Source Water Assessment

A Hydrogeologic Susceptibility and Vulnerability Assessment for BLM Marion Creek Campground Drinking Water System, Coldfoot, Alaska

PWSID # 700040.001

June 2004

DRINKING WATER PROTECTION PROGRAM REPORT 1351
Alaska Department of Environmental Conservation

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DRINKING WATER PROTECTION PROGRAM REPORT 1351

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 BLM Marion Creek Campground Source of Public Drinking Water,
Coldfoot, Alaska

Drinking Water Protection Program
Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

BLM Marion Creek Campground has one Public Water System (PWS) well. It is assumed that the well (PWSID# 700040.001) has been used as a drinking water source since it was drilled in 1993.

The well is a Class B (transient/non-community) water system located at milepost 179.9 on the Dalton Highway, which is a few miles from Coldfoot, Alaska. Available records indicate that there is no secondary storage of drinking water. Also, records do not indicate if the drinking water source that is derived directly from the wellhead is treated, but it is assumed to not be treated. This system operates from June to September and serves approximately 54 non-residents and 0 residents through one service connection. The wellhead received a susceptibility rating of **Low** and the aquifer received a susceptibility rating of **High**. Combining these two ratings produce a **Low** rating for the natural susceptibility of the well. Identified potential and current sources of contaminants for the primary public drinking water source include: pit toilets (open hole), a quarry, pipelines (oil and gas), campgrounds and RV parks, a placer metal mine, and roads. These identified potential and existing sources of contamination are considered as sources of bacteria and viruses, nitrates and/or nitrites, and volatile organic chemicals. Overall, the water well received a vulnerability rating of **Medium** for the bacteria and viruses, a vulnerability rating of **Medium** for nitrates and nitrites, and a vulnerability rating of **Medium** for volatile organic chemicals contaminant categories.

BLM MARION CREEK CAMPGROUND PUBLIC DRINKING WATER SYSTEM

The BLM Marion Creek Campground well is a Class B (transient/non-community) public water system. The well is located at milepost 179.9 on the Dalton Highway, which is a few miles from Coldfoot, Alaska (Sec. 16, T028N, R012W, Fairbanks Meridian; see Map A of Appendix A). Coldfoot is located at the mouth of Slate Creek on the east bank of the Middle Fork Koyukuk River. Coldfoot lies at milepost 175 of the Dalton Highway. The community has a population of 15 (ADCED, 2003). Average annual precipitation in Coldfoot is 10 inches, with 63 inches of snow. Galena has temperature extremes ranging from –14 to 50.

The community of Coldfoot obtains their water supply from individual wells. All households have individual septic tanks (ADCED, 2003). Coldfoot receives electrical power from individual generators, which are fueled by diesel sources. Refuse is collected by individuals and records did not indicate the use of a landfill (ADCED, 2003).

According to information supplied by ADEC for the BLM Marion Creek Campground PWS, the depth of the primary water well is 50 feet below the ground surface. The well is screened at 45 to 50 feet and is unconfined. Unconfined aquifers are more susceptible to groundwater impacts resulting from the downward migration of surface contaminants. The well is not located within a floodplain.

Information acquired from a September 1998 sanitary survey for the water system indicated that the land surface was sloped away from the well. Generally, land surfaces that slope away from the wellhead promote surface water drainage, which reduces potential of contaminant migration down the well casing annulus. The well is grouted according to ADEC regulations. Proper grouting provides added protection against contaminants traveling along the well casing annulus and into source waters.

Coldfoot is at the southern foot of the Brooks Range. It is within the Pleistocene glaciation by Brooks Range glaciers. Coldfoot is just north of the Koyukuk River Valley, which has alluvial and glacial-fluvial sediments. Discontinuous permafrost occurs in the alluvial sediments of the Koyukuk River Valley and may be absent in close proximity to large water bodies. Soils are classified as inceptisols. Lowland soils are derived from the silty alluvium and loess of the Koyukuk River Valley. A thick, peaty surface mat is present above the saturated active

layer. Freezing and thawing of the active layer produces an irregular land surface. Where present, the underlying permafrost is usually ice-rich. Similar soils and found in the uplands, but are usually more gravelly and loamy in texture (Cowan, 1995).

BLM MARION CREEK CAMPGROUND DRINKING WATER PROTECTION AREA

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

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

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

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

Table 1. Definition of Zones

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

The DWPA for the BLM Marion Creek Campground PWS was determined using an analytical calculation and includes Zones A, B, and D (See Map A of Appendix A).

INVENTORY OF POTENTIAL AND EXISTING CONTAMINANT SOURCES

The Drinking Water Protection Program has completed an inventory of potential and existing sources of contamination within the BLM Marion Creek Campground DWPA. This inventory was completed through a search of agency records and other publicly available information. Potential sources of contamination to the drinking water aquifer include a wide range of categories and types. Potential drinking water contaminants are found within agricultural, residential, commercial, and industrial areas, but can also occur within areas that have little or no development.

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

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

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

RANKING OF CONTAMINANT RISKS

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

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

The time-of-travel for contaminants within the water varies and is dependent on the physical and chemical characteristics of each contaminant. Bacteria and Viruses are only inventoried in Zones A and B because of their short life span. Only "Very High" and "High" rankings are inventoried within the outer Zone D due to the probability of contaminant dilution by the time the contaminants get to the well.

Tables 2 through 4 in Appendix B contain the ranking of potential and existing sources of contamination with respect to bacteria and viruses, nitrates and/or nitrites, and volatile organic chemicals.

VULNERABILITY OF THE BLM MARION CREEK CAMPGROUND DRINKING WATER SYSTEM

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

- Natural susceptibility, and
- Contaminant risks.

Appendix D contains eight charts, which together form the 'Vulnerability Analysis' for a source water assessment for a public drinking water source. Chart 1 analyzes the 'Susceptibility of the Wellhead' to contamination by looking at the construction of the well and its surrounding area. Chart 2 analyzes the 'Susceptibility of the Aquifer' to contamination by looking at the naturally occurring attributes of the water source and influences on the groundwater system that might lead to contamination. Chart 3 analyzes 'Contaminant Risks' for the drinking water source with respect to bacteria and viruses. The 'Contaminant Risks' portion of the analysis considers potential sources of contaminants as well as a review of contamination that has or may have occurred, but has not arrived or been detected at the well. Lastly, Chart 4 contains the 'Vulnerability Analysis for Bacteria and Viruses'. Charts 5 through 8 contain the Contaminant Risks and Vulnerability Analyses for nitrates and nitrites and volatile organic chemicals, respectively.

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

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

+

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

=

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

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

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

The BLM Marion Creek Campground's water well is in an unconfined aquifer. Unconfined aquifers are more susceptible to potential groundwater quality impacts posed by the migration of surface water contaminants downward from the surface. Table 2 shows the susceptibility scores and ratings for this PWS.

Table 2. Susceptibility

	Score	Rating
Susceptibility of the Wellhead	0	Low
Susceptibility of the Aquifer	15	High
Natural Susceptibility	15	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	35	High
Nitrates and/or Nitrites	37	High
Volatile Organic Chemicals	25	Medium

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

Natural Susceptibility (0 – 50 points)

+

Contaminant Risks (0 – 50 points)

=

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

Again, rankings are assigned according to a point score:

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

Table 4 contains the overall vulnerability scores (0 – 100) and ratings for each of the three categories of drinking water contaminants. Note: scores are rounded off to the nearest five.

Table 4. Overall Vulnerability

Category	Score	Rating
Bacteria and Viruses	50	Medium
Nitrates and Nitrites	50	Medium
Volatile Organic Chemicals	40	Medium

Bacteria and Viruses

The contaminant risk for bacteria and viruses is **High**. The risk is primarily attributed to the presence of nonresidential pit toilets (open hole) located in Zone A (see Table 2 – Appendix B).

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

No positive bacteria counts have been reported in recent (within five years) sampling events (See Chart 3 – Contaminant Risks for Bacteria and Viruses in Appendix D). Only a small amount of bacteria and viruses are required to endanger public health.

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

Nitrates and Nitrites

The contaminant risk for nitrates and nitrites is **High**. The risk to this source of public drinking water is primarily attributed to the presence of nonresidential pit toilets (open hole) in Zone A (see Table 3 – Appendix B).

Nitrates are very mobile, moving at approximately the same rate as water. The sampling history for this well indicates that low levels of nitrates have been detected in recent sampling events. However, the reported concentrations of nitrates do not exceed the maximum contaminant level (MCL) of 10 mg/L. Nitrate concentrations in uncontaminated groundwater are typically less than 2 mg/L; therefore, nitrate concentrations above 2 mg/L may be indicative of man-made sources (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 **Medium**. The risk is primarily attributed to the presence of pipelines (oil and gas) located in Zone A. A couple other potential contaminant sources are also found within the protection area (see Table 4 – Appendix B).

No recent sampling data was available in ADEC records for BLM Marion Creek Campground (See Chart 7 – Contaminant Risks for Volatile Organic Chemicals in Appendix D).

