Source Water Assessment

A Hydrogeologic Susceptibility and Vulnerability Assessment for Alaska General Seafoods Drinking Water System, Naknek, Alaska

PWSID # 261240.002

February 2004

DRINKING WATER PROTECTION PROGRAM REPORTS 1176
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 Alaska General Seafoods Source of Public Drinking Water, Naknek, Alaska

Drinking Water Protection Program
Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

Alaska General Seafoods has two Public Water System (PWS) wells. The well (PWSID 261240.002) has been used as a drinking water well since it was drilled in 1984. This source water assessment report is exclusively limited to PWSID #261240.002.

The well is a Class B (transient/non-community) water system that is located at Mile 1, Alaska Peninsula Highway in Naknek, Alaska. The well is located approximately 600 yards from the Naknek River. Available records indicate that the system operates seasonally, April through July, and serves approximately 600 non-residents and one resident. The water is treated with chlorine and stored in a 15,000 tank. 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 wells.

Identified potential and current sources of contaminants for the primary public drinking water source include: motor/motor vehicle repair shops, domestic wastewater collection systems, seafood processing, aboveground fuel tanks, electric power generation, an Alaska Department of Environmental Conservation (ADEC) recognized leaking underground storage tank (LUST) site, roads, residential areas, water supply wells, paint sales/service, boat yards and marinas, a petroleum product bulk station/terminal, a medical/veterinary facility, and airports. These identified potential and existing sources of contamination are considered as sources of bacteria and viruses, nitrates and/or nitrites, and volatile organic chemicals. Overall, the water well received vulnerability rating of **Medium** for the bacteria and viruses and nitrates and nitrites categories, and a vulnerability rating of **High** for volatile organic chemicals contaminant categories.

ALASKA GENERAL SEAFOODS PUBLIC DRINKING WATER SYSTEM

The Alaska General Seafoods water well is a Class B (transient/non-community) public water system. The system consists of two wells. PWS #261240.002 is located approximately 600 yards from the Naknek River in Naknek, Alaska (Sec. 2, T17S, R47W, Seward Meridian; see Map A of Appendix A).

Naknek is the primary fishery center in Bristol Bay, located about 12 miles northwest of King Salmon and 300 miles southwest of Anchorage. The community has a population of 642 (ADCED, 2003). Average annual precipitation in Naknek is 20 inches, including approximately 45 inches of snowfall. Temperatures range from 42 to 63°F in summer and -4 to 16°F in winter.

The community of Naknek gets most of their water supply from individual wells. Most households are served by the piped sewage collection system and the remaining households have individual septic tanks. Naknek receives electrical power from the Naknek Electric Association. Power generating facilities are fueled by diesel. Refuse is collected by the Patterson Sanitation Company and trucked to the landfill located five miles outside of the community (ADCED, 2003).

According to information supplied by ADEC, the depth of the water well is 238 feet below the ground surface. Based on available construction details, the well is screened in sand and gravel in a confined aquifer. The well is assumed to not be located in a floodplain.

Based on information acquired from an October 1998 sanitary survey for the adjacent public water system (PWSID #261240.001), it is assumed that the land surface was sloped away from the well and that the well is grouted according to ADEC standards. Generally, land surfaces that slope away from the wellhead promote surface water drainage, which reduces potential of contaminant migration down the well casing annulus. Proper grouting provides added protection against contaminants traveling along the well casing annulus and into source waters.

Naknek is located in an area that has been mapped as being underlain by isolated masses of permafrost; predominantly fine-grained deposits. Permafrost is

usually found either at a considerable depth as relict permafrost or near the surface as thin lenses of small extent where ground insulation is high or low. The terrain in this area consists of low hills with many shallow lakes. The lakes resulted from the delayed melting of buried ice blocks (ADOT&PF, 1982).

ALASKA GENERAL SEAFOODS 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 Alaska General Seafoods 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 B 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 Alaska General Seafoods 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 Alaska General Seafoods 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 B public water system assessments, three categories of drinking water contaminants were inventoried. They include:

- Bacteria and viruses,
- Nitrates and/or nitrites,
- Volatile 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, and volatile organic chemicals.

VULNERABILITY OF THE ALASKA GENERAL SEAFOODS 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 eight 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. Lastly, Chart 4 contains the 'Vulnerability Analysis for Bacteria and Viruses'. Charts 5 through 8 contain the Contaminant Risks and Vulnerability Analyses for nitrates and nitrites and volatile 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 Alaska General Seafoods 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 both wells in this PWS.

Table 2. Susceptibility

	Score	Rating
Susceptibility of the Wellhead	0	Low
Susceptibility of the Aquifer	22	Very High
Natural Susceptibility	22	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	30	High
Nitrates and/or Nitrites	26	Medium
Volatile 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 three categories of drinking water contaminants. Note: scores are rounded off to the nearest five.

Table 4. Overall Vulnerability

Category	Score	Rating
Bacteria and Viruses	50	Medium
Nitrates and Nitrites	50	Medium
Volatile Organic Chemicals	70	High

Bacteria and Viruses

The contaminant risk for bacteria and viruses is **High**. The risk is primarily attributed to the presence of a domestic wastewater collection system, seafood processing, and medical/veterinary facilities in Zones A and B (See Chart 3 – Contaminant Risks for Bacteria and Viruses in Appendix D).

No positive bacteria counts were reported in recent (previous five years) sampling events. 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 **Medium**.

Nitrates and Nitrites

The contaminant risk for nitrates and nitrites is **Medium**. The risk to this source of public drinking water is primarily attributed to domestic wastewater collection systems Zone A (See Chart 5 - Contaminant Risks for Nitrates and/or Nitrites in Appendix D).

Nitrates are very mobile, moving at approximately the same rate as water. The sampling history for this well indicates that low levels of nitrates have been detected in the water. However, the reported concentrations of nitrates do not exceed the maximum contaminant level (MCL) of 10 mg/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.

Nitrate levels are often derived from the decomposition of organic matter in soils. Although the nitrate source is unknown, such occurrences may be attributed to septic systems or other sources. 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 **Medium**.

Volatile Organic Chemicals

The contaminant risk for volatile organic chemicals is **Very High**. The risk is primarily attributed to the presence of an ADEC recognized LUST site, a petroleum product bulk station/terminal, and an airport in Zones A and B (see Table 4 – Appendix B).

No recent sampling data was available in ADEC records for Alaska General Seafoods (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**.

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 Alaska General Seafoods and the community of Naknek 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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Alaska Department of Transportation and Public Facilities (ADOT&PF), 1982, Engineering Geology and Soils Report, North Naknek Materials Investigation.

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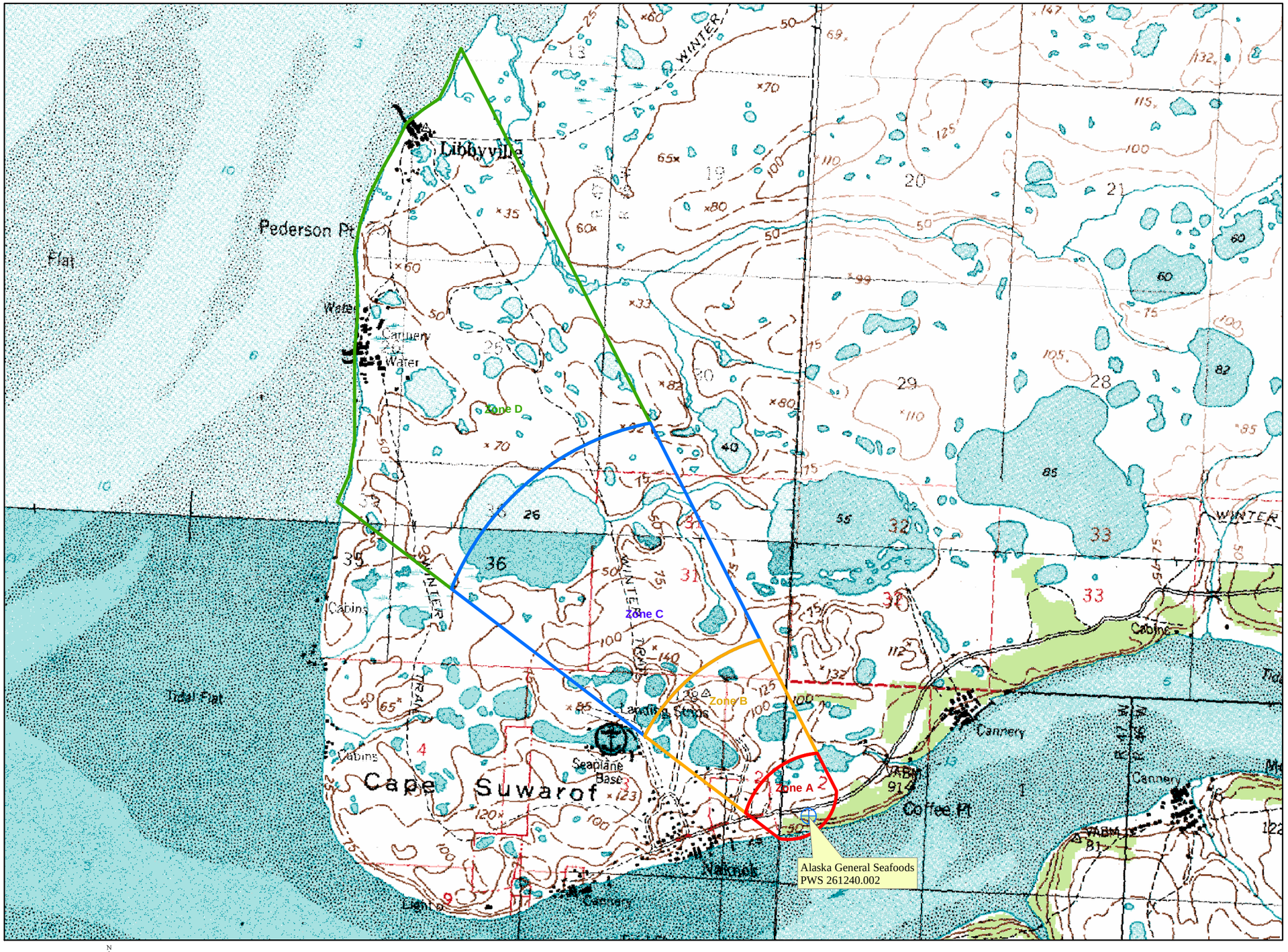
APPENDIX A

