Source Water Assessment

A Hydrogeologic Susceptibility and Vulnerability Assessment for the

City of Kodiak Water System

(Monashka Creek Reservoir and Upper Reservoir)

Kodiak, Alaska

PWSID # 250011.001, .002

March 2004

Drinking Water Protection Program Report #1420

Alaska Department of Environmental Conservation

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The Drinking Water Protection Program (DWPP) is producing Source Water Assessments in compliance with the Safe Drinking Water Act Amendments of 1996. Each assessment includes a delineation of the source water area, an inventory of potential and existing contaminant sources that may impact the water, a risk ranking for each of these contaminants, and an evaluation of the potential vulnerability of these drinking water sources.

These assessments are intended to provide public water systems owners/operators, communities, and local governments with the best available information that may be used to protect the quality of their drinking water. The assessments combine information obtained from various sources, including the U.S. Environmental Protection Agency, Alaska Department of Environmental Conservation (ADEC), public water system owners/operators, and other public information sources. The results of this assessment are subject to change if additional data becomes available. It is anticipated this assessment will be updated every five years to reflect any changes in the vulnerability and/or susceptibility of public drinking water source. If you have any additional information that may affect the results of this assessment, please contact the Program Coordinator of DWPP, (907) 269-7521.

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Source Water Assessment for the City of Kodiak Drinking Water System (Monashka Creek Reservoir & Upper Reservoir)

Drinking Water Protection Program
Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

The public water system for the City of Kodiak is a Class A water system that obtains water primarily from the Monashka Reservoir, approximately 5-miles north of Kodiak. Water collected at the Monashka Reservoir is piped to the Upper Reservoir, where it is stored before treatment and distribution. The Monashka Reservoir drinking water protection area is approximately 4 square miles in size and the Upper Reservoir drinking water protection area is approximately 6 acres in size. The susceptibility rating of both protection areas is **"very high**". *A rating of high to very high is typical for all systems with surface water intakes*. Potential and existing sources of the following contaminants were evaluated for the Source Water 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. No potential contaminant sources were identified for the drinking water source. This evaluation included all available water sampling data submitted to ADEC by the system operator. The samples may have been collected from either raw water or post-treated water. Combining the susceptibility of the surface water source with the contaminant risks, this water system has received a vulnerability rating of **"medium"** for all 6 contaminant categories. This assessment can be used as a foundation for local voluntary protection efforts as well as a basis for the continuous efforts on the part of the City of Kodiak to protect public health.

DRINKING WATER SYSTEM AND AREA OVERVIEW

The City of Kodiak (Sec. 32, T027S, R019W, Seward Meridian), is located near the eastern tip of Kodiak Island in the Gulf of Alaska. It is 252 air miles south of Anchorage, a 45-minute flight, and is a 4-hour flight from Seattle. As of 2003, the current population of Kodiak is approximately 9,000 (8177 resident, 859 transient).

The City of Kodiak public water system is a Class A water system that operates year-round and obtains water primarily from the Monashka Reservoir, approximately 5-miles north of Kodiak. The reservoir holds approximately 965 million gallons of water. Water from the reservoir is then pumped to the Upper Reservoir facility for storage before entering the City's water treatment process. Pillar Creek is used as an alternate backup source when needed.

Access to the Monashka Reservoir and Upper Reservoir areas is restricted via gated maintenance roads. No development of any kind is known to have existed in either watershed area.

The climate of the Kodiak Islands has a strong marine influence. There is little or no freezing weather, moderate precipitation, occasional high winds, and frequent cloud cover and fog. Severe storms are common from December through February. Annual rainfall is 67 inches, and snowfall averages 78 inches. January temperatures range from 14 to 46; July temperatures vary from 39 to 76 (ADCED, 2003).

CITY OF KODIAK 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 Monashka Reservoir and Upper Reservoir includes each of these Zones. Due to the small size of the overall protection area, Zones B and C cover the same region (See Map 1 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 Monashka Reservoir and Upper Reservoir protection areas. 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 Monashka Reservoir and Upper Reservoir protection areas 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 Zone 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.

The remaining tables in Appendix B (if necessary) 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:

- 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 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. Monashka/Upper Reservoir Contaminant Risks

Category	Score	Rating
Bacteria and Viruses	0	Low
Nitrates and/or Nitrites	1	Low
Volatile Organic Chemicals	0	Low
Heavy Metals, Cyanide, and Other Inorganic Chemicals	0	Low
Synthetic Organic Chemicals	0	Low
Other Organic Chemicals	0	Low

Finally, an overall vulnerability score is assigned for each 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. Monashka/Upper Reservoir Overall Vulnerability

Category	Score	Rating
Bacteria and Viruses	45	Medium
Nitrates and Nitrites	45	Medium
Volatile Organic Chemicals	45	Medium
Heavy Metals, Cyanide, and Other Inorganic Chemicals	45	Medium
Synthetic Organic Chemicals	45	Medium
Other Organic Chemicals	45	Medium

Bacteria and Viruses

The contaminant risk for bacteria and viruses is "low".

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. Typically, coliform detection in raw water samples collected from surface water sources is normal. (See Chart 2 – Contaminant Risks for Bacteria and Viruses in Appendix D).

No positive bacteria counts have been detected during the recent sampling periods.

Roads could serve as possible sources of bacteria for the drinking water system. See Table 2 in Appendix D for a complete listing.

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 considered "medium".

Nitrates and Nitrites

The contaminant risk for nitrates and nitrites is "low" (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.

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).

Sampling history for the water source indicates that low concentrations of nitrates (below MCL) were detected in sampling performed in 1999-2003.

Possible sources of nitrate/nitrites are airfields or roads. See Table 3 in Appendix D for a complete listing.

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

Volatile Organic Chemicals

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

Chloroform and trihalomethanes were detected at levels below the MCL during sampling in 2003, although both of these chemicals typically originate during the process of water treatment and not from the source waters. The MCL for chloroform is 0.2 milligrams per liter (mg/L) and the MCL for total trihalomethanes is 0.1 mg/L.

Aside from being byproducts of the drinking water treatment process, possible sources of volatile organic chemicals include facilities with automobiles, fuel spills, roads, and airports. See Table 4 in Appendix D for a complete listing.

After combining the contaminant risk for volatile organic chemicals with the natural susceptibility of the source, the overall vulnerability of the source to contamination remains "high".

Heavy Metals, Cyanide, and Other Inorganic Chemicals

The contaminant risk for heavy metals is "low". Low levels of copper and lead were detected in samples collected during 2001 (See Chart 8 – Contaminant Risks for Heavy Metals, Cyanide, and Other Inorganic Chemicals in Appendix D). The MCL for copper is 1.3 mg/l. and the MCL for lead is 0.015 mg/l.

The most common source of these chemicals is the infrastructure of the distribution system following the treatment process.

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

See Table 5 in Appendix D for a listing of the identified possible sources of heavy metals, cyanide, and other organic chemicals in the Protection Area.

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 source is "low" (See Chart 11 – Contaminant Risks for Synthetic Organic Chemicals in Appendix D).

Review of the historical sampling data indicates that test results for ethylene dibromide in 2003 & 2002 were negative.

See Table 6 in Appendix D for a listing of the identified possible sources of synthetic organic chemicals in the Protection Area.

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 recently.

See Table 7 in Appendix D for a listing of the identified possible sources of other organic chemicals in the Protection Area.

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 the City of Kodiak 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.

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

APPENDIX A

City of Kodiak
Drinking Water Protection Area Location Map
(Map 1)

Monashka Creek Reservoir - Drinking Water Protection Area

PWSID # 250011.001

PWSID # 250011.002

Upper Reservoir - Drinking Water Protection Area

Pillar Creek - Drinking Water Protection Area (Alternate water source)

PWSID # 250011.004

Area enlarged at left

Levelock

Ouzinkie

Karluk

Chiniak

Pilot Point

Old Harbor

0 25 50 Miles

N

W E

S

Map 1: City of Kodiak Water System Drinking Water Protection Area

PWSID: 250011.001, .002, and .004

Alaska Department of Environmental Conservation

Alaska Drinking Water Protection Program

0 2,500 5,000 10,000 15,000 20,000 Feet

1:60,000

Data Sources:

Background image
- USGS 1:63,000 mapping

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 reservoir/stream).

Legend

- City of Kodiak Water System
- Stream
- Zone A Protection Area
- Zone B Protection Area
- Zone C Protection Area

APPENDIX B

Contaminant Source Inventory and Risk Rankings (Table 1)

Table 1

Contaminant Source Inventory for

City of Kodiak Water System - Monashka Reservoir

PWSID 250011.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Map Number*	*Comments*
					No contaminant sources currently mapped for .001, .002, or .003

APPENDIX C

City of Kodiak
Drinking Water Protection Area
and Potential and Existing Contaminant Sources
(Map 2)

Monashka Reservoir
PWSID # 250011.001

No contaminant sources currently mapped

Pillar Creek
(Alternate Source)
PWSID # 250011.004

Upper Reservoir
PWSID # 250011.002

Area enlarged at left

Map 2: Potential and Existing Contaminant Sources

PWSID: 250011.001, .002.

Alaska Department of Environmental Conservation

Alaska Drinking Water Protection Program

0 1,250 2,500 5,000 7,500 10,000 Feet

1:32,000

Data Sources:

Background image
- USGS 1:63,000 mapping

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 lake).

Legend

- Water System Intake
- Zone A Protection Area
- Zone B Protection Area
- Zone C Protection Area
- River/Stream

N W E S

0 1 2 4 6 Miles

6/07/04

APPENDIX D

Vulnerability Analysis and Contaminant Risks
(Charts 1-13)

Chart 1. Susceptibility of the Surface Water Source - City of Kodiak - Monashka/Upper Reservoirs

