Source Water Assessment

A Hydrogeologic Susceptibility and Vulnerability Assessment for AK Gateway SD-Mentasta Lake Drinking Water System, Mentasta Lake, Alaska

PWSID # 380379.001

June 2004

DRINKING WATER PROTECTION PROGRAM REPORT 1393
Alaska Department of Environmental Conservation

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DRINKING WATER PROTECTION PROGRAM REPORT 1393

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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Drinking Water Protection Program
Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

AK Gateway SD-Mentasta Lake has one Public Water System (PWS) well. It is assumed that the well (PWSID# 380379.001) has been used as a drinking water source since it was drilled in approximately 1975.

The well is a Class A (community and non-transient non-community) water system located at the Mentasta Lake School in Mentasta Lake, Alaska. Available records indicate that drinking water is stored in a 100-gallon storage tank, and is not treated. This system operates August through May and serves approximately 49 nonresidents and 0 residents through one service connection. The wellhead received a susceptibility rating of **Very High** and the aquifer received a susceptibility rating of **Low**. Combining these two ratings produce a **Medium** rating for the natural susceptibility of the well.

Identified potential and current sources of contaminants for the public drinking water source include: large capacity septic system, laundromat without dry cleaning, domestic wastewater collection system, domestic wastewater treatment plant disposal pond, aboveground fuel tanks, landfill, DEC recognized contaminated sites, rail corridors, and roads. These identified potential and existing sources of contamination are considered as sources of bacteria and viruses, nitrates and/or nitrites, volatile organic chemicals, heavy metals, cyanide and other inorganic chemicals, synthetic organic chemicals, and other organic chemicals contaminant categories.

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

PUBLIC DRINKING WATER SYSTEM

The AK Gateway SD-Mentasta Lake well is a Class A (community/non-transient/non-community) public water system. The system is located at the Mentasta Lake School in Mentasta Lake, Alaska (Sec. 07, T013N, R009E, Copper River Meridian; see Map A of Appendix A). Mentasta Lake is located 6 miles off the Tok-Slana Cutoff of the Glenn Highway on the west side of Mentasta Pass, 38 miles southwest of Tok Junction. The community has a population of 143 (ADCED, 2003). Average annual precipitation in Mentasta Lake is 16 inches, with 69 inches of snowfall. Temperatures range from -57 to 93°F.

About half the community of Mentasta Lake obtains their water supply from individual wells, while most others utilize a public water system. About half of residences utilize individual septic systems and the rest make use of honeybuckets or outhouses. Mentasta Lake receives electrical power from Alaska Power Company, which is privately operated. Power generating facilities are fueled by diesel (ADCED, 2003).

According to information supplied by ADEC for the AK Gateway SD-Mentasta Lake PWS, the depth of the primary water well is 73 feet below the ground surface. The well is screened and based on the well log, the well is assumed to be confined by 3' of frozen clay. Unconfined aquifers are more susceptible to groundwater impacts resulting from the downward migration of surface contaminants. The well is not located in a floodplain.

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

Mentasta Lake lies toward the east end of the Alaska Range, north of the Copper River basin, in southeastern Interior Alaska. The Copper River basin, ranging from 500 to over 4,000 feet above sea level, is an intermontane basin rimmed by peaks of the Chugach, Alaska, Talkeetna, and Wrangell mountains. The terrain of the basin consists of two physiographic sub-units: the rolling, hummocky Copper River basin piedmont surface, and the Copper River basin trough. The Copper River basin trough is generally flat and lacks the hummocky, rolling character of the piedmont surface. Glaciers from the Chugach, Alaska, Talkeetna, and Wrangell ranges invaded the basin, perhaps at times filling it and flowing across the divides to the north, west, east, and south. This extensive glaciation has resulted in the deposition of a large thickness of coarse glacial boulder clays (till) and coarse outwash gravel and sand on the piedmont surface, with finer till and outwash interbedded with lake deposits in the basin trough (Nochols, 1956).

DRINKING WATER PROTECTION AREA

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

The most probable area for contamination to reach the drinking water spring is the area that contributes water to the spring, the groundwater recharge area. This area is designated as the drinking water protection area (DWPA). Because releases of contaminants within the protection area are most likely to impact the drinking water spring, this area will serve as the focus for voluntary protection efforts.

An analytical calculation was used to determine the size and shape of the DWPA for AK Gateway SD-Mentasta Lake PWS. The input parameters describing the attributes of the aquifer in this calculation were adopted from Groundwater (Freeze and Cherry, 1979). Available geology and groundwater contours were also considered to take into account any uncertainties in groundwater flow and aquifer characteristics to arrive at a meaningful protection area.

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

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

Table 1. Definition of Zones

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

The DWPA for the AK Gateway SD-Mentasta Lake PWS was determined using an analytical calculation and includes Zones A, B, and D (See Map A of Appendix A).

INVENTORY OF POTENTIAL AND EXISTING CONTAMINANT SOURCES

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

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

- Bacteria and viruses,
- Nitrates and/or nitrites,
- Volatile organic chemicals,
- Heavy metals, cyanide and other inorganic chemicals,
- Synthetic organic chemicals,
- Other organic chemicals.

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

RANKING OF CONTAMINANT RISKS

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

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

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

VULNERABILITY OF THE DRINKING WATER SYSTEM

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

- Natural susceptibility, and
- Contaminant risks.

Appendix D contains fourteen charts, which together form the 'Vulnerability Analysis' for a source water assessment for a public drinking water source. Chart 1 analyzes the 'Susceptibility of the Wellhead' to contamination by looking at the construction of the well and its surrounding area. Chart 2 analyzes the 'Susceptibility of the Aquifer' to contamination by looking at the naturally occurring attributes of the water source and influences on the groundwater system that might lead to contamination. Chart 3 analyzes 'Contaminant Risks' for the drinking water source with respect to bacteria and viruses. The 'Contaminant Risks' portion of the analysis considers potential sources of contaminants as well as a review of contamination that has or may have occurred, but has not arrived or been detected at the well. Chart 4 contains the 'Vulnerability Analysis for Bacteria and Viruses'. Charts 5 through 14 contain the Contaminant Risks and Vulnerability Analyses for nitrates and nitrites, volatile organic chemicals, heavy metals, cyanide and other inorganic chemicals, synthetic organic chemicals, and other organic chemicals, respectively.

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

Susceptibility of the Wellhead (0 – 25 Points)
(Chart 1 of Appendix D)

+

Susceptibility of the Aquifer (0 – 25 Points)
(Chart 2 of Appendix D)

=

Natural Susceptibility (Susceptibility of the Well)
(0 – 50 Points)

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

Natural Susceptibility Ratings	
40 to 50 pts	Very High
30 to < 40 pts	High
20 to < 30 pts	Medium
< 20 pts	Low

The AK Gateway SD-Mentasta Lake Public Water System's water well is in a confined aquifer. Confined aquifers are less susceptible to potential groundwater quality impacts posed by the migration of surface water contaminants downward from the surface. Table 2 shows the susceptibility scores and ratings for this PWS.

Table 2. Susceptibility

	Score	Rating
Susceptibility of the Wellhead	20	Very High
Susceptibility of the Aquifer	8	Low
Natural Susceptibility	28	Medium

Contaminant risks to a drinking water source depend on the type, number or density, and distribution of contaminant sources. This score has been derived from an examination of existing and historical contamination that has been detected at the drinking

water source through routine sampling. It also evaluates potential sources of contamination. Flow charts are used to assign a point score, and ratings are assigned in the same way as for the natural susceptibility

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

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

Table 3. Contaminant Risks

Category	Score	Rating
Bacteria and Viruses	50	Very High
Nitrates and/or Nitrites	50	Very High
Volatile Organic Chemicals	50	Very High
Heavy Metals, Cyanide and Other Inorganic Chemicals	44	Very High
Synthetic Organic Chemicals	50	Very High
Other Organic Chemicals	50	Very High

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

Natural Susceptibility (0 – 50 points)

+

Contaminant Risks (0 – 50 points)

=

Vulnerability of the Drinking Water Source to Contamination (0 – 100).

Again, rankings are assigned according to a point score:

Overall Vulnerability Ratings	
80 to 100 pts	Very High
60 to < 80 pts	High
40 to < 60 pts	Medium
< 40 pts	Low

Table 4 contains the overall vulnerability scores (0 – 100) and ratings for each of the six categories of drinking water contaminants. Note: scores are rounded off to the nearest five.

Table 4. Overall Vulnerability

Category	Score	Rating
Bacteria and Viruses	75	High
Nitrates and Nitrites	75	High
Volatile Organic Chemicals	75	High
Heavy Metals, Cyanide and Other Inorganic Chemicals	70	High
Synthetic Organic Chemicals	75	High
Other Organic Chemicals	75	High

Bacteria and Viruses

The contaminant risk for bacteria and viruses is **Very High**. The risk is primarily attributed to the presence of a landfill and large capacity septic systems in Zone A (see Table 2 – Appendix B).

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.

There have not been positive bacteria counts reported in recent (within five years) sampling events (See Chart 3 – Contaminant Risks for Bacteria and Viruses in Appendix D). Only a small amount of bacteria and viruses are required to endanger public health.

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

Nitrates and Nitrites

The contaminant risk for nitrates and nitrites is **Very High**. The risk to this source of public drinking water is primarily attributed to the presence of a landfill and large capacity septic systems in Zone A (see Table 3 – Appendix B).

Nitrates are very mobile, moving at approximately the same rate as water. The sampling history for this well indicates that low concentrations of nitrates have

been detected in recent sampling events. Nitrate concentrations in uncontaminated groundwater are typically less than 2 mg/L; therefore, nitrate concentrations above 2 mg/L may be indicative of man-made sources (See Chart 5 - Contaminant Risks for Nitrates and/or Nitrites in Appendix D).

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

Volatile Organic Chemicals

The contaminant risk for volatile organic chemicals is **Very High**. The risk is primarily attributed to the presence of a landfill and a DEC recognized contaminated sites in Zone A. Several other potential contaminant sources are also found within the protection area (see Table 4 – Appendix B).

Detectable concentrations of trihalomethanes were reported in sampling events for this public water system. However, the detectible concentrations of trihalomethanes reported in 2000 were well below the MCL of 0.08 mg/L. Trihalomethanes are considered byproducts of the water treatment process and are not from the source waters. Since the reported concentration of TTHM's in recent sampling events did not exceed the applicable MCLs, risk points were not retained (See Chart 7 – Contaminant Risks for Volatile Organic Chemicals in Appendix D).

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.

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

Heavy Metals, Cyanide and Other Inorganic Chemicals

The contaminant risk for heavy metals, cyanide and other inorganic chemicals is **High**. The risk is primarily attributed to the presence of a landfill in Zone A and the presence of chromium in recent sampling events. Several other potential contaminant sources are also found within the protection area (see Table 5 – Appendix B).

Based on review of recent sampling records for this public water system, low levels of chromium have been detected in recent sampling events and are well below the MCL of 0.1 mg/L (see Chart 9 – Contaminant Risks for Heavy Metals, Cyanide, and Other Inorganic Chemicals in Appendix D).

The reported concentration of chromium in a recent sampling event is likely to be representative of source water conditions. Chromium is a naturally occurring element found in rocks, animals, plants, soil, and in volcanic dust and gases. Chromium is present in the environment in several different forms. The most common forms are chromium (0), chromium (III), and chromium (VI). No taste or odor is associated with chromium compounds, but are both toxic.

After combining the contaminant risk for heavy metals, cyanide and other inorganic chemicals with the natural susceptibility of the spring, the overall vulnerability of the spring to contamination is **High**.

Synthetic Organic Chemicals

The contaminant risk for synthetic organic chemicals is **Very High**. The risk is primarily attributed to the presence of a landfill in Zone A. Several other potential contaminant sources are also found within the protection area (see Table 6 – Appendix B).

No recent sampling data was available in ADEC records for AK Gateway SD-Mentasta Lake and a SOC sampling waiver is in place for this system (See Chart 11 – Contaminant Risks for Synthetic Organic Chemicals in Appendix D).

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

Other Organic Chemicals

The contaminant risk for other organic chemicals is **Very High**. The risk is primarily attributed to the presence of a landfill in Zone A. Several other potential contaminant sources are also found within the protection area (see Table 7 – Appendix B).

No recent sampling data was available in ADEC records for AK Gateway SD-Mentasta Lake and a OOC sampling waiver is in place for this system (See Chart 13 – Contaminant Risks for Other Organic Chemicals in Appendix D).

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

Using the Source Water Assessment

This assessment of contaminant risks can be used as a foundation for local voluntary protection efforts as well as a basis for the continuous efforts on the part of the community of Mentasta Lake 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

Freeze, R. A., and Cherry, J.A. 1979, Groundwater, Prentice-Hall, Englewood Cliffs, New Jersey

Nochols, Donald R. 1956. Permafrost and Groundwater Conditions in the Glennallen area, Alaska. U.S. Geological Survey Open File Report 56-91.

United States Environmental Protection Agency (EPA), 2002 [WWW document]. URL http://www.epa.gov/safewater/mcl.html.

