Source Water Assessment

A Hydrogeologic Susceptibility and Vulnerability Assessment for Shoup Street Service Area, Ketchikan, Alaska

PWSID # 120062

September 2003

Drinking Water Protection Program Report #836

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 Shoup Street Service Area – Ketchikan, Alaska

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EXECUTIVE SUMMARY

The Shoup Street Service Area water system for the Ketchikan Gateway Borough Department of Public Works is a Class A water system (community) that obtains water from an unnamed stream. The system's intake is located approximately 1500-feet upstream from the shoreline and is accessible via Chacon Street. The overall protection area received a susceptibility rating of "**very high**". *A rating of high to very high is typical for all surface water catchment areas*. Identified potential and current sources of contaminants for the drinking water source include potential landslide areas, stream bank erosion, and human/pet activity from nearby residential areas. Potential and existing sources of the following contaminants were evaluated for this assessment: bacteria and viruses, nitrates and/or nitrites, heavy metals, cyanide, and other inorganic chemicals, synthetic organic chemicals, volatile organic chemicals, and other organic chemicals. Combining the natural susceptibility of the surface water source with the contaminant risk, this water system has received a vulnerability rating of "**medium"** for nitrates and/or nitrites, volatile organic chemicals, synthetic organic chemicals and other organic chemicals; "**high**" for bacteria and viruses; and "**very high**" for heavy metals, cyanide and other inorganic chemicals. According to Ketchikan Public Utilities (KPU) the Shoup Street Service Area will be shut down in one-year, when the area joins the main KPU water service.

DRINKING WATER SYSTEM AND AREA OVERVIEW

The Shoup Street Service Area water system is a Class A (community) water system that operates year round and serves approximately 100 users. The system's intake is located near the terminus of Chacon Street, approximately 1500-feet upstream of the shoreline approximately 3-miles southeast of Ketchikan. Road access is available via Shoup Street, north of South Tongass Highway (T76S, R91E, Section 4) (See Map 1 of Appendix A). Ketchikan and surrounding area are located in the Ketchikan Gateway Borough, which is in the Southeast Panhandle of Alaska (Please see the inset of Map 1 in Appendix A for location). The Borough's current population is 14,070 (ADCED, 2003).

The majority of residents in the Ketchikan area are connected to the water and sewer services. Heating oil (stored in both above and below ground tanks) is most commonly used for heating homes and buildings. Refuse is transported to Deer Mountain Landfill, which is equipped with an incinerator. Refuse is also baled and shipped out-of-state (ADCED, 2003).

The Ketchikan area is characterized by some of the most unique topography in Southeast Alaska. Predominate to the region are steep mountains slopes and large areas of rock outcroppings. This, coupled with area soils, results in forest production in moderate to low levels. Area streams are typically deeply incised. Footslopes and valley floors are often coated with glacial till, resulting in forested wetland areas (USDA, 2001).

Strong winds and frequent precipitation are normal here. Summer temperatures range from 51 to 65 degrees Fahrenheit; winter temperatures range from 29 to 48 degrees Fahrenheit. The Saxman area averages 163 inches (13.6 feet) of precipitation annually, including 69 inches of snowfall (ADCED, 2003).

The most recent Sanitary Survey (2001) indicates that the intake is screened. Water is pumped through treatment, stored in a 6000-gallon tank and sent to distribution via gravity flow. The system operator estimates a stream flow rate of approximately 200 gallons per minute (0.44 cubic feet per second) on low flow days and 2000 gallons per minute (4.45 cubic feet per second) on high rain days.

SHOUP STREET SERVICE AREA DRINKING WATER PROTECTION AREA

Identifying the pathways most likely for surface contamination to reach water intake areas is the first step in determining the water system's risk. These are initially determined by looking at the drainage area contributing overland water flow to a surface water source intake. The entire drainage area is also known as the "drinking water protection area". Please refer to pages 10-11of the "Guidance Manual for Class A Public Water Systems" for additional information.

The protection area established for surface water sources by the ADEC is usually separated into three zones, limited by the watershed boundary. These zones correspond to the overland-flow distance that water travels to get to the source. The ADEC Drinking Water

Protection Program's Technical Advisory Committee developed guidelines for derivation of these zones in 1998. The following is a summary of the three protection area zones:

Table 1. Definition of Zones

Zone	Definition
A	Areas within 1000-ft of lakes or streams
B	Areas within 1-mile of lakes or streams
C	The watershed boundary

The protection area for the Shoup Street Service Area includes each of these Zones (See Map 1 of Appendix A). It should be noted here that, because of the small watershed size, the Shoup Street Zone C and Zone B areas are identical.

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 Shoup Street protection area. This inventory was completed through a search of agency records and other publicly available information. There is a wide array of potential contamination sources to surface water. These contaminants are found within agricultural, residential, commercial, and industrial areas, but *can also occur within areas that have little or no development*.

For 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.

Sources identified in the Shoup Street protection area are displayed on Map 2 of Appendix C and summarized in Table 1 of Appendix B.

RANKING OF CONTAMINANT RISKS

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

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

The time-of-travel for contaminants within the water is dependent on the physical and chemical characteristics of each contaminant. Bacteria and Viruses are only inventoried in Zones A because of their short life span. Only "Very High" and "High" rankings are inventoried within Zones B and C due to the probability of contaminant dilution by the time the contaminants reach the water intake.

Tables 2 and 3 in Appendix B contain the ranking of potential and existing sources of contamination with respect to bacteria and viruses and nitrates and/or nitrites.

VULNERABILITY OF SHOUP STREET SERVICE AREA DRINKING WATER SYSTEM

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

- Surface Water Susceptibility; and
- Contaminant risks.

Appendix D contains 13 charts, which together form the 'Vulnerability Analysis' for the public drinking water Source Water Assessment. Chart 1 analyzes the 'Susceptibility of the Surface Water Source' to contamination by looking at the climate, terrain, and intake location. Chart 2 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 intake area. Chart 3 contains the 'Vulnerability Analysis for Bacteria and Viruses', which is a composite score of the Vulnerability Analysis and the overall Susceptibility. Charts 4 through 13 repeat 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 Surface Water Susceptibility of the source is reached by considering the properties of the water intake and the surrounding area. The derivation of this information is presented below and the data for this source is shown in Chart 1 of Appendix D.

Susceptibility of the Surface Water Source – always considered to be "high" (30 points)

+

Adequate Construction of the Intake (0 – 5 Points)

+

Runoff Potential Within Zone B (0 – 5 Points)

+

Dilution Capacity of the Surface Water (0 – 10 Points)

=

Natural Susceptibility
(0 – 50 Points)

A ranking is assigned for the Surface Water Susceptibility according to the point score:

Surface Water Source Susceptibility Ratings	
40 to 50 pts	Very High
30 to < 40 pts	High

Table 2. Susceptibility of the Shoup Street Service Area Water Source

	Score	Rating
Minimum Allowable Susceptibility	30	
Intake Construction Adequate	0	
Runoff Potential	5	
Dilution Capacity	10	
Overall Susceptibility	45	Very High

For contaminants, risks to a drinking water source depend on the type, number or density, and distribution of the contaminant sources. The Contaminant Risk score has been derived from an examination of existing, and historical contamination sources that have been detected in the protection area 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 the 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. Shoup Street Contaminant Risks

Category	Score	Rating
Bacteria and Viruses	20	Medium
Nitrates and/or Nitrites	12	Low
Volatile Organic Chemicals	7	Low
Heavy Metals, Cyanide, and Other Inorganic Chemicals	45	Very High
Synthetic Organic Chemicals	0	Low
Other Organic Chemicals	0	Low

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

Susceptibility of the Surface Water Source

(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 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	65	High
Nitrates and Nitrites	55	Medium
Volatile Organic Chemicals	50	Medium
Heavy Metals, Cyanide, and Other Inorganic Chemicals	90	Very High
Synthetic Organic Chemicals	45	Medium

Other Organic Chemicals	45	Medium

Bacteria and Viruses

The contaminant risk for bacteria and viruses is "medium". Typically, there is positive coliform detection in water samples, which is normal in samples of raw water collected from surface water sources. (See Chart 2 – Contaminant Risks for Bacteria and Viruses in Appendix D).

Coliforms (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 coliforms 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). Positive samples increase the overall vulnerability of the drinking water source, indicating that the source is susceptible to bacteria and virus contamination.

After combining the contaminant risk for bacteria and viruses with the natural susceptibility of the source, the overall vulnerability of the source to bacteria and virus contamination is "high".

Nitrates and Nitrites

The contaminant risk for nitrates and nitrites is "low" with the close proximity of the intake area to human and dog activity (from nearby residential areas) posing the most significant contaminant risk to this source of public drinking water (See Chart 4 - Contaminant Risks for Nitrates and/or Nitrites in Appendix D). Nitrates are very mobile, moving at approximately the same rate as water.

Sampling history for the Shoup Street Service Area water source indicates that nitrates have not been detected in the past 5 years. The Maximum Contaminant Level (MCL) for nitrates is 10 milligrams per liter (mg/L). The MCL is the maximum level of contaminant that is allowed to exist in drinking water and still be consumed by humans without harmful health effects (EPA, 2003).

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

Volatile Organic Chemicals

The contaminant risk for volatile organic chemicals is "low" (See Chart 6 – Contaminant Risks for Volatile Organic Chemicals in Appendix D).

Chloroform and tolulene, both volatile organic chemicals have been detected during recent sampling, although below MCL levels. The MCL for chloroform is 0.2 milligrams per liter (mg/L) and the MCL for Tolulene is 1.0 mg/L. Both of these chemicals have human-made sources. Chloroform and tolulene are often present in trace amounts following the water treatment process. After combining the contaminant risk for volatile organic chemicals with the natural susceptibility of the source, the overall vulnerability of the well to contamination is "medium".

Heavy Metals, Cyanide, and Other Inorganic Chemicals

The contaminant risk for heavy metals is "very high". This is primarily due to the detection of both lead and copper during 1997 at levels that exceed the MCL (See Chart 8 – Contaminant Risks for Heavy Metals, Cyanide, and Other Inorganic Chemicals in Appendix D).

After combining the contaminant risk for heavy metals with the natural susceptibility of the source, the overall vulnerability of the well to contamination is "very high".

Synthetic Organic Chemicals

The contaminant risk for synthetic organic chemicals is "low". After combining the contaminant risk with the natural susceptibility of the source, the overall vulnerability to synthetic organic chemicals of the well is "medium" (See Chart 11 – Contaminant Risks for Synthetic Organic Chemicals in Appendix D).

Review of the historical sampling data indicates that no synthetic organic chemicals have been detected in recent years.

Other Organic Chemicals

The contaminant risk for other organic chemicals is "low". After combining the contaminant risk with the natural susceptibility of the source, the overall vulnerability to other organic chemicals of the source is "medium" (See Chart 13 – Contaminant Risks for Other Organic Chemicals in Appendix D).

Review of the historical sampling data indicates that no other organic chemicals have been sampled since 1993.

REFERENCES

Alaska Department of Community and Economic Development (ADCED), 2003 [WWW document]. URL http://www.dced.state.ak.us/cbd/commdb/CF_COMDB.htm

United States Forest Service – Alaska Region (USDA), 2001. Technical Publication No. R10-TP-75. Ecological Subsections of Southeast Alaska and Neighboring Areas of Canada.

United States Environmental Protection Agency (EPA), 2003 [WWW document]. URL http://www.epa.gov/safewater/mcl.html.

APPENDIX A

Shoup Street Service Area
Drinking Water Protection Area Location Map
(Map 1)

Shoup Street -
Drinking Water Protection Area

Map 1: Shoup Street Drinking Water Protection Area

PWSID: 120062.001

Alaska Department of Environmental Conservation

Alaska Drinking Water Protection Program

0 2,000 4,000 8,000 12,000 16,000 Feet

1:48,055

Data Sources:

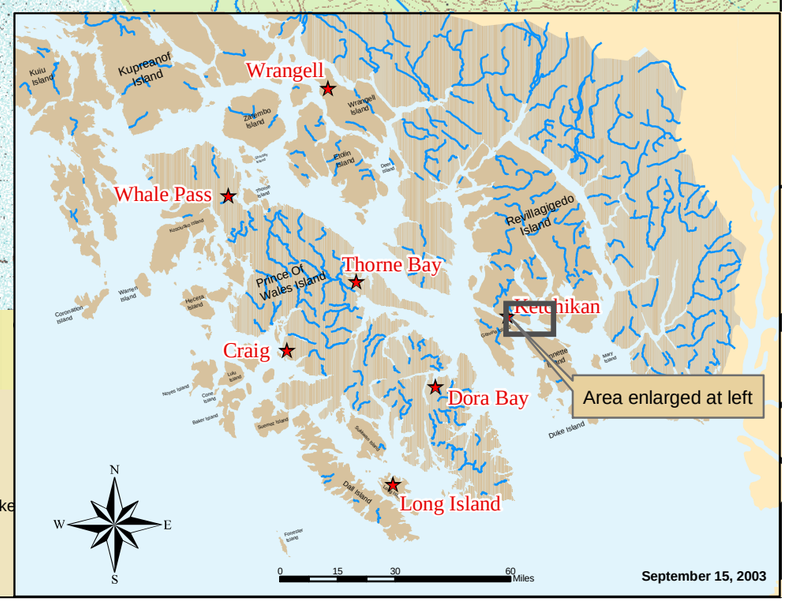
Background image - USGS 1:63,000 mapping
Lakes & streams - U.S. Forest Service, Tongass
Roads - Ketchikan Gateway Borough

Protection zones were delineated based upon streams noted on USGS 1:63,000 mapping.

