

Source Water Assessment

A Hydrogeologic Susceptibility and
Vulnerability Assessment for
Copper River School District, Glennallen
Elementary School
Drinking Water System,
Glennallen, Alaska

PWSID # 291392.001

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DRINKING WATER PROTECTION PROGRAM REPORT 1357
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 Copper River School District, Glennallen Elementary School Source of Public Drinking Water, Glennallen, Alaska

Drinking Water Protection Program Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

The Copper Rivers School District (CRSD) Glennallen Elementary School has one Public Water System (PWS) well. The well has been used as a drinking water source since it was drilled in June of 1976.

The well is a Class A (community and non-transient/non-community) water system located at 1976 Aurora Drive in Glennallen, Alaska. The 2002 sanitary survey indicates that there is a storage tank with a 1000-gallon capacity. Records also indicate that the drinking water source is treated with activated charcoal filters to purify the water. This system operates year round and serves approximately 152 non-residents through 1 service connection. The wellhead received a susceptibility rating of **Low** and the aquifer received a susceptibility rating of **Very High**. Combining these two ratings produce a **Medium** rating for the natural susceptibility of the well.

Identified potential and current sources of contaminants for the public drinking water source include: bulk fuel facilities, fuel tanks, and power generation facilities. A detailed inventory of potential or existing contamination sources can be found in Appendix B, Table 1. These identified potential and existing sources of contamination are considered as sources of bacteria and viruses, nitrates and/or nitrites, volatile organic chemicals, heavy metals, cyanide and other inorganic chemicals, synthetic organic chemicals, and other organic chemicals contaminant categories.

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

PUBLIC DRINKING WATER SYSTEM

The CRSD Glennallen Elementary School well is a Class A (community/non-transient/non-community) public water system. The system is located at 1976 Aurora Drive in Glennallen, Alaska. (Sec. 23, T004N, R002W, Copper River Meridian; see Map A of Appendix A). Glennallen is located at the junction of the Glenn and Richardson Highways, approximately 189 miles east of Anchorage. The community has a population of 574 (ADCED, 2003). Average annual precipitation for Glennallen is 9 inches, including approximately 39 inches of snowfall. Temperatures typically range between -10 in January to 56°F in July.

Households in Glennallen have individual wells and septic systems. Almost all homes are fully plumbed, and refuse is collected by a private firm, Copper Valley Construction, and is transported to the landfill operated by a private operator, Copper Basin Sanitation (ADCED, 2003). Copper Valley Electric Association, a REA cooperative, provides electricity. Power-generating facilities are hydro powered with diesel backups (ADCED, 2003).

According to information supplied by ADEC for the CRSD Glennallen Elementary School PWS, the depth of the primary water well is 180 feet below the ground surface. Based on available well construction details, the well is screened from 168 feet to 180 feet. The well is completed in a confined aquifer and is not located within a floodplain.

Information acquired from an December 2002 sanitary survey for the public water system indicated that the land surface was sloped away from the well. Generally, land surfaces that slope away from the wellhead promote surface water drainage, which reduces the potential of contaminant migration down the well casing annulus. The sanitary survey indicates that the well is not grouted according to ADEC regulations. Proper grouting provides added protection against contaminants traveling along the well casing annulus and into source waters.

The Glennallen area is in the southeastern portion of the Copper River basin, in southeastern Interior Alaska. The Copper River basin, ranging from 500 to over 4,000 feet above sea level, is an intermontane basin rimmed by peaks of the Chugach, Alaska, Talkeetna, and Wrangell mountains. The terrain of the basin can be divided into two physiographic sub-units: the rolling, hummocky Copper River basin piedmont surface, and the Copper River basin trough. The Copper River basin trough is generally flat and lacks the hummocky, rolling character of the piedmont surface (Nichols 1956).

The terrain, geology of the unconsolidated deposits, and foundation materials of the Copper River basin are related to Pleistocene and recent events. Glaciers from the Chugach, Wrangell, Talkeetna, and Alaska Ranges repeatedly invaded the basin, perhaps at times filling it and flowing across the divides to the north, west, east, and south. Such extensive glaciation has resulted in the deposition of large thicknesses of coarse glacial boulder clays (till) and coarse outwash gravel and sand on the piedmont surface, with finer till and outwash interbedded with lake deposits in the basin trough (Nichols 1956).

The Glennallen area is within the discontinuous permafrost zone (Nichols 1956).

Surface soils in the area generally consist of silt and clay with pebbles underlain by boulder clay with till, underlain by glacial outwash sand and gravel, underlain by boulder clay or till (Nichols 1956).

DRINKING WATER PROTECTION AREA

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

The most probable area for contamination to reach the drinking water well is the area that contributes water to the well, the groundwater recharge area. This area is designated as the drinking water protection area (DWPA). Because releases of contaminants within the protection area are most likely to impact the drinking water well, this area will serve as the focus for voluntary protection efforts. An analytical calculation was used to determine the size and shape of the DWPA for the CRSD Glennallen Elementary School PWS. The input parameters describing the attributes of the aquifer in this calculation were adopted from Groundwater

(Freeze and Cherry, 1979). Available geology and groundwater contours were also considered to take into account any uncertainties in groundwater flow and aquifer characteristics to arrive at a meaningful protection area.

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

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

Table 1. Definition of Zones

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

The DWPA for the CRSD Glennallen Elementary School PWS was determined using an analytical calculation and includes Zones A, B, C, and D (See Map A of Appendix A).

INVENTORY OF POTENTIAL AND EXISTING CONTAMINANT SOURCES

The Drinking Water Protection Program has completed an inventory of potential and existing sources of contamination within the CRSD Glennallen Elementary School DWPA. This inventory was completed through a search of agency records and other publicly available information. Potential sources of contamination to the drinking water aquifer include a wide range of categories and types. Potential drinking water contaminants are found within agricultural, residential, commercial, and industrial areas, but can also occur within areas that have little or no development.

For the basis of all Class A public water system assessments, six categories of drinking water contaminants were inventoried. They include:

- Bacteria and viruses,
- Nitrates and/or nitrites,
- Volatile organic chemicals,

- Heavy metals, cyanide and other inorganic chemicals,
- Synthetic organic chemicals,
- Other organic chemicals.

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

RANKING OF CONTAMINANT RISKS

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

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

The time-of-travel for contaminants within the water varies and is dependent on the physical and chemical characteristics of each contaminant. Bacteria and Viruses are only inventoried in Zones A and B because of their short life span. Only “Very High” and “High” rankings are inventoried within the outer Zone D due to the probability of contaminant dilution by the time the contaminants get to the well. Tables 2 through 4 in Appendix B contain the ranking of potential and existing sources of contamination with respect to bacteria and viruses, nitrates and/or nitrites, volatile organic chemicals, heavy metals, cyanide and other inorganic chemicals, synthetic organic chemicals, and other organic chemicals.

VULNERABILITY OF THE DRINKING WATER SYSTEM

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

- Natural susceptibility, and
- Contaminant risks.

Appendix D contains fourteen charts, which together form the ‘Vulnerability Analysis’ for a source water assessment for a public drinking water source. Chart 1 analyzes the ‘Susceptibility of the Wellhead’ to contamination by looking at the construction of the well and its surrounding area. Chart 2 analyzes the ‘Susceptibility of the Aquifer’ to contamination by looking at the naturally occurring attributes of the

water source and influences on the groundwater system that might lead to contamination. Chart 3 analyzes ‘Contaminant Risks’ for the drinking water source with respect to bacteria and viruses. The ‘Contaminant Risks’ portion of the analysis considers potential sources of contaminants as well as a review of contamination that has or may have occurred, but has not arrived or been detected at the well. Chart 4 contains the ‘Vulnerability Analysis for Bacteria and Viruses’. Charts 5 through 14 contain the Contaminant Risks and Vulnerability Analyses for nitrates and nitrites, volatile organic chemicals, heavy metals, cyanide and other inorganic chemicals, synthetic organic chemicals, and other organic chemicals, respectively.

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

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

Table 2. Susceptibility

	Score	Rating
Susceptibility of the Wellhead	5	Low
Susceptibility of the Aquifer	22	Very High
Natural Susceptibility	27	Medium

Contaminant risks to a drinking water source depend on the type, number or density, and distribution of contaminant sources. This score has been derived from an examination of existing and historical contamination that has been detected at the drinking water source through routine sampling. It also evaluates potential sources of contamination. Flow charts are used to assign a point score, and ratings are assigned in the same way as for the natural susceptibility:

Contaminant Risk Ratings	
40 to 50 pts	Very High
30 to < 40 pts	High
20 to < 30 pts	Medium
< 20 pts	Low

Table 3 summarizes the Contaminant Risks for each category of drinking water contaminants.

Table 3. Contaminant Risks

Category	Score	Rating
Bacteria and Viruses	12	Low
Nitrates and/or Nitrites	16	Low
Volatile Organic Chemicals	50	Very High
Heavy Metals, Cyanide and Other Inorganic Chemicals	27	Medium
Synthetic Organic Chemicals	12	Low
Other Organic Chemicals	50	Very High

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

$$\begin{array}{r}
 \text{Natural Susceptibility (0 – 50 points)} \\
 + \\
 \text{Contaminant Risks (0 – 50 points)} \\
 =
 \end{array}$$

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	35	Low
Nitrates and Nitrites	45	Medium
Volatile Organic Chemicals	75	High
Heavy Metals, Cyanide and Other Inorganic Chemicals	55	Medium
Synthetic Organic Chemicals	35	Low
Other Organic Chemicals	75	High

Bacteria and Viruses

The contaminant risk for bacteria and viruses is **Low**. The risk is primarily attributed to the presence of a domestic wastewater collection system located in Zone B. Numerous other contaminant sources are located in the protection area (see Table 2 – Appendix B).

Coliform (a bacteria) are found naturally in the environment and although they aren't necessarily a health threat, they are an indicator of other potentially harmful bacteria in the water, more specifically, fecal coliform and E. coli, which only come from human and animal fecal waste. Harmful bacteria can cause diarrhea, cramps, nausea, headaches, or other symptoms (EPA, 2003).

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

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

Nitrates and Nitrites

The contaminant risk for nitrates and nitrites is **Low**. The risk to this source of public drinking water is primarily attributed to the presence of a domestic wastewater collection system located in Zone B. Numerous other contaminant sources are located in the protection area (see Table 3 – Appendix B).

Nitrates are very mobile, moving at approximately the same rate as water. The sampling history for this well indicates that nitrates have been detected in recent sampling events, however they did not exceed the MCL of 10 mg/L. Nitrate concentrations in uncontaminated groundwater are typically less than 2 mg/L; therefore, nitrate concentrations above 2 mg/L may be indicative of man-made sources (See Chart 5 - Contaminant Risks for Nitrates and/or Nitrites in Appendix D).

Nitrate levels are often derived from the decomposition of organic matter in soils. Although the nitrate source is unknown, such occurrences may be attributed to septic systems or other sources.

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

Volatile Organic Chemicals

The contaminant risk for volatile organic chemicals is **Very High**. The risk is primarily attributed to the presence of a bulk fuel facility located in Zone A. Other potential contaminant sources are also found within the protection area (see Table 4 – Appendix B).

All recent sampling data for VOCs was below detection levels for CRSD Glennallen Elementary School (See Chart 7 – Contaminant Risks for Volatile Organic Chemicals in Appendix D).

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

Heavy Metals, Cyanide and Other Inorganic Chemicals

The contaminant risk for heavy metals, cyanide and other inorganic chemicals is **Medium**. The risk is

primarily attributed to the presence of an electric power generation facility using fossil fuels located in Zone A (see Table 5 – Appendix B).

Based on review of recent sampling records for this public water system, chromium has been detected in recent sampling history, however, it has not exceeded its MCL of 0.1 mg/L (see Chart 9 – Contaminant Risks for Heavy Metals, Cyanide, and Other Inorganic Chemicals in Appendix D).

Chromium is a naturally occurring element found in rocks, animals, plants, soil, and in volcanic dust and gases. Chromium is present in the environment in several different forms. The most common forms are chromium(0), chromium(III), and chromium(VI). No taste or odor is associated with chromium compounds.

Chromium is steel-gray, lustrous, hard, metallic, and takes a high polish. Its compounds are toxic. It is found as chromite ore. Siberian red lead (crocoite, PrCrO_4) is a chromium ore prized as a red pigment for oil paints. Chromium metal powder is a fire hazard. All chromium compounds should be regarded as highly toxic. Chromium(VI) compounds are highly toxic and carcinogenic. Chromium(III) compounds are less toxic. Chromium compounds are important pollutants.

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 **Medium**.

Synthetic Organic Chemicals

The contaminant risk for synthetic organic chemicals is **Low**. The risk is primarily attributed to the presence of bulk fuel facilities and domestic wastewater collection systems located in Zone A. (see Table 6 – Appendix B).

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

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

Other Organic Chemicals

The contaminant risk for other organic chemicals is **Very High**. The risk is primarily attributed to the

presence of bulk fuel facilities and an electric power generator (fossil fuels) in Zone A. Other potential contaminant sources are also found within the protection area (see Table 7 – Appendix B).

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

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

Using the Source Water Assessment

This assessment of contaminant risks can be used as a foundation for local voluntary protection efforts as well as a basis for the continuous efforts on the part of CRSD Glennallen Elementary School and the community of Glennallen to protect public health. It is anticipated that Source Water Assessments will be updated every five years to reflect any changes in the vulnerability and/or susceptibility of the drinking water source.

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- Alaska Department of Environmental Conservation, Contaminated Sites Database, 2003 [WWW database], URL http://www.state.ak.us/dec/dspar/csites/cs_search.htm
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- Nichols, Donald R. Permafrost and Groundwater Conditions in the Glennallen area, Alaska Open File Report 56-91, U.S. Geological Survey, dated January 1956.
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APPENDIX A

Drinking Water Protection Area Location Map (Map A)

APPENDIX B

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

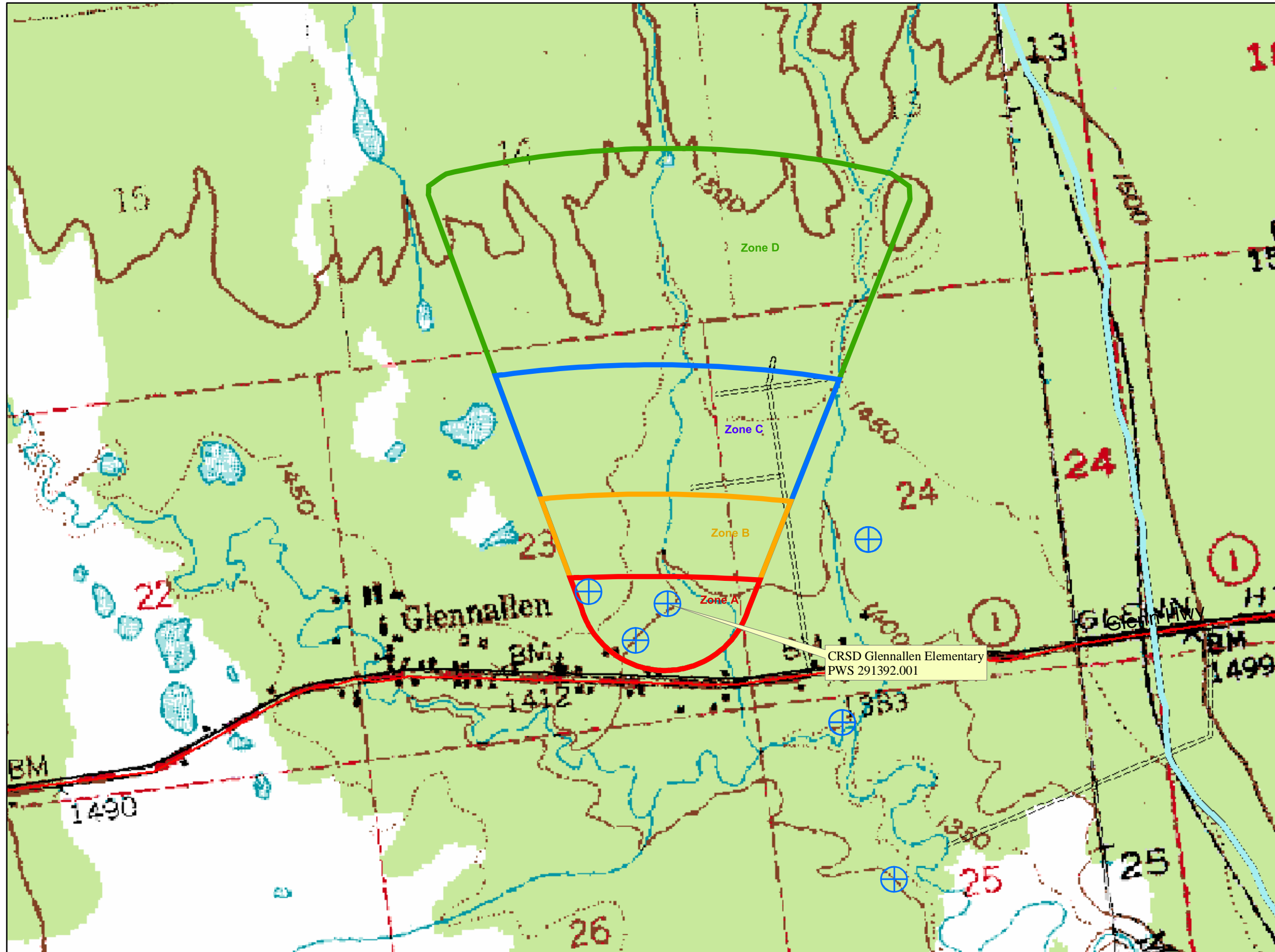
APPENDIX C

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

APPENDIX D

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

Public Water Well System for PWS #291392.001 CRSD Glennallen Elementary



LEGEND

- ⊕ Public Water System Well
- Hydrography/Physical**
 - ▭ Parcels
 - ~ Stream
 - ▭ Lake or Pond
 - ~ Contours
- Transportation**
 - Primary Route (Class 1)
 - - - Secondary Route (Class 2)
 - Road (Class 3)
 - ⋯ Road (Class 4)
 - ⋯ Road (Class 5, Four-wheel drive)
- Groundwater Protection Zones**
 - ▭ Zone A Protection Area— Several Months Travel Time
 - ▭ Zone B Protection Area— 2 Years Travel Time
 - ▭ Zone C Protection Area— 5 Years Travel Time
 - ▭ Zone D Protection Area— 10 Years Travel Time