APPENDIX A

Drinking Water Protection Area Location Map
(Map A)

APPENDIX B

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

APPENDIX C

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

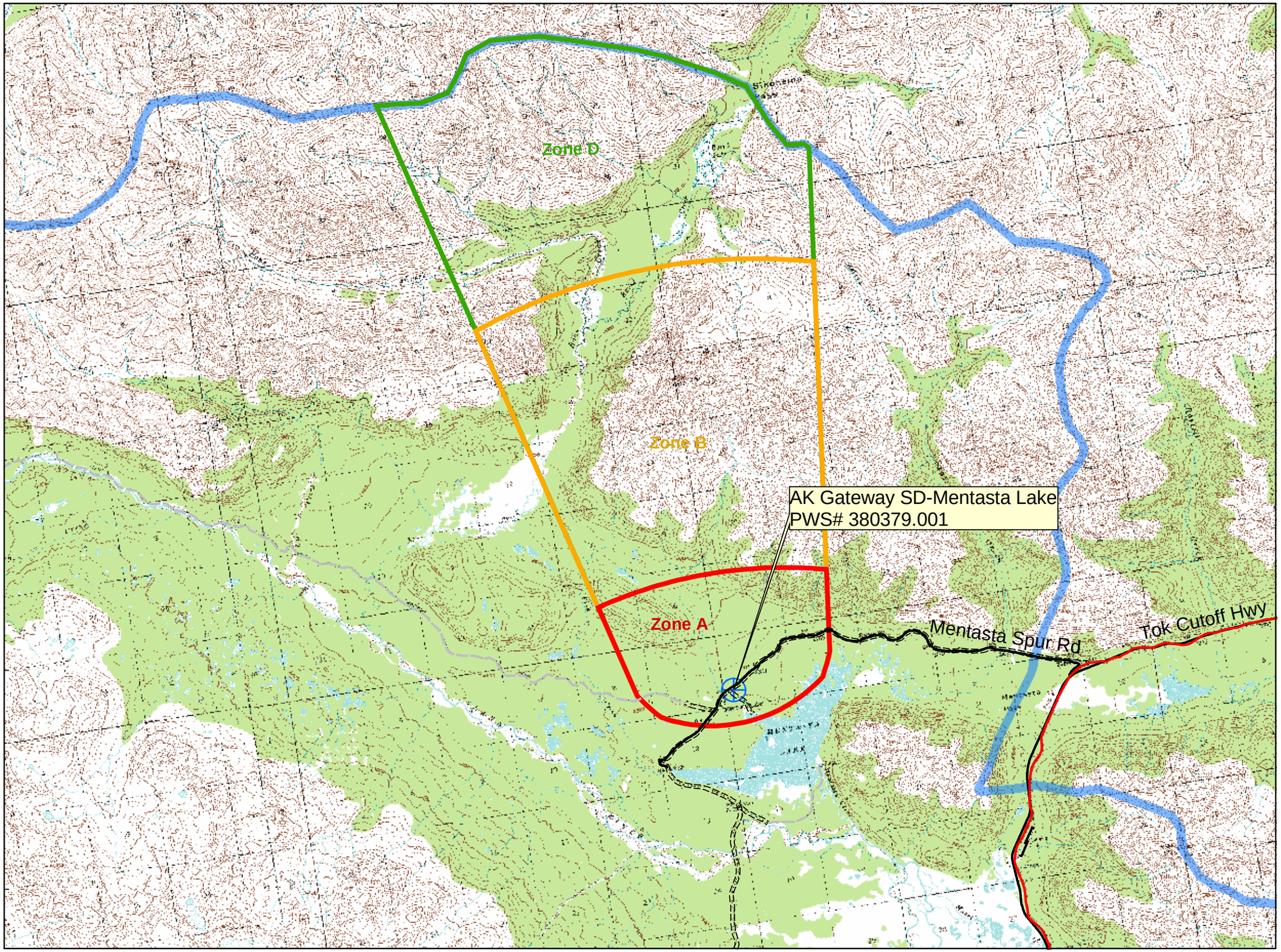
APPENDIX D

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

APPENDIX A

Drinking Water Protection Area Location Map
(Map A)

Public Water Well System for PWS# 380379.001 AK Gateway SD-Mentasta Lake



LEGEND

Public Water System Well

Hydrography/Physical

- Parcels
- Stream
- Lake or Pond
- Contours
- Watershed Boundary

Transportation

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

Groundwater Protection Zones

- Zone A Protection Area– Several Months Travel Time
- Zone B Protection Area– 2 Years Travel Time
- Zone D Protection Area– 10 Years Travel Time or watershed boundary

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

All other data:
United States Geological Survey (USGS)

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

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

0 0.5 1 2 3 4 Miles

AK Gateway SD-Mentasta Lake
PWS# 380379.001
App A Map A

APPENDIX B

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

Table 1

Contaminant Source Inventory for
AK Gateway SD - Mentasta Lake

PWSID 380379.00

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Map Number*	*Comments*
Laundromats without dry cleaning	C22	C22-01	A	C	
Domestic wastewater collection systems (sewer lines or lift stati	D01	D01-01	A	C	
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-01	A	C	
Injection wells (Class V) Large-Capacity Septic System (Drainfie Disposal Method)	D10	D10-01	A	C	AKGATEWAY SD-MENTASTA LAKE SCH
Injection wells (Class V) Large-Capacity Septic System (Drainfie Disposal Method)	D10	D10-02	A	C	
Landfills (municipal; Class III)	D51	D51-01	A	C	Landfills (municipal; Class III)- Domestic Waste
Tanks, gasoline (above ground)	T10	T10-01	A	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-01	A	C	
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-01	A	C	Mentasta Village Clinic, Reckey# 1990330112901, Status: Inactive, A hi of leakage from a 300 gallon heating fuel tank located behind the clinic building and next to clinic's well house resulted in fuel contaminated soils. Samples don't show contam
Highways and roads, dirt/gravel	X24	X24-01	A	C	Mentasta Spur Rd
Rail corridors	X30	X30-01	A	C	

Table 2

Contaminant Source Inventory and Risk Ranking for AK Gateway SD - Mentasta Lake Sources of Bacteria and Viruses

PWSID 380379.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Laundromats without dry cleaning	C22	C22-01	A	Low	C	
Domestic wastewater collection systems (sewer line or lift stations)	D01	D01-01	A	Medium	C	
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-01	A	High	C	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-01	A	High	C	AKGATEWAY SD-MENTASTA LAKE SCH
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-02	A	High	C	
Landfills (municipal; Class III)	D51	D51-01	A	High	C	Landfills (municipal; Class III)- Domestic Waste
Highways and roads, dirt/gravel	X24	X24-01	A	Low	C	Mentasta Spur Rd

Table 3

Contaminant Source Inventory and Risk Ranking for AK Gateway SD - Mentasta Lake Sources of Nitrates/Nitrites

PWSID 380379.001

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Risk Ranking for Analysis	Map Number	Comments
Laundromats without dry cleaning	C22	C22-01	A	Low	C	
Domestic wastewater collection systems (sewer line or lift stations)	D01	D01-01	A	Medium	C	
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-01	A	High	C	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-01	A	High	C	AKGATEWAY SD-MENTASTA LAKE SCH
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-02	A	High	C	
Landfills (municipal; Class III)	D51	D51-01	A	Very High	C	Landfills (municipal; Class III)- Domestic Waste
Highways and roads, dirt/gravel	X24	X24-01	A	Low	C	Mentasta Spur Rd

Table 4

Contaminant Source Inventory and Risk Ranking for AK Gateway SD - Mentasta Lake Sources of Volatile Organic Chemicals

PWSID 380379.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Laundromats without dry cleaning	C22	C22-01	A	Low	C	
Domestic wastewater collection systems (sewer line or lift stations)	D01	D01-01	A	Low	C	
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-01	A	Low	C	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-01	A	Low	C	AKGATEWAY SD-MENTASTA LAKE SCH
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-02	A	Low	C	
Landfills (municipal; Class III)	D51	D51-01	A	High	C	Landfills (municipal; Class III)- Domestic Waste
Tanks, gasoline (above ground)	T10	T10-01	A	Medium	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-01	A	Low	C	
Contaminated sites, DEC recognized, non-Superfun non-RCRA	U04	U04-01	A	High	C	Mentasta Village Clinic, Reckey# 1990330112901, Status: Inactive, A hist of leakage from a 300 gallon heating fuel tank located behind the clinic building and next to clinic's well house resulted in fuel contaminated soils. Samples don't show contam
Highways and roads, dirt/gravel	X24	X24-01	A	Low	C	Mentasta Spur Rd
Rail corridors	X30	X30-01	A	Medium	C	

Table 5

Contaminant Source Inventory and Risk Ranking for AK Gateway SD - Mentasta Lake

Sources of Heavy Metals, Cyanide and Other Inorganic Chemicals

PWSID 380379.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Domestic wastewater collection systems (sewer line or lift stations)	D01	D01-01	A	Low	C	
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-01	A	Low	C	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-01	A	Low	C	AKGATEWAY SD-MENTASTA LAKE SCH
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-02	A	Low	C	
Landfills (municipal; Class III)	D51	D51-01	A	High	C	Landfills (municipal; Class III)- Domestic Waste
Tanks, gasoline (above ground)	T10	T10-01	A	Medium	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-01	A	Low	C	
Contaminated sites, DEC recognized, non-Superfun non-RCRA	U04	U04-01	A	Low	C	Mentasta Village Clinic, Reckey# 1990330112901, Status: Inactive, A hist of leakage from a 300 gallon heating fuel tank located behind the clinic building and next to clinic's well house resulted in fuel contaminated soils. Samples don't show contam
Highways and roads, dirt/gravel	X24	X24-01	A	Low	C	Mentasta Spur Rd
Rail corridors	X30	X30-01	A	Low	C	

Table 6

Contaminant Source Inventory and Risk Ranking for AK Gateway SD - Mentasta Lake Sources of Synthetic Organic Chemicals

PWSID 380379.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Domestic wastewater collection systems (sewer line or lift stations)	D01	D01-01	A	Low	C	
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-01	A	Low	C	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-01	A	Low	C	AKGATEWAY SD-MENTASTA LAKE SCH
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-02	A	Low	C	
Landfills (municipal; Class III)	D51	D51-01	A	Very High	C	Landfills (municipal; Class III)- Domestic Waste
Contaminated sites, DEC recognized, non-Superfun non-RCRA	U04	U04-01	A	Low	C	Mentasta Village Clinic, Reckey# 1990330112901, Status: Inactive, A hist of leakage from a 300 gallon heating fuel tank located behind the clinic building and next to clinic's well house resulted in fuel contaminated soils. Samples don't show contam
Rail corridors	X30	X30-01	A	Medium	C	

Table 7

Contaminant Source Inventory and Risk Ranking for AK Gateway SD - Mentasta Lake Sources of Other Organic Chemicals

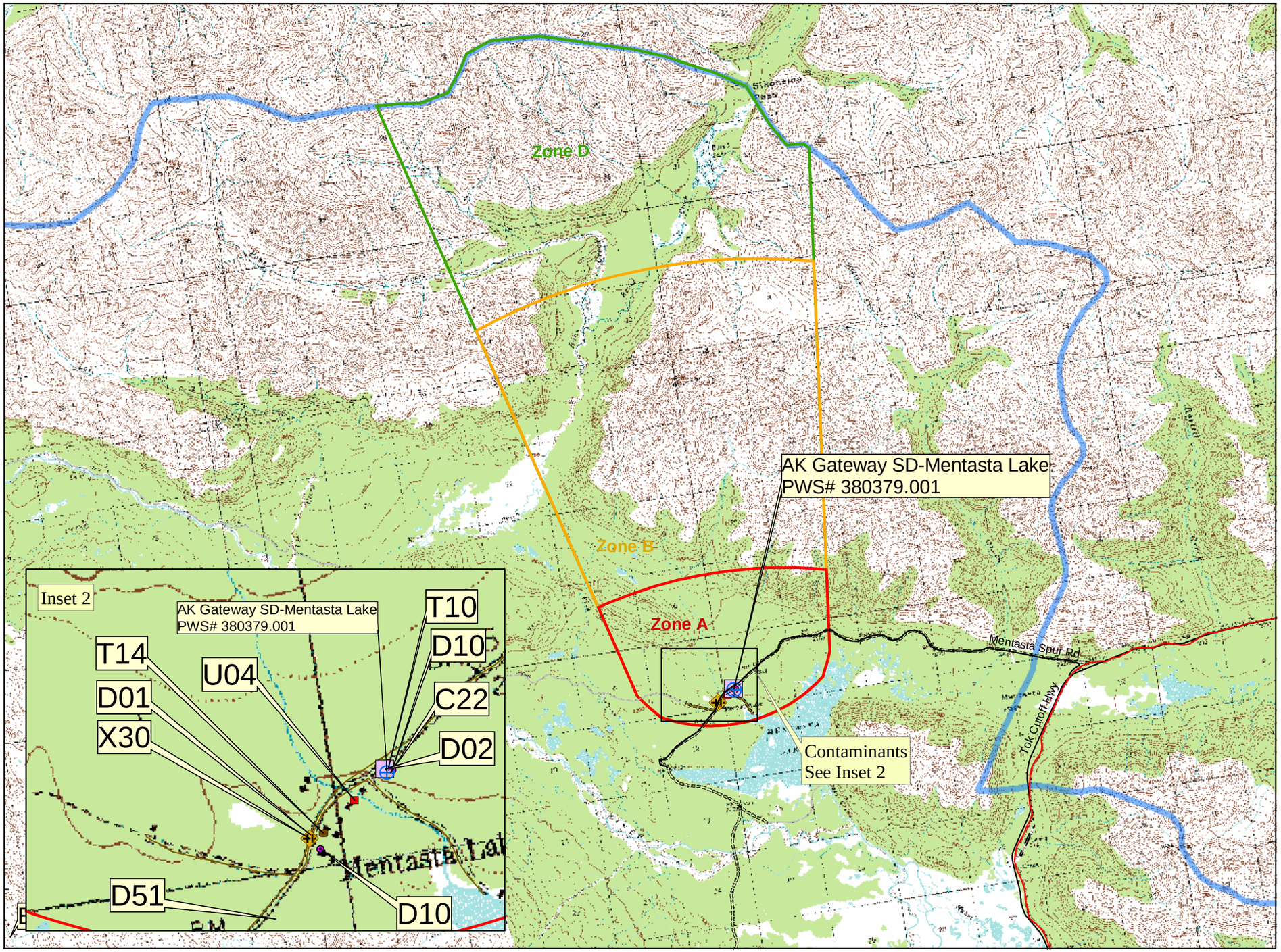
PWSID 380379.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Domestic wastewater collection systems (sewer line or lift stations)	D01	D01-01	A	Low	C	
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-01	A	Low	C	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-01	A	Low	C	AKGATEWAY SD-MENTASTA LAKE SCH
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-02	A	Low	C	
Landfills (municipal; Class III)	D51	D51-01	A	Very High	C	Landfills (municipal; Class III)- Domestic Waste
Contaminated sites, DEC recognized, non-Superfun non-RCRA	U04	U04-01	A	Low	C	Mentasta Village Clinic, Reckey# 1990330112901, Status: Inactive, A hist of leakage from a 300 gallon heating fuel tank located behind the clinic building and next to clinic's well house resulted in fuel contaminated soils. Samples don't show contam
Highways and roads, dirt/gravel	X24	X24-01	A	Low	C	Mentasta Spur Rd
Rail corridors	X30	X30-01	A	Low	C	

APPENDIX C

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

Public Water Well System for PWS# 380379.001 AK Gateway SD-Mentasta Lake
Sources of Potential and Existing Contamination



LEGEND

Public Water System Well

Hydrography/Physical

- Parcels
- Stream
- Lake or Pond
- Contours
- Watershed Boundary

Transportation

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

Groundwater Protection Zones

- Zone A Protection Area– Several Months Travel Time
- Zone B Protection Area– 2 Years Travel Time
- Zone D Protection Area– 10 Years Travel Time or watershed boundary

Existing or Potential Contaminant Sources

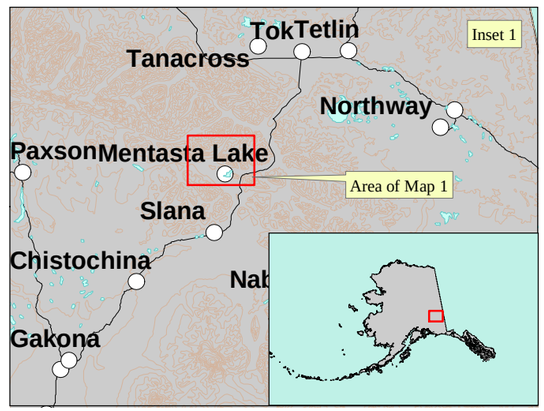
- C22- Laundromats without dry cleaning
- D01- Domestic wastewater collection systems (sewer lines or lift stations)
- D02- Domestic wastewater treatment plant disposal ponds/lagoons
- D10- Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)
- D51- Landfills (municipal; Class III)
- T10- Tanks, gasoline (above ground)
- T14 - Nonresidential aboveground heating oil tank
- U04- Contaminated sites, DEC recognized, non-Superfund, non-RCRA
- X30- Rail corridors