For this PWS, Zone C (the entire watershed) covers the same area as Zone B (areas within 1-mile of the stream).

Legend

- Zone A Protection Area
- Zone B Protection Area
- Zone C Potection Area
- Shoup Street - System Intake
- Streams
- Lake



September 15, 2003

APPENDIX B

Contaminant Source Inventory and Risk Rankings (Tables 1-3)

Table 1

Contaminant Source Inventory for
Shoup Street Service Area

PWSID 120062.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Map Number*	*Comments*
Landslides or other hillside areas subject to significant erosion	B06	B6 - 1	A	2	Information from Richard Smith, P.E. - Ketchikan Dept. of Public Works
River/stream bank erosion	B09	B9 - 1	A	2	Information from Richard Smith, P.E. - Ketchikan Dept. of Public Works
Dog walking areas/foot trails	X46	X46 - 1	A	2	Information taken from 2001 sanitary survey

Table 2

Contaminant Source Inventory and Risk Ranking for Shoup Street Service Area Sources of Bacteria and Viruses

PWSID 120062.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Dog walking areas/foot trails	X46	X46 - 1	A	Low	2	Information taken from 2001 sanitary survey

Table 3

Contaminant Source Inventory and Risk Ranking for Shoup Street Service Area Sources of Nitrates/Nitrites

PWSID 120062.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Dog walking areas/foot trails	X46	X46 - 1	A	Low	2	Information taken from 2001 sanitary survey

APPENDIX C

Shoup Street Service Area
Drinking Water Protection Area
and Potential and Existing Contaminant Sources
(Map 2)

B6 -1
(Landslide Potential)

B9 - 1
(Stream bank erosion)

X46 - 1
(Dog walking / foot trails)

20-meter Contours

10-foot Contours

Buck Mountain

Fawn Mountain

Map 2: Potential and Exisitng Contaminant Sources

PWSID: 120062.001

Alaska Department of Environmental Conservation

Alaska Drinking Water Protection Program

0 500 1,000 2,000 3,000 Feet

1:12,000

Data Sources:

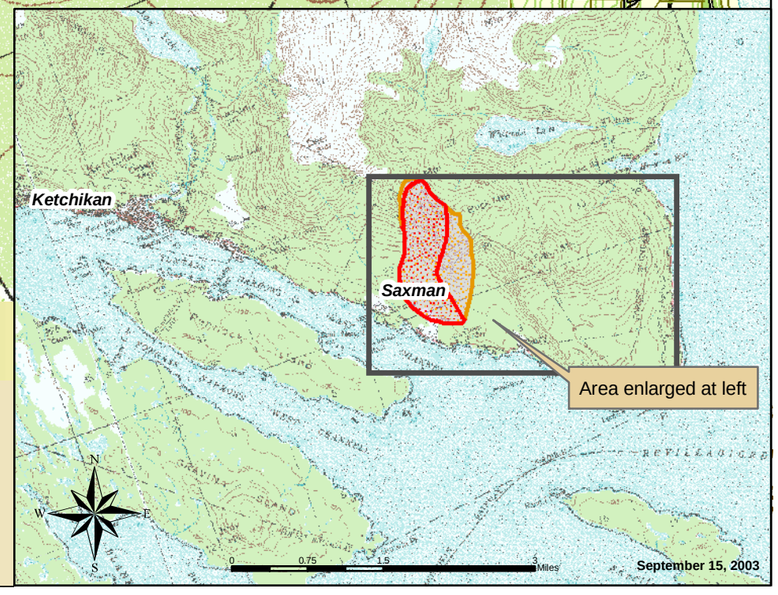
Background image - USGS 1:63,000 mapping
Lakes & streams - U.S. Forest Service, Tongass
Roads - Ketchikan Gateway Borough

Protection zones were delineated based upon streams noted on USGS 1:63,000 mapping.

For this PWS, Zone C (the entire watershed) covers the same area as Zone B (areas within 1-mile of the stream).

Legend

- Shoup Street Service Area
- Zone A Protection Area
- Zone B Protection Area
- Zone C Protection Area
- Lake
- Roads
- Elevation contours



September 15, 2003

APPENDIX D

Vulnerability Analysis and Contaminant Risks
(Charts 1-13)

Chart 1. Susceptibility of the Surface Water Source - Shoup Street Service Area

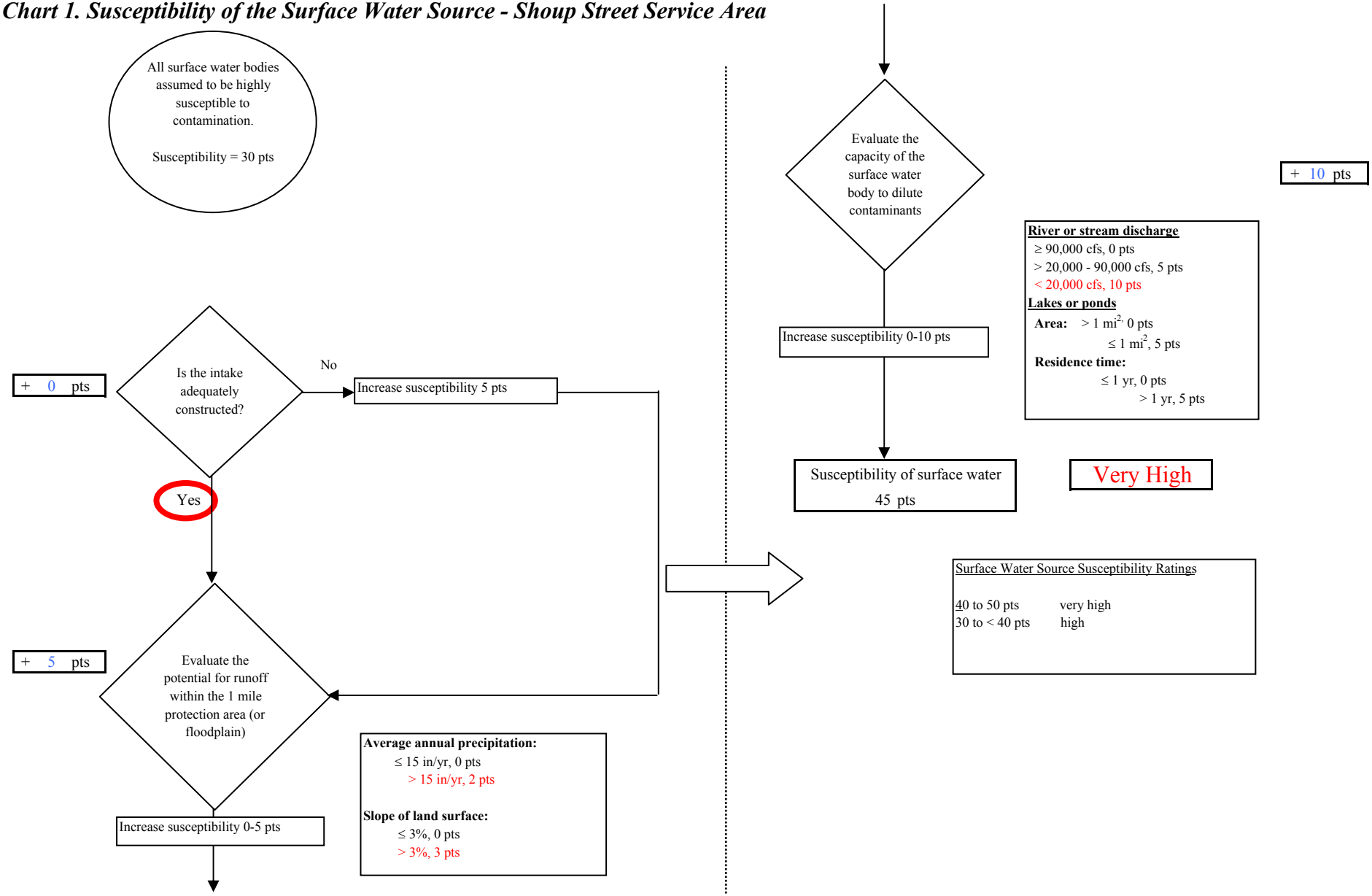
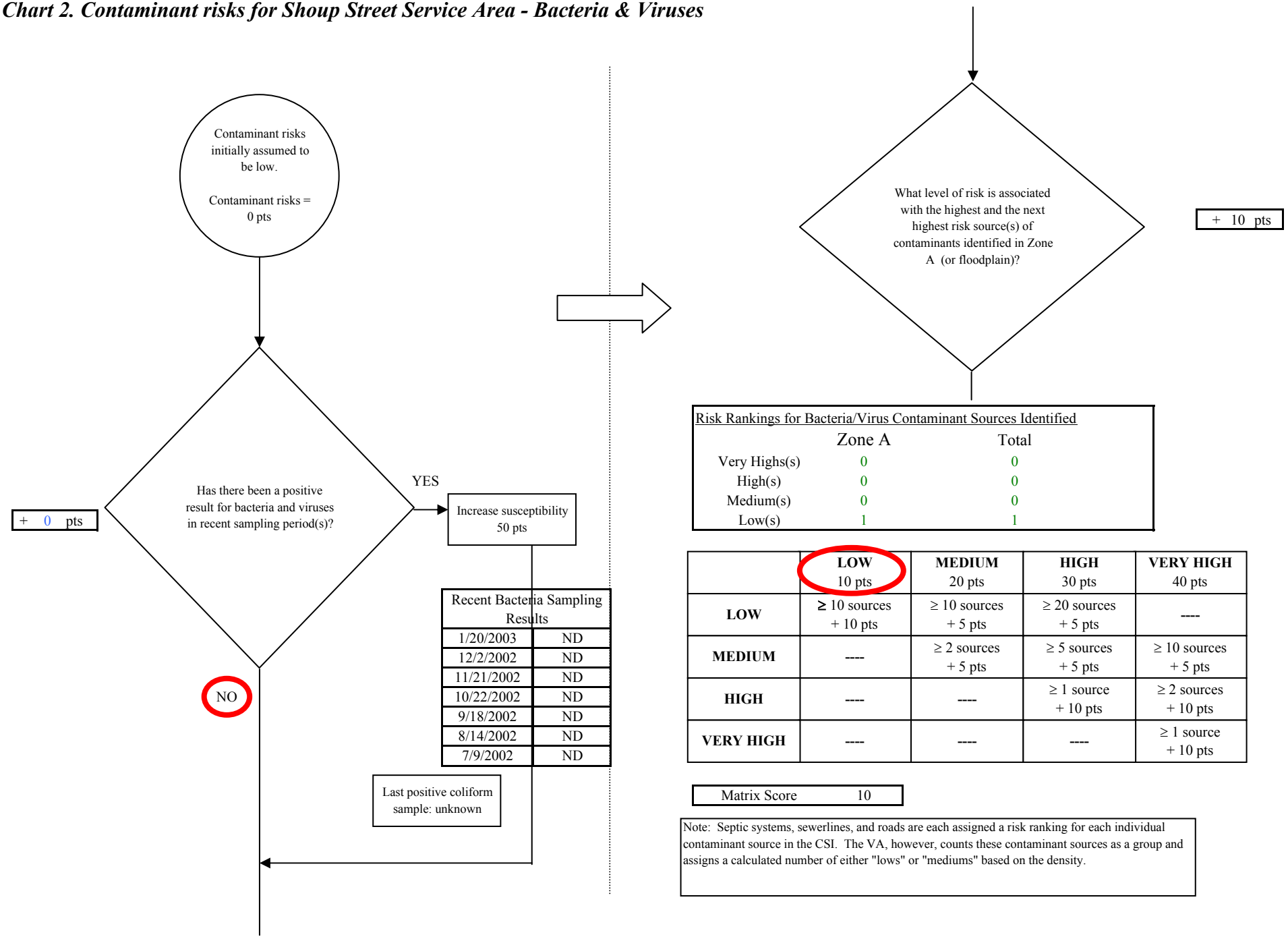


