Source Water Assessment

A Hydrogeologic Susceptibility and Vulnerability Assessment for Camp Gorsuch Boy Scout Camp Drinking Water System, Peters Creek, Alaska

Camp Gorsuch Boy Scout Camp #211326

DRINKING WATER PROTECTION PROGRAM REPORT #200
Alaska Department of Environmental Conservation

AUGUST 2002

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By Shannon & Wilson, Inc.

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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.

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Source Water Assessment for Camp Gorsuch Boy Scout Camp Source of Public Drinking Water, Peters Creek, Alaska

By Shannon & Wilson, Inc.

Drinking Water Protection Program
Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

The Camp Gorsuch Boy Scout Camp is a Class B (transient/non-community) water system consisting of one surface water intake in Mirror Lake, located at Mile 24.5 of the Old Glenn Highway. Identified potential and current sources of contaminants for Camp Gorsuch Boy Scout Camp public drinking water source include: residential areas, single-family septic systems, highways and roads, and municipal or city park. These identified potential and existing sources of contamination are considered sources of bacteria and viruses, nitrates and/or nitrites, and volatile organic chemicals. Overall, the public water sources for Camp Gorsuch Boy Scout Camp received a vulnerability rating of **Medium** for volatile organic chemicals, **High** for bacteria and viruses, and **High** for nitrates and nitrites.

INTRODUCTION

The Alaska Department of Environmental Conservation (ADEC) is completing source water assessments for all public drinking water sources in the State of Alaska. The purpose of this assessment is to provide owners and/or operators, communities, and local governments with information they can use to preserve the quality of Alaska's public drinking water supplies. The results of this source water assessment can be used to decide where voluntary protection efforts are needed and feasible, and also what efforts will be most effective in reducing contaminant risks to your water system. Shannon & Wilson has been contracted to perform these assessments under the supervision of ADEC.

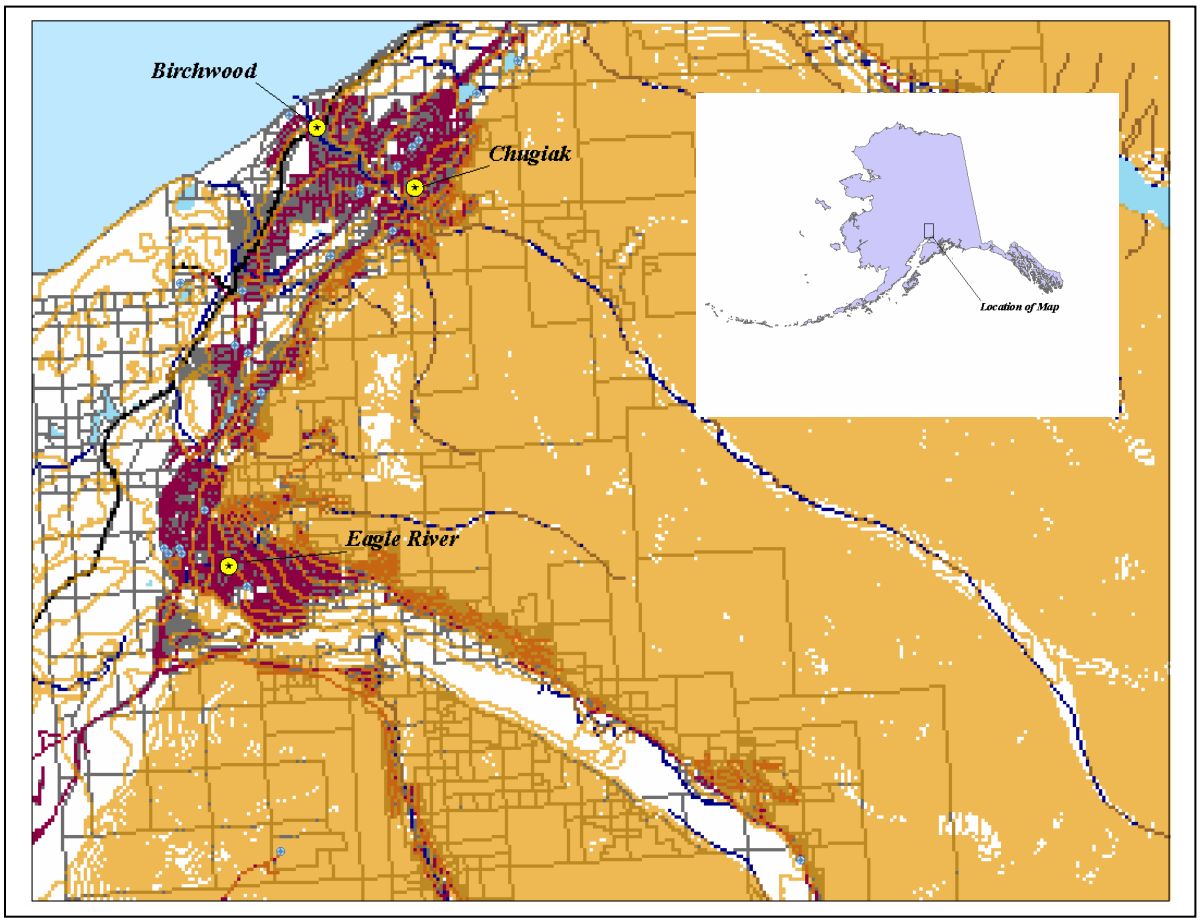

Figure 1. Index map showing the Anchorage of the Eagle River Valley and Surrounding Areas.

This source water assessment combines a review of the natural conditions at the site and the potential and existing contaminant risks. These are combined to determine the overall vulnerability of the drinking water source to contamination.

DESCRIPTION OF THE CHUGACH MOUNTAIN FRONT EAST OF ANCHORAGE

Location

Between the Chugach Mountain Front east of Anchorage and Knik Arm lie the communities of Eagle River, Chugiak, Peters Creek, and Eklutna. The Eagle River Valley is one of the largest valleys in the western Chugach Mountains. The area surrounding Eagle River is shown in Figure 1. Eagle River and the neighboring communities are located in the Municipality of Anchorage.

Glacial and alluvial forces have shaped the Eagle River Valley and Chugach Mountain front in this area. These forces have resulted in the U-shaped river valleys and moraine-mantled mountain flanks of the mountain front and lakes, streams and undulating ridges and hills of the glaciated lowlands extending to Knik Arm.

Precipitation

Eagle River averages between 20 and 25 inches of precipitation per year, including about 68 inches of snowfall.

Topography and Drainage

The area topography varies from sea level to about 400 feet in the area surrounding Knik Arm to several thousand feet on the surrounding ridges and mountain flanks.

Groundwater

Although the quality can vary significantly in a short distance, groundwater supplies are generally abundant in the area, except for some reported well failures that have occurred within the city limits of Eagle River. Groundwater occurs within both confined and unconfined aquifers and from both unconsolidated and bedrock aquifers. Many homes and businesses in the area rely on individual wells for their water supply. Most of these wells are shallow with depths of less than 100 feet to 200 feet. Static water levels in many of these wells are less than 15 feet below the surface.

Geology and Soils

Most of the soils in the area provide good sources of sand, gravel and topsoil. The deposition of silt, clay and organic muck in old lakes, oxbows and depressions means that some areas have soil conditions that vary over relatively short distances.

CAMP GORSUCH BOY SCOUT CAMP PUBLIC DRINKING WATER SYSTEM

Camp Gorsuch Boy Scout Camp is a Class B (transient/non-community) surface water intake. The system consists of one surface water intake in Mirror Lake, located at approximately Mile 24.5 of the Old Glenn Highway.

The surface water intake was initially put into operation prior to 1960. The most recent Sanitary Survey (4/27/89) indicates the intake was adequately constructed. An adequately constructed intake may provide protection against debris and contaminants from entering the system. The surface water source that the system draws from is less than 1 square mile in size.

This system operates seasonally and serves 4 residents and more than 995 non-residents through one service connection.

CAMP GORSUCH BOY SCOUT CAMP 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 lake. These pathways are determined by looking at the characteristics of the soil, lake, surrounding area, and the intake.

The most probable area for contamination to reach the drinking water system is the area that contributes water to the surface water body that water is being drawn from. This area is designated as the Drinking Water Protection Area (DWPA). Because a release of contaminants within the DWPA are most likely to impact the drinking water system, this area will serve as the focus for voluntary protection efforts.

The size and shape of the DWPAs were established based on aerial distances from the surface water body, and the watershed that recharges the surface water body. Additional methods were also used to take into account any uncertainties in surface water flow and topographic characteristics to arrive at a meaningful DWPA (Please refer to the Guidance Manual for Class B Public Water Systems for additional information).

The DWPAs established for surface water systems by the ADEC are separated into three zones. These zones correspond to different distances from the surface water body, and the watershed that recharges the surface water body. The following is a summary of the three DWPA zones and their definitions:

Table 1. Definition of Zones

Zone	Definition
A	1000 Feet From the Surface Water Body
B	1 Mile From the Surface Water Body
C	The Entire Watershed

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 Camp Gorsuch Boy Scout Camp DWPA. This inventory was completed through a search of agency records and other publicly available information. Potential sources of contamination to the drinking water system 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; and
- Volatile organic chemicals.

