Source Water Assessment

A Hydrogeologic Susceptibility and Vulnerability Assessment for Kwigillingok Washeteria

Kwigillingok, Alaska

PWSID # 271700.001

January 2004

Drinking Water Protection Program Report #1138

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 (EPA), the 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 that 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 Kwigillingok Washeteria Drinking Water System, Kwigillingok, Alaska

Drinking Water Protection Program
Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

The public water system for the Kwigillingok washeteria is a Class A water system that obtains water from unnamed tundra ponds north of the village. Water is pumped twice a year from the lakes to the water treatment facility. Raw water is injected with polymer, filtered, chlorinated, and stored in a 212,000-gallon tank outside the water treatment facility.

The Kwigillingok washeteria protection area is approximately one-tenth of a square mile in size and has received a susceptibility rating of **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. The contaminant risks sources identified in the protection area for this public water system included dirt roads.

This evaluation included all available water sampling data submitted to the Alaska Department of Environmental Conservation (ADEC) by the system operator. As stated previously, the samples were collected from post-treated water. Vulnerability ratings for the water system have been determined by combining the susceptibility of the surface water source with the contaminant risks. The system received a vulnerability rating of **Medium** for four of the six contaminant categories: nitrates and/or nitrites, volatile organic chemicals, heavy metals, cyanide, and other inorganic chemicals, and other organic chemicals. Bacteria and viruses received a vulnerability rating of **Very High** and the remaining category, synthetic organic chemicals, was rated **Low**.

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 community of Kwigillingok to protect public health.

DRINKING WATER SYSTEM AND AREA OVERVIEW

Kwigillingok (Sec. 01, T004S, R081W, Seward Meridian), is located on the west bank of the Kuskokwim Bay near the mouth of the Kuskokwim River. This Yup'ik Eskimo community is located approximately 77 miles southwest of Bethel and 388 miles west of Anchorage in the lower Yukon-Kuskokwim (Y-K) delta area. Kwingillingok has a population of 337 (ADCED, 2003). Average annual precipitation is 22 inches, including approximately 43 inches of annual snowfall. Temperatures range from 41 to 57°F in summer to 6 to 24°F in winter.

The public water system is a Class A surface water system that operates during the summer months and stores water for use throughout the winter. The system obtains water from unnamed tundra ponds just north of the village. Water is pumped twice a year from the ponds to the water treatment facility. Raw water is injected with polymer, filtered, chlorinated, and stored in a 212,000-gallon tank outside the water treatment facility. The residents of Kwigillingok haul water from the washeteria to their homes and use honeybuckets for sewage disposal (ADCED, 2003).

Kwig Power Company provides electricity to the community and school. The facility is operated by the village council and fueled by diesel (ADCED, 2003). The village council also operates the local washeteria and landfill.

Information acquired from an October 1998 sanitary survey for the public water system indicated that the surface water intake is adequately constructed and is screened. Average daily production for the system is approximately 2,500 gallons.

Kwigillingok is located on the Yukon-Kuskokwim (Y-K) Delta. The Y-K Delta is located on the southwest coast of Alaska and primarily consists of lowlands formed by the deposition of fluvial sediment from the Yukon and Kuskokwim Rivers.

The Y-K Delta topography is relatively flat and approximately 40% to 50% of the delta surface is wet (Alaska Geographic Society). The lower delta area generally receives about 20 inches of precipitation annually. Areas of both discontinuous and continuous permafrost are present on the Y-K Delta. Permafrost is often present within 10 feet of ground surface and varies in thickness from 15 feet to 600 feet thick (R&M, 1979b). Thaw bulbs generally persist around areas of standing and flowing water.

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 pathways 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 10-11 of 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. 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 Kwigillingok Washeteria intake includes each of these Zones (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 Kwigillingok Washeteria 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.

No potential contaminant sources were identified in the Kwigillingok Washeteria protection area as displayed on Map C of Appendix C and 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.

As stated earlier, no potential contaminant sources were identified within the drinking water protection area for this public water system (Table 1 of Appendix B). Due to the lack of potential contaminant sources, no additional Tables were included in Appendix B detailing potential contaminant sources for each of the six categories of drinking water contaminants.

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	2	
Dilution Capacity	5	
Overall Susceptibility	***37***	***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. Kwigillingok Washeteria Contaminant Risks

Category	Score	Rating
Bacteria and Viruses	50	Very High
Nitrates and/or Nitrites	13	Low
Volatile Organic Chemicals	12	Low
Heavy Metals, Cyanide, and Other Inorganic Chemicals	12	Low
Synthetic Organic Chemicals	0	Low
Other Organic Chemicals	12	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. Kwigillingok Washeteria Overall Vulnerability

Category	Score	Rating
Bacteria and Viruses	85	Very High
Nitrates and Nitrites	50	Medium
Volatile Organic Chemicals	50	Medium
Heavy Metals, Cyanide, and Other Inorganic Chemicals	50	Medium
Synthetic Organic Chemicals	35	Low
Other Organic Chemicals	50	Medium

Bacteria and Viruses

The contaminant risk for bacteria and viruses is **Very High**. The contaminant risk for bacteria and viruses is primarily attributed to the presense of bacteria in recent sampling events.

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).

Positive bacteria counts were reported in recent (previous five years) sampling events, and were followed up with positive confirmation samples resulting in an increased susceptibility for this water source

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 remains **Very High**.

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). One potential contaminant risk source for nitrates was identified in the protection area for this public water system. The contaminate risk is primary attributed to the presence of roads in Zone A.

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).

Although low concentrations of nitrates have been reported in recent sampling history, none of the concentrations exceed the MCL of 10 mg/L.

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 **Low** (See Chart 6 – Contaminant Risks for Volatile Organic Chemicals in Appendix D). One potential contaminant source for volatile organic chemicals was identified in the protection area for this public water system. The contaminate risk is primary attributed to the presence of roads in Zone A.

Detectable concentrations of trihalomethane were reported in sampling events for this public water system. The concentrations of trihalomethanes

recorded in 1998 and 2000 exceeded the MCL of 0.08 mg/L by over 100%, however, the more recent concentrations recorded in 2001 and 2002 did not exceed the MCL. Trihalomethanes are considered byproducts of the water treatment process and are not attributed to the source waters. Since the reported concentration of trihalomethane in the most recent sampling did not exceed the applicable MCL, risk points were not retained.

Aside from being byproducts of the drinking water treatment process, possible sources of volatile organic chemicals include facilities with automobiles, residential areas, fuel tanks, 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 is **Medium**.

Heavy Metals, Cyanide, and Other Inorganic Chemicals

The contaminant risk for heavy metals is **Low**. One contaminant source for heavy metals, cyanide, and other inorganic chemicals was identified in the protection area for this public water system. The contaminate risk is primary attributed to the presence of roads in Zone A.

Based on review of recent sampling records for this public water system, low levels of copper have been detected. Although copper has been detected in recent sampling events, it has not exceeded the MCL of 1.3 mg/L (See Chart 8 – Contaminant Risks for Heavy Metals, Cyanide, and Other Inorganic Chemicals in Appendix D).

The reported concentration of copper in recent sampling events is not likely representative of source water conditions. The presence of this analyte is likely attributed to either the water treatment process or water distribution network; therefore, no risk points were assigned based on the presence of this analyte.

After combining the contaminant risk for heavy metals with the natural susceptibility of the source, the overall vulnerability of the water system to contamination is **Medium**.

Synthetic Organic Chemicals

The contaminant risk for synthetic organic chemicals is **Low**. No potential contaminant sources for synthetic organic chemicals were identified in the protection area for this public water system.

Review of historical sampling data found no recent sampling results for synthetic organic chemical contaminants.

After combining the contaminant risk with the natural susceptibility of the source, the overall vulnerability to synthetic organic chemicals of the source remains **Low** (See Chart 11 – Contaminant Risks for Synthetic Organic Chemicals in Appendix D).

Other Organic Chemicals

The contaminant risk for other organic chemicals is **Low**. One potential contaminant risk source for other organic chemicals was identified in the protection area. The contaminate risk is primary attributed to the presence of roads in Zone A.

Review of the historical sampling data found no recent sampling results for other organic chemicals.

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).

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 community of Kwigillingok 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

Alaska Geographic Society, 1979, The Yukon Kuskokwim Delta. Alaska Geographic, v. 6, no. 1, 95 p.

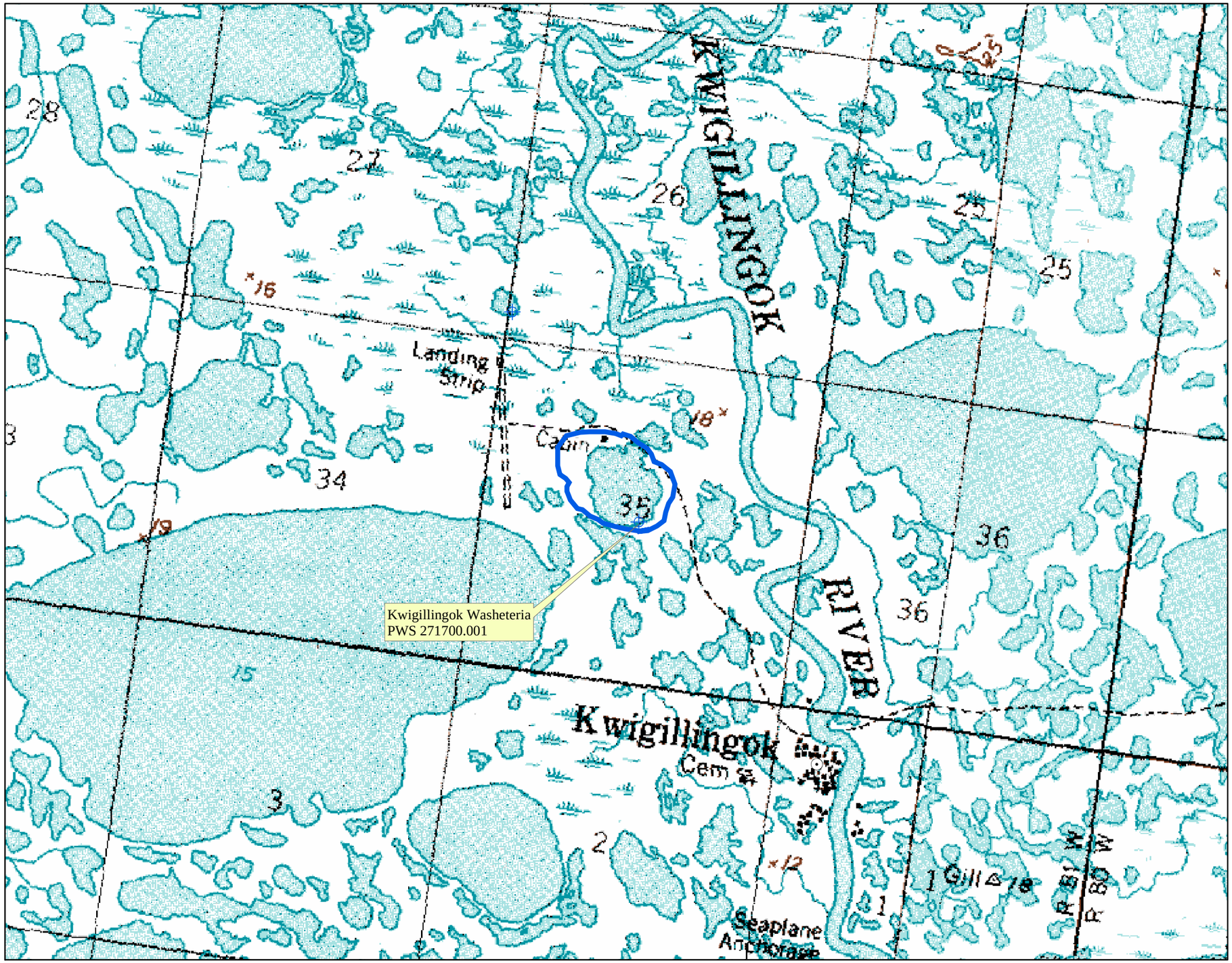
R&M Consultants, Inc., 1979b, Lower Kuskokwim School District School Site Investigation for Tununak, Alaska.