Drinking Water Protection Area Location Map
(Map A)

Public Water Well System for PWS #261240.002 Alaska General Seafoods



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)
- Road Ferry Crossing

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 or Watershed Boundary

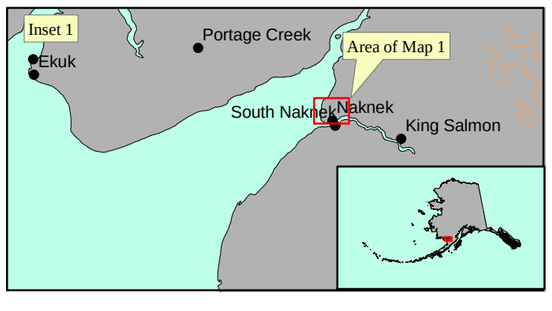
Data Sources:
Contaminant Sources, Public Water System Wells, Contours
Alaska Department of Environmental Conservation (ADEC)

Critical Facilities, Federal Emergency Management Agency (FEMA)

All other data:
United States Geological Survey (USGS)

Drinking Water Protection Areas based on "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.



N W E S

0 0.25 0.5 1 1.5 2 Miles

Alaska General Seafoods
PWS 261240.002

Appendix A Map A

APPENDIX B

Contaminant Source Inventory and Risk Ranking (Tables 1-4)

Table 1

Contaminant Source Inventory for ***Alaska General Seafoods***

PWSID 261240.002

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Map Number*	*Comments*
Motor /motor vehicle repair shops	C31	C31-01	A	C	PENINSULA AUTOMOTIVE
Motor /motor vehicle repair shops	C31	C31-02	A	C	ADOT & PF Maintenance Station
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D01-01	A	C	
Seafood processing	N10	N10-01	A	C	
Tanks, diesel (above ground)	T06	T06-04	A	C	Assumed that one above ground diesel tank is located in Zone A for facility support services
Tanks, gasoline (above ground)	T10	T10-02	A	C	Assumed that one above ground gasoline tank is located in Zone A for facility support services
Tanks, heating oil, nonresidential (aboveground)	T14	T14-01	A	C	Church
Tanks, heating oil, nonresidential (aboveground)	T14	T14-06	A	C	Assumed that one above ground heating oil tank is located in Zone A for facility support services
Open Leaking Underground Fuel Storage Tank (LUST) Sites	U07	U07-01	A	C	PENINSULA AUTOMOTIVE, RecKey #1996250031101, Event ID 882, Facility ID 2649, petroleum contaminated soil was identified during UST closure site assessment.
Water supply wells	W09	W09-01	A	C	4 water supply wells in Zone A
Highways and roads, dirt/gravel	X24	X24-01	A	C	Assumed that 1 to 20 roads are present in Zone A
Electric power generation (fossil fuels)	X36	X36-01	A	C	
Residential Areas	R01	R01-01	B	C	Assumed that 50 or less acres of residential area is located in Zone B
Tanks, heating oil, residential (above ground)	R08	R08-01	B	C	Assumed that 10 or less above ground residential heating oil tanks are located in Zone B
Tanks, heating oil, nonresidential (aboveground)	T14	T14-02	B	C	Naknek Electric Association
Tanks, heating oil, nonresidential (aboveground)	T14	T14-03	B	C	Bristol Bay Borough Health Clinic
Tanks, heating oil, nonresidential (aboveground)	T14	T14-04	B	C	Police Station
Tanks, heating oil, nonresidential (aboveground)	T14	T14-05	B	C	BRISTOL BAY CONS. HIGH SCHOOL
Water supply wells	W09	W09-02	B	C	1 water supply well in Zone B
Petroleum product bulk station/terminals	X11	X11-01	B	C	Naknek Electric Assn Fuel Storage

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Map Number*	*Comments*
Airports	X14	X14-01	B	C	Tibbetts
Highways and roads, dirt/gravel	X24	X24-02	B	C	Assumed that 1 to 20 roads are present in Zone B
Electric power generation (fossil fuels)	X36	X36-02	B	C	NAKNEK ELECTRIC ASSOCIATION
Medical/veterinary facilities (doctor or dentist offices, hospitals, nursing homes)	X40	X40-01	B	C	Bristol Bay Borough Health Clinic
Highways and roads, dirt/gravel	X24	X24-03	C	C	Assumed that 1 to 20 roads are present in Zone C
Paint sales /service	C32	C32-01	D	C	
Seafood processing	N10	N10-02	D	C	
Tanks, diesel (above ground)	T06	T06-01	D	C	
Tanks, diesel (above ground)	T06	T06-02	D	C	
Tanks, diesel (above ground)	T06	T06-03	D	C	
Tanks, gasoline (above ground)	T10	T10-01	D	C	
Water supply wells	W09	W09-03	D	C	2 water supply wells in Zone D
Boat yards and marinas	X15	X15-01	D	C	
Electric power generation (fossil fuels)	X36	X36-03	D	C	

Table 2

Contaminant Source Inventory and Risk Ranking for Alaska General Seafoods Sources of Bacteria and Viruses

PWSID 261240.002

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	
Seafood processing	N10	N10-01	A	Medium	C	
Highways and roads, dirt/gravel	X24	X24-01	A	Low	C	Assumed that 1 to 20 roads are present in Zone A
Residential Areas	R01	R01-01	B	Low	C	Assumed that 50 or less acres of residential area is located in Zone B
Highways and roads, dirt/gravel	X24	X24-02	B	Low	C	Assumed that 1 to 20 roads are present in Zone B
Medical/veterinary facilities (doctor or dentist offices, hospitals, nursing homes)	X40	X40-01	B	Medium	C	Bristol Bay Borough Health Clinic
Highways and roads, dirt/gravel	X24	X24-03	C	Low	C	Assumed that 1 to 20 roads are present in Zone C
Seafood processing	N10	N10-02	D	Medium	C	

Table 3

Contaminant Source Inventory and Risk Ranking for Alaska General Seafoods Sources of Nitrates/Nitrites

PWSID 261240.002

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	
Seafood processing	N10	N10-01	A	Low	C	
Highways and roads, dirt/gravel	X24	X24-01	A	Low	C	Assumed that 1 to 20 roads are present in Zone A
Residential Areas	R01	R01-01	B	Low	C	Assumed that 50 or less acres of residential area is located in Zone B
Airports	X14	X14-01	B	Low	C	Tibbetts
Highways and roads, dirt/gravel	X24	X24-02	B	Low	C	Assumed that 1 to 20 roads are present in Zone B
Medical/veterinary facilities (doctor or dentist offices, hospitals, nursing homes)	X40	X40-01	B	Low	C	Bristol Bay Borough Health Clinic
Highways and roads, dirt/gravel	X24	X24-03	C	Low	C	Assumed that 1 to 20 roads are present in Zone C
Seafood processing	N10	N10-02	D	Low	C	

Table 4

Contaminant Source Inventory and Risk Ranking for Alaska General Seafoods
Sources of Volatile Organic Chemicals

