Source Water Assessment for Wilderness East Community

A Hydrogeologic Susceptibility and Vulnerability Assessment

DRINKING WATER PROTECTION PROGRAM REPORT 405
PWSID 222987.001

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Alaska Department of Environmental Conservation

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The Drinking Water Protection Program 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. If you have any additional information that may affect the results of this assessment, please contact the Program Coordinator of DWPP, (907) 269-7521

ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION: 2002

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Alaska Department of Environmental Conservation

Drinking Water Protection Program
Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

The Wilderness East Community is a Class A (community) drinking water source consisting of one well. Identified potential and current sources of contaminants for Wilderness East Community includes large capacity septic systems, residential septic systems, paved roads and residential areas. These existing and potential sources of contamination are considered a source of bacteria and viruses, nitrates and/or nitrites, volatile organic chemicals, heavy metals, synthetic organic chemicals, and other organic chemicals. Overall, Wilderness East Community public water source received vulnerability rating of **Medium** for bacteria and viruses and nitrates/nitrites; **Low** for volatile organic chemicals, heavy metals, synthetics organic chemicals and other organic chemicals.

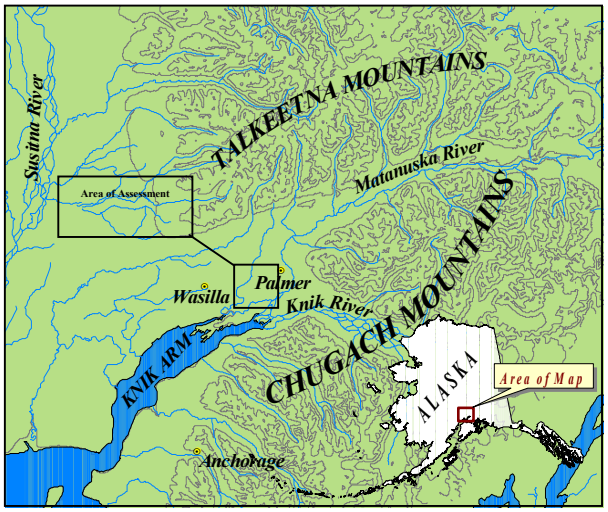

Figure 1. Index Map showing the location of the Matanuska-Susitna Valley and area of assessment.

INTRODUCTION

The purpose of this environmental assessment is to provide public water system owners/operators, communities, and local governments with information they can use to preserve the quality of Alaska's public drinking water supplies. This assessment was completed for the Wilderness East Community source of public drinking water. This source consists of one well in the Palmer area (Figure 1). This assessment, known under the Alaska Drinking Water Protection Program as the Source Water Assessment, has combined a review of the natural hydrogeologic sensitivity with potential and existing contaminant risks to arrive at an overall vulnerability of the drinking water source to contamination. This assessment has been completed as a basis for local voluntary protection efforts and to assist agencies in their efforts to reduce risk to this public drinking water supply.

DESCRIPTION OF THE MATANUSKA-SUSITNA VALLEY-AREA, ALASKA

Location

The Matanuska-Susitna Valley is part of the lowland lying about 50 miles north of Anchorage in south-central Alaska. The well described in this report is part of the Matanuska River Watershed. This study area is roughly bounded on the north by the Talkeetna Mountains; on the west by Wasilla Creek; on the south by the Knik River; and on the east by the Chugach Mountains. The area covers approximately 150 square miles.

Climate

The climate of the Matanuska-Susitna Valley is the result of a combination of marine and continental influences. The climate is somewhat transitional in that it does not experience large daily and annual temperature fluctuations like those experienced in the

interior of Alaska nor does it experience high amounts of precipitation typified by gulf coast regions. Mean annual precipitation is approximately 15 inches per year. On the average, the Valley receives a total snow accumulation of 58 inches per year. Precipitation generally increased inland toward the Talkeetna Mountains where annual precipitation may exceed 60 inches. Mean daily temperature ranges from 67° F during July to 5° F in January (Western Regional Climate Center, 2000).

Physiography and Groundwater Conditions

The Matanuska-Susitna Valley is surrounded by rugged mountains that rise abruptly above the valley floor. The Chugach Mountains at the southern edge of the valley reach altitudes greater than 6300 feet. These mountains are composed primarily of metamorphosed sedimentary marine and volcanic rocks. Along the northern edge of the valley, peaks in the Talkeetna Mountains reach altitudes of 3000 to 5000 feet. The Talkeetna Mountains are composed mainly of igneous rocks, chiefly granite intrusives and subordinate lavas and tuffs; Cretaceous and Tertiary sedimentary rocks form the south flank of the mountains. Although the altitude of the valley floor ranges from sea level at Knik Arm to 1000 feet at the base of Wishbone Hill, the local relief is commonly not more than 100 to 200 feet.

The Matanuska and Knik River's drain the area. These rivers are braided glacial outwash streams having wide floodplains. Drainage is poor in many interstream tracts resulting in large areas of swampy ground with shallow lakes occupying depressions.

The Matanuska-Susitna Valley is floored with unconsolidated deposits, chiefly glacial drift that represents several episodes of glacial advances and retreats. The drift includes till, outwash stream deposits, and estuarine and lake deposits. Physiographic features formed by these deposits in or adjacent to the study area include end moraine, lateral moraines, eskers, crevasse fillings, and other pitted

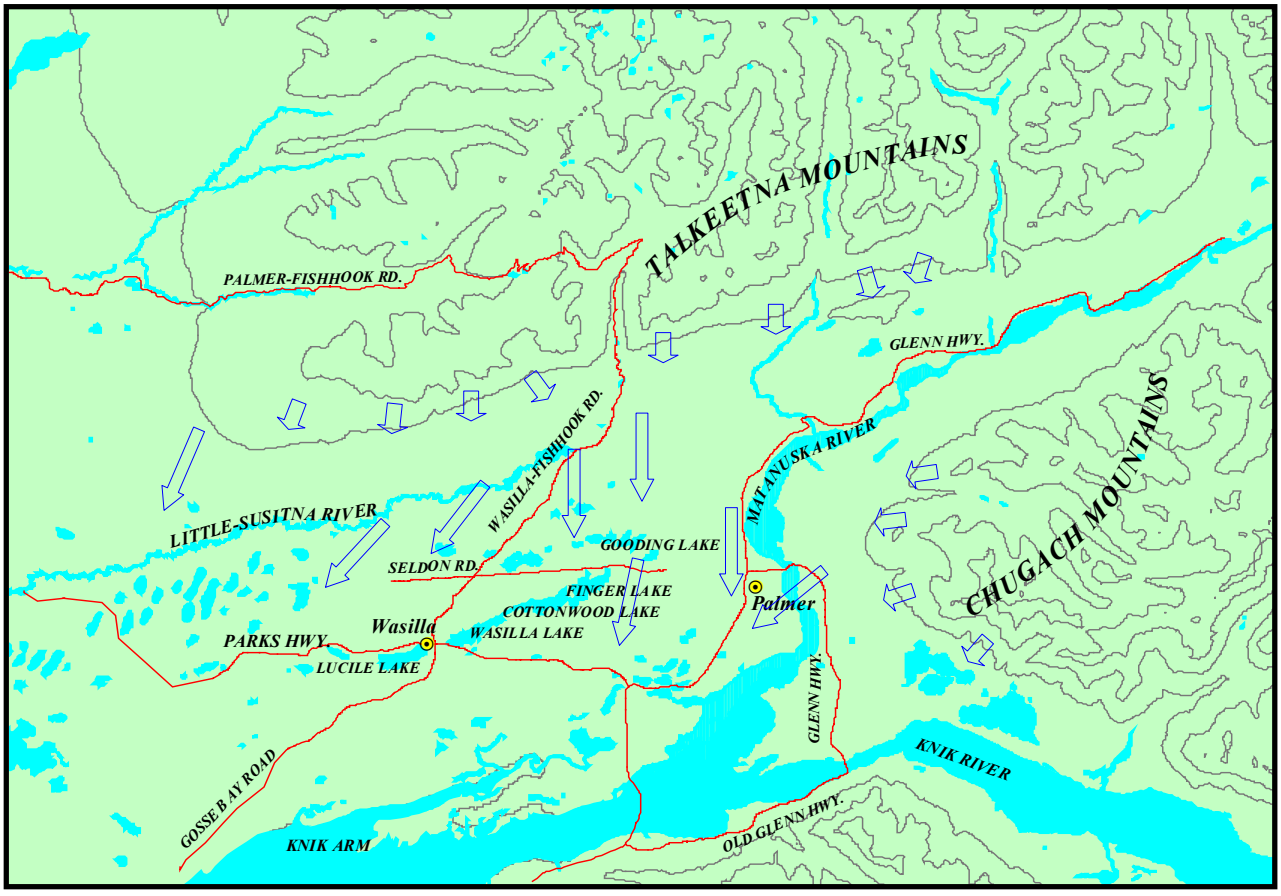

Figure 2. Map showing groundwater flow in the Matanuska-Susitna Valley (Jokela, Munter and Evans, 1991).

features, river terraces, outwash floodplains and an extensive estuarine flat (Trainer, 1960).

The glacial till and bedrock form aquifers of minor importance. The chief hydrologic significance of the till is in confining the artesian aquifer. Generally, the till is poorly permeable, although locally thin layers of sand may yield small quantities of water. Till that is present at or near the land surface in much of the area makes the acquisition of shallow groundwater difficult. The bedrock is poorly permeable. It yields water only from fractures, whose location and frequency cannot be easily predicted.

The chief aquifers are composed of outwash sand and gravel laid down by melt-water streams or in lakes. The outwash deposits are of two chief forms. The first consists of sheet-like deposits that lie just beneath the ground surface. These deposits range in thickness from a few feet to more than 100 feet. They typically rest on till or bedrock. The water in these deposits is unconfined. The other outwash deposits are buried beneath till. They are known to be as much as 50 to 60 feet thick, and probably are considerably thicker in some places. They commonly contain confined, or artesian, groundwater. Well logs and data from pumping tests suggest that outwash sand and gravel form a continuous or nearly continuous sheet in an area of more than 10 square miles north and west of Palmer (Jakola et al, 1991).

In the Mat-Su Valley, groundwater is primarily recharged by snowmelt and precipitation infiltrating both directly and also from the infiltration into the foothill slopes of the Talkeetna and Chugach Mountains. In addition,, aquifers may be recharged by streams where surface water percolates into surrounding permeable sediments (losing reaches of streams). This is the case for the water-table aquifers in the terrace south of Palmer and in the Bodenburg Butte area, which receive underground flow from the Matanuska River. Groundwater flow in the confined aquifers is generally from the north and north-northwest. The direction of groundwater flow in the upper unconfined aquifer is more variable due to the influence from surficial topography as well as its close connection with surface water bodies (Trainer,1960).

WILDERNESS EAST COMMUNITY PUBLIC WATER SOURCE

Wilderness East Community public water source is a Class A (community) water source, which is privately owned and operated. The source consists of one well located approximately 300 feet north of the Parks Highway and 300 ft east of James Street. The well is at an approximate elevation of 140 feet above sea level. The well was drilled in 1973. No well log exists however records indicate that the well is 129 feet below the surface and the static water level in 1984 was 70 feet below the surface. Well logs nearby indicate thick and inconsistent confining layers exist in the area. It is not know if the well is screened. The well casing is not grouted. Grouting is a seal surrounding the well casing. The seal helps protect ground water resource from surface and/or subsurface contamination (NGWA, 2001).

The water system at Wilderness East Community collectively serves approximately 70 residents and 20 non-residents through 12 service connections and operates 365 days per year.

ASSESSMENT AND PROTECTION AREA FOR WILDERNESS EAST COMMUNITY DRINKING WATER SOURCE

The Drinking Water Protection and Assessment Area that has been established for Wilderness East Community is the area that is most sensitive to contamination. This area has served as a basis for assessing the risk of the drinking water source to contamination. This zone around the drinking water source is the most critical area for the preservation of the quality of the drinking water for this source. For simplicity, this area will be known as your Drinking Water Protection Area and will serve as the area of focus for voluntary protection efforts.

Conceptually, groundwater enters the aquifer systems along the front range of the Talkeetna Mountains and flows toward Cook Inlet. An analytical calculation was used to calculate the size and shape of the area that contributes water to the well. The input parameters describing the attributes of the aquifer in this calculation were adopted from the well log and the recent Sanitary Survey. This analytical calculation was used as a guide in establishing the protection area for Wilderness East Community. Additional methods were further employed to take into account any uncertainties in groundwater flow and aquifer characteristics to arrive at a meaningful and conservative protection area with respect to public health (Please refer to the Guidance Manual for Class A Public Water Systems for additional information).

The Drinking Water Protection Areas established for wells by the Alaska Department of Environmental Conservation (ADEC) are separated into zones. These zones correspond to a time-of-travel. Time-of-travel is the time required for water to move in the saturated zone of the ground from a specific point to the well.

The Drinking Water Protection Areas for Wilderness East Community contains four zones, Zone A, Zone B, Zone C and Zone D (Map 1, Appendix A). Zone A corresponds to the area between the well and the distance equal to ¼ of the distance of the 2-year time-of-travel. Depending on where a contaminant source is located within Zone A, travel time for a contaminant to the well may be on the order of several days to several hours. Zone A also extends down gradient from the well to take into account the area of the aquifer that is influenced by pumping of the well. The Zone B protection area for Wilderness East Community corresponds to a time-of-travel of less than two years and extends toward base of the Talkeetna Mountains. Zone C protection area corresponds to a time-of-travel of greater than 2 years and less than 5 years. Zone D corresponds to a time-of-travel of greater than 5 years and less than 10 years.

INVENTORY OF POTENTIAL AND EXISTING CONTAMINANT SOURCES

The Drinking Water Protection Program has completed an inventory of potential and existing sources of contamination within Wilderness East Community Drinking Water Protection Area. This survey was completed through a search of agency records and other publicly available information.

Potential sources of contamination to drinking water supplies cover 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 this assessment and all Class A public water system assessments, six categories of drinking water contaminants were inventoried. They include:

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

Table 1 in Appendix C lists the Contaminant Source Inventory for Wilderness East Community. Below is a summary of the categories of the contaminant sources inventoried within the Equestrian Acres protection area:

- Large capacity septic systems (Class V Injection Wells)
- Paved roads
- Residential Septic Systems
- Residential Areas

These potential contaminant sources present risks for all six categories of drinking water contaminants for Wilderness East Community drinking water source.

RANKING OF CONTAMINANT RISKS

Potential and existing sources of contamination have been identified, sorted, and ranked 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. Contaminant risks are further a function of the number and density of those types of contaminant sources as well as the proximity of those sources to the well (Appendices B & C).

VULNERABILITY OF WILDERNESS EAST COMMUNITY DRINKING WATER SOURCES

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

- Natural susceptibility; and
- Contaminant risks.

Each of the three categories of drinking water contaminants has been analyzed and an overall vulnerability score of 0 to 100 is ultimately assigned:

Natural Susceptibility (0 – 50 points)

+

Contaminant Risks (0 – 50 points)

=

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

A score for the Natural Susceptibility is achieved by analyzing the properties of the well and the aquifer.

Susceptibility of the Wellhead (0 – 25 Points)
+
Susceptibility of the Aquifer (0 – 25 Points)

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

The Wilderness East Community well is completed in a confined-aquifer setting. Nearby well logs indicate that

a thick clay-confining layer exists in the area. However, the confining layer appears to be inconsistent. Well logs directly north of this system indicate the absence of a barrier. The presence of a confining layer may provide a protective barrier from the movement of contaminants in the subsurface. However, the inconsistency of the layer and the lack of grouting may allow contaminants to enter the subsurface aquifer uninhibited by any protective layer.

Combining the susceptibilities of the wellhead and the aquifer to contamination leads to a score (0 – 50 points) and rating of overall Susceptibility (Appendix D). Table 1 shows the overall Susceptibility score and rating for Wilderness East Community.

Table 1. Natural Susceptibility - Susceptibility of the Wellheads and Aquifer to Contamination

	Score	Rating
Susceptibility of the Wellheads	5	Low
Susceptibility of the Aquifer	4	Low
Natural Susceptibility	9	Low

Contaminant risks to a drinking water source depend on the type, number or density, and distribution of contaminant sources. A score (0 – 50 points) and rating of Contaminant Risks (See Appendix D) is assigned based on the findings of the Contaminant Source Inventory (See Appendix B - Table 1 – Table 7). This portion of the analysis examines recent existing or historical contamination that has been detected at the drinking water sources through routine sampling. It also reviews contamination that has or may have occurred but has not arrived or been detected at the either well. Table 2 summarizes the Contaminant Risks for each category of drinking water contaminants.

Table 2. Contaminant Risks

Contaminant Risks	Score	Rating
Bacteria and Viruses	50	Very High
Nitrates and/or Nitrites	50	Very High
Volatile Organic Chemicals	12	Low
Heavy Metals, Cyanide, And Other Inorganic Chemicals	12	Low
Synthetic Organic Chemicals	12	Low
Other Organic Chemicals	13	Low

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

Vulnerability of drinking water sources to contamination is the combination of susceptibility of the aquifer and the well with contaminant risks. Table 3 contains the overall vulnerability scores (0 – 100) and ratings for each of the six categories of drinking water contaminants (See Appendix D). Note: scores are rounded off to the nearest five.

Table 3. Overall Vulnerability of Wilderness East Community Public Drinking Water Source to Contamination by Category

Category	Score	Rating
Bacteria and Viruses	55	Medium
Nitrates and Nitrites	55	Medium
Volatile Organic Chemicals	20	Low
Heavy Metals, Cyanide, and Other Inorganic Chemicals	20	Low
Synthetic Organic Chemicals	20	Low
Other Organic Chemicals	20	Low

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, heavy metals, synthetic organic chemicals, and other organic chemicals, respectively.

The contamination risk for the Bacteria/Viruses is driven by the potential risk associated with large capacity septic systems (Class V Injection Wells) and

residential septic systems. No detection of Bacteria and Viruses has occurred in recent sampling history. Combining the contamination risk with the natural susceptibility of the well leads to an overall vulnerability to bacteria and virus contamination of high.

The contamination risk for bactera and viruses is driven by the potential risk associated with large capacity septic systems (class V injection wells), residential septic systems, residential areas, and roads.

Recent historical sampling indicates no detection of bacteria and viruses. Combining the contaminant risk with the natural susceptibility of the well leads to an overall vulnerability to bacteria and virus contamination of medium.

The contamination risk for nitrate/nitrites is driven by the potential risk associated with large capacity septic systems (class V injection wells), residential septic systems, residential areas, and roads.

Exisitng risk was determined by reviewing recent historical sampling data. The most recent detection indicates that nitrates were detected at 5% the maximum contaminant level (MCL) of 10 mg/l on 10/13/1998. (See Chart 5 – Contaminant Risks for nitrates and/or nitrites in Appendix D.) The MCL is the maximum level of contaminant that is allowed to exist in drinking water and still be consumed by humans without harmful effects. Combining the contamination risk with the natural susceptibility of the well leads to an overall vulnerability to nitrate/nitrite contamination of very high.

The very high risk ranking for bacteria and viruses and nitrates/nitrites is largely attributed to the presence of two large capacity of septic systems (LCSS's) in Zone A. For purposes of this study, LCSS are defined as septic systems serving more then one single family home. The United States Environmental Protection Agency's (USEPA) Underground Injection Control Program (UICP) is responsible for regulating large capacity septic systems (LCSS's) serving 20 or more individuals (USEPA, 1999). It is unknown how many individuals are served by the LCSS's located in Zone A.

Nitrates and/or nitrites are found in natural background concentration at this site, as elsewhere in Alaska. Other sources of nitrate and/or nitrites are human sewage, livestock manure, especially from feedlots and fertilizers. Due to high solubility and weak retention by soil, nitrates are very mobile often moving at approximately the same rate as water. It is unknown whether the existing contamination is naturally occurring or human influenced. According to the USEPA, short-term exposure to levels excessively above the MCL has caused serious illness and sometimes death. Serious illness in infants can occur due to the conversion of nitrate to nitrite by the body, which can interfere with the oxygen-carrying capacity of the childs blood. This can be an acute condition in which health deteriorates rapidly over a period of days. Symptoms include shortness of breath and blueness of the skin. Long term exposure to nitrates and nitrites at levels above the MCL can lead to diuresis, increased starchy deposits and hemorrhaging of the spleen (USEPA, 2001).

Because naturally occurring nitrate levels are typically less than 2 mg/l (or 20% the MCL), it is suspected that the nitrate levels detected are naturally occurring. (Wang, Strelakos, Jokela, 2000).

The contaminant risks for volatile organic chemicals are driven by the potential risk associated with roads, residential areas, large capacity septic systems (LCSS's) and residential septic systems.

Recent historical sampling indicate no detection of volatile organic chemicals. Combining the contaminant risk with the natural susceptibility of the well leads to an overall vulnerability to volatile organic chemical contamination of low.

The contaminant risks for heavy metals and inorganic are driven by the potential risks associated with roads, large capacity septic systems, residential areas and residential septic systems and the risks associated with existing contamination.

Recent historical sampling indicates that barium was detected at very low levels. Sampling done on 10/13/98 detected barium at 0.020 mg/l or 1% the MCL of 0.2mg/l. Combining the contaminant risk with the natural susceptibility of the well leads to an overall vulnerability to heavy metals and inorganic chemical contamination of low.