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

APPENDIX A

Drinking Water Protection Area Location Map
(Map A)

Public Water System for PWS #271700.001 Kwigillingok Washeteria



LEGEND

- Public Water System

Hydrography/Physical

- Parcels
- Stream
- Lake or Pond
- Contours (approx. 50 ft. or as indicated)

Transportation

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

Surface Water Protection Zones

- Zone C – 30 Miles from Surface Water or Watershed Boundary

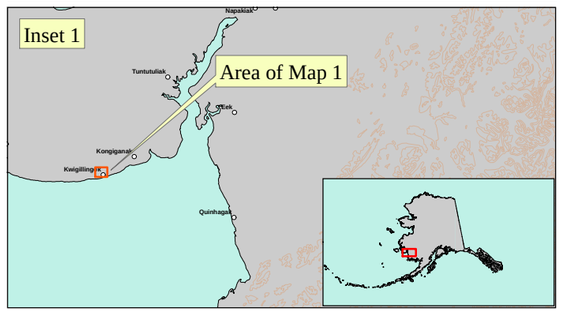
Data Sources:
Contaminant Sources, Public Water System Wells, Contours
Alaska Department of Environmental Conservation (ADEC)

Critical Facilities
Federal Emergency Management Agency (FEMA)

All other data
United States Geological Survey (USGS)

Drinking Water Protection Areas based on ADEC published document:
"Alaska Drinking Water Protection Progarm - Guidance Manual for Class A Public Water Systems"

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



0 0.15 0.3 0.6 0.9 1.2 Miles

APPENDIX B

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

Table 1

Contaminant Source Inventory for ***Kwigillingok Washteria***

PWSID 271700.001

Contaminant Source Type	***Contaminant Source ID***	***CS ID tag***	***Zone***	***Map Number***	***Comments***
Water supply wells	W09	W09-01	A	C	Kwigillingok Washeria
Highways and roads, dirt/gravel	X24	X24-01	A	C	Assumed 1-20 unpaved roads in Zone A

Table 2

Contaminant Source Inventory and Risk Ranking for Kwigillingok Washteria
Sources of Bacteria and Viruses

PWSID 271700.001

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Risk Ranking for Analysis	Map Number	Comments
Highways and roads, dirt/gravel	X24	X24-01	A	Low	C	Assumed 1-20 unpaved roads in Zone A

Table 3

Contaminant Source Inventory and Risk Ranking for Kwigillingok Washteria Sources of Nitrates/Nitrites

PWSID 271700.001

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Risk Ranking for Analysis	Map Number	Comments
Highways and roads, dirt/gravel	X24	X24-01	A	Low	C	Assumed 1-20 unpaved roads in Zone A

Table 4

Contaminant Source Inventory and Risk Ranking for Kwigillingok Washteria
Sources of Volatile Organic Chemicals

PWSID 271700.001

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Risk Ranking for Analysis	Map Number	Comments
Highways and roads, dirt/gravel	X24	X24-01	A	Low	C	Assumed 1-20 unpaved roads in Zone A

Table 5

Contaminant Source Inventory and Risk Ranking for Kwigillingok Washteria

Sources of Heavy Metals, Cyanide and Other Inorganic Chemicals

PWSID 271700.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Highways and roads, dirt/gravel	X24	X24-01	A	Low	C	Assumed 1-20 unpaved roads in Zone A

Table 6

Contaminant Source Inventory and Risk Ranking for Kwigillingok Washteria

Sources of Other Organic Chemicals

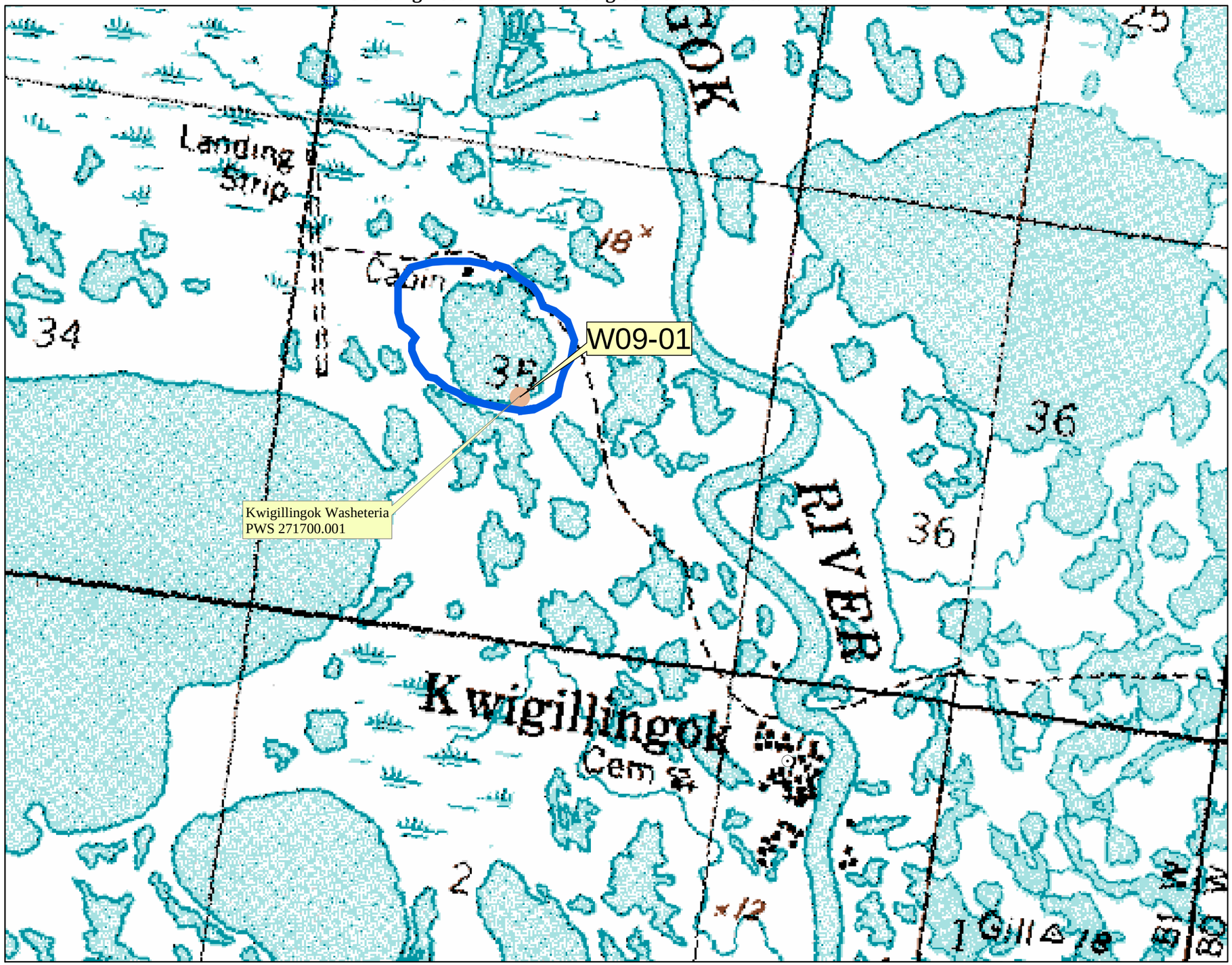
PWSID 271700.001

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Risk Ranking for Analysis	Map Number	Comments
Highways and roads, dirt/gravel	X24	X24-01	A	Low	C	Assumed 1-20 unpaved roads in Zone A

APPENDIX C

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

Public Water System for PWS #271700.001 Kwigillingok Washeteria
Showing Potential and Existing Sources of Contamination



LEGEND

Public Water System

Hydrography/Physical

Parcels
Stream
Lake or Pond
Contours (approx. 50 ft. or as indicated)

Transportation

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

Surface Water Protection Zones

Zone C – 30 Miles from Surface Water or Watershed Boundary

Existing or Potential Contaminant Sources

Reservoir/Water Supply (W09)

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

Critical Facilities
Federal Emergency Management Agency (FEMA)

All other data
United States Geological Survey (USGS)

Drinking Water Protection Areas based on ADEC published document:
"Alaska Drinking Water Protection Progarm - Guidance Manual for
Class A Public Water Systems"

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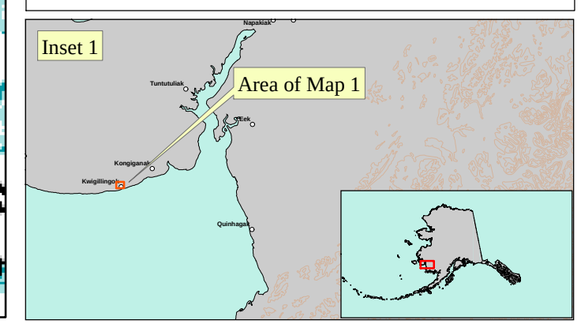

N
W E
S

0 0.1 0.2 0.4 0.6 0.8 Miles

Kwigillingok Washeteria PWS 271700.001
Appendix C Map C

APPENDIX D

Vulnerability Analysis and Contaminant Risks
(Charts 1-13)

Chart 1. Susceptibility of the Surface Water Source - Kwingillingok_Washteria (PWS No. 271700.001)

