake, Moose Creek, North Pole, Pleasant Valley, Salcha, and Two Rivers.

Residents of Two Rivers use individual wells or have water delivered, and septic systems or outhouses. Electricity for the city is provided by Golden Valley Electric Association. The majority of residents use heating oil (typically stored in both above and below ground 275 to 500-gallon tanks) to heat homes and buildings. Refuse is collected in dumpsters and transported to the Fairbanks North Star Borough Class I Landfill on South Cushman Street in Fairbanks.

This general area includes two distinct topographic areas: the alluvial plain between the Tanana River and the Chena River, and the uplands north of this alluvial plain. The Two Rivers Elementary water system is located in uplands at an elevation of approximately 750 feet above sea level.

According to the well log for this well, the depth of the well is 205 feet below the ground surface and is screened in fractured bedrock. Bedrock in this area is predominantly a metamorphosed marine mud deposit, called a pelitic schist. The schist is locally intruded by granitic rocks – granite and quartz diorite. Groundwater in the bedrock is principally contained in fractures. The water wells in this area with the greatest well recharge appear to be in quartz veins, quartzite, and siliceous schist (Nelson, 1978).

Groundwater in the uplands is recharged by local precipitation. Outflow of ground water in the uplands primarily occurs two ways. In areas under artesian pressure (pressure caused by overlying permafrost), water can flow to the surface through thawed conduits within the permafrost. Otherwise groundwater will flow under the permafrost (if present) and out to the groundwater beneath the adjacent flood plain or creek valley (Nelson, 1978). Areas with discontinuous permafrost may locally affect the ground water flow directions.

The Two Rivers Elementary public drinking water system serves approximately 96 non-residents through one service connection.

TWO RIVERS ELEMENTARY 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 well 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.

An outline of the immediate watershed was used to determine the size and shape of the protection area for the Two Rivers Elementary School. Available geology was also considered to take into account any uncertainties in groundwater flow and aquifer characteristics to arrive at a meaningful protection area.

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 the rate at which water travels through fractured bedrock is unknown but usually relatively fast, the protection area for the Two Rivers Elementary consists only of Zone A.

The following is a summary of the four zones for wells and the calculated time-of-travel of the groundwater 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 Two Rivers Elementary 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 Two Rivers Elementary 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 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 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.

Tables 2 through 7 in Appendix B contain the ranking of inventoried potential and existing sources of contamination with respect to the six contaminant categories.

VULNERABILITY OF TWO RIVERS ELEMENTARY 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 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 Two Rivers Elementary received a Low Susceptibility rating. The 4/18/01 Sanitary Survey indicates the well is capped with a sanitary seal and the land surface is sloped away from the well; 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 in the area the Two Rivers Elementary well is completed in received a Medium Susceptibility rating. Although the fractured bedrock aquifer material allows contaminants to quickly travel downward from the surface with the precipitation and surface water runoff, the depth of the well and the lower water table allow for more natural filtering of contaminants. Table 2 summarizes the Susceptibility scores and ratings for Two Rivers Elementary.

Table 2. Susceptibility

	Score	Rating
Susceptibility of the Wellhead	5	Low
Susceptibility of the Aquifer	14	Medium
Natural Susceptibility	19	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	50	Very High
Nitrates and/or Nitrites	27	Medium
Volatile Organic Chemicals	30	High
Heavy Metals, Cyanide, and Other Inorganic Chemicals	23	Medium
Synthetic Organic Chemicals	10	Low
Other Organic Chemicals	10	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	70	High
Nitrates and/or Nitrites	45	Medium
Volatile Organic Chemicals	50	Medium
Heavy Metals, Cyanide, and Other Inorganic Chemicals	40	Medium
Synthetic Organic Chemicals	30	Low
Other Organic Chemicals	30	Low

Bacteria and Viruses

The residential septic systems represent the greatist risk of Bacteria and Viruses to this water system.

Only a small amount of bacteria and viruses are required to endanger public health. Coliforms are found naturally in the environment and although they aren't necessarily a health threat, they are an indicator of other potentially harmful bacteria in the water, more specifically, fecal coliforms and E. coli which only come from human and animal fecal waste (EPA, 2002). Harmful bacteria can cause diarrhea, cramps, nausea, headaches, or other symptoms (EPA, 2002). Routine sampling has detected coliforms in this water system on 8/8/02 (verified on 8/13/02). Fecal coliforms and E. Coli have not been detected.

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 high.

Nitrates and Nitrites

The residential septic systems also represent the greatest risk to nitrates and nitrites for this source of public drinking water.

Nitrates are very mobile, moving at approximately the same rate as water. Nitrates have consistently been detected in low concentrations (about 0.8 mg/L or 8% of the Maximum Contaminant Level – a MCL is the highest concentration of a contaminant allowed in drinking water by the Environmental Protection Agency) in recent sampling history for the Two Rivers Elementary 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 medium.

Volatile Organic Chemicals

The residential heating oil tanks represent the greatest risk of volatile organic chemical contamination to the well.

Both underground and above ground heating oil storage tanks are the standard way of heating homes and businesses in the area surrounding Fairbanks. 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. Regular system maintenance can help prevent many of these harmful fuel leaks.

Volatile Organic Chemicals were not detected during the most recent sampling of the this water system (4/12/01). 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 medium.

Heavy Metals, Cyanide, and Other Inorganic Chemicals

The septic systems represent the greatest risk to Heavy Metals, Cyanide, and Other Inorganic Chemicals for this source of public drinking water.

Arsenic was detected most recently on 9/27/02 at a concentration of 0.013 mg/L, or 26% of its current MCL. Arsenic occurs naturally in the environment as well as from outside sources such mining and smelting (EPA, 2002).

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 medium.

Synthetic Organic Chemicals

The septic systems and residential area represent the only identified risk to Synthetic Organic Chemicals for this source of public drinking water.

Synthetic Organic Chemicals have not recently been sampled for.

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 septic systems also represent the greatest risk to Other Organic Chemicals for Moose Creek Apartments public drinking water system.

Other Organic Chemicals have not recently been sampled for.

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.

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APPENDIX A

Two Rivers Elementary
Drinking Water Protection Area Location Map
(Map 1)

TELEMARK TRAIL

MCKEE FARM ROAD

MEGAN ROAD

TWO RIVERS ROAD

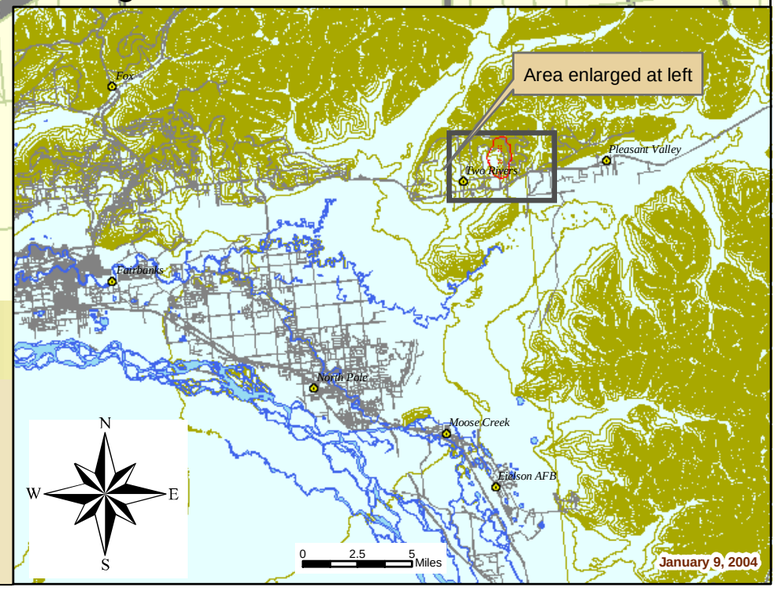
JILL STREET

HIRN ROAD

CHENA HOT SPRINGS ROAD

KANUTI ROAD

LOETA WAY



Map 1: Two Rivers Elementary Drinking Water Protection Area

PWSID: 310578

Alaska Department of Environmental Conservation

Alaska Drinking Water Protection Program

0 787.5 1,575 3,150 Feet

1:18,900

Data Sources:

Parcel, roads - Fairbanks North Star Borough
Water bodies, railroad - Geographic Data Technology
Elevation contours - USGS digital elevation models (DEMs)

Legend

- Two Rivers Elementary well
- Zone A
- Towns
- Parcels
- Roads

APPENDIX B

Contaminant Source Inventory and Risk Ranking for Two Rivers Elementary (Tables 1-7)

Table 1

Contaminant Source Inventory for

FNSB SD - Two Rivers Elem.

PWSID 310578.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Map Number*	*Comments*
Residential Areas	R01		A	2	Approximately 40 acres of residential area in Zone A
Septic systems (serves one single-family home)	R02		A	2	Assumed 9 septic systems in Zone A
Tanks, heating oil, residential (above ground)	R08		A	2	Assumed 9 heating oil tanks in Zone A
Highways and roads, dirt/gravel	X24		A	2	3 roads in the protection area

Table 2

Contaminant Source Inventory and Risk Ranking for FNSB SD - Two Rivers Elem. Sources of Bacteria and Viruses

PWSID 310578.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Highways and roads, dirt/gravel	X24		A	Low	2	3 roads in the protection area
Residential Areas	R01		A	Low	2	Approximately 40 acres of residential area in Zone A
Septic systems (serves one single-family home)	R02		A	Low	2	Assumed 9 septic systems in Zone A

Table 3

Contaminant Source Inventory and Risk Ranking for FNSB SD - Two Rivers Elem. Sources of Nitrates/Nitrites

PWSID 310578.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Residential Areas	R01		A	Low	2	Approximately 40 acres of residential area in Zone A
Highways and roads, dirt/gravel	X24		A	Low	2	3 roads in the protection area
Septic systems (serves one single-family home)	R02		A	Low	2	Assumed 9 septic systems in Zone A

Table 4

Contaminant Source Inventory and Risk Ranking for FNSB SD - Two Rivers Elem. Sources of Volatile Organic Chemicals

PWSID 310578.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Residential Areas	R01		A	Low	2	Approximately 40 acres of residential area in Zone A
Septic systems (serves one single-family home)	R02		A	Low	2	Assumed 9 septic systems in Zone A
Highways and roads, dirt/gravel	X24		A	Low	2	3 roads in the protection area
Tanks, heating oil, residential (above ground)	R08		A	Medium	2	Assumed 9 heating oil tanks in Zone A

Table 5

Contaminant Source Inventory and Risk Ranking for FNSB SD - Two Rivers Elem.

Sources of Heavy Metals, Cyanide and Other Inorganic Chemicals

PWSID 310578.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Highways and roads, dirt/gravel	X24		A	Low	2	3 roads in the protection area
Residential Areas	R01		A	Low	2	Approximately 40 acres of residential area in Zone A
Septic systems (serves one single-family home)	R02		A	Low	2	Assumed 9 septic systems in Zone A

Table 6

Contaminant Source Inventory and Risk Ranking for FNSB SD - Two Rivers Elem. Sources of Synthetic Organic Chemicals

PWSID 310578.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Septic systems (serves one single-family home)	R02		A	Low	2	Assumed 9 septic systems in Zone A
Residential Areas	R01		A	Low	2	Approximately 40 acres of residential area in Zone A

Table 7

Contaminant Source Inventory and Risk Ranking for FNSB SD - Two Rivers Elem. Sources of Other Organic Chemicals

PWSID 310578.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Septic systems (serves one single-family home)	R02		A	Low	2	Assumed 9 septic systems in Zone A
Highways and roads, dirt/gravel	X24		A	Low	2	3 roads in the protection area
Residential Areas	R01		A	Low	2	Approximately 40 acres of residential area in Zone A

APPENDIX C

Two Rivers Elementary
Drinking Water Protection Area
and Potential and Existing Contaminant Sources
(Map 2)

TELEMARK TRAIL

TWO RIVERS ROAD

MEGAN ROAD

MAKALIE STR

JILL STREET

MCKEE

HIRU

Map 2: Two Rivers Elementary Drinking Water Protection Area

PWSID: 310578

Alaska Department of Environmental Conservation

Alaska Drinking Water Protection Program

0 612.5 1,225 Feet

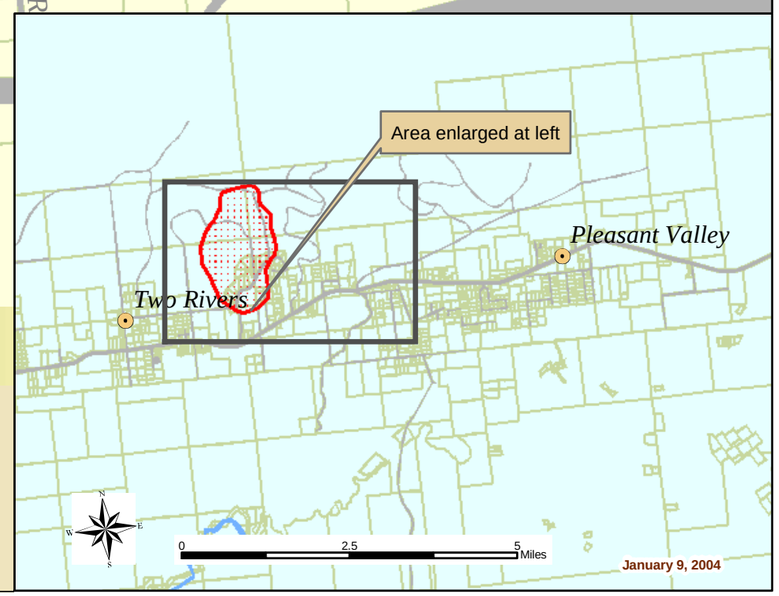
1:14,700

Data Sources:

Parcel, roads - Fairbanks North Star Borough
Water bodies, railroad - Geographic Data Technology
Elevation contours - USGS digital elevation models (DEMs)

Legend

- R01, Residential area
- R08, Residential heating oil tanks
- R02, Residential septic systems
- Two Rivers Elementary well
- Zone A
- Roads
- Parcels



APPENDIX D

Vulnerability Analysis for Two Rivers Elementary Public Drinking Water Source

(Charts 1-14)

Chart 1. Susceptibility of the wellhead - Two Rivers Elementary School

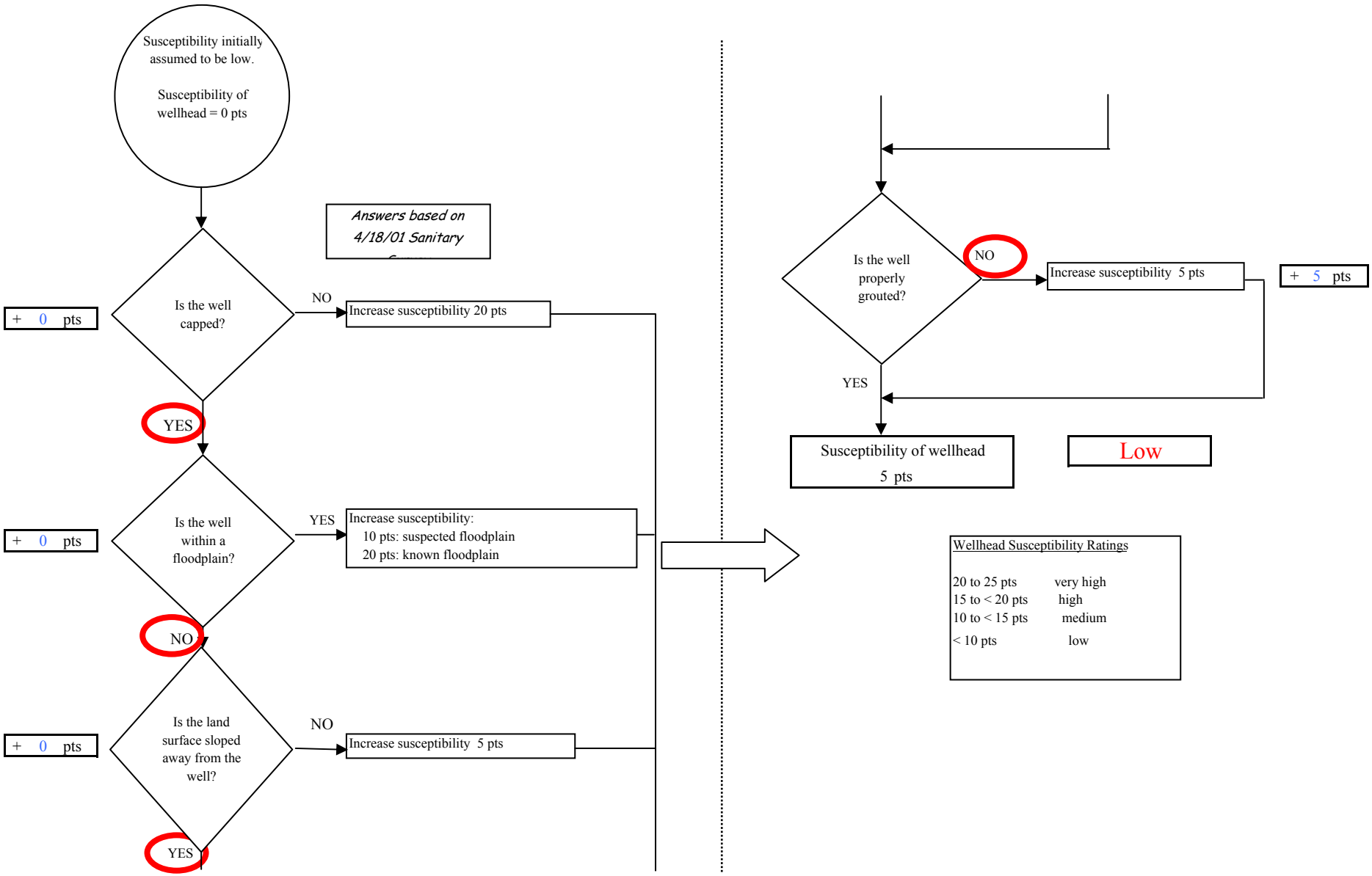


Chart 2. Susceptibility of the aquifer - Two Rivers Elementary School

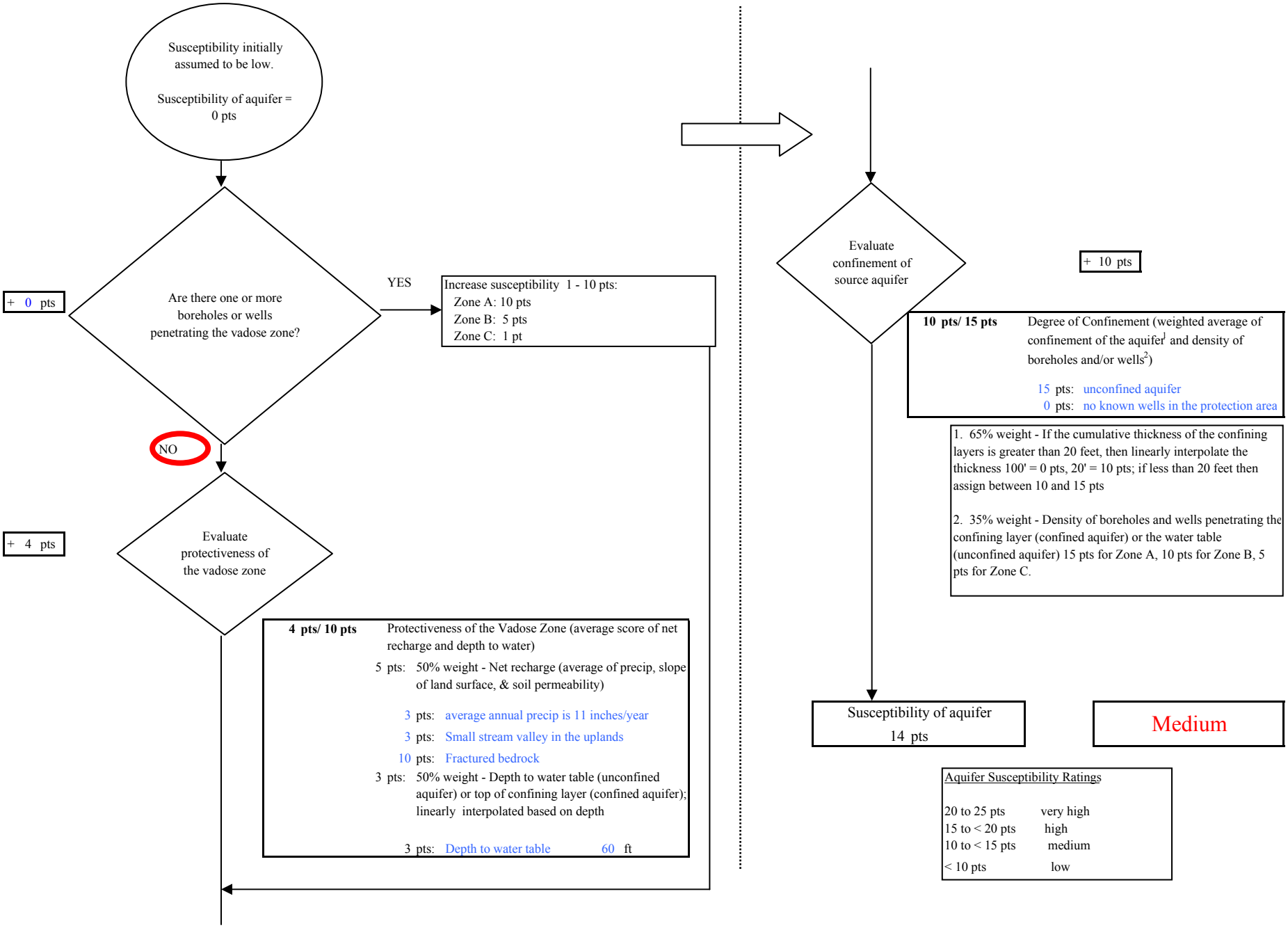
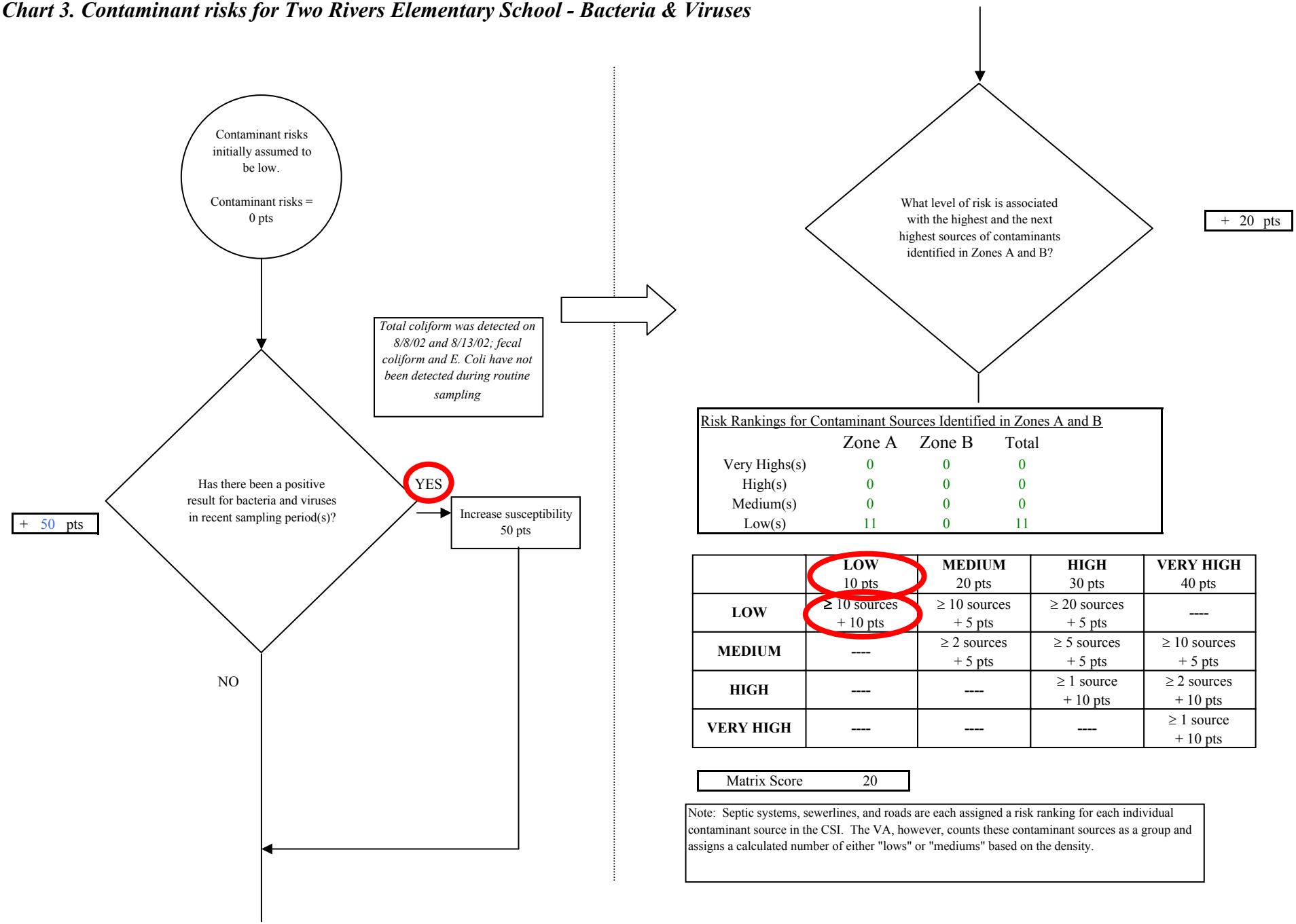


