Source Water Assessment

A Hydrogeologic Susceptibility and Vulnerability Assessment for the Tetlin Utility System Drinking Water System, Tetlin, Alaska

PWSID # 380638.001

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DRINKING WATER PROTECTION PROGRAM REPORT 1397
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 Tetlin Utility System Source of Public Drinking Water, Tetlin, Alaska

Drinking Water Protection Program
Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

The Tetlin Utility System has one Public Water System (PWS) well. The well (PWS No. 380638.001) has been used as a drinking water source since it was completed in March of 1985.

The well is a Class A (community and non-transient non-community) water system adjacent to the Tetlin River in Tetlin, Alaska. Available records indicate that the system is a watering point only and that it does not have a storage facility. Records also indicate that the drinking water source is untreated. This system operates year round and serves approximately 125 residents. The wellhead received a susceptibility rating of **Medium** and the aquifer received a susceptibility rating of **Very High.** Combining these two ratings produce a **High** rating for the natural susceptibility of the well.

Identified potential and current sources of contaminants for the public drinking water source include: landfills, domestic wastewater treatment processes, aboveground fuel storage tanks, and ADEC recognized contaminated sites. An inventory of potential or existing contamination sources can be found in Appendix B, Table 1. These identified potential and existing sources of contamination are considered sources of bacteria and viruses, nitrates and/or nitrites, volatile organic chemicals, heavy metals, cyanide and other inorganic chemicals, synthetic organic chemicals, and other organic chemicals contaminant categories.

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

PUBLIC DRINKING WATER SYSTEM

The Tetlin Utility System well is a Class A (community/non-transient/non-community) public water system. The system is system is adjacent to the Tetlin River in Tetlin, Alaska. (Sec. 29, T018N, R015E, Copper River Meridian, see Map A of Appendix A). The community of Tetlin is between Tetlin Lake and the Tanana River, 20 miles southeast of Tok. The community has a population of 137 (ADCED, 2003). Average annual precipitation in Tetlin is 11 inches. Temperatures can be as extreme as -71 to 99°F.

The community of Tetlin obtains most of their water supply from the well at the washeteria. The schools use their own well water systems. The majority of the occupied households use honeybuckets or outhouses and all lack complete plumbing (ADCED, 2003). Tetlin receives electrical power from Alaska Power Company; power-generating facilities are diesel powered. The local landfill is operated by the Village Council (ADCED, 2003).

According to information supplied by ADEC for the Tetlin Utility System PWS, the depth of the well is 56.6 feet below the ground surface. Based on available well construction details, the well is assumed to be completed in a confined aquifer and screened. The well is suspected to be located within a floodplain.

Information acquired from a November 2002 sanitary survey for the public water system indicated that the land surface was sloped away from the well. Generally, land surfaces that slope away from the wellhead promote surface water drainage, which reduces the potential of contaminant migration down the well casing annulus. The sanitary survey indicates that the well is grouted according to ADEC regulations. Proper grouting provides added protection against contaminants traveling along the well casing annulus and into source waters.

Tok and the surrounding areas are in the eastern reaches of the Tanana-Kuskokwim Lowland, a broad depression bordering the Alaska Range on the north. Coalescing alluvial fans composed of moderately well-sorted silt, sand and gravel are the principal surficial deposits in the Tok area. The thickness of the unconsolidated material is estimated to be as much as 760 meters. Not all of this thickness is alluvium; however, because alluvial deposits are typically not deposited below sea level. It is likely

that deep sediments in the area are poorly sorted lacustrine, glacial, or marine sediments of low permeability. The area was glaciated in at least three episodes, which is evidenced by the presence of terminal moraines in the Delta and Gerstle River valleys and in the valleys of several small creeks draining the north face of the Alaska Range. Five major soil types exist in the Big Delta area: Salchaket, Jarvis, Nenana, Chena, and Tanana. These soils range in drainage from the somewhat poorly drained Salchaket to well drained Chena. The area lies in the discontinuous permafrost zone (Nelson, 1995).

DRINKING WATER PROTECTION AREA

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

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

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

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

Table 1. Definition of Zones

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

The DWPA for the Tetlin Utility System 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 Tetlin Utility System DWPA. This inventory was completed through a search of agency records and other publicly available information. Potential sources of contamination to the drinking water aquifer include a wide range of categories and types. Potential drinking water contaminants are found within agricultural, residential, commercial, and industrial areas, but can also occur within areas that have little or no development.

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

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

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

RANKING OF CONTAMINANT RISKS

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

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

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

VULNERABILITY OF THE DRINKING WATER SYSTEM

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

- Natural susceptibility, and
- Contaminant risks.

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

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

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

+

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

=

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

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

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

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

Table 2. Susceptibility

	Score	**Rating**
Susceptibility of the Wellhead	10	Medium
Susceptibility of the Aquifer	22	Very High
Natural Susceptibility	32	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:

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

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

Table 3. Contaminant Risks

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

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

Natural Susceptibility (0 – 50 points)

+

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

Contaminant Risks (0 – 50 points)

=

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

Again, rankings are assigned according to a point score:

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	80	Very High
Nitrates and Nitrites	80	Very High
Volatile Organic Chemicals	80	Very High
Heavy Metals, Cyanide and Other Inorganic Chemicals	80	Very High
Synthetic Organic Chemicals	80	Very High
Other Organic Chemicals	80	Very High

Bacteria and Viruses

The contaminant risk for bacteria and viruses is **Very High**. The risk is primarily attributed to the presence of bacteria and viruses in recent sampling events as well as landfills and large capacity domestic wastewater treatment processes in Zone A. Numerous other potential contaminant sources are also found within the protection area (see Table 2 – Appendix B).

Coliforms (a bacteria) are found naturally in the environment and although they aren't necessarily a health threat, they are an indicator of other potentially harmful bacteria in the water, more specifically, fecal coliforms and E. coli, which only come from human and animal fecal waste. Harmful bacteria can cause diarrhea, cramps, nausea, headaches, or other symptoms (EPA, 2003). Positive samples increase the overall vulnerability of the drinking water source, indicating that the source is susceptible to bacteria and virus contamination.

Positive bacteria counts have 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 landfills and domestic wastewater treatment processes in Zone A. Numerous other potential contaminant sources are also found within the protection area (see Table 3 – Appendix B).

Nitrates are very mobile, moving at approximately the same rate as water. The sampling history for this well indicates that nitrates have not been detected in recent sampling events (See Chart 5 - Contaminant Risks for Nitrates and/or Nitrites in Appendix D).

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

Volatile Organic Chemicals

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

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

Aside from being byproducts of the drinking water treatment process, possible sources of volatile organic chemicals include facilities with automobiles, residential areas, fuel tanks, roads, and airports.

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

Heavy Metals, Cyanide and Other Inorganic Chemicals

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

Based on review of recent sampling records for this public water system, low levels of barium have been detected, however has not exceeded its MCL of 2.0 mg/L (see Chart 9 – Contaminant Risks for Heavy Metals, Cyanide, and Other Inorganic Chemicals in Appendix D). Low levels of copper have also been detected. The reported concentrations of copper are likely attributed to the water treatment/conveyance system. No risk point were assigned since the analyte did not exceed 100% of the MCL (1.3 mg/L) in the most recent sampling events.

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

Synthetic Organic Chemicals

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

No recent sampling data was available in ADEC records for the Tetlin Utility System (See Chart 11 – Contaminant Risks for Synthetic Organic Chemicals in Appendix D).

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

Other Organic Chemicals

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

No recent sampling data was available in ADEC records for the Tetlin Utility System (See Chart 13 – Contaminant Risks for Other Organic Chemicals in Appendix D).

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

Using the Source Water Assessment

This assessment of contaminant risks can be used as a foundation for local voluntary protection efforts as well as a basis for the continuous efforts on the part of the community of Tetlin to protect public health. It is anticipated that Source Water Assessments will be updated every five years to reflect any changes in the vulnerability and/or susceptibility of the drinking water source.

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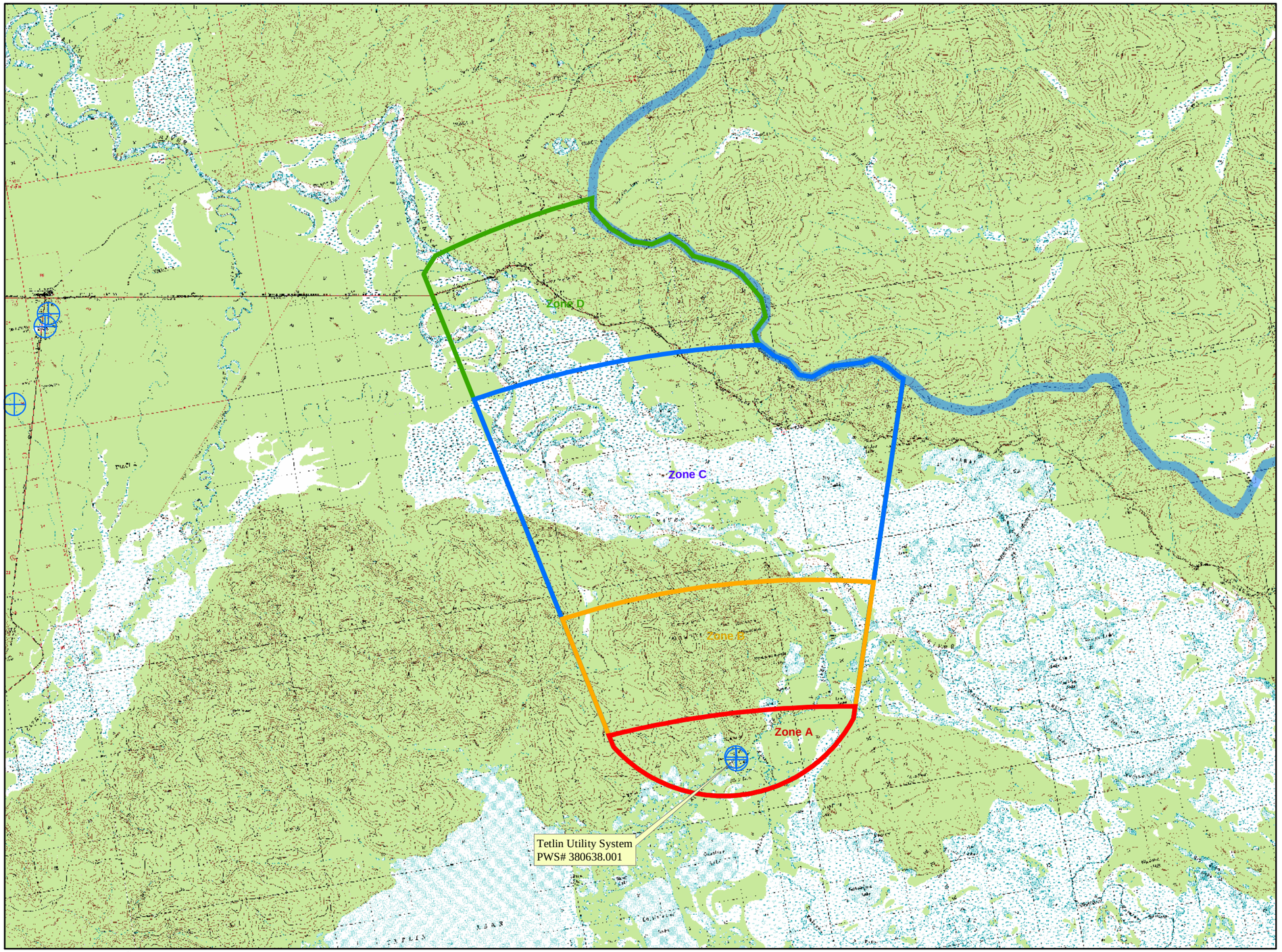
APPENDIX A

Drinking Water Protection Area Location Map
(Map A)

Public Water Well System for PWS #380638.001 Tetlin Utility System



LEGEND

Public Water System Well

Hydrography/Physical

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

Transportation

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

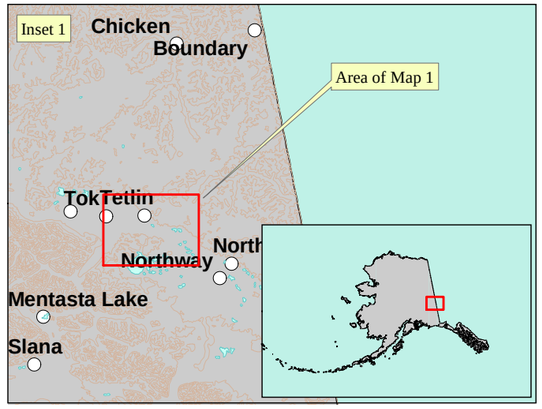
Groundwater Protection Zones

- Zone A Protection Area– Several Months Travel Time
- Zone B Protection Area– 2 Years Travel Time
- Zone 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.



