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# Source Water Assessment

A Hydrogeologic Susceptibility and  
Vulnerability Assessment for  
Yukon-Kuskokwim Correctional Center  
Drinking Water System,  
Bethel, Alaska

PWSID # 271334.001

April 2004

DRINKING WATER PROTECTION PROGRAM REPORT 1132  
Alaska Department of Environmental Conservation

Source Water Assessment for  
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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 Yukon-Kuskokwim Correctional Center Source of Public Drinking Water, Bethel, Alaska

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## Drinking Water Protection Program Alaska Department of Environmental Conservation

### EXECUTIVE SUMMARY

The Yukon-Kuskokwim Correctional Center has one Public Water System (PWS) well. The date of well construction is unknown; however, it is assumed that the well (PWS No. 271334.001) has been used as a drinking water source since that time.

The well is a Class A (community and non-transient/non-community) water system located at 1000 State Highway in Bethel, Alaska. Available records and interviews with the operator indicate that there is water storage with a capacity of 9,500-gallons, and that the drinking water is filtered and then treated with calcium hypochlorite. This system operates year-round and serves approximately 100 residents and 41 non-residents through 3 service connections. The service connections serve the Correctional Center, the Bethel Youth Facility, and the Bethel Group Home. It is anticipated that the Bethel Group Home will be disconnected from this system in the Fall of 2004.

The wellhead received a susceptibility rating of **Low** and the aquifer received a susceptibility rating of **Very High**. Combining these two ratings produce a **Medium** rating for the natural susceptibility of the well.

Identified potential and current sources of contaminants for the public drinking water source include: domestic wastewater collection systems, aboveground fuel tanks, roads, medical/veterinary facilities, underground fuel tanks, water supply wells, an injection well, an Alaska Department of Environmental Conservation (ADEC) recognized leaking underground storage tank (LUST) site, and an airport. These identified potential and existing sources of contamination are considered as sources of bacteria and viruses, nitrates and/or nitrites, volatile organic chemicals, heavy metals, cyanide and other inorganic chemicals, synthetic organic chemicals, and other organic chemicals contaminant categories.

Overall, the water well received a vulnerability rating of **Low** for synthetic organic chemicals, a

vulnerability rating of **High** for bacteria and viruses, nitrates and nitrites, other organic chemicals, volatile organic chemicals, and heavy metals, cyanide and other inorganic chemicals.

### PUBLIC DRINKING WATER SYSTEM

The Yukon-Kuskokwim Correctional Center is a Class A (community/non-transient/non-community) public water system. The system is located at 1000 State Highway in Bethel, Alaska (Sec. 17, T8N, R71W, Seward Meridian; see Map A of Appendix A). Bethel serves as the regional center for 56 villages in the Yukon-Kuskokwim Delta. Food, fuel, transportation, medical care, and other services for the region are provided by Bethel. Bethel is located at the mouth of the Kuskokwim River, 40-miles inland from the Bering Sea, and approximately 400-air miles west of Anchorage. The community has a population of 5,736 (ADCED, 2003). Average annual precipitation for Bethel is 16 inches, including approximately 50 inches of snowfall. Temperatures range from 42 to 62°F in summer and -2 to 19°F in winter.

The community of Bethel obtains a portion of their water supply from city wells. Some households are served by the central piped water and sewage collection system; however, approximately 75% of households have water delivered and sewage hauled by truck. Several facilities have individual wells and septic tanks (ADCED, 2003). Bethel receives electrical power from the Bethel Utilities Corporation. Power generating facilities are fueled by diesel. Refuse is collected by the City of Bethel and transported to the City operated landfill (ADCED, 2003).

According to information supplied by ADEC for the Yukon-Kuskokwim Correctional Center PWS, the depth of the primary water well is 131 feet below the ground surface (bgs). The well is screened in an unconfined aquifer based on available construction details. The well is not located within a floodplain.

Information acquired from a February 1997 sanitary survey for the public water system indicated that the

land surface was sloped away from the well. Generally, land surfaces that slope away from the wellhead promote surface water drainage, which reduces the potential of contaminant migration down the well casing annulus. The sanitary survey indicates that the well is grouted according to ADEC regulations. Proper grouting provides added protection against contaminants traveling along the well casing annulus and into source waters.

The Bethel area is near the southern border of the continuous permafrost zone and the City of Bethel, and most of the area west of the Kuskokwim River, appear to be underlain with permafrost. The permafrost generally extends to a depth of at least 300 feet bgs, with depths of over 600 feet bgs recorded in some areas. The geology in the area consists primarily of unconsolidated floodplain alluvium, silt deposits, and reworked silt. The Bethel area consists of poorly drained wetlands that have permanently ponded water in local depressions. Sloughs, small lakes, ponds, and marshes in meander scars surround Bethel (Dames & Moore, 1996).

**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 well.

The most probable area for contamination to reach the drinking water well is the area that contributes water to the well, the groundwater recharge area. This area is designated as the drinking water protection area (DWPA). Because releases of contaminants within the protection area are most likely to impact the drinking water well, this area will serve as the focus for voluntary protection efforts. An analytical calculation was used to determine the size and shape of the DWPA for the Yukon-Kuskokwim Correctional Center PWS. The input parameters describing the attributes of the aquifer in this calculation were adopted from Groundwater (Freeze and Cherry, 1979). Available geology and groundwater contours were also considered to take into account any uncertainties in groundwater flow and aquifer characteristics to arrive at a meaningful protection area.

The protection areas established for wells by the ADEC are usually separated into four zones, limited by the watershed. These zones correspond to differences in the time-of-travel (TOT) of the water

moving through the aquifer to the well (Please refer to the Guidance Manual for Class A Public Water Systems for additional information).

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

**Table 1. Definition of Zones**

<b>Zone</b>	<b>Definition</b>
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 Yukon-Kuskokwim Correctional Center PWS was determined using an analytical calculation and includes Zones A, B, C, and D (See Map A of Appendix A).

**INVENTORY OF POTENTIAL AND EXISTING CONTAMINANT SOURCES**

The Drinking Water Protection Program has completed an inventory of potential and existing sources of contamination within the Yukon-Kuskokwim Correctional Center 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 Yukon-Kuskokwim Correctional Center’s water well is in an unconfined aquifer. Unconfined aquifers are more susceptible to potential groundwater quality impacts posed by the migration of surface water contaminants downward from the surface. Table 2 shows the susceptibility scores and ratings for this PWS.

**Table 2. Susceptibility**

	Score	Rating
Susceptibility of the Wellhead	0	Low
Susceptibility of the Aquifer	23	Very High
Natural Susceptibility	23	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	40	Very High
Nitrates and/or Nitrites	40	Very High
Volatile Organic Chemicals	50	Very High
Heavy Metals, Cyanide and		
Other Inorganic Chemicals	50	Very High
Synthetic Organic Chemicals	2	Low
Other Organic Chemicals	40	Very High

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

$$\begin{array}{r}
 \text{Natural Susceptibility (0 – 50 points)} \\
 + \\
 \text{Contaminant Risks (0 – 50 points)} \\
 = \\
 \text{Vulnerability of the} \\
 \text{Drinking Water Source to Contamination (0 – 100).}
 \end{array}$$

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	60	High
Nitrates and Nitrites	60	High
Volatile Organic Chemicals	70	High
Heavy Metals, Cyanide and		
Other Inorganic Chemicals	70	High
Synthetic Organic Chemicals	25	Low
Other Organic Chemicals	60	High

**Bacteria and Viruses**

The contaminant risk for bacteria and viruses is **Very High**. The risk is primarily attributed to the presence of an injection well in Zone A (see Table 2 – Appendix B).

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

After combining the contaminant risk for bacteria and viruses with the natural susceptibility of the well, the overall vulnerability of the well to contamination is **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 an injection well 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 nitrates have not 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).

Nitrate levels are often derived from the decomposition of organic matter in soils. After combining the contaminant risk for nitrates and nitrites with the natural susceptibility of the well, the

overall vulnerability of the well to nitrate and nitrite contamination is **High**.

### **Volatile Organic Chemicals**

The contaminant risk for volatile organic chemicals is **Very High**. The risk is primarily attributed to the presence of an underground fuel tank, an injection well, an ADEC recognized LUST site, and an airport in Zones A, B, and D. Numerous other potential contaminant sources are also found within the protection area (see Table 4 – Appendix B).

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

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

### **Heavy Metals, Cyanide and Other Inorganic Chemicals**

The contaminant risk for heavy metals, cyanide and other inorganic chemicals is **Very High**. The risk is primarily attributed to the presence of an injection well in Zone A. Numerous 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, arsenic has been detected in the recent sampling history. However, the analyte did not exceed the MCL of 0.05 mg/L (see Chart 9 – Contaminant Risks for Heavy Metals, Cyanide, and Other Inorganic Chemicals in Appendix D).

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

### **Synthetic Organic Chemicals**

The contaminant risk for synthetic organic chemicals is **Low**. The risk is primarily attributed to the presence of an airport in Zone D (see Table 6 – Appendix B).

No recent sampling data was available in ADEC records for the Yukon-Kuskokwim Correctional Center (See Chart 11 – Contaminant Risks for Synthetic Organic Chemicals in Appendix D).

After combining the contaminant risk for synthetic organic chemicals with the natural susceptibility of

the well, the overall vulnerability of the well to contamination is **Low**.

### **Other Organic Chemicals**

The contaminant risk for other organic chemicals is **Very High**. The risk is primarily attributed to the presence of an injection well in Zone A. Numerous 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 the Yukon-Kuskokwim Correctional Center (See Chart 13 – Contaminant Risks for Other Organic Chemicals in Appendix D).

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

### **Using the Source Water Assessment**

This assessment of contaminant risks can be used as a foundation for local voluntary protection efforts as well as a basis for the continuous efforts on the part of the Yukon-Kuskokwim Correctional Center and the community of Bethel 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.



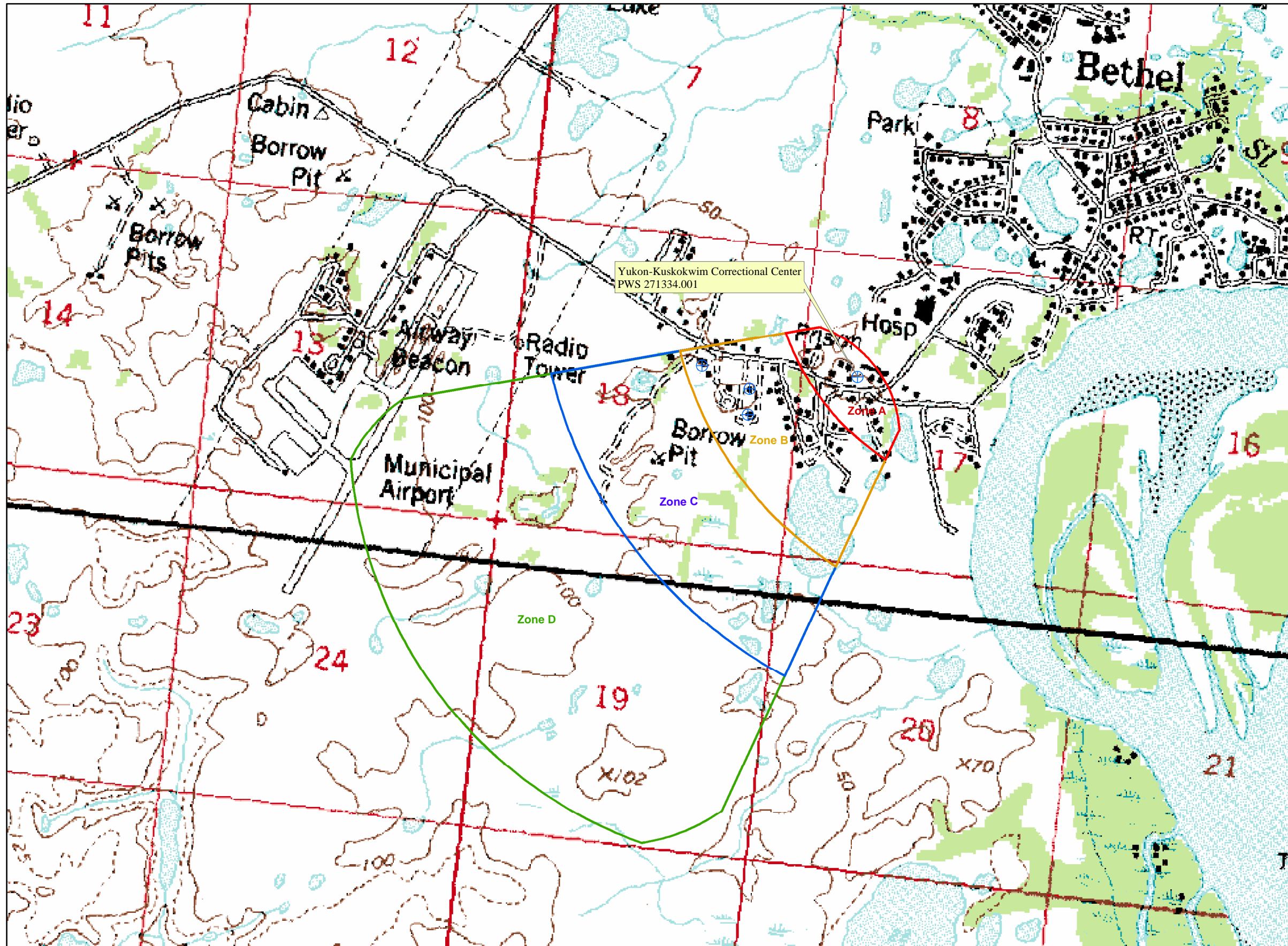
## REFERENCES

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# **APPENDIX A**

## **Drinking Water Protection Area Location Map (Map A)**

Public Water Well System for PWS #271334.001 Yukon-Kuskokwim Correctional Center



**LEGEND**

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

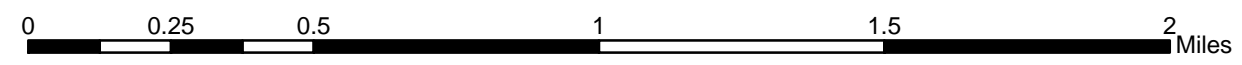
Data Sources:  
 Contaminant Sources, Public Water System Wells, Contours  
 Alaska Department of Environmental Conservation (ADEC)

Critical Facilities, Federal Emergency Management Agency (FEMA)

All other data:  
 United States Geological Survey (USGS)

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

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



## **APPENDIX B**

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

**Table 1****Contaminant Source Inventory for  
Yukon-Kuskokwim Correctional****PWSID 271334.001**

<b>Contaminant Source Type</b>	<b>Contaminant Source ID</b>	<b>CS ID tag</b>	<b>Zone</b>	<b>Map Number</b>	<b>Comments</b>
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D01-01	A	C	Assume area connected to municipal sewage
Injection wells (Class V) Industrial Process Water & Water Disposal Wells	D40	D40-01	A	C	Correction Facility
Tanks, heating oil, residential (above ground)	R08	R08-01	A	C	Assume 50 or less residential heating oil tanks in Zone A
Highways and roads, dirt/gravel	X24	X24-01	A	C	Assume 1-20 roads in Zone A
Medical/veterinary facilities (doctor or dentist offices, hospitals, nursing homes)	X40	X40-01	A	C	
Tanks, heating oil, residential (above ground)	R08	R08-02	B	C	Assume 50 or less residential heating oil tanks in Zone B
Tanks, diesel (underground)	T08	T08-01	B	C	YKCC
Tanks, heating oil, nonresidential (aboveground)	T14	T14-01	B	C	Bethel Trailer Court
Closed Leaking Underground Fuel Storage Tank (LUST) Sites	U08	U08-01	B	C	USFWS Yukon Delta NWR Headquarters, RecKey #1993250031801, Event ID 736, Facility ID 1272, petroleum contaminated soil identified during UST closure site assessment, site closed, NFA issued from ADEC.
Water supply wells	W09	W09-01	B	C	3 water supply wells in Zone B
Highways and roads, dirt/gravel	X24	X24-02	B	C	Assume 1-20 roads in Zone B
Highways and roads, dirt/gravel	X24	X24-03	C	C	Assume 1-20 roads in Zone C
Airports	X14	X14-01	D	C	