Barium is a lustrous, machinable metal, which exists in nature in ores containing mixtures of elements. It is used in making a wide variety of electronic components, in metal alloys, bleaches, dyes, fireworks, ceramics and glass. In particular, it is used in well drilling operations where it is directly released into the ground (EPA, 2002). It is unknown where the barium originates from but due to its low levels it is highly likely that it is from natural sources.

The contaminant risk for synthetic organic chemicals is driven by the potential risk associated with residential areas, large capacity septic systems and residential septic systems.

Recent sampling history indicates that no synthetic organic contamination has been detected. Combining the contaminant risk with the natural susceptibility of the well leads to an overall vulnerability to synthetic chemical contamination of low.

The contamination risk for other organic chemicals is driven by the potential risk associated with roads, large capacity septic systems, residential areas and residential septic systems.

Recent sampling history indicates that no contamination from other organic chemicals have been detected. Combining the contaminant risk with the natural susceptibility of the well leads to an overall vulnerability to other organic chemical contamination of low.

SUMMARY

A Source Water Assessment has been completed for the source of public drinking water serving Wilderness East Community. The overall vulnerability of this source to contamination is; **Medium** for nitrate/nitrite and bacteria and viruses; **Low** for volatile organic chemicals, heavy metals and inorganic chemicals, synthetic organic chemicals and other organic chemicals. 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 Wilderness East Community 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 Wilderness East Community's public drinking water source.

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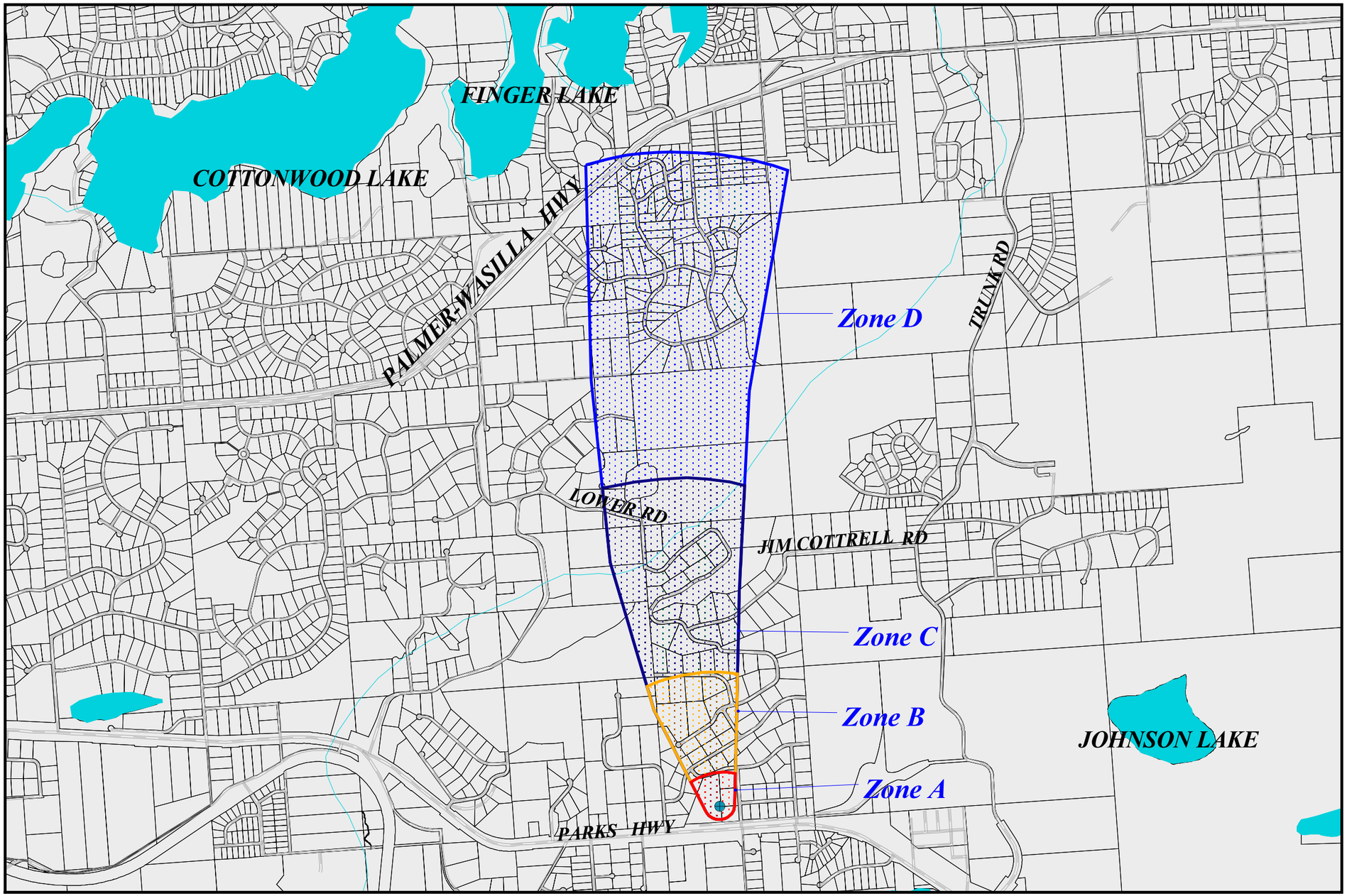
APPENDIX A

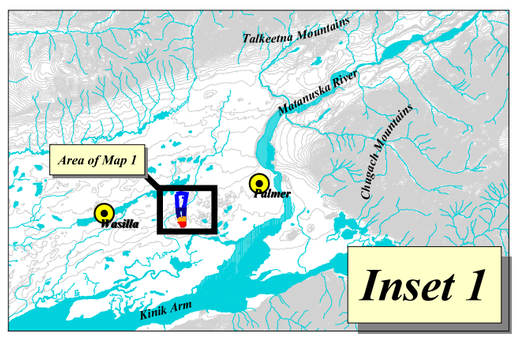
Wilderness East Community
Drinking Water Protection Area

Drinking Water Protection Area for Wilderness East Community



Legend

- Wilderness East Public Water System
- Zone A Protection Area
  - Several Months Travel Time
- Zone B Protection Area
  - Less than 2 Years Travel Time
- Zone C Protection Area
  - Less than 5 Years Time of Travel
- Zone D Protection Area
  - Less than 10 Years Travel Time
- Residential (R01)
- Septics (R02)
- Lakes
- Rivers and Streams
- Roads
- Matanuska Susitna Borough Parcels
- Cities



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Map 1

APPENDIX B

Contaminant Source Inventory and Risk Ranking for Wilderness East Community

Table 1 *Contaminant Source Inventory for* ***PWSID 222987.001***

Wilderness East Community

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Location*	*Map Number*	*Comments*
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-01	A	Near Parks Hwy	3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-02	A	Near Parks Hwy	3	
Residential Areas	R01	R01-01	A	All residential area in Zone A	2	8 Acres
Septic systems (serves one single-family home)	R02	R02-01	A	Near Mesa Drive	3	
Highways and roads, paved (cement or asphalt)	X20	X20-01	A	Lower Mesa Road	2	
Residential Areas	R01	R01-02	B	All residential area in Zone B	2	21 Acres
Septic systems (serves one single-family home)	R02	R02-02	B	Near Middle Mesa Drive	3	
Septic systems (serves one single-family home)	R02	R02-03	B	Near Middle Mesa Drive	3	
Septic systems (serves one single-family home)	R02	R02-04	B	Near Middle Mesa Drive	3	
Septic systems (serves one single-family home)	R02	R02-05	B	Near Middle Mesa Drive	3	
Septic systems (serves one single-family home)	R02	R02-06	B	Near Middle Mesa Drive	3	
Septic systems (serves one single-family home)	R02	R02-07	B	Near Connect Court	3	
Septic systems (serves one single-family home)	R02	R02-08	B	Near Lower Road	3	
Septic systems (serves one single-family home)	R02	R02-09	B	Near Lower Road	3	
Septic systems (serves one single-family home)	R02	R02-10	B	Near Lower Road	3	
Septic systems (serves one single-family home)	R02	R02-11	B	Near Lonesome Drive	3	
Highways and roads, paved (cement or asphalt)	X20	X20-02	B	Middle Mesa Drive	2	
Highways and roads, paved (cement or asphalt)	X20	X20-03	B	Connect Court	2	
Highways and roads, paved (cement or asphalt)	X20	X20-04	B	Lower Circle	2	
Highways and roads, paved (cement or asphalt)	X20	X20-05	B	Lonesome Drive	2	
Residential Areas	R01	R01-03	C	All Residential area in Zone C	2	63 Acres
Septic systems (serves one single-family home)	R02	R02-12-36	C	All residential septic systems in Zone C	3	
Highways and roads, paved (cement or asphalt)	X20	X20-06	C	Upper Mesa	2	

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Location*	*Map Number*	*Comments*
Highways and roads, paved (cement or asphalt)	X20	X20-07	C	Lower Road	2	

Table 2

Contaminant Source Inventory and Risk Ranking for Wilderness East Community Sources of Bacteria and Viruses

PWSID 222987.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Location*	*Map Number*	*Comments*
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-01	A	High	Near Parks Hwy	3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-02	A	High	Near Parks Hwy	3	
Septic systems (serves one single-family home)	R02	R02-01	A	Low	Near Mesa Drive	3	
Residential Areas	R01	R01-01	A	Low	All residential area in Zone A	2	8 Acres
Highways and roads, paved (cement or asphalt)	X20	X20-01	A	Low	Lower Mesa Road	2	
Residential Areas	R01	R01-02	B	Low	All residential area in Zone B	2	21 Acres
Septic systems (serves one single-family home)	R02	R02-02	B	Low	Near Middle Mesa Drive	3	
Septic systems (serves one single-family home)	R02	R02-03	B	Low	Near Middle Mesa Drive	3	
Septic systems (serves one single-family home)	R02	R02-04	B	Low	Near Middle Mesa Drive	3	
Septic systems (serves one single-family home)	R02	R02-05	B	Low	Near Middle Mesa Drive	3	
Septic systems (serves one single-family home)	R02	R02-06	B	Low	Near Middle Mesa Drive	3	
Septic systems (serves one single-family home)	R02	R02-07	B	Low	Near Connect Court	3	
Septic systems (serves one single-family home)	R02	R02-08	B	Low	Near Lower Road	3	
Septic systems (serves one single-family home)	R02	R02-09	B	Low	Near Lower Road	3	
Septic systems (serves one single-family home)	R02	R02-10	B	Low	Near Lower Road	3	
Septic systems (serves one single-family home)	R02	R02-11	B	Low	Near Lonesome Drive	3	
Highways and roads, paved (cement or asphalt)	X20	X20-02	B	Low	Middle Mesa Drive	2	
Highways and roads, paved (cement or asphalt)	X20	X20-03	B	Low	Connect Court	2	
Highways and roads, paved (cement or asphalt)	X20	X20-04	B	Low	Lower Circle	2	
Highways and roads, paved (cement or asphalt)	X20	X20-05	B	Low	Lonesome Drive	2	
Septic systems (serves one single-family home)	R02	R02-12-36	C	Low	All residential septic systems in Zone C	3	
Highways and roads, paved (cement or asphalt)	X20	X20-06	C	Low	Upper Mesa	2	

Table 2 (continued)

Contaminant Source Inventory and Risk Ranking for Wilderness East Community Sources of Bacteria and Viruses

PWSID 222987.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Location*	*Map Number*	*Comments*
Highways and roads, paved (cement or asphalt)	X20	X20-07	C	Low	Lower Road	2	

Table 3

Contaminant Source Inventory and Risk Ranking for Wilderness East Community Sources of Nitrates/Nitrites

PWSID 222987.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Location*	*Map Number*	*Comments*
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-01	A	High	Near Parks Hwy	3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-02	A	High	Near Parks Hwy	3	
Septic systems (serves one single-family home)	R02	R02-01	A	Low	Near Mesa Drive	3	
Residential Areas	R01	R01-01	A	Low	All residential area in Zone A	2	8 Acres
Highways and roads, paved (cement or asphalt)	X20	X20-01	A	Low	Lower Mesa Road	2	
Residential Areas	R01	R01-02	B	Low	All residential area in Zone B	2	21 Acres
Septic systems (serves one single-family home)	R02	R02-02	B	Low	Near Middle Mesa Drive	3	
Septic systems (serves one single-family home)	R02	R02-03	B	Low	Near Middle Mesa Drive	3	
Septic systems (serves one single-family home)	R02	R02-04	B	Low	Near Middle Mesa Drive	3	
Septic systems (serves one single-family home)	R02	R02-05	B	Low	Near Middle Mesa Drive	3	
Septic systems (serves one single-family home)	R02	R02-06	B	Low	Near Middle Mesa Drive	3	
Septic systems (serves one single-family home)	R02	R02-07	B	Low	Near Connect Court	3	
Septic systems (serves one single-family home)	R02	R02-08	B	Low	Near Lower Road	3	
Septic systems (serves one single-family home)	R02	R02-09	B	Low	Near Lower Road	3	
Septic systems (serves one single-family home)	R02	R02-10	B	Low	Near Lower Road	3	
Septic systems (serves one single-family home)	R02	R02-11	B	Low	Near Lonesome Drive	3	
Highways and roads, paved (cement or asphalt)	X20	X20-02	B	Low	Middle Mesa Drive	2	
Highways and roads, paved (cement or asphalt)	X20	X20-03	B	Low	Connect Court	2	
Highways and roads, paved (cement or asphalt)	X20	X20-04	B	Low	Lower Circle	2	
Highways and roads, paved (cement or asphalt)	X20	X20-05	B	Low	Lonesome Drive	2	
Septic systems (serves one single-family home)	R02	R02-12-36	C	Low	All residential septic systems in Zone C	3	
Highways and roads, paved (cement or asphalt)	X20	X20-06	C	Low	Upper Mesa	2	

Table 3 (continued)

Contaminant Source Inventory and Risk Ranking for Wilderness East Community Sources of Nitrates/Nitrites

PWSID 222987.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Location*	*Map Number*	*Comments*
Highways and roads, paved (cement or asphalt)	X20	X20-07	C	Low	Lower Road	2	

Table 4

Contaminant Source Inventory and Risk Ranking for Wilderness East Community Sources of Volatile Organic Chemicals

PWSID 222987.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Location*	*Map Number*	*Comments*
Highways and roads, paved (cement or asphalt)	X20	X20-01	A	Low	Lower Mesa Road	2	
Residential Areas	R01	R01-01	A	Low	All residential area in Zone A	2	8 Acres
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-01	A	Low	Near Parks Hwy	3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-02	A	Low	Near Parks Hwy	3	
Septic systems (serves one single-family home)	R02	R02-01	A	Low	Near Mesa Drive	3	
Residential Areas	R01	R01-02	B	Low	All residential area in Zone B	2	21 Acres
Septic systems (serves one single-family home)	R02	R02-02	B	Low	Near Middle Mesa Drive	3	
Septic systems (serves one single-family home)	R02	R02-03	B	Low	Near Middle Mesa Drive	3	
Septic systems (serves one single-family home)	R02	R02-04	B	Low	Near Middle Mesa Drive	3	
Septic systems (serves one single-family home)	R02	R02-05	B	Low	Near Middle Mesa Drive	3	
Septic systems (serves one single-family home)	R02	R02-06	B	Low	Near Middle Mesa Drive	3	
Septic systems (serves one single-family home)	R02	R02-07	B	Low	Near Connect Court	3	
Septic systems (serves one single-family home)	R02	R02-08	B	Low	Near Lower Road	3	
Septic systems (serves one single-family home)	R02	R02-09	B	Low	Near Lower Road	3	
Septic systems (serves one single-family home)	R02	R02-10	B	Low	Near Lower Road	3	
Septic systems (serves one single-family home)	R02	R02-11	B	Low	Near Lonesome Drive	3	
Highways and roads, paved (cement or asphalt)	X20	X20-02	B	Low	Middle Mesa Drive	2	
Highways and roads, paved (cement or asphalt)	X20	X20-03	B	Low	Connect Court	2	
Highways and roads, paved (cement or asphalt)	X20	X20-04	B	Low	Lower Circle	2	
Highways and roads, paved (cement or asphalt)	X20	X20-05	B	Low	Lonesome Drive	2	
Septic systems (serves one single-family home)	R02	R02-12-36	C	Low	All residential septic systems in Zone C	3	
Highways and roads, paved (cement or asphalt)	X20	X20-06	C	Low	Upper Mesa	2	

Table 4 (continued)

Contaminant Source Inventory and Risk Ranking for Wilderness East Community Sources of Volatile Organic Chemicals

PWSID 222987.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Location*	*Map Number*	*Comments*
Highways and roads, paved (cement or asphalt)	X20	X20-07	C	Low	Lower Road	2	

Table 5

Contaminant Source Inventory and Risk Ranking for Wilderness East Community

Sources of Heavy Metals, Cyanide and Other Inorganic Chemicals

PWSID 222987.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Location*	*Map Number*	*Comments*
Highways and roads, paved (cement or asphalt)	X20	X20-01	A	Low	Lower Mesa Road	2	
Residential Areas	R01	R01-01	A	Low	All residential area in Zone A	2	8 Acres
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-01	A	Low	Near Parks Hwy	3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-02	A	Low	Near Parks Hwy	3	
Septic systems (serves one single-family home)	R02	R02-01	A	Low	Near Mesa Drive	3	
Residential Areas	R01	R01-02	B	Low	All residential area in Zone B	2	21 Acres
Septic systems (serves one single-family home)	R02	R02-02	B	Low	Near Middle Mesa Drive	3	
Septic systems (serves one single-family home)	R02	R02-03	B	Low	Near Middle Mesa Drive	3	
Septic systems (serves one single-family home)	R02	R02-04	B	Low	Near Middle Mesa Drive	3	
Septic systems (serves one single-family home)	R02	R02-05	B	Low	Near Middle Mesa Drive	3	
Septic systems (serves one single-family home)	R02	R02-06	B	Low	Near Middle Mesa Drive	3	
Septic systems (serves one single-family home)	R02	R02-07	B	Low	Near Connect Court	3	
Septic systems (serves one single-family home)	R02	R02-08	B	Low	Near Lower Road	3	
Septic systems (serves one single-family home)	R02	R02-09	B	Low	Near Lower Road	3	
Septic systems (serves one single-family home)	R02	R02-10	B	Low	Near Lower Road	3	
Septic systems (serves one single-family home)	R02	R02-11	B	Low	Near Lonesome Drive	3	
Highways and roads, paved (cement or asphalt)	X20	X20-02	B	Low	Middle Mesa Drive	2	
Highways and roads, paved (cement or asphalt)	X20	X20-03	B	Low	Connect Court	2	
Highways and roads, paved (cement or asphalt)	X20	X20-04	B	Low	Lower Circle	2	
Highways and roads, paved (cement or asphalt)	X20	X20-05	B	Low	Lonesome Drive	2	
Septic systems (serves one single-family home)	R02	R02-12-36	C	Low	All residential septic systems in Zone C	3	
Highways and roads, paved (cement or asphalt)	X20	X20-06	C	Low	Upper Mesa	2	

Contaminant Source Inventory and Risk Ranking for
Wilderness East Community
Sources of Heavy Metals, Cyanide and Other Inorganic Chemicals

Contaminant Source Type	***Contaminant Source ID***	***CS ID tag***	***Zone***	***Risk Ranking for Analysis***	***Location***	***Map Number***	***Comments***
Highways and roads, paved (cement or asphalt)	X20	X20-07	C	Low	Lower Road	2	

Table 6

Contaminant Source Inventory and Risk Ranking for Wilderness East Community
Sources of Synthetic Organic Chemicals

PWSID 222987.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Location*	*Map Number*	*Comments*
Residential Areas	R01	R01-01	A	Low	All residential area in Zone A	2	8 Acres
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-01	A	Low	Near Parks Hwy	3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-02	A	Low	Near Parks Hwy	3	
Septic systems (serves one single-family home)	R02	R02-01	A	Low	Near Mesa Drive	3	
Residential Areas	R01	R01-02	B	Low	All residential area in Zone B	2	21 Acres
Septic systems (serves one single-family home)	R02	R02-02	B	Low	Near Middle Mesa Drive	3	
Septic systems (serves one single-family home)	R02	R02-03	B	Low	Near Middle Mesa Drive	3	
Septic systems (serves one single-family home)	R02	R02-04	B	Low	Near Middle Mesa Drive	3	
Septic systems (serves one single-family home)	R02	R02-05	B	Low	Near Middle Mesa Drive	3	
Septic systems (serves one single-family home)	R02	R02-06	B	Low	Near Middle Mesa Drive	3	
Septic systems (serves one single-family home)	R02	R02-07	B	Low	Near Connect Court	3	
Septic systems (serves one single-family home)	R02	R02-08	B	Low	Near Lower Road	3	
Septic systems (serves one single-family home)	R02	R02-09	B	Low	Near Lower Road	3	
Septic systems (serves one single-family home)	R02	R02-10	B	Low	Near Lower Road	3	
Septic systems (serves one single-family home)	R02	R02-11	B	Low	Near Lonesome Drive	3	
Septic systems (serves one single-family home)	R02	R02-12-36	C	Low	All residential septic systems in Zone C	3	

Table 7

Contaminant Source Inventory and Risk Ranking for Wilderness East Community Sources of Other Organic Chemicals

