Hydrogeologic Susceptibility and Vulnerability Assessment for Alaska State Elks Youth Camp Drinking Water Well, Palmer, Alaska

DRINKING WATER PROTECTION PROGRAM REPORT #111

September 2001

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By Michael Baxter, B.E.S.T. Resource

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ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION: 2001

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Drinking Water Protection Program
Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

The Alaska State Elks Youth Camp is a Class B (transient/noncommunity) drinking water source consisting of one well. Only one potential and current sources of contaminant was identified for Alaska State Elks Youth Camp. The lawn and garden is considered a source of bacteria and viruses, nitrates and/or nitrites, and volatile organic chemicals. Overall, Alaska State Elks Youth Camp public water source received a vulnerability rating of **Low** for bacteria and viruses, nitrates and/or nitrites, and volatile organic chemicals.

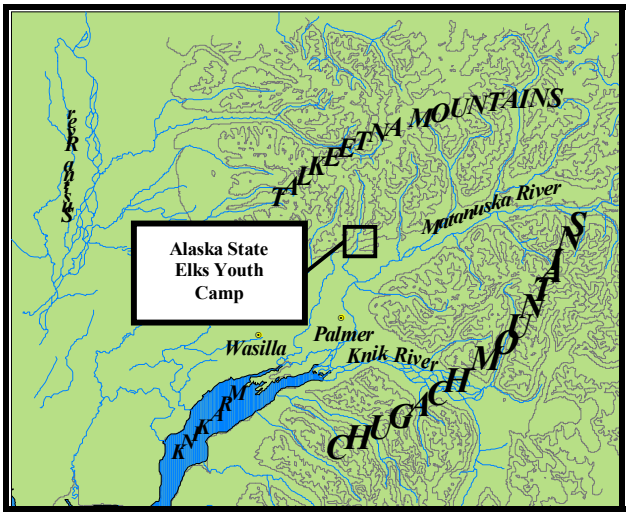

Figure 1. Index map showing the location of well assessment

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 Alaska State Elks Youth Camp source of public drinking water. This source consists of one well in the Palmer/Sutton-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 PALMER-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 per year. 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 bounded by rugged

mountains that rise abruptly above its 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, and greenstone of Mesozoic age. Along the northern edge of the valley, peaks in the Talkeetna Mountains reach altitudes of 3000 to 5000 feet. The Talkeeta Mountains are composed mainly of igneous rocks, chiefly granitic intrusives (Mesozoic?) 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 (Trainer, 1960).

The Matanuska and Knik Rivers 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 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 essentially nonpermeable. 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).

Recharge of the groundwater is chiefly from precipitation but it is likely that only a small proportion of the annual precipitation reaches the water source. During very dry seasons conspicuous declines in of water levels occur in many wells (Trainer, 1960). Along the mountain fronts, groundwater seeps from fractures in bedrock into the sediments. At these higher elevations, rain and snowmelt also enter the sediments. Lastly, 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).

ALASKA STATE ELKS YOUTH CAMP PUBLIC WATER SOURCE

Alaska State Elks Youth Camp public water source is a Class B (transient/noncommunity) water source, which is privately owned and operated. The source consists of one well near the base of the Talkeetna Mountains at an elevation of 350 feet above sea level. The well is located on the northeast end of Elk Lake 1.5 miles north of the Glennallen Highway and 5 miles west of Sutton. According to the well log, Alaska State Elks Youth Camp well does not appear to be grouted, but functioning properly in all respects. The well penetrates gravel and silty sand with blue, red and gray clay 57 feet below land surface. The well is screened from 40 to 43 feet below land surface and had a static water level of 38 feet below land surface at the time of drilling (3/16/85).

The water system from Alaska State Elks Youth Camp consists of three hydropneumatic pressure tanks, jet pump and three atmospheric storage tanks. This water source operates year round. The Alaska State Elks Youth Camp drinking water source collectively serves approximately 25 residents and non-residents through three service connections.

ASSESSMENT AND PROTECTION AREA FOR ALASKA STATE ELKS YOUTH CAMP DRINKING WATER SOURCE

The Drinking Water Protection and Assessment Area that has been established for Alaska State Elks Youth Camp 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 as the first step in establishing the protection area for Alaska State Elks Youth Camp. 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 B 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 Alaska State Elks Youth Camp contain three zones, Zone A, Zone B, and Zone C (See Map 1 in 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 Alaska State Elks Youth Camp corresponds to a time-of-travel of less than two years and extends toward the Talkeetna Mountains. Zone C corresponds to a time-of-travel of two to five years. Zone D corresponds to a time-of-travel five to ten years. Since Zone C extends to the top of the groundwater divide no Zone D was delineated.

INVENTORY OF POTENTIAL AND EXISTING CONTAMINANT SOURCES

The Drinking Water Protection Program has completed an inventory of potential and existing sources of contamination within Alaska State Elks Youth Camp 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 B public water system assessments, three categories of drinking water contaminants were inventoried. They include:

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

Table 1 in Appendix C depicts the Contaminant Source Inventory for Alaska State Elks Youth Camp. Inventoried potential sources of contamination within Zones A through Zone B were associated with residential activity. Zone C contains only natural wilderness. Because of the undeveloped nature of Zone C, no contaminants sources were considered in the Vulnerability Analysis. The only contaminant source inventoried within the Alaska State Elks Youth Camp protection area was the residential lawn and garden.

This potential contaminant source presents risks for all three categories of drinking water contaminants for Alaska State Elks Youth Camp 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 ALASKA STATE ELKS YOUTH CAMP 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)

Alaska State Elks Youth Camp is completed in a confined or semi-confined aquifer setting. The well penetrates 60 feet of sand and gravel with four clay bearing layers. These clay layers, encountered at 17 to 28, 32 to 40, 40 to 43 and 45 to 50 feet below land surface, may provide a protective barrier for the movement of contaminants in the subsurface. However, near the base of the Talkeetna Mountains, the clay and till layers tend to be discontinuous and thin toward the mountains. Therefore, contaminants that enter the subsurface near the base of the mountains may enter the confined aquifer uninhibited by the absence of any protective layer. This well does not appear to be properly grouted as indicated previously from information obtained from ADEC records. The absence of grouting can promote the transport of contaminants along the well casing. Combining the susceptibility of the wellhead and the aquifer to contamination leads to a score (0 – 50 points) and rating of overall Susceptibility (See Appendix D). Table 1 shows the overall Susceptibility score and rating for Alaska State Elks Youth Camp.

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

	Score	Rating
Susceptibility of the Wellhead	5	Low
Susceptibility of the Aquifer	7	Low
Natural Susceptibility	12	Low

Contaminant risks to a drinking water source depend on the type, number or density, and distribution of contaminant sources. One domestic lawn and garden contributes the only identified risk for potential contamination to the Alaska State Elks Youth Camp source of public drinking water.

A score (0 – 50 points) and rating of Contaminant Risks (See Appendix D) is assigned based on the findings of the Contaminant Source Inventory (Appendix B - Table 1 – Table 7). This portion of the analysis examines any existing or historical contamination that has been detected at the drinking water source through routine sampling. It also reviews contamination that has or may have occurred but has not arrived or been detected at the 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	12	Low
Nitrates and/or Nitrites	14	Low
Volatile Organic Chemicals	12	Low

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 Analysis for nitrates and nitrites and volatile organic chemicals, respectively.

Vulnerability of the drinking water source 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 three categories of drinking water contaminants (Appendix D). Note: scores are rounded off to the nearest five.

Table 3. Overall Vulnerability of Alaska State Elks Youth Camp Public Drinking Water Source to Contamination by Category

Category	Score	Rating
Bacteria and Viruses	30	Low
Nitrates and Nitrites	30	Low
Volatile Organic Chemicals	30	Low

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.

The residential lawn and garden in Zone A is the driving factor in determining contaminant risks for all categories of contaminants (See "Overall Rank after Analysis" in Table 2 – 4 of Appendix B).

No significant sources of contamination from Bacteria and Viruses were inventoried with in the Drinking Water Protection and Assessment Area.

Nitrates and/or nitrites are found in background concentrations at the site, as elsewhere in the Alaska. Sampling history of Alaska State Elks Youth Camp source waters indicate low concentrations of nitrate (See Chart 6 – Contaminant Risks for Nitrates/Nitrites in Appendix D). Existing nitrate contamination is approximately 5% of the allowable limit (MCL) for this contaminant. Due to the high solubility and weak retention by soil, nitrates are very mobile in soil, moving at approximately the same rate as water. Nevertheless, the current nitrate concentration in Alaska State Elks Youth Camp remains at safe levels with respect to human health.

Overall, contaminant risks for the nitrate/nitrite category are low with the domestic lawn and garden driving the score. Combining this potential nitrates and/or nitrites contamination risk with the susceptibility of the well yields an overall vulnerability to contamination of low for this source of public drinking water.