PWSID 261240.002

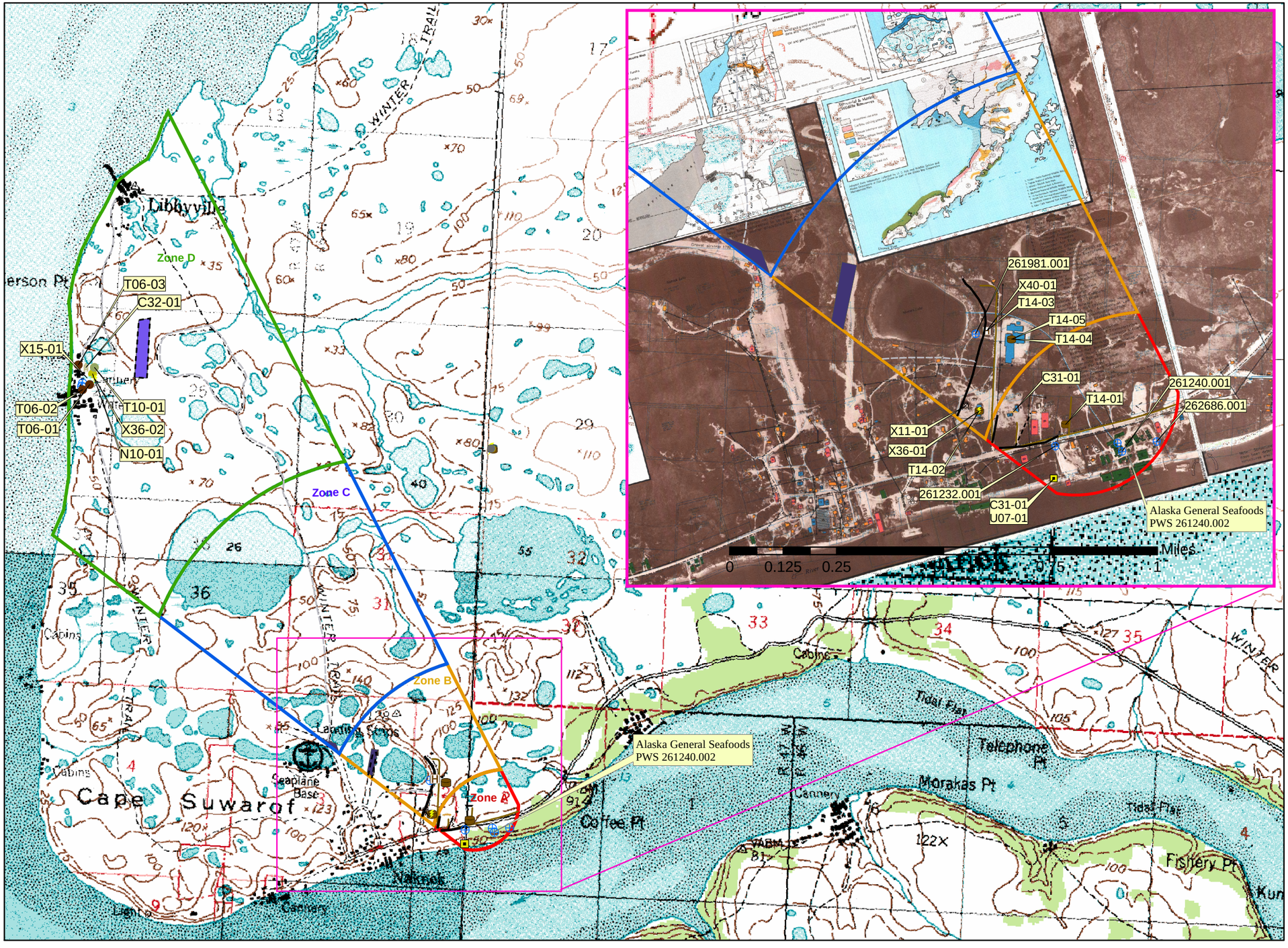
Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Motor /motor vehicle repair shops	C31	C31-01	A	Medium	C	PENINSULA AUTOMOTIVE
Motor /motor vehicle repair shops	C31	C31-02	A	Medium	C	ADOT & PF Maintenance Station
Domestic wastewater collection systems (sewer line or lift stations)	D01	D01-01	A	Low	C	
Tanks, diesel (above ground)	T06	T06-04	A	Medium	C	Assumed that one above ground diesel tank is located in Zone A for facility support services
Tanks, gasoline (above ground)	T10	T10-02	A	Medium	C	Assumed that one above ground gasoline tank is located in Zone A for facil support services
Tanks, heating oil, nonresidential (aboveground)	T14	T14-01	A	Low	C	Church
Tanks, heating oil, nonresidential (aboveground)	T14	T14-06	A	Low	C	Assumed that one above ground heating oil tank is located in Zone A for facility support services
Open Leaking Underground Fuel Storage Tank (LUST) Sites	U07	U07-01	A	High	C	PENINSULA AUTOMOTIVE, RecKey #1996250031101, Event ID 882, Facility ID 2649, petroleum contaminated soil was identified during UST closure site assessment.
Highways and roads, dirt/gravel	X24	X24-01	A	Low	C	Assumed that 1 to 20 roads are present in Zone A
Electric power generation (fossil fuels)	X36	X36-01	A	Medium	C	
Residential Areas	R01	R01-01	B	Low	C	Assumed that 50 or less acres of residential area is located in Zone B
Tanks, heating oil, residential (above ground)	R08	R08-01	B	Medium	C	Assumed that 10 or less above ground residential heating oil tanks are locat in Zone B
Tanks, heating oil, nonresidential (aboveground)	T14	T14-02	B	Low	C	Naknek Electric Association
Tanks, heating oil, nonresidential (aboveground)	T14	T14-03	B	Low	C	Bristol Bay Borough Health Clinic
Tanks, heating oil, nonresidential (aboveground)	T14	T14-04	B	Low	C	Police Station
Tanks, heating oil, nonresidential (aboveground)	T14	T14-05	B	Low	C	BRISTOL BAY CONS. HIGH SCHOOL
Petroleum product bulk station/terminals	X11	X11-01	B	Very High	C	Naknek Electric Assn Fuel Storage
Airports	X14	X14-01	B	High	C	Tibbetts
Highways and roads, dirt/gravel	X24	X24-02	B	Low	C	Assumed that 1 to 20 roads are present in Zone B
Electric power generation (fossil fuels)	X36	X36-02	B	Medium	C	NAKNEK ELECTRIC ASSOCIATION

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Medical/veterinary facilities (doctor or dentist offices, hospitals, nursing homes)	X40	X40-01	B	Low	C	Bristol Bay Borough Health Clinic
Highways and roads, dirt/gravel	X24	X24-03	C	Low	C	Assumed that 1 to 20 roads are present in Zone C
Paint sales /service	C32	C32-01	D	Medium	C	
Tanks, diesel (above ground)	T06	T06-01	D	Medium	C	
Tanks, diesel (above ground)	T06	T06-02	D	Medium	C	
Tanks, diesel (above ground)	T06	T06-03	D	Medium	C	
Tanks, gasoline (above ground)	T10	T10-01	D	Medium	C	
Boat yards and marinas	X15	X15-01	D	Low	C	
Electric power generation (fossil fuels)	X36	X36-03	D	Medium	C	

APPENDIX C

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

Public Water Well System for PWS #261240.002 Alaska General Seafoods
Showing Potential and Existng 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

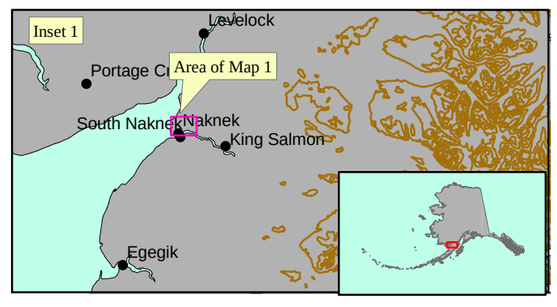
Existing or Potential Contaminant Sources

- Motor/Motor Vehicle Repair Shops (C31)
- Paint shop or service (C32)
- Domestic Watewater Treatment Plant Disposal Ponds/Lagoons (D02)
- Seafood Processing (N10)
- Tanks, Diesel (Above Ground) (T06)
- Tanks, Gasoline (Above Ground) (T10)
- Tanks, Heating Oil, non-Residential (above ground) (T14)
- Open Leaking Underground Fuel Storage Tank (LUST) (U07)
- Petroleum Product Bulk Station (X11)
- Electric Power Generation (fossil fuels) (X36)
- Medical/Veterinary Facilities (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 B Public Water Systems" published by ADEC
URS Corporation does not guarantee the accuracy or validity of the data provided.



Alaska General Seafoods
PWS 261240.002

Appendix C Map 2

APPENDIX D

Vulnerability Analysis for Public Drinking Water Source (Charts 1-7)

Chart 1. Susceptibility of the wellhead - Alaska General Seafoods (PWS No. 261240.002)

