Source Water Assessment

A Hydrogeologic Susceptibility and Vulnerability Assessment for Nome Joint Utilities, Moonlight Springs Drinking Water System, Nome, Alaska

PWSID # 340010.002 (Well No. 1), 340010.003 (Well No. 2) and 340010.004 (Well No. 3)

Revised December 2004

DRINKING WATER PROTECTION PROGRAM REPORT 1322
Alaska Department of Environmental Conservation

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DRINKING WATER PROTECTION PROGRAM REPORT 1322

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 Nome Joint Utilities - Moonlight Springs Well No. 1, 2 and 3 Community Source of Public Drinking Water, Nome, Alaska

Drinking Water Protection Program
Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

The public water system for Nome Joint Utilities is a Class A (Community) water system consisting of three wells. The wells are located east of the community of Nome, at the base of Anvil Mountain. There are 2 storage tanks with a capacity of 1,000,000 gallons each. The drinking water is treated with chlorine and fluoride. This system operates year round and serves approximately 4,300 residents. The wellhead received a natural susceptibility rating of **Low.** This rating is the combination of the susceptibility rating of **Low** for the actual wellhead and a **Medium** rating for the aquifer which the well is drawing water from. Identified potential and current sources of contaminants for the public drinking water source include: a landfill, individual septic systems, residential heating oil tanks, a DEC recognized contaminated site, roads, and mines. A detailed inventory can be found in Table 1 of Appendix B. 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 **Medium** for bacteria and viruses, nitrates and/or nitrites, volatile organic chemicals and **Low** for heavy metals, cyanide and other inorganic chemicals, other organic chemicals and synthetic organic chemicals contaminant categories. Identified potential and current sources of contaminants for the public drinking water source include: a landfill, individual septic systems, residential heating oil tanks, a DEC recognized contaminated site, roads, and mines. A detailed inventory can be found in Table 1 of Appendix B. 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.

PUBLIC DRINKING WATER SYSTEM

The Nome Joint Utilities - Moonlight Springs Public Water System (PWS) consists of three wells. The wells have been used as a public drinking water source since they were drilled in September of 1993. This report assesses all three sources PWSID No. 340010.002 (Well No. 1), 340010.003 (Well No. 2) and 340010.003 (Well No. 3).

The Nome Joint Utilities - Moonlight Springs Public Water System is a Class A (community) public water system. The system is located east of the community of Nome at the Base of Anvil Mountain (Sec. 26, T011S, R034W, Kateel River Meridian, see Map 1 of Appendix A). The community of Nome is located on the south coast of the Seward Peninsula, approximately 540 air miles northwest of Anchorage. The community has a population of 3,448 (ADCED, 2003). Average annual precipitation in Nome is 18 inches, including approximately 56 inches of snowfall. Average temperatures range from –3 to 65°F.

Most residents of Nome have complete piped water and sewer (ADCED, 2003). The remaining residents haul honeybuckets and have water delivered. Nome residents rely on the Nome Joint Utilities for electricity, which is powered by diesel. Refuse is collected by a private contractor and disposed of at the new landfill, which is operated by the City of Nome.

According to well logs and sanitary surveys Nome Joint Utilities - Moonlight Springs Well No. 1 PWS, the depths of Well No. 1, 2 and 4 are 122 feet, 81feet and 84 feet respectively. All three wells are completed in fractured limestone. Based on available well construction details, the wells are not screened and are not located within a floodplain.

The most current information acquired from the CE2 Operation and Maintenance Manual for the PWS does not indicate whether the land surface is sloped away from the wells, however based on the date of construction, it is assumed to be. 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 O&M Manual does not indicate whether the well is grouted according to ADEC regulations, however based on the well construction date, it is assumed to be properly grouted. Proper grouting provides added protection against contaminants traveling along the well casing annulus and into source waters.

The geology of the region consists of Quaternary coastal and glacial sand and gravel deposits. The sands are reworked clastics derived from Paleozoic sedimentary and metasedimentary rocks which form the highlands of Anvil Mountain and North Newton Peak north of Nome. The surface geology of the surrounding area consists of glacial terminal and ground moraines and scoured and kettled areas. These moraine deposits have been reworked by coastal processes during a marine regression, which left at least three identifiable coastal terraces.

Depth to groundwater, based on U.S. Geological Survey (USGS) topographic maps, is estimated at 30 to 50 feet below the ground elevation. However, discontinuous permafrost is likely to be present below the vegetative layer. At various undisturbed locations surrounding the wells, surface water collects above the shallow permafrost and has contributed to the wet tundra and wet near-surface conditions (URS, 1997).

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.

The City of Nome and the State of Alaska, Department of Natural Resources, Division of Geological and Geophysical Surveys have completed the "*Recharge Area Evaluation for Moonlight Springs, Nome Alaska"*. The primary and secondary recharge areas identified in this study were used to determine the size and shape of the DWPA.

An analytical calculation was used to determine size of the DWPA around the wellhead. 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 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

As an example, water moving through the aquifer in Zone B will reach the well in less than 2 years from the time it crosses the outer limit of Zone B.

Zone A also incorporates the area down gradient from the well to take into account the area of the aquifer that is influenced by pumping of the well. Water within the aquifer in Zone A will reach the well in several hours to several months.

The DWPA for Nome Joint Utilities is limited by its immediate watershed and includes only Zones A and B (See Map 1of 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 Nome Joint Utilities - Moonlight Springs Well No. 1, 2 and 3 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 2 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, 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 Nome Joint Utilities - Moonlight Springs Well No. 1, 2 and 3 water wells are completed in a semi-confined aquifer. In the immediate area a thin clay layer and permafrost layer above the fractured limestone provide some protection from contaminants traveling downward from the surface with precipitation and surface water runoff.

Groundwater can move extremely quickly through fractures within the limestone, depending on their width, density, connectivity, and direction in the area. The areas up gradient of the wells may offer an easy pathway for contaminants to travel down into the

aquifer and potentially towards the well. Table 2 shows the Susceptibility scores and ratings for Nome Joint Utilities - Moonlight Springs Well No. 1, 2 and 3.

Table 2. Susceptibility

	Score	Rating
Susceptibility of the Wellhead	0	Low
Susceptibility of the Aquifer	14	Medium
Natural Susceptibility	14	Low

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	25	Medium
Nitrates and/or Nitrites	26	Medium
Volatile Organic Chemicals	35	High
Heavy Metals, Cyanide and Other Inorganic Chemicals	22	Medium
Synthetic Organic Chemicals	12	Low
Other Organic Chemicals	12	Low

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	40	Medium
Nitrates and Nitrites	40	Medium
Volatile Organic Chemicals	50	Medium
Heavy Metals, Cyanide and Other Inorganic Chemicals	35	Low
Synthetic Organic Chemicals	25	Low
Other Organic Chemicals	25	Low

Bacteria and Viruses

The contaminant risk for bacteria and viruses is **Medium**. The risk is attributed to the presence of septic systems in the area (see Table 2 – Appendix B).

Bacteria and viruses have not been detected in source waters.

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). Bacteria and viruses have not been detected in source waters.

After combining the contaminant risk for bacteria and viruses with the natural susceptibility of the well, the overall vulnerability of the well to contamination is **Medium**.

Nitrates and Nitrites

The contaminant risk for nitrates and nitrites is **Medium**. The risk to this source of public drinking water is primarily attributed to the presence of septic systems and roads (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 been detected in recent sampling events, but 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.

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

Volatile Organic Chemicals

The contaminant risk for volatile organic chemicals is **High**. The risk is primarily attributed to the presence of above ground heating oil tanks located in the DWPP. Other potential contaminant sources are also found within the protection area (see Table 4 – Appendix B).

Recent sampling results indicate the presence of total trihalomethanes (TTHM's). TTHM's are generally a byproduct of water treatment and are not indicative of source water conditions. Risk points were not assigned due to the MCL of 0.08 mg/L not being exceeded (See Chart 7 – Contaminant Risks for Volatile Organic Chemicals in Appendix D).

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

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

Heavy Metals, Cyanide and Other Inorganic Chemicals

The contaminant risk for heavy metals, cyanide and other inorganic chemicals is **Medium**. The risk is primarily attributed to the presence of thallium in the initial sampling of the well. Other potential contaminant sources are also found within the protection area (see Table 5 – Appendix B).

Based on review of sampling records for this PWS, moderate levels of thallium were detected when the wells were first developed. The concentrations have not exceeded thallium's MCL's of 0.002 mg/L. No further detection has occurred since 2001. (see Chart 9 – Contaminant Risks for Heavy Metals, Cyanide, and Other Inorganic Chemicals in Appendix D).

Thallium is a metal found in natural deposits as ores containing other elements. The greatest use of thallium is in specialized electronic research equipment. It is suspected that the levels of thallium detected originate from natural sources (see Table 5 in Appendix B for list of potential contaminant sources).

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 **Low**.

Synthetic Organic Chemicals

The contaminant risk for synthetic organic chemicals is **Low**. The risk is primarily attributed to roads and septic systems. Other contaminant sources are also located within the protection area (see Table 6 – Appendix B).

The Nome Joint Utilities holds an SOC/OOC sampling waiver. There has been no recent sampling for SOC/OOC's (See Chart 11 – Contaminant Risks for Synthetic Organic Chemicals in Appendix D).

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

Other Organic Chemicals

The contaminant risk for other organic chemicals is **Low**. The risk is primarily attributed to the presence of a landfill, recognized contaminated site and roads.(see Table 7 – Appendix B).

The Nome Joint Utilities holds an SOC/OOC sampling waiver. There has been no recent sampling

for SOC/OOC's. (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 **Low**.

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 Nome 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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Acknowledgment

Source Water Assessments in the Nome area were jointly prepared by ADEC-Drinking Water Protection Program and URS Corporation. The Drinking Water Protection Program would like to thank URS Corporation for their efforts in researching the area.

APPENDIX A

Drinking Water Protection Area Location Map
(Map 1)

Map 1- Nome Joint Utilities Public Water System

PWSID: 340010.002, 340010.003 and 340010.004

Alaska Department of Environmental Conservation

Alaska Drinking Water Protection Program

0 1,400 2,800 5,600 Feet

1:33,974

Data Sources:
USGS- 1:24,000 Topog Map, Road

- Public Water System
- Zone A (Primary Recharge)
- Zone B (Secondary Recharge)
- Lakes
- Rivers

APPENDIX B

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

Table 1 *Contaminant Source Inventory for* ***PWSID 340010***

Nome Joint Utilities-Moonlight Springs Well No. 1, 2 and 3

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Map Number*	*Comments*
Landfills (municipal; Class III)	D51	D51-01	A	2	Anvil Mountain Landfill- Classified as Non-municipal monofill. Past disposal of inert waste including construction and demolition debris, scrap metal, tires, white goods, and vehicles. Status: Closed
Septic systems (serves one single-family home)	R02	R02-01	A	2	Assume 20 or fewer households utilize septics in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-01	A	2	Assume 20 or fewer residential aboveground heating oil tanks in Zone A
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-02	A	2	Anvil Mt. Whie Alice Site; Reckey #198932X902508. A 1996 site investigation confirmed petroleum and low level PCBs in soil. Petroleum contaminated soil has been cleaned up. PCB contaminated soils are scheduled to be remediated in 2005.
Highways and roads, dirt/gravel	X24	X24-01	A	2	Assume 1-10 roads in Zone A
Metals mining, placer	E04	E04-01	B	2	Anvil Creek
Metals mining, placer	E04	E04-02	B	2	Specimen Gulch
Metals mining, placer	E04	E04-03	B	2	Grass Gulch
Metals mining, placer	E04	E04-04	B	2	Grouse Gulch
Metals mining, placer	E04	E04-05	B	2	Nekula Gulch
Quarries	E10	E10-01	B	2	King Mountain
Septic systems (serves one single-family home)	R02	R02-02	B	2	Assume 20 residential septics in Zone D
Tanks, heating oil, residential (above ground)	R08	R08-02	B	2	Assume 1-20 residential aboveground heating oil tanks in Zone D
Highways and roads, dirt/gravel	X24	X24-02	B	2	Assume 1-10 roads in Zone D

Table 2

Contaminant Source Inventory and Risk Ranking for Nome Joint Utilities-Moonlight Springs Well No. 1, 2 and 3 Sources of Bacteria and Viruses

PWSID 340010

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Landfills (municipal; Class III)	D51	D51-01	A	Low	2	Anvil Mountain Landfill- Classified as Non-municipal monofill. Past disposal of inert waste including construction and demolition debris, scrap metal, tires, white goods, and vehicles. Status: Closed
Septic systems (serves one single-family home)	R02	R02-01	A	Low	2	Assume 20 or fewer households utilize septics in Zone A
Highways and roads, dirt/gravel	X24	X24-01	A	Low	2	Assume 1-10 roads in Zone A
Septic systems (serves one single-family home)	R02	R02-02	B	Low	2	Assume 20 residential septics in Zone D
Highways and roads, dirt/gravel	X24	X24-02	B	Low	2	Assume 1-10 roads in Zone D

Table 3

Contaminant Source Inventory and Risk Ranking for Nome Joint Utilities-Moonlight Springs Well No. 1, 2 and 3 Sources of Nitrates/Nitrites

PWSID 340010

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Landfills (municipal; Class III)	D51	D51-01	A	Low	2	Anvil Mountain Landfill- Classified as Non-municipal monofill. Past disposal of inert waste including construction and demolition debris, scrap metal, tires, white goods, and vehicles. Status: Closed
Septic systems (serves one single-family home)	R02	R02-01	A	Low	2	Assume 20 or fewer households utilize septics in Zone A
Highways and roads, dirt/gravel	X24	X24-01	A	Low	2	Assume 1-10 roads in Zone A
Quarries	E10	E10-01	B	Low	2	King Mountain
Septic systems (serves one single-family home)	R02	R02-02	B	Low	2	Assume 20 residential septics in Zone D
Highways and roads, dirt/gravel	X24	X24-02	B	Low	2	Assume 1-10 roads in Zone D

Table 4

Contaminant Source Inventory and Risk Ranking for Nome Joint Utilities-Moonlight Springs Well No. 1, 2 and 3 Sources of Volatile Organic Chemicals

