Source Water Assessment

A Hydrogeologic Susceptibility and Vulnerability Assessment for the GSA Alcan Border Station Drinking Water System, Alcan Border, Alaska

PWSID # 380468.001

June 2004

DRINKING WATER PROTECTION PROGRAM REPORT 1394
Alaska Department of Environmental Conservation

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

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

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Source Water Assessment for GSA Alcan Border Station Public Water System Source of Public Drinking Water, Alcan Border, Alaska

Drinking Water Protection Program
Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

The GSA Alcan Border Station Public Water System has two Public Water System (PWS) wells. The primary well (PWS No. 380468.001) has been used as a drinking water source since it was drilled in 1971. The second well is used as a backup water source. This source water assessment report is exclusively limited to PWSID #380468.001.

The well is a Class A (community and non-transient non-community) water system located adjacent to the west face of the triplex at the Alcan Border Station, Alaska. Available records indicate that there is secondary storage of drinking water, with a capacity of 6,000-gallons, and that the drinking water source is treated with filtration and aeration. This system operates year round and serves approximately 18 residents and between one half to one third of the travelers of the Alaska Highway Border Station (Station) through 15 service connections. The wellhead received a susceptibility rating of **Low** and the aquifer received a susceptibility rating of **Medium**. Combining these two ratings produce a **Low** rating for the natural susceptibility of the well.

Identified potential and current sources of contaminants for the public drinking water source include: domestic wastewater collections systems, large capacity septic systems, aboveground fuel storage tanks, highways and roads, and a landfill. An inventory of potential or existing contamination sources can be found in Appendix B, Table 1. These identified potential and existing sources of contamination are considered 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 well received a vulnerability rating of **High** for bacteria and viruses, nitrates and nitrites, volatile organic chemicals, heavy metals, cyanide and other inorganic chemicals, synthetic organic chemicals and other organic chemicals.

PUBLIC DRINKING WATER SYSTEM

The GSA Alcan Border Station Public Water System well is a Class A (community/non-transient/non-community) public water system. The system is located adjacent to the west face of the triplex at the Alcan Border Station, Alaska. (Sec. 04, T026N, R022E, Copper River Meridian, see Map A of Appendix A). The Alcan Border Station is located along the Alaska Highway, just inside the Alaska border, 42 miles from Northway. The Station has a population of 13 (ADCED, 2003). Average annual precipitation at the Station is 10 inches. Average temperatures range from -27 to 69°F.

The occupants of the Station obtain their water supply from two central watering wells. A majority of the structures utilize a piped sewage system and approximately 60% of the structures have complete plumbing. Outhouses and individual septic tanks are also used (ADCED, 2003). The Station generates its own electricity; power-generating facilities are unknown. Individuals haul solid waste to the landfill operated by US Customs at the station (ADCED, 2003).

According to information supplied by ADEC for the GSA Alcan Border Station PWS, the depth of the well is 380 feet below the ground surface. Based on available well construction details the well is unscreened and completed in an unconfined aquifer. The well is not located within a floodplain.

Information acquired from a June 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 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.

Regionally, Alcan Border lies within the broad northwest-trending valley of the Tanana River.

Granite rocks and older metamorphic rocks of the Yukon-Tanana terrace form the unnamed hills on the northeast side of the valley. Marine sedimentary rocks form the Nutzotin and Mentasta Mountains on the west side of the valley, which are separated from the main portion of the valley by the active, northwest-trending Denali fault (Dames & Moore 1995).

The general area is located on a flat, swampy floodplain that was once a channel of the Nabesna River. Unconsolidated sediments within the floodplain were deposited by glaciers and streams. The floodplain deposits consist of sand and gravel units with traces of peat and clay, which are overlain by eolian silt. The surface soils are generally composed of silts and silty sands, with minor amounts of sand and clay. Little gravel or clay is present. Soils in the vicinity are generally poorly-drained, and numerous lakes and small ponds dot the landscape (Dames & Moore 1995).

The vicinity is reportedly underlain by discontinuous lenses or isolated masses of permafrost (Dames & Moore 1995).

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 GSA Alcan Border Station Public Water System 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

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 GSA Alcan Border Station Public Water System PWS was determined using an analytical calculation and includes Zone A (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 GSA Alcan Border Station 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, and
- 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 characteris tics 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 GSA Alcan Border Station Public Water System's water well is in an unconfined 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	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	50	Very High
Nitrates and/or Nitrites	50	Very High
Volatile Organic Chemicals	45	Very High
Heavy Metals, Cyanide and Other Inorganic Chemicals	50	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	70	High
Heavy Metals, Cyanide and Other Inorganic Chemicals	75	High
Synthetic Organic Chemicals	75	High
Other Organic Chemicals	65	High

Bacteria and Viruses

The contaminant risk for bacteria and viruses is **Very High**. The risk is primarily attributed to the presence of a large capacity septic system and a landfill in Zone A. Numerous other potential contaminant sources are also found within the protection area (see Table 2 – Appendix B).

Coliform (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 coliform 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 bacteria counts have 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 a landfill in Zone A. Numerous other potential contaminant sources are also found within the protection area (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 moderate levels of nitrates have been detected in recent sampling events, however they did not exceed the MCL of 10mg/L. 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 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 a landfill in Zone A. Numerous other potential contaminant sources are also found within the protection area (see Table 4 – Appendix B).

Significant levels of dichloromethane (DCM) were reported in recent sampling events for the GSA Alcan Border Station Public Water System, however the detectible concentrations of DCM reported were below the MCL of 0.005 mg/L (See Chart 7 – Contaminant Risks for Volatile Organic Chemicals in Appendix D).

The greatest use of DCM is as a paint remover. Other uses include: solvent and cleaning agent in chemical manufacture, textiles, electronics, metals and plastics, pesticides industries; blowing and cleaning agent in the urethane foam industry; fumigant for strawberries and grains, and as degreener for citrus fruits; in pharmaceuticals and as an anesthetic; in extraction of caffeine, cocoa, fats, spices and beer hops; as a heat transfer agent in refrigeration products. EPA has found dichloromethane to potentially cause the following health effects from acute exposures at levels above the MCL: neurological (encephalosis) and blood cell damage.

Possible sources of volatile organic chemicals include facilities with automobiles, residential areas, fuel tanks, and roads. See Table 4 in Appendix B for a complete listing.

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 a landfill in Zone A and the reported presence of lead in recent sampling events (see Table 5 – Appendix B).

Based on review of recent sampling records for this public water system, significantly high levels of lead have been detected in recent sampling history. The sampling history indicates that the MC of 0.015 mg/L has been exceeded (see Chart 8 – 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 **Very High**. The risk is primarily attributed to a landfill in Zone A (see Table 6 – Appendix B).

No recent sampling data was available in ADEC records for the GSA Alcan Border Station Public Water 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 well, the overall vulnerability of the well to contamination is **High**.

Other Organic Chemicals

The contaminant risk for other organic chemicals is **Low**. 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 the GSA Alcan Border Station Public Water 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 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 community of Alcan Border Station 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.

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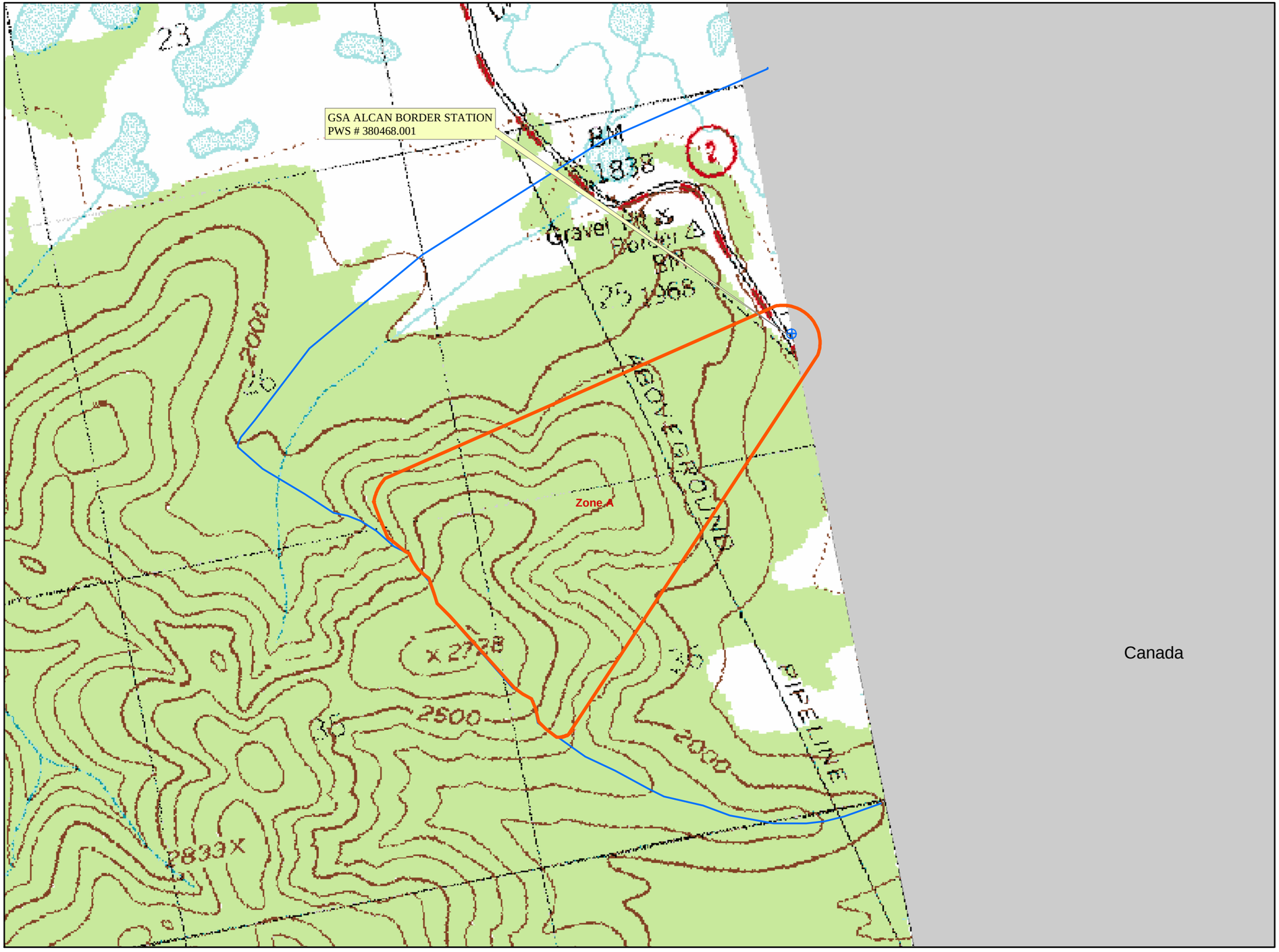
APPENDIX A

Drinking Water Protection Area Location Map
(Map A)

Public Water Well System for PWS #380468.001GSA Alcan Border Station



LEGEND

Public Water System Well

Hydrography/Physical

- Parcels
- Stream
- Lake or Pond
- Contours
- watershed

Transportation

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

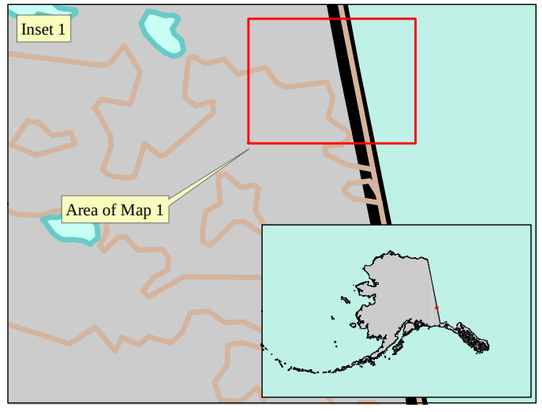
Groundwater Protection Zones

- Zone A Protection Area– Several Months Travel Time and watershed boundry

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.



0 0.15 0.3 0.6 0.9 1.2 Miles

GSA ALCAN BORDER STATION
PWS# 380468.001
Appendix A Map A

APPENDIX B

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

Table 1

Contaminant Source Inventory for
GSA / ALCAN Border Station

PWSID380468.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Map Number*	*Comments*
Domestic wastewater collection systems (sewer lines or lift stati	D01	D01-01	A	C	GSA/Alcan Border Station
Injection wells (Class V) Large-Capacity Septic Systems (Well Disposal Method)	D12	D12-01	A	C	GSA/Alcan Border Station
Landfills (municipal; Class III)	D51	D51-01	A	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-01	A	C	GSA/Alcan Border Station
Tanks, heating oil, nonresidential (aboveground)	T14	T14-02	A	C	GSA/Alcan Border Station
Tanks, heating oil, nonresidential (aboveground)	T14	T14-03	A	C	GSA/Alcan Border Station
Tanks, heating oil, nonresidential (aboveground)	T14	T14-04	A	C	GSA/Alcan border station
Tanks, heating oil, nonresidential (aboveground)	T14	T14-05	A	C	GSA/Alcan border station
Tanks, heating oil, nonresidential (aboveground)	T14	T14-06	A	C	GSA/Alcan Border Station
Highways and roads, paved (cement or asphalt)	X20	X20-01	A	C	Alcan Highway

Table 2

Contaminant Source Inventory and Risk Ranking for GSA / ALCAN Border Station Sources of Bacteria and Viruses

PWSID 380468.001

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	Medium	C	GSA/Alcan Border Station
Injection wells (Class V) Large-Capacity Septic Systems (Well Disposal Method)	D12	D12-01	A	High	C	GSA/Alcan Border Station
Landfills (municipal; Class III)	D51	D51-01	A	High	C	
Highways and roads, paved (cement or asphalt)	X20	X20-01	A	Low	C	Alcan Highway

Table 3

Contaminant Source Inventory and Risk Ranking for GSA / ALCAN Border Station Sources of Nitrates/Nitrites

PWSID 380468.001

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	Medium	C	GSA/Alcan Border Station
Injection wells (Class V) Large-Capacity Septic Systems (Well Disposal Method)	D12	D12-01	A	High	C	GSA/Alcan Border Station
Landfills (municipal; Class III)	D51	D51-01	A	Very High	C	
Highways and roads, paved (cement or asphalt)	X20	X20-01	A	Low	C	Alcan Highway

Table 4

Contaminant Source Inventory and Risk Ranking for GSA / ALCAN Border Station Sources of Volatile Organic Chemicals