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

All other data:
United States Geological Survey (USGS)

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

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



AK Gateway SD-Mentasta Lake
PWS# 380379.001
App C Map C

APPENDIX D

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

Chart 1. Susceptibility of the wellhead - AK Gateway SD - Mentasta Lake (PWS No. 380379.001)

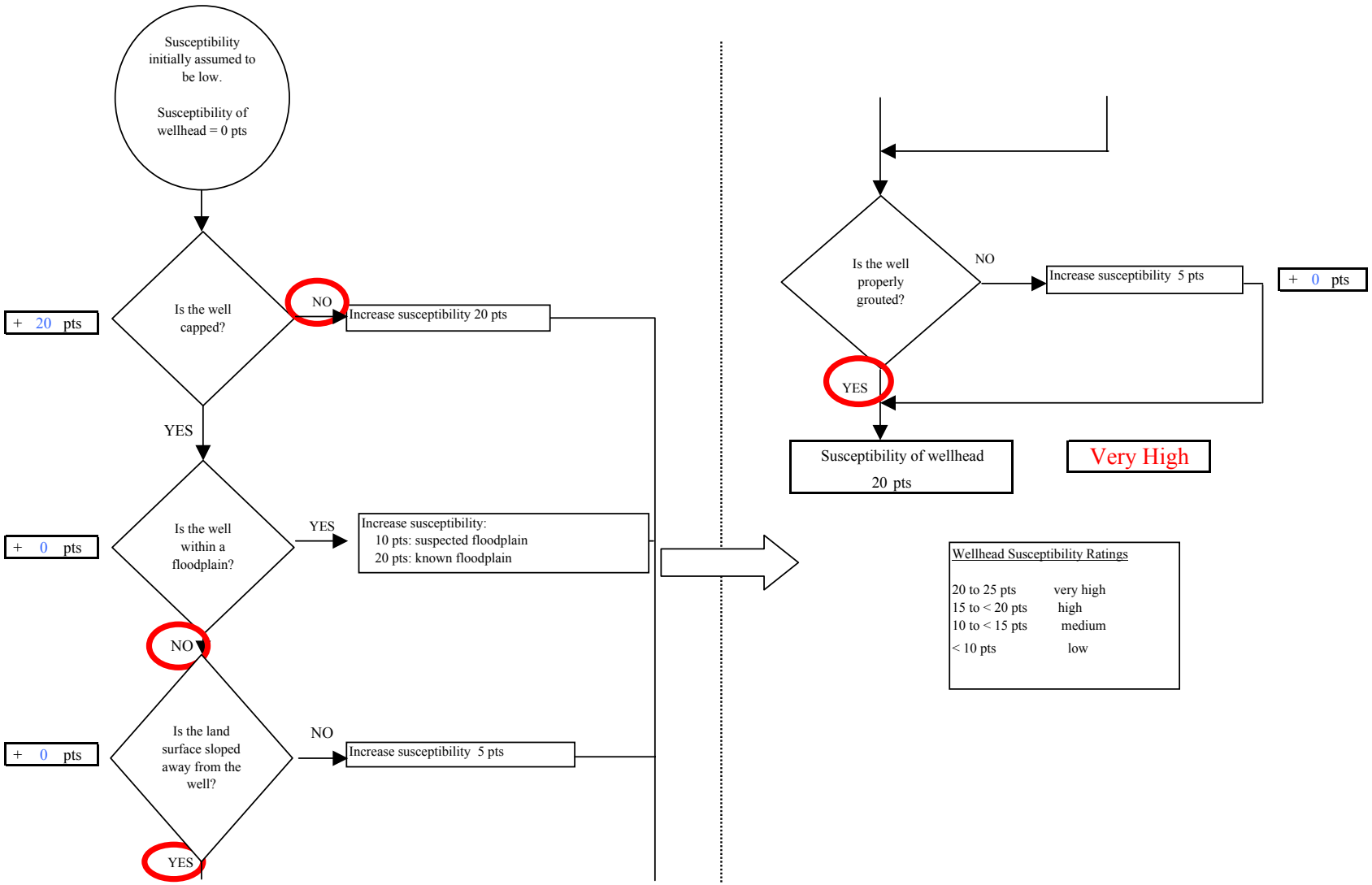


Chart 2. Susceptibility of the aquifer AK Gateway SD - Mentasta Lake (PWS No. 380379.001)

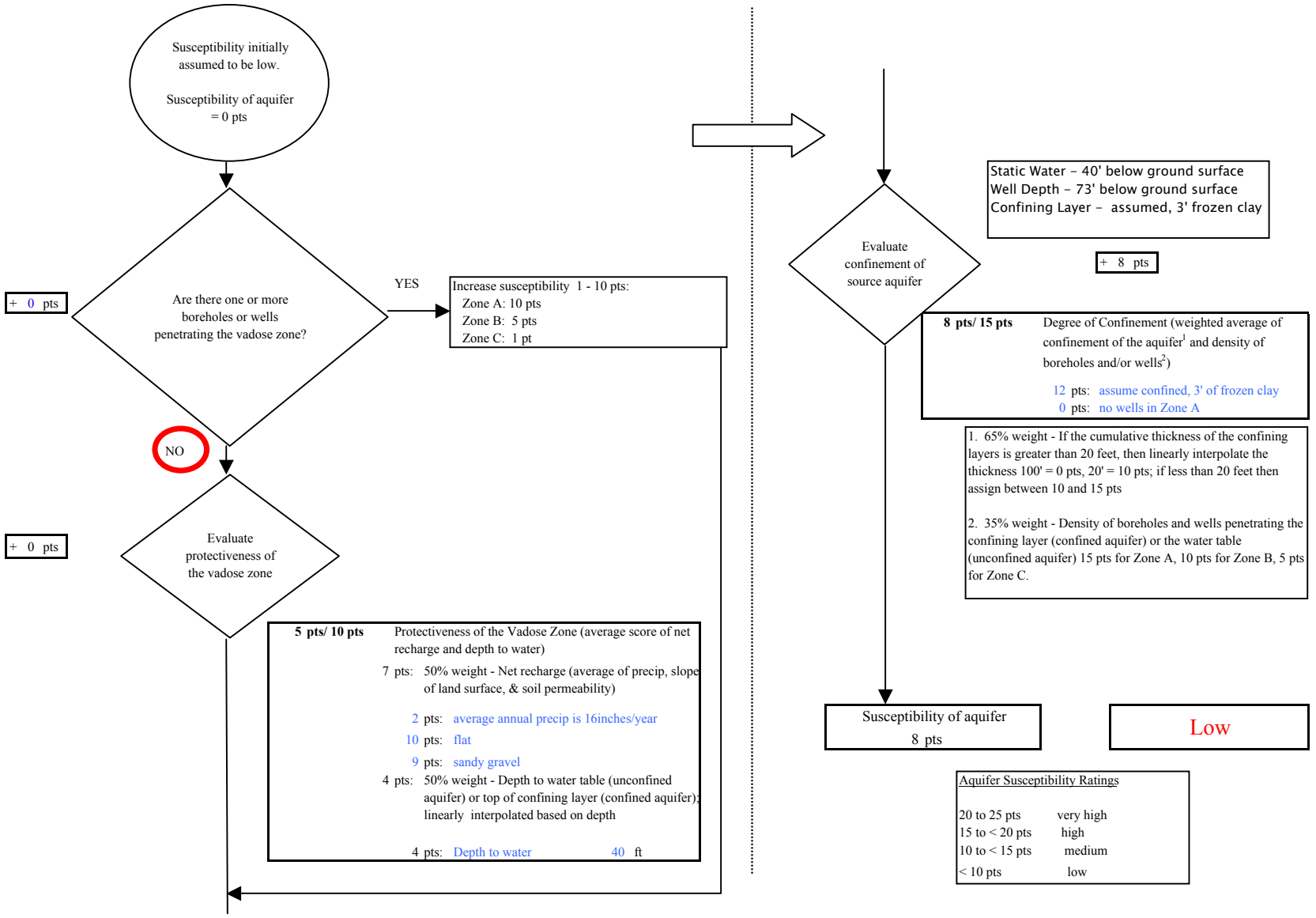
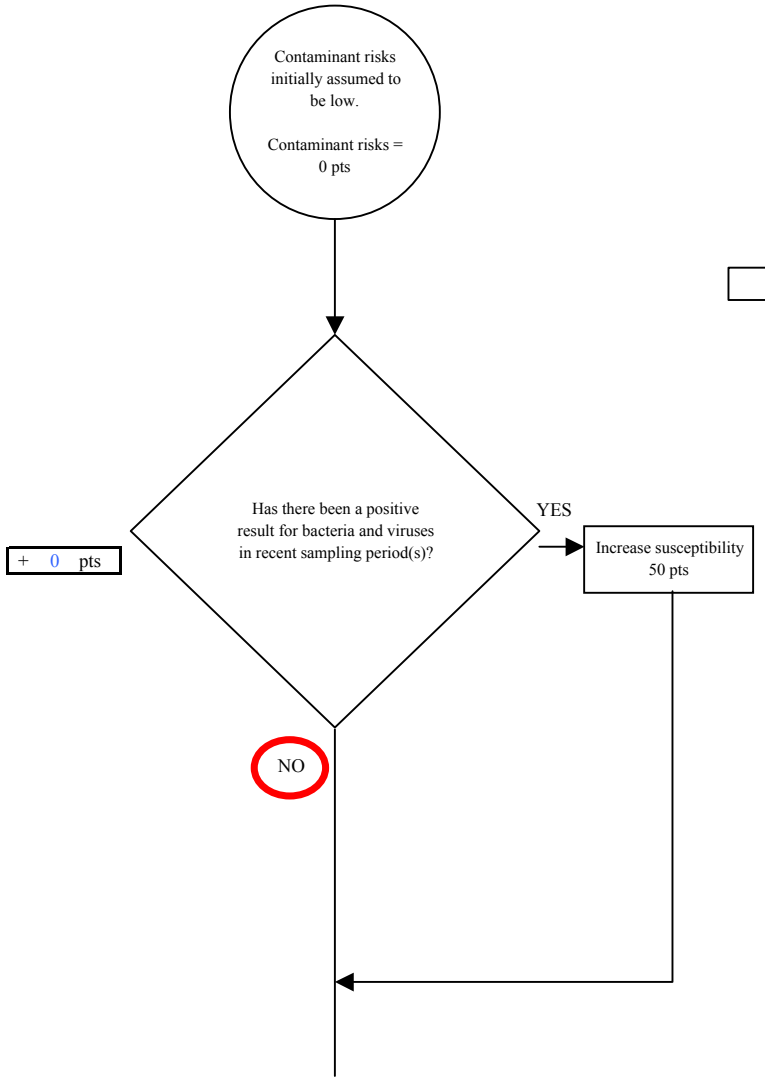
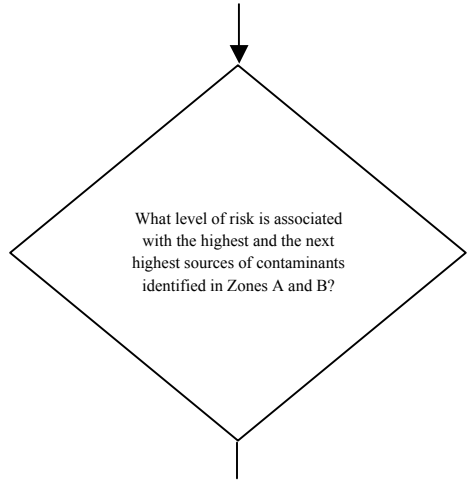


Chart 3. Contaminant risks for AK Gateway SD - Mentasta Lake (PWS No. 380379.001) - Bacteria & Viruses





+ 40 pts

Risk Rankings for Contaminant Sources Identified in Zones A and B

	Zone A	Zone B	Total
Very Highs(s)	0	0	0
High(s)	4	0	4
Medium(s)	1	0	1
Low(s)	2	0	2

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

Matrix Score 40

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

Chart 3. Contaminant risks for AK Gateway SD - Mentasta Lake (PWS No. 380379.001) - Bacteria & Viruses

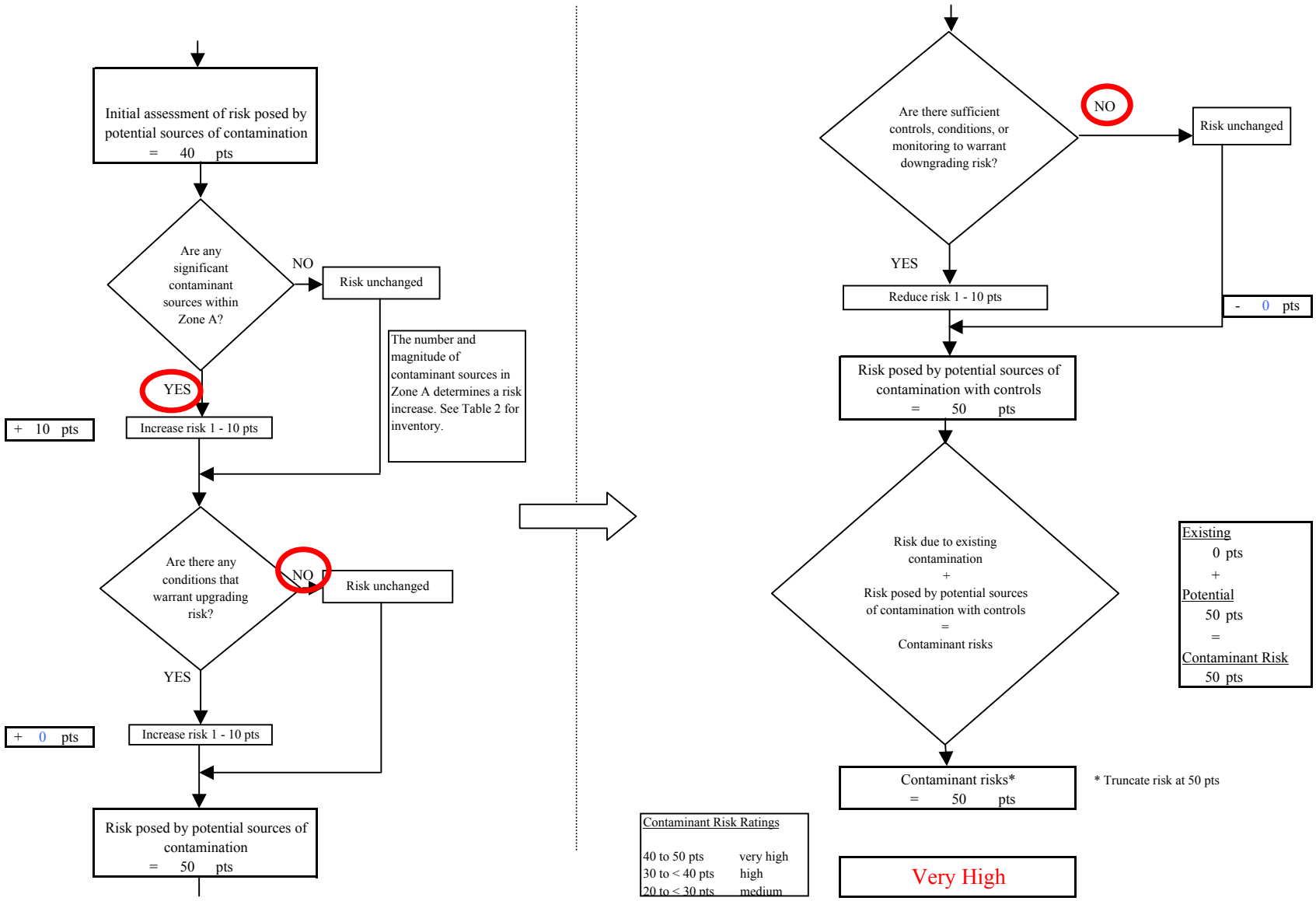


Chart 4. Vulnerability analysis for AK Gateway SD - Mentasta Lake (PWS No. 380379.001) - Bacteria & Viruses

