Source Water Assessment

A Hydrogeologic Susceptibility and Vulnerability Assessment for The Kiana Drinking Water System, Kiana, Alaska

PWSID # 340230.001

June 2004

DRINKING WATER PROTECTION PROGRAM REPORT 1329
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 the Kiana Source of Public Drinking Water, Kiana, Alaska

Drinking Water Protection Program
Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

The community of Kiana has two Public Water System (PWS) wells. This source water assessment is exclusively limited to the primary well (PWS No 340230.001). The well has been used as a drinking water source since it was drilled in December of 1972.

The well is a Class A (community and non-transient non-community) water system located on the bank of the Kobuk River. Available records indicate that there is secondary storage of drinking water, with a capacity of 212,000-gallons, and that the drinking water source is treated with calcium hypochlorite. This system operates year round and serves approximately 385 residents through 85 service connections. The wellhead received a susceptibility rating of **Very High** and the aquifer received a susceptibility rating of **Very High**. Combining these two ratings produce a **Very High** rating for the natural susceptibility of the well.

Identified potential and current sources of contaminants for the public drinking water source include water treatment facilities, fuel tanks, cemeteries, ADEC recognized contaminated sites, airports, power generation facilities, and bulk fuel facilities. A detailed inventory is located on Table 1 of Appendix B. 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 **Very High** for the bacteria and viruses, nitrates and nitrites, volatile organic chemicals, heavy metals, cyanide and other inorganic chemicals, synthetic organic chemicals, and other organic chemicals.

PUBLIC DRINKING WATER SYSTEM

The Kiana well is a Class A (community/non-transient/non-community) public water system. The system located on the north bank of the Kobuk River in Kiana, Alaska (Sec. 09, T018N, R008W, Kateel River Meridian; see Map A of Appendix A). Kiana is located approximately 57 air miles east of Kotzebue. Kiana has a population of 408 (ADCED, 2003). Average annual precipitation in Kiana is 16 inches, including approximately 60 inches of snowfall. Temperatures range from the 50-60's°F in summer and –10-(+)15°F in the winter.

Piped water and sewer are provided to most of the community, and the remaining residents haul water and use honeybuckets or septic tanks (ADCED, 2003). Kiana receives electrical power from the AVEC, a REA Cooperative. Power generating facilities are fueled by diesel. Refuse is collected by individuals and transported to the UIC operated landfill (ADCED, 2003).

According to information supplied by ADEC for the Kiana PWS, the depth of the well is 98 feet below the ground surface. Well construction details indicate the well completed in a confined aquifer, is not screened and is located within a floodplain.

Information acquired from a May 1998 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 not grouted according to ADEC regulations. Proper grouting provides added protection against contaminants traveling along the well casing annulus and into source waters.

The community of Kiana is built on frozen sandy silt. Soils under older homes partially thaw each summer to depths of 4 to 7 feet. The thickness of seasonally thawed ground is much less where tundra vegetation has not been disturbed. Thawed sandy gravel is found at the base of the bluff along the Kobuk River.

Kiana lies on a gently sloping terrace about 100 feet above sea level. The terrace ends abruptly at an 80 foot high bluff which forms the northwest bank of the Kobuk River.

Soil in and around Kiana consists primarily of sandy silt. The soil contains few masses of ice.

The area in and around Kiana is made up of generally well-sorted floodplain, terrace, and alluvial fan deposits associated with streams and rivers (IHS, 1986).

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 Kiana 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 Kiana 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 Kiana 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 7 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 S YSTEM

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

Kiana's water well is completed in a confined aquifer. Confined aquifers are less susceptible to potential groundwater quality impacts posed by the migration of surface water contaminants downward from the surface. Table 2 shows the susceptibility scores and ratings for this PWS.

Table 2. Susceptibility

	Score	**Rating**
Susceptibility of the Wellhead	25	Very High
Susceptibility of the Aquifer	20	Very High
Natural Susceptibility	45	Very High

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:

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

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

Table 3. Contaminant Risks

Category	Score	Rating
Bacteria and Viruses	50	Very High
Nitrates and/or Nitrites	50	Very High
Volatile Organic Chemicals	50	Very High
Heavy Metals, Cyanide and Other Inorganic Chemicals	35	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	95	Very High
Nitrates and Nitrites	95	Very High
Volatile Organic Chemicals	95	Very High
Heavy Metals, Cyanide and Other Inorganic Chemicals	80	Very High
Synthetic Organic Chemicals	95	Very High
Other Organic Chemicals	95	Very High

Bacteria and Viruses

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

Coliforms (a bacteria) are found naturally in the environment and although they aren't necessarily a health threat, they are an indicator of other potentially harmful bacteria in the water, more specifically, fecal coliforms and E. coli, which only come from human and animal fecal waste. Harmful bacteria can cause diarrhea, cramps, nausea, headaches, or other symptoms (EPA, 2002). Positive samples increase the overall vulnerability of the drinking water source, indicating that the source is susceptible to bacteria and virus contamination.

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 **Very 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 large capacity septic systems located in Zone A and a landfill and wastewater treatment plant located in Zone B (see Table 3 – Appendix B).

Nitrates are very mobile, moving at approximately the same rate as water. The sampling history for this well indicates that low levels of nitrates have been detected in recent sampling events, however have not exceeded the 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 (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. Although the nitrate source is unknown, such occurrences may be attributed to septic systems or other sources as listed in Table 3 of Appendix B.

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 **Very High**.

Volatile Organic Chemicals

The contaminant risk for volatile organic chemicals is **Very High**. The risk is primarily attributed to the presence of bulk fuel facilities and ADEC recognized contaminated sites located in Zone A (see Table 4 – Appendix B).

Recent sampling data for VOC's indicated the presence of total trihalomethanes (TTHM's). TTHM's are generally a byproduct of water treatment and not indicative of source water conditions. Risk points were not assigned due to the TTHM's not exceeding the MCL in the most recent sampling events for Kiana (See Chart 7 – Contaminant Risks for Volatile Organic Chemicals in Appendix D).

Possible sources of VOC's 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 **Very High**.

Heavy Metals, Cyanide and Other Inorganic Chemicals

The contaminant risk for heavy metals, cyanide and other inorganic chemicals is **High**. The risk is primarily attributed to the presence of a landfill located in Zone B (see Table 5 – Appendix B).

Based on review of recent sampling records for this public water system, moderate levels of copper and lead have been detected in recent sampling events but have not exceeded their respective MCL's of 1.3 and 0.015 mg/L (see Chart 8 – Contaminant Risks for Heavy Metals, Cyanide, and Other Inorganic Chemicals in Appendix D).

The reported concentrations of copper and lead are likely attributable to the water distribution/conveyance system and are not likely indicative of source water conditions. Risk points were downgraded due to the MCL not being exceeded in recent sampling history.

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 **Very High.**

Synthetic Organic Chemicals

The contaminant risk for synthetic organic chemicals is **Very High**. The risk is primarily attributed to the presence of a landfill in Zone B (see Table 6 – Appendix B).

No recent sampling data was available in ADEC records for the Kiana (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 **Very High**.

Other Organic Chemicals

The contaminant risk for other organic chemicals is **Very High**. The risk is primarily attributed to the presence of a landfill in Zone B (see Table 7 – Appendix B).

No recent sampling data was available in ADEC records for the Kiana (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 **Very 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 Kiana 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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Freeze, R. A., and Cherry, J.A. 1979, Groundwater, Prentice-Hall, Englewood Cliffs, New Jersey

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

APPENDIX A

Drinking Water Protection Area Location Map
(Map A)

APPENDIX B

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

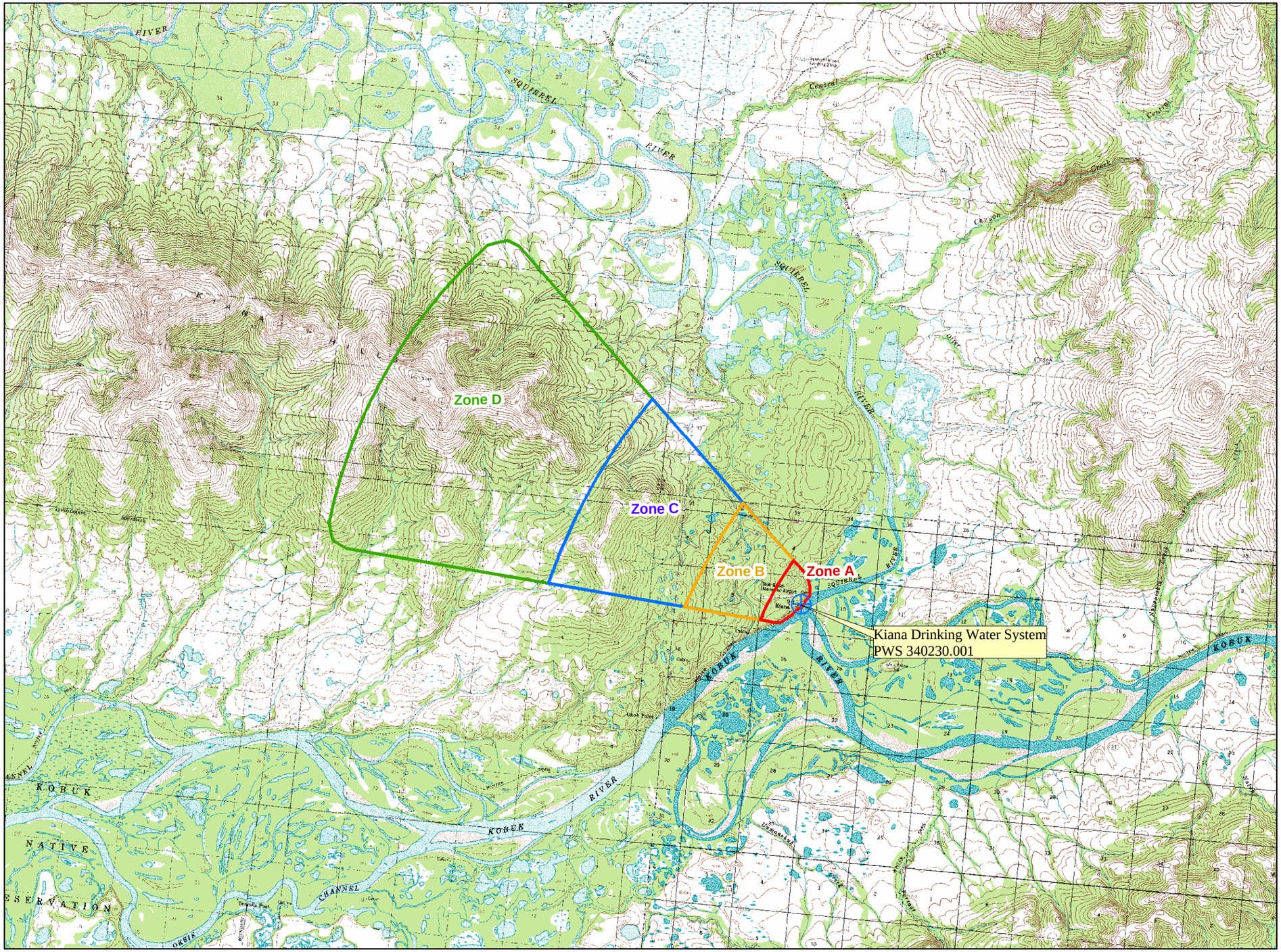
APPENDIX C

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

APPENDIX D

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

Public Water Well System for PWS #340230.001 Kiana Drinking Water System



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)

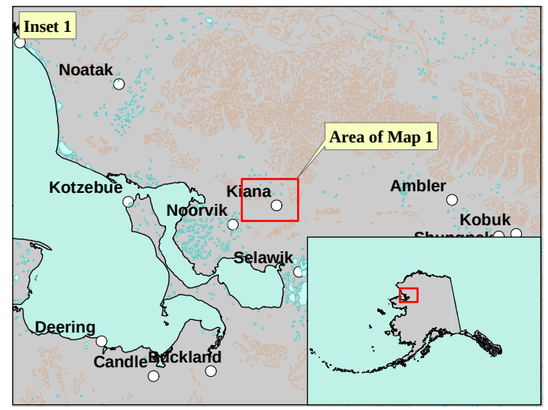
Protection Zones

- 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.



Kiana Drinking Water System
PWS 340230.001
Appendix A Map A

Table 1

Contaminant Source Inventory for ***Kiana Water System***

PWSID 340230.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Map Number*	*Comments*
Motor /motor vehicle repair shops	C31	X31-01	A	C	State Equipment Building
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D01-01	A	C	Assume 50 or less sewer lines in Zone A
Domestic wastewater treatment plants	D05	D05-01	A	C	Sewage Plant/Lift Station
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-01	A	C	KIANA PHS WATER PROJECT
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-02	A	C	NW ARCTIC SD-KIANA ELEMENTARY SCHOOL
Pit toilets (open hole), nonresidential (one or more)	D16	D16-01	A	C	Assume 40 or less pit toilets/outhouses in Zone A
Septic systems (serves one single-family home)	R02	R02-01	A	C	Assume 5 or less septic systems in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-01	A	C	Assume 80 or less residential heating oil tanks in Zone A
Tanks, aviation fuel (above ground)	T02	T02-01	A	C	Assume 1 aboveground aviation fuel tank in Zone A
Tanks, diesel (above ground)	T06	T06-01	A	C	Kiana Trading Post
Tanks, diesel (above ground)	T06	T06-02	A	C	Lee's Sea Air
Tanks, diesel (above ground)	T06	T06-03	A	C	School
Tanks, heating oil, nonresidential (aboveground)	T14	T14-01	A	C	AVEC Power Plant
Tanks, heating oil, nonresidential (aboveground)	T14	T14-02	A	C	Kiana Clinic
Tanks, heating oil, nonresidential (aboveground)	T14	T14-03	A	C	Blankenship Trading Post
Tanks, heating oil, nonresidential (aboveground)	T14	T14-04	A	C	Lee's Sea Air
Tanks, heating oil, nonresidential (aboveground)	T14	T14-05	A	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-06	A	C	Kiana Trading Post
Tanks, heating oil, nonresidential (aboveground)	T14	T14-07	A	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-08	A	C	Baptist Church

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Map Number*	*Comments*
Tanks, heating oil, nonresidential (aboveground)	T14	T14-09	A	C	Friends Church
Tanks, heating oil, nonresidential (aboveground)	T14	T14-10	A	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-11	A	C	City Garage
Tanks, heating oil, nonresidential (aboveground)	T14	T14-12	A	C	Red Storage
Tanks, heating oil, nonresidential (aboveground)	T14	T14-13	A	C	Search and Rescue
Tanks, heating oil, nonresidential (aboveground)	T14	T14-14	A	C	Fire Hall
Tanks, heating oil, nonresidential (aboveground)	T14	T14-15	A	C	Armory
Tanks, heating oil, nonresidential (aboveground)	T14	T14-16	A	C	City Hall
Tanks, heating oil, nonresidential (aboveground)	T14	T14-17	A	C	City Office
Tanks, heating oil, nonresidential (aboveground)	T14	T14-18	A	C	IRA Office or Kiana Traditional Council Office
Tanks, heating oil, nonresidential (aboveground)	T14	T14-19	A	C	Family Resource Specialist
Tanks, heating oil, nonresidential (aboveground)	T14	T14-20	A	C	Fetal Alcohol Diagnostic Team
Tanks, heating oil, nonresidential (aboveground)	T14	T14-21	A	C	NANA Resource Specialist
Tanks, heating oil, nonresidential (aboveground)	T14	T14-22	A	C	Rural Alcohol Specialist
Tanks, heating oil, nonresidential (aboveground)	T14	T14-23	A	C	VSPO
Tanks, heating oil, nonresidential (aboveground)	T14	T14-24	A	C	Post Office
Tanks, heating oil, nonresidential (aboveground)	T14	T14-25	A	C	Community
Tanks, heating oil, nonresidential (aboveground)	T14	T14-26	A	C	School
Tanks, heating oil, nonresidential (aboveground)	T14	T14-27	A	C	High School
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-01	A	C	Kiana Federal Scout Armory
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-02	A	C	AKARNG Kiana FSA. Reckey: 1998320103003. Status: Inactive. Petroleum contamination (DRO) in soil.
Cemeteries	X01	X01-01	A	C	Cemetery-inactive
Cemeteries	X01	X01-02	A	C	Kiana Cemetery1