Chart 3. Contaminant risks for Two Rivers Elementary School - Bacteria & Viruses



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)	11	0	11

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

Matrix Score 20

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

Chart 3. Contaminant risks for Two Rivers Elementary School - Bacteria & Viruses

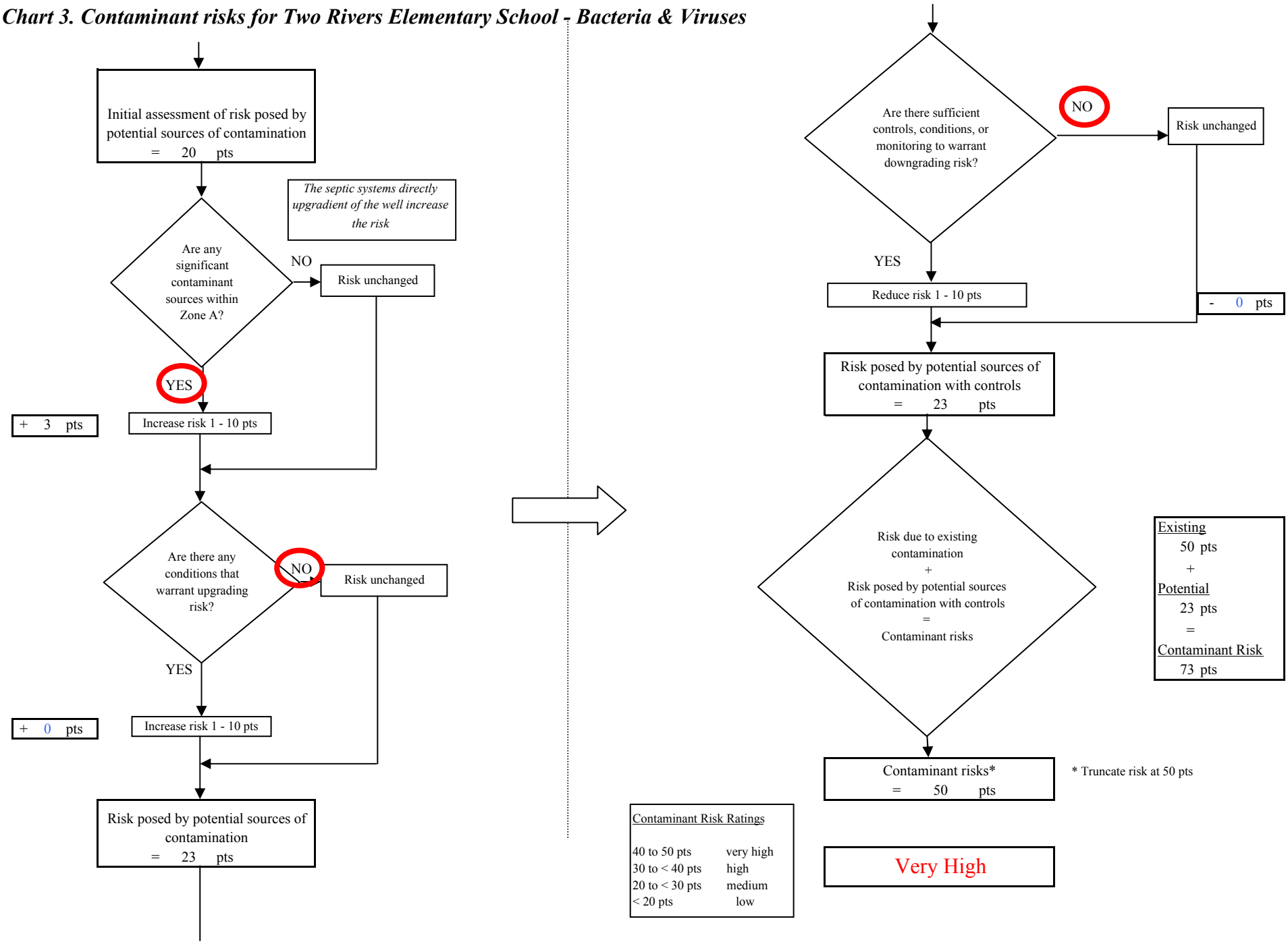


Chart 4. Vulnerability analysis for Two Rivers Elementary School - Bacteria & Viruses

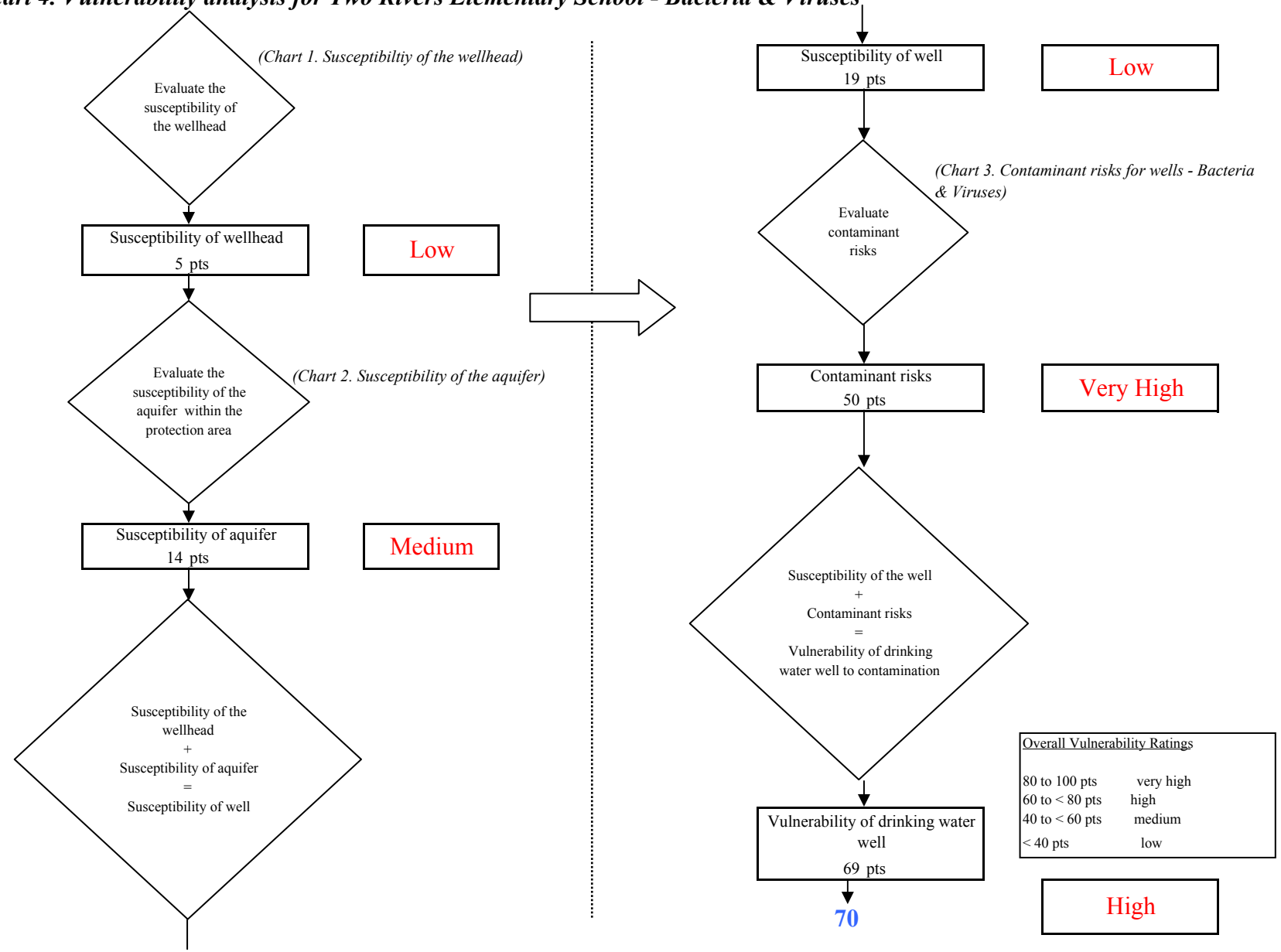


Chart 5. Contaminant risks for Two Rivers Elementary School - Nitrates and Nitrites

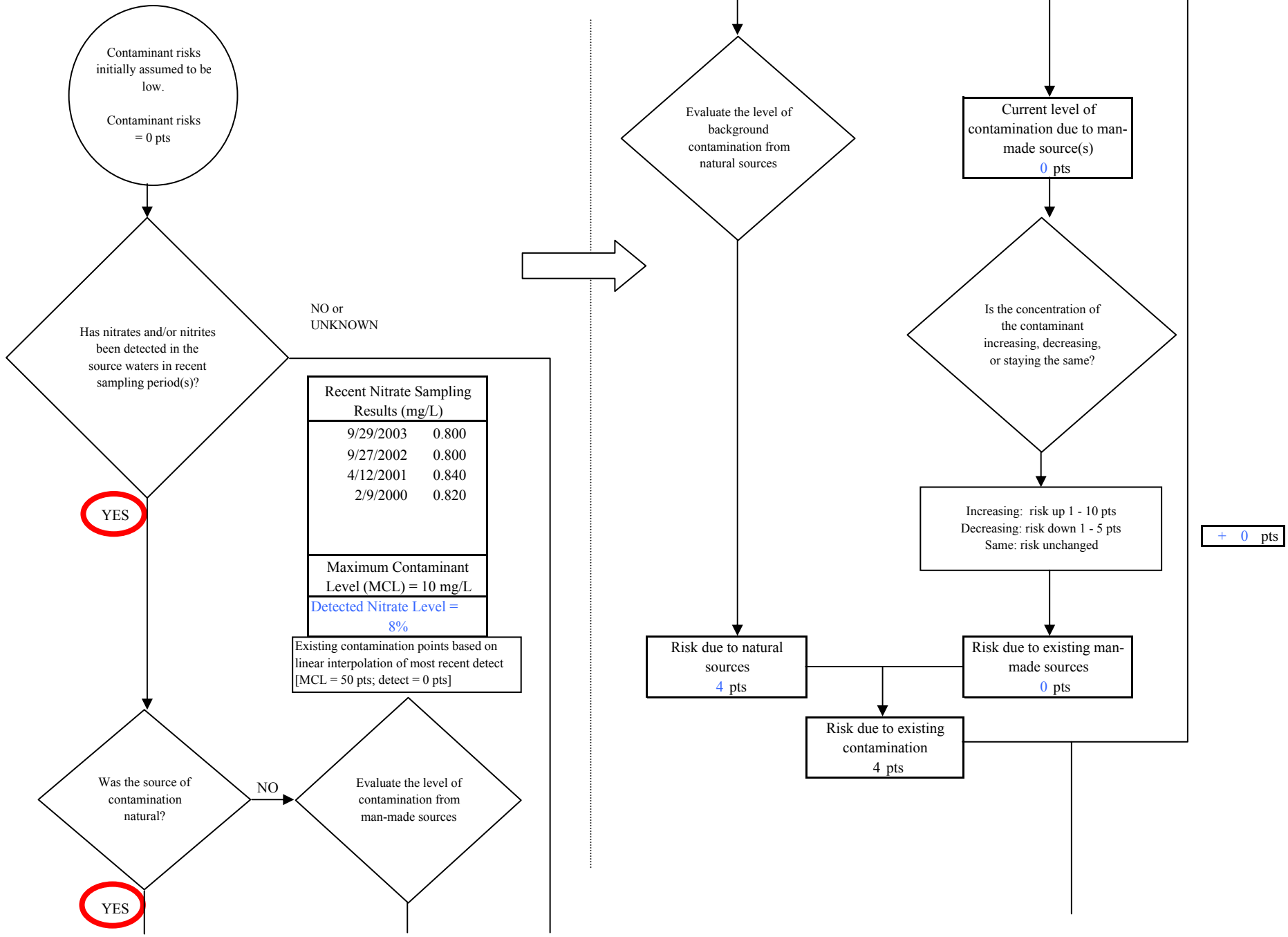


Chart 5. Contaminant risks for Two Rivers Elementary School - Nitrates and Nitrites

+ 20 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)	11	0	11

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

Matrix Score 20

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

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

YES

Is the source aquifer fractured rock or karst?