PWSID 222987.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Location*	*Map Number*	*Comments*
Highways and roads, paved (cement or asphalt)	X20	X20-01	A	Low	Lower Mesa Road	2	
Residential Areas	R01	R01-01	A	Low	All residential area in Zone A	2	8 Acres
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-01	A	Low	Near Parks Hwy	3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-02	A	Low	Near Parks Hwy	3	
Septic systems (serves one single-family home)	R02	R02-01	A	Low	Near Mesa Drive	3	
Residential Areas	R01	R01-02	B	Low	All residential area in Zone B	2	21 Acres
Septic systems (serves one single-family home)	R02	R02-02	B	Low	Near Middle Mesa Drive	3	
Septic systems (serves one single-family home)	R02	R02-03	B	Low	Near Middle Mesa Drive	3	
Septic systems (serves one single-family home)	R02	R02-04	B	Low	Near Middle Mesa Drive	3	
Septic systems (serves one single-family home)	R02	R02-05	B	Low	Near Middle Mesa Drive	3	
Septic systems (serves one single-family home)	R02	R02-06	B	Low	Near Middle Mesa Drive	3	
Septic systems (serves one single-family home)	R02	R02-07	B	Low	Near Connect Court	3	
Septic systems (serves one single-family home)	R02	R02-08	B	Low	Near Lower Road	3	
Septic systems (serves one single-family home)	R02	R02-09	B	Low	Near Lower Road	3	
Septic systems (serves one single-family home)	R02	R02-10	B	Low	Near Lower Road	3	
Septic systems (serves one single-family home)	R02	R02-11	B	Low	Near Lonesome Drive	3	
Highways and roads, paved (cement or asphalt)	X20	X20-02	B	Low	Middle Mesa Drive	2	
Highways and roads, paved (cement or asphalt)	X20	X20-03	B	Low	Connect Court	2	
Highways and roads, paved (cement or asphalt)	X20	X20-04	B	Low	Lower Circle	2	
Highways and roads, paved (cement or asphalt)	X20	X20-05	B	Low	Lonesome Drive	2	
Septic systems (serves one single-family home)	R02	R02-12-36	C	Low	All residential septic systems in Zone C	3	
Highways and roads, paved (cement or asphalt)	X20	X20-06	C	Low	Upper Mesa	2	

Table 7 (continued)

Contaminant Source Inventory and Risk Ranking for Wilderness East Community Sources of Other Organic Chemicals

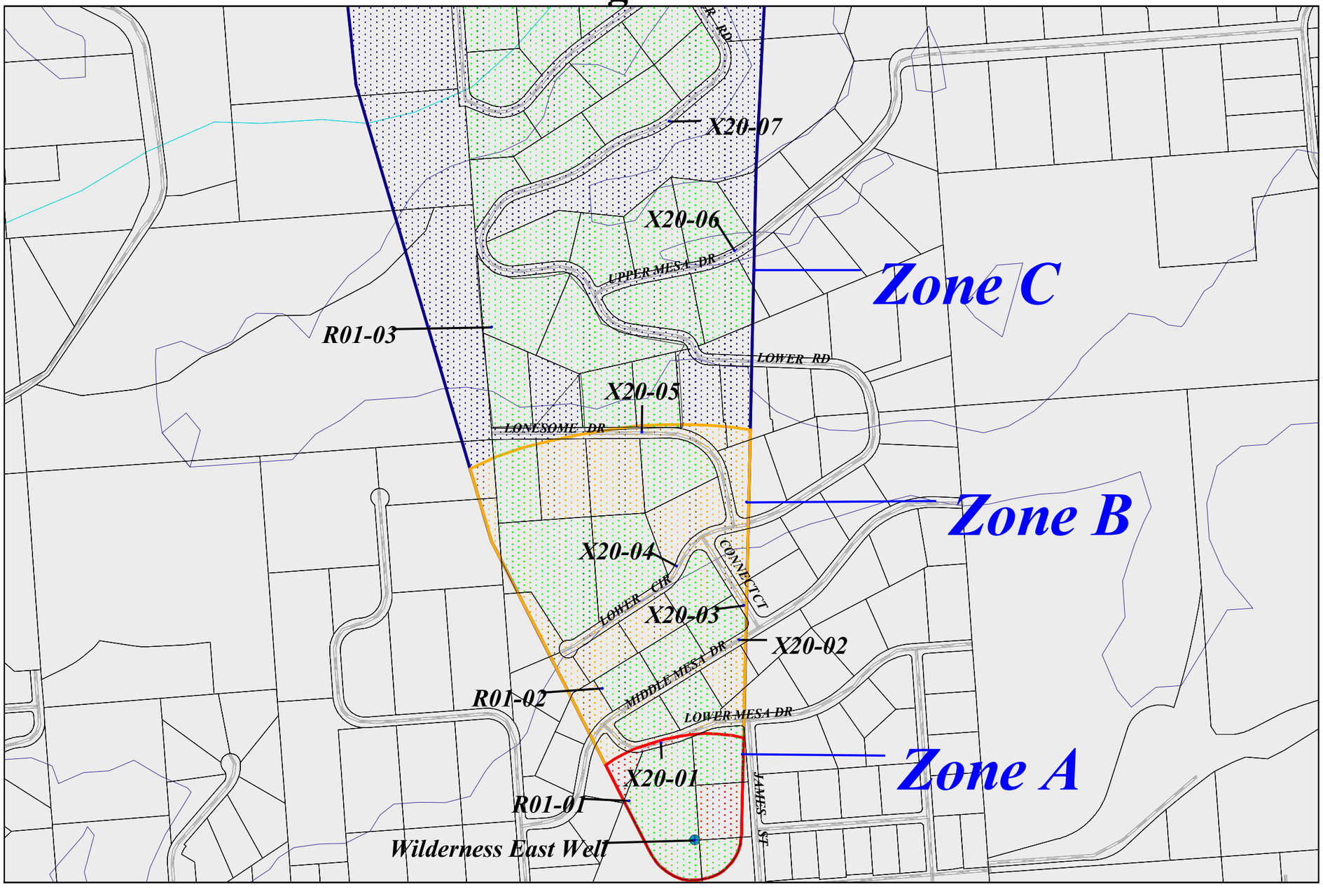
PWSID 222987.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Location*	*Map Number*	*Comments*
Highways and roads, paved (cement or asphalt)	X20	X20-07	C	Low	Lower Road	2	

APPENDIX C

Wilderness East Community
Drinking Water Protection Area
And Potential & Existing Contaminant Sources

Drinking Water Protection Area for Wilderness East Community and Potential and Exisitng Sources of Contamination



Legend

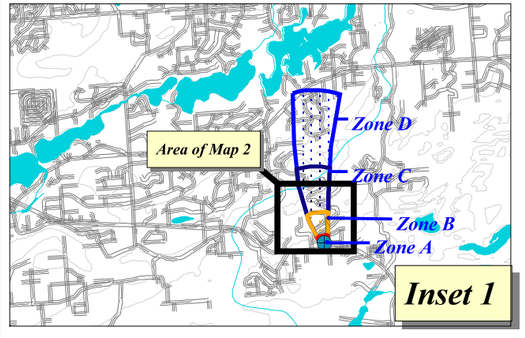
- Wilderness East Public Water System
- Residential (R01)

Zone A Protection Area
- Several Months Travel Time

Zone B Protection Area
- Less than 2 Years Travel Time

Zone C Protection Area
- Less than 5 Years Time of Travel

Zone D Protection Area
- Less than 10 Years Travel Time
- Septics (R02)
- Lakes
- Rivers and Streams
- Roads
- Matanuska Susitna Borough Parcels



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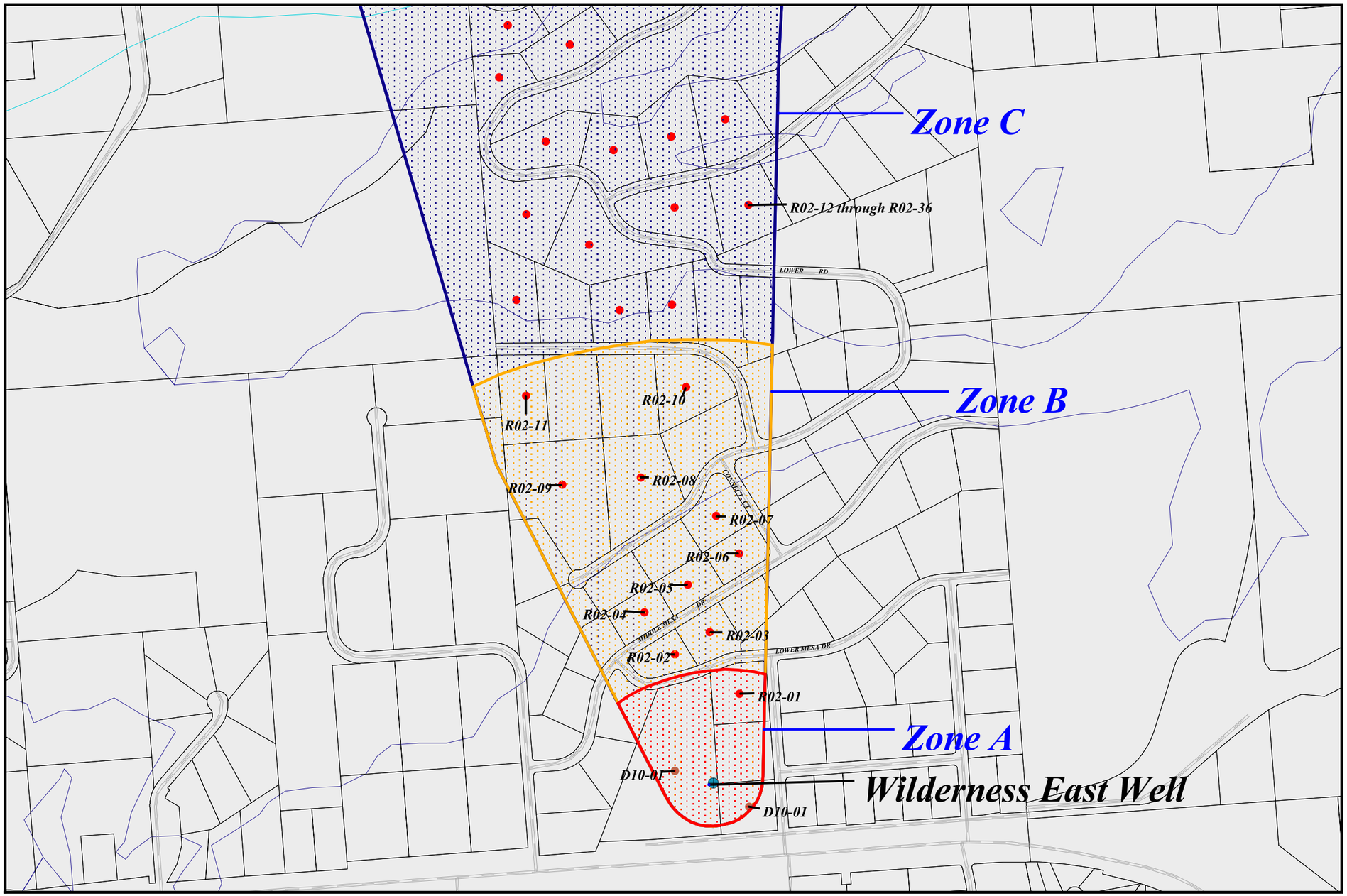
PWSID 222987.001

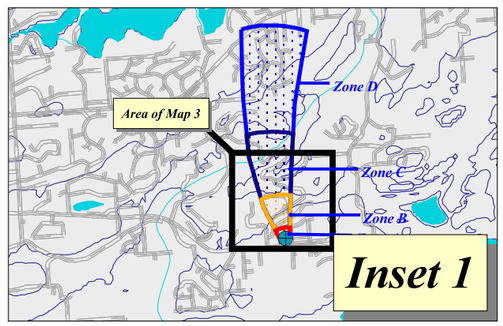
Map 2

Drinkingwater Protection Area for Wilderness East and Protection and Potential and Exisiting Sources of Contamination



Legend

- Wilderness East Public Water System
- Zone A Protection Area
  - Several Months Travel Time
- Zone B Protection Area
  - Less than 2 Years Travel Time
- Zone C Protection Area
  - Less than 5 Years Time of Travel
- Zone D Protection Area
  - Less than 10 Years Travel Time
- Lakes
- Rivers and Streams
- Roads
- Matanuska Susitna Borough Parcels
- Elevation Contours



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PWSID 222987.001

Map 3

APPENDIX D

Vulnerability Analysis for Wilderness East Community Public Drinking Water Source

Table 2

Contaminant Source Inventory and Risk Ranking for Violet Circle

Sources of Bacteria and Viruses

PWSID 226428.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Location*	*Map Number*	*Comments*
Septic systems (serves one single-family home)	R02	R02-01	A	Low	Near Violet Circle	3	
Septic systems (serves one single-family home)	R02	R02-02	A	Low	Near Vilolet Circle	3	
Septic systems (serves one single-family home)	R02	R02-03	A	Low	Near Violet Circle	3	
Septic systems (serves one single-family home)	R02	R02-04	A	Low	Near Violet Circle	3	
Residential Areas	R01	R01-01	A	Low	Residential Area in Zone A	2	
Highways and roads, paved (cement or asphalt)	X20	X20-01	A	Low	Violet Circle	2	
Highways and roads, dirt/gravel	X24	X24-01	B	Low	Cullison Circle	2	
Highways and roads, dirt/gravel	X24	X24-02	B	Low	Valley Crest Drive	2	
Septic systems (serves one single-family home)	R02	R02-05	B	Low	Near Valley Crest Drive	3	
Residential Areas	R01	R01-02	B	Low	Residential Area in Zone B	2	
Residential Areas	R01	R01-03	C	Low	Residential Area in Zone C	2	
Septic systems (serves one single-family home)	R02	R02-06	C	Low	Near Valley Crest Drive	3	
Highways and roads, dirt/gravel	X24	X24-03	C	Low	Drift Lane	2	

Table 3

Contaminant Source Inventory and Risk Ranking for Violet Circle

Sources of Nitrates/Nitrites

PWSID 226428.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Location*	*Map Number*	*Comments*
Septic systems (serves one single-family home)	R02	R02-01	A	Low	Near Violet Circle	3	
Septic systems (serves one single-family home)	R02	R02-02	A	Low	Near Vilolet Circle	3	
Septic systems (serves one single-family home)	R02	R02-03	A	Low	Near Violet Circle	3	
Septic systems (serves one single-family home)	R02	R02-04	A	Low	Near Violet Circle	3	
Residential Areas	R01	R01-01	A	Low	Residential Area in Zone A	2	
Highways and roads, paved (cement or asphalt)	X20	X20-01	A	Low	Violet Circle	2	
Highways and roads, dirt/gravel	X24	X24-01	B	Low	Cullison Circle	2	
Highways and roads, dirt/gravel	X24	X24-02	B	Low	Valley Crest Drive	2	
Septic systems (serves one single-family home)	R02	R02-05	B	Low	Near Valley Crest Drive	3	
Residential Areas	R01	R01-02	B	Low	Residential Area in Zone B	2	
Residential Areas	R01	R01-03	C	Low	Residential Area in Zone C	2	
Septic systems (serves one single-family home)	R02	R02-06	C	Low	Near Valley Crest Drive	3	
Highways and roads, dirt/gravel	X24	X24-03	C	Low	Drift Lane	2	

Table 4

Contaminant Source Inventory and Risk Ranking for Violet Circle

Sources of Volatile Organic Chemicals

PWSID 226428.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Location*	*Map Number*	*Comments*
Highways and roads, paved (cement or asphalt)	X20	X20-01	A	Low	Violet Circle	2	
Highways and roads, dirt/gravel	X24	X24-01	B	Low	Cullison Circle	2	
Highways and roads, dirt/gravel	X24	X24-02	B	Low	Valley Crest Drive	2	
Residential Areas	R01	R01-01	A	Low	Residential Area in Zone A	2	
Septic systems (serves one single-family home)	R02	R02-01	A	Low	Near Violet Circle	3	
Septic systems (serves one single-family home)	R02	R02-02	A	Low	Near Vilolet Circle	3	
Septic systems (serves one single-family home)	R02	R02-03	A	Low	Near Violet Circle	3	
Septic systems (serves one single-family home)	R02	R02-04	A	Low	Near Violet Circle	3	
Residential Areas	R01	R01-02	B	Low	Residential Area in Zone B	2	
Highways and roads, dirt/gravel	X24	X24-03	C	Low	Drift Lane	2	
Septic systems (serves one single-family home)	R02	R02-05	B	Low	Near Valley Crest Drive	3	
Residential Areas	R01	R01-03	C	Low	Residential Area in Zone C	2	
Septic systems (serves one single-family home)	R02	R02-06	C	Low	Near Valley Crest Drive	3	

Table 5

Contaminant Source Inventory and Risk Ranking for Violet Circle

Sources of Heavy Metals, Cyanide and Other Inorganic Chemicals

PWSID 226428.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Location*	*Map Number*	*Comments*
Highways and roads, paved (cement or asphalt)	X20	X20-01	A	Low	Violet Circle	2	
Highways and roads, dirt/gravel	X24	X24-01	B	Low	Cullison Circle	2	
Highways and roads, dirt/gravel	X24	X24-02	B	Low	Valley Crest Drive	2	
Residential Areas	R01	R01-01	A	Low	Residential Area in Zone A	2	
Septic systems (serves one single-family home)	R02	R02-01	A	Low	Near Violet Circle	3	
Septic systems (serves one single-family home)	R02	R02-02	A	Low	Near Vilolet Circle	3	
Septic systems (serves one single-family home)	R02	R02-03	A	Low	Near Violet Circle	3	
Septic systems (serves one single-family home)	R02	R02-04	A	Low	Near Violet Circle	3	
Residential Areas	R01	R01-02	B	Low	Residential Area in Zone B	2	
Highways and roads, dirt/gravel	X24	X24-03	C	Low	Drift Lane	2	
Septic systems (serves one single-family home)	R02	R02-05	B	Low	Near Valley Crest Drive	3	
Residential Areas	R01	R01-03	C	Low	Residential Area in Zone C	2	
Septic systems (serves one single-family home)	R02	R02-06	C	Low	Near Valley Crest Drive	3	

Table 6

Contaminant Source Inventory and Risk Ranking for Violet Circle

Sources of Synthetic Organic Chemicals

PWSID 226428.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Location*	*Map Number*	*Comments*
Residential Areas	R01	R01-01	A	Low	Residential Area in Zone A	2	
Septic systems (serves one single-family home)	R02	R02-01	A	Low	Near Violet Circle	3	
Septic systems (serves one single-family home)	R02	R02-02	A	Low	Near Vilolet Circle	3	
Septic systems (serves one single-family home)	R02	R02-03	A	Low	Near Violet Circle	3	
Septic systems (serves one single-family home)	R02	R02-04	A	Low	Near Violet Circle	3	
Residential Areas	R01	R01-02	B	Low	Residential Area in Zone B	2	
Septic systems (serves one single-family home)	R02	R02-05	B	Low	Near Valley Crest Drive	3	
Septic systems (serves one single-family home)	R02	R02-06	C	Low	Near Valley Crest Drive	3	
Residential Areas	R01	R01-03	C	Low	Residential Area in Zone C	2	