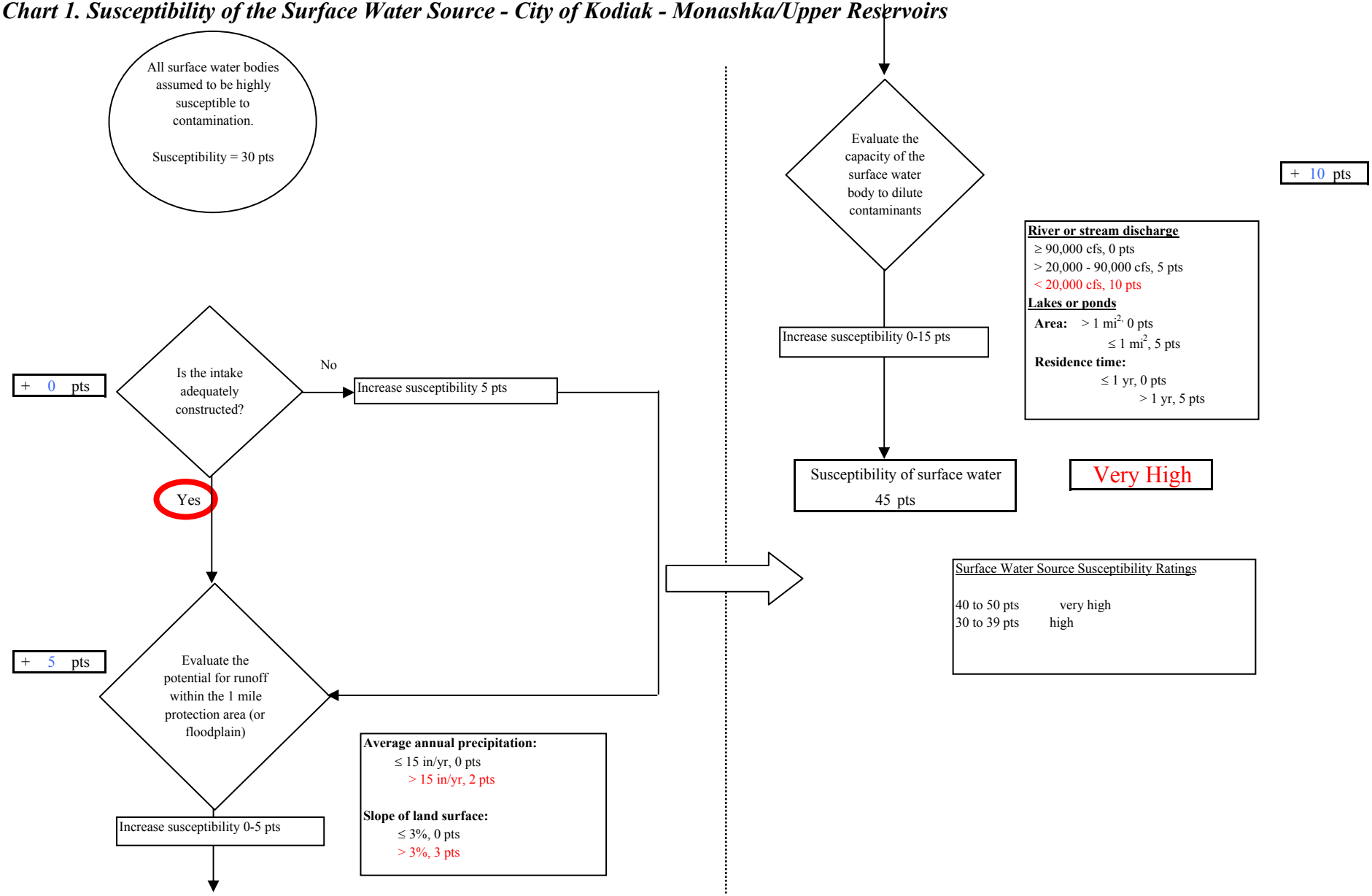
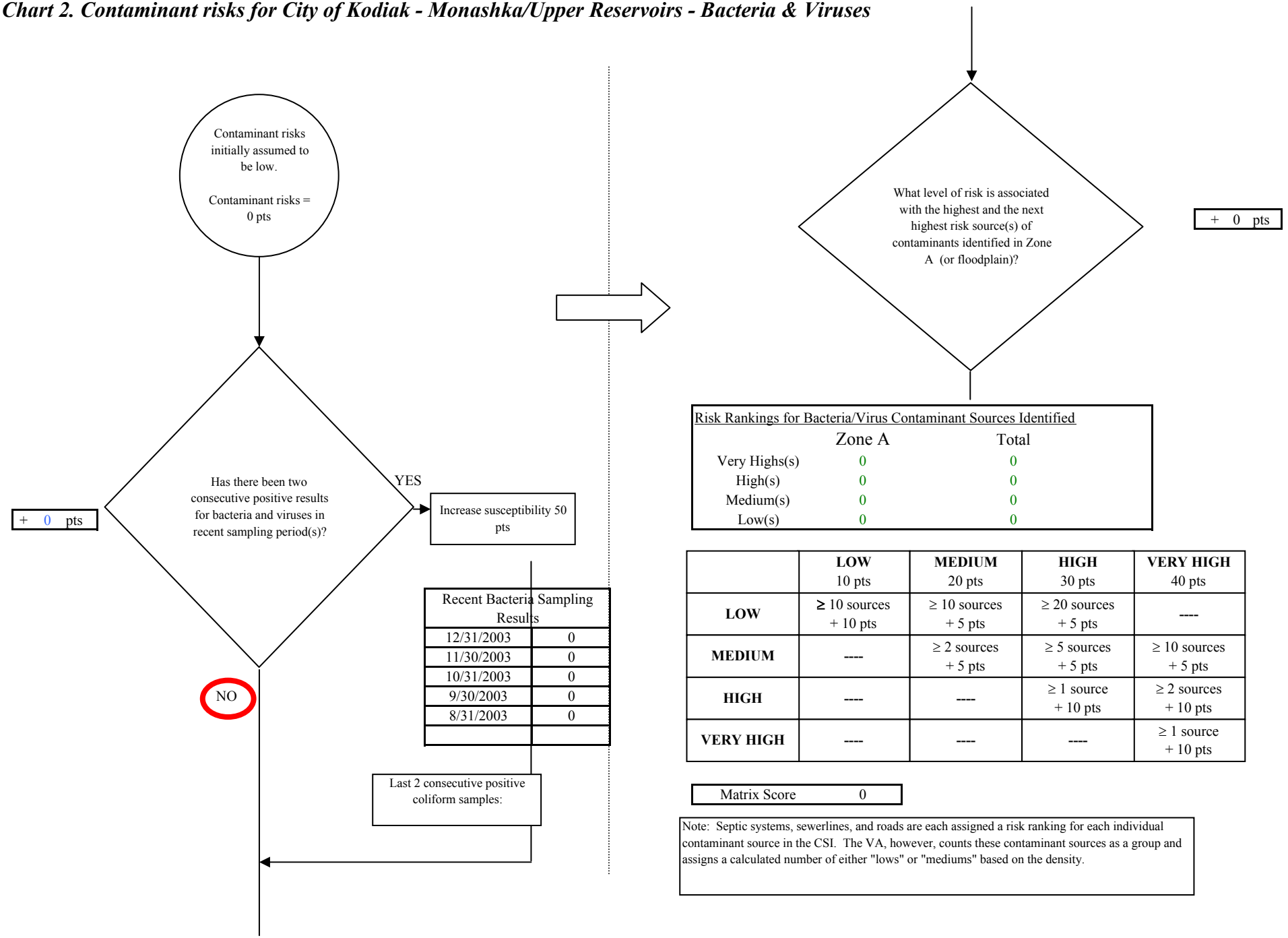


Chart 2. Contaminant risks for City of Kodiak - Monashka/Upper Reservoirs - Bacteria & Viruses



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)	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 2. Contaminant risks for City of Kodiak - Monashka/Upper Reservoirs - Bacteria & Viruses

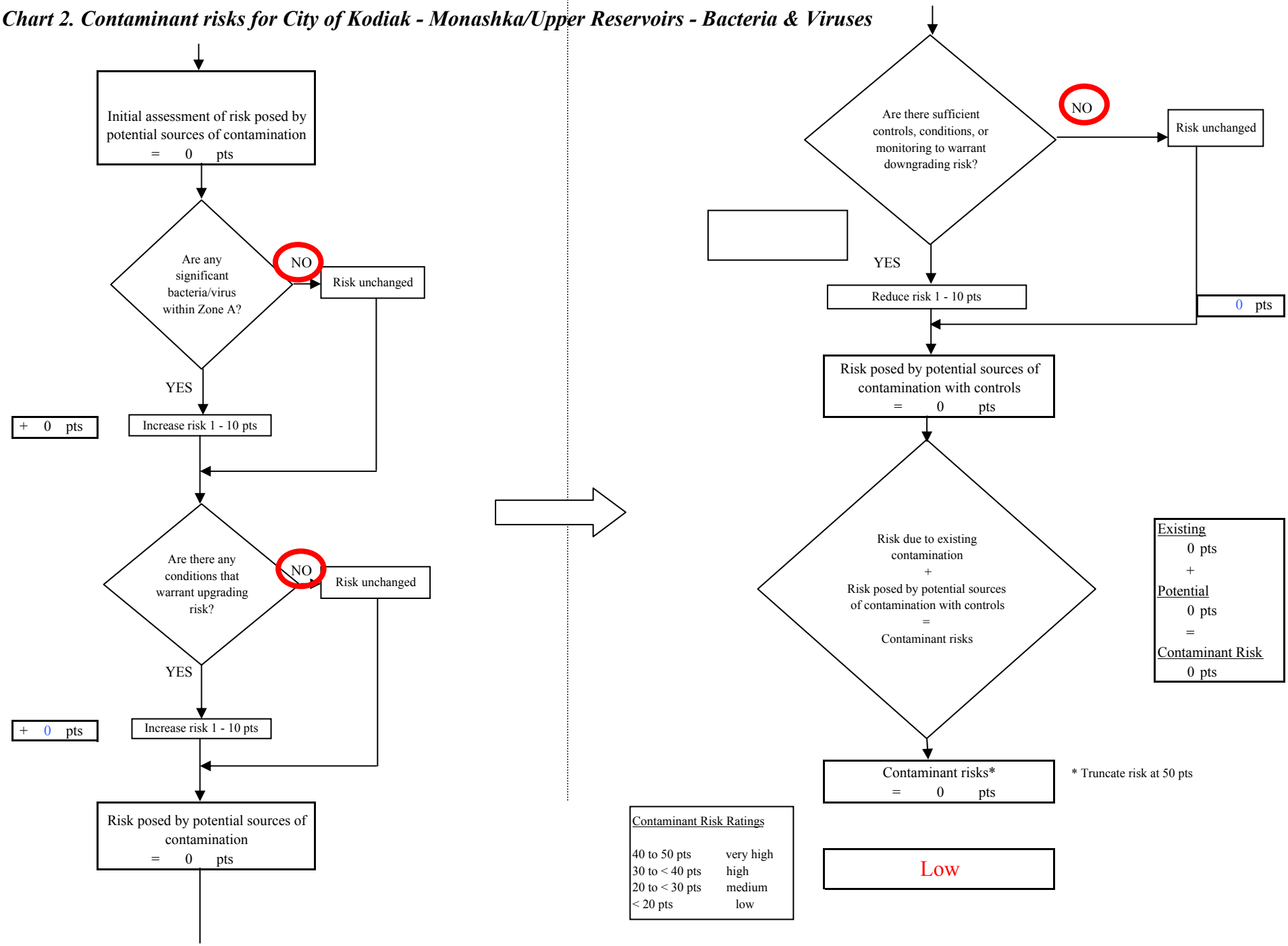


Chart 3. Vulnerability analysis for City of Kodiak - Monashka/Upper Reservoirs - Bacteria & Viruses