PWSID 380468.001

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	GSA/Alcan Border Station
Injection wells (Class V) Large-Capacity Septic Systems (Well Disposal Method)	D12	D12-01	A	Low	C	GSA/Alcan Border Station
Landfills (municipal; Class III)	D51	D51-01	A	High	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-01	A	Low	C	GSA/Alcan Border Station
Tanks, heating oil, nonresidential (aboveground)	T14	T14-02	A	Low	C	GSA/Alcan Border Station
Tanks, heating oil, nonresidential (aboveground)	T14	T14-03	A	Low	C	GSA/Alcan Border Station
Tanks, heating oil, nonresidential (aboveground)	T14	T14-04	A	Low	C	GSA/Alcan border station
Tanks, heating oil, nonresidential (aboveground)	T14	T14-05	A	Low	C	GSA/Alcan border station
Tanks, heating oil, nonresidential (aboveground)	T14	T14-06	A	Low	C	GSA/Alcan Border Station
Highways and roads, paved (cement or asphalt)	X20	X20-01	A	Low	C	Alcan Highway

Table 5

Contaminant Source Inventory and Risk Ranking for GSA / ALCAN Border Station

Sources of Heavy Metals, Cyanide and Other Inorganic Chemicals

PWSID 380468.001

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	GSA/Alcan Border Station
Injection wells (Class V) Large-Capacity Septic Systems (Well Disposal Method)	D12	D12-01	A	Low	C	GSA/Alcan Border Station
Landfills (municipal; Class III)	D51	D51-01	A	High	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-01	A	Low	C	GSA/Alcan Border Station
Tanks, heating oil, nonresidential (aboveground)	T14	T14-02	A	Low	C	GSA/Alcan Border Station
Tanks, heating oil, nonresidential (aboveground)	T14	T14-03	A	Low	C	GSA/Alcan Border Station
Tanks, heating oil, nonresidential (aboveground)	T14	T14-04	A	Low	C	GSA/Alcan border station
Tanks, heating oil, nonresidential (aboveground)	T14	T14-05	A	Low	C	GSA/Alcan border station
Tanks, heating oil, nonresidential (aboveground)	T14	T14-06	A	Low	C	GSA/Alcan Border Station
Highways and roads, paved (cement or asphalt)	X20	X20-01	A	Low	C	Alcan Highway

Table 6

Contaminant Source Inventory and Risk Ranking for GSA / ALCAN Border Station Sources of Synthetic Organic Chemicals

PWSID 380468.001

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	GSA/Alcan Border Station
Injection wells (Class V) Large-Capacity Septic Systems (Well Disposal Method)	D12	D12-01	A	Low	C	GSA/Alcan Border Station
Landfills (municipal; Class III)	D51	D51-01	A	Very High	C	

Table 7

Contaminant Source Inventory and Risk Ranking for GSA / ALCAN Border Station Sources of Other Organic Chemicals

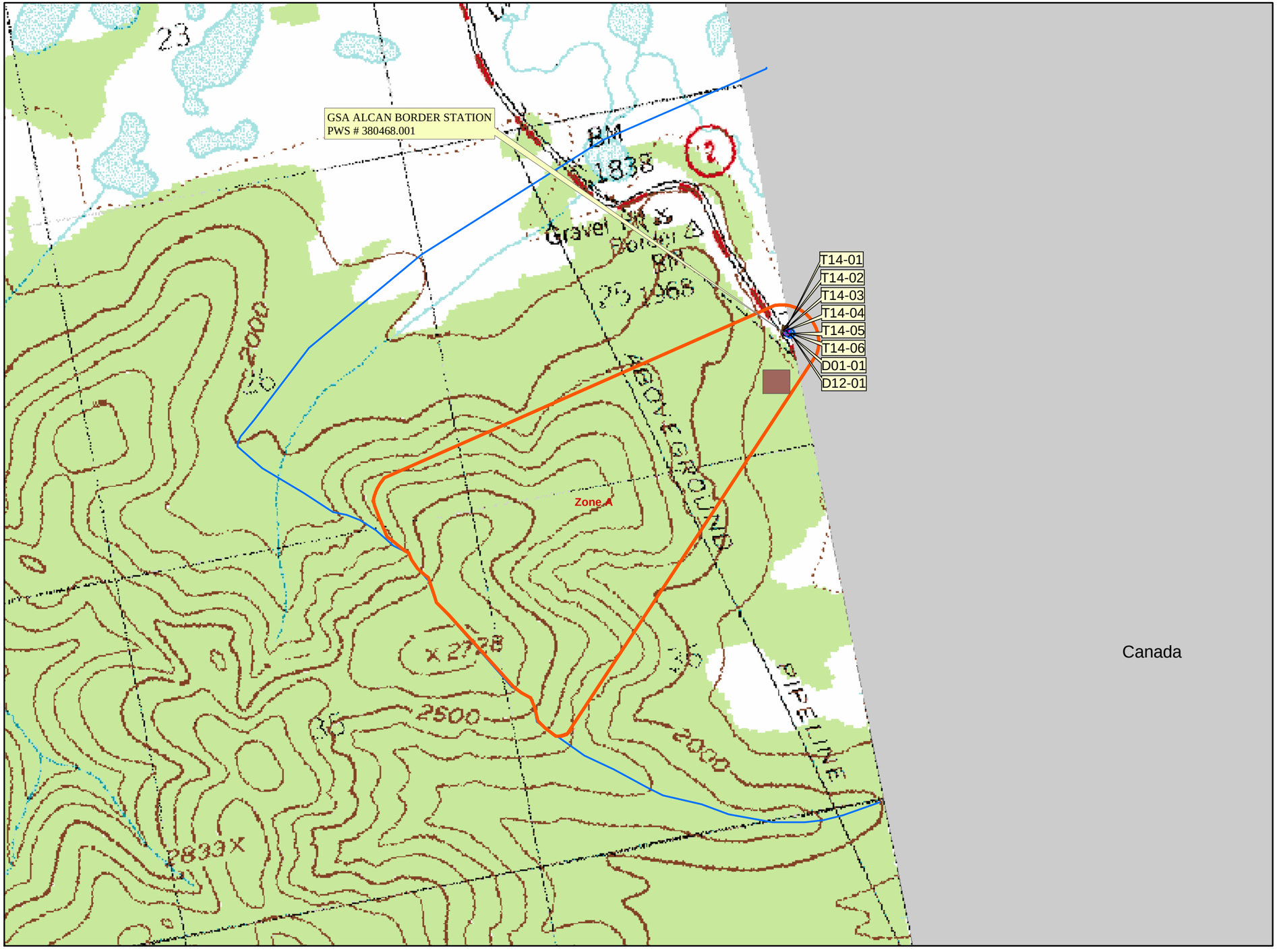
PWSID 380468.001

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	GSA/Alcan Border Station
Injection wells (Class V) Large-Capacity Septic Systems (Well Disposal Method)	D12	D12-01	A	Low	C	GSA/Alcan Border Station
Landfills (municipal; Class III)	D51	D51-01	A	Very High	C	
Highways and roads, paved (cement or asphalt)	X20	X20-01	A	Low	C	Alcan Highway

APPENDIX C

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

Public Water Well System for PWS #380468.001GSA Alcan Border Station
Sources of Existing and Potential Contamination



LEGEND

- Public Water System Well

Hydrography/Physical

- Parcels
- Stream
- Lake or Pond
- Contours
- watershed

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 and watershed boundry

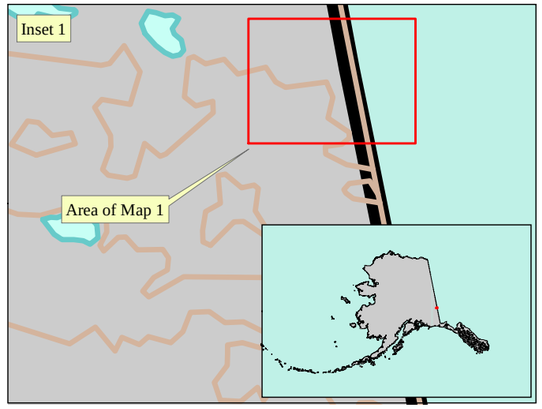
Existing or Potential Contaminant Sources

- Domestic wastewater collection systems (sewer lines or lift stations) (D01)
- Injection Wells (Class V) Large-Capacity Septic Systems (Well Disposal Method) (D12)
- Tanks, heating oil, nonresidential (aboveground) (T14)
- Landfills (Municipal, Class III) (D51)

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.



0 0.15 0.3 0.6 0.9 1.2 Miles

GSA ALCAN BORDER STATION
PWS# 380468.001
Appendix C Map C

APPENDIX D

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

Chart 1. Susceptibility of the wellhead - GSA Alcan Border Station (PWS No. 380468.001)

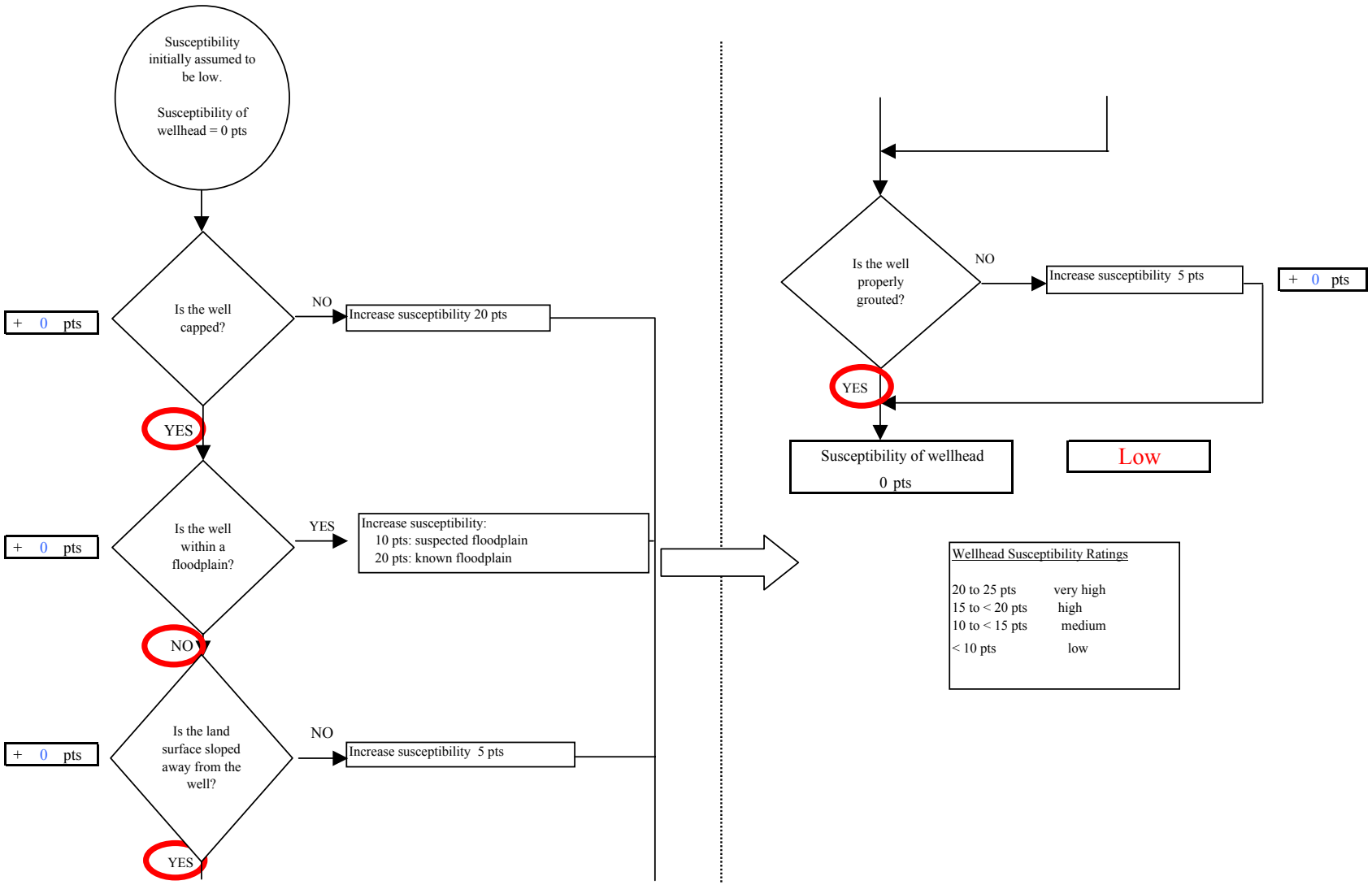


Chart 2. Susceptibility of the aquifer GSA Alcan Border Station (PWS No. 380468.001)