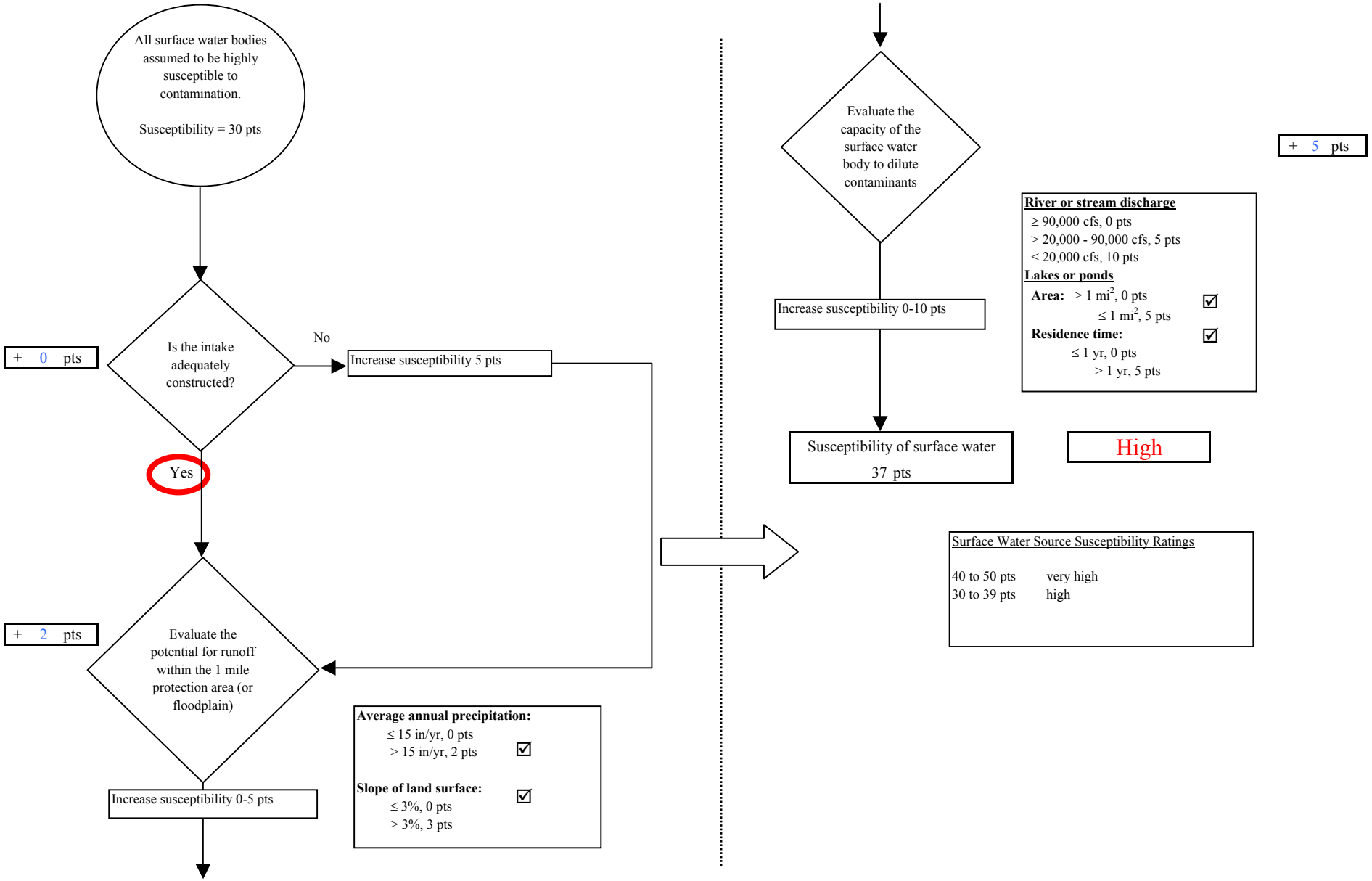

Chart 2. Contaminant risks for Kwingillingok_Washteria (PWS No. 271700.001) - Bacteria & Viruses

Contaminant risks initially assumed to be low.

Contaminant risks = 0 pts

Has there been a positive result for bacteria and viruses in recent sampling period(s)?

+ 50 pts

YES

Increase susceptibility 50 pts

Recent Bacteria Sampling Results	
1/23/2002	ND
1/3/2001	ND
8/11/2000	Positive
8/1/2000	Positive
1/3/2000	ND
1/4/1999	ND

Last positive coliform sample: 8/1/2000
Confirmation sample 8/11/2000

NO

What level of risk is associated with the highest and the next highest risk source(s) of contaminants identified in Zone A (or floodplain)?

+ 10 pts

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 Kwingillingok_Washteria (PWS No. 271700.001) - Bacteria & Viruses

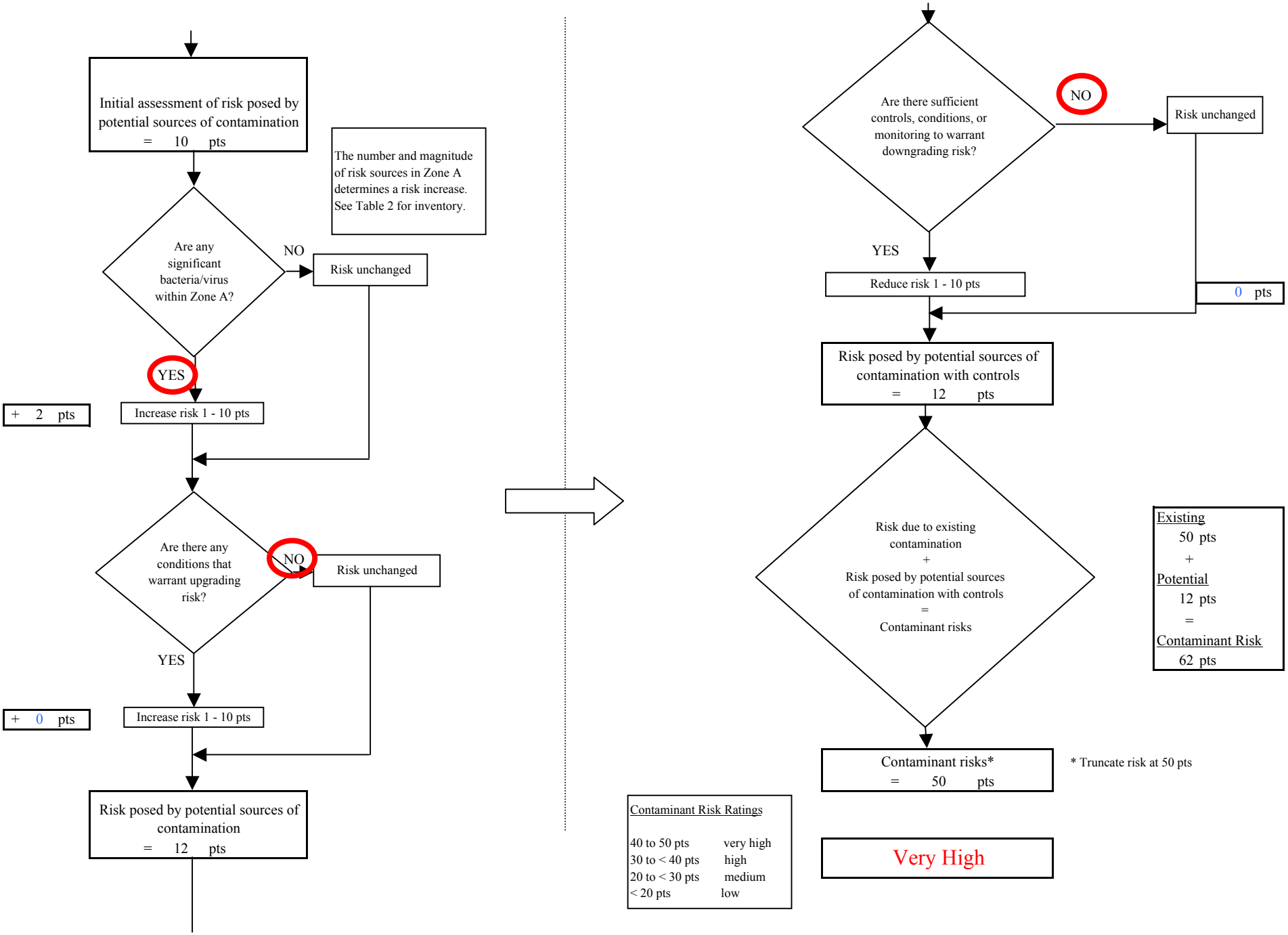

Chart 3. Vulnerability analysis for Kwingillingok_Washteria (PWS No. 271700.001) - Bacteria & Viruses

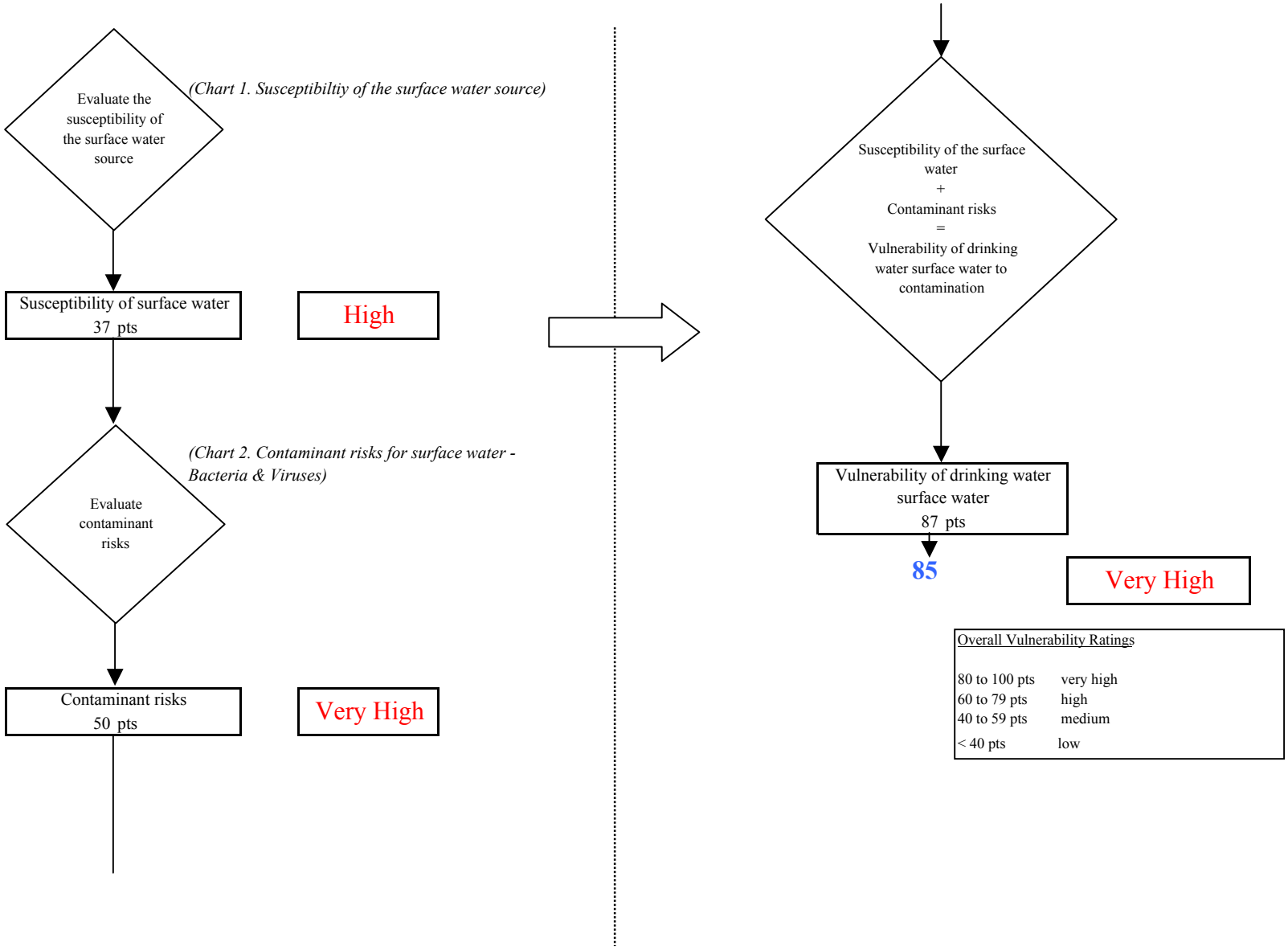

Chart 4. Contaminant risks for Kwingillingok_Washteria (PWS No. 271700.001) - Nitrates and Nitrites