In May of 2000, dichloromethane, a volatile organic chemical, was detected in the source waters of Alaska State Elks Youth Camp. One sample registered a very high concentration, as did the trip blank. The reported concentration of 0.63 μg/L of dichloromethane exceeds the MCL for this contaminant. The Maximum Contaminant Level or MCL is the maximum level of contaminant that is allowed to exist in drinking water and still be consumed by humans without harmful health effects. The one possible explanation for the presence of dichloromethane in the water sample is cross-contamination of the sample at the laboratory. Nevertheless, volatile organic chemicals are of concern and should be monitored closely during future sampling events.

SUMMARY

A *Source Water Assessment* has been completed for the Alaska State Elks Youth Camp source of public drinking water. The overall vulnerability of this source to contamination is Low for bacteria and viruses, nitrates and/or nitrites, and volatile organic chemicals. The exception is with volatile organic chemicals; which should be monitored through regular water testing. This assessment of contaminant risks can be used as a foundation for local voluntary protection efforts as well as a basis for the continuous efforts on the part of the Alaska State Elks Youth Camp 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 public drinking water source.

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Jakola, J.B., Munter, J.A., and Evans, J.G., 1991, Ground-water resources of the Palmer-big Lake area, Alaska: a conceptual model. Division of Geological & Geophysical Surveys Reported of Investigations 90-4, State of Alaska Department of Natural Resources, Fairbanks, AK.

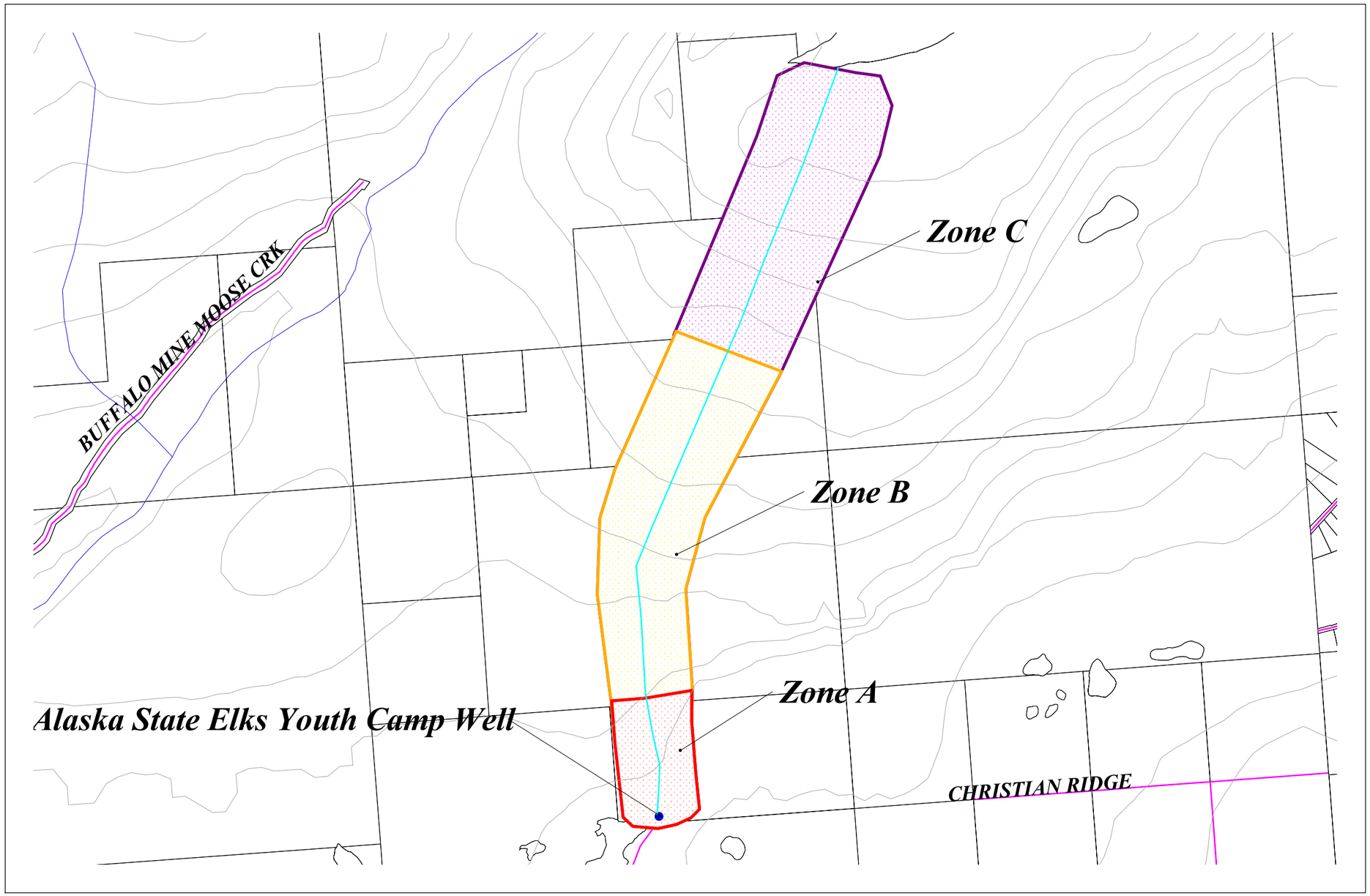
Trainer, F.W., 1960, Geology and Groundwater Resources, Matanuska Valley, Alaska, U.S. Geological Survey Water Supply Paper 1494 U.S. Printing Office, Washington, D.C.

Western Regional Climate Center, 2000, August 24, Web extension to the *Western Regional Climate Center* [WWW document]. URL http://www.uaa.alaska.edu/enri/ascc_web/ascc_home.html .

APPENDIX A

Alaska State Elks Youth Camp
Drinking Water Protection Area

Alaska State Elks Youth Camp (PWSID 227513)
Drinking Water Protection Areas



N

- Public Water System Wells
- Lakes and Rivers
- Zone A Protection Area Several Months to 2 Years Travel Time
- Zone B Protection Area Less Than 2 Years Travel Time
- Zone C Protection Area 2 to 5 Years Travel Time
- Roads
- Mat-Su Borough Parcel Boundaries
- Elevation Contours
- Groundwater Centerline

Map 1

Prepared by: B.E.S.T. Resource

APPENDIX B

Contaminant Source Inventory and Risk Ranking for Alaska State Elks Youth Camp

Contaminant Source Inventory for Alaska State Elks Youth Camp

Contaminate Source Category	Contaminant Source ID	CS ID Tag	Zone	Location	Map	Comments
Lawns and gardens	R1	R1-1	A	Located between well and Lodge	2	

Potential and Existing Sources of Contamination for Alaska Elks Youth Camp Bacterias and Viruses

Contaminant Source Category	Contaminant Source ID	CS ID Tag	Zone	Risk Ranking for Analysis	Overall Rank for Analysis	Location	Map	Comments
Lawns and gardens	R1	R1-1	A	Low	1	Located between well and Lodge	2	

Potential and Existing Sources of Contamination for Alaska Elks Youth Camp Nitrates and Nitrites

Contaminant Source Category	Contaminant Source ID	CS ID Tag	Zone	Risk Ranking for Analysis	Overall Rank for Analysis	Location	Map	Comments
Lawns and gardens	R1	R1-1	A	Low	1	Located between well and Lodge	2	