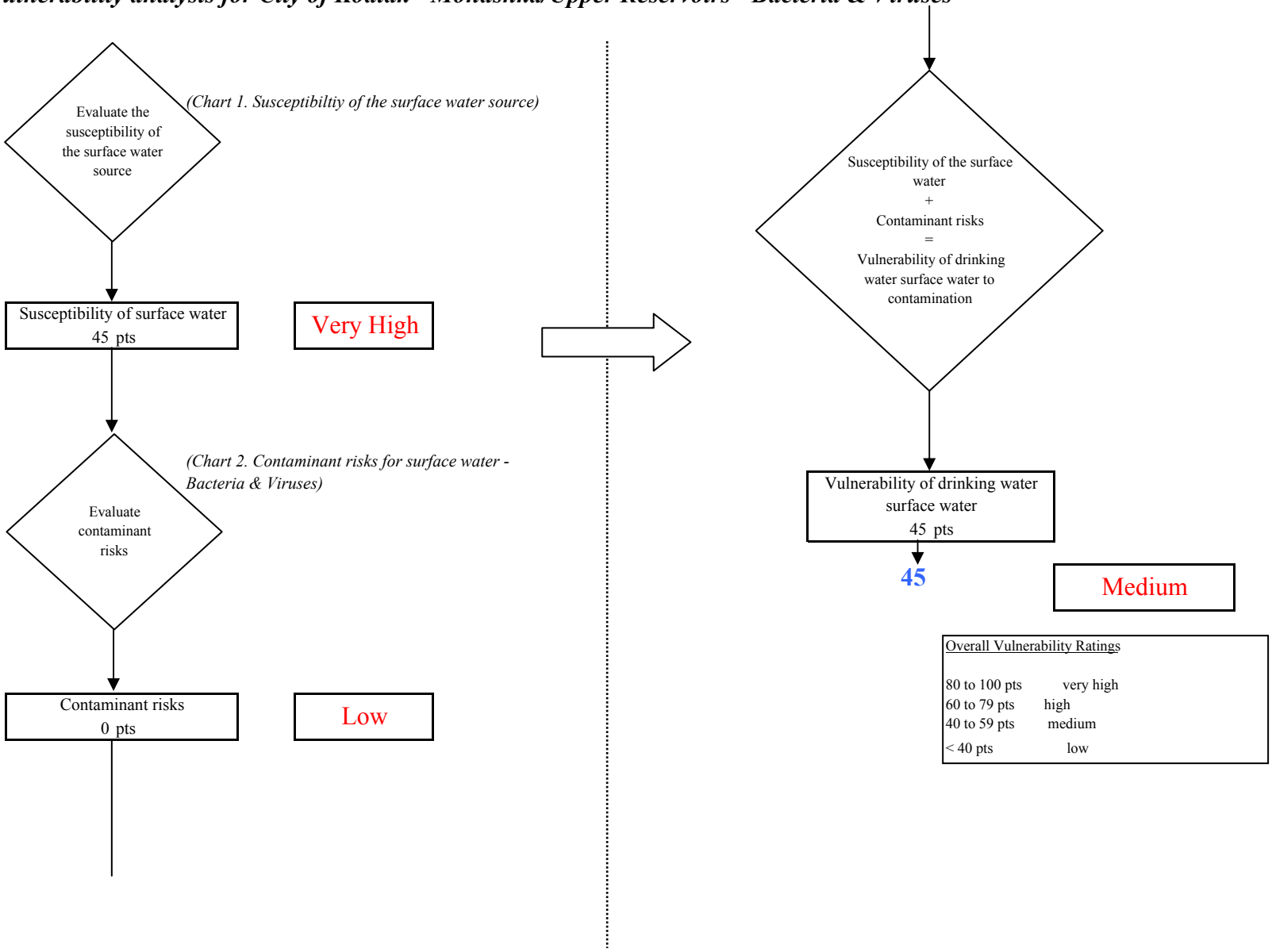


Chart 4. Contaminant risks for City of Kodiak - Monashka/Upper Reservoirs - Nitrates and Nitrites

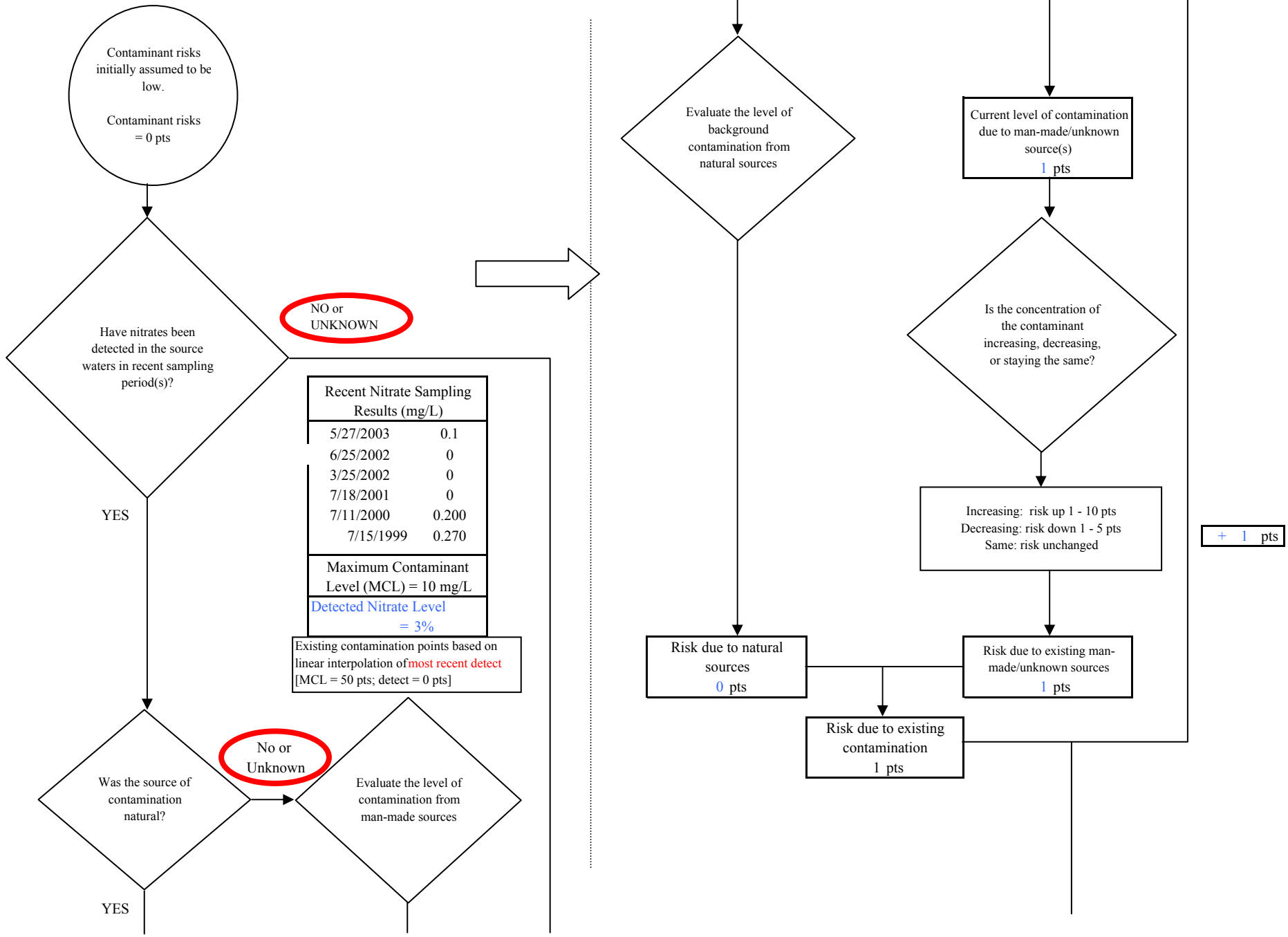


Chart 4. Contaminant risks for City of Kodiak - Monashka/Upper Reservoirs - Nitrates and Nitrites

+ 0 pts

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

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)	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 nitrate/nitrite sources in Zone A?

NO

Risk unchanged

YES

Increase risk 1 - 10 pts

+ 0 pts

Chart 4. Contaminant risks for City of Kodiak - Monashka/Upper Reservoirs - Nitrates and Nitrites

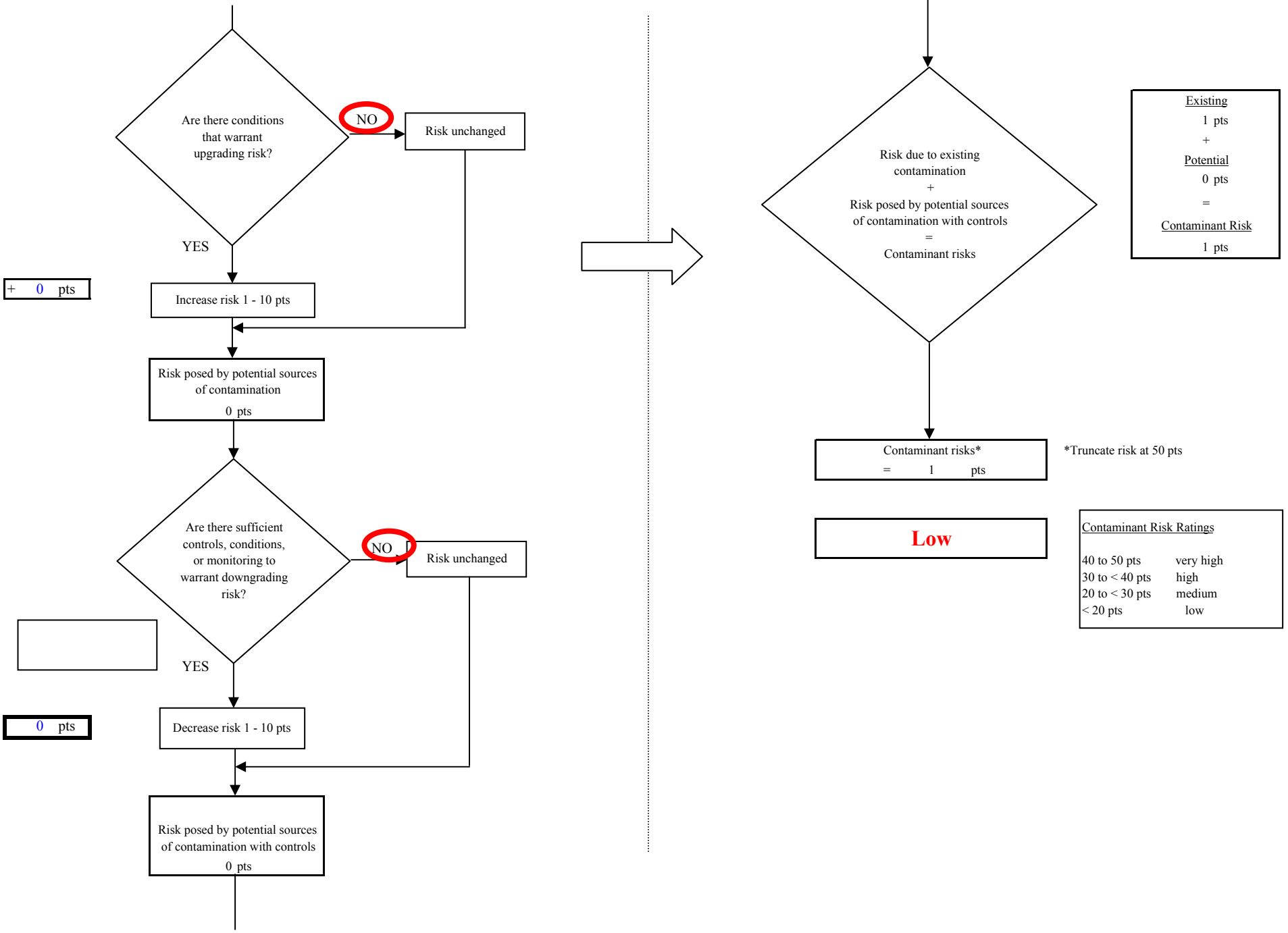


Chart 5. Vulnerability analysis for City of Kodiak - Monashka/Upper Reservoirs - Nitrates and Nitrites