Inventoried potential sources of contamination within Zones A through Zone C were associated with residential and commercial type activities. The sources are summarized in the tables in Appendix B.

RANKING OF CONTAMINANT RISKS

Once the potential and existing sources of contamination have been identified, they are 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. Further, contaminant risks are a function of the number and density of those types of contaminant sources as well as the proximity of those sources to the intake.

VULNERABILITY OF CAMP GORSUCH BOY SCOUT CAMP DRINKING WATER SOURCE

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 intake and the water source.

Susceptibility of the Surface Water Source
(0 – 50 Points)

The surface water intake for Camp Gorsuch Boy Scout Camp is completed in Mirror Lake. Because the lake is recharged by surface water and precipitation, contaminants at the surface have the potential to adversely impact this water. Table 2 shows the Overall Susceptibility score and rating for Camp Gorsuch Boy Scout Camp.

Table 2. Natural Susceptibility - Susceptibility of the Surface Water Source to Contamination

	Score	Rating
Natural Susceptibility	35	High

Contaminant risks to a drinking water source depend on the type, number or density, and distribution of contaminant sources. This data has been derived from an examination of existing or historical contamination that has been detected at the drinking water source through routine sampling. It also evaluates potential sources of contamination. Table 3 summarizes the Contaminant Risks for each category of drinking water contaminants.

Table 3. Contaminant Risks

Category	Score	Rating
Bacteria and Viruses	25	Medium
Nitrates and/or Nitrites	43	Very High
Volatile Organic Chemicals	12	Low

Appendix D contains seven 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 Surface Water Source' to contamination by looking at the construction of the intake and its surrounding area and naturally-occurring attributes of the water source and influences on the groundwater system that might lead to contamination. Chart 2 analyzes 'Contaminant Risks' for the drinking water source with respect to bacteria and viruses. The 'Contaminant Risks' portion of the analysis considers potential sources of contaminants as well as a review of contamination that has or may have occurred, but has not arrived or been detected at the well. Chart 3 contains the 'Vulnerability Analysis for Bacteria and Viruses.' Charts 4 through 7 contain the Contaminant Risks and Vulnerability Analyses for nitrates and nitrites and volatile organic chemicals, respectively.

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 of Camp Gorsuch Boy Scout Camp to Contamination by Category

Category	Score	Rating
Bacteria and Viruses	60	High
Nitrates and Nitrites	75	High
Volatile Organic Chemicals	45	Medium

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 areas, single-family septic systems, highways and roads, and municipal or city park create a risk increase for the bacteria and viruses, nitrates and nitrites, and volatile organic compounds.

Only a small amount of bacteria and viruses are required to endanger public health. The sanitary survey indicates chemical treatment and monitoring are performed. Sample results indicate bacteria and viruses have not been detected in the water of the system at Camp Gorsuch Boy Scout Camp.

Nitrates and/or nitrites are found in natural background concentration at this site, as elsewhere throughout Alaska. Nitrate concentrations in uncontaminated groundwater are typically less than 2 milligrams per liter (mg/L) and are derived primarily from the decomposition of organic matter in soils, adopted from the U.S. Geological Survey (Wang, et al., 2000).

Sampling history for Camp Gorsuch Boy Scout Camp indicates that has been detected in the water nitrate samples (see Chart 5 - Contaminant Risks for Nitrates and/or Nitrites in Appendix D). The Maximum Contaminant Level (MCL) for nitrates/nitrates is 10 mg/L. The 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. Nitrate has been reported at a maximum concentration of 3.680 mg/L or about 37% of the MCL. Due to the high solubility and weak retention by soil, nitrates are very mobile, moving at approximately the same rate as water. Though nitrates have been detected in the water samples, concentrations remain below the MCL.

The large-capacity septic system and roads located in Zone A form the greatest risk for volatile organic chemicals.

SUMMARY

A *Source Water Assessment* has been completed for the sources of public drinking water serving Camp Gorsuch Boy Scout Camp. The overall vulnerability of this source to contamination is **Medium** for volatile organic chemicals, **High** for bacteria and viruses, and **High** for nitrates and nitrites. 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 Camp Gorsuch Boy Scout 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 Camp Gorsuch Boy Scout Camp public drinking water source.

REFERENCES CITED

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Patrick, L.D., Brabets, T.P., and Glass, R.L., 1989, Simulation of ground-water flow at Anchorage, Alaska: US Geological Survey Water-Resources Investigations Report 88-4139, 41p.

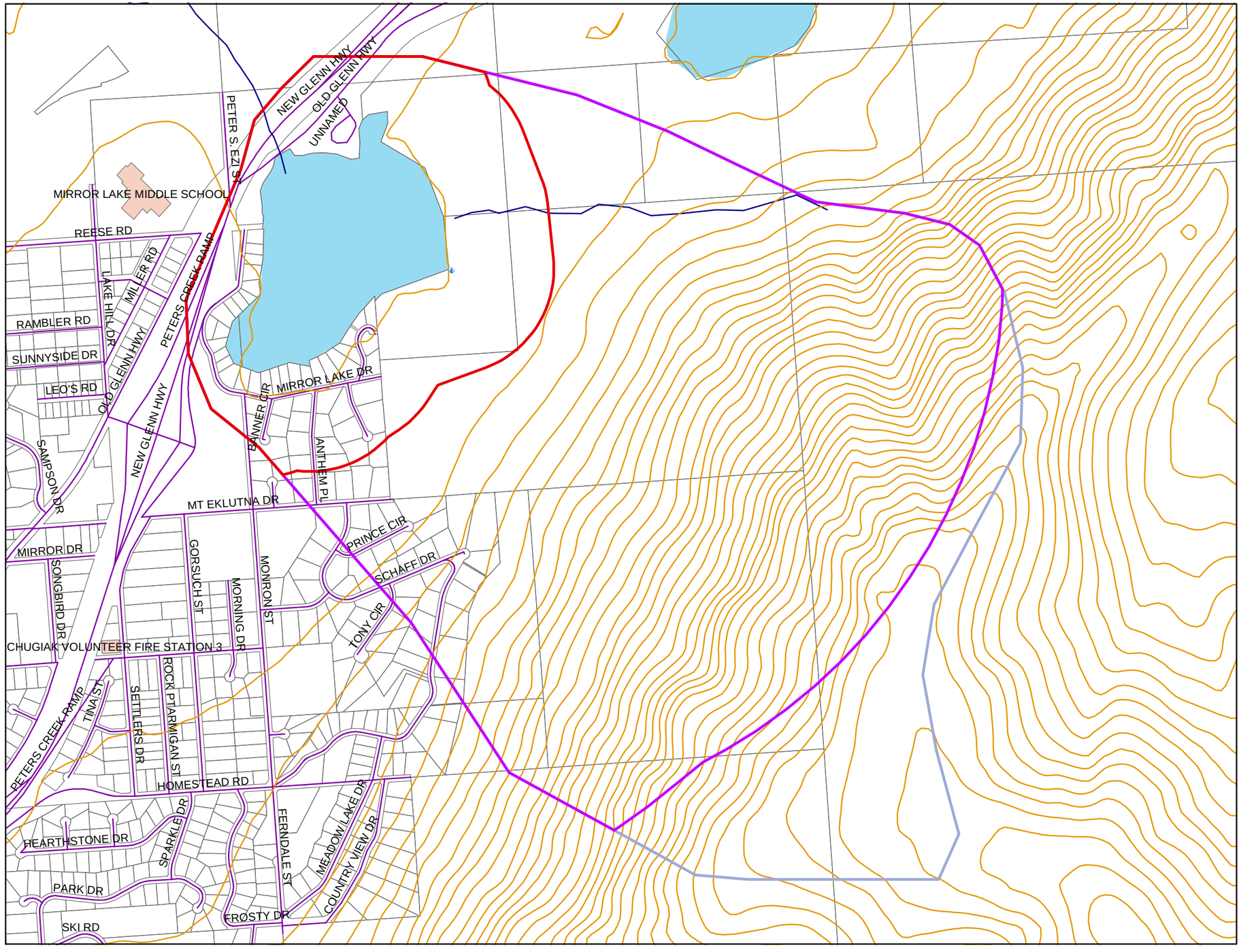
Wang, B., Strelakos, P.M., and Jokela, J.B., 2000, Nitrate source indicators in ground water of the scimitar subdivision, Peters Creek Area, Anchorage, Alaska: US Geological Survey Water-Resources Investigations Report 00-4137.