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

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 BLM Marion Creek Campground and the community of Coldfoot to protect public health. It is anticipated that Source Water Assessments will be updated every five years to reflect any changes in the vulnerability and/or susceptibility of the drinking water source.

REFERENCES

Alaska Department of Community and Economic Development (ADCED), 2003 [WWW document]. URL: http://www.dced.state.ak.us/cbd/commdb/CF_COMDB.htm

Alaska Department of Environmental Conservation, Contaminated Sites Database, 2003 [WWW database], URL http://www.state.ak.us/dec/dspar/csites/cs_search.htm

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Cowan, James R. Overview of Environmental and Hydrogeologic Conditions at Bettles Field, Alaska. 1995. U.S. Geological Survey Open File Report 95-343 (prepared in cooperation with the FAA).

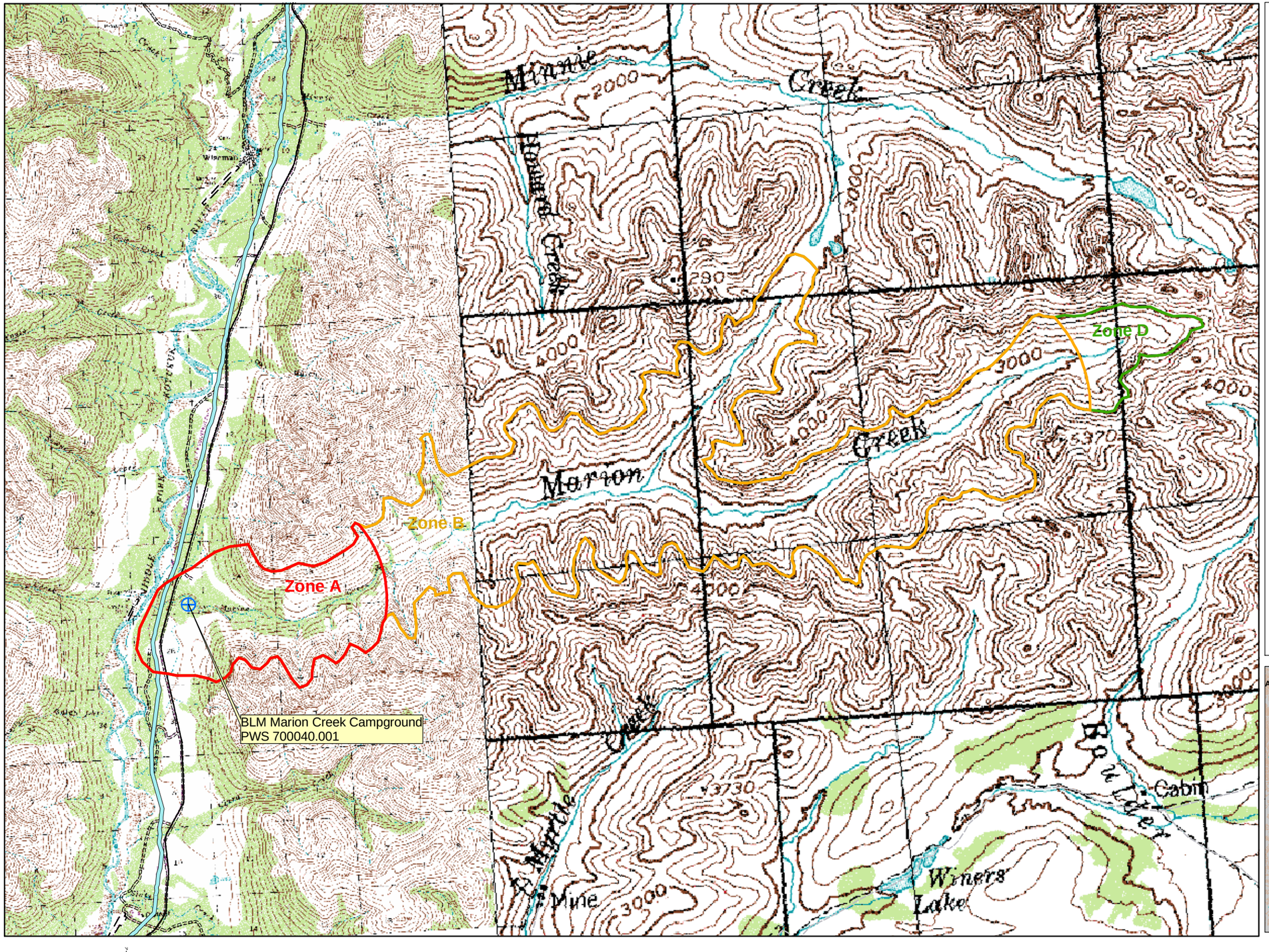
Freeze, R. A., and Cherry, J.A. 1979, Groundwater, Prentice-Hall, Englewood Cliffs, New Jersey

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

APPENDIX A

Drinking Water Protection Area Location Map
(Map A)

Public Water Well System for PWS #700040.001 BLM Marion Creek Campground



LEGEND

Public Water System Well

Hydrography/Physical

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

Transportation

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

Groundwater Protection Zones

- Zone A Protection Area– Several Months Travel Time
- Zone B Protection Area– 2 Years Travel Time
- Zone D Protection Area– 10 Years Travel Time, or Watershed Boundary

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

All other data:
United States Geological Survey (USGS)

Drinking Water Protection Areas based on "Alaska Drinking Water Protection Program - Guidance Manual for Class B Public Water Systems" published by ADEC

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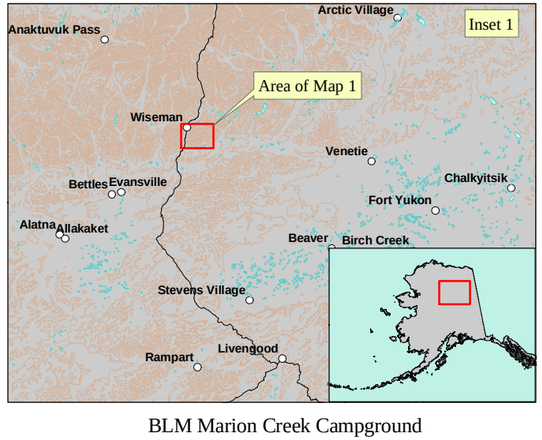


0 0.5 1 2 3 4 Miles

BLM Marion Creek Campground
PWS 700040.001
Appendix A Map A

APPENDIX B

Contaminant Source Inventory and Risk Ranking (Tables 1-6)

Table 1

Contaminant Source Inventory for

BLM Marion Creek Campground

PWSID 700040.00

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Map Number*	*Comments*
Pit toilets (open hole), nonresidential (one or more)	D16	D16-01	A	C	BLM Marion Creek Campground: 4 pit toilets assumed in Zone A
Quarries (sand, gravel, rock, other?)	E10	E10-01	A	C	MATERIAL SITE 99-1.1, SURFACE
Highways and roads, paved (cement or asphalt)	X20	X20-01	A	C	James Dalton Hwy
Pipelines (oil and gas)	X28	X28-01	A	C	TRANS-ALASKA PIPELINE
Campgrounds and RV Parks	X35	X35-01	A	C	Campground assumed in Zone A
Metals mining, placer (active or inactive?)	E04	E04-01	B	C	MARION CREEK, PLACER

Table 2

Contaminant Source Inventory and Risk Ranking for BLM Marion Creek Campground Sources of Bacteria and Viruses

PWSID 700040.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Pit toilets (open hole), nonresidential (one or more	D16	D16-01	A	Medium	C	BLM Marion Creek Campground: 4 pit toilets assumed in Zone A
Highways and roads, paved (cement or asphalt)	X20	X20-01	A	Low	C	James Dalton Hwy
Campgrounds and RV Parks	X35	X35-01	A	Low	C	Campground assumed in Zone A

Table 3

Contaminant Source Inventory and Risk Ranking for BLM Marion Creek Campground Sources of Nitrates/Nitrites

PWSID 700040.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Pit toilets (open hole), nonresidential (one or more	D16	D16-01	A	Medium	C	BLM Marion Creek Campground: 4 pit toilets assumed in Zone A
Quarries (sand, gravel, rock, other?)	E10	E10-01	A	Low	C	MATERIAL SITE 99-1.1, SURFACE
Highways and roads, paved (cement or asphalt)	X20	X20-01	A	Low	C	James Dalton Hwy
Campgrounds and RV Parks	X35	X35-01	A	Low	C	Campground assumed in Zone A

Table 4

Contaminant Source Inventory and Risk Ranking for BLM Marion Creek Campground Sources of Volatile Organic Chemicals

PWSID 700040.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Pit toilets (open hole), nonresidential (one or more	D16	D16-01	A	Low	C	BLM Marion Creek Campground: 4 pit toilets assumed in Zone A
Quarries (sand, gravel, rock, other?)	E10	E10-01	A	Low	C	MATERIAL SITE 99-1.1, SURFACE
Highways and roads, paved (cement or asphalt)	X20	X20-01	A	Low	C	James Dalton Hwy
Pipelines (oil and gas)	X28	X28-01	A	Medium	C	TRANS-ALASKA PIPELINE
Campgrounds and RV Parks	X35	X35-01	A	Low	C	Campground assumed in Zone A