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Map Number*	*Comments*
Cemeteries	X01	X01-03	A	C	Kiana Cemetery2
Petroleum product bulk station/terminals	X11	X11-01	A	C	Tank Farm
Airports	X14	X14-01	A	C	BOB BAKER MEMORIAL AI
Boat yards and marinas	X15	X15-01	A	C	Dock-Center
Boat yards and marinas	X15	X15-02	A	C	Dock-East
Boat yards and marinas	X15	X15-03	A	C	Dock-West
Highways and roads, dirt/gravel	X24	X24-01	A	C	Assume 1-20 roads in Zone A
Electric power generation (fossil fuels)	X36	X36-01	A	C	AVEC Power Plant
Firehouses	X38	X38-01	A	C	Fire Hall
Medical/veterinary facilities (doctor or dentist offices, hospitals, nursing homes)	X40	X40-01	A	C	Kiana Clinic
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-01	B	C	Sewage Lagoon
Landfills (municipal; Class III)	D51	D51-01	B	C	Kiana Landfill
Quarries (sand, gravel, rock, other?)	E10	E10-01	C	C	KIANA

Table 2

Contaminant Source Inventory and Risk Ranking for Kiana Water System

Sources of Bacteria and Viruses

PWSID 340230.001

Contaminant Source Type	***Contaminant Source ID***	***CS ID tag***	***Zone***	***Risk Ranking for Analysis***	***Map Number***	***Comments***
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D01-01	A	Medium	C	Assume 50 or less sewer lines in Zone A
Domestic wastewater treatment plants	D05	D05-01	A	Medium	C	Sewage Plant/Lift Station
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-01	A	High	C	KIANA PHS WATER PROJECT
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-02	A	High	C	NW ARCTIC SD-KIANA ELEMENTARY SCHOOL
Pit toilets (open hole), nonresidential (one or more)	D16	D16-01	A	Medium	C	Assume 40 or less pit toilets/outhouses in Zone A
Septic systems (serves one single-family home)	R02	R02-01	A	Low	C	Assume 5 or less septic systems 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	Medium	C	Kiana Clinic
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-01	B	High	C	Sewage Lagoon
Landfills (municipal; Class III)	D51	D51-01	B	High	C	Kiana Landfill

Table 3

Contaminant Source Inventory and Risk Ranking for Kiana Water System
Sources of Nitrates/Nitrites

PWSID 340230.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D01-01	A	Medium	C	Assume 50 or less sewer lines in Zone A
Domestic wastewater treatment plants	D05	D05-01	A	Medium	C	Sewage Plant/Lift Station
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-01	A	High	C	KIANA PHS WATER PROJECT
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-02	A	High	C	NW ARCTIC SD-KIANA ELEMENTARY SCHOOL
Pit toilets (open hole), nonresidential (one or more)	D16	D16-01	A	Medium	C	Assume 40 or less pit toilets/outhouses in Zone A
Septic systems (serves one single-family home)	R02	R02-01	A	Low	C	Assume 5 or less septic systems in Zone A
Cemeteries	X01	X01-01	A	Medium	C	Cemetery-inactive
Cemeteries	X01	X01-02	A	Medium	C	Kiana Cemetery1
Cemeteries	X01	X01-03	A	Medium	C	Kiana Cemetery2
Airports	X14	X14-01	A	Low	C	BOB BAKER MEMORIAL AI
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	Kiana Clinic
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-01	B	High	C	Sewage Lagoon
Landfills (municipal; Class III)	D51	D51-01	B	Very High	C	Kiana Landfill

Table 4

Contaminant Source Inventory and Risk Ranking for Kiana Water System

Sources of Volatile Organic Chemicals

PWSID 340230.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D01-01	A	Low	C	Assume 50 or less sewer lines in Zone A
Domestic wastewater treatment plants	D05	D05-01	A	Low	C	Sewage Plant/Lift Station
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-01	A	Low	C	KIANA PHS WATER PROJECT
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-02	A	Low	C	NW ARCTIC SD-KIANA ELEMENTARY SCHOOL
Pit toilets (open hole), nonresidential (one or more)	D16	D16-01	A	Low	C	Assume 40 or less pit toilets/outhouses in Zone A
Septic systems (serves one single-family home)	R02	R02-01	A	Low	C	Assume 5 or less septic systems in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-01	A	Medium	C	Assume 80 or less residential heating oil tanks in Zone A
Tanks, aviation fuel (above ground)	T02	T02-01	A	Medium	C	Assume 1 aboveground aviation fuel tank in Zone A
Tanks, diesel (above ground)	T06	T06-01	A	Medium	C	Kiana Trading Post
Tanks, diesel (above ground)	T06	T06-02	A	Medium	C	Lee's Sea Air
Tanks, diesel (above ground)	T06	T06-03	A	Medium	C	School
Tanks, heating oil, nonresidential (aboveground)	T14	T14-01	A	Low	C	AVEC Power Plant
Tanks, heating oil, nonresidential (aboveground)	T14	T14-02	A	Low	C	Kiana Clinic
Tanks, heating oil, nonresidential (aboveground)	T14	T14-03	A	Low	C	Blankenship Trading Post
Tanks, heating oil, nonresidential (aboveground)	T14	T14-04	A	Low	C	Lee's Sea Air
Tanks, heating oil, nonresidential (aboveground)	T14	T14-05	A	Low	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-06	A	Low	C	Kiana Trading Post
Tanks, heating oil, nonresidential (aboveground)	T14	T14-07	A	Low	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-08	A	Low	C	Baptist Church

Contaminant Source Inventory and Risk Ranking for Kiana Water System

Sources of Volatile Organic Chemicals

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Tanks, heating oil, nonresidential (aboveground)	T14	T14-09	A	Low	C	Friends Church
Tanks, heating oil, nonresidential (aboveground)	T14	T14-10	A	Low	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-11	A	Low	C	City Garage
Tanks, heating oil, nonresidential (aboveground)	T14	T14-12	A	Low	C	Red Storage
Tanks, heating oil, nonresidential (aboveground)	T14	T14-13	A	Low	C	Search and Rescue
Tanks, heating oil, nonresidential (aboveground)	T14	T14-14	A	Low	C	Fire Hall
Tanks, heating oil, nonresidential (aboveground)	T14	T14-15	A	Low	C	Armory
Tanks, heating oil, nonresidential (aboveground)	T14	T14-16	A	Low	C	City Hall
Tanks, heating oil, nonresidential (aboveground)	T14	T14-17	A	Low	C	City Office
Tanks, heating oil, nonresidential (aboveground)	T14	T14-18	A	Low	C	IRA Office or Kiana Traditional Council Office
Tanks, heating oil, nonresidential (aboveground)	T14	T14-19	A	Low	C	Family Resource Specialist
Tanks, heating oil, nonresidential (aboveground)	T14	T14-20	A	Low	C	Fetal Alcohol Diagnostic Team
Tanks, heating oil, nonresidential (aboveground)	T14	T14-21	A	Low	C	NANA Resource Specialist
Tanks, heating oil, nonresidential (aboveground)	T14	T14-22	A	Low	C	Rural Alcohol Specialist
Tanks, heating oil, nonresidential (aboveground)	T14	T14-23	A	Low	C	VSPO
Tanks, heating oil, nonresidential (aboveground)	T14	T14-24	A	Low	C	Post Office
Tanks, heating oil, nonresidential (aboveground)	T14	T14-25	A	Low	C	Community
Tanks, heating oil, nonresidential (aboveground)	T14	T14-26	A	Low	C	School
Tanks, heating oil, nonresidential (aboveground)	T14	T14-27	A	Low	C	High School
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-01	A	High	C	Kiana Federal Scout Armory

Table 4 (continued)

Contaminant Source Inventory and Risk Ranking for Kiana Water System

Sources of Volatile Organic Chemicals

PWSID 340230.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-02	A	High	C	AKARNG Kiana FSA. Reckey: 1998320103003. Status: Inactive. Petroleum contamination (DRO) in soil.
Petroleum product bulk station/terminals	X11	X11-01	A	Very High	C	Tank Farm
Airports	X14	X14-01	A	High	C	BOB BAKER MEMORIAL AI
Boat yards and marinas	X15	X15-01	A	Low	C	Dock-Center
Boat yards and marinas	X15	X15-02	A	Low	C	Dock-East
Boat yards and marinas	X15	X15-03	A	Low	C	Dock-West
Highways and roads, dirt/gravel	X24	X24-01	A	Low	C	Assume 1-20 roads in Zone A
Motor /motor vehicle repair shops	C31	X31-01	A	Medium	C	State Equipment Building
Electric power generation (fossil fuels)	X36	X36-01	A	Medium	C	AVEC Power Plant
Firehouses	X38	X38-01	A	Low	C	Fire Hall
Medical/veterinary facilities (doctor or dentist offices, hospitals, nursing homes)	X40	X40-01	A	Low	C	Kiana Clinic
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-01	B	Low	C	Sewage Lagoon
Landfills (municipal; Class III)	D51	D51-01	B	High	C	Kiana Landfill

Table 5

Contaminant Source Inventory and Risk Ranking for Kiana Water System

Sources of Heavy Metals, Cyanide and Other Inorganic Chemicals

PWSID 340230.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D01-01	A	Low	C	Assume 50 or less sewer lines in Zone A
Domestic wastewater treatment plants	D05	D05-01	A	Low	C	Sewage Plant/Lift Station
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-01	A	Low	C	KIANA PHS WATER PROJECT
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-02	A	Low	C	NW ARCTIC SD-KIANA ELEMENTARY SCHOOL
Pit toilets (open hole), nonresidential (one or more)	D16	D16-01	A	Low	C	Assume 40 or less pit toilets/outhouses in Zone A
Septic systems (serves one single-family home)	R02	R02-01	A	Low	C	Assume 5 or less septic systems in Zone A
Tanks, heating oil, nonresidential (aboveground)	T14	T14-01	A	Low	C	AVEC Power Plant
Tanks, heating oil, nonresidential (aboveground)	T14	T14-02	A	Low	C	Kiana Clinic
Tanks, heating oil, nonresidential (aboveground)	T14	T14-03	A	Low	C	Blankenship Trading Post
Tanks, heating oil, nonresidential (aboveground)	T14	T14-04	A	Low	C	Lee's Sea Air
Tanks, heating oil, nonresidential (aboveground)	T14	T14-05	A	Low	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-06	A	Low	C	Kiana Trading Post
Tanks, heating oil, nonresidential (aboveground)	T14	T14-07	A	Low	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-08	A	Low	C	Baptist Church
Tanks, heating oil, nonresidential (aboveground)	T14	T14-09	A	Low	C	Friends Church
Tanks, heating oil, nonresidential (aboveground)	T14	T14-10	A	Low	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-11	A	Low	C	City Garage
Tanks, heating oil, nonresidential (aboveground)	T14	T14-12	A	Low	C	Red Storage
Tanks, heating oil, nonresidential (aboveground)	T14	T14-13	A	Low	C	Search and Rescue

Contaminant Source Inventory and Risk Ranking for Kiana Water System

Sources of Heavy Metals, Cyanide and Other Inorganic Chemicals

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Tanks, heating oil, nonresidential (aboveground)	T14	T14-14	A	Low	C	Fire Hall
Tanks, heating oil, nonresidential (aboveground)	T14	T14-15	A	Low	C	Armory
Tanks, heating oil, nonresidential (aboveground)	T14	T14-16	A	Low	C	City Hall
Tanks, heating oil, nonresidential (aboveground)	T14	T14-17	A	Low	C	City Office
Tanks, heating oil, nonresidential (aboveground)	T14	T14-18	A	Low	C	IRA Office or Kiana Traditional Council Office
Tanks, heating oil, nonresidential (aboveground)	T14	T14-19	A	Low	C	Family Resource Specialist
Tanks, heating oil, nonresidential (aboveground)	T14	T14-20	A	Low	C	Fetal Alcohol Diagnostic Team
Tanks, heating oil, nonresidential (aboveground)	T14	T14-21	A	Low	C	NANA Resource Specialist
Tanks, heating oil, nonresidential (aboveground)	T14	T14-22	A	Low	C	Rural Alcohol Specialist
Tanks, heating oil, nonresidential (aboveground)	T14	T14-23	A	Low	C	VSPO
Tanks, heating oil, nonresidential (aboveground)	T14	T14-24	A	Low	C	Post Office
Tanks, heating oil, nonresidential (aboveground)	T14	T14-25	A	Low	C	Community
Tanks, heating oil, nonresidential (aboveground)	T14	T14-26	A	Low	C	School
Tanks, heating oil, nonresidential (aboveground)	T14	T14-27	A	Low	C	High School
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-01	A	Low	C	Kiana Federal Scout Armory
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-02	A	Low	C	AKARNG Kiana FSA. Reckey: 1998320103003. Status: Inactive. Petroleum contamination (DRO) in soil.
Cemeteries	X01	X01-01	A	Low	C	Cemetery-inactive
Cemeteries	X01	X01-02	A	Low	C	Kiana Cemetery1
Cemeteries	X01	X01-03	A	Low	C	Kiana Cemetery2

Contaminant Source Inventory and Risk Ranking for Kiana Water System

Sources of Heavy Metals, Cyanide and Other Inorganic Chemicals

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Petroleum product bulk station/terminals	X11	X11-01	A	Low	C	Tank Farm
Airports	X14	X14-01	A	Low	C	BOB BAKER MEMORIAL AI
Boat yards and marinas	X15	X15-01	A	Low	C	Dock-Center
Boat yards and marinas	X15	X15-02	A	Low	C	Dock-East
Boat yards and marinas	X15	X15-03	A	Low	C	Dock-West
Highways and roads, dirt/gravel	X24	X24-01	A	Low	C	Assume 1-20 roads in Zone A
Motor /motor vehicle repair shops	C31	X31-01	A	Medium	C	State Equipment Building
Electric power generation (fossil fuels)	X36	X36-01	A	Medium	C	AVEC Power Plant
Firehouses	X38	X38-01	A	Low	C	Fire Hall
Medical/veterinary facilities (doctor or dentist offices, hospitals, nursing homes)	X40	X40-01	A	Low	C	Kiana Clinic
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-01	B	Low	C	Sewage Lagoon
Landfills (municipal; Class III)	D51	D51-01	B	High	C	Kiana Landfill

Table 6

Contaminant Source Inventory and Risk Ranking for Kiana Water System

Sources of Synthetic Organic Chemicals

PWSID 340230.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D01-01	A	Low	C	Assume 50 or less sewer lines in Zone A
Domestic wastewater treatment plants	D05	D05-01	A	Low	C	Sewage Plant/Lift Station
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-01	A	Low	C	KIANA PHS WATER PROJECT
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-02	A	Low	C	NW ARCTIC SD-KIANA ELEMENTARY SCHOOL
Septic systems (serves one single-family home)	R02	R02-01	A	Low	C	Assume 5 or less septic systems in Zone A
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-01	A	Low	C	Kiana Federal Scout Armory
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-02	A	Low	C	AKARNG Kiana FSA. Reckey: 1998320103003. Status: Inactive. Petroleum contamination (DRO) in soil.
Cemeteries	X01	X01-01	A	Medium	C	Cemetery-inactive
Cemeteries	X01	X01-02	A	Medium	C	Kiana Cemetery1
Cemeteries	X01	X01-03	A	Medium	C	Kiana Cemetery2
Petroleum product bulk station/terminals	X11	X11-01	A	Low	C	Tank Farm
Airports	X14	X14-01	A	Medium	C	BOB BAKER MEMORIAL AI
Medical/veterinary facilities (doctor or dentist offices, hospitals, nursing homes)	X40	X40-01	A	Low	C	Kiana Clinic
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-01	B	Low	C	Sewage Lagoon
Landfills (municipal; Class III)	D51	D51-01	B	Very High	C	Kiana Landfill