Chart 2. Contaminant risks for Shoup Street Service Area - Bacteria & Viruses



Risk Rankings for Bacteria/Virus Contaminant Sources Identified

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

Chart 2. Contaminant risks for Shoup Street Service Area - Bacteria & Viruses

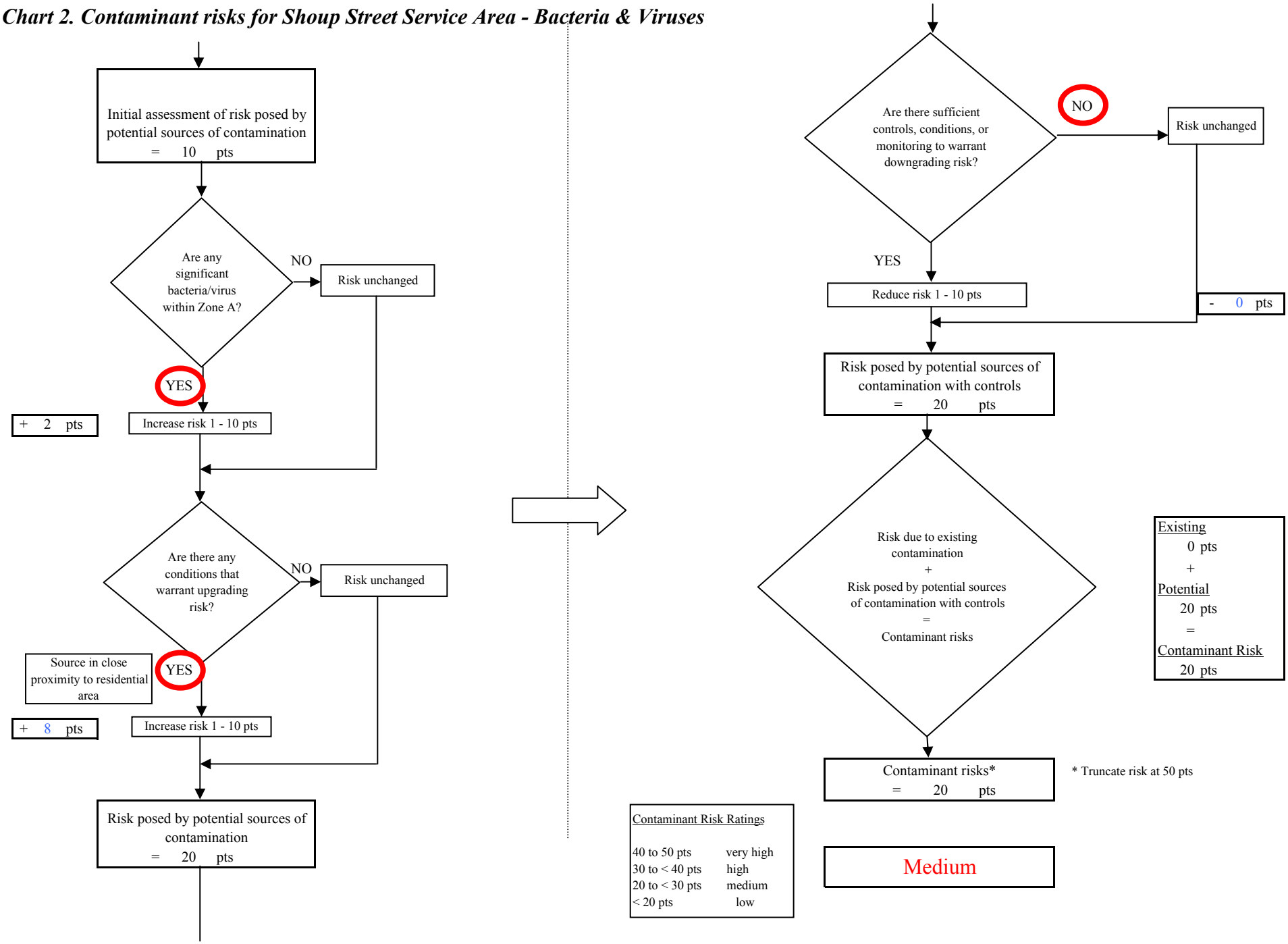


Chart 3. Vulnerability analysis for Shoup Street Service Area - Bacteria & Viruses

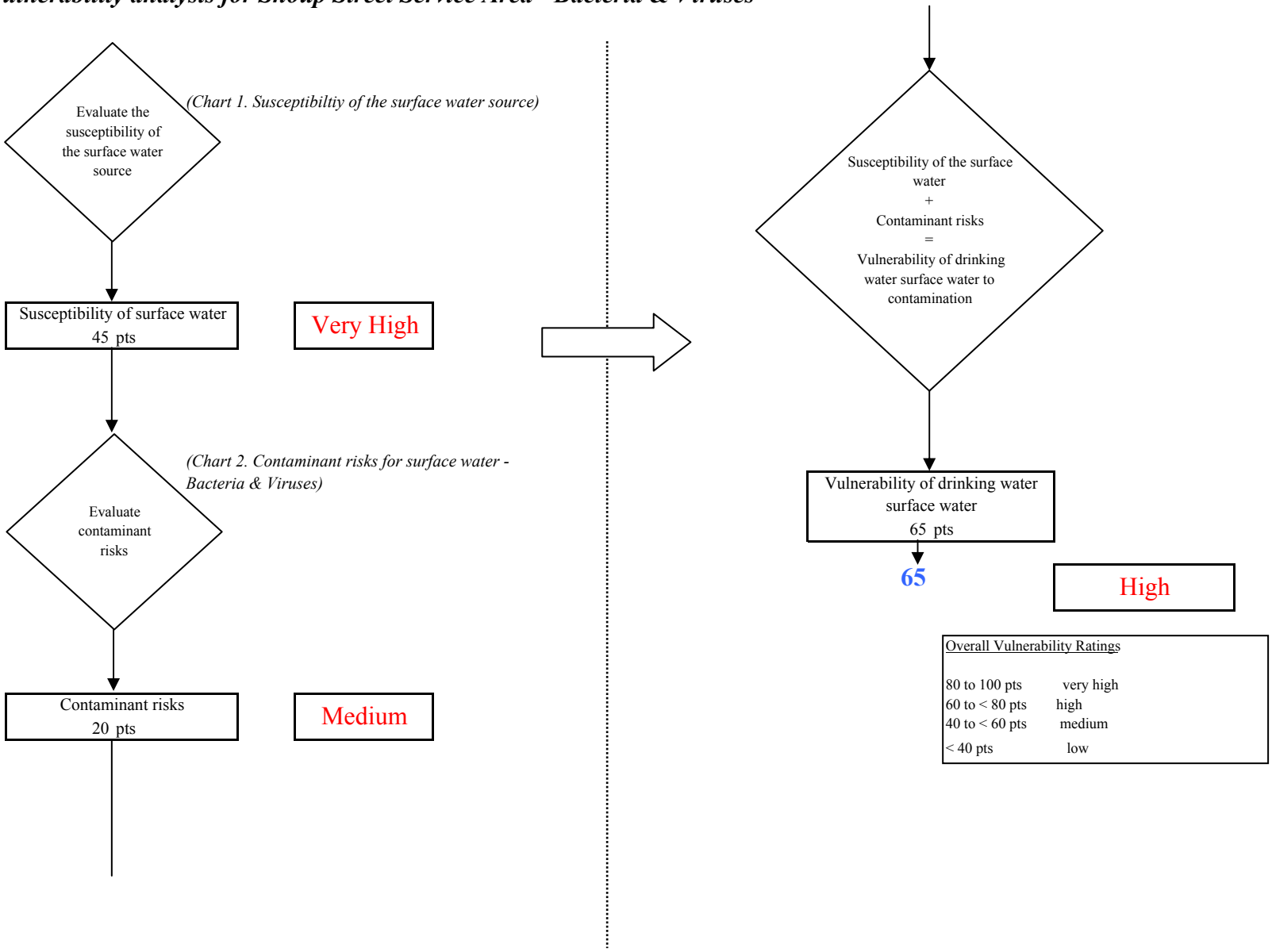


Chart 4. Contaminant risks for Shoup Street Service Area - Nitrates and Nitrites

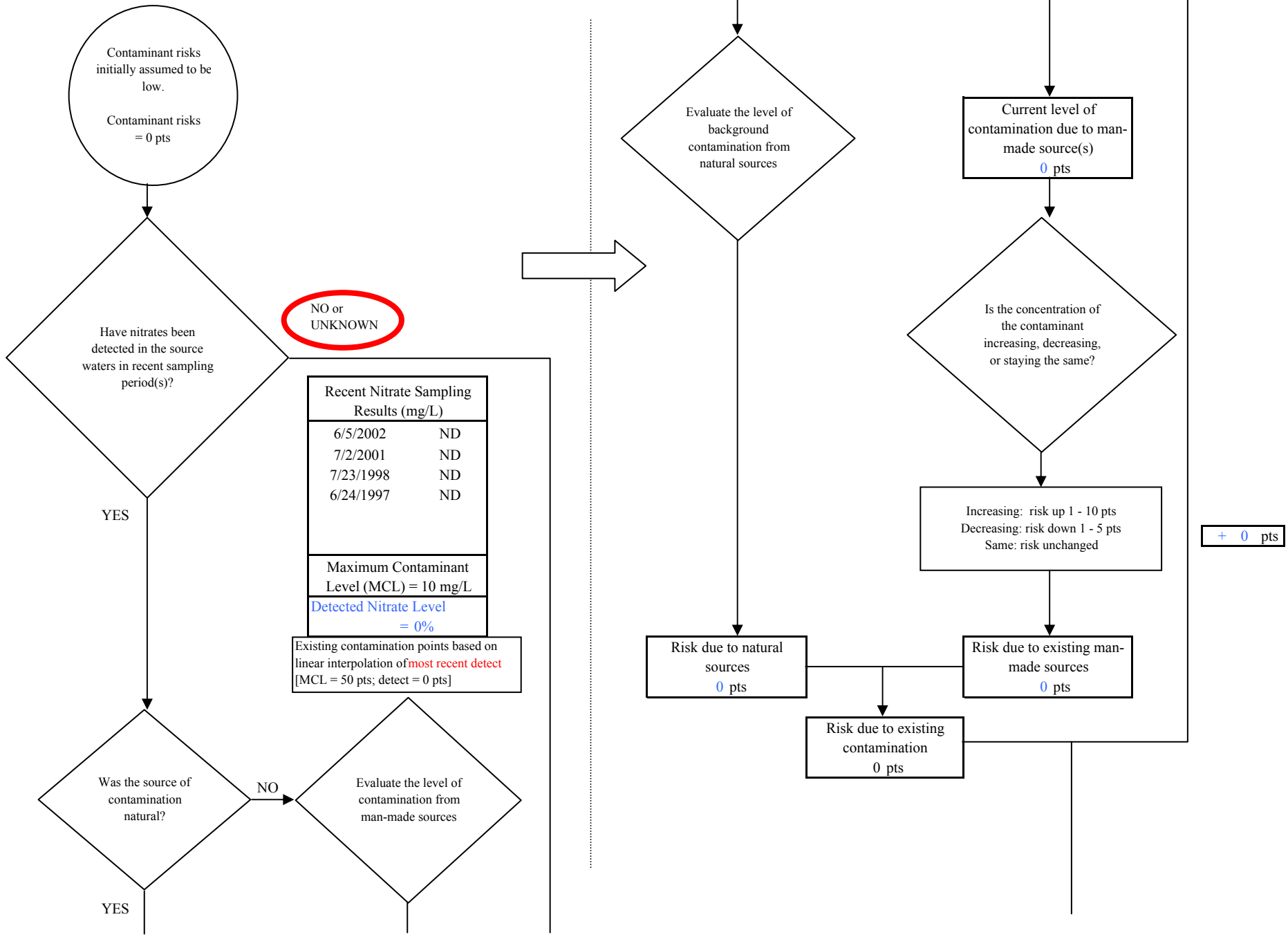
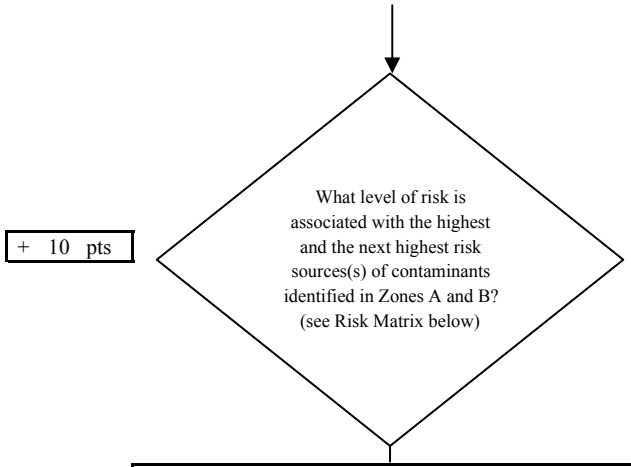


Chart 4. Contaminant risks for Shoup Street Service Area - Nitrates and Nitrites



+ 10 pts

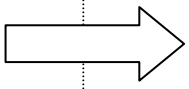
Risk Levels for Nitrate/Nitrite Sources identified in Zones A and B