0 1 2 4 6 8 Miles

Tetlin Utility System
PWS 380638.001
Appendix A Map A

APPENDIX B

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

Table 1

Contaminant Source Inventory for ***Tetlin Utility System***

PWSID 380638.00

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Map Number*	*Comments*
Laundromats without dry cleaning	C22	C22-01	A	C	
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-01	A	C	Tetlin Sewage Lagoon
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-03	A	C	
Injection wells (Class V) Large-Capacity Septic System (Drainfie Disposal Method)	D10	D10-01	A	C	AKGATEWAY SD-TETLIN SCHOOL
Landfills (municipal; Class III)	D51	D51-01	A	C	Tetlin Landfill
Landfills (municipal; Class III)	D51	D51-02	A	C	
Tanks, gasoline (above ground)	T10	T10-01	A	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-01	A	C	Fuel tank for clinic, WTP and Council Building
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-01	A	C	Tetlin Utilities Tank Farm
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-02	A	C	Tetlin School Pond
Airports	X14	X14-01	A	C	TETLIN LANDING STRIP
Airports	X14	X14-02	A	C	
Highways and roads, paved (cement or asphalt)	X20	X20-01	A	C	Alyeska Highway
Highways and roads, paved (cement or asphalt)	X20	X20-02	A	C	Taylor Highway
Highways and roads, dirt/gravel	X24	X24-01	A	C	Assume 20 or less roads in Zone A
Highways and roads (winter)	X26	X26-01	A	C	Winter sled trail
Electric power generation (fossil fuels)	X36	X36-01	A	C	Power Generation Facility

Table 2

Contaminant Source Inventory and Risk Ranking for Tetlin Utility System

Sources of Bacteria and Viruses

PWSID 380638.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Laundromats without dry cleaning	C22	C22-01	A	Low	C	
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-01	A	High	C	Tetlin Sewage Lagoon
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-03	A	High	C	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-01	A	High	C	AKGATEWAY SD-TETLIN SCHOOL
Landfills (municipal; Class III)	D51	D51-01	A	High	C	Tetlin Landfill
Landfills (municipal; Class III)	D51	D51-02	A	High	C	
Highways and roads, paved (cement or asphalt)	X20	X20-01	A	Low	C	Alyeska Highway
Highways and roads, paved (cement or asphalt)	X20	X20-02	A	Low	C	Taylor Highway
Highways and roads, dirt/gravel	X24	X24-01	A	Low	C	Assume 20 or less roads in Zone A
Highways and roads (winter)	X26	X26-01	A	Low	C	Winter sled trail
Highways and roads (winter)	X26	X26-01	A	Low	C	Winter sled trail

Table 3

Contaminant Source Inventory and Risk Ranking for Tetlin Utility System
Sources of Nitrates/Nitrites

PWSID 380638.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Laundromats without dry cleaning	C22	C22-01	A	Low	C	
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-01	A	High	C	Tetlin Sewage Lagoon
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-03	A	High	C	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-01	A	High	C	AKGATEWAY SD-TETLIN SCHOOL
Landfills (municipal; Class III)	D51	D51-01	A	Very High	C	Tetlin Landfill
Landfills (municipal; Class III)	D51	D51-02	A	Very High	C	
Airports	X14	X14-01	A	Low	C	TETLIN LANDING STRIP
Airports	X14	X14-02	A	Low	C	
Highways and roads, paved (cement or asphalt)	X20	X20-01	A	Low	C	Alyeska Highway
Highways and roads, paved (cement or asphalt)	X20	X20-02	A	Low	C	Taylor Highway
Highways and roads, dirt/gravel	X24	X24-01	A	Low	C	Assume 20 or less roads in Zone A
Highways and roads (winter)	X26	X26-01	A	Low	C	Winter sled trail
Highways and roads (winter)	X26	X26-01	A	Low	C	Winter sled trail

Table 4

Contaminant Source Inventory and Risk Ranking for Tetlin Utility System

Sources of Volatile Organic Chemicals

PWSID 380638.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Laundromats without dry cleaning	C22	C22-01	A	Low	C	
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-01	A	Low	C	Tetlin Sewage Lagoon
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-03	A	Low	C	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-01	A	Low	C	AKGATEWAY SD-TETLIN SCHOOL
Landfills (municipal; Class III)	D51	D51-01	A	High	C	Tetlin Landfill
Landfills (municipal; Class III)	D51	D51-02	A	High	C	
Tanks, gasoline (above ground)	T10	T10-01	A	Medium	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-01	A	Low	C	Fuel tank for clinic, WTP and Council Building
Contaminated sites, DEC recognized, non-Superfun non-RCRA	U04	U04-01	A	High	C	Tetlin Utilities Tank Farm
Contaminated sites, DEC recognized, non-Superfun non-RCRA	U04	U04-02	A	High	C	Tetlin School Pond
Airports	X14	X14-01	A	High	C	TETLIN LANDING STRIP
Airports	X14	X14-02	A	High	C	
Highways and roads, paved (cement or asphalt)	X20	X20-01	A	Low	C	Alyeska Highway
Highways and roads, paved (cement or asphalt)	X20	X20-02	A	Low	C	Taylor Highway
Highways and roads, dirt/gravel	X24	X24-01	A	Low	C	Assume 20 or less roads in Zone A
Highways and roads (winter)	X26	X26-01	A	Low	C	Winter sled trail
Highways and roads (winter)	X26	X26-01	A	Low	C	Winter sled trail
Electric power generation (fossil fuels)	X36	X36-01	A	Medium	C	Power Generation Facility

Table 5

Contaminant Source Inventory and Risk Ranking for Tetlin Utility System

Sources of Heavy Metals, Cyanide and Other Inorganic Chemicals

PWSID 380638.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-01	A	Low	C	Tetlin Sewage Lagoon
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-03	A	Low	C	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-01	A	Low	C	AKGATEWAY SD-TETLIN SCHOOL
Landfills (municipal; Class III)	D51	D51-01	A	High	C	Tetlin Landfill
Landfills (municipal; Class III)	D51	D51-02	A	High	C	
Tanks, gasoline (above ground)	T10	T10-01	A	Medium	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-01	A	Low	C	Fuel tank for clinic, WTP and Council Building
Contaminated sites, DEC recognized, non-Superfun non-RCRA	U04	U04-01	A	Low	C	Tetlin Utilities Tank Farm
Contaminated sites, DEC recognized, non-Superfun non-RCRA	U04	U04-02	A	Low	C	Tetlin School Pond
Airports	X14	X14-01	A	Low	C	TETLIN LANDING STRIP
Airports	X14	X14-02	A	Low	C	
Highways and roads, paved (cement or asphalt)	X20	X20-01	A	Low	C	Alyeska Highway
Highways and roads, paved (cement or asphalt)	X20	X20-02	A	Low	C	Taylor Highway
Highways and roads, dirt/gravel	X24	X24-01	A	Low	C	Assume 20 or less roads in Zone A
Highways and roads (winter)	X26	X26-01	A	Low	C	Winter sled trail
Highways and roads (winter)	X26	X26-01	A	Low	C	Winter sled trail
Electric power generation (fossil fuels)	X36	X36-01	A	Medium	C	Power Generation Facility

Table 6

Contaminant Source Inventory and Risk Ranking for Tetlin Utility System
Sources of Synthetic Organic Chemicals

PWSID 380638.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-01	A	Low	C	Tetlin Sewage Lagoon
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-03	A	Low	C	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-01	A	Low	C	AKGATEWAY SD-TETLIN SCHOOL
Landfills (municipal; Class III)	D51	D51-01	A	Very High	C	Tetlin Landfill
Landfills (municipal; Class III)	D51	D51-02	A	Very High	C	
Contaminated sites, DEC recognized, non-Superfun non-RCRA	U04	U04-01	A	Low	C	Tetlin Utilities Tank Farm
Contaminated sites, DEC recognized, non-Superfun non-RCRA	U04	U04-02	A	Low	C	Tetlin School Pond
Airports	X14	X14-01	A	Medium	C	TETLIN LANDING STRIP
Airports	X14	X14-02	A	Medium	C	

Table 7

Contaminant Source Inventory and Risk Ranking for Tetlin Utility System

Sources of Other Organic Chemicals

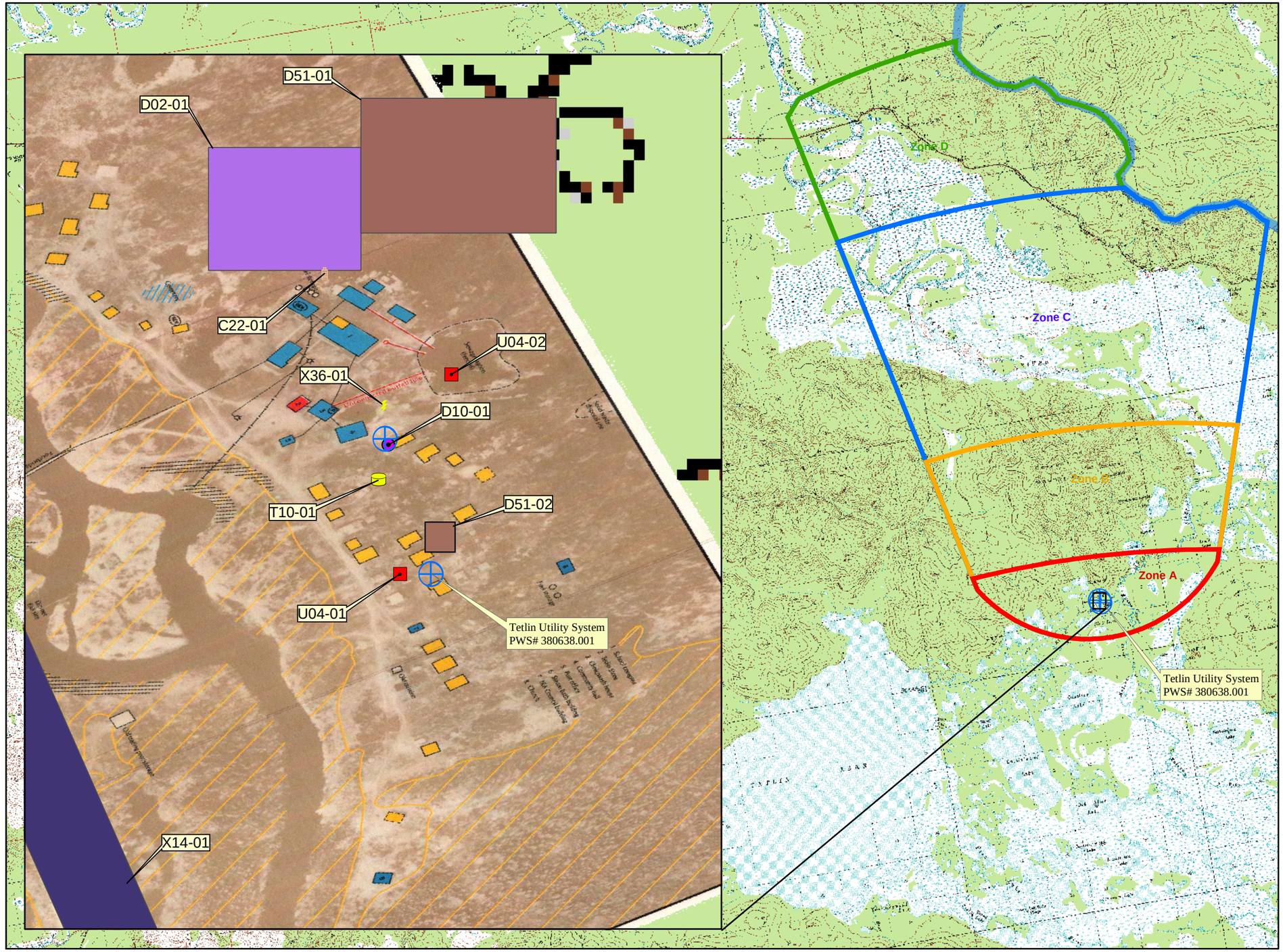
PWSID 380638.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-01	A	Low	C	Tetlin Sewage Lagoon
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-03	A	Low	C	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-01	A	Low	C	AKGATEWAY SD-TETLIN SCHOOL
Landfills (municipal; Class III)	D51	D51-01	A	Very High	C	Tetlin Landfill
Landfills (municipal; Class III)	D51	D51-02	A	Very High	C	
Contaminated sites, DEC recognized, non-Superfun non-RCRA	U04	U04-01	A	Low	C	Tetlin Utilities Tank Farm
Contaminated sites, DEC recognized, non-Superfun non-RCRA	U04	U04-02	A	Low	C	Tetlin School Pond
Airports	X14	X14-01	A	Medium	C	TETLIN LANDING STRIP
Airports	X14	X14-02	A	Medium	C	
Highways and roads, paved (cement or asphalt)	X20	X20-01	A	Low	C	Alyeska Highway
Highways and roads, paved (cement or asphalt)	X20	X20-02	A	Low	C	Taylor Highway
Highways and roads, dirt/gravel	X24	X24-01	A	Low	C	Assume 20 or less roads in Zone A
Highways and roads (winter)	X26	X26-01	A	Low	C	Winter sled trail
Electric power generation (fossil fuels)	X36	X36-01	A	High	C	Power Generation Facility

APPENDIX C

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

Public Water Well System for PWS #380638.001 Tetlin Utility System
Potential and Existing Sources of Contamination



LEGEND

Public Water System Well

Hydrography/Physical

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

Transportation

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

Groundwater Protection Zones

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

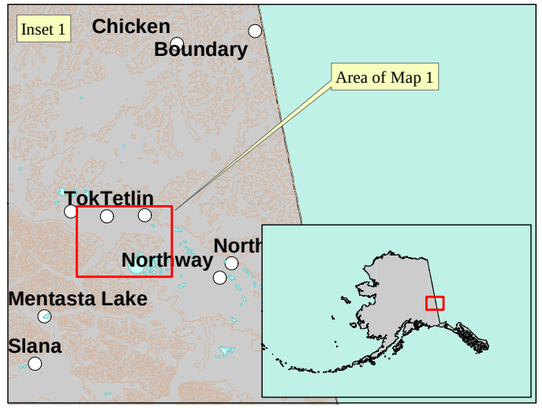
Existing or Potential Contaminant Sources

- Laundromats without dry cleaning (C22)
- Injection Wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method) (D10)
- Tanks, gasoline (aboveground) (T10)
- Tanks, heating oil, nonresidential (aboveground) (T14)
- Contaminated sites, DEC recognized, non-Superfund, non-RCRA (U04)
- Electric Power Generation (fossil fuels) (X36)
- Domestic Wastewater Treatment pond or lagoon (D02)
- Landfill, 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.