Table 7

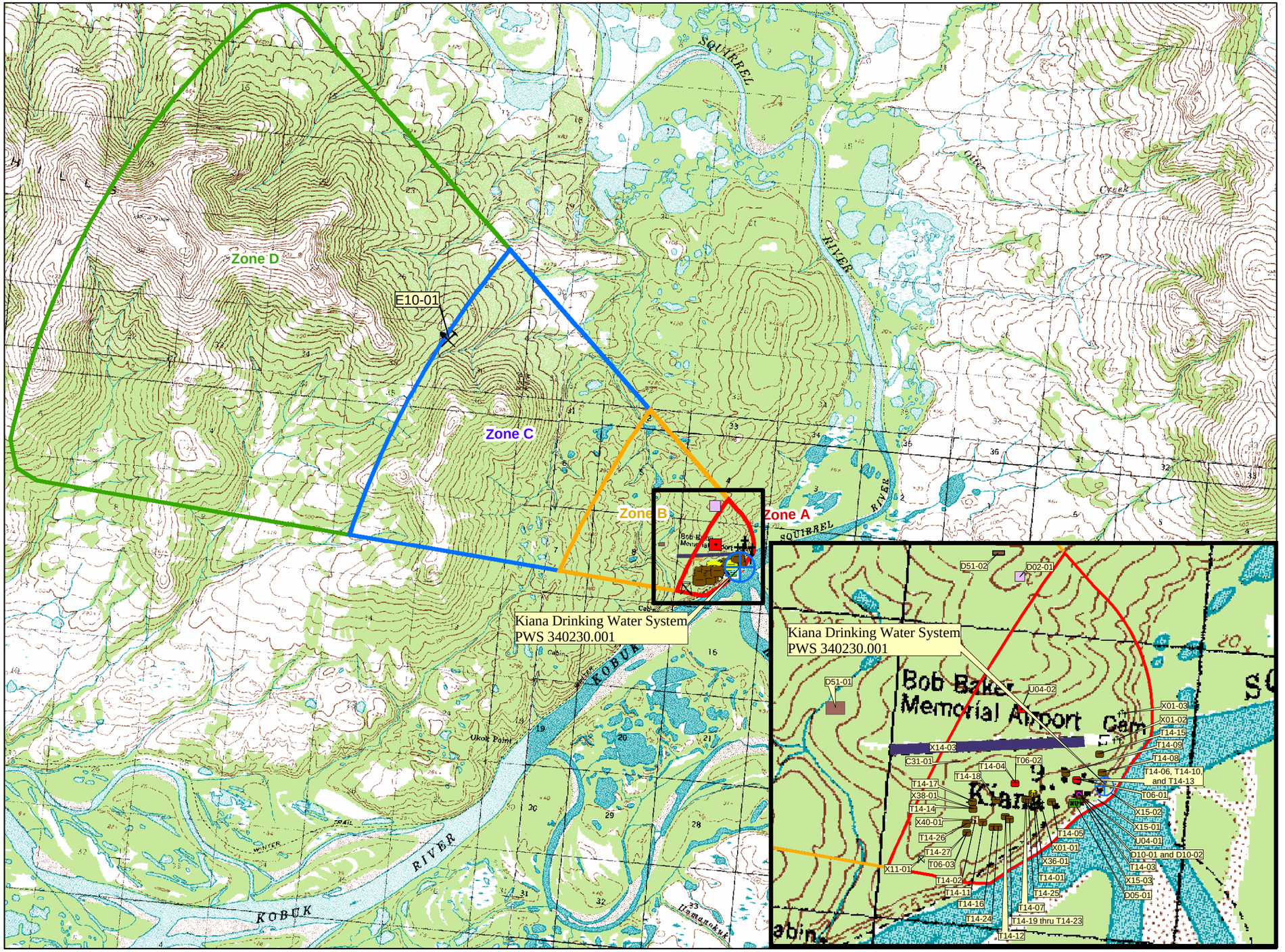
Contaminant Source Inventory and Risk Ranking for Kiana Water System

Sources of Other Organic Chemicals

PWSID 340230.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D01-01	A	Low	C	Assume 50 or less sewer lines in Zone A
Domestic wastewater treatment plants	D05	D05-01	A	Low	C	Sewage Plant/Lift Station
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-01	A	Low	C	KIANA PHS WATER PROJECT
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-02	A	Low	C	NW ARCTIC SD-KIANA ELEMENTARY SCHOOL
Septic systems (serves one single-family home)	R02	R02-01	A	Low	C	Assume 5 or less septic systems in Zone A
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-01	A	Low	C	Kiana Federal Scout Armory
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-02	A	Low	C	AKARNG Kiana FSA. Reckey: 1998320103003. Status: Inactive. Petroleum contamination (DRO) in soil.
Petroleum product bulk station/terminals	X11	X11-01	A	High	C	Tank Farm
Airports	X14	X14-01	A	Medium	C	BOB BAKER MEMORIAL AI
Boat yards and marinas	X15	X15-01	A	Low	C	Dock-Center
Boat yards and marinas	X15	X15-02	A	Low	C	Dock-East
Boat yards and marinas	X15	X15-03	A	Low	C	Dock-West
Highways and roads, dirt/gravel	X24	X24-01	A	Low	C	Assume 1-20 roads in Zone A
Motor /motor vehicle repair shops	C31	X31-01	A	Medium	C	State Equipment Building
Electric power generation (fossil fuels)	X36	X36-01	A	High	C	AVEC Power Plant
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-01	B	Low	C	Sewage Lagoon
Landfills (municipal; Class III)	D51	D51-01	B	Very High	C	Kiana Landfill

Public Water Well System for PWS #340230.001 Kiana Drinking Water System
Showing Potential and Existing Sources of Contamination



0 0.5 1 2 3 4 Miles

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)

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

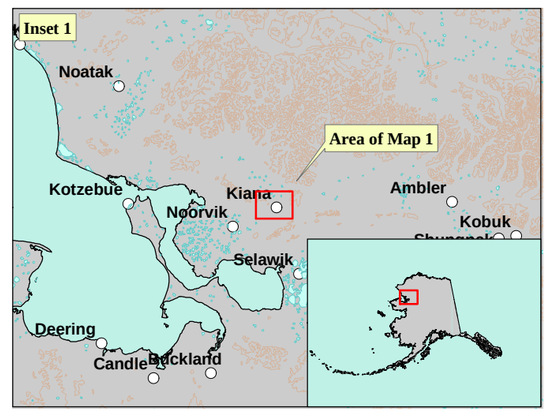
Existing or Potential Contaminant Sources

- Motor/motor vehicle repair shops (C31)
- Domestic wastewater treatment plants (D05)
- Injection wells (Class V) Large-Capacity Septic System (D10)
- Other mines or Quarries (E10)
- Tanks, diesel (above ground) (T06)
- Tanks, heating oil, nonresidential (aboveground) (T14)
- Contaminated sites, DEC recognized, non-Superfund, non-RCRA (U04)
- Cemetery (X01)
- Petroleum product bulk station/terminals (X11)
- Boat yards and marinas (X15)
- Electric Power Generation (fossil fuels) (X36)
- Firehouses (X38)
- Medical/veterinary facilities (X40)
- Domestic wastewater treatment plant disposal ponds/lagoons (D02)
- Landfills (municipal; Class III) (D51)
- Airport or landing strip (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.



Kiana Drinking Water System
PWS 340230.001
Appendix C Map C

Chart 1. Susceptibility of the wellhead - Kiana Water System (PWS No. 340230.001)

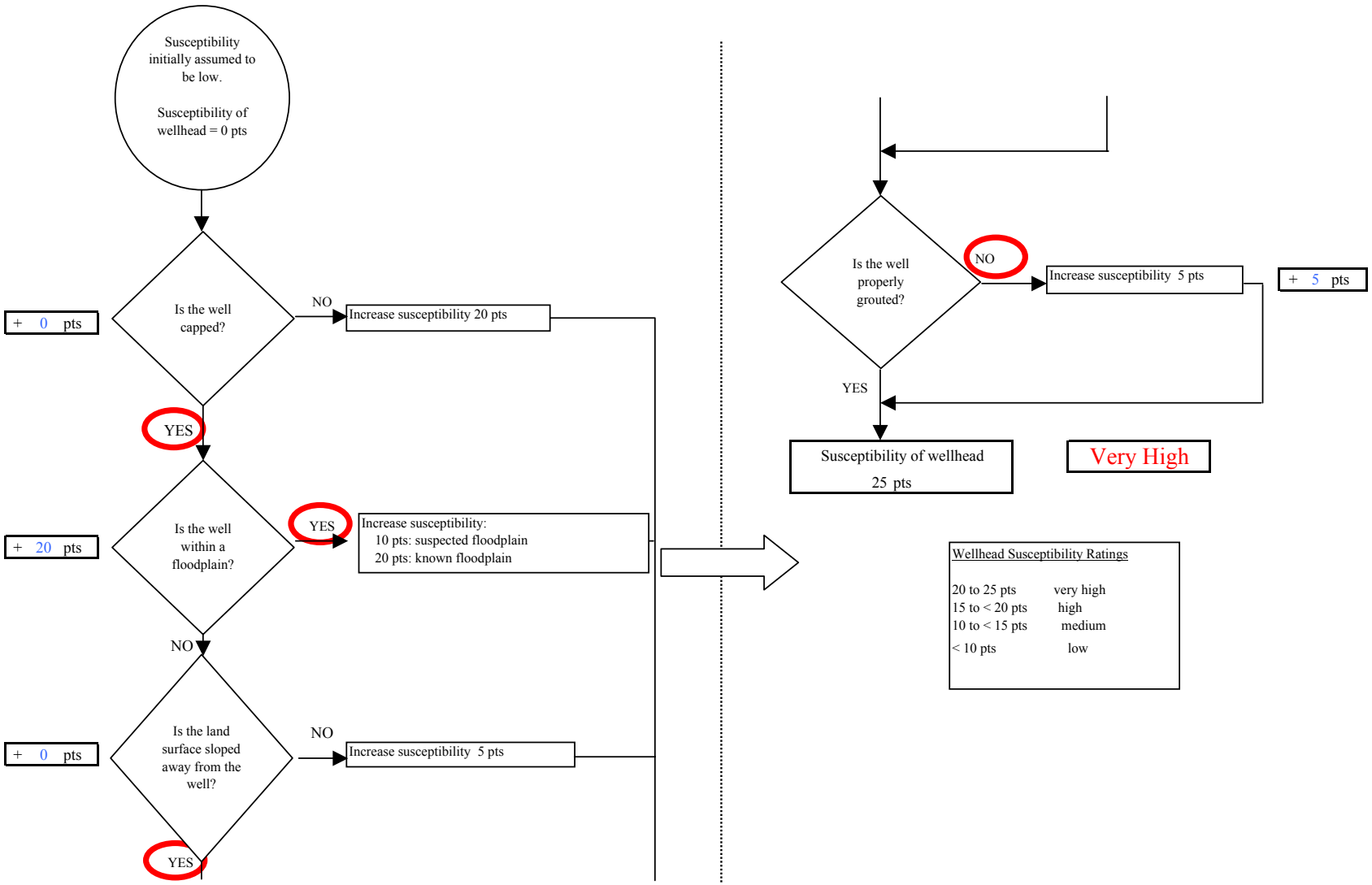


Chart 2. Susceptibility of the aquifer Kiana Water System (PWS No. 340230.001)

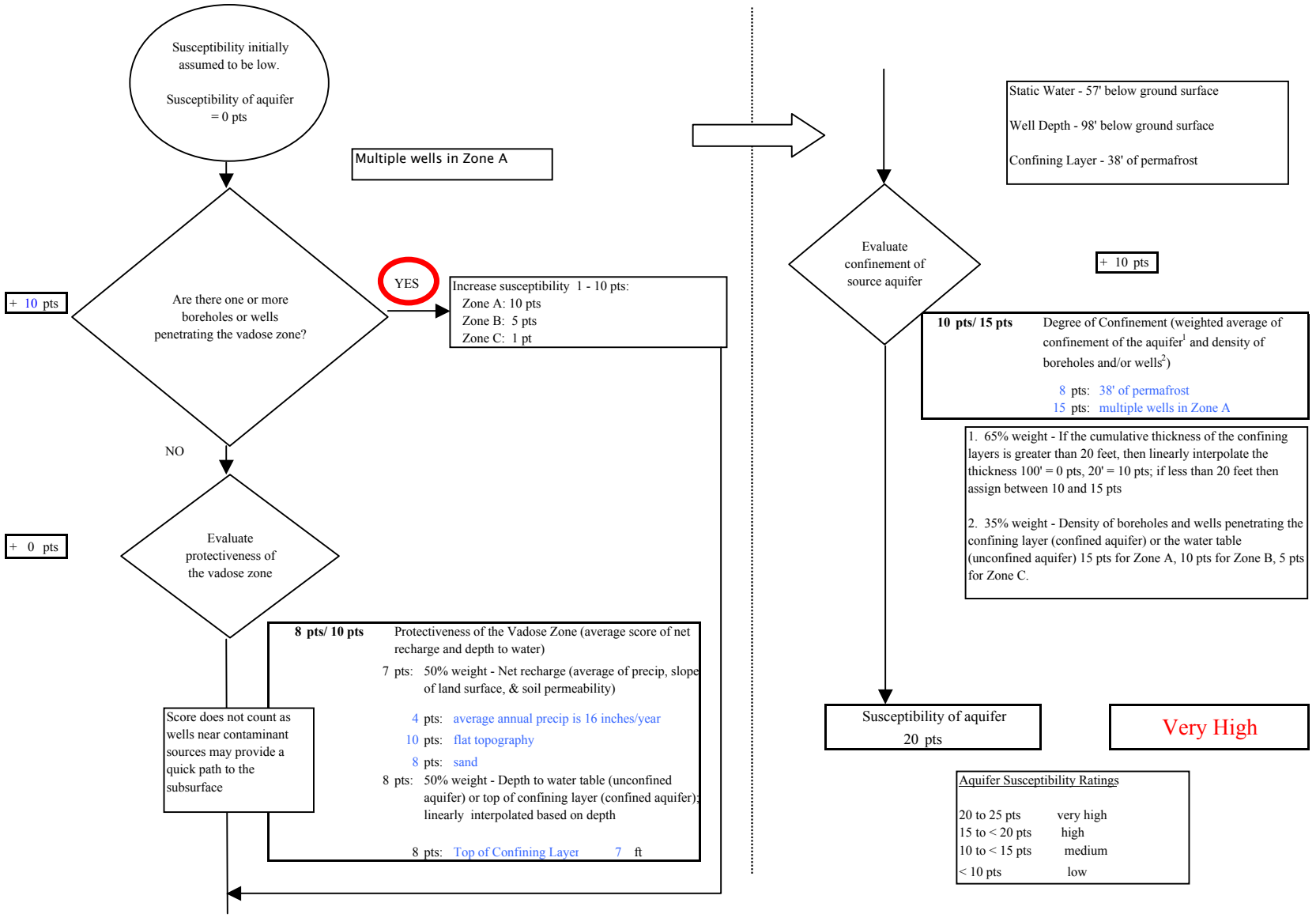
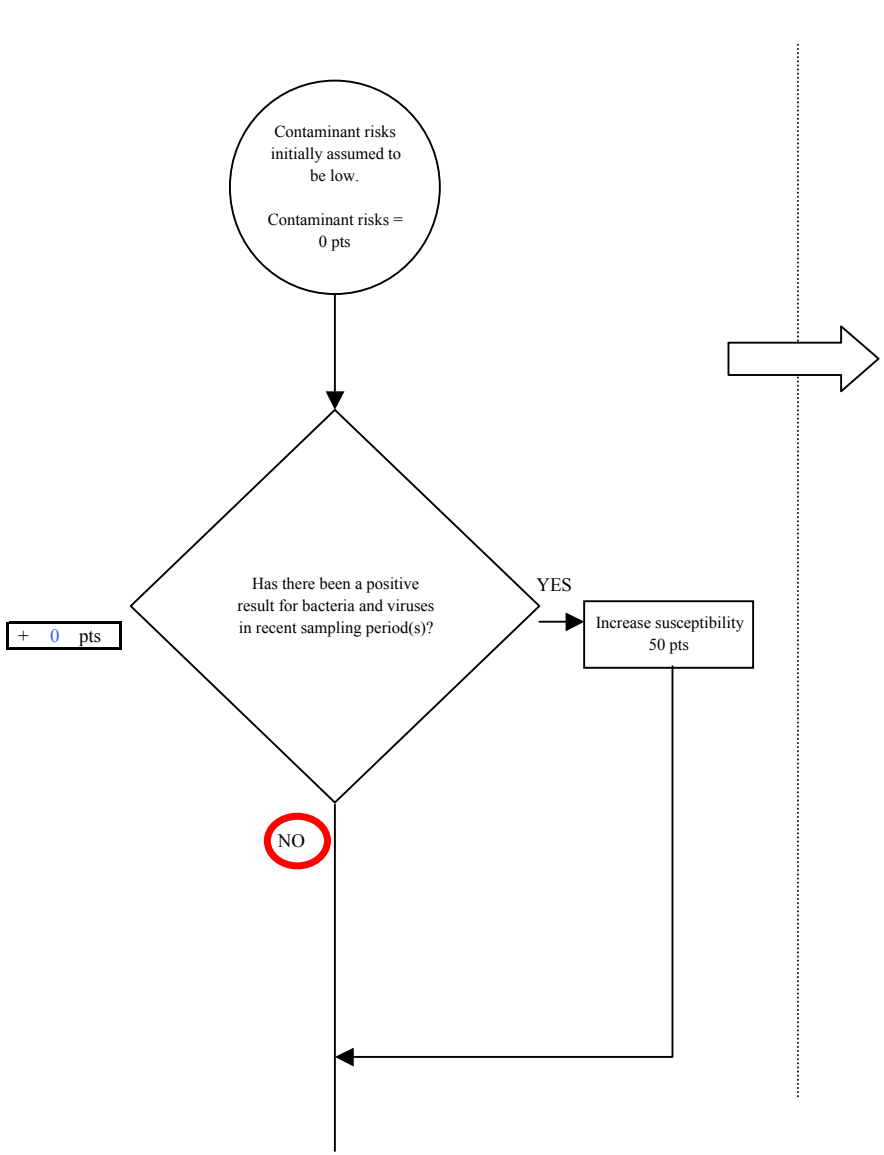
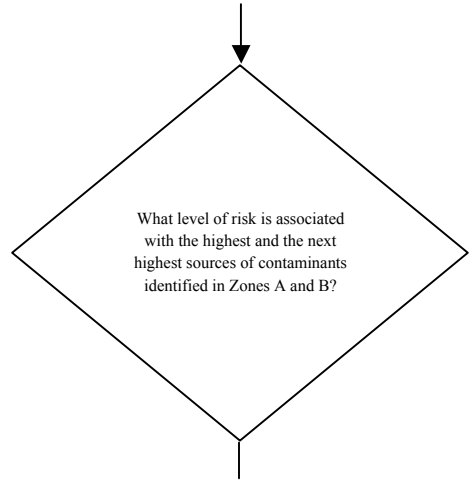