Table 7

Contaminant Source Inventory and Risk Ranking for Violet Circle

Sources of Other Organic Chemicals

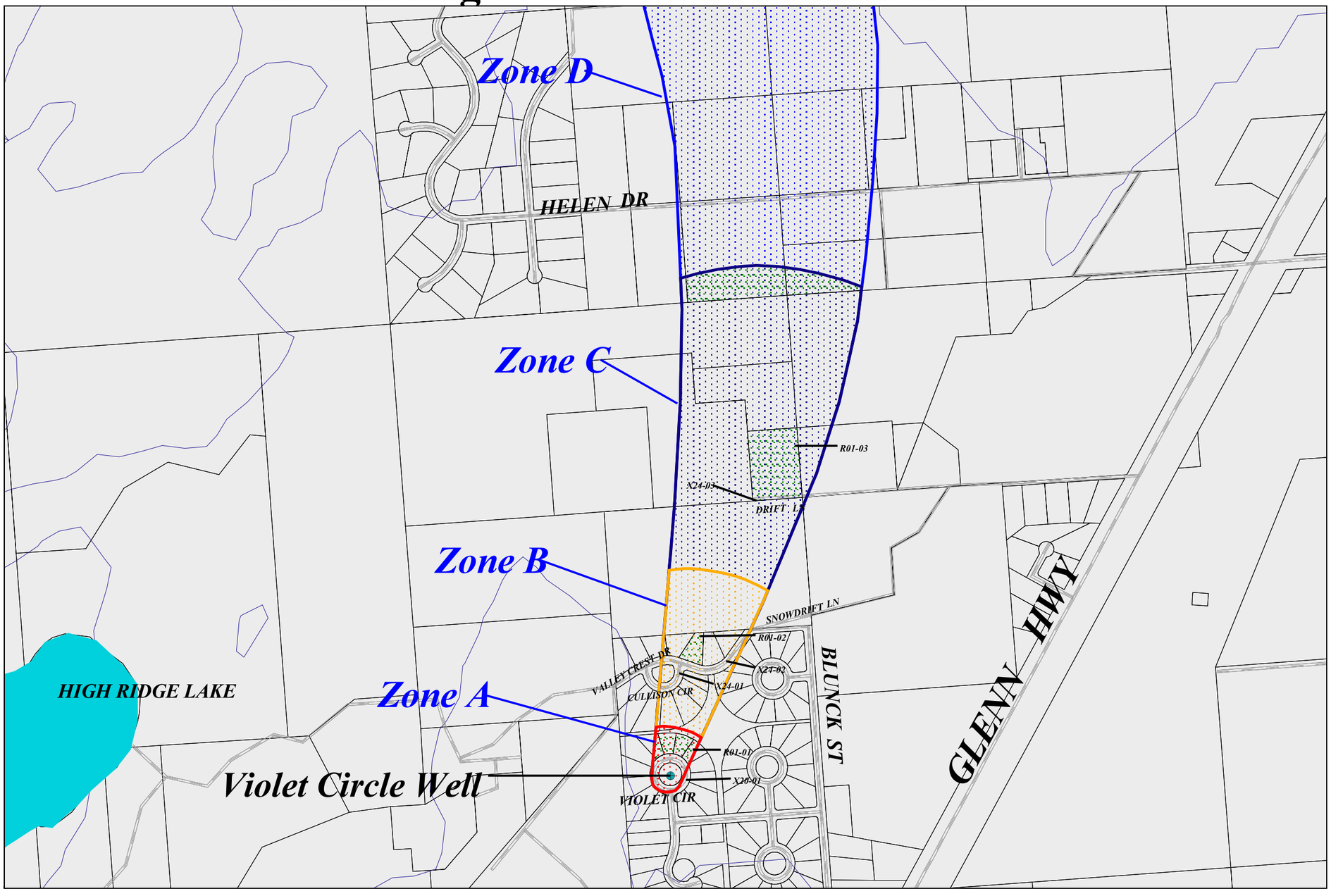
PWSID 226428.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Location*	*Map Number*	*Comments*
Highways and roads, paved (cement or asphalt)	X20	X20-01	A	Low	Violet Circle	2	
Highways and roads, dirt/gravel	X24	X24-01	B	Low	Cullison Circle	2	
Highways and roads, dirt/gravel	X24	X24-02	B	Low	Valley Crest Drive	2	
Residential Areas	R01	R01-01	A	Low	Residential Area in Zone A	2	
Septic systems (serves one single-family home)	R02	R02-01	A	Low	Near Violet Circle	3	
Septic systems (serves one single-family home)	R02	R02-02	A	Low	Near Vilolet Circle	3	
Septic systems (serves one single-family home)	R02	R02-03	A	Low	Near Violet Circle	3	
Septic systems (serves one single-family home)	R02	R02-04	A	Low	Near Violet Circle	3	
Residential Areas	R01	R01-02	B	Low	Residential Area in Zone B	2	
Highways and roads, dirt/gravel	X24	X24-03	C	Low	Drift Lane	2	
Septic systems (serves one single-family home)	R02	R02-05	B	Low	Near Valley Crest Drive	3	
Residential Areas	R01	R01-03	C	Low	Residential Area in Zone C	2	
Septic systems (serves one single-family home)	R02	R02-06	C	Low	Near Valley Crest Drive	3	

APPENDIX C

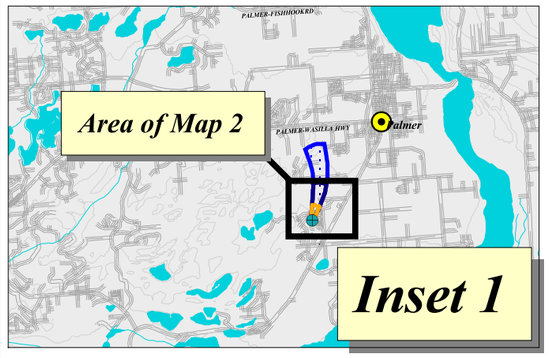
Violet Circle
Drinking Water Protection Area
And Potential & Existing Contaminant Sources

Drinking Water Protection Area for Violet Circle and Potential and Exisitng Sources of Contamination



Legend

- Violet Circle Public Water System
- Zone A Protection Area
  - Several Months Travel Time
- Zone B Protection Area
  - Less than 5 Years Travel Time
- Zone C Protection Area
  - Less than 2 Years Travel Time
- Zone D Protecition Area
  - Less than 10 Years Travel Time
  - Residential (R02)
  - Roads
  - Cities



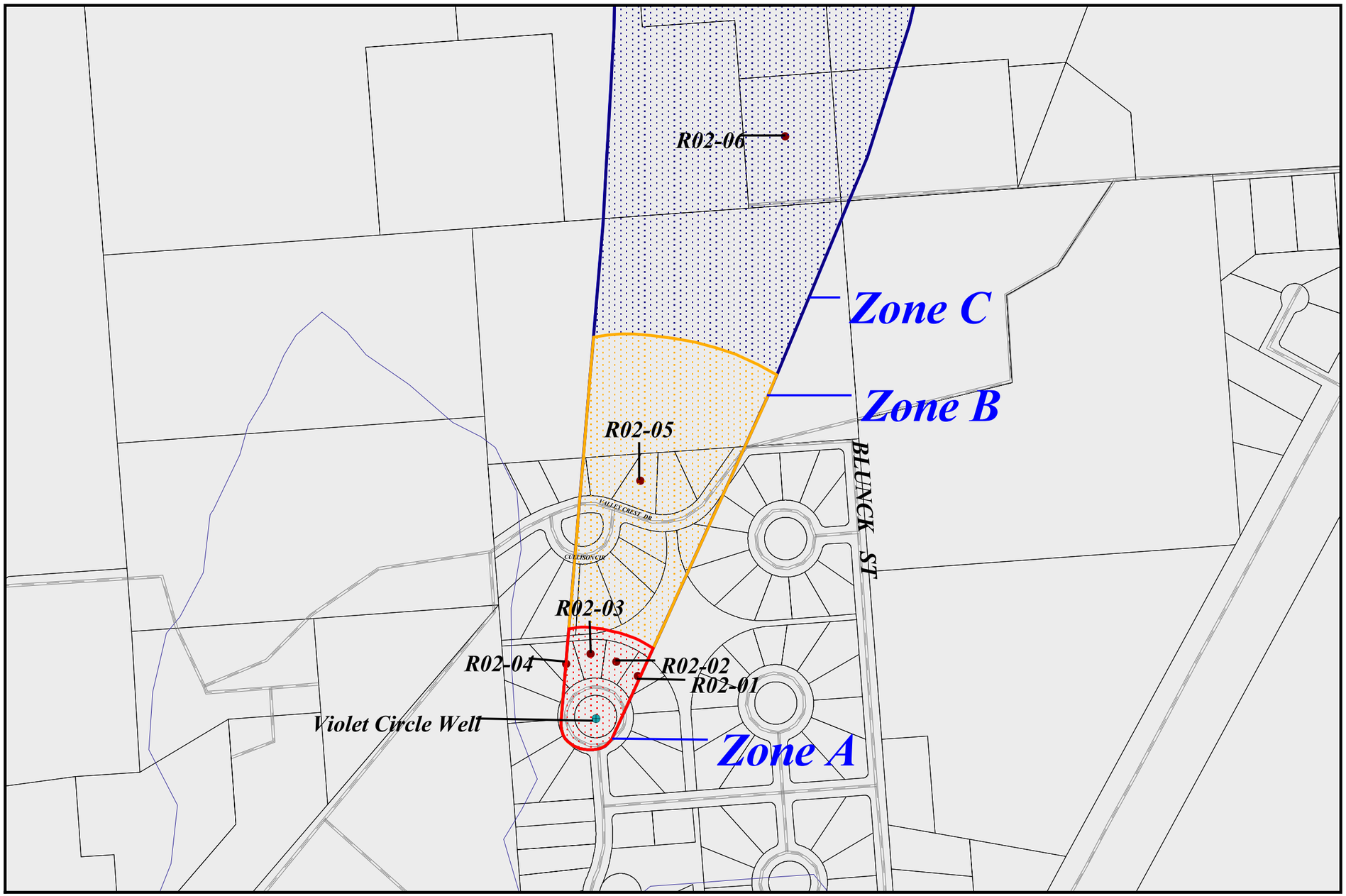
N
W E
S

1000 0 1000 Feet

PWSID 226428.001

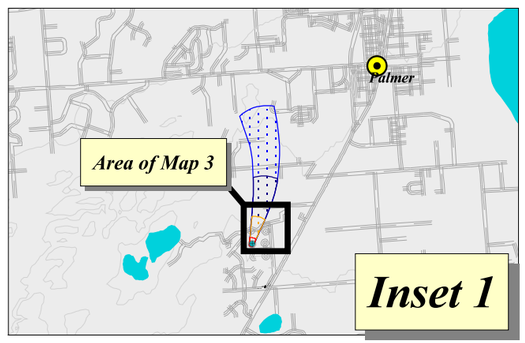
Map 2

Drinkingwater Protection Area for Violet Circle and Potential and Existing Sources of Contamination



Legend

- Violet Circle Public Water System
- Zone A Protection Area
  - Several Months Travel Time
- Zone B Protection Area
  - Less than 5 Years Travel Time
- Zone C Protection Area
  - Less than 2 Years Travel Time
- Zone D Protecition Area
  - Less than 10 Years Travel Time
- Septics (R02)
- Lakes
- Rivers and Streams
- Roads
- Elevation Contours
- Matanuska Susitna Borough Parcels
- Cities



N
W E
S

300 0 300 Feet

PWSID 226428.001

Map 3

APPENDIX D

Vulnerability Analysis for Violet Circle Public Drinking Water Source

Chart 1. Susceptibility of the wellhead - Wilderness East Community

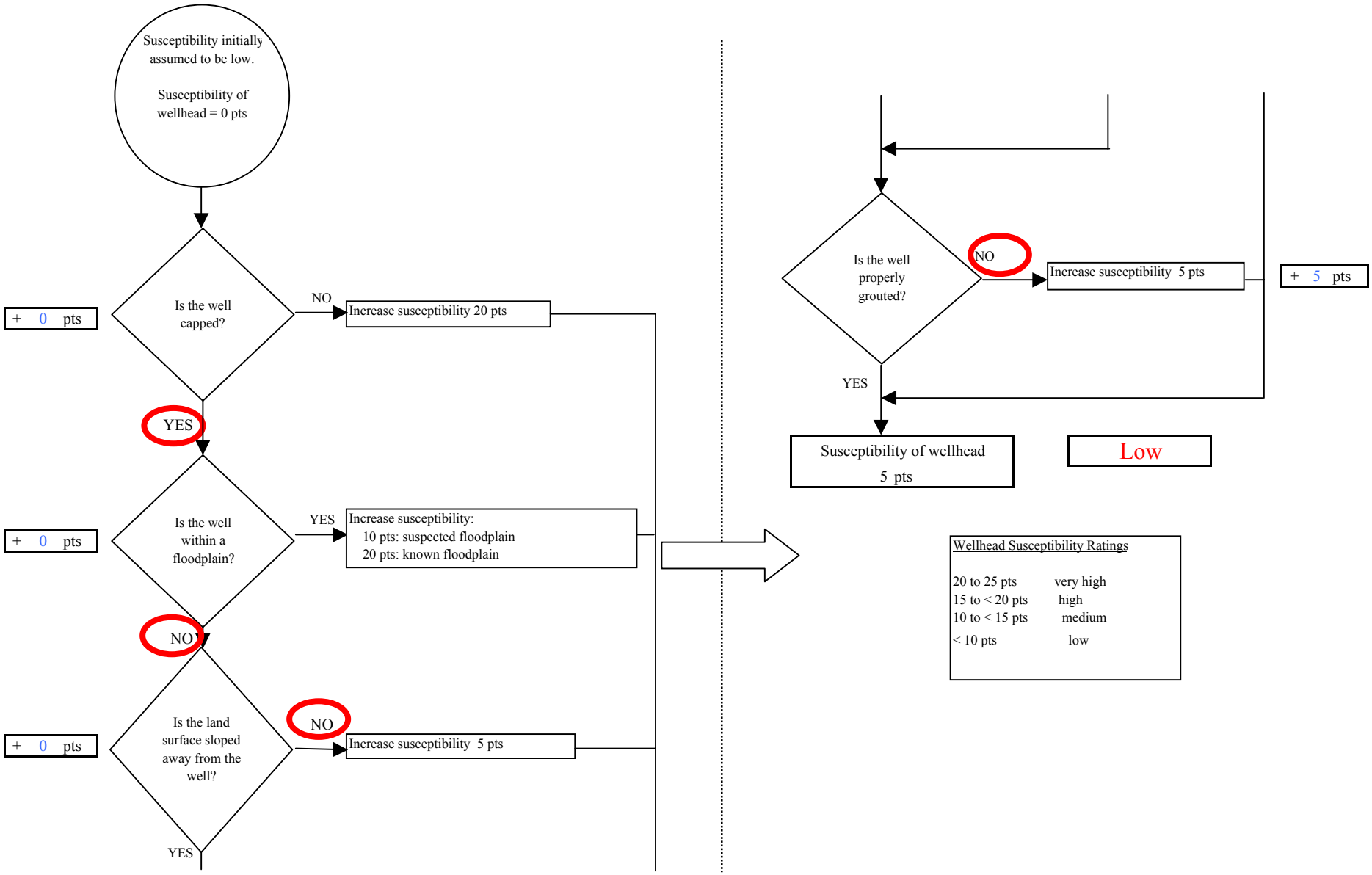


Chart 2. Susceptibility of the aquifer - Wilderness East Community

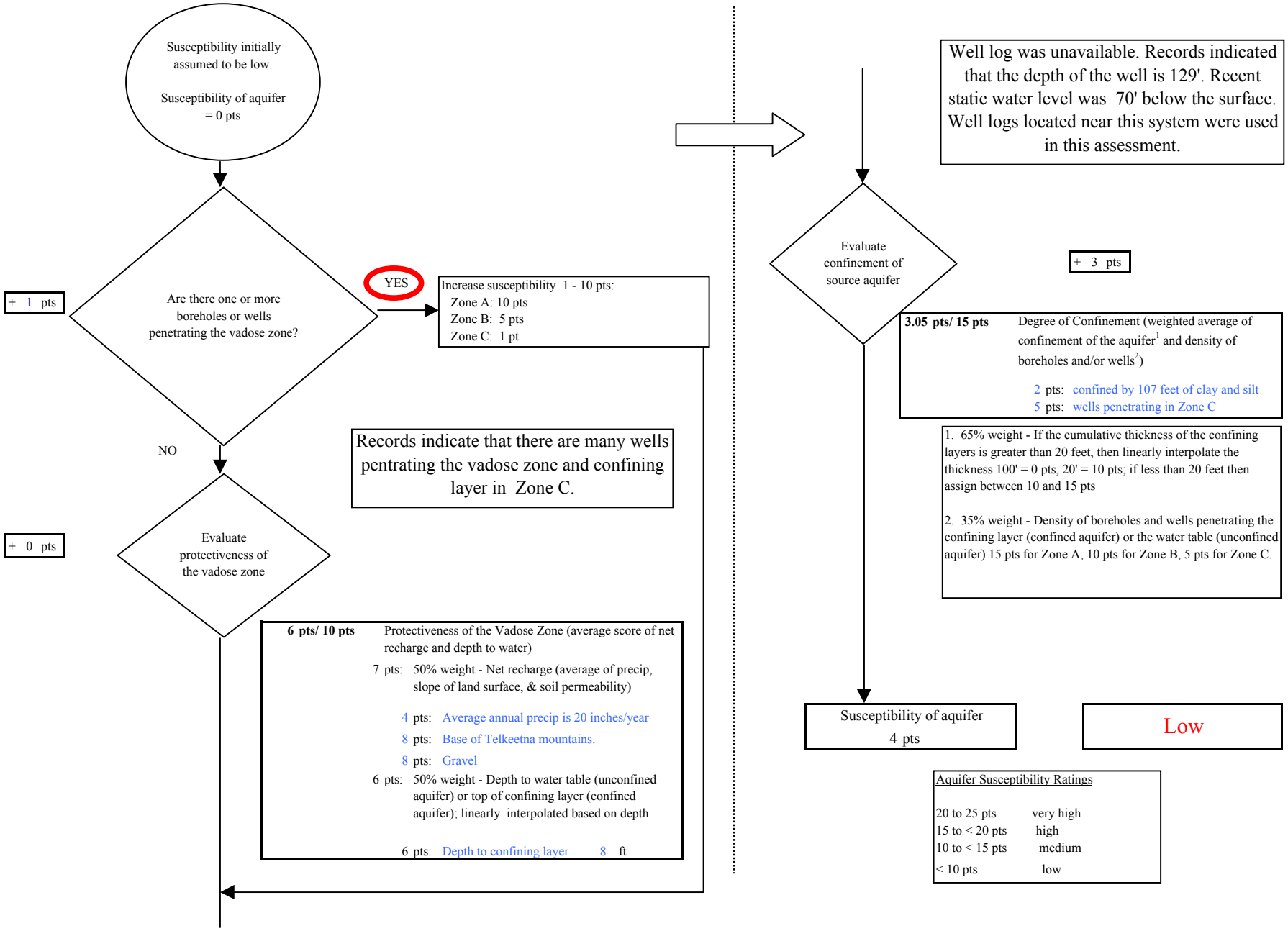
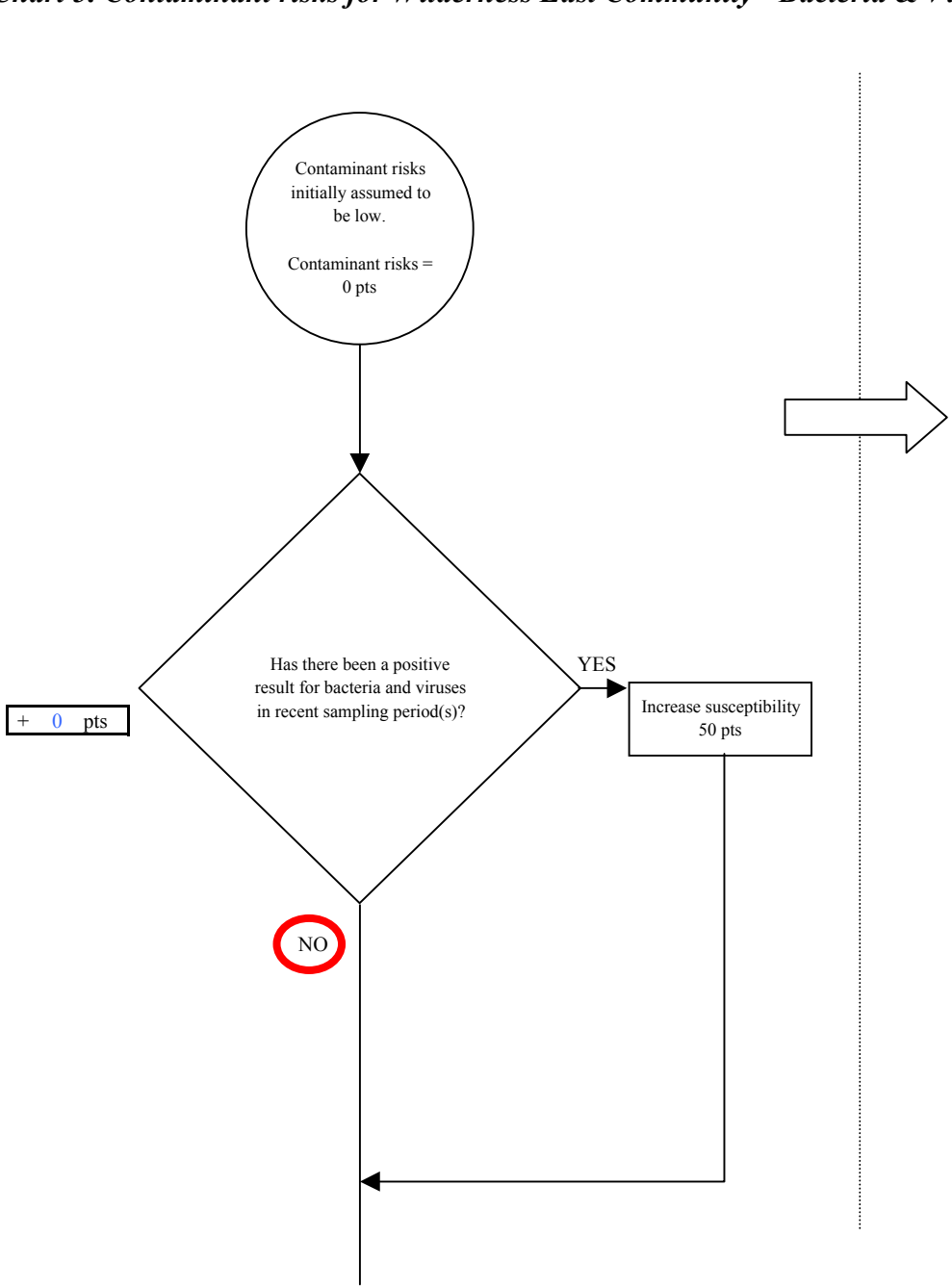
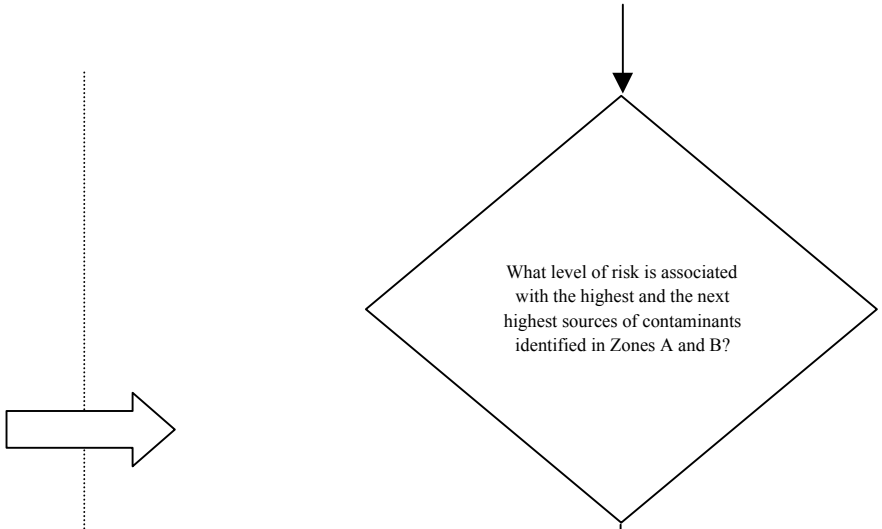