Weather Underground, June 18, 2002, Web extension to the *Western Regional Climate Center* [WWW document]. URL http://www.wunderground.com

APPENDIX A

Camp Gorsuch Boy Scout Camp
Drinking Water Protection Area
(Map 1)

Drinking Water Protection Areas for Camp Gorsuch Boy Scout Camp

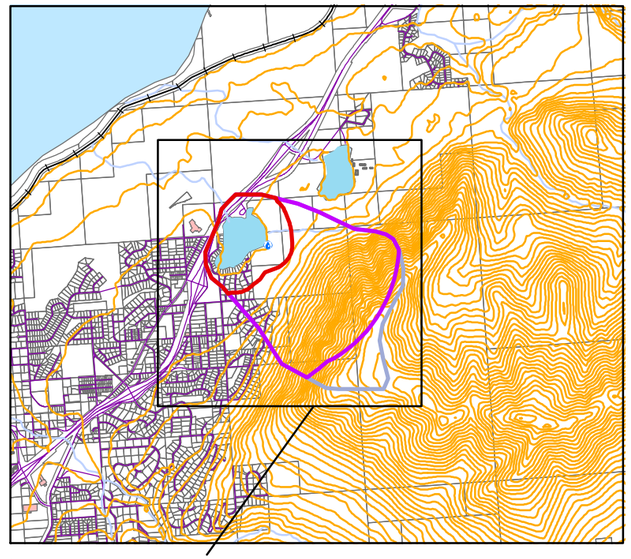


Camp Gorsuch Boy Scout Camp Intake
25m Contours
Railroads
Streams
Roads
MOA Buildings
MOA land parcels
Cook Inlet
MOA Airports
Site Buildings

Zone A Protection Area
1000 Feet from Surface Water Body

Zone B Protection Area
1 Mile from Surface Water Body

Zone C Protection Area
Entire Watershed



Location of map

2,000 1,000 0 2,000 Feet

PWSID 211326.001

N W E S

Map 1

APPENDIX B

Contaminant Source Inventory and Risk Ranking for Camp Gorsuch Boy Scout Camp (Tables 1-4)

Table 1

Contaminant Source Inventory for Camp Gorsuch Boy Scout Camp

PWSID 211326.001

Contaminant Source Type	***Contaminant Source ID***	***CS ID tag***	***Zone***	***Location***	***Map Number***	***Comments***
Residential Areas	R01	R1-1	A	Residential area around Mirror Lake	2	36 acres of residential area in Zone A
Septic systems (serves one single-family home)	R02	R2-1-25	A	Next to Mirror Lake	3	
Highways and roads, paved (cement or asphalt)	X20	X20-1-2	A	Paved roads in Zone A	2	2 paved roads in Zone A
Highways and roads, dirt/gravel	X24	X24-1-7	A	Roads in Zone A	2	6 roads in Zone A
Municipal or city parks (with green areas)	X04	X4-1	A	Adjacent to Mirror Lake	3	

Contaminant Source Inventory and Risk Ranking for

Table 2 ***PWSID 211326.001***

Camp Gorsuch Boy Scout Camp

Sources of Bacteria and Viruses

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Overall Rank after Analysis*	*Location*	*Map Number*	*Comments*
Municipal or city parks (with green areas)	X04	X4-1	A	Medium	1	Adjacent to Mirror	3	
Residential Areas	R01	R1-1	A	Low	2	Residential area around Mirror Lake	2	36 acres of residential area in Zone A
Septic systems (serves one single-family home)	R02	R2-1-25	A	Low	3	Next to Mirror Lake	3	
Highways and roads, paved (cement or asphalt)	X20	X20-1-2	A	Low	4	Paved roads in Zone A	2	2 paved roads in Zone A
Highways and roads, dirt/gravel	X24	X24-1-7	A	Low	5	Roads in Zone A	2	6 roads in Zone A

Contaminant Source Inventory and Risk Ranking for

Table 3 ***PWSID 211326.001***

Camp Gorsuch Boy Scout Camp

Sources of Nitrates/Nitrites

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Overall Rank after Analysis*	*Location*	*Map Number*	*Comments*
Municipal or city parks (with green areas)	X04	X4-1	A	Medium	1	Adjacent to Mirror	3	
Residential Areas	R01	R1-1	A	Low	2	Residential area around Mirror Lake	2	36 acres of residential area in Zone A
Septic systems (serves one single-family home)	R02	R2-1-25	A	Low	3	Next to Mirror Lake	3	
Highways and roads, paved (cement or asphalt)	X20	X20-1-2	A	Low	4	Paved roads in Zone A	2	2 paved roads in Zone A
Highways and roads, dirt/gravel	X24	X24-1-7	A	Low	5	Roads in Zone A	2	6 roads in Zone A

Contaminant Source Inventory and Risk Ranking for

Table 4 ***PWSID 211326.001***

Camp Gorsuch Boy Scout Camp

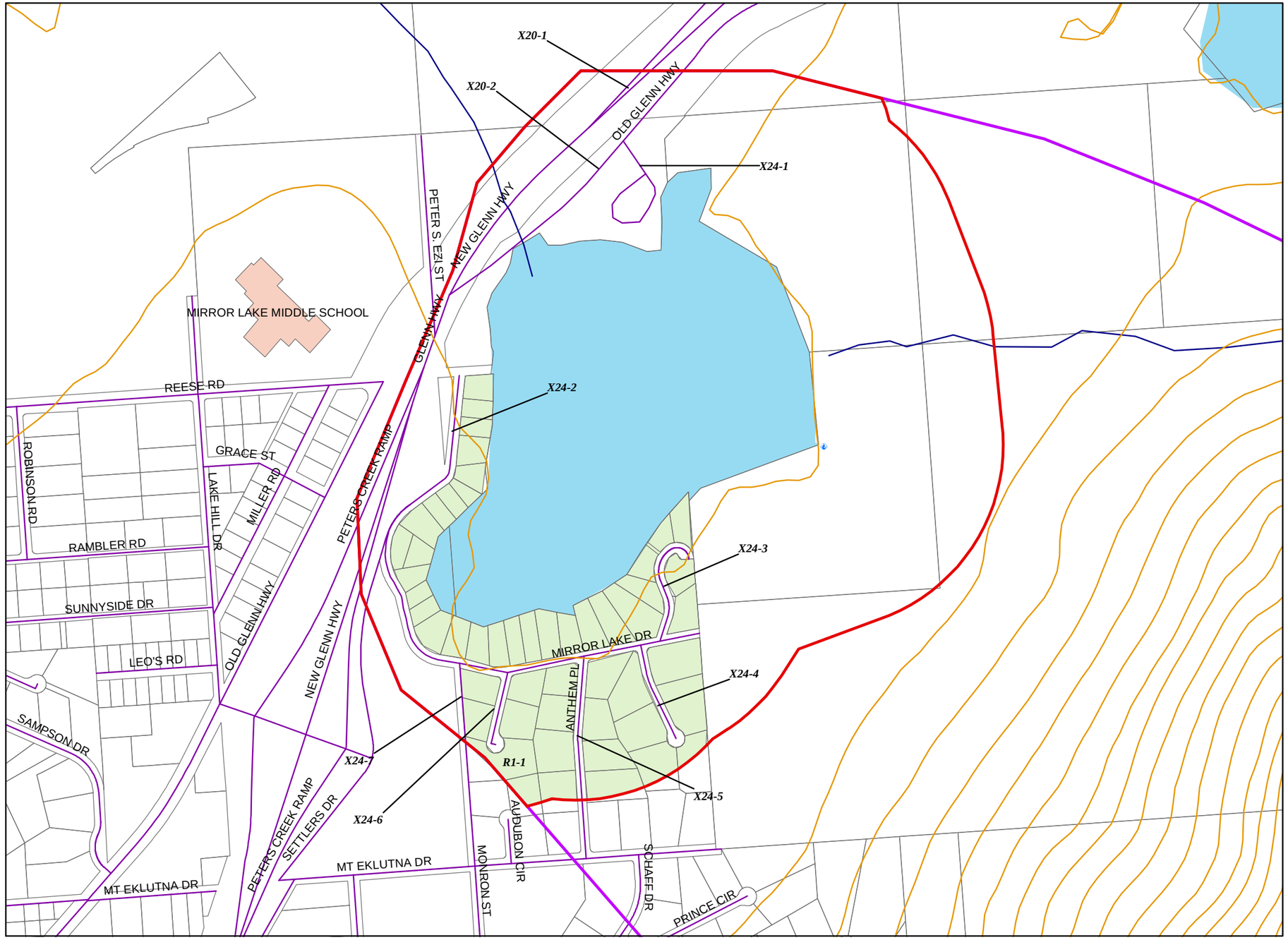
Sources of Volatile Organic Chemicals

Contaminant Source Type	***Contaminant Source ID***	***CS ID tag***	***Zone***	***Risk Ranking for Analysis***	***Overall Rank after Analysis***	***Location***	***Map Number***	***Comments***
Residential Areas	R01	R1-1	A	Low	1	Residential area around Mirror Lake	2	36 acres of residential area in Zone A
Septic systems (serves one single-family home)	R02	R2-1-25	A	Low	2	Next to Mirror Lake	3	
Highways and roads, paved (cement or asphalt)	X20	X20-1-2	A	Low	3	Paved roads in Zone A	2	2 paved roads in Zone A
Highways and roads, dirt/gravel	X24	X24-1-7	A	Low	4	Roads in Zone A	2	6 roads in Zone A

APPENDIX C

Camp Gorsuch Boy Scout Camp
Drinking Water Protection Area
and Potential and Existing Contaminant Sources
(Maps 2-3)

Drinking Water Protection Areas for Camp Gorsuch Boy Scout Camp and Potential and Existing Sources of Contamination