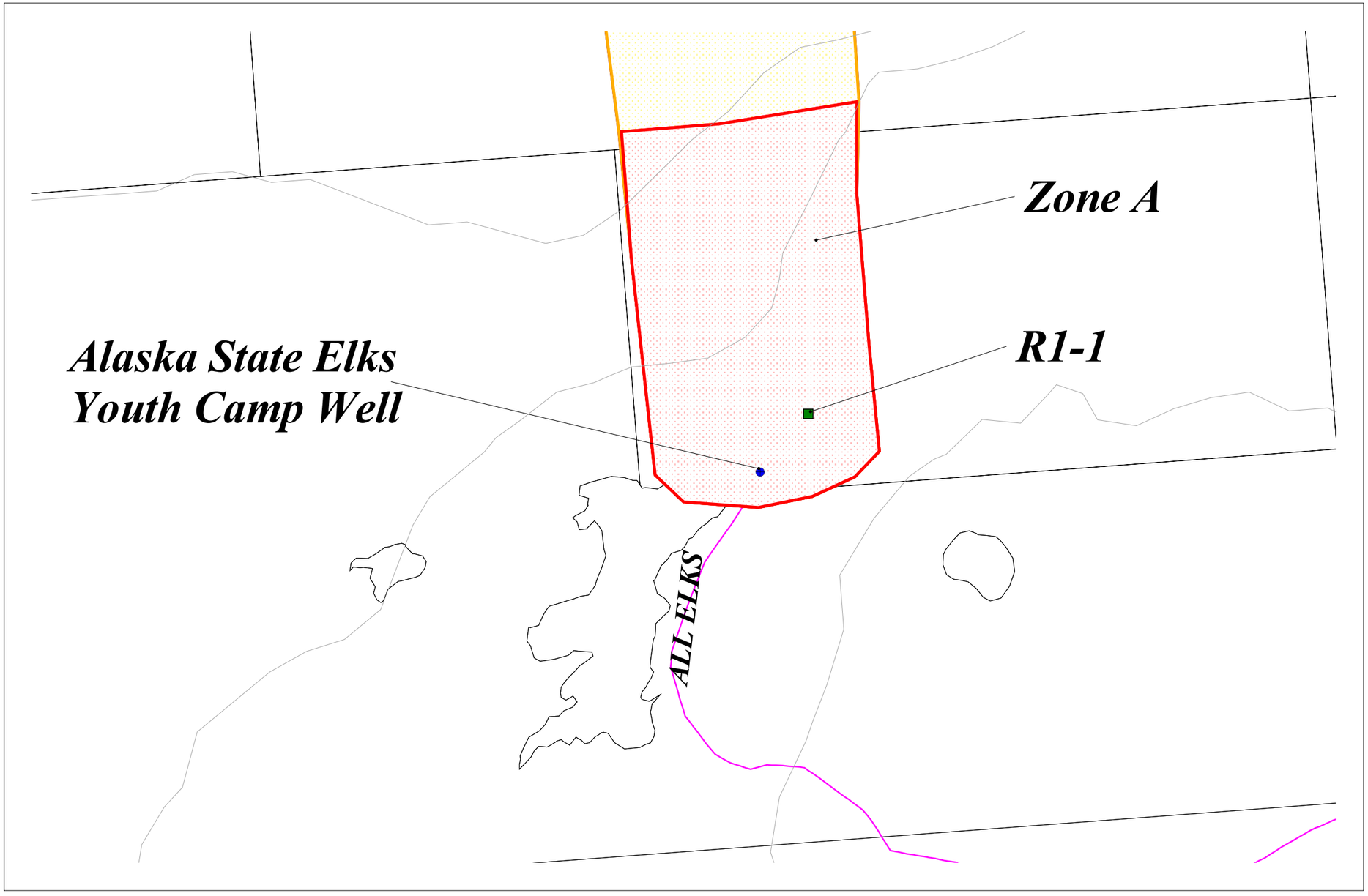
Potential and Existing Sources of Contamination for Alaska Elks Youth Camp Volatile Organic Chemicals (VOCs)

Contaminant Source Category	Contaminant Source ID	CS ID Tag	Zone	Risk Ranking for Analysis	Overall Rank for Analysis	Location	Map	Comments
Lawns and gardens	R1	R1-1	A	Low	1	Located between well and Lodge	2	

APPENDIX C

Alaska State Elks Youth Camp
Drinking Water Protection Area
and Potential & Existing Contaminant Sources

Drinking Water Protection Areas Potential & Existing Sources of Contamination for Alaska State Elks Youth Camp



N

- Public Water System Wells
- Zone A Protection Area Several Months to 2 Years Travel Time
- Zone B Protection Area Less Than 2 Years Travel Time
- Roads
- Mat-Su Borough Parcel Boundaries
- Elevation Contours
- Lawn & Garden (R1)
- Lakes and Rivers

Map 2

Prepared by: B.E.S.T. Resource

APPENDIX D

Vulnerability Analysis for Alaska State Elks Youth Camp Public Drinking Water Source