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 septic systems directly upgradient of the well increase the risk

YES

Increase risk 1 - 10 pts

+ 3 pts

Chart 5. Contaminant risks for Two Rivers Elementary School - Nitrates and Nitrites

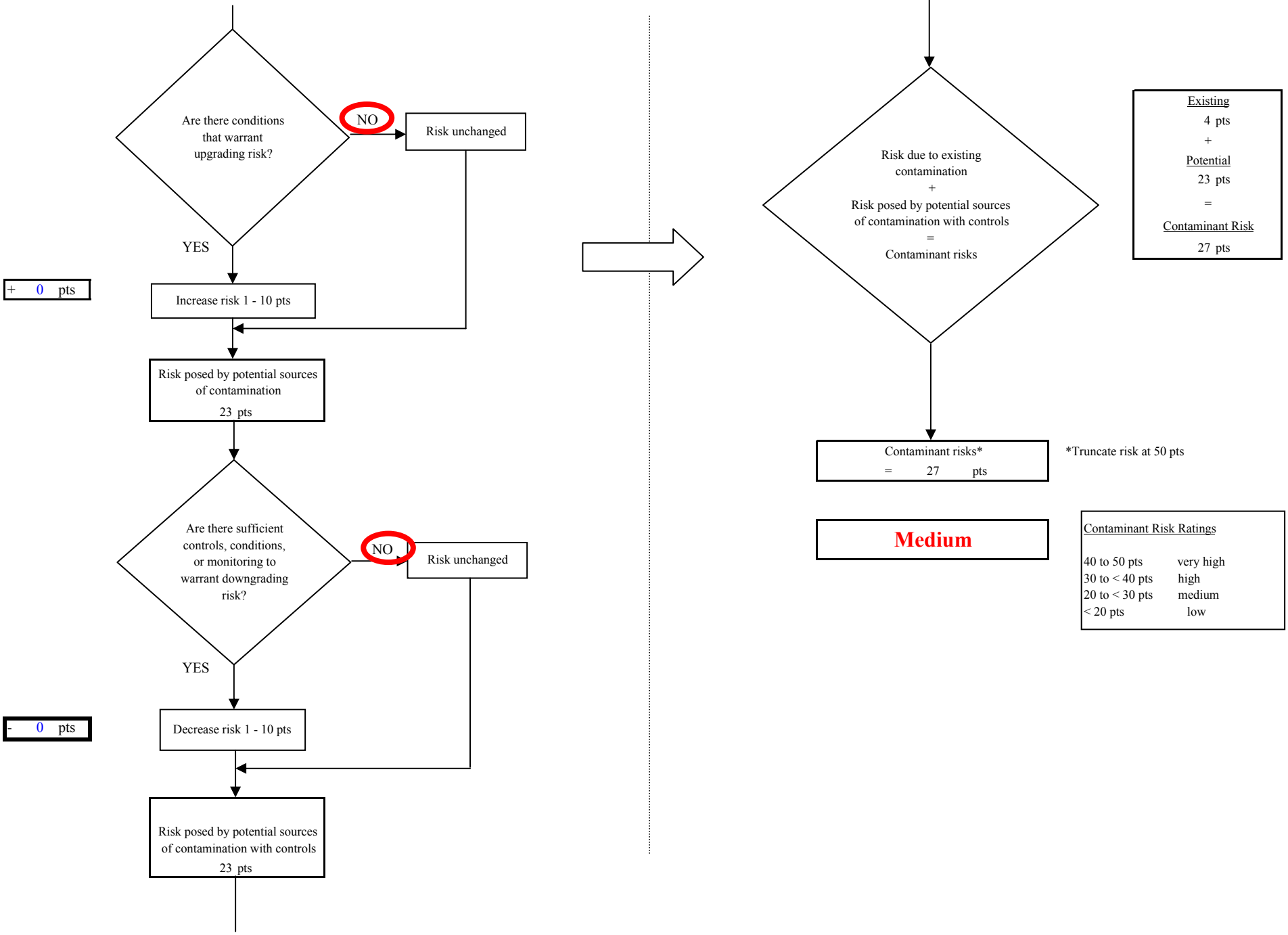


Chart 6. Vulnerability analysis for Two Rivers Elementary School - Nitrates and Nitrites

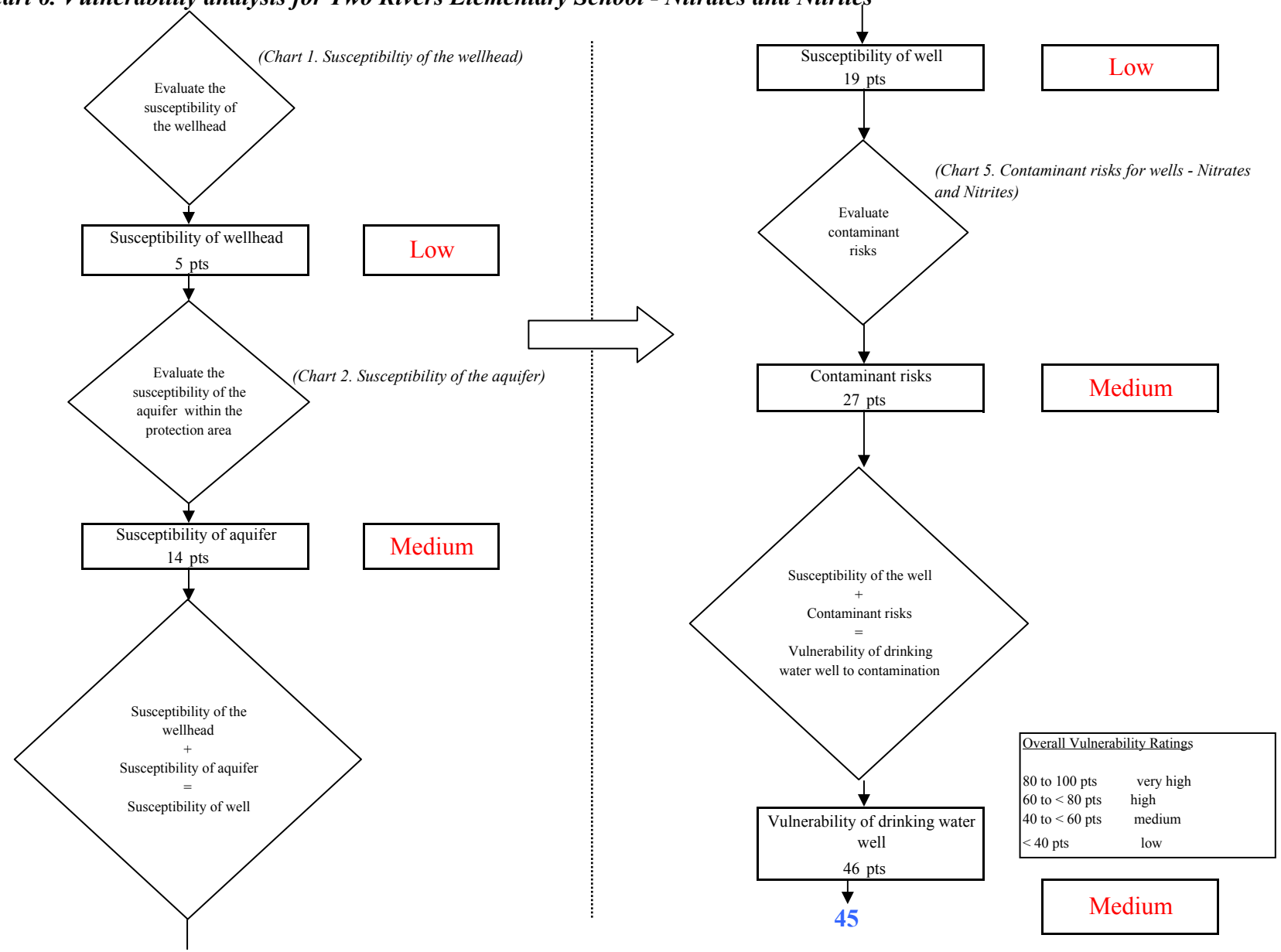


Chart 7. Contaminant risks for Two Rivers Elementary School - Volatile Organic Chemicals

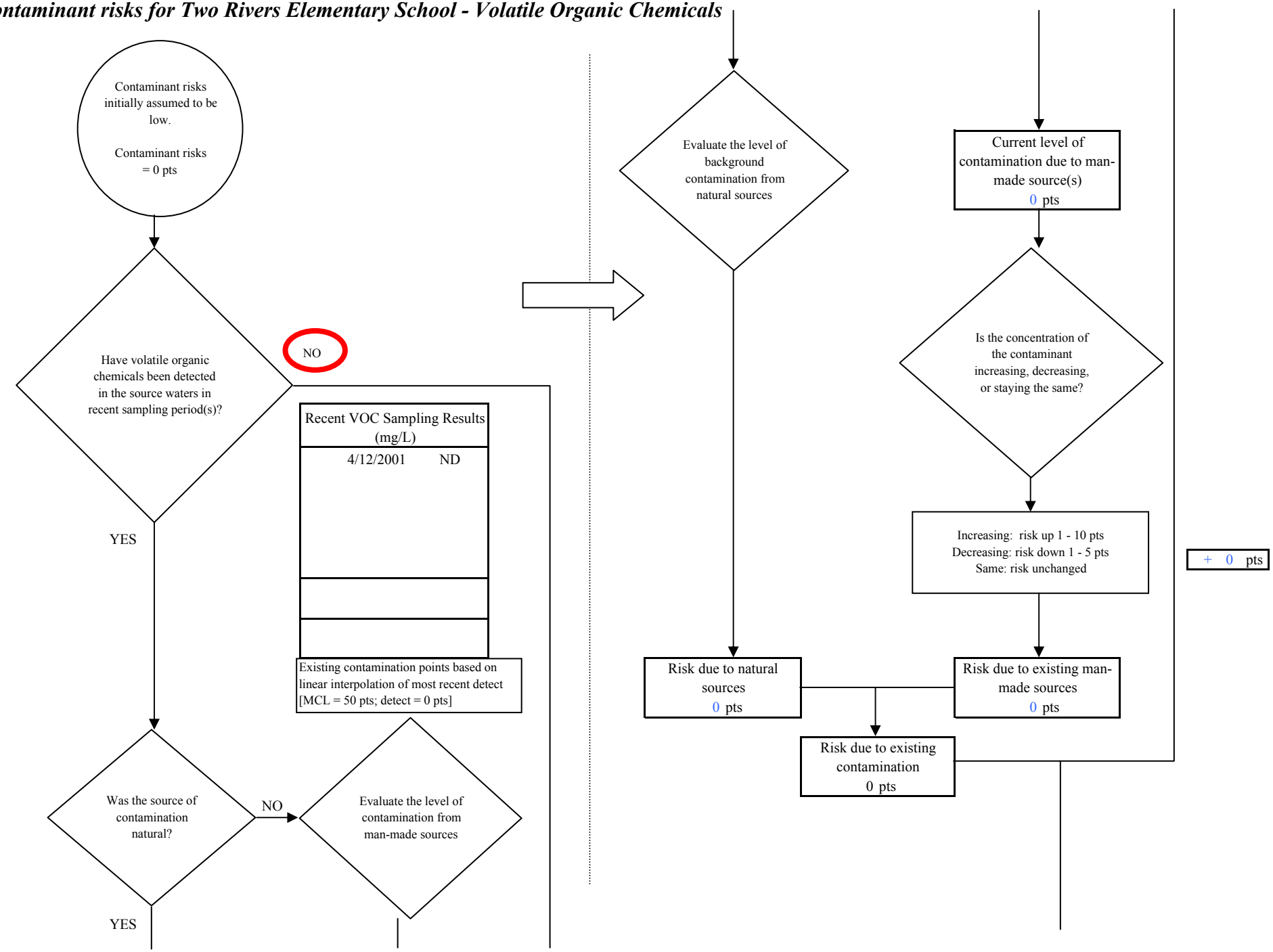
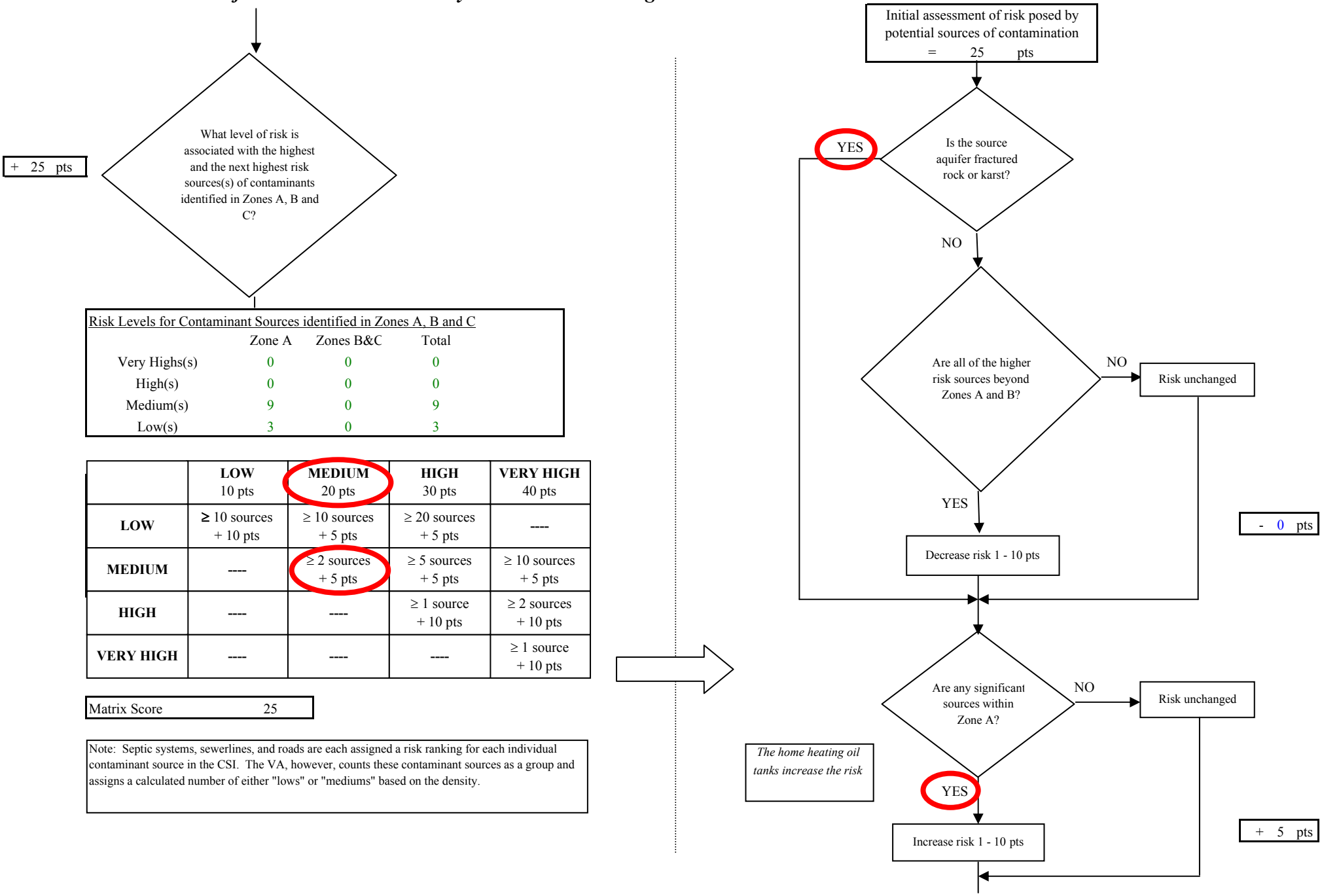