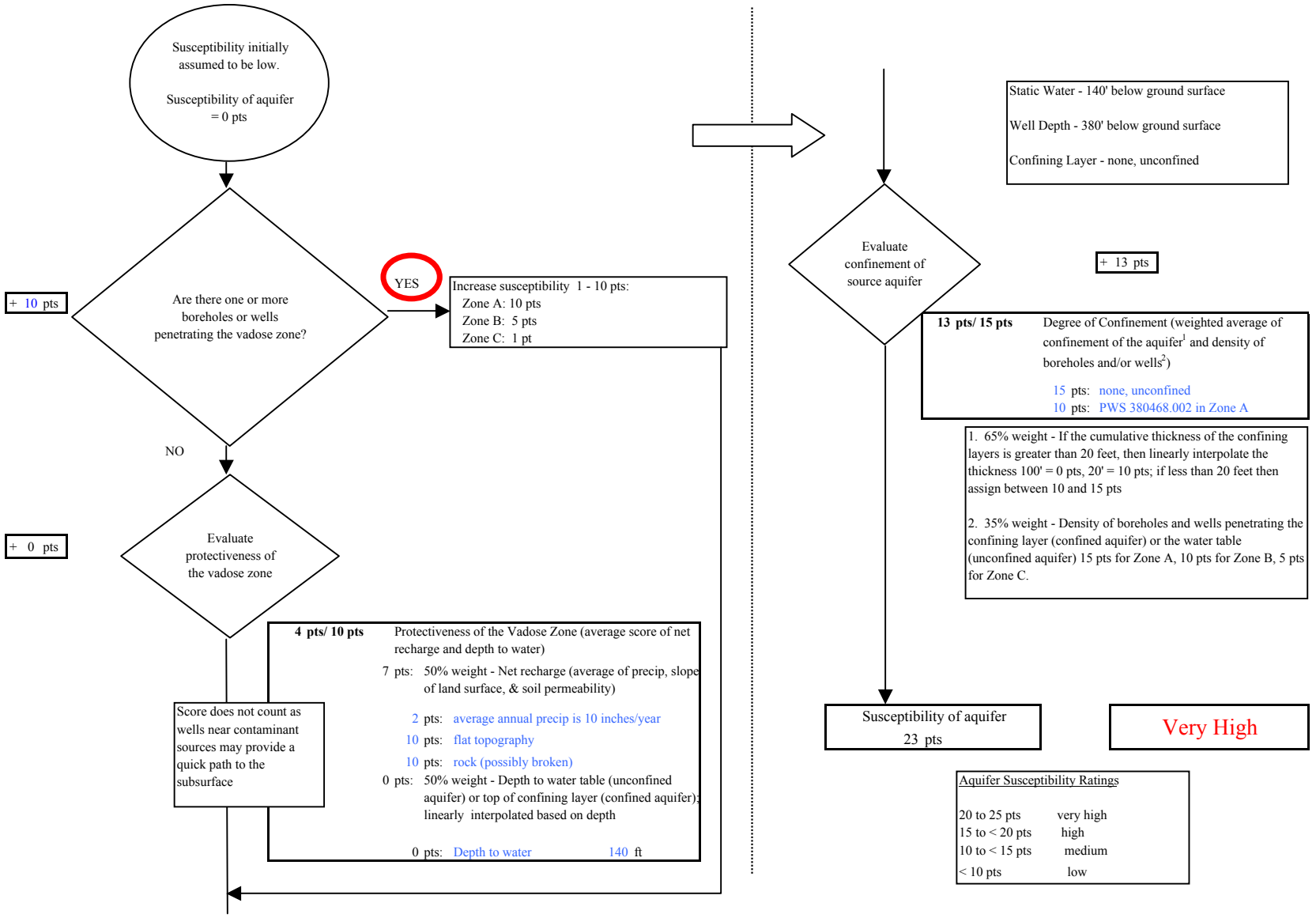
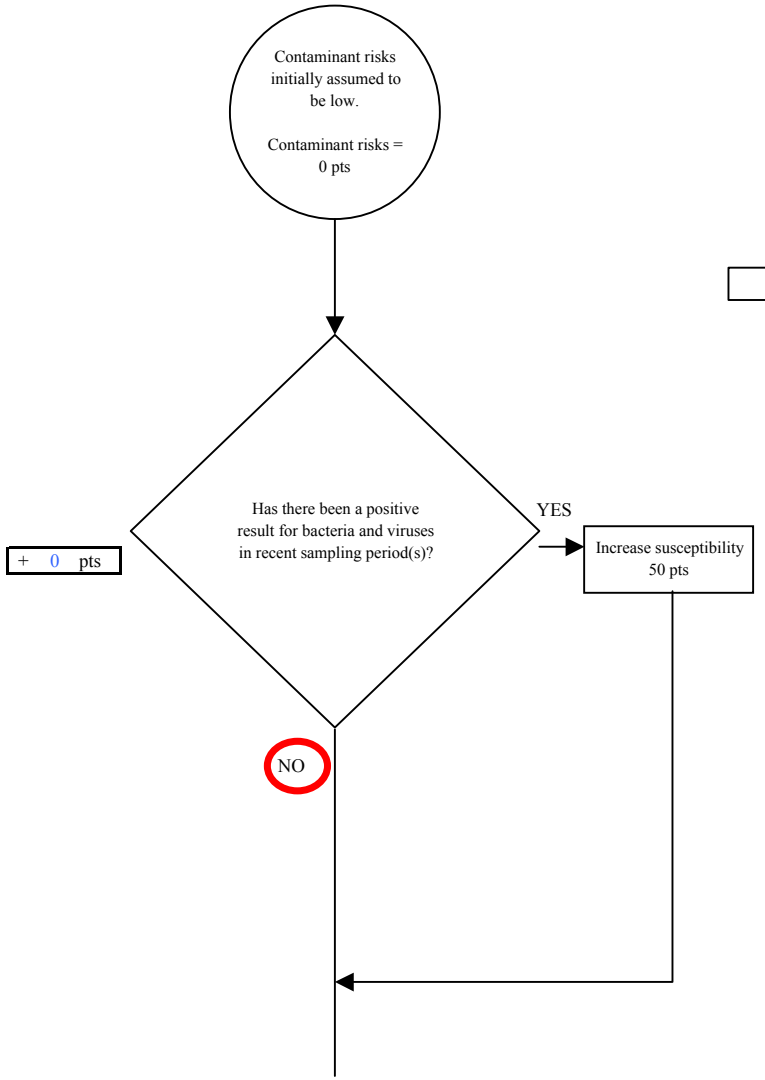
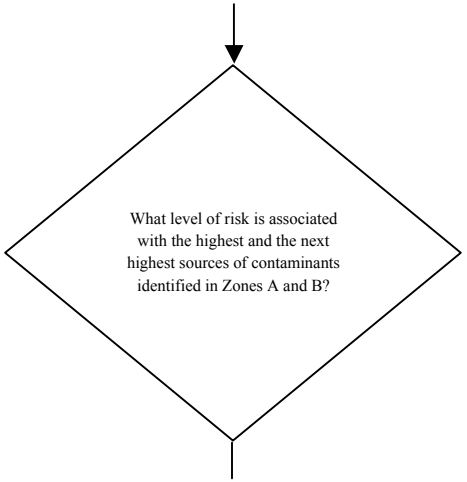


Chart 3. Contaminant risks for GSA Alcan Border Station (PWS No. 380468.001) - Bacteria & Viruses





+ 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)	2	0	2
Medium(s)	1	0	1
Low(s)	1	0	1

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

Matrix Score 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 GSA Alcan Border Station (PWS No. 380468.001) - Bacteria & Viruses

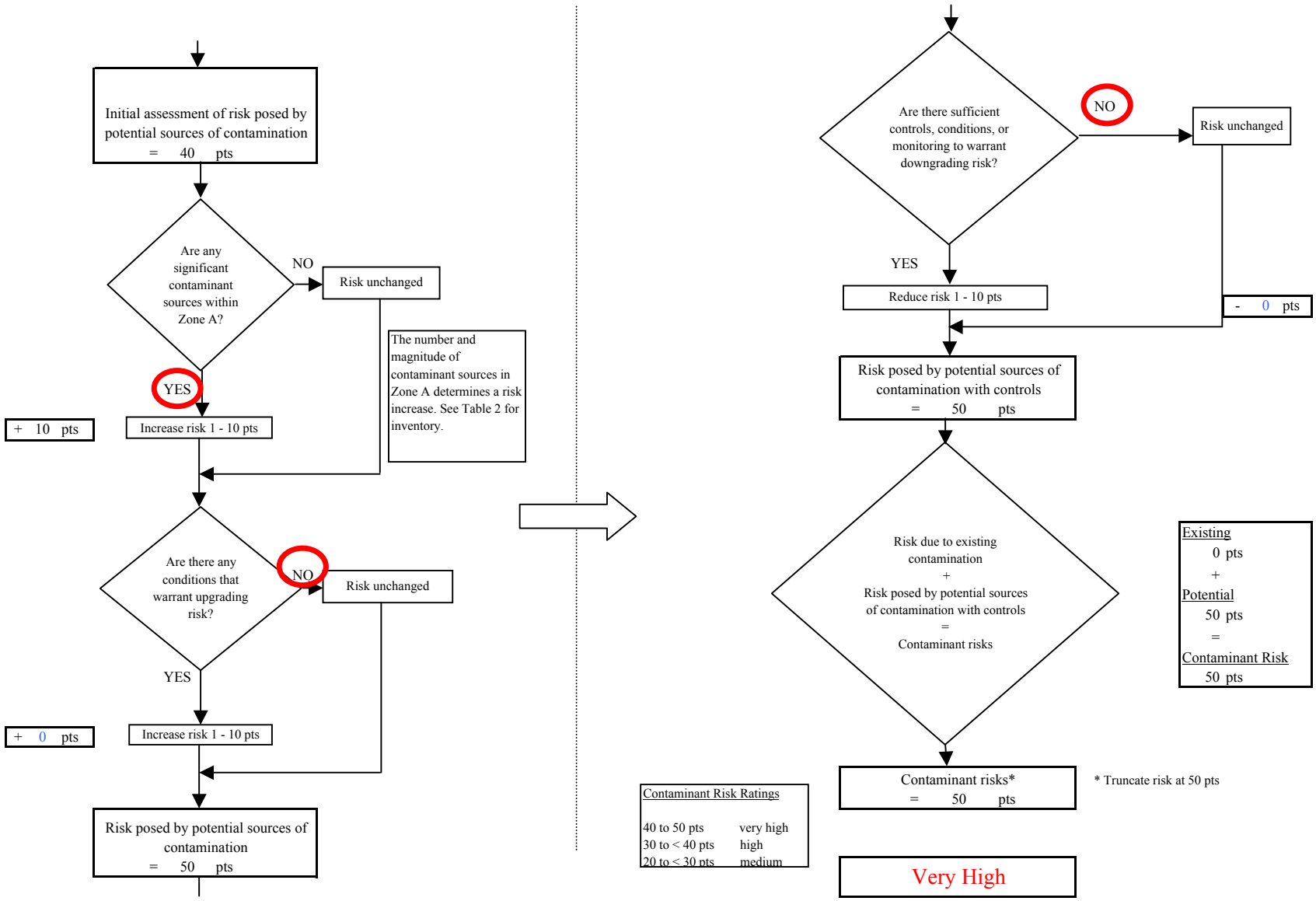


Chart 4. Vulnerability analysis for GSA Alcan Border Station (PWS No. 380468.001) - Bacteria & Viruses

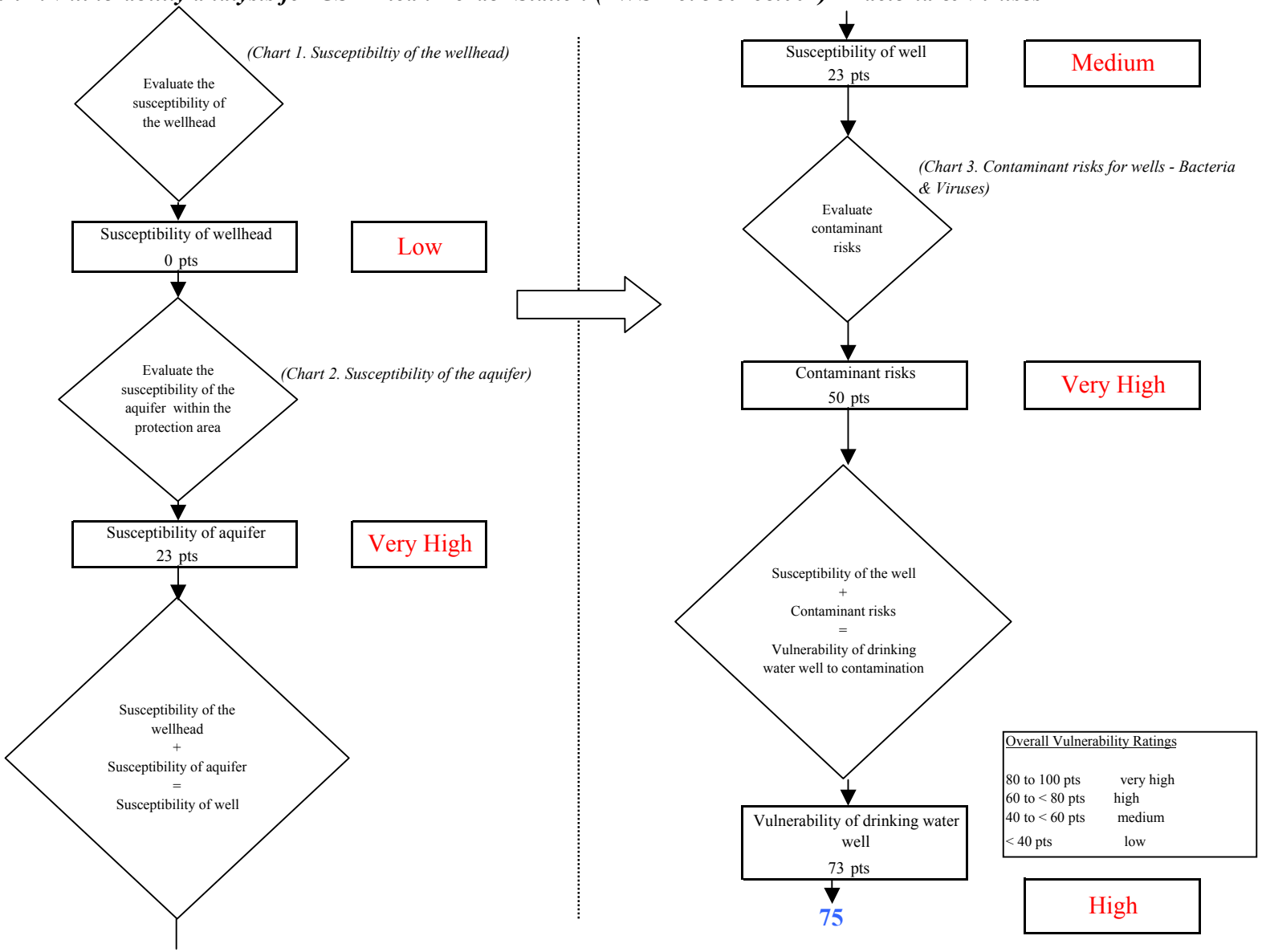


Chart 5. Contaminant risks for GSA Alcan Border Station (PWS No. 380468.001) - Nitrates and Nitrites