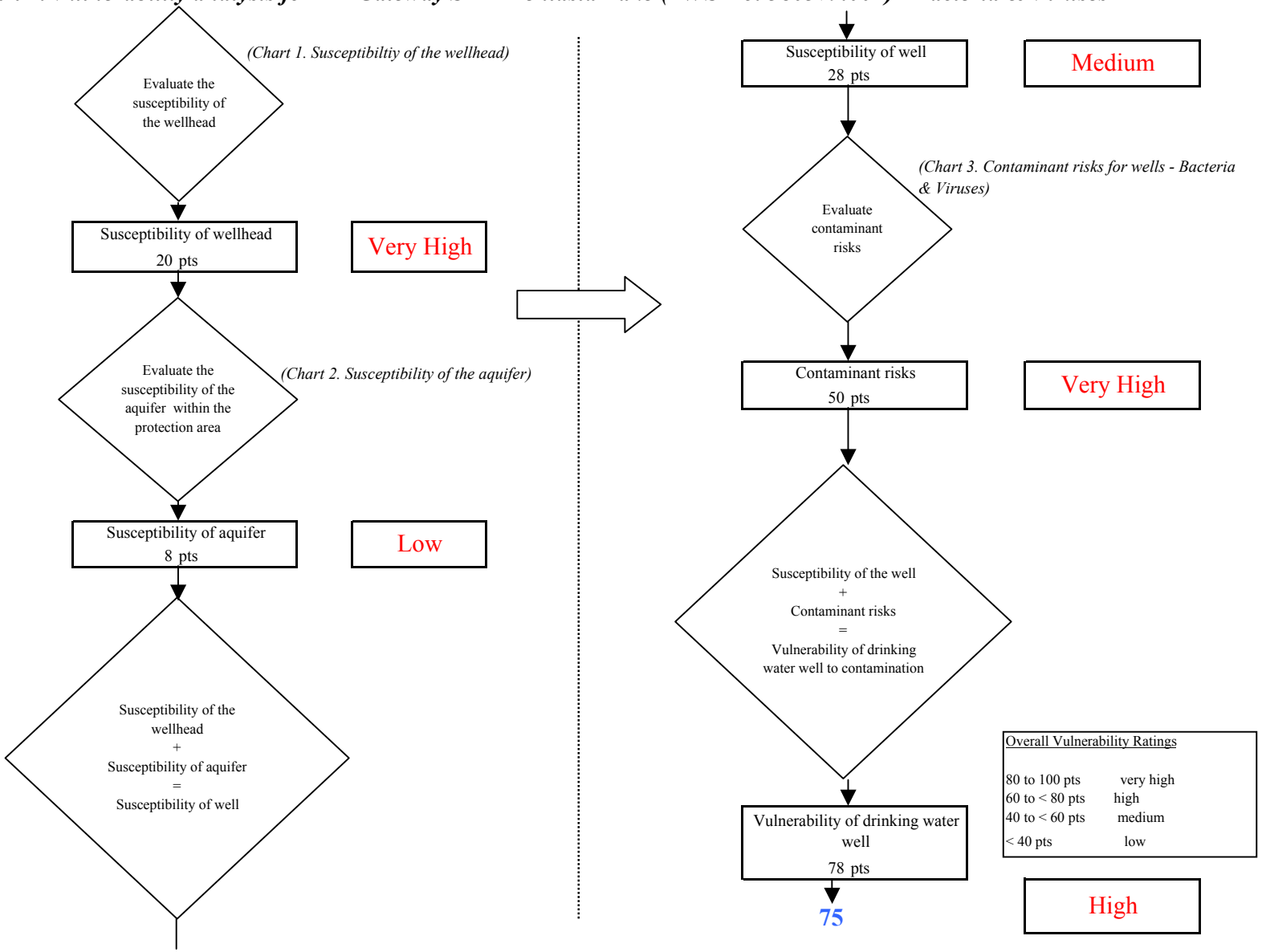


Chart 5. Contaminant risks for AK Gateway SD - Mentasta Lake (PWS No. 380379.001) - Nitrates and Nitrites

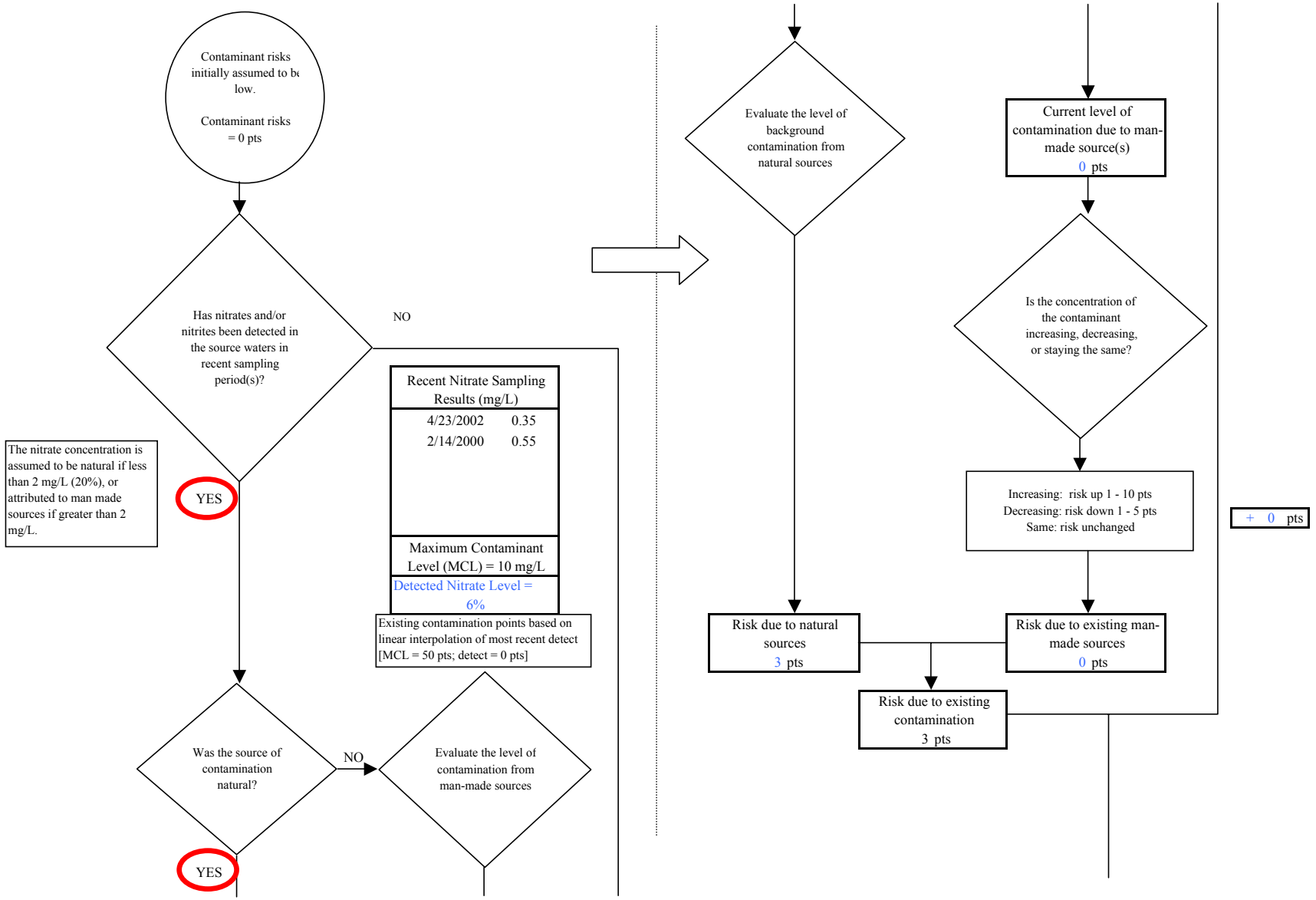


Chart 5. Contaminant risks for AK Gateway SD - Mentasta Lake (PWS No. 380379.001) - Nitrates and Nitrites

+ 50 pts

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

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

	Zone A	Zones B&C	Total
Very Highs(s)	1	0	1
High(s)	3	0	3
Medium(s)	1	0	1
Low(s)	2	0	2

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

Matrix Score 50

Note: Septic systems, sewerlines, and roads are each assigned a risk ranking for each individua 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 = 50 pts

Is the source aquifer fractured rock or karst?

YES

NO

Are all of the higher risk sources beyond Zones A and B?

NO

Risk unchanged

YES

Decrease risk 1 - 10 pts

- 0 pts

Are any significant sources within Zone A?

NO

Risk unchanged

YES

Increase risk 1 - 10 pts

+ 10 pts

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

Chart 5. Contaminant risks for AK Gateway SD - Mentasta Lake (PWS No. 380379.001) - Nitrates and Nitrites

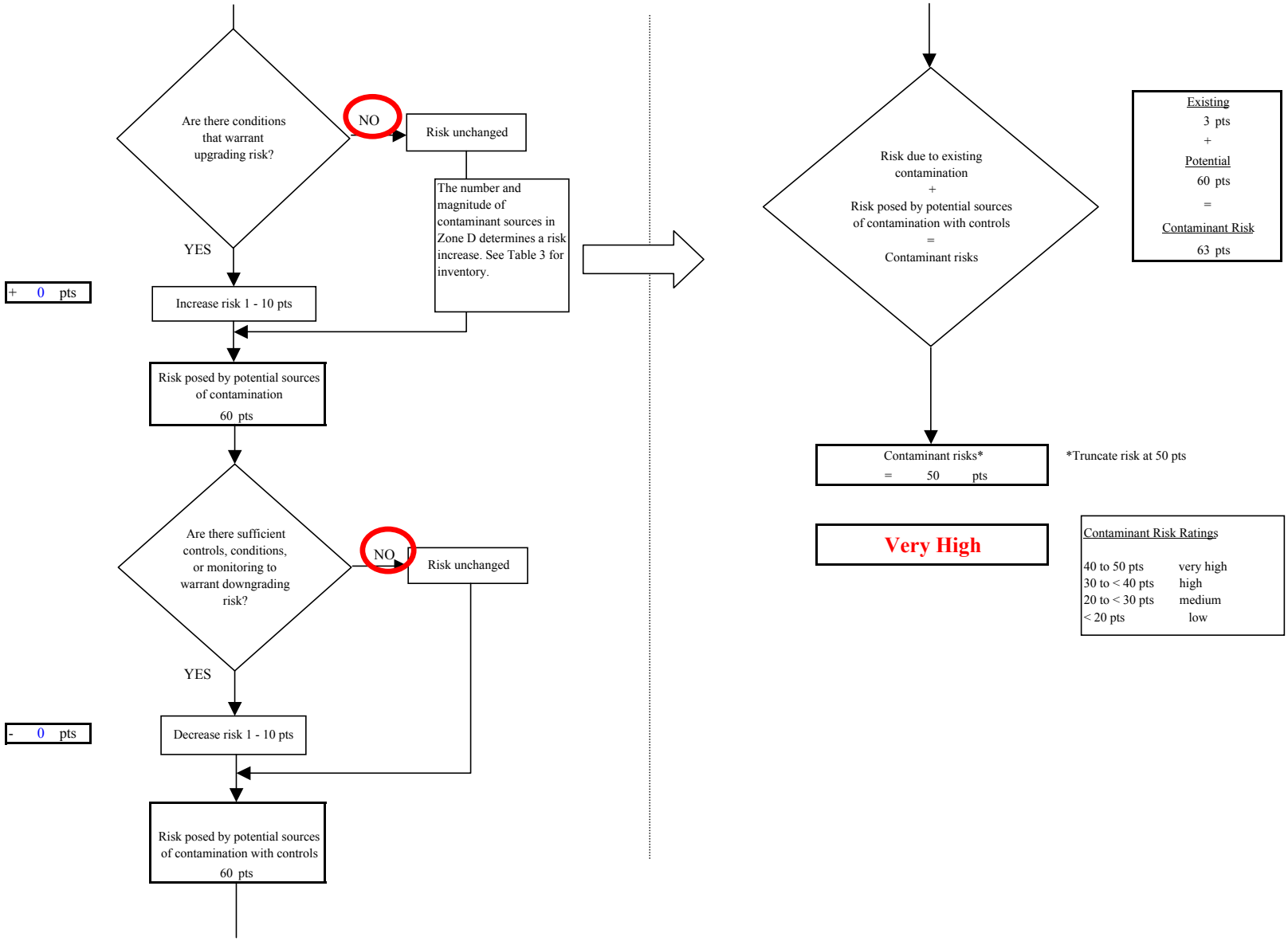


Chart 6. Vulnerability analysis for AK Gateway SD - Mentasta Lake (PWS No. 380379.001) - Nitrates and Nitrites