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



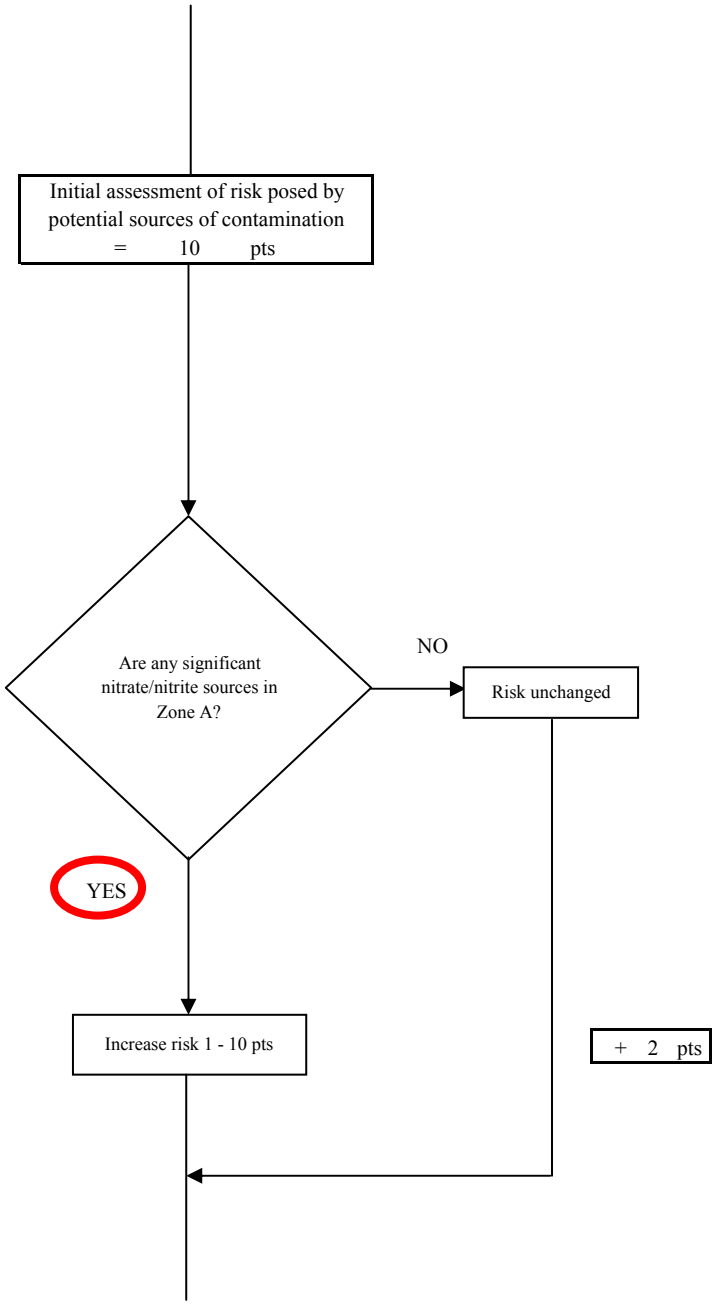
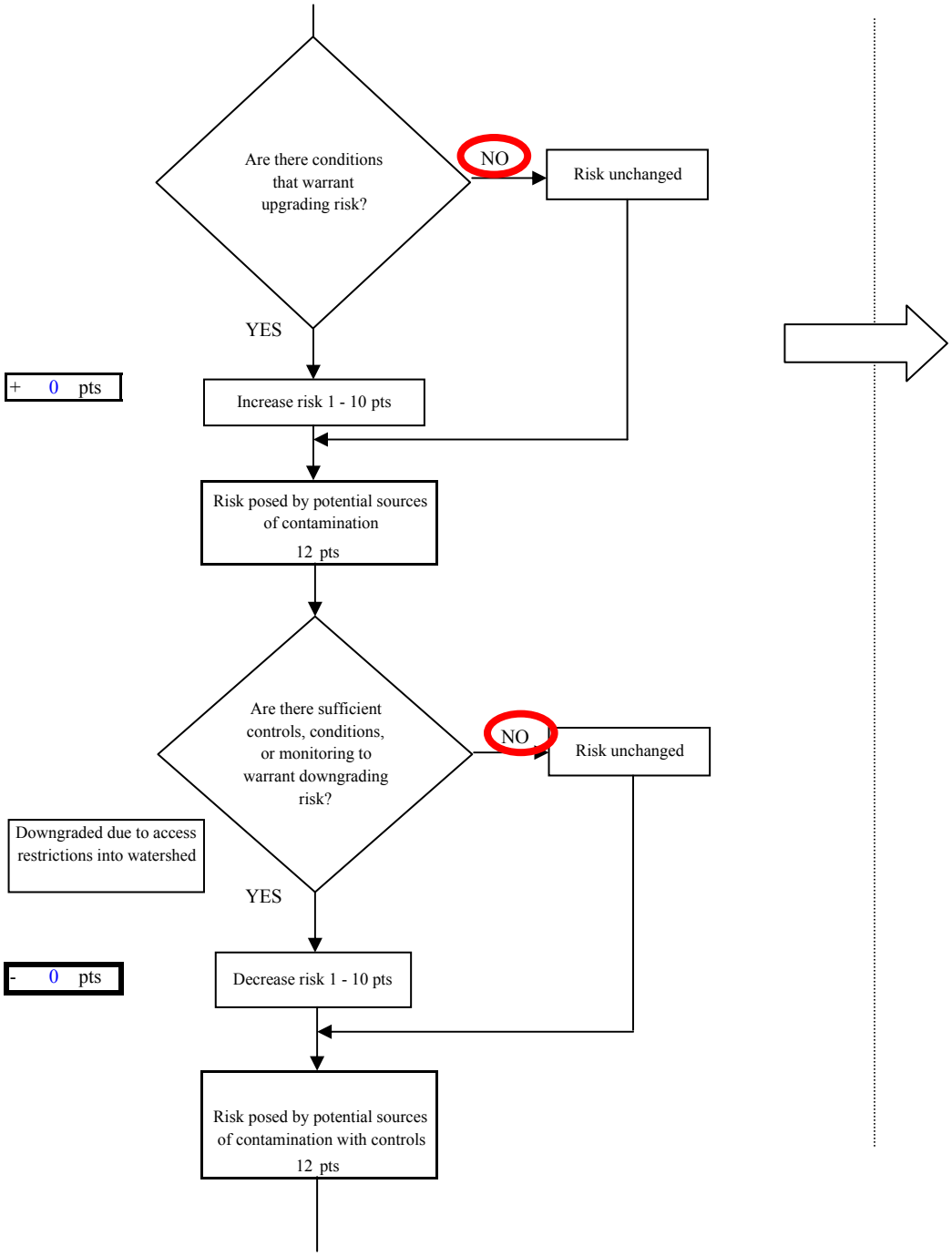


Chart 4. Contaminant risks for Shoup Street Service Area - Nitrates and Nitrites



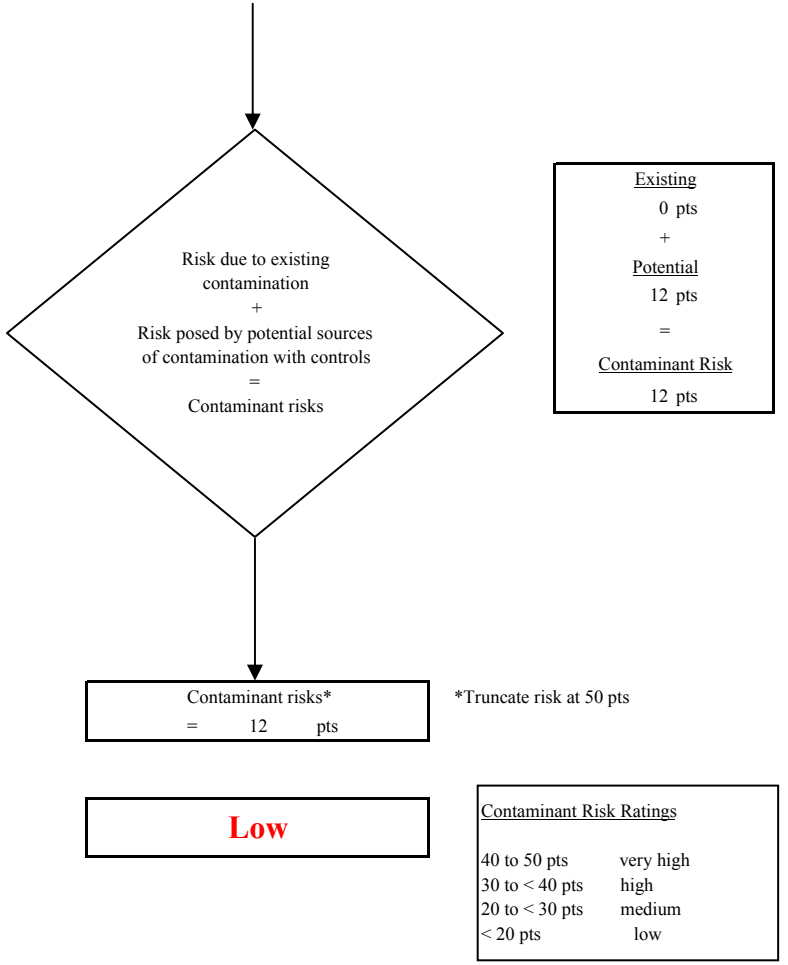


Chart 5. Vulnerability analysis for Shoup Street Service Area - Nitrates and Nitrites

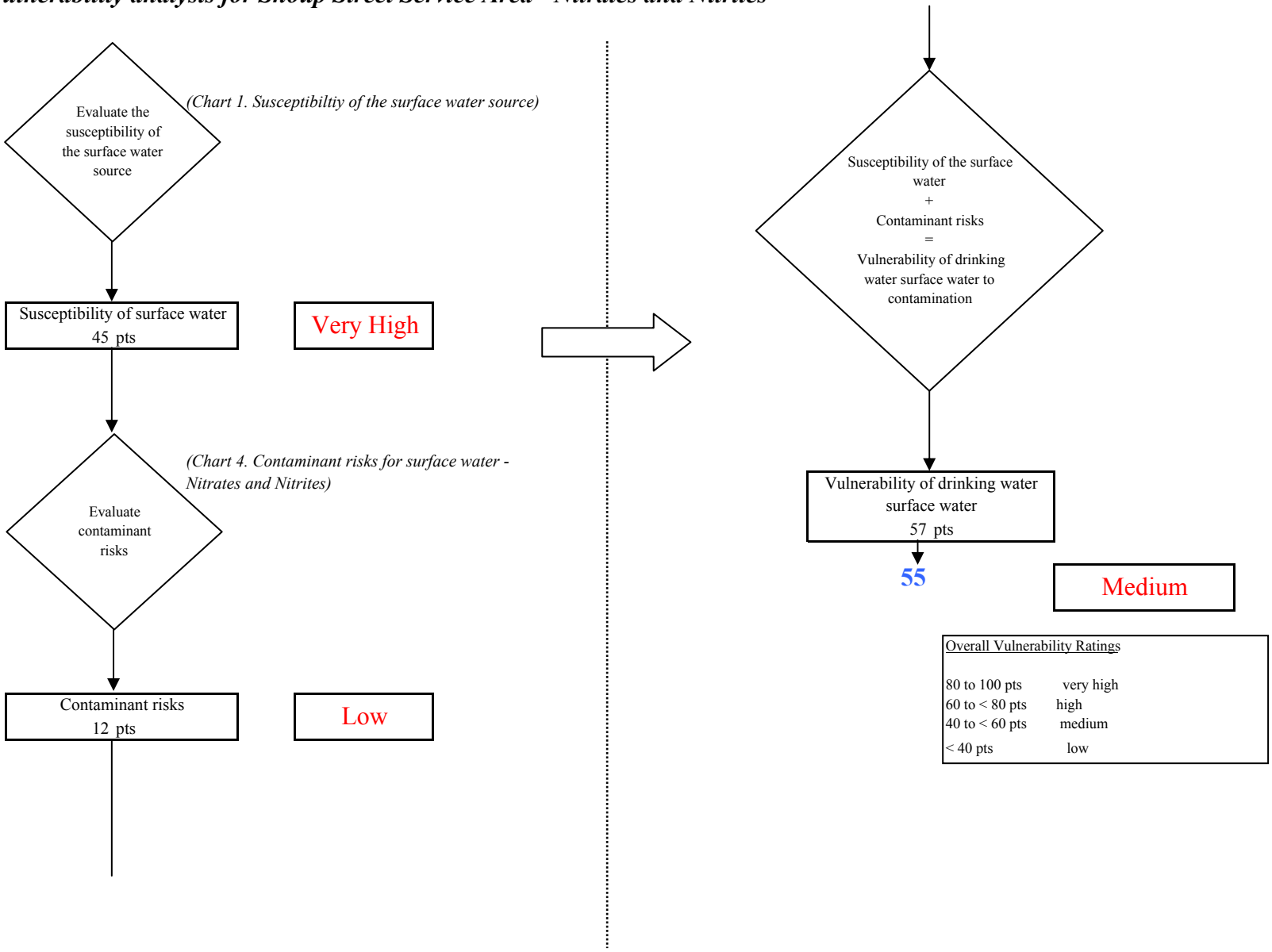


Chart 6. Contaminant risks for Shoup Street Service Area - Volatile Organic Chemicals

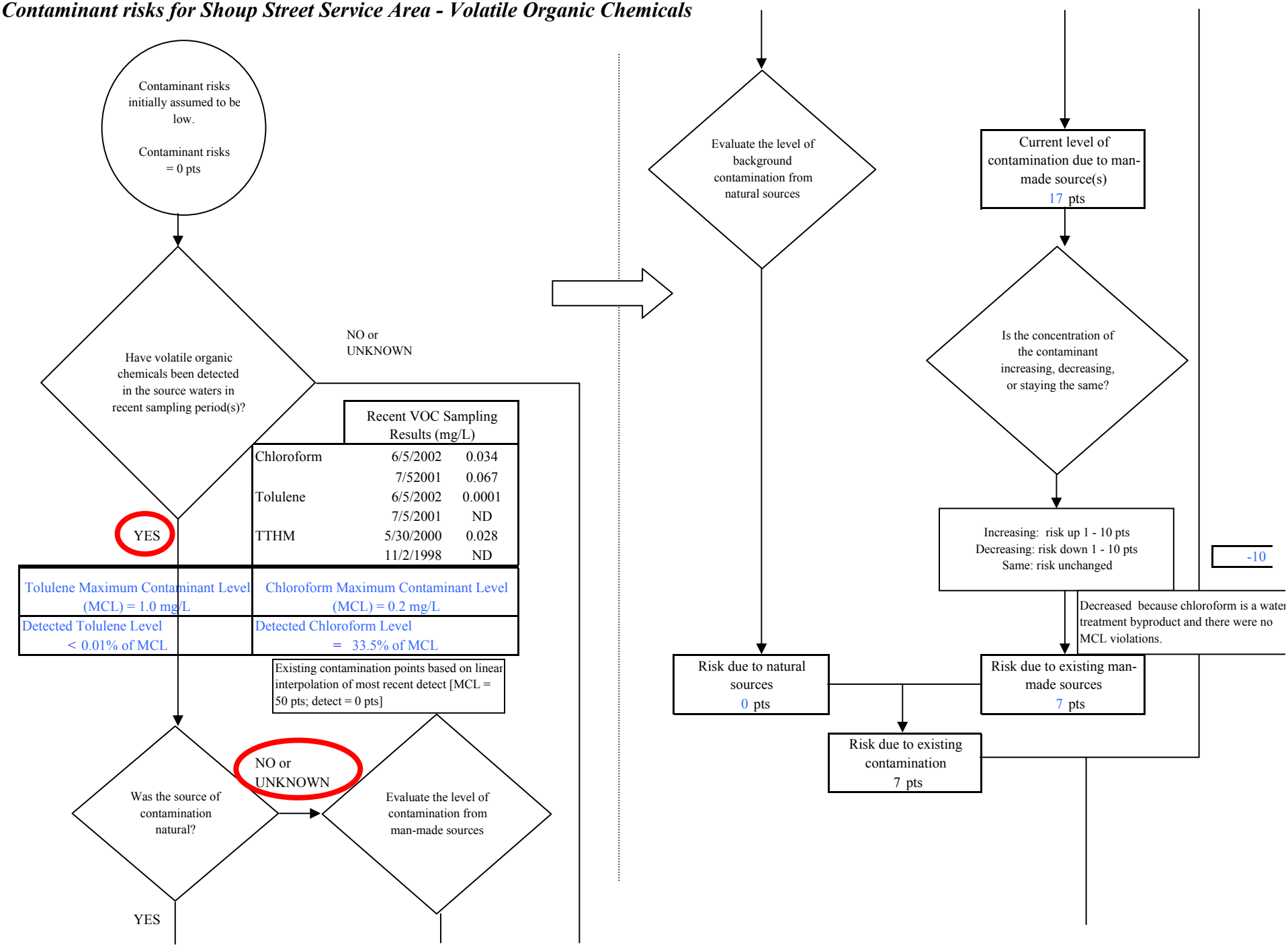


Chart 6. Contaminant risks for Shoup Street Service Area - Volatile Organic Chemicals