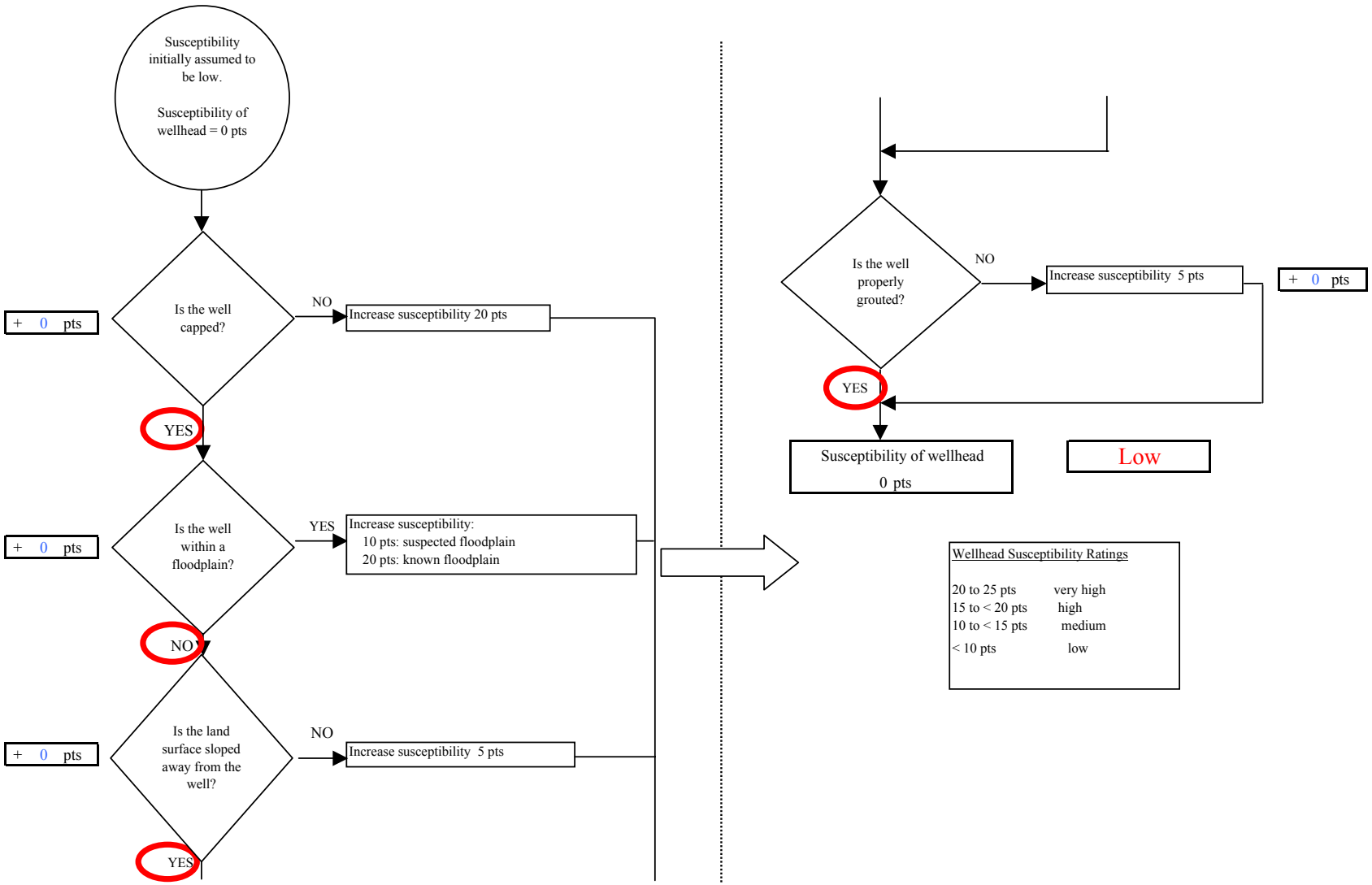


Chart 2. Susceptibility of the aquifer Alaska General Seafoods (PWS No. 261240.002)

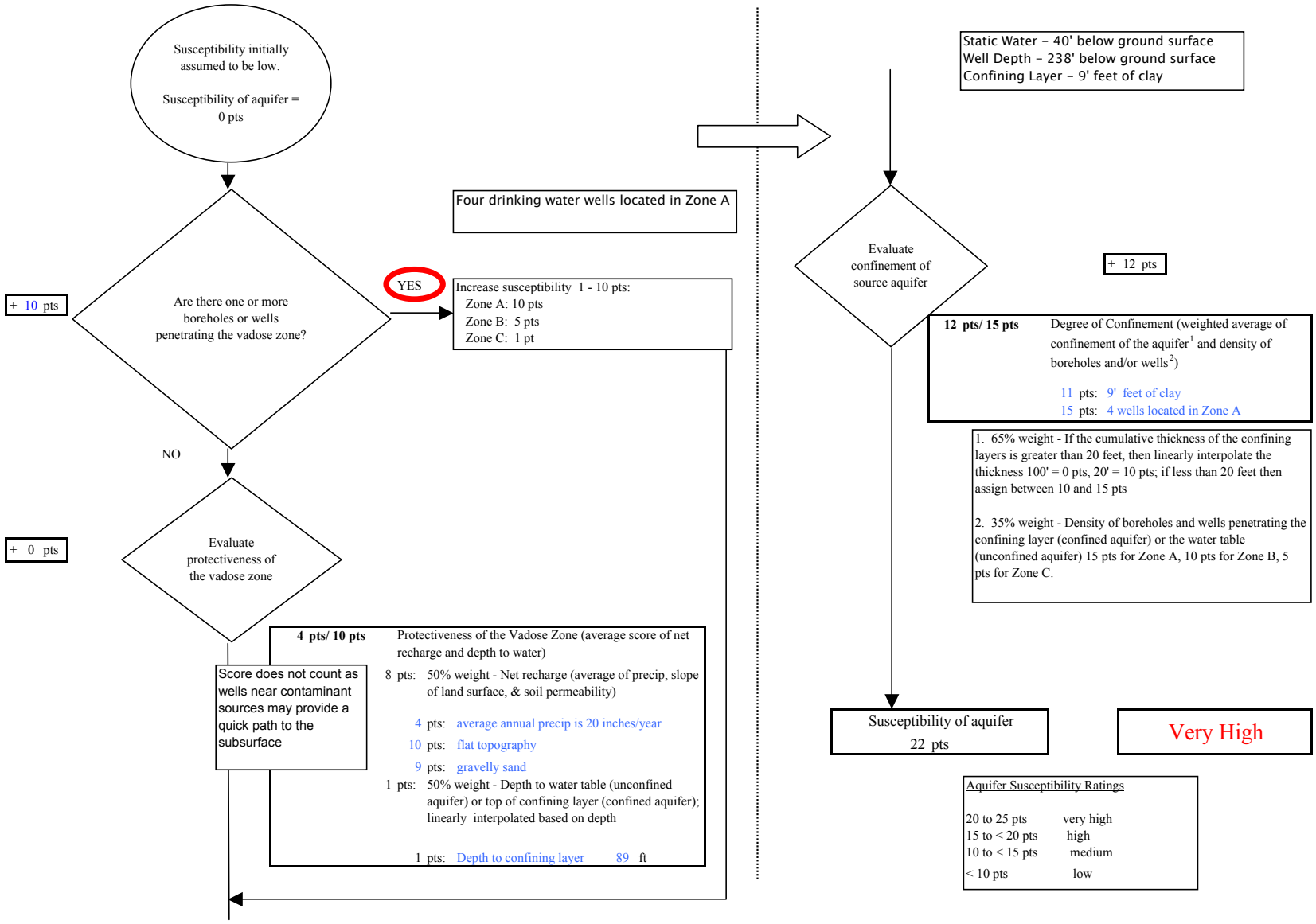
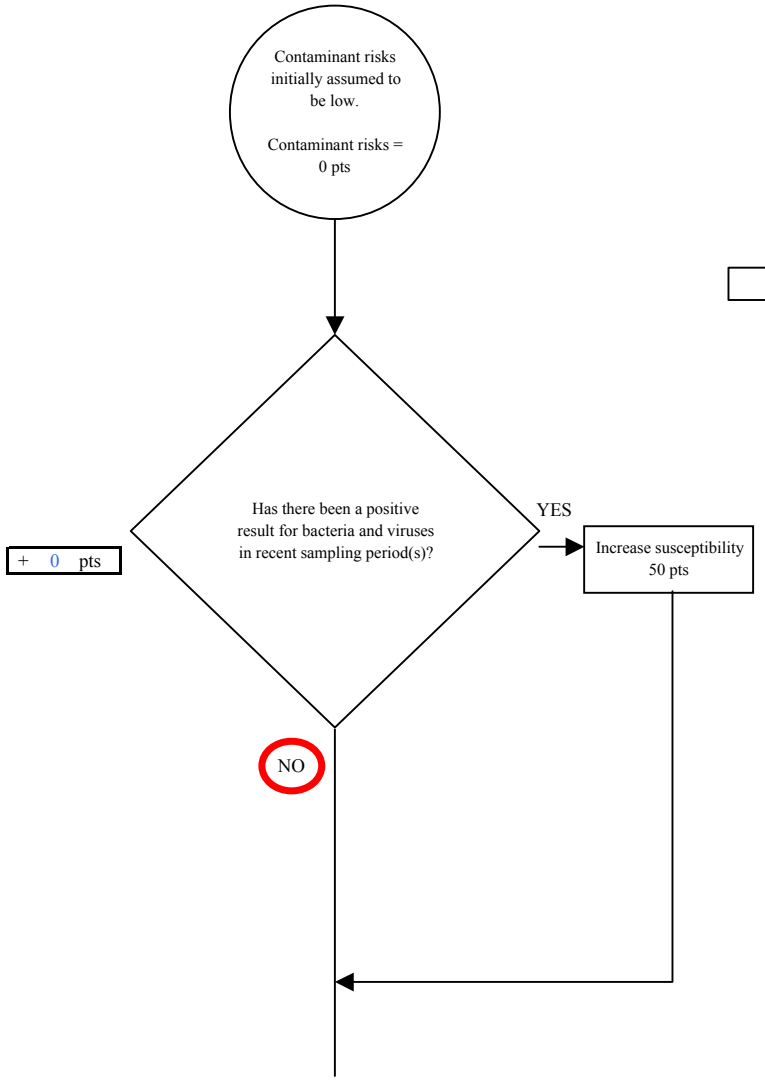
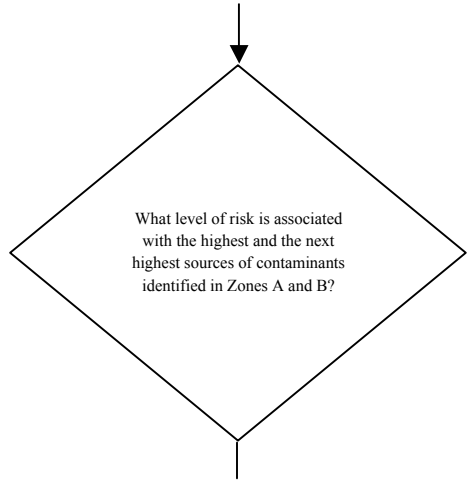