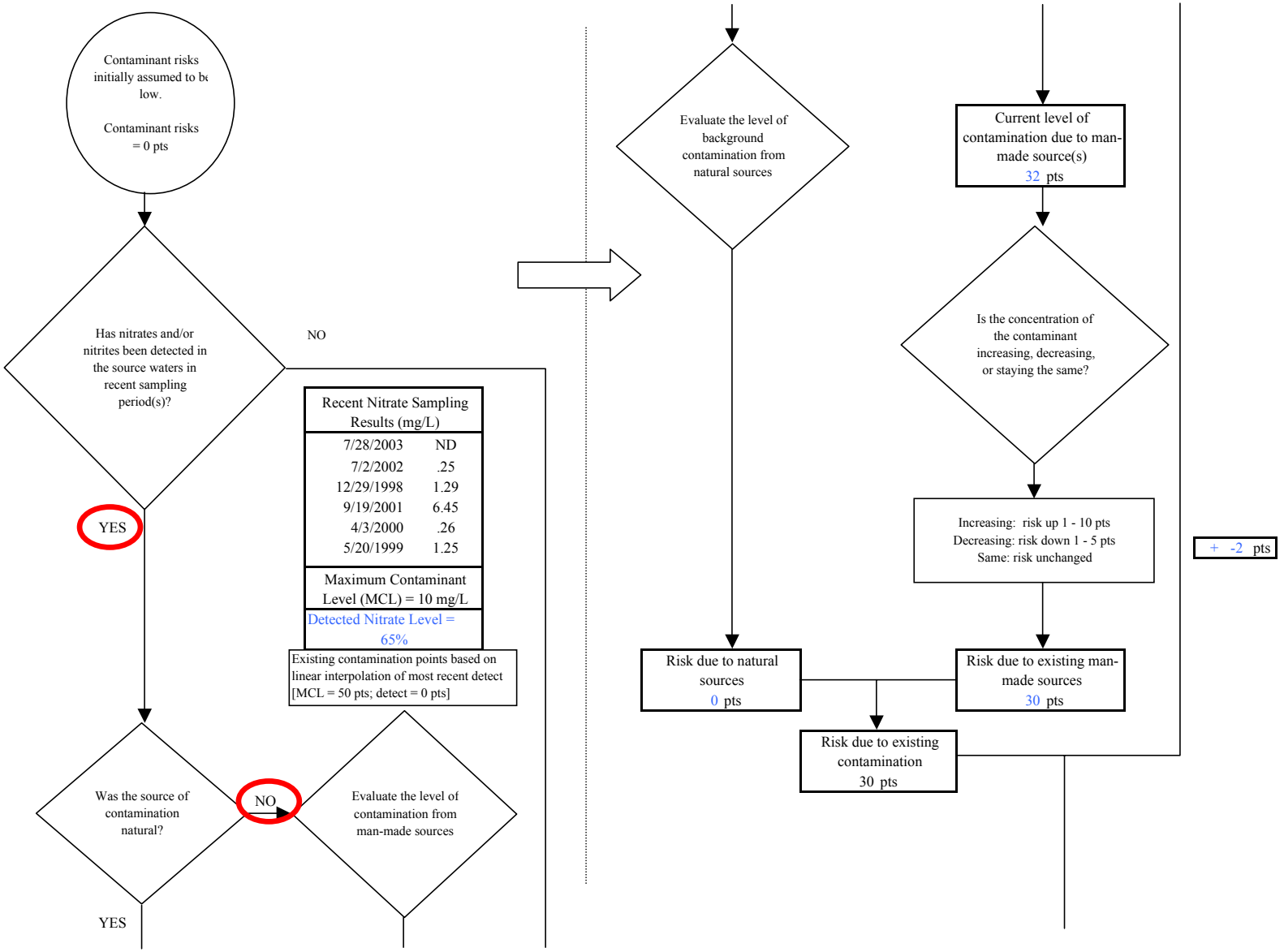
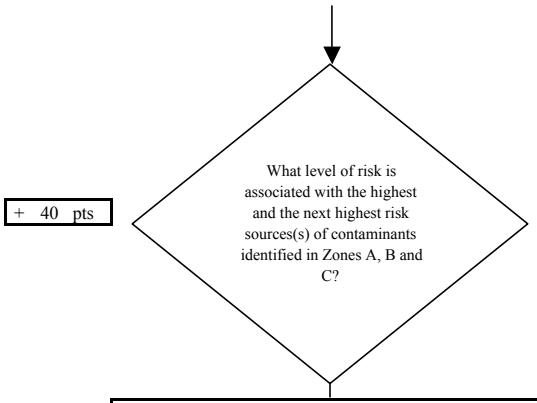


Chart 5. Contaminant risks for GSA Alcan Border Station (PWS No. 380468.001) - Nitrates and Nitrites



+ 40 pts

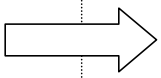
Risk Levels for Contaminant Sources identified in Zones A, B and C

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

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

Matrix Score 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.



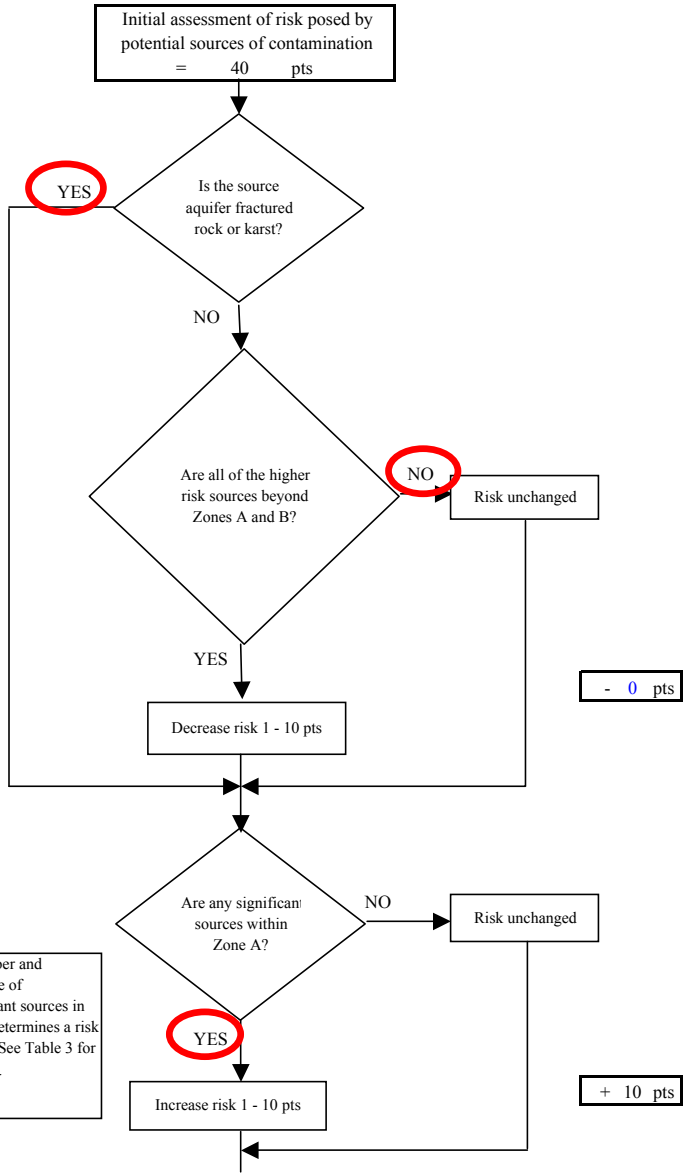


Chart 5. Contaminant risks for GSA Alcan Border Station (PWS No. 380468.001) - Nitrates and Nitrites

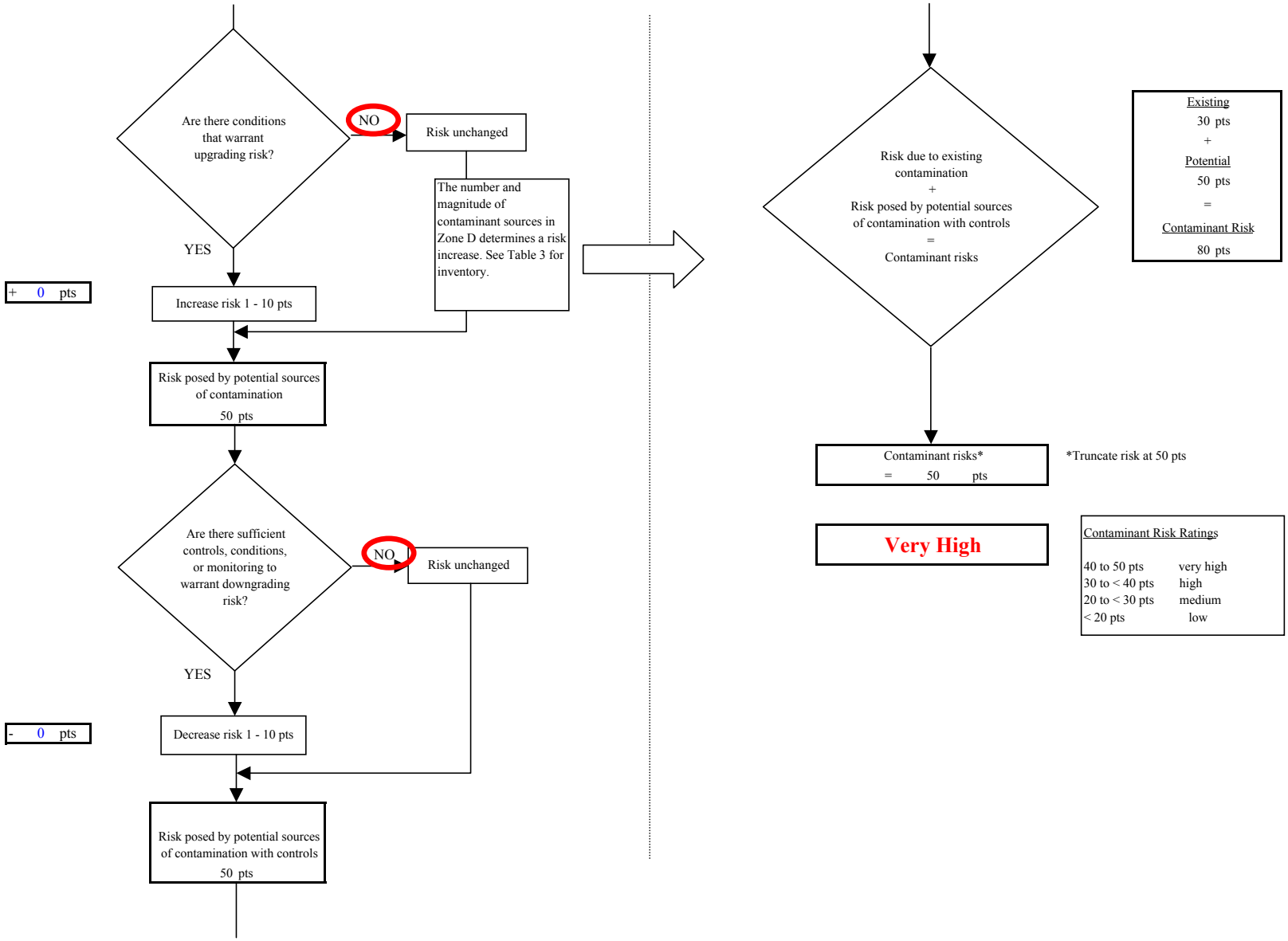


Chart 6. Vulnerability analysis for GSA Alcan Border Station (PWS No. 380468.001) - Nitrates and Nitrites

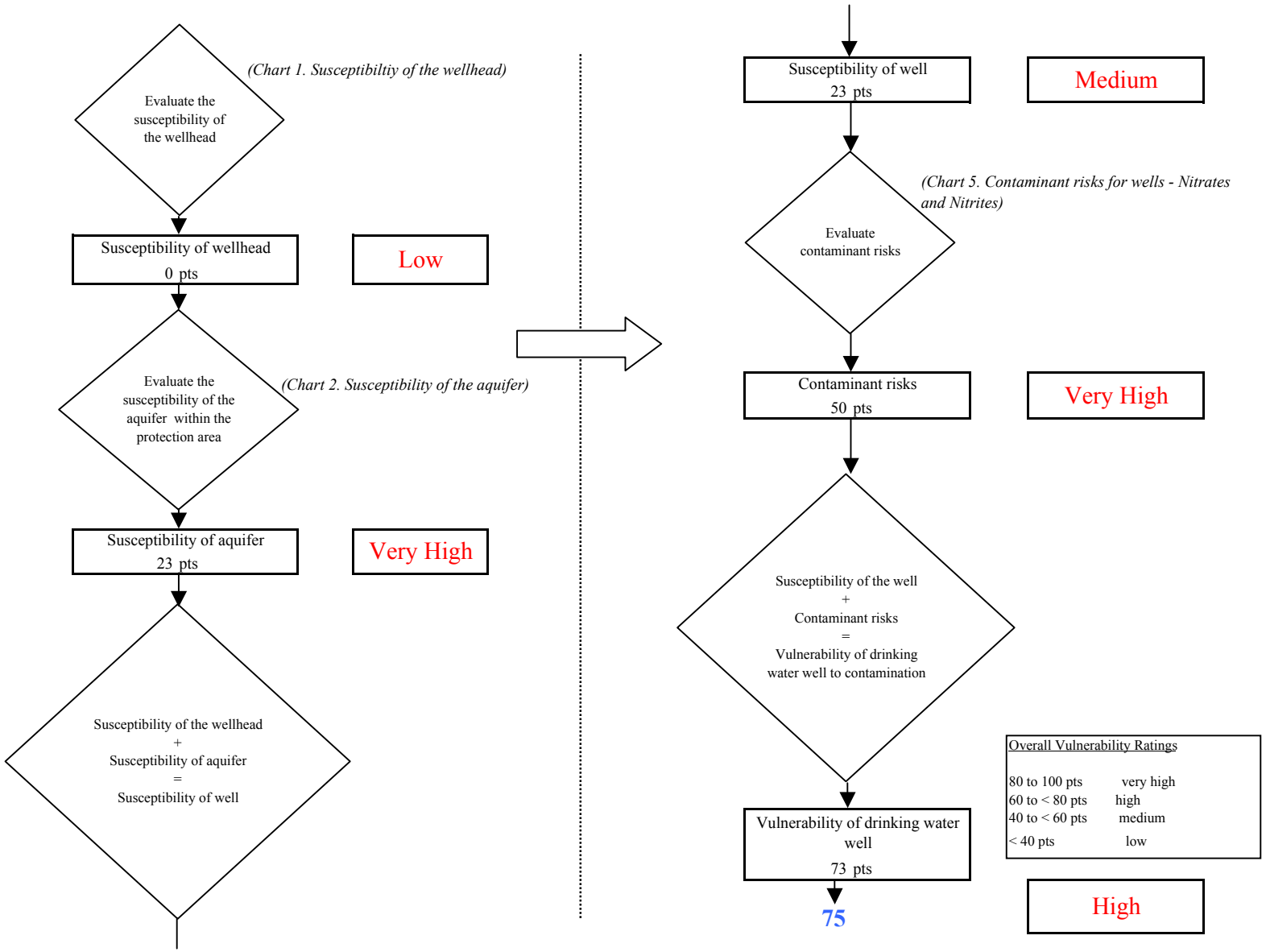


Chart 7. Contaminant risks for GSA Alcan Border Station (PWS No. 380468.001) - Volatile Organic Chemicals