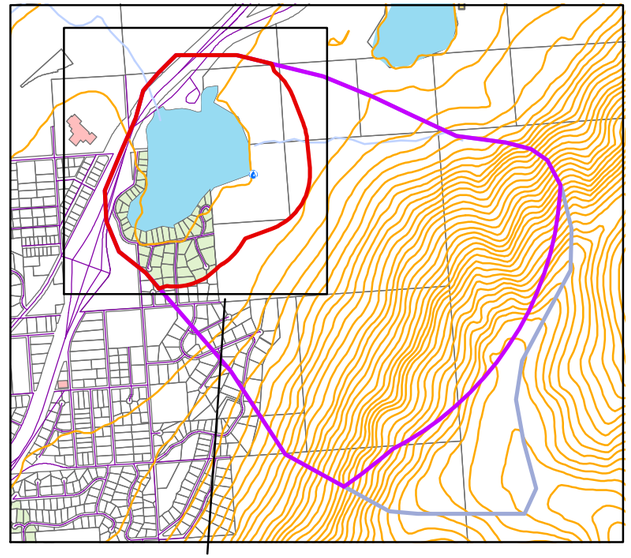
1,200 600 0 1,200 Feet

- Camp Gorsuch Boy Scout Camp Intake
- 25m Contours
- Railroads
- Streams
- Roads
- MOA Buildings
- MOA land parcels
- Cook Inlet
- MOA Airports
- Residential Areas (R1)
- Site Buildings

Zone A Protection Area
1000 Feet from Surface Water Body

Zone B Protection Area
1 Mile from Surface Water Body

Zone C Protection Area
Entire Watershed



Location of map

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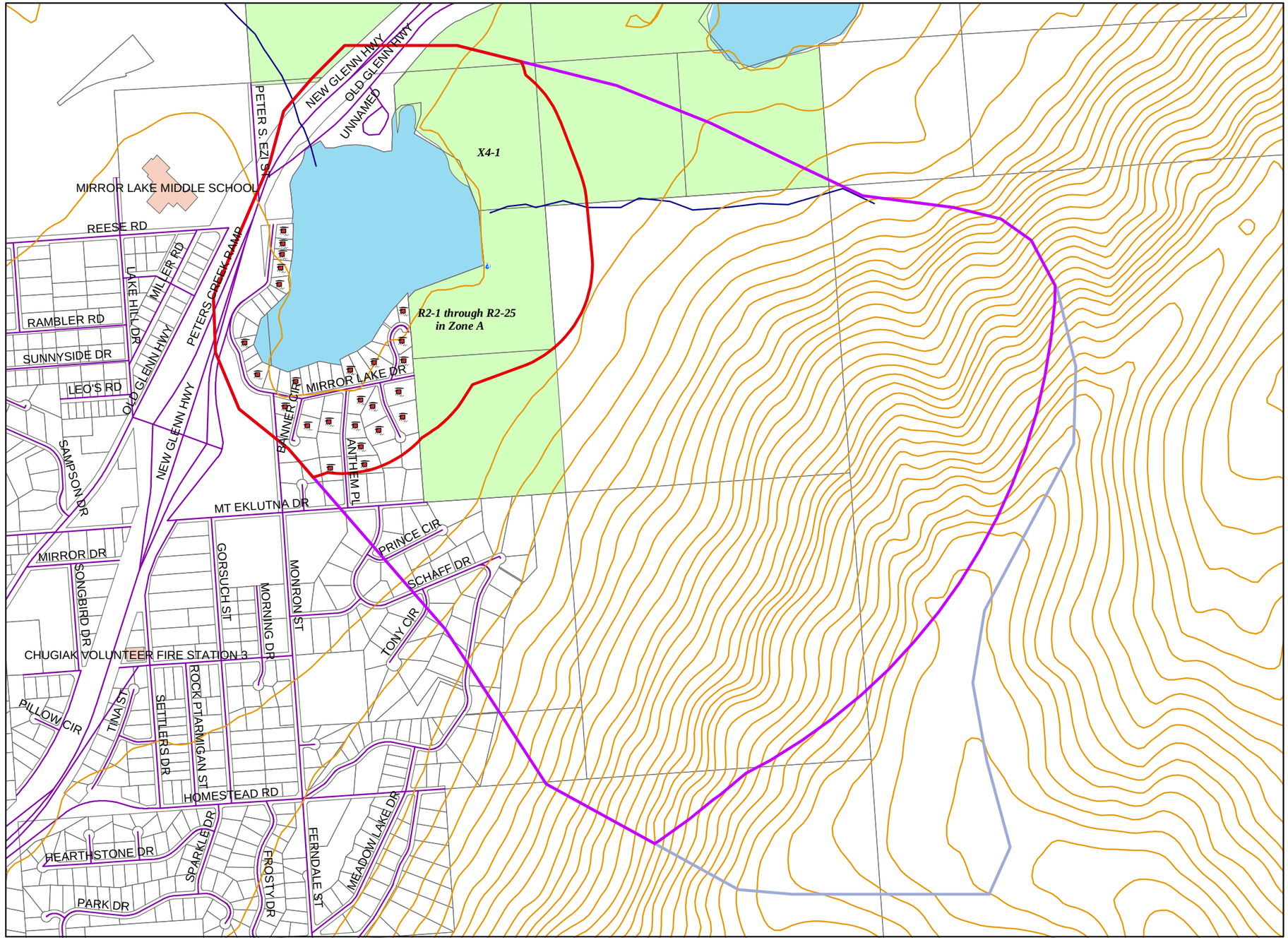
N W E S

Map 2

Drinking Water Protection Areas for Camp Gorsuch Boy Scout Camp and Potential and Existing Sources of Contamination

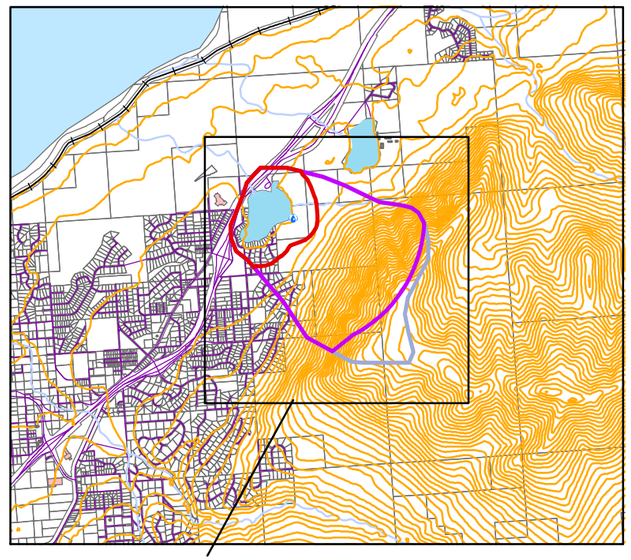


- Camp Gorsuch Boy Scout Camp Intake
- Single Family Septic Systems (R2)
- 25m Contours
- Railroads
- Streams
- Roads
- MOA Buildings
- MOA land parcels
- Cook Inlet
- MOA Airports
- Municipal or Public Parks (X4)
- Site Buildings

Zone A Protection Area
1000 Feet from Surface Water Body

Zone B Protection Area
1 Mile from Surface Water Body

Zone C Protection Area
Entire Watershed



Location of map

2,000 1,000 0 2,000 Feet

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PWSID 211326.001

Map 3

APPENDIX D

Vulnerability Analysis for Camp Gorsuch Boy Scout Camp Public Drinking Water Source

(Charts 1-7)

Chart 1. Susceptibility of the Surface Water Source - Camp Gorsuch Boy Scout Camp