Chart 3. Contaminant risks for Alaska General Seafoods (PWS No. 261240.002) - Bacteria & Viruses





+ 25 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)	0	0	0
Medium(s)	2	1	3
Low(s)	1	2	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 25

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 Alaska General Seafoods (PWS No. 261240.002) - Bacteria & Viruses

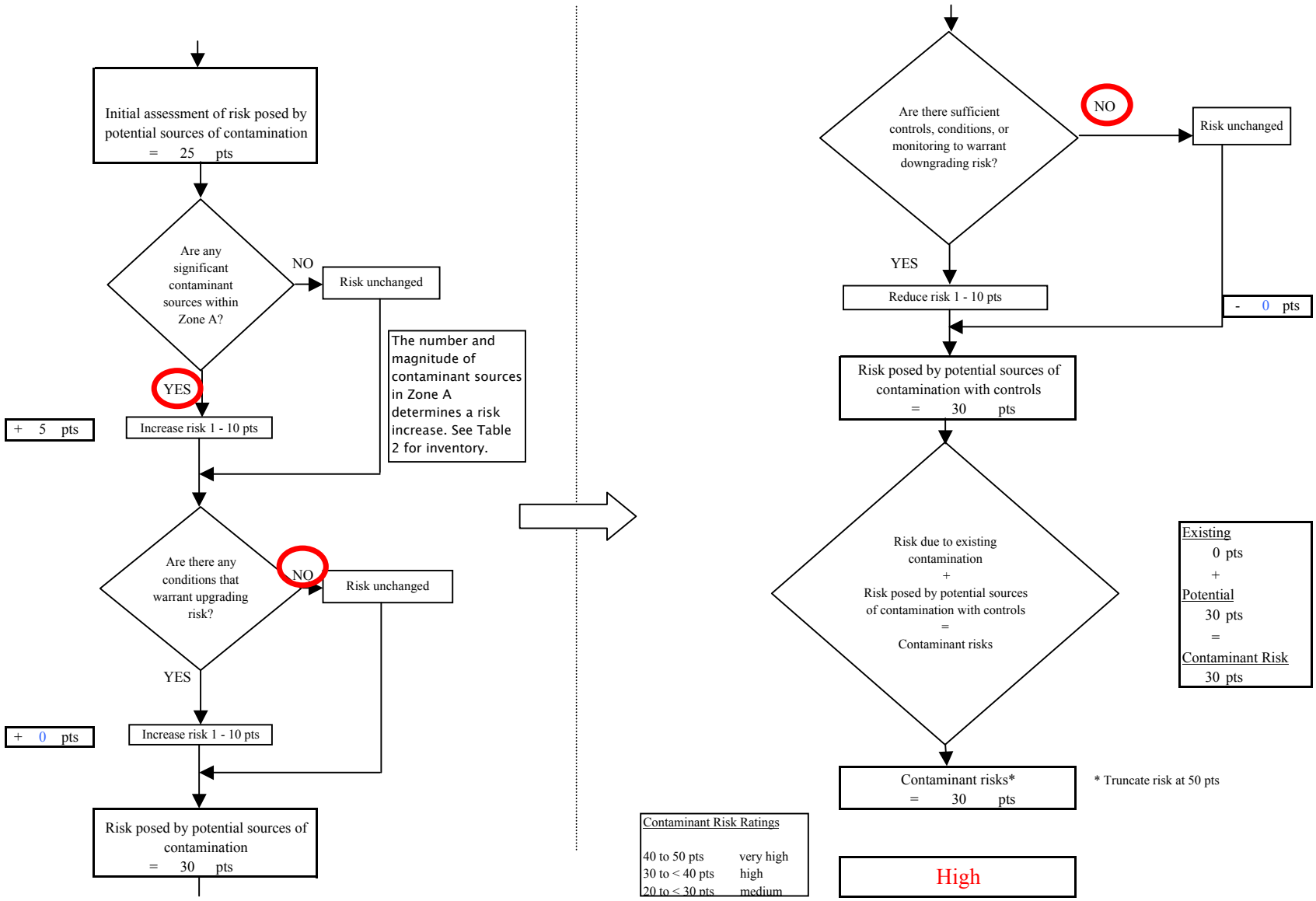


Chart 4. Vulnerability analysis for Alaska General Seafoods (PWS No. 261240.002) - Bacteria & Viruses

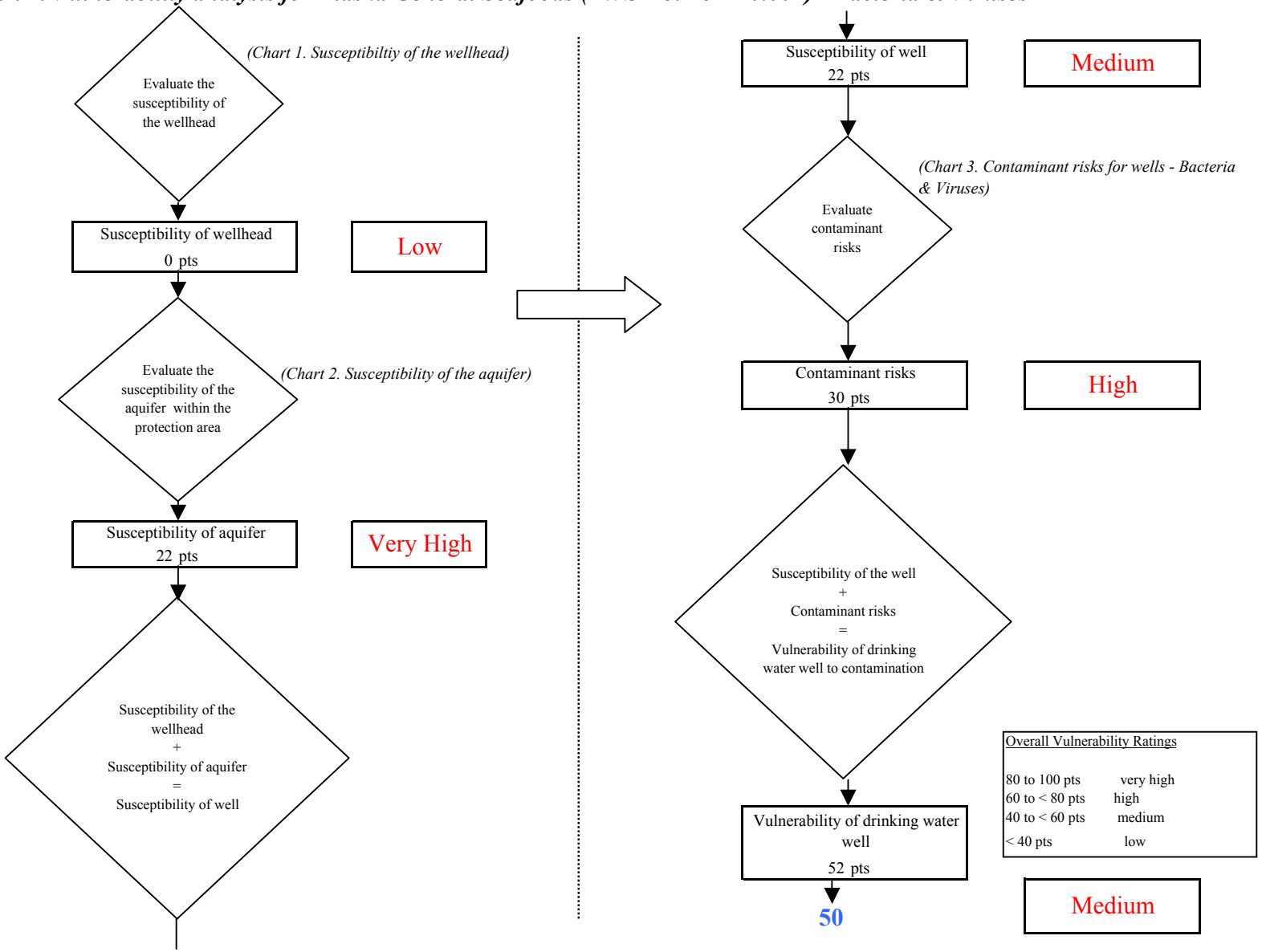


Chart 5. Contaminant risks for Alaska General Seafoods (PWS No. 261240.002) - Nitrates and Nitrites