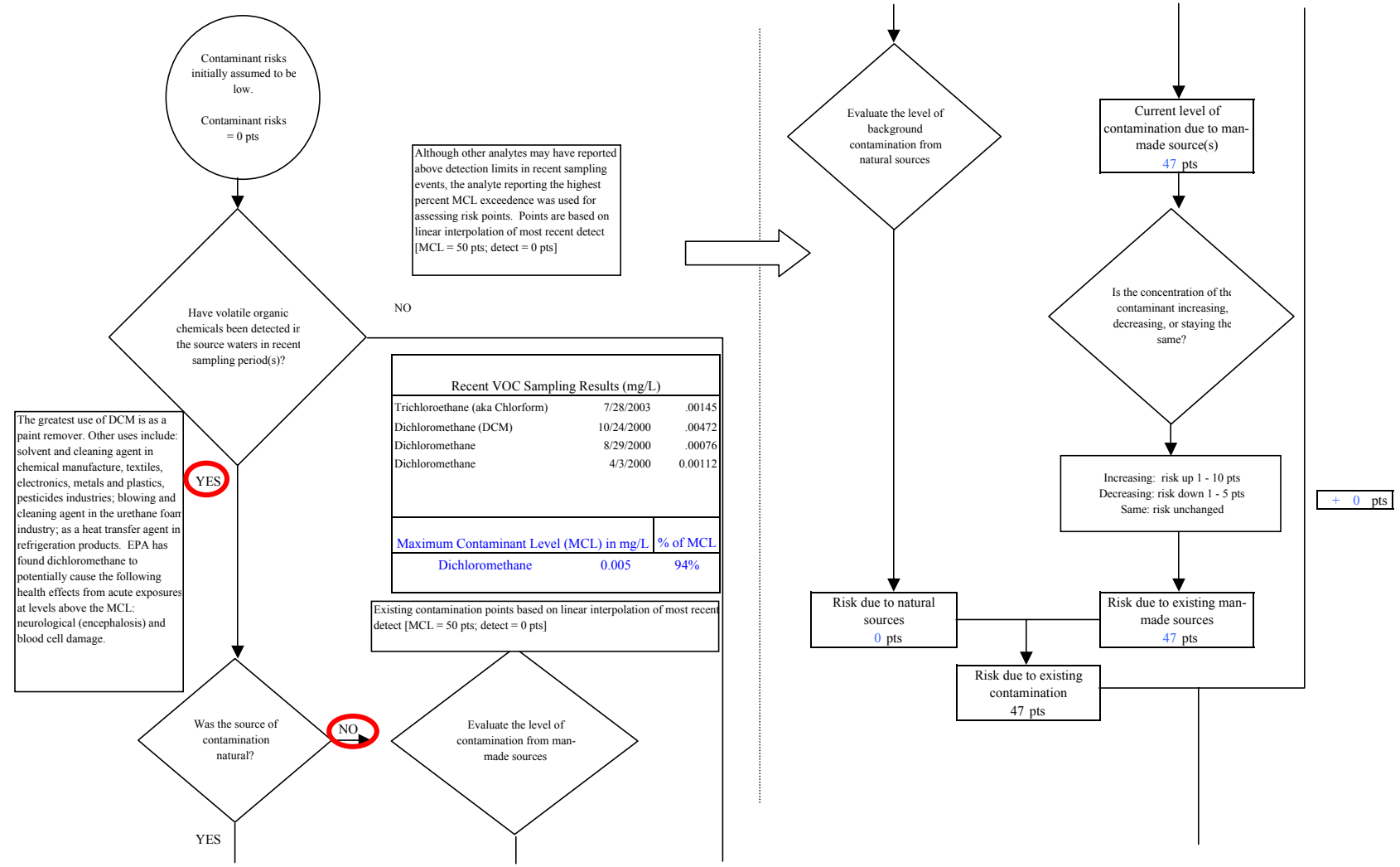
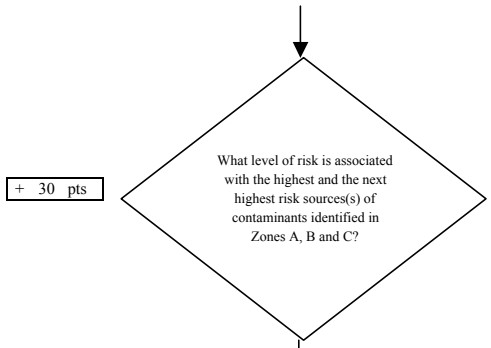


Chart 7. Contaminant risks for GSA Alcan Border Station (PWS No. 380468.001) - Volatile Organic Chemicals



+ 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)	0	0	0
Low(s)	9	0	9

	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 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.

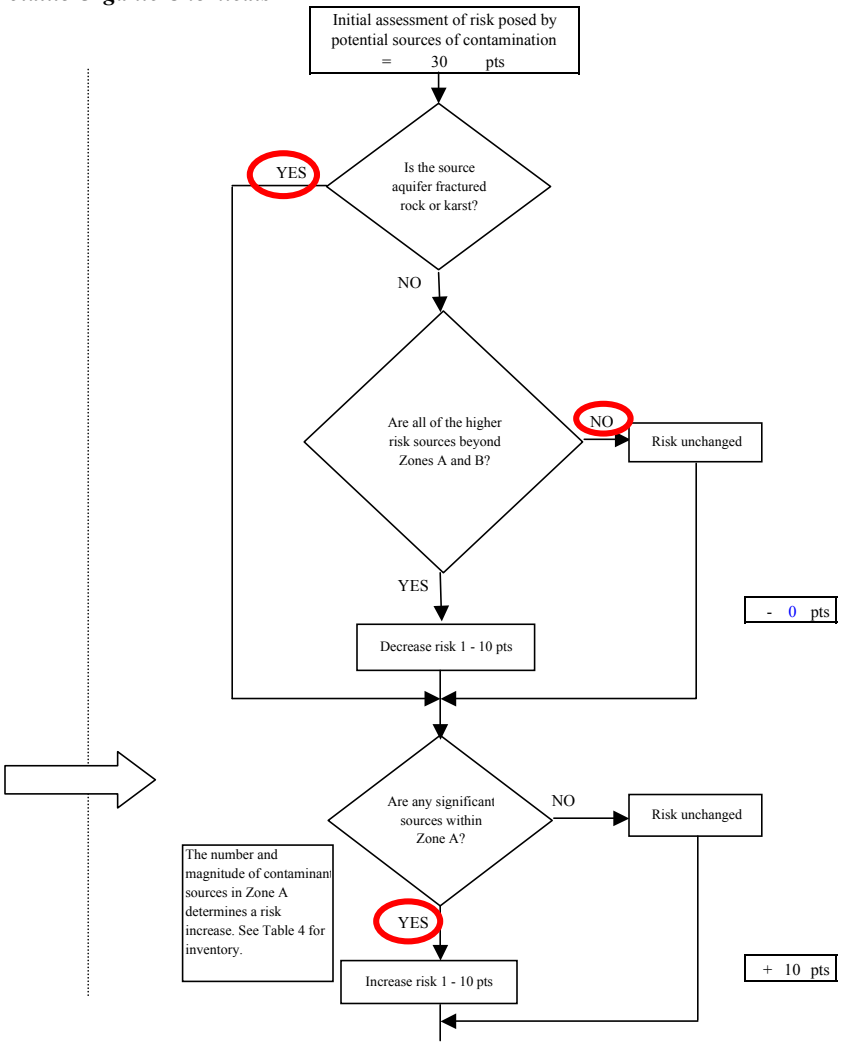


Chart 7. Contaminant risks for GSA Alcan Border Station (PWS No. 380468.001) - Volatile Organic Chemicals

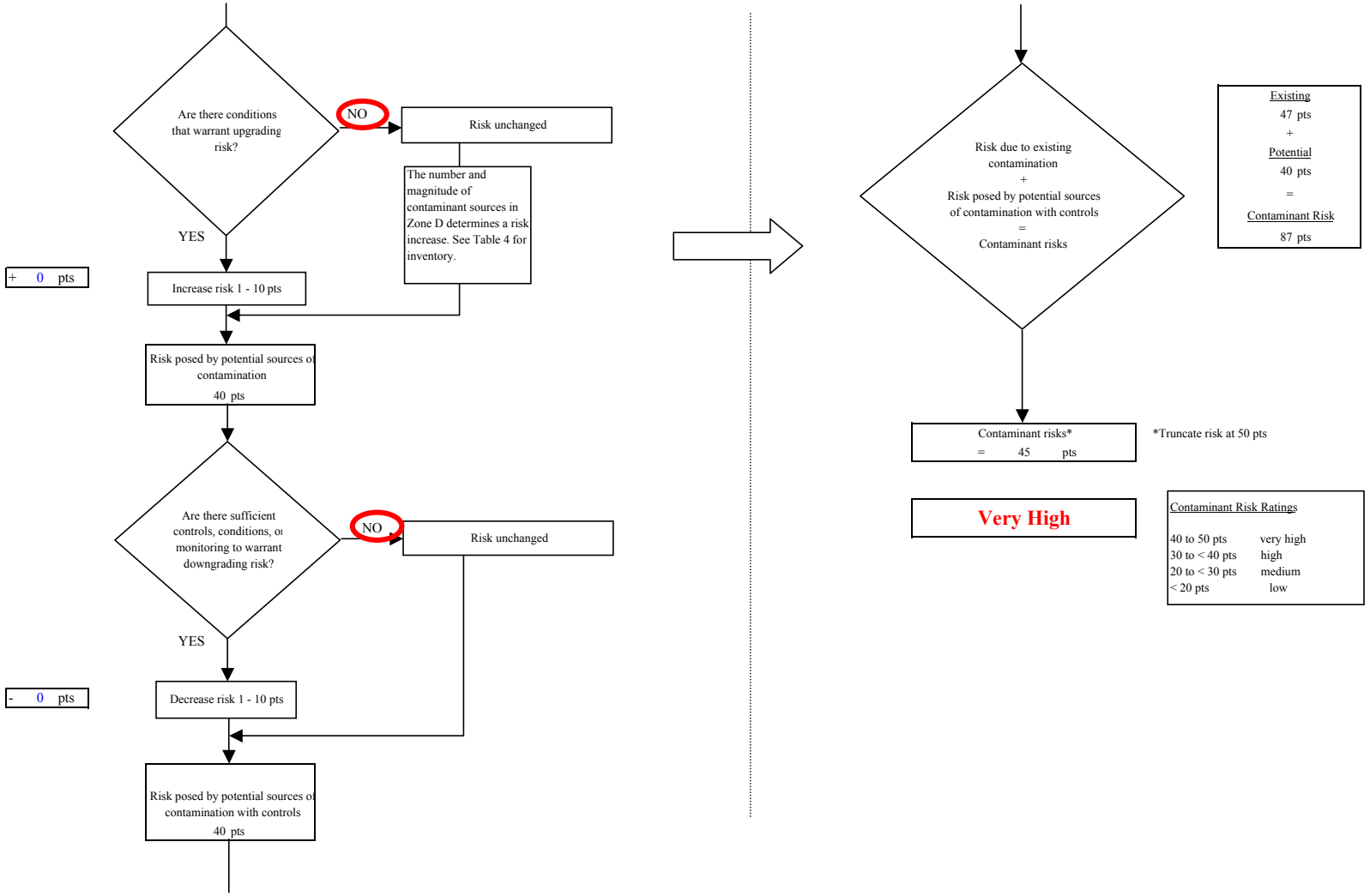


Chart 8. Vulnerability analysis for GSA Alcan Border Station (PWS No. 380468.001) - Volatile Organic Chemicals

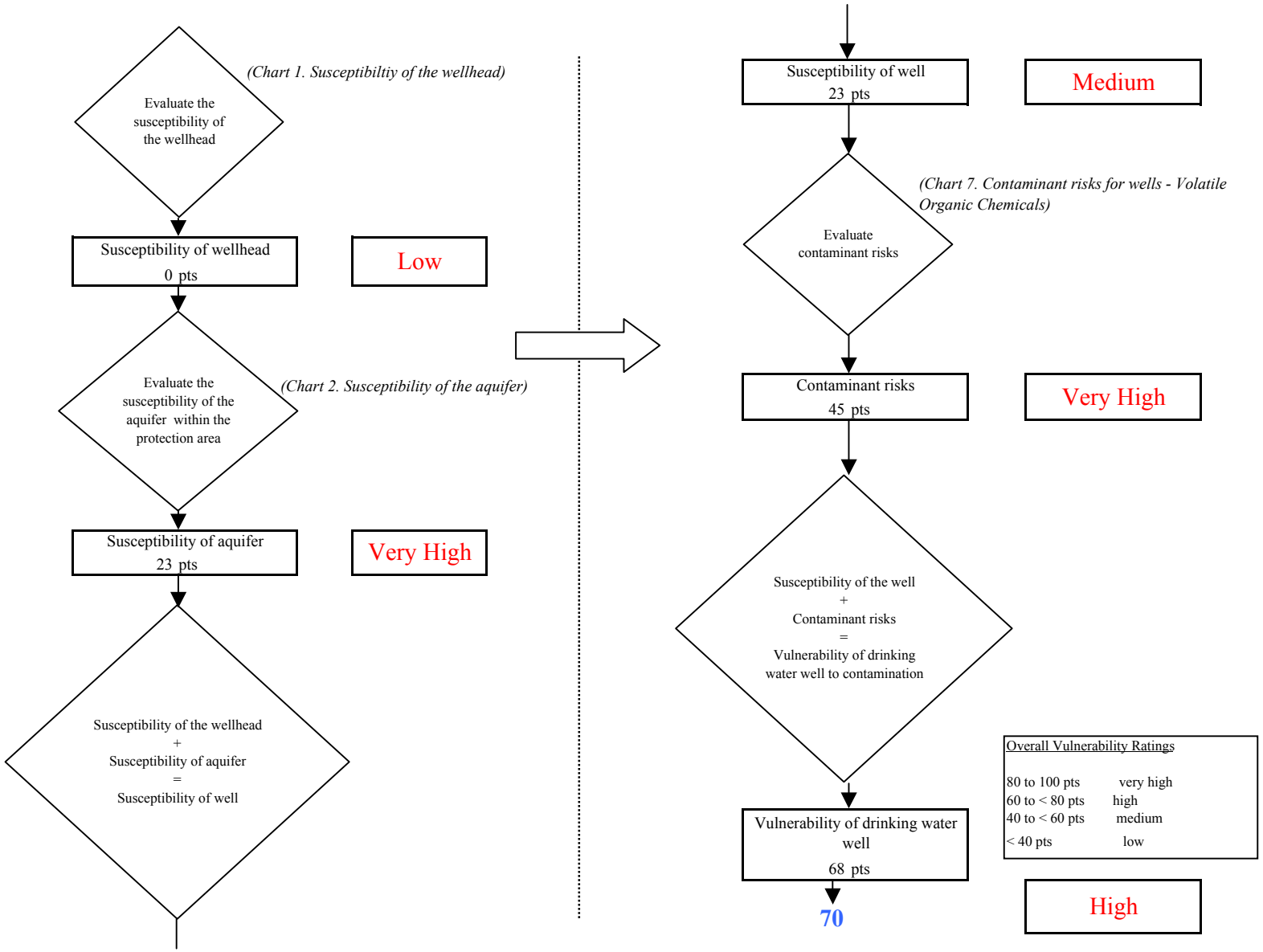


Chart 9. Contaminant risks for GSA Alcan Border Station (PWS No. 380468.001) - Heavy Metals, Cyanide and Other Inorganic Chemicals