+ 0 pts

What level of risk is associated with the highest and the next highest risk sources(s) of contaminants identified in Zones A and B? (see Risk Matrix below)

Risk Levels for VOC 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
Low(s)	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

Are any significant VOC sources in Zone A?

NO

Risk unchanged

YES

Increase risk 1 - 10 pts

+ 0

Chart 6. Contaminant risks for Shoup Street Service Area - Volatile Organic Chemicals

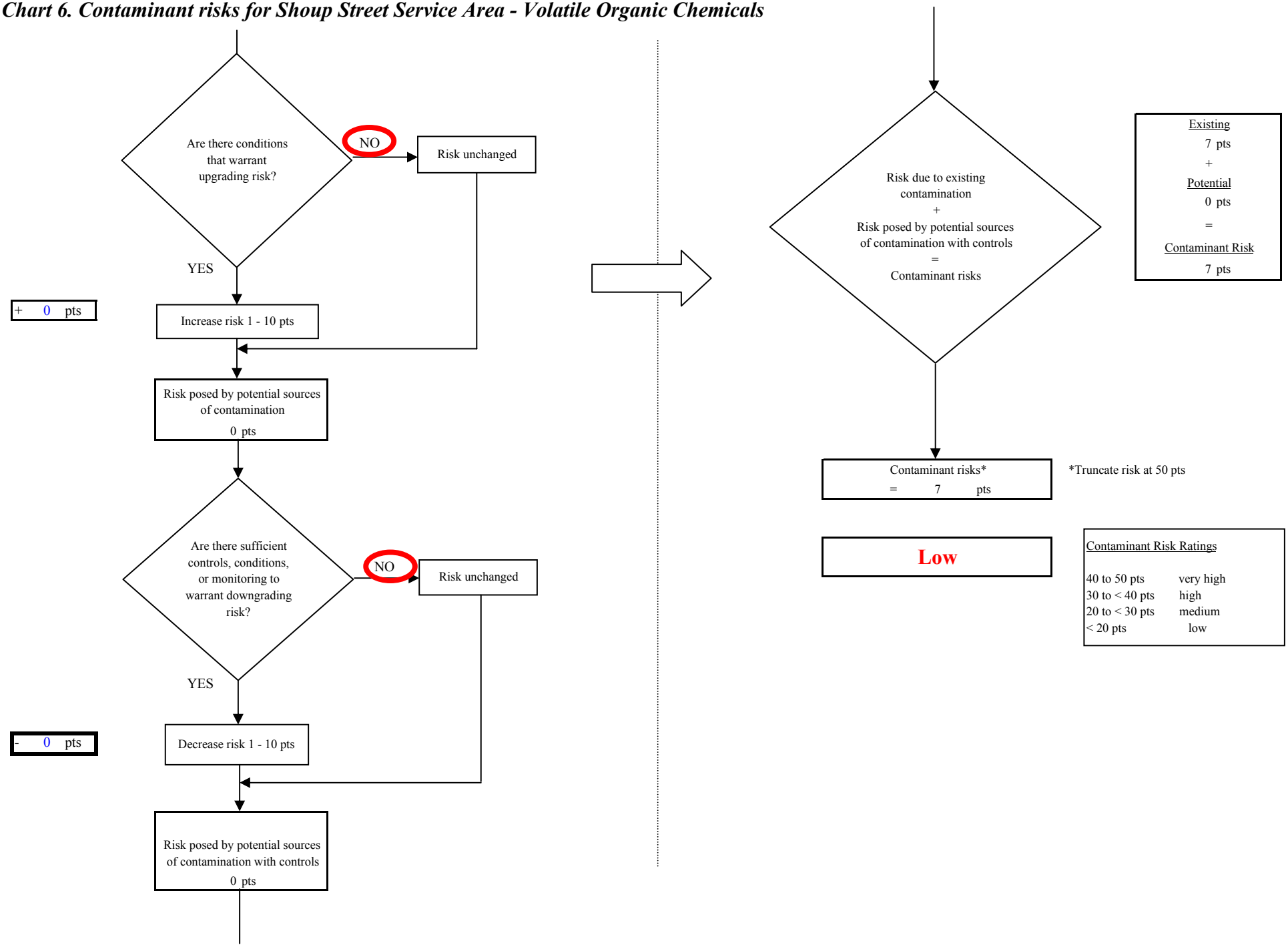


Chart 7. Vulnerability analysis for Shoup Street Service Area - Volatile Organic Chemicals

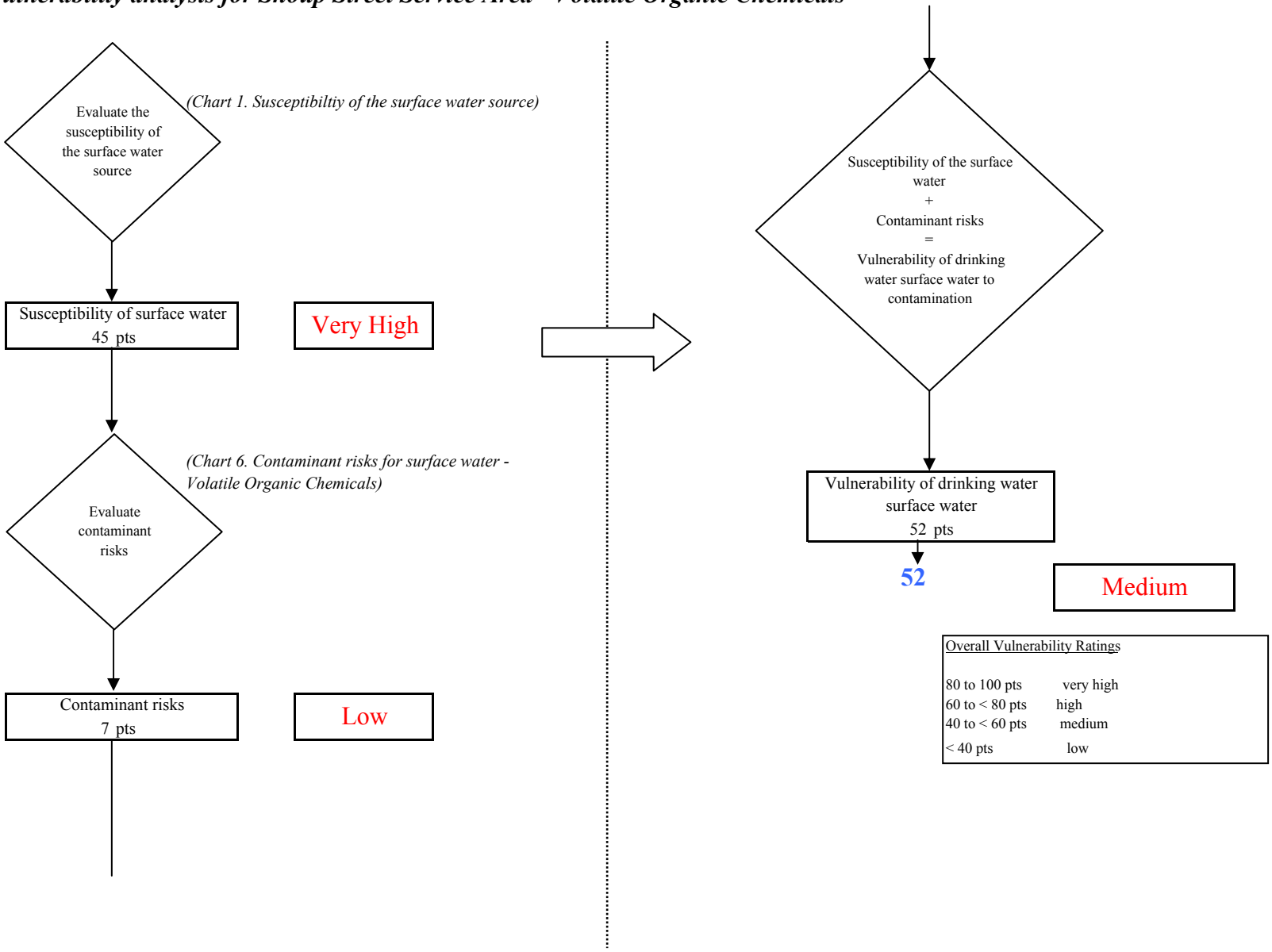


Chart 8. Contaminant risks for Shoup Street Service Area - Heavy Metals, Cyanide and Other Inorganic Chemicals

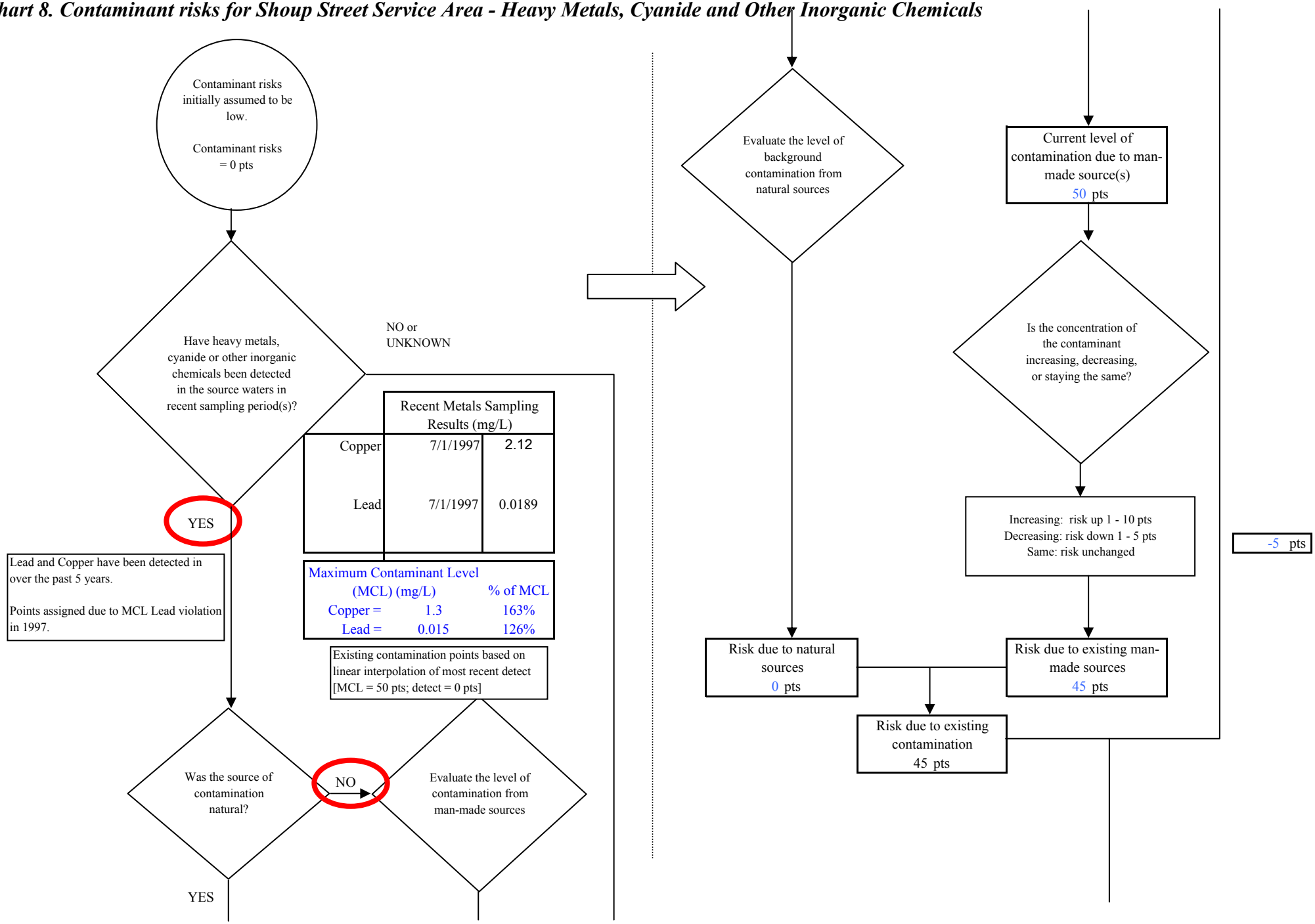
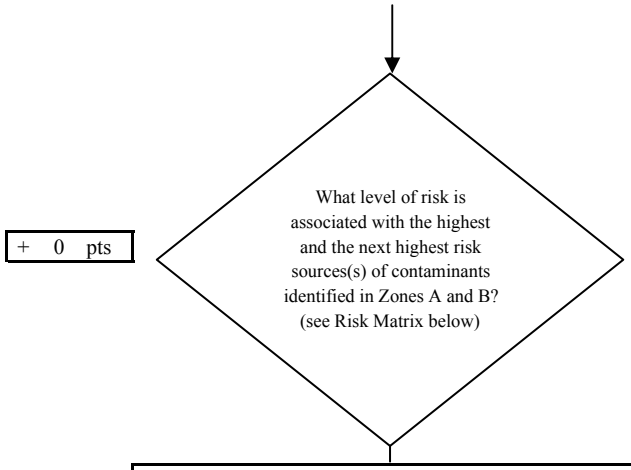