Chart 3. Contaminant risks for Wilderness East Community - Bacteria & Viruses





+ 40 pts

Risk Rankings for Contaminant Sources Identified in Zones A and B

	Zone A	Zone B	Total
Very Highs(s)	0	0	0
High(s)	2	0	2
Medium(s)	0	0	0
Low(s)	3	3	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 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 Wilderness East Community - Bacteria & Viruses

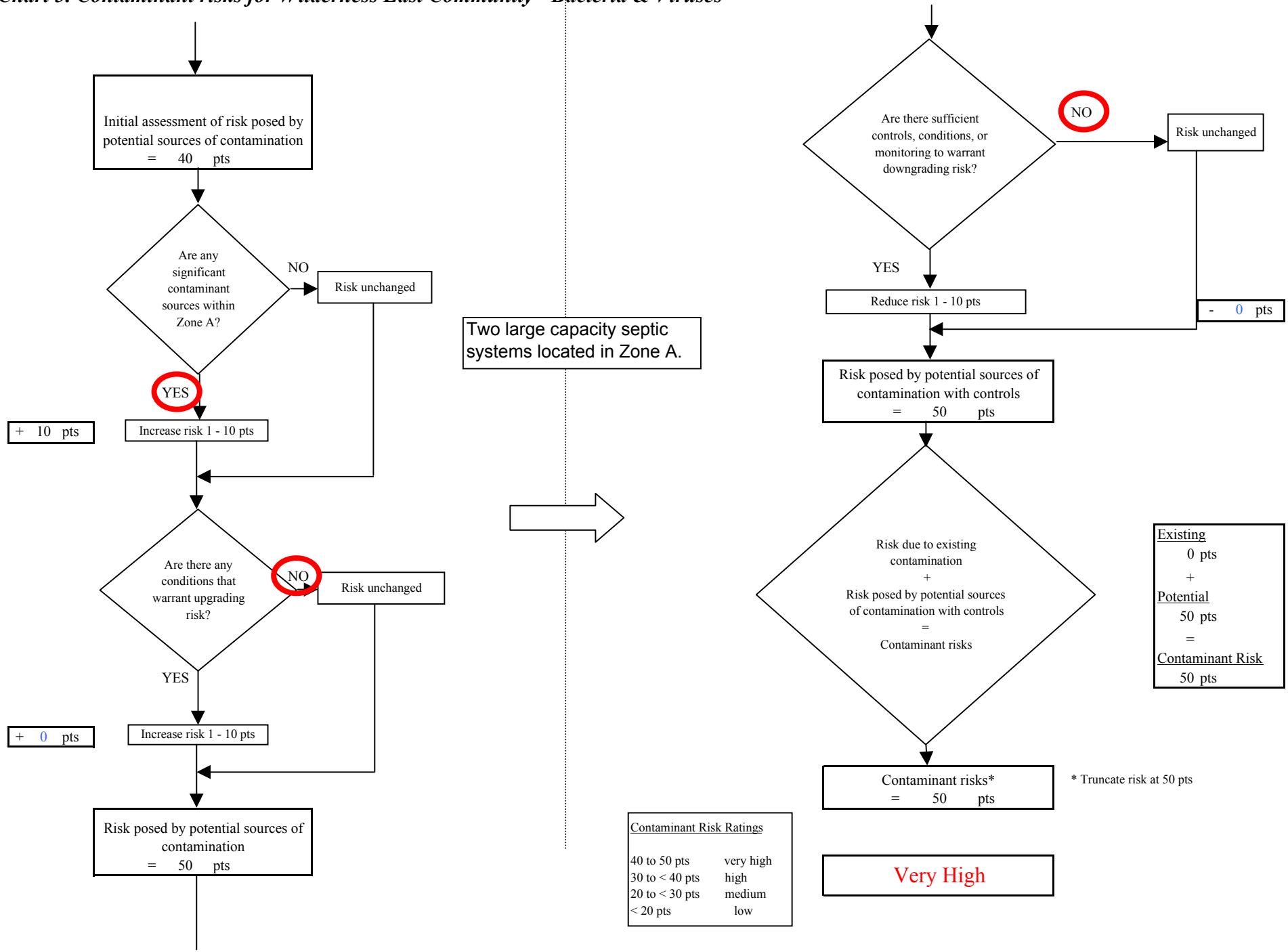


Chart 4. Vulnerability analysis for Wilderness East Community - Bacteria & Viruses

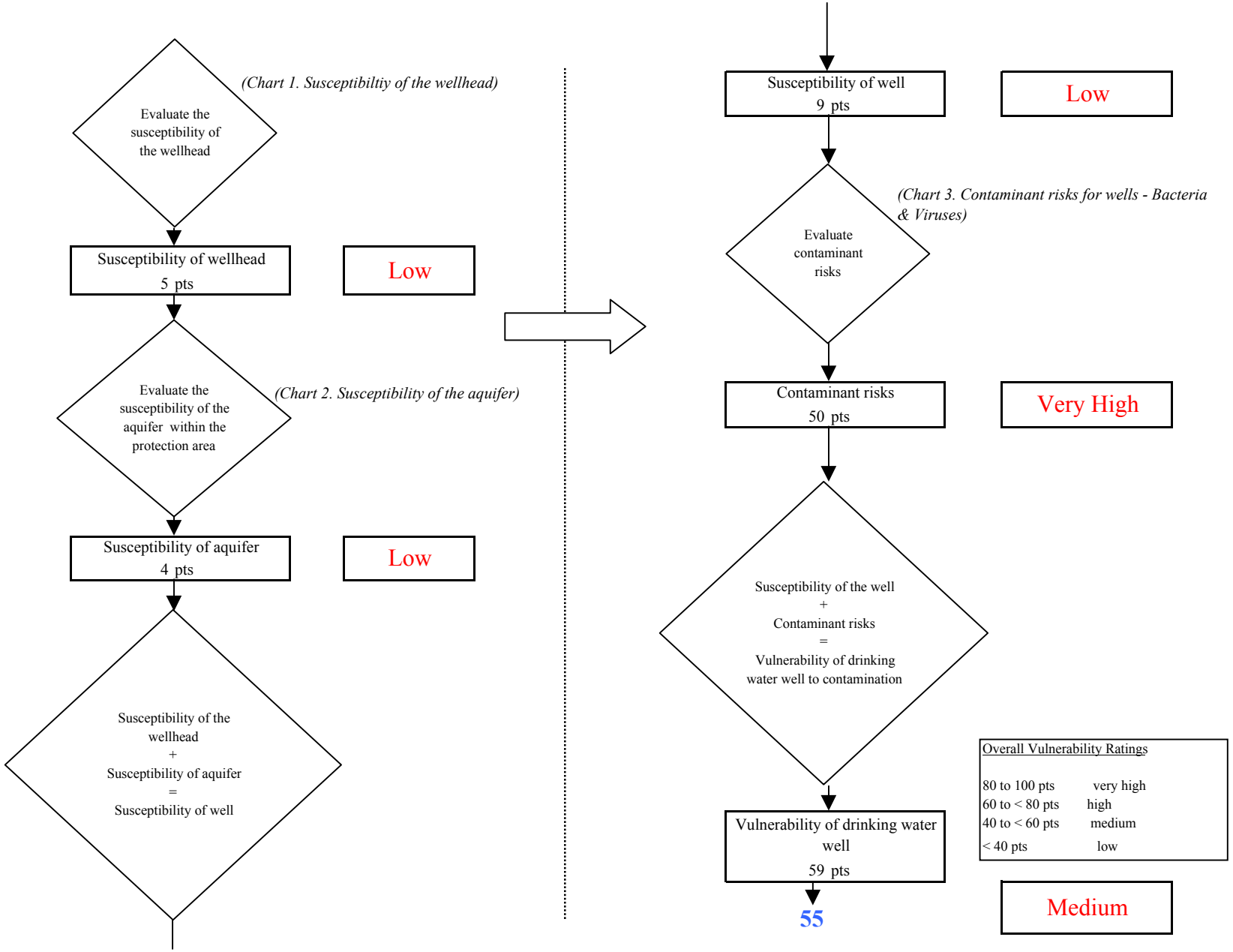


Chart 5. Contaminant risks for Wilderness East Community - Nitrates and Nitrites

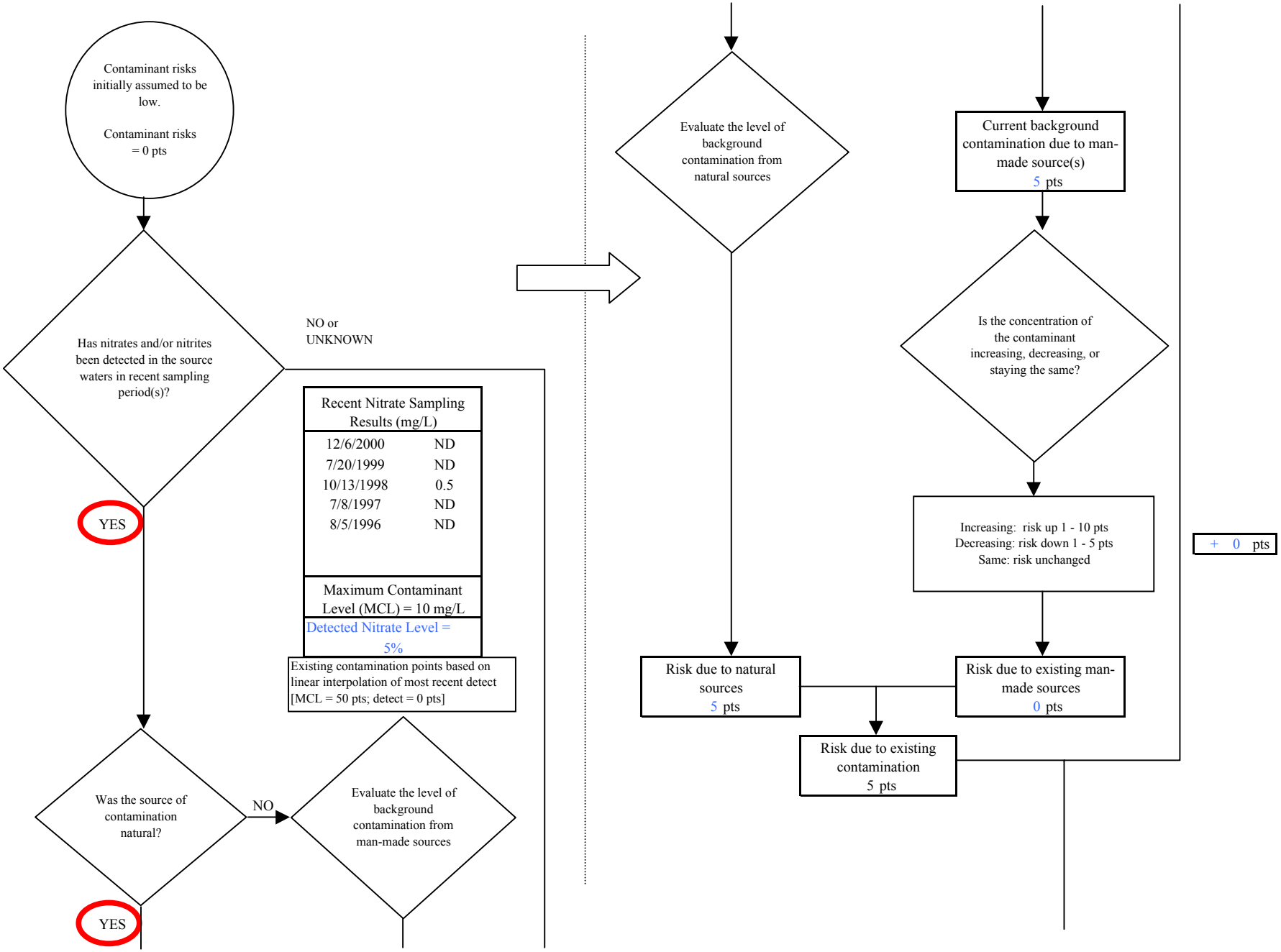
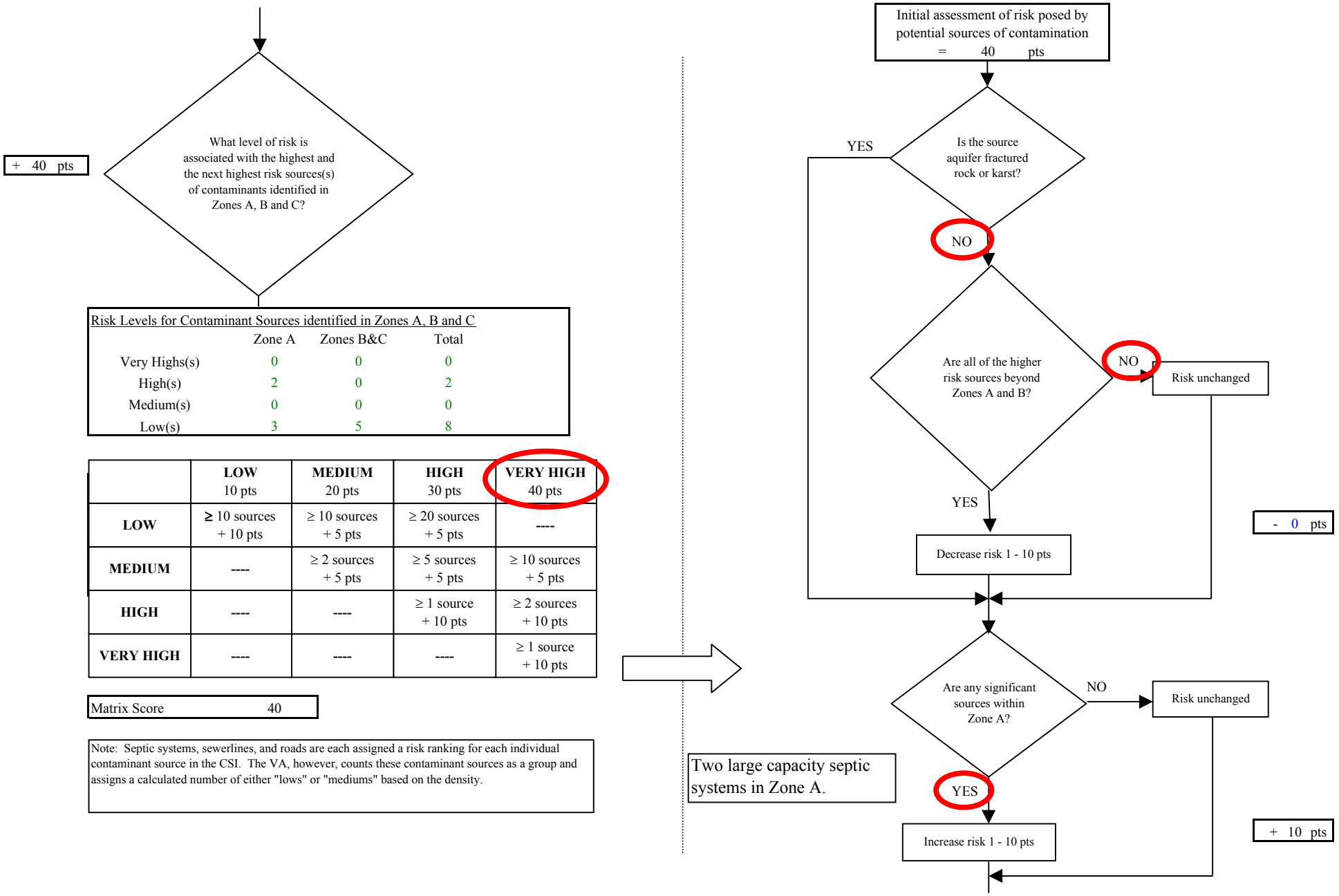


Chart 5. Contaminant risks for Wilderness East Community - Nitrates and Nitrites



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

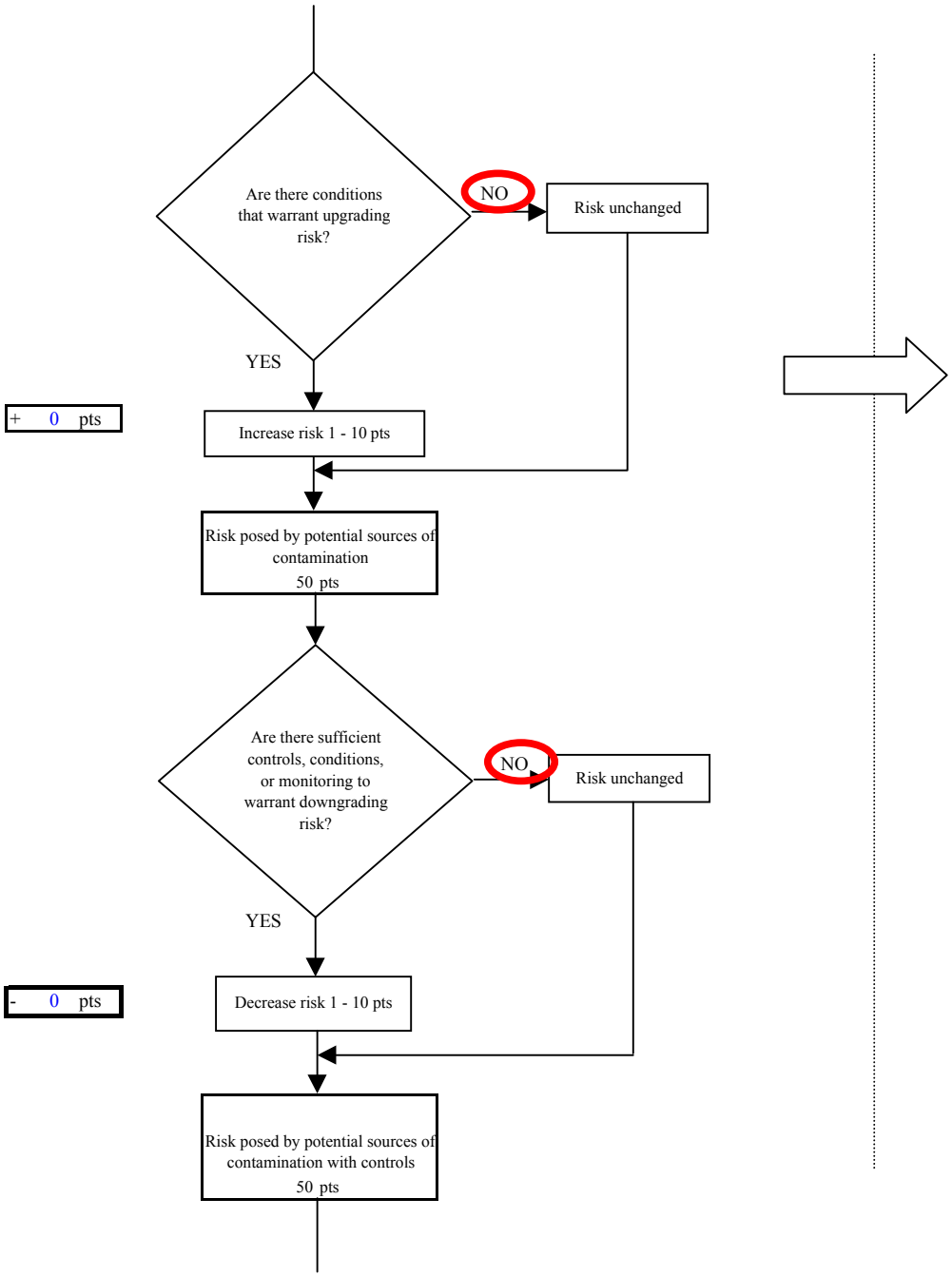
	Zone A	Zones B&C	Total
Very Highs(s)	0	0	0
High(s)	2	0	2
Medium(s)	0	0	0
Low(s)	3	5	8

	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 5. Contaminant risks for Wilderness East Community - Nitrates and Nitrites