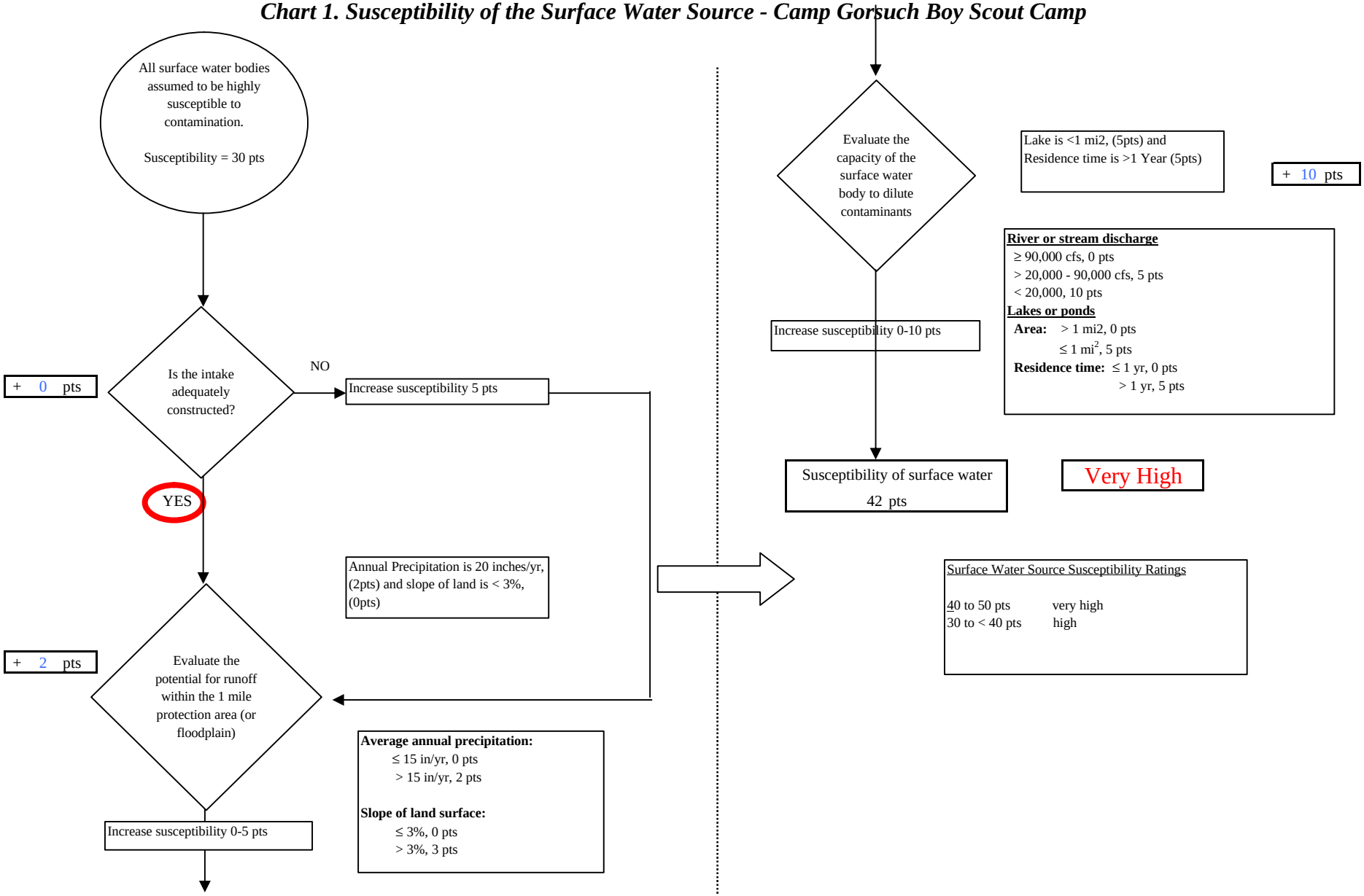
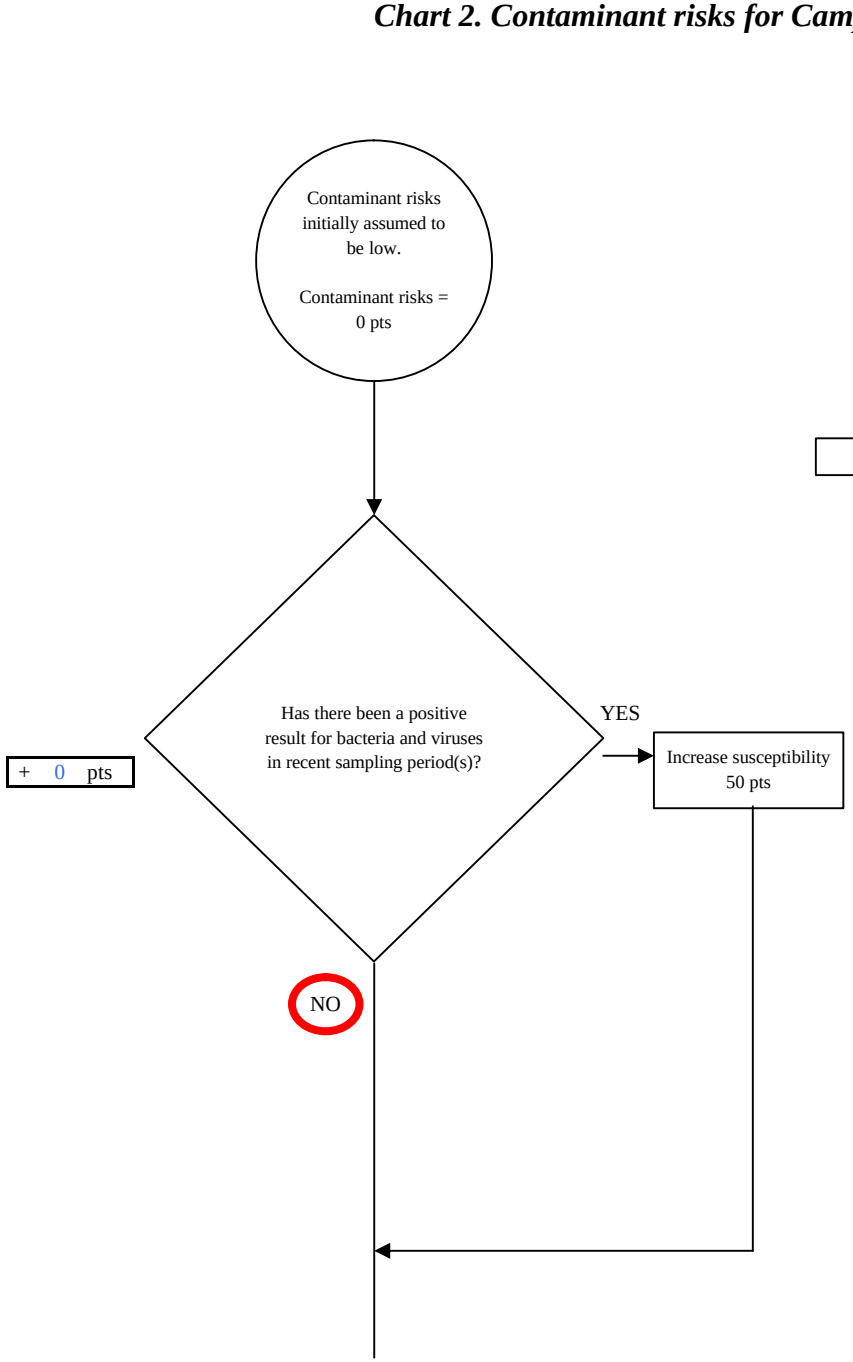
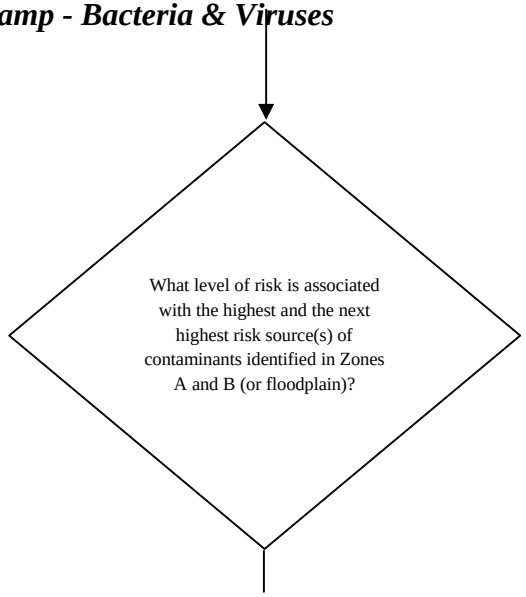


Chart 2. Contaminant risks for Camp Gorsuch Boy Scout Camp - Bacteria & Viruses





+ 20 pts

Risk Rankings for Contaminant Sources Identified in Zones A and B

	Zone A	Zone B	Total
Very Highs(s)	0	0	0
High(s)	0	0	0
Medium(s)	1		1
Low(s)	3		3

	LOW 10 pts	MEDIUM 20 pts	HIGH 30 pts	VERY HIGH 40 pts
LOW	³ 10 sources + 10 pts	≥ 10 sources + 5 pts	≥ 20 sources + 5 pts	----
MEDIUM	----	≥ 2 sources + 5 pts	≥ 5 sources + 5 pts	≥ 10 sources + 5 pts
HIGH	----	----	≥ 1 source + 10 pts	≥ 2 sources + 10 pts
VERY HIGH	----	----	----	≥ 1 source + 10 pts