0 1 2 4 6 8 Miles

Tetlin Utility System
PWS 380638.001
Appendix C Map C

APPENDIX D

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

Chart 1. Susceptibility of the wellhead - Tetlin Utility System (PWS No. 380638.001)

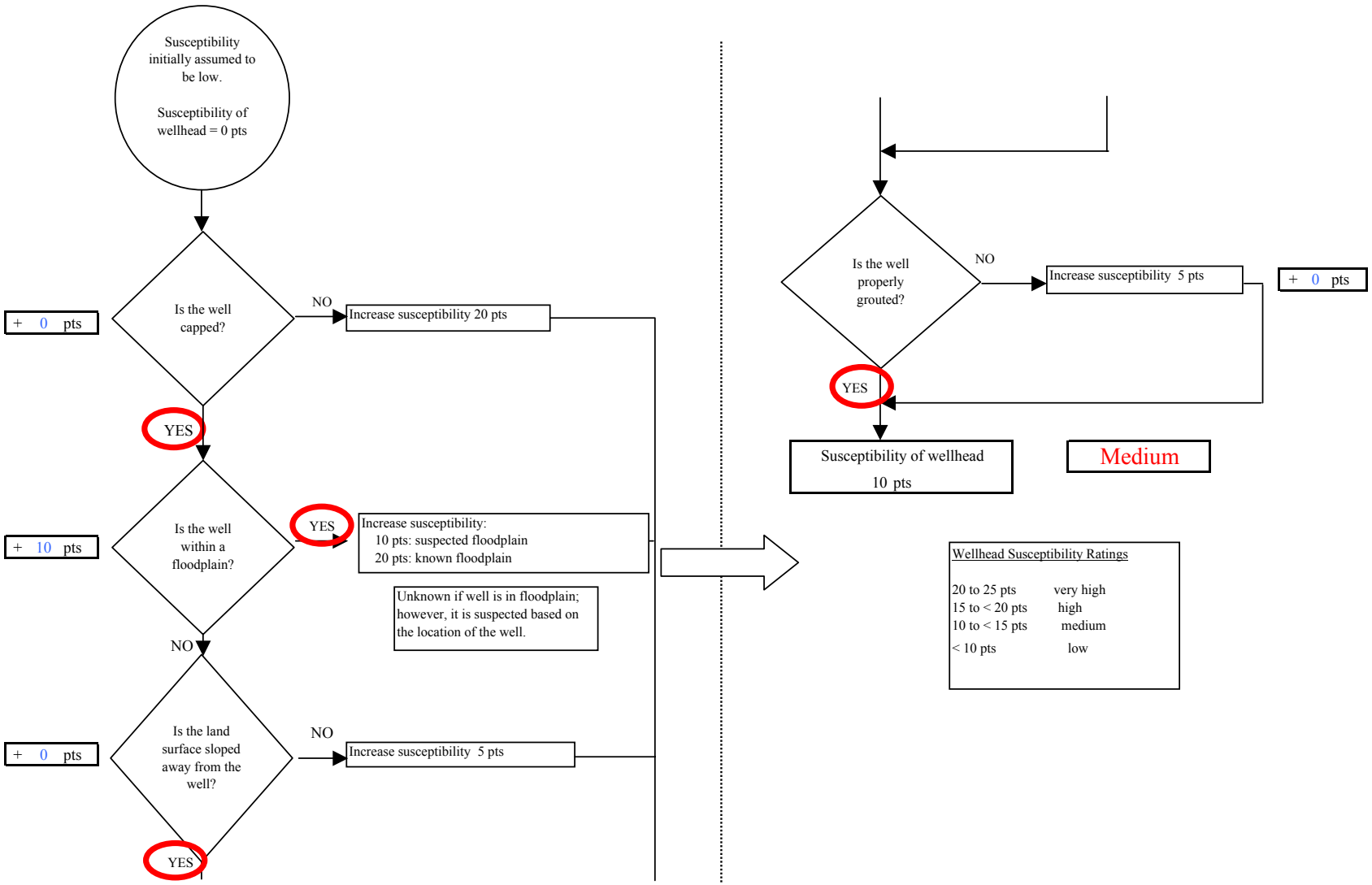


Chart 2. Susceptibility of the aquifer Tetlin Utility System (PWS No. 380638.001)

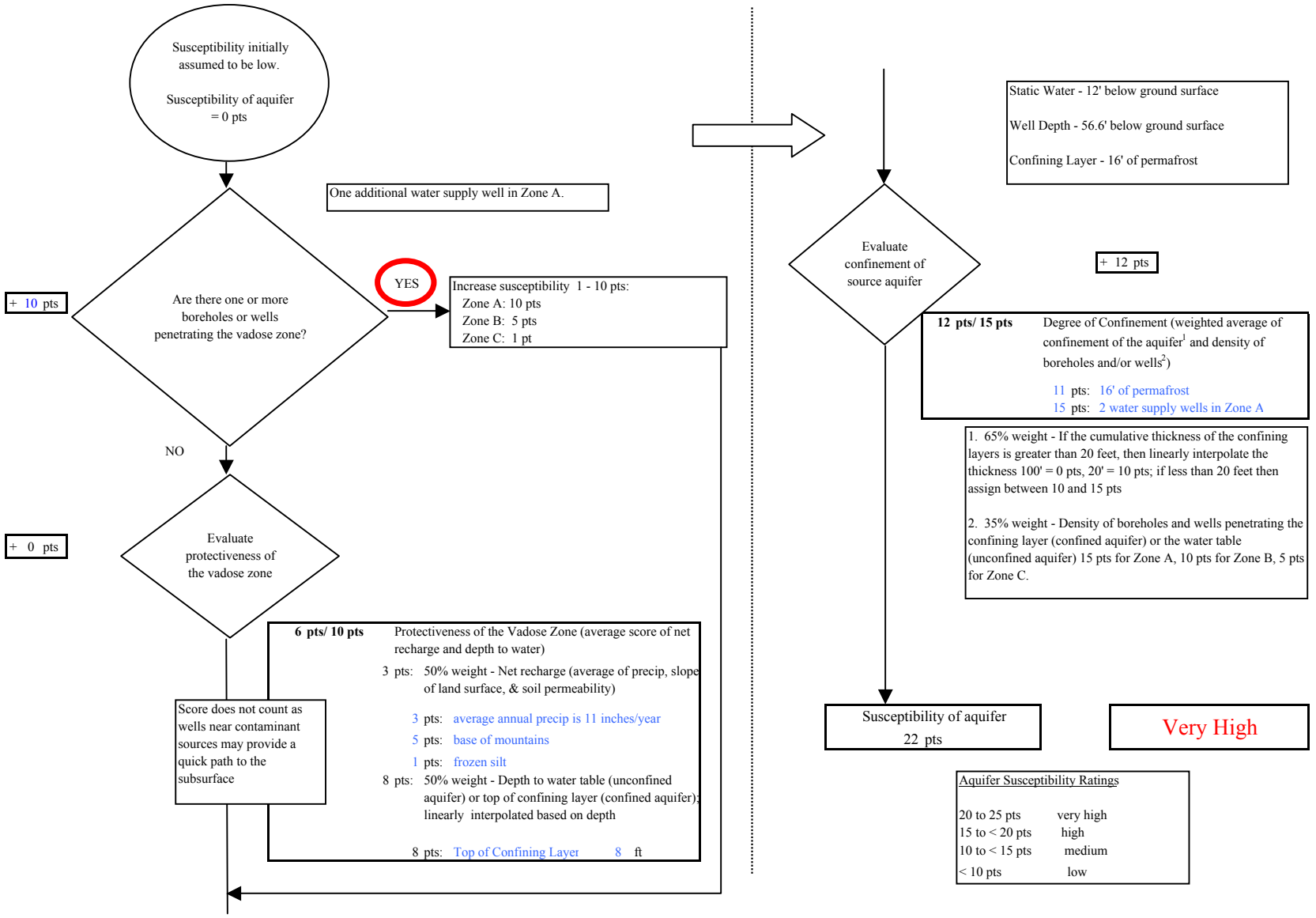
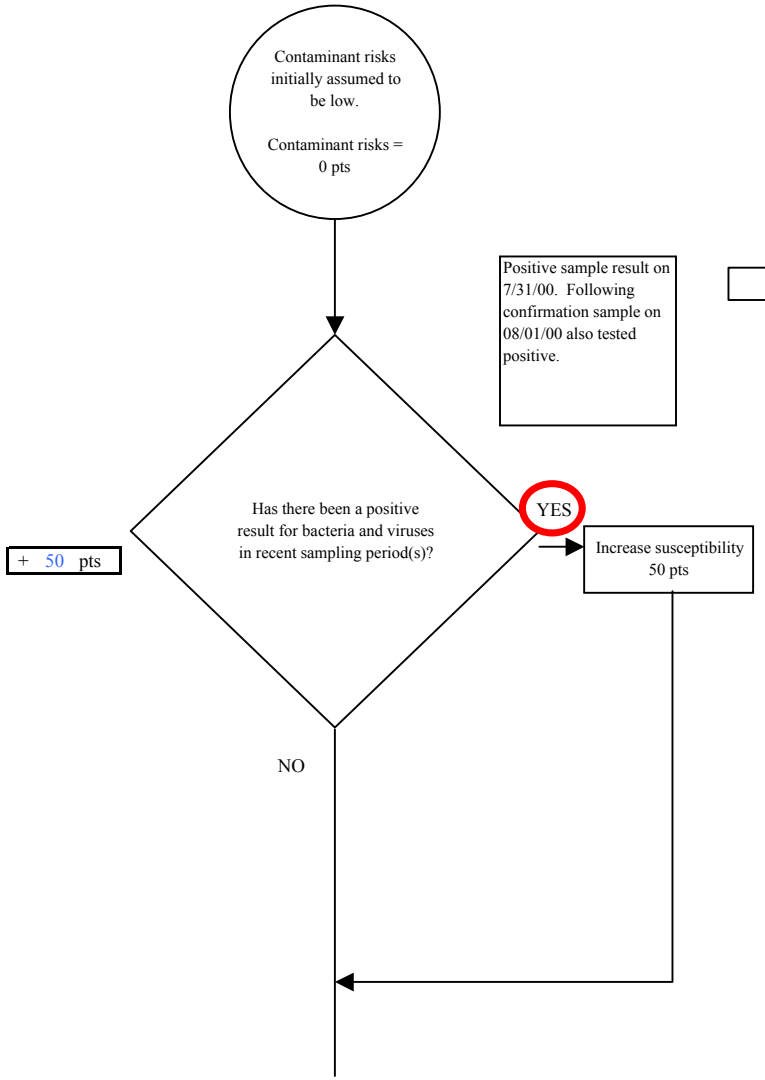
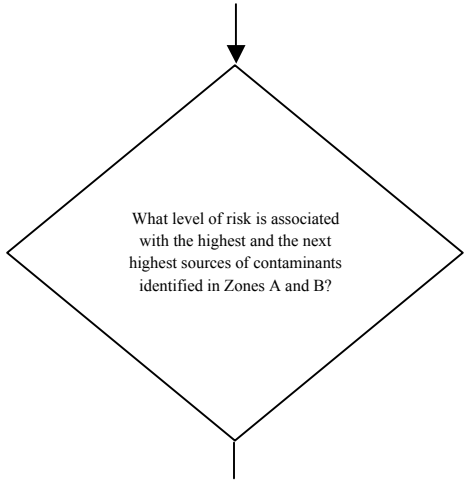


Chart 3. Contaminant risks for Tetlin Utility System (PWS No. 380638.001) - Bacteria & Viruses





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

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

Matrix Score 40

Note: Septic systems, sewerlines, and roads are each assigned a risk ranking for each 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 Tetlin Utility System (PWS No. 380638.001) - Bacteria & Viruses

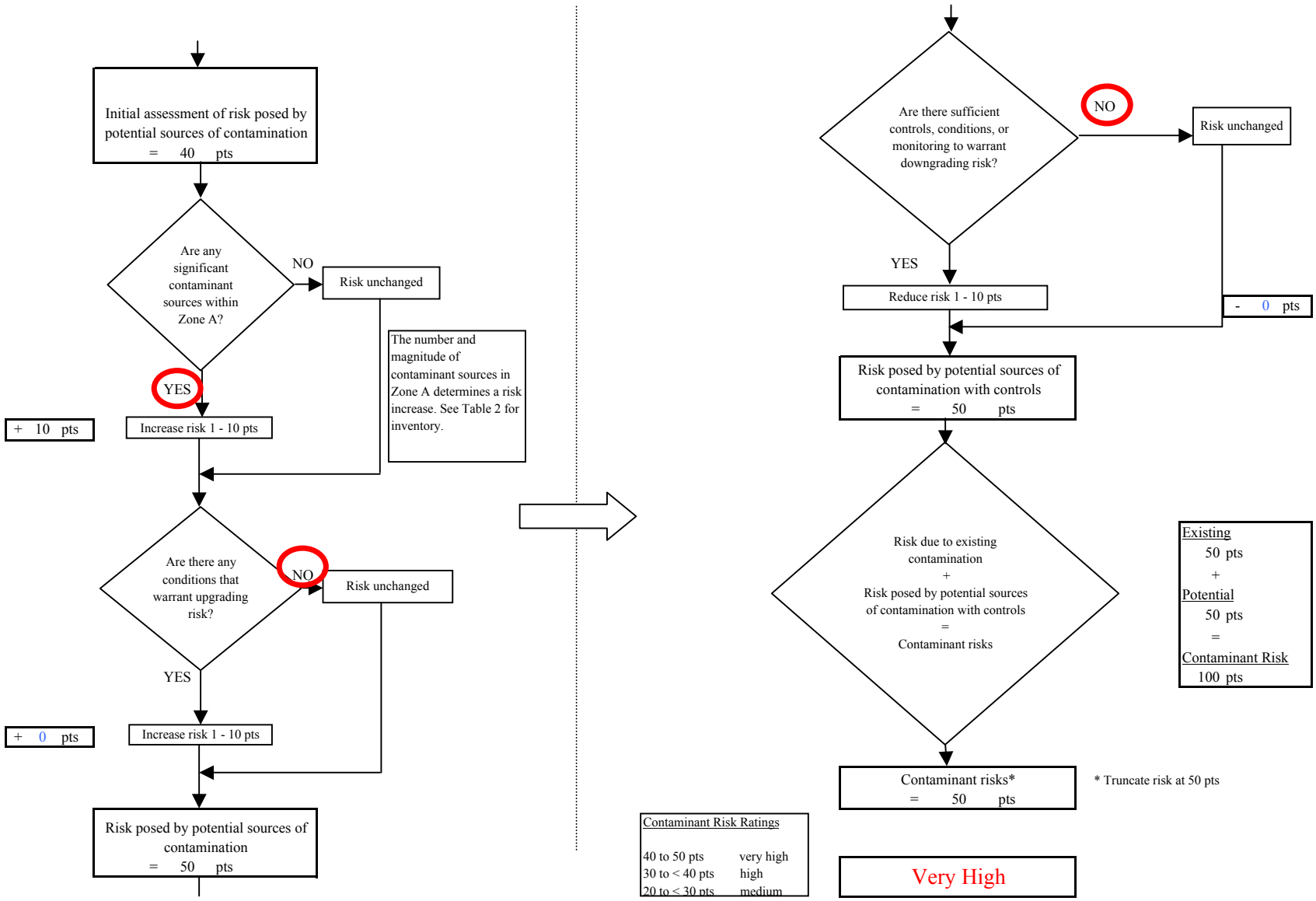


Chart 4. Vulnerability analysis for Tetlin Utility System (PWS No. 380638.001) - Bacteria & Viruses