**Table 2**

*Contaminant Source Inventory and Risk Ranking for  
Yukon-Kuskokwim Correctional  
Sources of Bacteria and Viruses*

**PWSID 271334.001**

<i>Contaminant Source Type</i>	<i>Contaminant Source ID</i>	<i>CS ID tag</i>	<i>Zone</i>	<i>Risk Ranking for Analysis</i>	<i>Map Number</i>	<i>Comments</i>
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D01-01	A	Medium	C	Assume area connected to municipal sewage
Injection wells (Class V) Industrial Process Water & Water Disposal Wells	D40	D40-01	A	High	C	Correction Facility
Highways and roads, dirt/gravel	X24	X24-01	A	Low	C	Assume 1-20 roads in Zone A
Medical/veterinary facilities (doctor or dentist offices, hospitals, nursing homes)	X40	X40-01	A	Medium	C	
Closed Leaking Underground Fuel Storage Tank (LUST) Sites	U08	U08-01	B	Low	C	USFWS Yukon Delta NWR Headquarters, RecKey #1993250031801, Event ID 736, Facility ID 1272, petroleum contaminated soil identified during UST closure site assessment, site closed, NFA issued from ADEC.
Highways and roads, dirt/gravel	X24	X24-02	B	Low	C	Assume 1-20 roads in Zone B
Highways and roads, dirt/gravel	X24	X24-03	C	Low	C	Assume 1-20 roads in Zone C

Table 3

*Contaminant Source Inventory and Risk Ranking for  
Yukon-Kuskokwim Correctional  
Sources of Nitrates/Nitrites*

PWSID 271334.001

<i>Contaminant Source Type</i>	<i>Contaminant Source ID</i>	<i>CS ID tag</i>	<i>Zone</i>	<i>Risk Ranking for Analysis</i>	<i>Map Number</i>	<i>Comments</i>
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D01-01	A	Medium	C	Assume area connected to municipal sewage
Injection wells (Class V) Industrial Process Water & Water Disposal Wells	D40	D40-01	A	High	C	Correction Facility
Highways and roads, dirt/gravel	X24	X24-01	A	Low	C	Assume 1-20 roads in Zone A
Medical/veterinary facilities (doctor or dentist offices, hospitals, nursing homes)	X40	X40-01	A	Low	C	
Closed Leaking Underground Fuel Storage Tank (LUST) Sites	U08	U08-01	B	Low	C	USFWS Yukon Delta NWR Headquarters, RecKey #1993250031801, Event ID 736, Facility ID 1272, petroleum contaminated soil identified during UST closure site assessment, site closed, NFA issued from ADEC.
Highways and roads, dirt/gravel	X24	X24-02	B	Low	C	Assume 1-20 roads in Zone B
Highways and roads, dirt/gravel	X24	X24-03	C	Low	C	Assume 1-20 roads in Zone C
Airports	X14	X14-01	D	Low	C	

*Contaminant Source Inventory and Risk Ranking for  
Yukon-Kuskokwim Correctional  
Sources of Volatile Organic Chemicals*

*PWSID 271334.001*

**Table 4**

<i>Contaminant Source Type</i>	<i>Contaminant Source ID</i>	<i>CS ID tag</i>	<i>Zone</i>	<i>Risk Ranking for Analysis</i>	<i>Map Number</i>	<i>Comments</i>
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D01-01	A	Low	C	Assume area connected to municipal sewage
Injection wells (Class V) Industrial Process Water & Water Disposal Wells	D40	D40-01	A	High	C	Correction Facility
Tanks, heating oil, residential (above ground)	R08	R08-01	A	Medium	C	Assume 50 or less residential heating oil tanks in Zone A
Highways and roads, dirt/gravel	X24	X24-01	A	Low	C	Assume 1-20 roads in Zone A
Medical/veterinary facilities (doctor or dentist offices, hospitals, nursing homes)	X40	X40-01	A	Low	C	
Tanks, heating oil, residential (above ground)	R08	R08-02	B	Medium	C	Assume 50 or less residential heating oil tanks in Zone B
Tanks, diesel (underground)	T08	T08-01	B	High	C	YKCC
Tanks, heating oil, nonresidential (aboveground)	T14	T14-01	B	Low	C	Bethel Trailer Court
Closed Leaking Underground Fuel Storage Tank (LUST) Sites	U08	U08-01	B	High	C	USFWS Yukon Delta NWR Headquarters, RecKey #1993250031801, Event ID 736, Facility ID 1272, petroleum contaminated soil identified during UST closure site assessment, site closed, NFA issued from ADEC.
Highways and roads, dirt/gravel	X24	X24-02	B	Low	C	Assume 1-20 roads in Zone B
Highways and roads, dirt/gravel	X24	X24-03	C	Low	C	Assume 1-20 roads in Zone C
Airports	X14	X14-01	D	High	C	



*Contaminant Source Inventory and Risk Ranking for  
Yukon-Kuskokwim Correctional*

*PWSID 271334.001*

**Table 5**

*Sources of Heavy Metals, Cyanide and Other Inorganic Chemicals*

<i>Contaminant Source Type</i>	<i>Contaminant Source ID</i>	<i>CS ID tag</i>	<i>Zone</i>	<i>Risk Ranking for Analysis</i>	<i>Map Number</i>	<i>Comments</i>
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D01-01	A	Low	C	Assume area connected to municipal sewage
Injection wells (Class V) Industrial Process Water & Water Disposal Wells	D40	D40-01	A	High	C	Correction Facility
Highways and roads, dirt/gravel	X24	X24-01	A	Low	C	Assume 1-20 roads in Zone A
Medical/veterinary facilities (doctor or dentist offices, hospitals, nursing homes)	X40	X40-01	A	Low	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-01	B	Low	C	Bethel Trailer Court
Closed Leaking Underground Fuel Storage Tank (LUST) Sites	U08	U08-01	B	Low	C	USFWS Yukon Delta NWR Headquarters, RecKey #1993250031801, Event ID 736, Facility ID 1272, petroleum contaminated soil identified during UST closure site assessment, site closed, NFA issued from ADEC.
Highways and roads, dirt/gravel	X24	X24-02	B	Low	C	Assume 1-20 roads in Zone B
Highways and roads, dirt/gravel	X24	X24-03	C	Low	C	Assume 1-20 roads in Zone C
Airports	X14	X14-01	D	Low	C	

*Contaminant Source Inventory and Risk Ranking for  
Yukon-Kuskokwim Correctional  
Sources of Synthetic Organic Chemicals*

*PWSID 271334.001*

**Table 6**

<i>Contaminant Source Type</i>	<i>Contaminant Source ID</i>	<i>CS ID tag</i>	<i>Zone</i>	<i>Risk Ranking for Analysis</i>	<i>Map Number</i>	<i>Comments</i>
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D01-01	A	Low	C	Assume area connected to municipal sewage
Medical/veterinary facilities (doctor or dentist offices, hospitals, nursing homes)	X40	X40-01	A	Low	C	
Closed Leaking Underground Fuel Storage Tank (LUST) Sites	U08	U08-01	B	Low	C	USFWS Yukon Delta NWR Headquarters, RecKey #1993250031801, Event ID 736, Facility ID 1272, petroleum contaminated soil identified during UST closure site assessment, site closed, NFA issued from ADEC.
Airports	X14	X14-01	D	Medium	C	

*Contaminant Source Inventory and Risk Ranking for  
Yukon-Kuskokwim Correctional  
Sources of Other Organic Chemicals*

*PWSID 271334.001*

**Table 7**

<i>Contaminant Source Type</i>	<i>Contaminant Source ID</i>	<i>CS ID tag</i>	<i>Zone</i>	<i>Risk Ranking for Analysis</i>	<i>Map Number</i>	<i>Comments</i>
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D01-01	A	Low	C	Assume area connected to municipal sewage
Injection wells (Class V) Industrial Process Water & Water Disposal Wells	D40	D40-01	A	High	C	Correction Facility
Highways and roads, dirt/gravel	X24	X24-01	A	Low	C	Assume 1-20 roads in Zone A
Closed Leaking Underground Fuel Storage Tank (LUST) Sites	U08	U08-01	B	Low	C	USFWS Yukon Delta NWR Headquarters, RecKey #1993250031801, Event ID 736, Facility ID 1272, petroleum contaminated soil identified during UST closure site assessment, site closed, NFA issued from ADEC.
Highways and roads, dirt/gravel	X24	X24-02	B	Low	C	Assume 1-20 roads in Zone B
Highways and roads, dirt/gravel	X24	X24-03	C	Low	C	Assume 1-20 roads in Zone C
Airports	X14	X14-01	D	Medium	C	

## **APPENDIX C**

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

**Public Water Well System for PWS #271334.001 Yukon-Kuskokwim Correctional Center  
Showing Potential and Existing Sources of Contamination**

**LEGEND**

- Public Water System Well

**Hydrography/Physical**

- Parcels
- Stream
- Lake or Pond
- Contours

**Transportation**

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

**Groundwater Protection Zones**

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

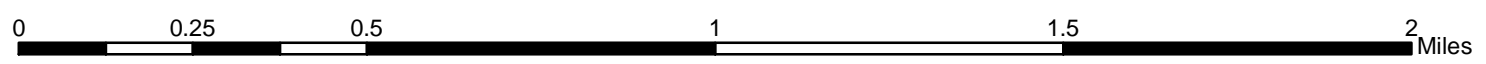
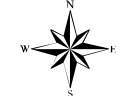
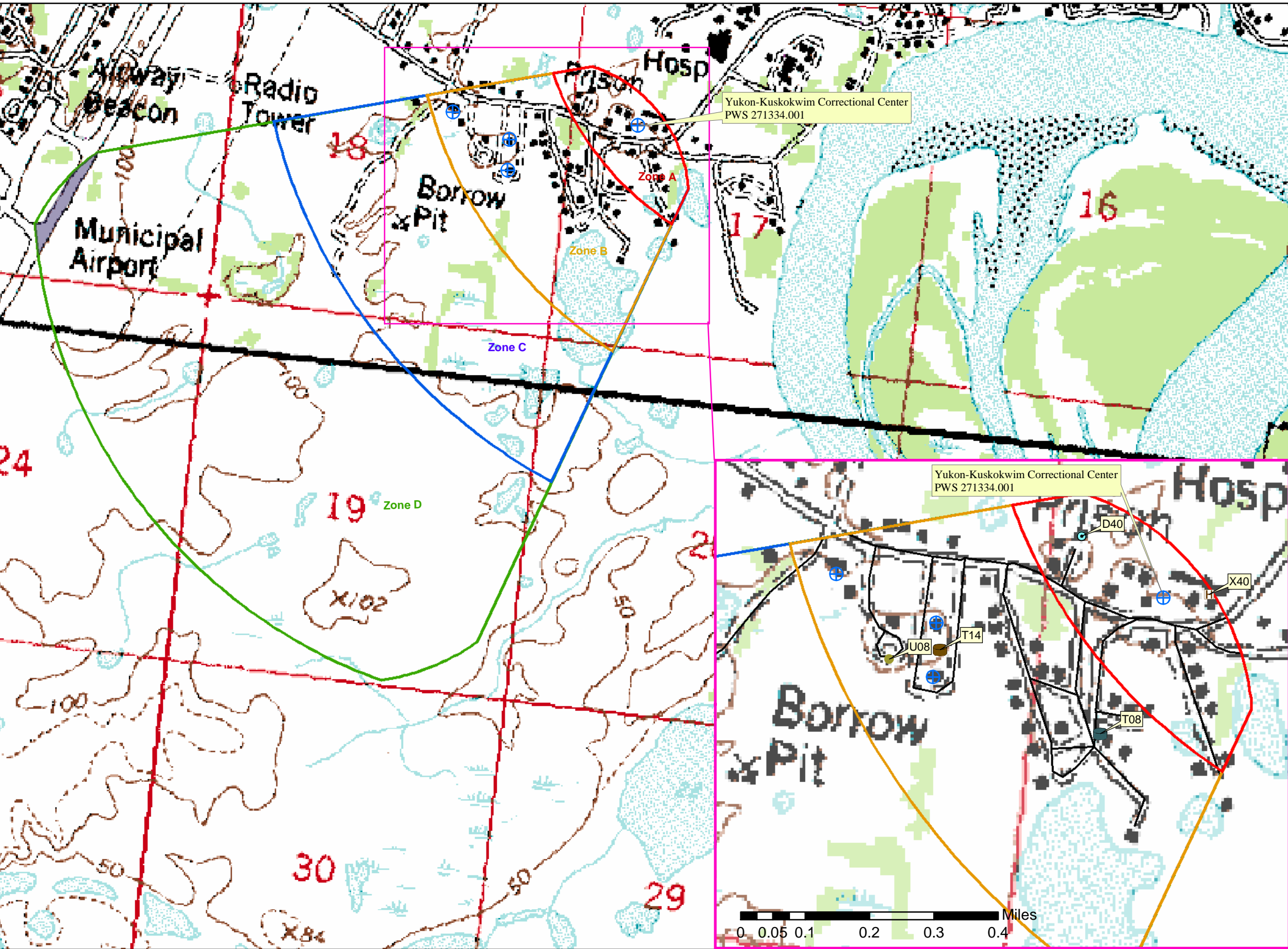
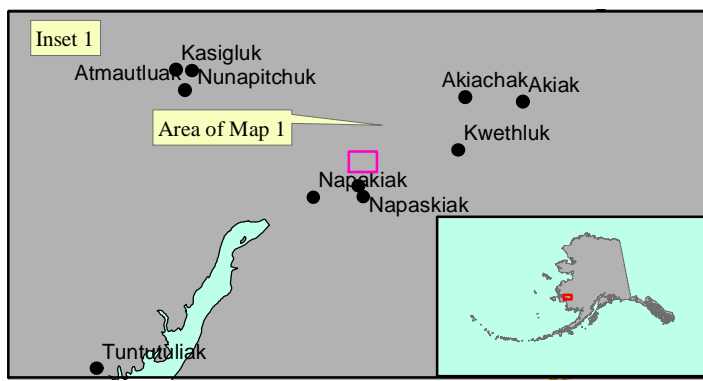
**Existing or Potential Contaminant Sources**

- Injection wells (Class V) industrial process water & water disposal wells (D40)
- Tanks, diesel (underground) (T08)
- Nonresidential aboveground heating oil tank (T14)
- Closed leaking underground fuel storage tank (LUST) (lubricants or other petroleum products) (U08)
- Medical/veterinary facility (X40)
- Airports/landing strips (X14)