Matrix Score 20

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

Chart 2. Contaminant risks for Camp Gorsuch Boy Scout Camp - Bacteria & Viruses

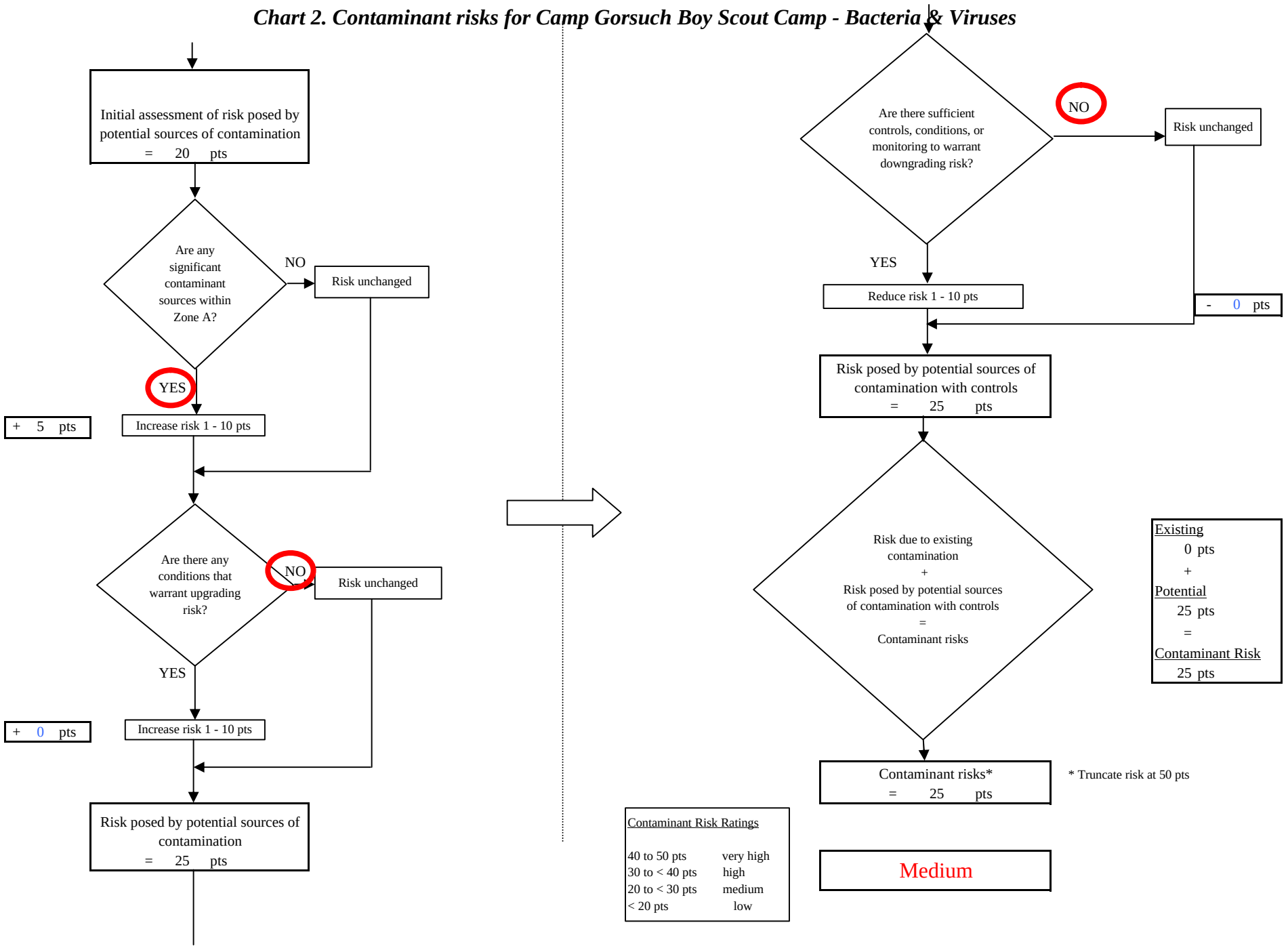


Chart 3. Vulnerability analysis for Camp Gorsuch Boy Scout Camp - Bacteria & Viruses

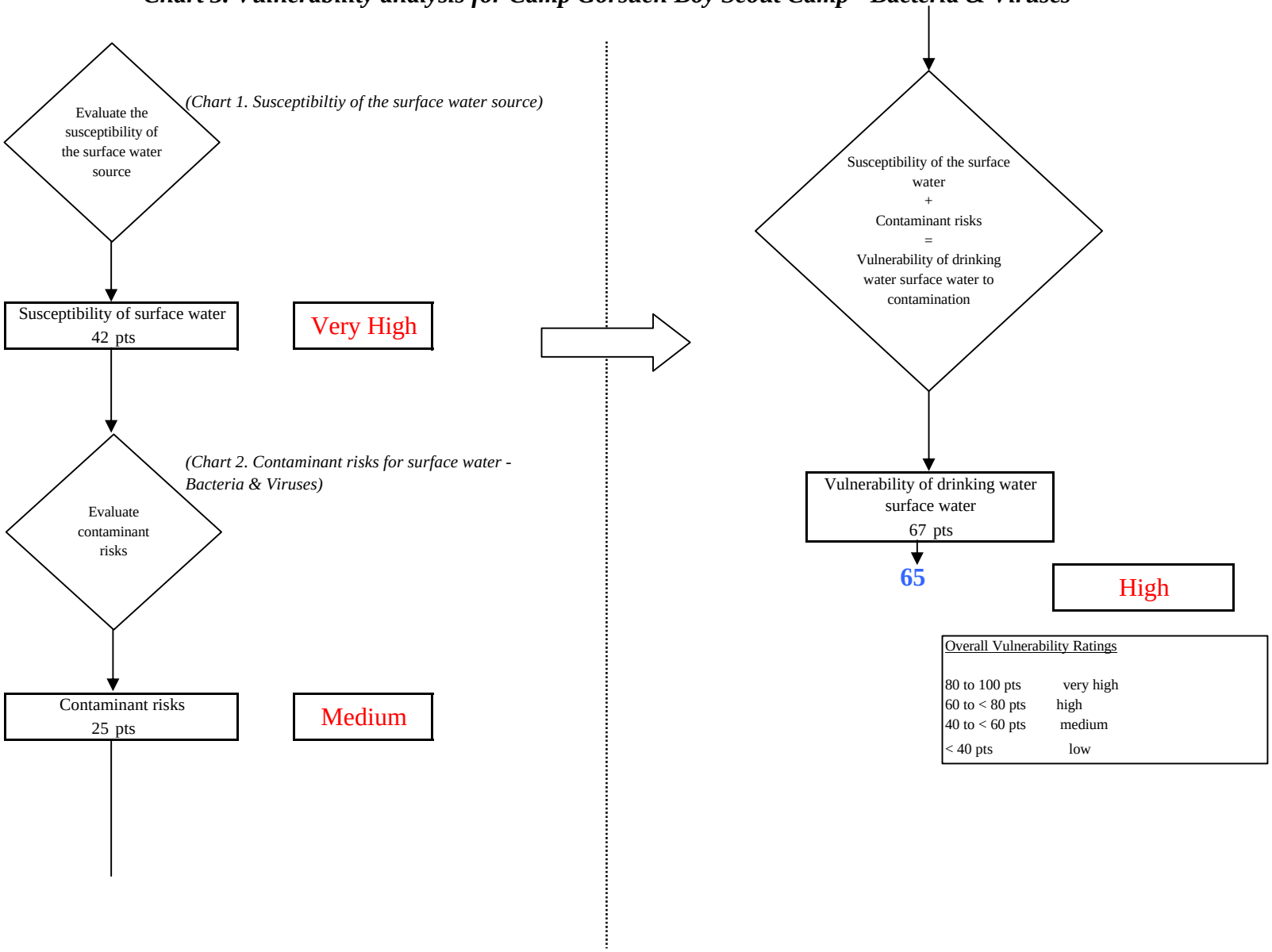


Chart 4. Contaminant risks for Camp Gorsuch Boy Scout Camp - Nitrates and Nitrites

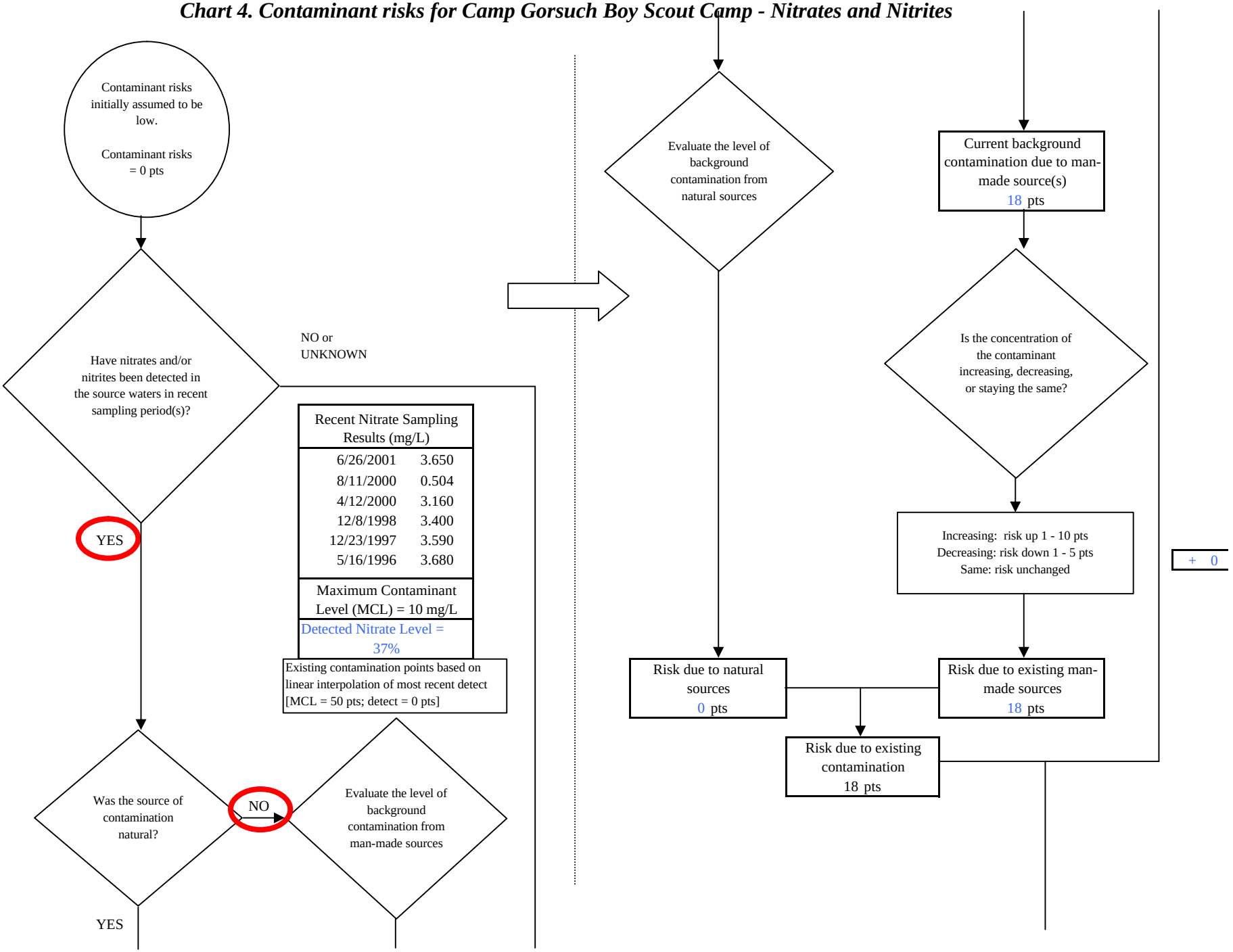


Chart 4. Contaminant risks for Camp Gorsuch Boy Scout Camp - Nitrates and Nitrites

+ 20 pts

What level of risk is associated with the highest and the next highest risk sources(s) of contaminants identified in Zones A and B? (see Risk Matrix below)

Initial assessment of risk posed by potential sources of contamination = 20 pts

Are any significant sources in Zone A?