Data Sources:
 Contaminant Sources, Public Water System Wells, Contours
 Alaska Department of Environmental Conservation (ADEC)

All other data:
 United States Geological Survey (USGS)

Drinking Water Protection Areas based on "Alaska Drinking Water Protection Program - Guidance Manual for Class A Public Water Systems" published by ADEC

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

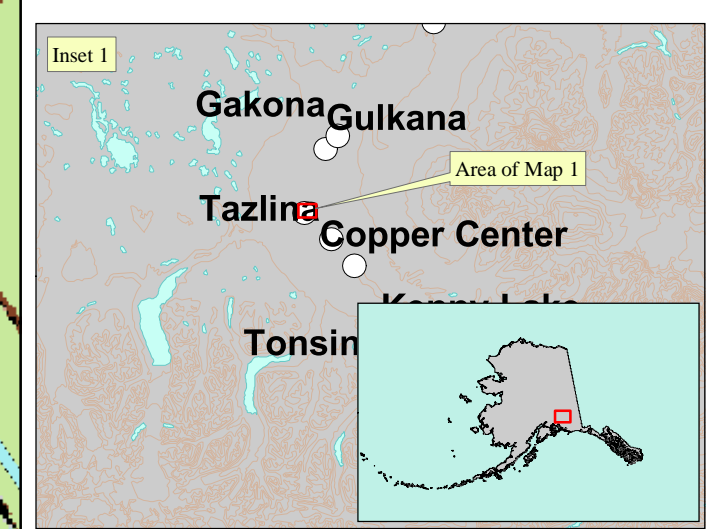


Table 1**Contaminant Source Inventory for
CRSD Glennallen Elementary****PWSID 291392.001**

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Map Number	Comments
Motor/motor vehicle supplies stores	C28	C28-01	A	C	Auto supply store assumed in Zone A (indicated through communication with well owner)
Quarries (sand, gravel, rock, other?)	E10	E10-01	A	C	COPPER VALLEY PORTABLE CRUSHER, SURFACE, PAST PROD
Tanks, heating oil, residential (above ground)	R08	R08-01	A	C	
Petroleum product bulk station/terminals	X11	X11-01	A	C	
Highways and roads, dirt/gravel	X24	X24-01	A	C	1-20 roads assumed in Zone A
Electric power generation (fossil fuels)	X36	X36-01	A	C	Alaska Bible College
Domestic wastewater collection systems (sewer lines or lift station)	D01	D01-01	B	C	Alaska Bible College
Tanks, heating oil, nonresidential (aboveground)	T14	T14-02	B	C	Radio Transmitter: KCAM 790
Highways and roads, dirt/gravel	X24	X24-02	B	C	1-20 roads assumed in Zone B
Tanks, heating oil, nonresidential (aboveground)	T14	T14-01	C	C	Power Generation Facility: COPPER VALLEY ELEC GLEN
Highways and roads, dirt/gravel	X24	X24-03	C	C	1-20 roads assumed in Zone C
Electric power generation (fossil fuels)	X36	X36-01	C	C	Power Generation Facility: COPPER VALLEY ELEC GLEN
Highways and roads, dirt/gravel	X24	X24-04	D	C	1-20 roads assumed in Zone D

*Contaminant Source Inventory and Risk Ranking for
CRSD Glennallen Elementary
Sources of Bacteria and Viruses*

PWSID 291392.001

Table 2

<i>Contaminant Source Type</i>	<i>Contaminant Source ID</i>	<i>CS ID tag</i>	<i>Zone</i>	<i>Risk Ranking for Analysis</i>	<i>Map Number</i>	<i>Comments</i>
Motor/motor vehicle supplies stores	C28	C28-01	A	Low	C	Auto supply store assumed in Zone A (indicated through communication w well owner)
Highways and roads, dirt/gravel	X24	X24-01	A	Low	C	1-20 roads assumed in Zone A
Domestic wastewater collection systems (sewer line or lift stations)	D01	D01-01	B	Medium	C	Alaska Bible College

Table 3

*Contaminant Source Inventory and Risk Ranking for
CRSD Glennallen Elementary
Sources of Nitrates/Nitrites*

PWSID 291392.001

<i>Contaminant Source Type</i>	<i>Contaminant Source ID</i>	<i>CS ID tag</i>	<i>Zone</i>	<i>Risk Ranking for Analysis</i>	<i>Map Number</i>	<i>Comments</i>
Motor/motor vehicle supplies stores	C28	C28-01	A	Low	C	Auto supply store assumed in Zone A (indicated through communication w well owner)
Quarries (sand, gravel, rock, other?)	E10	E10-01	A	Low	C	COPPER VALLEY PORTABLE CRUSHER, SURFACE, PAST PROD
Highways and roads, dirt/gravel	X24	X24-01	A	Low	C	1-20 roads assumed in Zone A
Domestic wastewater collection systems (sewer line or lift stations)	D01	D01-01	B	Medium	C	Alaska Bible College
Highways and roads, dirt/gravel	X24	X24-03	C	Low	C	1-20 roads assumed in Zone C

*Contaminant Source Inventory and Risk Ranking for
CRSD Glennallen Elementary
Sources of Volatile Organic Chemicals*

PWSID 291392.001

Table 4

<i>Contaminant Source Type</i>	<i>Contaminant Source ID</i>	<i>CS ID tag</i>	<i>Zone</i>	<i>Risk Ranking for Analysis</i>	<i>Map Number</i>	<i>Comments</i>
Motor/motor vehicle supplies stores	C28	C28-01	A	Low	C	Auto supply store assumed in Zone A (indicated through communication w well owner)
Quarries (sand, gravel, rock, other?)	E10	E10-01	A	Low	C	COPPER VALLEY PORTABLE CRUSHER, SURFACE, PAST PROD
Tanks, heating oil, residential (above ground)	R08	R08-01	A	Medium	C	
Petroleum product bulk station/terminals	X11	X11-01	A	Very High	C	
Highways and roads, dirt/gravel	X24	X24-01	A	Low	C	1-20 roads assumed in Zone A
Electric power generation (fossil fuels)	X36	X36-01	A	Medium	C	Alaska Bible College
Domestic wastewater collection systems (sewer line or lift stations)	D01	D01-01	B	Low	C	Alaska Bible College
Tanks, heating oil, nonresidential (aboveground)	T14	T14-02	B	Low	C	Radio Transmitter: KCAM 790
Tanks, heating oil, nonresidential (aboveground)	T14	T14-01	C	Low	C	Power Generation Facility: COPPER VALLEY ELEC GLEN
Highways and roads, dirt/gravel	X24	X24-03	C	Low	C	1-20 roads assumed in Zone C
Electric power generation (fossil fuels)	X36	X36-01	C	Medium	C	Power Generation Facility: COPPER VALLEY ELEC GLEN

*Contaminant Source Inventory and Risk Ranking for
CRSD Glennallen Elementary*

PWSID 291392.001

Table 5

Sources of Heavy Metals, Cyanide and Other Inorganic Chemicals

<i>Contaminant Source Type</i>	<i>Contaminant Source ID</i>	<i>CS ID tag</i>	<i>Zone</i>	<i>Risk Ranking for Analysis</i>	<i>Map Number</i>	<i>Comments</i>
Motor/motor vehicle supplies stores	C28	C28-01	A	Low	C	Auto supply store assumed in Zone A (indicated through communication w well owner)
Petroleum product bulk station/terminals	X11	X11-01	A	Low	C	
Highways and roads, dirt/gravel	X24	X24-01	A	Low	C	1-20 roads assumed in Zone A
Electric power generation (fossil fuels)	X36	X36-01	A	Medium	C	Alaska Bible College
Domestic wastewater collection systems (sewer line or lift stations)	D01	D01-01	B	Low	C	Alaska Bible College
Tanks, heating oil, nonresidential (aboveground)	T14	T14-02	B	Low	C	Radio Transmitter: KCAM 790
Tanks, heating oil, nonresidential (aboveground)	T14	T14-01	C	Low	C	Power Generation Facility: COPPER VALLEY ELEC GLEN
Highways and roads, dirt/gravel	X24	X24-03	C	Low	C	1-20 roads assumed in Zone C
Electric power generation (fossil fuels)	X36	X36-01	C	Medium	C	Power Generation Facility: COPPER VALLEY ELEC GLEN

Table 6

*Contaminant Source Inventory and Risk Ranking for
CRSD Glennallen Elementary
Sources of Synthetic Organic Chemicals*

PWSID 291392.001

<i>Contaminant Source Type</i>	<i>Contaminant Source ID</i>	<i>CS ID tag</i>	<i>Zone</i>	<i>Risk Ranking for Analysis</i>	<i>Map Number</i>	<i>Comments</i>
Petroleum product bulk station/terminals	X11	X11-01	A	Low	C	
Domestic wastewater collection systems (sewer line or lift stations)	D01	D01-01	B	Low	C	Alaska Bible College

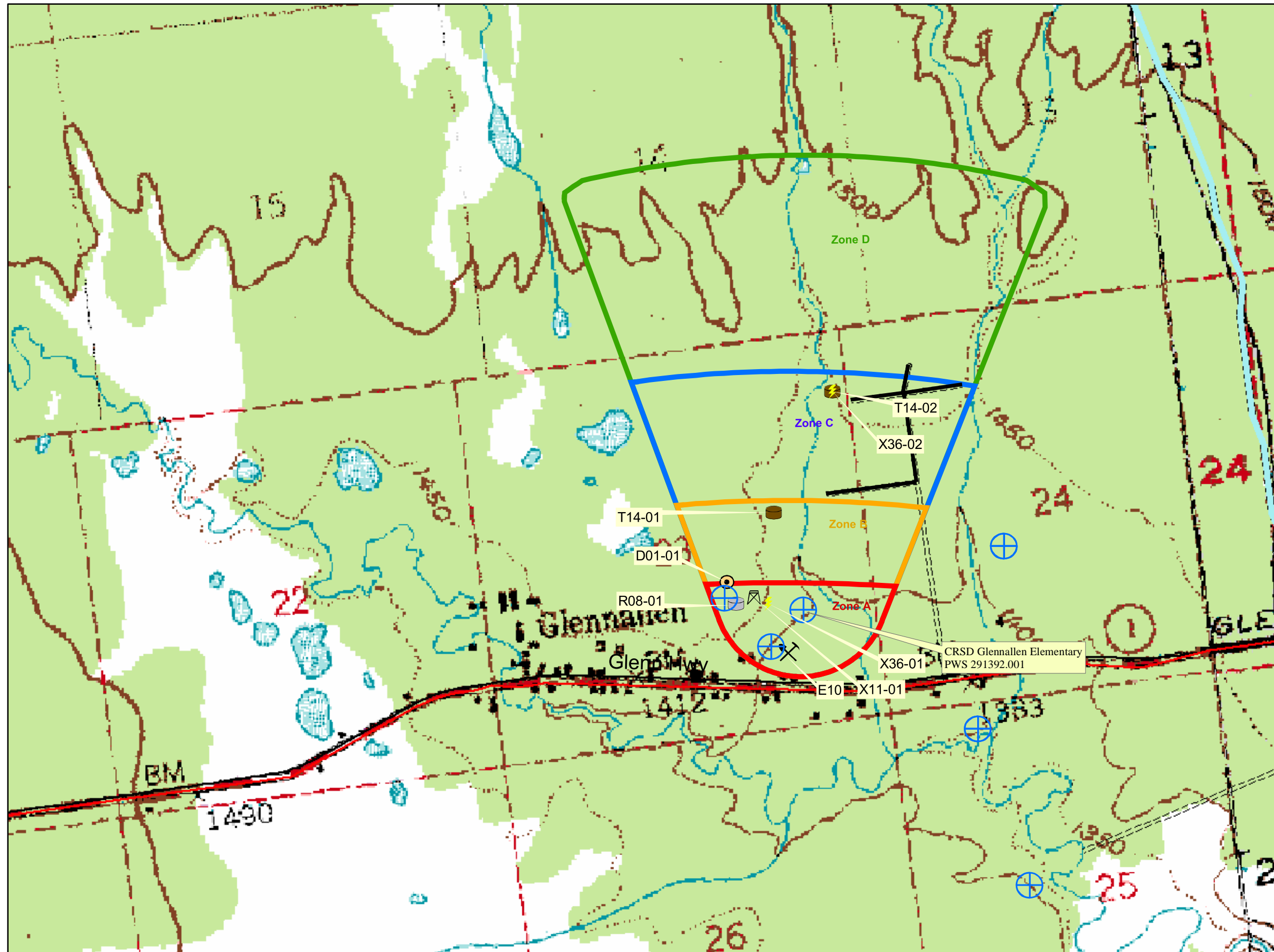
*Contaminant Source Inventory and Risk Ranking for
CRSD Glennallen Elementary
Sources of Other Organic Chemicals*

PWSID 291392.001

Table 7

<i>Contaminant Source Type</i>	<i>Contaminant Source ID</i>	<i>CS ID tag</i>	<i>Zone</i>	<i>Risk Ranking for Analysis</i>	<i>Map Number</i>	<i>Comments</i>
Motor/motor vehicle supplies stores	C28	C28-01	A	Low	C	Auto supply store assumed in Zone A (indicated through communication w well owner)
Quarries (sand, gravel, rock, other?)	E10	E10-01	A	Low	C	COPPER VALLEY PORTABLE CRUSHER, SURFACE, PAST PROD
Petroleum product bulk station/terminals	X11	X11-01	A	High	C	
Highways and roads, dirt/gravel	X24	X24-01	A	Low	C	1-20 roads assumed in Zone A
Electric power generation (fossil fuels)	X36	X36-01	A	High	C	Alaska Bible College
Domestic wastewater collection systems (sewer line or lift stations)	D01	D01-01	B	Low	C	Alaska Bible College
Highways and roads, dirt/gravel	X24	X24-03	C	Low	C	1-20 roads assumed in Zone C
Electric power generation (fossil fuels)	X36	X36-01	C	High	C	Power Generation Facility: COPPER VALLEY ELEC GLEN

**Public Water Well System for PWS #291392.001 CRSD Glennallen Elementary
Potential and Existing Sources of Contamination**



LEGEND

- ⊕ Public Water System Well

Hydrography/Physical

- ▭ Parcels
- ~ Stream
- ▭ Lake or Pond
- ~ Contours

Transportation

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

Groundwater Protection Zones

- ▭ Zone A Protection Area— Several Months Travel Time
- ▭ Zone B Protection Area— 2 Years Travel Time
- ▭ Zone C Protection Area— 5 Years Travel Time
- ▭ Zone D Protection Area— 10 Years Travel Time

Existing or Potential Contaminant Sources

- ⊙ Domestic wastewater collection systems (sewer lines or lift stations) (D01)
- Tanks, heating oil, non-residential, aboveground (T14)
- Tanks, heating oil, residential (above ground) (R08)
- ⊠ Petroleum product bulk station/terminal (X11)
- ⚡ Power Generation Facility (fossil fuel) (X36)