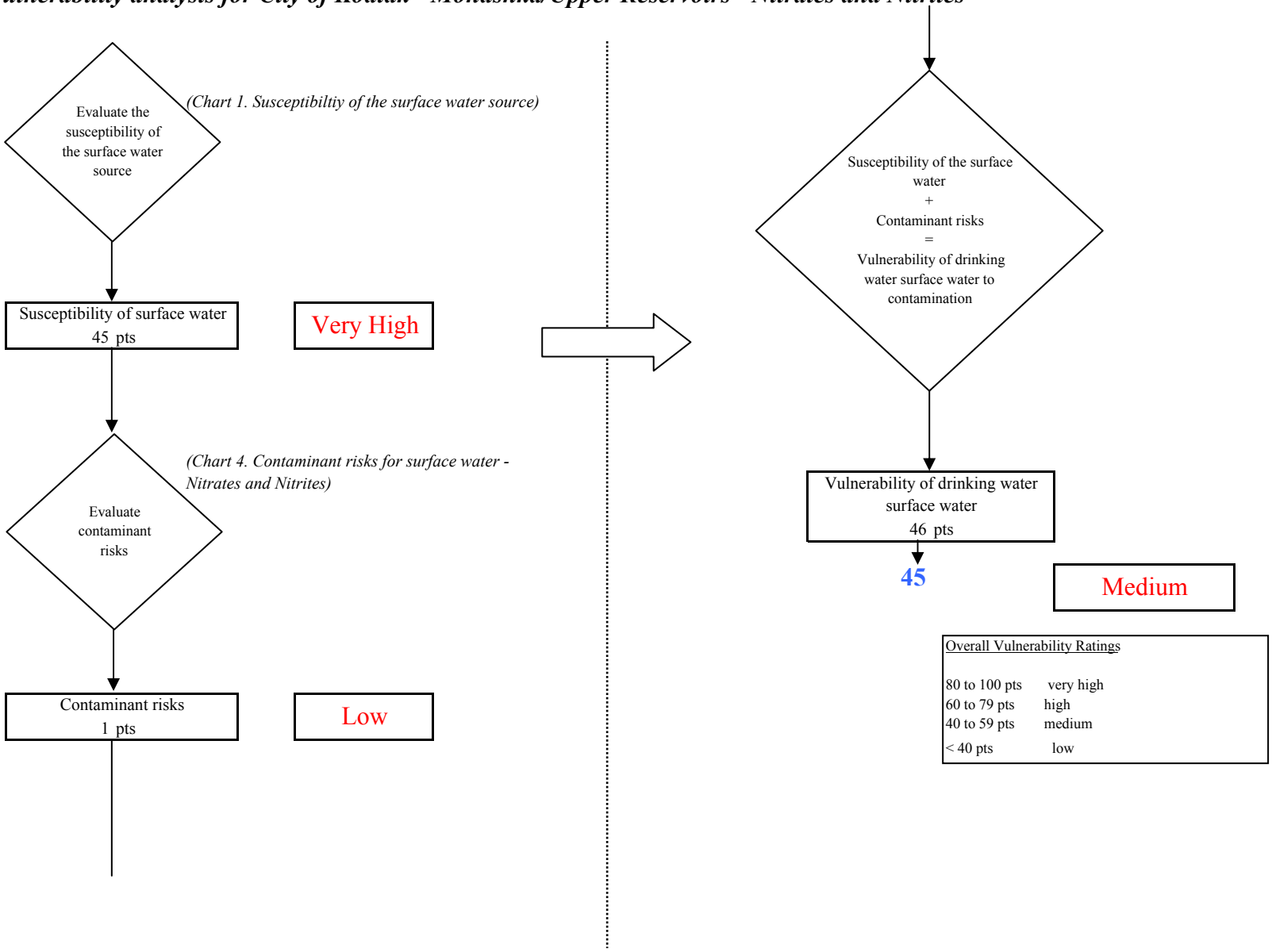


Chart 6. Contaminant risks for City of Kodiak - Monashka/Upper Reservoirs - Volatile Organic Chemicals

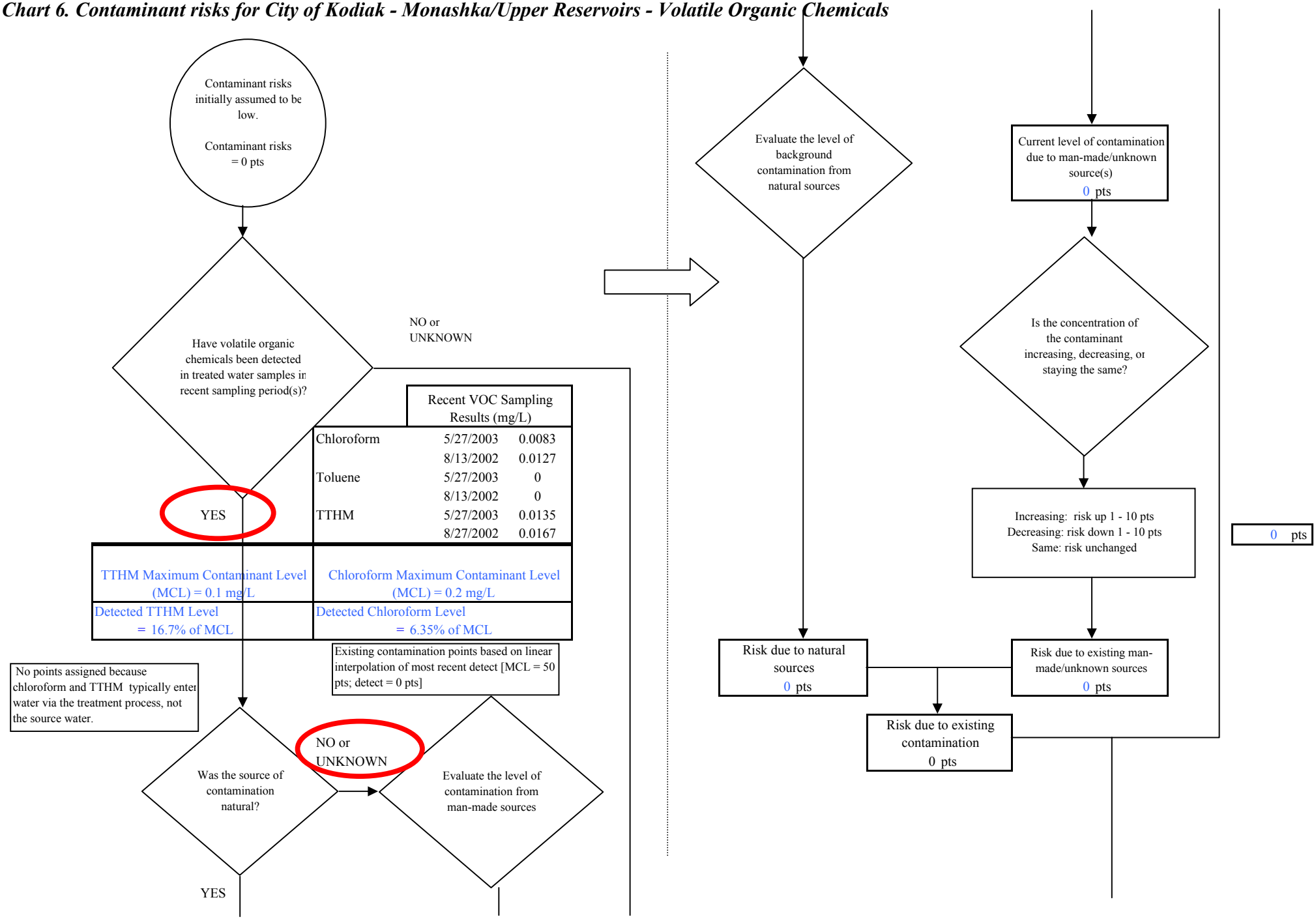
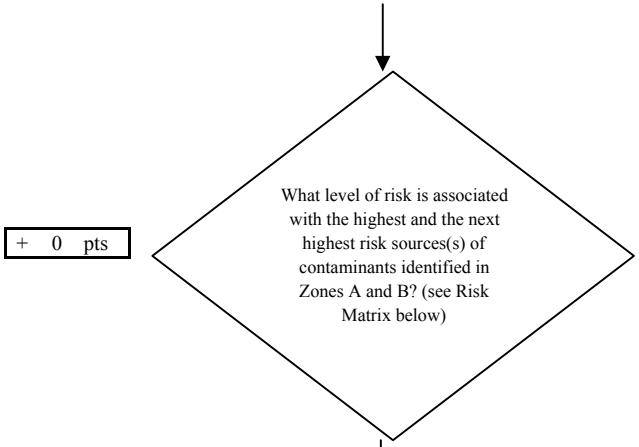


Chart 6. Contaminant risks for City of Kodiak - Monashka/Upper Reservoirs - Volatile Organic Chemicals



+ 0 pts

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.