PWSID 340010

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Landfills (municipal; Class III)	D51	D51-01	A	Low	2	Anvil Mountain Landfill- Classified as Non-municipal monofill. Past disposal of inert waste including construction and demolition debris, scrap metal, tires, white goods, and vehicles. Status: Closed
Septic systems (serves one single-family home)	R02	R02-01	A	Low	2	Assume 20 or fewer households utilize septics in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-01	A	Medium	2	Assume 20 or fewer residential aboveground heating oil tanks in Zone A
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-02	A	Low	2	Anvil Mt. Whie Alice Site; Reckey #198932X902508. A 1996 site investigation confirmed petroleum and low level PCBs in soil. Petroleum contaminated soil has been cleaned up. PCB contaminated soils are scheduled to be remediated in 2005.
Highways and roads, dirt/gravel	X24	X24-01	A	Low	2	Assume 1-10 roads in Zone A
Quarries	E10	E10-01	B	Low	2	King Mountain
Septic systems (serves one single-family home)	R02	R02-02	B	Low	2	Assume 20 residential septics in Zone D
Tanks, heating oil, residential (above ground)	R08	R08-02	B	Medium	2	Assume 1-20 residential aboveground heating oil tanks in Zone D
Highways and roads, dirt/gravel	X24	X24-02	B	Low	2	Assume 1-10 roads in Zone D

Table 5

Contaminant Source Inventory and Risk Ranking for Nome Joint Utilities-Moonlight Springs Well No. 1, 2 and 3 Sources of Heavy Metals, Cyanide and Other Inorganic Chemicals

PWSID 340010

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Landfills (municipal; Class III)	D51	D51-01	A	Low	2	Anvil Mountain Landfill- Classified as Non-municipal monofill. Past disposal of inert waste including construction and demolition debris, scrap metal, tires, white goods, and vehicles. Status: Closed
Septic systems (serves one single-family home)	R02	R02-01	A	Low	2	Assume 20 or fewer households utilize septics in Zone A
Highways and roads, dirt/gravel	X24	X24-01	A	Low	2	Assume 1-10 roads in Zone A
Metals mining, placer	E04	E04-01	B	Low	2	Anvil Creek
Metals mining, placer	E04	E04-03	B	Low	2	Grass Gulch
Metals mining, placer	E04	E04-04	B	Low	2	Grouse Gulch
Metals mining, placer	E04	E04-05	B	Low	2	Nekula Gulch
Septic systems (serves one single-family home)	R02	R02-02	B	Low	2	Assume 20 residential septics in Zone D
Highways and roads, dirt/gravel	X24	X24-02	B	Low	2	Assume 1-10 roads in Zone D

Table 6

Contaminant Source Inventory and Risk Ranking for Nome Joint Utilities-Moonlight Springs Well No. 1, 2 and 3 Sources of Synthetic Organic Chemicals

PWSID 340010

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Landfills (municipal; Class III)	D51	D51-01	A	Low	2	Anvil Mountain Landfill- Classified as Non-municipal monofill. Past disposal of inert waste including construction and demolition debris, scrap metal, tires, white goods, and vehicles. Status: Closed
Septic systems (serves one single-family home)	R02	R02-01	A	Low	2	Assume 20 or fewer households utilize septics in Zone A
Septic systems (serves one single-family home)	R02	R02-02	B	Low	2	Assume 20 residential septics in Zone D

Table 7

Contaminant Source Inventory and Risk Ranking for Nome Joint Utilities-Moonlight Springs Well No. 1, 2 and 3 Sources of Other Organic Chemicals

PWSID 340010

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Landfills (municipal; Class III)	D51	D51-01	A	Low	2	Anvil Mountain Landfill- Classified as Non-municipal monofill. Past disposal of inert waste including construction and demolition debris, scrap metal, tires, white goods, and vehicles. Status: Closed
Septic systems (serves one single-family home)	R02	R02-01	A	Low	2	Assume 20 or fewer households utilize septics in Zone A
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-02	A	Low	2	Anvil Mt. Whie Alice Site; Reckey #198932X902508. A 1996 site investigation confirmed petroleum and low level PCBs in soil. Petroleum contaminated soil has been cleaned up. PCB contaminated soils are scheduled to be remediated in 2005.
Highways and roads, dirt/gravel	X24	X24-01	A	Low	2	Assume 1-10 roads in Zone A
Quarries	E10	E10-01	B	Low	2	King Mountain
Septic systems (serves one single-family home)	R02	R02-02	B	Low	2	Assume 20 residential septics in Zone D
Highways and roads, dirt/gravel	X24	X24-02	B	Low	2	Assume 1-10 roads in Zone D

APPENDIX C

Drinking Water Protection Area and Potential and Existing Contaminant Sources (Map 2)

E10-1
E04-5
E04-4
E04-2
E04-1
E04-3
D51-1
U04-1

Map 2- Nome Joint Utilities Potential Source of Contamination

PWSID: 340010.002, 340010.003 and 340010.004

Alaska Department of Environmental Conservation

Alaska Drinking Water Protection Program

0 1,450 2,900 5,800 Feet

1:34,800

Data Sources:
USGS- 1:24,000 Topog Map, Road

- Public Water System
- Zone A (Primary Recharge)
- Zone B (Secondary Recharge)
- Municiple Class III Landfill (D51)
- Placer Mines (E04)
- ADEC Recognized Contaminated Site (U04)
- Quarries (D10)

APPENDIX D

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

Chart 1. Susceptibility of the wellhead - Nome Joint Utilites - Moonlight Springs Well No. 1, 2 and 3

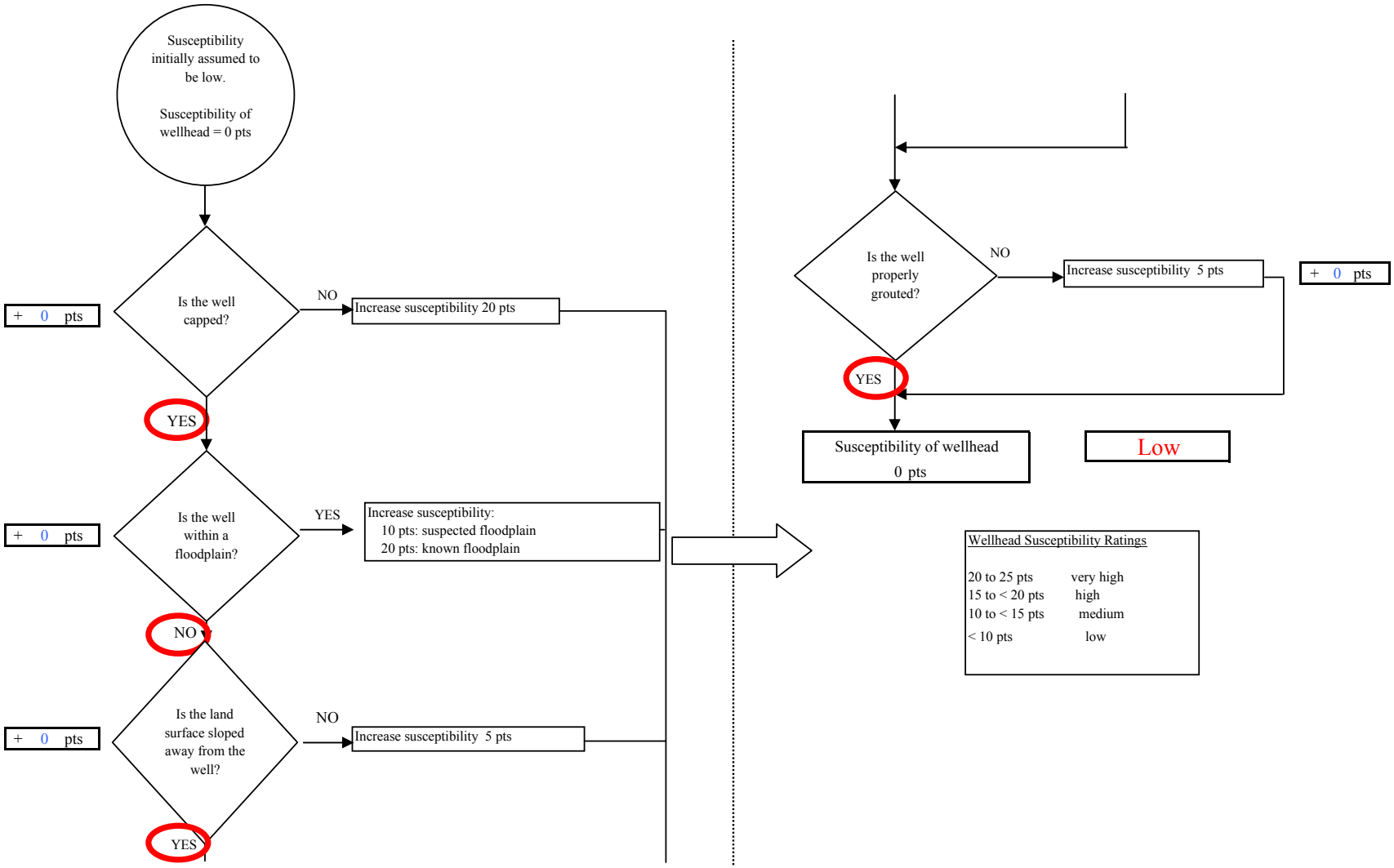


Chart 2. Susceptibility of the aquifer Nome Joint Utilites - Moonlight Springs Well No. 1, 2 and 3

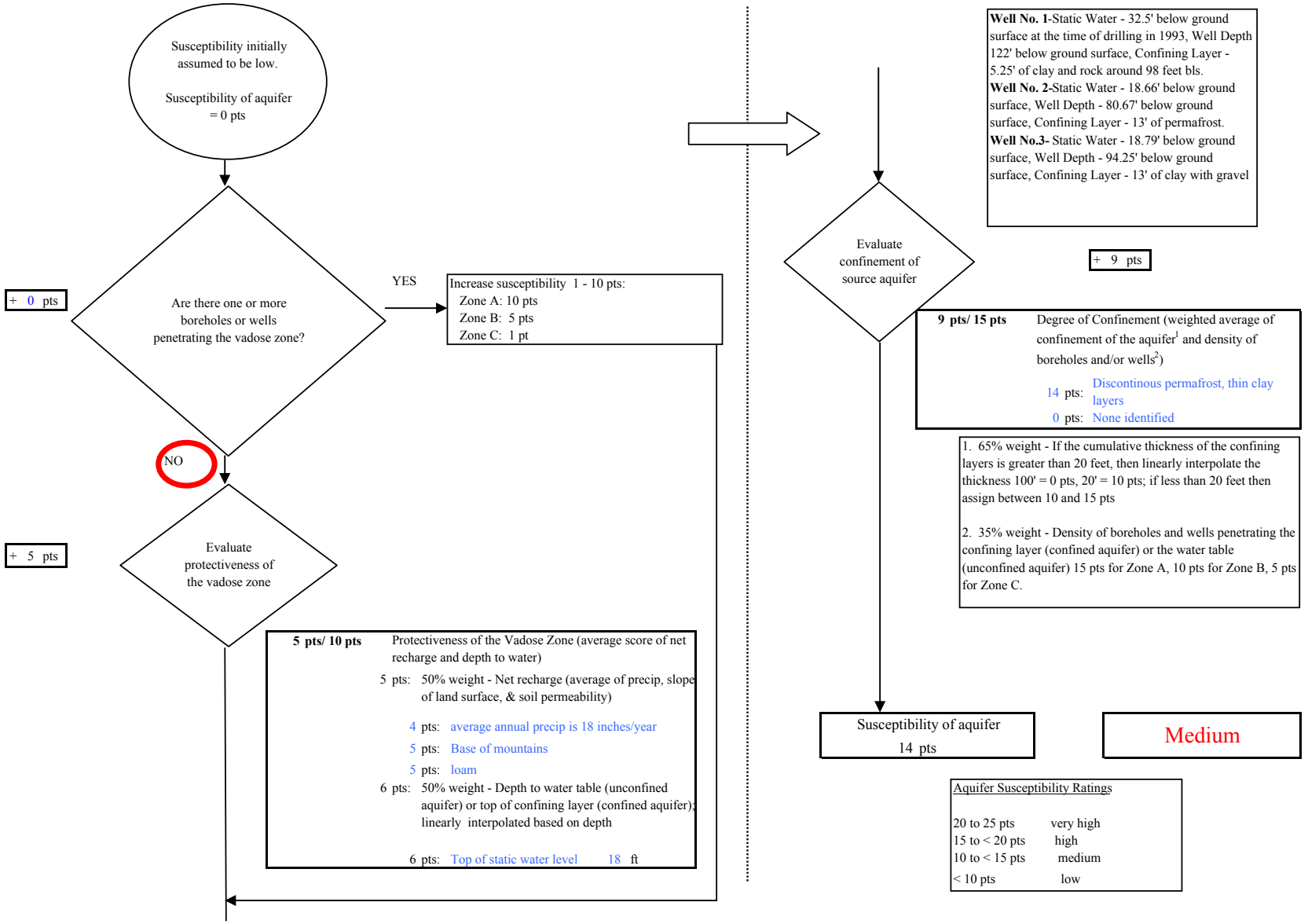


Chart 3. Contaminant risks for Nome Joint Utilites - Moonlight Springs Well No. 1, 2 and 3 - Bacteria & Viruses