Data Sources:
Contaminant Sources, Public Water System Wells, Contours
Alaska Department of Environmental Conservation (ADEC)

All other data:
United States Geological Survey (USGS)

Drinking Water Protection Areas based on "Alaska Drinking Water Protection Program - Guidance Manual for Class A Public Water Systems" published by ADEC

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

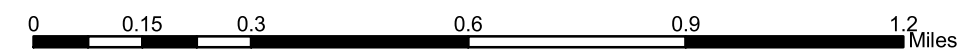


Chart 1. Susceptibility of the wellhead - CRSD Glennallen Elementary (PWS No. 291392.001)

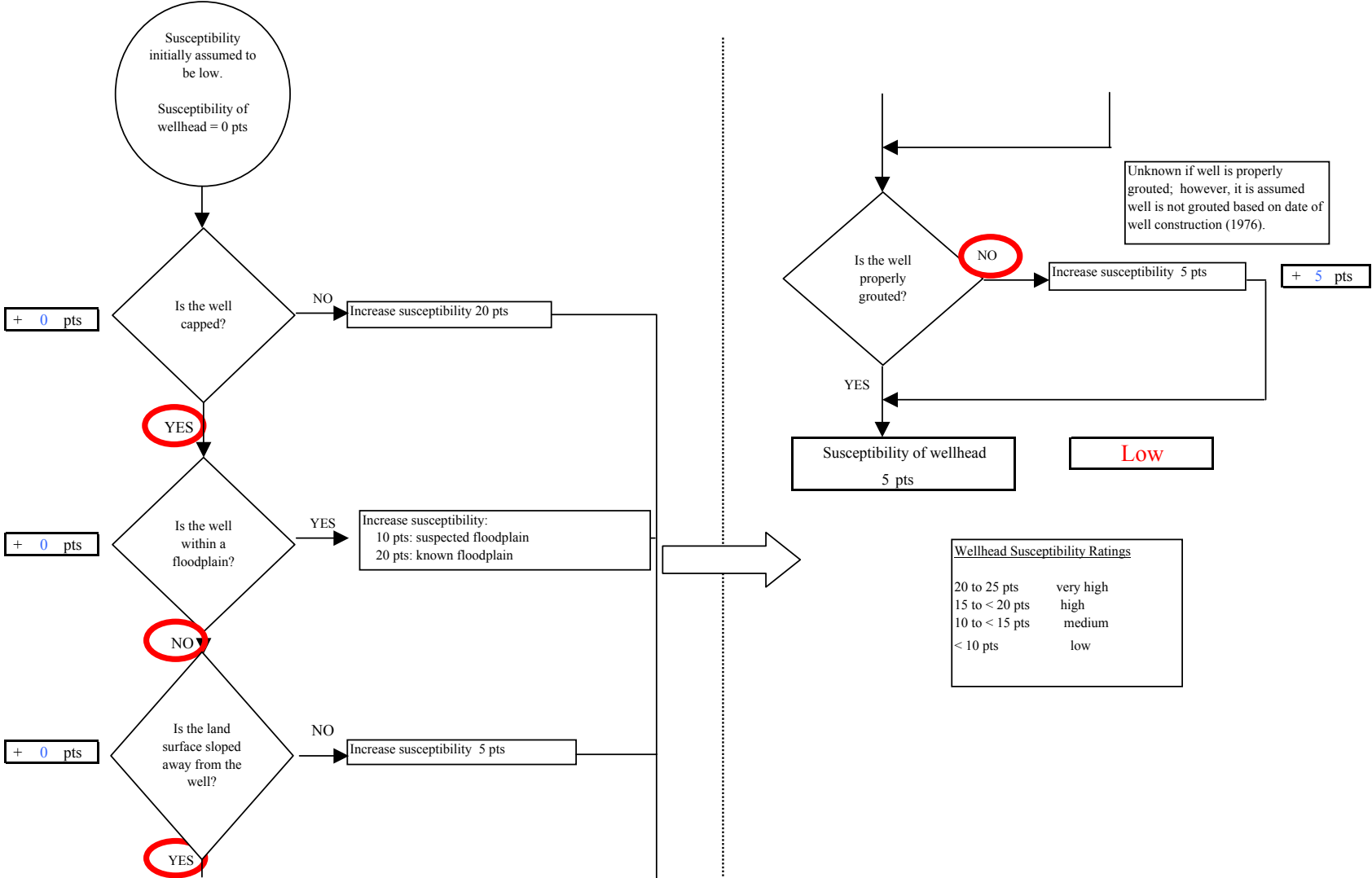


Chart 2. Susceptibility of the aquifer CRSD Glennallen Elementary (PWS No. 291392.001)

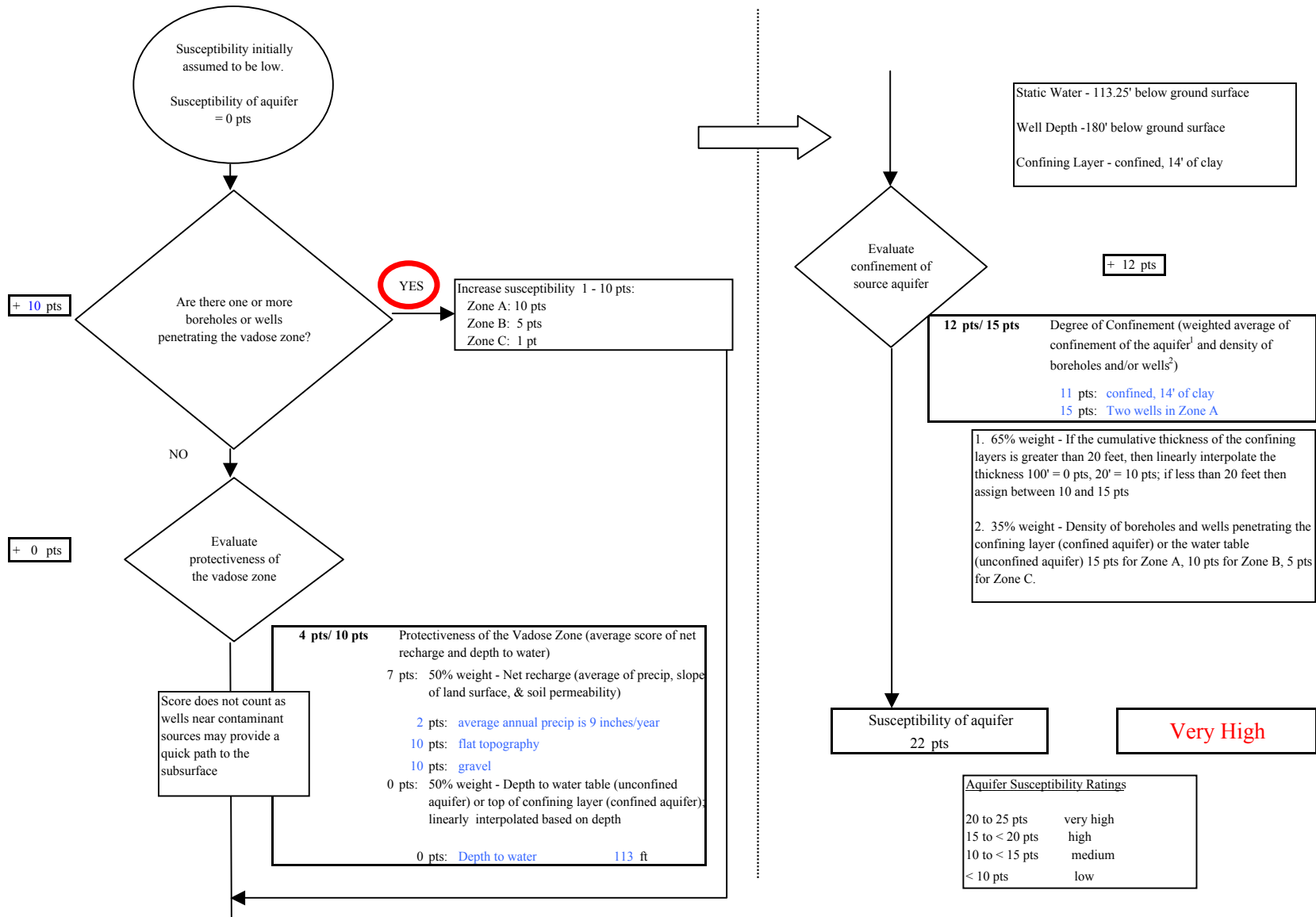


Chart 3. Contaminant risks for CRSD Glennallen Elementary (PWS No. 291392.001) - Bacteria & Viruses

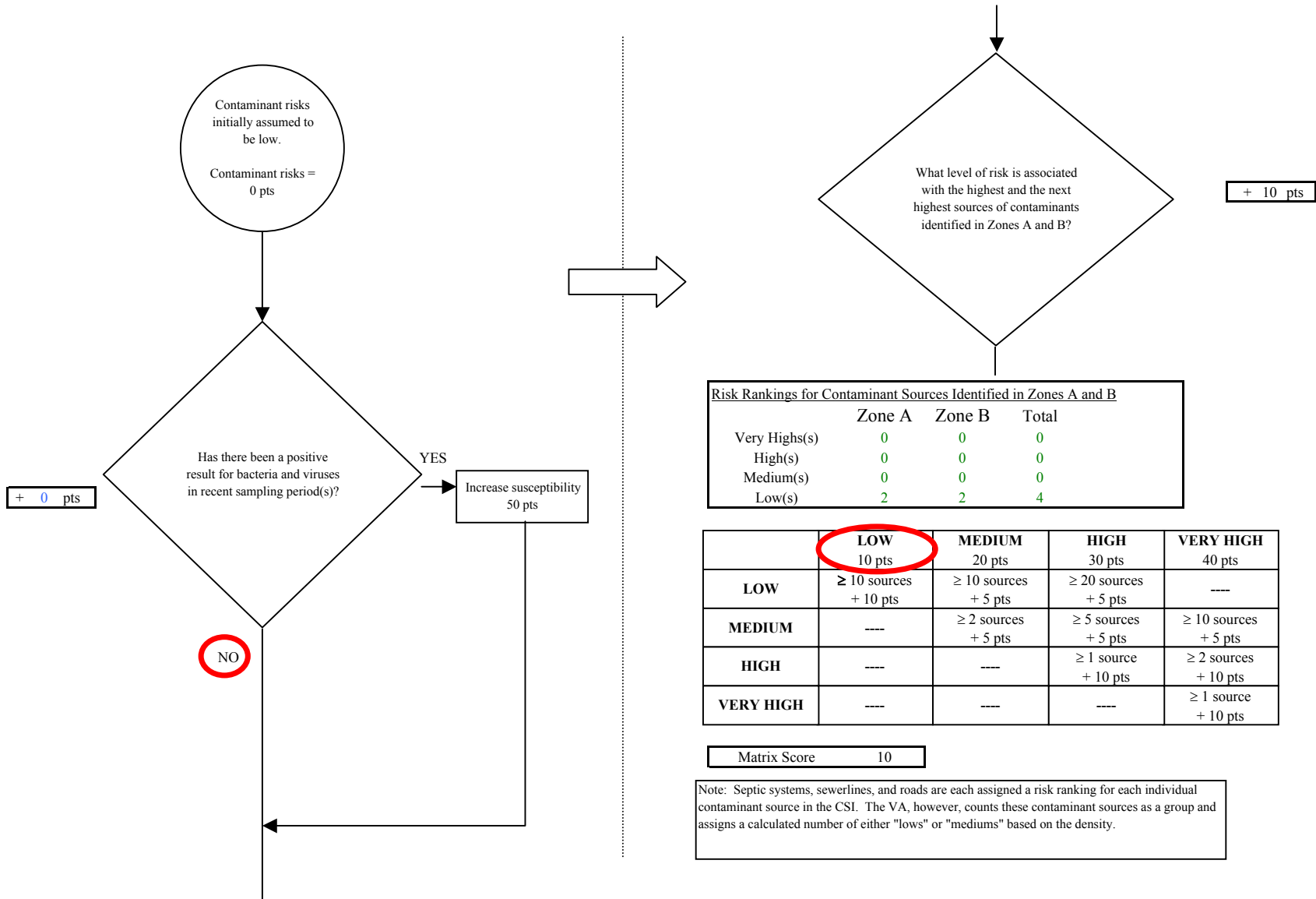


Chart 3. Contaminant risks for CRSD Glennallen Elementary (PWS No. 291392.001) - Bacteria & Viruses

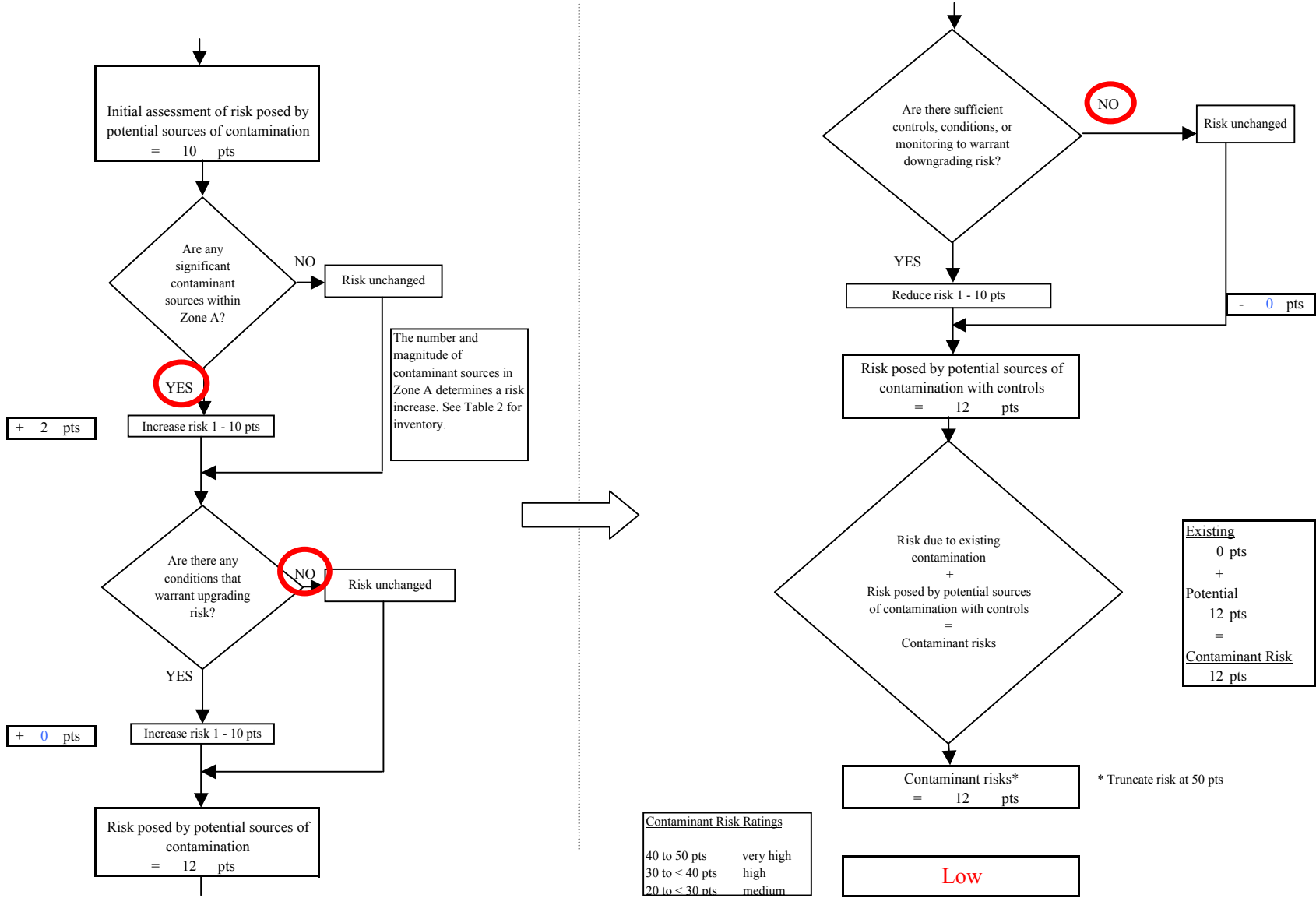


Chart 4. Vulnerability analysis for CRSD Glennallen Elementary (PWS No. 291392.001) - Bacteria & Viruses