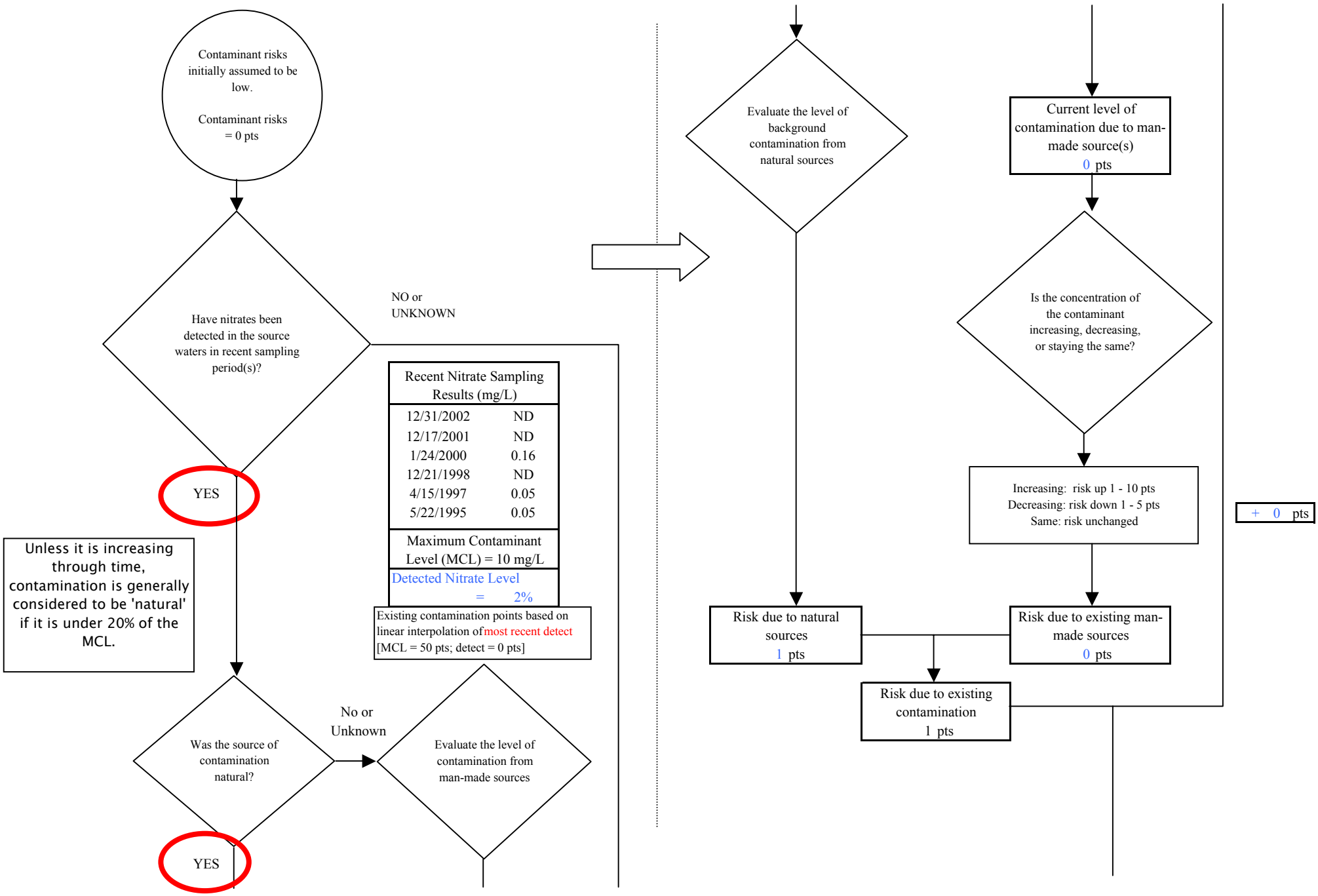

Chart 4. Contaminant risks for Kwingillingok_Washteria (PWS No. 271700.001) - Nitrates and Nitrites

+ 10 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)	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.

Initial assessment of risk posed by potential sources of contamination = 10 pts

Are any significant nitrate/nitrite sources in Zone A?

NO → Risk unchanged

YES

The number and magnitude of risk sources in Zone A determines a risk increase. See Table 3 for inventory.

Increase risk 1 - 10 pts

+ 2 pts

Chart 4. Contaminant risks for Kwingillingok_Washteria (PWS No. 271700.001) - Nitrates and Nitrites

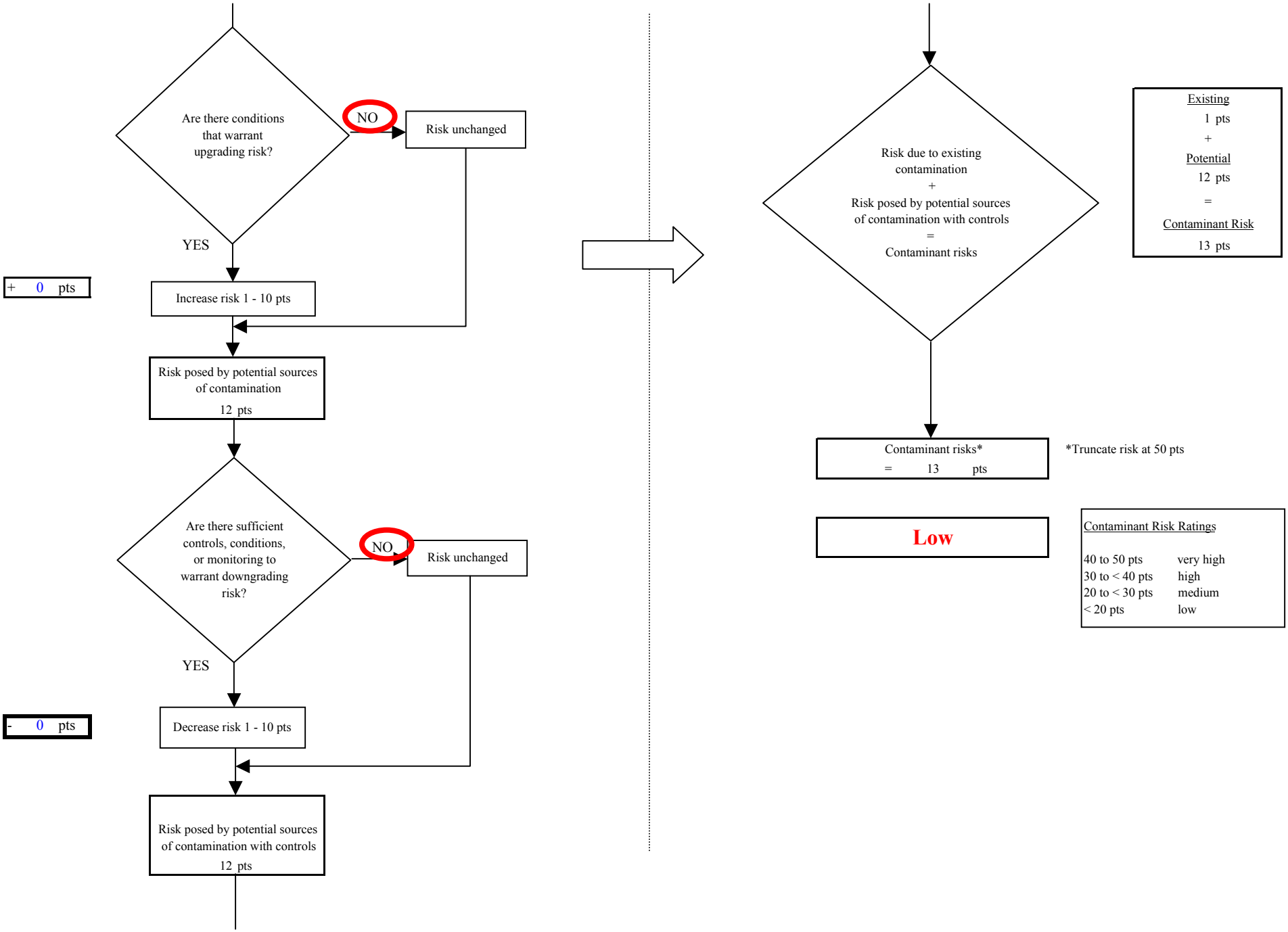

Chart 5. Vulnerability analysis for Kwingillingok_Washteria (PWS No. 271700.001) - Nitrates and Nitrites

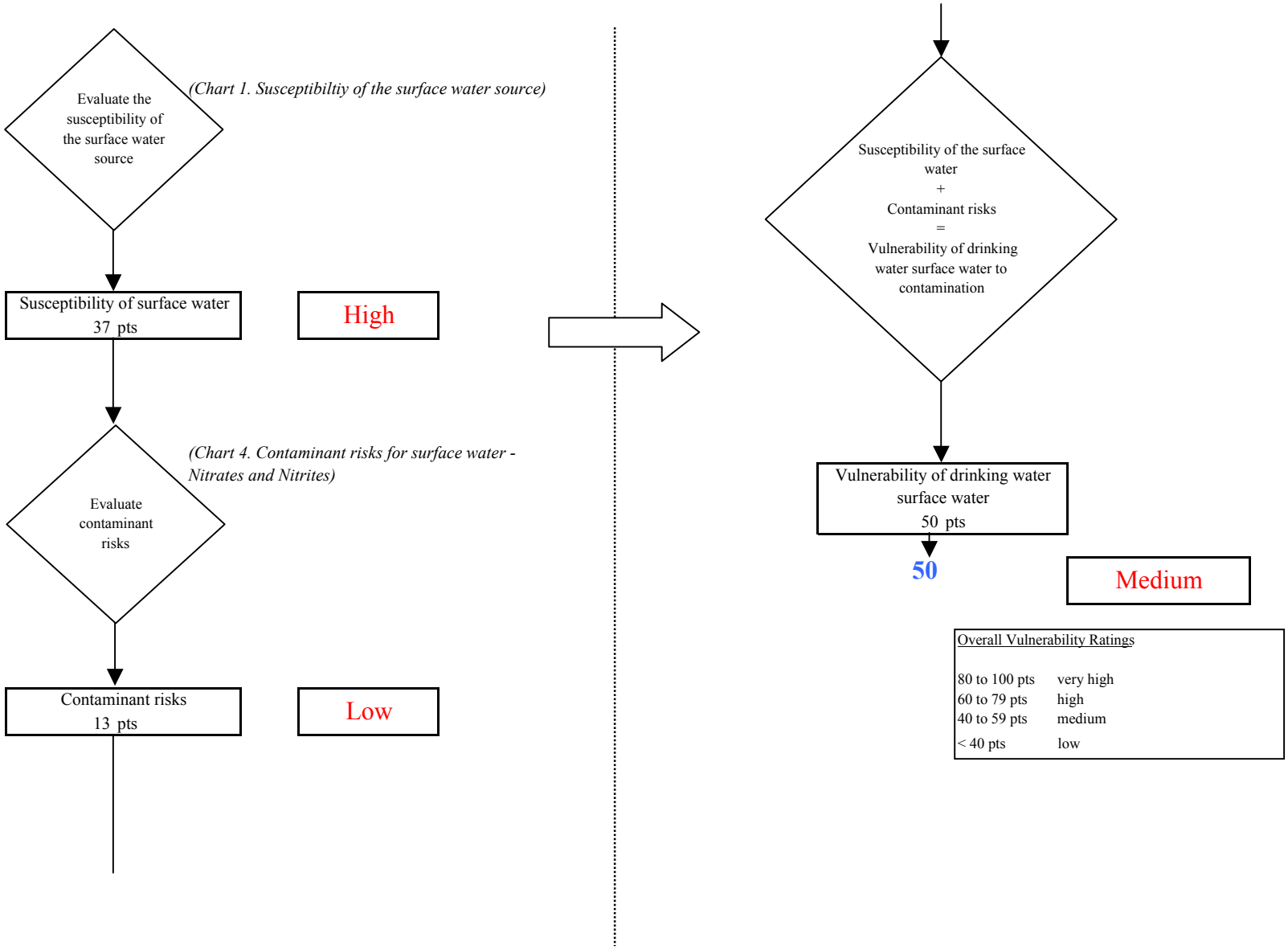

Chart 6. Contaminant risks for Kwingillingok_Washteria (PWS No. 271700.001) - Volatile Organic Chemicals

