Source Water Assessment

A Hydrogeologic Susceptibility and Vulnerability Assessment for Greens Creek Mining Co., Alaska

Hawk Inlet Facility

PWSID # 113560.001

September 2003

Drinking Water Protection Program Report #1005

Alaska Department of Environmental Conservation

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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 Hawk Inlet Facility Public Water System

Drinking Water Protection Program
Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

The Greens Creek Mining Company - Hawk Inlet Facility public water system is a Class A (community) water system that obtains water from Cannery Creek. The system intake is located approximately 150-feet upstream of where Cannery Creek flows into Hawk Inlet. The Hawk Inlet Facility protection area is approximately 0.5 square miles in size and received a susceptibility rating of "**very high**". *A rating of high to very high is typical for all systems with surface water intakes*. Potential and existing sources of the following contaminants were evaluated for the Source Water Assessment: bacteria and viruses, nitrates and/or nitrites, heavy metals, cyanide, and other inorganic chemicals, synthetic organic chemicals, volatile organic chemicals, and other organic chemicals. A gravel road was identified as a potential source of contaminants for the drinking water source. This evaluation included all available water sampling data submitted to ADEC by the system operator. The samples may have been collected from either raw water or post-treated water. Combining the susceptibility of the surface water source with the contaminant risks, this water system has received a vulnerability rating of **"medium"** for bacteria and viruses, nitrates and/or nitrites, volatile organic chemicals, heavy metals, cyanide, and other inorganic chemicals, other organic chemicals, and synthetic organic chemicals.

DRINKING WATER SYSTEM AND AREA OVERVIEW

The Hawk Inlet Facility (Sec. 22, T043S, R065E, Copper River Meridian) is located on the east side of Hawk Inlet on Admiralty Island, approximately 20 miles southwest of Juneau (Please see the inset of Map 1 in Appendix A for location). There are approximately 150 users of the system. The Hawk Inlet Facility water system is a Class A (community) water system that operates year round and obtains water from Cannery Creek, which drains into Hawk Inlet. The system intake is located approximately 150-feet upstream of the mouth of the creek (See Map 1 of Appendix A).

This region of Admiralty Island has a wide variety of lithologies composed principally of undivided sedimentary and volcanic rocks. Volcanic rocks of basaltic and andesitic origin are particularly common. Rocks include lava flows, breccia, tuffs, graywacke, mudstone, carbonates, and conglomerate. Glacial flow and drainage patterns tend to follow geologic structure and bedding, if present. A mixture of forest types and plant communities exists across the area as a function of drainage, aspect, and elevation (USDA, 2001).

This area has a mild, maritime climate. Average summer temperatures range from 44 to 65; winter temperatures range from 25 to 35. It is in the mildest climate zone in Alaska. Annual precipitation ranges between 54 – 92 inches. Snowfall averages 101 inches. (ADCED, 2003).

According to the system operator, Cannery Creek flow at the take-up point weir averages 180 cubic feet per minute (cfm). The 2000 sanitary survey states that the intake area is screened and inspected regularly. The survey also states that the average daily production of the system averages approximately 6,300 – 7,000 gallons per day (4.4-4.9 gpm) with peak productions of 9,400 gallons (6.5 gpm).

HAWK INLET FACILITY DRINKING WATER PROTECTION AREA

Identifying the pathways most likely for surface contamination to reach water intake areas is the first step in determining the water system's risk. These are initially determined by looking at the drainage area contributing overland water flow to a surface water source intake. The entire drainage area is also known as the "drinking water protection area". Please refer to pages 10-11of the "Guidance Manual for Class A Public Water Systems" for additional information.