Chart 1. Susceptibility of the wellhead – AK State Elks Youth Camp

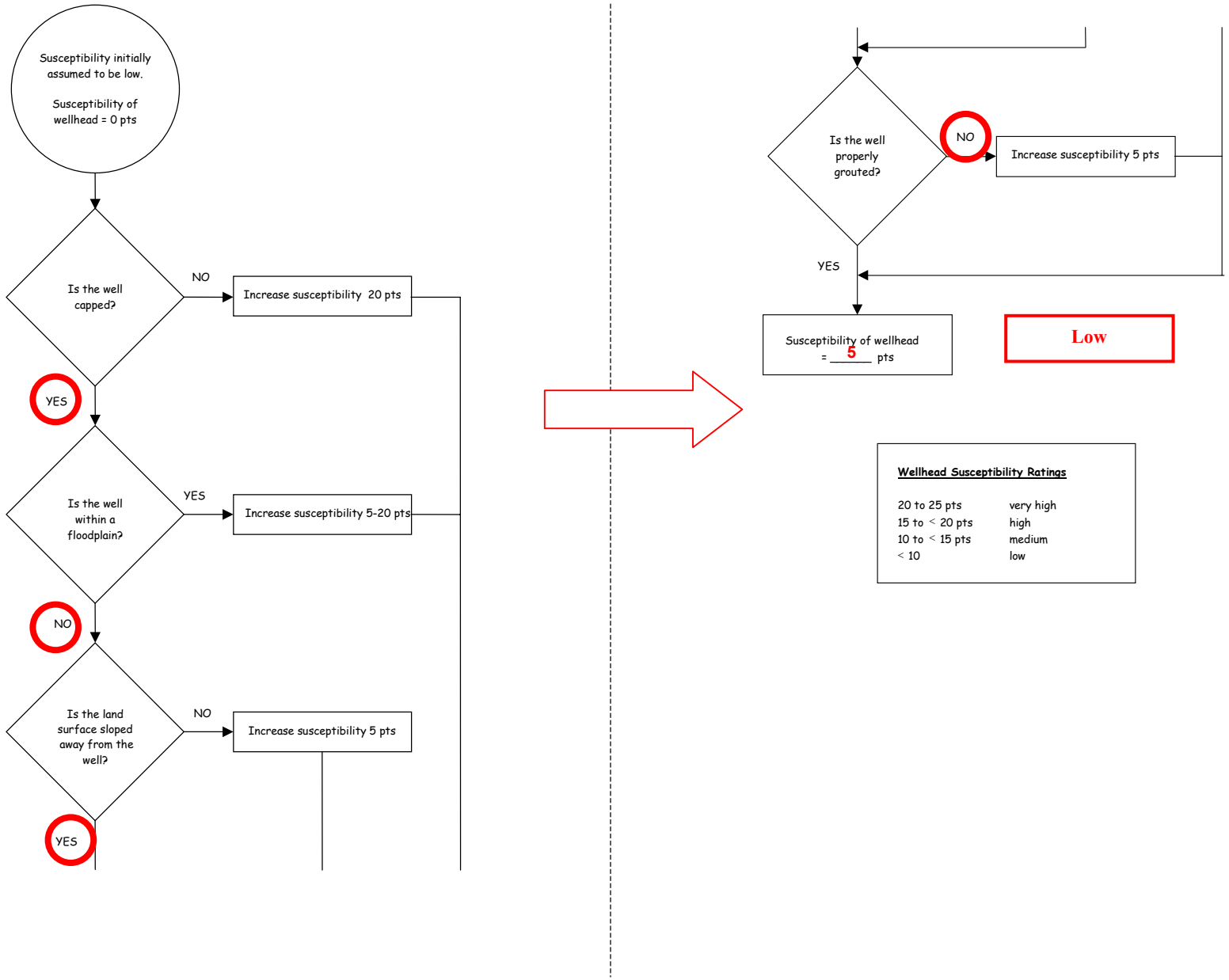


Chart 2. Susceptibility of the aquifer – AK State Elks Youth Camp

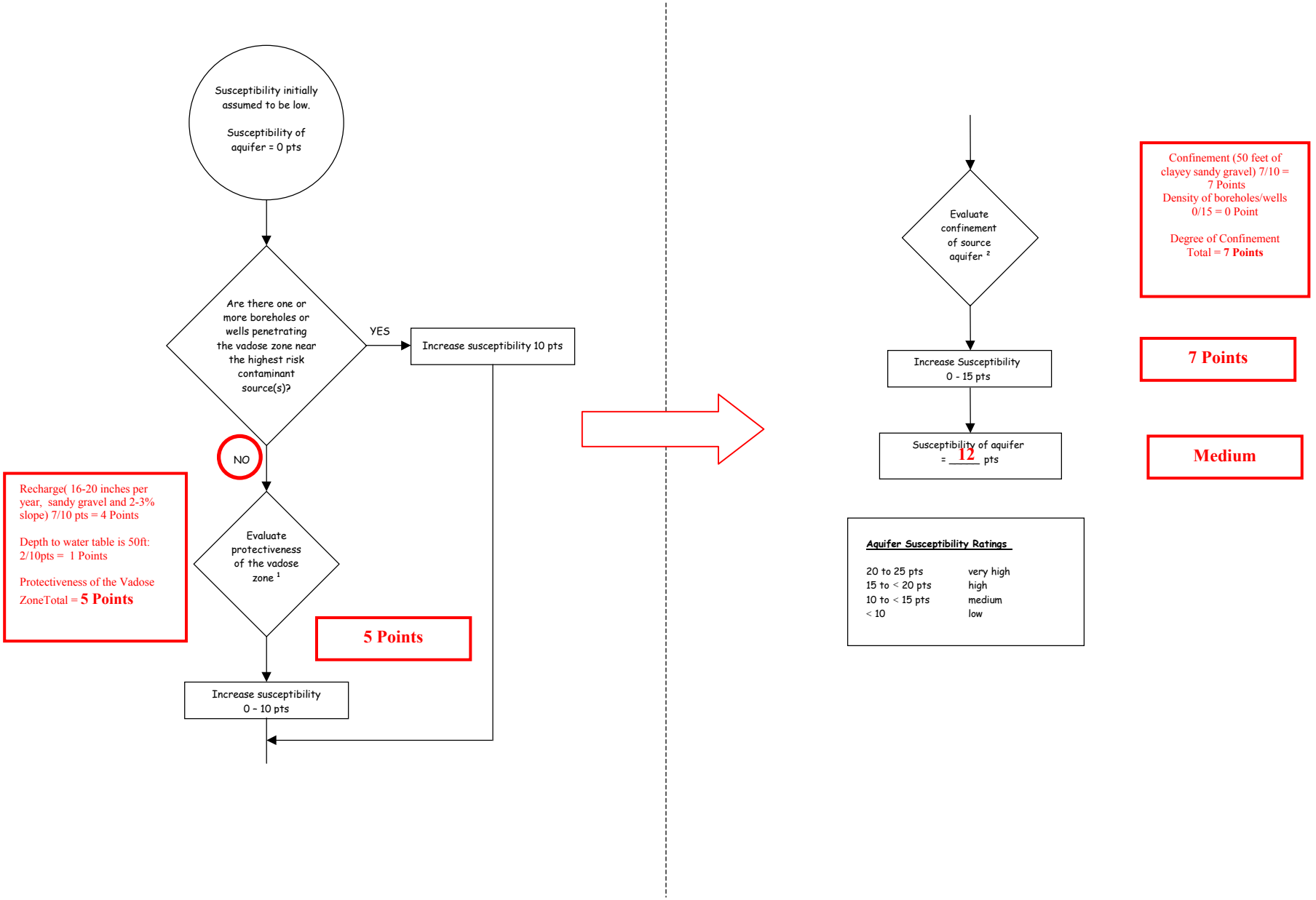


Chart 3. Contaminant risks for AK State Elks Youth Camp – Bacteria & Viruses

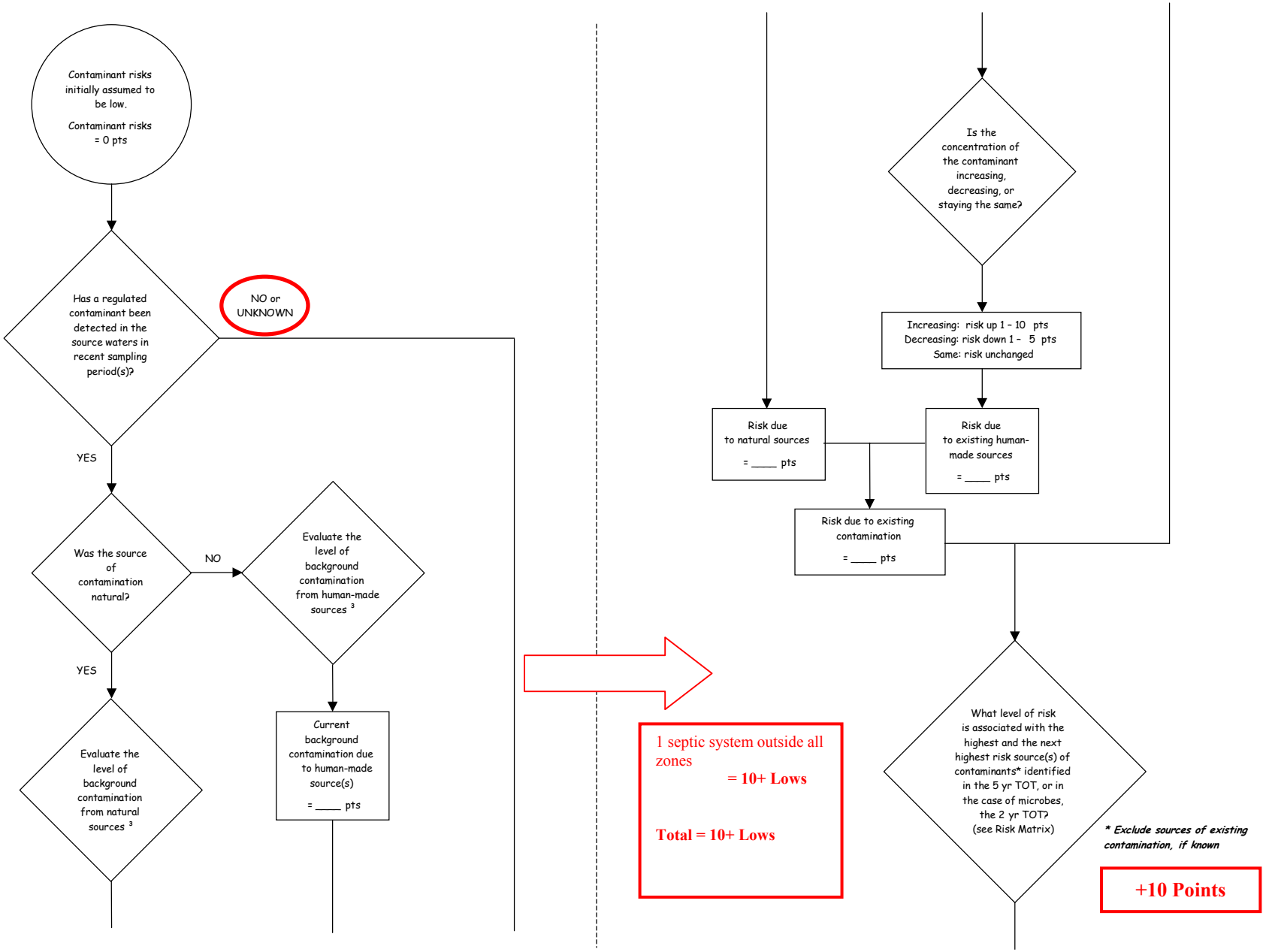


Chart 3. Contaminant risks for AK State Elks Youth Camp – Bacteria & Viruses (Continued)