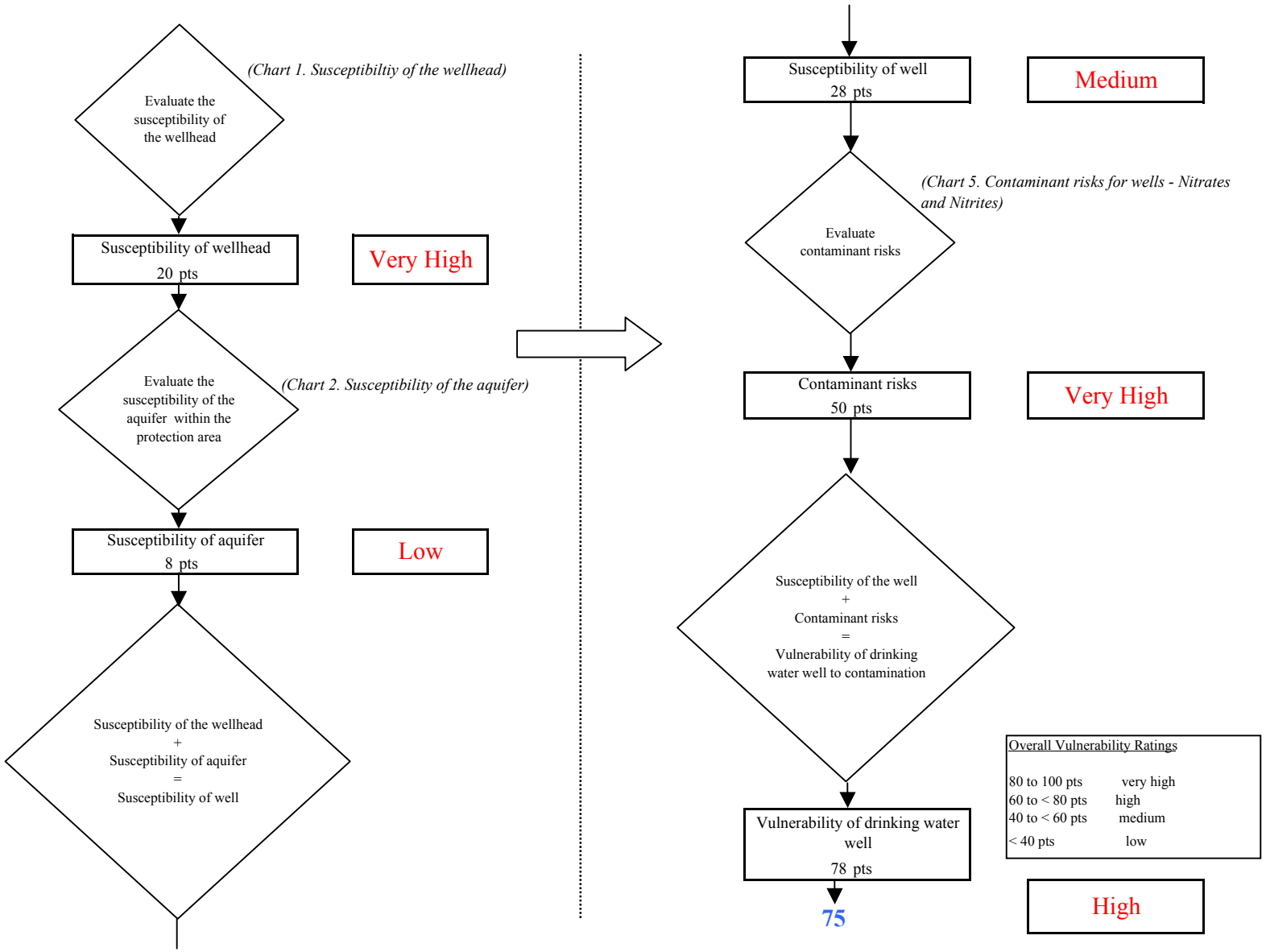


Chart 7. Contaminant risks for AK Gateway SD - Mentasta Lake (PWS No. 380379.001) - Volatile Organic Chemicals

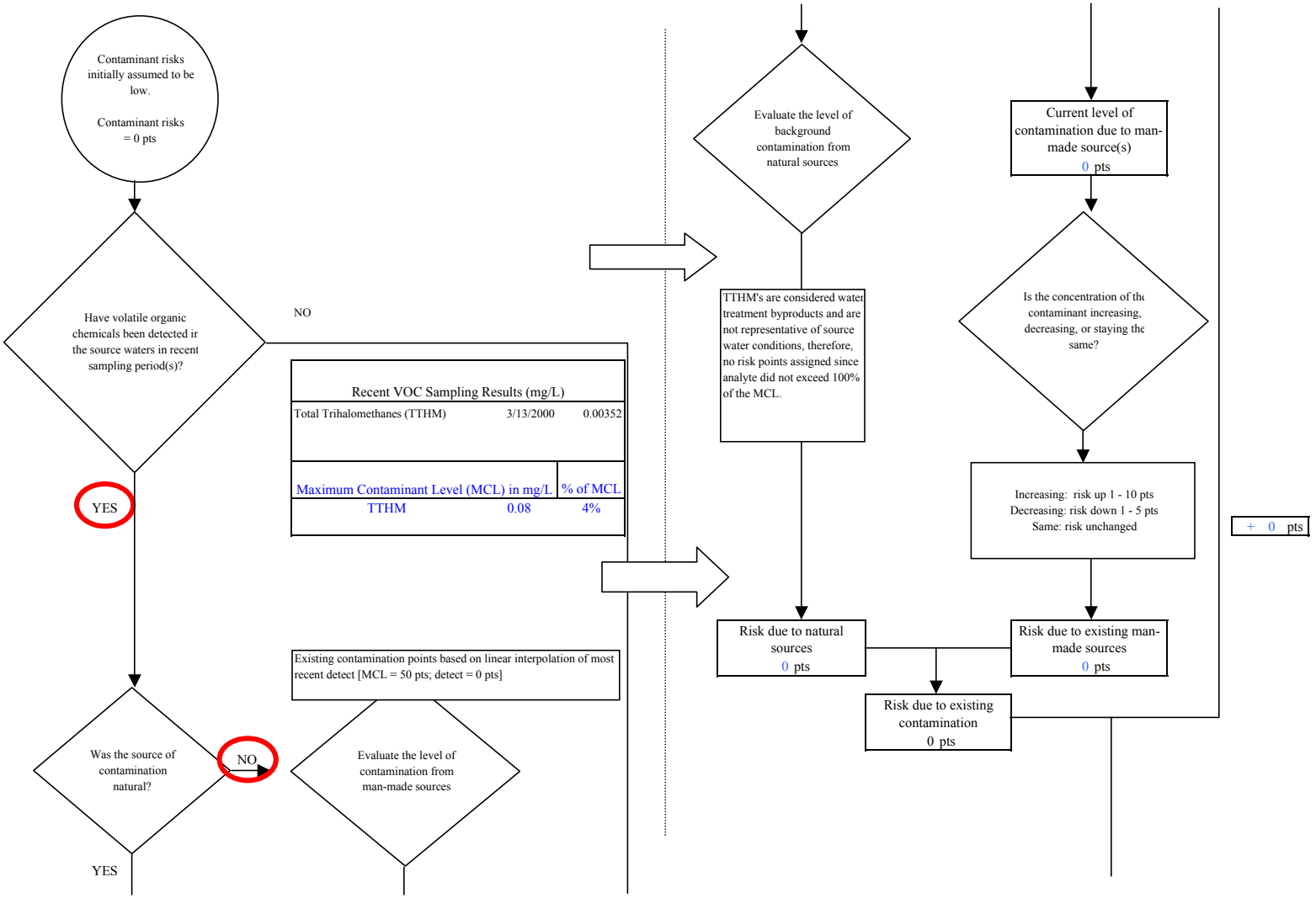
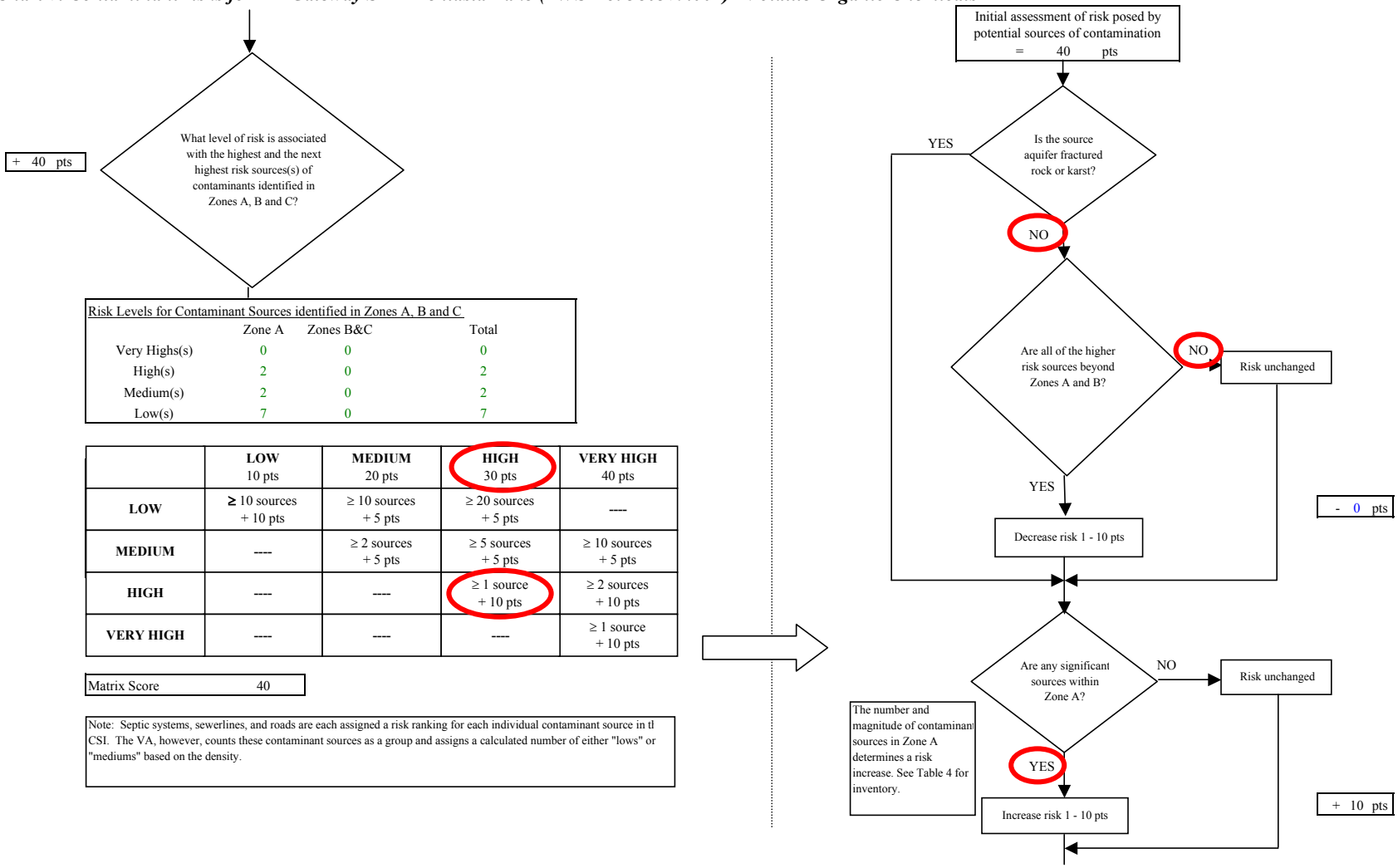


Chart 7. Contaminant risks for AK Gateway SD - Mentasta Lake (PWS No. 380379.001) - Volatile Organic Chemicals



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

	Zone A	Zones B&C	Total
Very Highs(s)	0	0	0
High(s)	2	0	2
Medium(s)	2	0	2
Low(s)	7	0	7

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

Matrix Score 40

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

Chart 7. Contaminant risks for AK Gateway SD - Mentasta Lake (PWS No. 380379.001) - Volatile Organic Chemicals

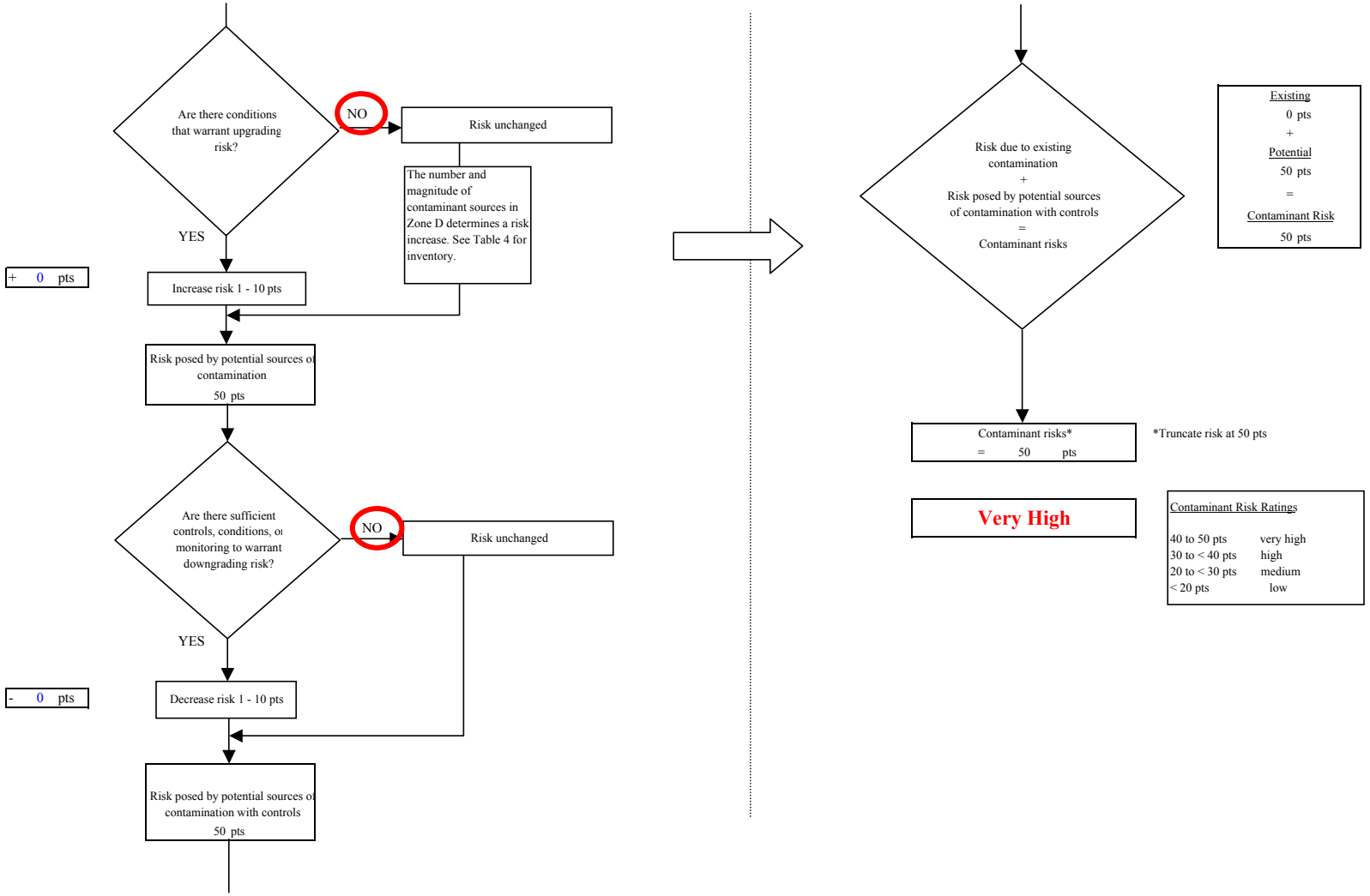


Chart 8. Vulnerability analysis for AK Gateway SD - Mentasta Lake (PWS No. 380379.001) - Volatile Organic Chemicals