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

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

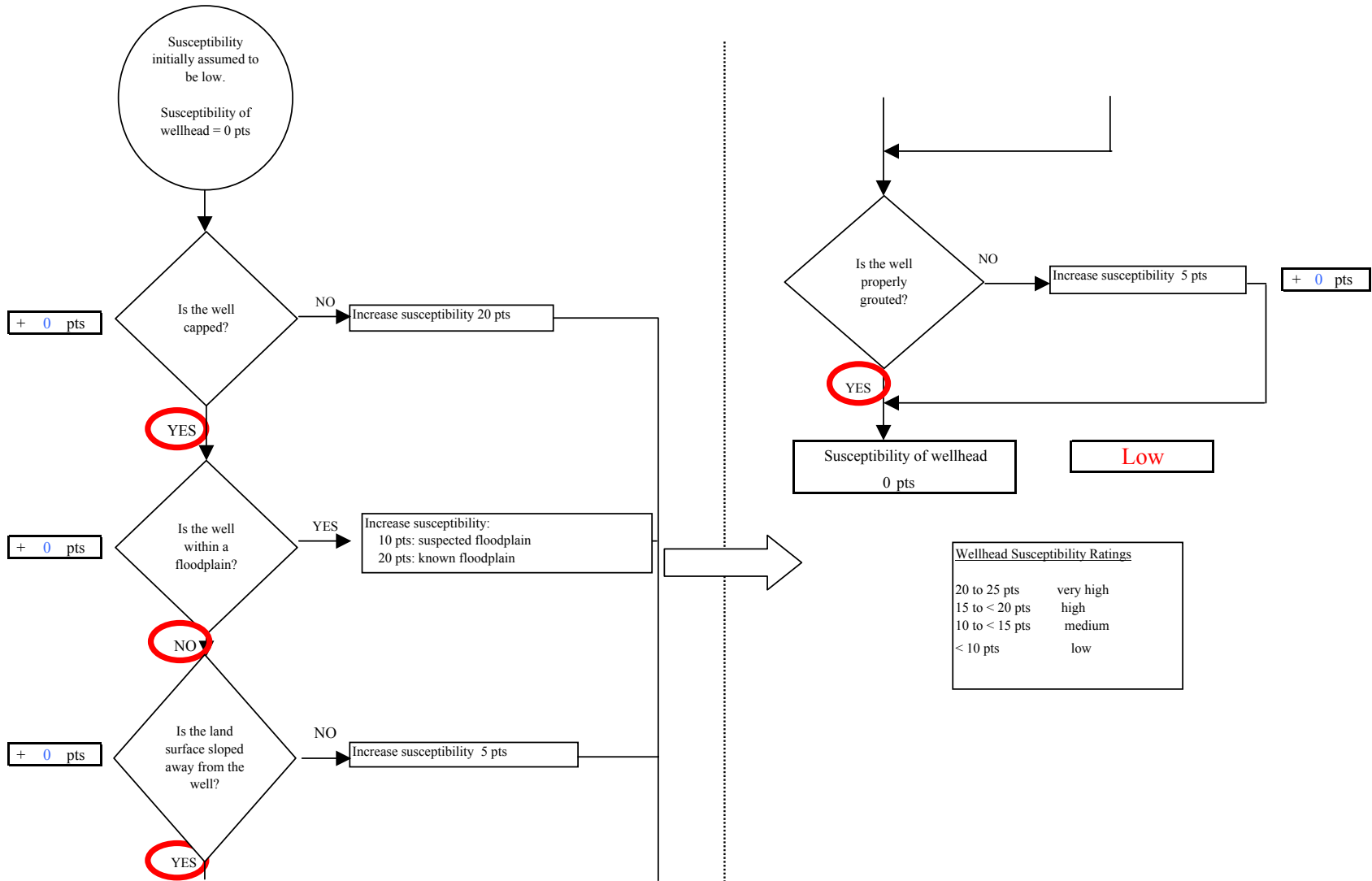


Yukon-Kuskokwim Correctional Center  
PWS 271334.001

## **APPENDIX D**

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

**Chart 1. Susceptibility of the wellhead - Yukon Kuskokwim Correctional Center (PWS No.271334.001)**



**Chart 2. Susceptibility of the aquifer Yukon Kuskokwim Correctional Center (PWS No.271334.001)**

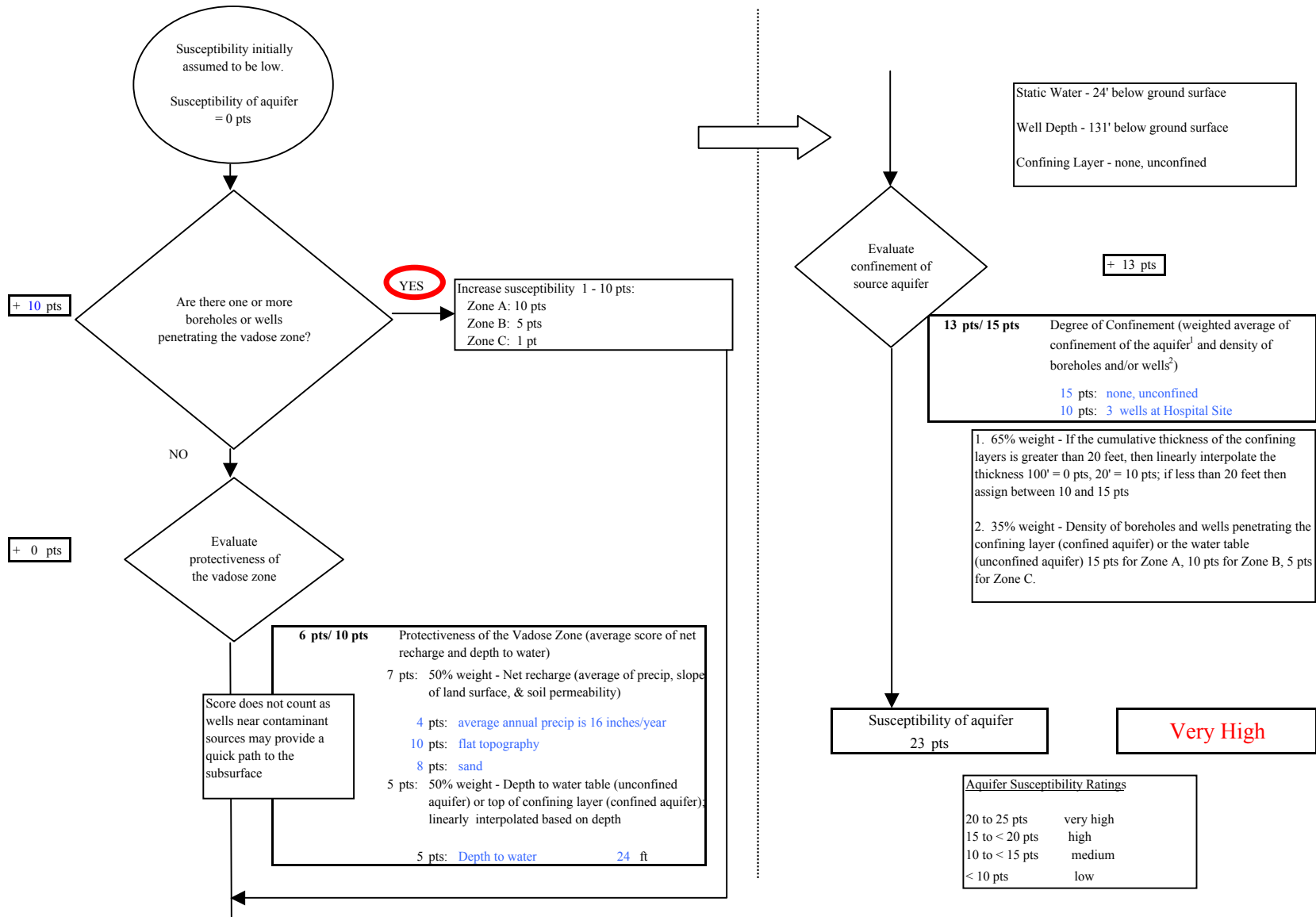




Chart 3. Contaminant risks for Yukon Kuskokwim Correctional Center (PWS No.271334.001) - Bacteria & Viruses

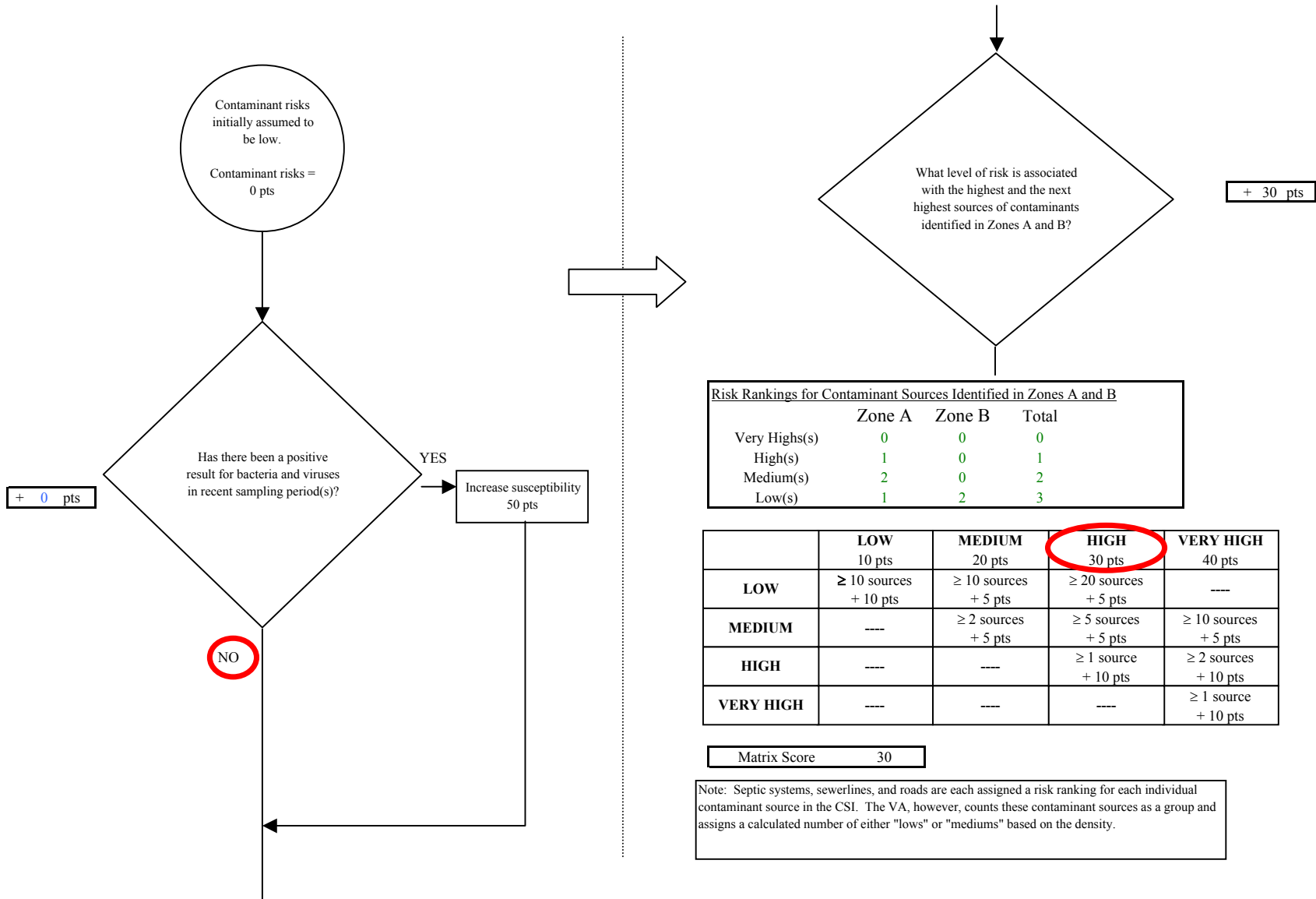
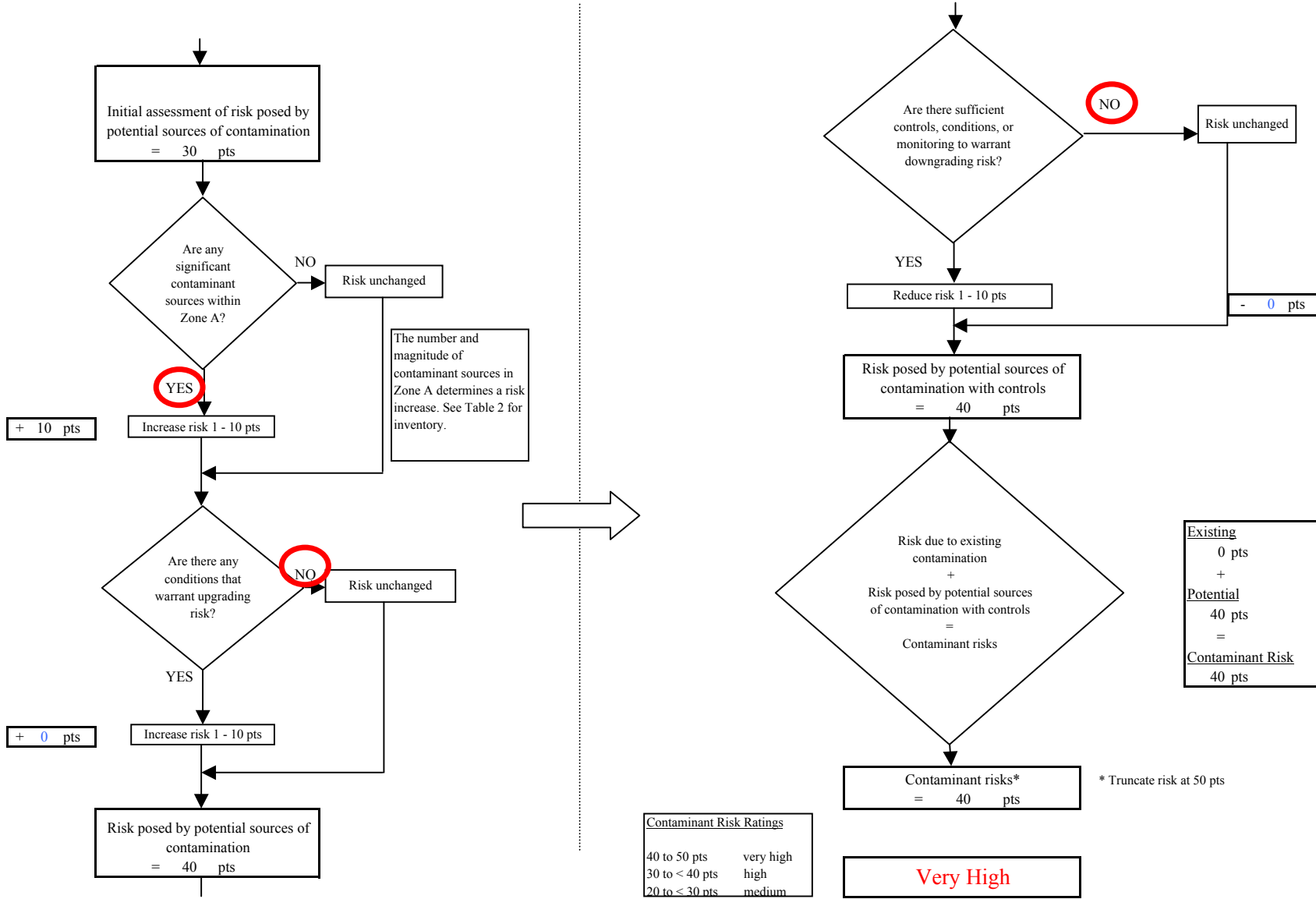
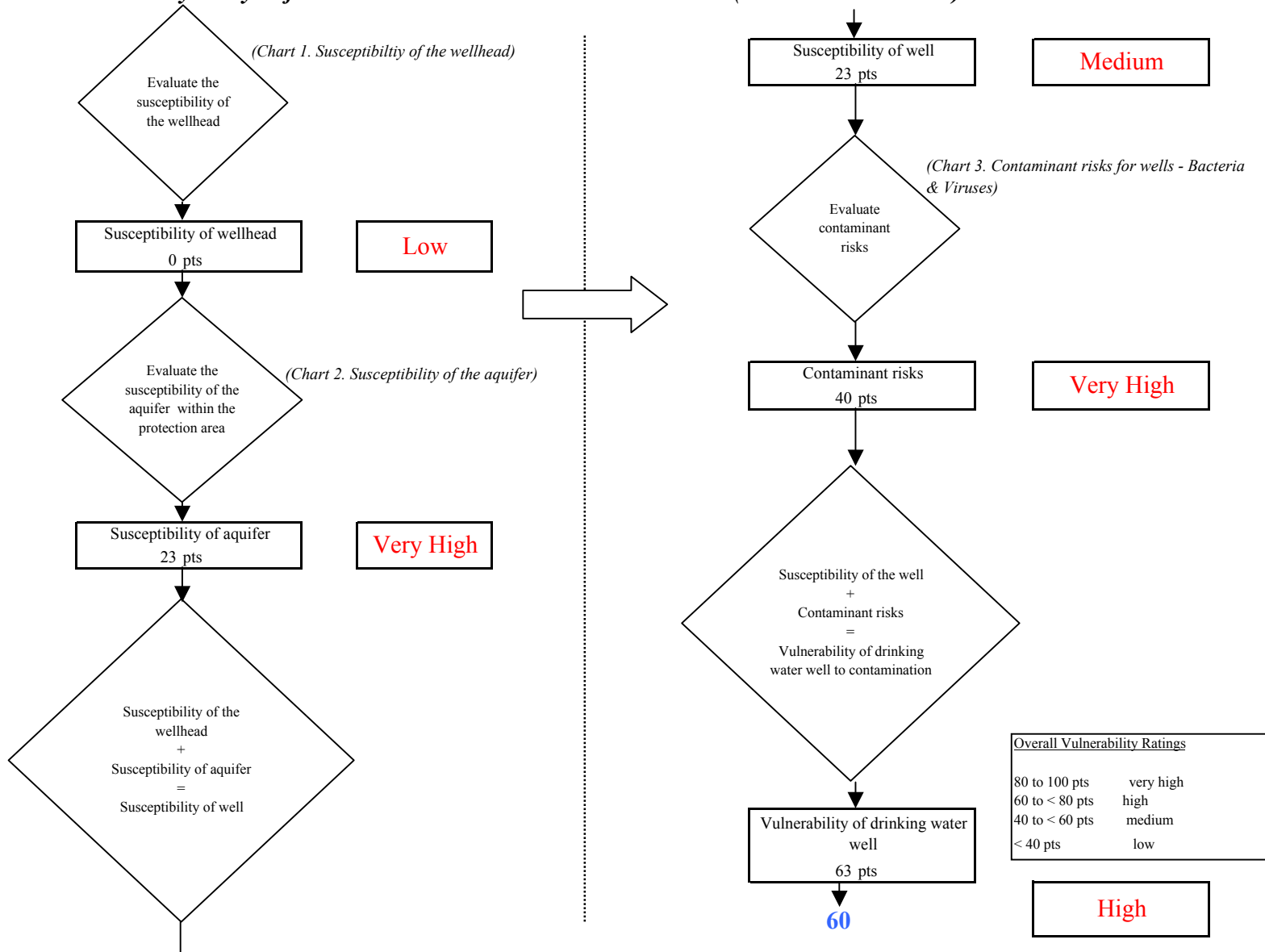