Chart 7. Contaminant risks for Two Rivers Elementary School - Volatile Organic Chemicals



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)	9	0	9
Low(s)	3	0	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 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 Two Rivers Elementary School - Volatile Organic Chemicals

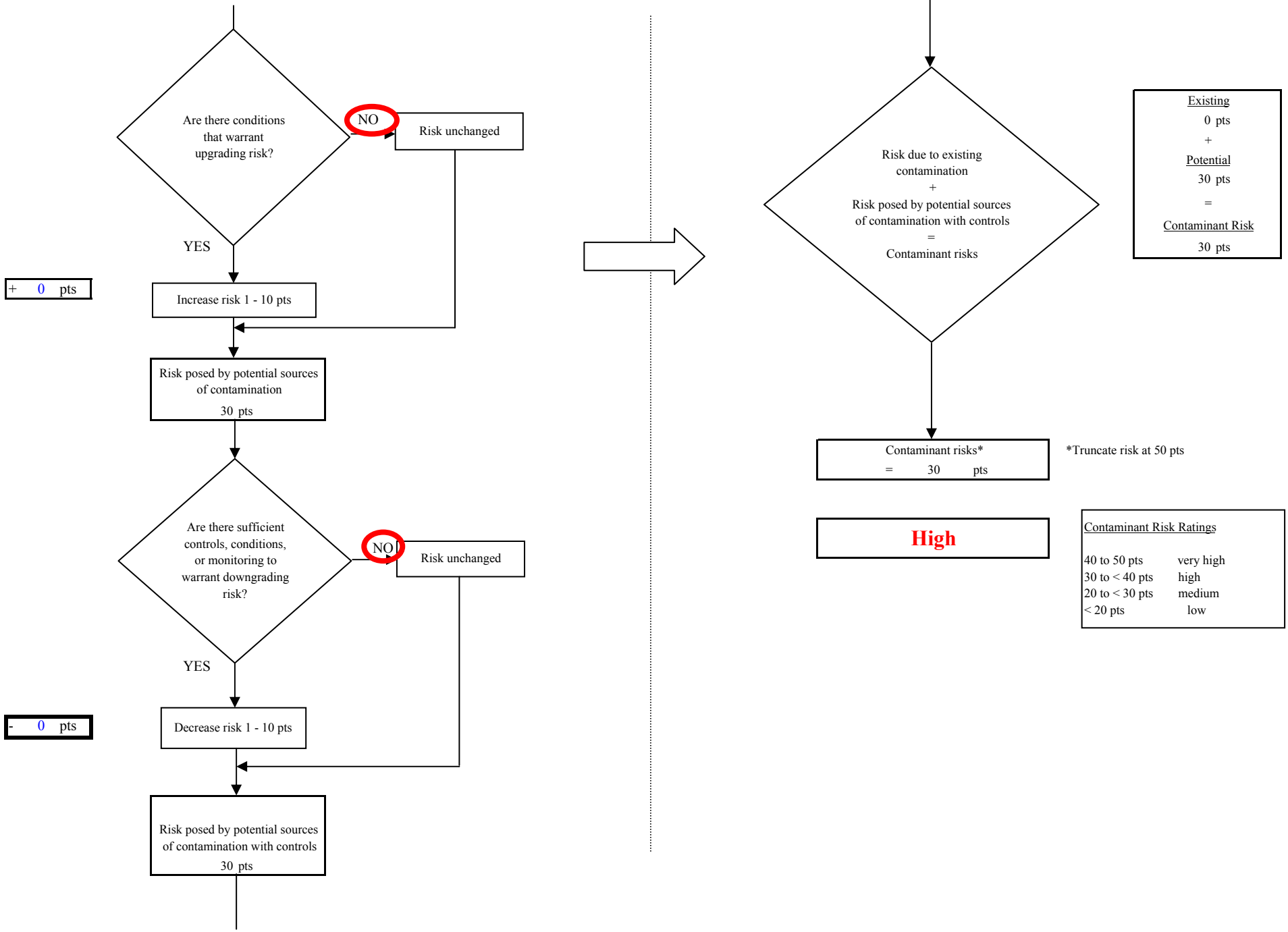


Chart 8. Vulnerability analysis for Two Rivers Elementary School - Volatile Organic Chemicals

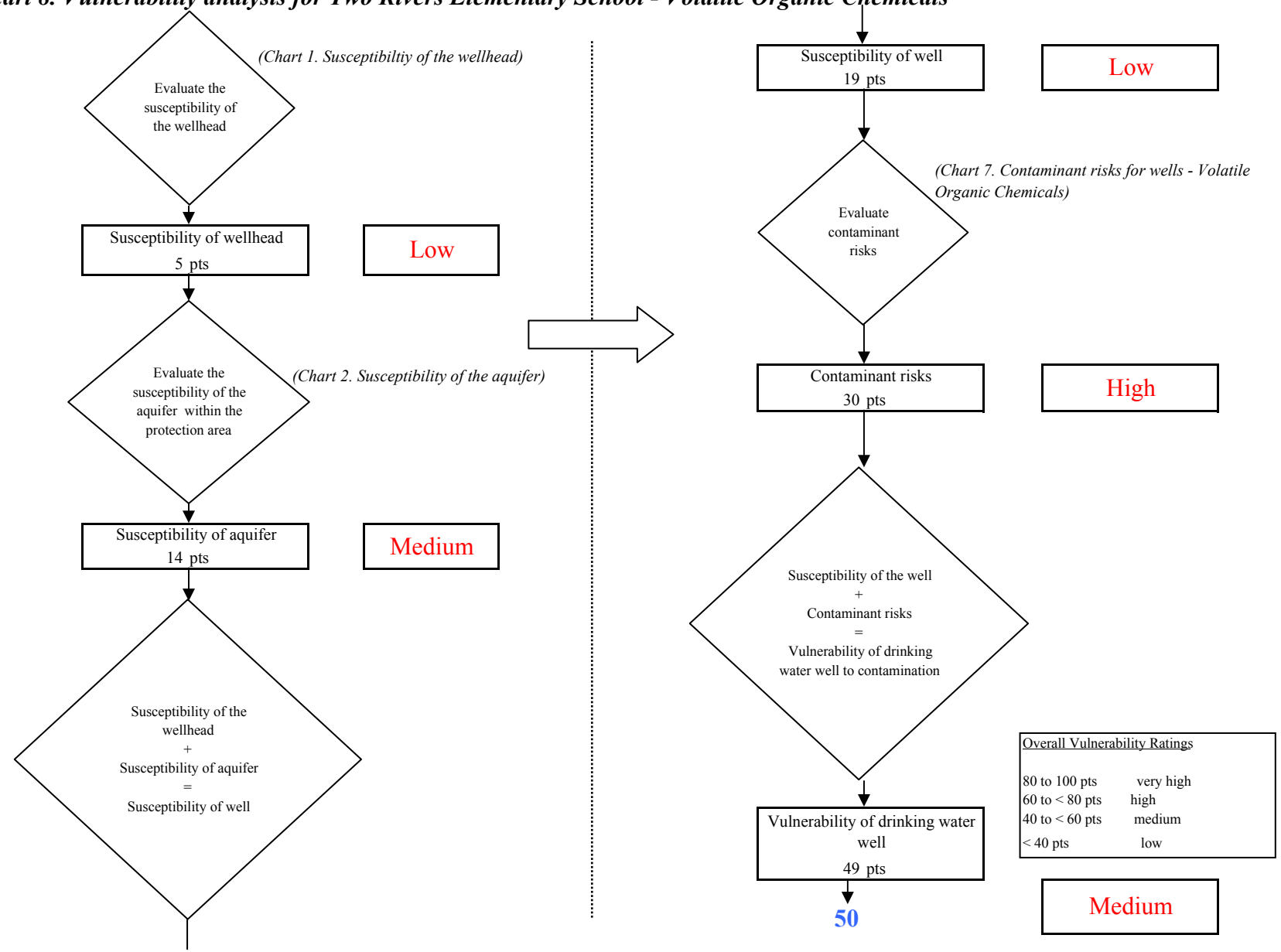


Chart 9. Contaminant risks for Two Rivers Elementary School - Heavy Metals, Cyanide and Other Inorganic Chemicals

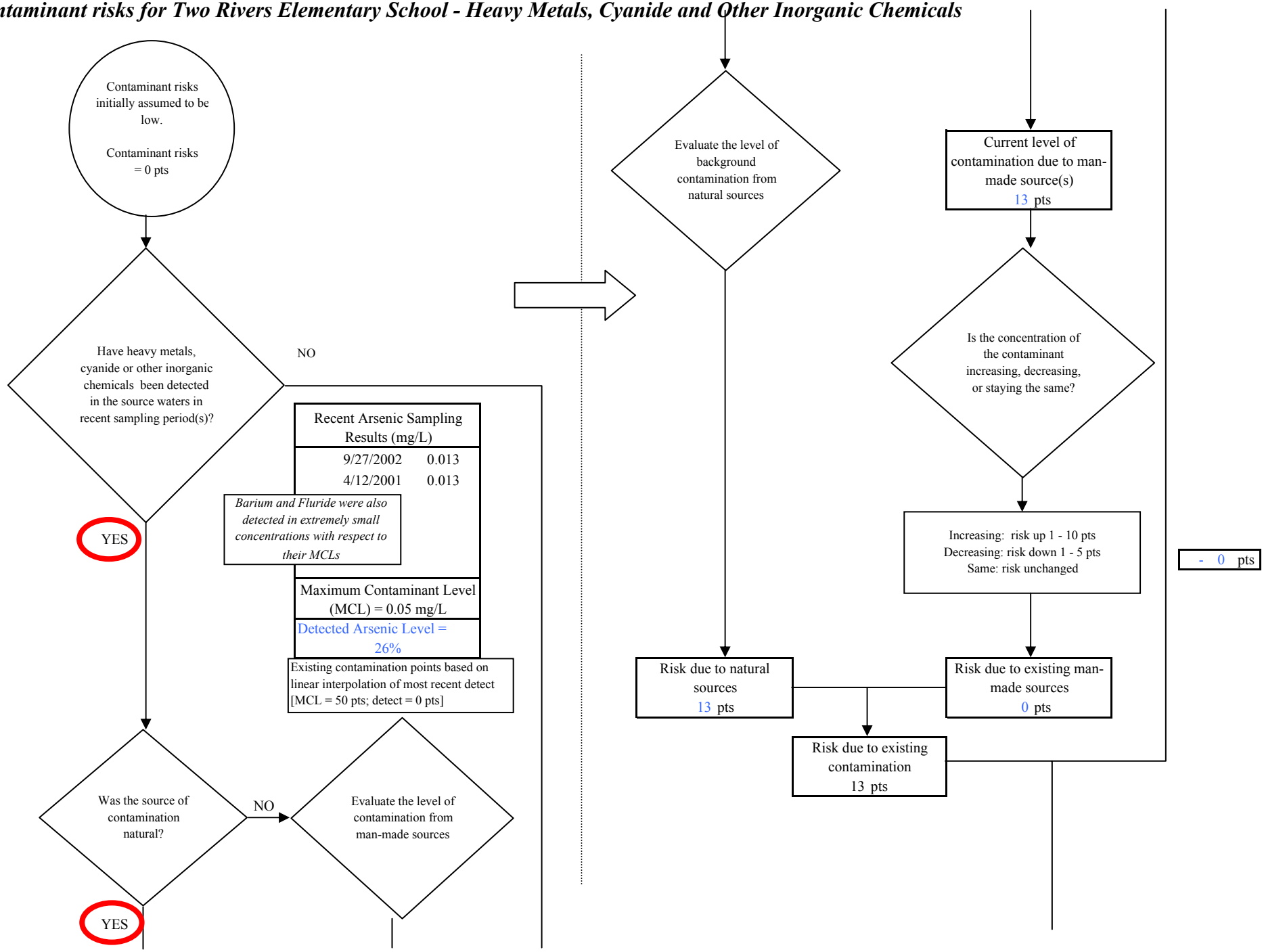


Chart 9. Contaminant risks for Two Rivers Elementary School - Heavy Metals, Cyanide and Other Inorganic Chemicals

+ 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)	3	0	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.