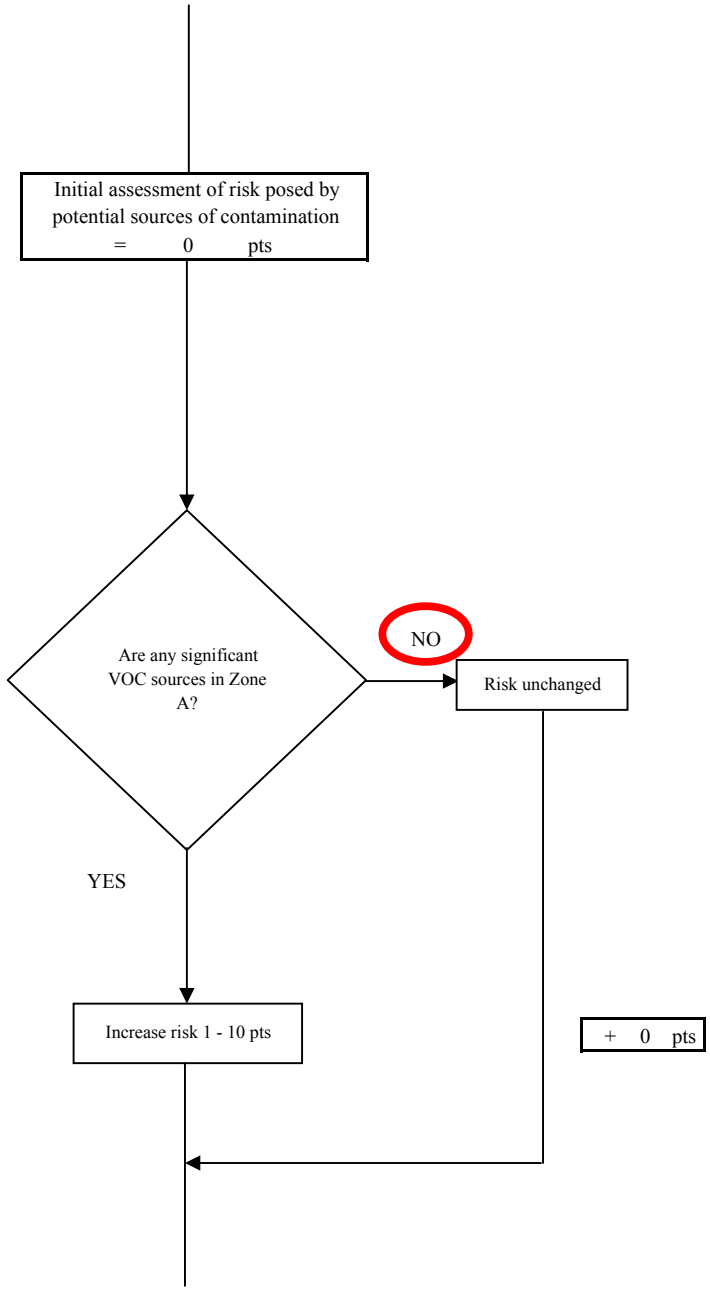
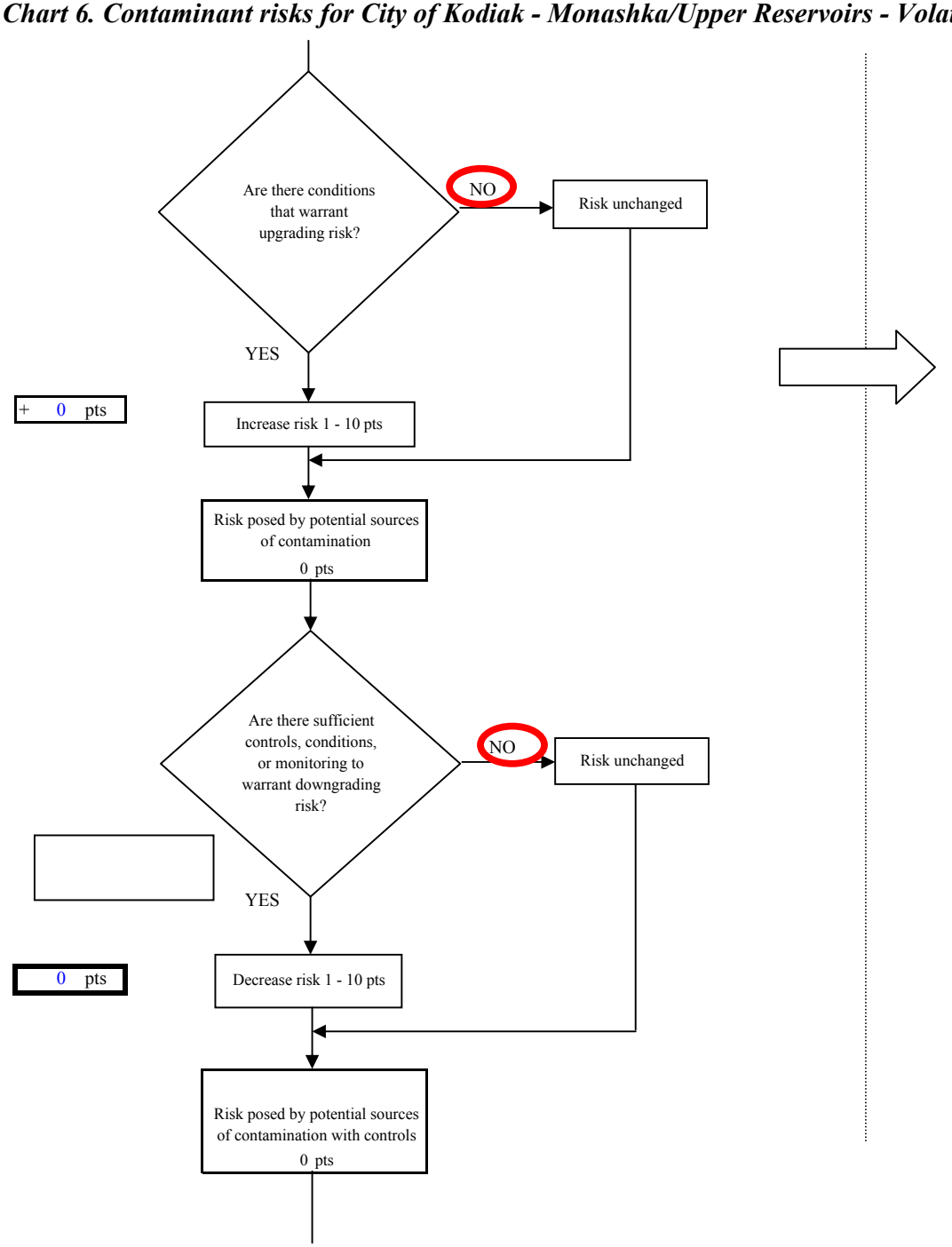
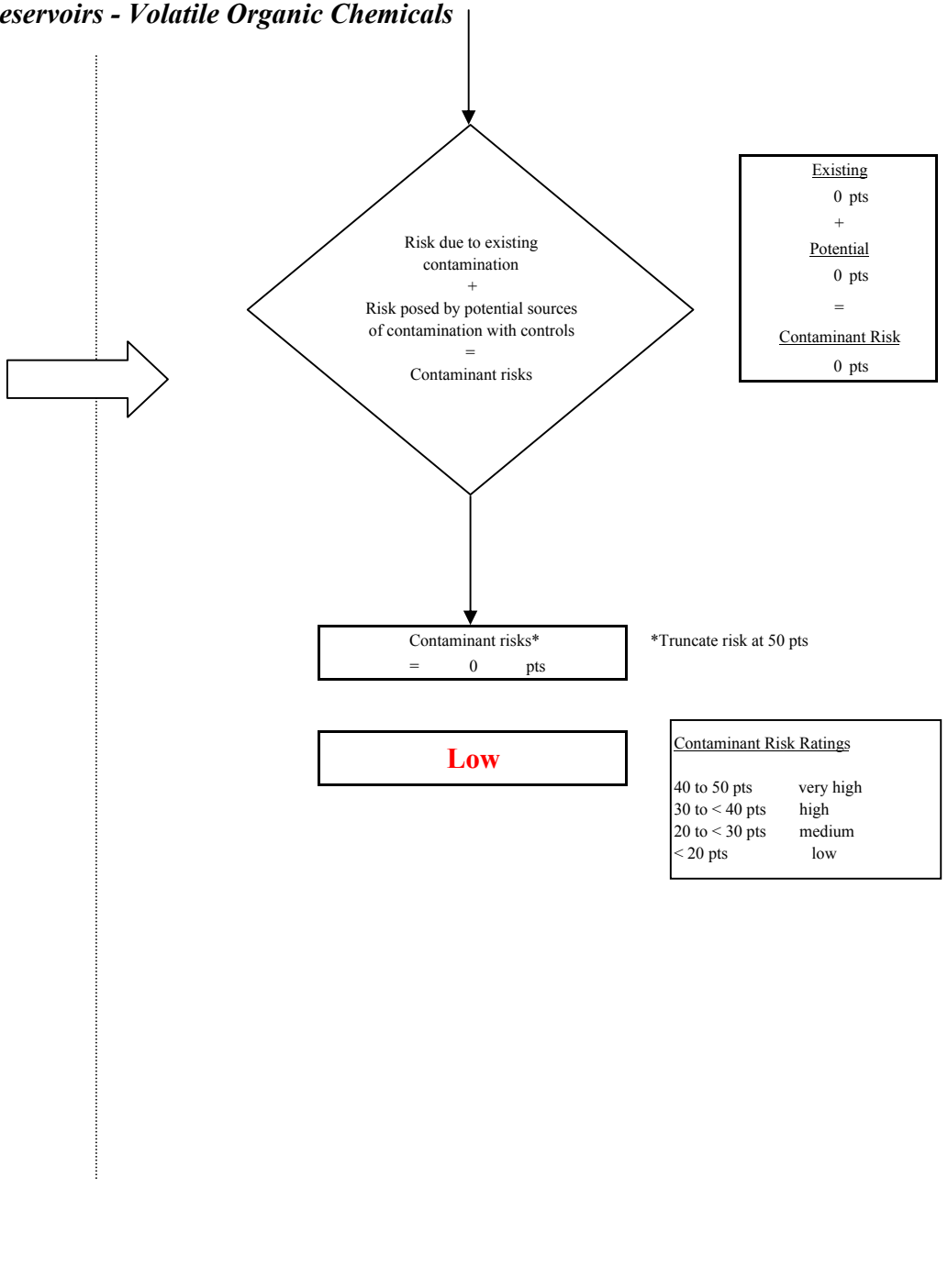


Chart 6. Contaminant risks for City of Kodiak - Monashka/Upper Reservoirs - Volatile Organic Chemicals





detect

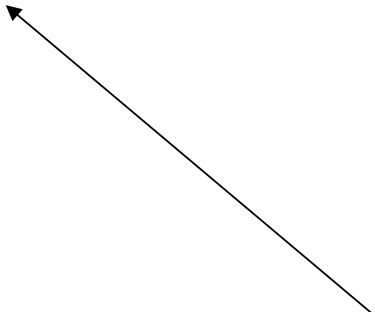
%

> MCL

List ~ past 5 years of sampling history. Divide most recent detect by MCL to get "Detected ???? Level %". This % is interpolated into points in the blue to the right of this page.

Need to move red circles to appropriate place. Formulas for calculating score are underneath the risk matrix.

Calculated by matrix shown in blue to the right.



Risk matrix to the right of this page calculates points assigned for highs and very highs in zone C. Can also add points for other conditions.

Extra liners in landfills, extra leak protection for fuel storage tanks etc.....

Chart 7. Vulnerability analysis for City of Kodiak - Monashka/Upper Reservoirs - Volatile Organic Chemicals

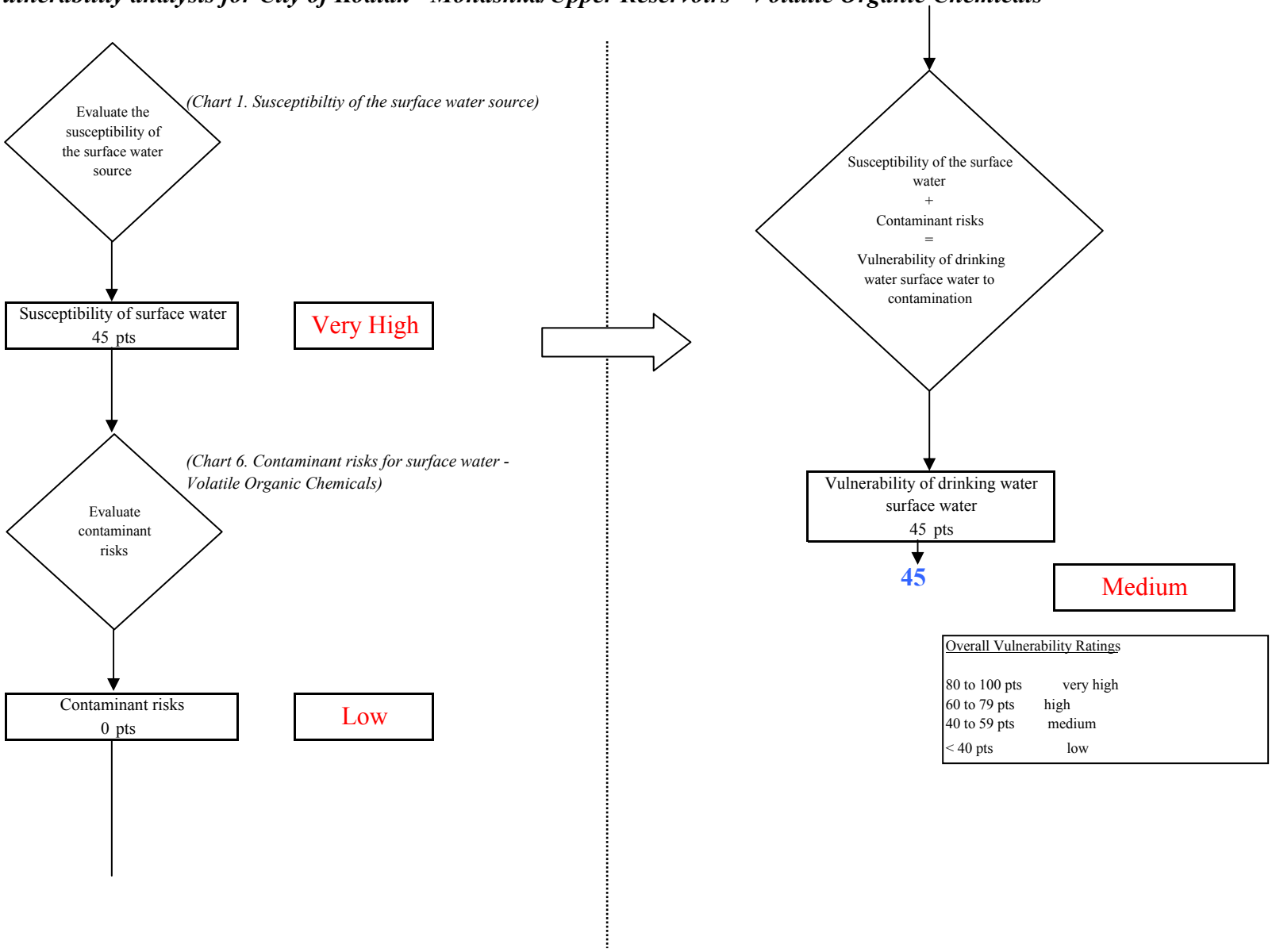


Chart 8. Contaminant risks for City of Kodiak - Monashka/Upper Reservoirs - Heavy Metals, Cyanide and Other Inorganic Chemicals