Chart 3. Contaminant risks for Yukon Kuskokwim Correctional Center (PWS No.271334.001) - Bacteria & Viruses



**Chart 4. Vulnerability analysis for Yukon Kuskokwim Correctional Center (PWS No.271334.001) - Bacteria & Viruses**



**Chart 5. Contaminant risks for Yukon Kuskokwim Correctional Center (PWS No.271334.001) - Nitrates and Nitrites**

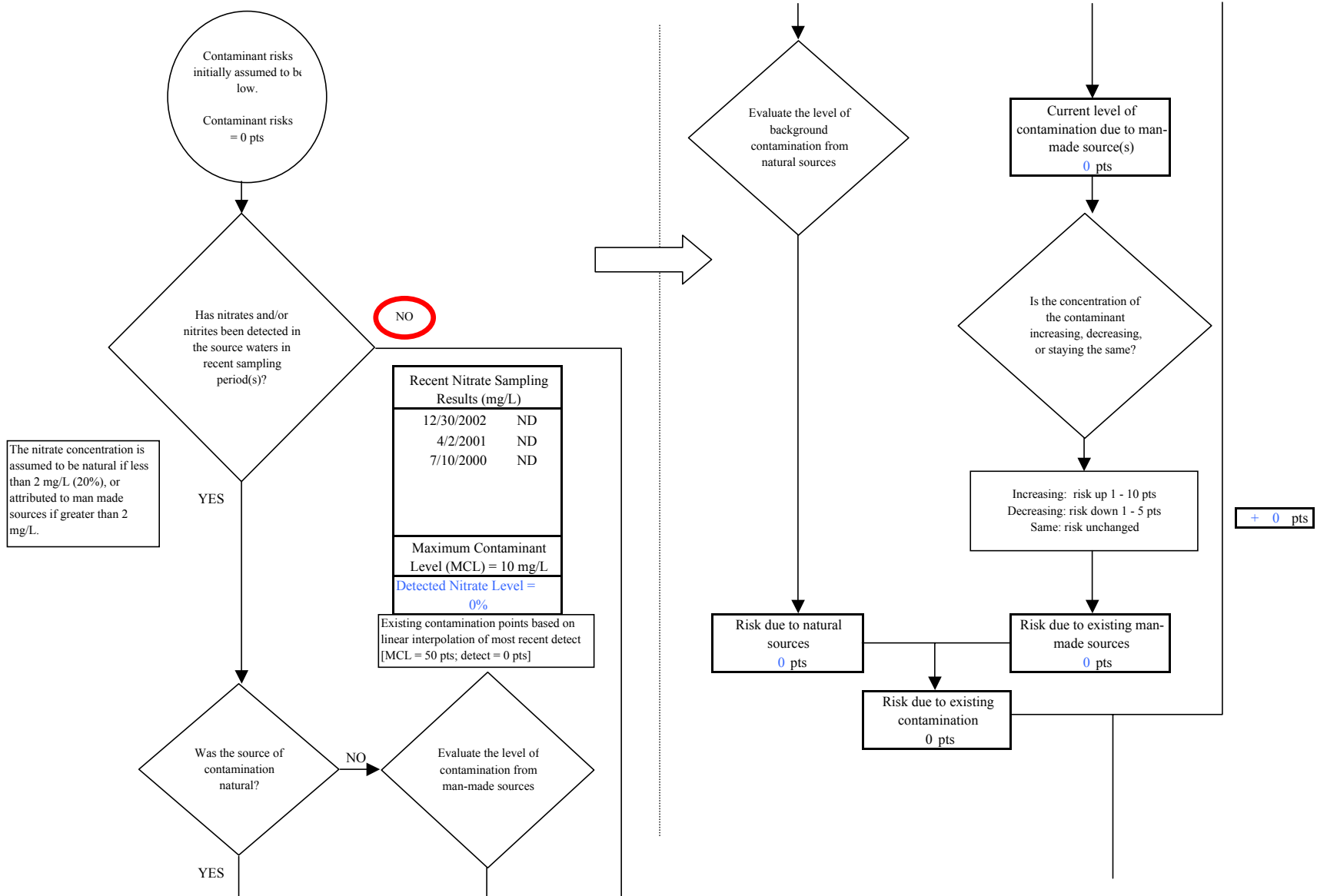
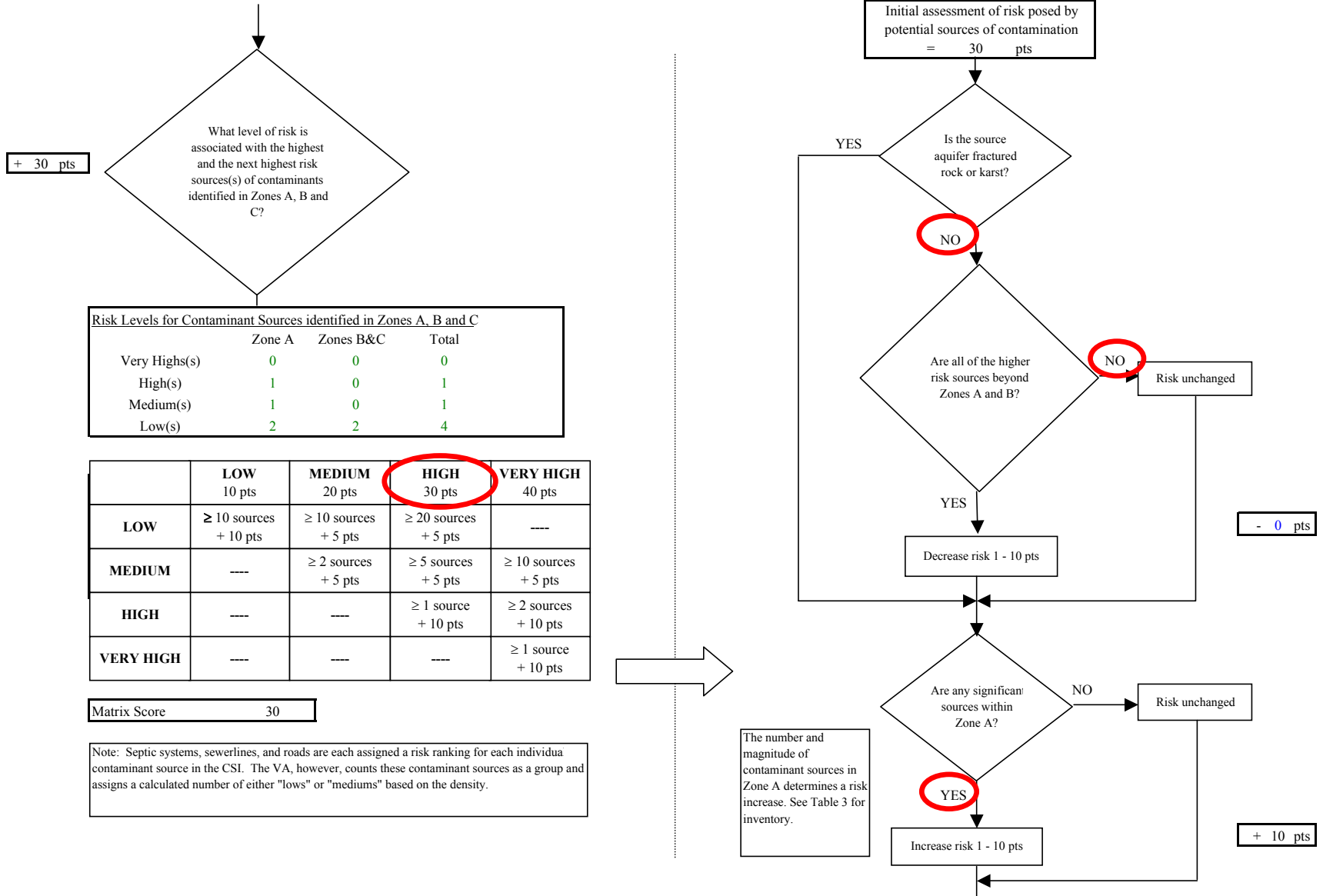
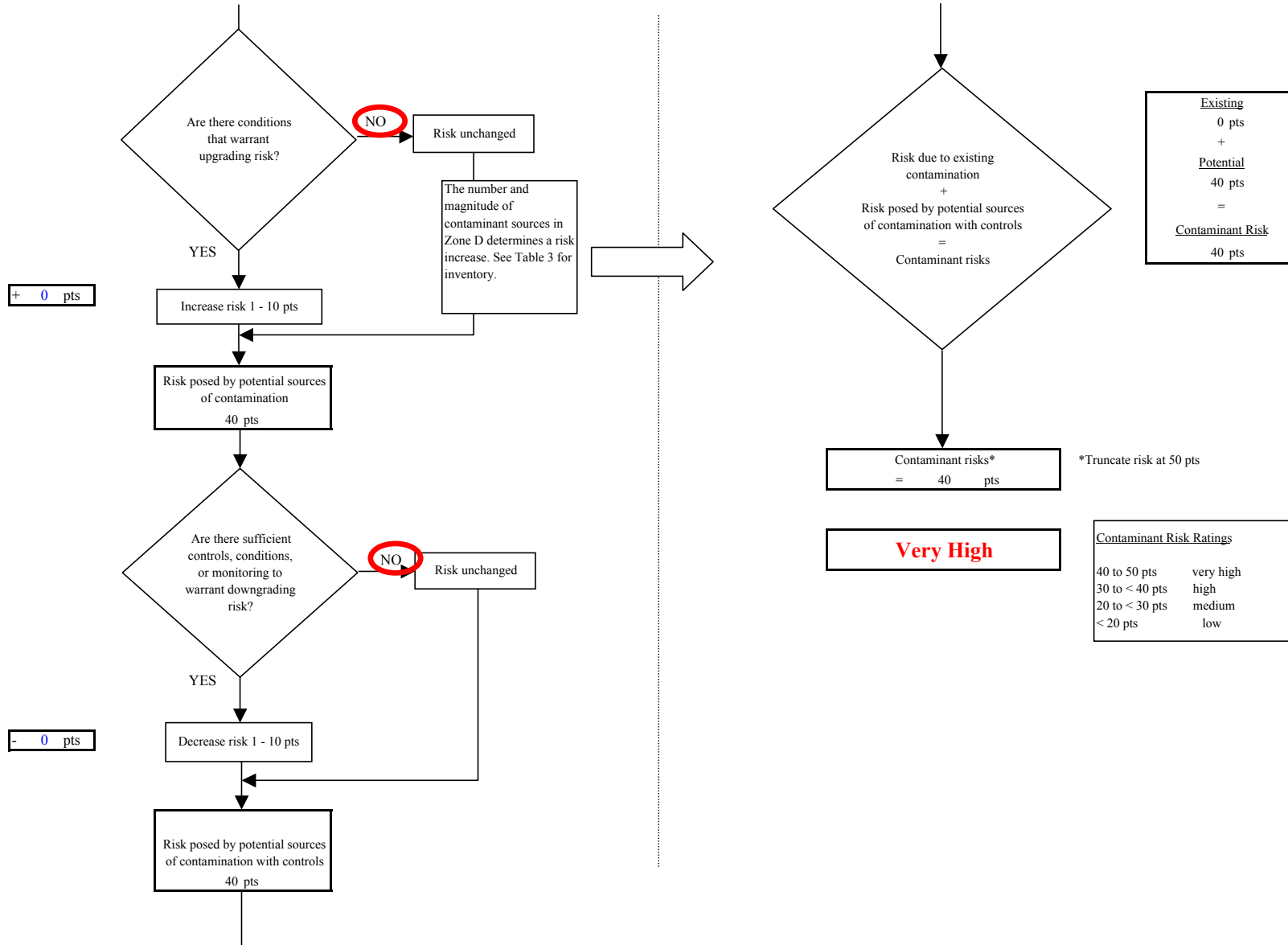