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

YES → Increase risk 1 - 10 pts

+ 0 pts

Chart 9. Contaminant risks for Two Rivers Elementary School - Heavy Metals, Cyanide and Other Inorganic Chemicals

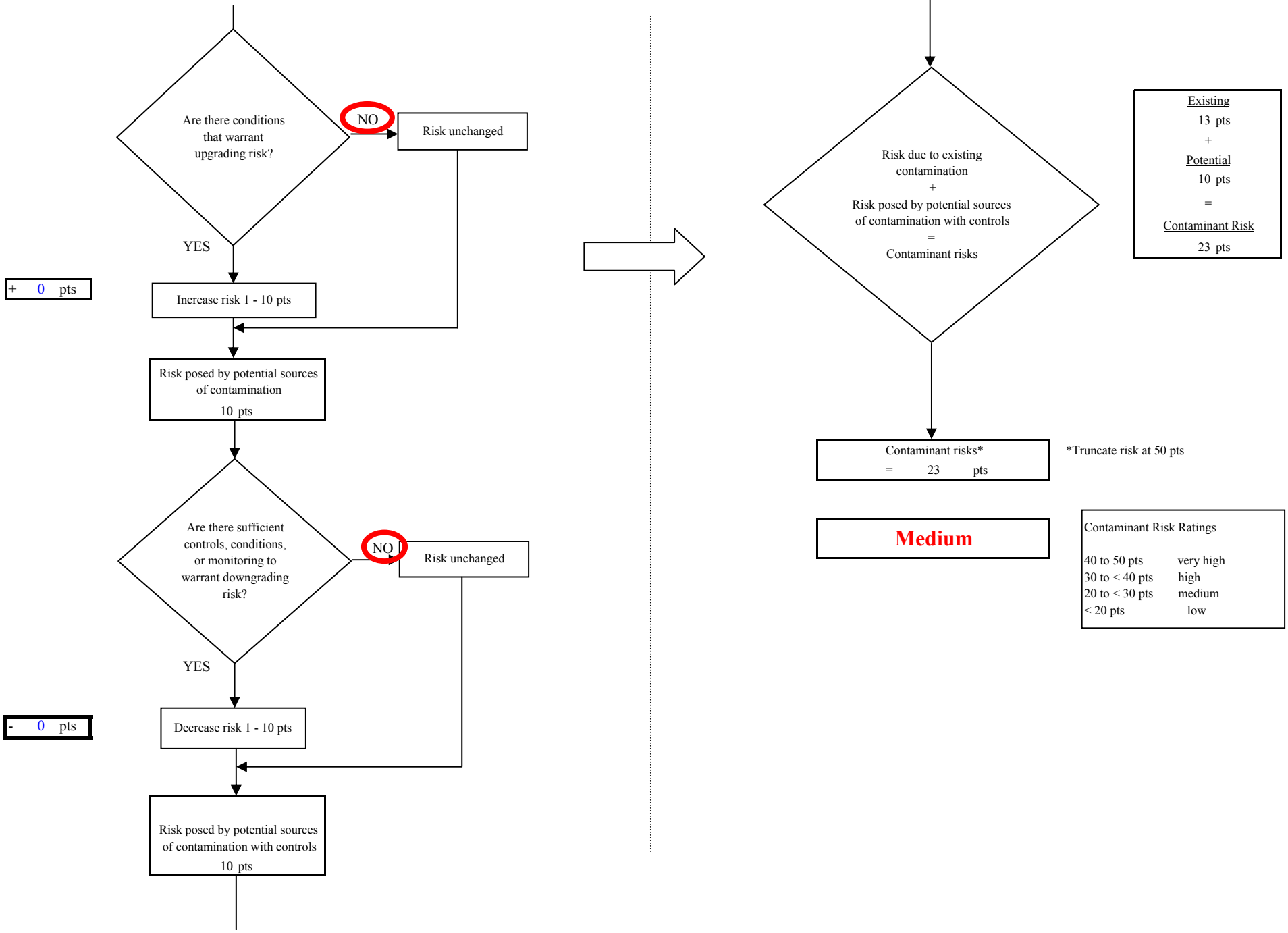


Chart 10. Vulnerability analysis for Two Rivers Elementary School - Heavy Metals, Cyanide and Other Inorganic Chemicals

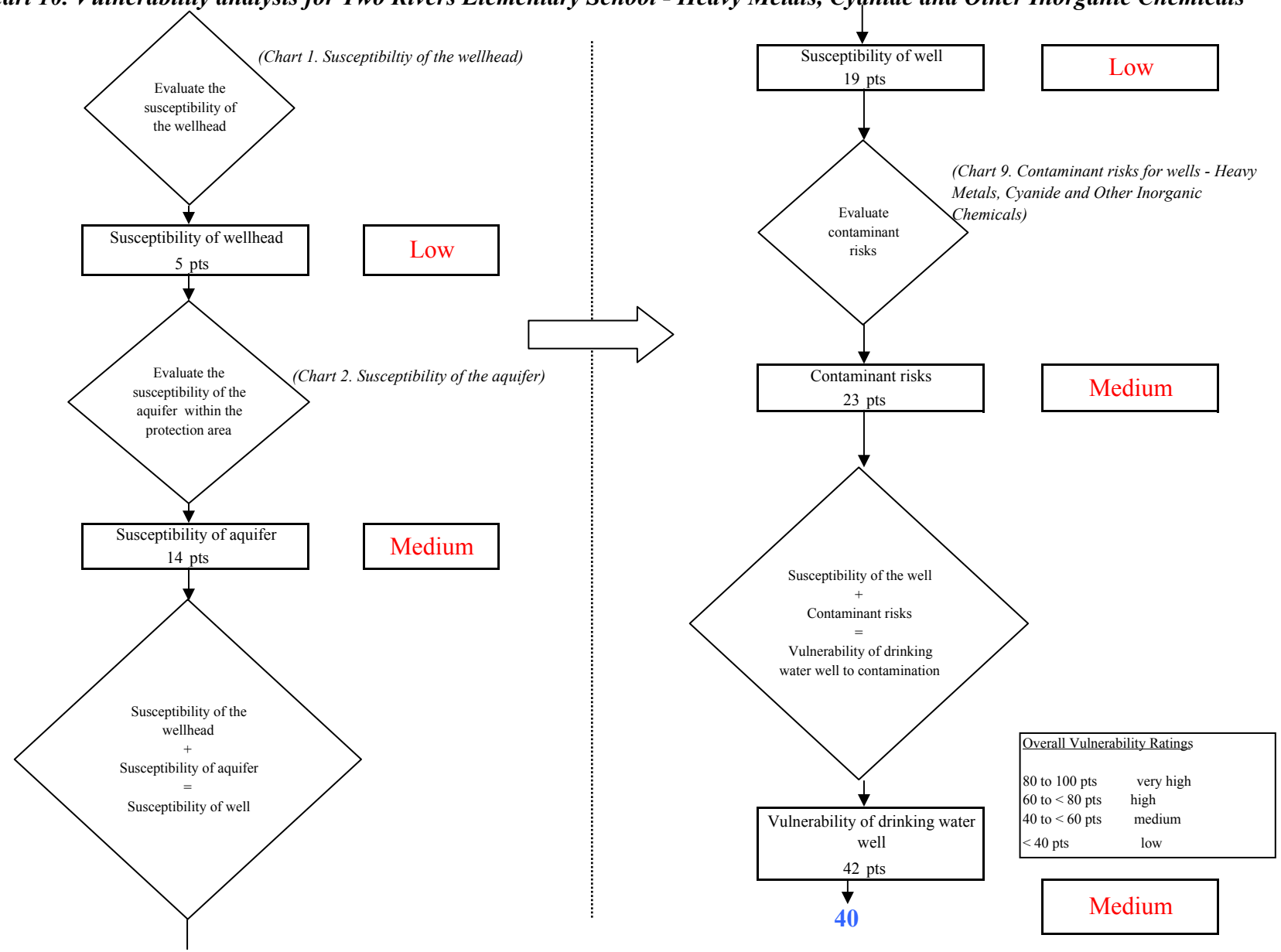


Chart 11. Contaminant risks for Two Rivers Elementary School - Synthetic Organic Chemicals