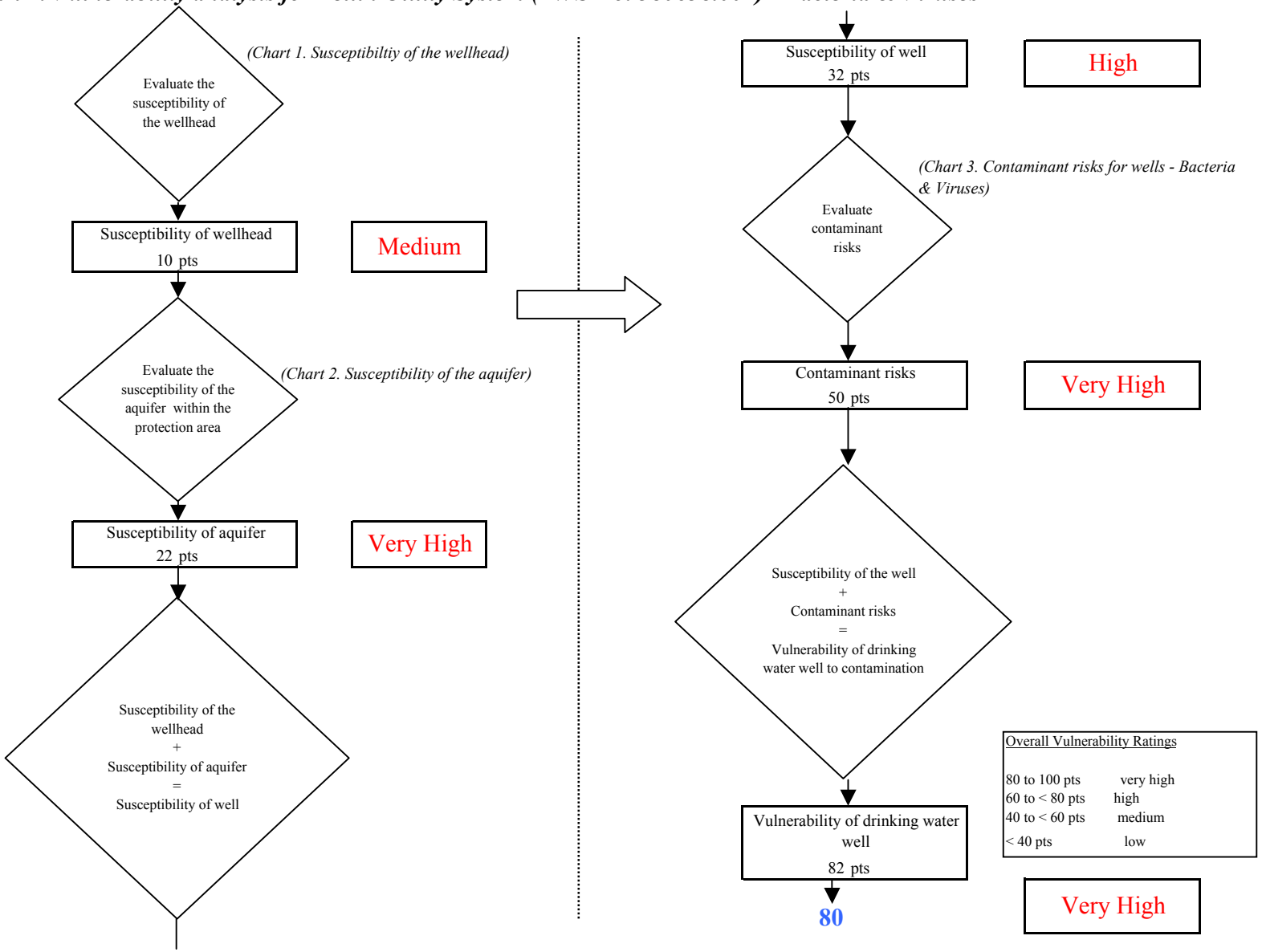


Chart 5. Contaminant risks for Tetlin Utility System (PWS No. 380638.001) - Nitrates and Nitrites

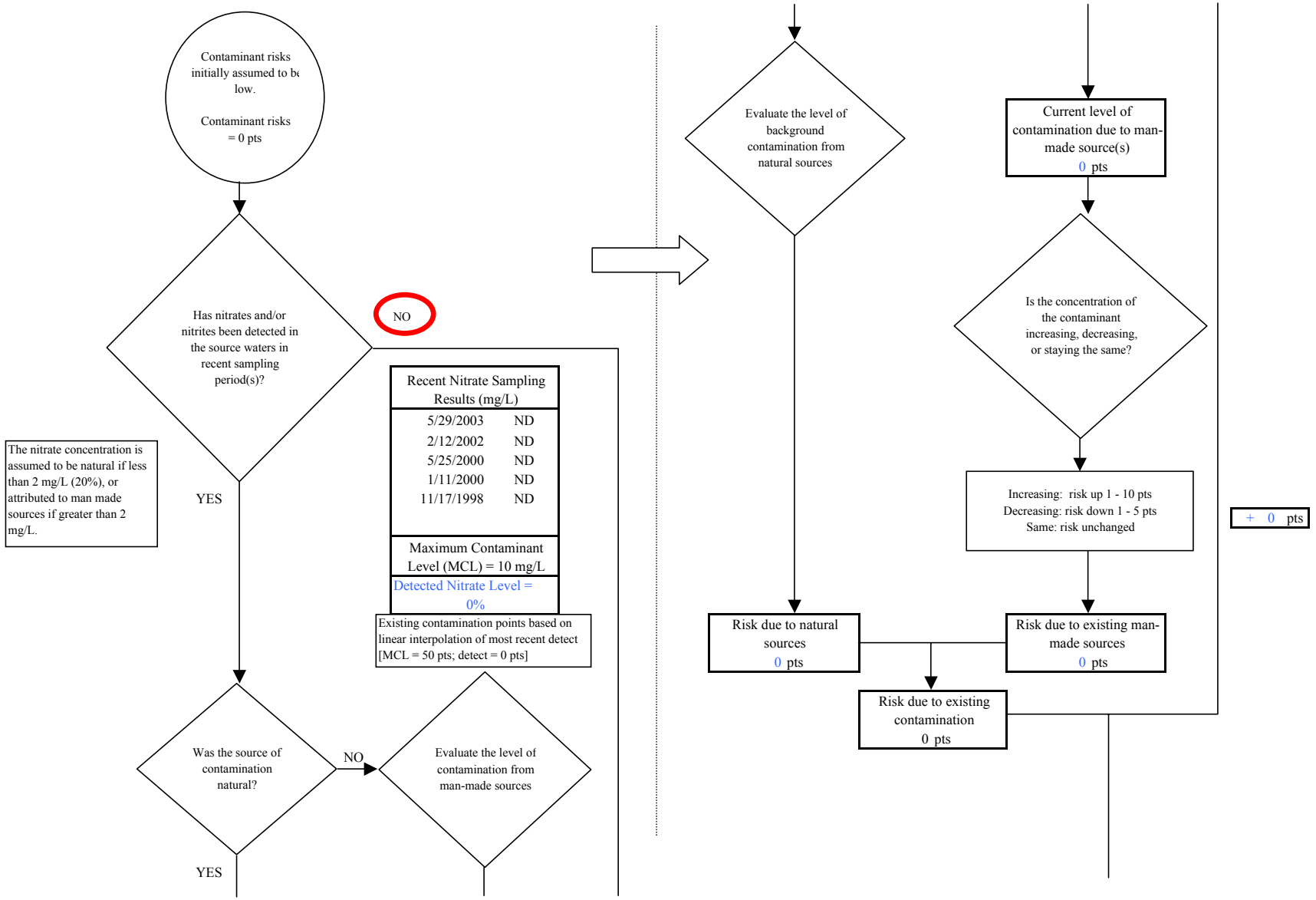


Chart 5. Contaminant risks for Tetlin Utility System (PWS No. 380638.001) - Nitrates and Nitrites

+ 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)	2	0	2
High(s)	3	0	3
Medium(s)	0	0	0
Low(s)	4	0	4

	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 Tetlin Utility System (PWS No. 380638.001) - Nitrates and Nitrites

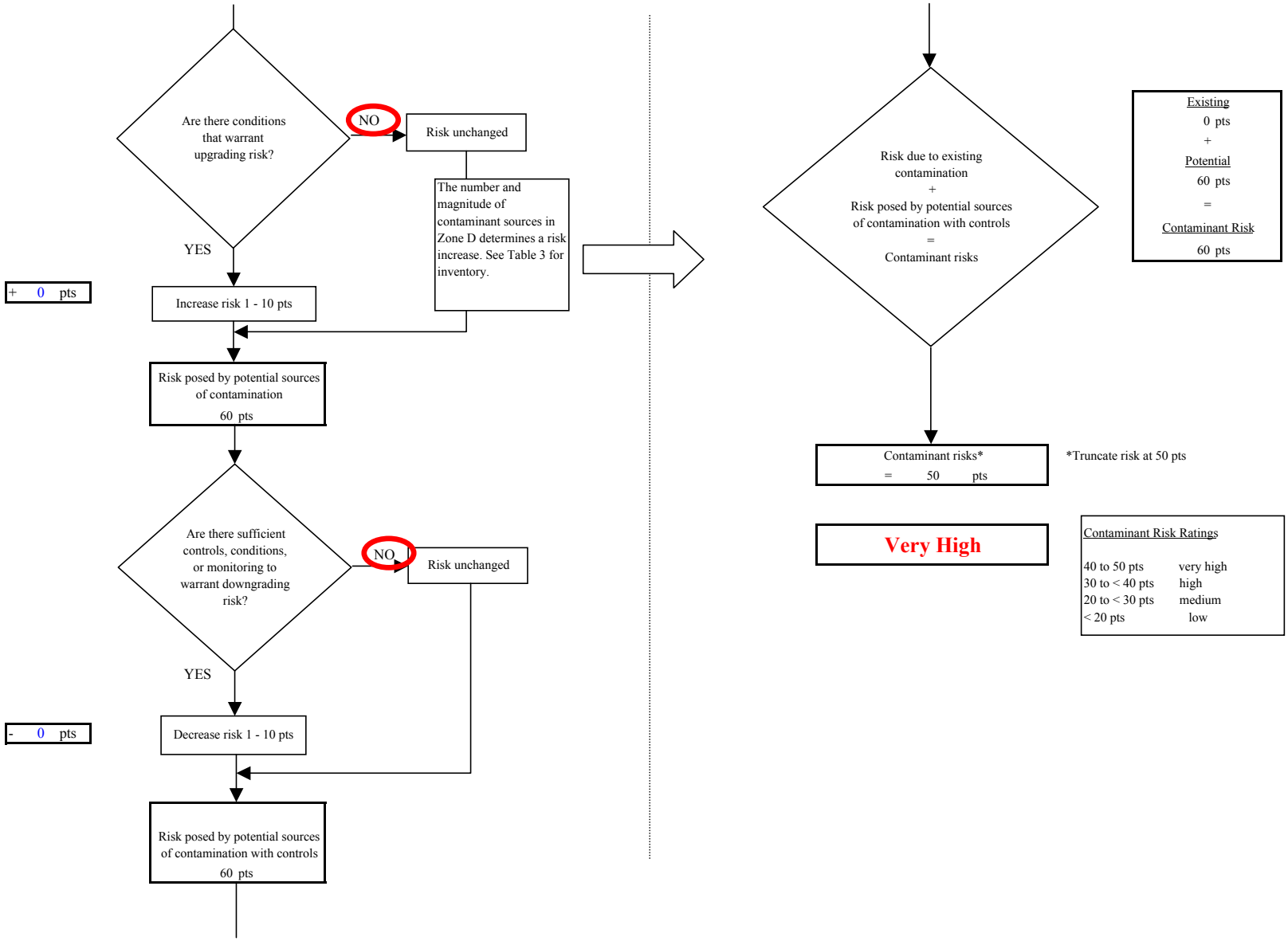


Chart 6. Vulnerability analysis for Tetlin Utility System (PWS No. 380638.001) - Nitrates and Nitrites

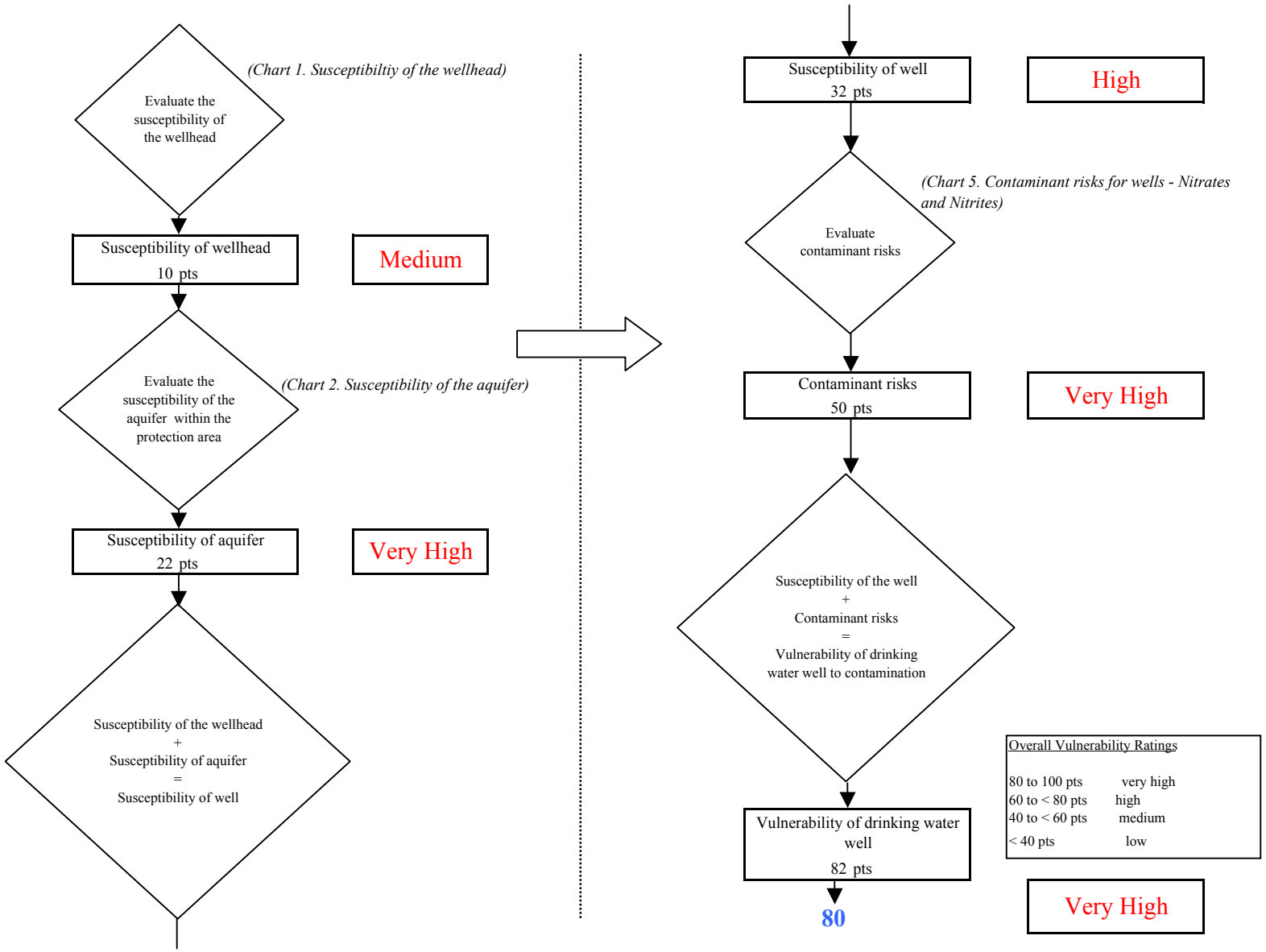


Chart 7. Contaminant risks for Tetlin Utility System (PWS No. 380638.001) - Volatile Organic Chemicals