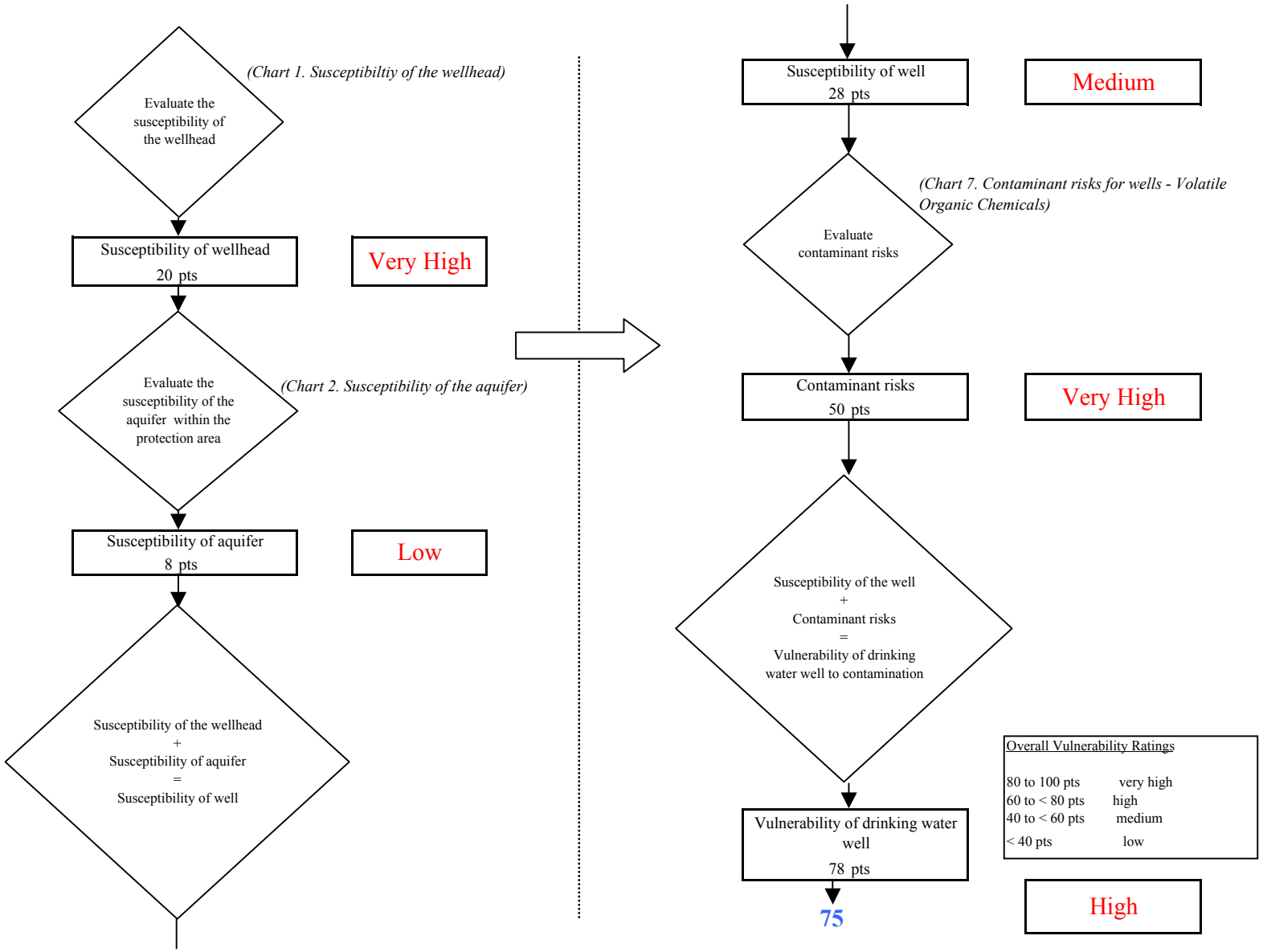


Chart 9. Contaminant risks for AK Gateway SD - Mentasta Lake (PWS No. 380379.001) - Heavy Metals, Cyanide and Other Inorganic Chemicals

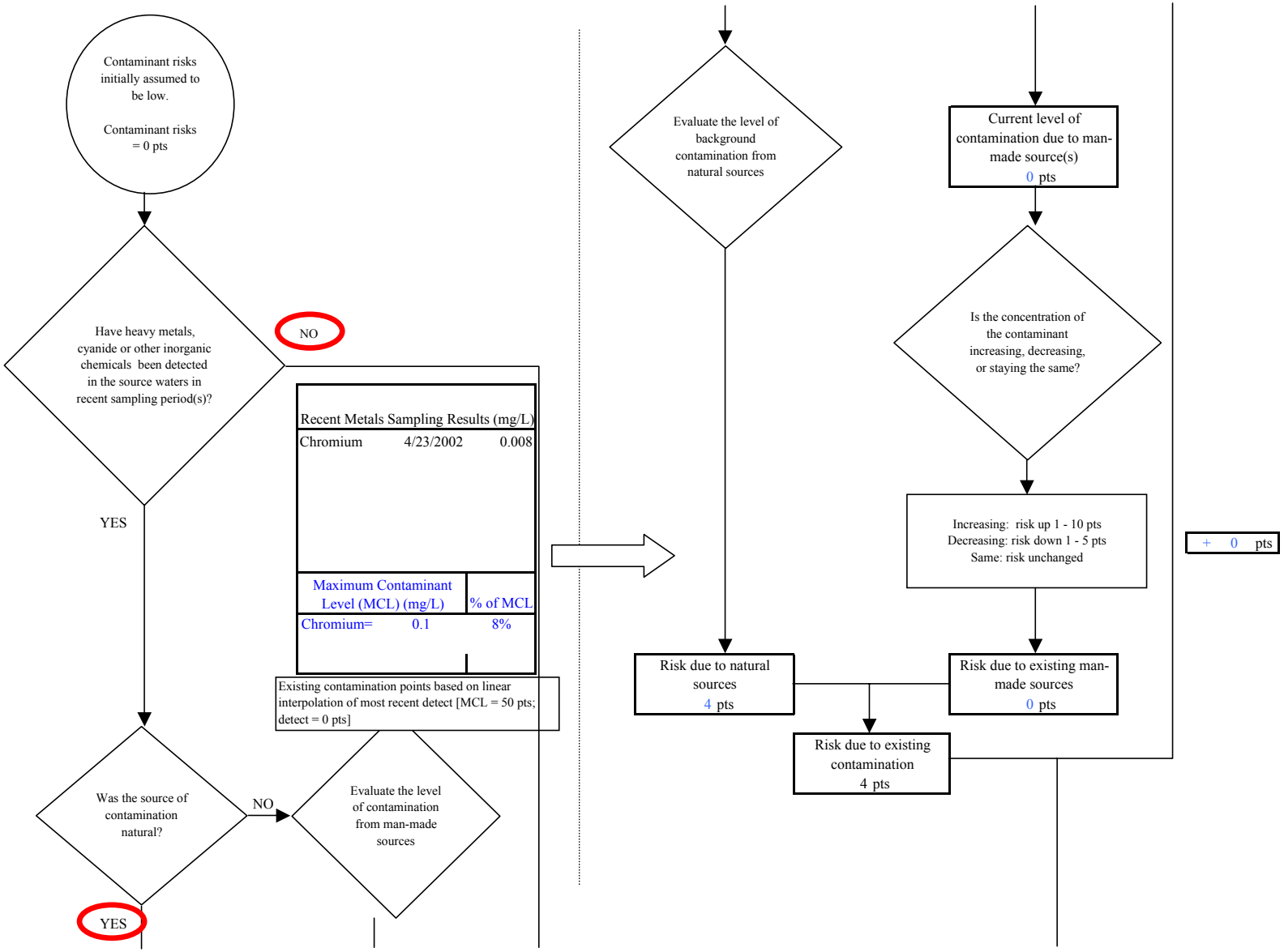
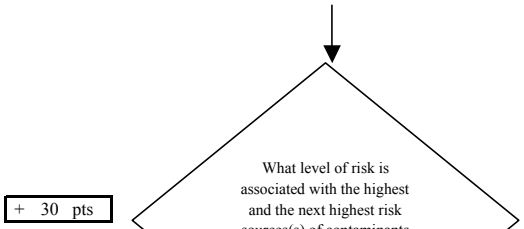


Chart 9. Contaminant risks for AK Gateway SD - Mentasta Lake (PWS No. 380379.001) - Heavy Metals, Cyanide and Other Inorganic Chemicals



+ 30 pts

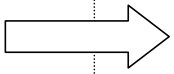
Risk Levels for Contaminant Sources identified in Zones A, B and C

	Zone A	Zones B&C	Total
Very Highs(s)	0	0	0
High(s)	1	0	1
Medium(s)	1	0	1
Low(s)	8	0	8

	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 30

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.



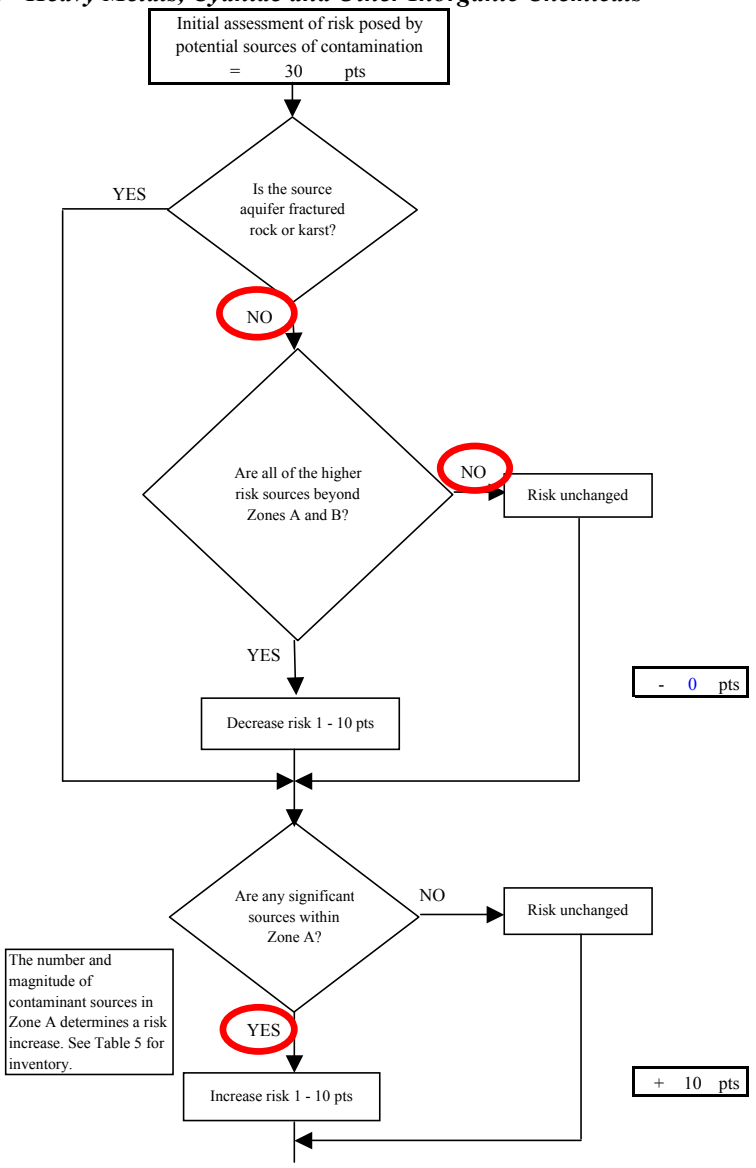


Chart 9. Contaminant risks for AK Gateway SD - Mentasta Lake (PWS No. 380379.001) - Heavy Metals, Cyanide and Other Inorganic Chemicals

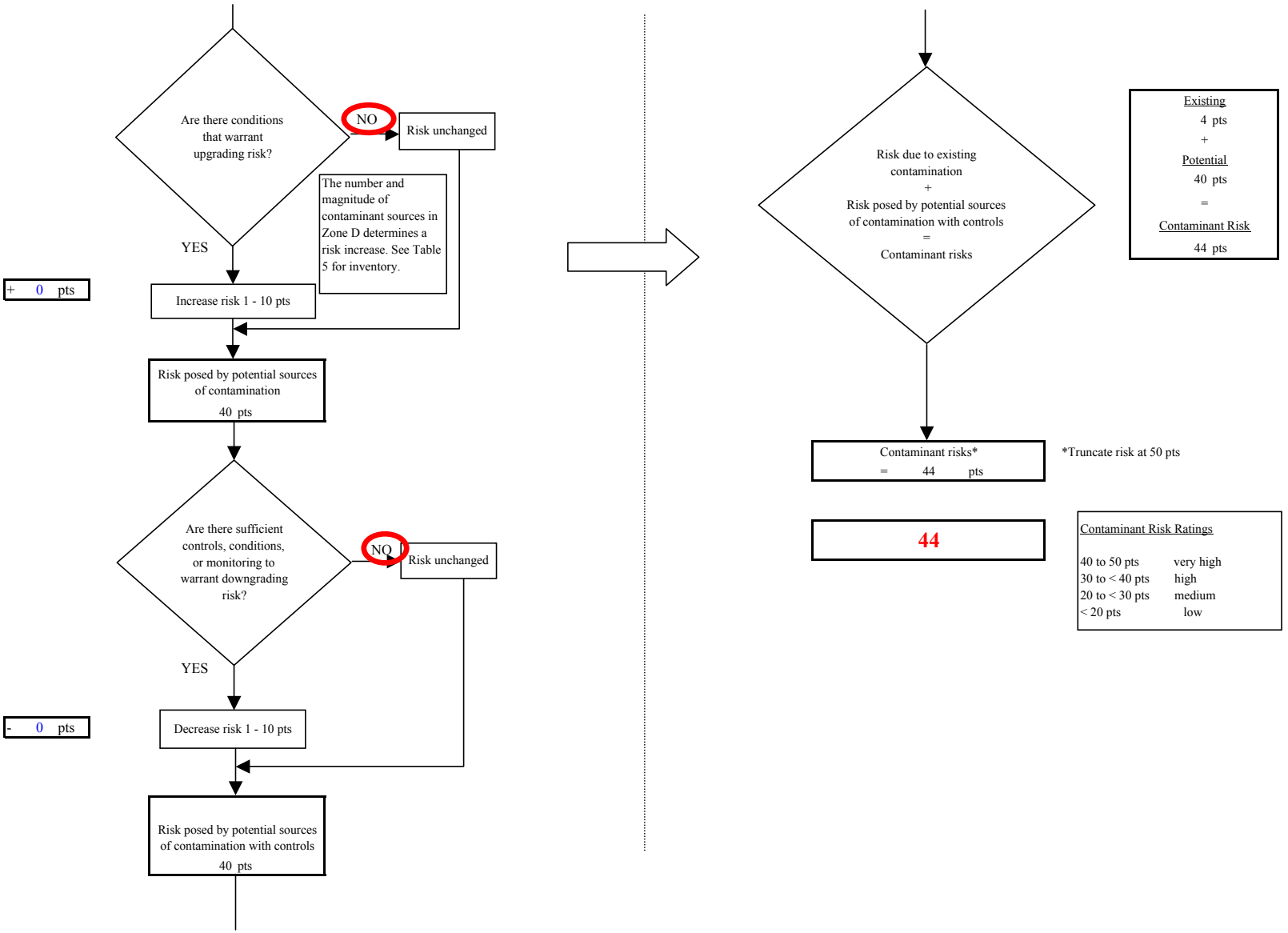


Chart 10. Vulnerability analysis for AK Gateway SD - Mentasta Lake (PWS No. 380379.001) - Heavy Metals, Cyanide and Other Inorganic Chemicals