NO → Risk unchanged

YES → Increase risk 1 - 10 pts

+ 5

Risk Levels 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)	1		1
Low(s)	3		3

	LOW 10 pts	**MEDIUM** 20 pts	**HIGH** 30 pts	**VERY HIGH** 40 pts
LOW	[3] 10 sources + 10 pts	≥ 10 sources + 5 pts	≥ 20 sources + 5 pts	----
MEDIUM	----	≥ 2 sources + 5 pts	≥ 5 sources + 5 pts	≥ 10 sources + 5 pts
HIGH	----	----	≥ 1 source + 10 pts	≥ 2 sources + 10 pts
VERY HIGH	----	----	----	≥ 1 source + 10 pts

Matrix Score 20

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

Chart 4. Contaminant risks for Camp Gorsuch Boy Scout Camp - Nitrates and Nitrites

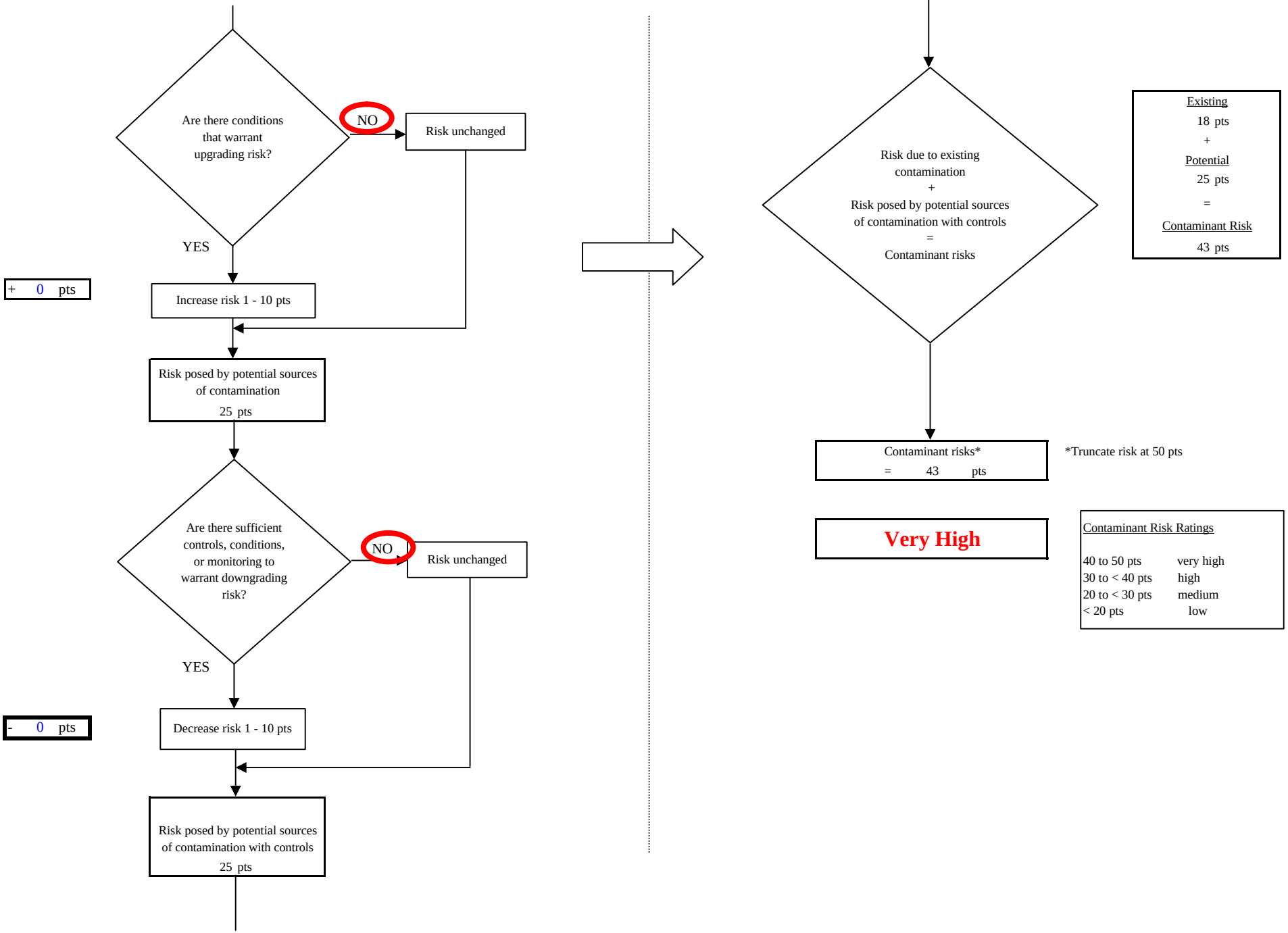


Chart 5. Vulnerability analysis for Camp Gorsuch Boy Scout Camp - Nitrates and Nitrites

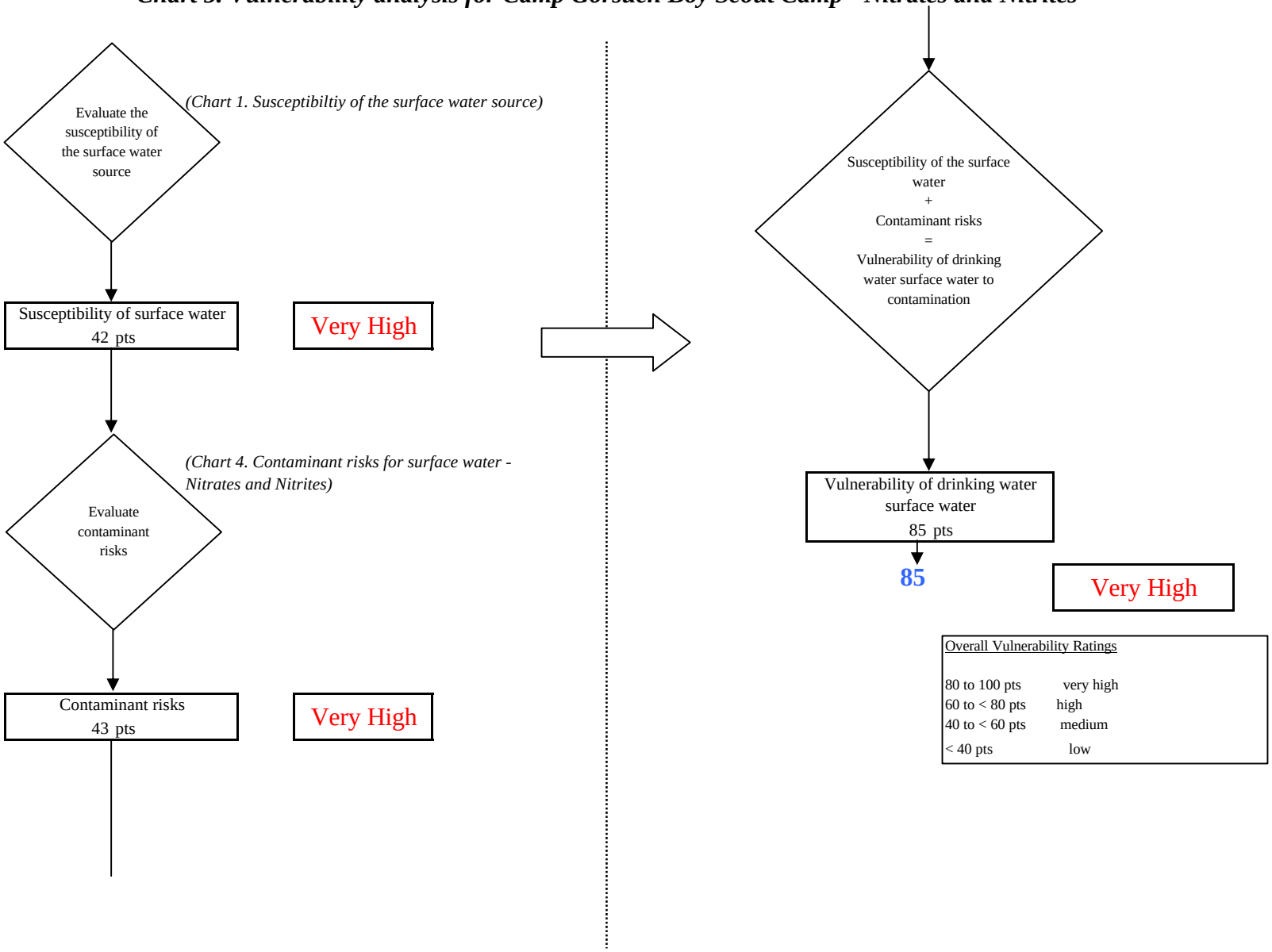


Chart 6. Contaminant risks for Camp Gorsuch Boy Scout Camp - Volatile Organic Chemicals