Chart 3. Contaminant risks for Kiana Water System (PWS No. 340230.001) - Bacteria & Viruses





+ 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	2	4
Medium(s)	47	0	47
Low(s)	5	0	5

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

Matrix Score 40

Note: Septic systems, sewerlines, and roads are each assigned a risk ranking for each 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 Kiana Water System (PWS No. 340230.001) - Bacteria & Viruses

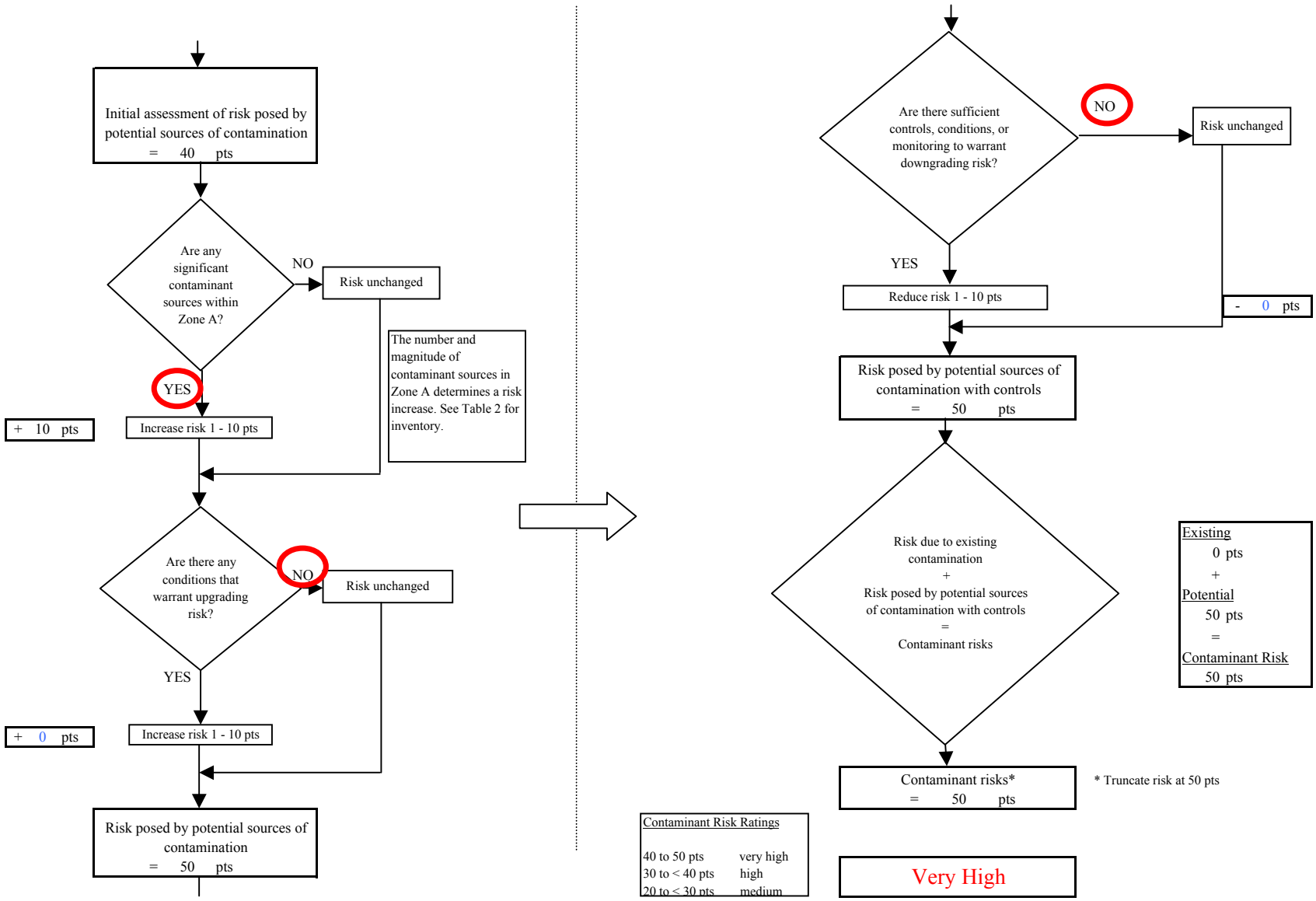


Chart 4. Vulnerability analysis for Kiana Water System (PWS No. 340230.001) - Bacteria & Viruses

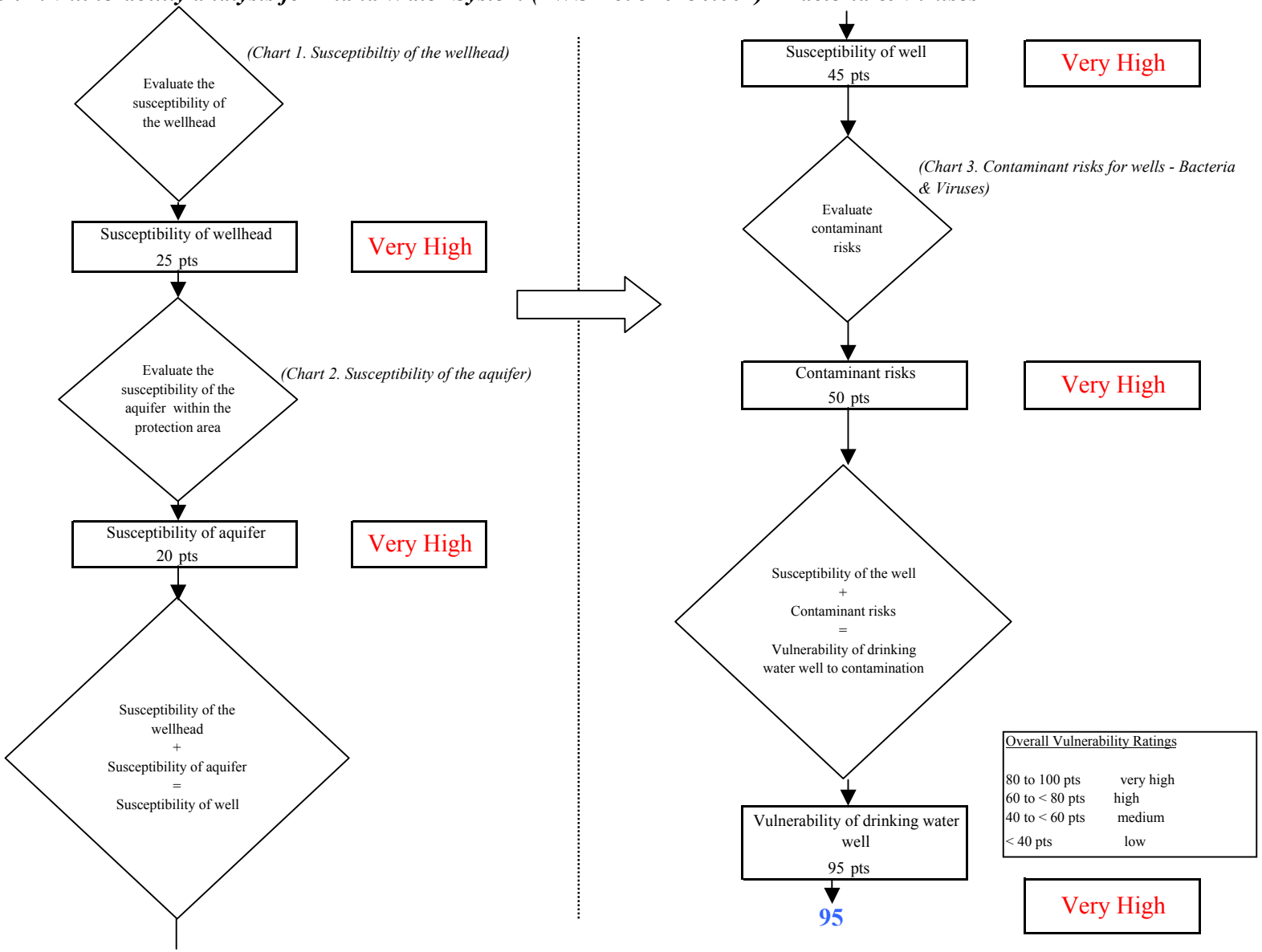


Chart 5. Contaminant risks for Kiana Water System (PWS No. 340230.001) - Nitrates and Nitrites

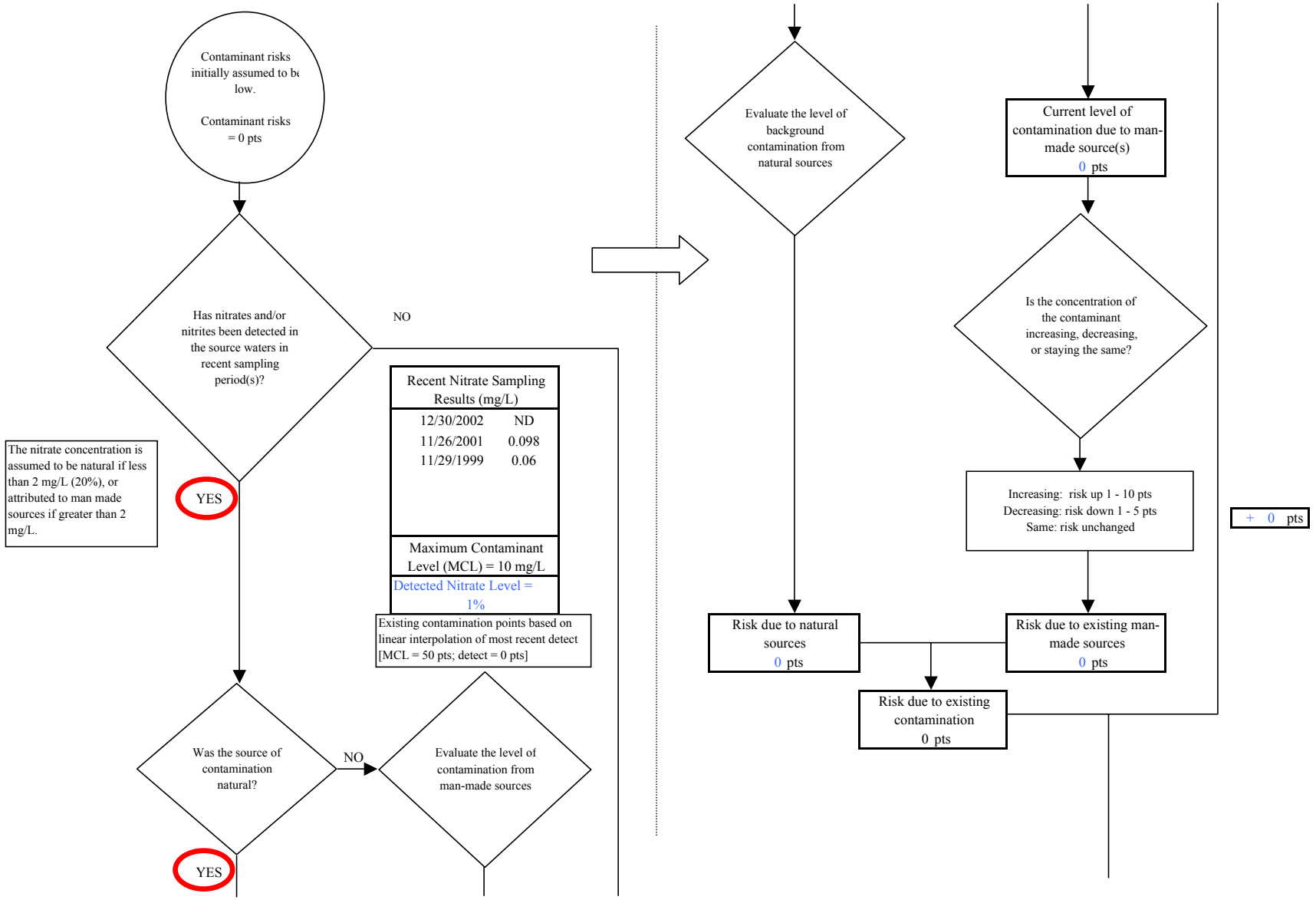


Chart 5. Contaminant risks for Kiana Water System (PWS No. 340230.001) - Nitrates and Nitrites

+ 50 pts

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

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

	Zone A	Zones B&C	Total
Very Highs(s)	0	1	1
High(s)	2	1	3
Medium(s)	49	0	49
Low(s)	7	0	7

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

Matrix Score 50

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

Initial assessment of risk posed by potential sources of contamination = 50 pts

Is the source aquifer fractured rock or karst?