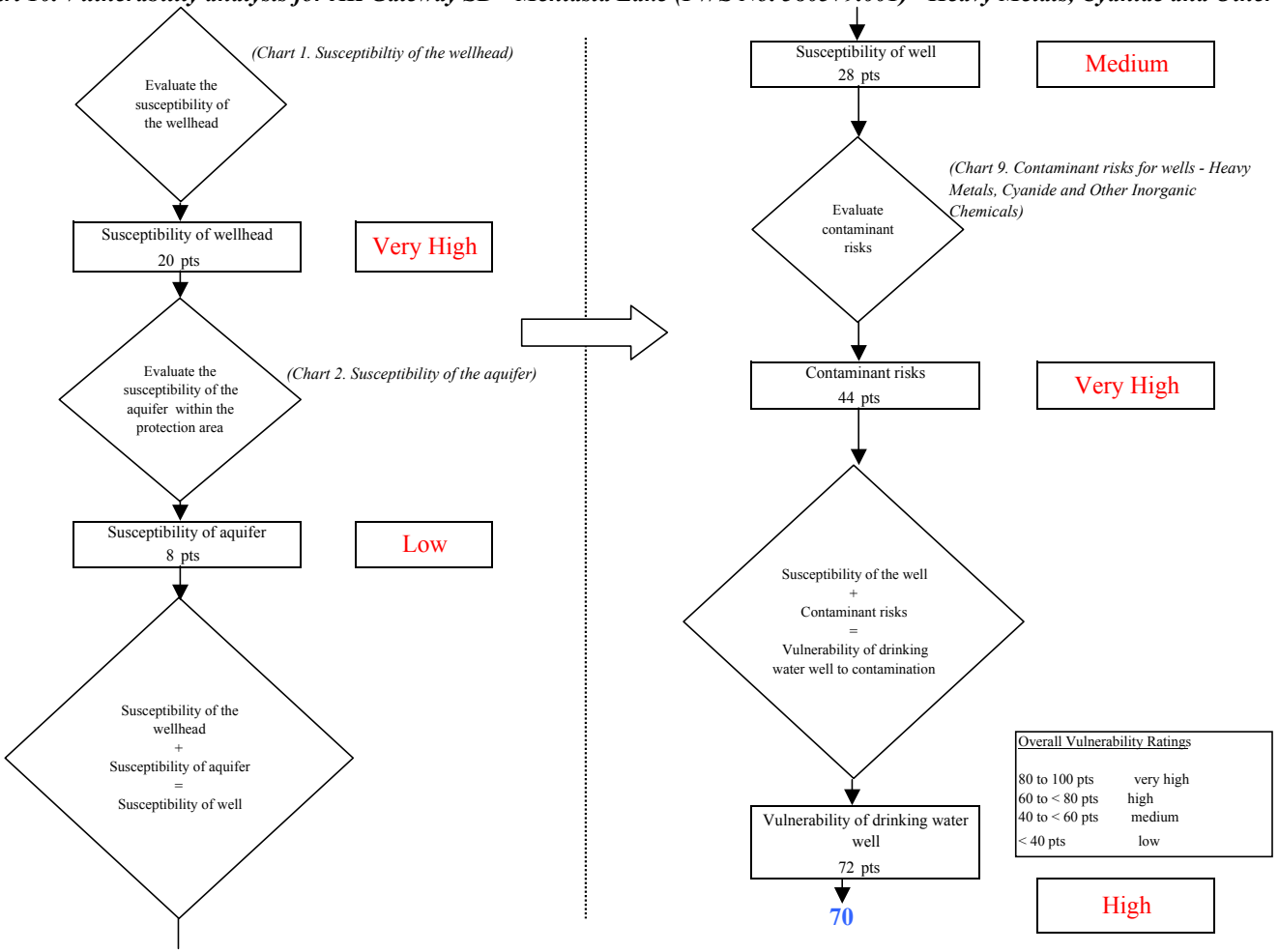


Chart 11. Contaminant risks for AK Gateway SD - Mentasta Lake (PWS No. 380379.001) - Synthetic Organic Chemicals

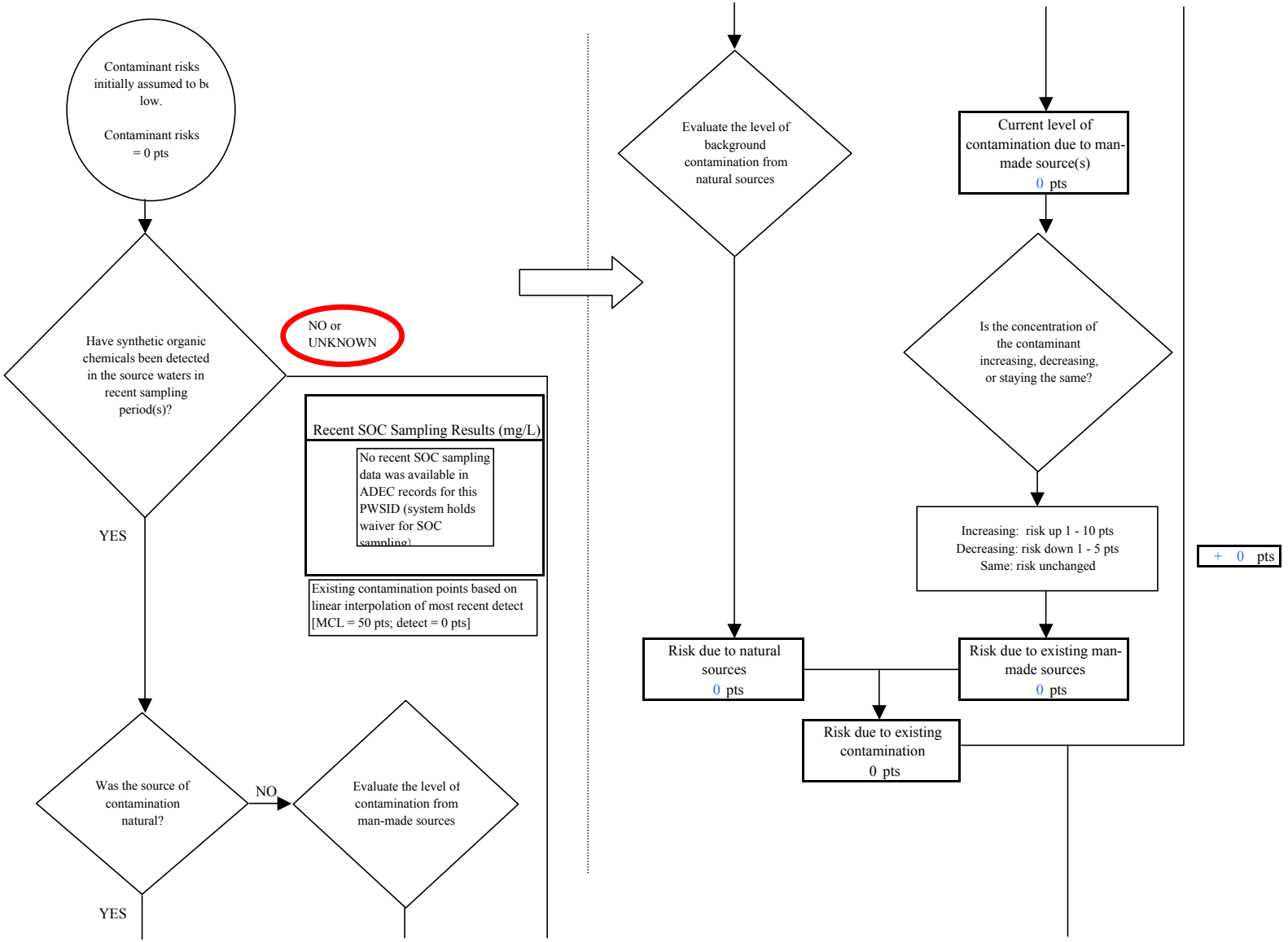
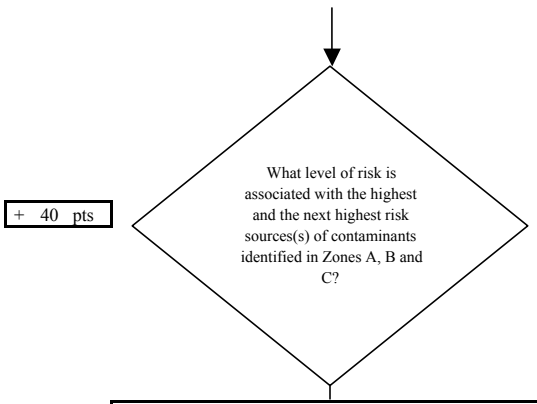


Chart 11. Contaminant risks for AK Gateway SD - Mentasta Lake (PWS No. 380379.001) - Synthetic Organic Chemicals



+ 40 pts

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

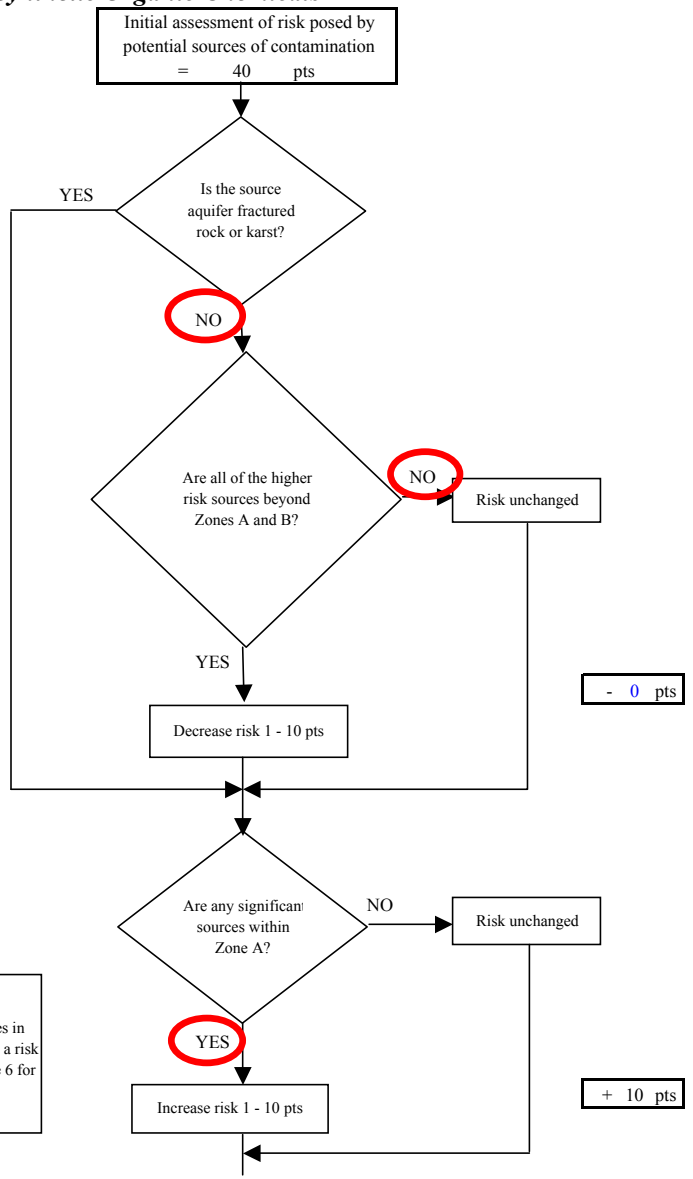
	Zone A	Zones B&C	Total
Very Highs(s)	1	0	1
High(s)	0	0	0
Medium(s)	1	0	1
Low(s)	5	0	5

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

Matrix Score 40

Note: Septic systems, sewerlines, and roads are each assigned a risk ranking for each individua 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.

The number and magnitude of contaminant sources in Zone A determines a risk increase. See Table 6 for inventory.