Chart 8. Contaminant risks for Shoup Street Service Area - Heavy Metals, Cyanide and Other Inorganic Chemicals



+ 0 pts

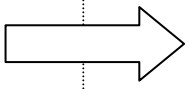
Risk Levels for HM, Cyanide, or OIC Sources identified in Zones A and B

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



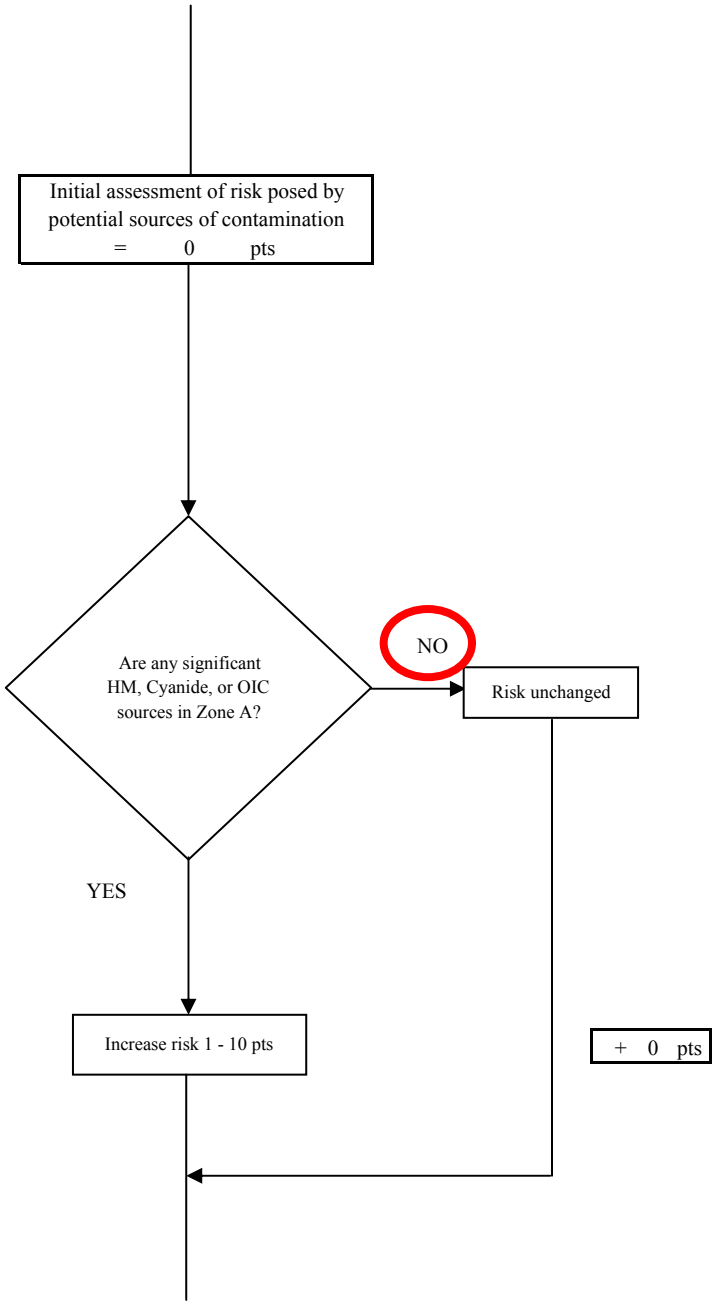


Chart 8. Contaminant risks for Shoup Street Service Area - Heavy Metals, Cyanide and Other Inorganic Chemicals

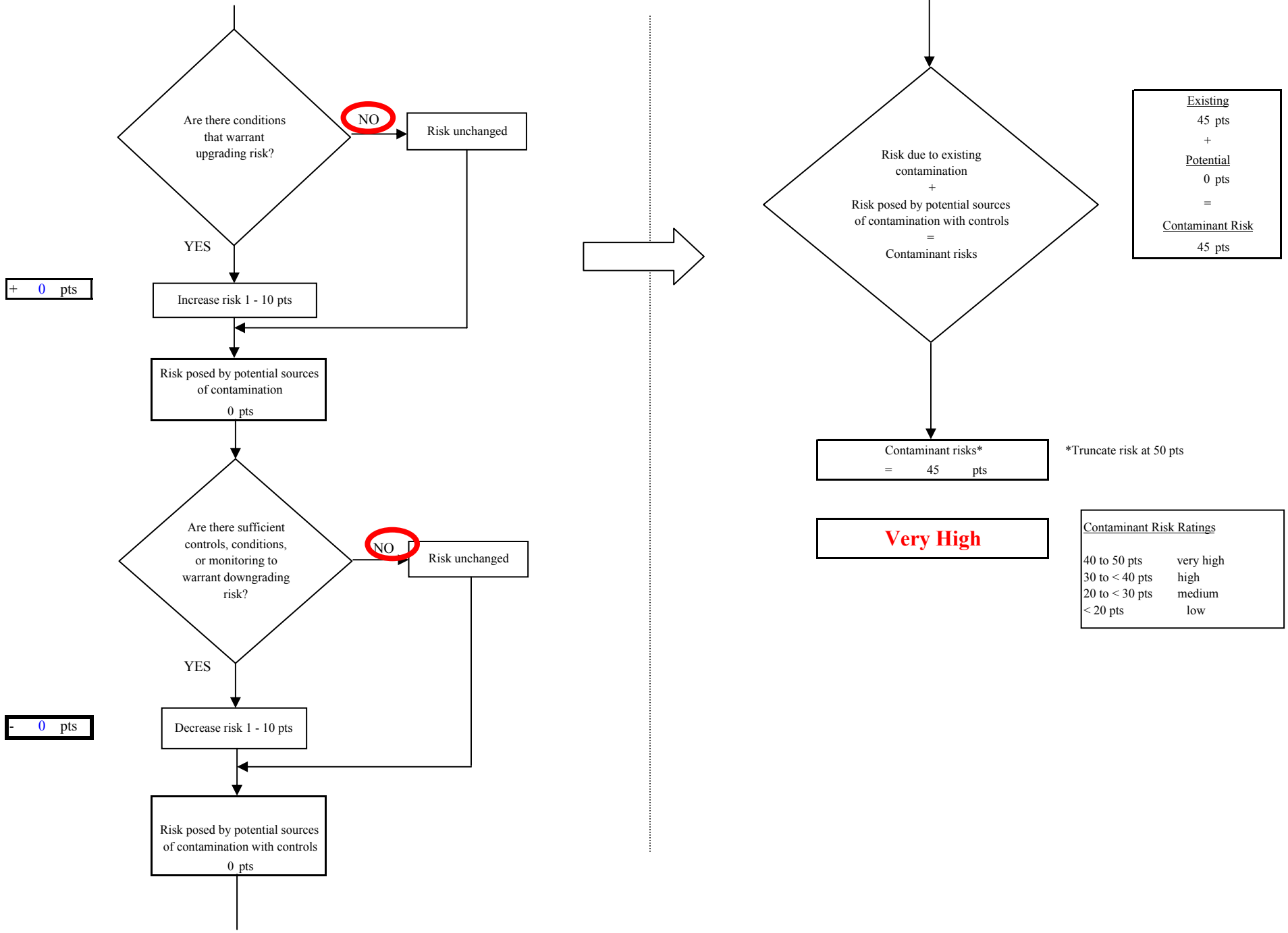


Chart 9. Vulnerability analysis for Shoup Street Service Area - Heavy Metals, Cyanide and Other Inorganic Chemicals

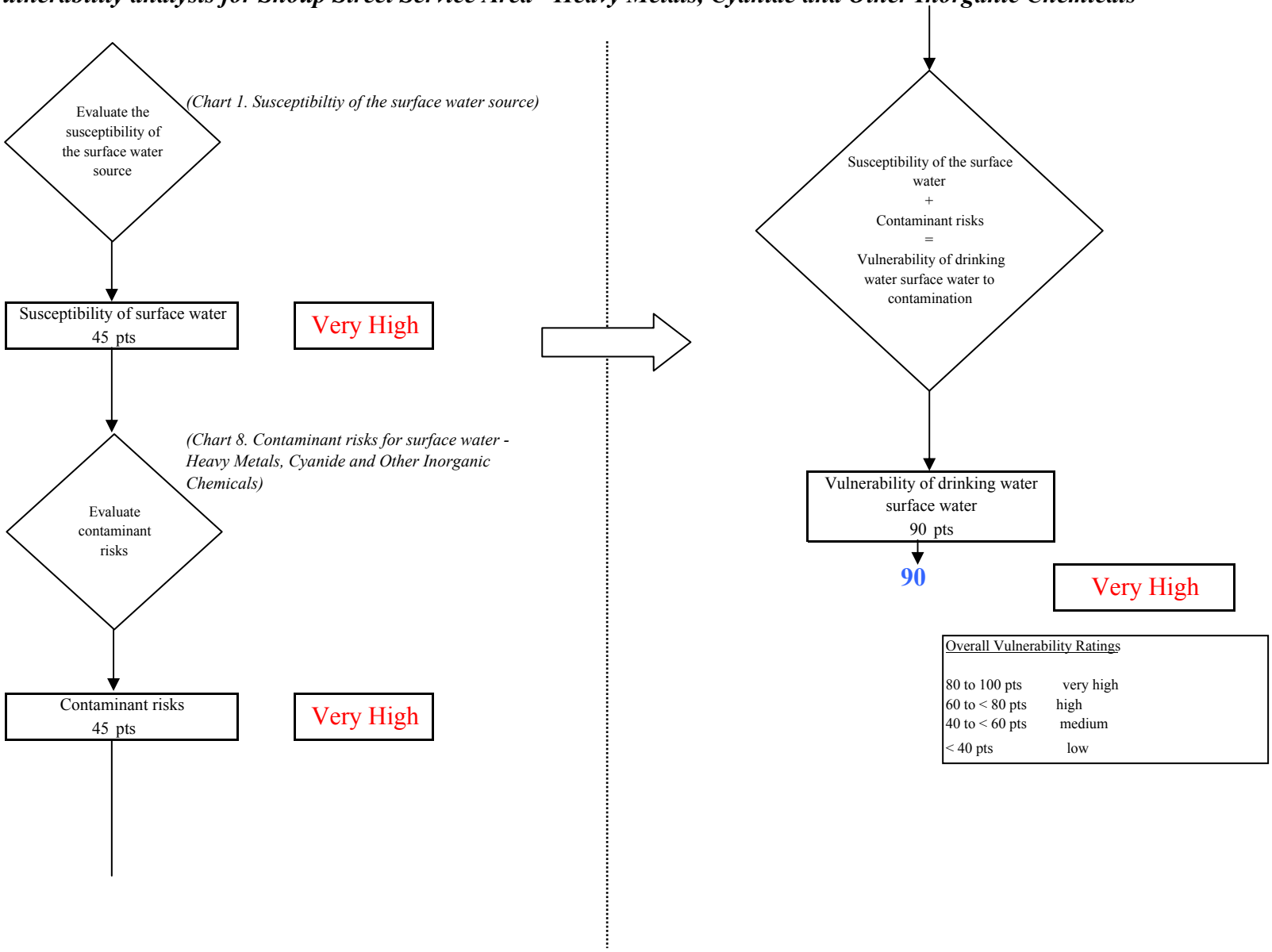


Chart 10. Contaminant risks for Shoup Street Service Area - Synthetic Organic Chemicals