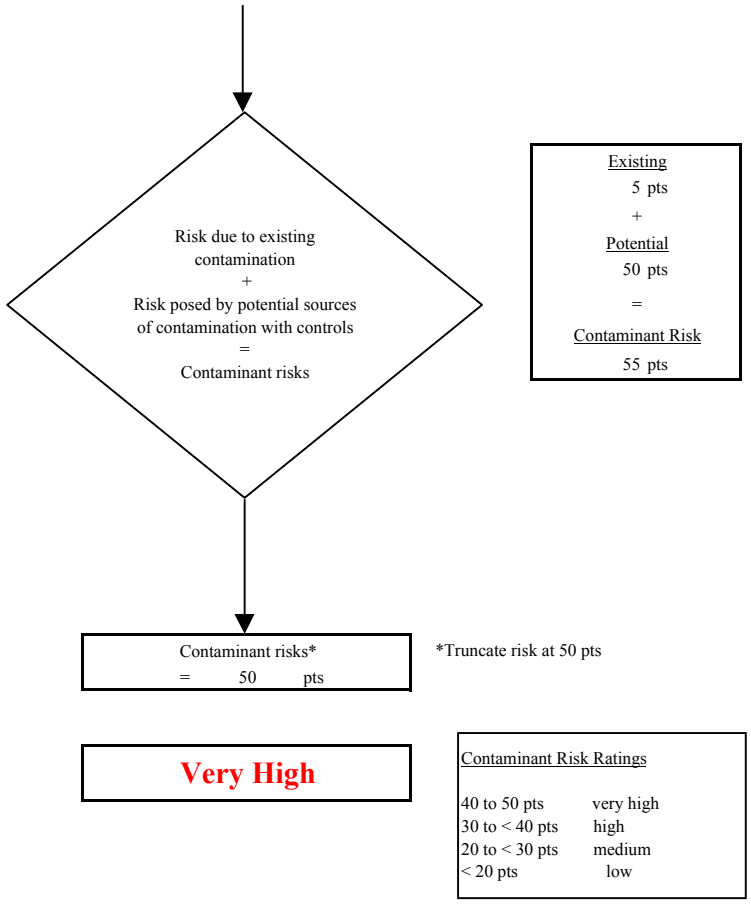


Chart 6. Vulnerability analysis for Wilderness East Community - Nitrates and Nitrites

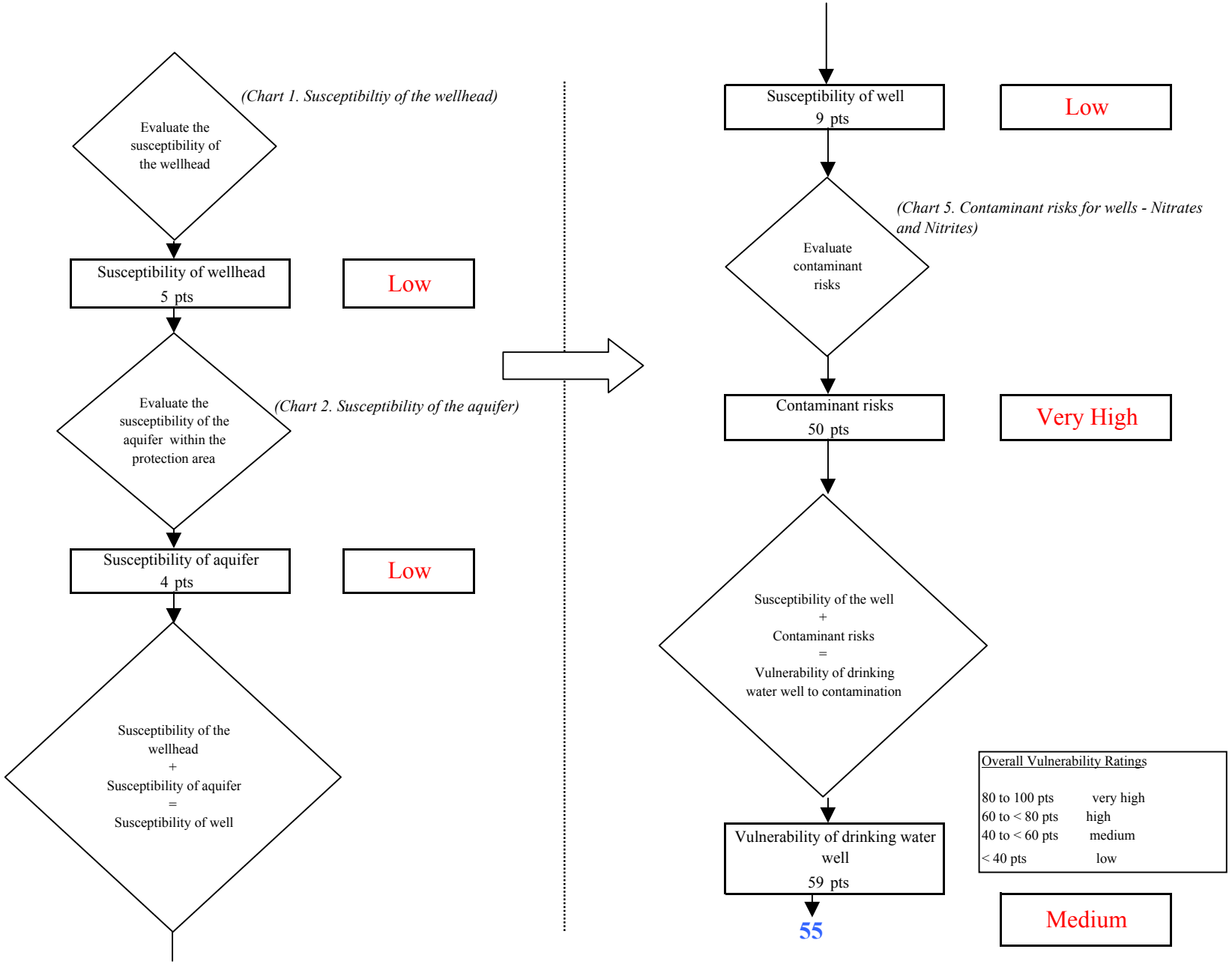


Chart 7. Contaminant risks for Wilderness East Community - Volatile Organic Chemicals

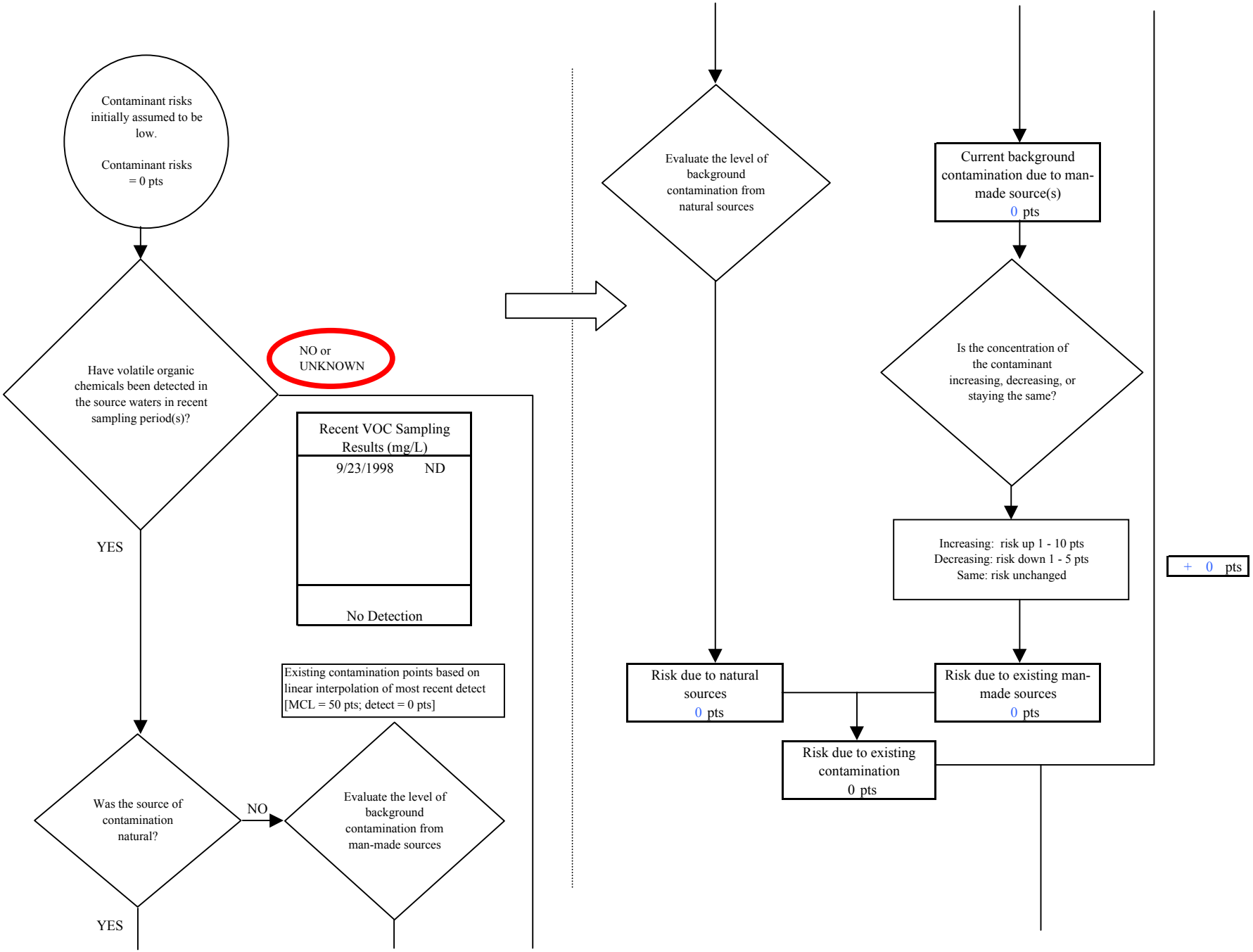


Chart 7. Contaminant risks for Wilderness East Community - Volatile Organic Chemicals

+ 10 pts

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

Risk Levels for Contaminant Sources identified in Zones A, B and C			
	Zone A	Zones B&C	Total
Very Highs(s)	0	0	0
High(s)	0	0	0
Medium(s)	0	0	0
Low(s)	5	2	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 individual contaminant source in the CSI. The VA, however, counts these contaminant sources as a group and assigns a calculated number of either "lows" or "mediums" based on the density.

Initial assessment of risk posed by potential sources of contamination = 10 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

+ 2 pts

Chart 7. Contaminant risks for Wilderness East Community - Volatile Organic Chemicals

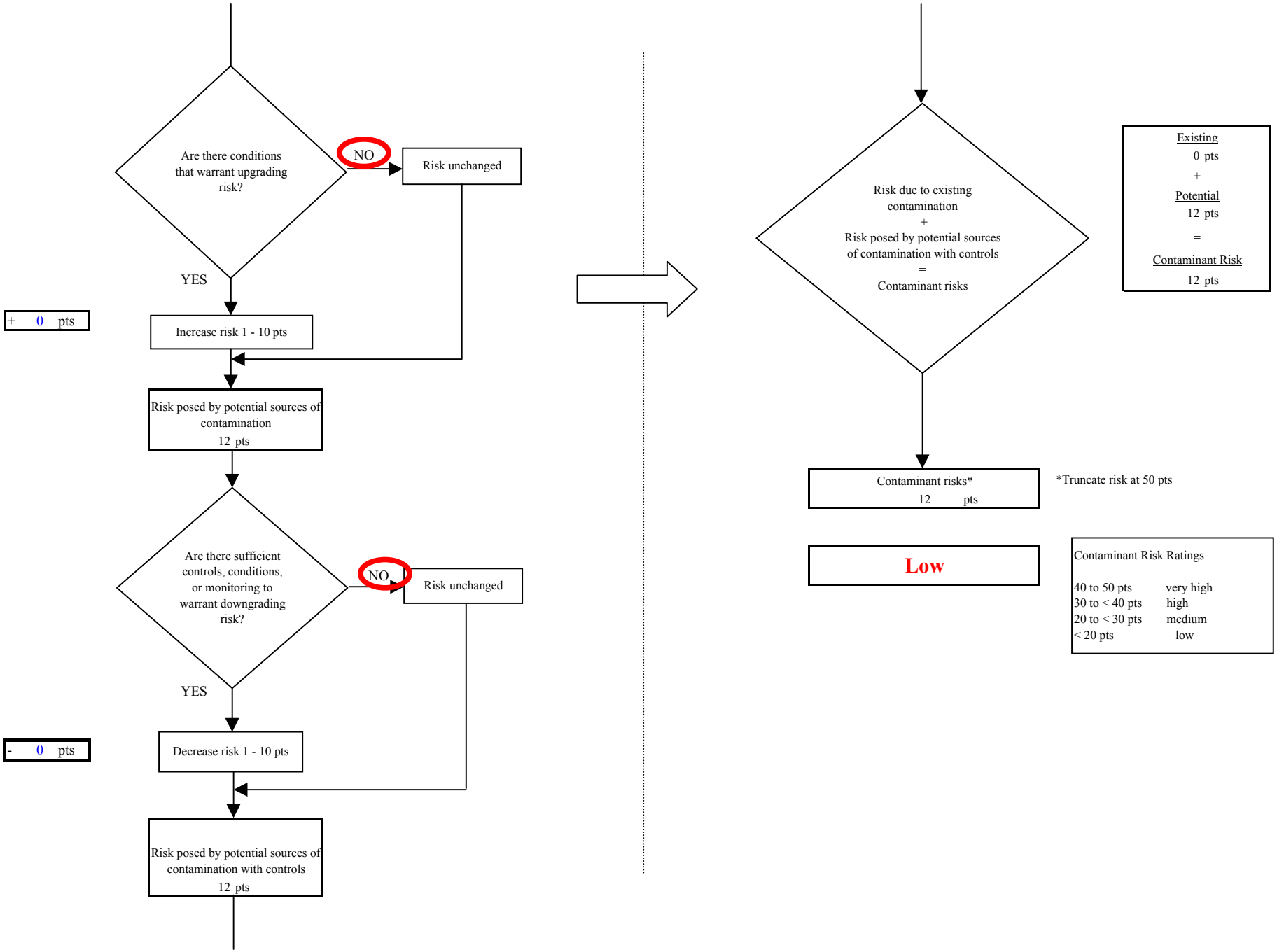


Chart 8. Vulnerability analysis for Wilderness East Community - Volatile Organic Chemicals

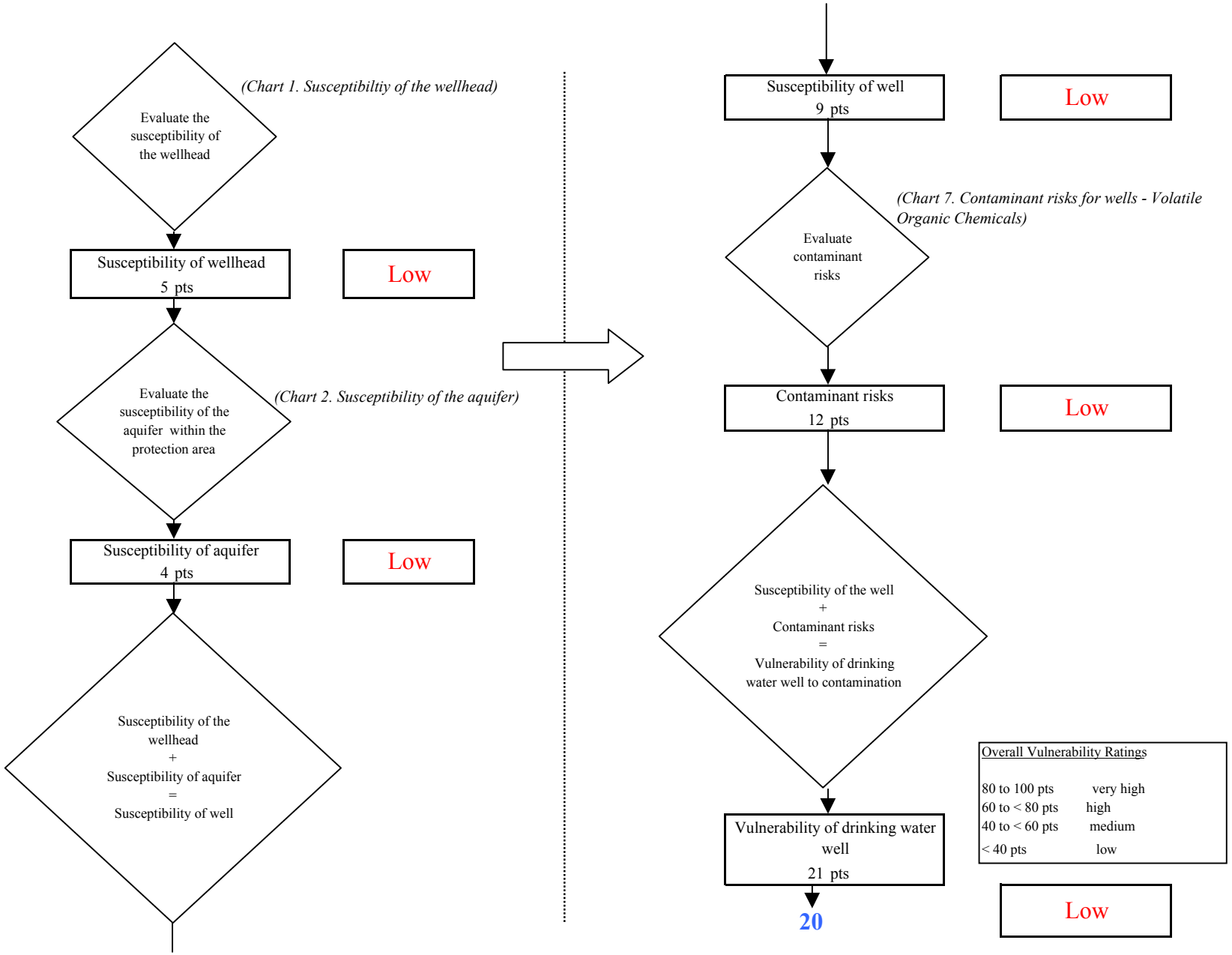


Chart 9. Contaminant risks for Wilderness East Community - Heavy Metals, Cyanide and Other Inorganic Chemicals

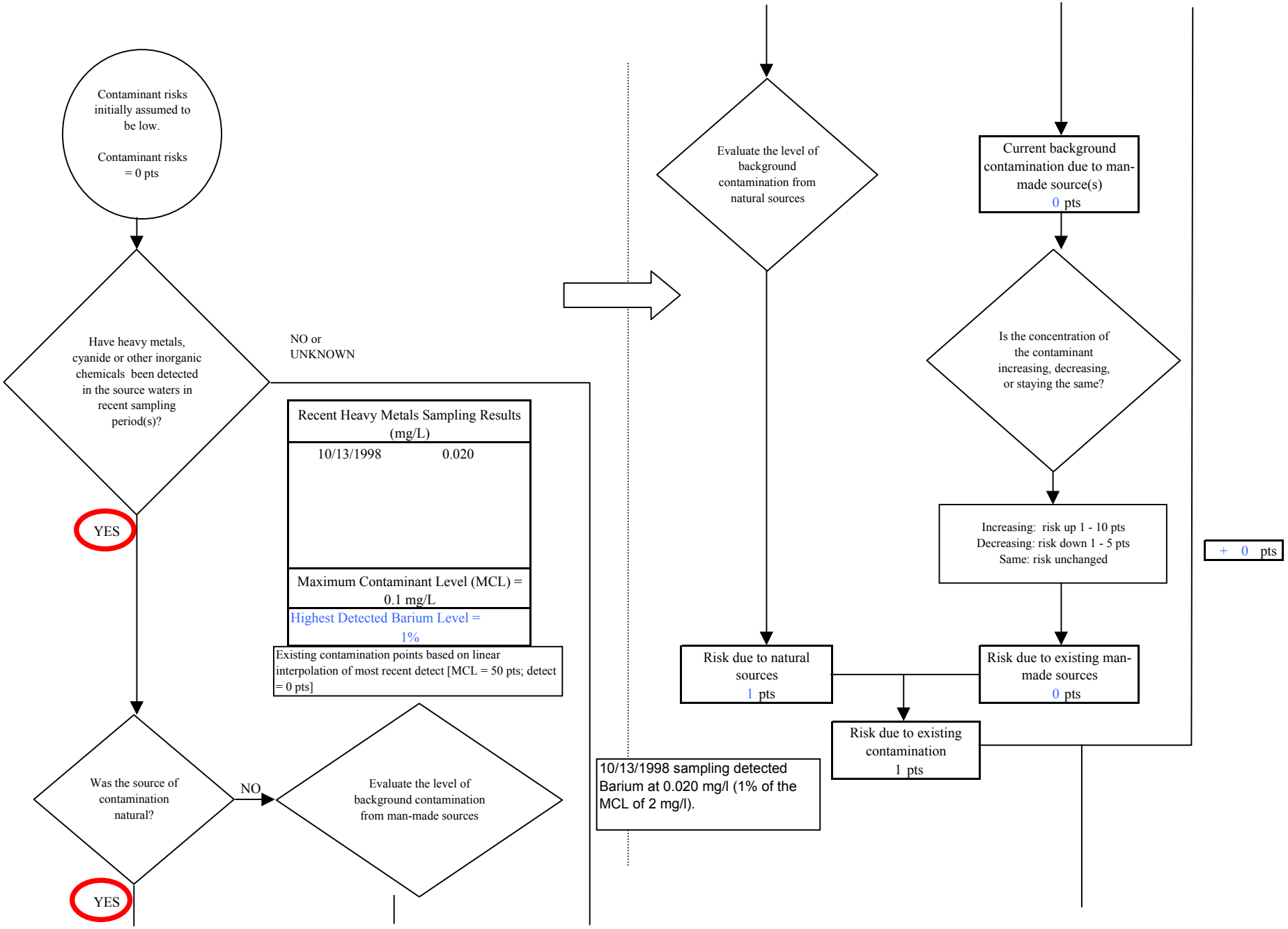
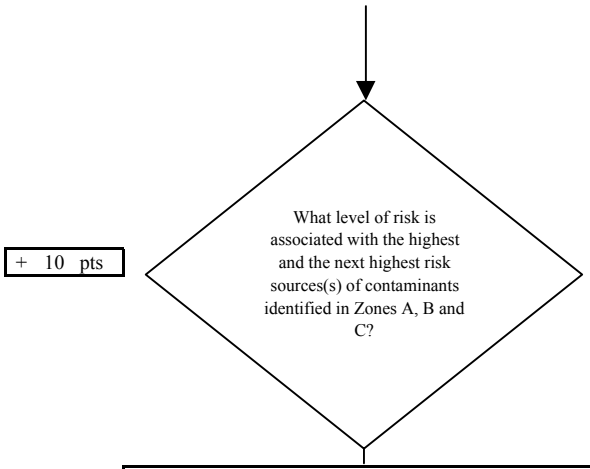


Chart 9. Contaminant risks for Wilderness East Community - Heavy Metals, Cyanide and Other Inorganic Chemicals



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)	5	2	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 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.