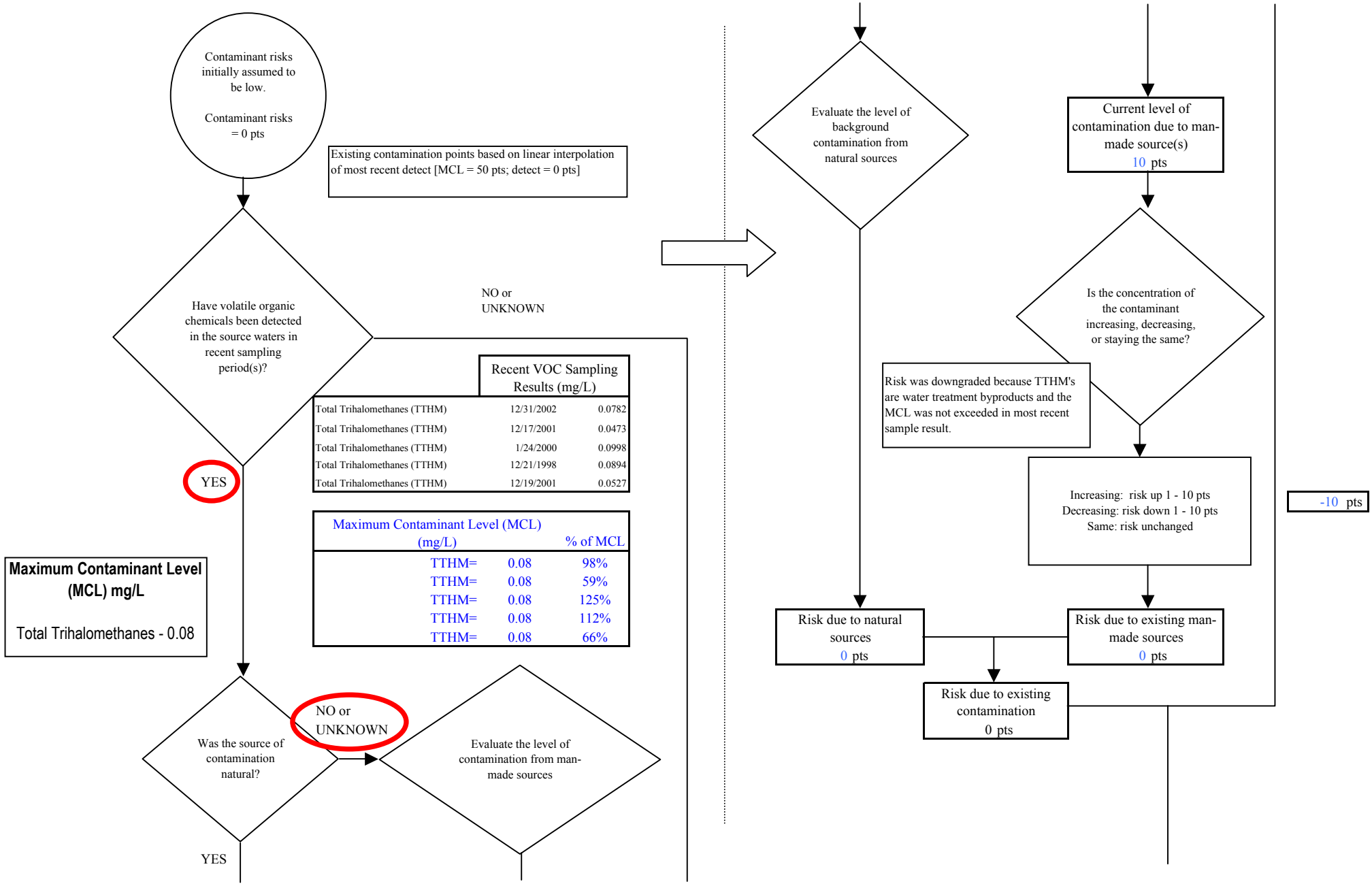

Chart 6. Contaminant risks for Kwingillingok_Washteria (PWS No. 271700.001) - Volatile Organic Chemicals

+ 10 pts

What level of risk is associated with the highest and the next highest risk sources(s) of contaminants identified in Zones A 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)	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.

Initial assessment of risk posed by potential sources of contamination = 10 pts

Are any significant VOC sources in Zone A?

NO → Risk unchanged

The number and magnitude of risk sources in Zone A determines a risk increase. See Table 4 for inventory.

+ 2 pts

YES → Increase risk 1 - 10 pts

Chart 6. Contaminant risks for Kwingillingok_Washteria (PWS No. 271700.001) - Volatile Organic Chemicals

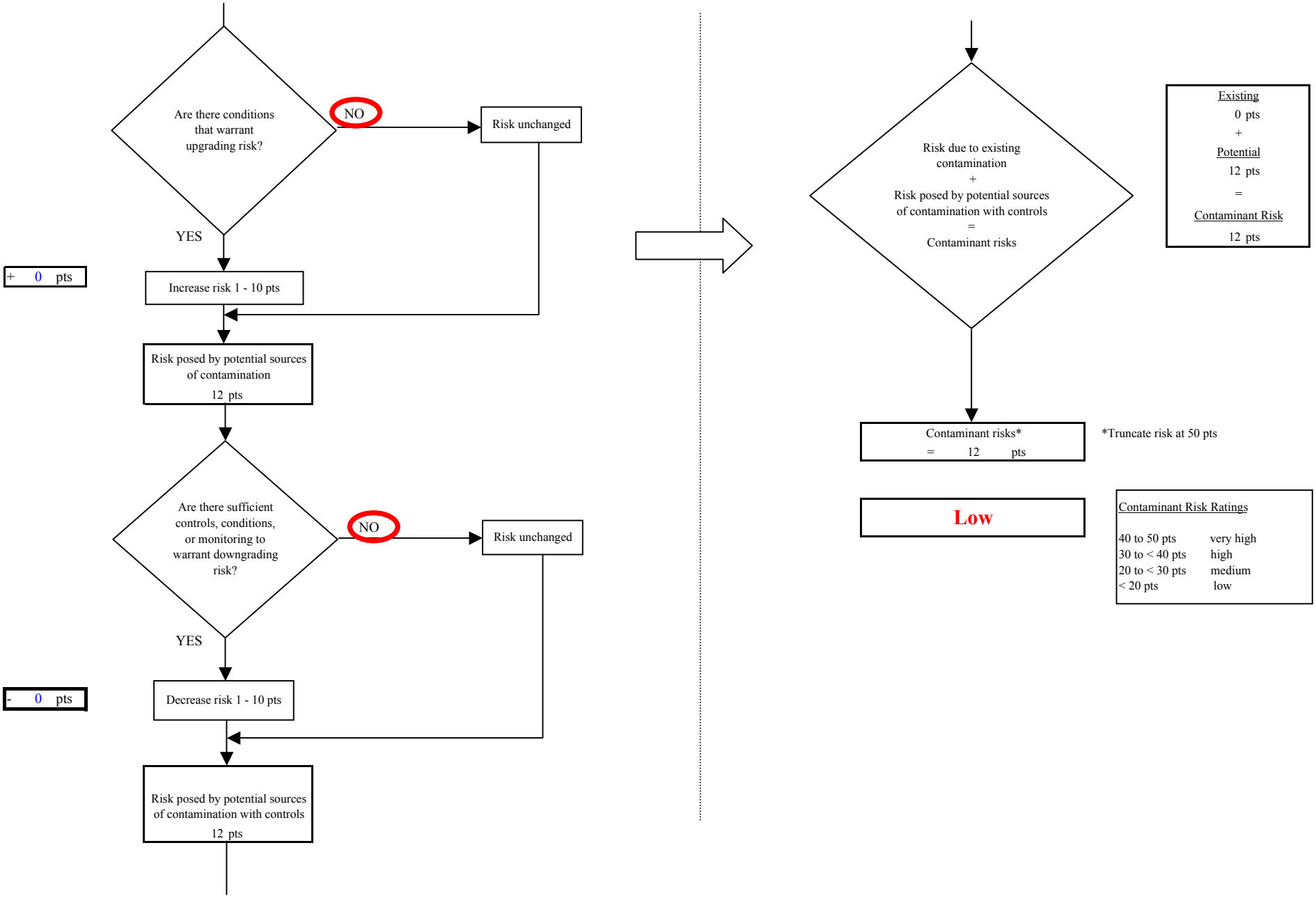

Chart 7. Vulnerability analysis for Kwingillingok_Washteria (PWS No. 271700.001) - Volatile Organic Chemicals

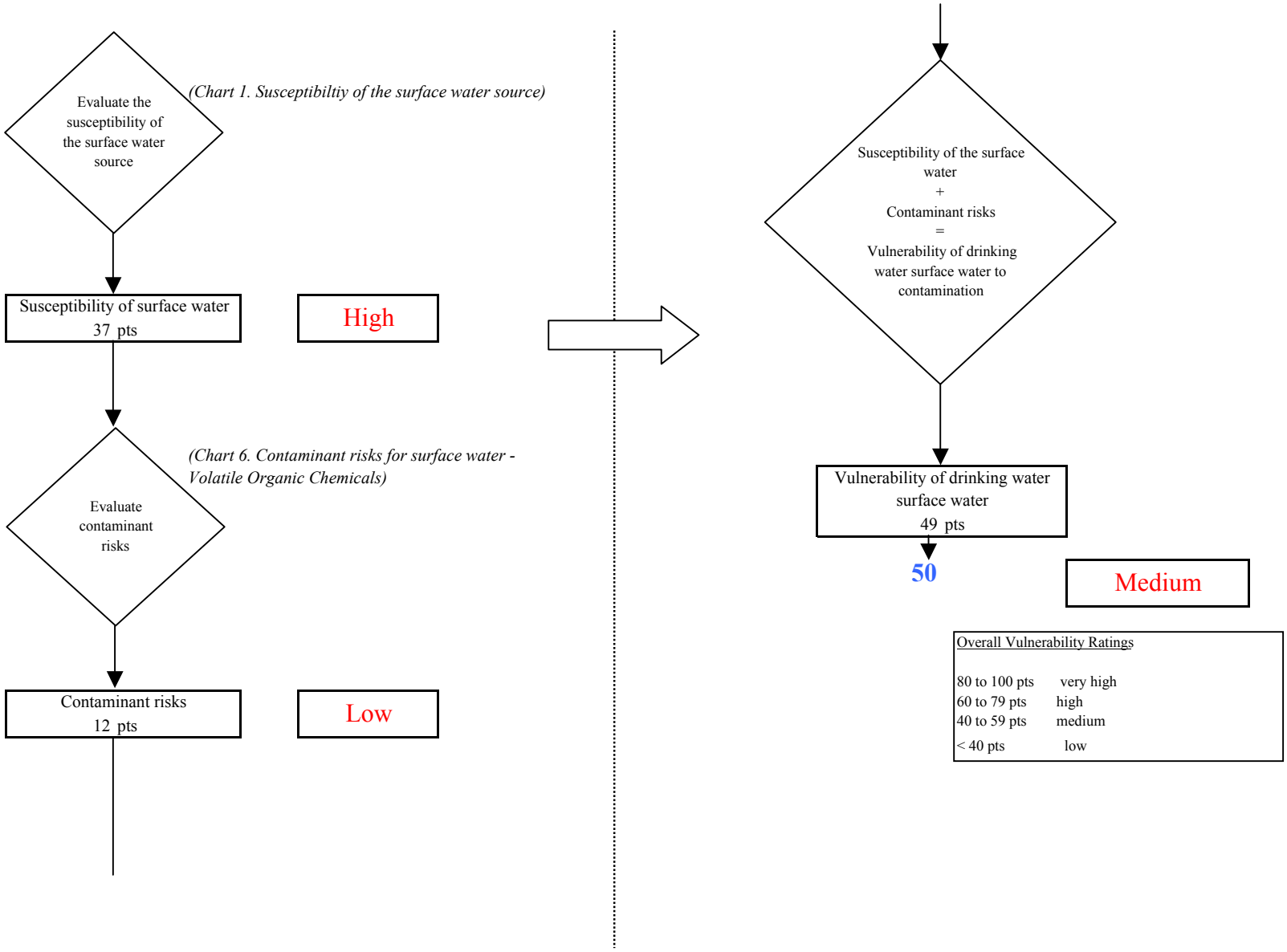

Chart 8. Contaminant risks for Kwingillingok_Washteria (PWS No. 271700.001) - Heavy Metals, Cyanide and Other Inorganic Chemicals