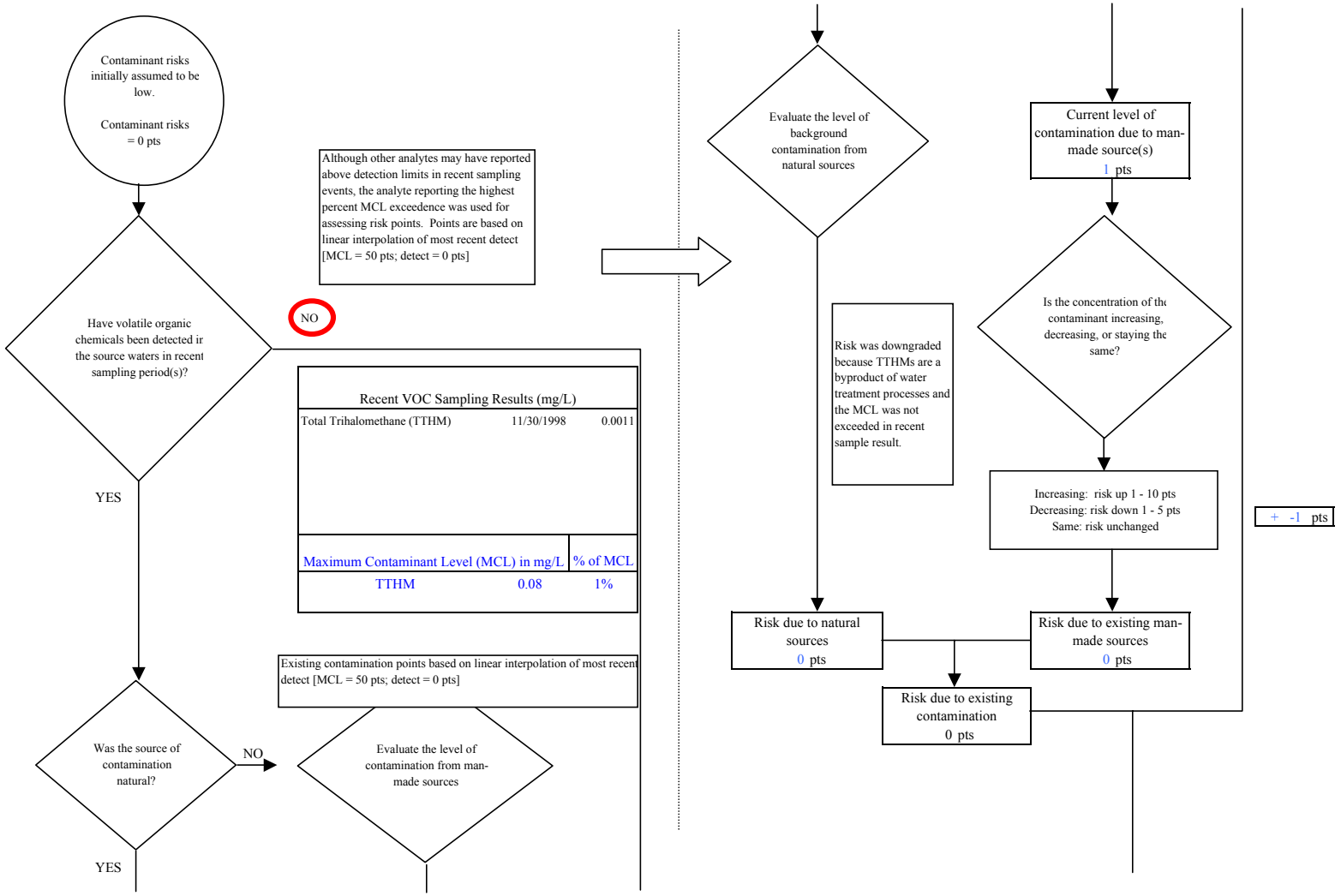
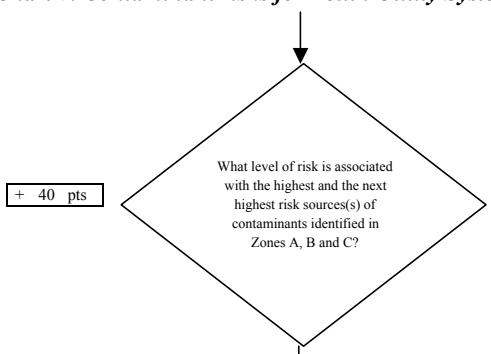


Chart 7. Contaminant risks for Tetlin Utility System (PWS No. 380638.001) - Volatile Organic Chemicals



+ 40 pts

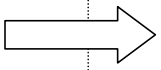
Risk Levels for Contaminant Sources identified in Zones A, B and C

	Zone A	Zones B&C	Total
Very Highs(s)	0	0	0
High(s)	6	0	6
Medium(s)	2	0	2
Low(s)	6	0	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 40

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



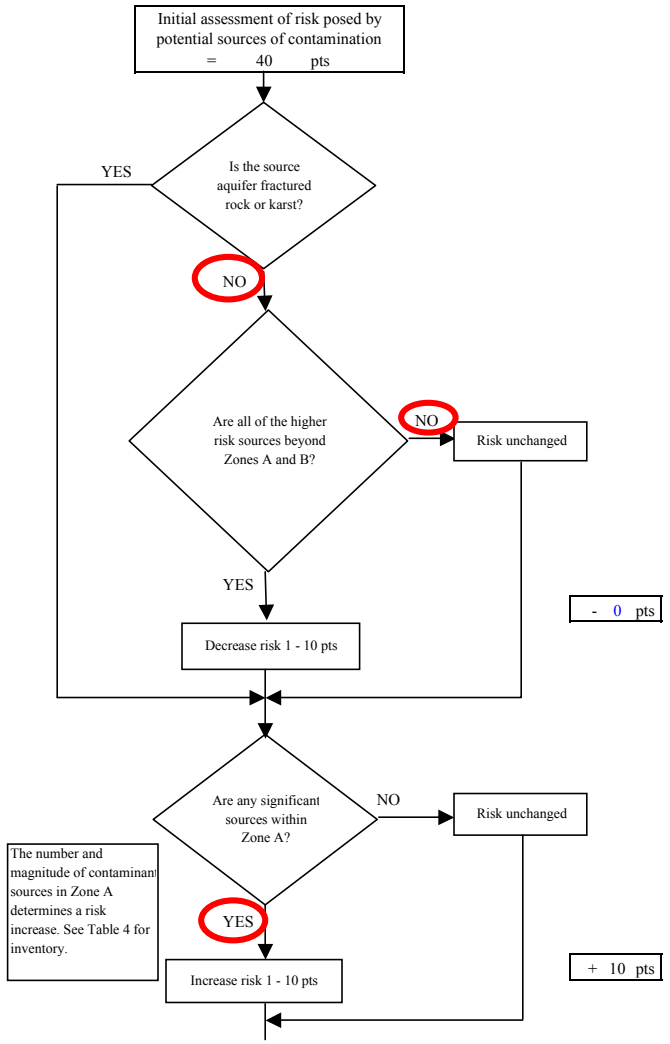


Chart 7. Contaminant risks for Tetlin Utility System (PWS No. 380638.001) - Volatile Organic Chemicals

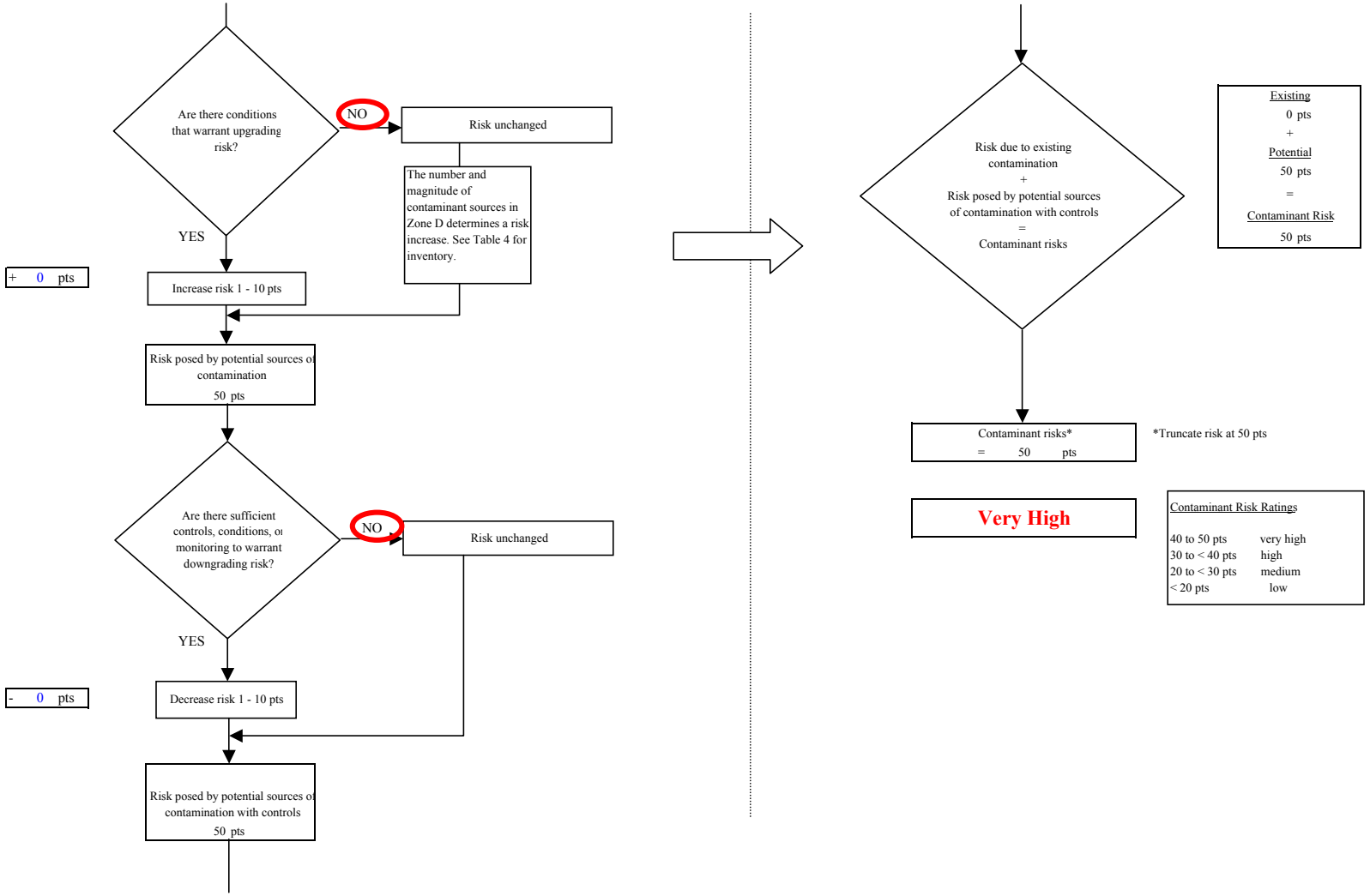


Chart 8. Vulnerability analysis for Tetlin Utility System (PWS No. 380638.001) - Volatile Organic Chemicals

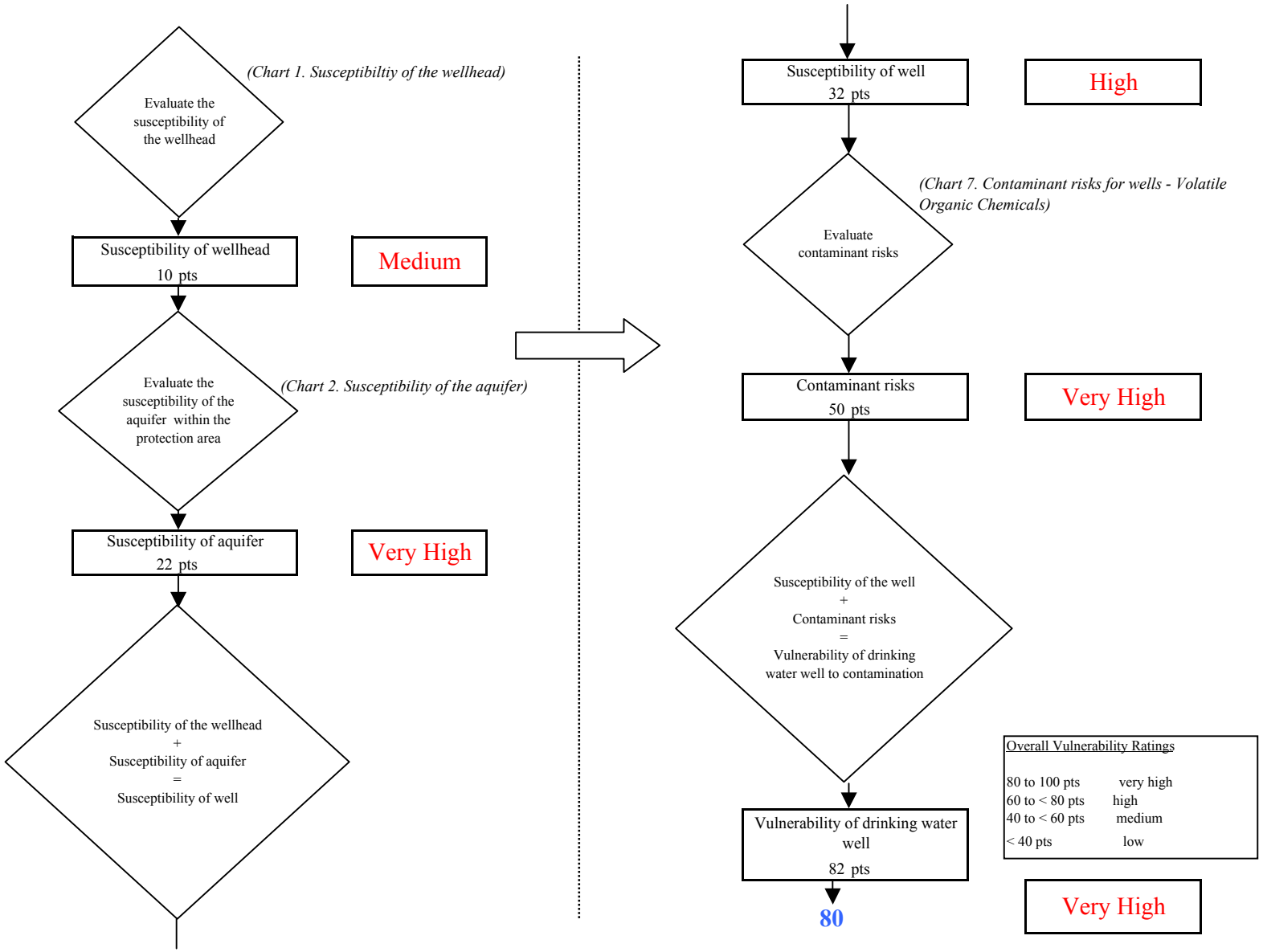


Chart 9. Contaminant risks for Tetlin Utility System (PWS No. 380638.001) - Heavy Metals, Cyanide and Other Inorganic Chemicals