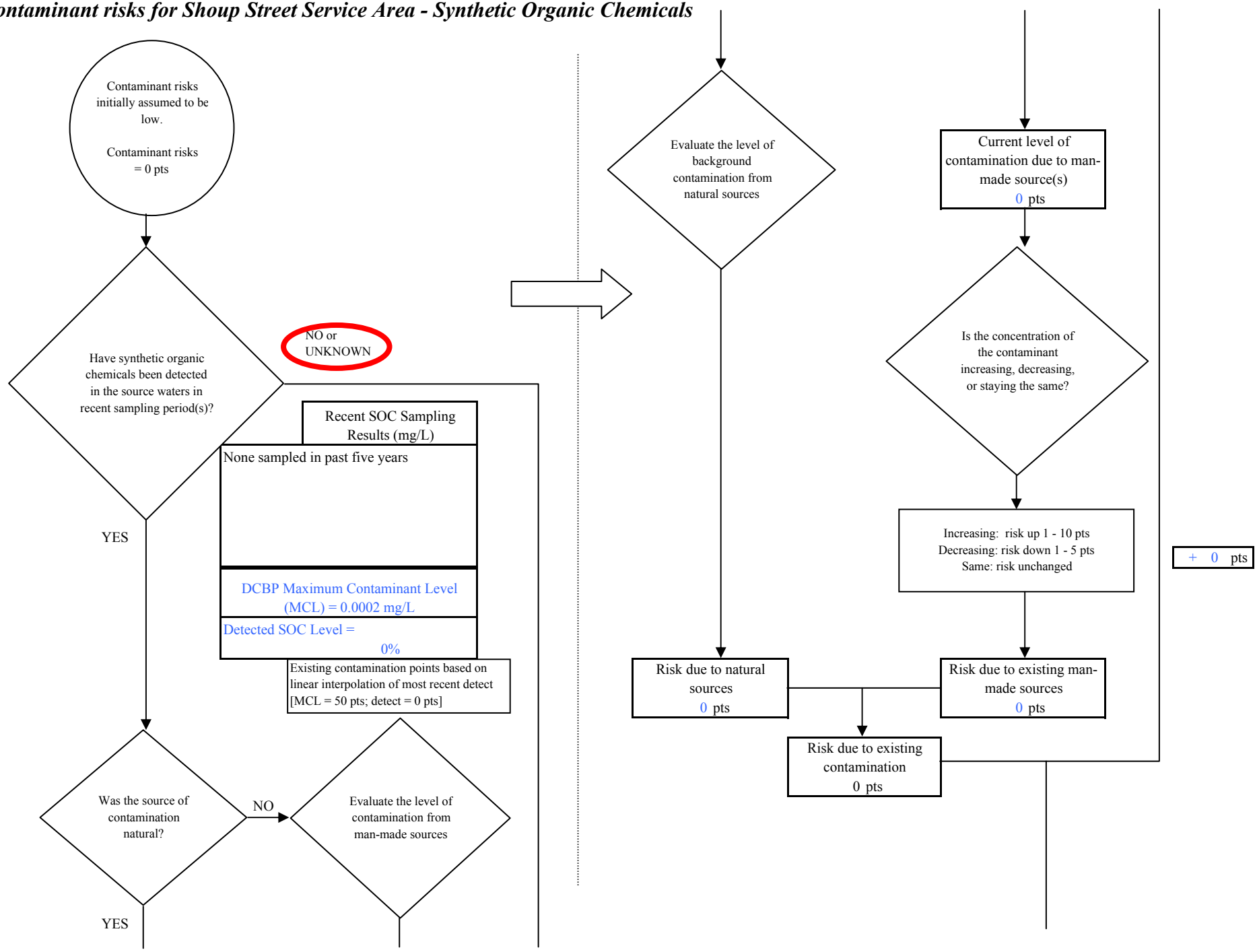
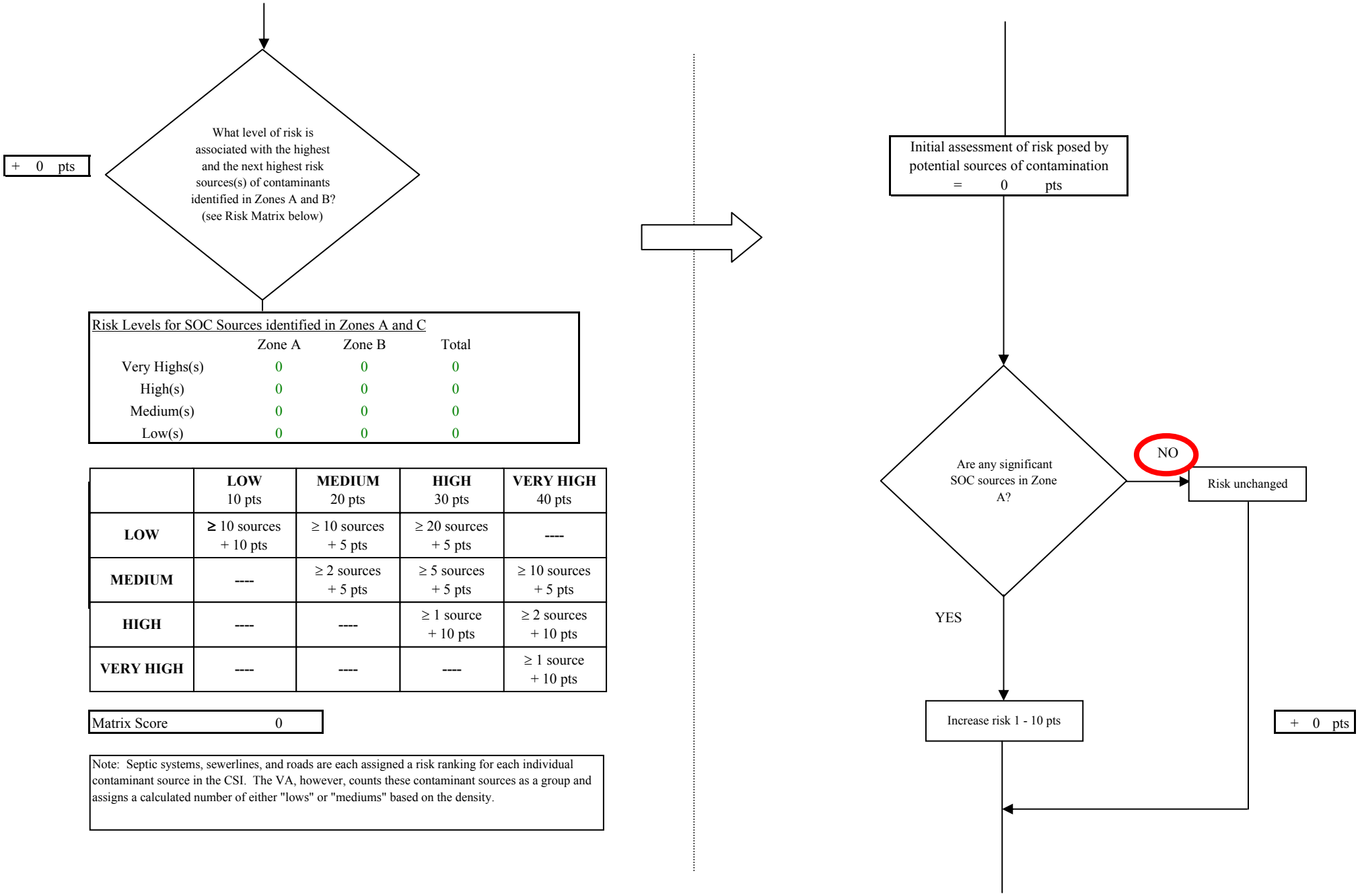


Chart 10. Contaminant risks for Shoup Street Service Area - Synthetic Organic Chemicals



Risk Levels for SOC Sources identified in Zones A and C

	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 10. Contaminant risks for Shoup Street Service Area - Synthetic Organic Chemicals

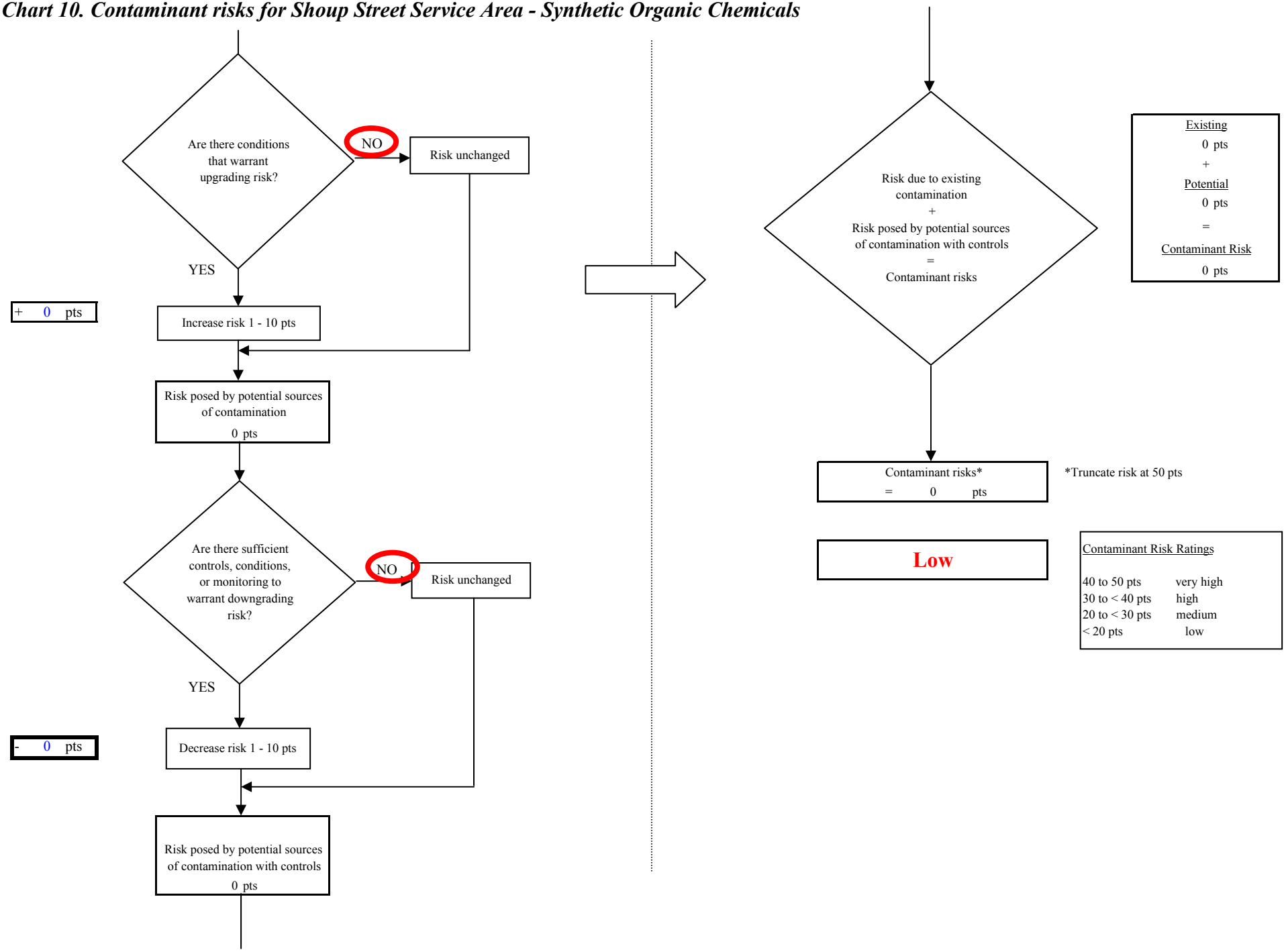


Chart 11. Vulnerability analysis for Shoup Street Service Area - Synthetic Organic Chemicals

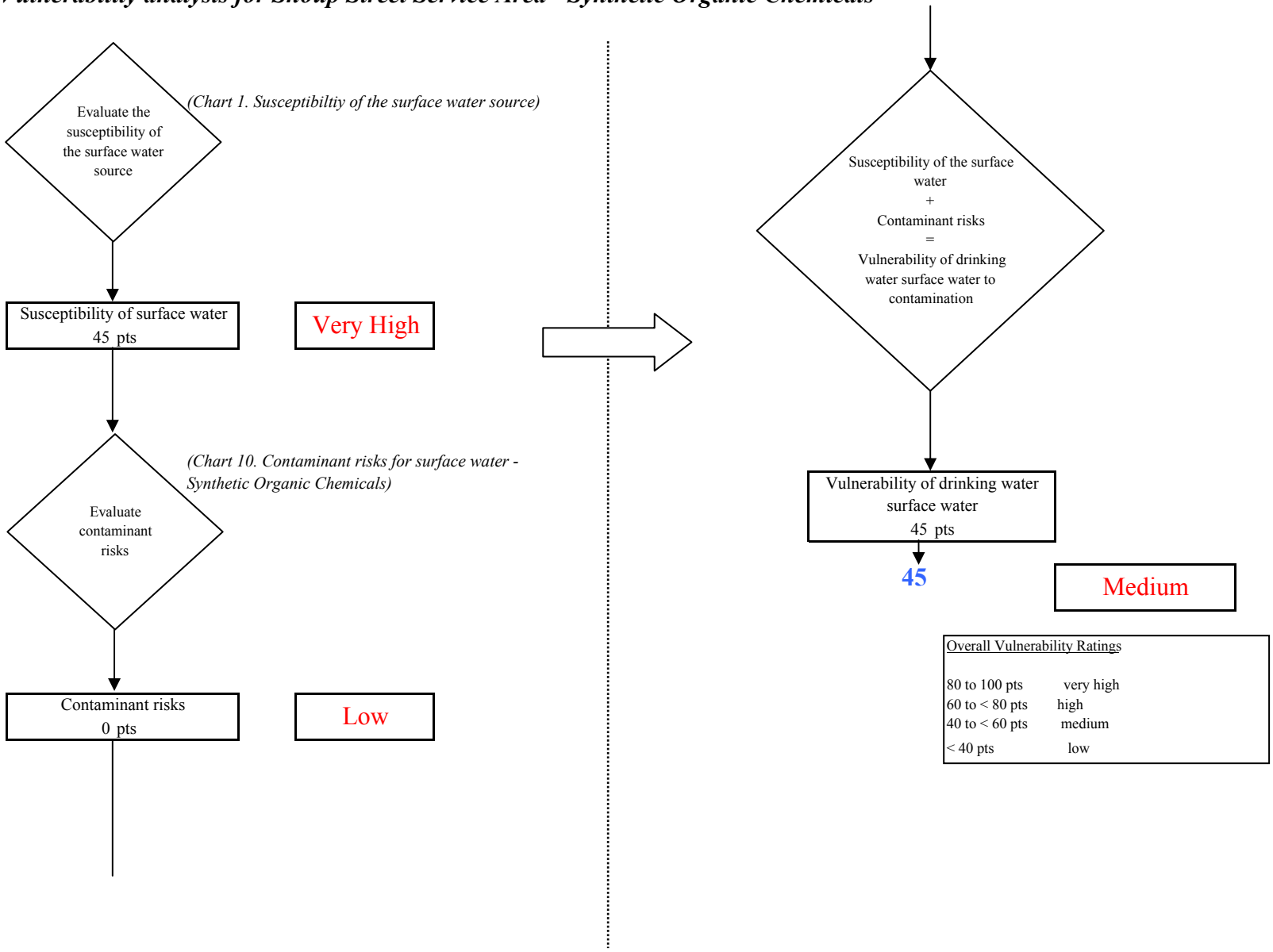


Chart 12. Contaminant risks for Shoup Street Service Area - Other Organic Chemicals