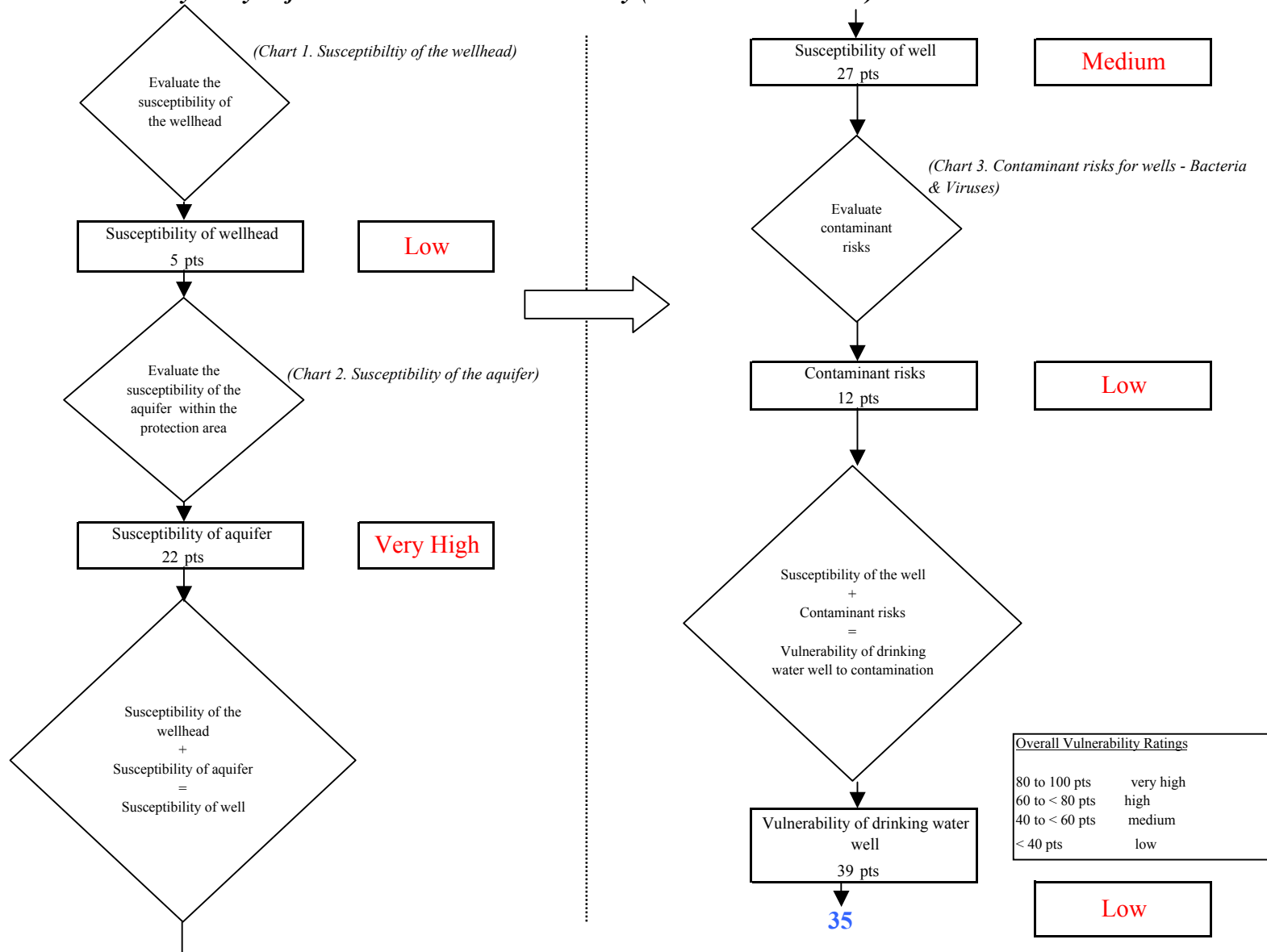


Chart 5. Contaminant risks for CRSD Glennallen Elementary (PWS No. 291392.001) - Nitrates and Nitrites

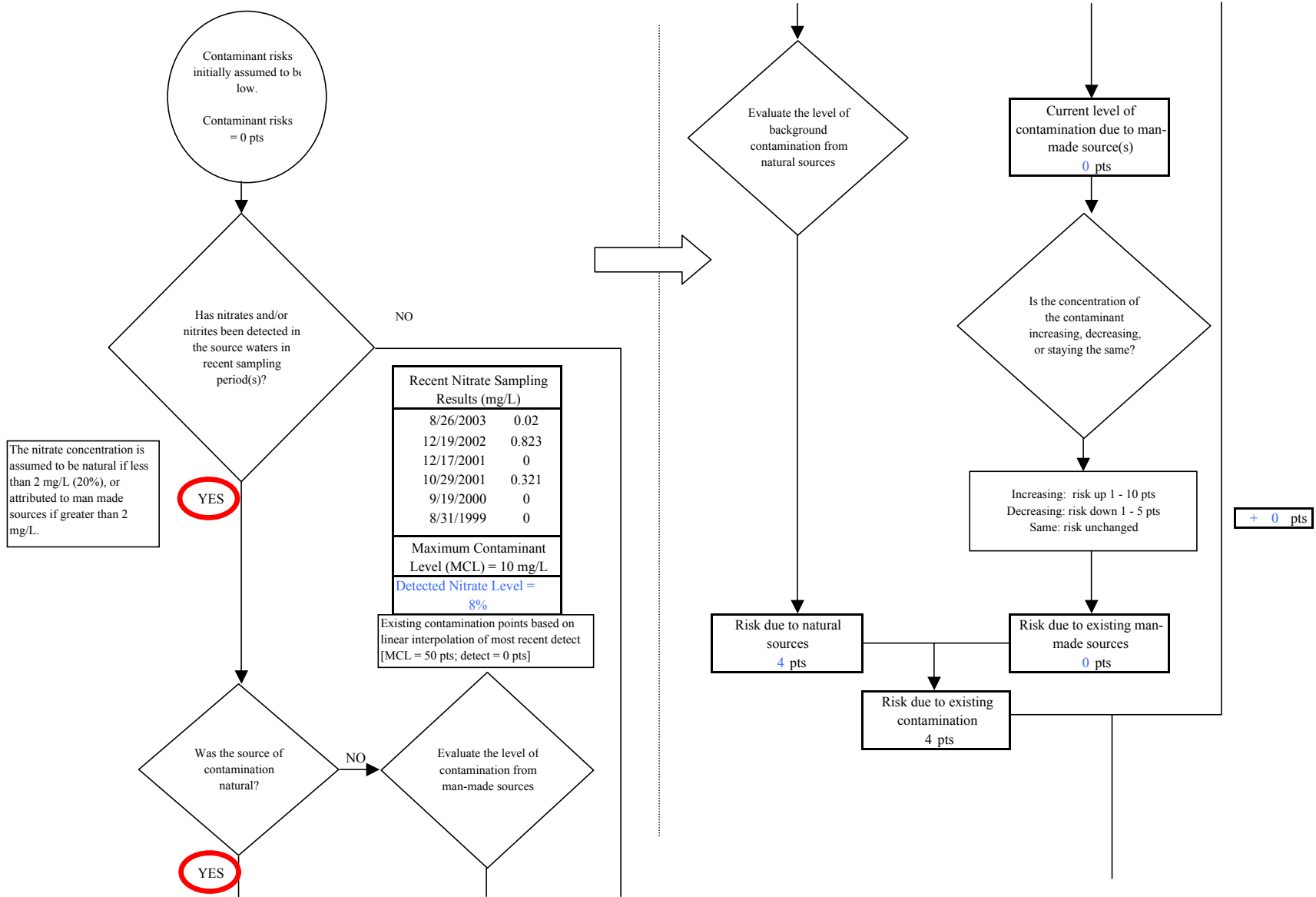


Chart 5. Contaminant risks for CRSD Glennallen Elementary (PWS No. 291392.001) - Nitrates and Nitrites

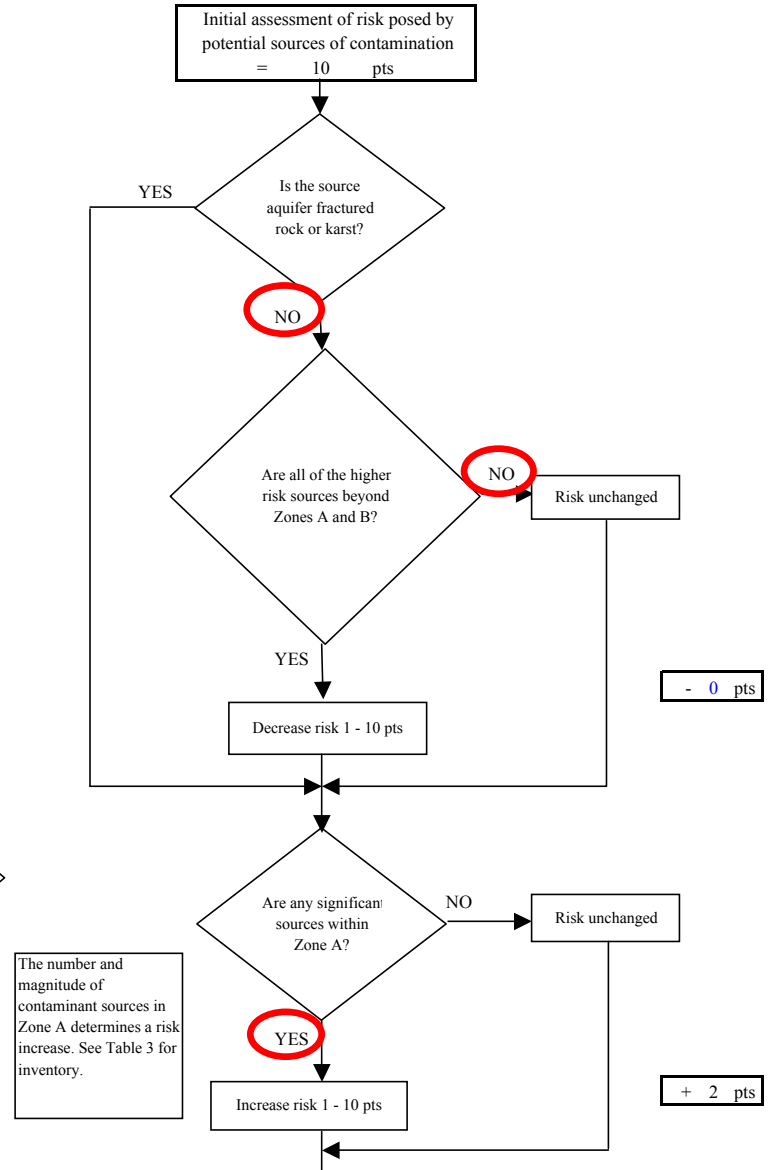
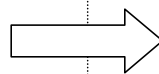
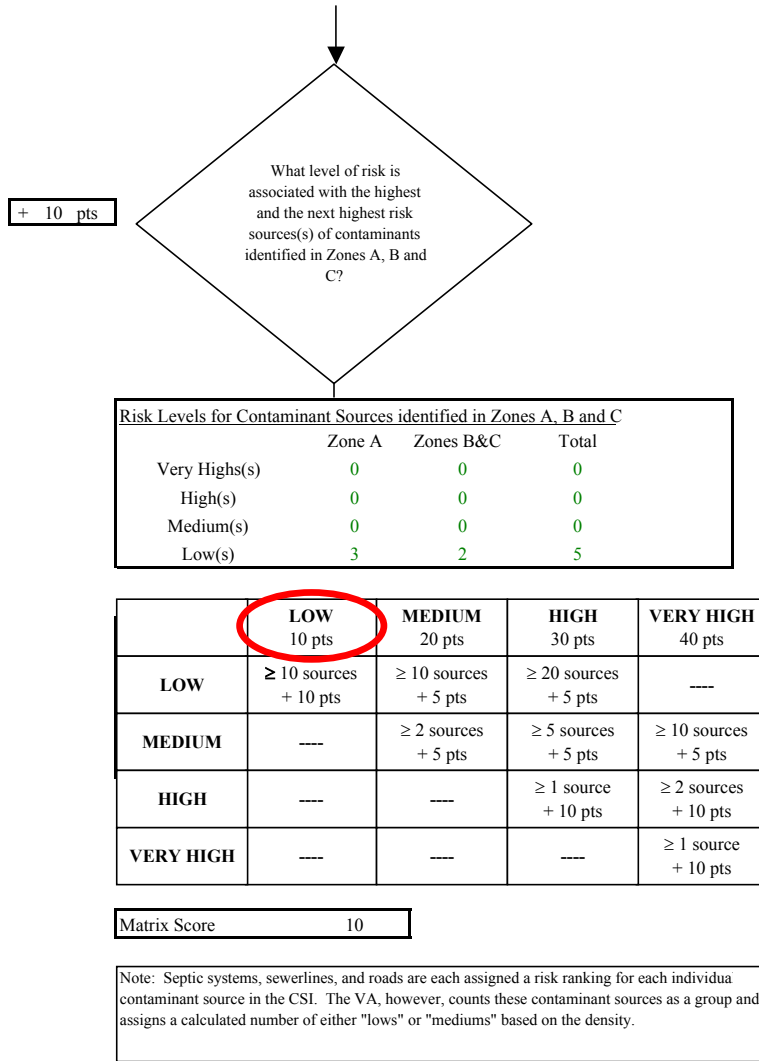


Chart 5. Contaminant risks for CRSD Glennallen Elementary (PWS No. 291392.001) - Nitrates and Nitrites

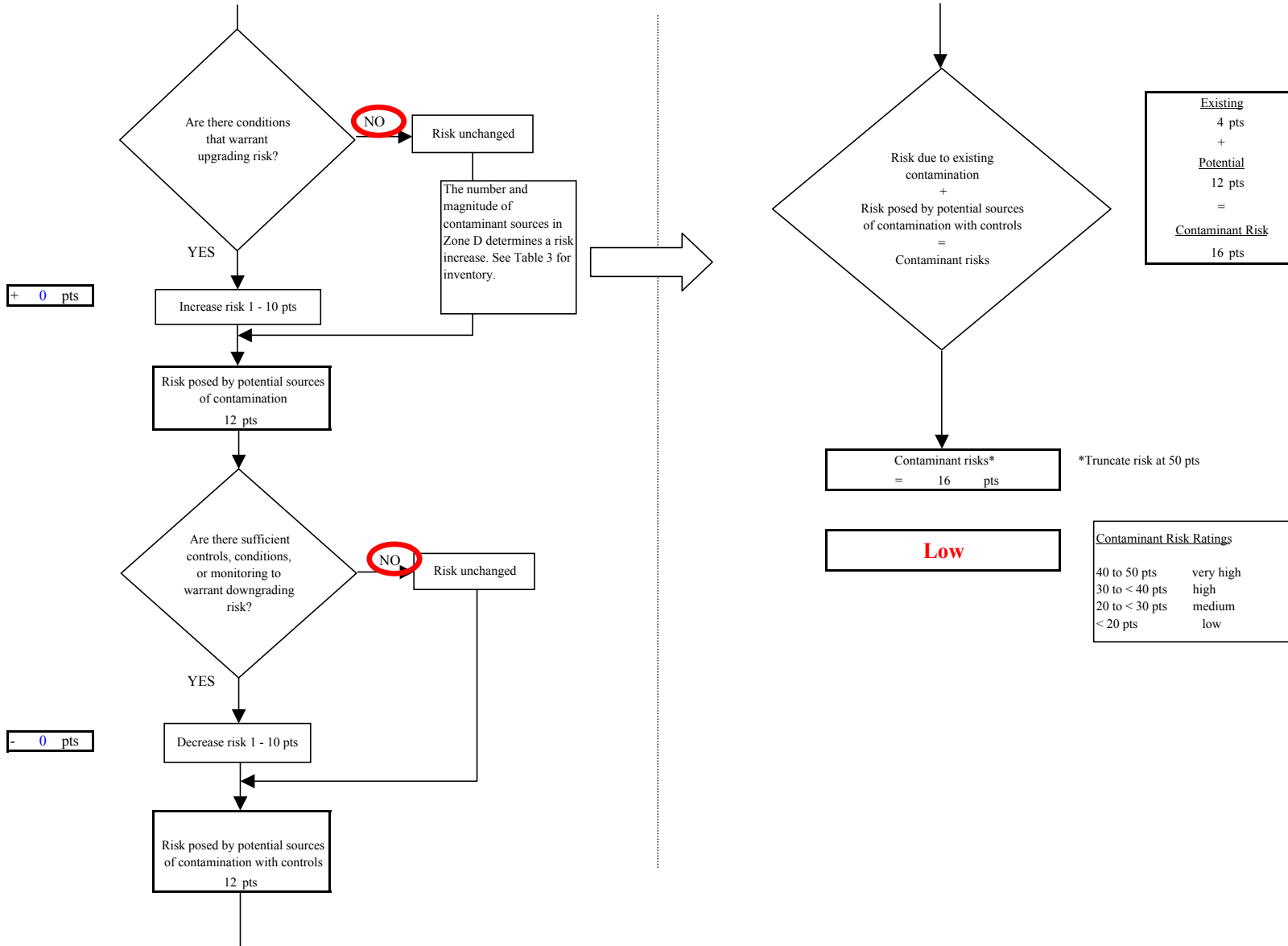


Chart 6. Vulnerability analysis for CRSD Glennallen Elementary (PWS No. 291392.001) - Nitrates and Nitrites