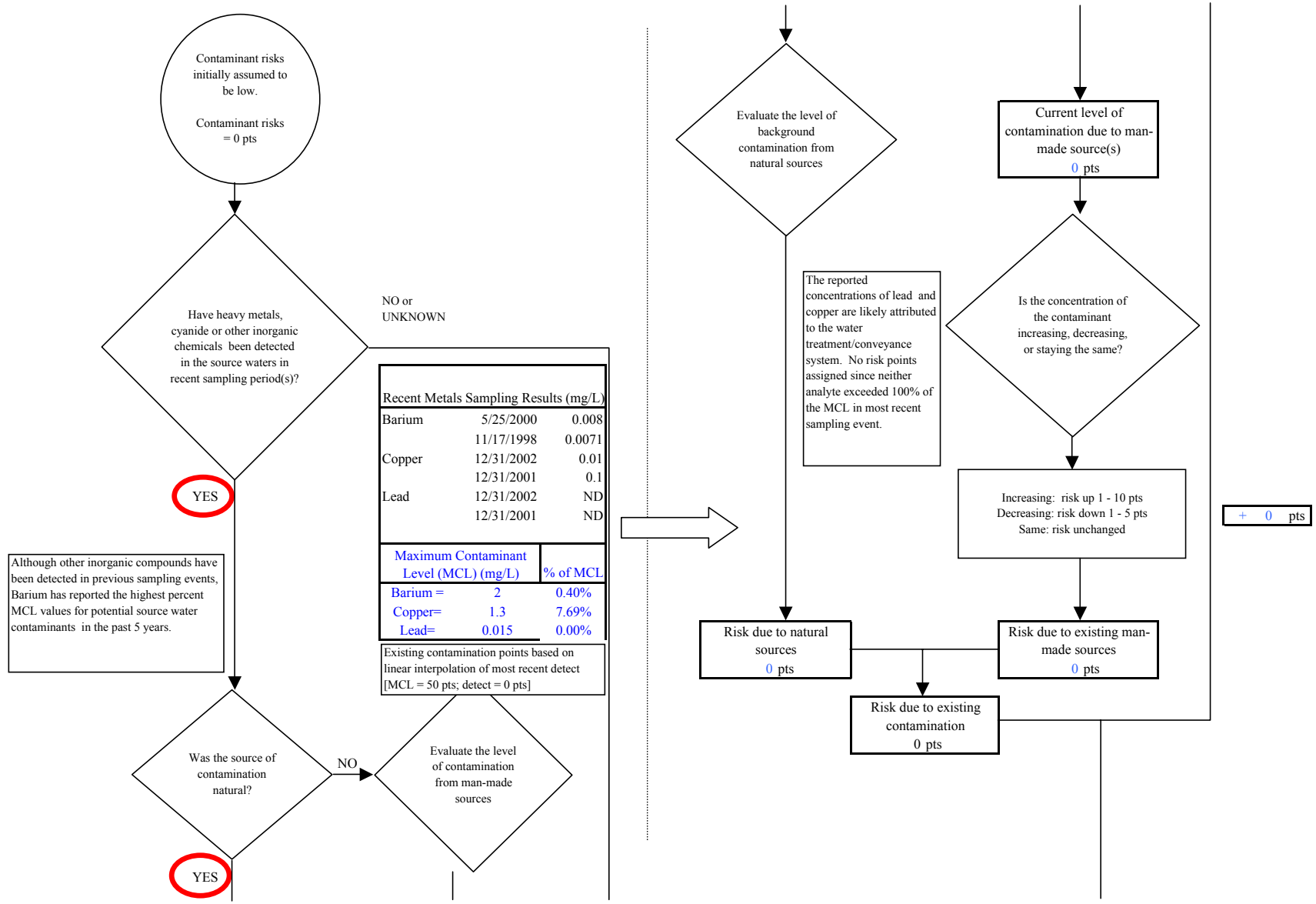
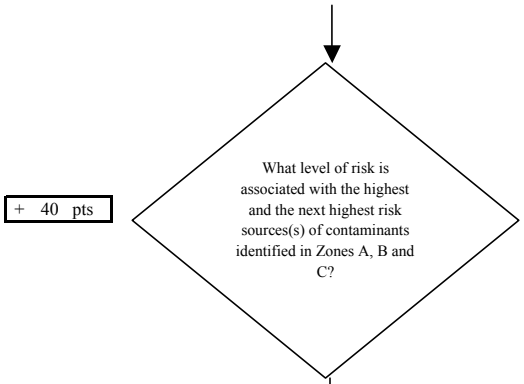


Chart 9. Contaminant risks for Tetlin Utility System (PWS No. 380638.001) - Heavy Metals, Cyanide and Other Inorganic Chemicals



+ 40 pts

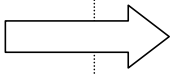
Risk Levels for Contaminant Sources identified in Zones A, B and C

	Zone A	Zones B&C	Total
Very Highs(s)	0	0	0
High(s)	2	0	2
Medium(s)	2	0	2
Low(s)	9	0	9

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

Matrix Score 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.



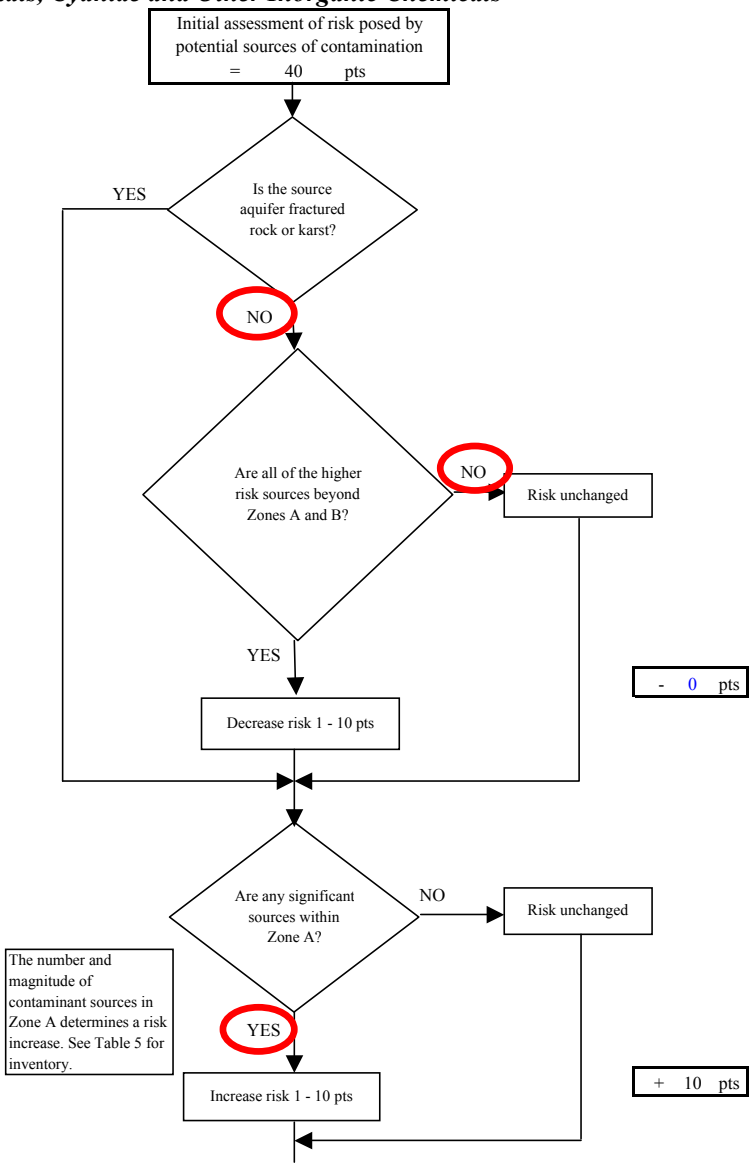


Chart 9. Contaminant risks for Tetlin Utility System (PWS No. 380638.001) - Heavy Metals, Cyanide and Other Inorganic Chemicals

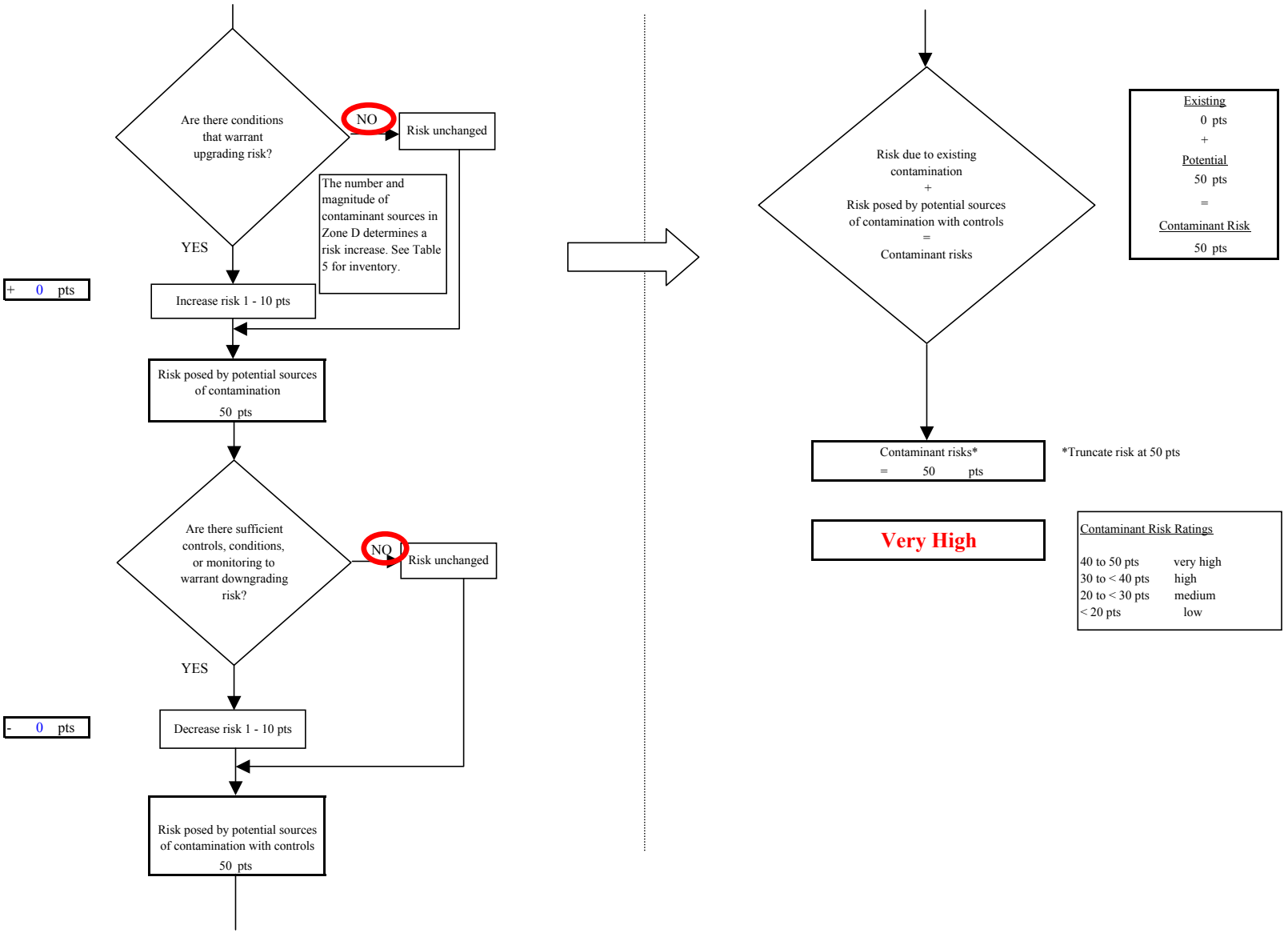


Chart 10. Vulnerability analysis for Tetlin Utility System (PWS No. 380638.001) - Heavy Metals, Cyanide and Other Inorganic Chemicals