Table 5

Contaminant Source Inventory and Risk Ranking for BLM Marion Creek Campground Sources of Heavy Metals, Cyanide and Other Inorganic Chemicals

PWSID 700040.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Pit toilets (open hole), nonresidential (one or more	D16	D16-01	A	Low	C	BLM Marion Creek Campground: 4 pit toilets assumed in Zone A
Highways and roads, paved (cement or asphalt)	X20	X20-01	A	Low	C	James Dalton Hwy
Pipelines (oil and gas)	X28	X28-01	A	Low	C	TRANS-ALASKA PIPELINE
Metals mining, placer (active or inactive?)	E04	E04-01	B	Low	C	MARION CREEK, PLACER

Table 6

Contaminant Source Inventory and Risk Ranking for BLM Marion Creek Campground Sources of Other Organic Chemicals

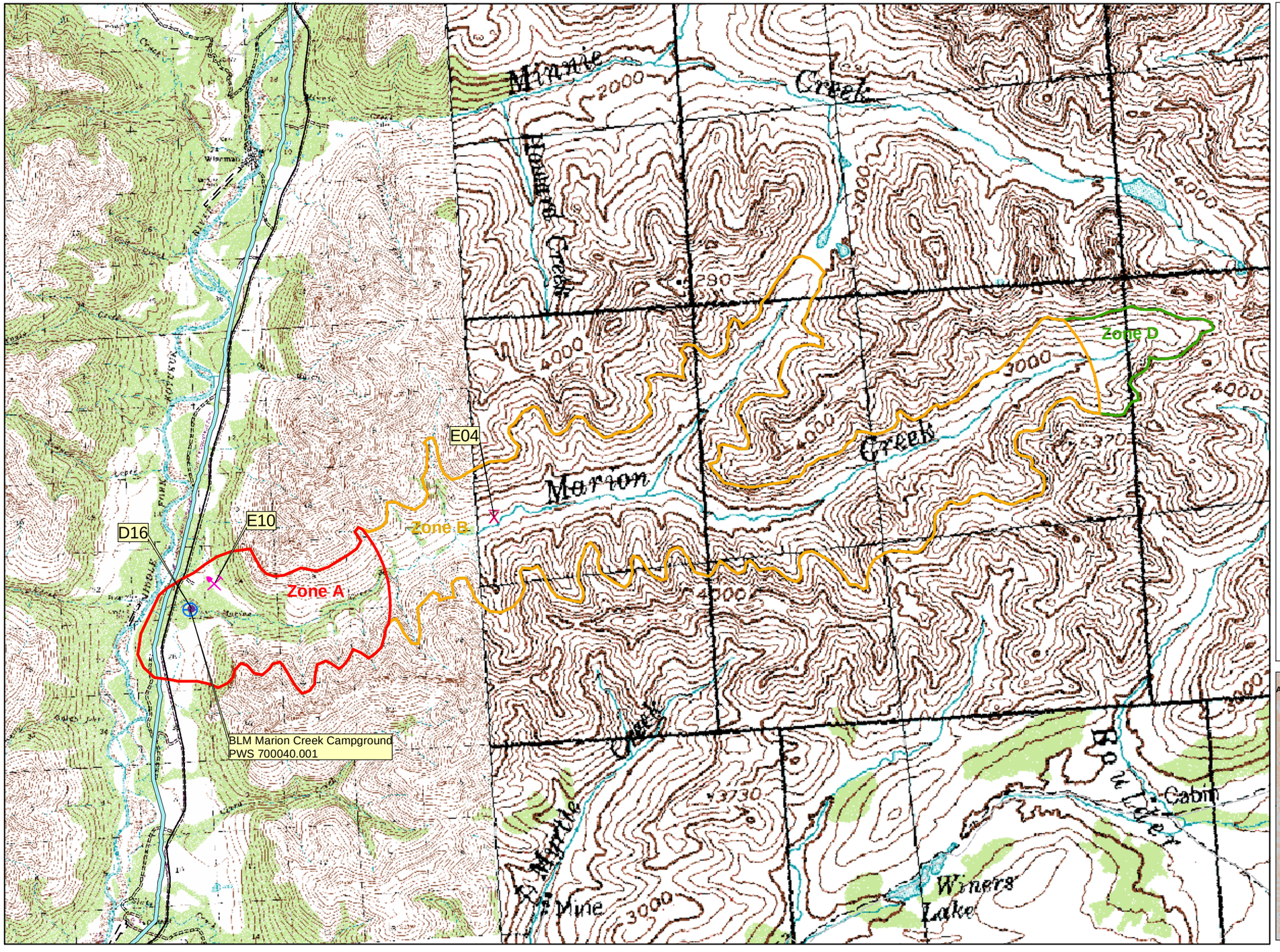
PWSID 700040.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Quarries (sand, gravel, rock, other?)	E10	E10-01	A	Low	C	MATERIAL SITE 99-1.1, SURFACE
Highways and roads, paved (cement or asphalt)	X20	X20-01	A	Low	C	James Dalton Hwy
Pipelines (oil and gas)	X28	X28-01	A	High	C	TRANS-ALASKA PIPELINE

APPENDIX C

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

Public Water Well System for PWS #700040.001 BLM Marion Creek Campground
Sources of Potential and Existing Contamination



LEGEND

Public Water System Well

Hydrography/Physical

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

Transportation

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

Groundwater Protection Zones

- Zone A Protection Area– Several Months Travel Time
- Zone B Protection Area– 2 Years Travel Time
- Zone D Protection Area– 10 Years Travel Time, or Watershed Boundary

Existing or Potential Contaminant Sources

- Pit toilets (open hole), nonresidential (one or more) (D16)
- Metals mining, placer (E04)
- Quarries (E10)
- Pipelines (oil and gas) (X28)

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

All other data:
United States Geological Survey (USGS)

Drinking Water Protection Areas based on "Alaska Drinking Water Protection Program - Guidance Manual for Class B Public Water Systems" published by ADEC

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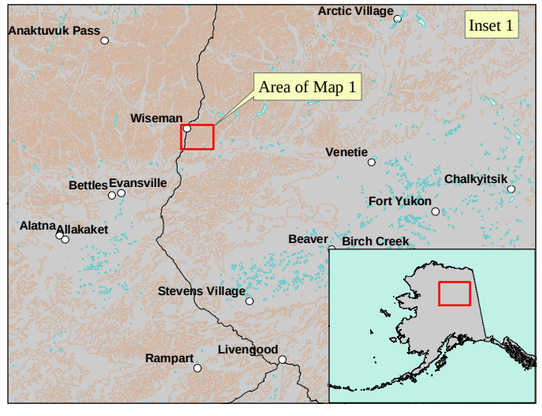


0 0.5 1 2 3 4 Miles

BLM Marion Creek Campground
PWS 700040.001
Appendix C Map C

APPENDIX D

Vulnerability Analysis for Public Drinking Water Source (Charts 1-8)

Chart 1. Susceptibility of the wellhead - BLM Marion Creek Campground (PWS No. 700040.001)