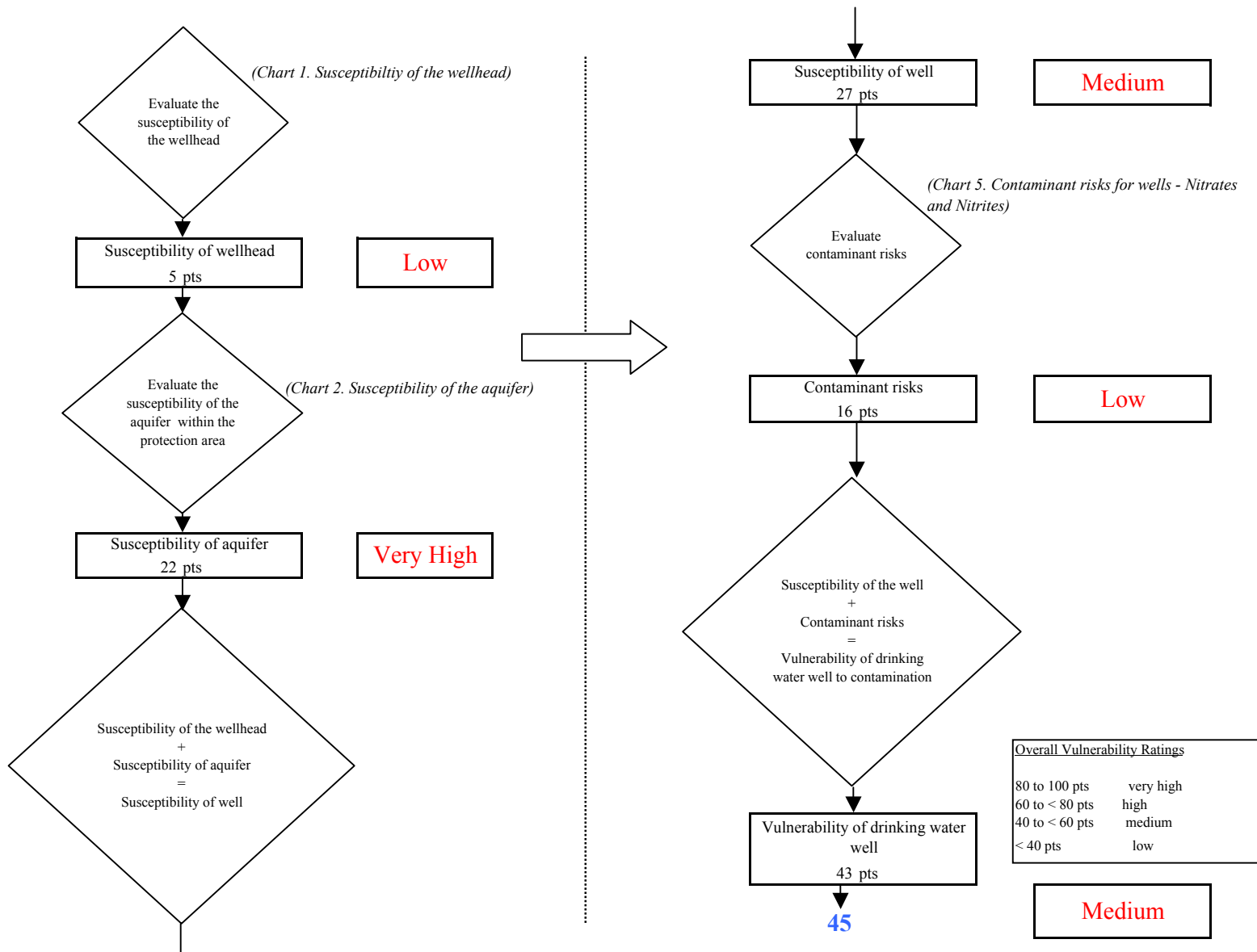


Chart 7. Contaminant risks for CRSD Glennallen Elementary (PWS No. 291392.001) - Volatile Organic Chemicals

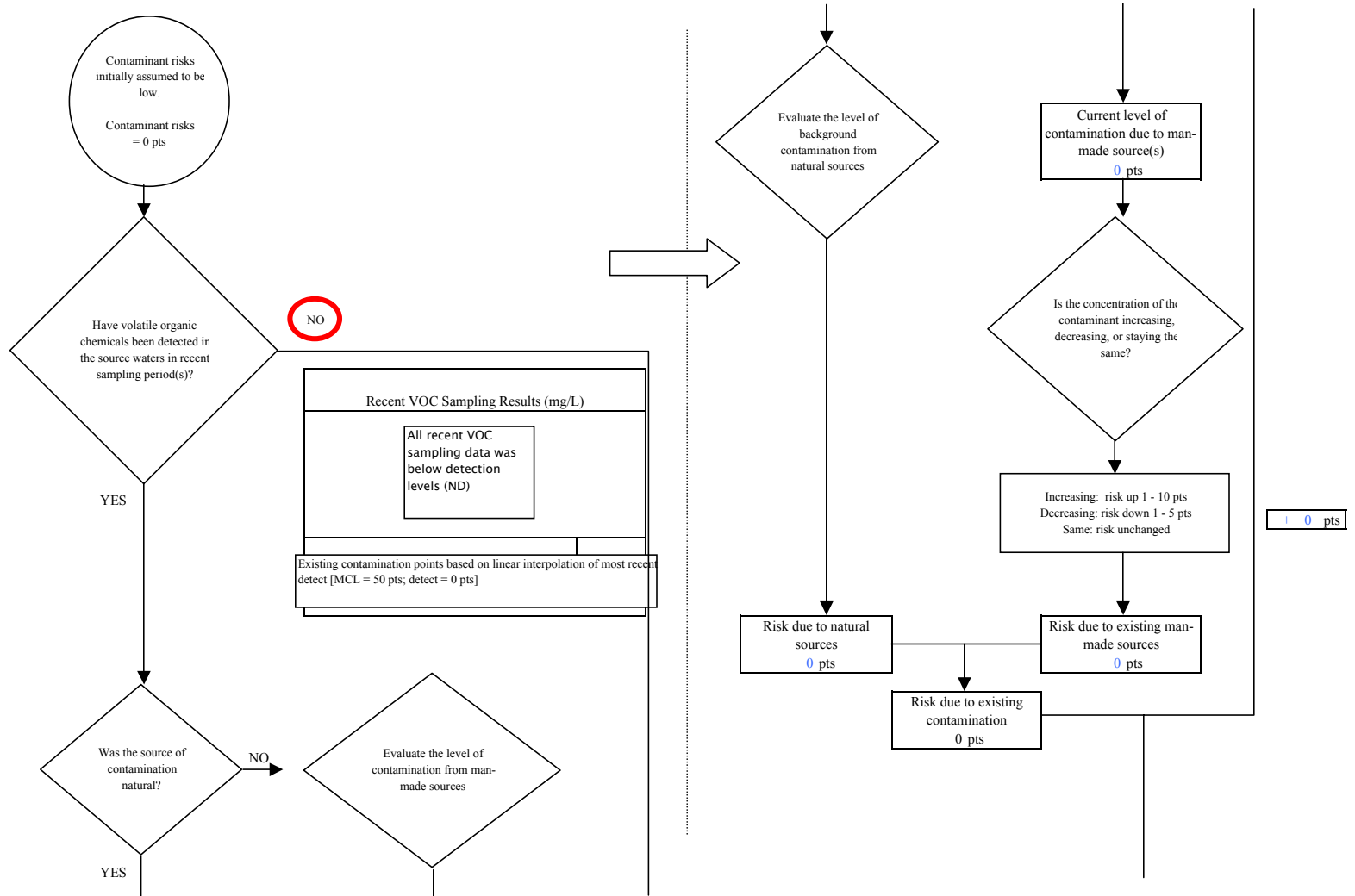


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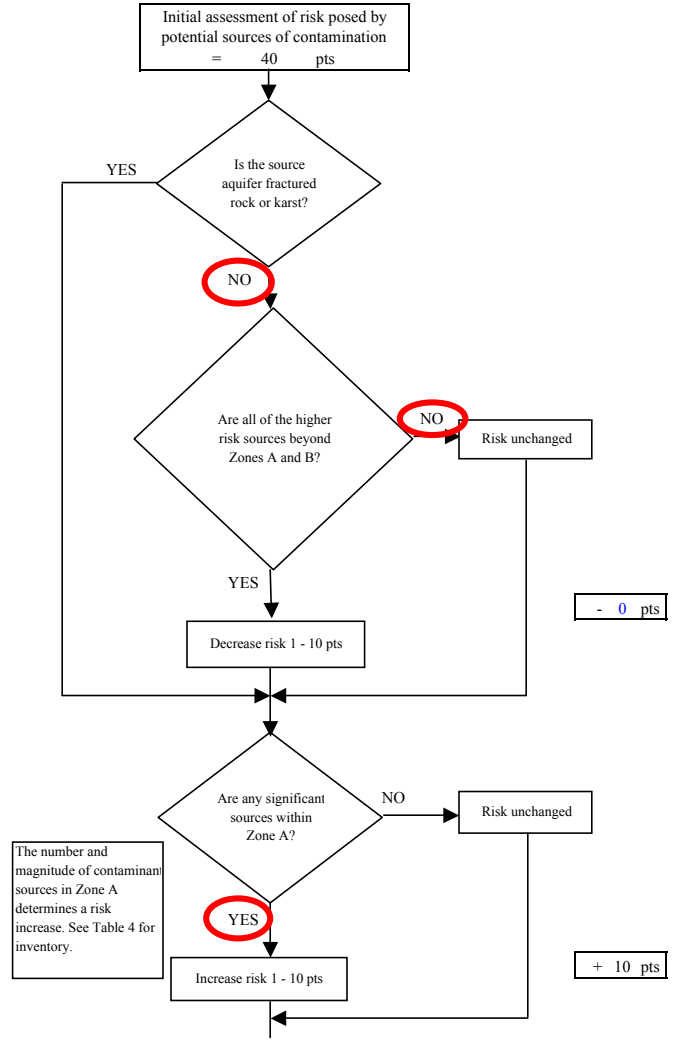
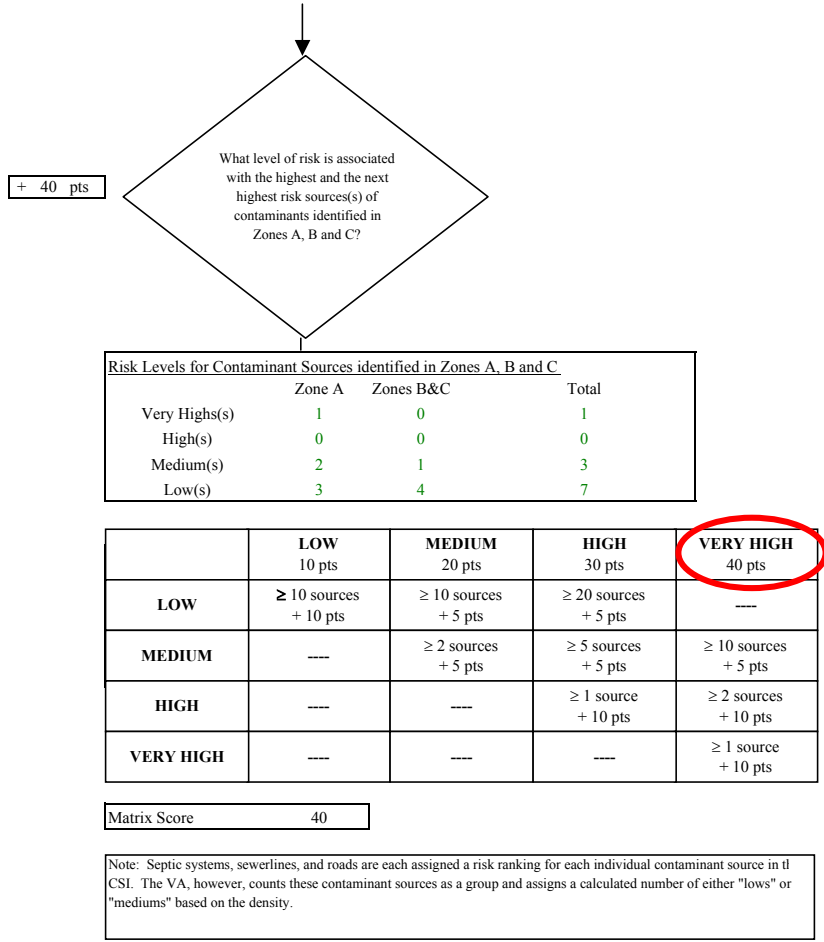


Chart 7. Contaminant risks for CRSD Glennallen Elementary (PWS No. 291392.001) - Volatile Organic Chemicals

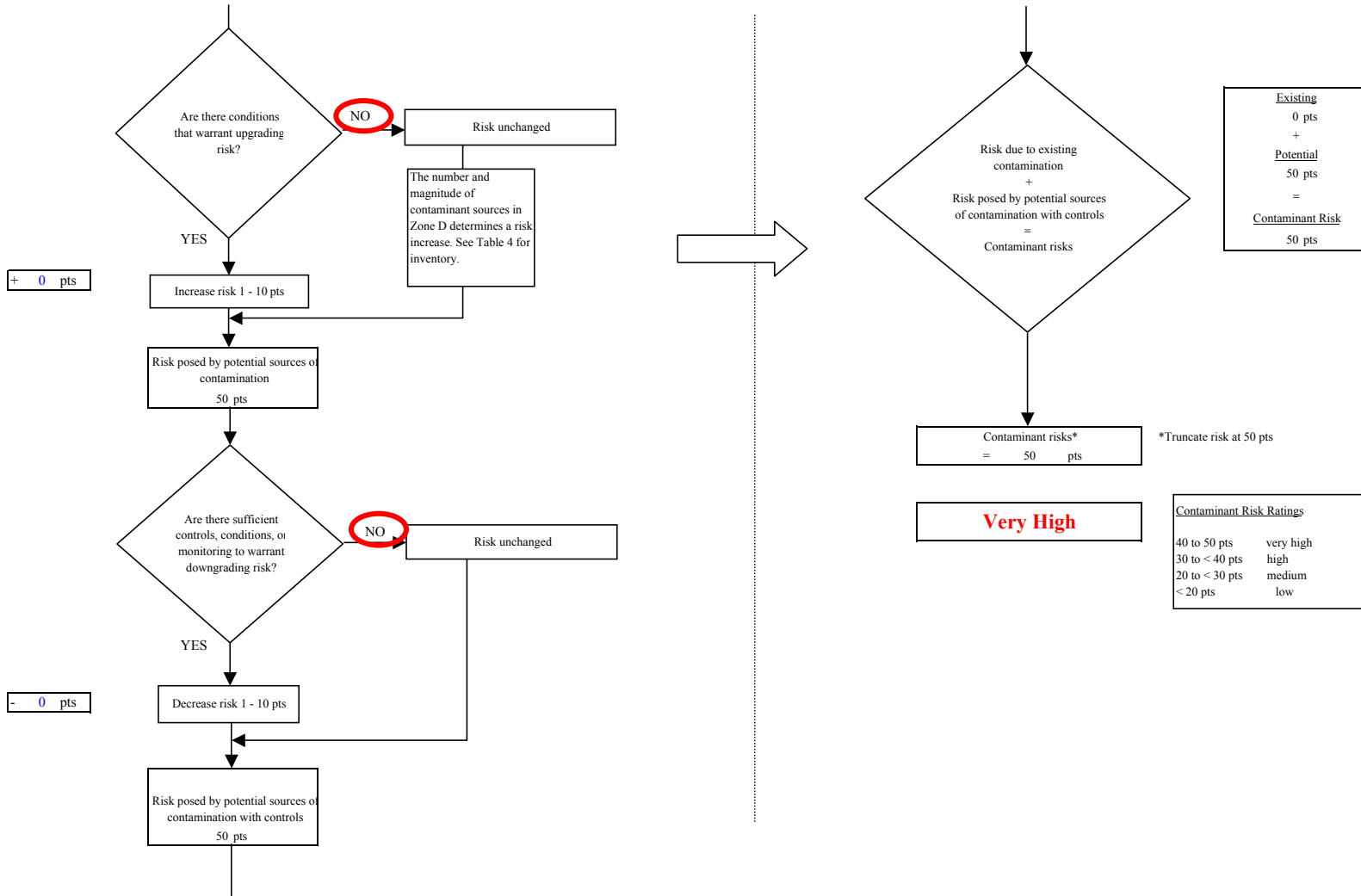


Chart 8. Vulnerability analysis for CRSD Glennallen Elementary (PWS No. 291392.001) - Volatile Organic Chemicals