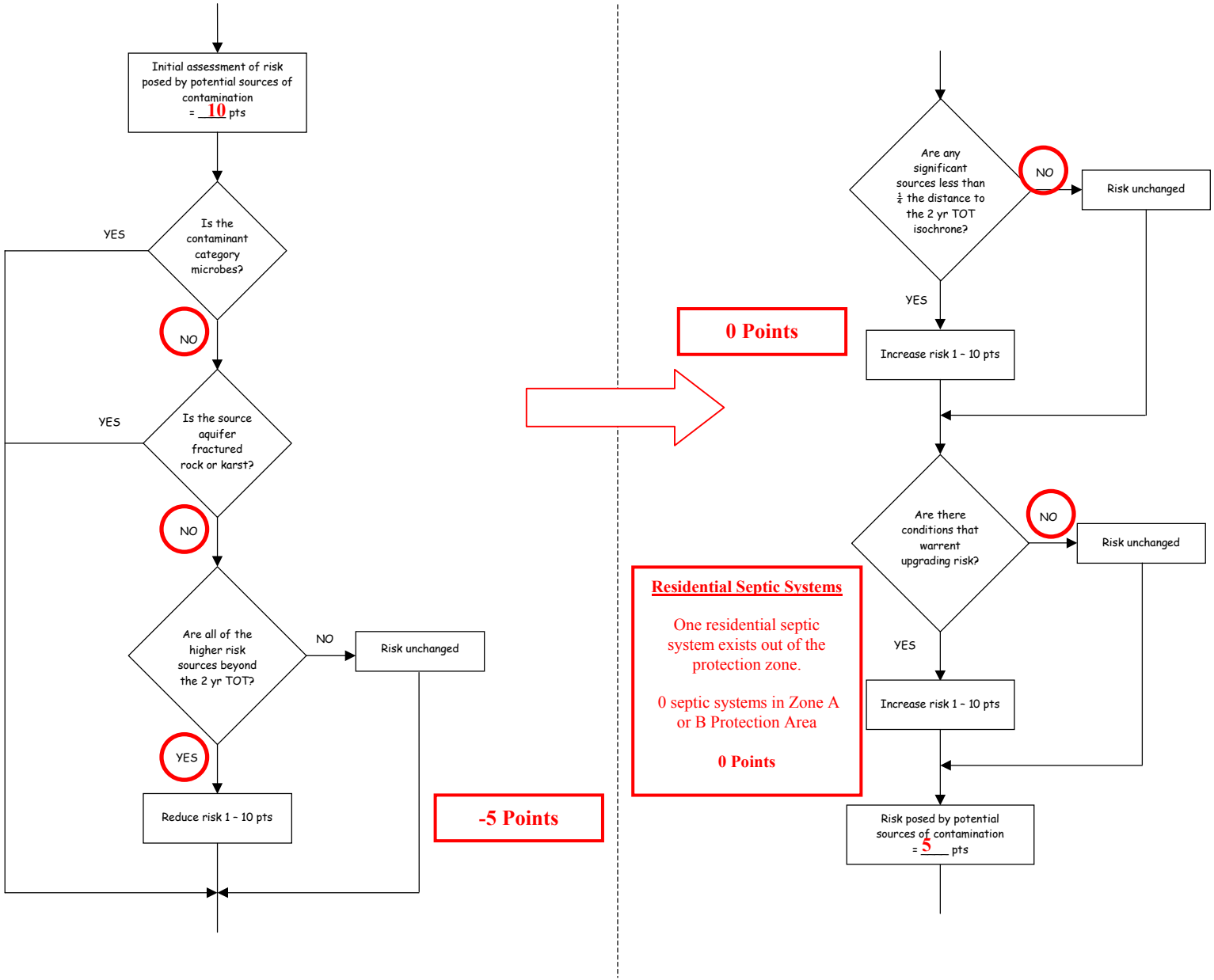
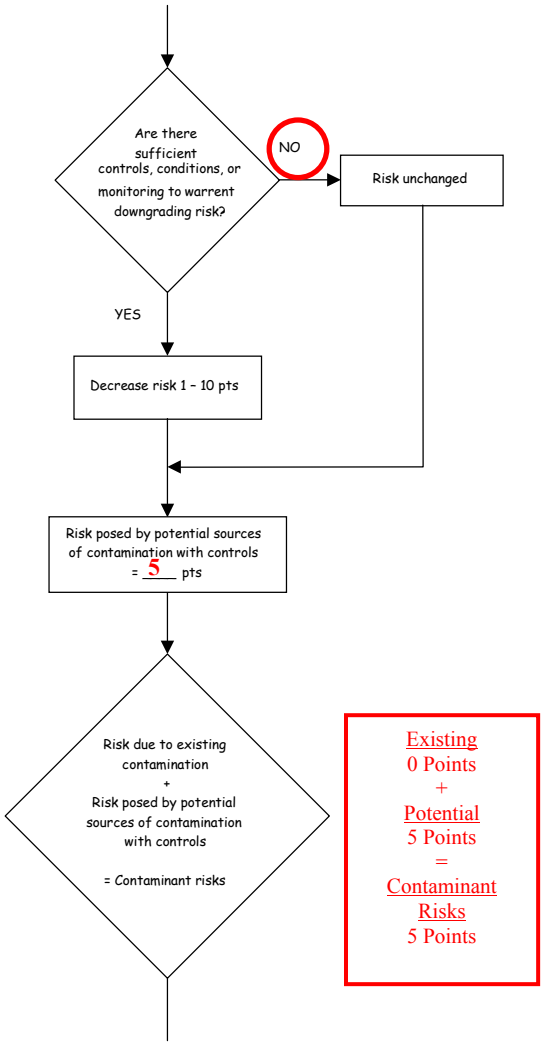
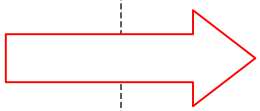
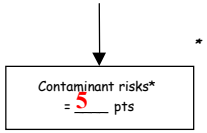


Chart 3. Contaminant risks for AK State Elks Youth Camp – Bacteria & Viruses (Continued)



Existing
0 Points
+
Potential
5 Points
=
Contaminant Risks
5 Points





** Truncate risk at 50 pts*

Low

3. Level of Background Contamination

> MCL	21 - 50 pts
0.5 MCL to < MCL	11 - 20 pts
0.2 MCL to < 0.5 MCL	6 - 10 pts
'detect' to < 0.2 MCL	0 - 5 pts

Contaminant Risk Ratings

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

Table 1. Risk Matrix for Contaminant Sources for AK State Elks Youth Camp – Bacteria & Viruses

Level of Risk Associated with the Highest Risk Sources

Next Highest Risk Sources(s)	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