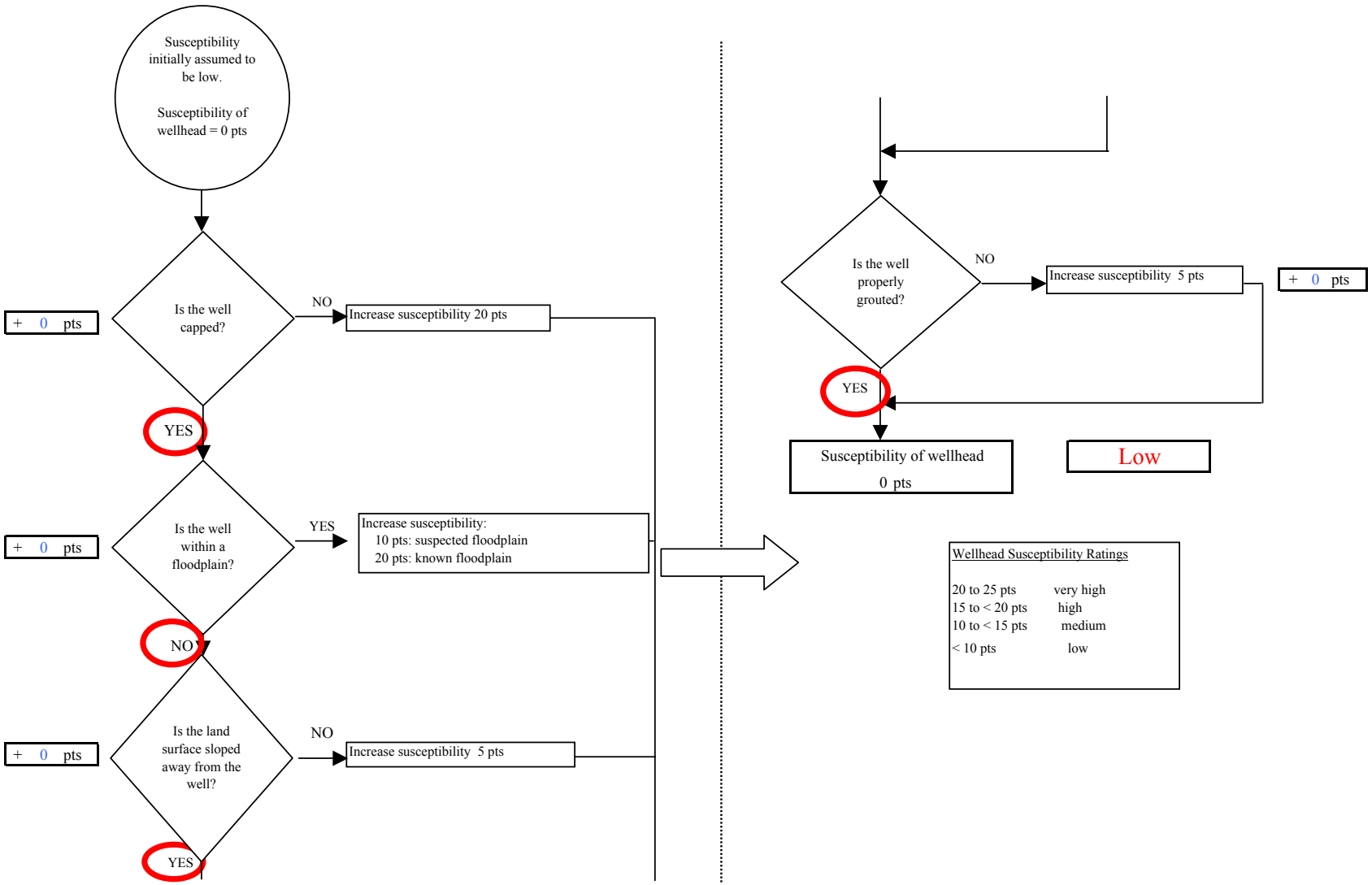


Chart 2. Susceptibility of the aquifer BLM Marion Creek Campground (PWS No. 700040.001)

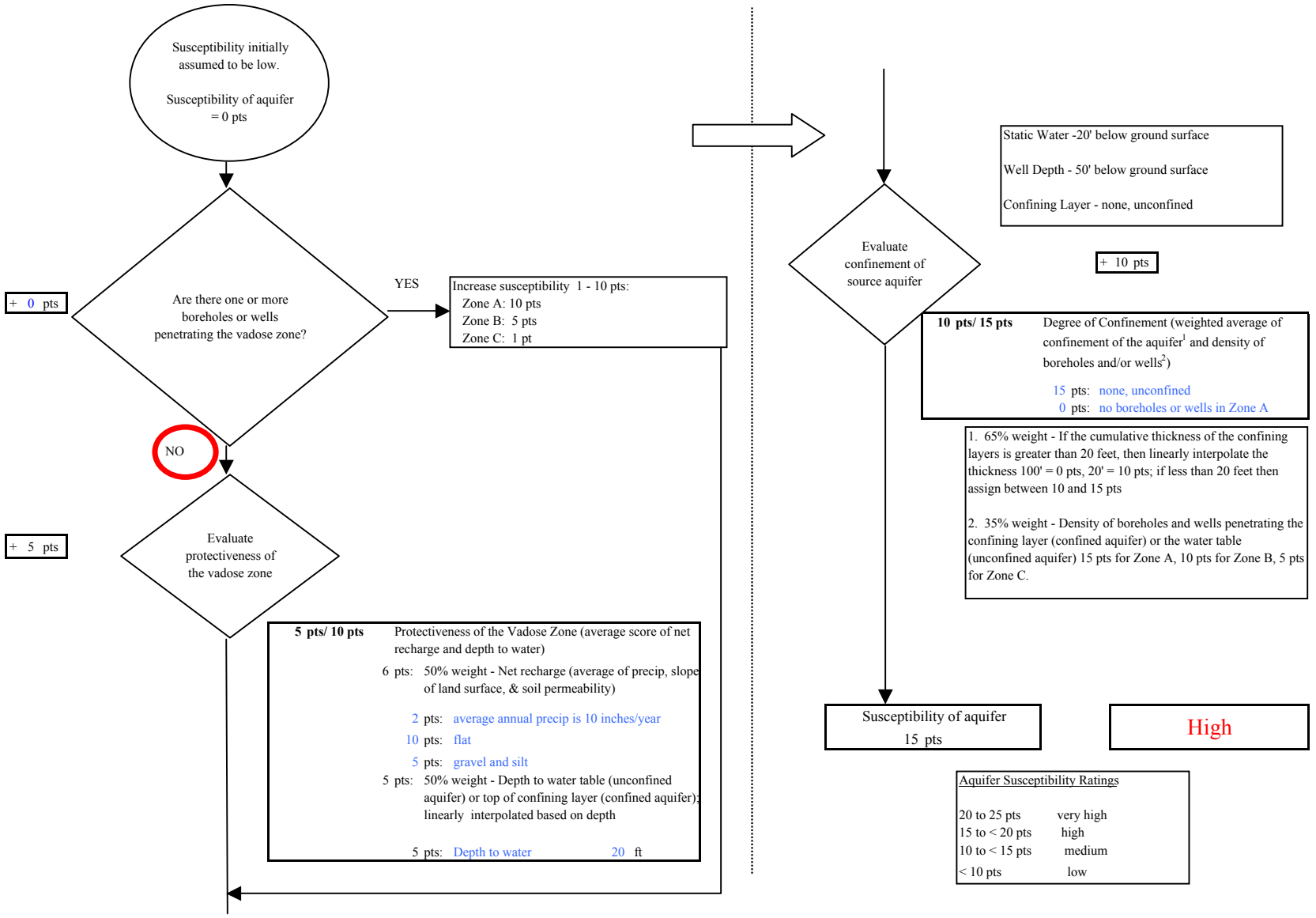
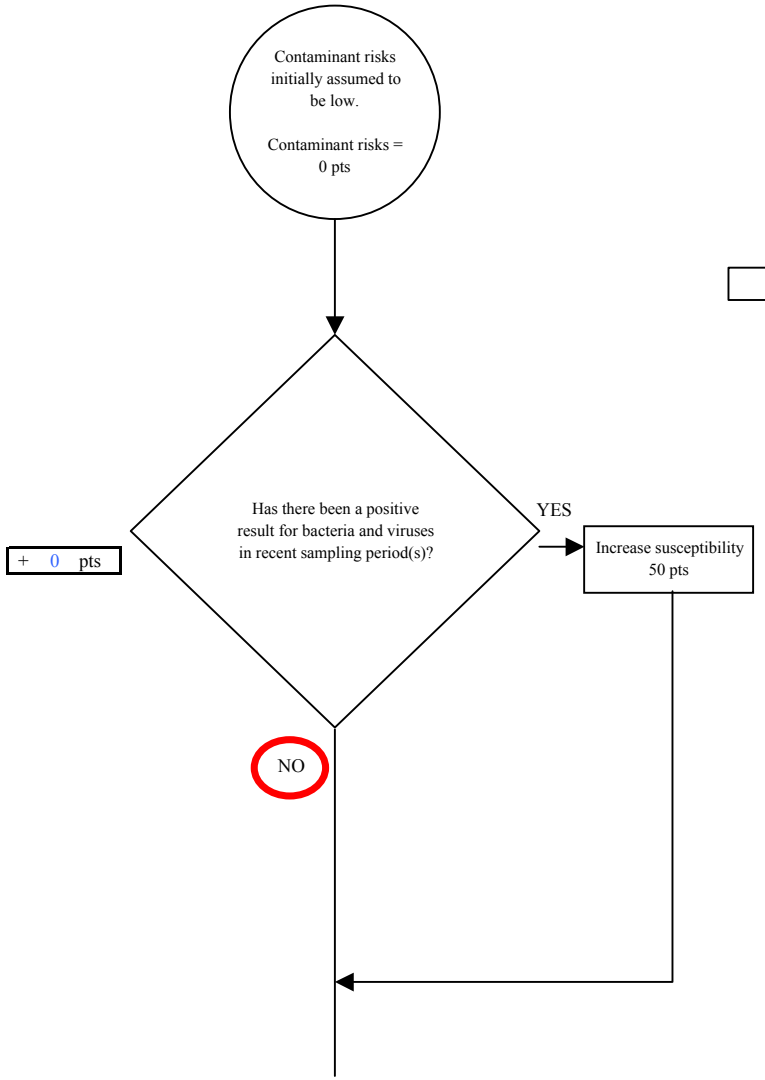
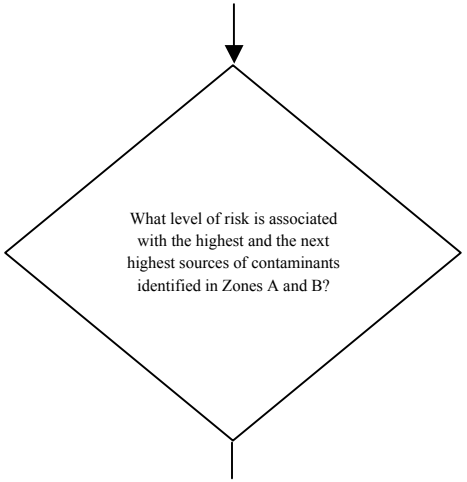