- 0 pts

+ 10 pts

Chart 11. Contaminant risks for AK Gateway SD - Mentasta Lake (PWS No. 380379.001) - Synthetic Organic Chemicals

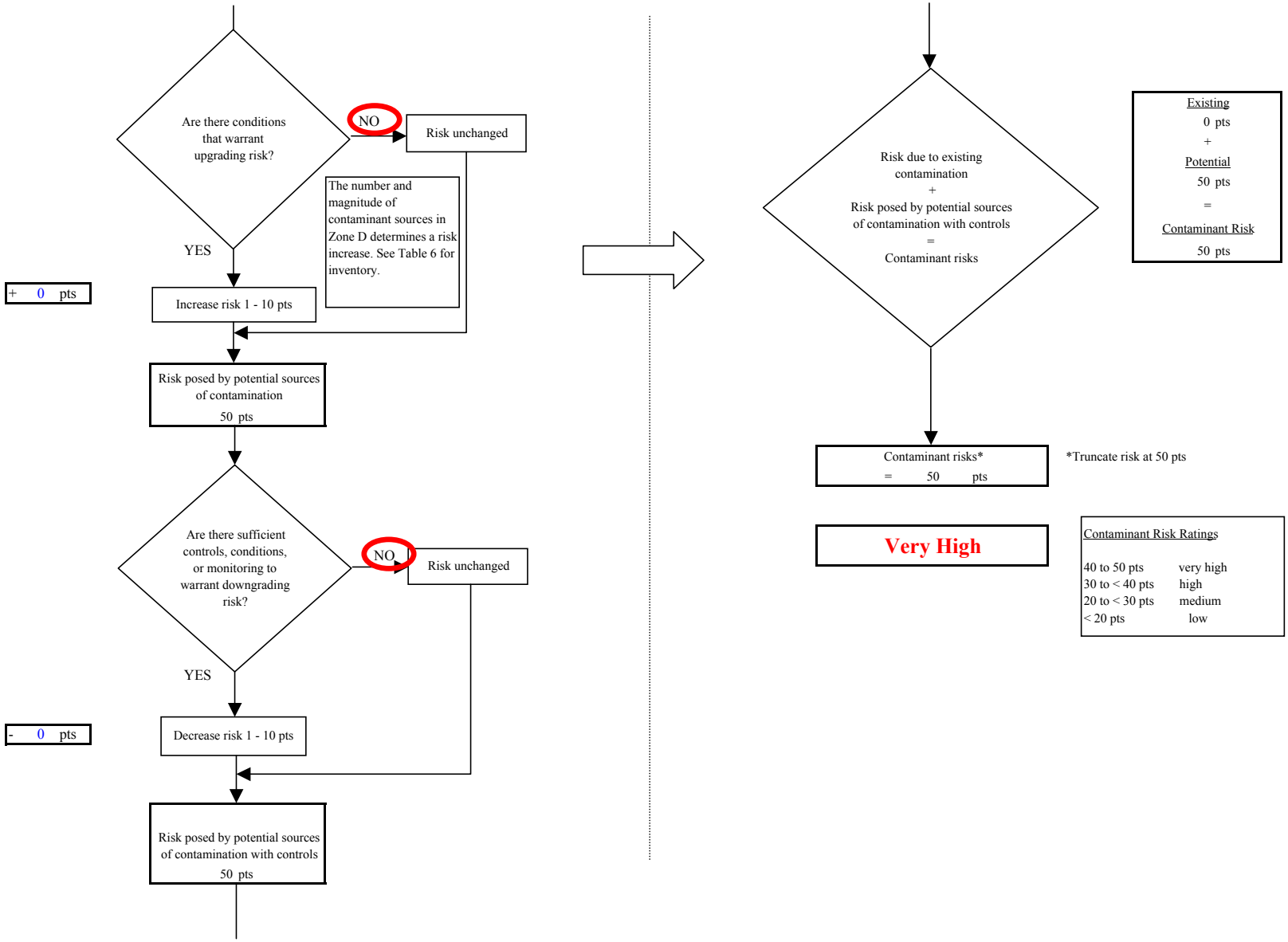


Chart 12. Vulnerability analysis for AK Gateway SD - Mentasta Lake (PWS No. 380379.001) - Synthetic Organic Chemicals

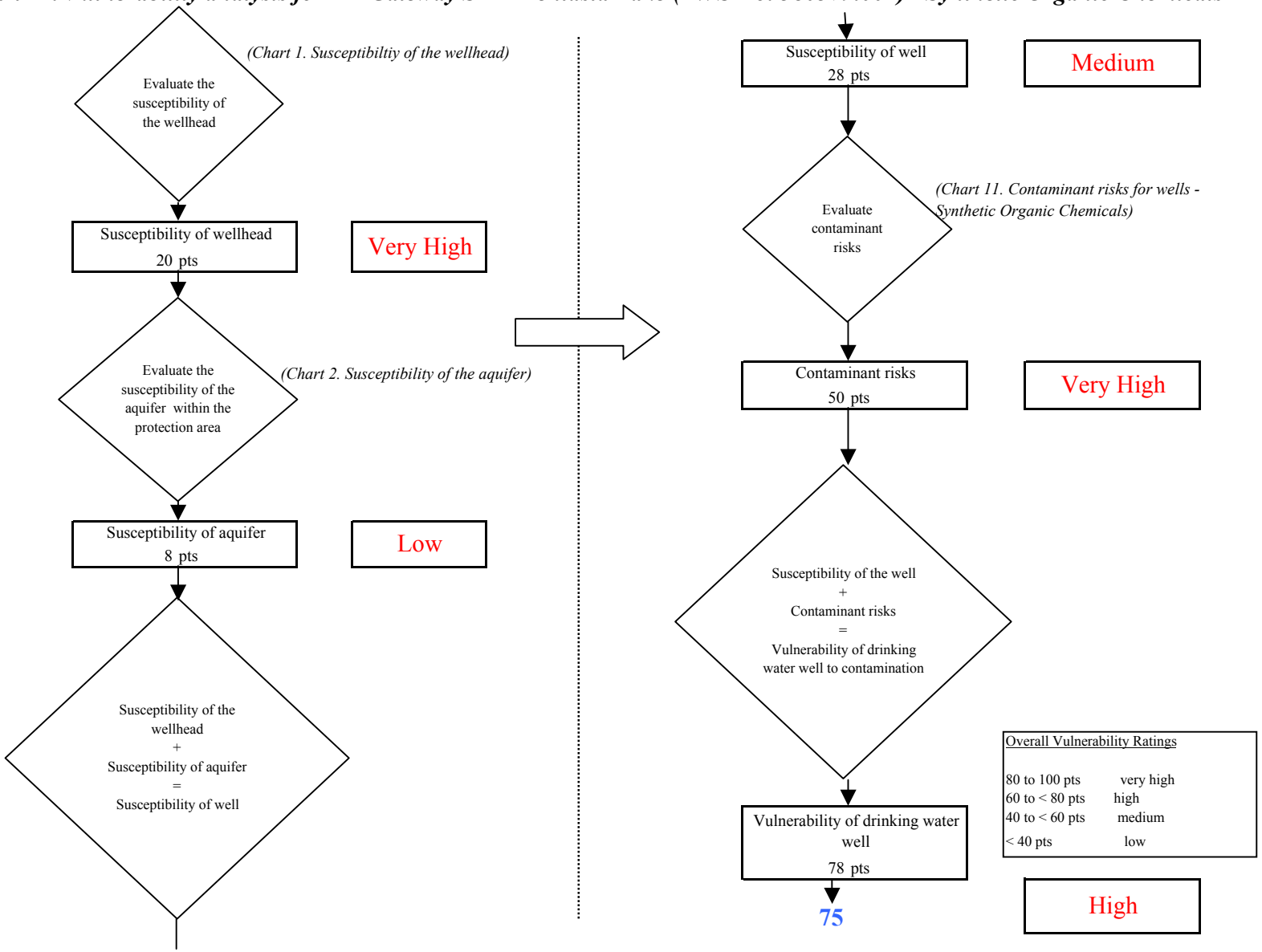


Chart 13. Contaminant risks for AK Gateway SD - Mentasta Lake (PWS No. 380379.001) - Other Organic Chemicals

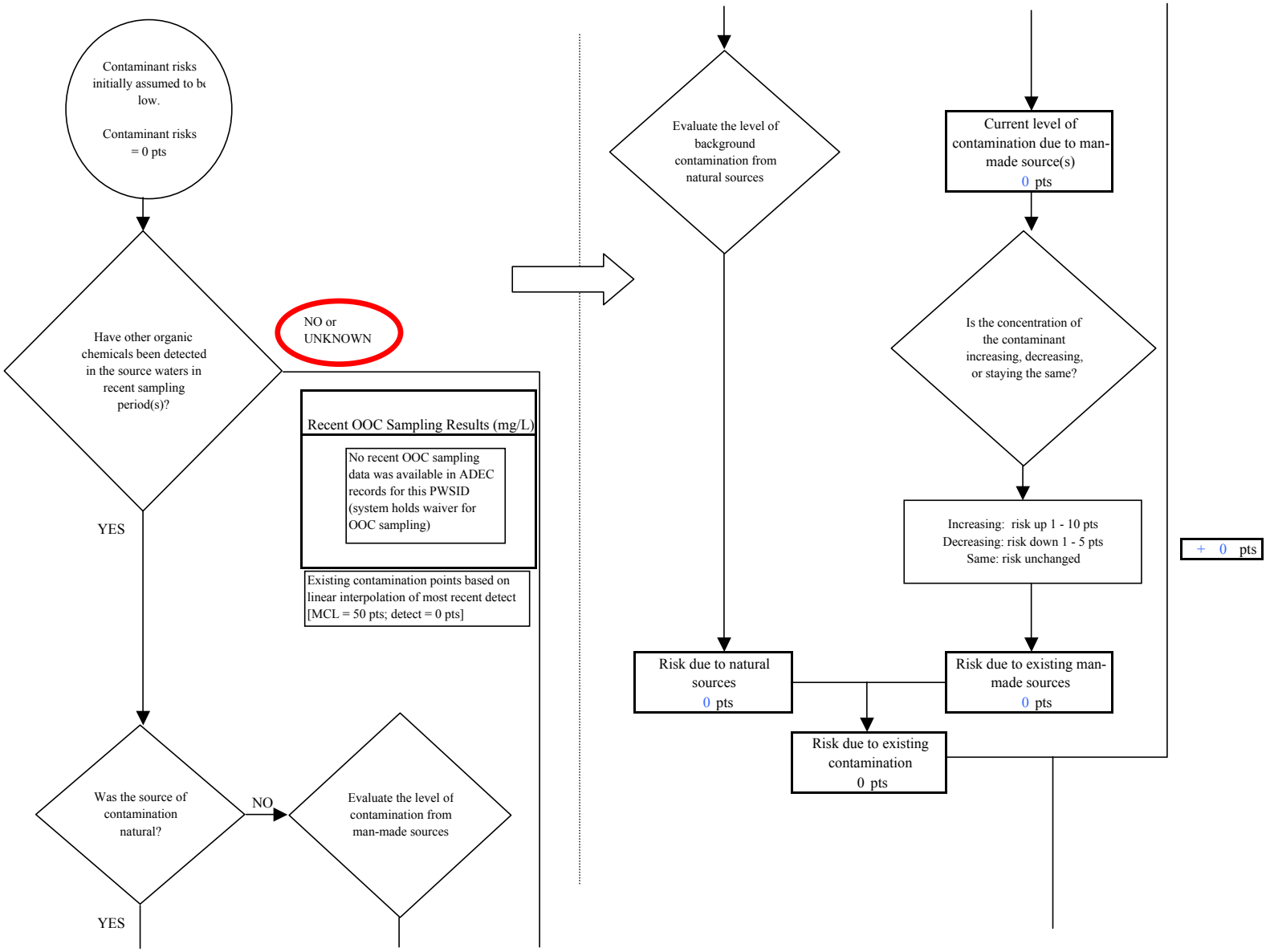


Chart 13. Contaminant risks for AK Gateway SD - Mentasta Lake (PWS No. 380379.001) - Other Organic Chemicals

+ 40 pts

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

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

	Zone A	Zones B&C	Total
Very Highs(s)	1	0	1
High(s)	0	0	0
Medium(s)	0	0	0
Low(s)	7	0	7

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

Matrix Score 40

Note: Septic systems, sewerlines, and roads are each assigned a risk ranking for each individua 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 = 40 pts

Is the source aquifer fractured rock or karst?

YES

NO

Are all of the higher risk sources beyond Zones A and B?

NO

Risk unchanged

YES

Decrease risk 1 - 10 pts

- 0 pts

Are any significant sources within Zone A?

NO

Risk unchanged

YES

Increase risk 1 - 10 pts

+ 10 pts

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

Chart 13. Contaminant risks for AK Gateway SD - Mentasta Lake (PWS No. 380379.001) - Other Organic Chemicals

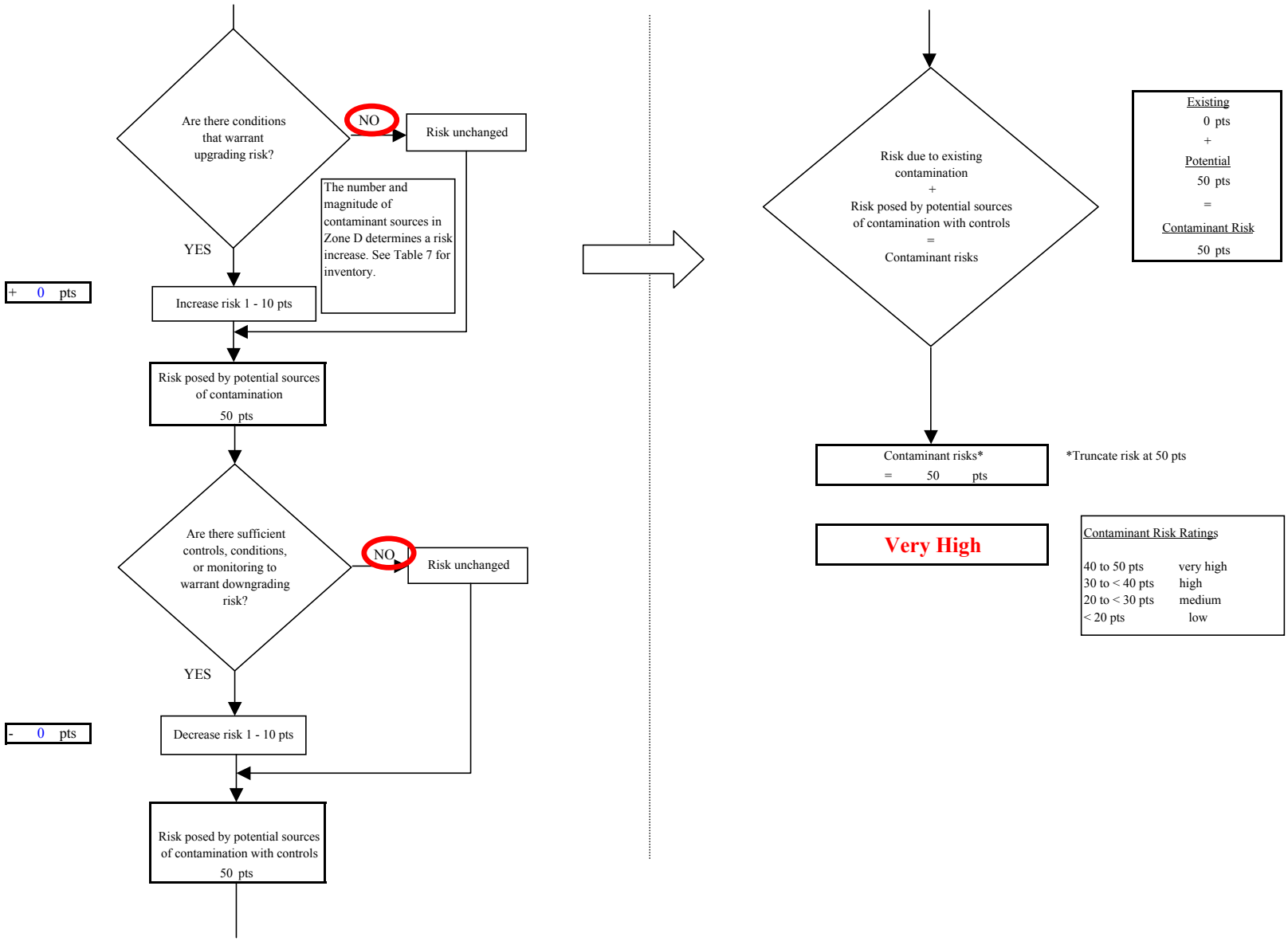


Chart 14. Vulnerability analysis for AK Gateway SD - Mentasta Lake (PWS No. 380379.001) - Other Organic Chemicals