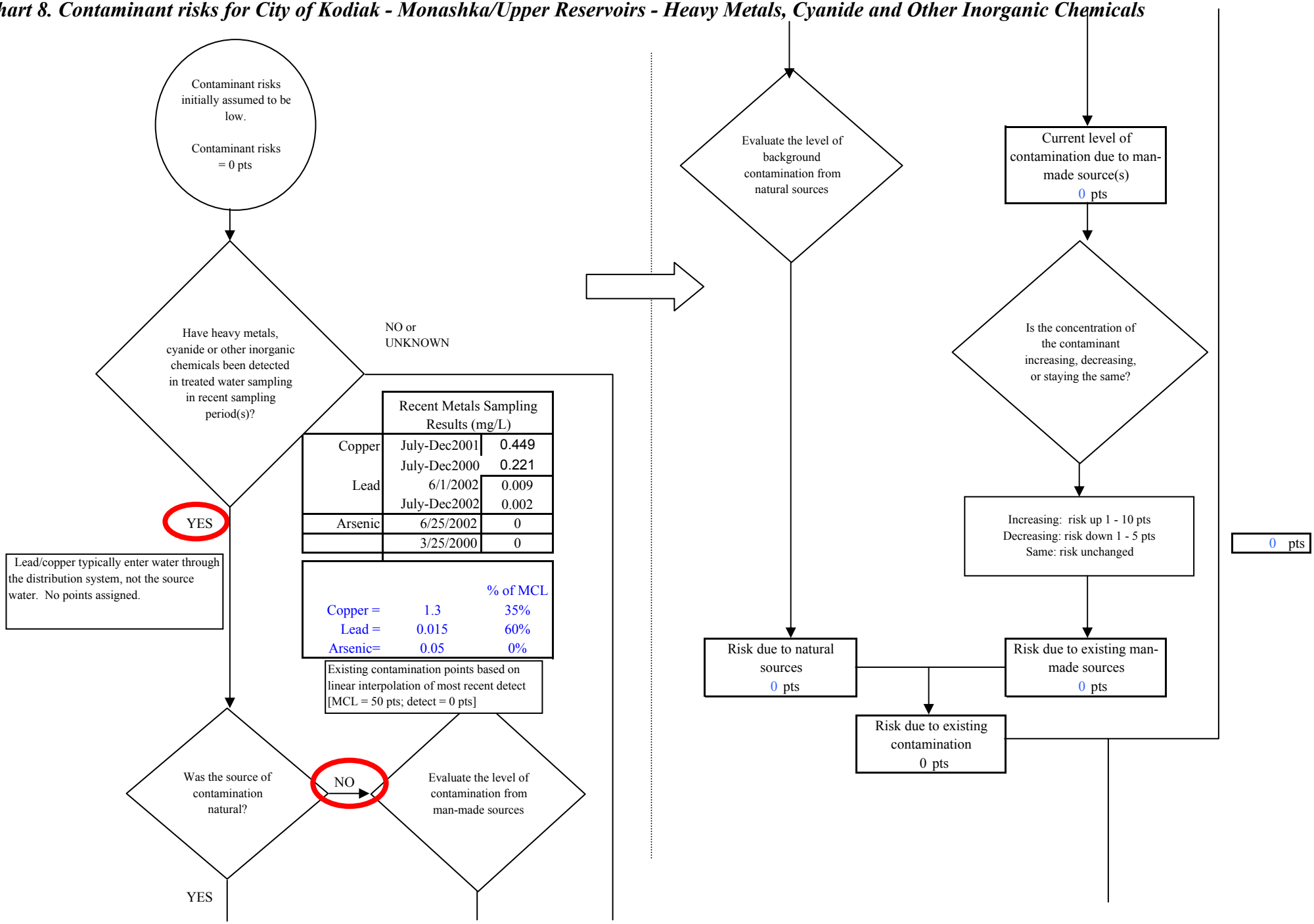


Chart 8. Contaminant risks for City of Kodiak - Monashka/Upper Reservoirs - Heavy Metals, Cyanide and Other Inorganic Chemicals

+ 0 pts

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

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.

Initial assessment of risk posed by potential sources of contamination = 0 pts

Are any significant HM, Cyanide, or OIC sources in Zone A?

NO

Risk unchanged

YES

Increase risk 1 - 10 pts

+ 0 pts

Chart 8. Contaminant risks for City of Kodiak - Monashka/Upper Reservoirs - Heavy Metals, Cyanide and Other Inorganic Chemicals

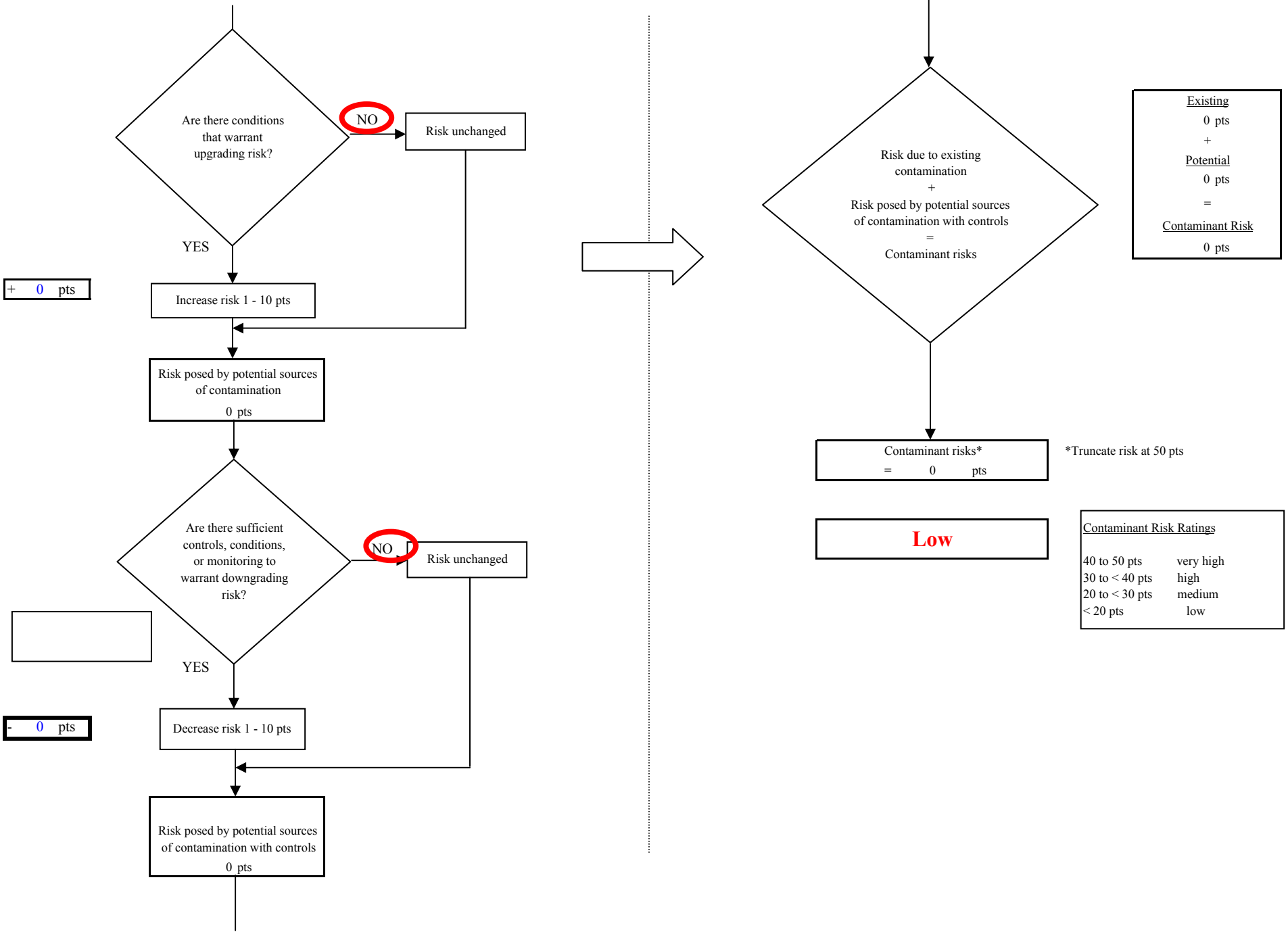


Chart 9. Vulnerability analysis for City of Kodiak - Monashka/Upper Reservoirs - Heavy Metals, Cyanide and Other Inorganic Chemicals

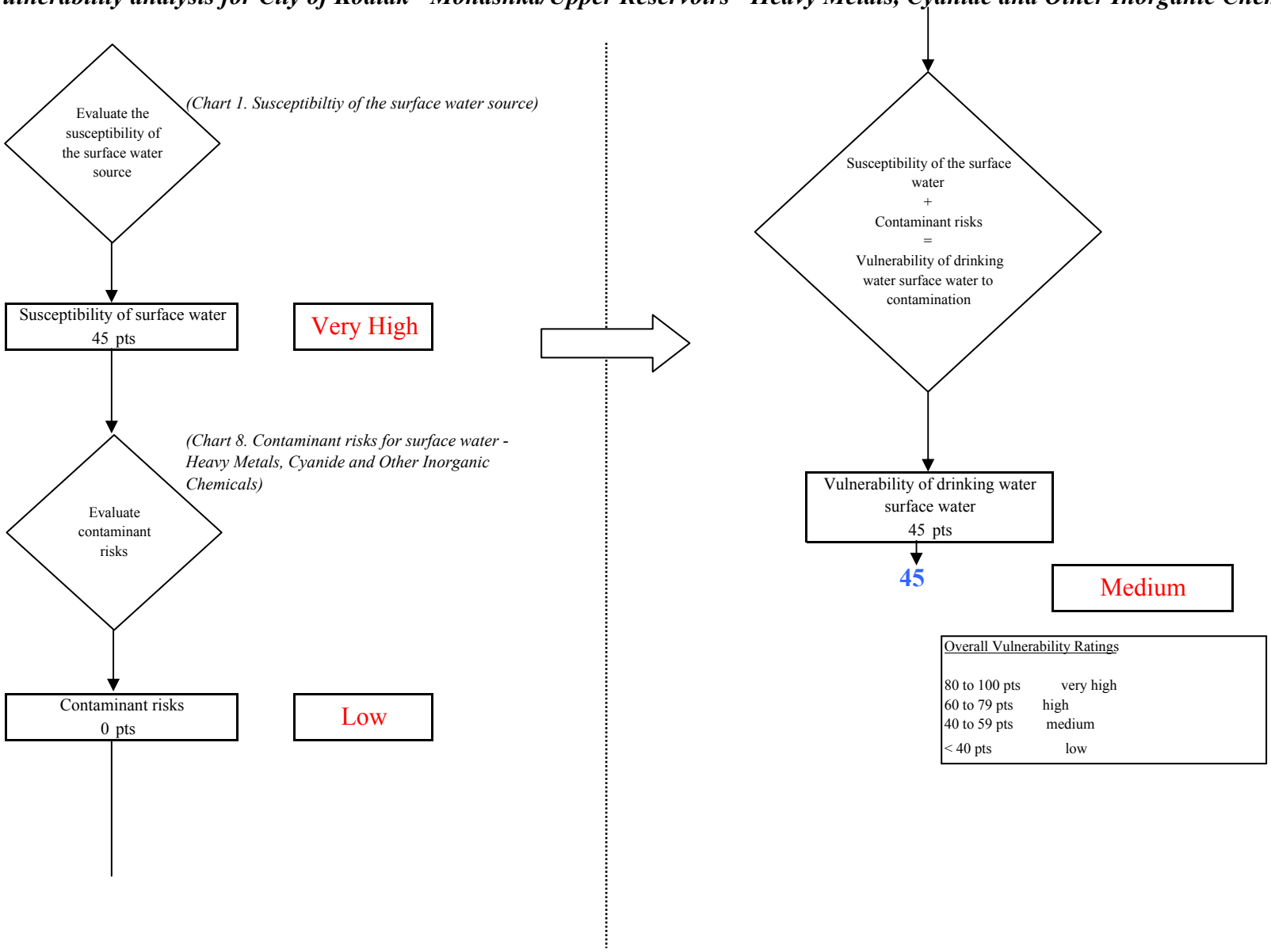


Chart 10. Contaminant risks for City of Kodiak - Monashka/Upper Reservoirs - Synthetic Organic Chemicals