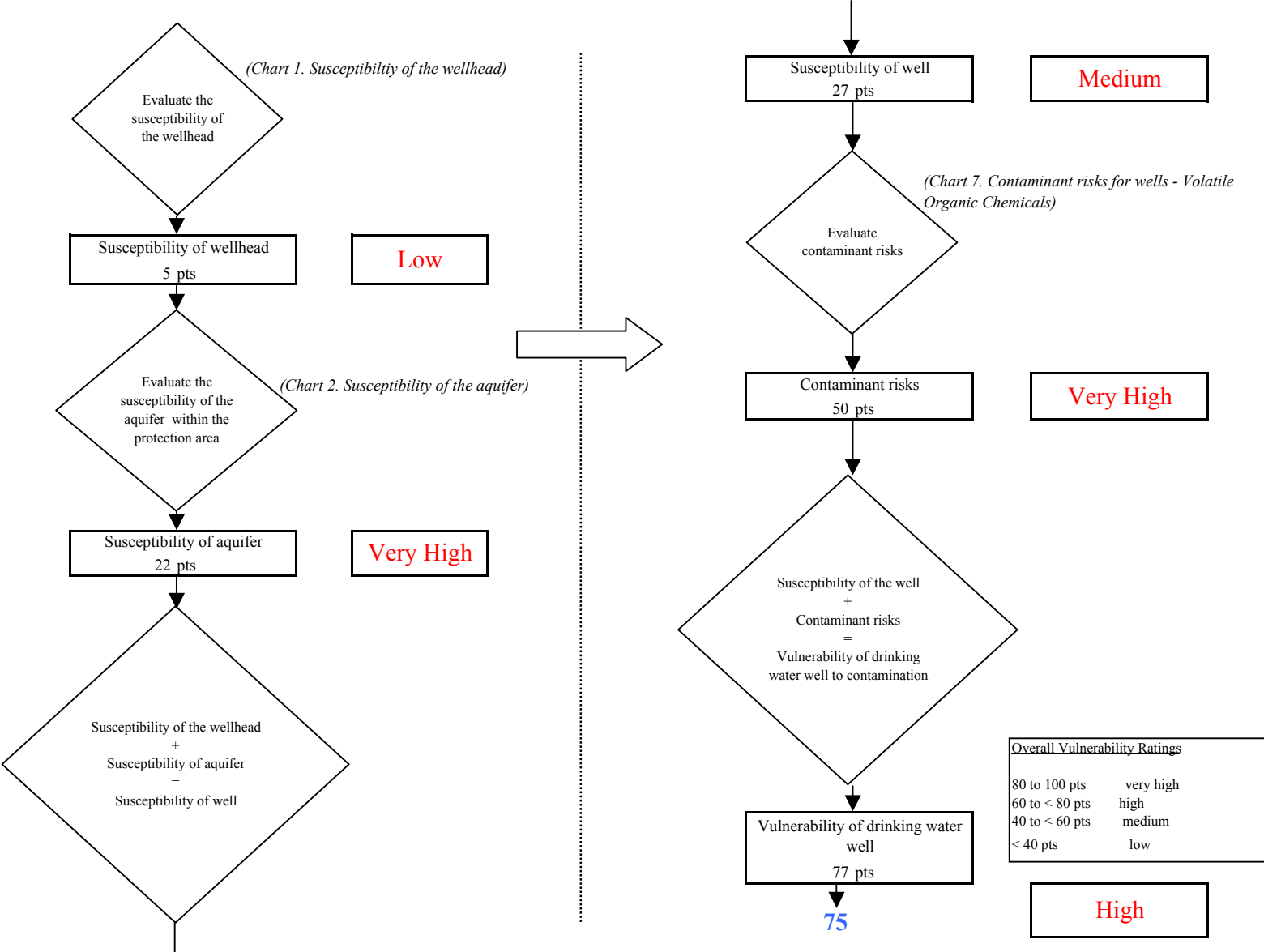


Chart 9. Contaminant risks for CRSD Glennallen Elementary (PWS No. 291392.001) - Heavy Metals, Cyanide and Other Inorganic Chemicals

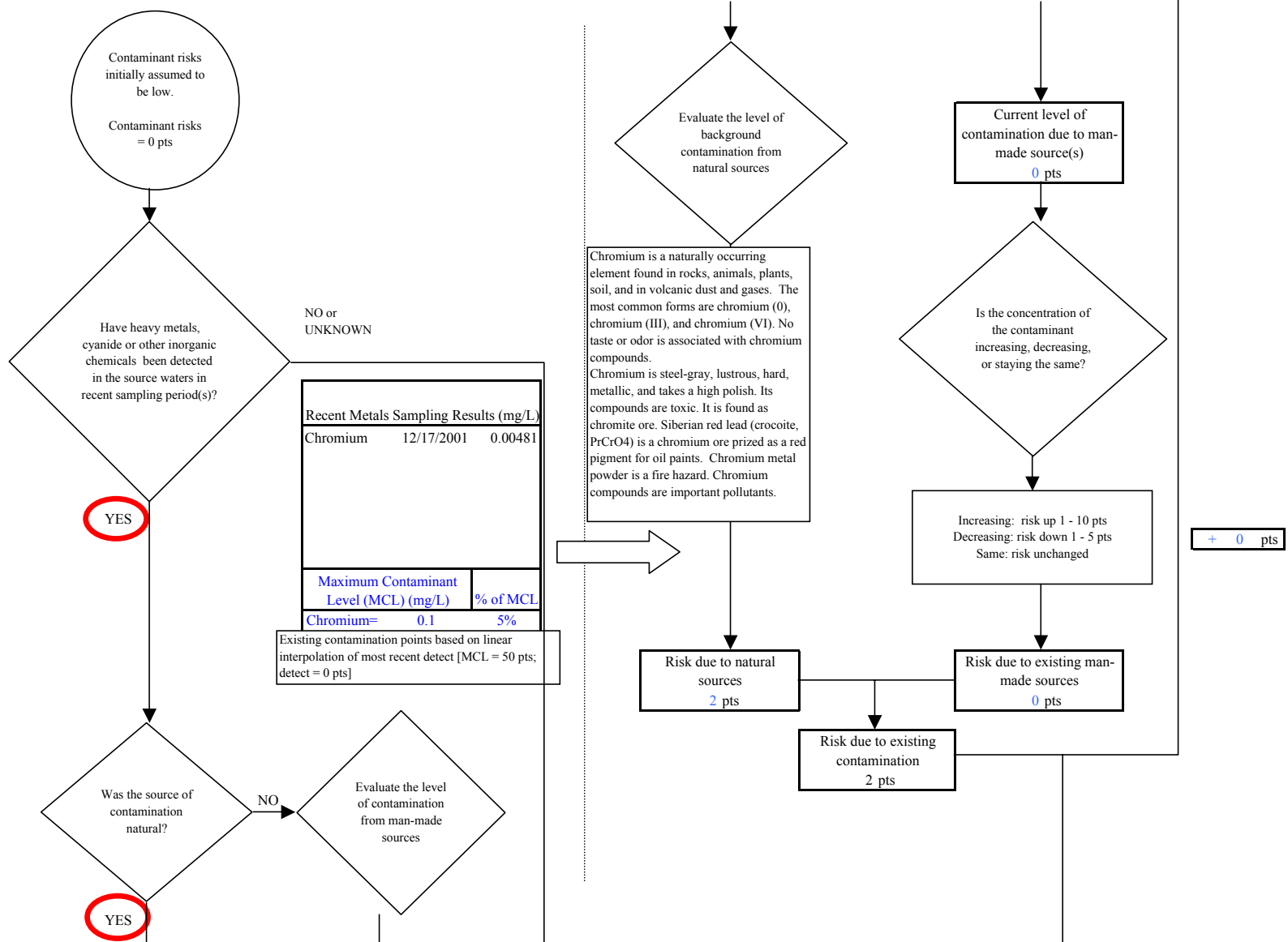


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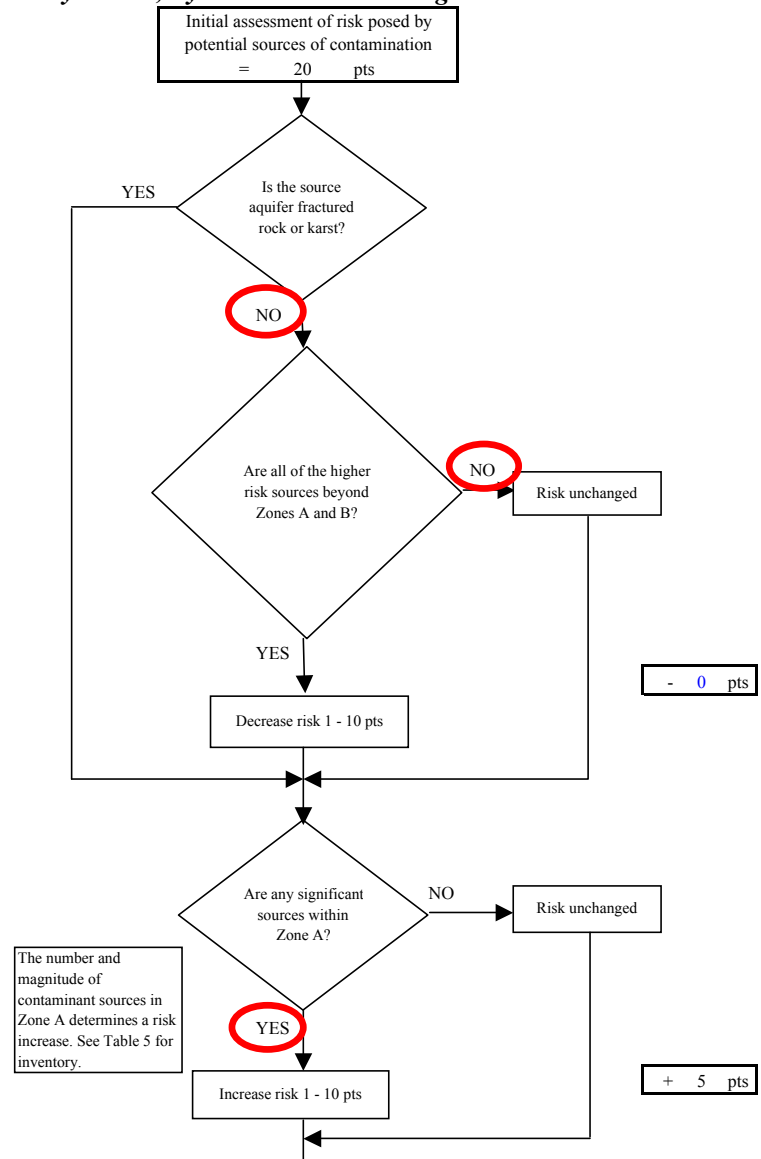
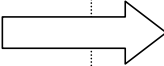
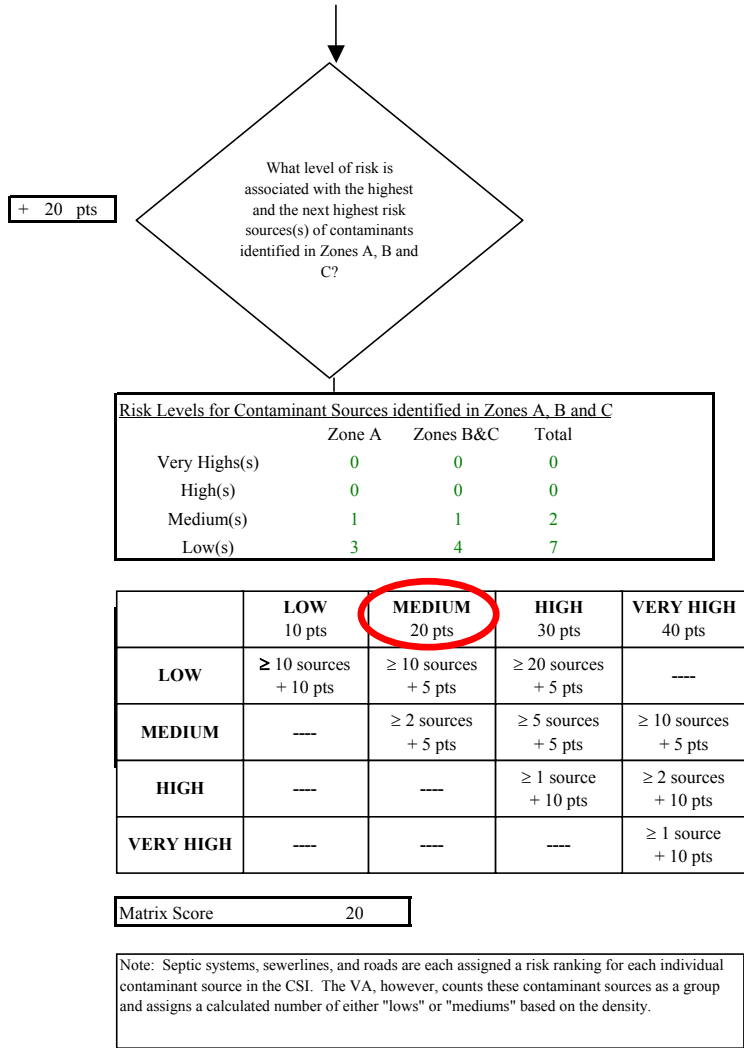


Chart 9. Contaminant risks for CRSD Glennallen Elementary (PWS No. 291392.001) - Heavy Metals, Cyanide and Other Inorganic Chemicals

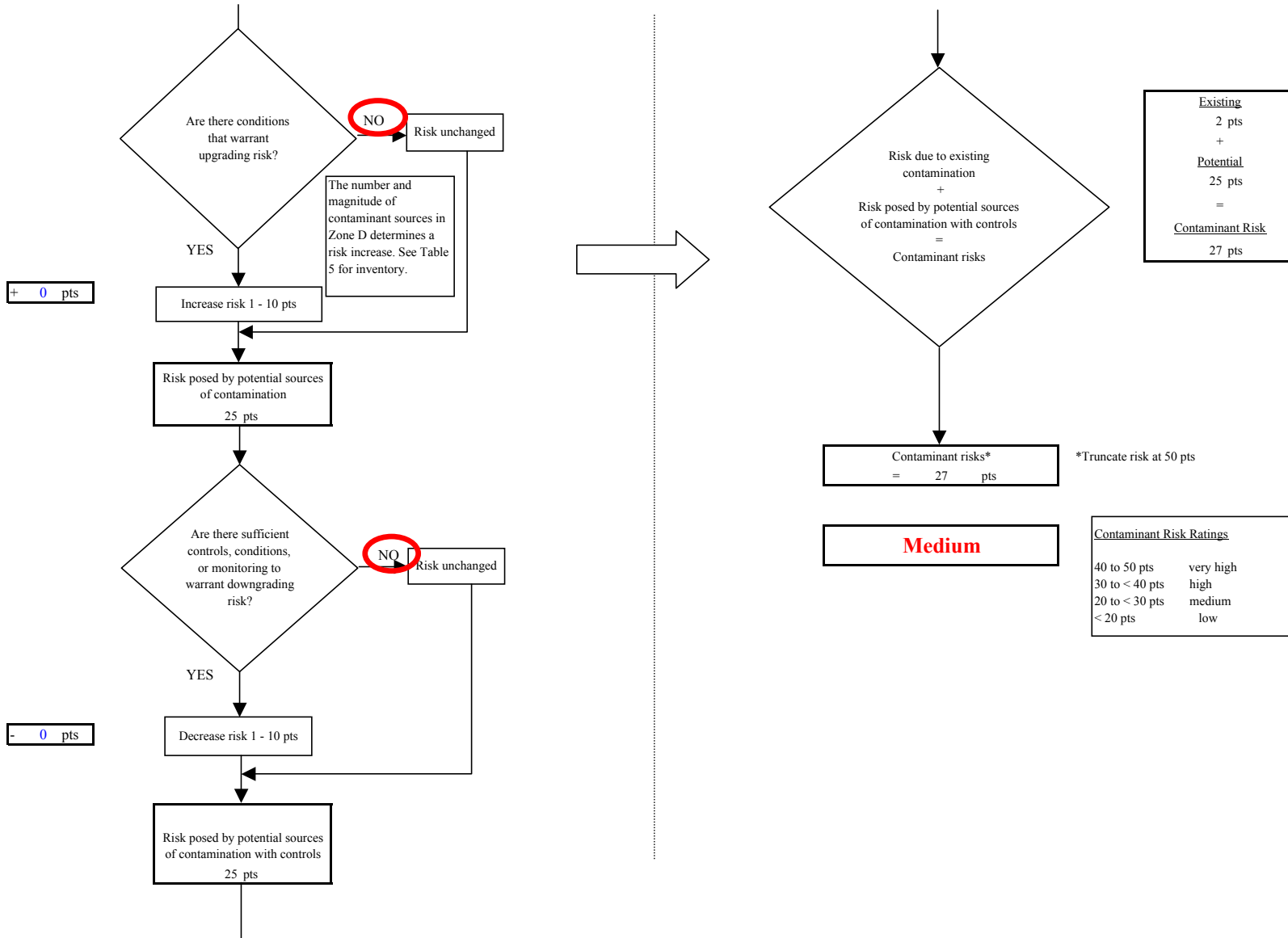


Chart 10. Vulnerability analysis for CRSD Glennallen Elementary (PWS No. 291392.001) - Heavy Metals, Cyanide and Other Inorganic Chemicals