YES

NO

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

NO

Risk unchanged

YES

Decrease risk 1 - 10 pts

- 0 pts

Are any significant sources within Zone A?

NO

Risk unchanged

YES

Increase risk 1 - 10 pts

+ 10 pts

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

Chart 5. Contaminant risks for Kiana Water System (PWS No. 340230.001) - Nitrates and Nitrites

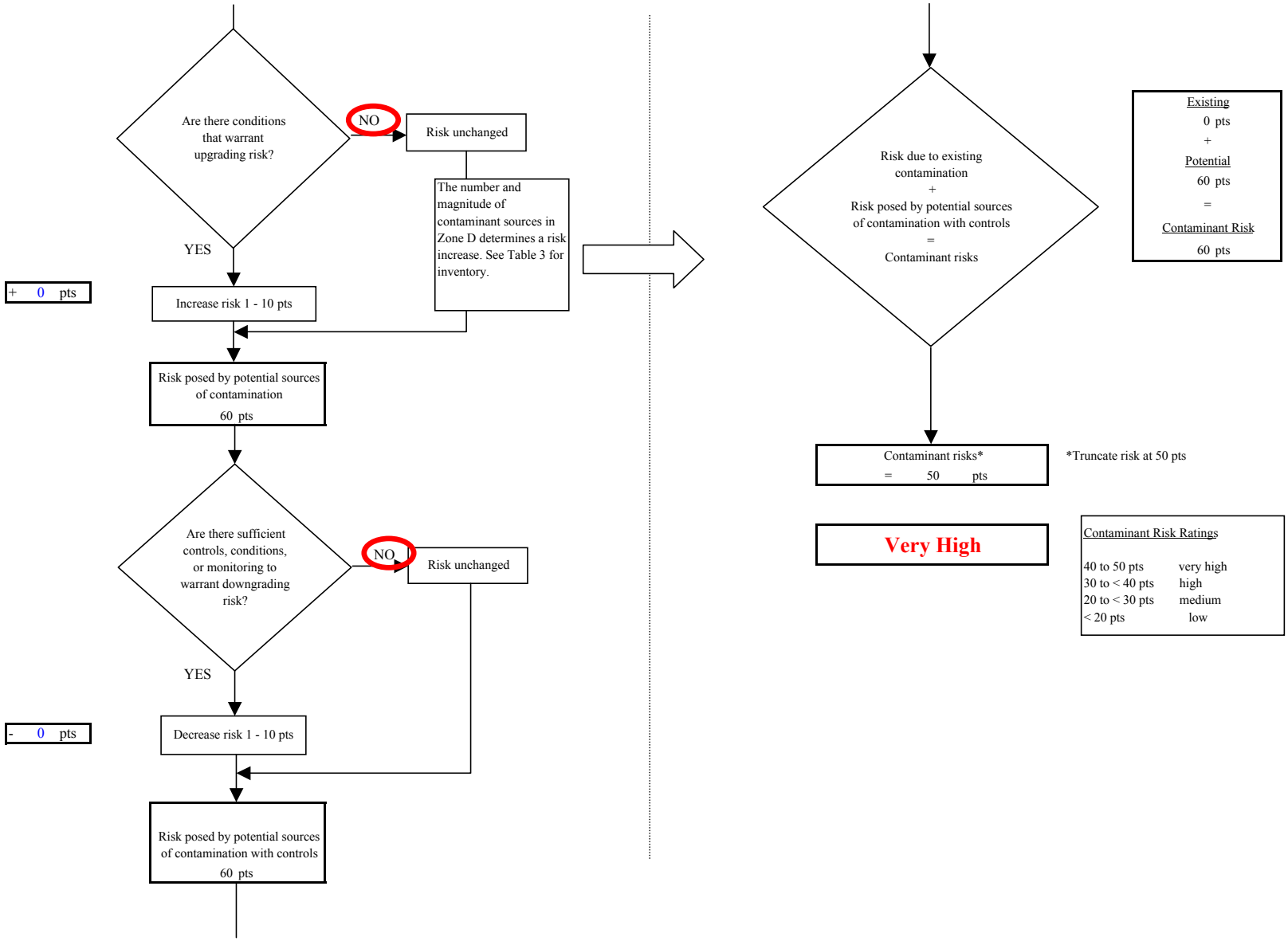


Chart 6. Vulnerability analysis for Kiana Water System (PWS No. 340230.001) - Nitrates and Nitrites

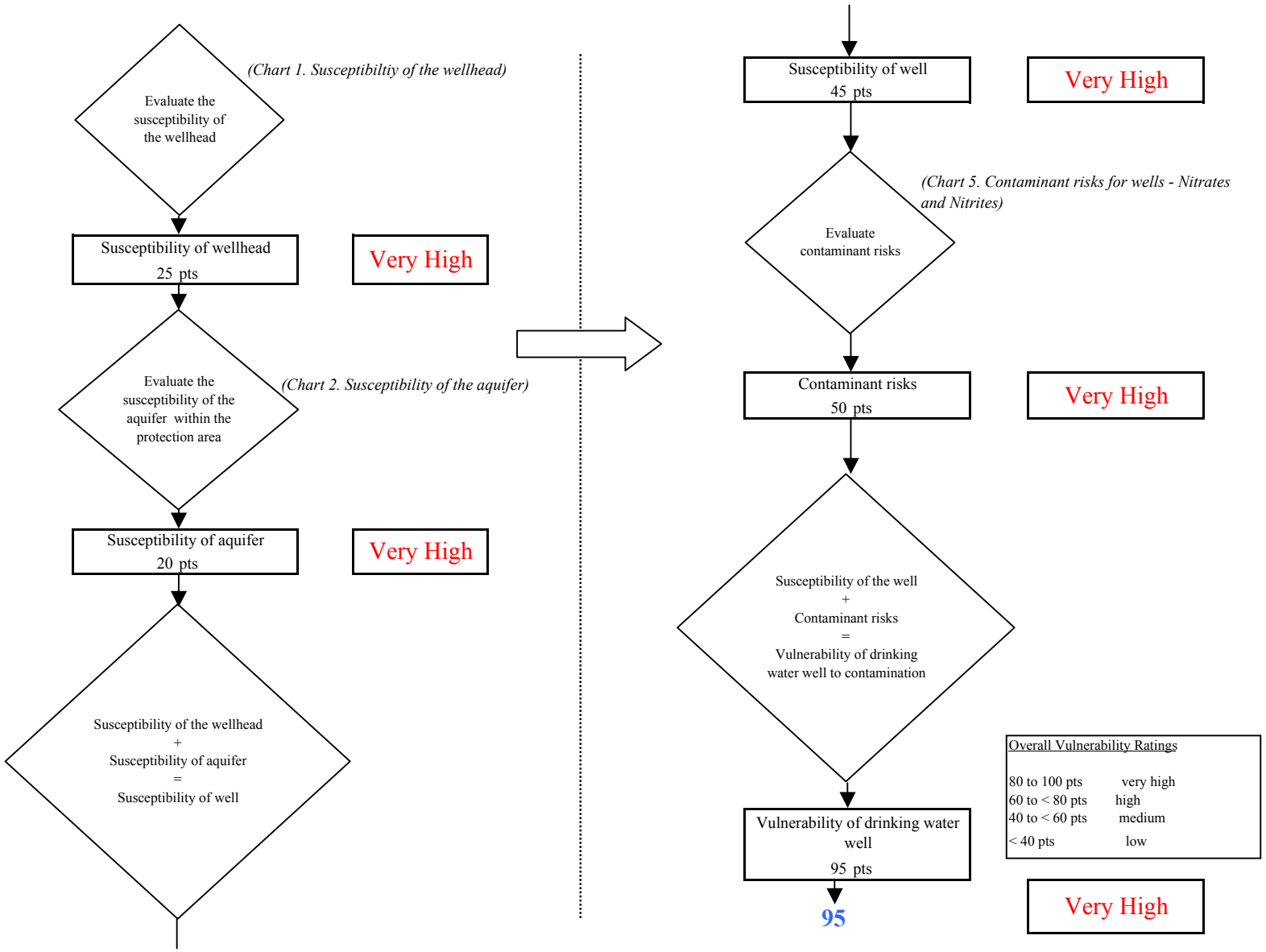


Chart 7. Contaminant risks for Kiana Water System (PWS No. 340230.001) - Volatile Organic Chemicals

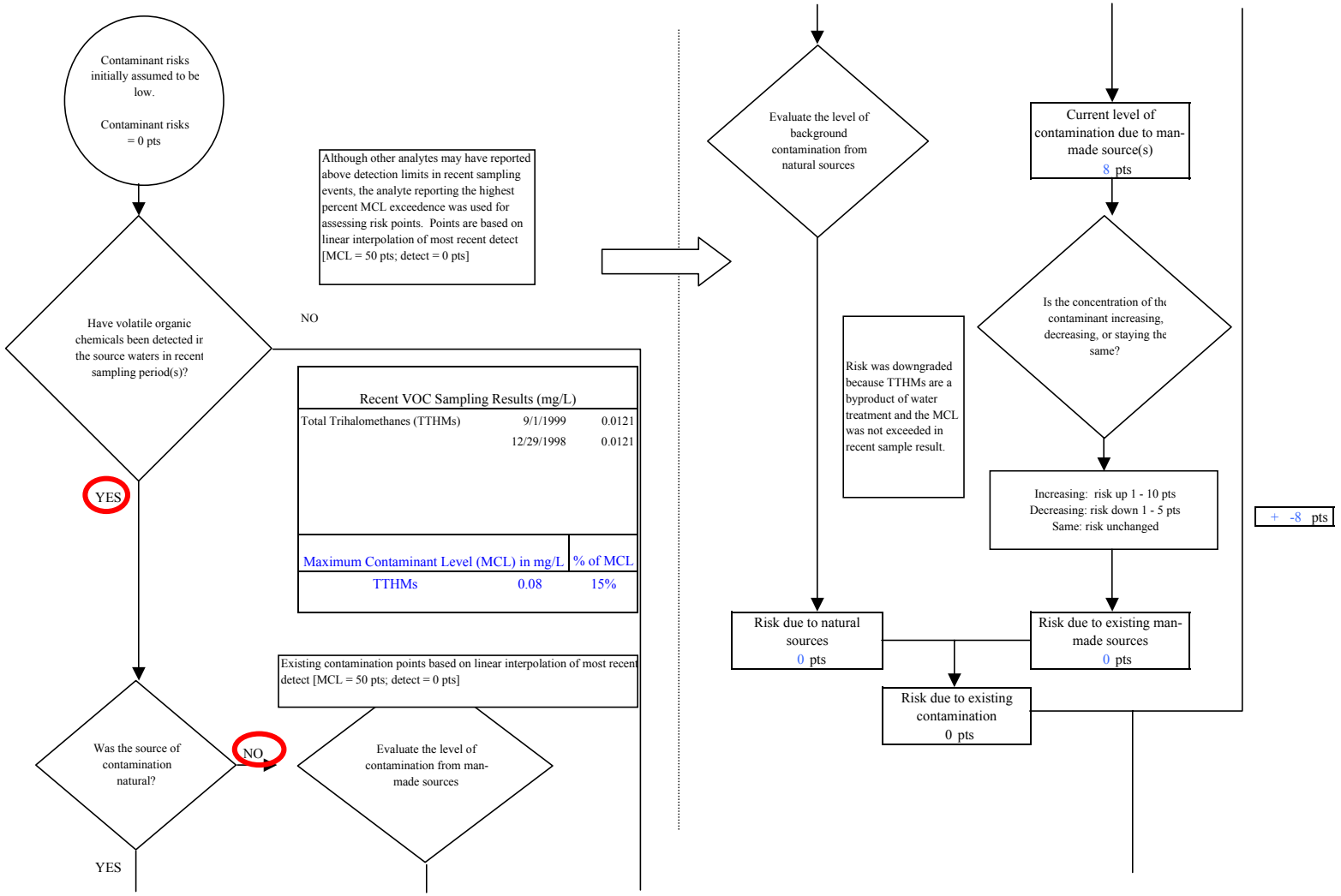
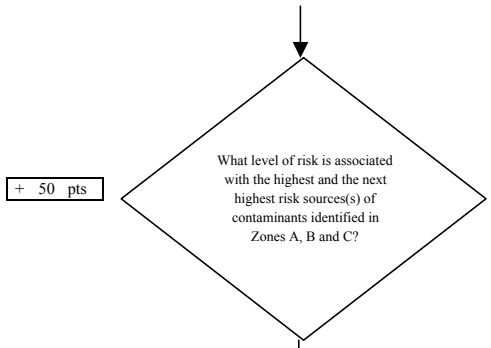


Chart 7. Contaminant risks for Kiana Water System (PWS No. 340230.001) - Volatile Organic Chemicals



+ 50 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)	3	1	4
Medium(s)	86	0	86
Low(s)	82	1	83

	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 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.

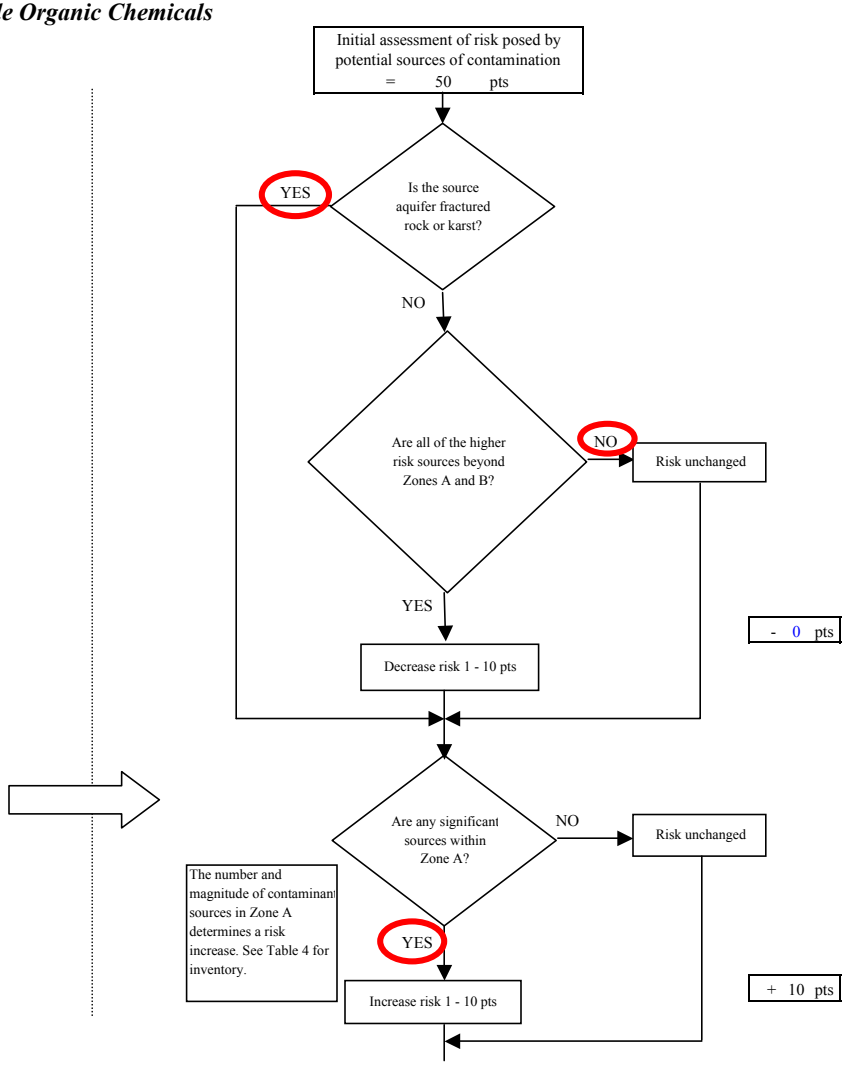


Chart 7. Contaminant risks for Kiana Water System (PWS No. 340230.001) - Volatile Organic Chemicals