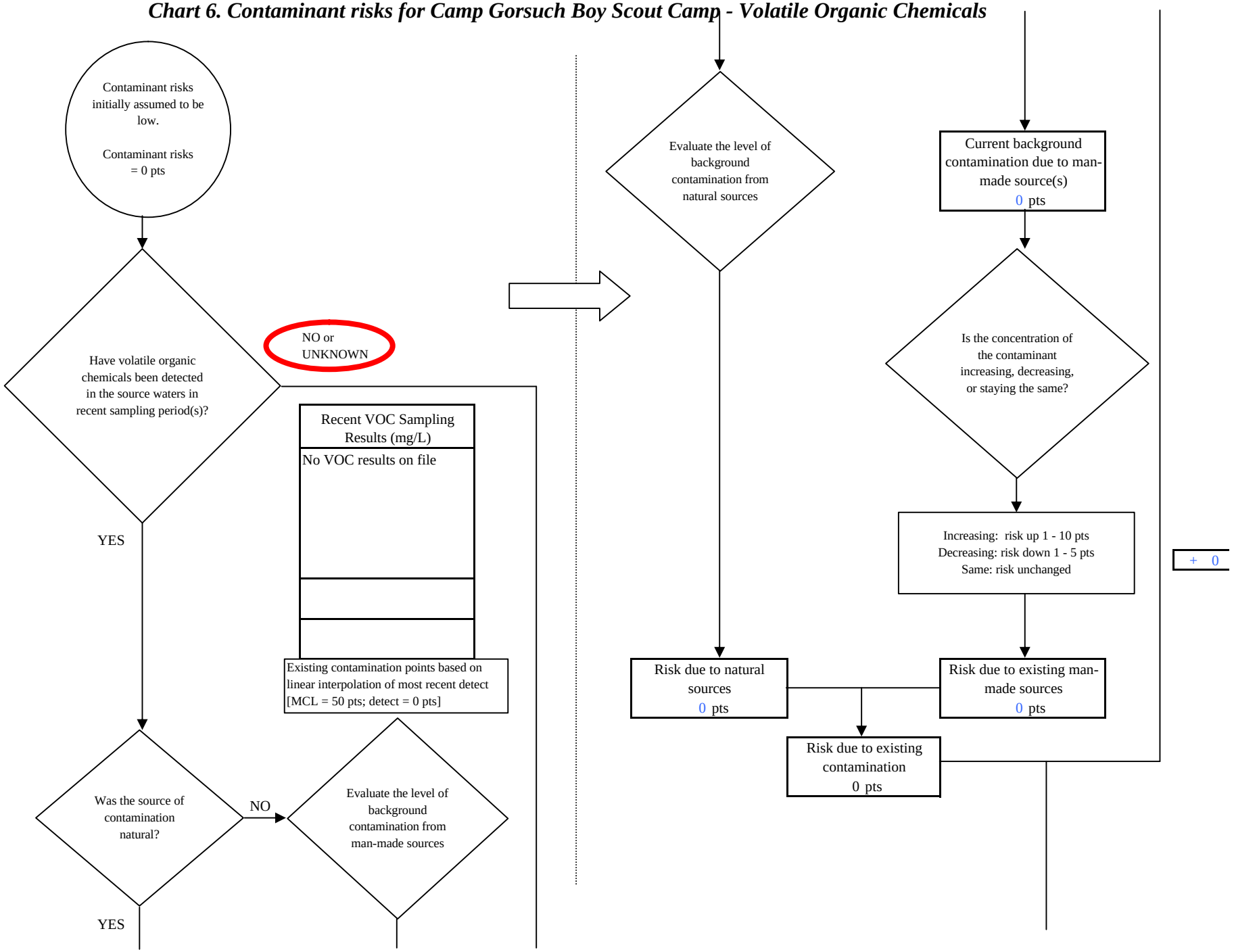


Chart 6. Contaminant risks for Camp Gorsuch Boy Scout Camp - Volatile Organic Chemicals

+ 10 pts

What level of risk is associated with the highest and the next highest risk sources(s) of contaminants identified in Zones A and B? (see Risk Matrix below)

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

Risk Levels for Contaminant Sources identified in Zones A and B

	Zone A	Zone B	Total
Very Highs(s)	0	0	0
High(s)	0	0	0
Medium(s)	0		0
Low(s)	3		3

	LOW 10 pts	MEDIUM 20 pts	HIGH 30 pts	VERY HIGH 40 pts
LOW	[3] 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.

Are any significant sources in Zone A?

NO

Risk unchanged

YES

Increase risk 1 - 10 pts

+ 2

Chart 6. Contaminant risks for Camp Gorsuch Boy Scout Camp - Volatile Organic Chemicals

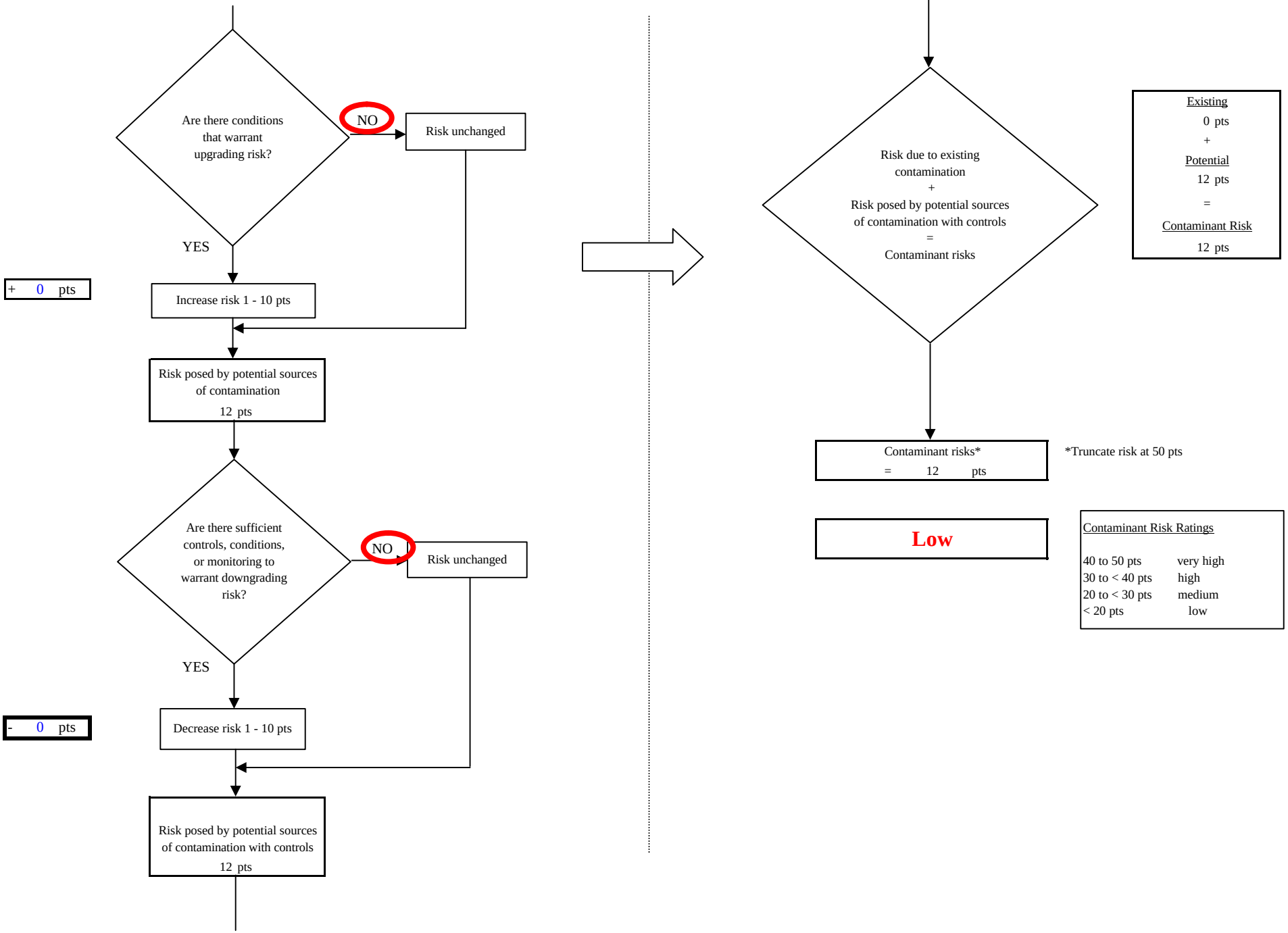


Chart 7. Vulnerability analysis for Camp Gorsuch Boy Scout Camp - Volatile Organic Chemicals