Chart 4. Vulnerability analysis for AK State Elks Youth Camp– Bacteria & Viruses

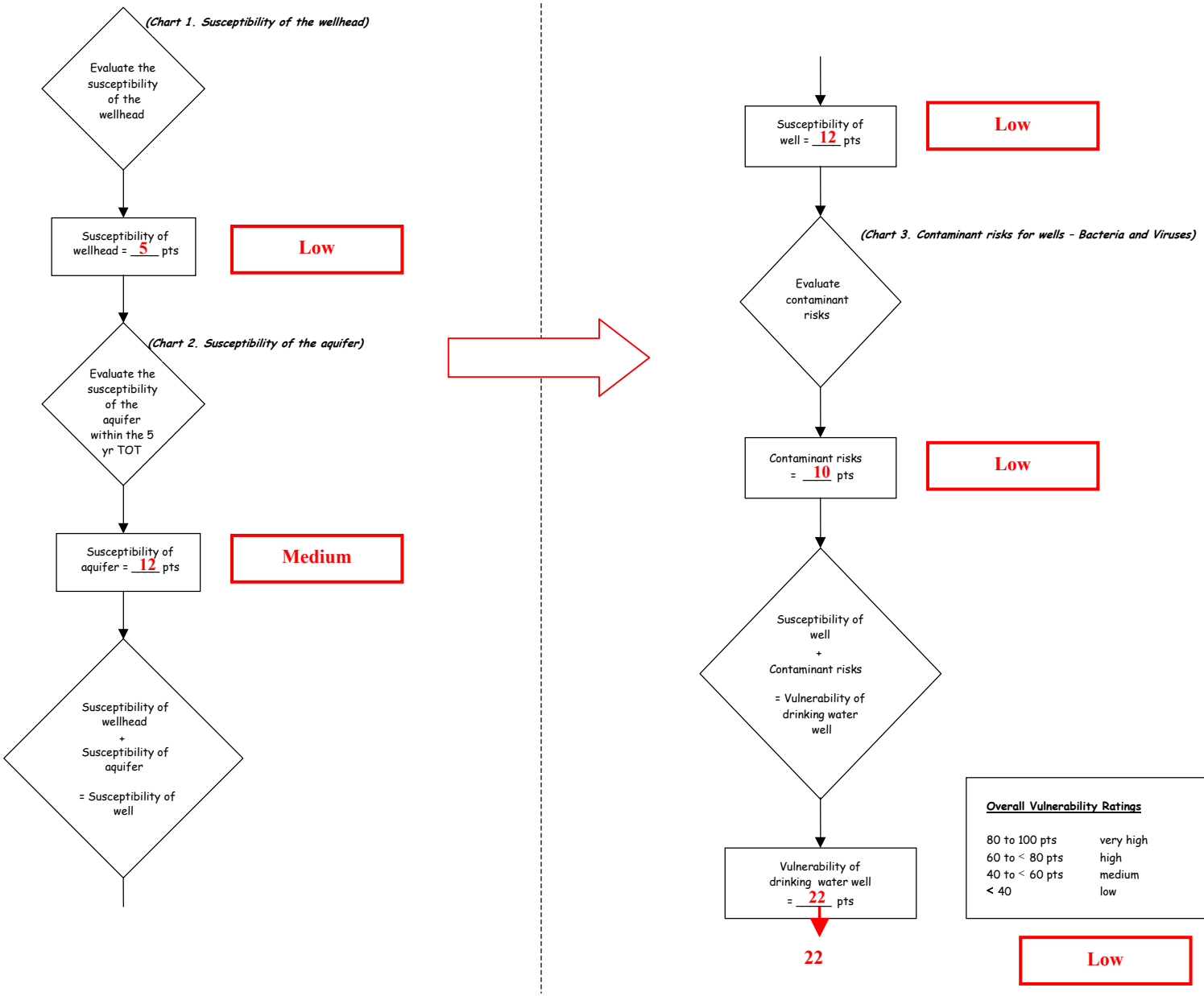


Chart 5. Contaminant risks for AK State Elks Youth Camp– Nitrates and Nitrites

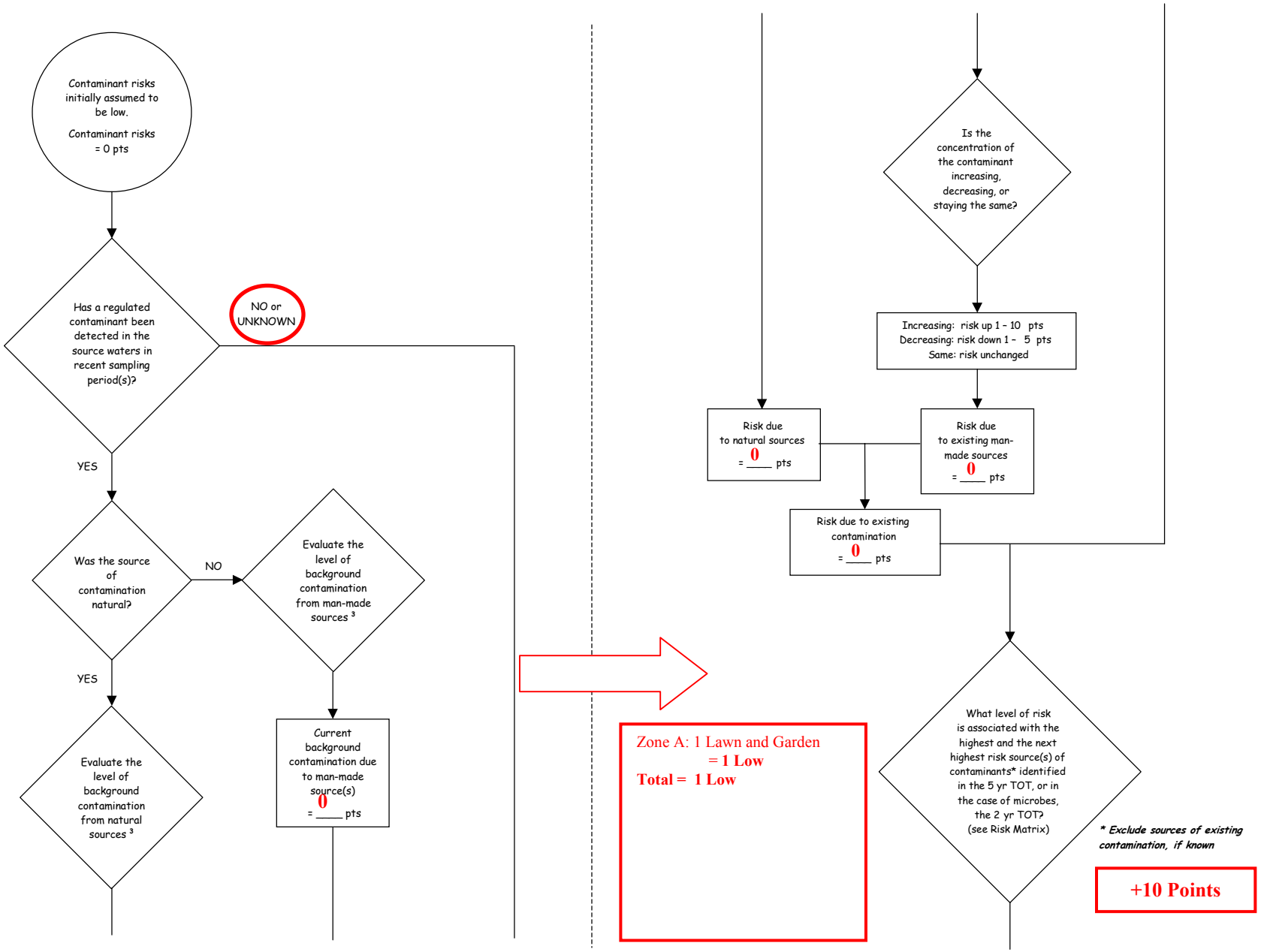


Chart 5. Contaminant risks for AK State Elks Youth Camp– Nitrates and Nitrites (Continued)

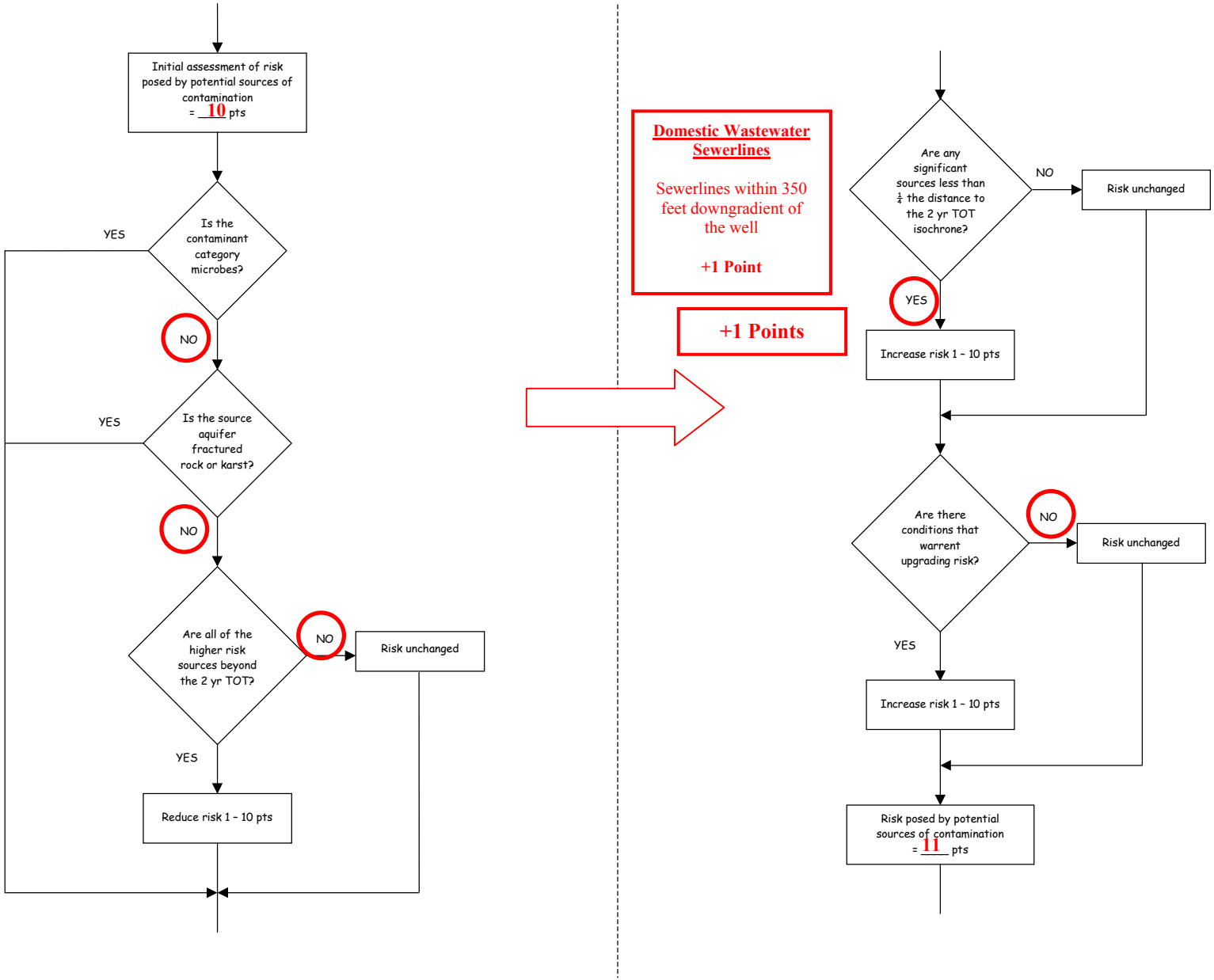
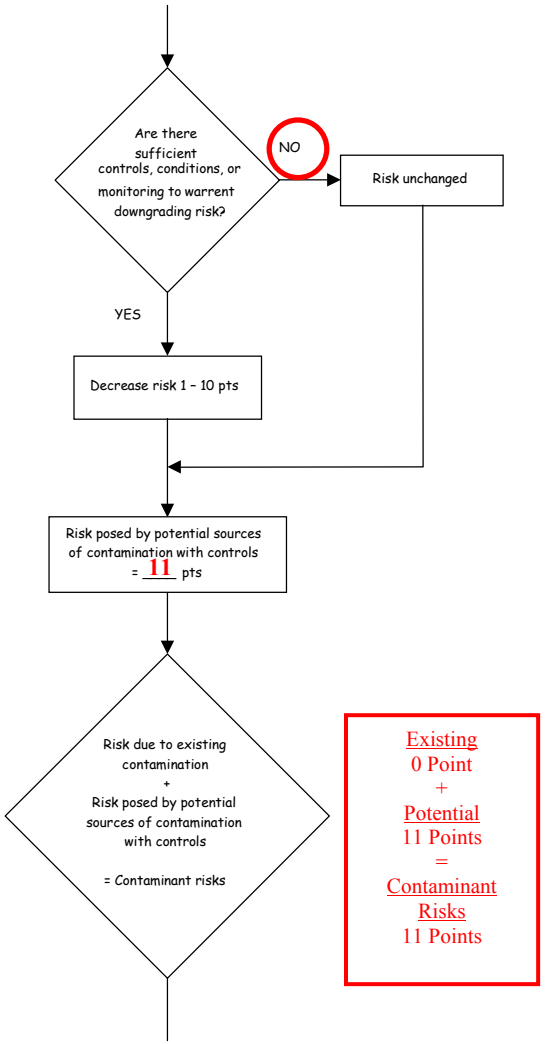
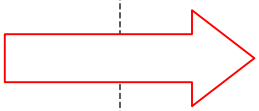