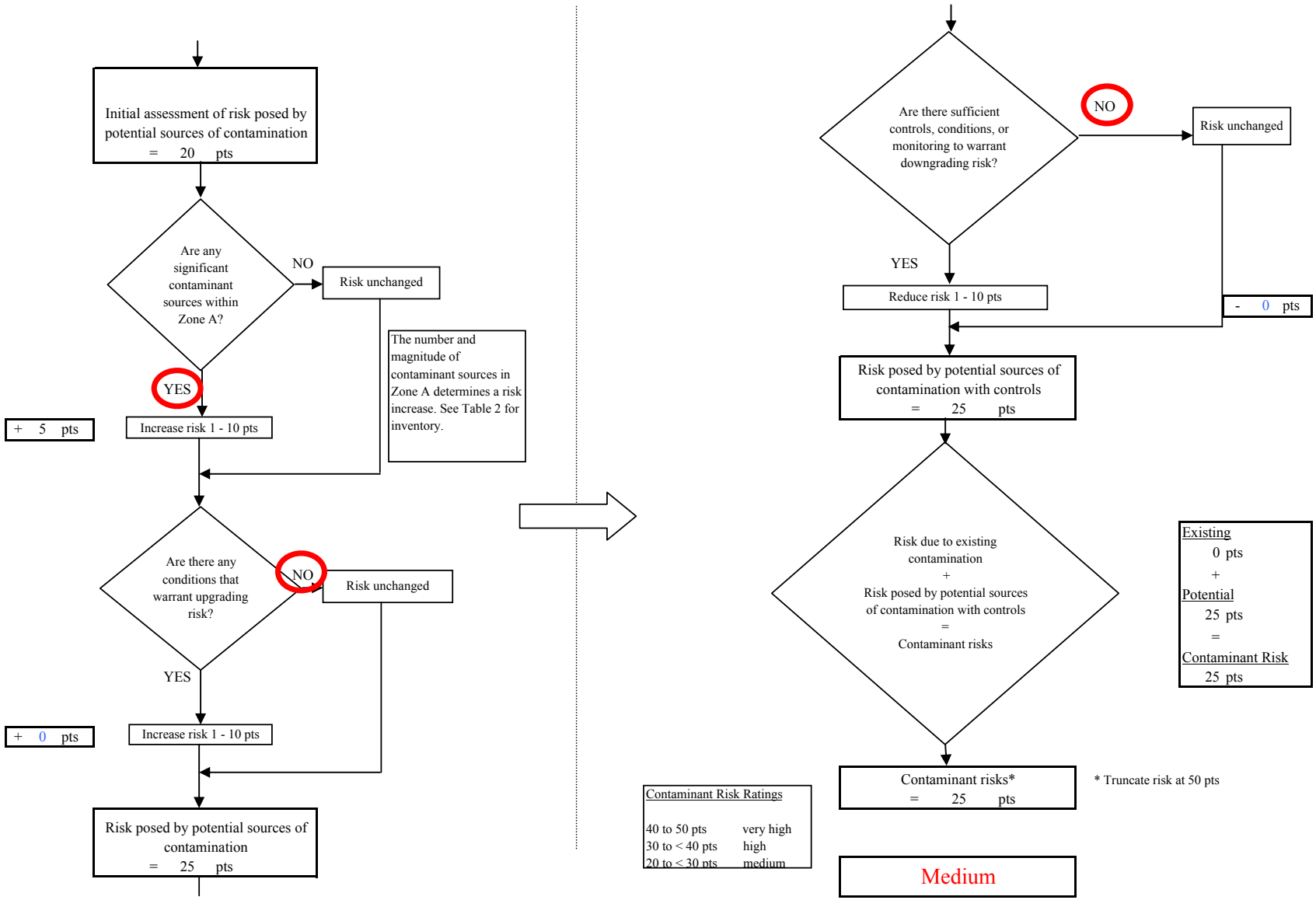
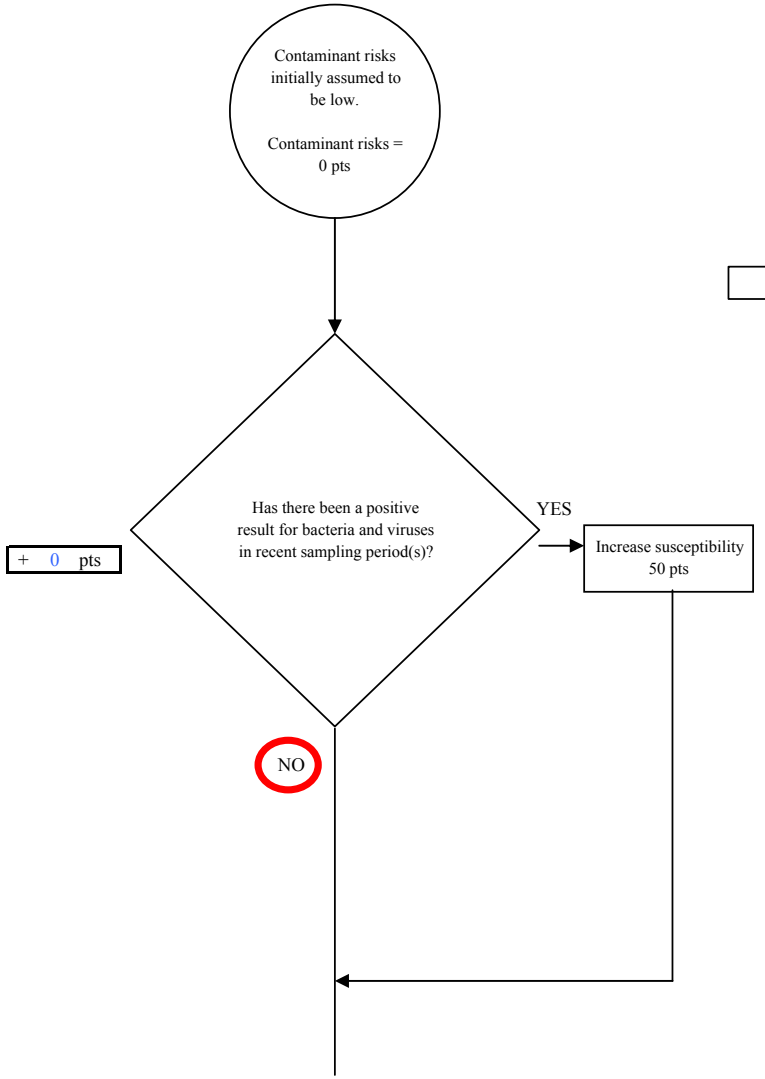
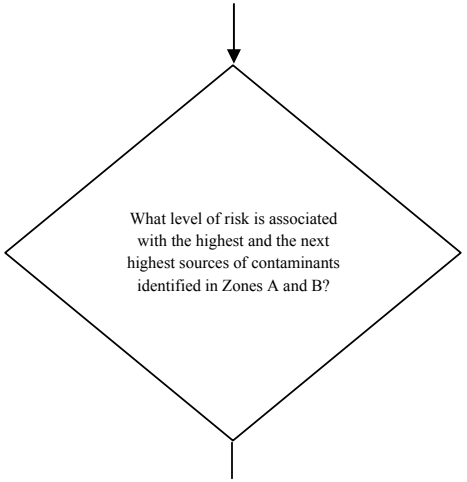


Chart 3. Contaminant risks for Nome Joint Utilites - Moonlight Springs Well No. 1, 2 and 3 - Bacteria & Viruses





+ 20 pts

Risk Rankings for Contaminant Sources Identified in Zones A and B

	Zone A	Zone B	Total
Very Highs(s)	0	0	0
High(s)	0	0	0
Medium(s)	0	0	0
Low(s)	21	2	23

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

Matrix Score 20

Note: Septic systems, sewerlines, and roads are each assigned a risk ranking for each 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 4. Vulnerability analysis for Nome Joint Utilites - Moonlight Springs Well No. 1, 2 and 3 - Bacteria & Viruses

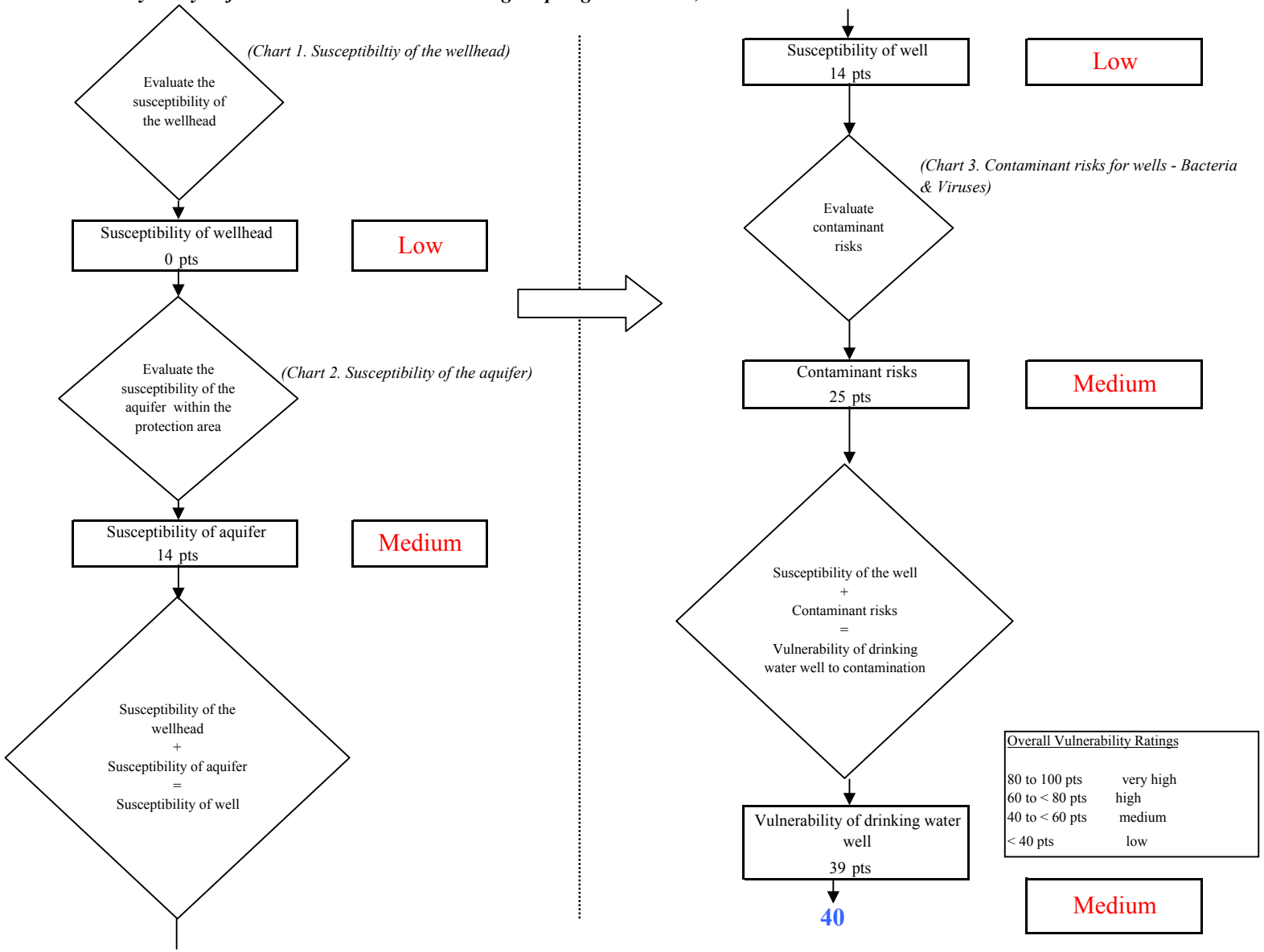


Chart 5. Contaminant risks for Nome Joint Utilites - Moonlight Springs Well No. 1, 2 and 3 - Nitrates and Nitrites

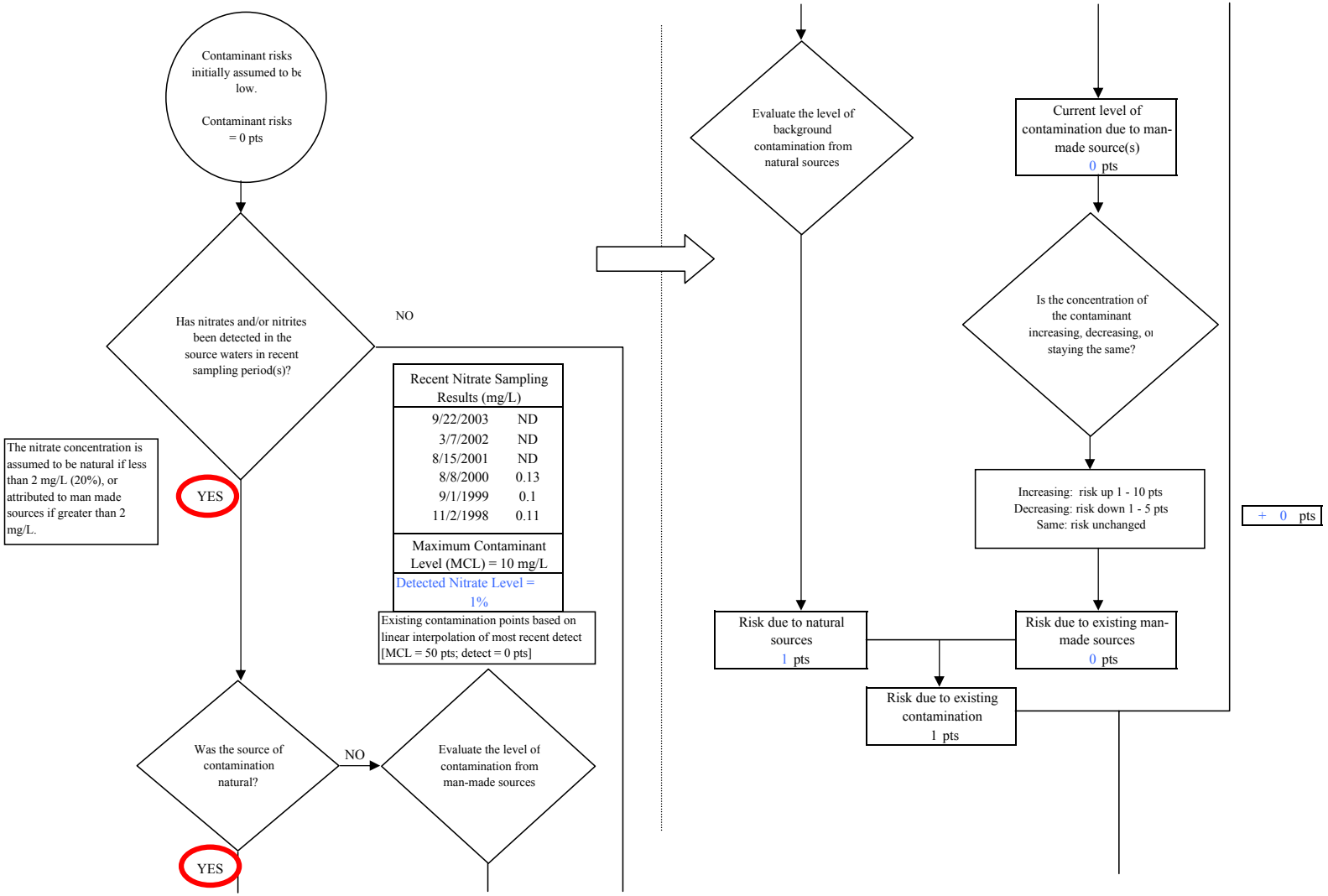
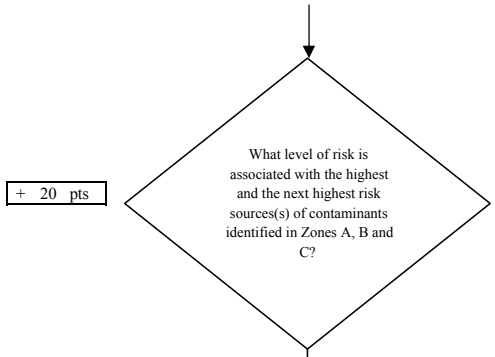