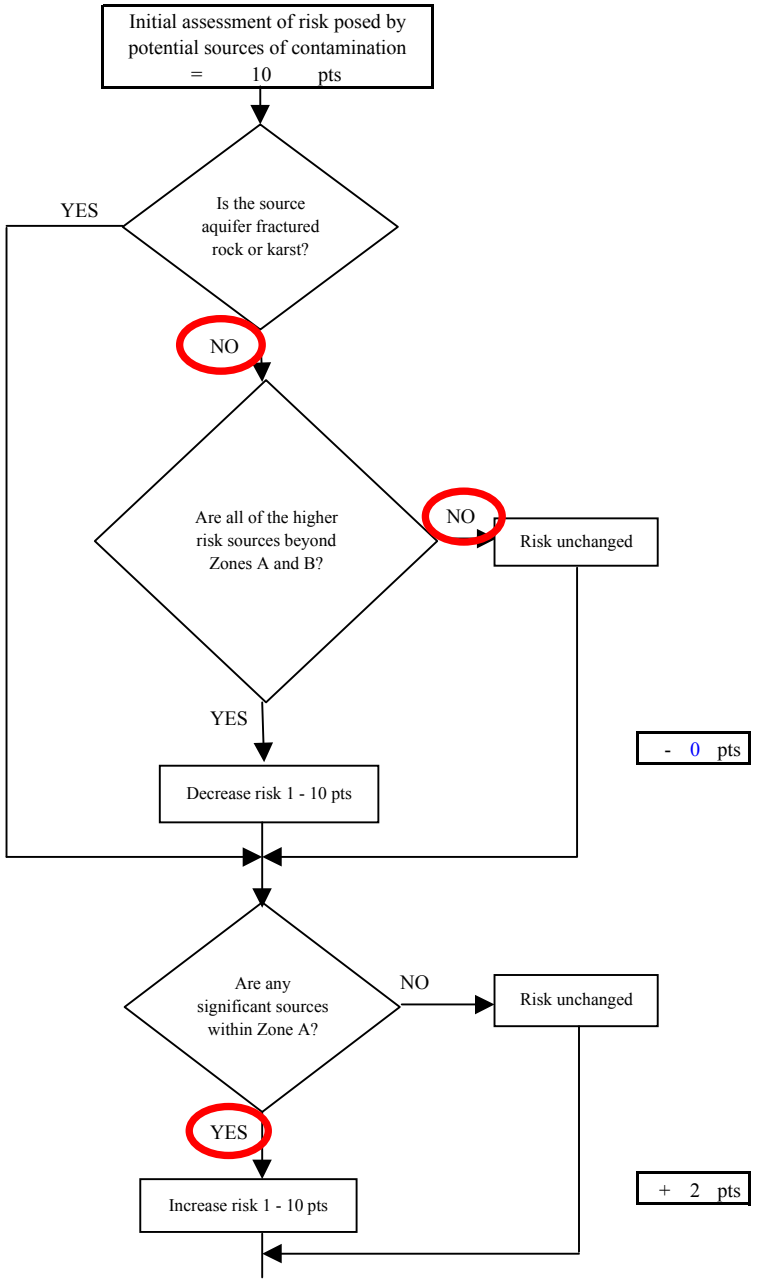


Chart 9. Contaminant risks for Wilderness East Community - Heavy Metals, Cyanide and Other Inorganic Chemicals

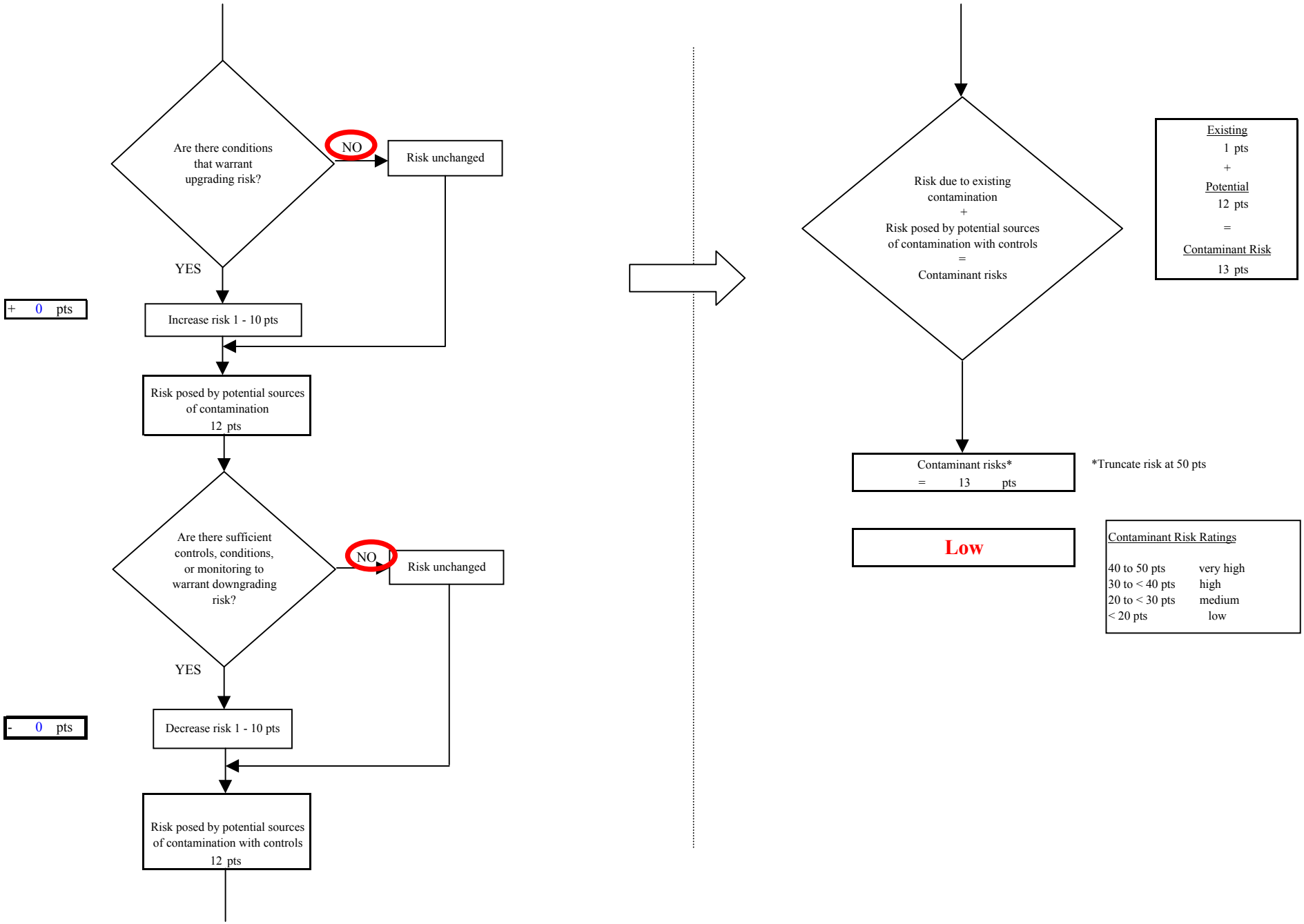


Chart 10. Vulnerability analysis for Wilderness East Community - Heavy Metals, Cyanide and Other Inorganic Chemicals

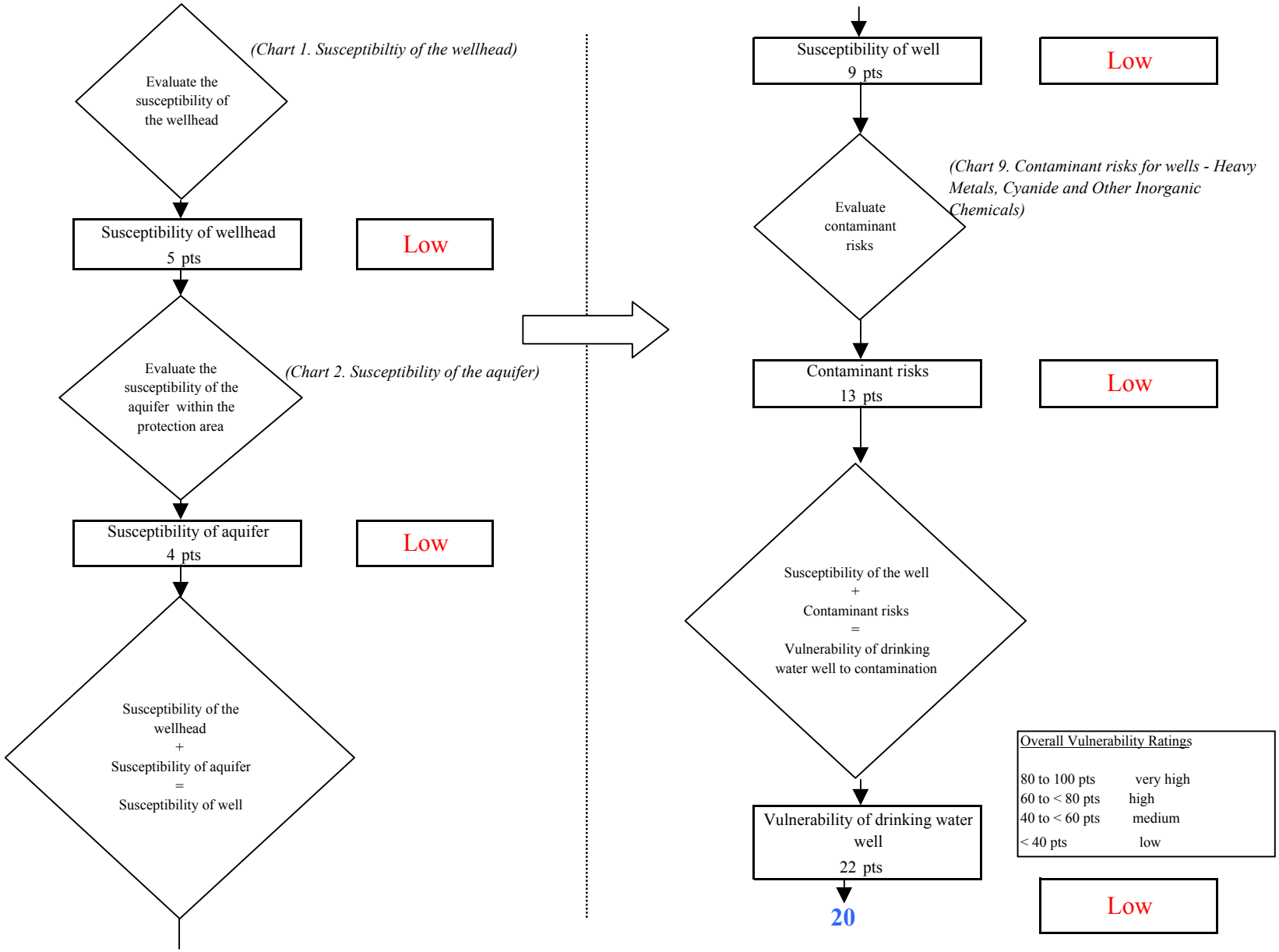


Chart 11. Contaminant risks for Wilderness East Community - Synthetic Organic Chemicals

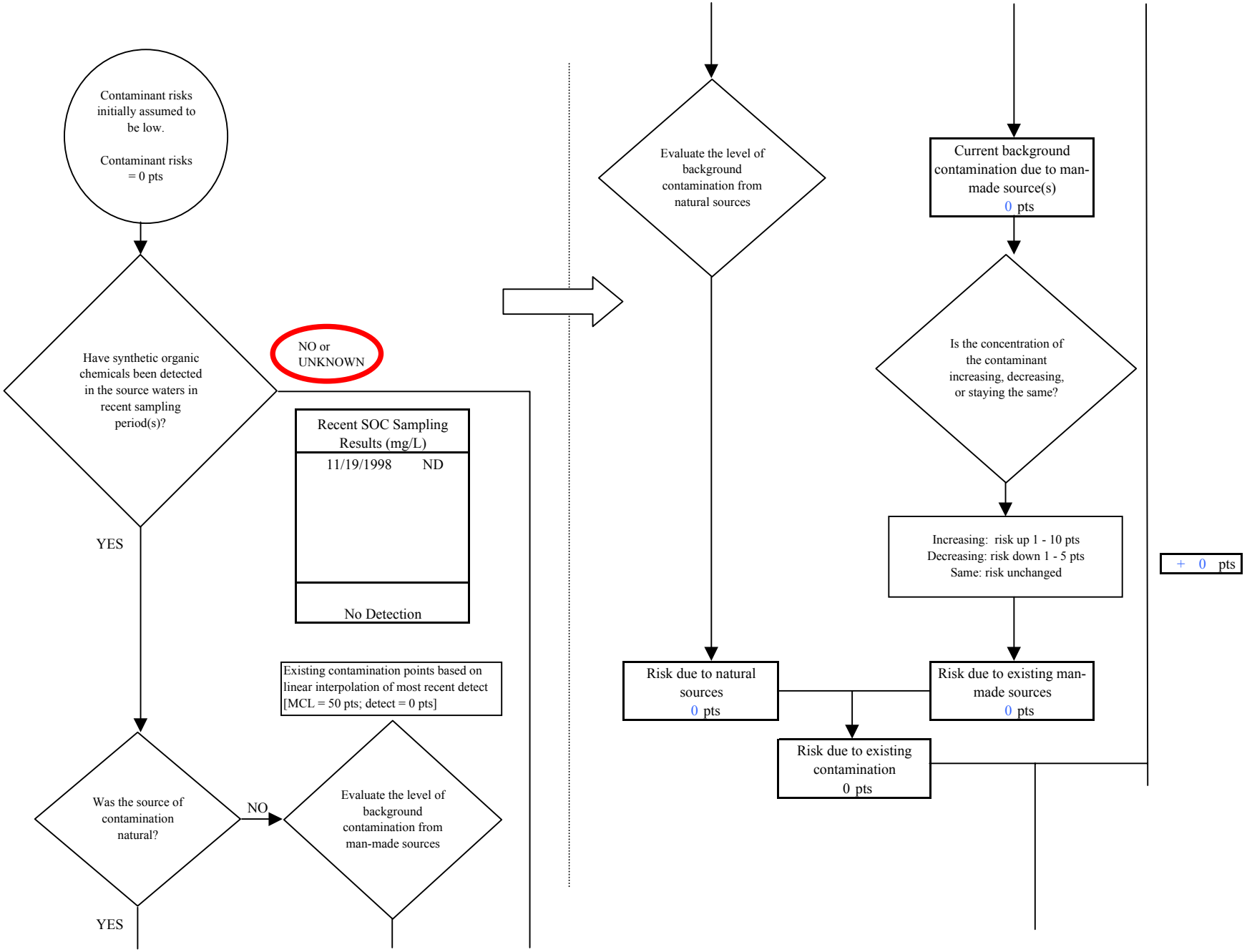
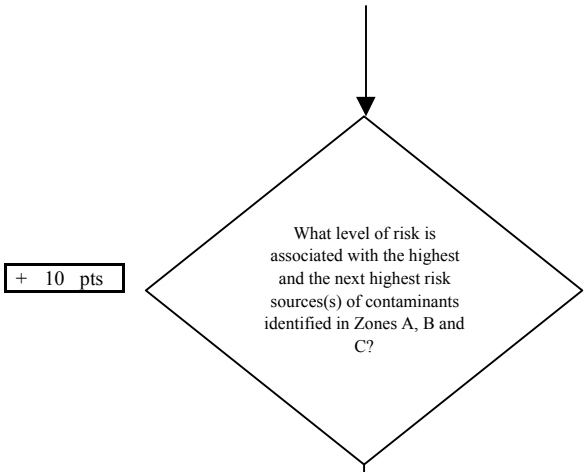


Chart 11. Contaminant risks for Wilderness East Community - Synthetic Organic Chemicals



+ 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)	4	1	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 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.

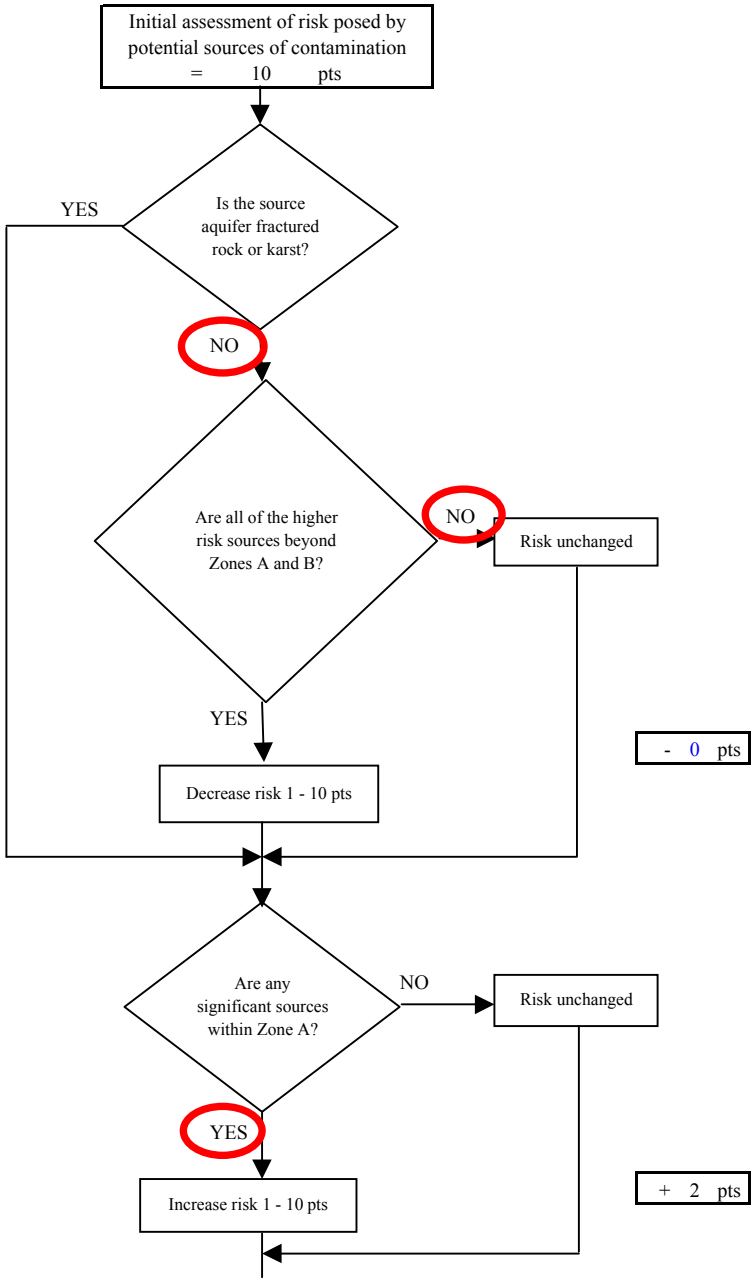
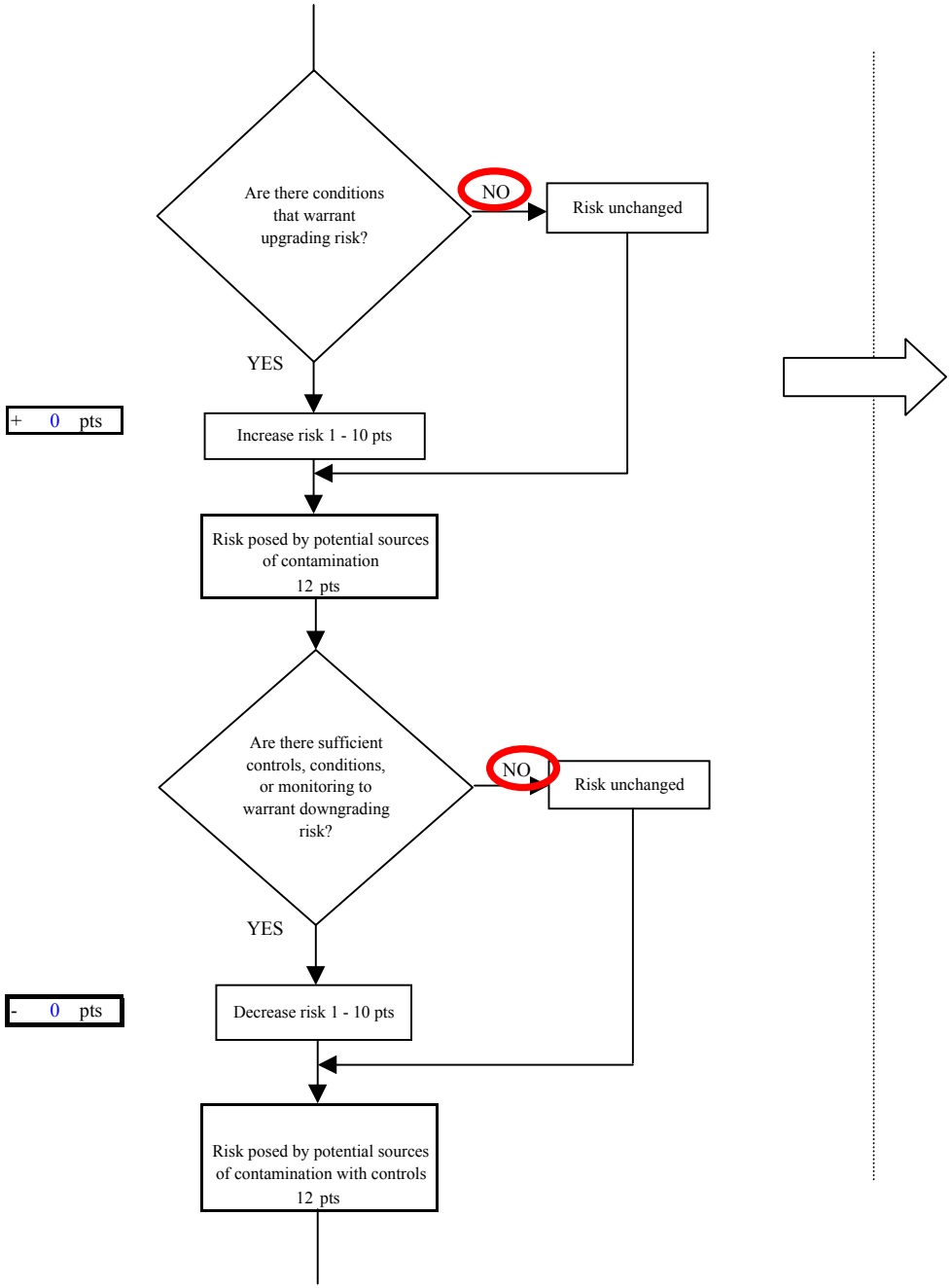