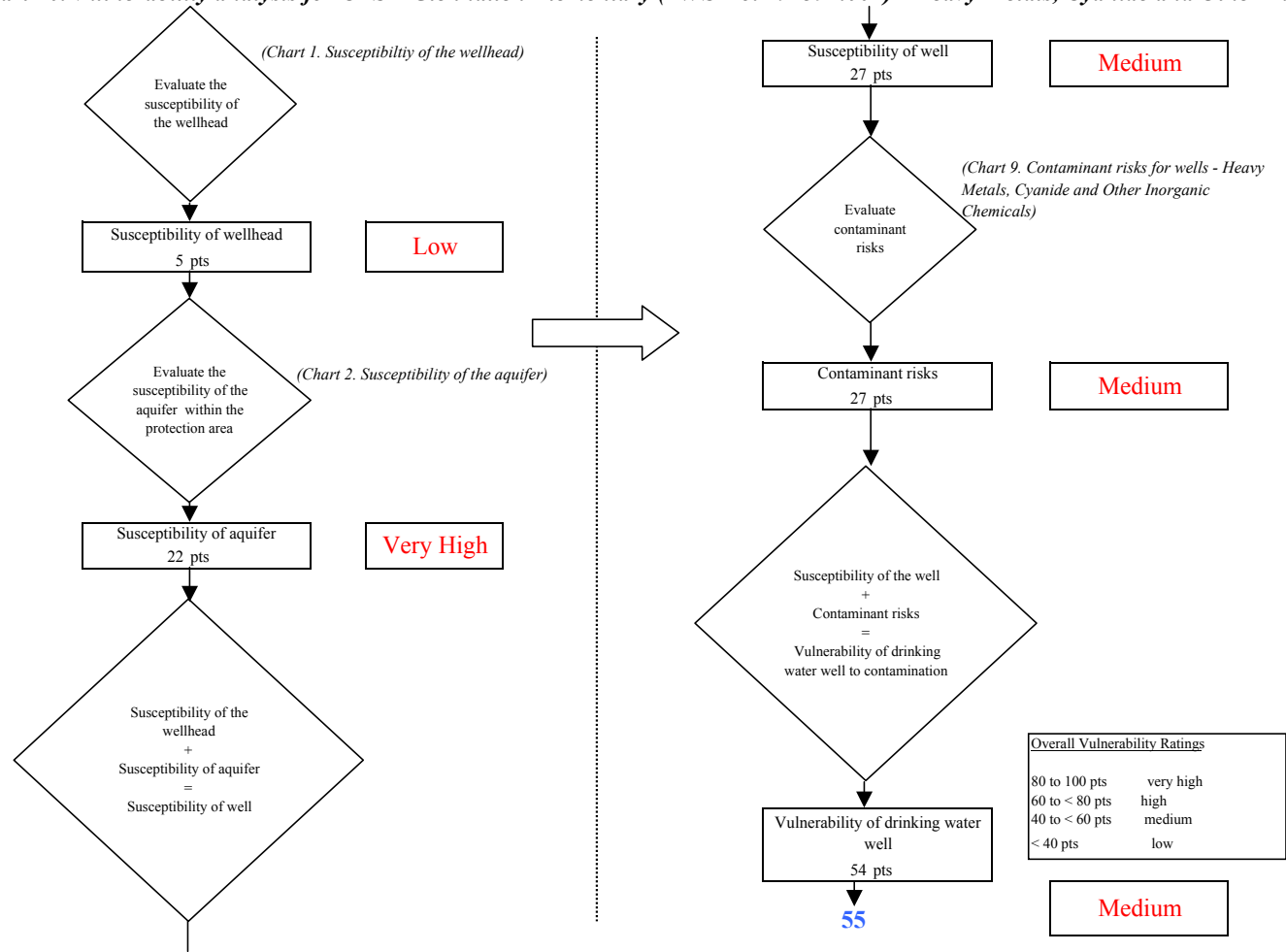


Chart 11. Contaminant risks for CRSD Glennallen Elementary (PWS No. 291392.001) - Synthetic Organic Chemicals

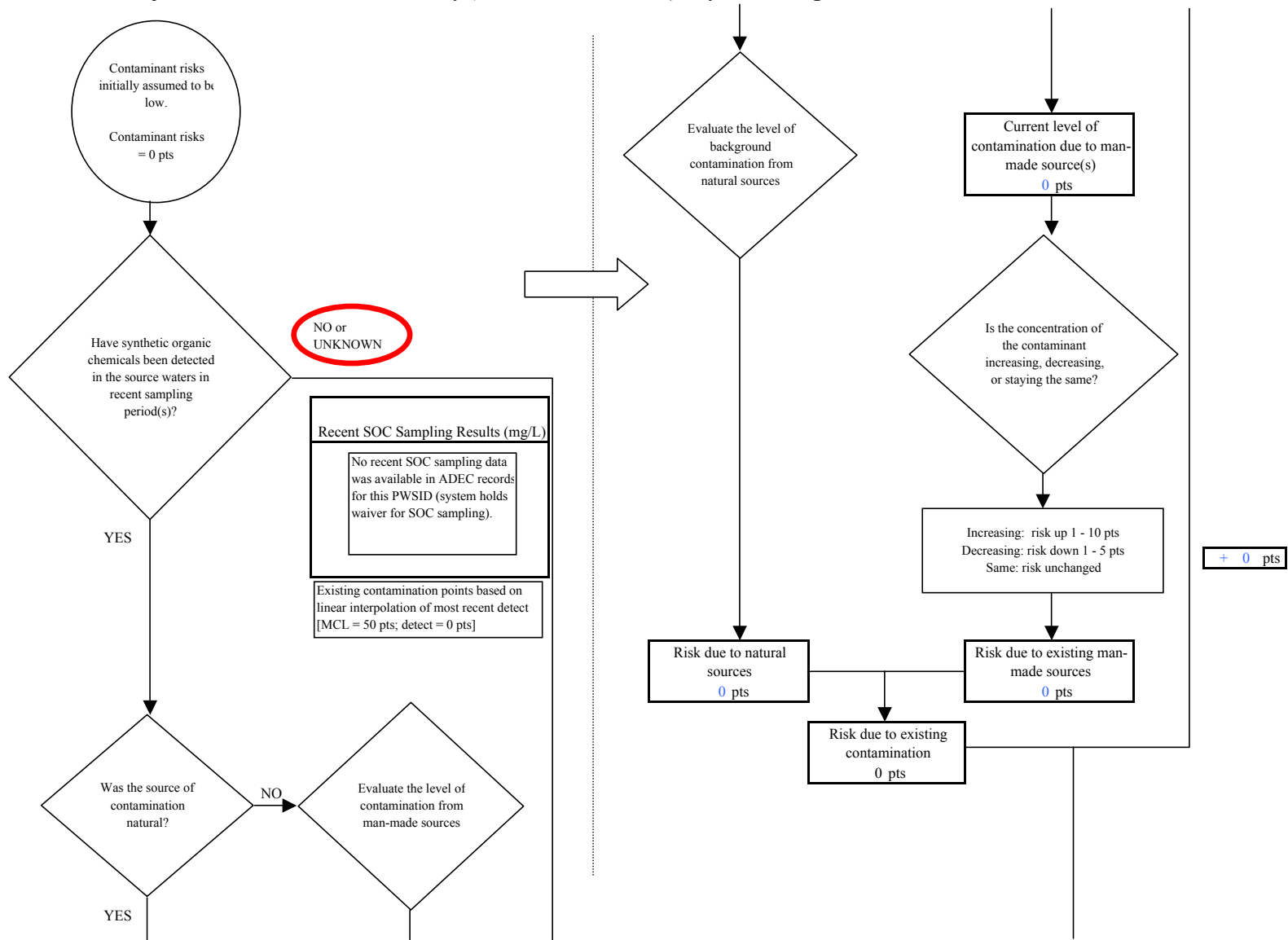


Chart 11. Contaminant risks for CRSD Glennallen Elementary (PWS No. 291392.001) - Synthetic Organic Chemicals

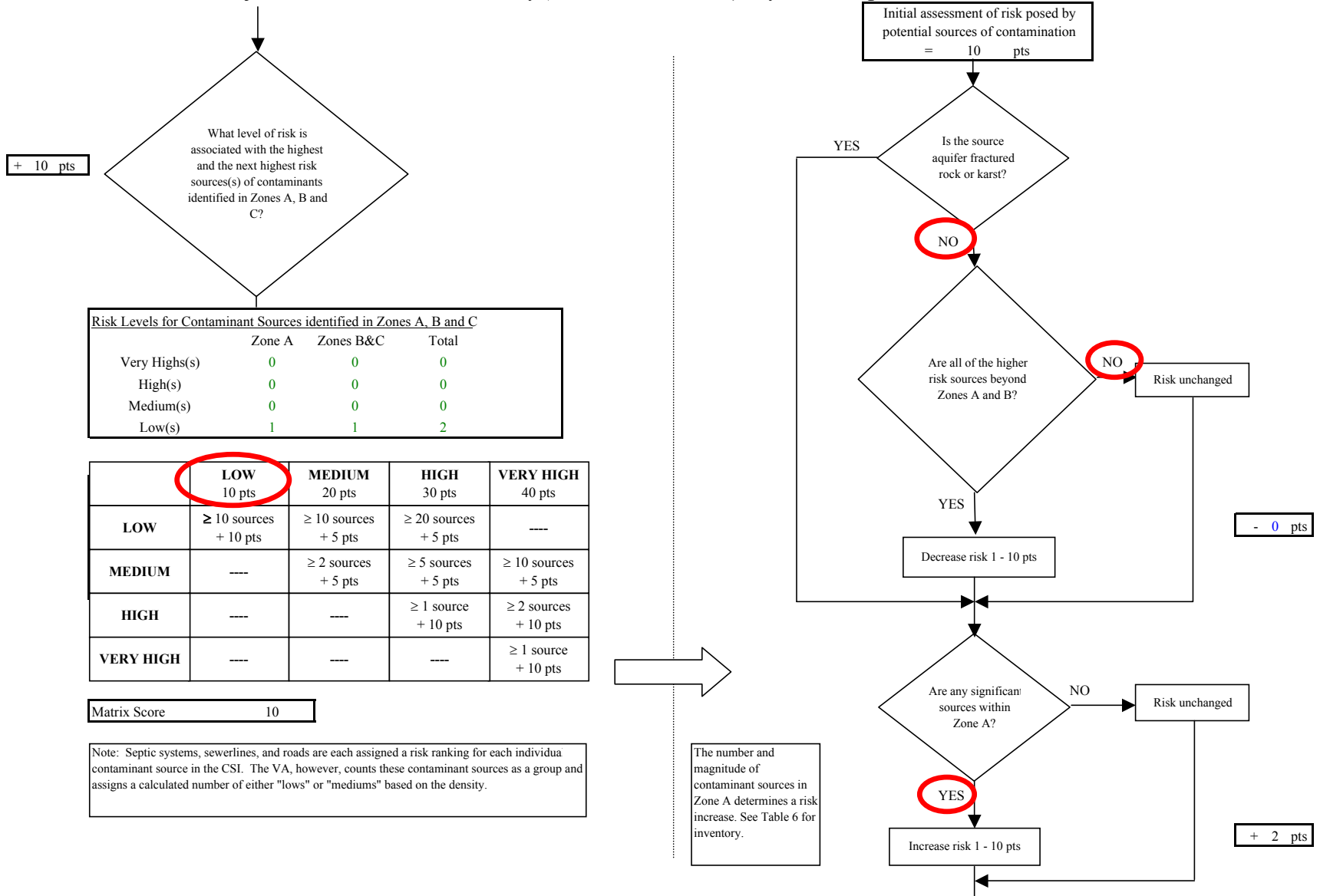


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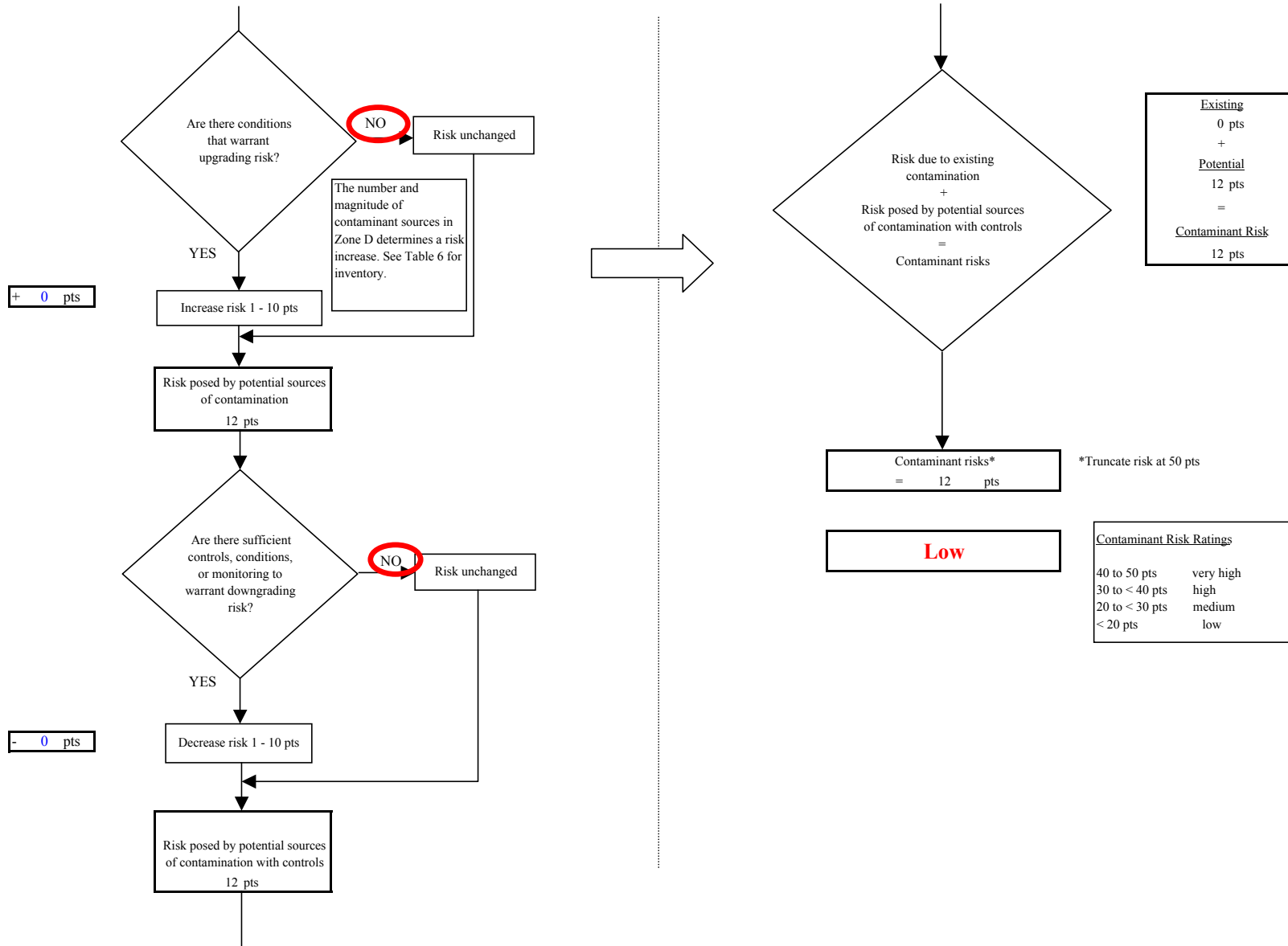