Chart 5. Contaminant risks for Nome Joint Utilites - Moonlight Springs Well No. 1, 2 and 3 - Nitrates and Nitrites



+ 20 pts

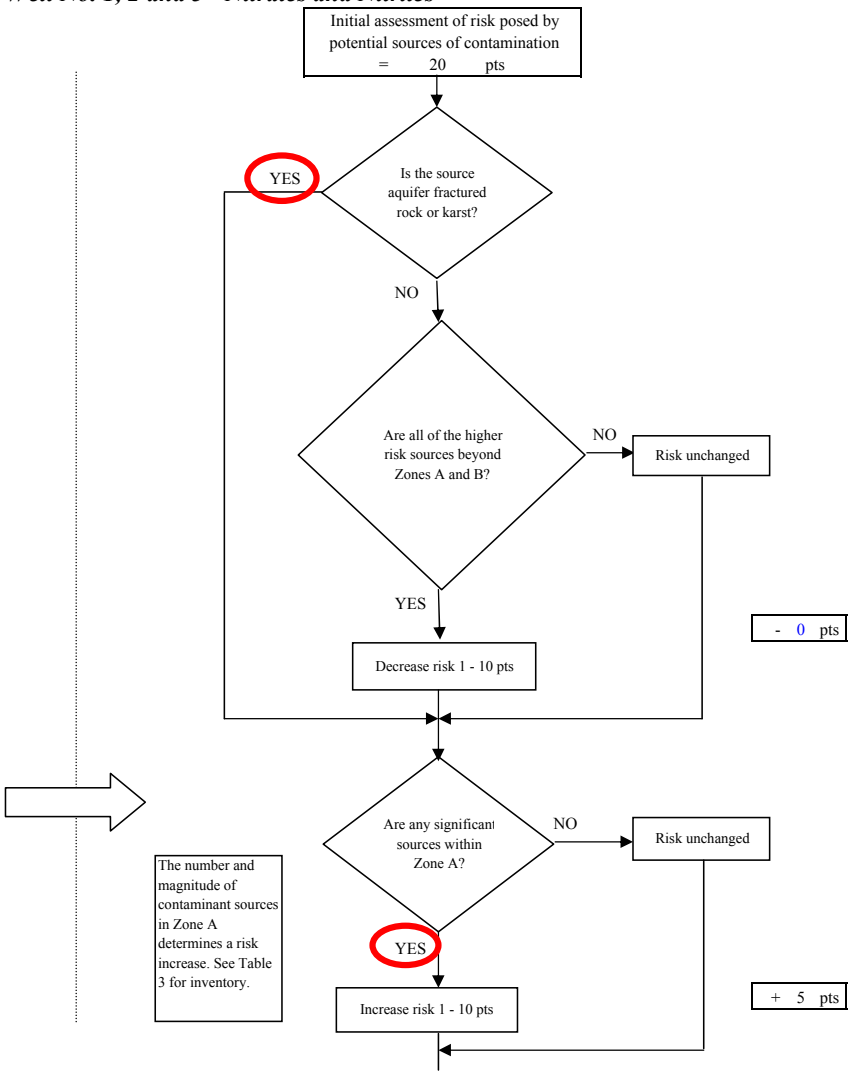
Risk Levels for Contaminant Sources identified in Zones A, B and C

	Zone A	Zones B&C	Total
Very Highs(s)	0	0	0
High(s)	0	0	0
Medium(s)	0	0	0
Low(s)	21	3	24

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

Matrix Score 20

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



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

Chart 5. Contaminant risks for Nome Joint Utilites - Moonlight Springs Well No. 1, 2 and 3 - Nitrates and Nitrites

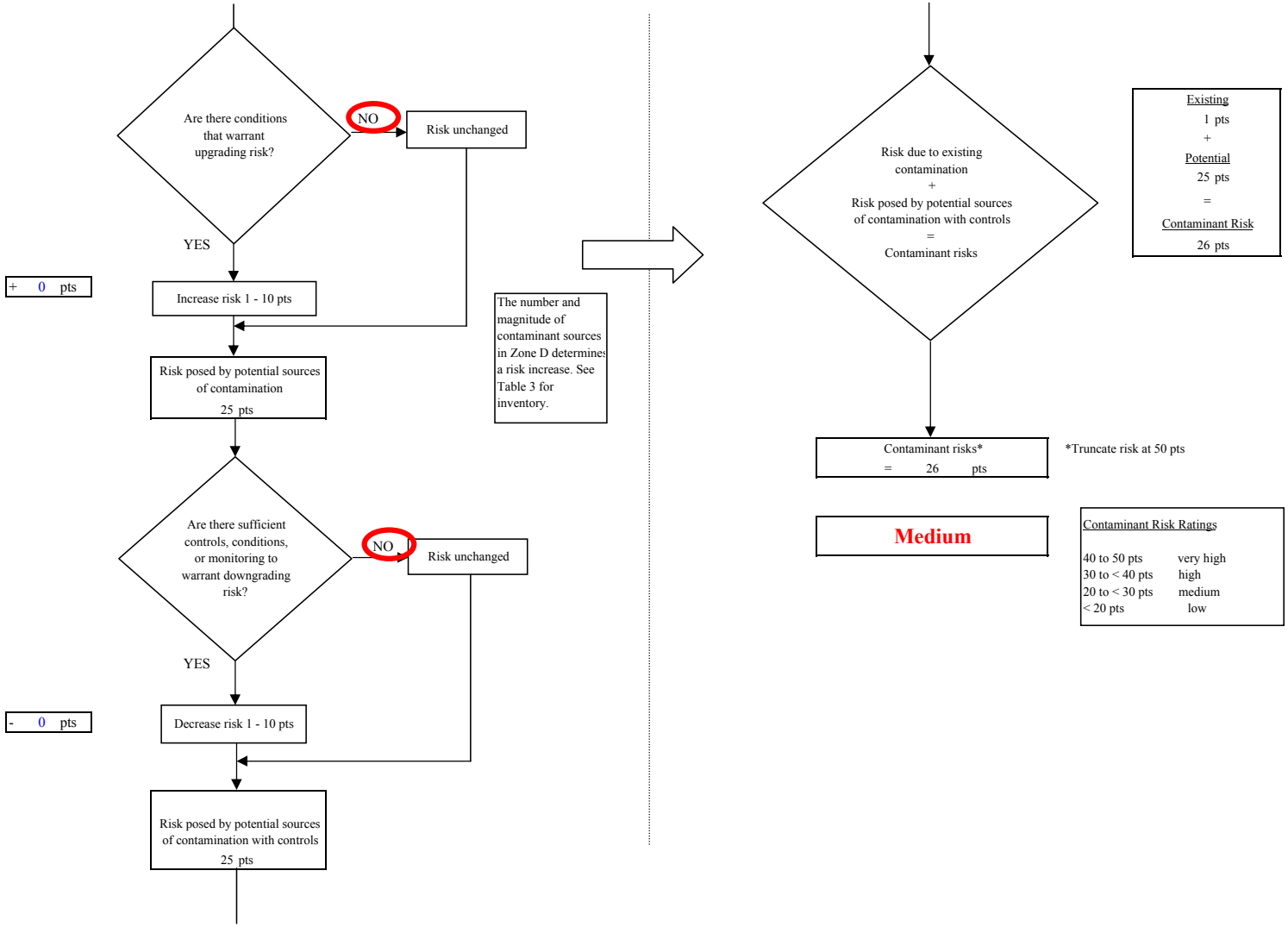


Chart 6. Vulnerability analysis for Nome Joint Utilites - Moonlight Springs Well No. 1, 2 and 3 - Nitrates and Nitrites

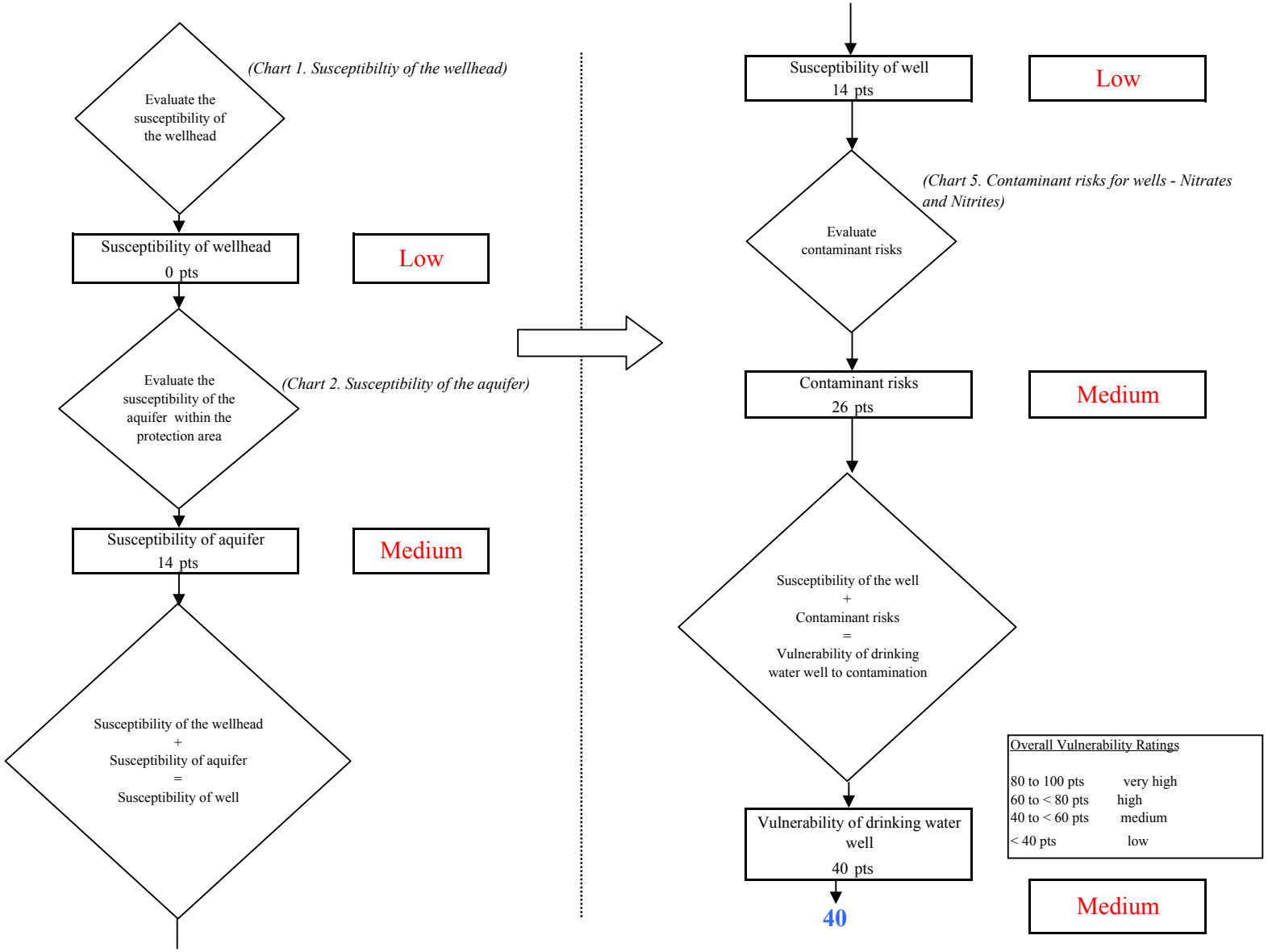


Chart 7. Contaminant risks for Nome Joint Utilites - Moonlight Springs Well No. 1, 2 and 3 - Volatile Organic Chemicals