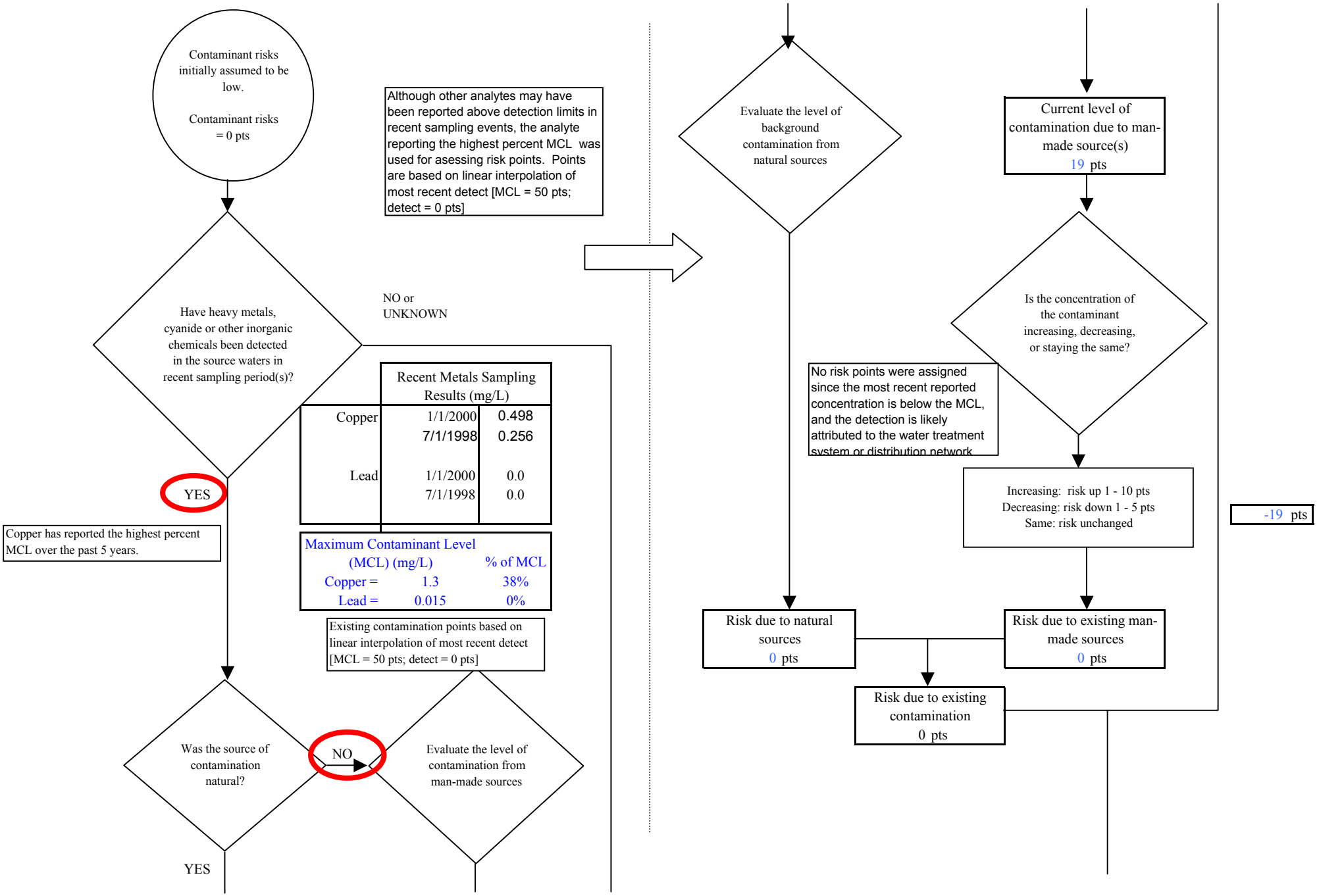

Chart 8. Contaminant risks for Kwingillingok_Washteria (PWS No. 271700.001) - Heavy Metals, Cyanide and Other Inorganic Chemicals

+ 10 pts

What level of risk is associated with the highest and the next highest risk sources(s) of contaminants identified in Zones A 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)	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.

Initial assessment of risk posed by potential sources of contamination = 10 pts

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

NO → Risk unchanged

The number and magnitude of risk sources in Zone A determines a risk increase. See Table 5 for inventory.

+ 2 pts

YES

Increase risk 1 - 10 pts

Chart 8. Contaminant risks for Kwingillingok_Washteria (PWS No. 271700.001) - Heavy Metals, Cyanide and Other Inorganic Chemicals

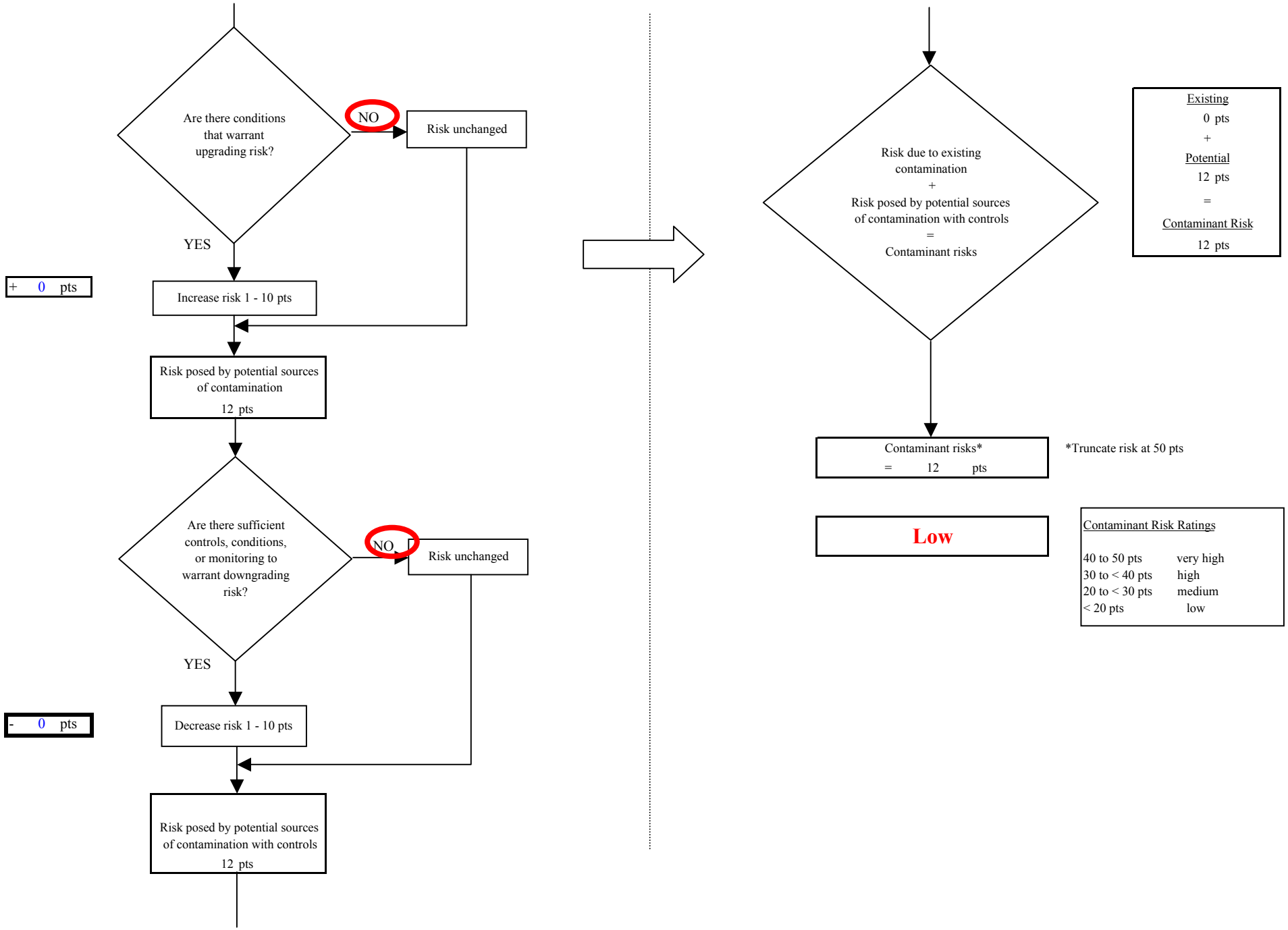

Chart 9. Vulnerability analysis for Kwingillingok_Washteria (PWS No. 271700.001) - Heavy Metals, Cyanide and Other Inorganic Chemicals