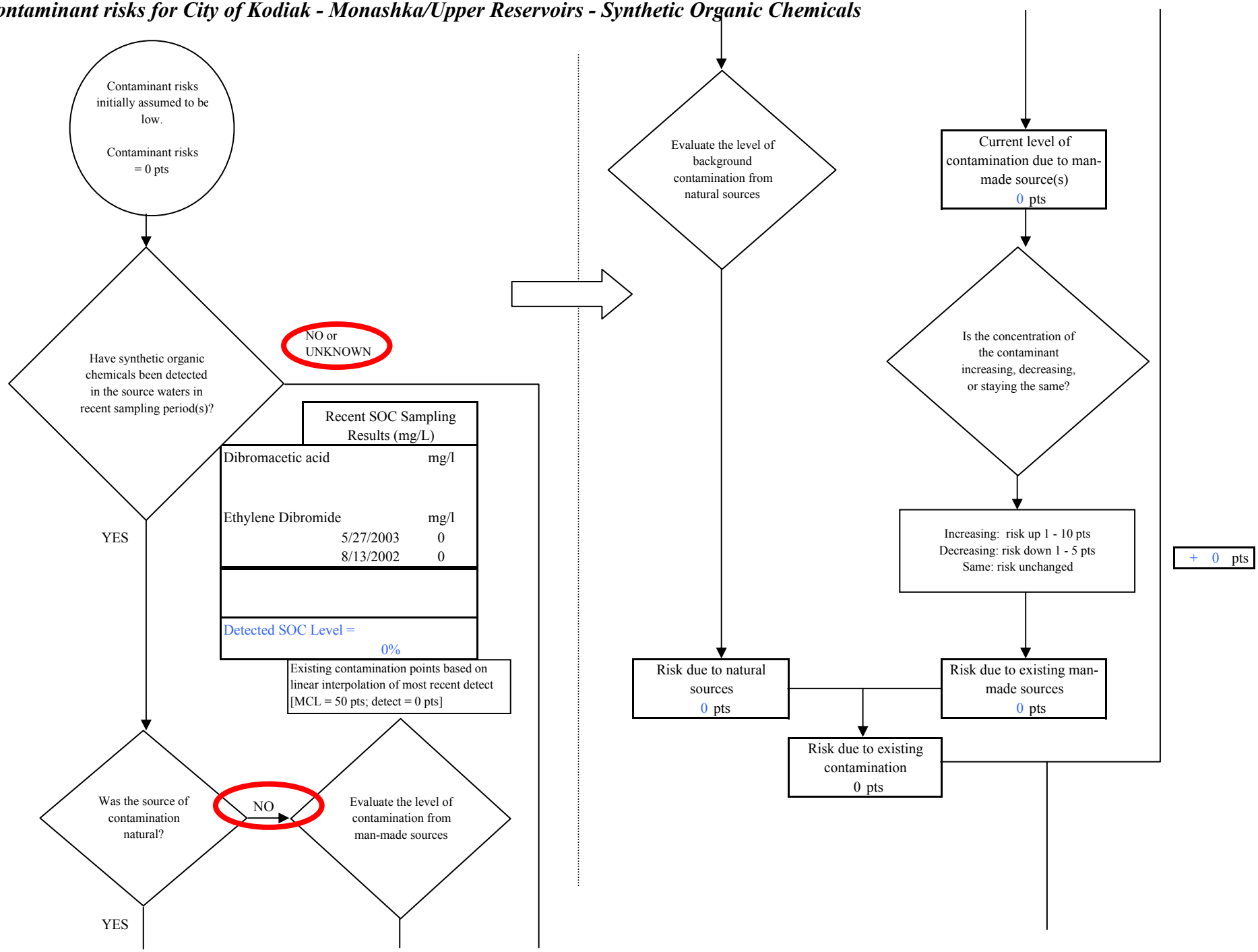


Chart 10. Contaminant risks for City of Kodiak - Monashka/Upper Reservoirs - Synthetic Organic Chemicals

+ 0 pts

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

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.

Initial assessment of risk posed by potential sources of contamination = 0 pts

Are any significant SOC sources in Zone A?

NO

Risk unchanged

YES

Increase risk 1 - 10 pts

+ 0 pts

Chart 10. Contaminant risks for City of Kodiak - Monashka/Upper Reservoirs - Synthetic Organic Chemicals

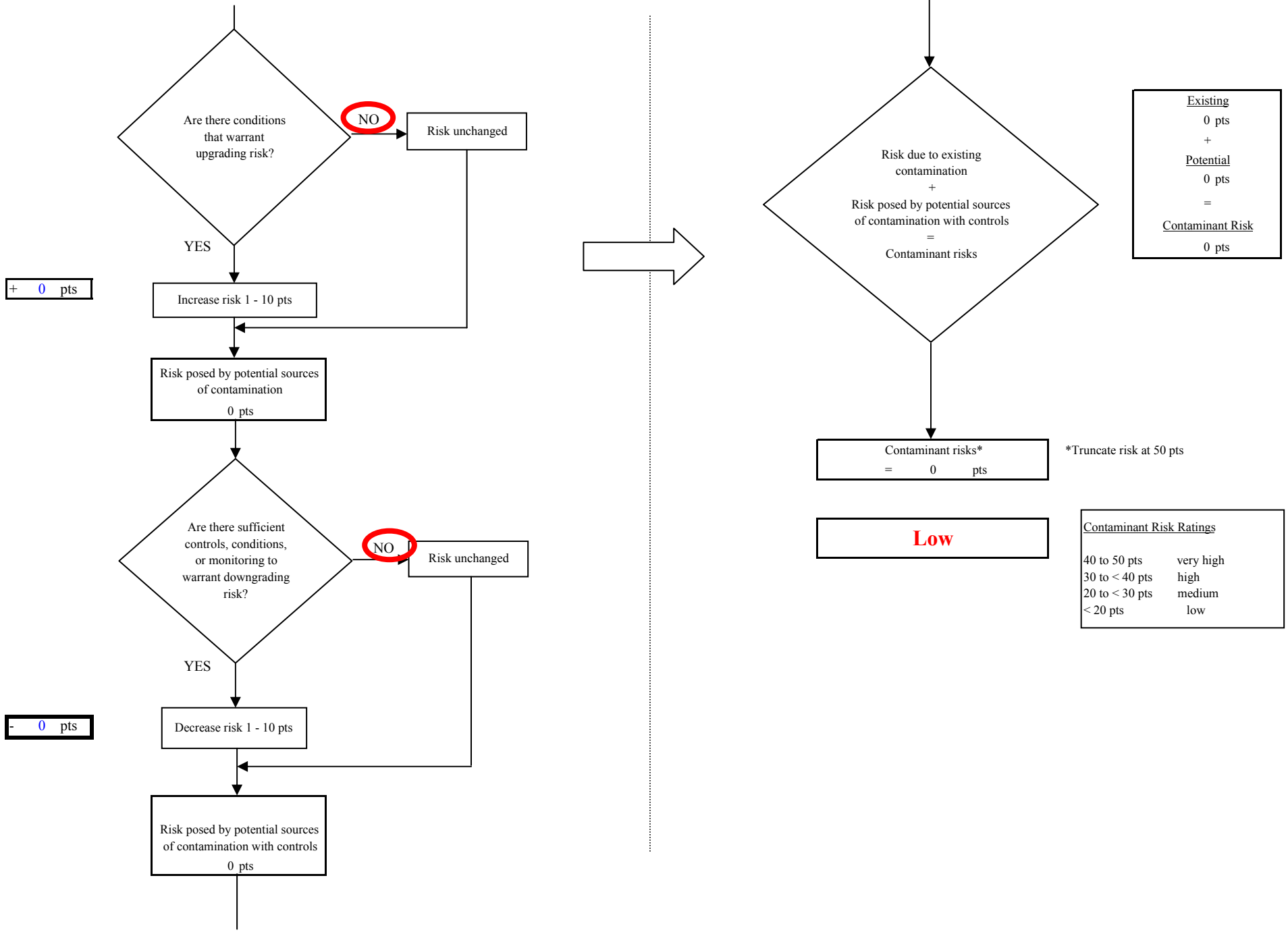


Chart 11. Vulnerability analysis for City of Kodiak - Monashka/Upper Reservoirs - Synthetic Organic Chemicals

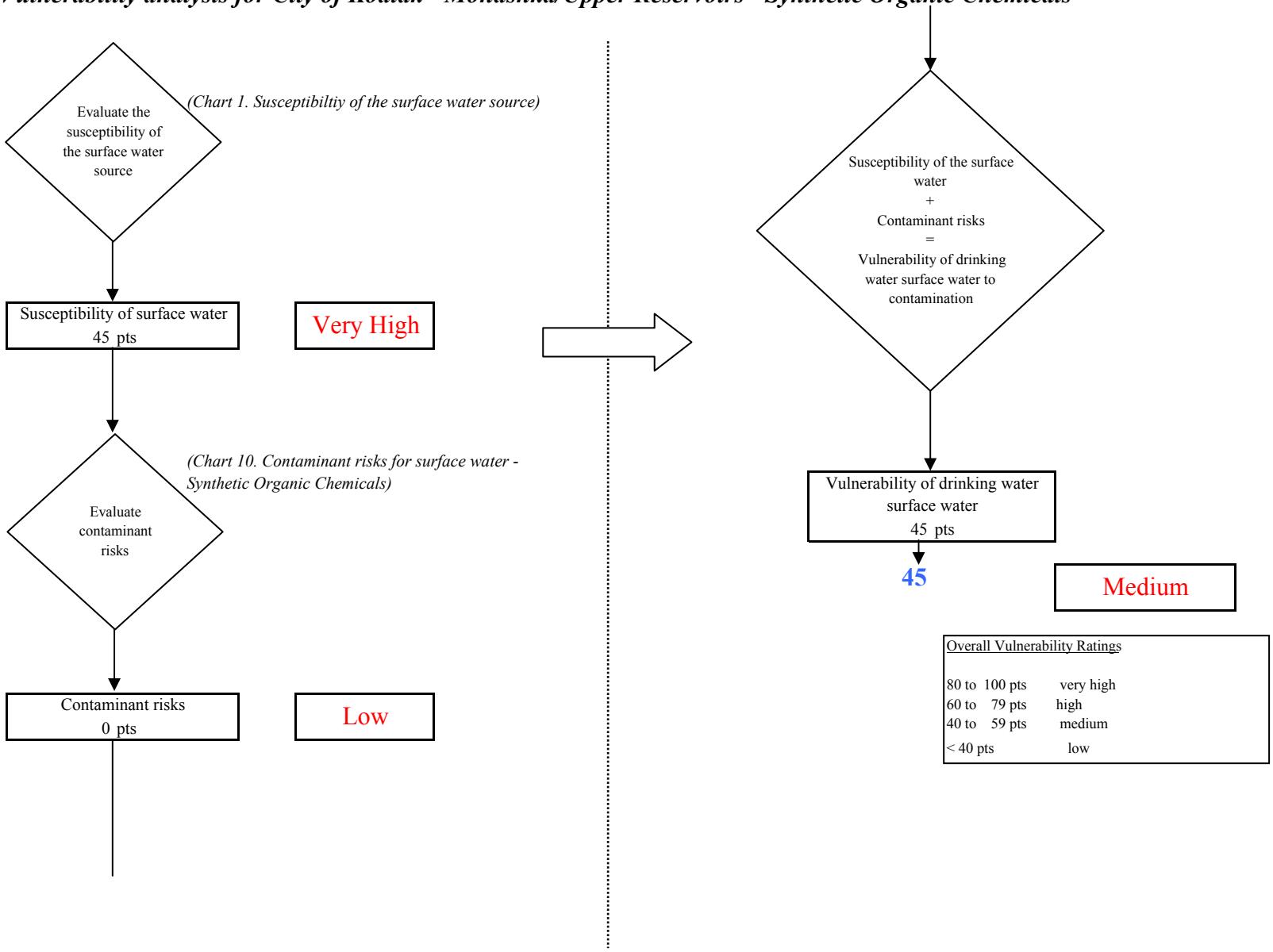


Chart 12. Contaminant risks for City of Kodiak - Monashka/Upper Reservoirs - Other Organic Chemicals