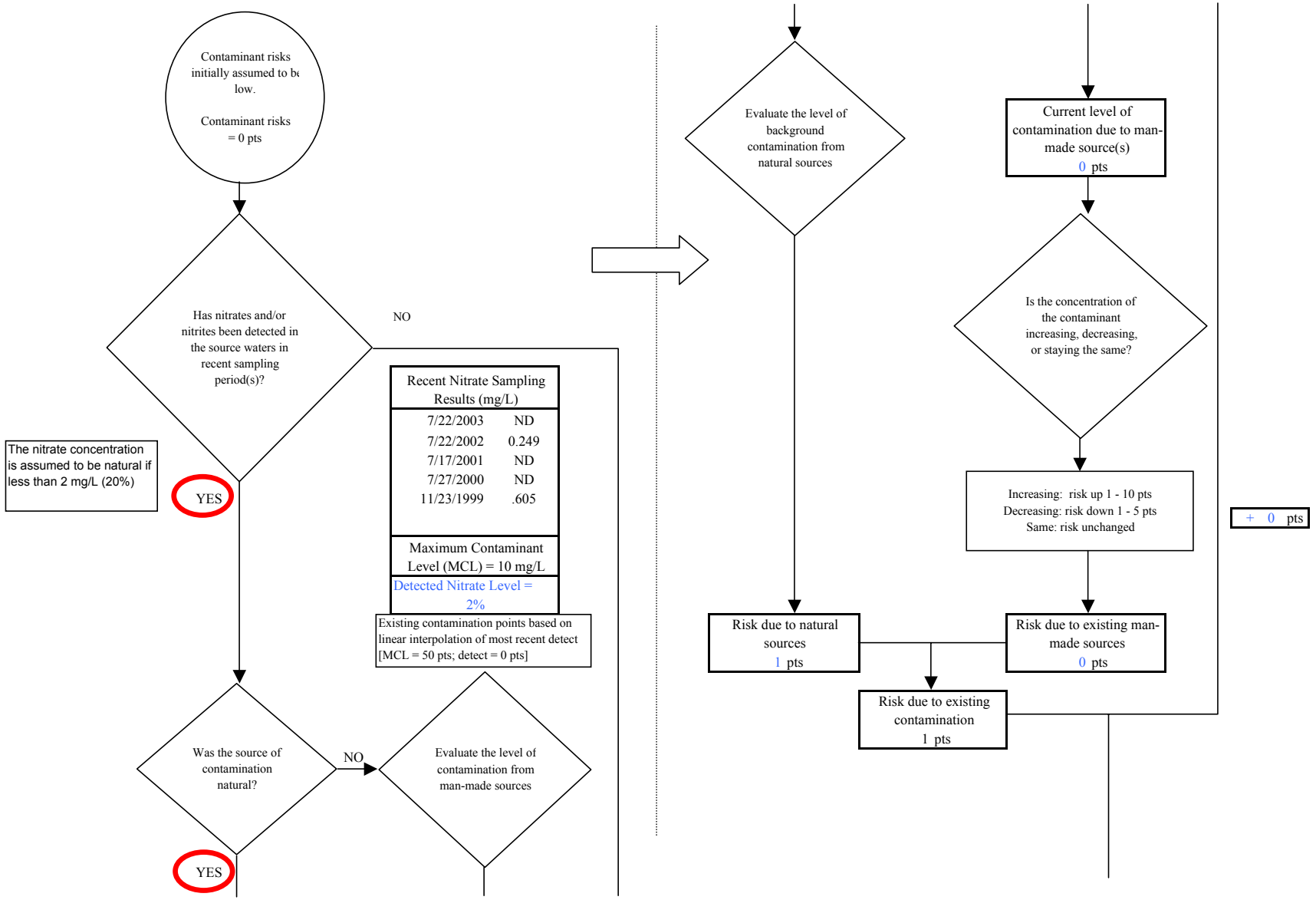
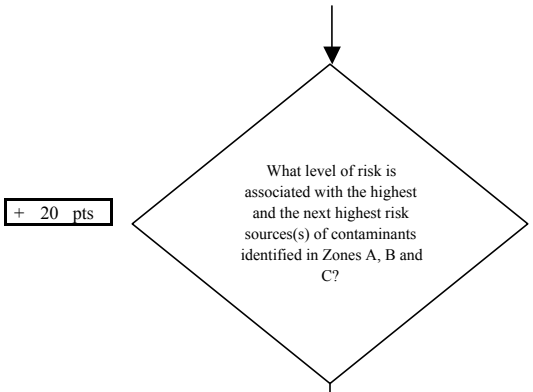


Chart 5. Contaminant risks for Alaska General Seafoods (PWS No. 261240.002) - Nitrates and Nitrites



+ 20 pts

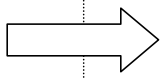
Risk Levels for Contaminant Sources identified in Zones A, B and C

	Zone A	Zones B&C	Total
Very Highs(s)	0	0	0
High(s)	0	0	0
Medium(s)	1	0	1
Low(s)	2	4	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 20

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.



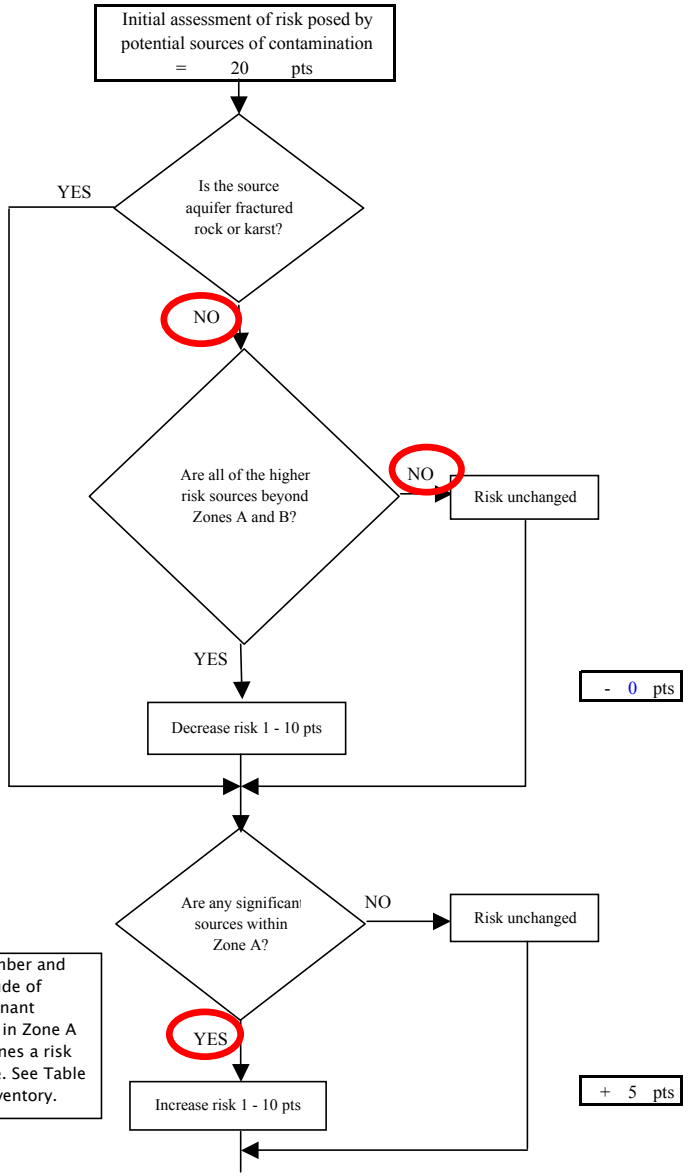


Chart 5. Contaminant risks for Alaska General Seafoods (PWS No. 261240.002) - Nitrates and Nitrites