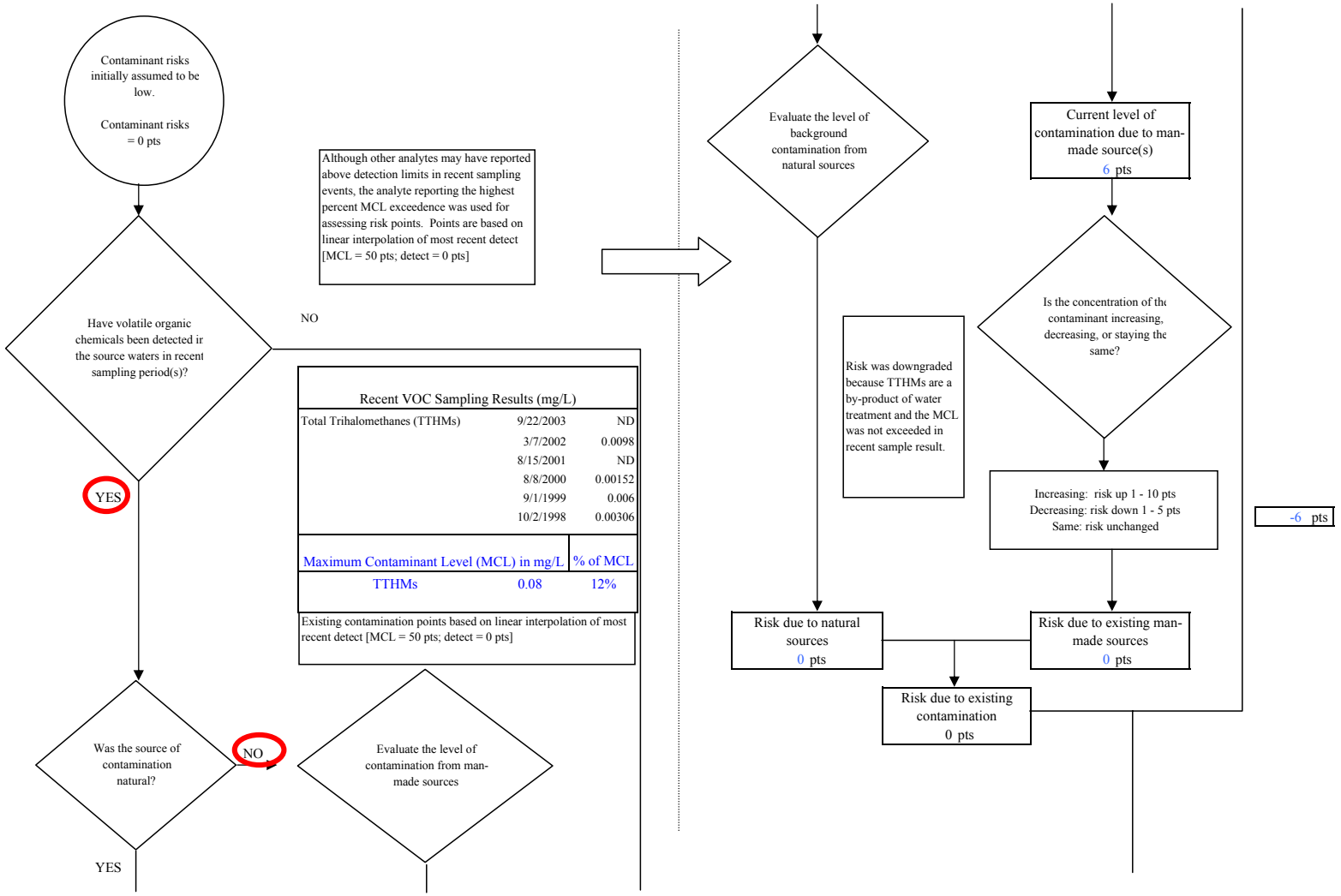
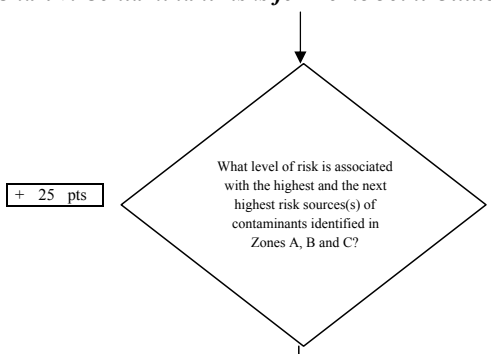


Chart 7. Contaminant risks for Nome Joint Utilites - Moonlight Springs Well No. 1, 2 and 3 - Volatile Organic Chemicals



+ 25 pts

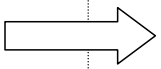
Risk Levels for Contaminant Sources identified in Zones A, B and C

	Zone A	Zones B&C	Total
Very Highs(s)	0	0	0
High(s)	0	0	0
Medium(s)	20	1	21
Low(s)	4	3	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 25

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.



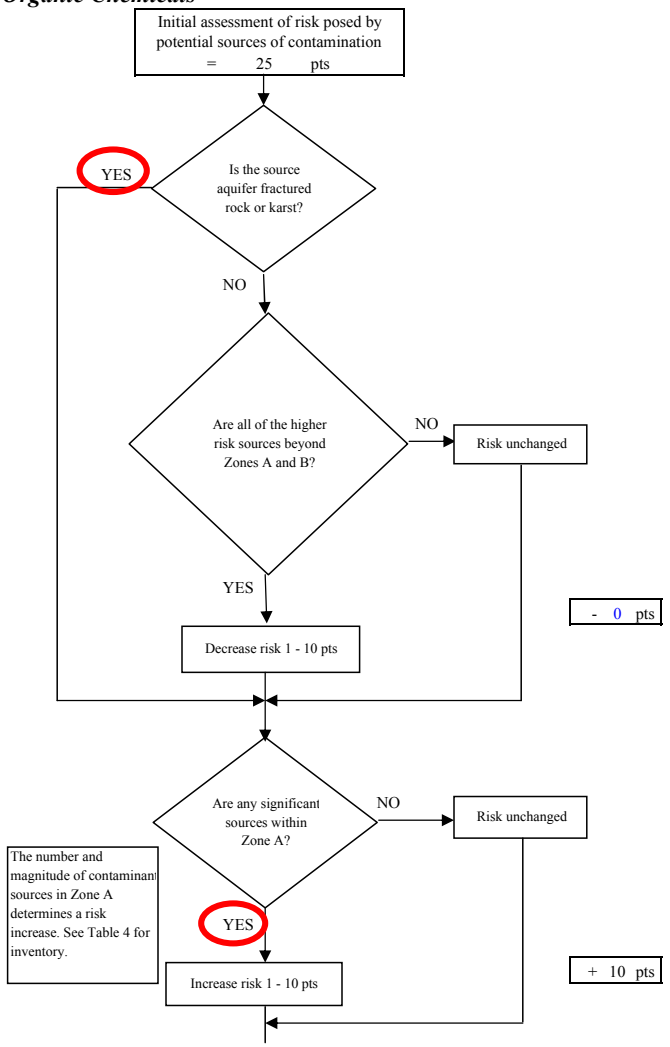


Chart 7. Contaminant risks for Nome Joint Utilites - Moonlight Springs Well No. 1, 2 and 3 - Volatile Organic Chemicals

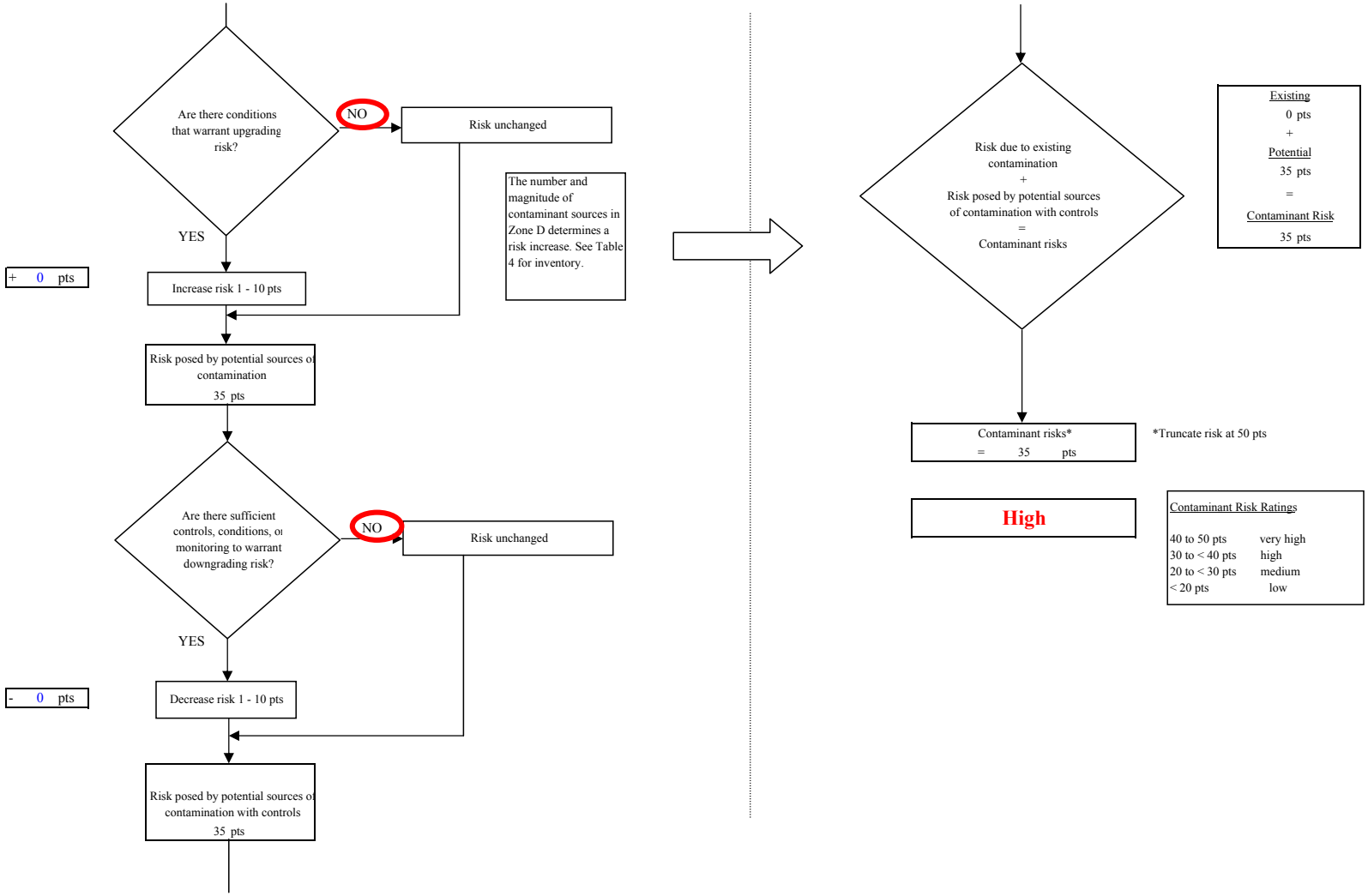


Chart 8. Vulnerability analysis for Nome Joint Utilites - Moonlight Springs Well No. 1, 2 and 3 - Volatile Organic Chemicals

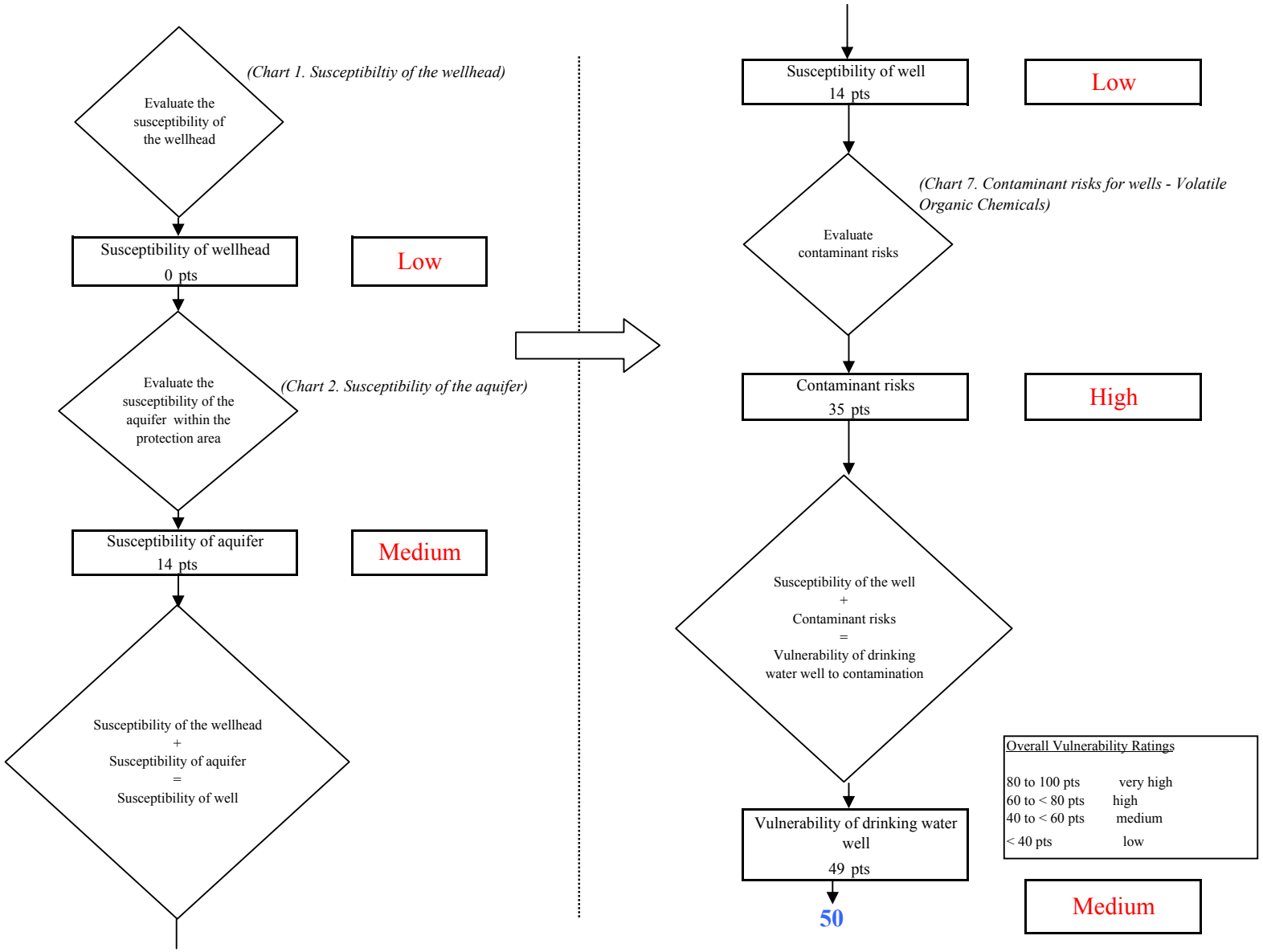


Chart 10. Vulnerability analysis for Nome Joint Utilites - Moonlight Springs Well No. 1, 2 and 3 - Heavy Metals, Cyanide and Other Inorganic Chemicals