Chart 11. Contaminant risks for Wilderness East Community - Synthetic Organic Chemicals



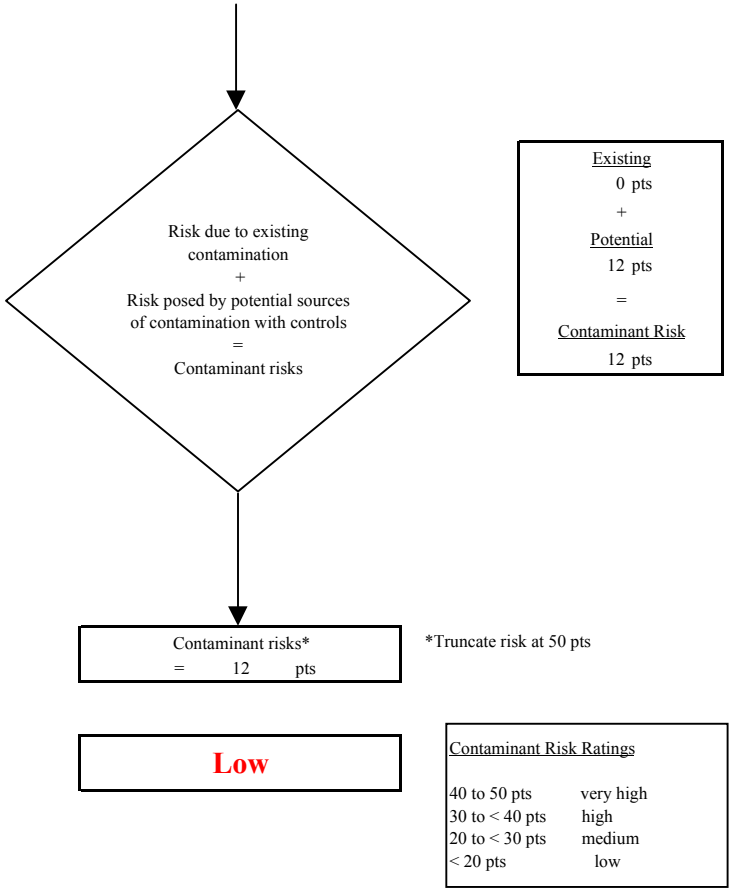


Chart 12. Vulnerability analysis for Wilderness East Community - Synthetic Organic Chemicals

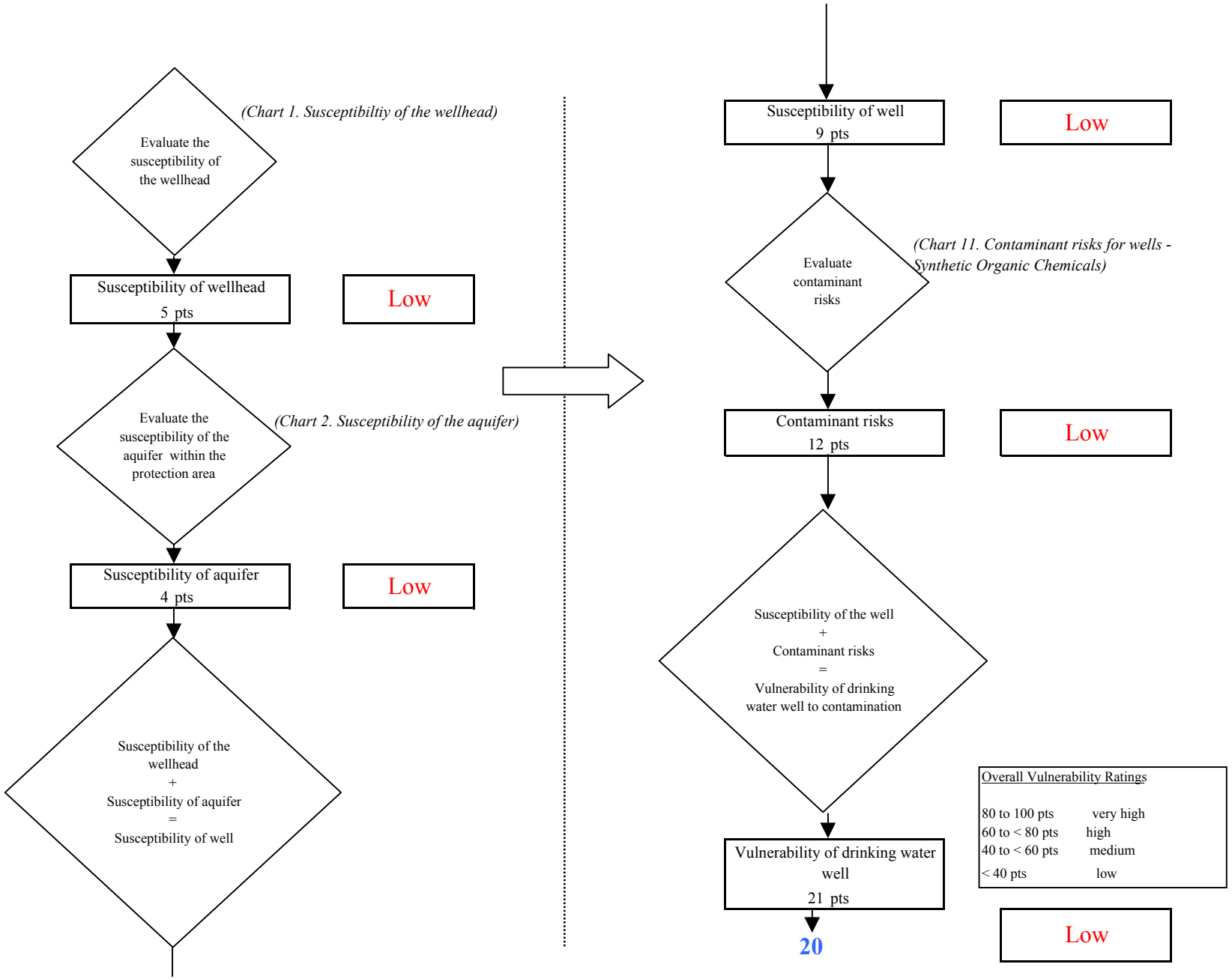


Chart 13. Contaminant risks for Wilderness East Community - Other Organic Chemicals

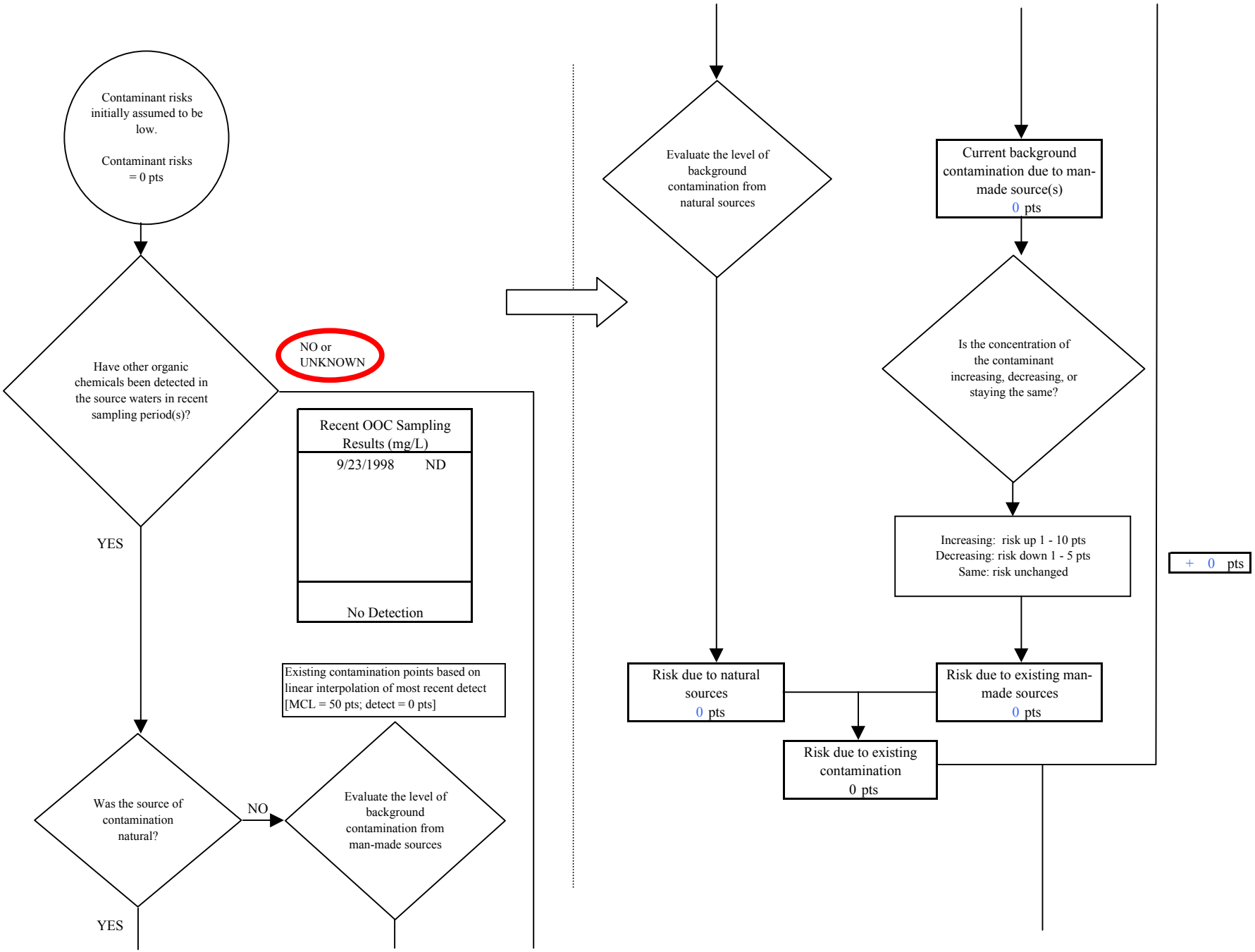
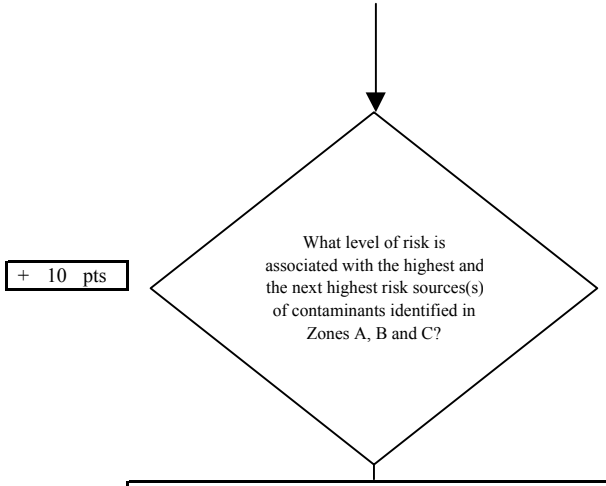


Chart 13. Contaminant risks for Wilderness East Community - Other Organic Chemicals



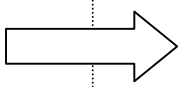
+ 10 pts

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)	5	2	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 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.



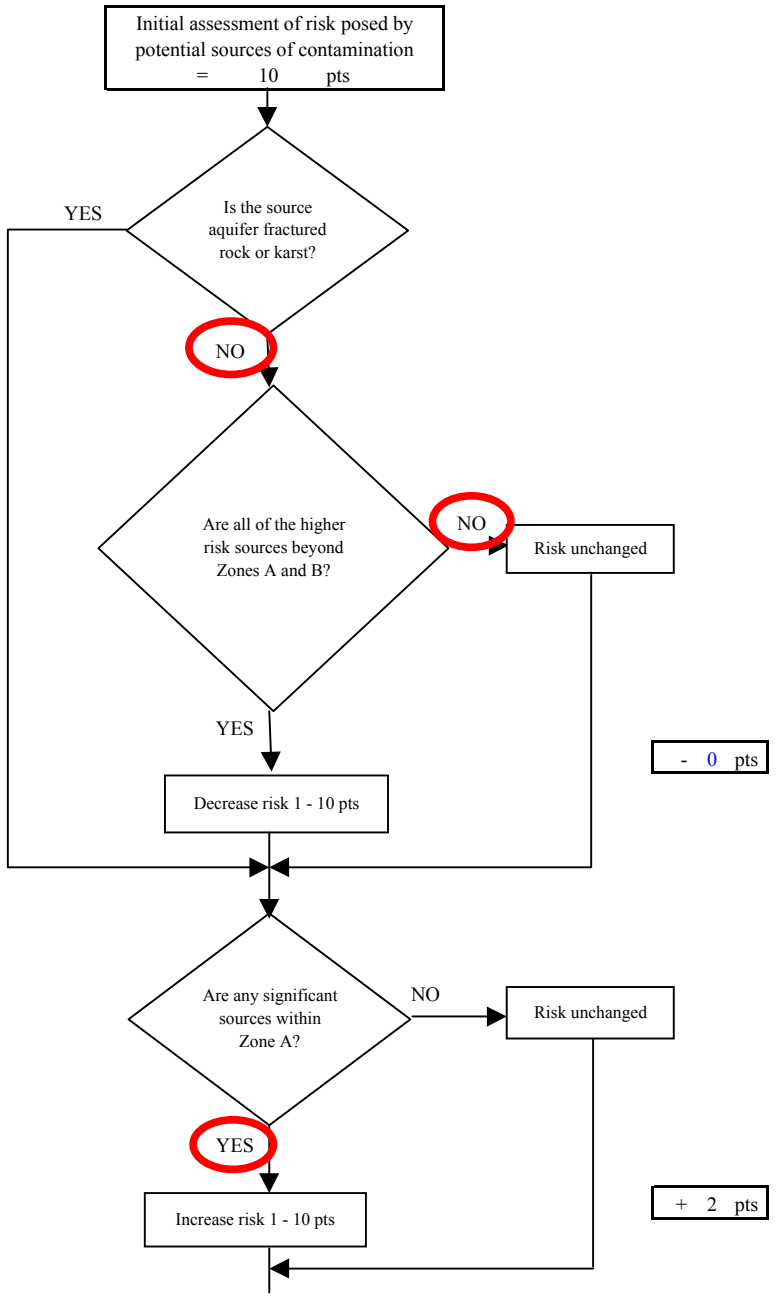
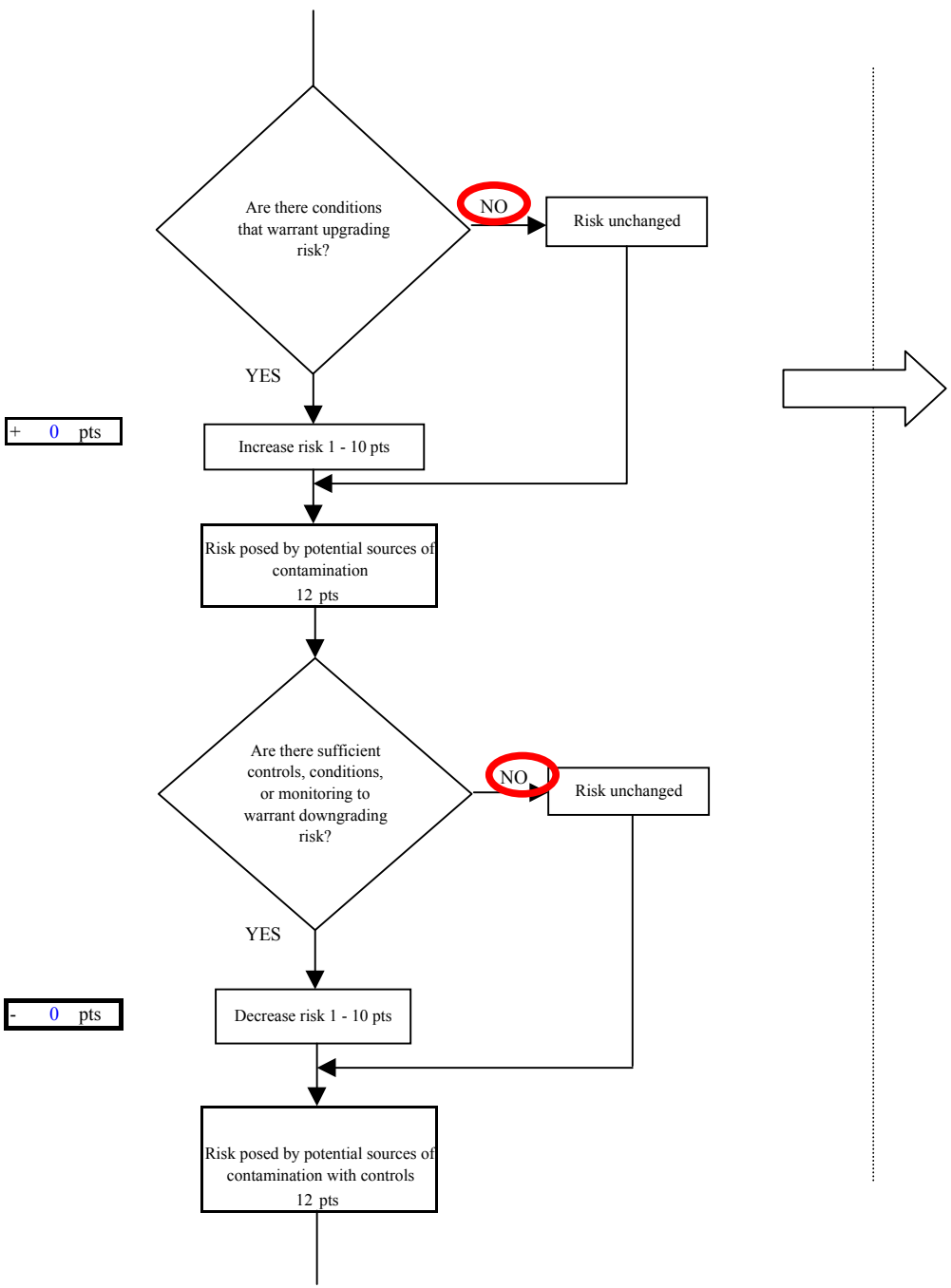
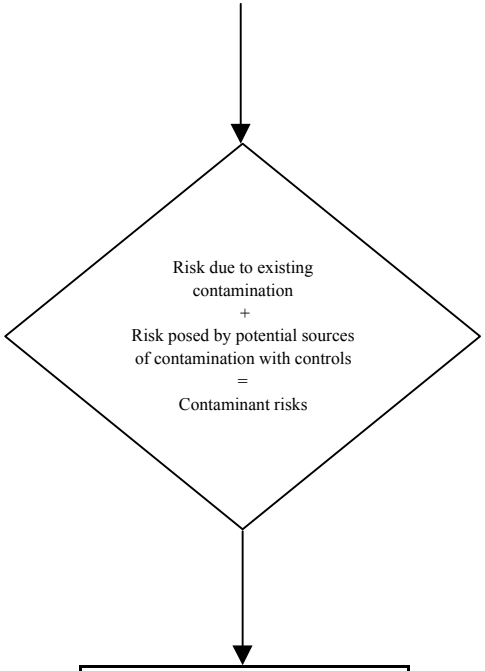


Chart 13. Contaminant risks for Wilderness East Community - Other Organic Chemicals





Existing
0 pts
+
Potential
12 pts
=
Contaminant Risk
12 pts

Contaminant risks*
= 12 pts

*Truncate risk at 50 pts

Low

Contaminant Risk Ratings

40 to 50 pts	very high
30 to < 40 pts	high
20 to < 30 pts	medium
< 20 pts	low

Chart 14. Vulnerability analysis for Wilderness East Community - Other Organic Chemicals