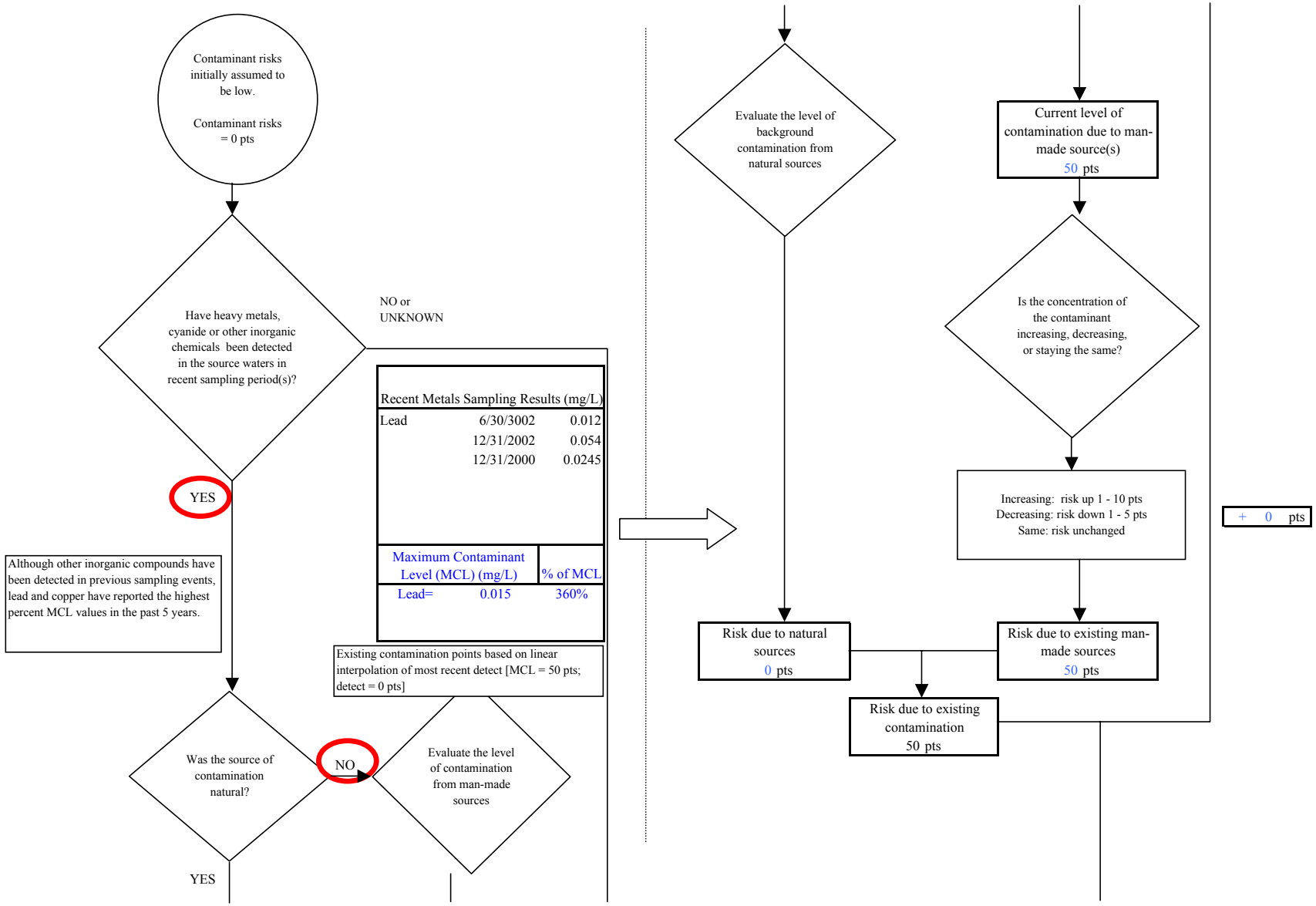
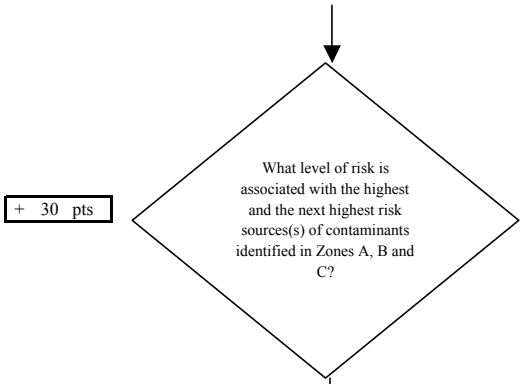


Chart 9. Contaminant risks for GSA Alcan Border Station (PWS No. 380468.001) - Heavy Metals, Cyanide and Other Inorganic Chemicals



+ 30 pts

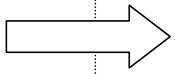
Risk Levels for Contaminant Sources identified in Zones A, B and C

	Zone A	Zones B&C	Total
Very Highs(s)	0	0	0
High(s)	1	0	1
Medium(s)	0	0	0
Low(s)	9	0	9

	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.



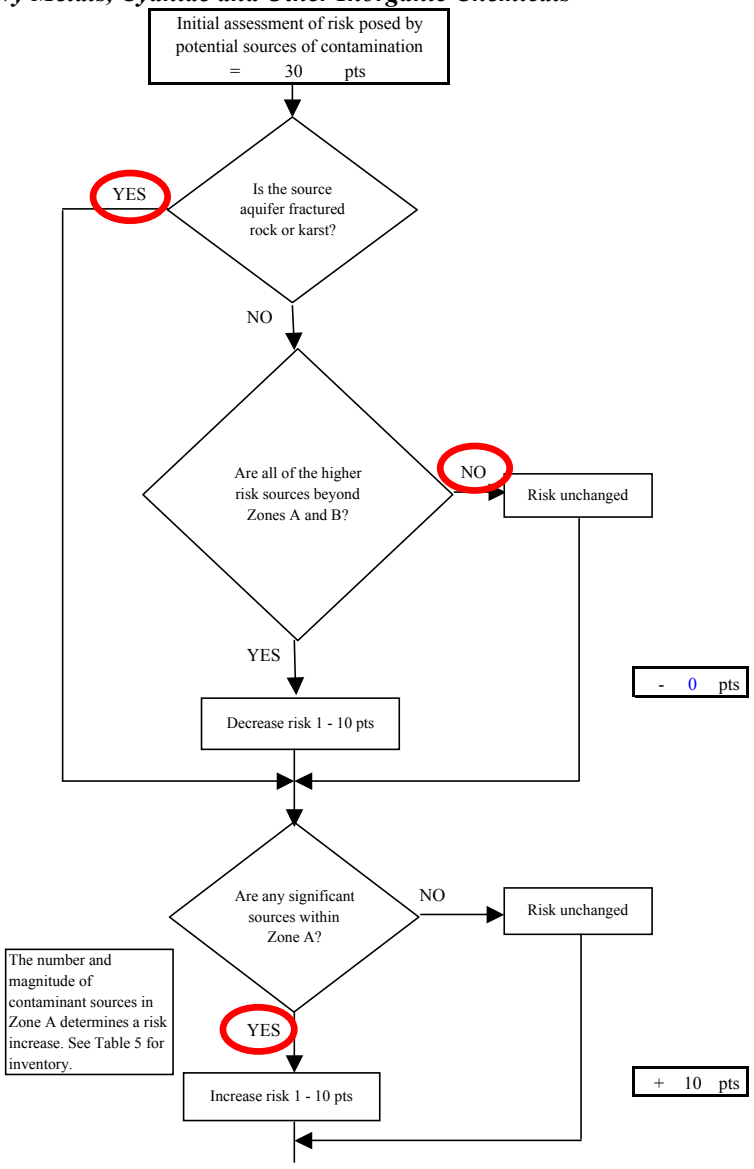


Chart 9. Contaminant risks for GSA Alcan Border Station (PWS No. 380468.001) - Heavy Metals, Cyanide and Other Inorganic Chemicals

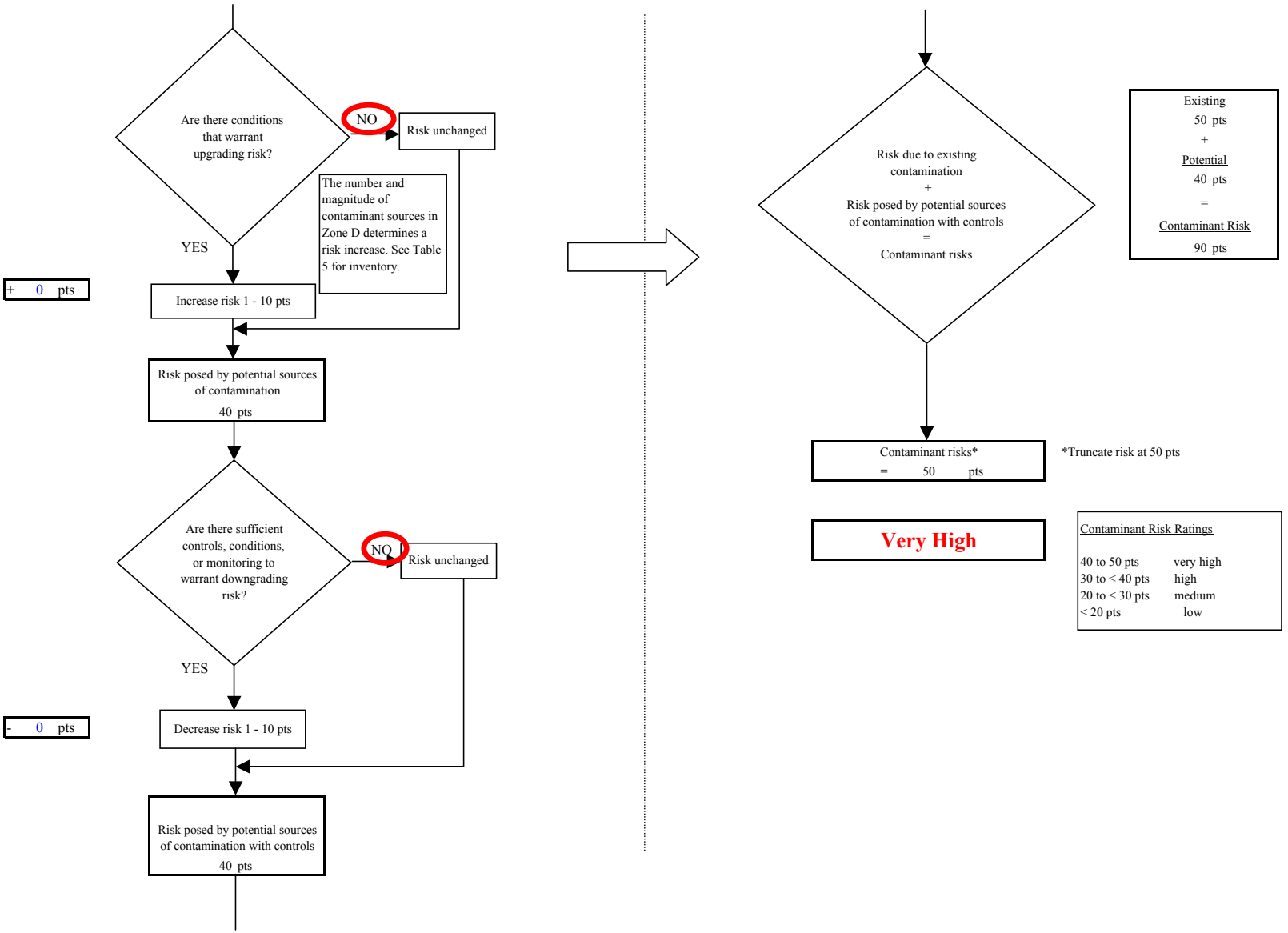


Chart 10. Vulnerability analysis for GSA Alcan Border Station (PWS No. 380468.001) - Heavy Metals, Cyanide and Other Inorganic Chemicals

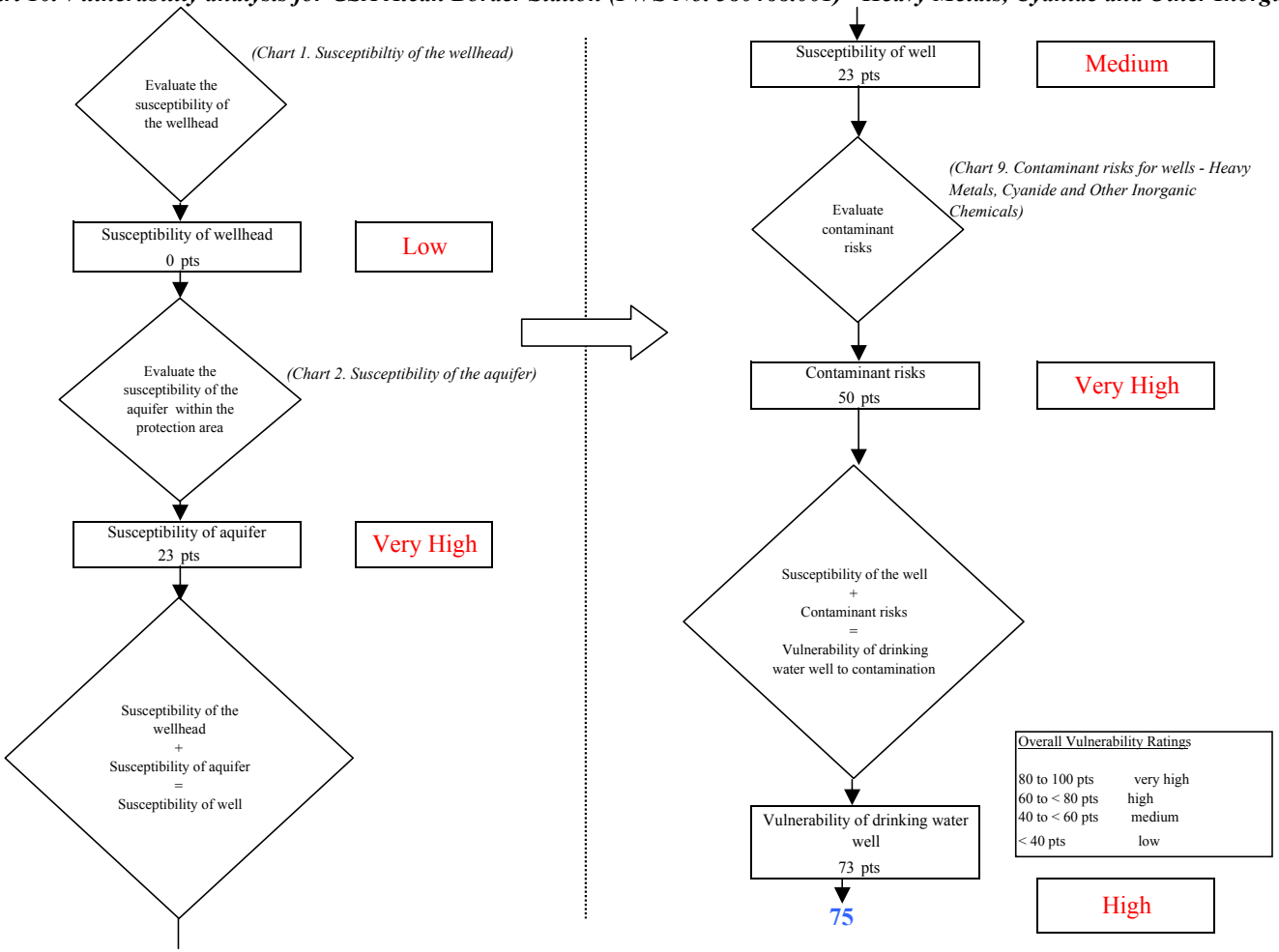


Chart 11. Contaminant risks for GSA Alcan Border Station (PWS No. 380468.001) - Synthetic Organic Chemicals