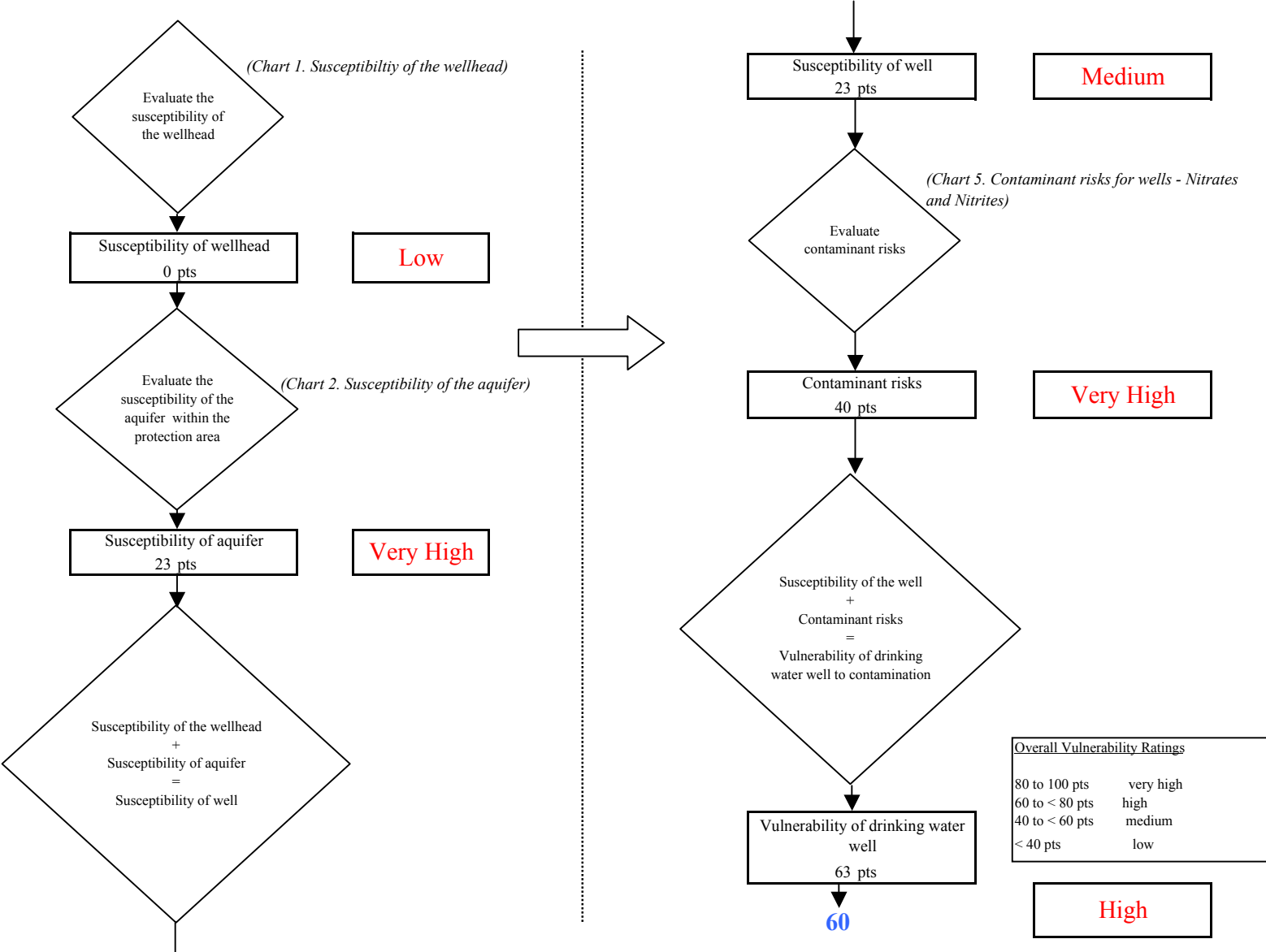
Chart 5. Contaminant risks for Yukon Kuskokwim Correctional Center (PWS No.271334.001) - Nitrates and Nitrites



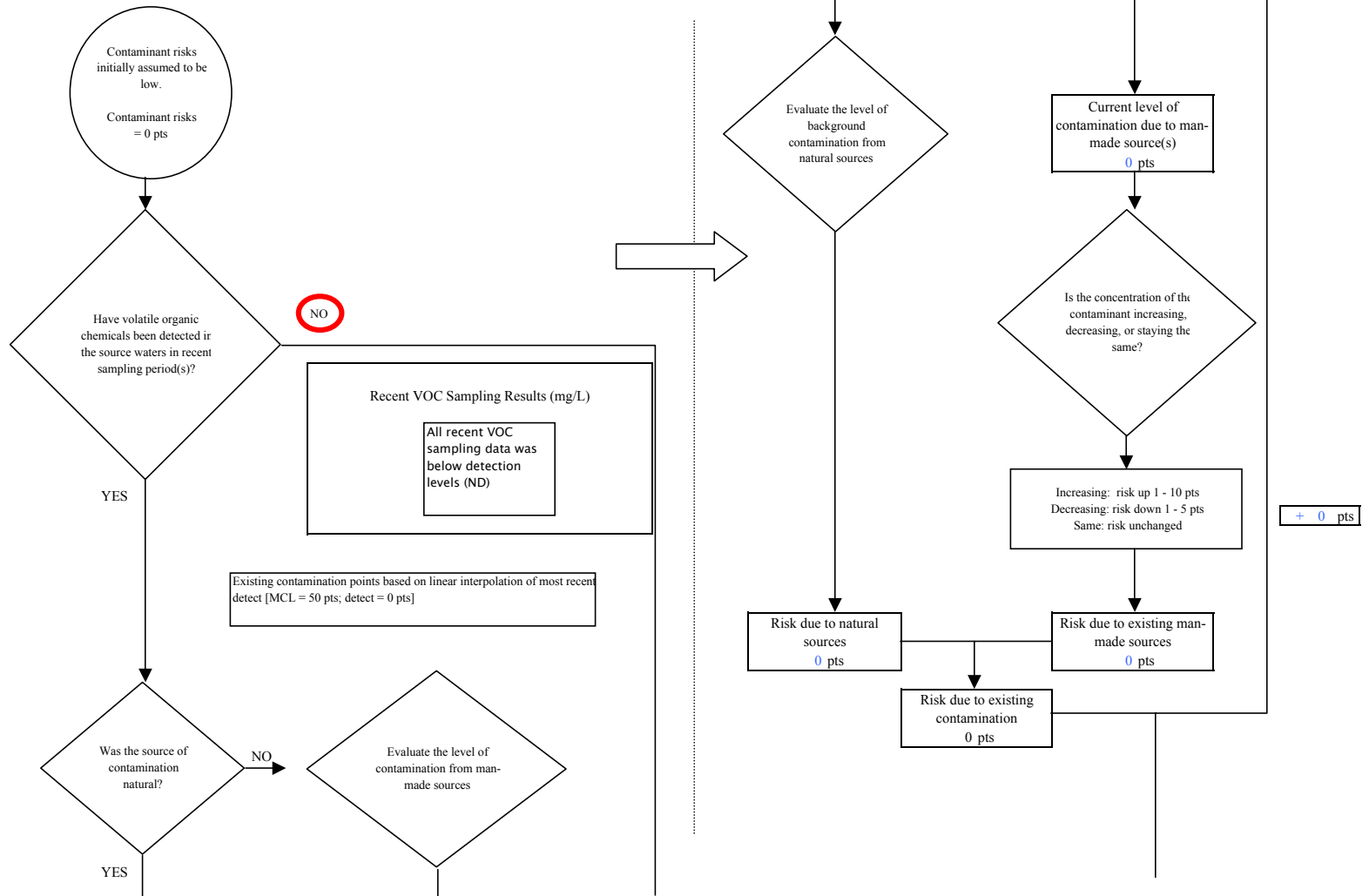
**Chart 5. Contaminant risks for Yukon Kuskokwim Correctional Center (PWS No.271334.001) - Nitrates and Nitrites**



**Chart 6. Vulnerability analysis for Yukon Kuskokwim Correctional Center (PWS No.271334.001) - Nitrates and Nitrites**

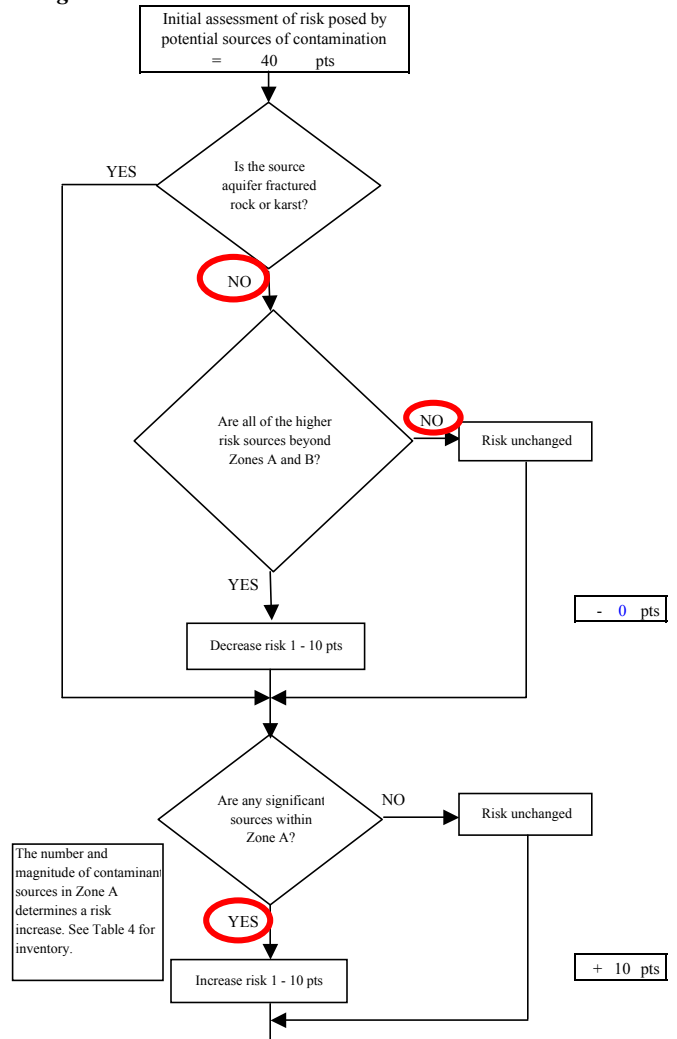
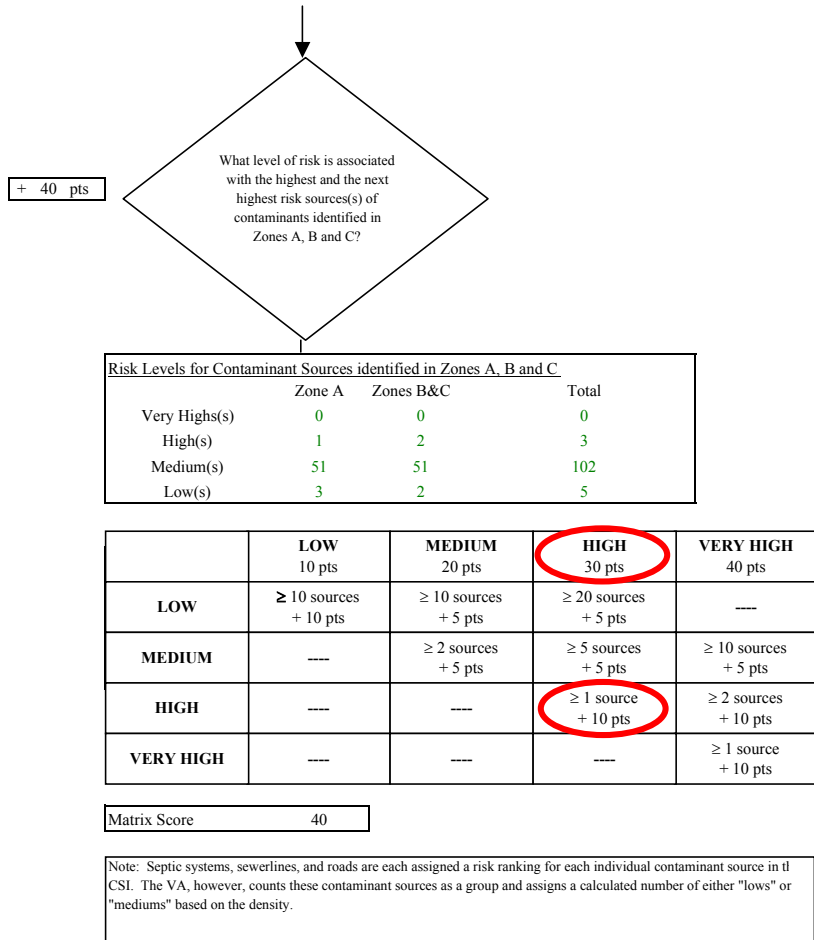