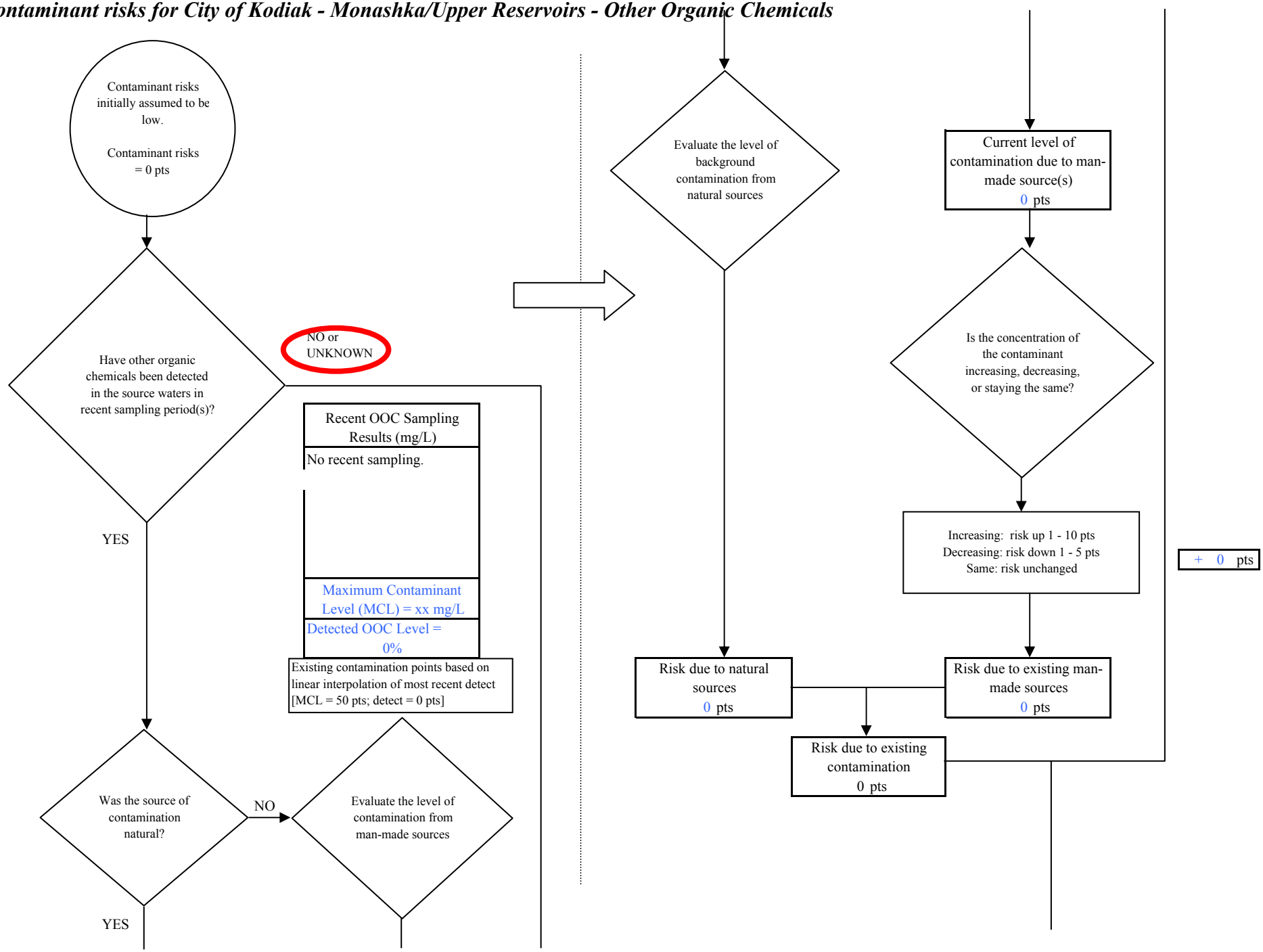
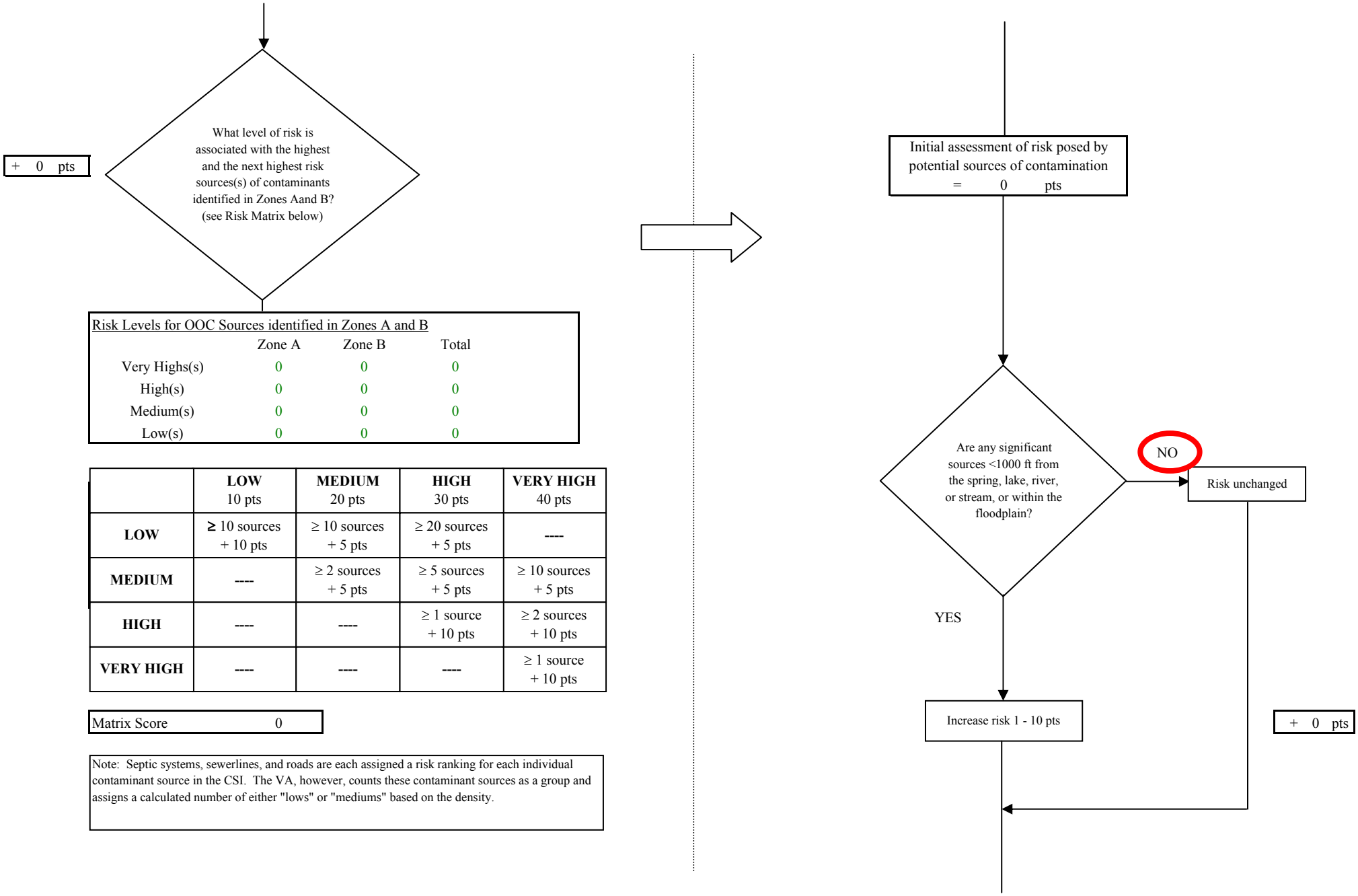


Chart 12. Contaminant risks for City of Kodiak - Monashka/Upper Reservoirs - Other Organic Chemicals



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 City of Kodiak - Monashka/Upper Reservoirs - Other Organic Chemicals

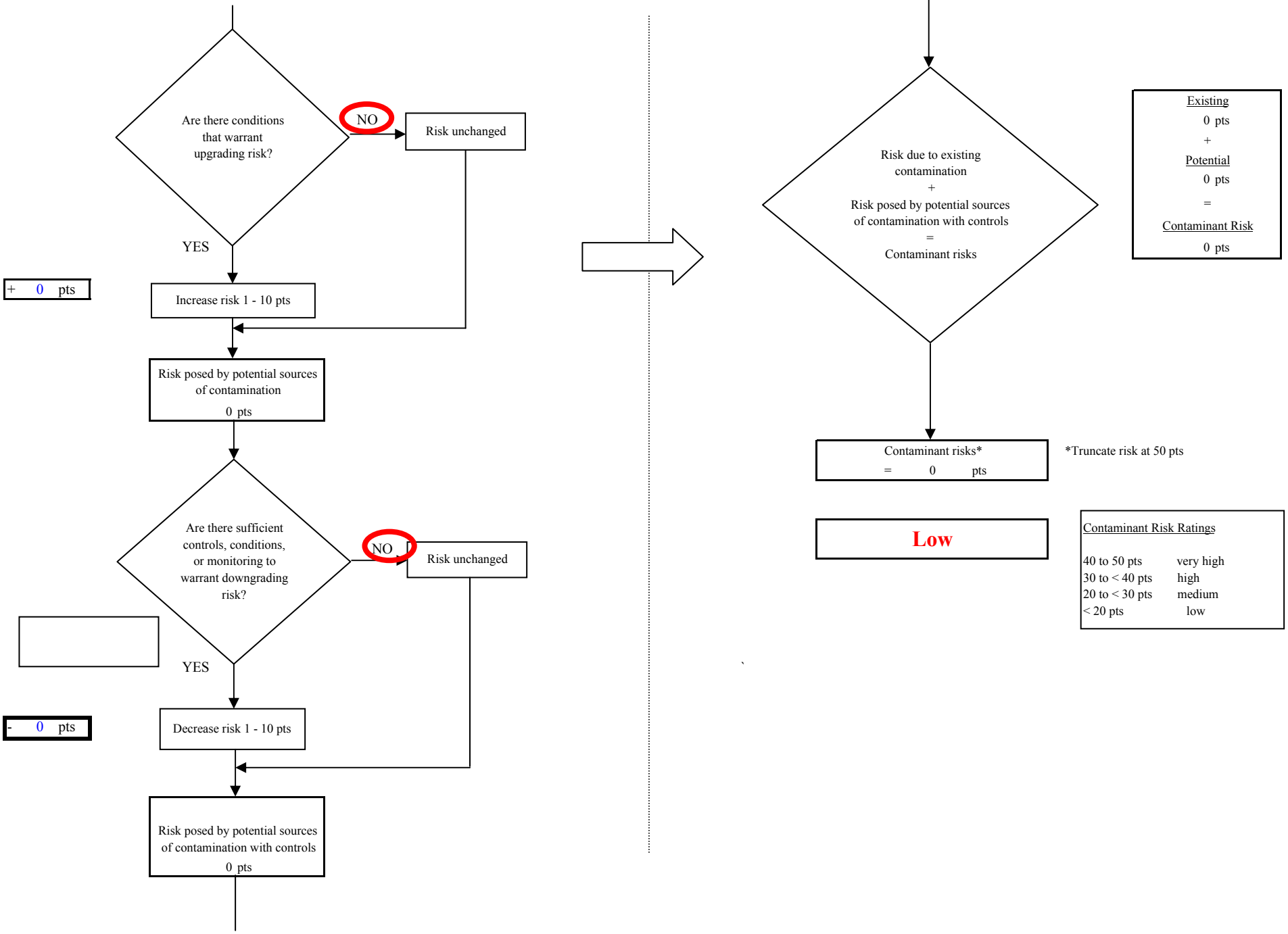


Chart 13. Vulnerability analysis for City of Kodiak - Monashka/Upper Reservoirs - Other Organic Chemicals