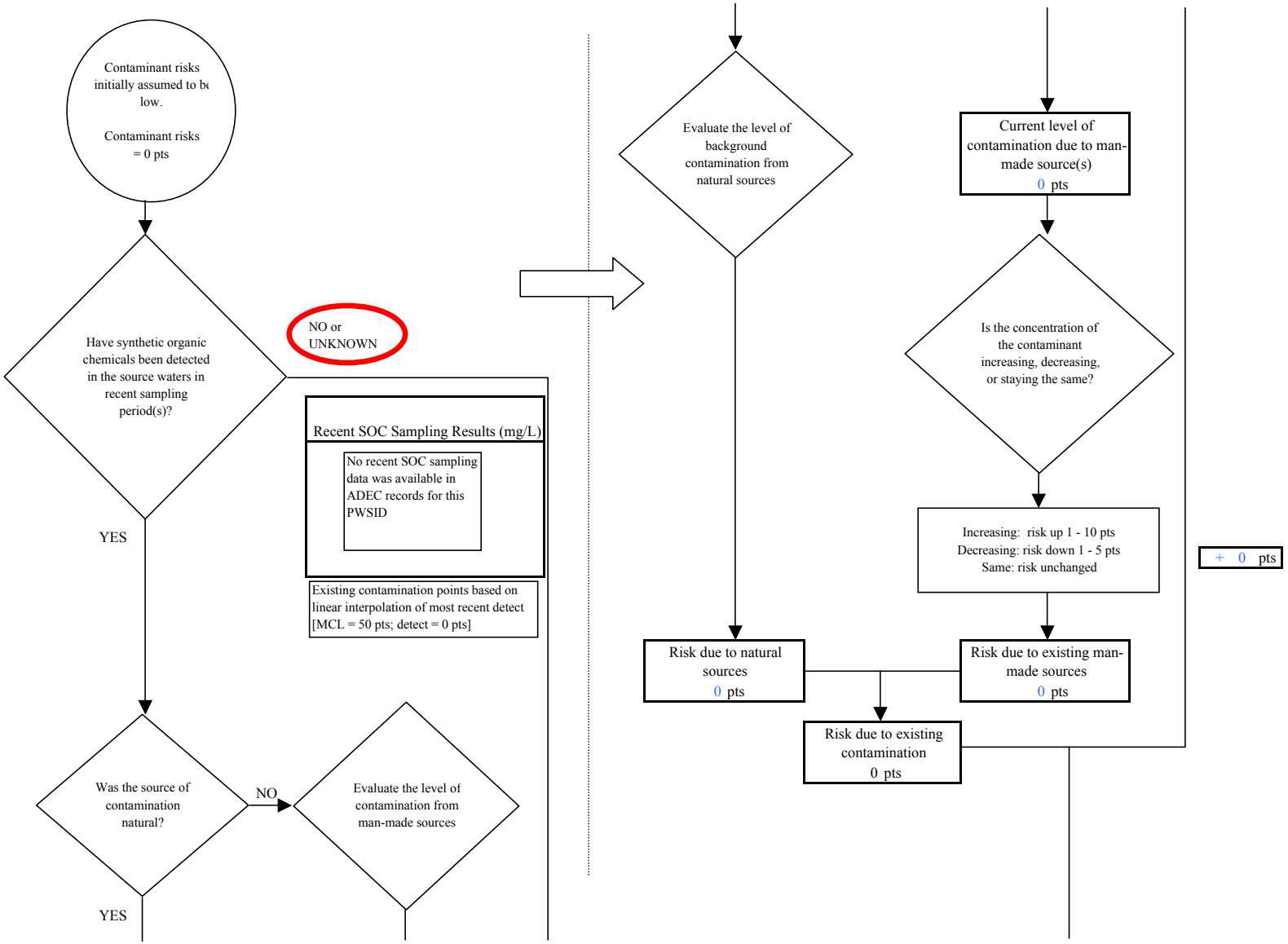
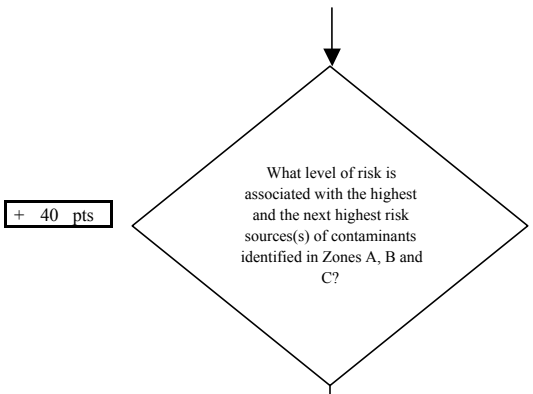


Chart 11. Contaminant risks for GSA Alcan Border Station (PWS No. 380468.001) - Synthetic Organic Chemicals



+ 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)	0	0	0
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 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.

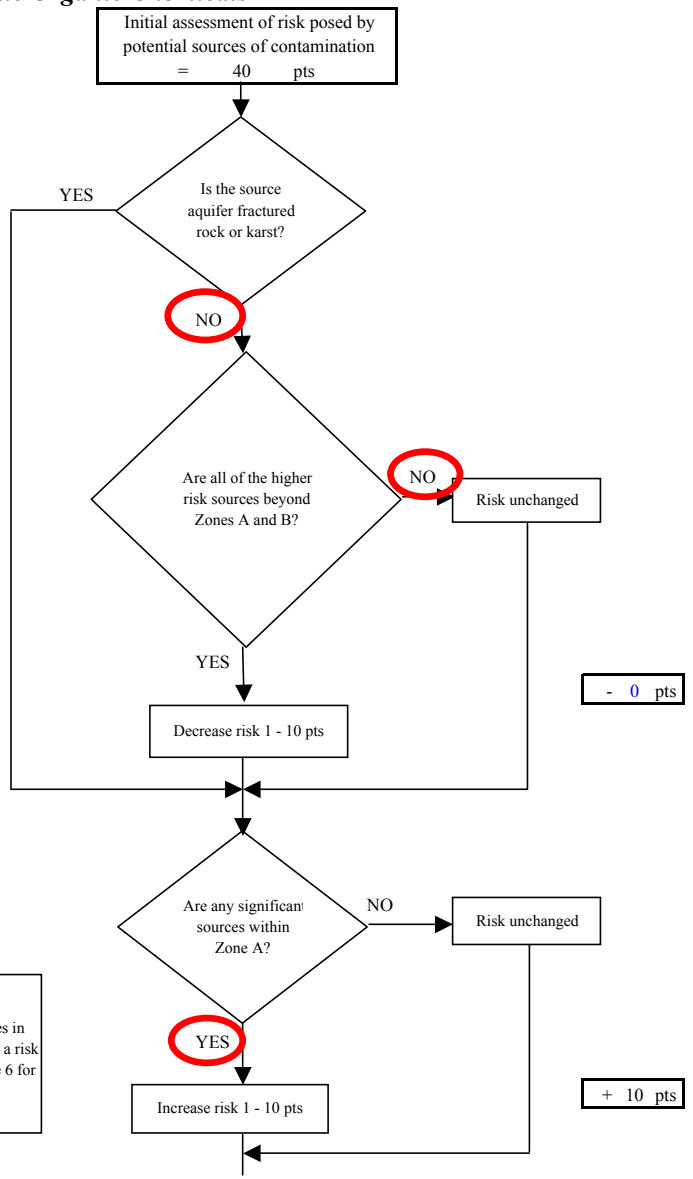


Chart 11. Contaminant risks for GSA Alcan Border Station (PWS No. 380468.001) - Synthetic Organic Chemicals

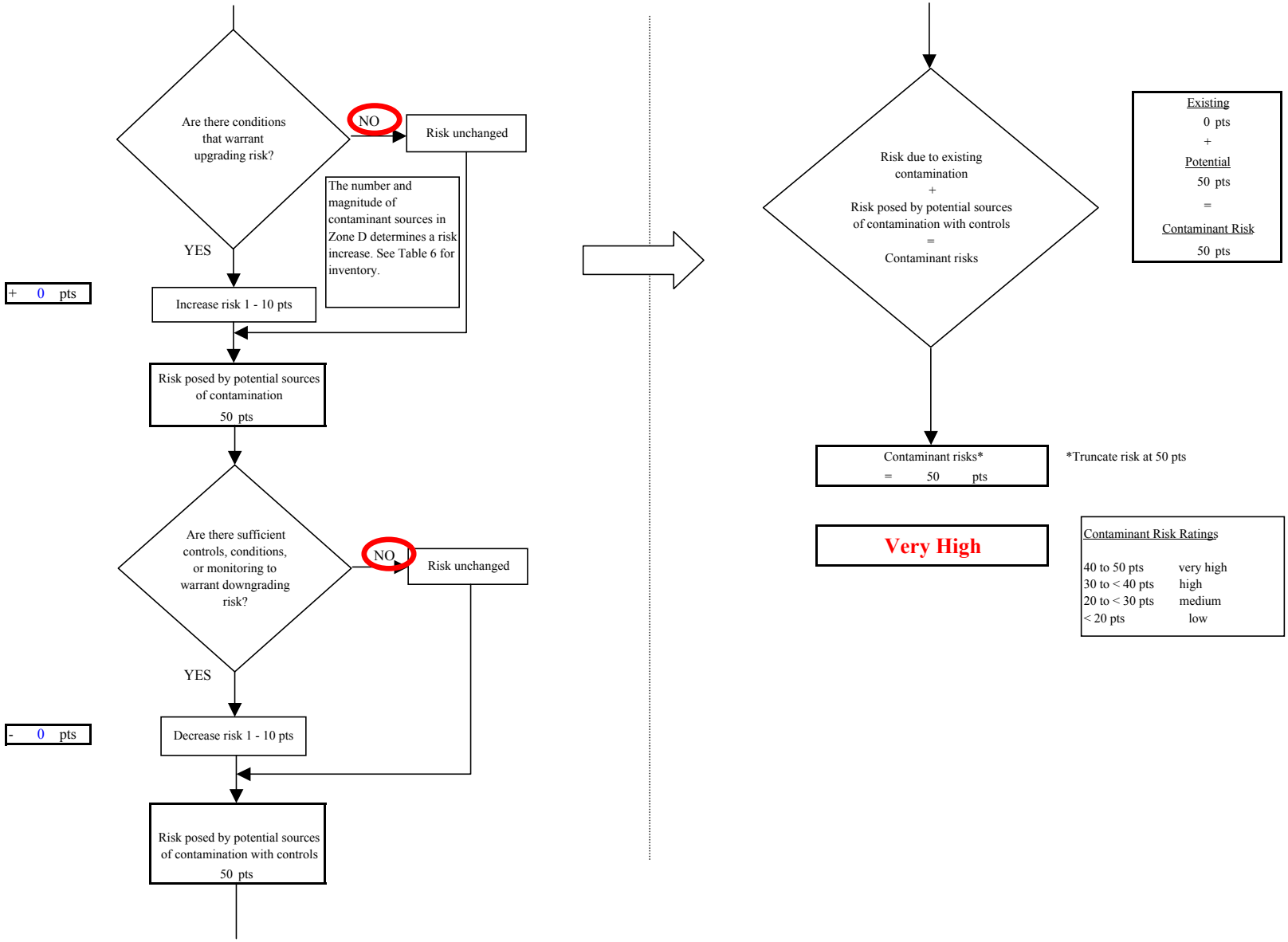


Chart 12. Vulnerability analysis for GSA Alcan Border Station (PWS No. 380468.001) - Synthetic Organic Chemicals