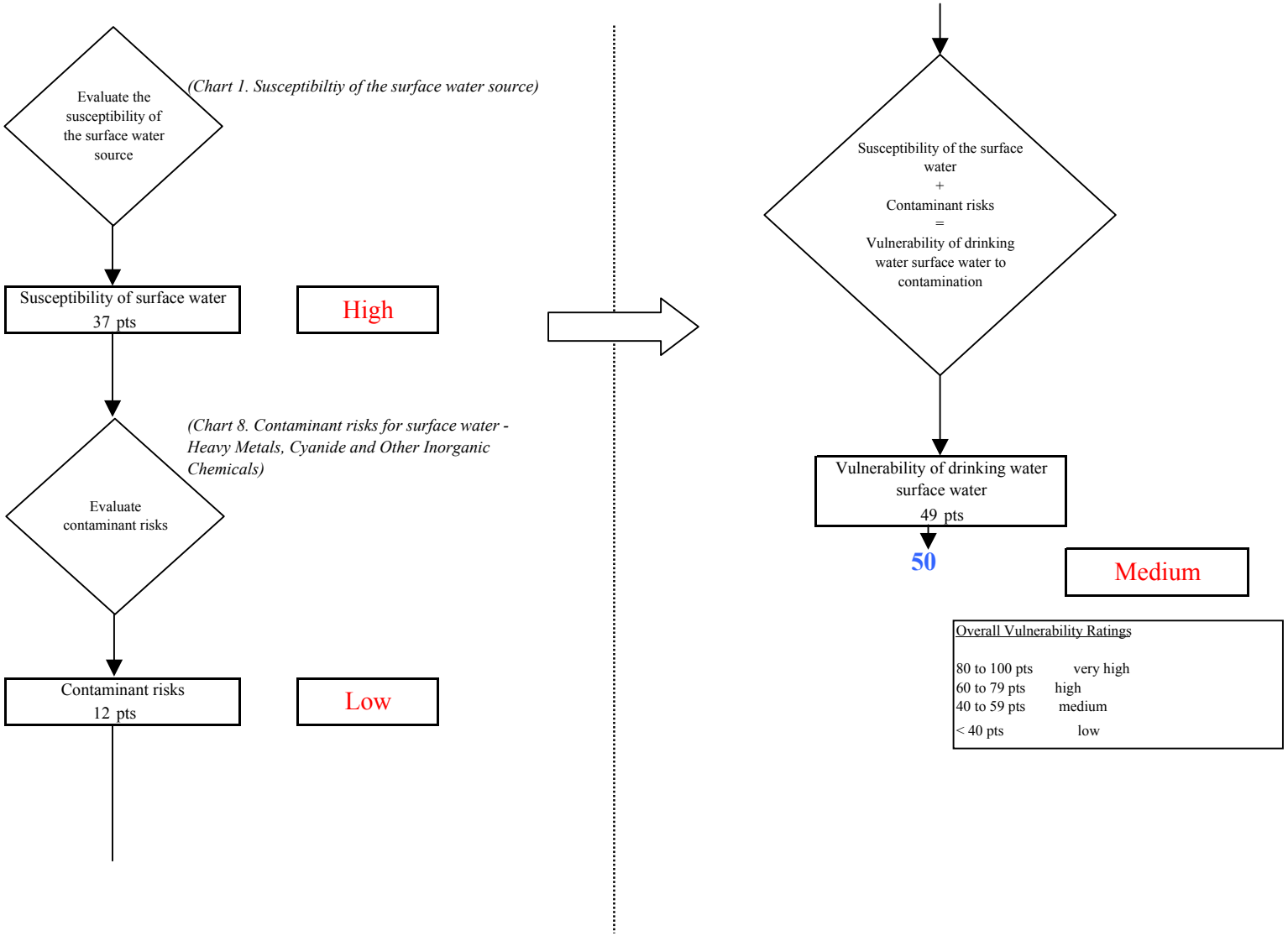

Chart 10. Contaminant risks for Kwingillingok_Washteria (PWS No. 271700.001) - Synthetic Organic Chemicals

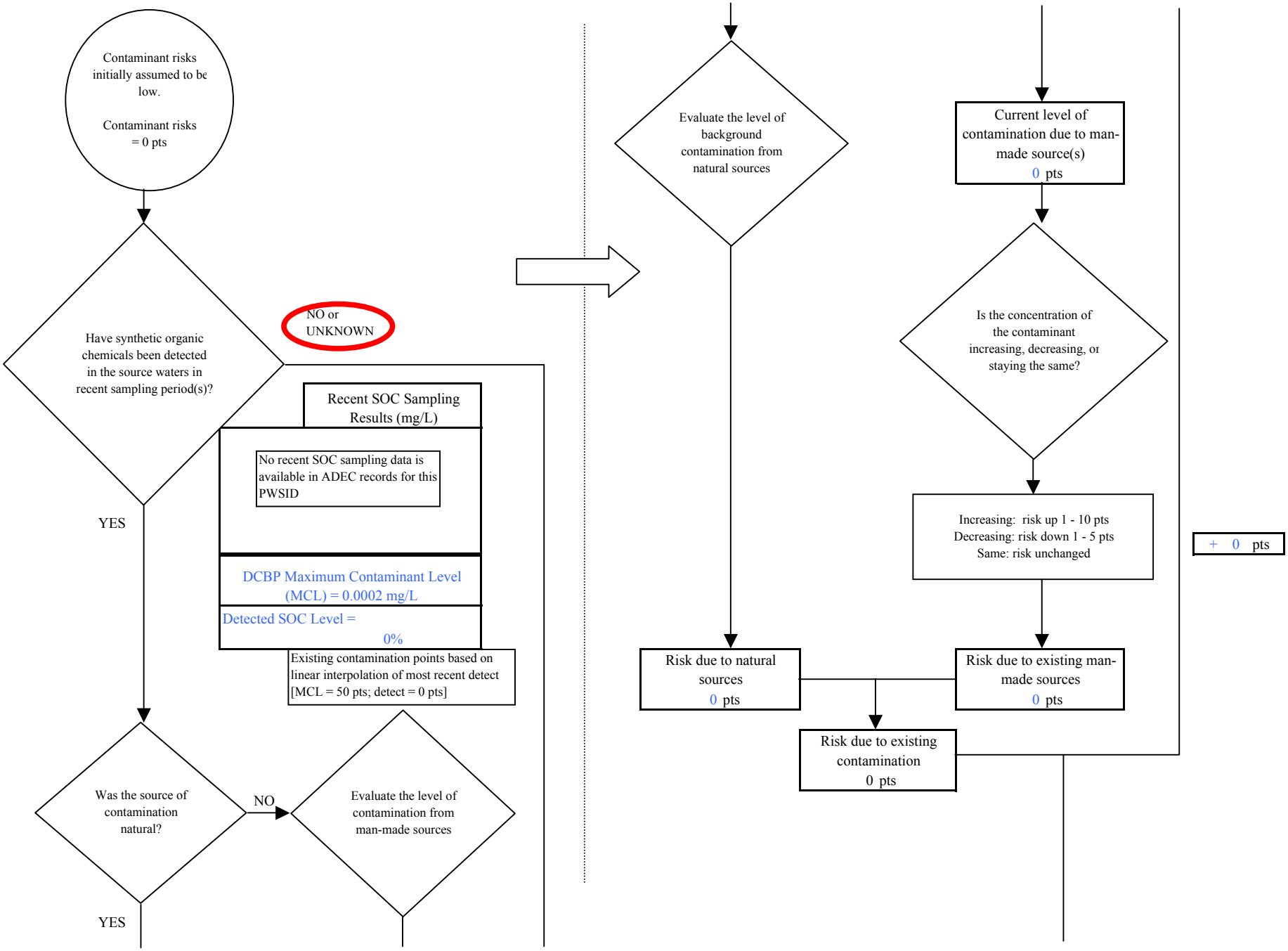

Chart 10. Contaminant risks for Kwingillingok_Washteria (PWS No. 271700.001) - Synthetic Organic Chemicals

+ 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 Kwingillingok_Washteria (PWS No. 271700.001) - Synthetic Organic Chemicals

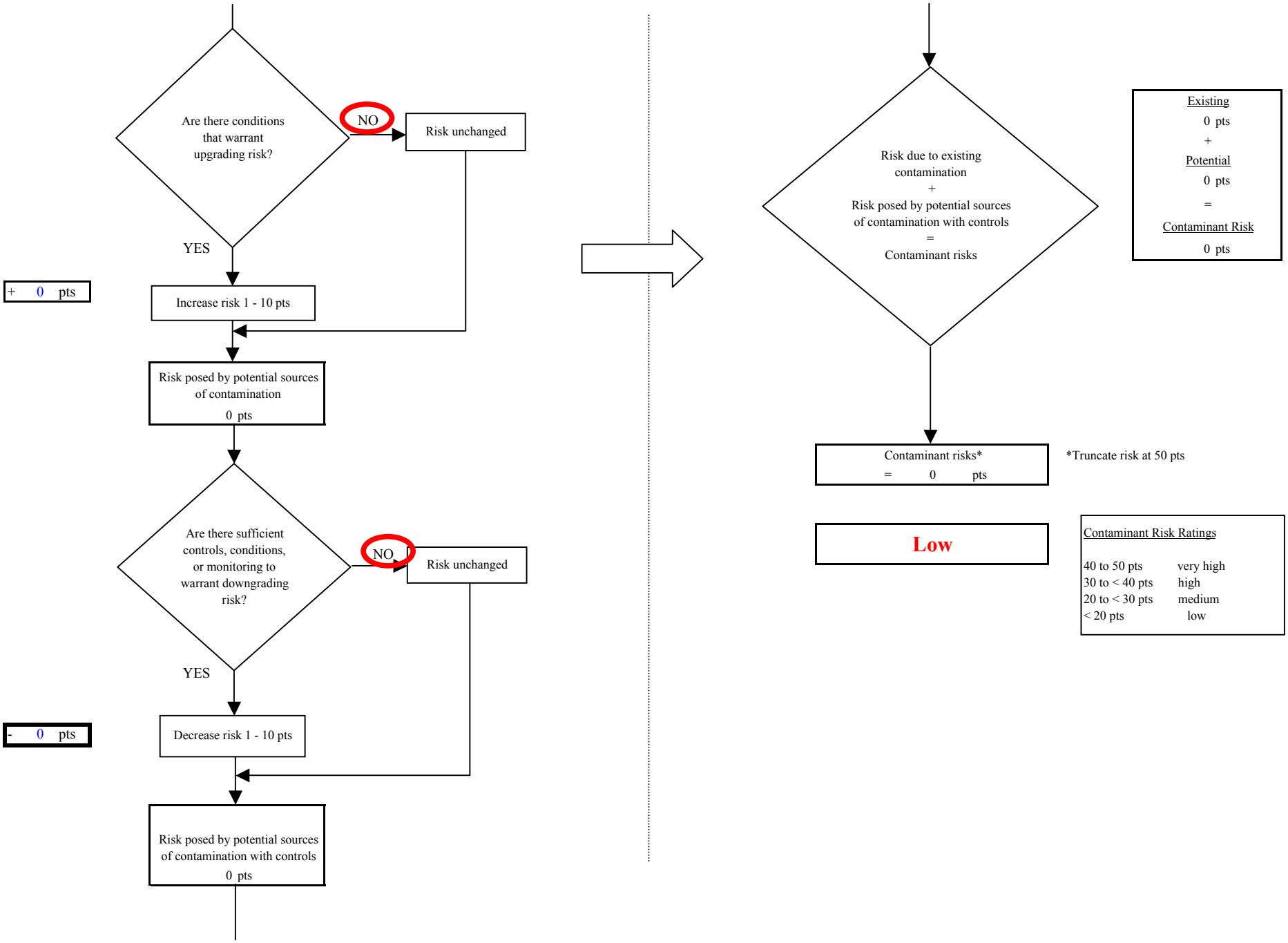

Chart 11. Vulnerability analysis for Kwingillingok_Washteria (PWS No. 271700.001) - Synthetic Organic Chemicals