**Chart 7. Contaminant risks for Yukon Kuskokwim Correctional Center (PWS No.271334.001) - Volatile Organic Chemicals**

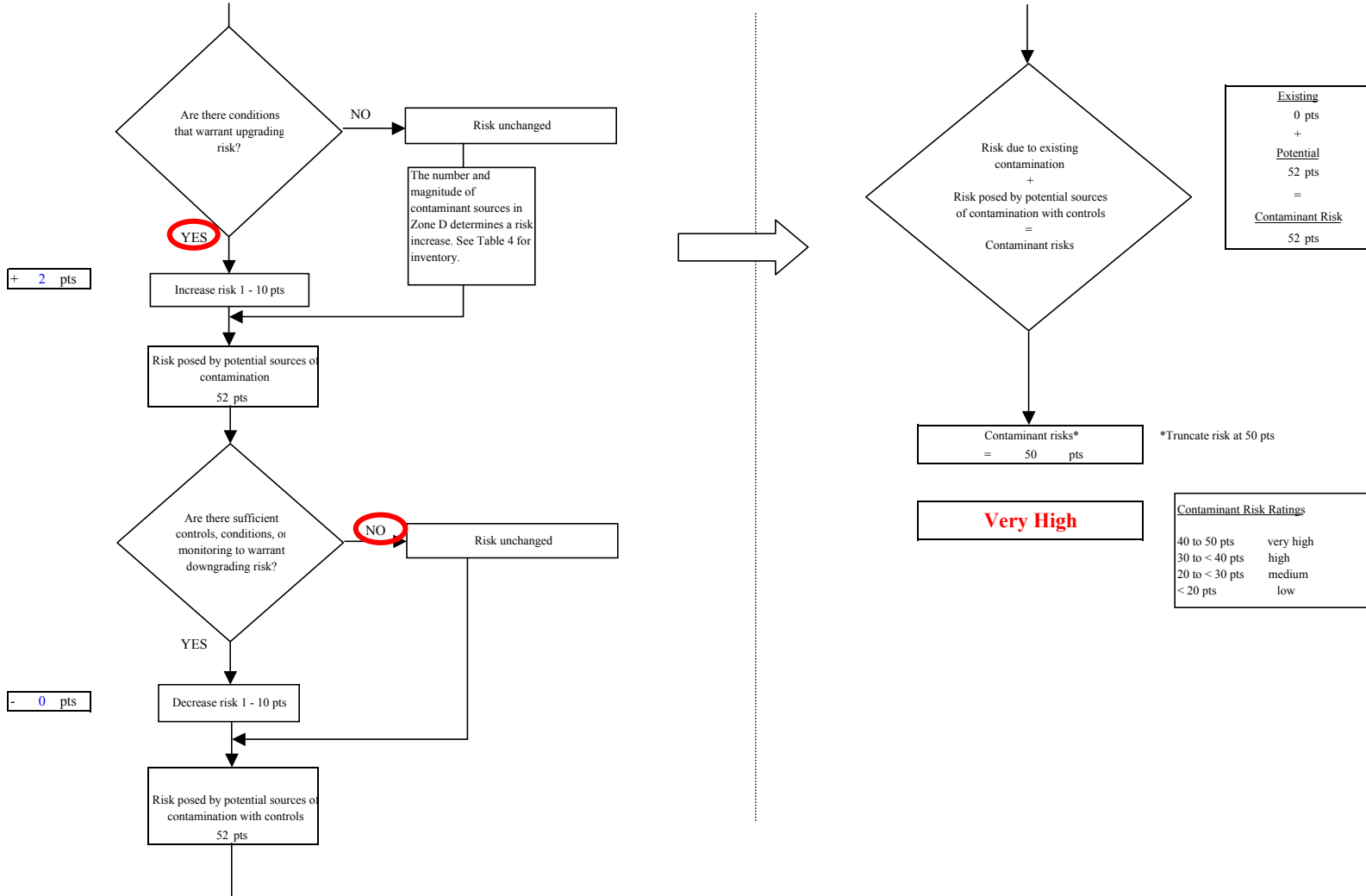




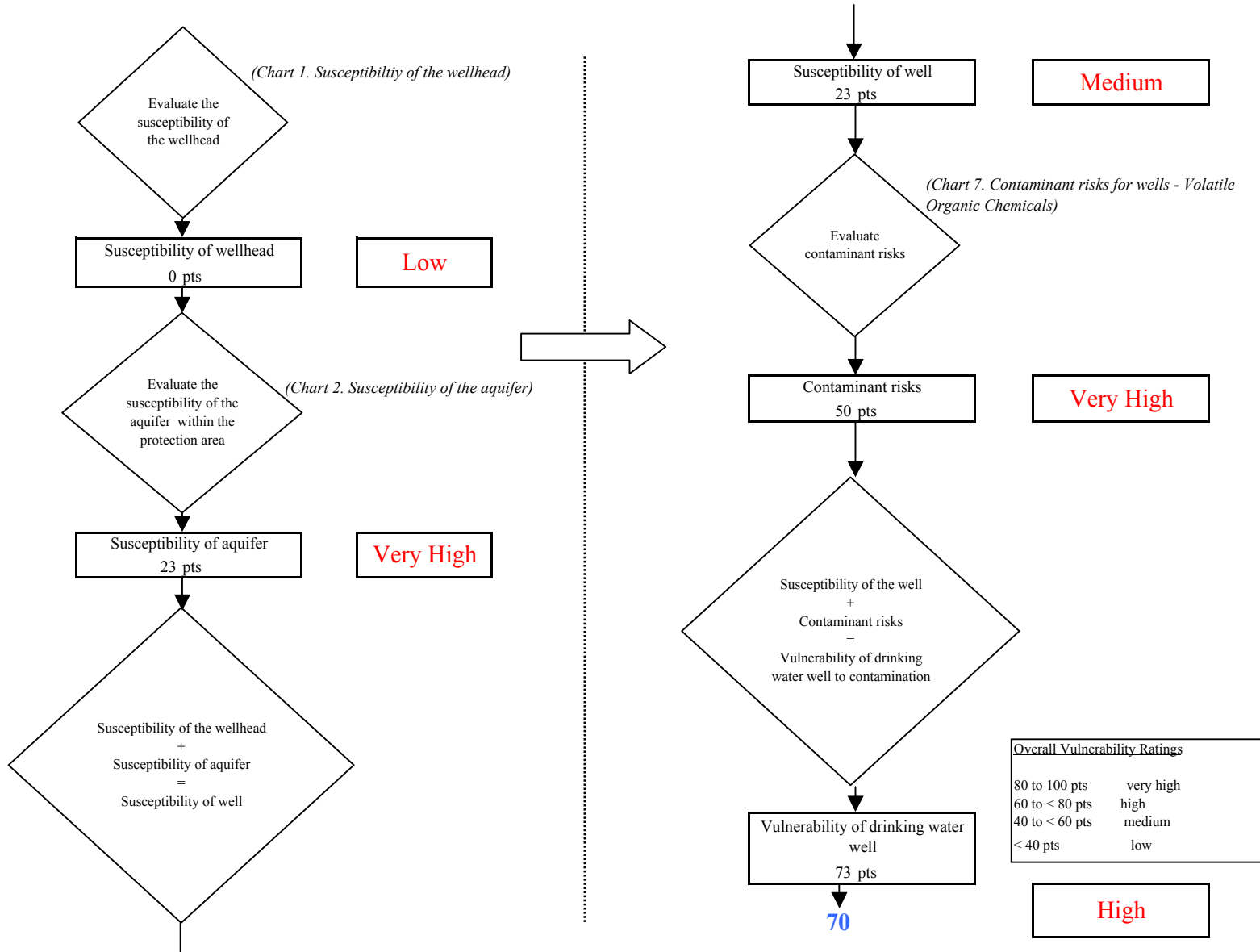
**Chart 7. Contaminant risks for Yukon Kuskokwim Correctional Center (PWS No.271334.001) - Volatile Organic Chemicals**



**Chart 7. Contaminant risks for Yukon Kuskokwim Correctional Center (PWS No.271334.001) - Volatile Organic Chemicals**



**Chart 8. Vulnerability analysis for Yukon Kuskokwim Correctional Center (PWS No.271334.001) - Volatile Organic Chemicals**



**Chart 9. Contaminant risks for Yukon Kuskokwim Correctional Center (PWS No.271334.001) - Heavy Metals, Cyanide and Other Inorganic Chemicals**

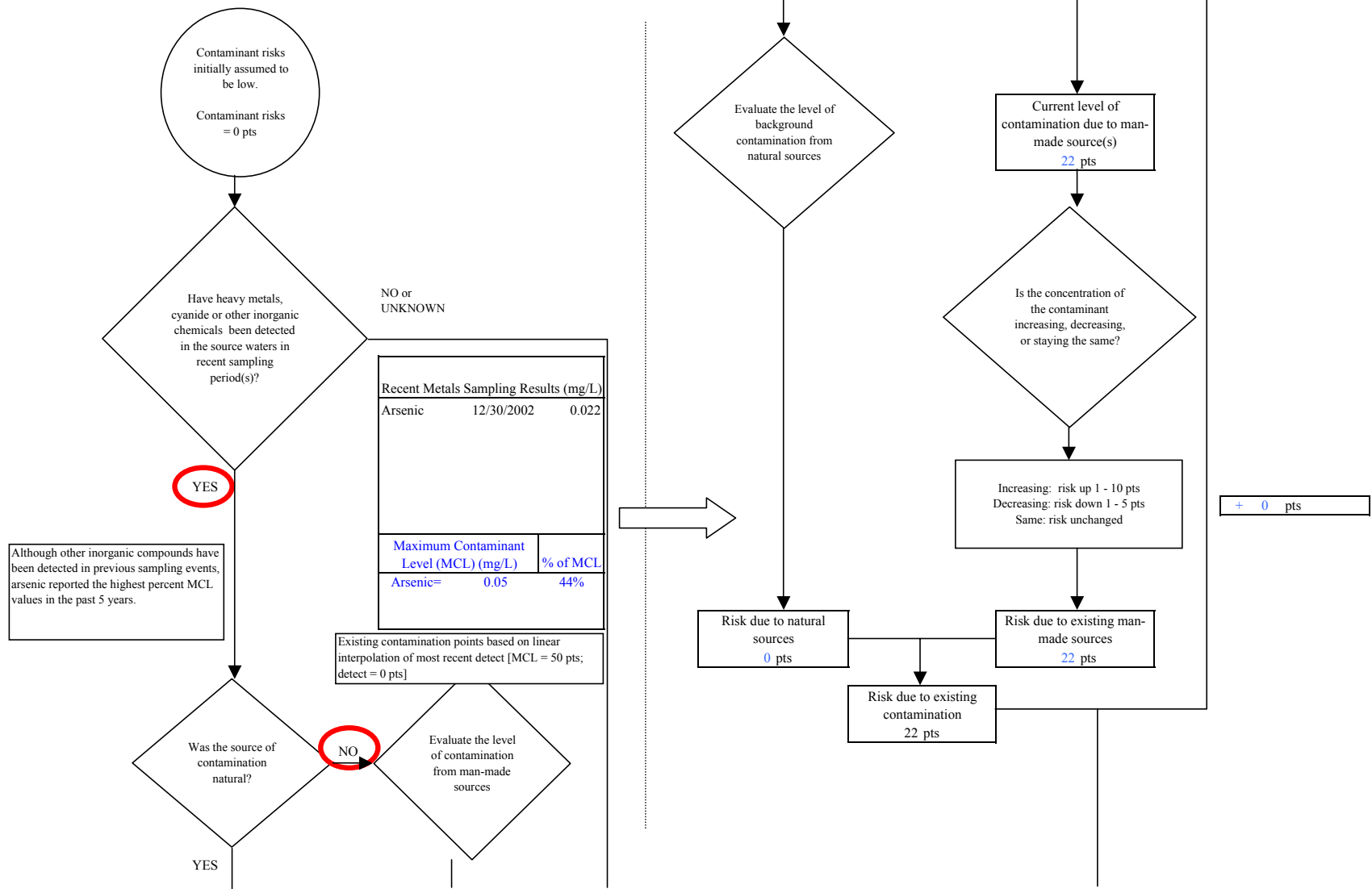
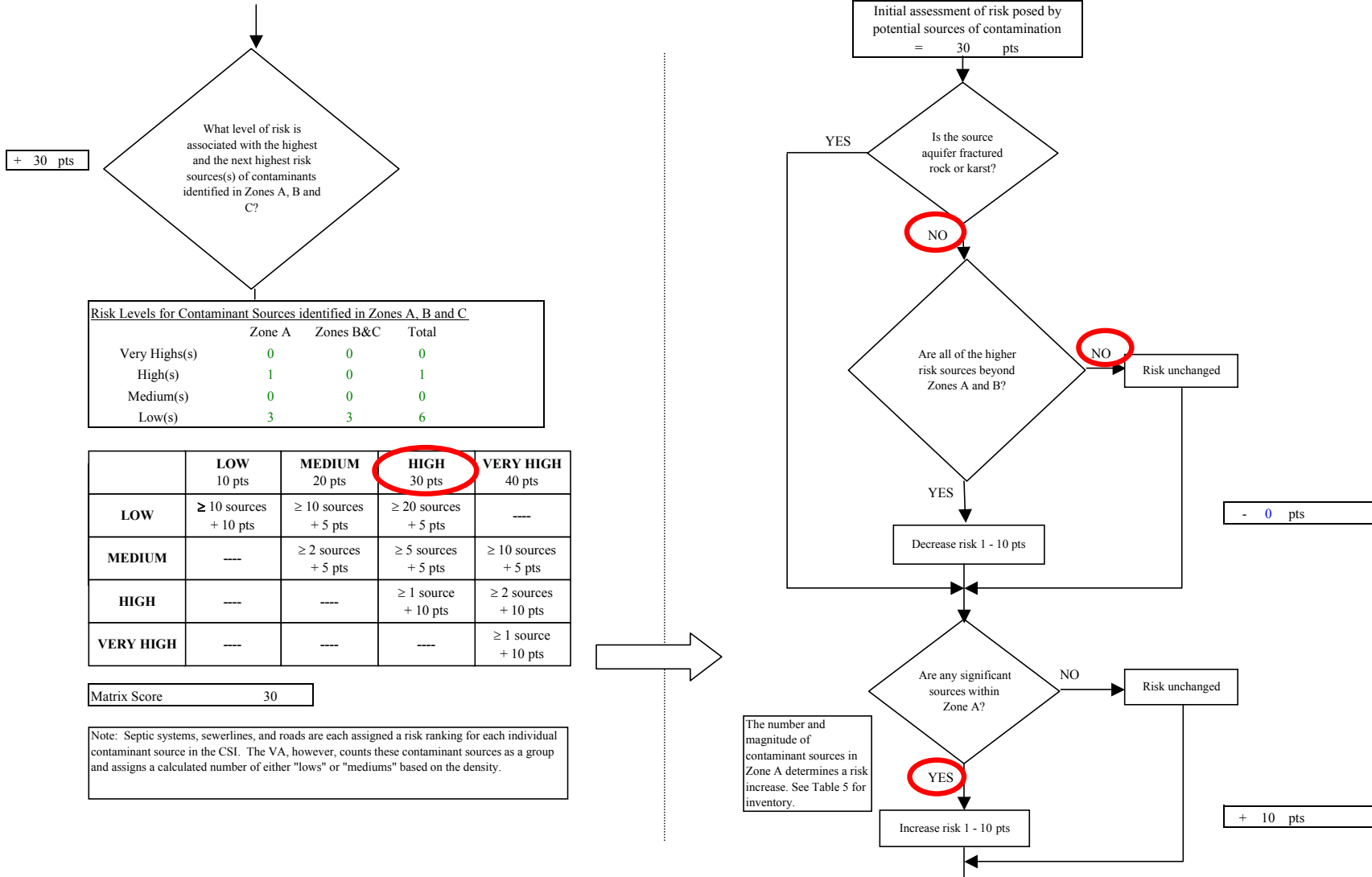


Chart 9. Contaminant risks for Yukon Kuskokwim Correctional Center (PWS No.271334.001) - Heavy Metals, Cyanide and Other Inorganic Chemicals



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

+ 30 pts

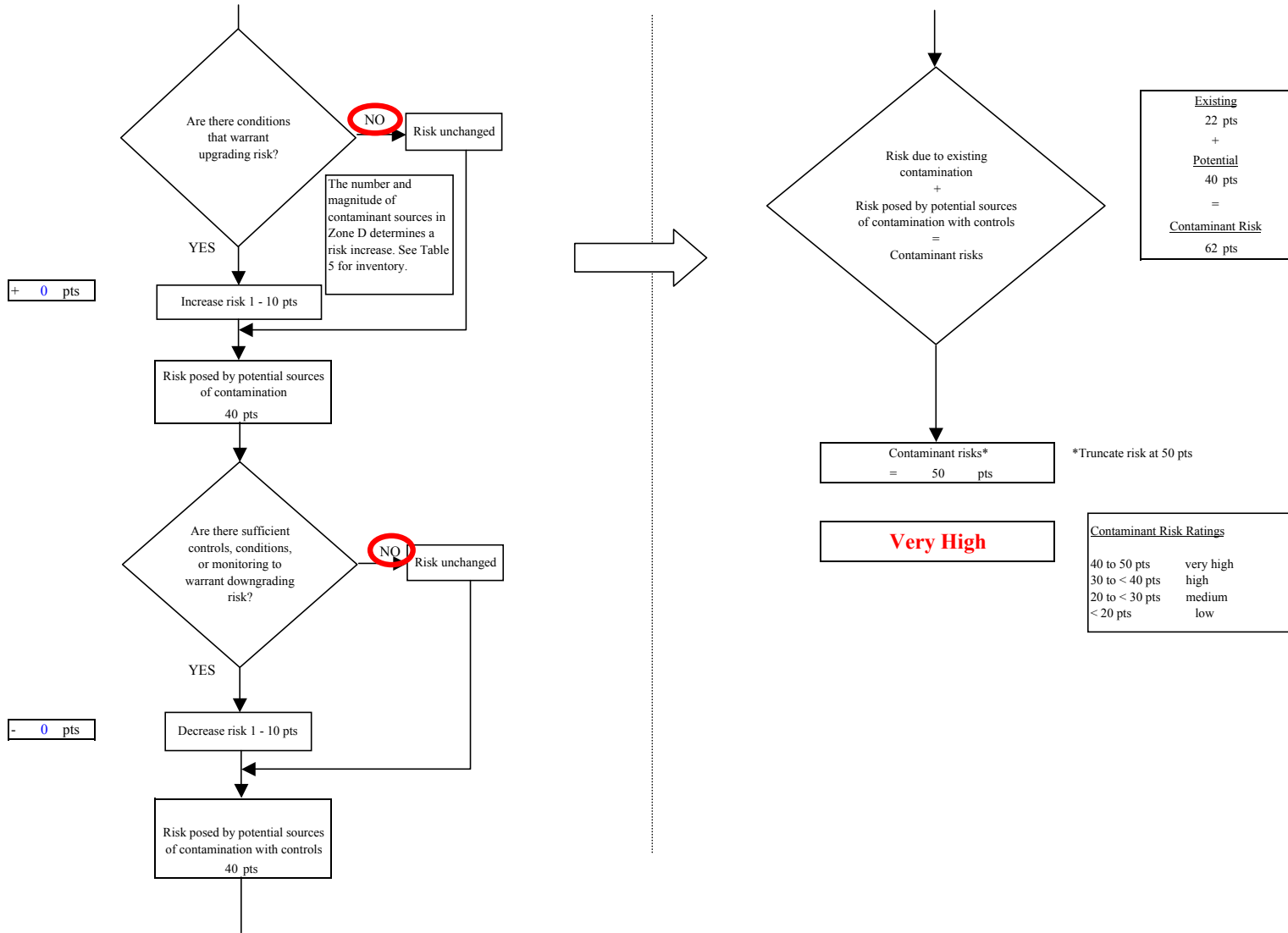
Risk Levels for Contaminant Sources identified in Zones A, B and C			
	Zone A	Zones B&C	Total
Very High(s)	0	0	0
High(s)	1	0	1
Medium(s)	0	0	0
Low(s)	3	3	6