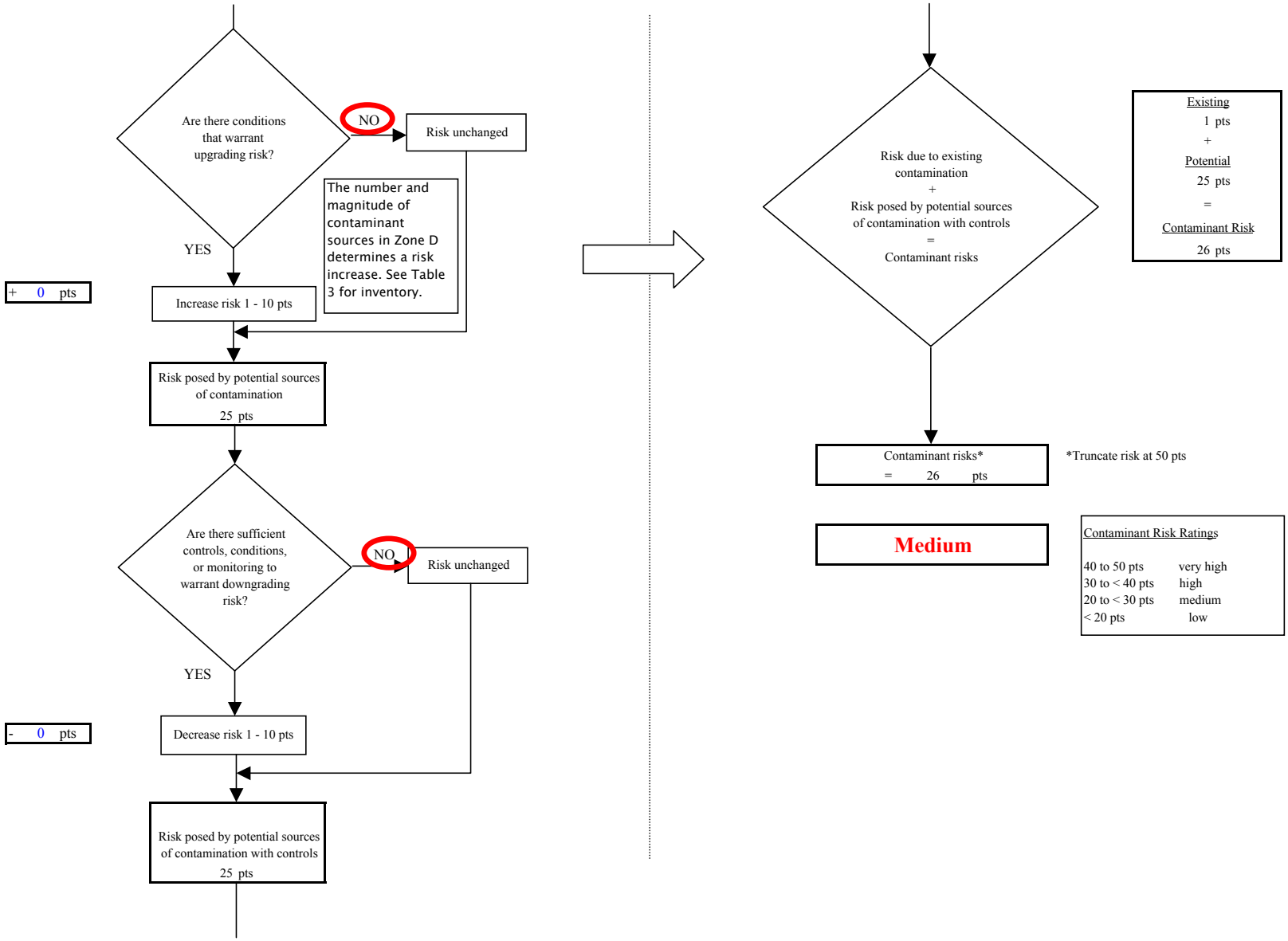


Chart 6. Vulnerability analysis for Alaska General Seafoods (PWS No. 261240.002) - Nitrates and Nitrites

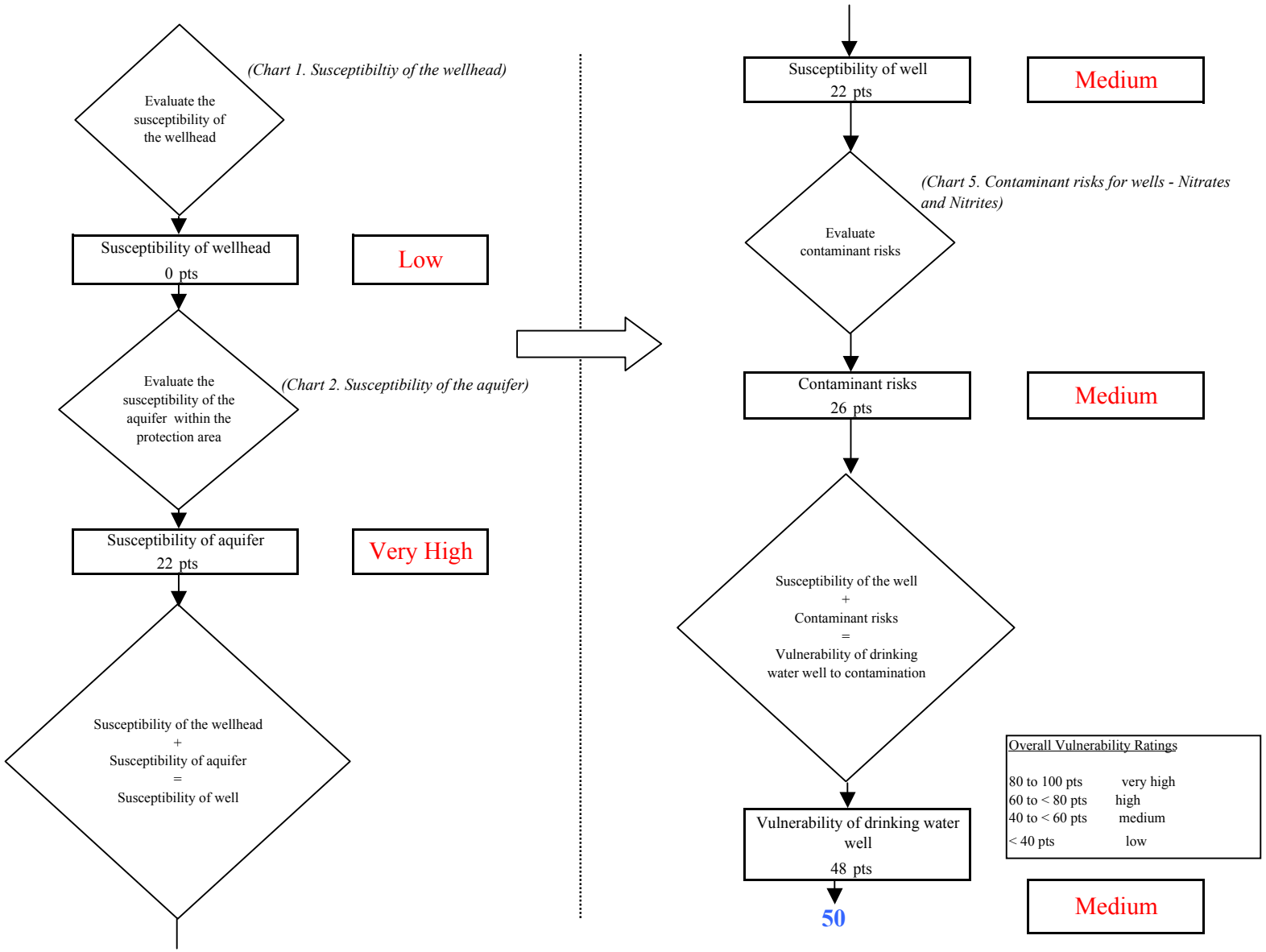


Chart 7. Contaminant risks for Alaska General Seafoods (PWS No. 261240.002) - Volatile Organic Chemicals

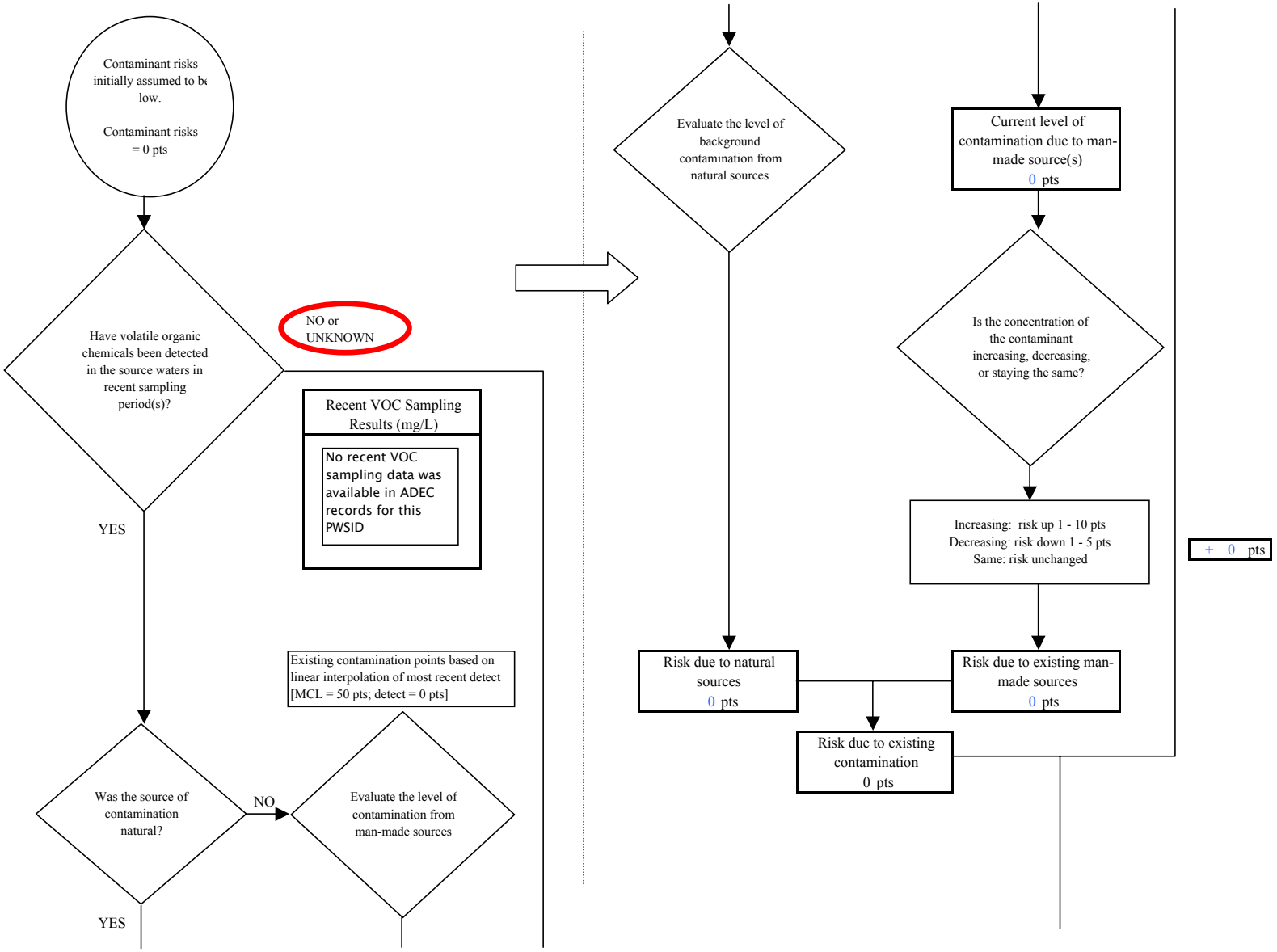
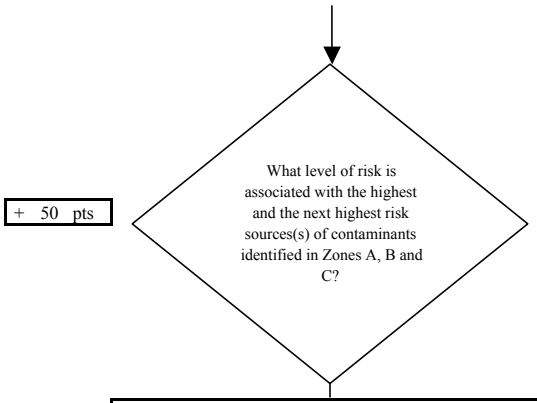