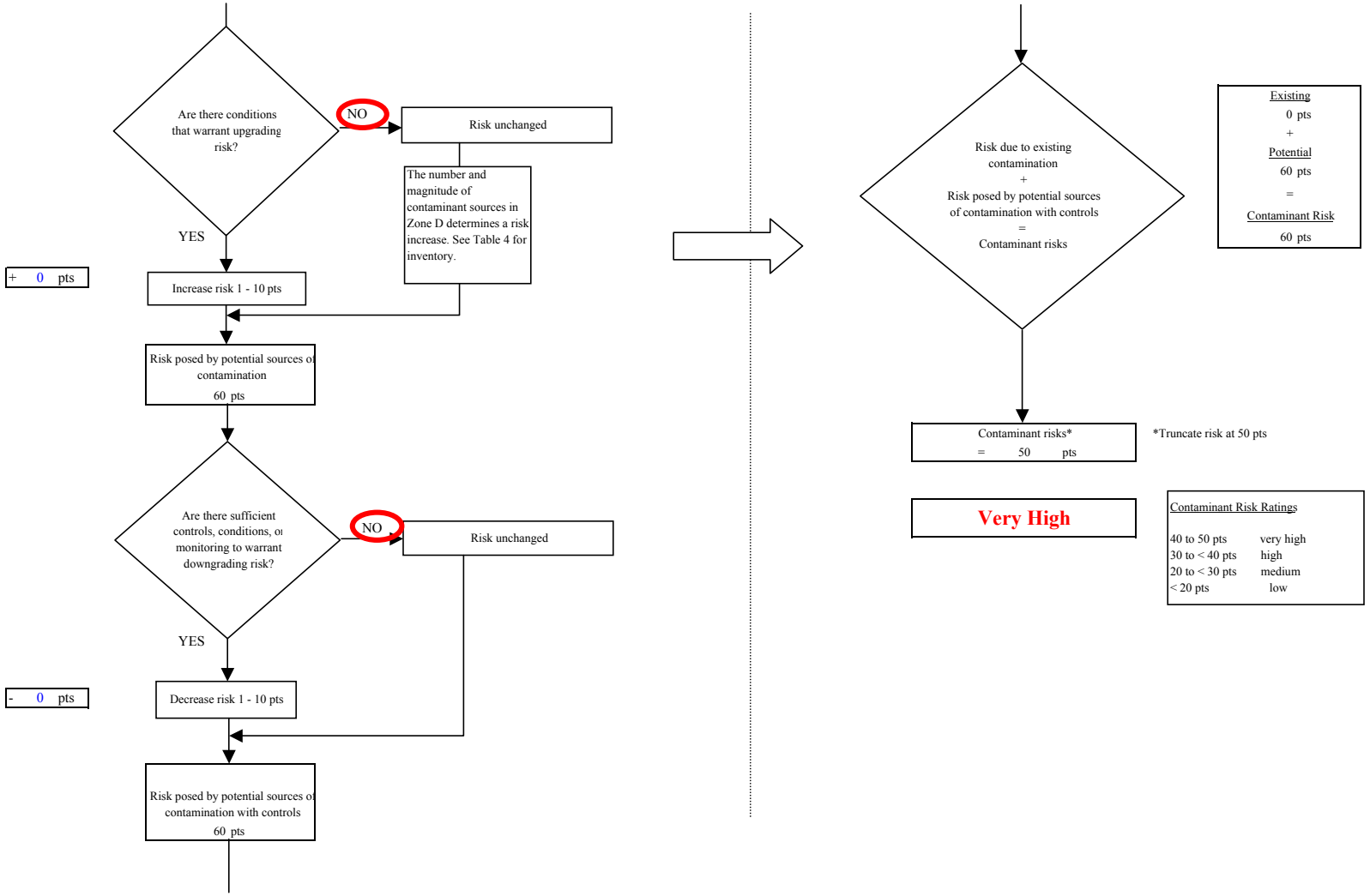


Chart 8. Vulnerability analysis for Kiana Water System (PWS No. 340230.001) - Volatile Organic Chemicals

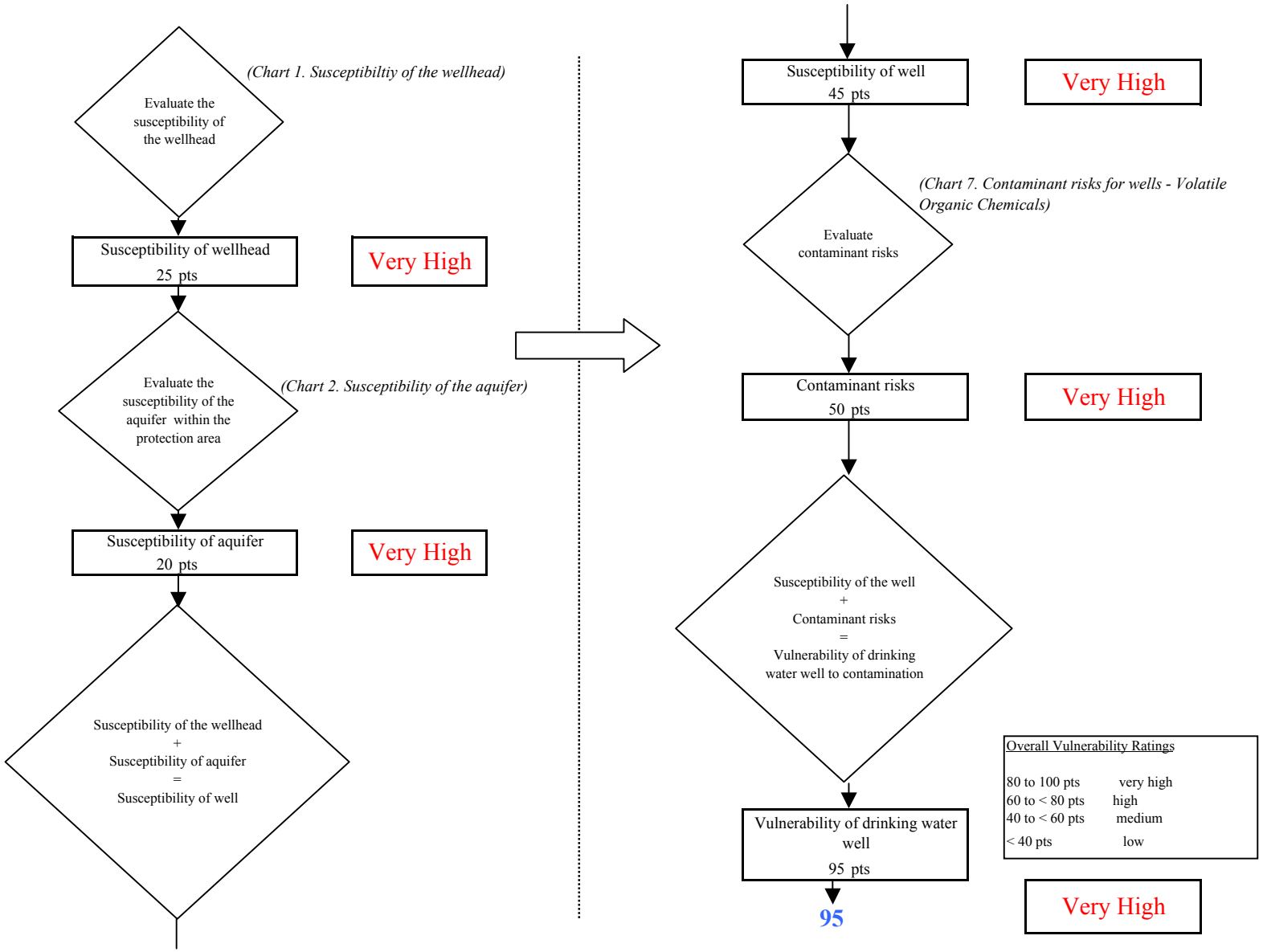


Chart 9. Contaminant risks for Kiana Water System (PWS No. 340230.001) - Heavy Metals, Cyanide and Other Inorganic Chemicals

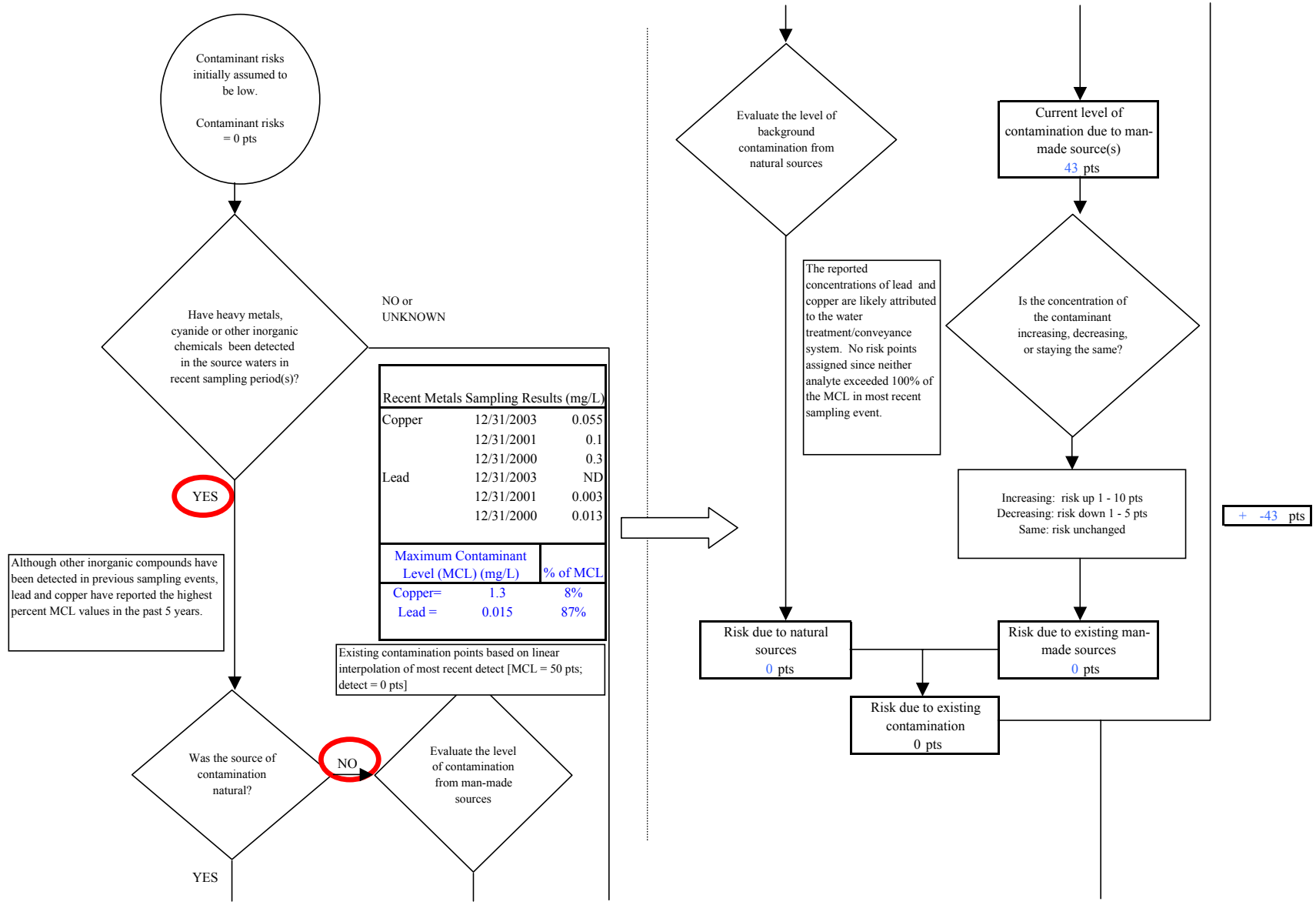


Chart 9. Contaminant risks for Kiana Water System (PWS No. 340230.001) - Heavy Metals, Cyanide and Other Inorganic Chemicals

+ 30 pts

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

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

	Zone A	Zones B&C	Total
Very Highs(s)	0	0	0
High(s)	0	1	1
Medium(s)	2	0	2
Low(s)	86	1	87

	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.

Initial assessment of risk posed by potential sources of contamination = 30 pts

Is the source aquifer fractured rock or karst?

YES

NO

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

NO

Risk unchanged

YES

- 0 pts

Decrease risk 1 - 10 pts

Are any significant sources within Zone A?

NO

Risk unchanged

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

YES

Increase risk 1 - 10 pts

+ 5 pts

Chart 9. Contaminant risks for Kiana Water System (PWS No. 340230.001) - Heavy Metals, Cyanide and Other Inorganic Chemicals

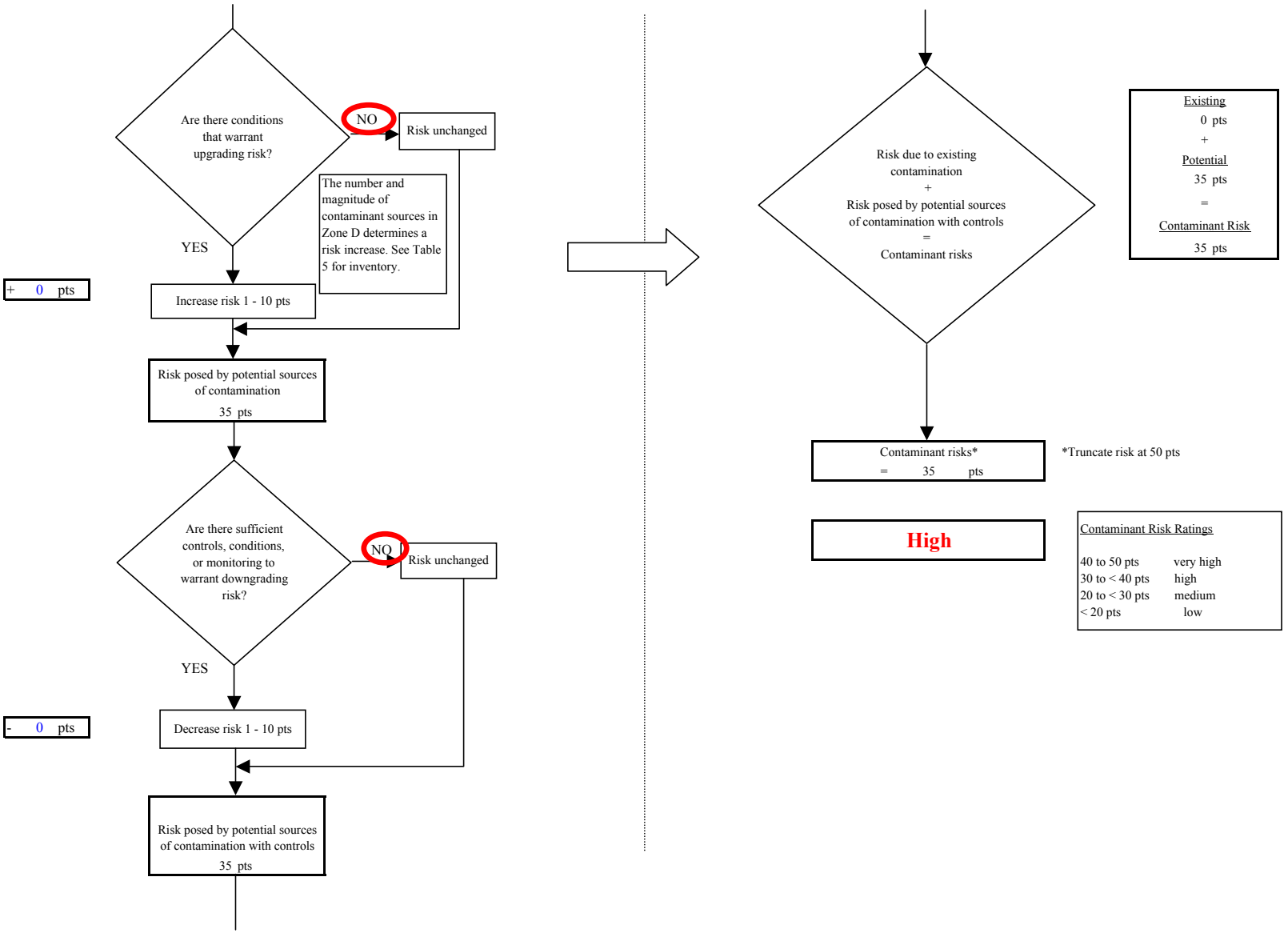


Chart 10. Vulnerability analysis for Kiana Water System (PWS No. 340230.001) - Heavy Metals, Cyanide and Other Inorganic Chemicals