	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

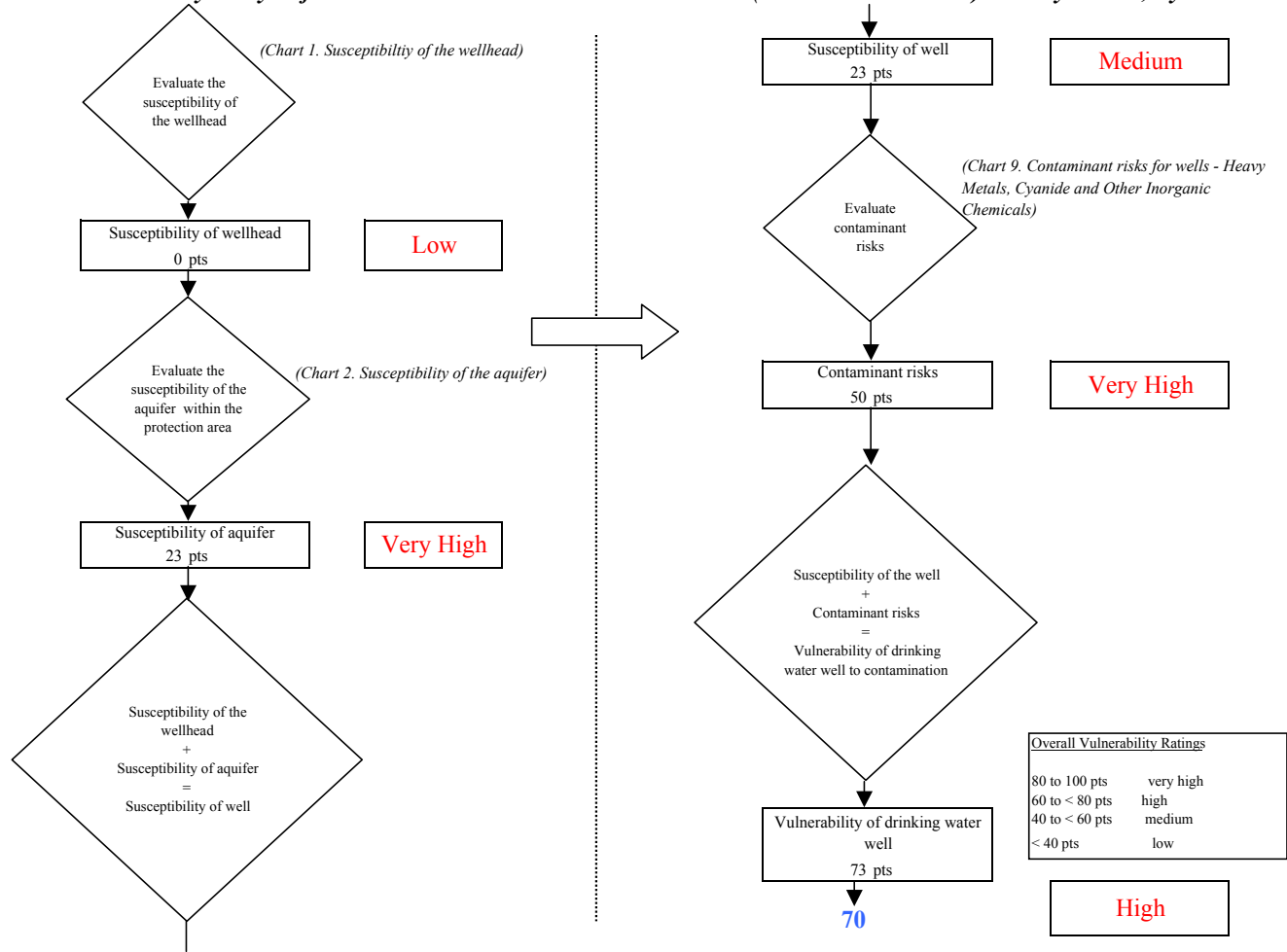
Matrix Score 30

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.

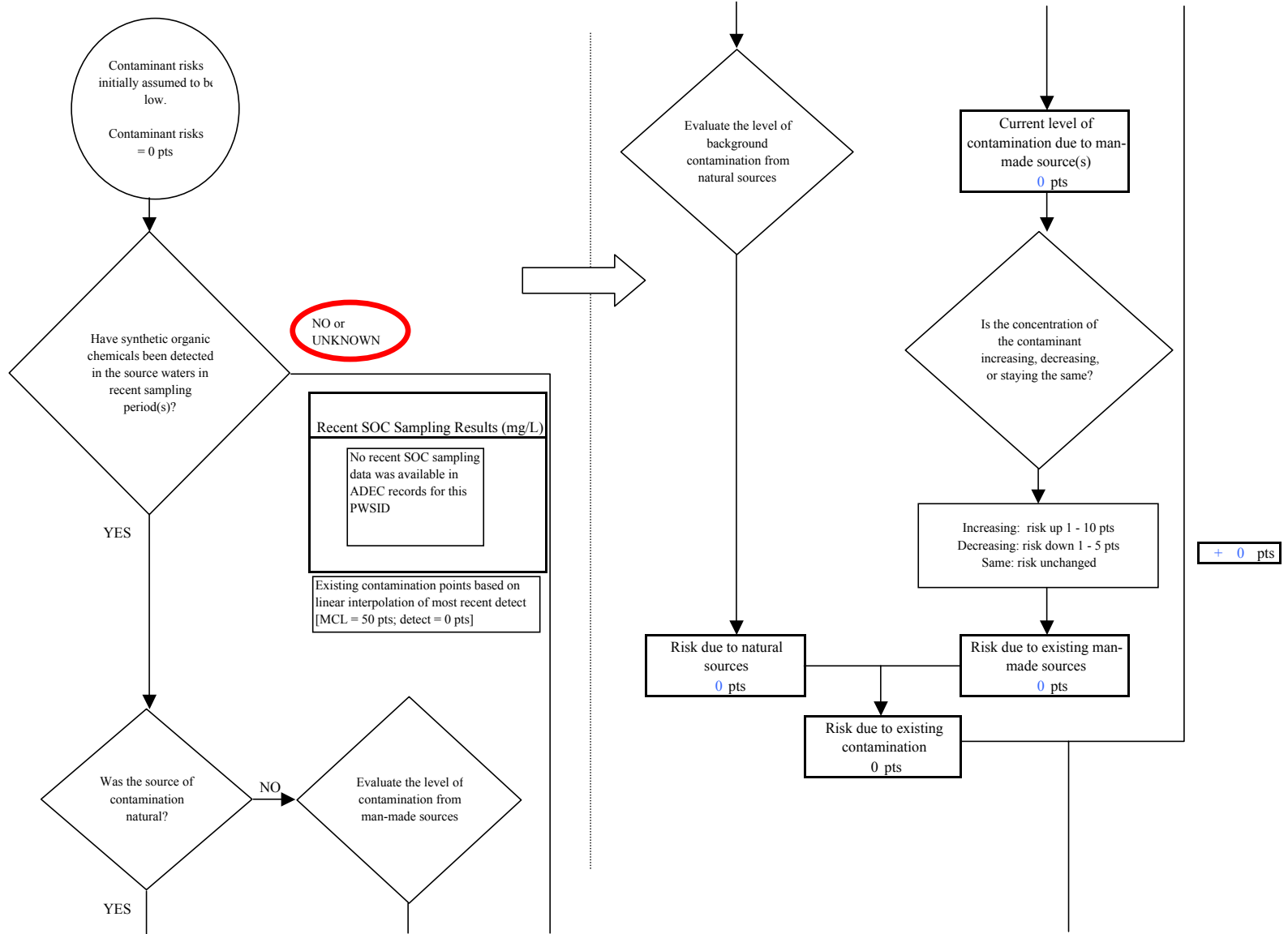
**Chart 9. Contaminant risks for Yukon Kuskokwim Correctional Center (PWS No.271334.001) - Heavy Metals, Cyanide and Other Inorganic Chemicals**



**Chart 10. Vulnerability analysis for Yukon Kuskokwim Correctional Center (PWS No.271334.001) - Heavy Metals, Cyanide and Other Inorganic Chemicals**

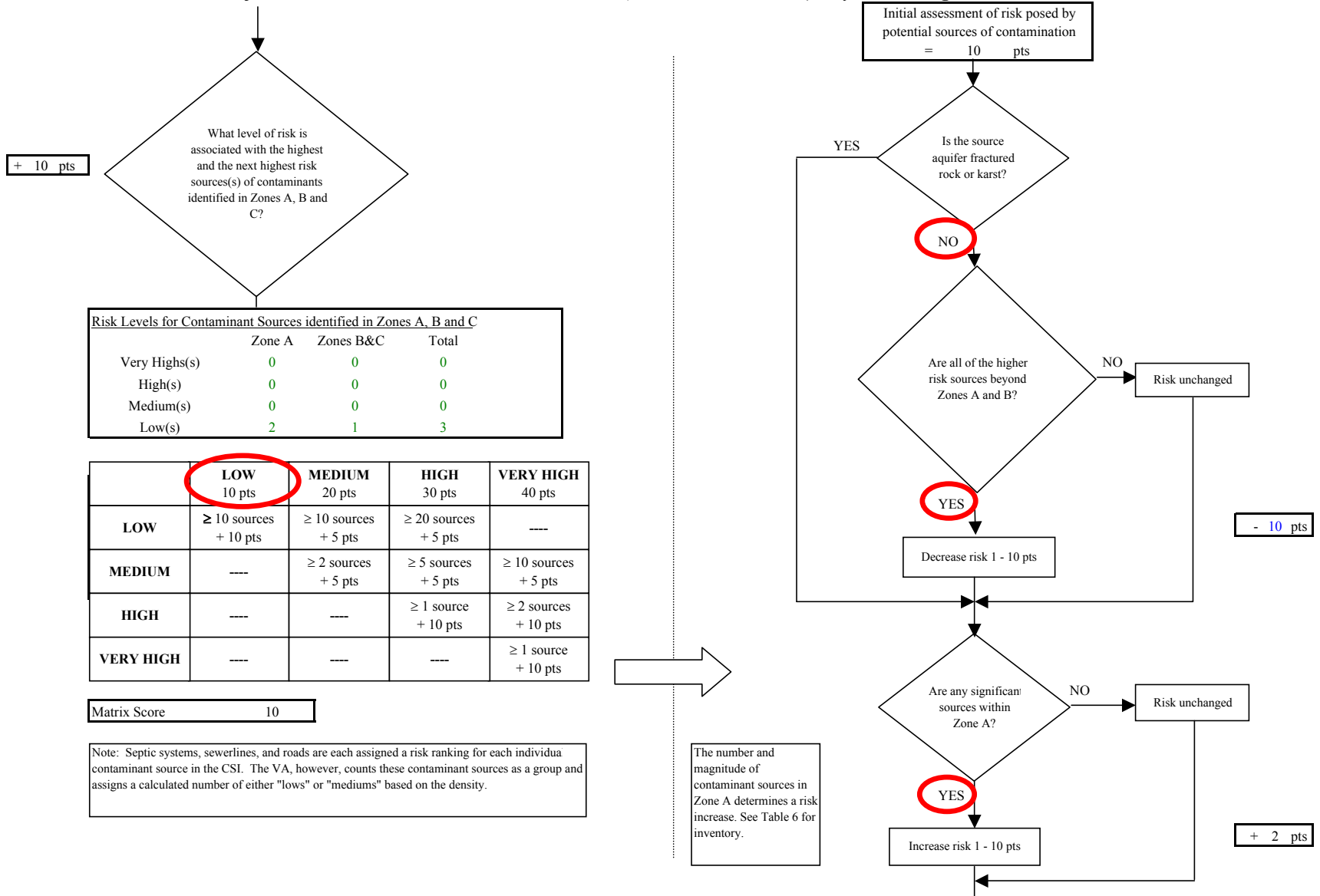


**Chart 11. Contaminant risks for Yukon Kuskokwim Correctional Center (PWS No.271334.001) - Synthetic Organic Chemicals**





**Chart 11. Contaminant risks for Yukon Kuskokwim Correctional Center (PWS No.271334.001) - Synthetic Organic Chemicals**



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

+ 10 pts

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

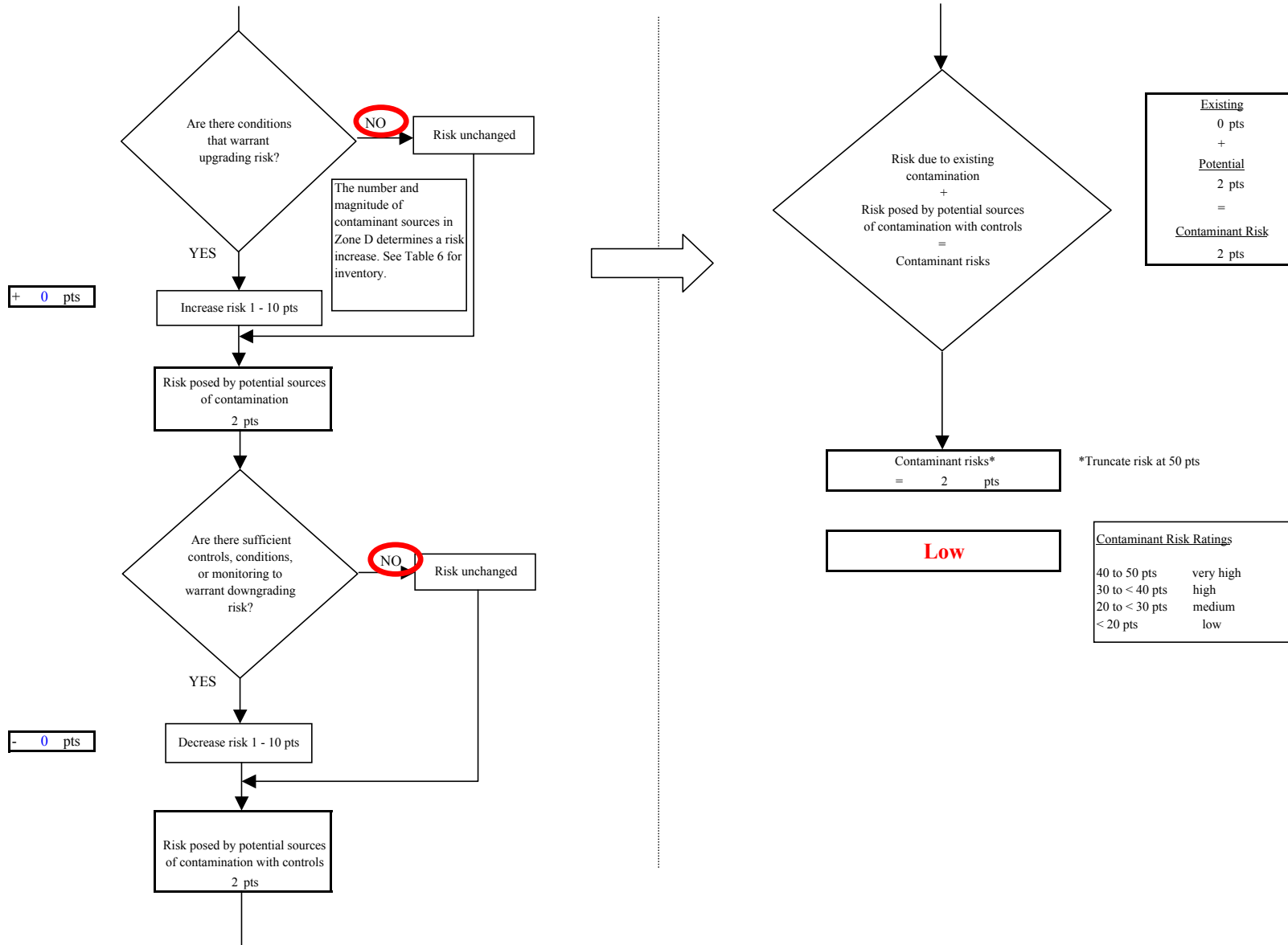
  

	LOW 10 pts	MEDIUM 20 pts	HIGH 30 pts	VERY HIGH 40 pts
LOW	≥ 10 sources + 10 pts	≥ 10 sources + 5 pts	≥ 20 sources + 5 pts	---
MEDIUM	---	≥ 2 sources + 5 pts	≥ 5 sources + 5 pts	≥ 10 sources + 5 pts
HIGH	---	---	≥ 1 source + 10 pts	≥ 2 sources + 10 pts
VERY HIGH	---	---	---	≥ 1 source + 10 pts