Chart 7. Contaminant risks for Alaska General Seafoods (PWS No. 261240.002) - Volatile Organic Chemicals



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

	Zone A	Zones B&C	Total
Very Highs(s)	0	1	1
High(s)	1	1	2
Medium(s)	5	12	17
Low(s)	4	7	11

	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.

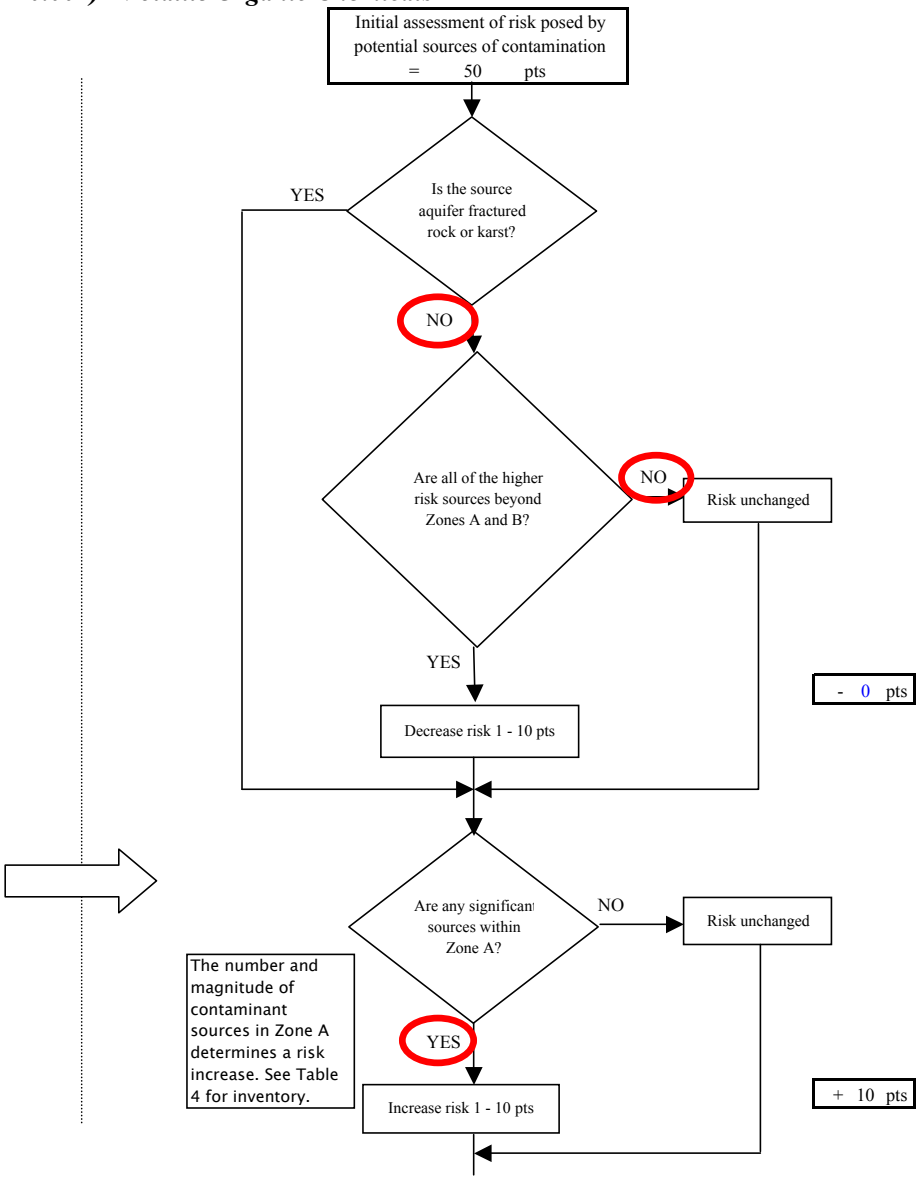


Chart 7. Contaminant risks for Alaska General Seafoods (PWS No. 261240.002) - Volatile Organic Chemicals

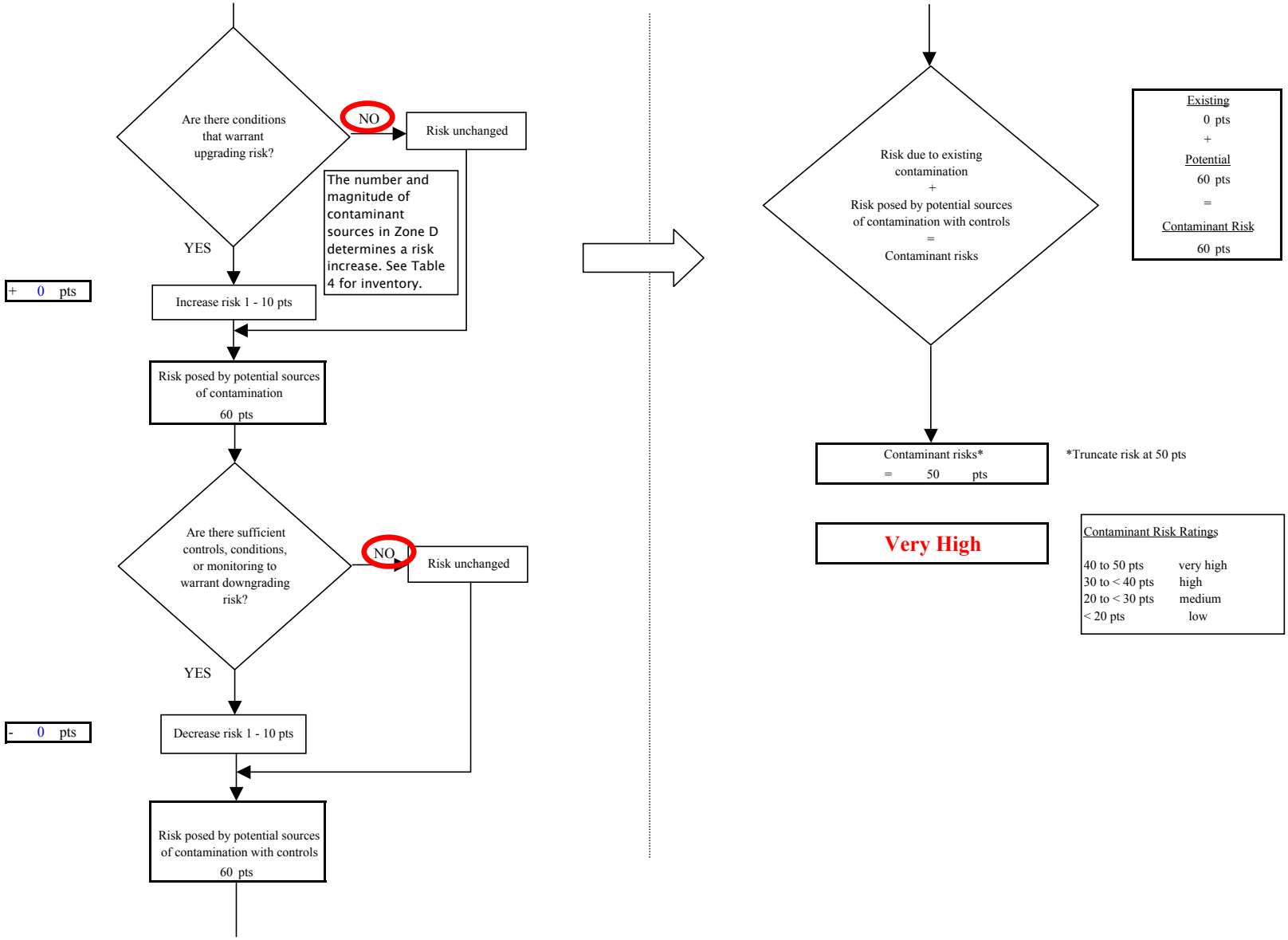


Chart 8. Vulnerability analysis for Alaska General Seafoods (PWS No. 261240.002) - Volatile Organic Chemicals