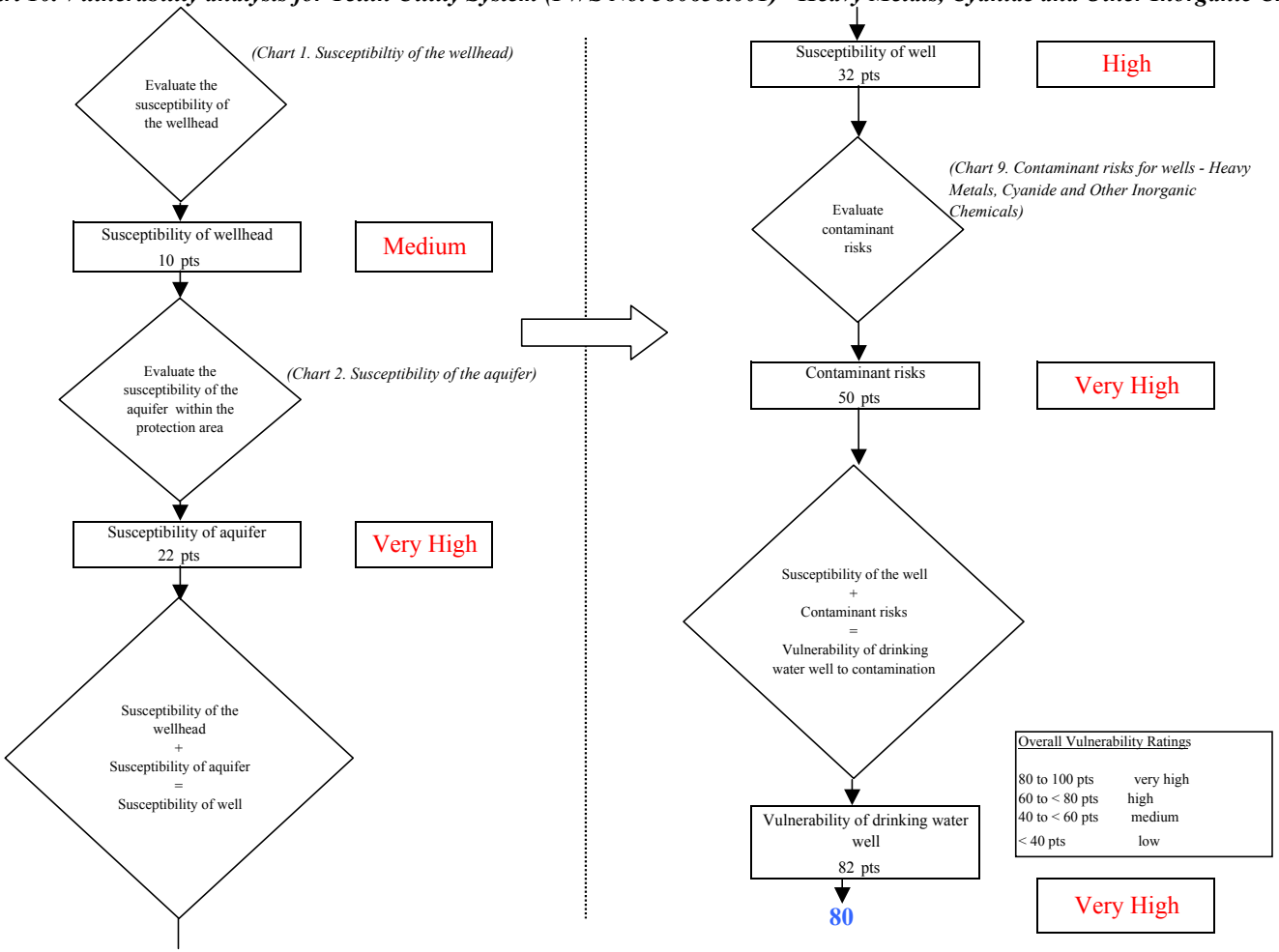


Chart 11. Contaminant risks for Tetlin Utility System (PWS No. 380638.001) - Synthetic Organic Chemicals

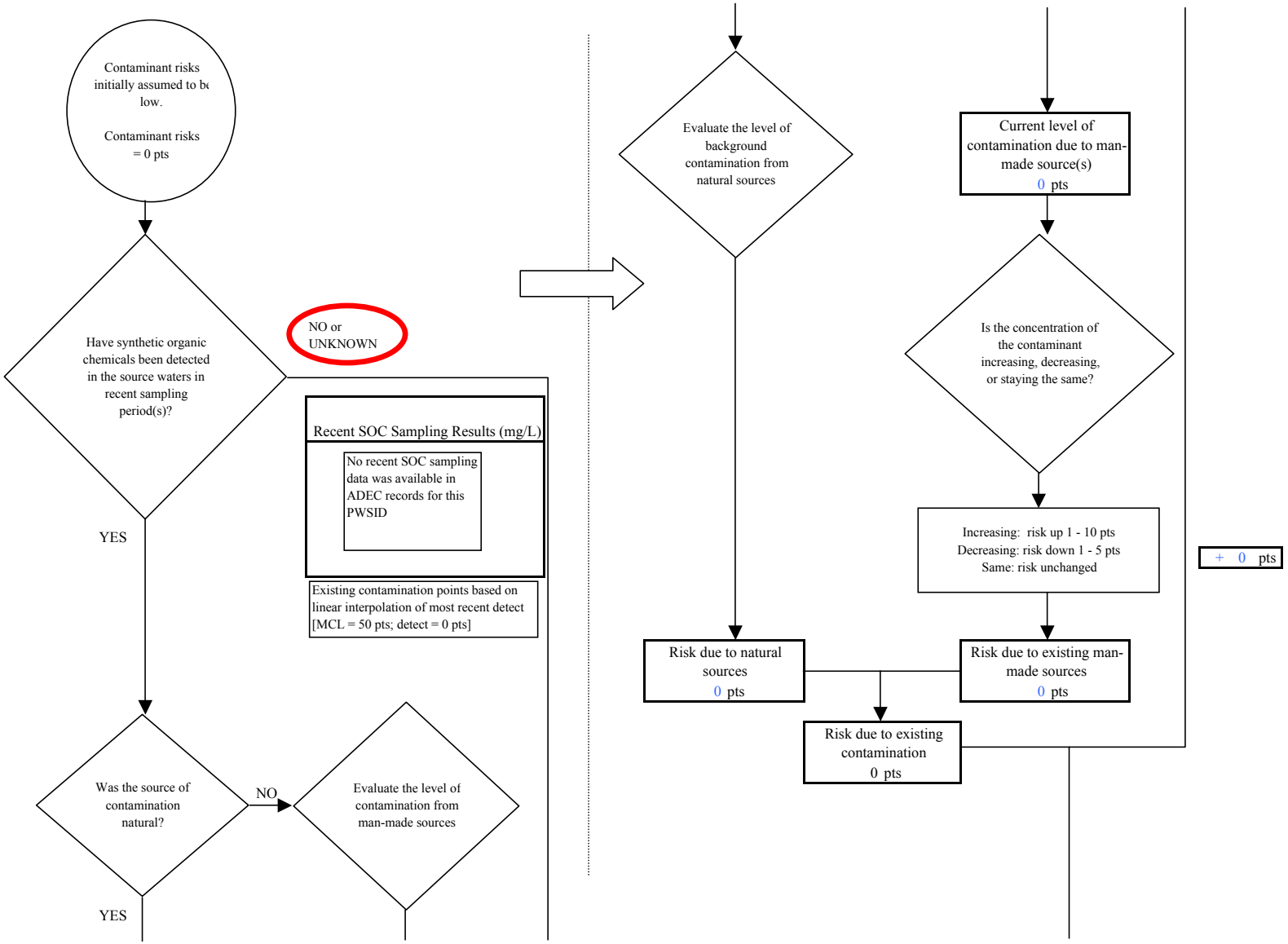
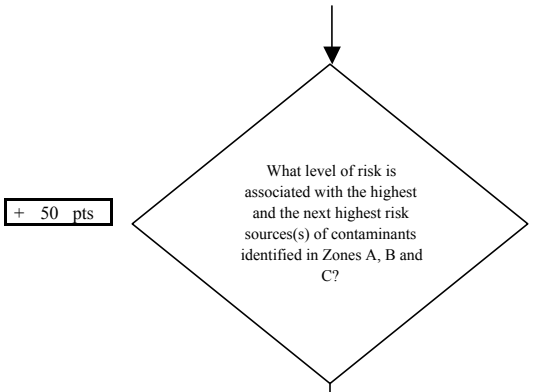


Chart 11. Contaminant risks for Tetlin Utility System (PWS No. 380638.001) - Synthetic Organic Chemicals



+ 50 pts

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

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

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

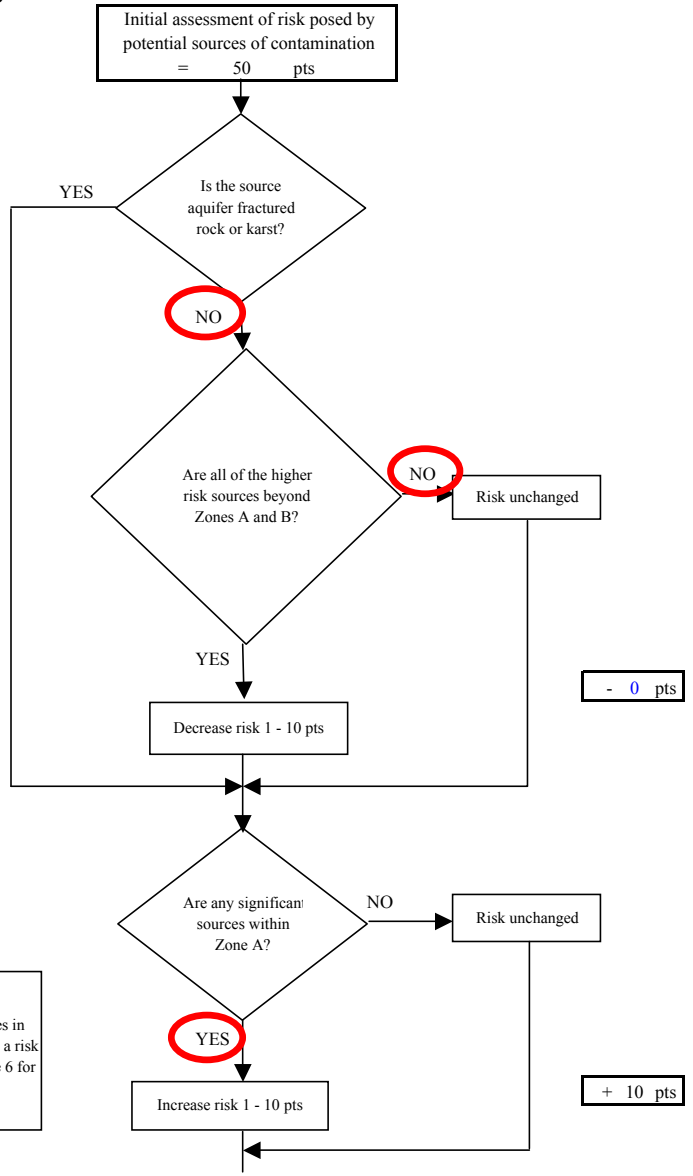


Chart 11. Contaminant risks for Tetlin Utility System (PWS No. 380638.001) - Synthetic Organic Chemicals

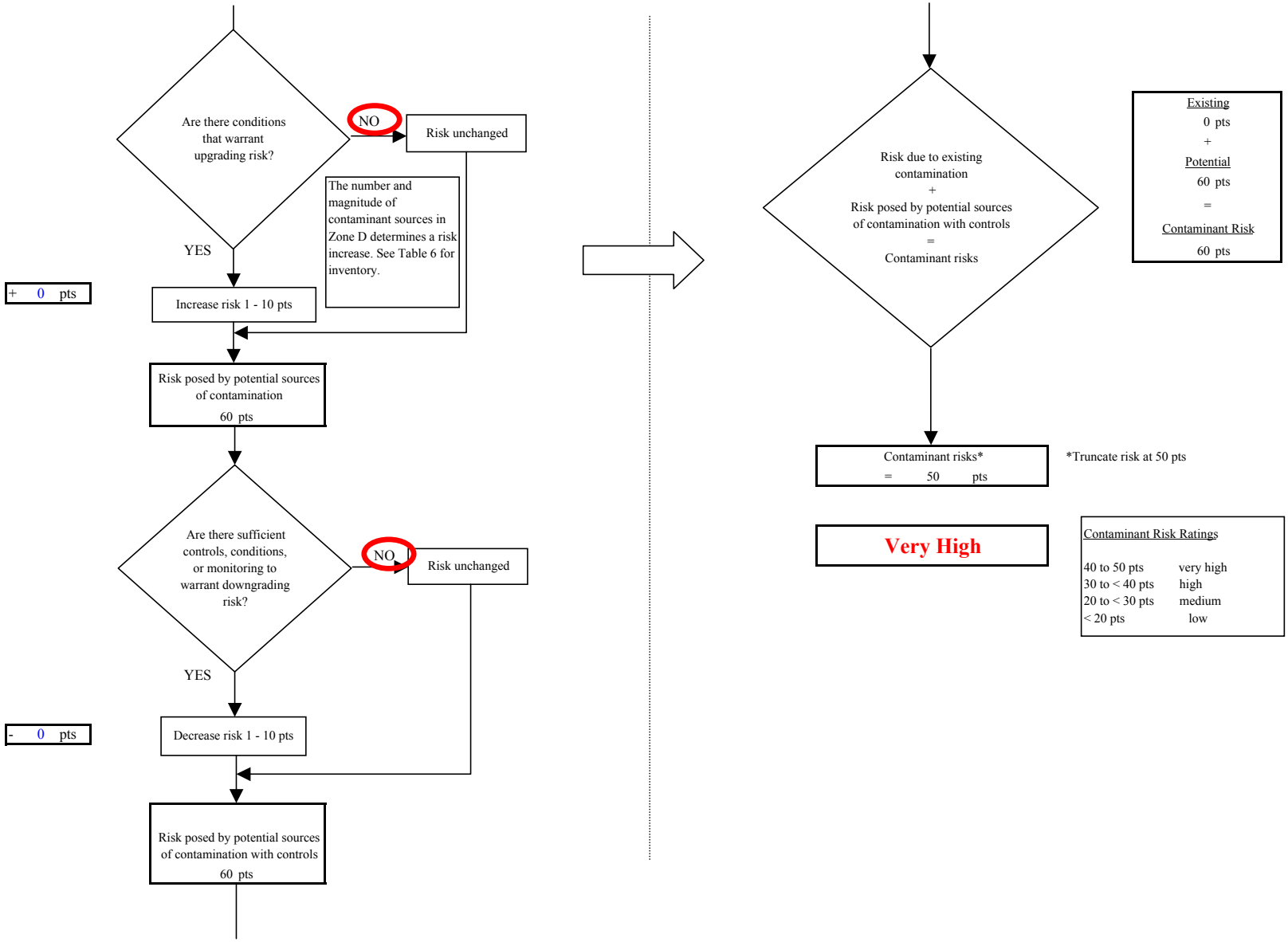


Chart 12. Vulnerability analysis for Tetlin Utility System (PWS No. 380638.001) - Synthetic Organic Chemicals