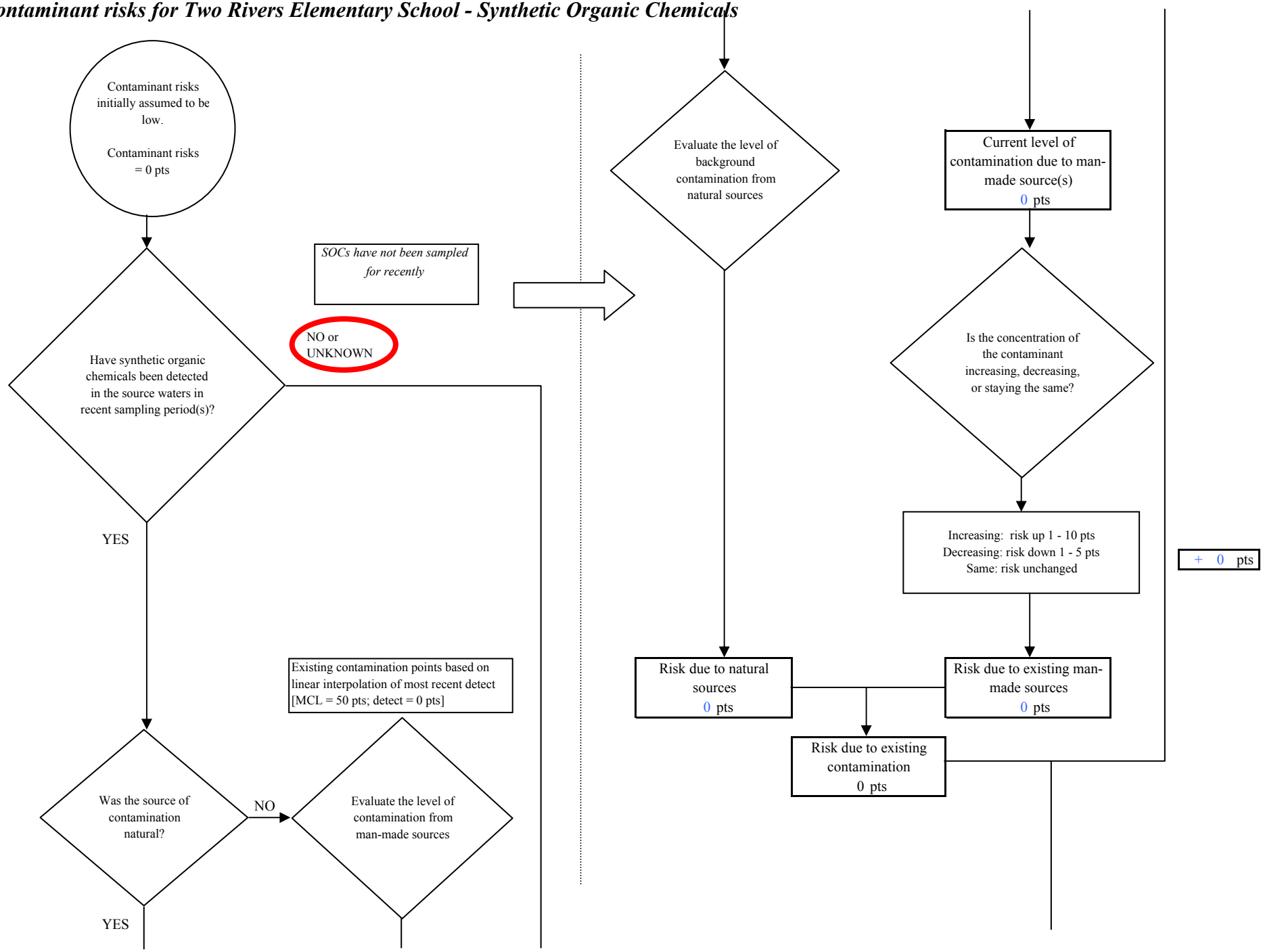
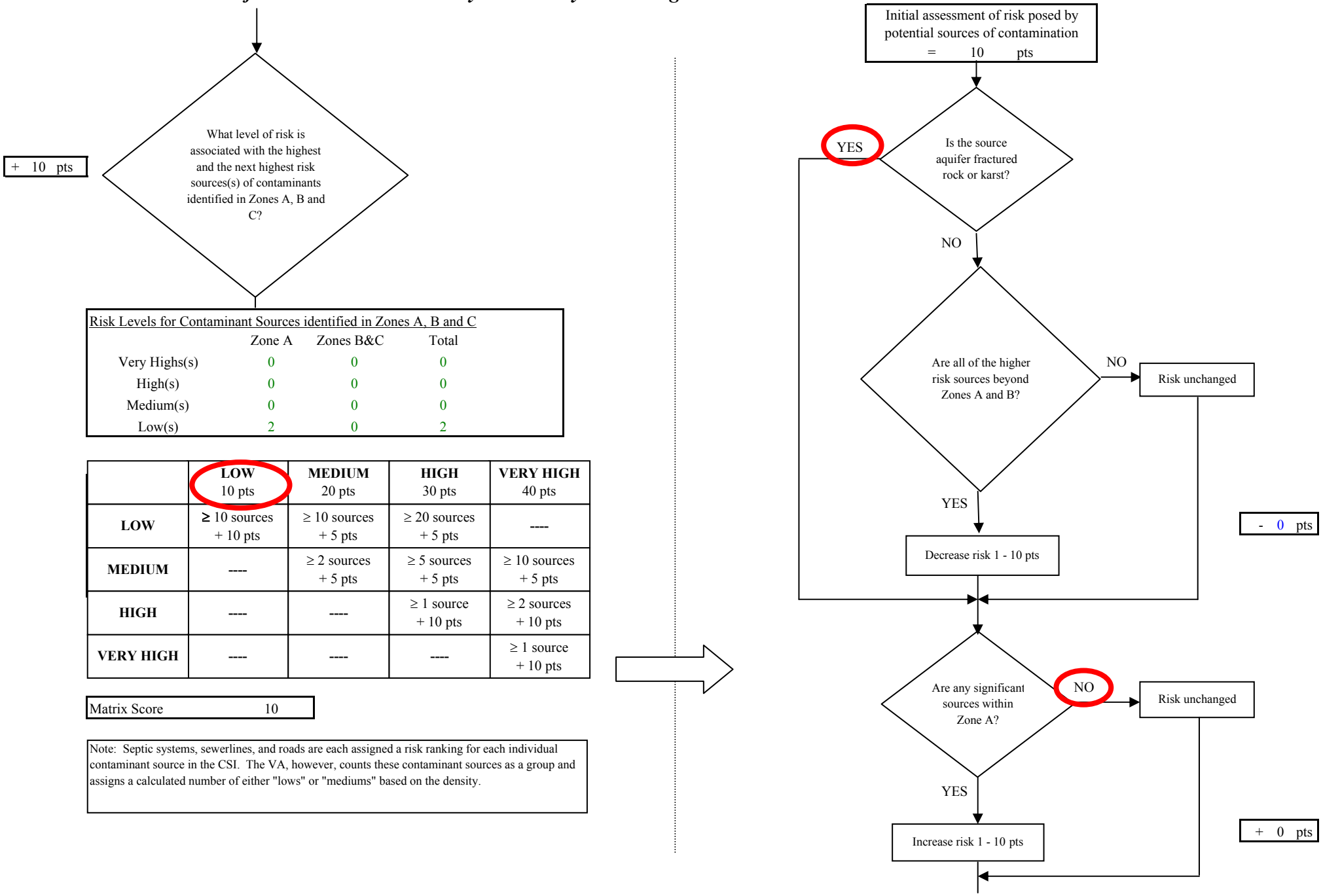


Chart 11. Contaminant risks for Two Rivers Elementary School - Synthetic Organic Chemicals



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	0	2

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

Matrix Score 10

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

Chart 11. Contaminant risks for Two Rivers Elementary School - Synthetic Organic Chemicals

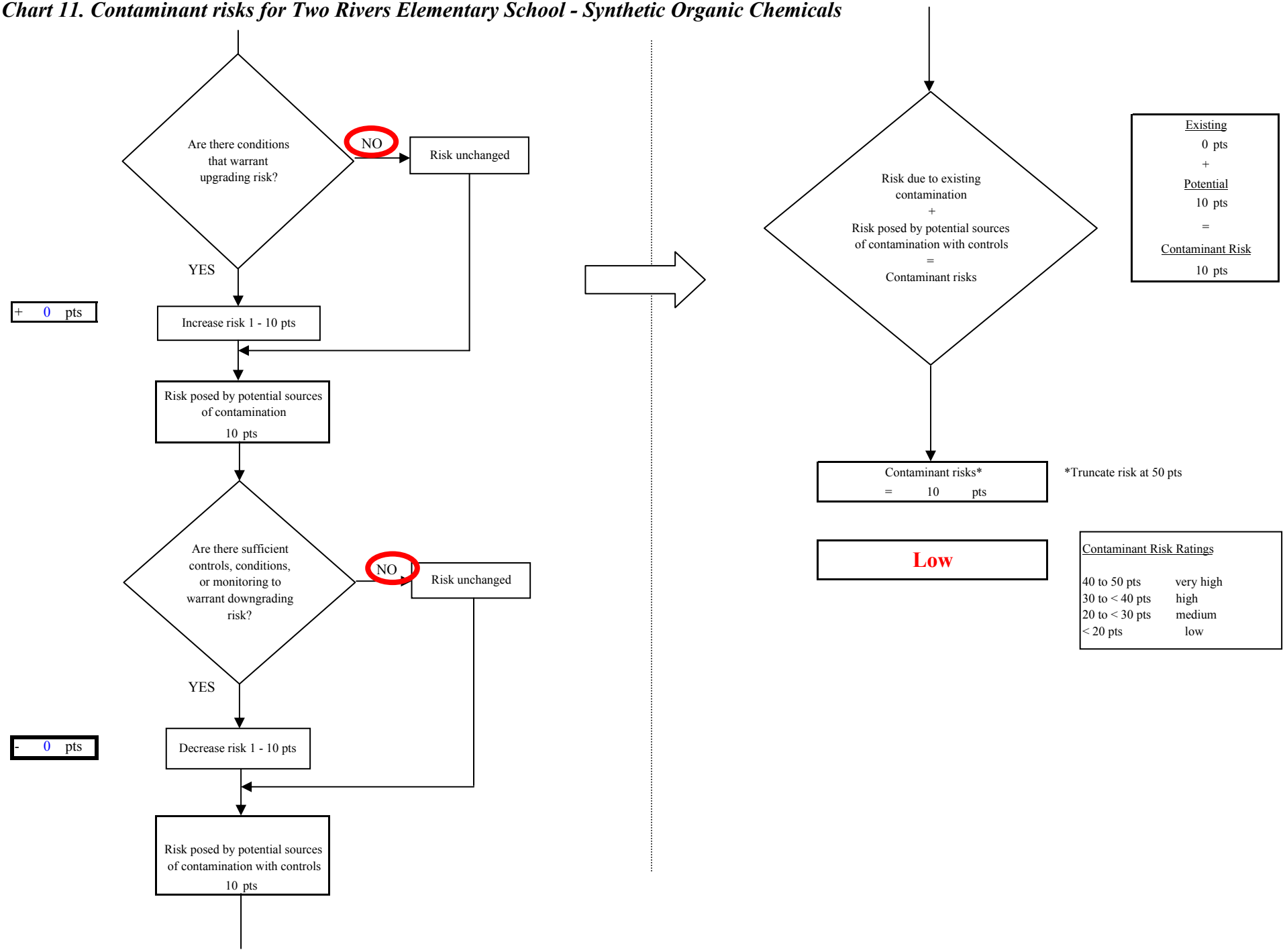


Chart 12. Vulnerability analysis for Two Rivers Elementary School - Synthetic Organic Chemicals

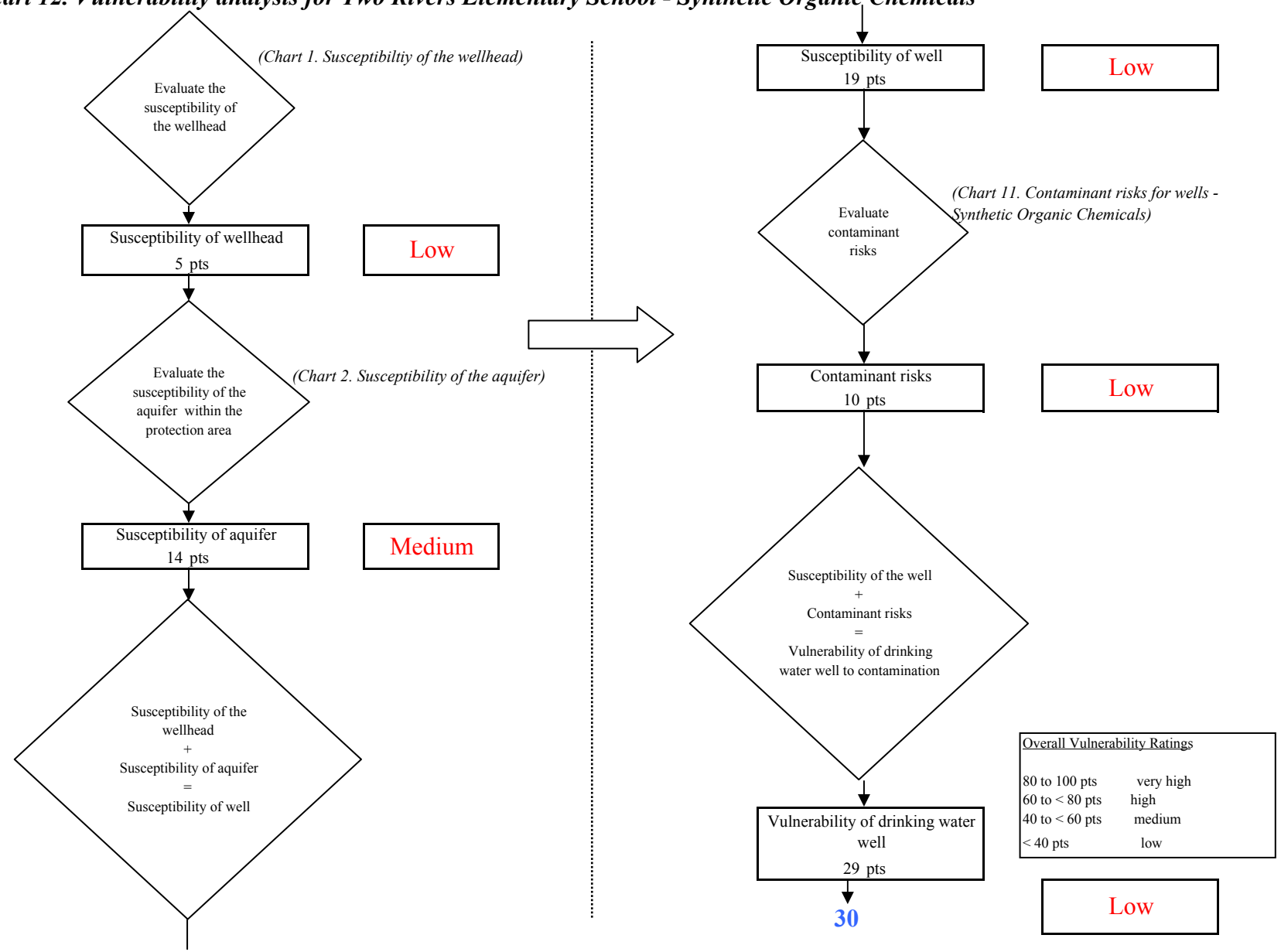


Chart 13. Contaminant risks for Two Rivers Elementary School - Other Organic Chemicals