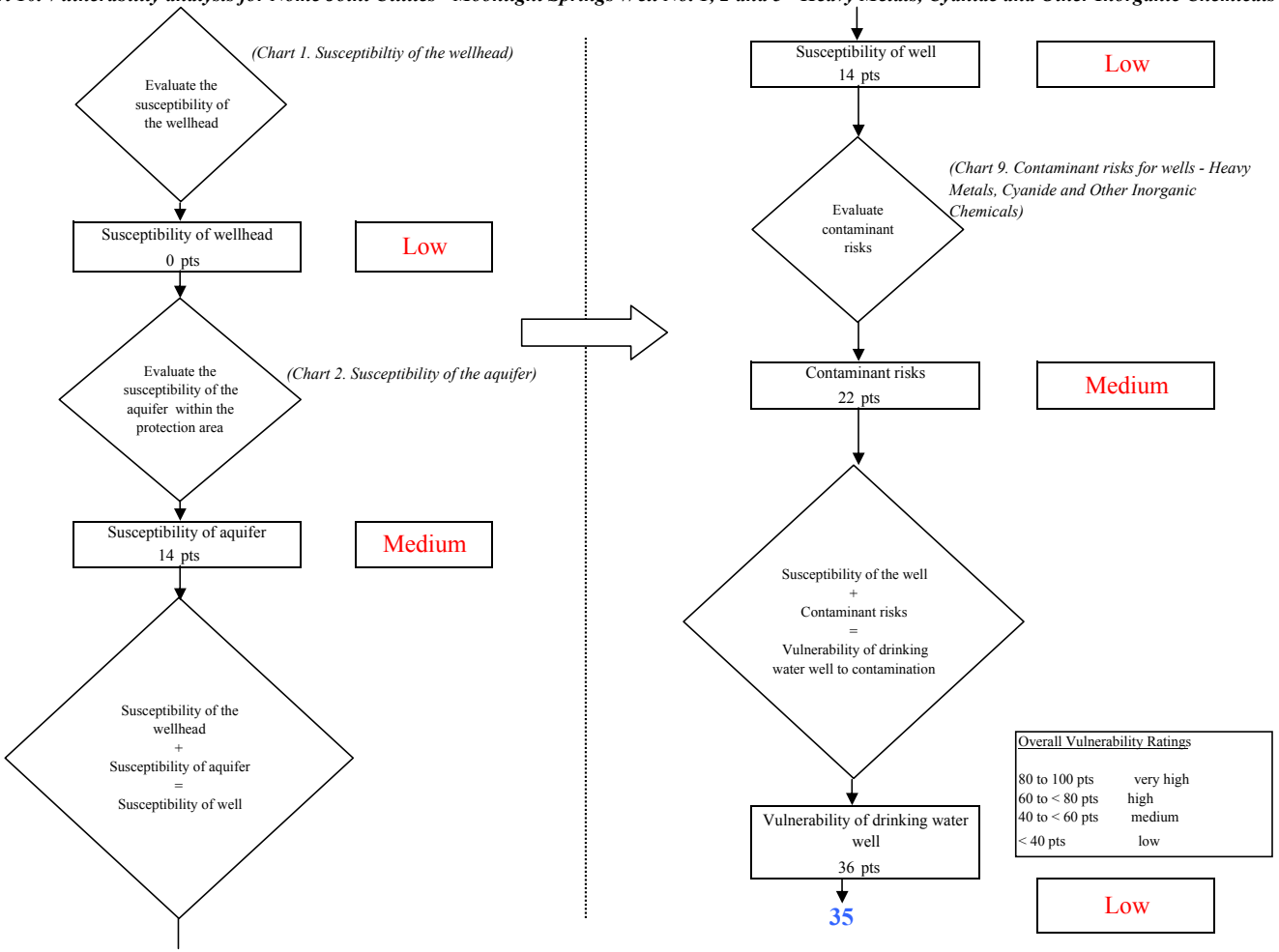


Chart 9. Contaminant risks for Nome Joint Utilites - Moonlight Springs Well No. 1, 2 and 3 - Heavy Metals, Cyanide and Other Inorganic Chemicals

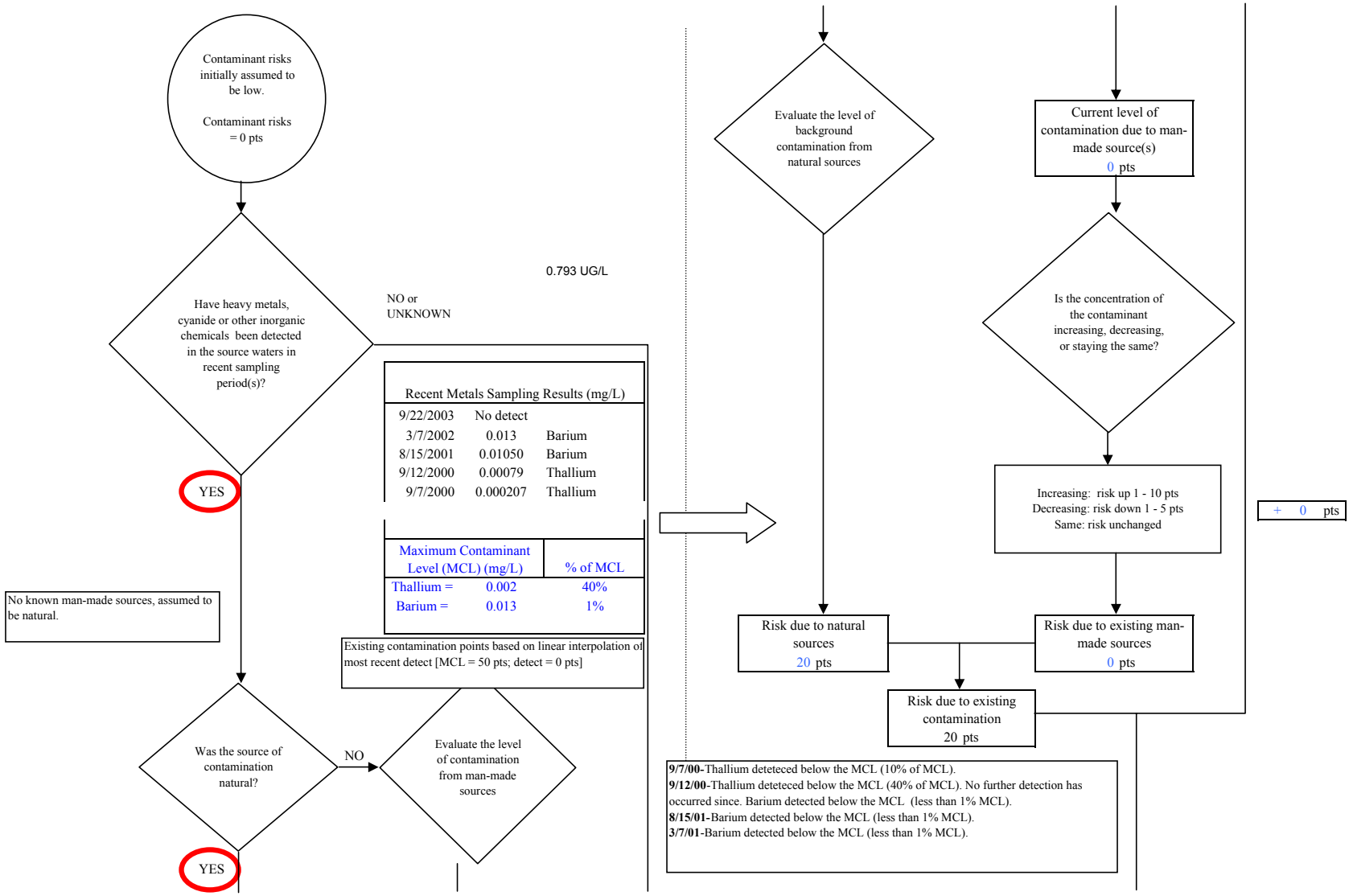
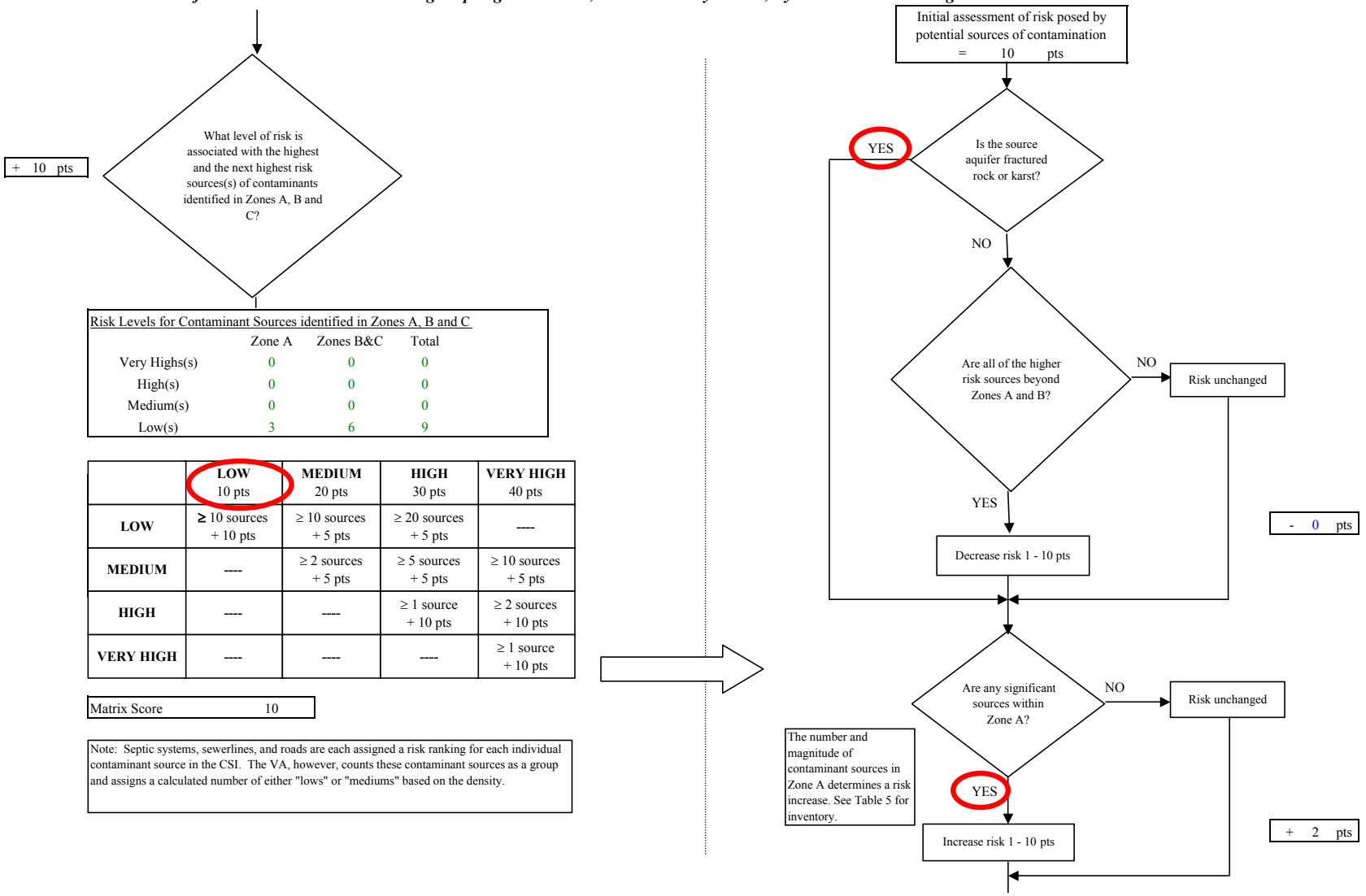


Chart 9. Contaminant risks for Nome Joint Utilites - Moonlight Springs Well No. 1, 2 and 3 - Heavy Metals, Cyanide and Other Inorganic Chemicals



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

	Zone A	Zones B&C	Total
Very Highs(s)	0	0	0
High(s)	0	0	0
Medium(s)	0	0	0
Low(s)	3	6	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 10

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

Chart 9. Contaminant risks for Nome Joint Utilites - Moonlight Springs Well No. 1, 2 and 3 - Heavy Metals, Cyanide and Other Inorganic Chemicals

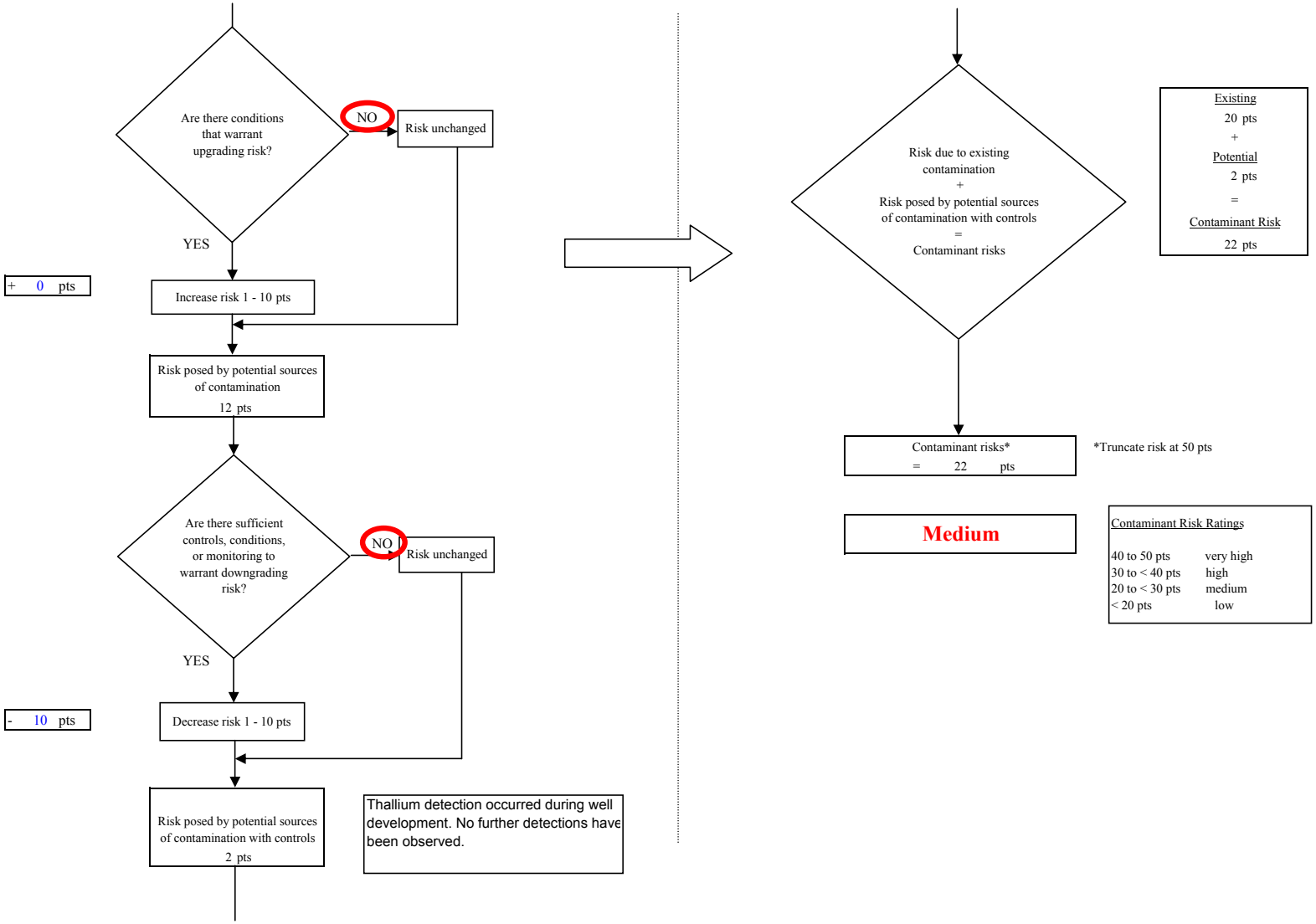


Chart 11. Contaminant risks for Nome Joint Utilites - Moonlight Springs Well No. 1, 2 and 3 - Synthetic Organic Chemicals