Chart 3. Contaminant risks for BLM Marion Creek Campground (PWS No. 700040.001) - Bacteria & Viruses





+ 25 pts

Risk Rankings for Contaminant Sources Identified in Zones A and B

	Zone A	Zone B	Total
Very Highs(s)	0	0	0
High(s)	0	0	0
Medium(s)	4	0	4
Low(s)	2	0	2

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

Matrix Score 25

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

Chart 3. Contaminant risks for BLM Marion Creek Campground (PWS No. 700040.001) - Bacteria & Viruses

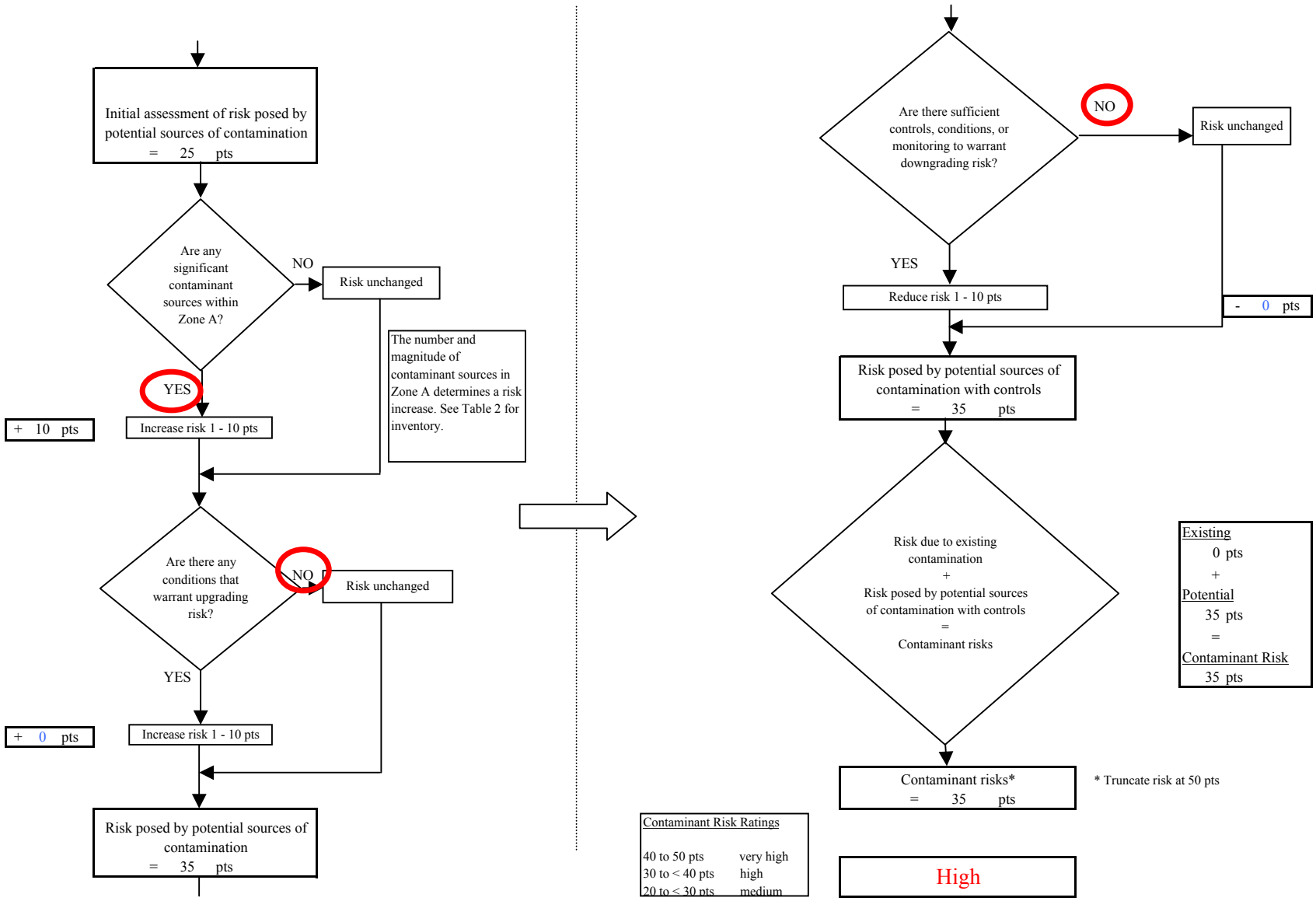


Chart 4. Vulnerability analysis for BLM Marion Creek Campground (PWS No. 700040.001) - Bacteria & Viruses

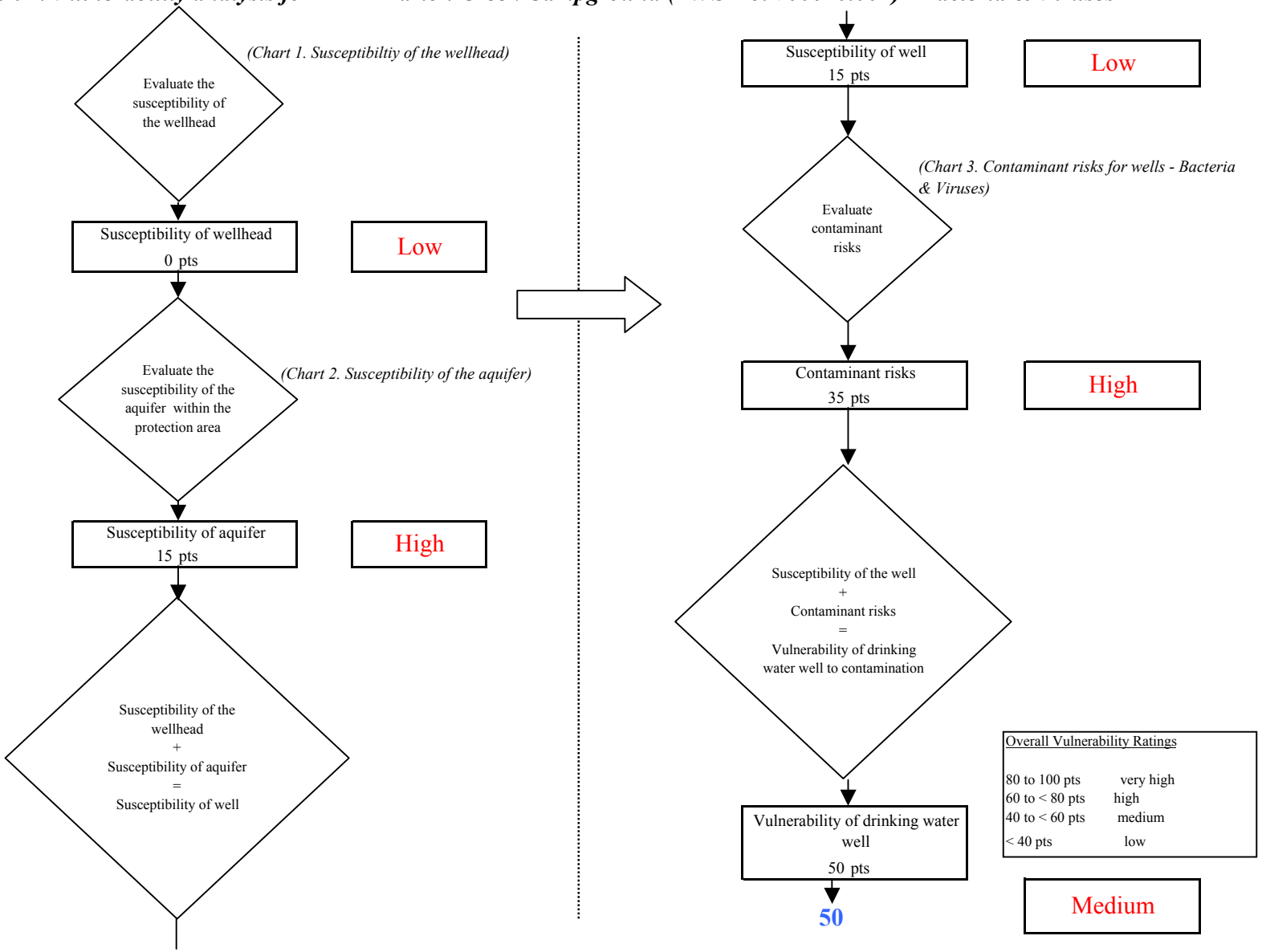


Chart 5. Contaminant risks for BLM Marion Creek Campground (PWS No. 700040.001) - Nitrates and Nitrites