Chart 12. Vulnerability analysis for CRSD Glennallen Elementary (PWS No. 291392.001) - Synthetic Organic Chemicals

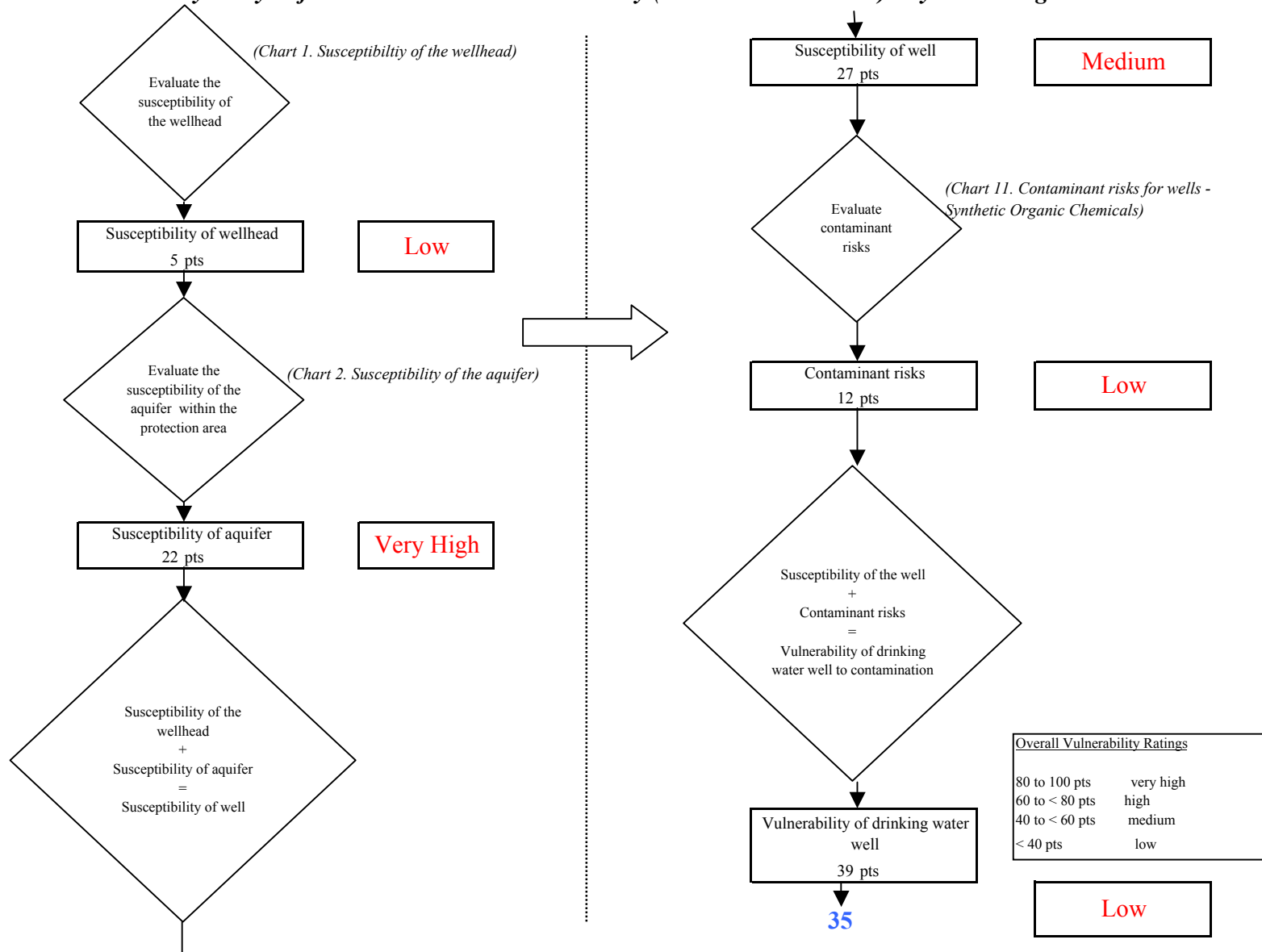


Chart 13. Contaminant risks for CRSD Glennallen Elementary (PWS No. 291392.001) - Other Organic Chemicals

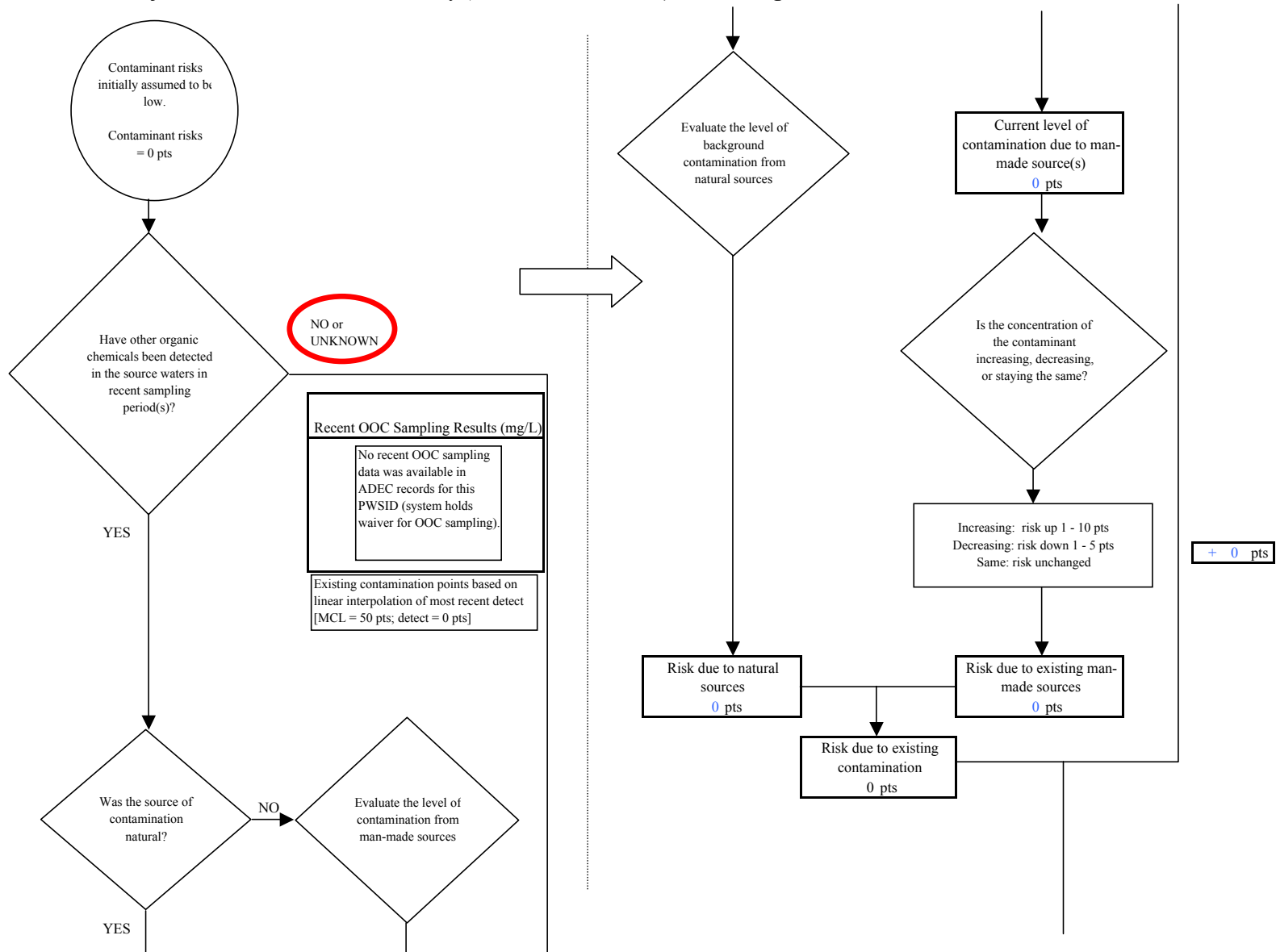
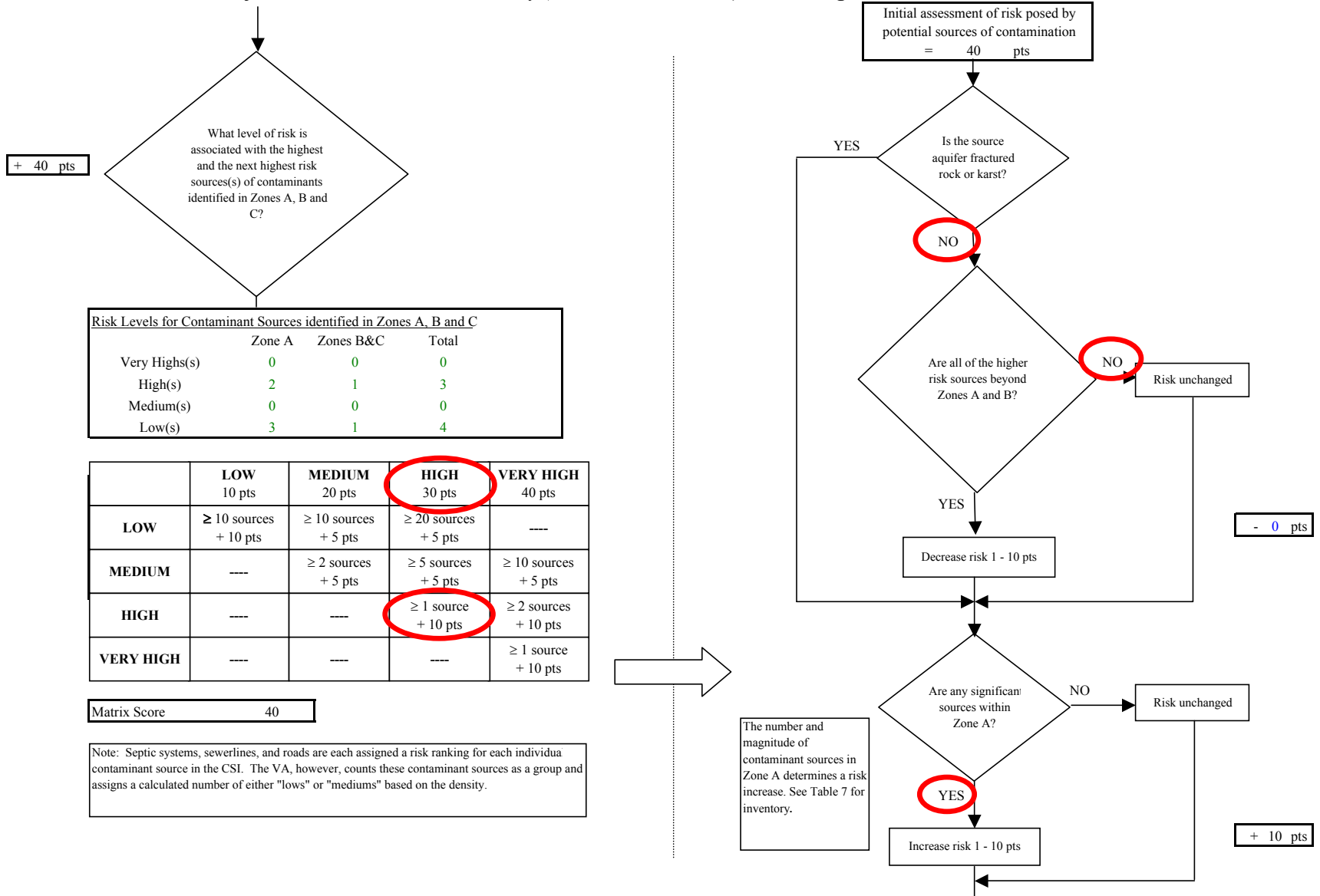


Chart 13. Contaminant risks for CRSD Glennallen Elementary (PWS No. 291392.001) - Other Organic Chemicals



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?

+ 40 pts

Risk Levels for Contaminant Sources identified in Zones A, B and C			
	Zone A	Zones B&C	Total
Very High(s)	0	0	0
High(s)	2	1	3
Medium(s)	0	0	0
Low(s)	3	1	4

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

Matrix Score 40

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 CRSD Glennallen Elementary (PWS No. 291392.001) - Other Organic Chemicals

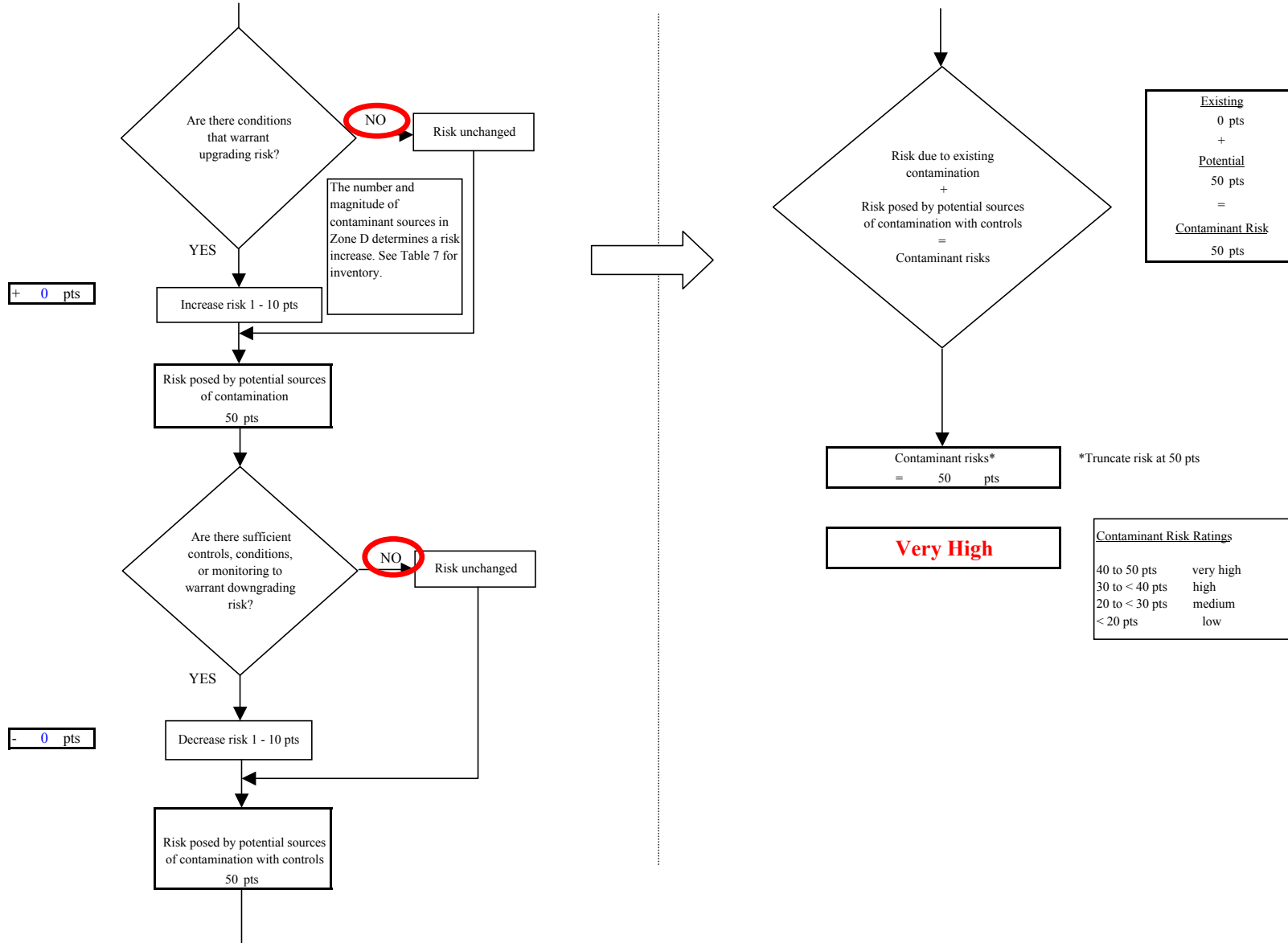


Chart 14. Vulnerability analysis for CRSD Glennallen Elementary (PWS No. 291392.001) - Other Organic Chemicals