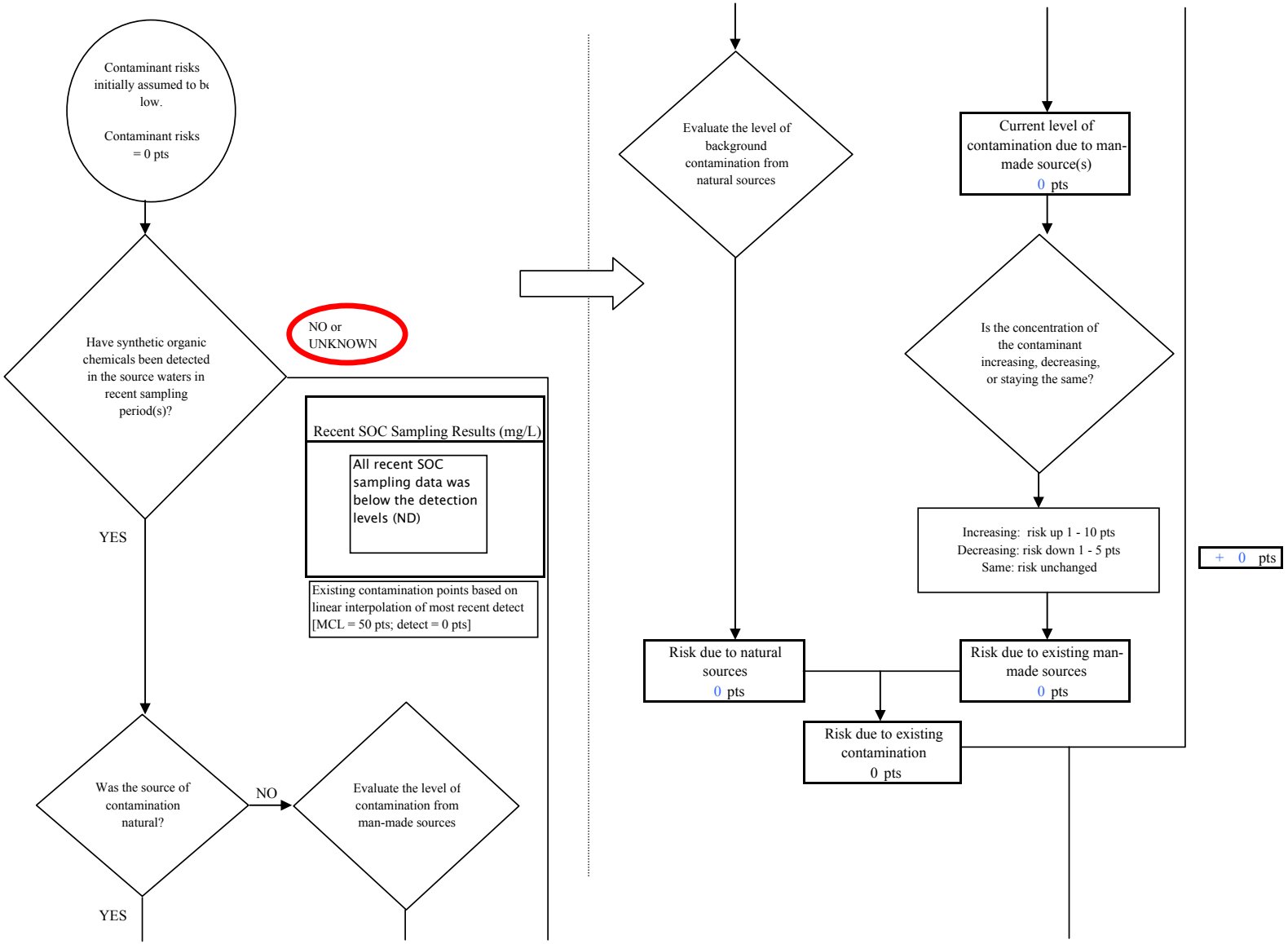
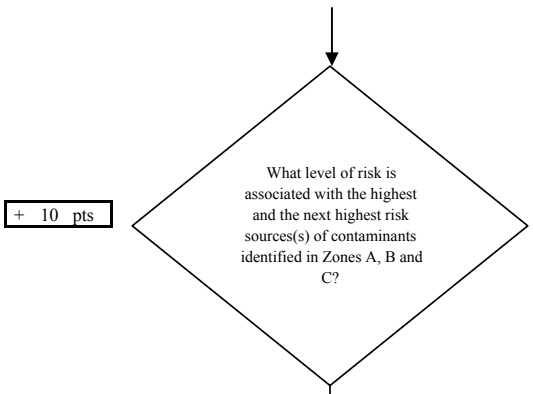


Chart 11. Contaminant risks for Nome Joint Utilites - Moonlight Springs Well No. 1, 2 and 3 - Synthetic Organic Chemicals



+ 10 pts

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

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

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

Matrix Score 10

Note: Septic systems, sewerlines, and roads are each assigned a risk ranking for each 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.

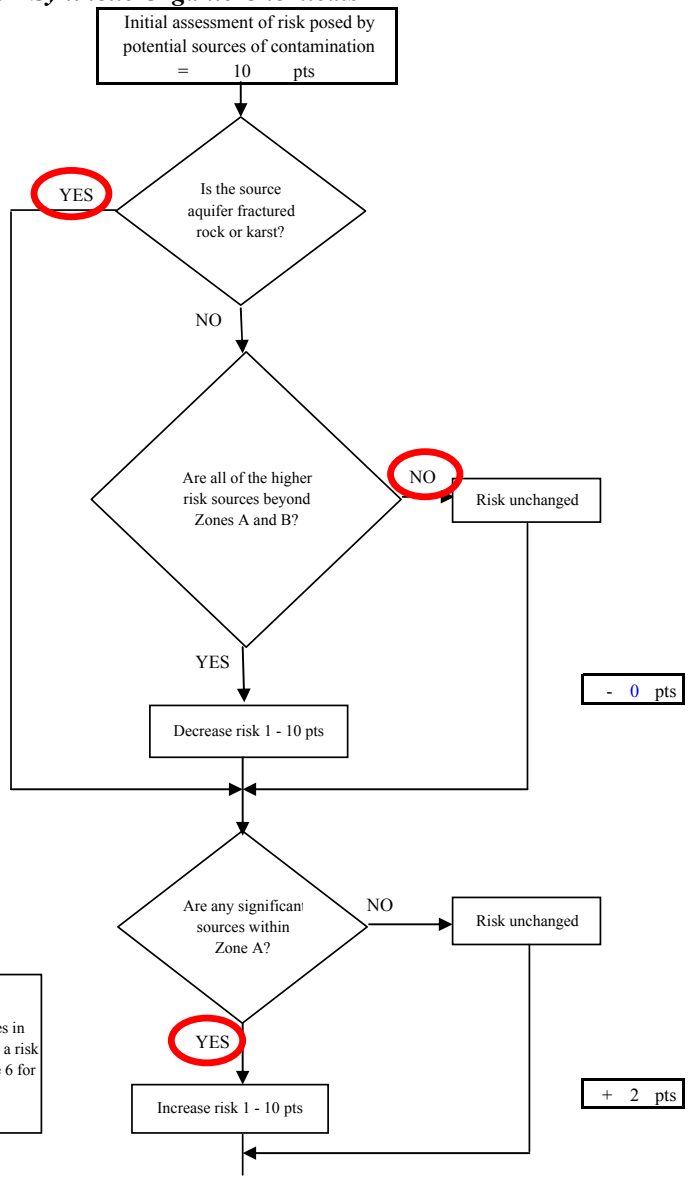


Chart 11. Contaminant risks for Nome Joint Utilites - Moonlight Springs Well No. 1, 2 and 3 - Synthetic Organic Chemicals

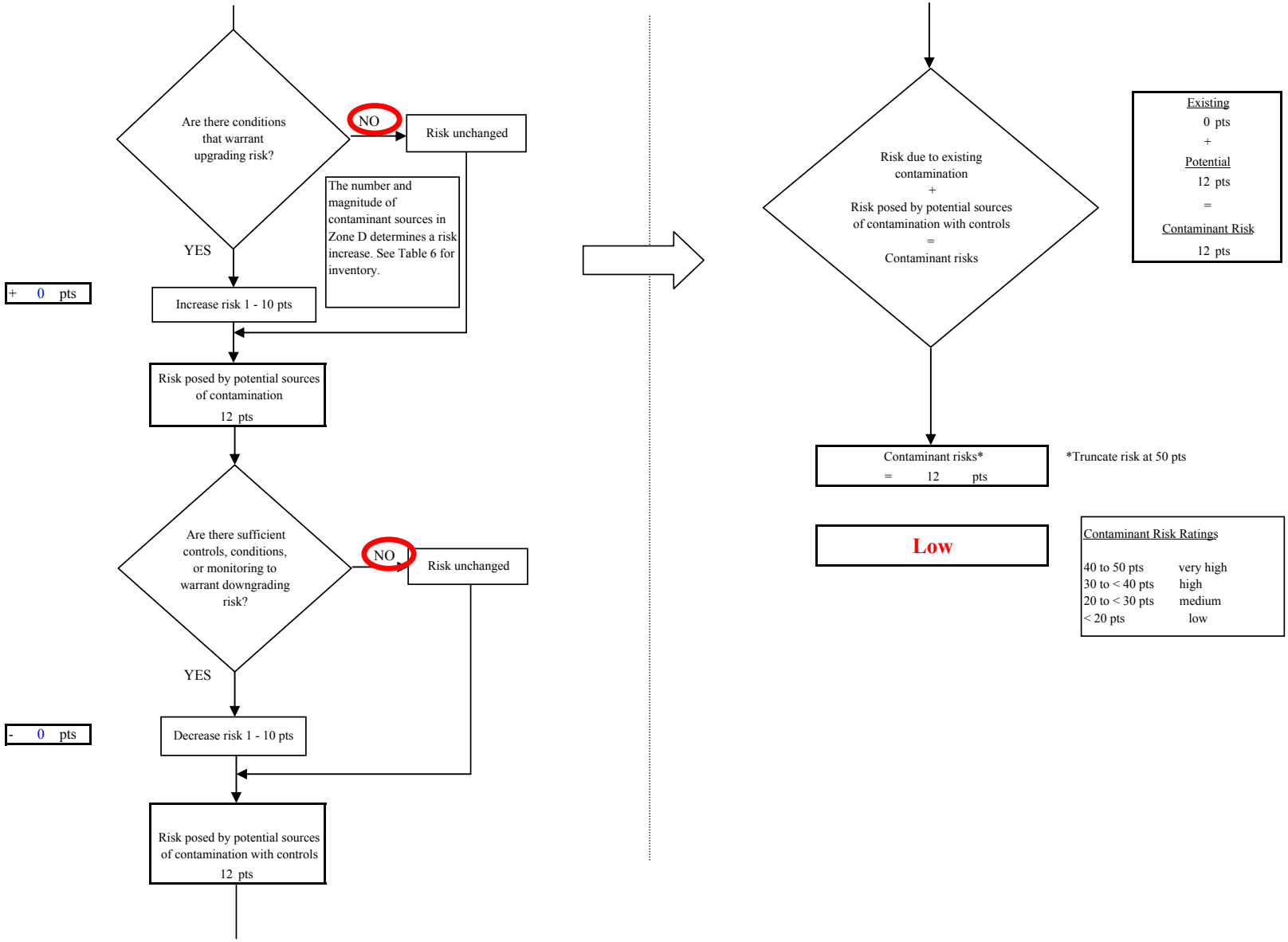


Chart 12. Vulnerability analysis for Nome Joint Utilites - Moonlight Springs Well No. 1, 2 and 3 - Synthetic Organic Chemicals