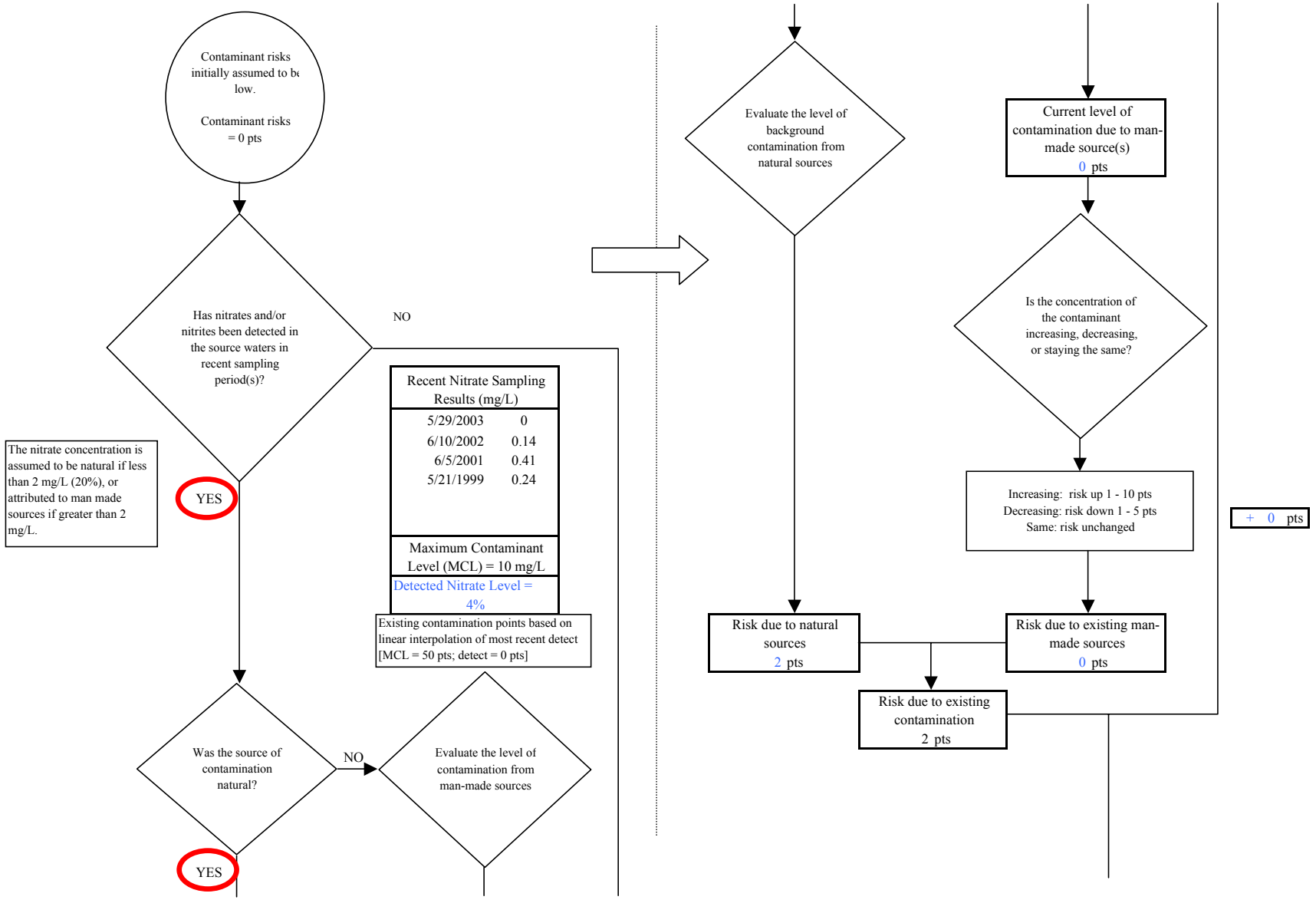
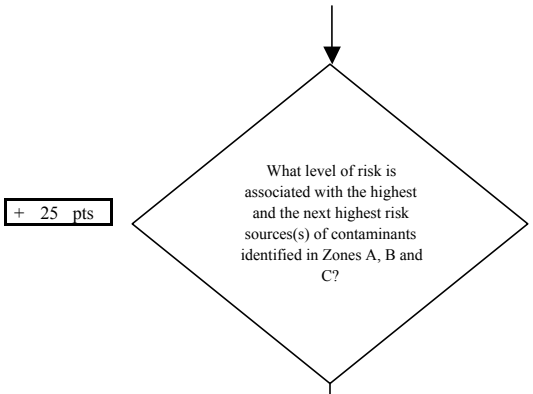


Chart 5. Contaminant risks for BLM Marion Creek Campground (PWS No. 700040.001) - Nitrates and Nitrites



+ 25 pts

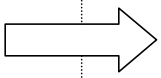
Risk Levels for Contaminant Sources identified in Zones A, B and C

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

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

Matrix Score 25

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



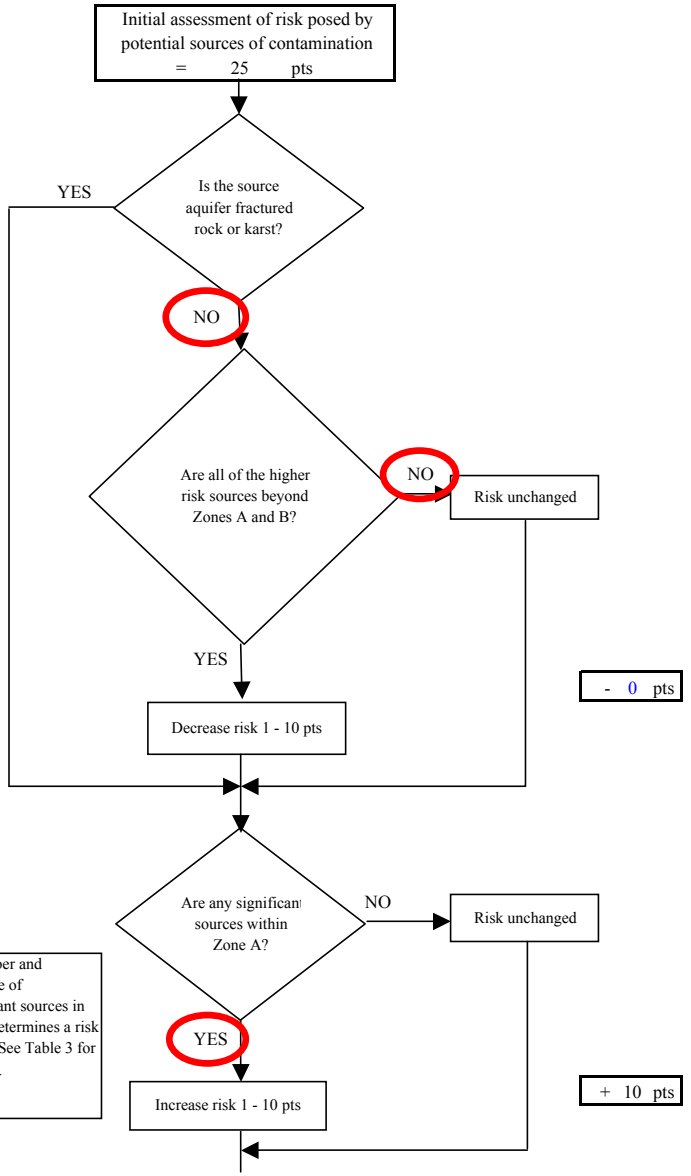


Chart 5. Contaminant risks for BLM Marion Creek Campground (PWS No. 700040.001) - Nitrates and Nitrites