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 11. Contaminant risks for Yukon Kuskokwim Correctional Center (PWS No.271334.001) - Synthetic Organic Chemicals**



**Chart 12. Vulnerability analysis for Yukon Kuskokwim Correctional Center (PWS No.271334.001) - Synthetic Organic Chemicals**

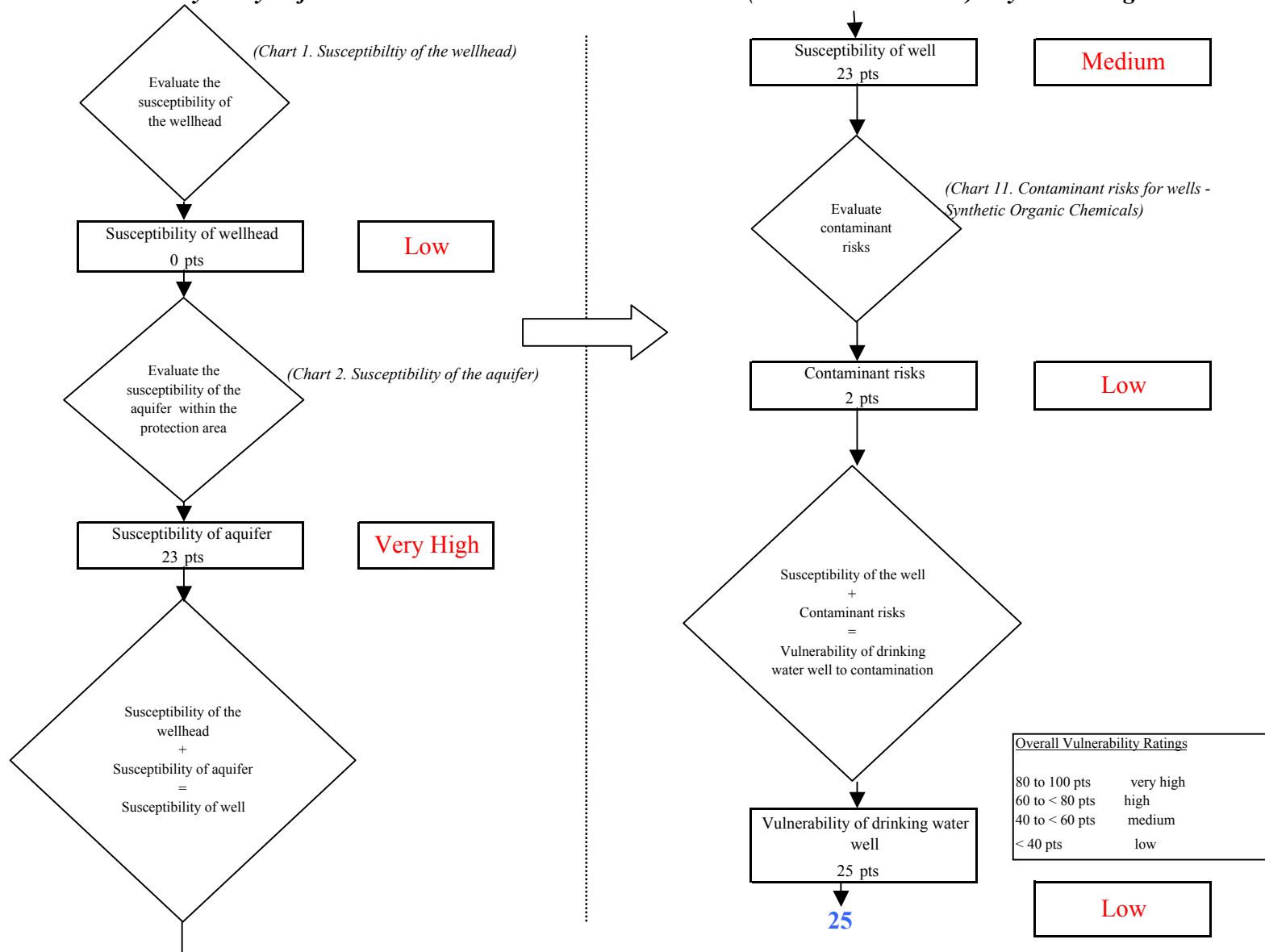


Chart 13. Contaminant risks for Yukon Kuskokwim Correctional Center (PWS No.271334.001) - Other Organic Chemicals

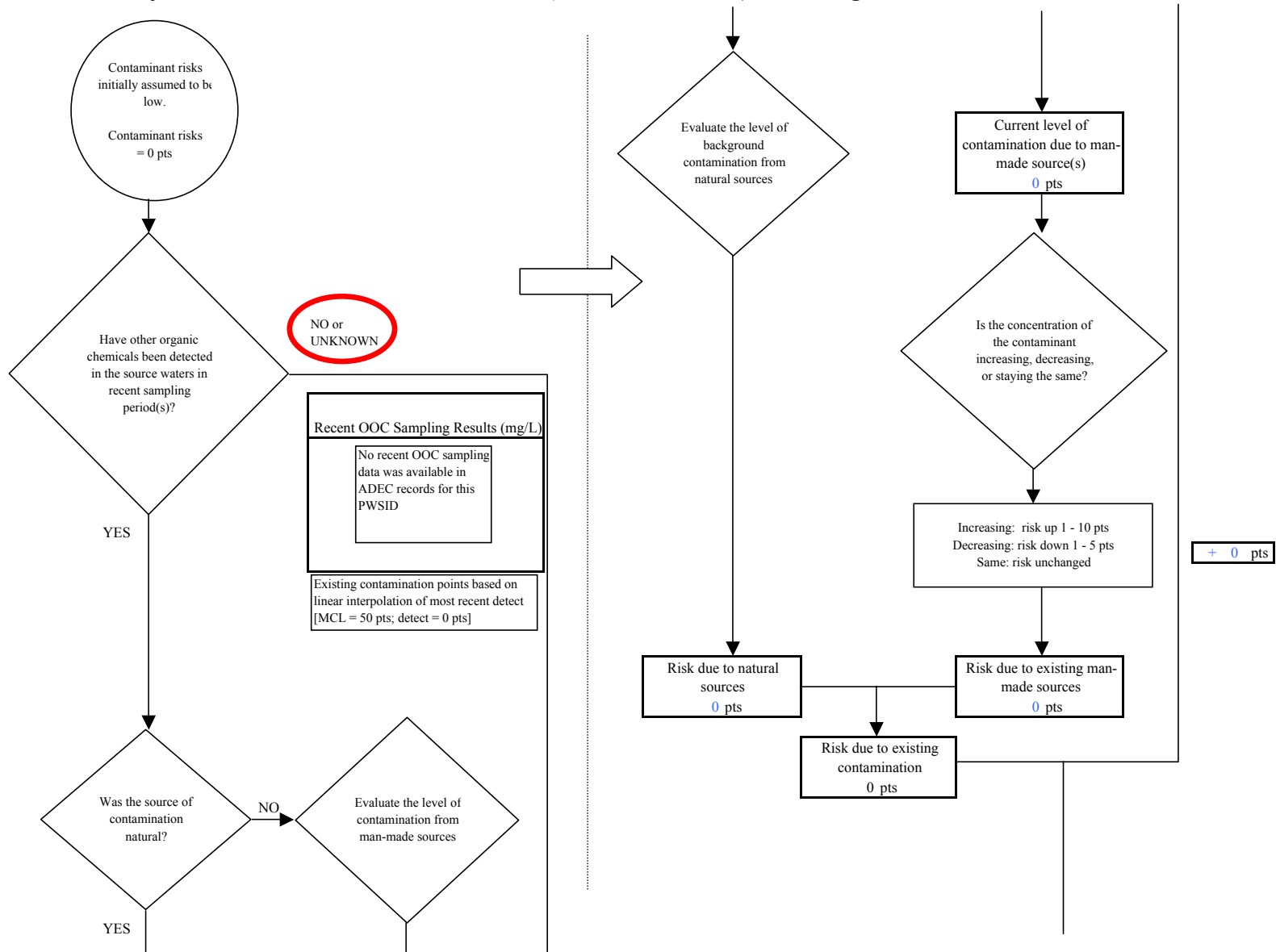


Chart 13. Contaminant risks for Yukon Kuskokwim Correctional Center (PWS No.271334.001) - Other Organic Chemicals

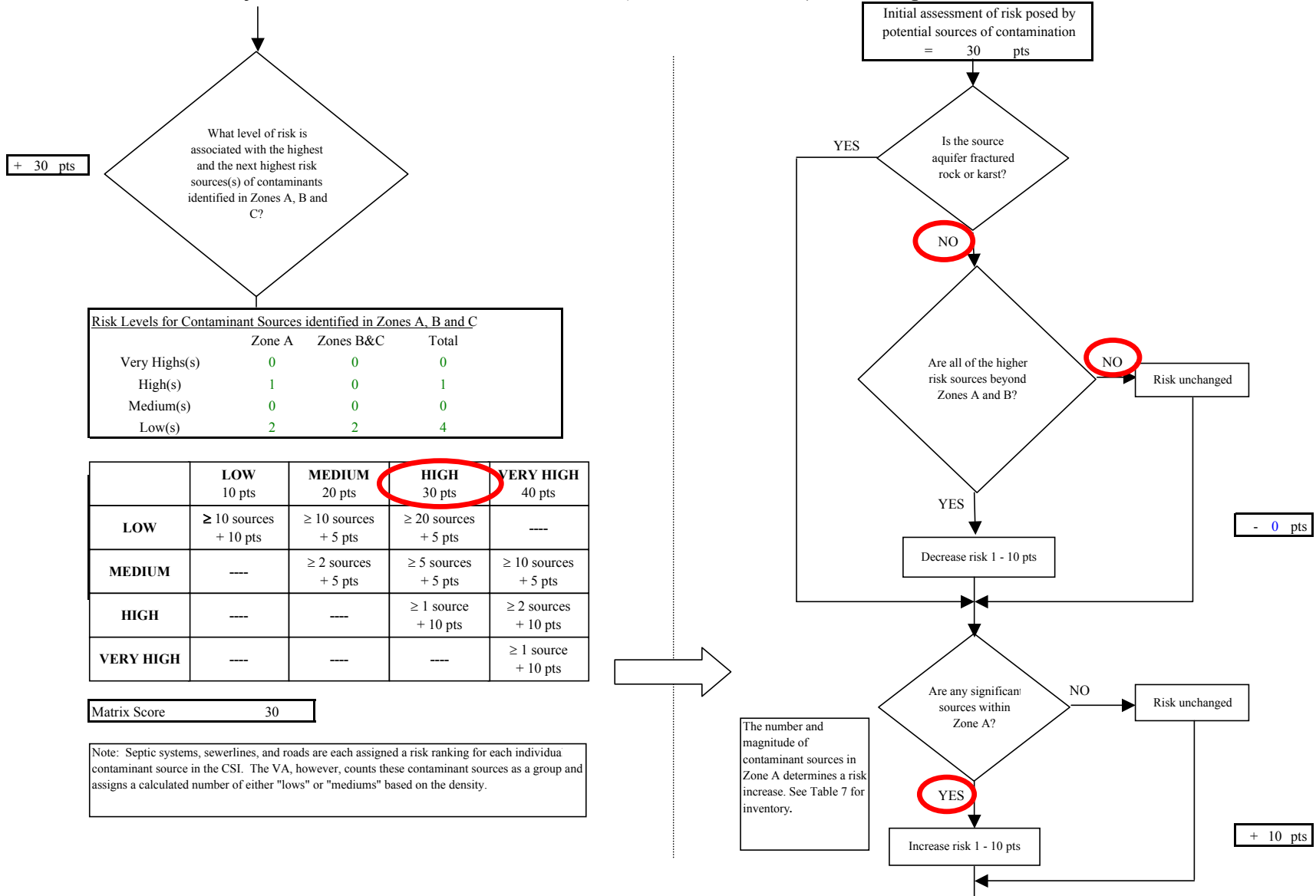
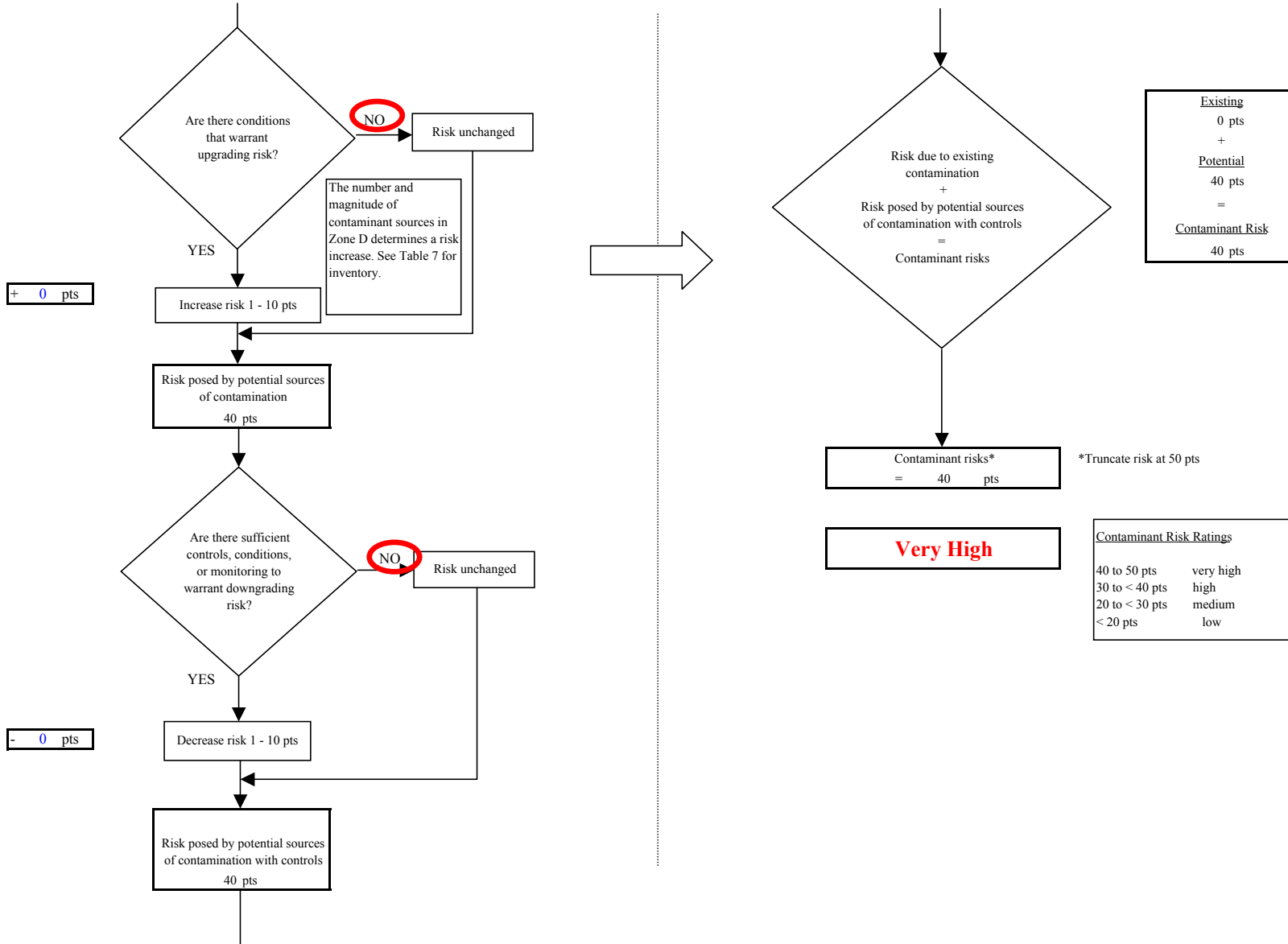


Chart 13. Contaminant risks for Yukon Kuskokwim Correctional Center (PWS No.271334.001) - Other Organic Chemicals



**Chart 14. Vulnerability analysis for Yukon Kuskokwim Correctional Center (PWS No.271334.001) - Other Organic Chemicals**