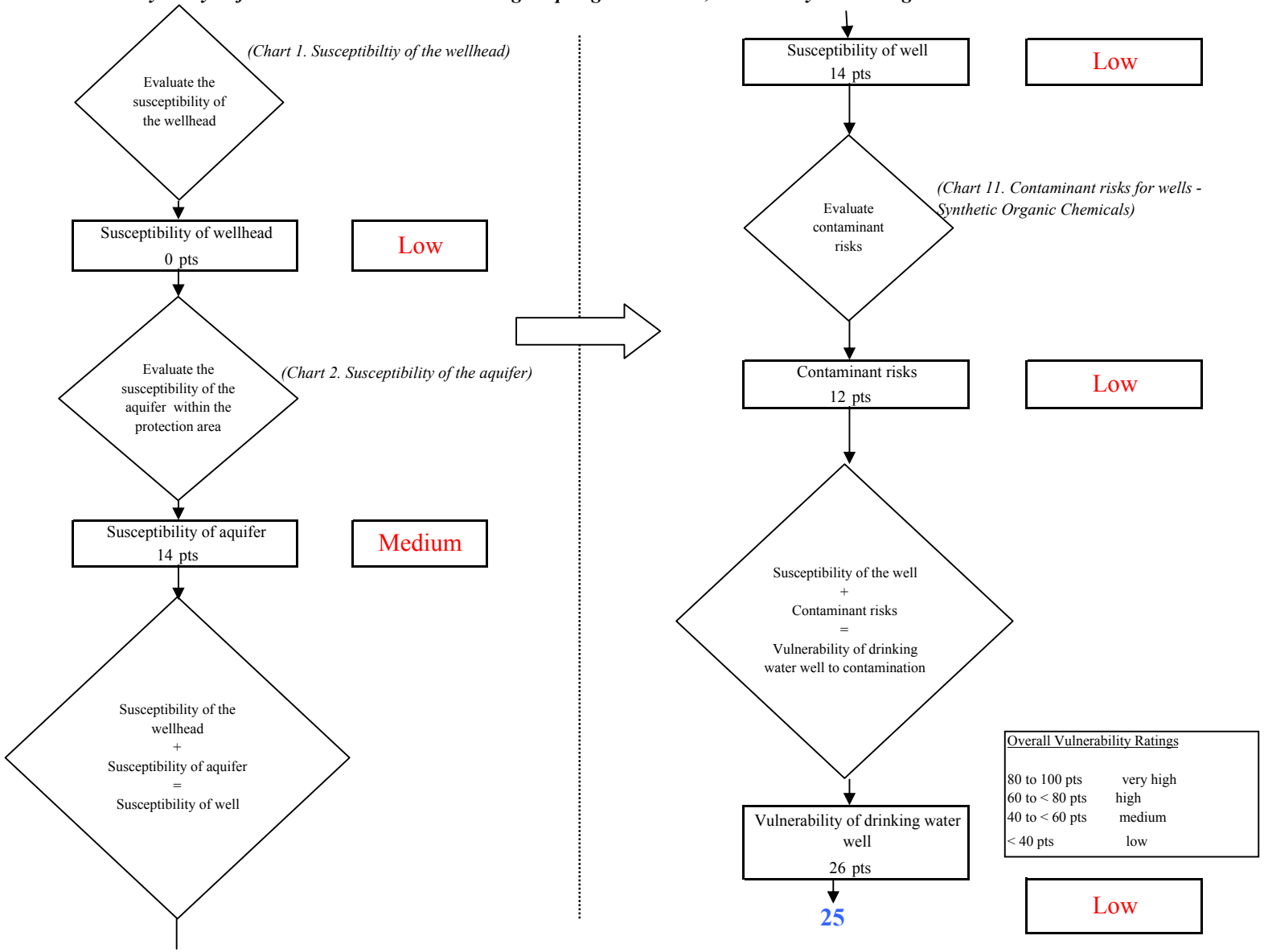


Chart 13. Contaminant risks for Nome Joint Utilites - Moonlight Springs Well No. 1, 2 and 3 - Other Organic Chemicals

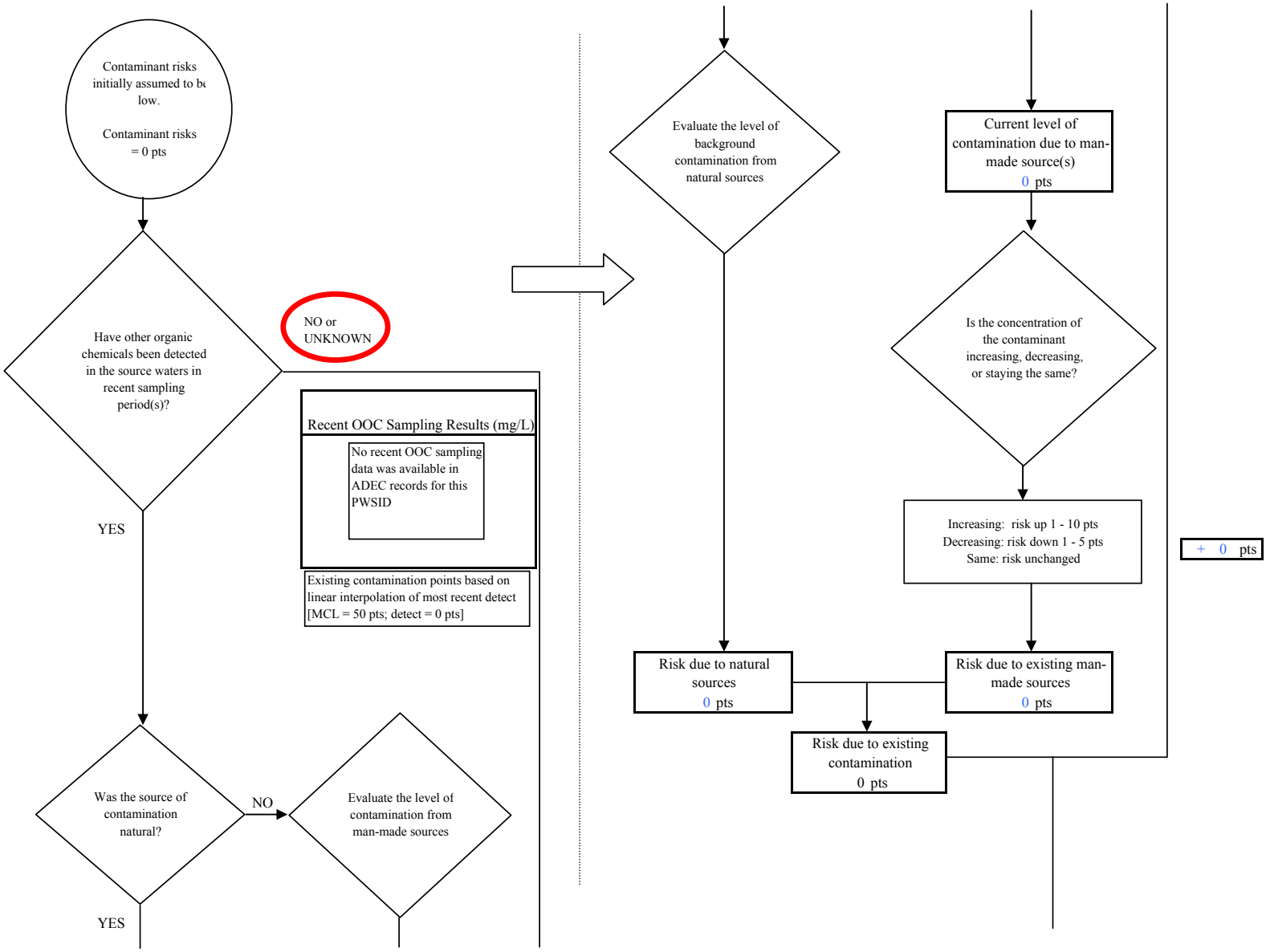
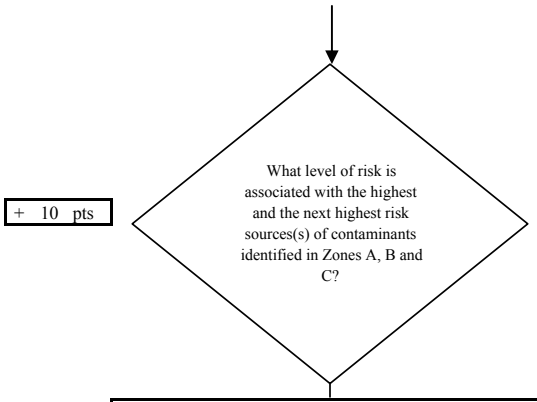


Chart 13. Contaminant risks for Nome Joint Utilites - Moonlight Springs Well No. 1, 2 and 3 - Other Organic Chemicals



+ 10 pts

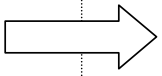
Risk Levels for Contaminant Sources identified in Zones A, B and C

	Zone A	Zones B&C	Total
Very Highs(s)	0	0	0
High(s)	0	0	0
Medium(s)	0	0	0
Low(s)	4	3	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 10

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.



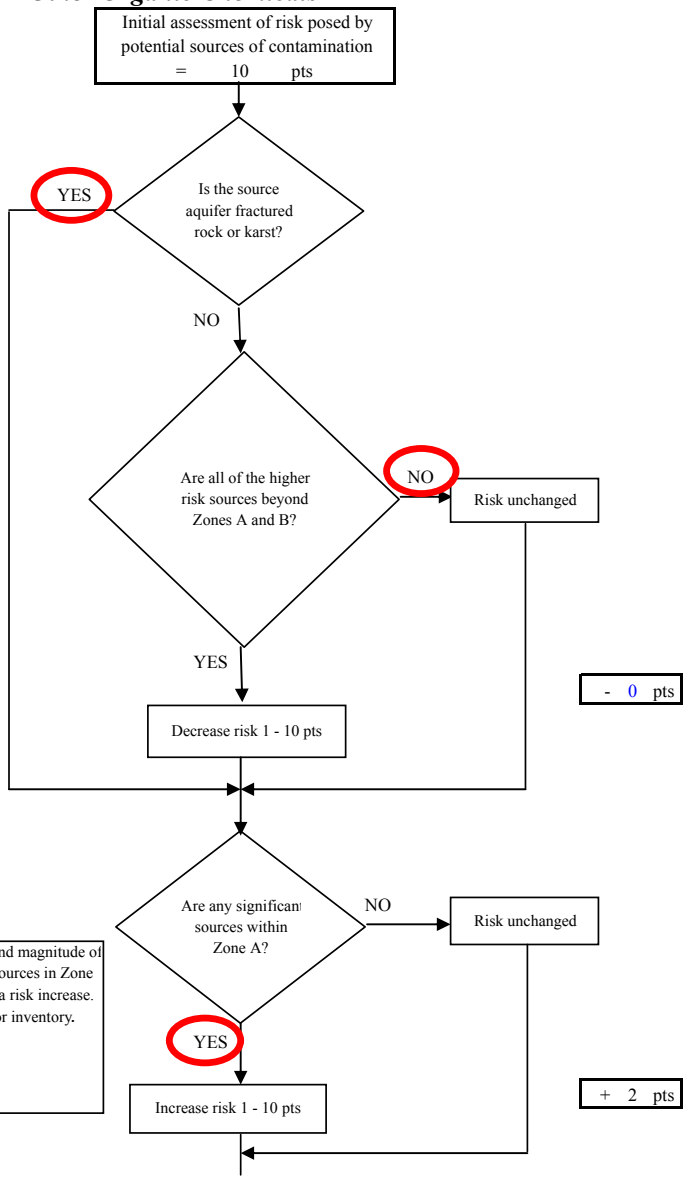


Chart 13. Contaminant risks for Nome Joint Utilites - Moonlight Springs Well No. 1, 2 and 3 - Other Organic Chemicals

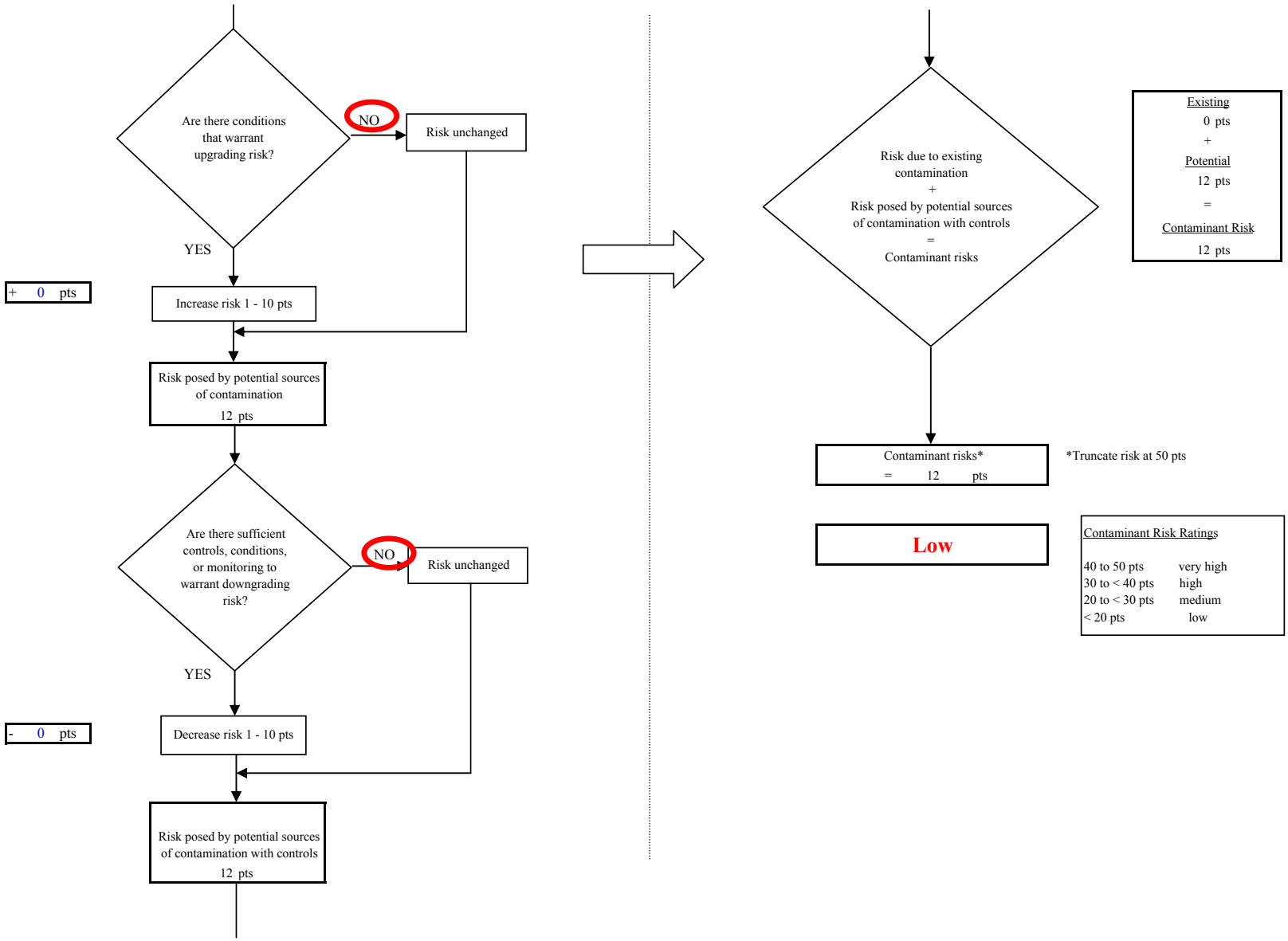


Chart 14. Vulnerability analysis for Nome Joint Utilites - Moonlight Springs Well No. 1, 2 and 3 - Other Organic Chemicals