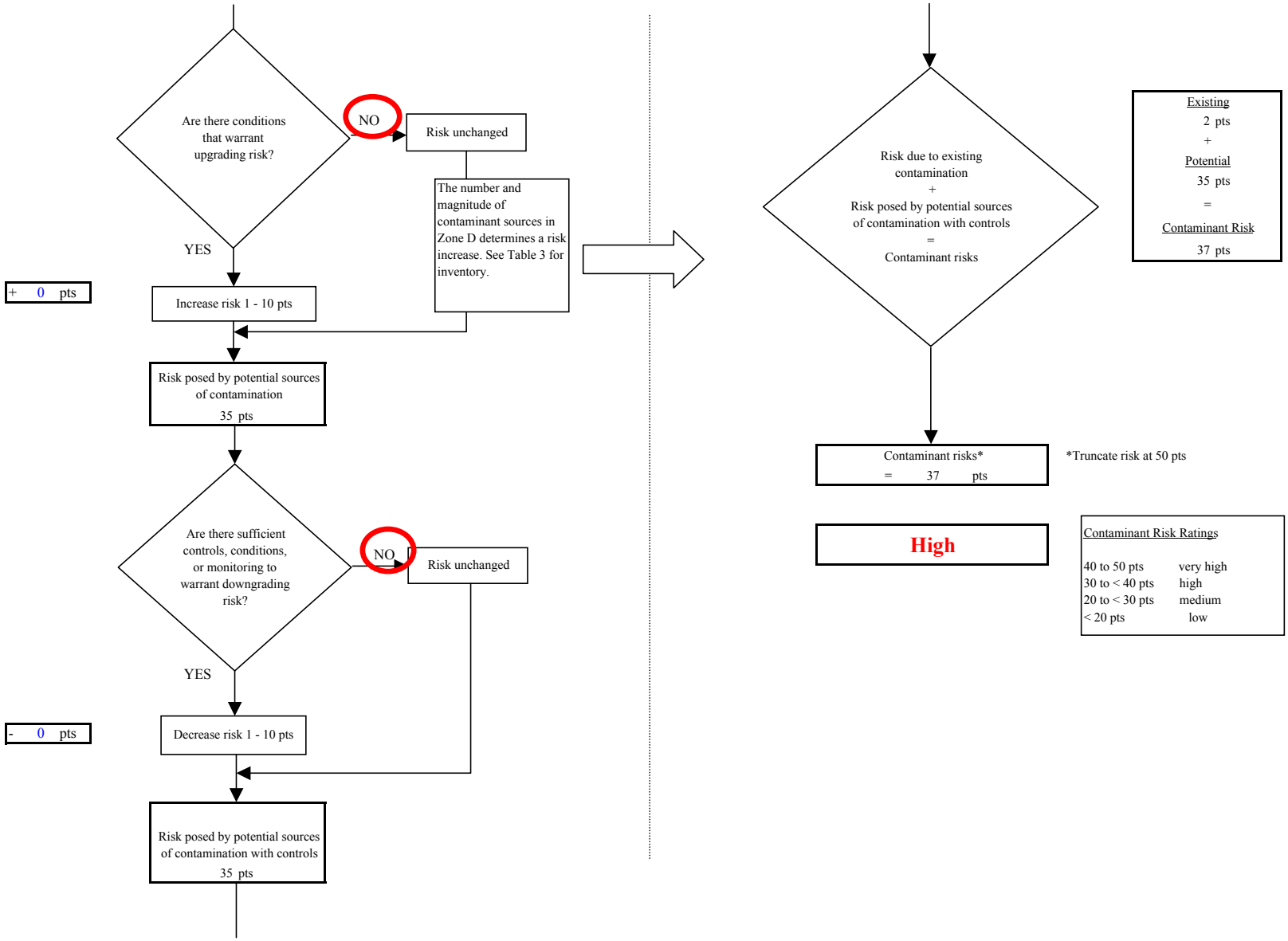


Chart 6. Vulnerability analysis for BLM Marion Creek Campground (PWS No. 700040.001) - Nitrates and Nitrites

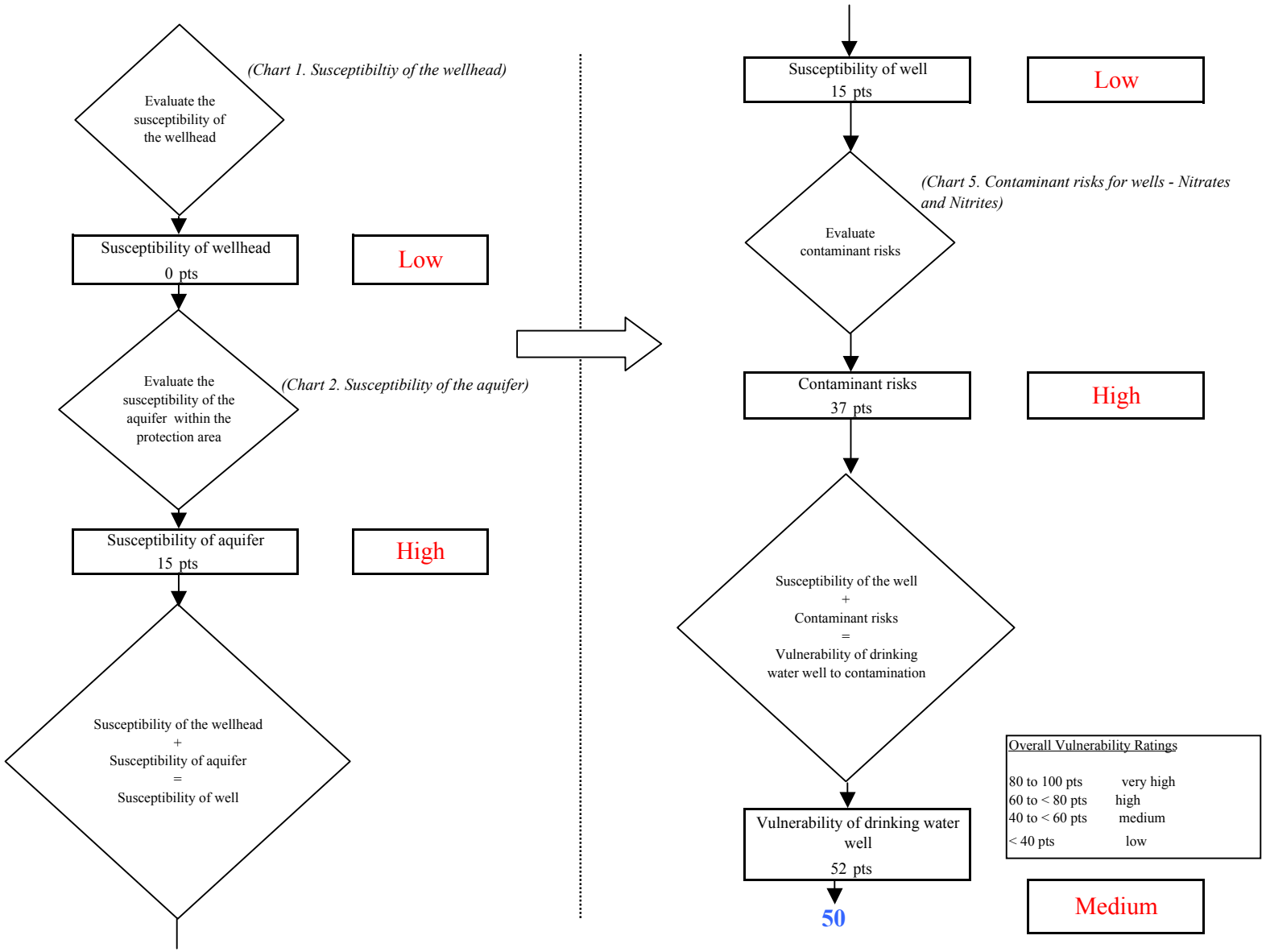


Chart 7. Contaminant risks for BLM Marion Creek Campground (PWS No. 700040.001) - Volatile Organic Chemicals