Chart 5. Contaminant risks for AK State Elks Youth Camp– Nitrates and Nitrites (Continued)



Existing
0 Point
+
Potential
11 Points
=
Contaminant
Risks
11 Points



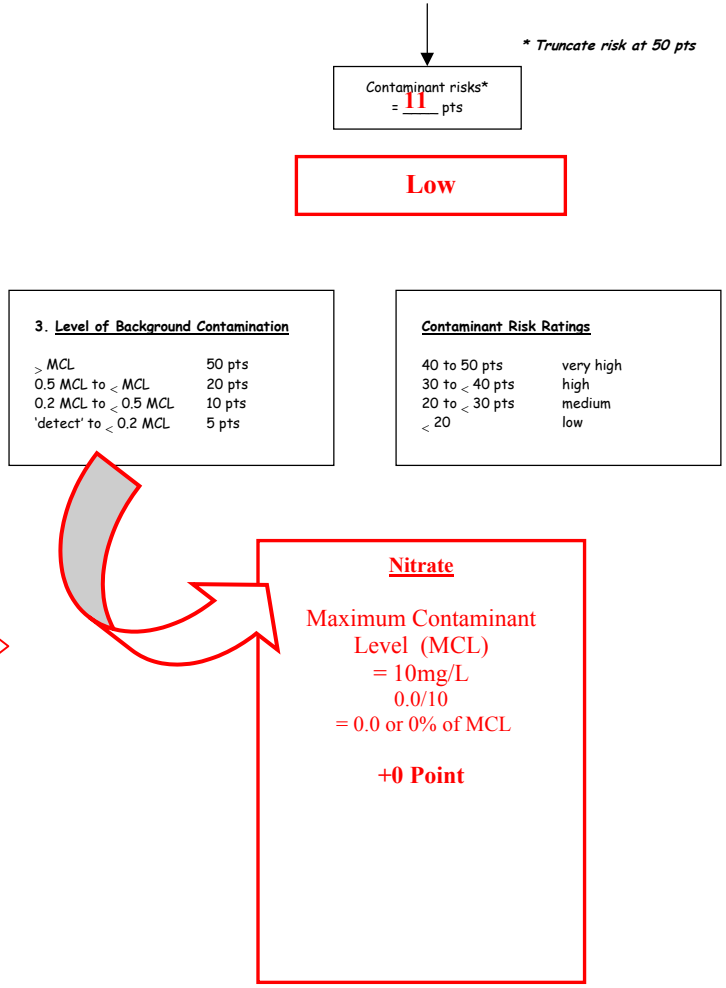


Table 2. Risk Matrix for Contaminant Sources for AK State Elks Youth Camp– Nitrates and Nitrites

Level of Risk Associated with the Highest Risk Sources

	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

Chart 6. Vulnerability analysis for AK State Elks Youth Camp– Nitrates and Nitrites

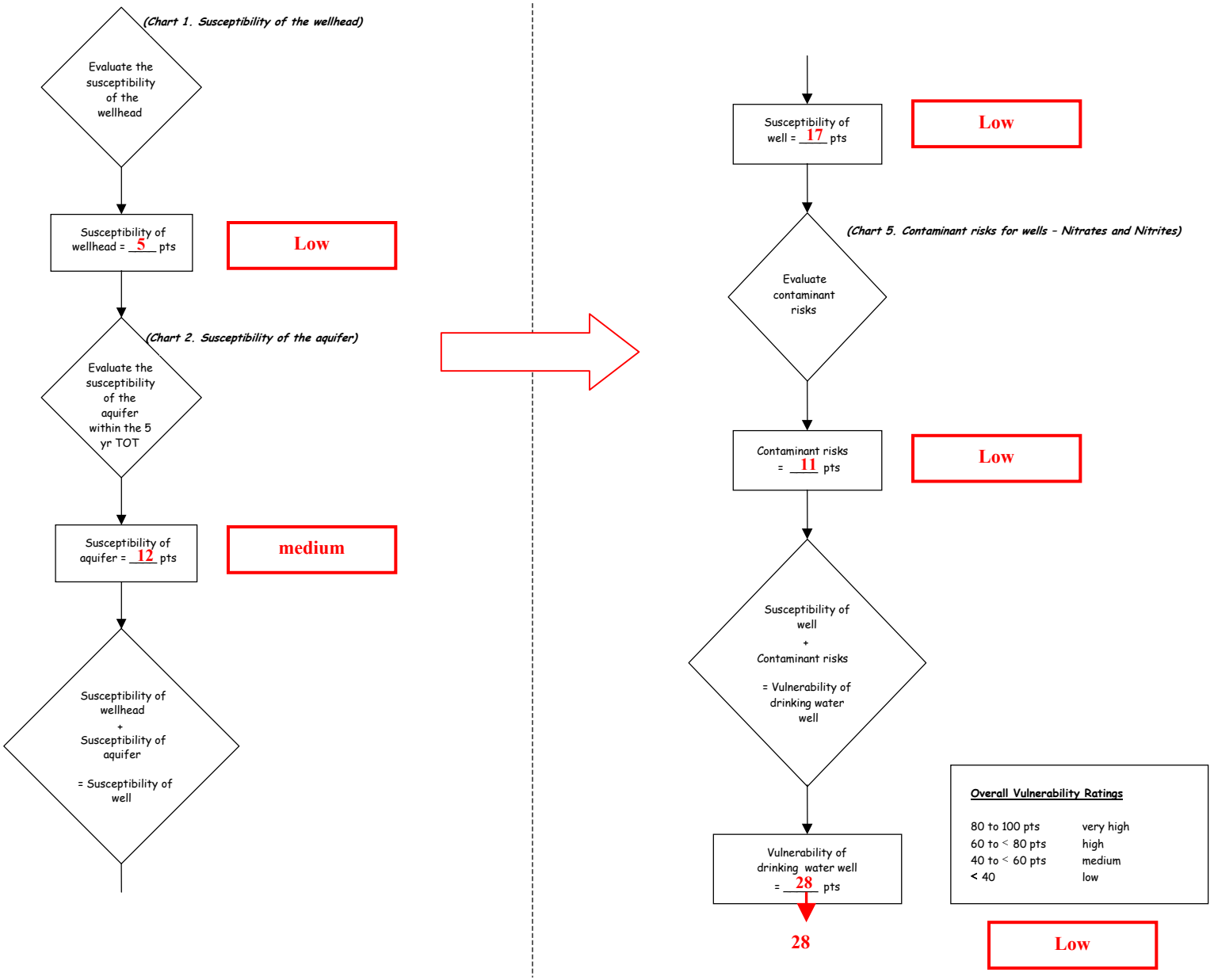


Chart 7. Contaminant risks for AK State Elks Youth Camp – Volatile Organic Chemicals