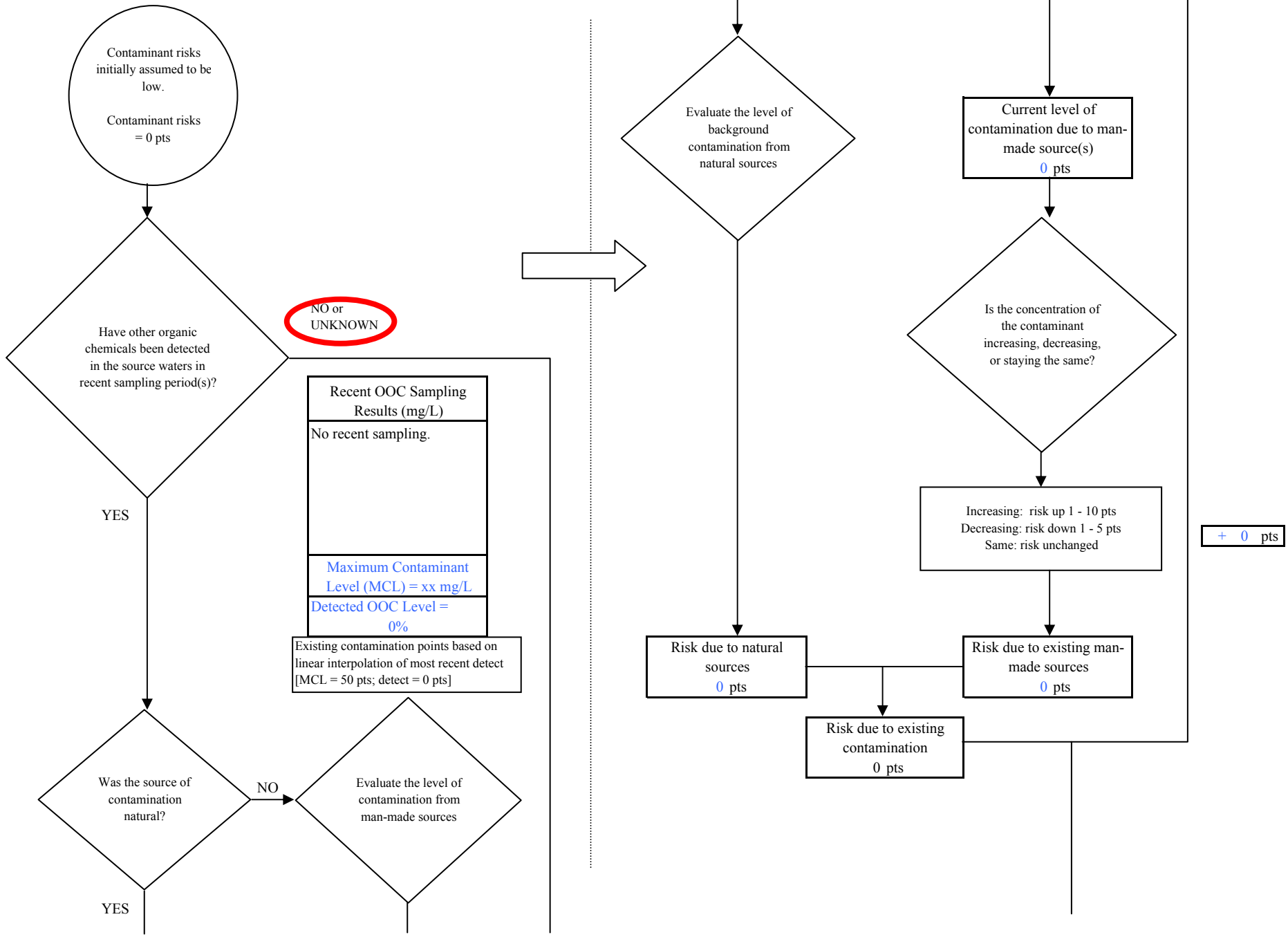
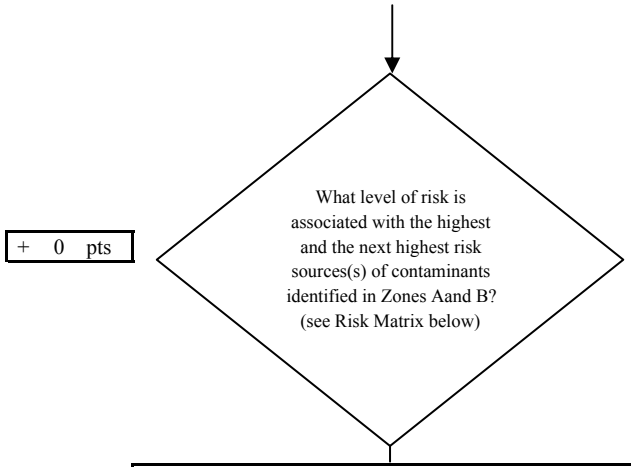


Chart 12. Contaminant risks for Shoup Street Service Area - Other Organic Chemicals



+ 0 pts

Risk Levels for OOC 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.

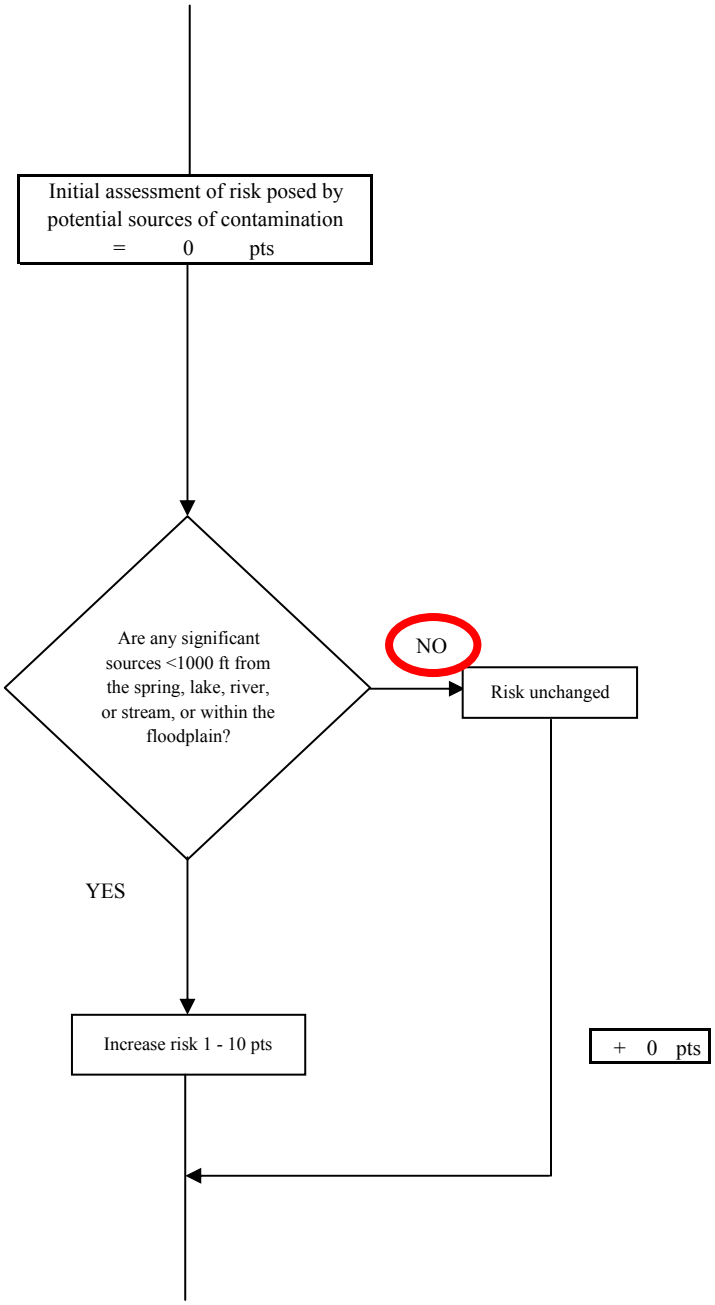


Chart 12. Contaminant risks for Shoup Street Service Area - Other Organic Chemicals

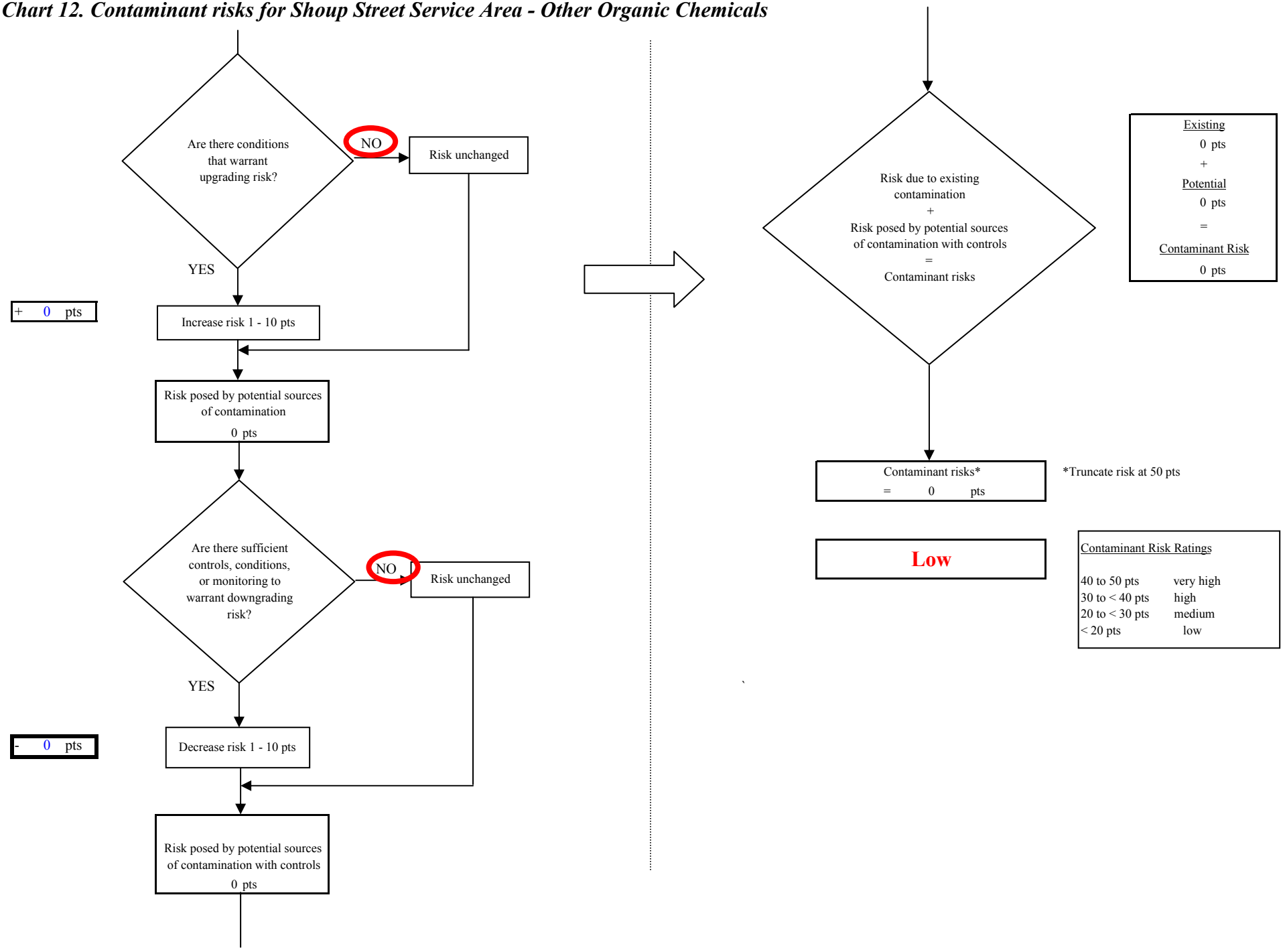


Chart 13. Vulnerability analysis for Shoup Street Service Area - Other Organic Chemicals