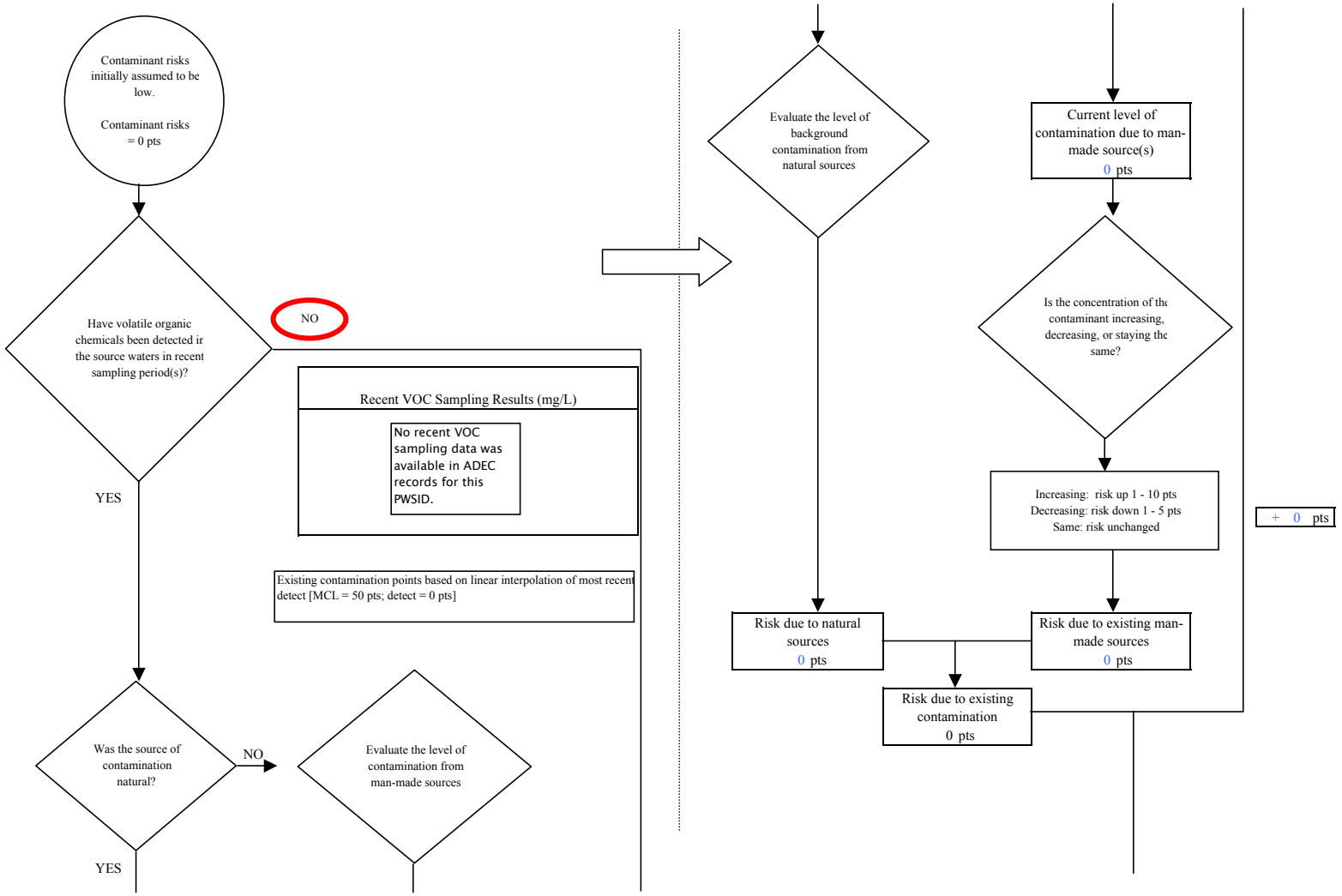
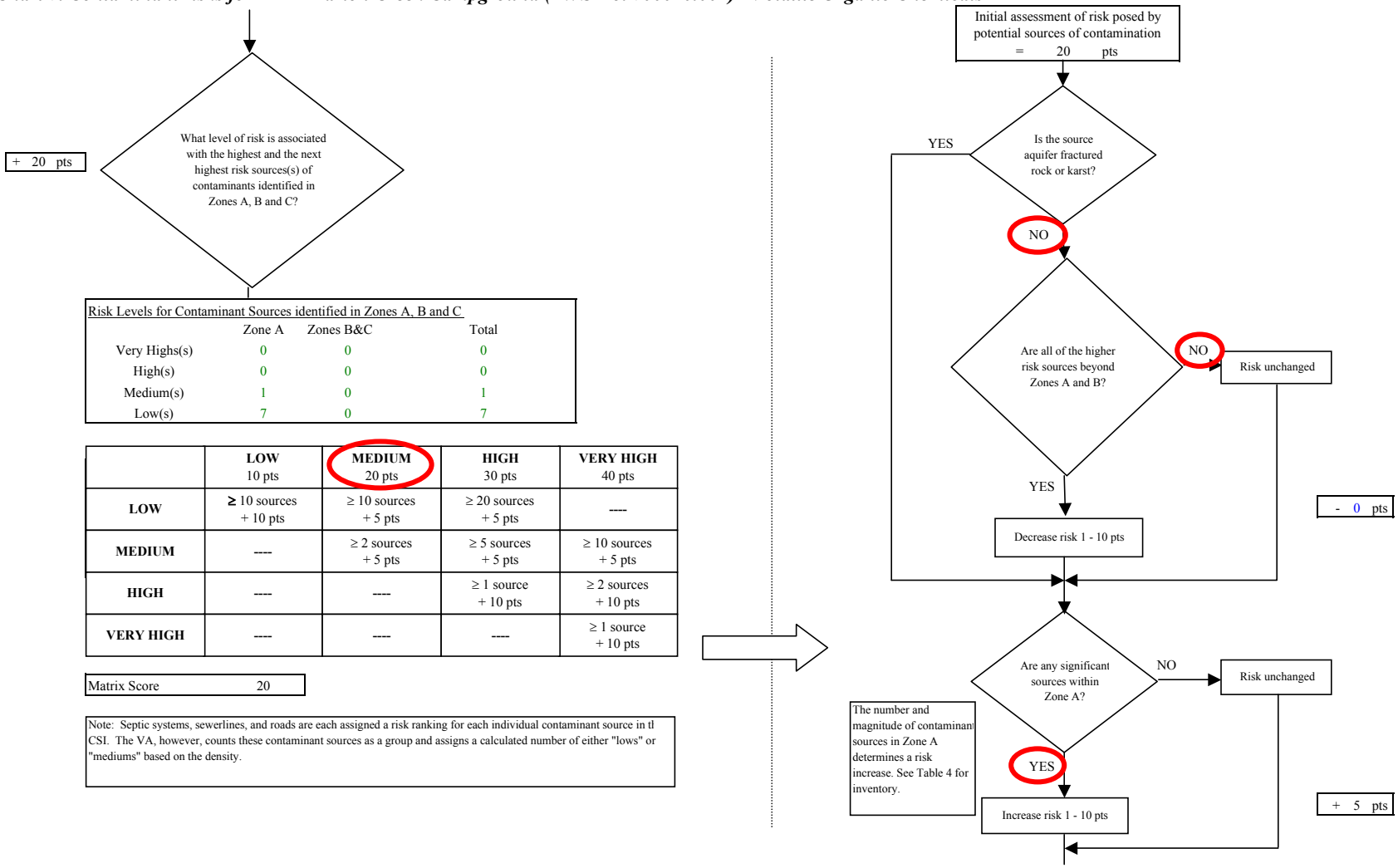


Chart 7. Contaminant risks for BLM Marion Creek Campground (PWS No. 700040.001) - Volatile Organic Chemicals



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

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

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

Matrix Score 20

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 BLM Marion Creek Campground (PWS No. 700040.001) - Volatile Organic Chemicals

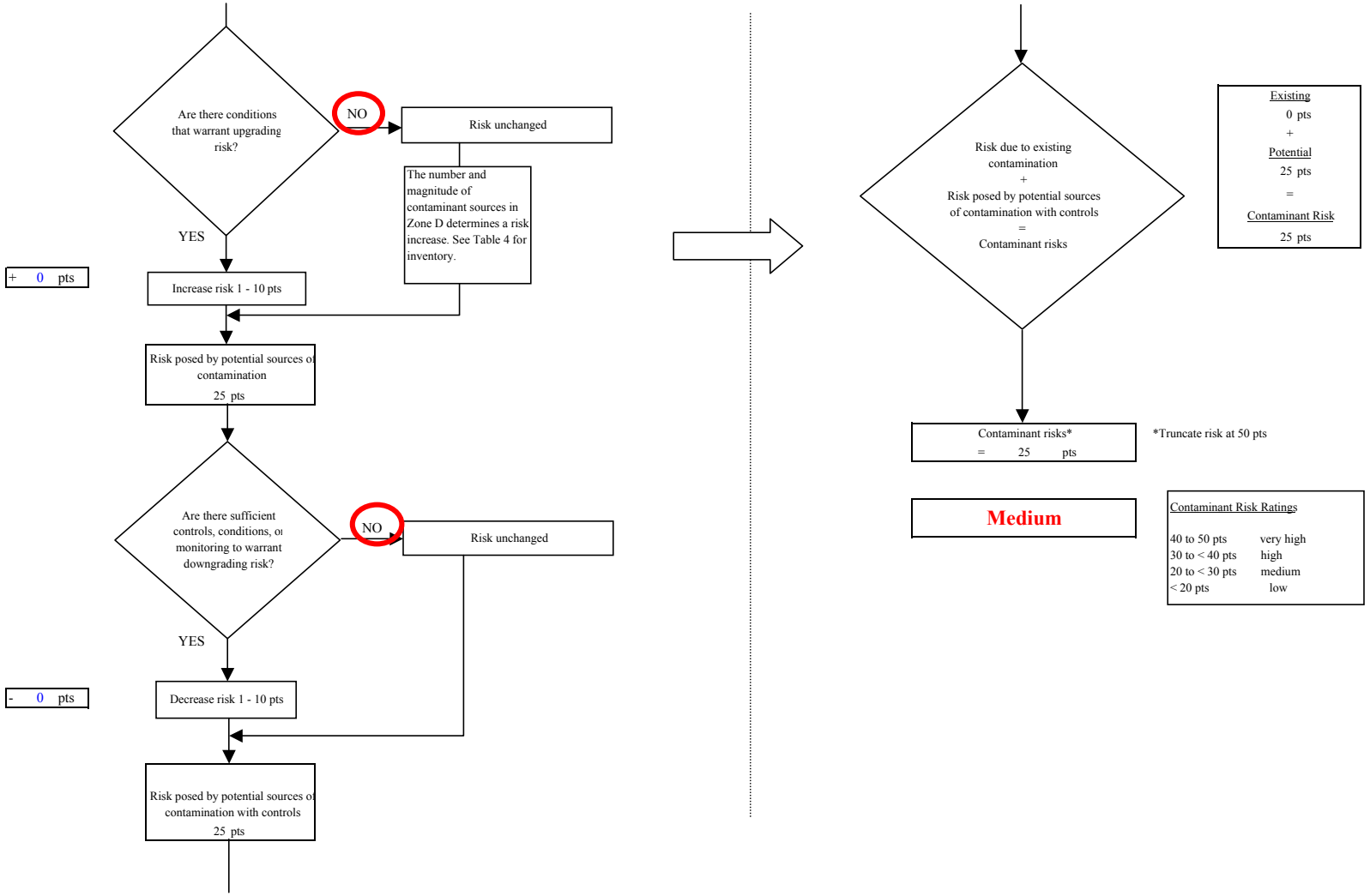


Chart 8. Vulnerability analysis for BLM Marion Creek Campground (PWS No. 700040.001) - Volatile Organic Chemicals