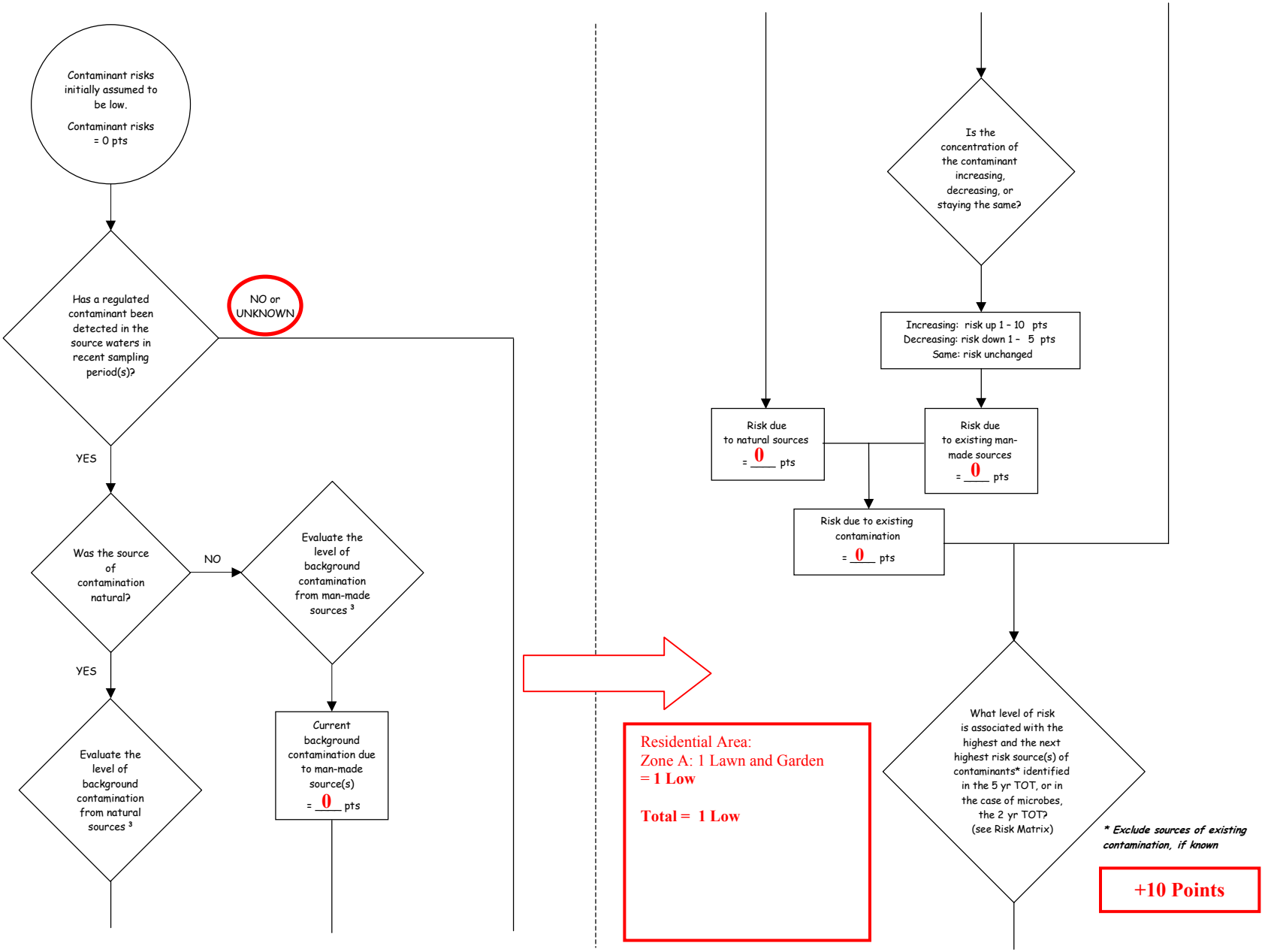


Chart 7. Contaminant risks for AK State Elks Youth Camp – Volatile Organic Chemicals (Continued)

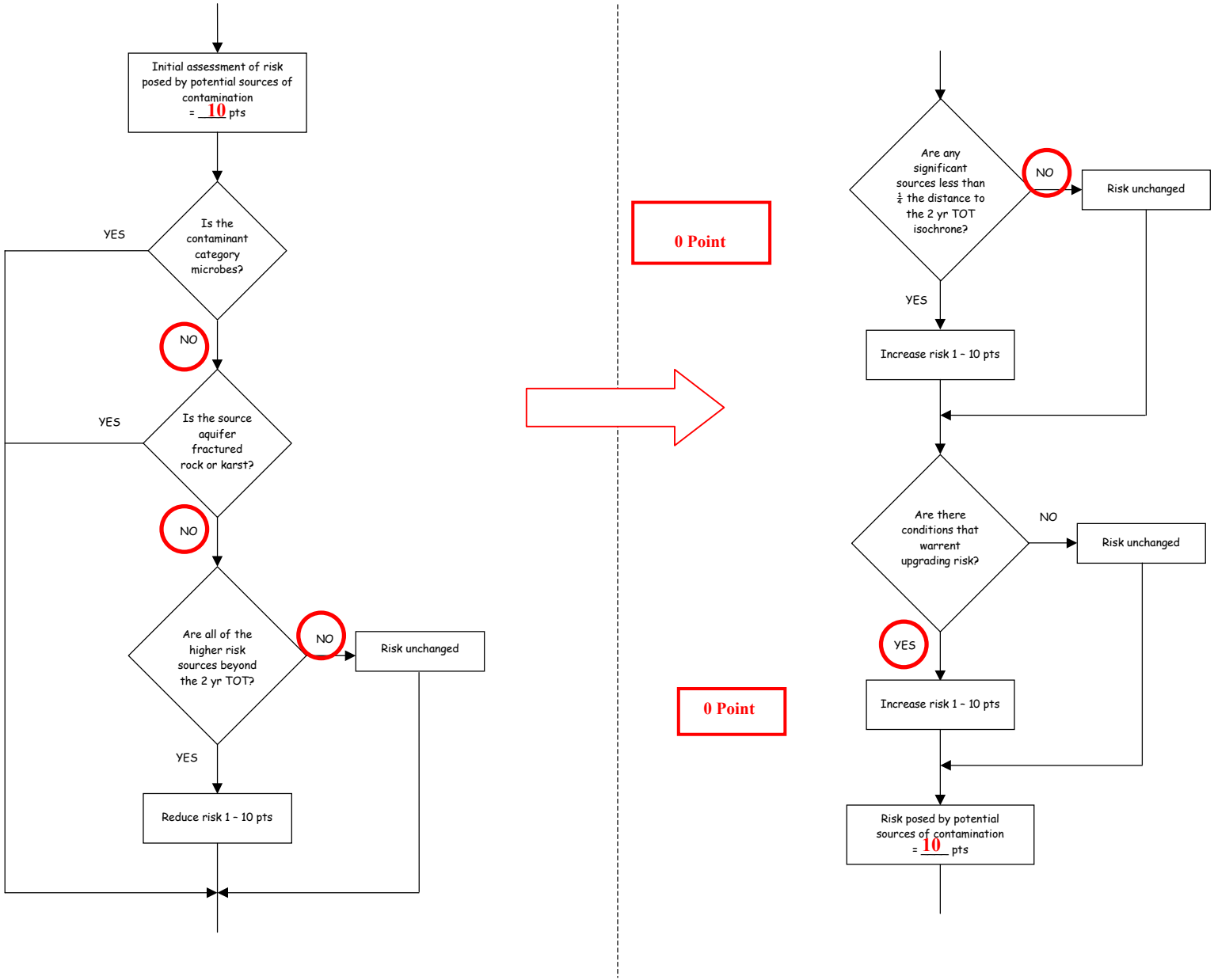
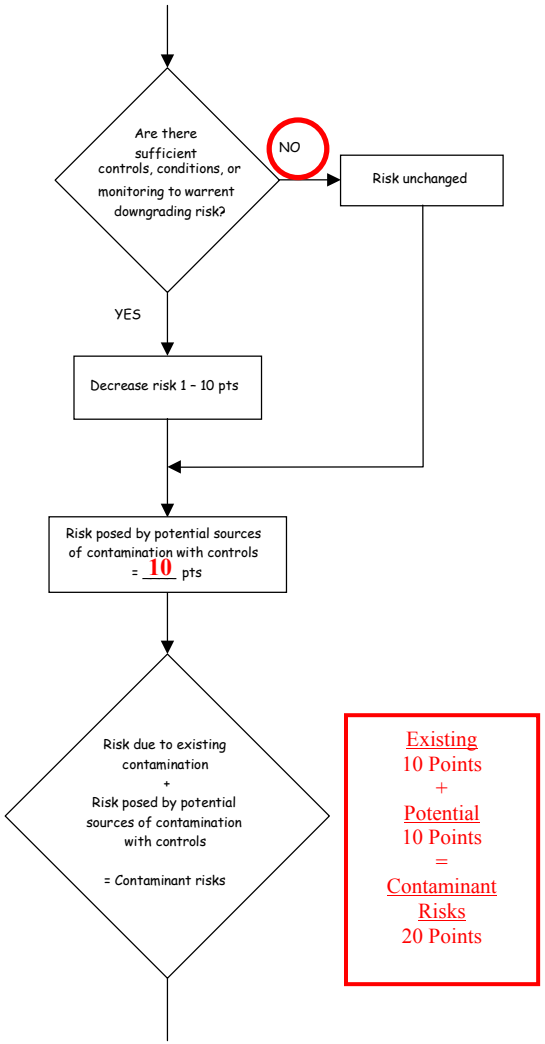


Chart 7. Contaminant risks for AK State Elks Youth Camp – Volatile Organic Chemicals (Continued)



Existing
10 Points
+
Potential
10 Points
=
Contaminant
Risks
20 Points

* *Truncate risk at 50 pts*

Contaminant risks*
= 20 pts

Medium

3. Level of Background Contamination

> MCL	50 pts
0.5 MCL to < MCL	20 pts
0.2 MCL to < 0.5 MCL	10 pts
'detect' to < 0.2 MCL	5 pts

Contaminant Risk Ratings

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

Table 3. Risk Matrix for Contaminant Sources for AK State Elks Youth Camp – Volatile Organic Chemicals

Level of Risk Associated with the Highest Risk Sources

Next Highest Risk Sources(s)

1 Lawn and Garden (1 low)	**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

Chart 8. Vulnerability analysis for AK State Elks Youth Camp– Volatile Organic Chemicals