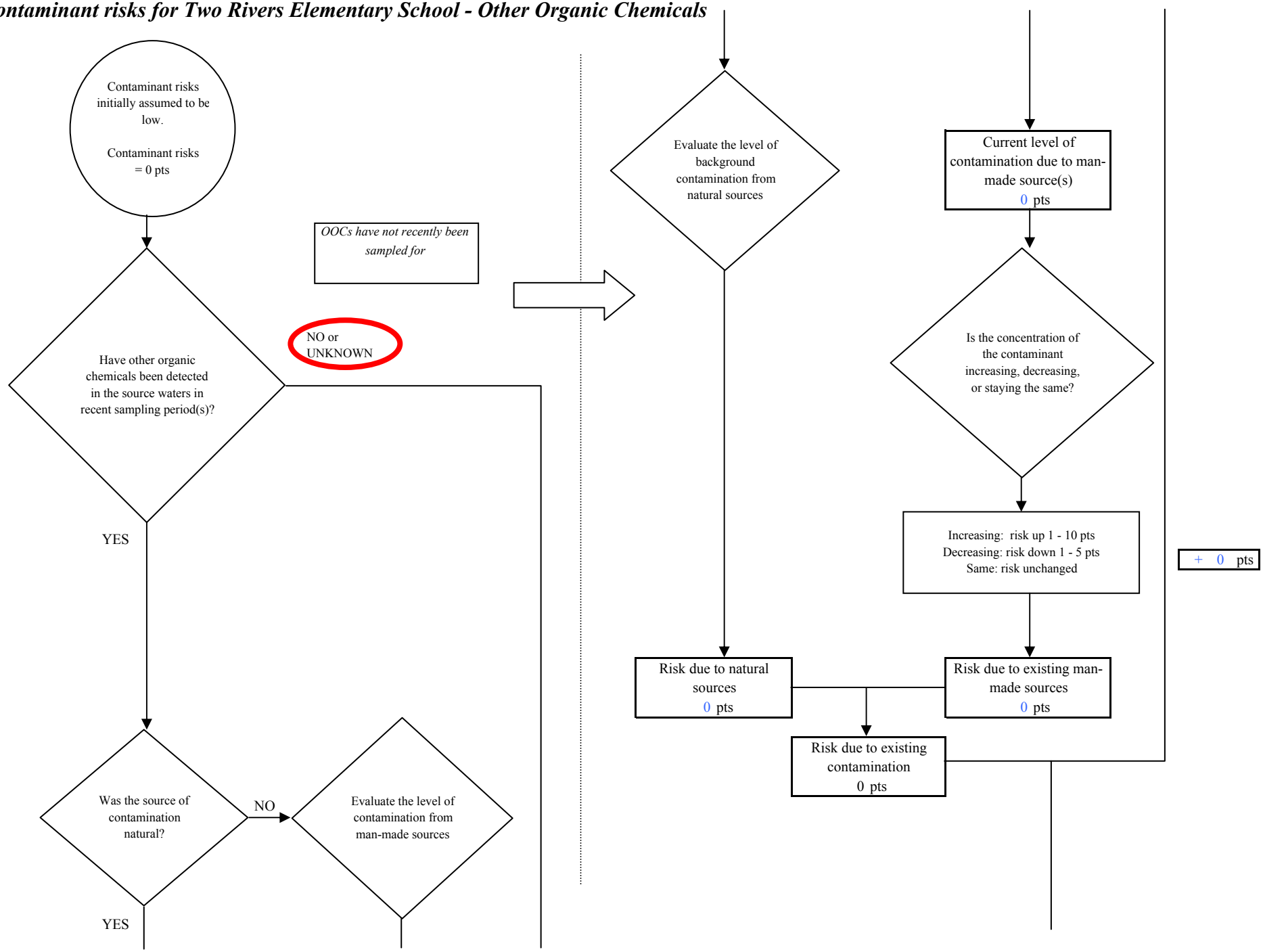
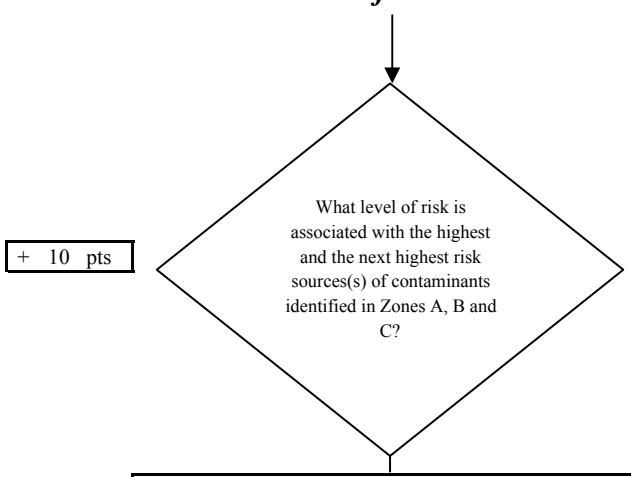


Chart 13. Contaminant risks for Two Rivers Elementary School - Other Organic Chemicals



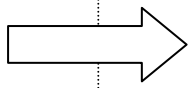
Risk Levels for Contaminant Sources identified in Zones A, B and C

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



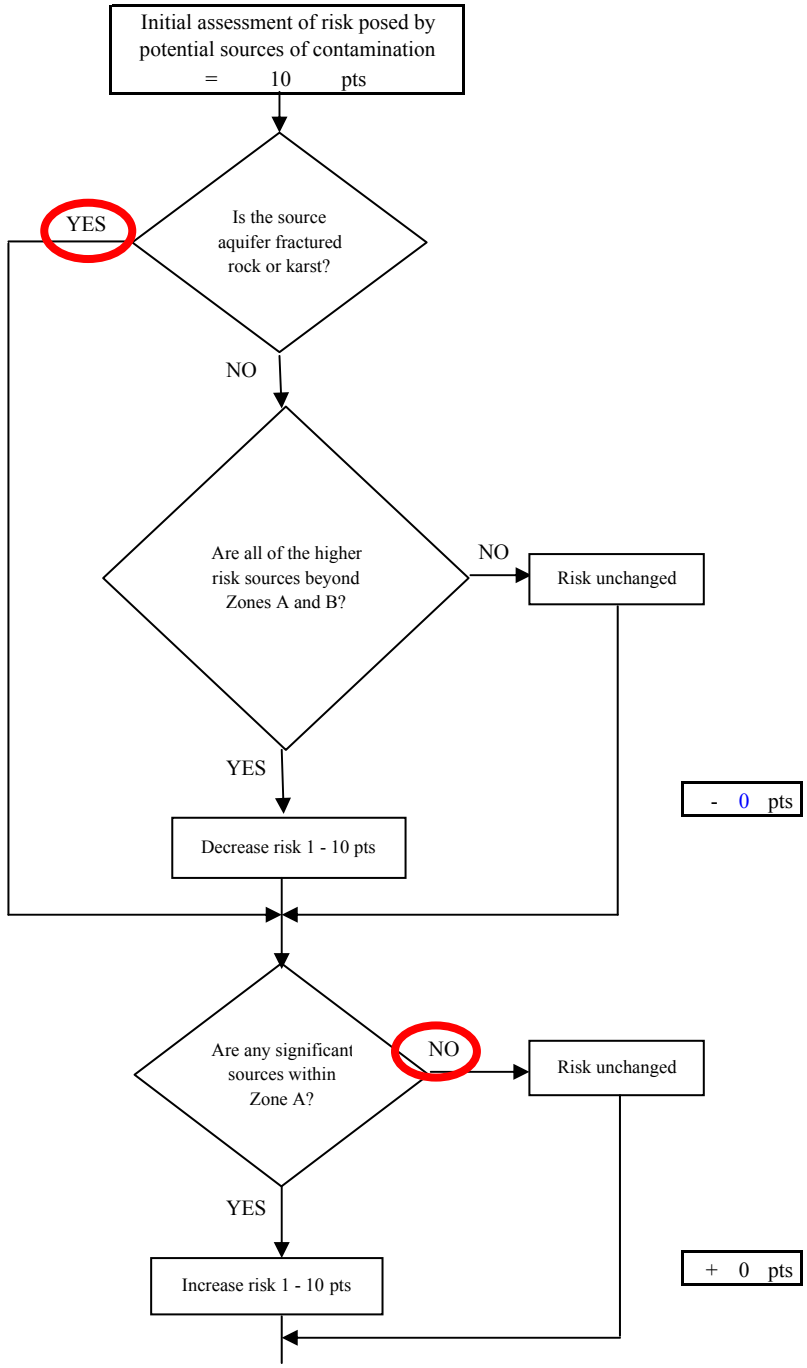


Chart 13. Contaminant risks for Two Rivers Elementary School - Other Organic Chemicals

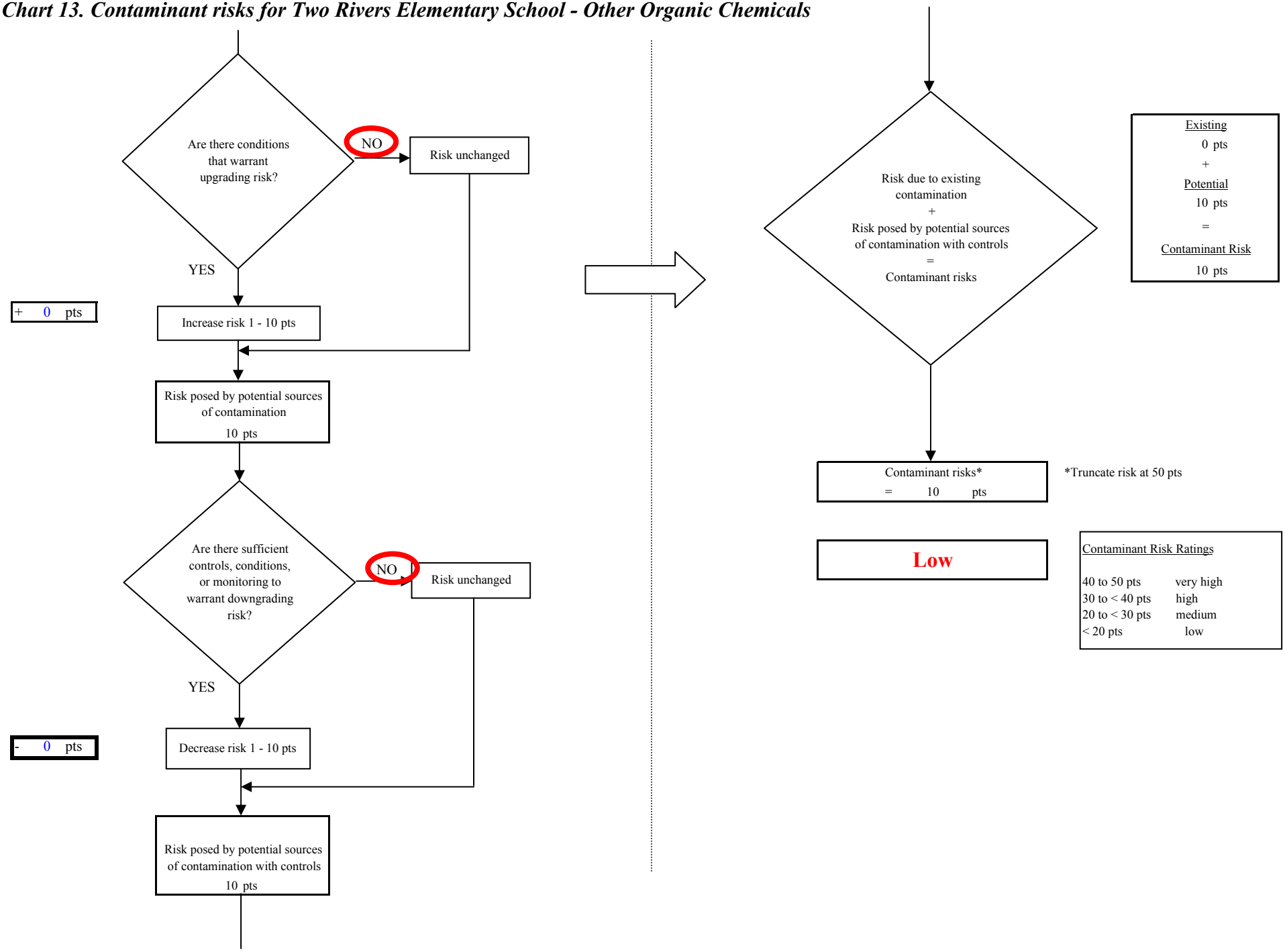


Chart 14. Vulnerability analysis for Two Rivers Elementary School - Other Organic Chemicals