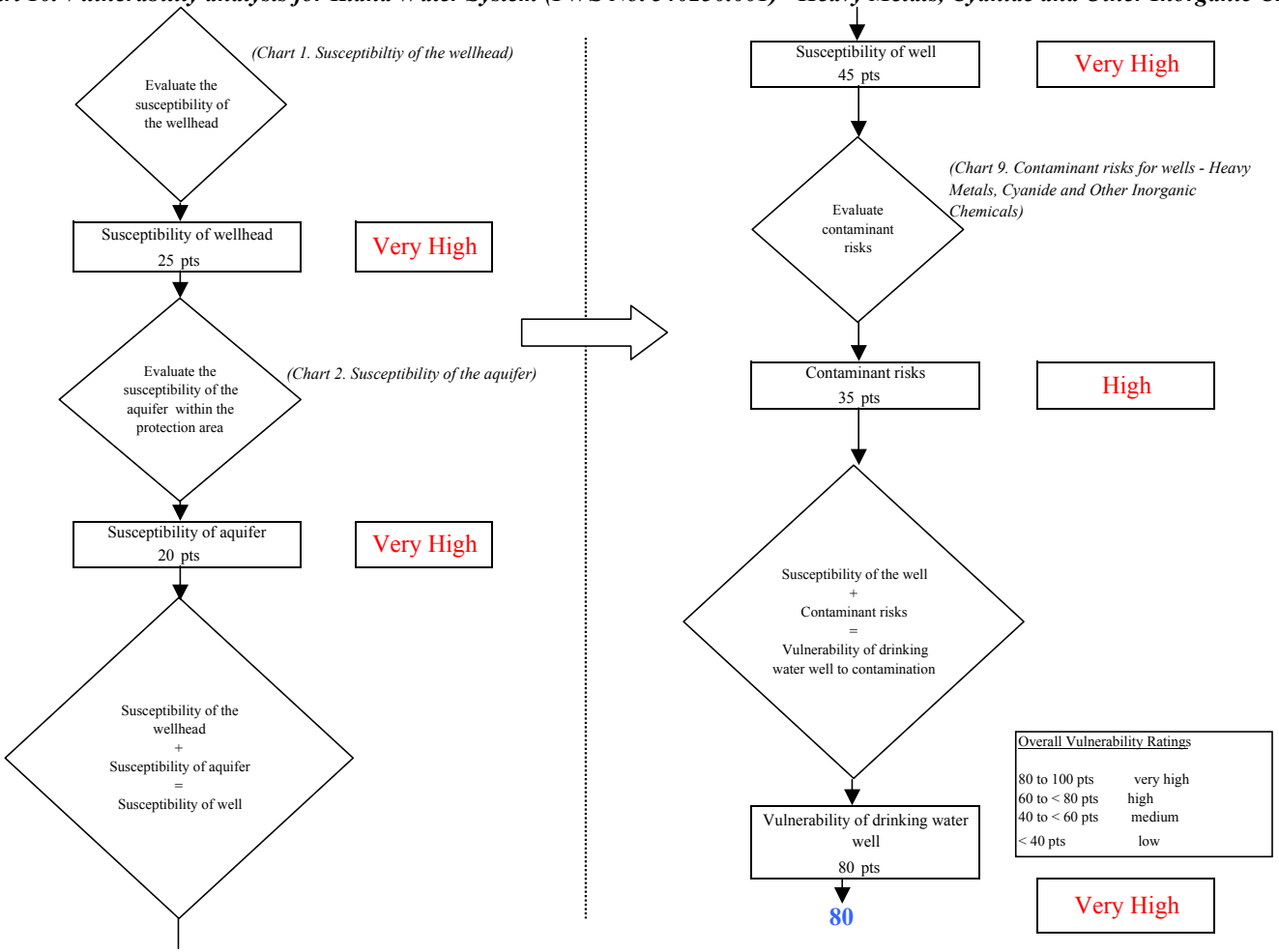


Chart 11. Contaminant risks for Kiana Water System (PWS No. 340230.001) - Synthetic Organic Chemicals

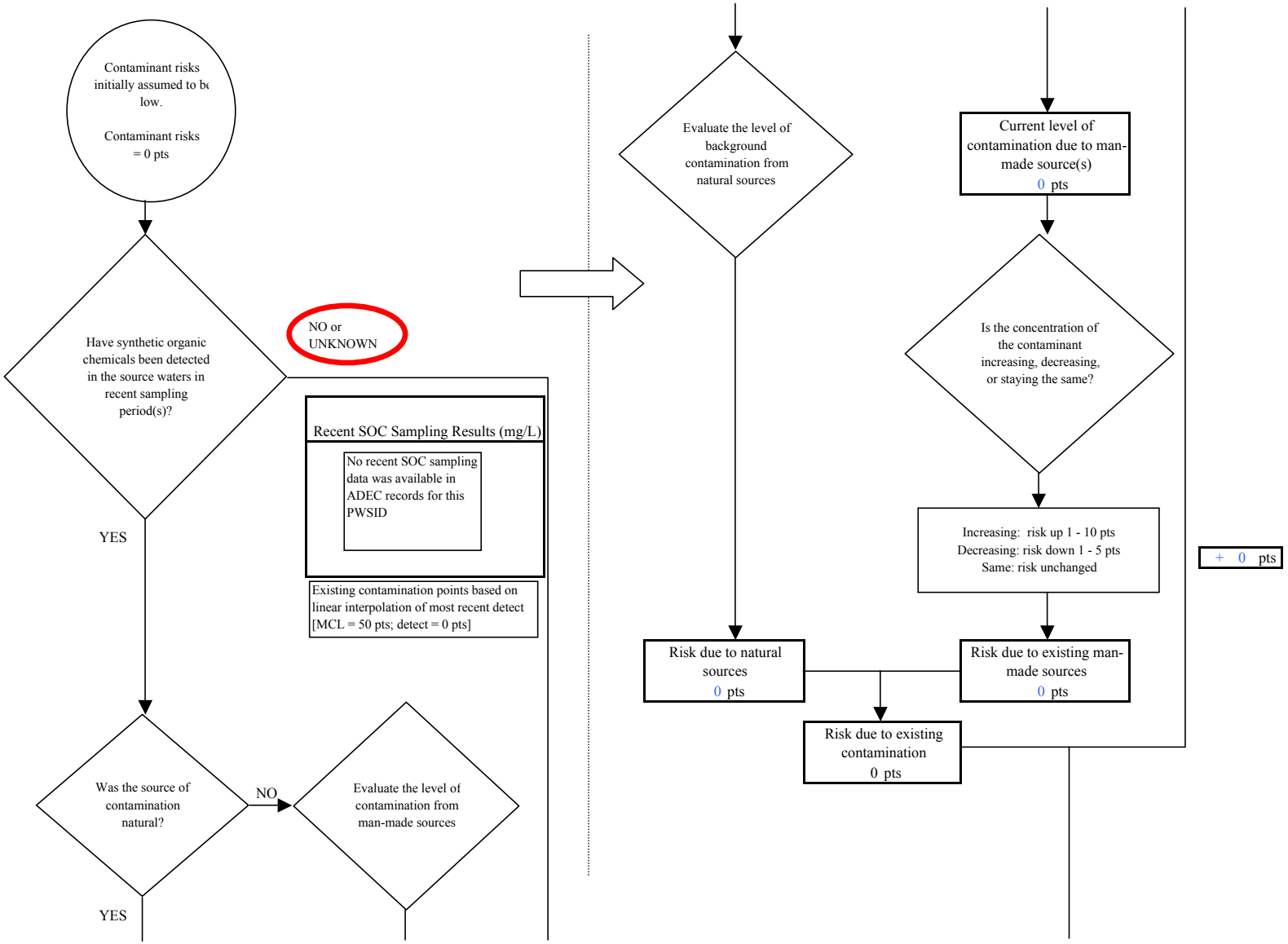
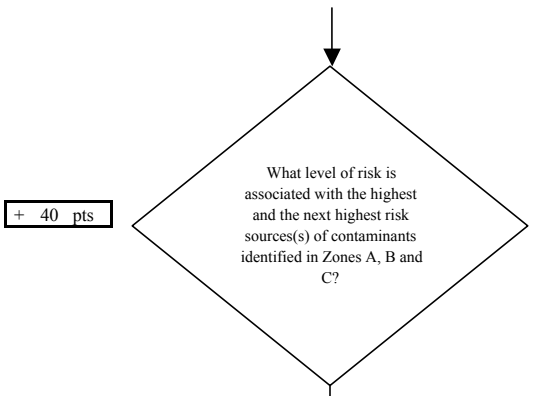


Chart 11. Contaminant risks for Kiana Water System (PWS No. 340230.001) - Synthetic Organic Chemicals



+ 40 pts

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

	Zone A	Zones B&C	Total
Very Highs(s)	0	1	1
High(s)	0	0	0
Medium(s)	4	0	4
Low(s)	9	1	10

	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.

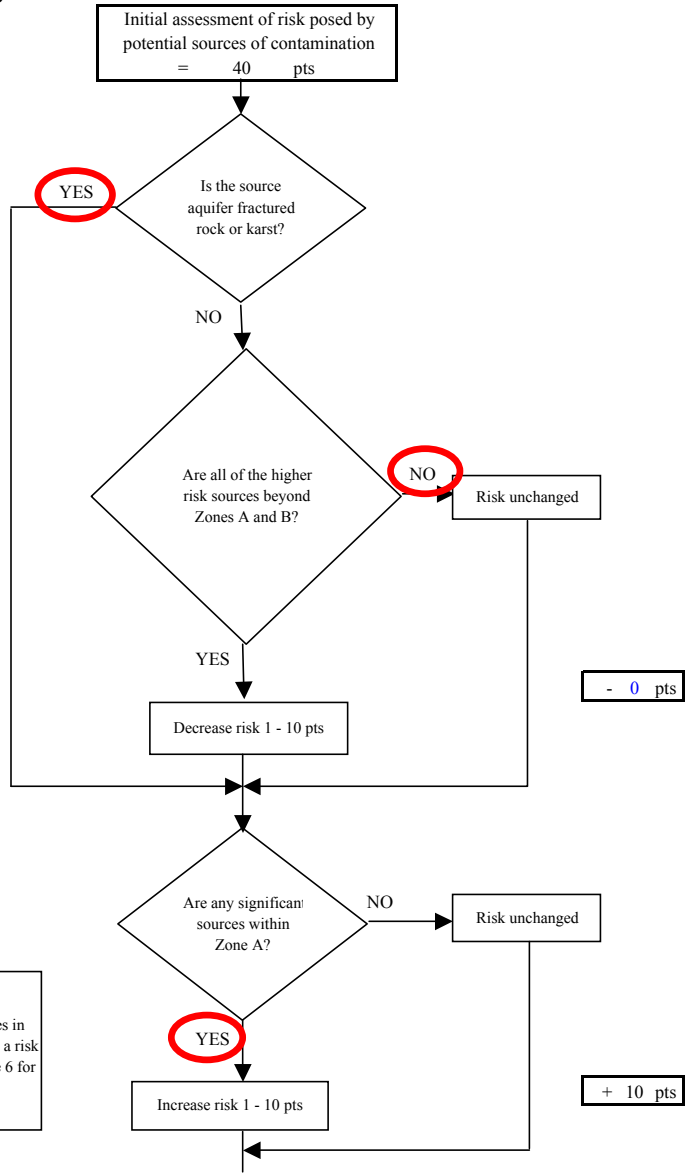


Chart 11. Contaminant risks for Kiana Water System (PWS No. 340230.001) - Synthetic Organic Chemicals

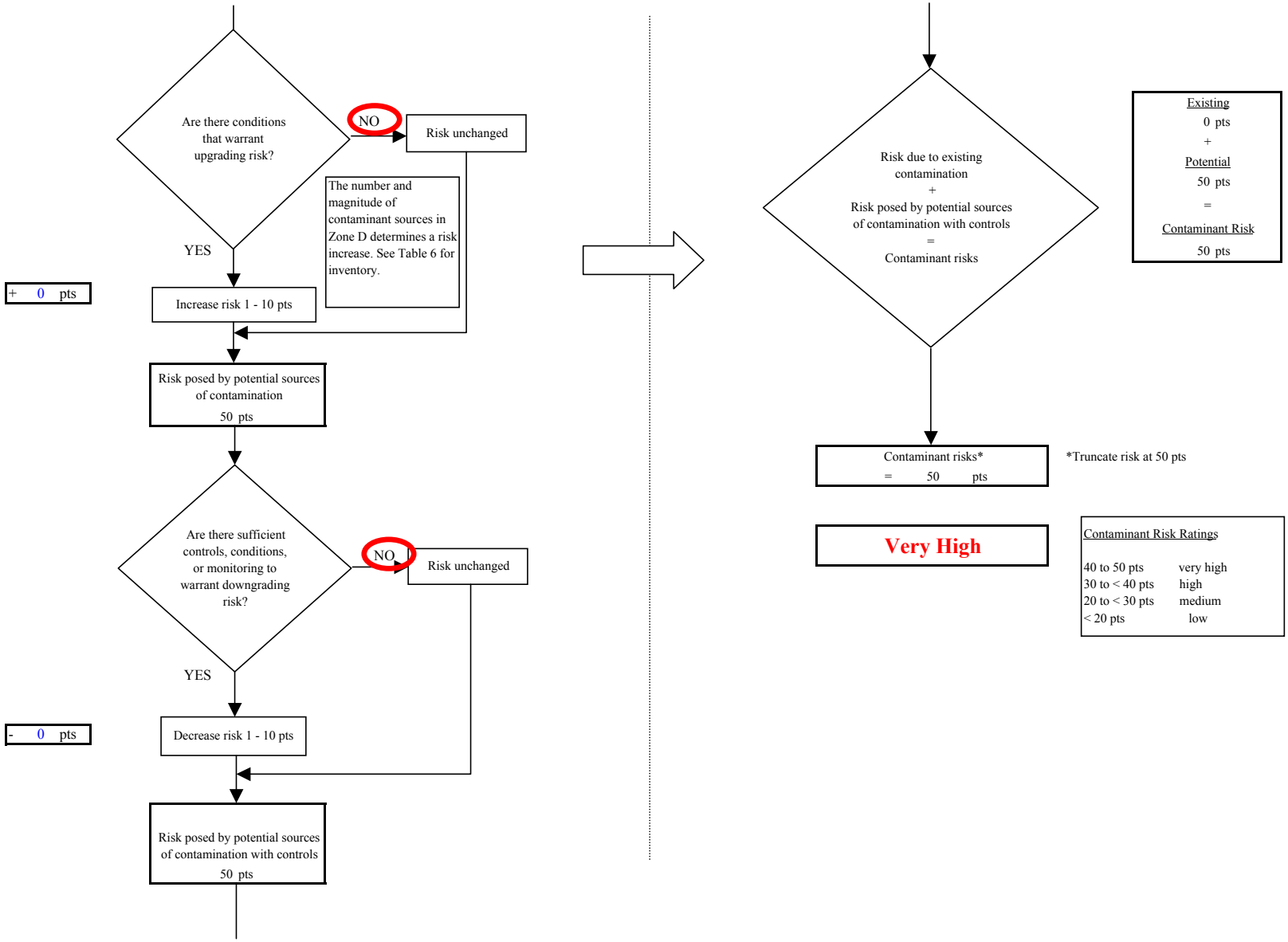


Chart 12. Vulnerability analysis for Kiana Water System (PWS No. 340230.001) - Synthetic Organic Chemicals