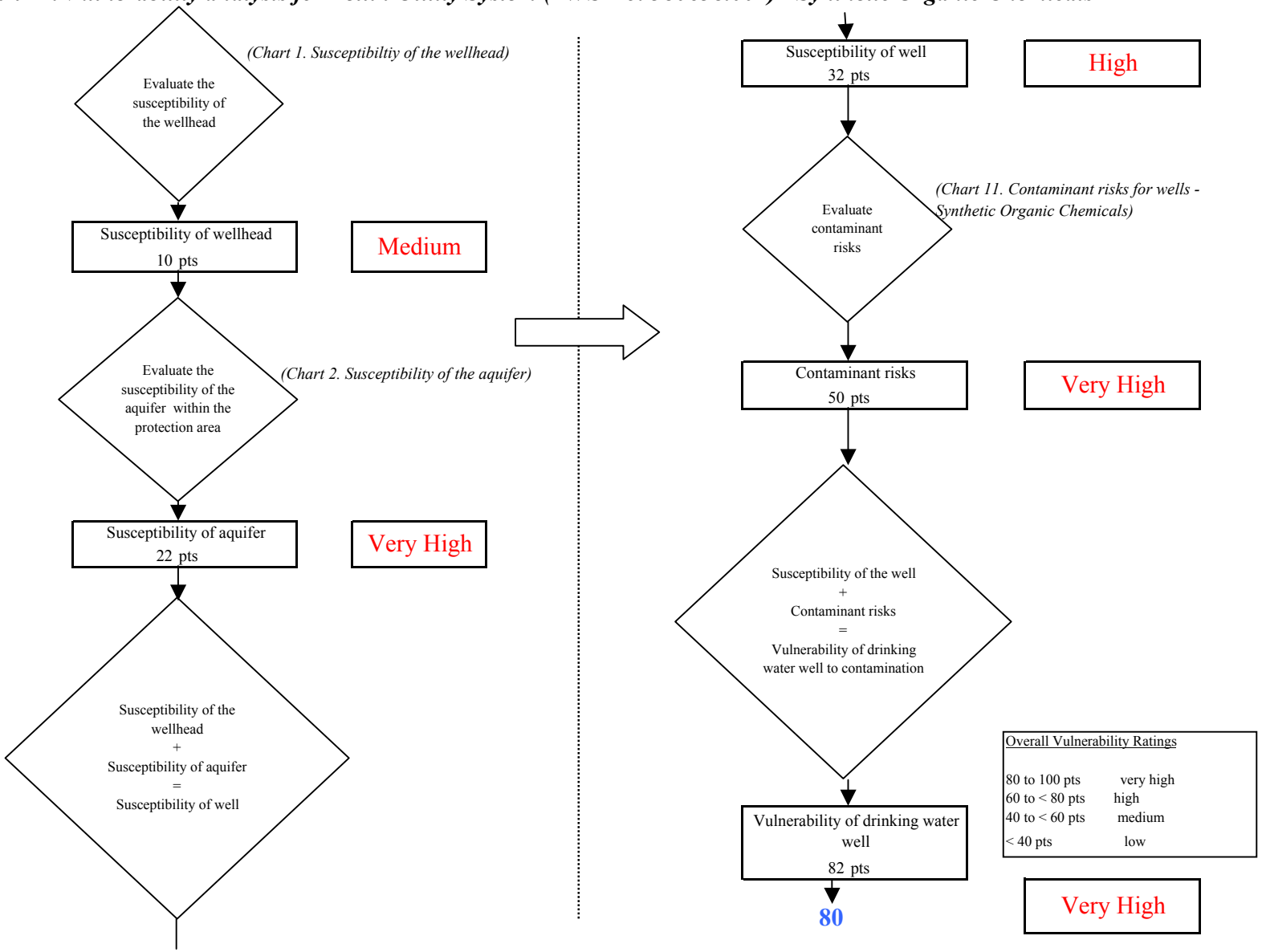


Chart 13. Contaminant risks for Tetlin Utility System (PWS No. 380638.001) - Other Organic Chemicals

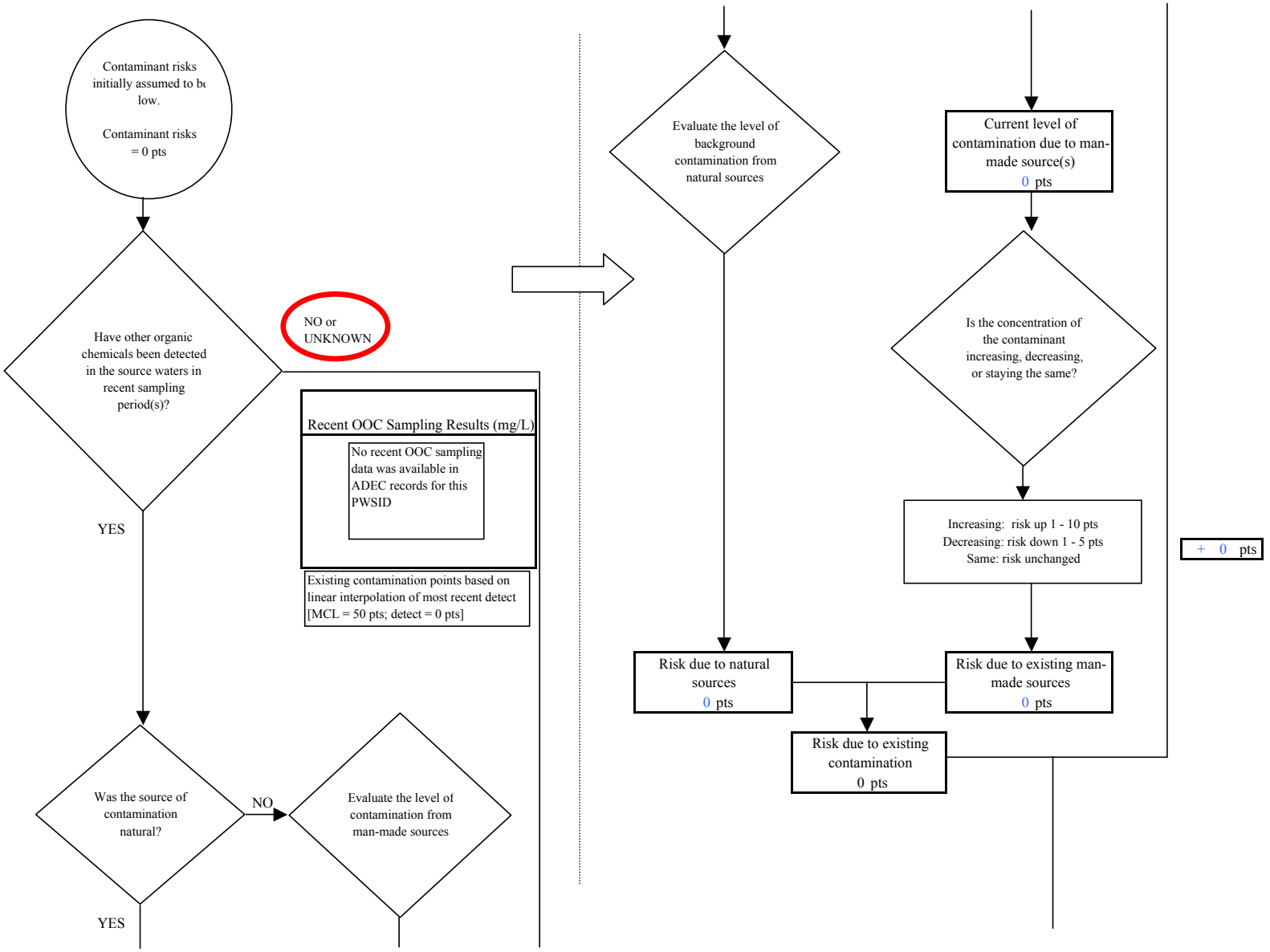
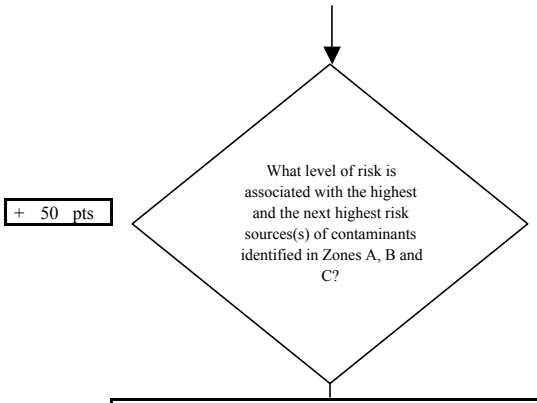


Chart 13. Contaminant risks for Tetlin Utility System (PWS No. 380638.001) - Other Organic Chemicals



+ 50 pts

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

	Zone A	Zones B&C	Total
Very Highs(s)	2	0	2
High(s)	1	0	1
Medium(s)	2	0	2
Low(s)	6	0	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 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.

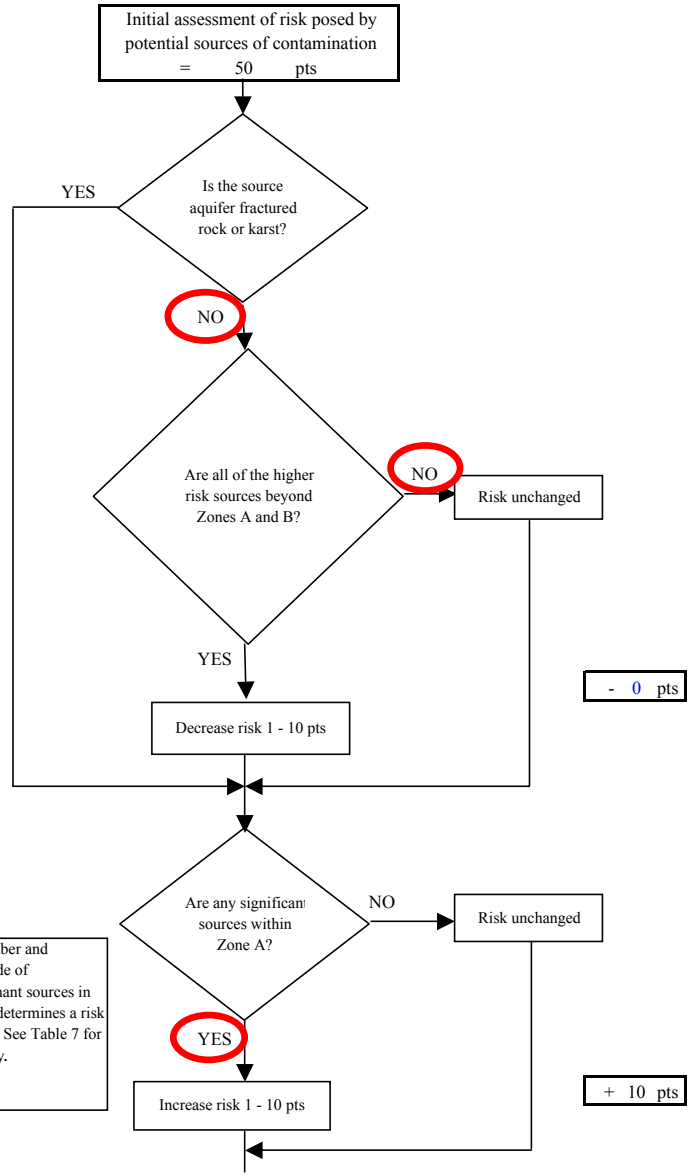


Chart 13. Contaminant risks for Tetlin Utility System (PWS No. 380638.001) - Other Organic Chemicals

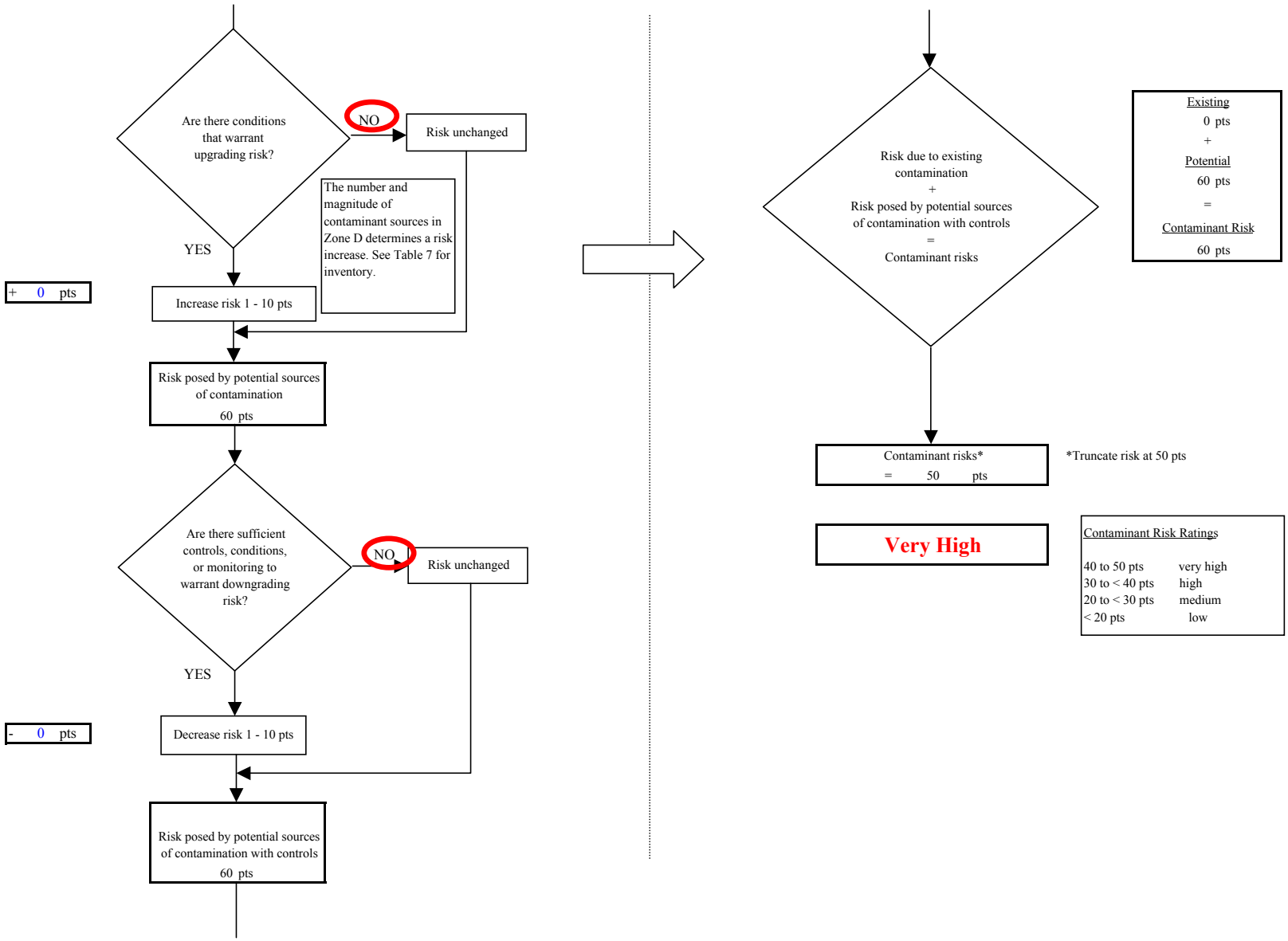


Chart 14. Vulnerability analysis for Tetlin Utility System (PWS No. 380638.001) - Other Organic Chemicals