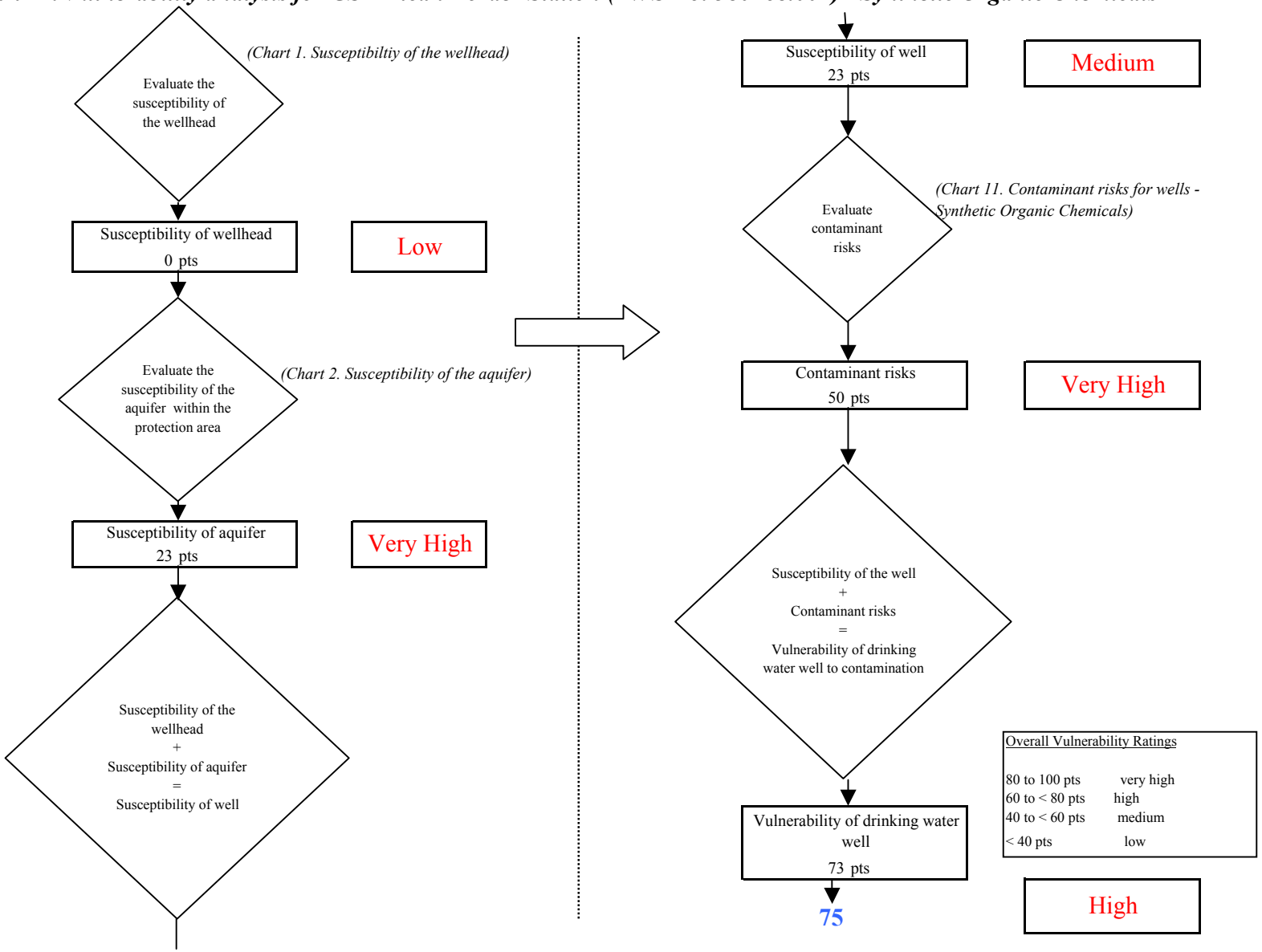


Chart 13. Contaminant risks for GSA Alcan Border Station (PWS No. 380468.001) - Other Organic Chemicals

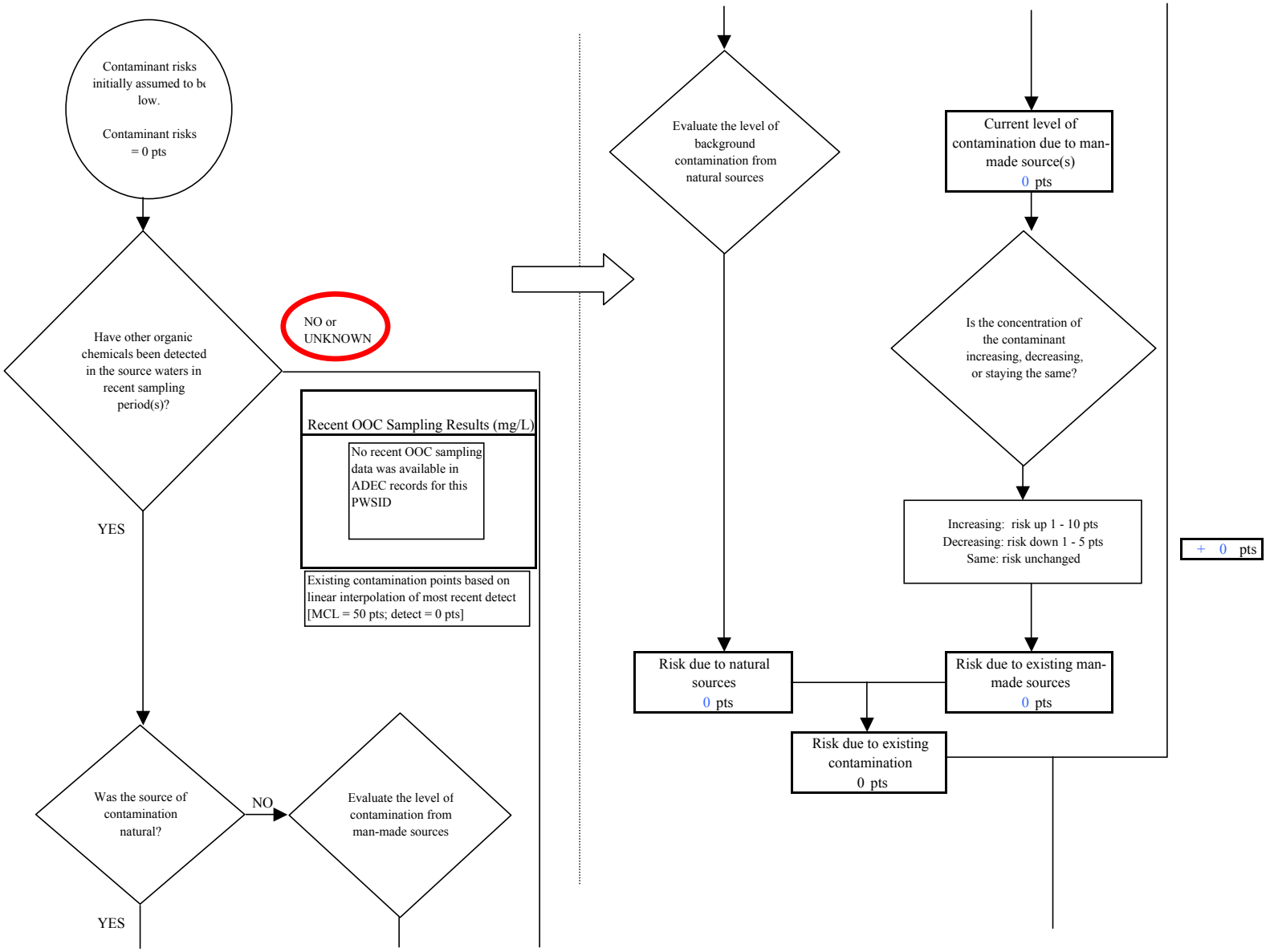
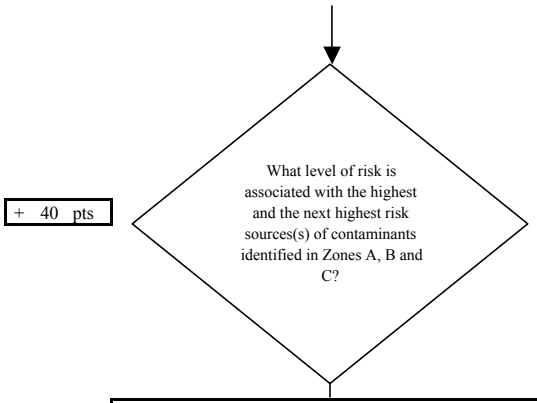


Chart 13. Contaminant risks for GSA Alcan Border Station (PWS No. 380468.001) - Other Organic Chemicals



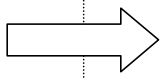
Risk Levels for Contaminant Sources identified in Zones A, B and C

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



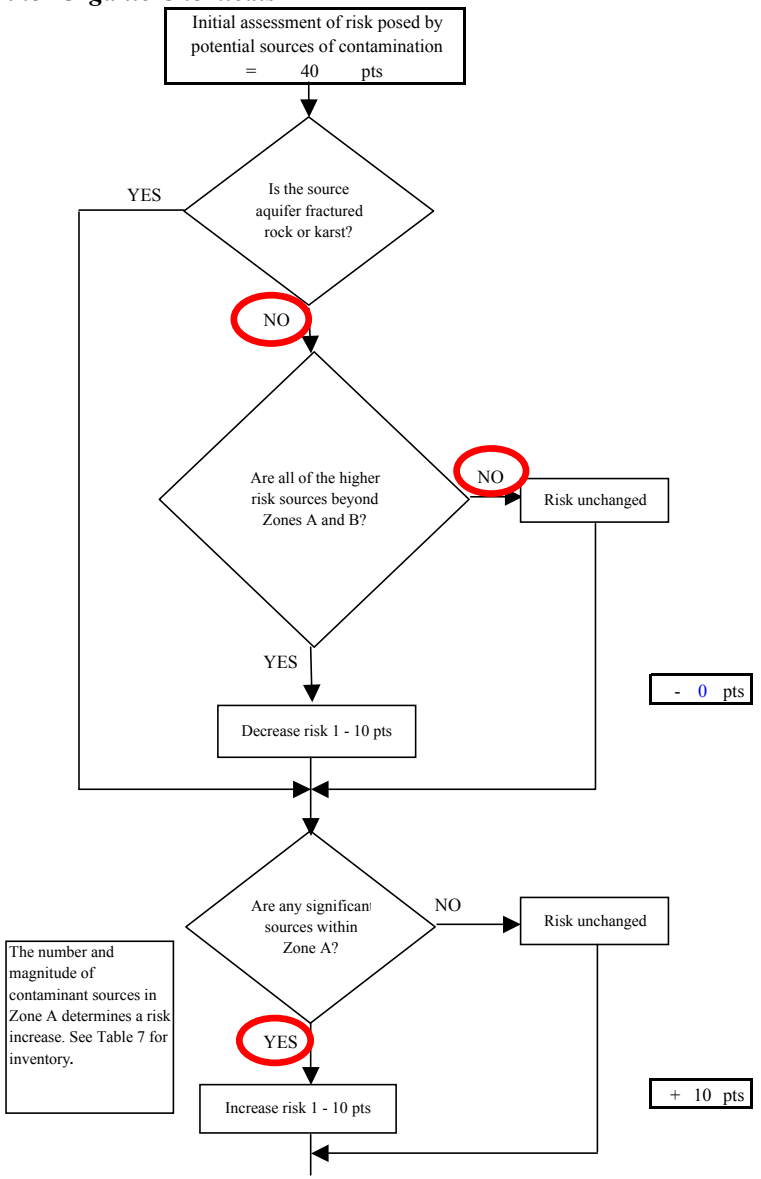


Chart 13. Contaminant risks for GSA Alcan Border Station (PWS No. 380468.001) - Other Organic Chemicals

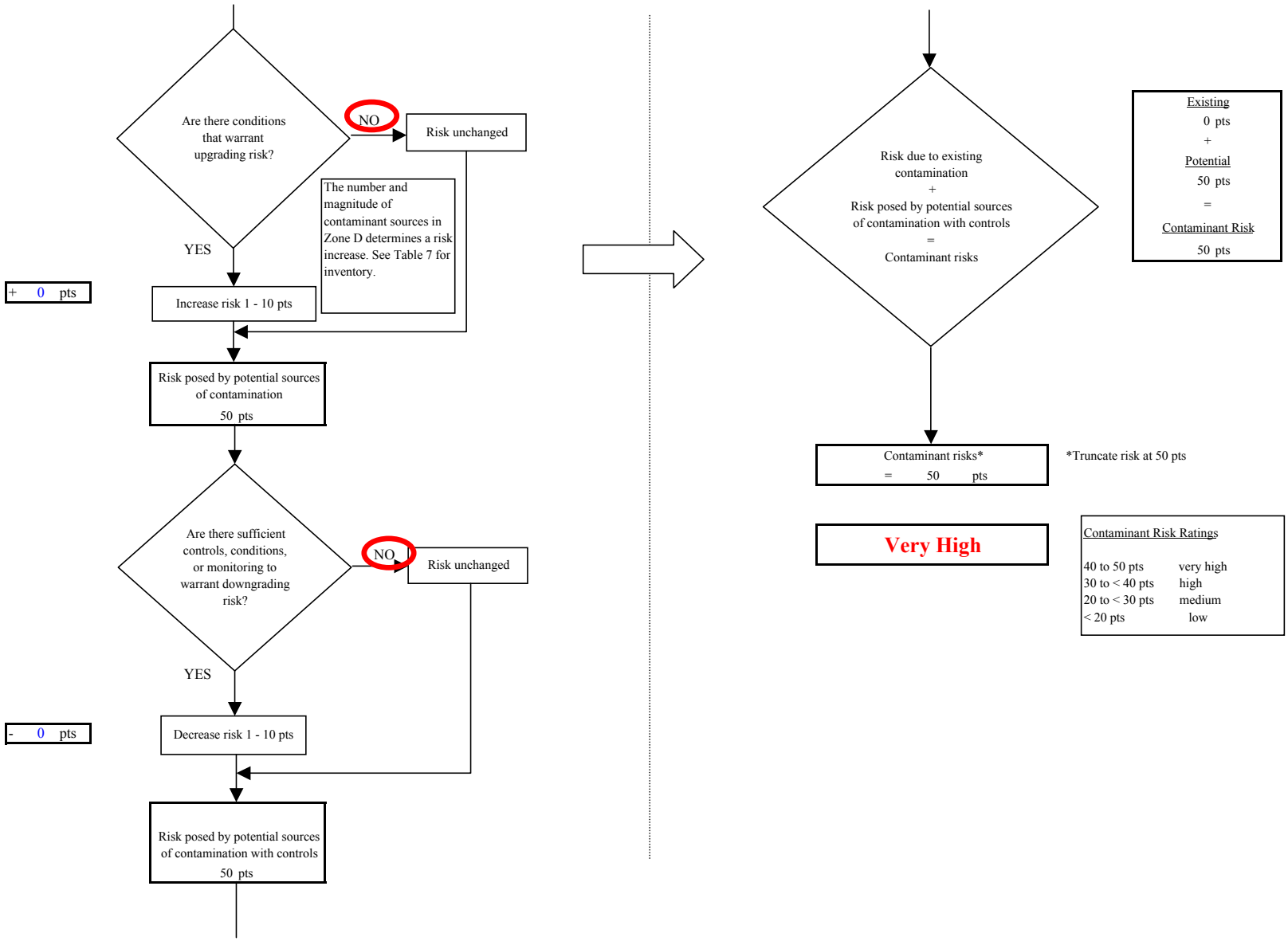


Chart 14. Vulnerability analysis for GSA Alcan Border Station (PWS No. 380468.001) - Other Organic Chemicals