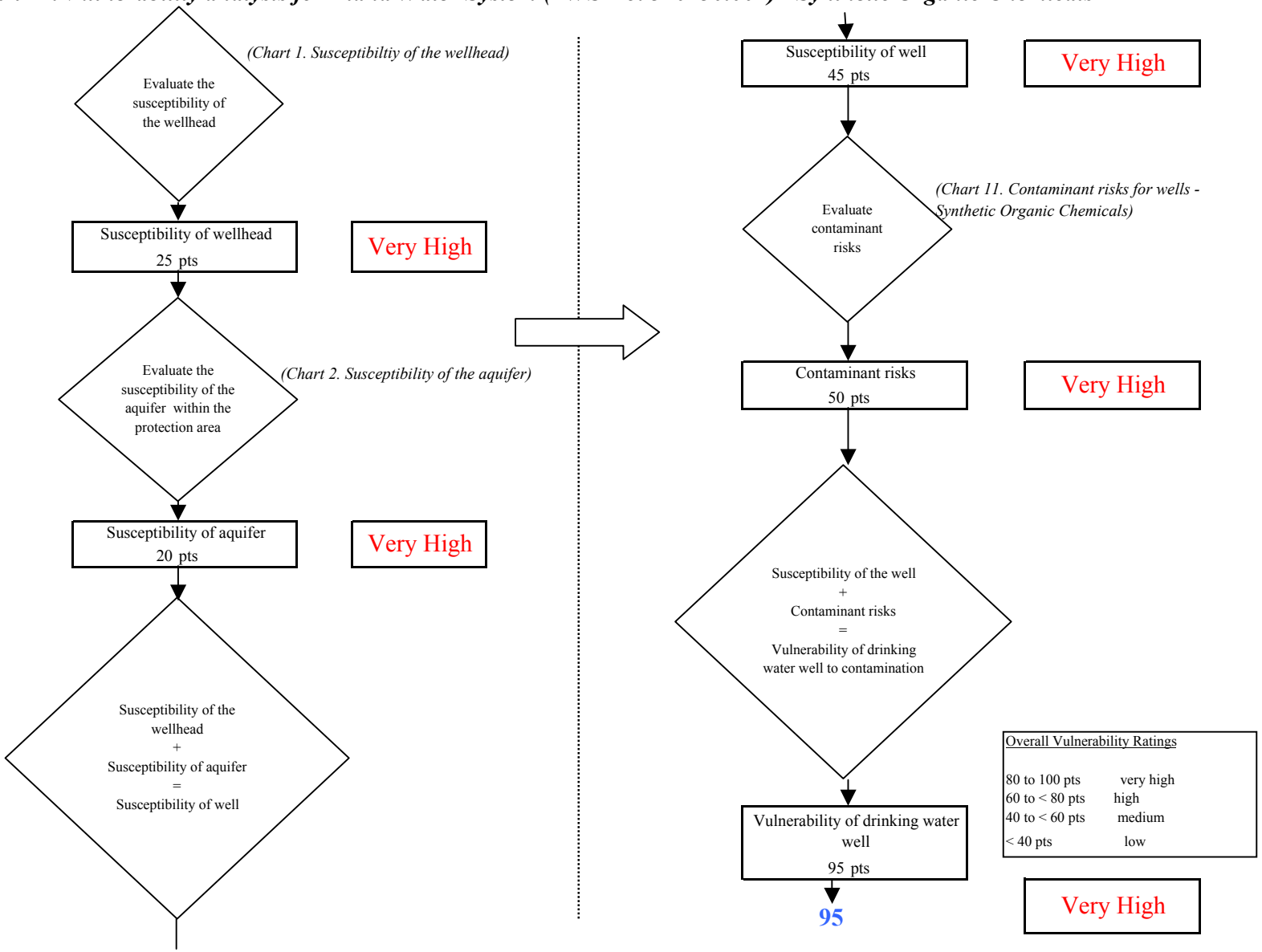


Chart 13. Contaminant risks for Kiana Water System (PWS No. 340230.001) - Other Organic Chemicals

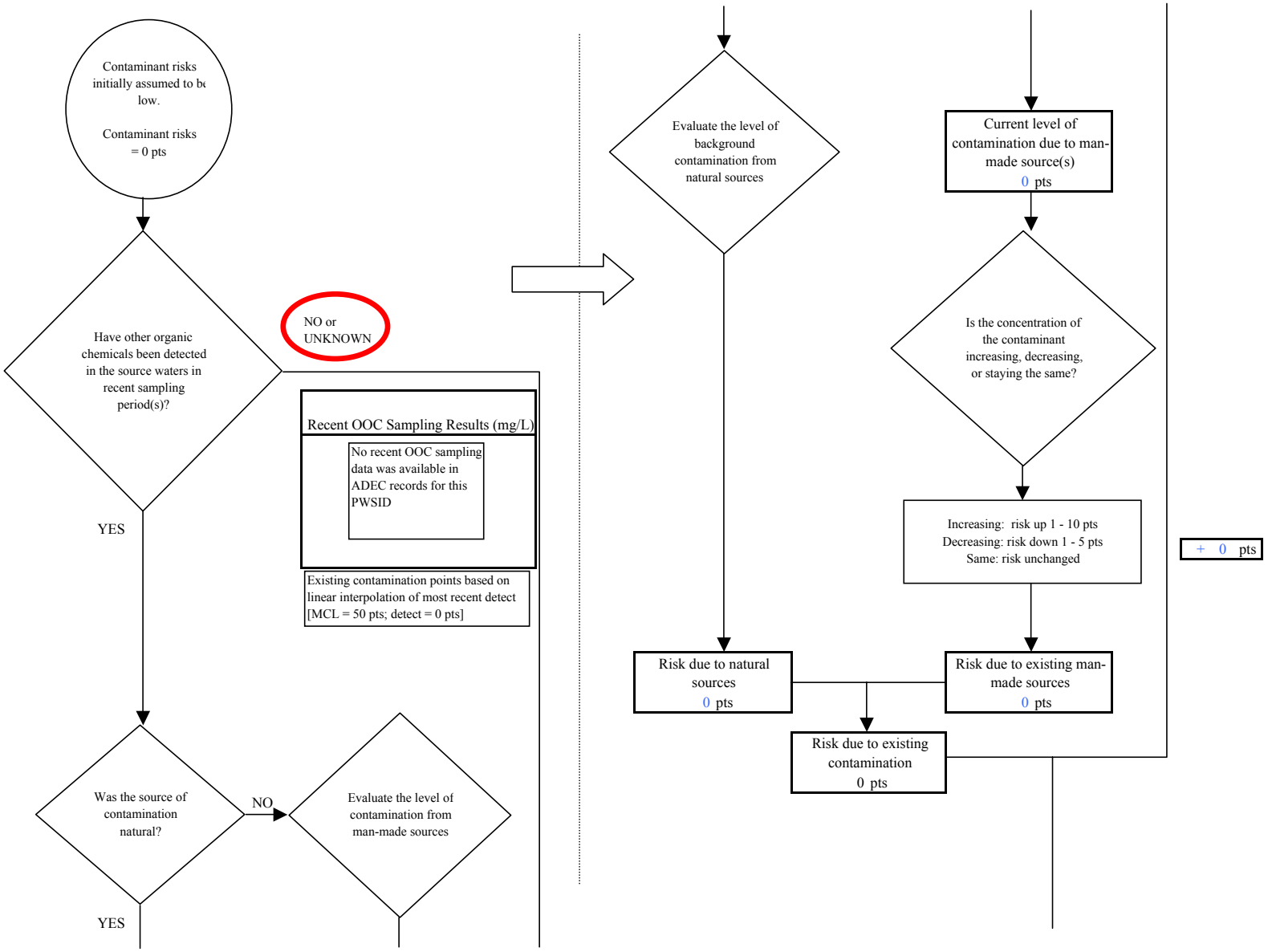
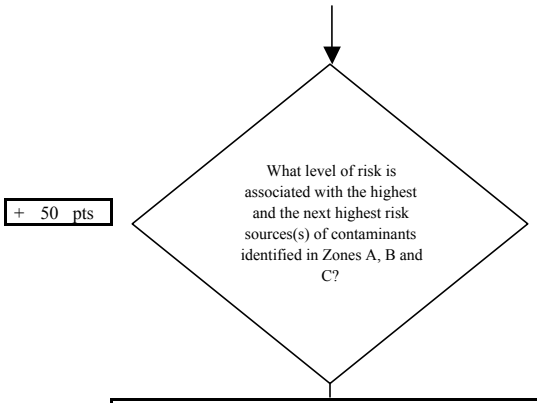


Chart 13. Contaminant risks for Kiana Water System (PWS No. 340230.001) - Other Organic Chemicals



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

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

	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.

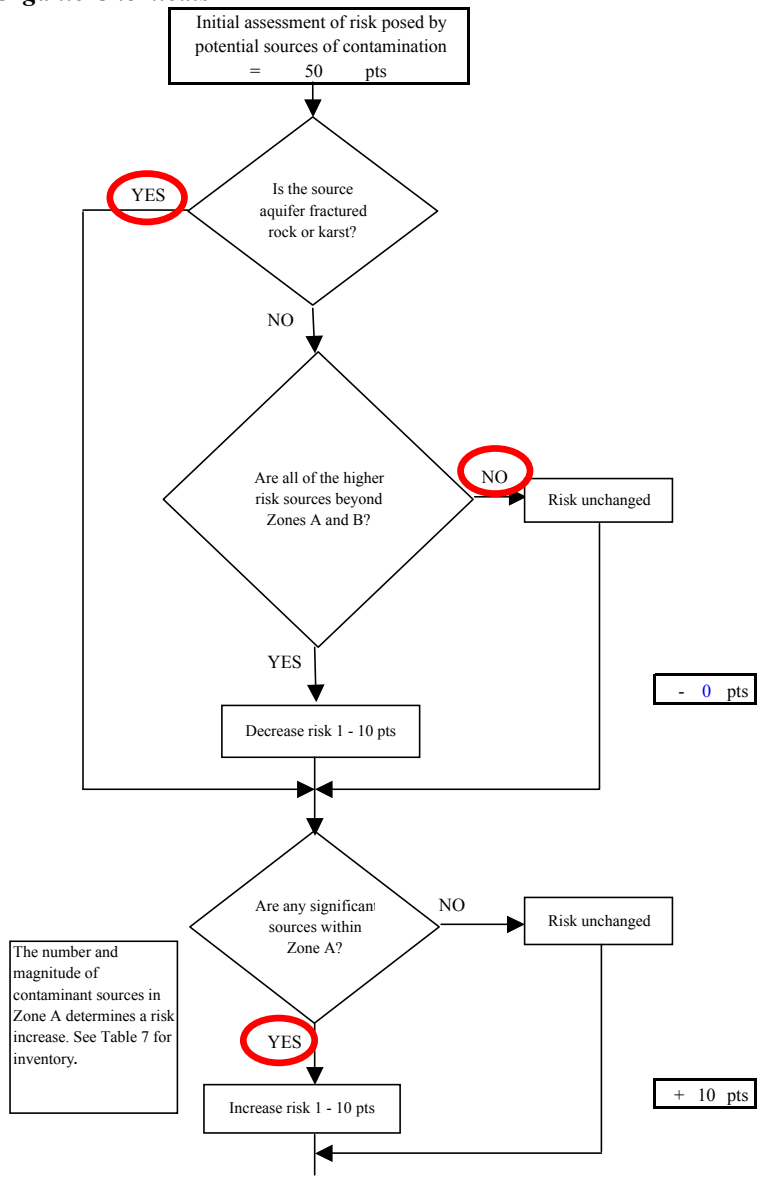


Chart 13. Contaminant risks for Kiana Water System (PWS No. 340230.001) - Other Organic Chemicals

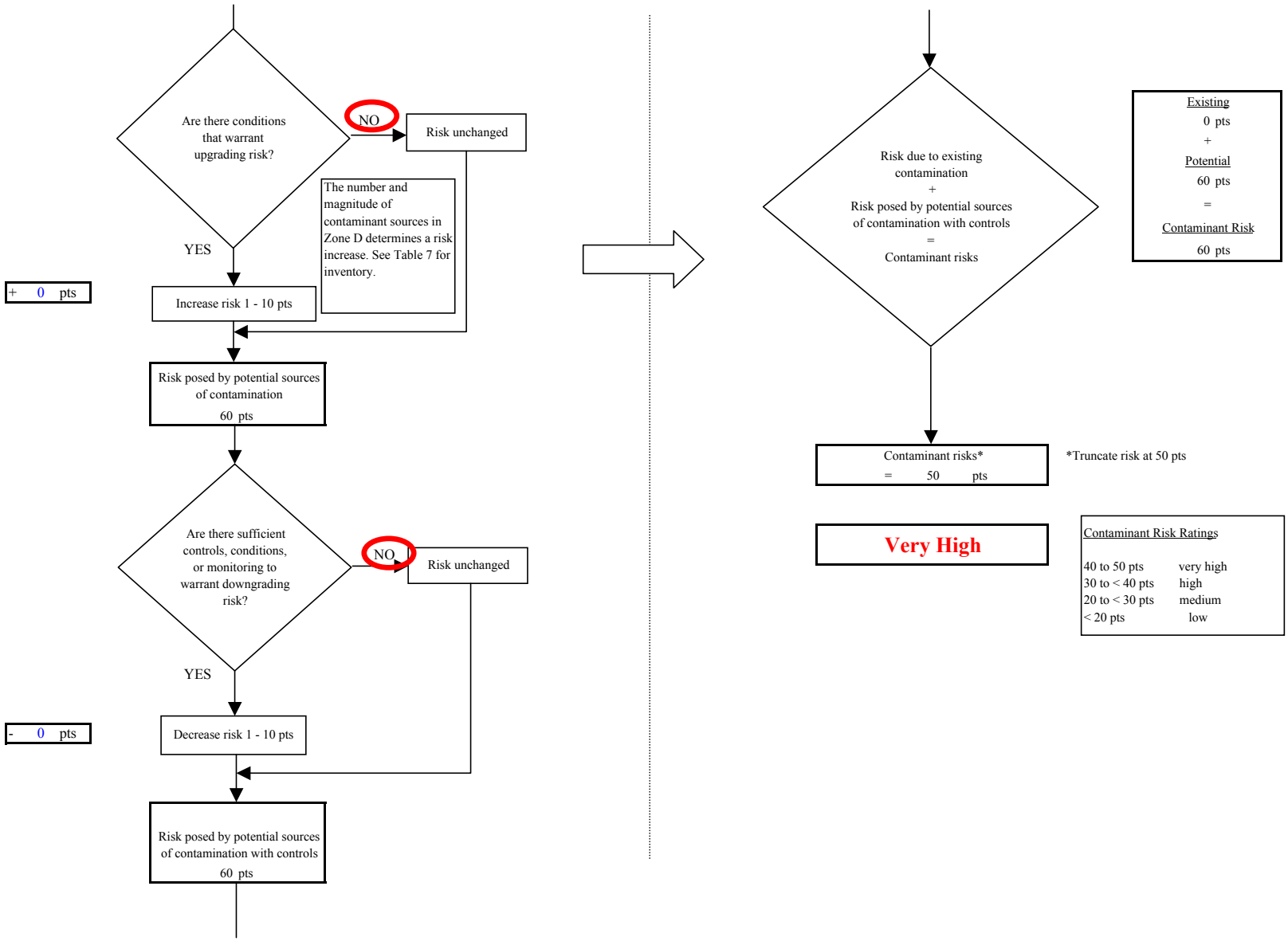


Chart 14. Vulnerability analysis for Kiana Water System (PWS No. 340230.001) - Other Organic Chemicals