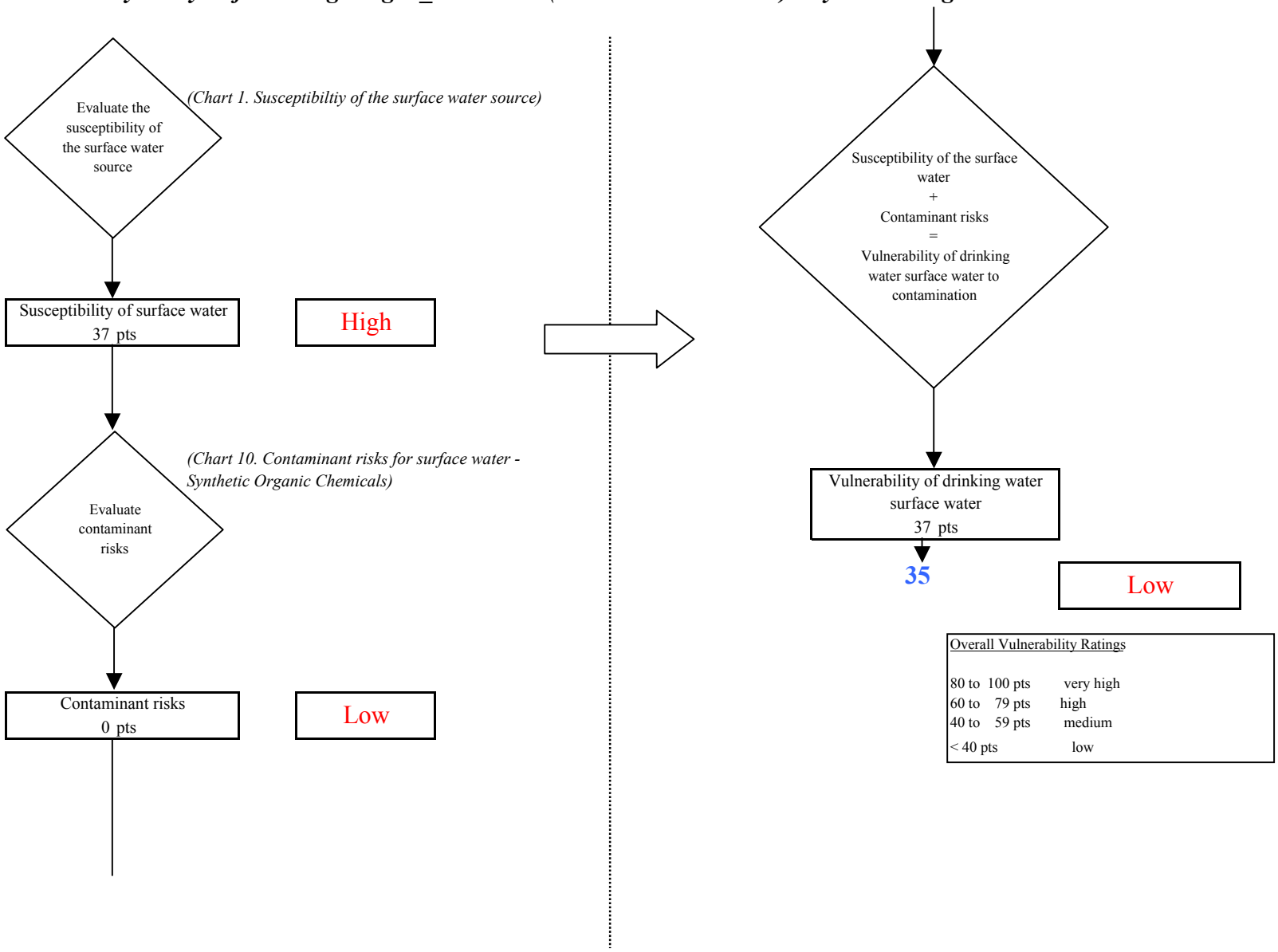

Chart 12. Contaminant risks for Kwingillingok_Washteria (PWS No. 271700.001) - Other Organic Chemicals

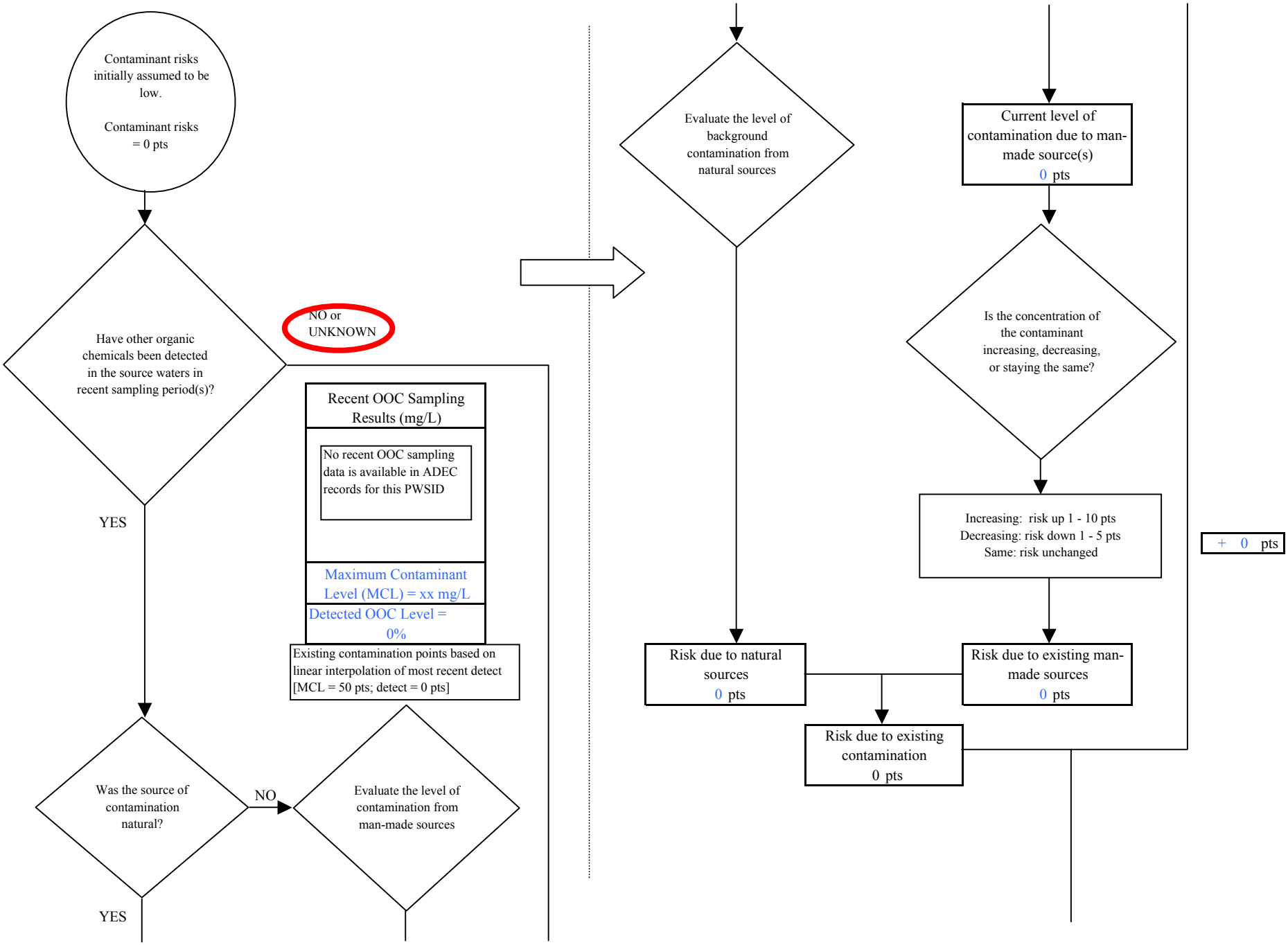

Chart 12. Contaminant risks for Kwingillingok_Washteria (PWS No. 271700.001) - Other Organic Chemicals

+ 10 pts

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

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)	1	0	1

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

Matrix Score 10

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

Initial assessment of risk posed by potential sources of contamination = 10 pts

Are any significant sources <1000 ft from the spring, lake, river, or stream, or within the floodplain?

NO → Risk unchanged

YES

The number and magnitude of risk sources in Zone A determines a risk increase. See Table 7 for inventory.

+ 2 pts

Increase risk 1 - 10 pts

Chart 12. Contaminant risks for Kwingillingok_Washteria (PWS No. 271700.001) - Other Organic Chemicals

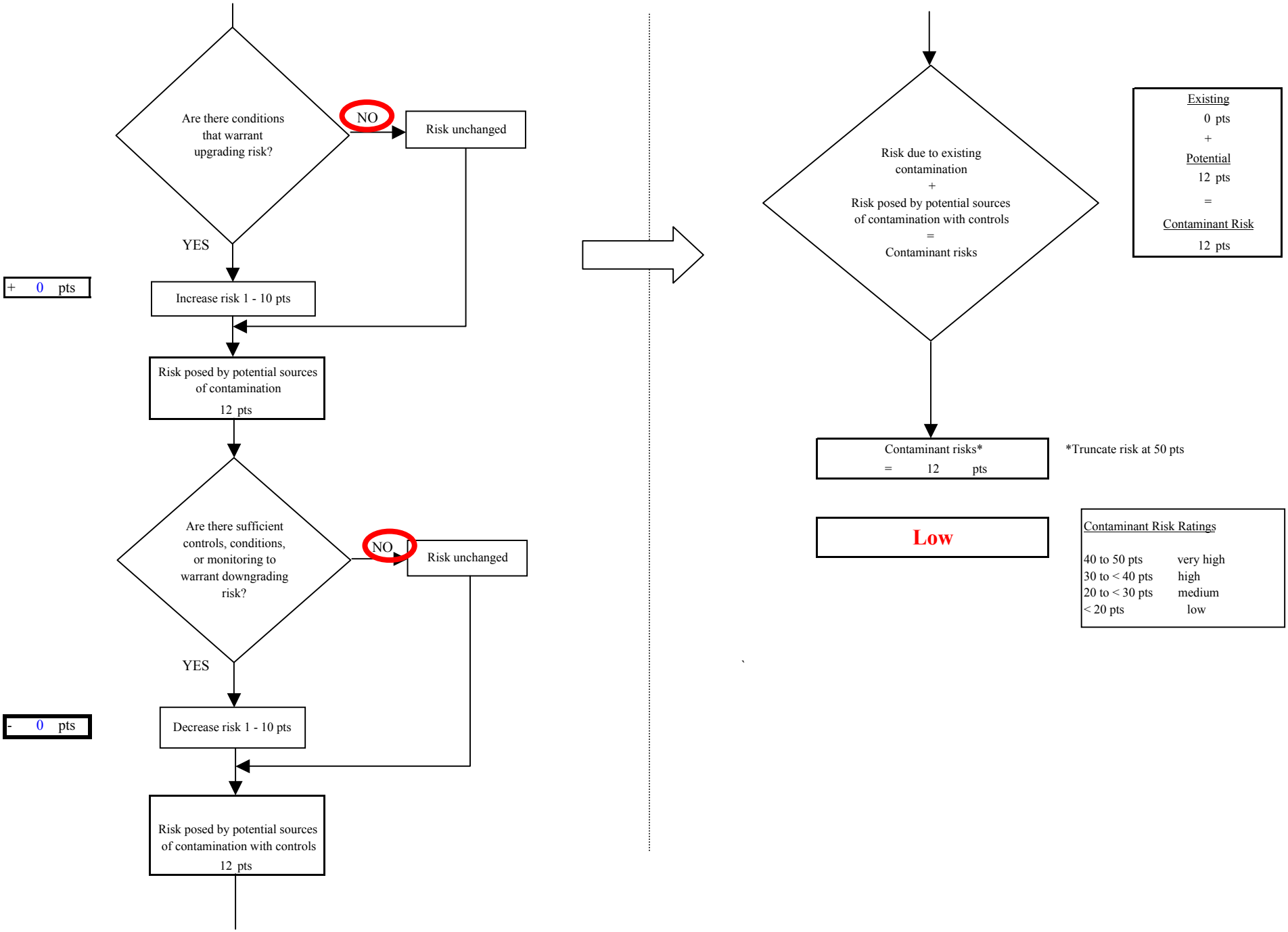

Chart 13. Vulnerability analysis for Kwingillingok_Washteria (PWS No. 271700.001) - Other Organic Chemicals