The protection area established for surface water sources by the ADEC is usually separated into three zones, limited by the watershed boundary. These zones correspond to the overland-flow distance that water travels to get to the source. The ADEC Drinking Water Protection Program's Technical Advisory Committee developed guidelines for derivation of these zones in 1998. The following is a summary of the three protection area zones:

Table 1. Definition of Zones

Zone	Definition
A	Areas within 1000-ft of lakes or streams
B	Areas within 1-mile of lakes or streams
C	The watershed boundary

The protection area for the Hawk Inlet Facility water intake includes each of these Zones; however, due to the size of the watershed, Zones C and B cover the same area (See Map 1 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 Hawk Inlet Facility protection area. This inventory was completed through a search of agency records and other publicly available information. There is a wide array of potential contamination sources to surface water. These contaminants are found within agricultural, residential, commercial, and industrial areas, but *can also occur within areas that have little or no development*.

For Class A public water system assessments, six categories of drinking water contaminants were inventoried. They include:

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

Sources identified in the Hawk Inlet Facility protection area are displayed on Map 2 of Appendix C and summarized in Table 1 of Appendix B.

RANKING OF CONTAMINANT RISKS

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

- Low;
- Medium;
- High; and
- Very High.

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

The remaining tables in Appendix B (if necessary) contain the ranking of potential and existing sources of contamination with respect to bacteria and viruses, nitrates and/or nitrites, volatile organic chemicals, heavy metals, cyanide, and other inorganic chemicals, synthetic organic chemicals, and other organic chemicals.

VULNERABILITY OF THE DRINKING WATER SYSTEM

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

- Surface Water Susceptibility; and
- Contaminant risks.

Appendix D contains 13 charts, which together form the 'Vulnerability Analysis' for the public drinking water Source Water Assessment. Chart 1 analyzes the 'Susceptibility of the Surface Water Source' to contamination by looking at the climate, terrain, and intake location. 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 intake area. Chart 3 contains the 'Vulnerability Analysis for Bacteria and Viruses', which is a composite score of the Vulnerability Analysis and the overall Susceptibility. Charts 4 through 13 repeat the Contaminant Risks and Vulnerability Analyses for nitrates and nitrites, volatile organic chemicals, heavy metals, cyanide, and other inorganic chemicals, synthetic organic chemicals, and other organic chemicals, respectively.

A score for the Surface Water Susceptibility of the source is reached by considering the properties of the water intake and the surrounding area. The derivation of this information is presented below and the data for this source is shown in Chart 1 of Appendix D.

Susceptibility of the Surface Water Source – always considered to be "high" (30 points)

+

Adequate Construction of the Intake (0 – 5 Points)

+

Runoff Potential Within Zone B (0 – 5 Points)

+

Dilution Capacity of the Surface Water (0 – 10 Points)

=

Natural Susceptibility
(0 – 50 Points)

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

Surface Water Source Susceptibility Ratings	
40 to 50 pts	Very High
30 to < 40 pts	High

Table 2. Susceptibility of the Water Source

	Score	Rating
Minimum Allowable Susceptibility	30	
Intake Construction Adequate	0	
Runoff Potential	5	
Dilution Capacity	10	
Overall Susceptibility	45	Very High

For contaminants, risks to a drinking water source depend on the type, number or density, and distribution of the contaminant sources. The Contaminant Risk score has been derived from an examination of existing, and historical contamination sources that have been detected in the protection area 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 the 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. Hawk Inlet Facility Contaminant Risks

Category	Score	Rating
Bacteria and Viruses	12	Low
Nitrates and/or Nitrites	13	Low
Volatile Organic Chemicals	12	Low
Heavy Metals, Cyanide, and Other Inorganic Chemicals	12	Low
Synthetic Organic Chemicals	0	Low
Other Organic Chemicals	12	Low

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

Susceptibility of the Surface Water Source

(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 and ratings for each of the six categories of drinking water contaminants. Note: scores are rounded off to the nearest five.

Table 4. Hawk Inlet Facility Overall Vulnerability

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

Synthetic Organic Chemicals	45	Medium
Other Organic Chemicals	55	Medium

Bacteria and Viruses

The contaminant risk for bacteria and viruses is "low".

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. Typically, coliform detection in raw water samples collected from surface water sources is normal. (See Chart 2 – Contaminant Risks for Bacteria and Viruses in Appendix D).

No two consecutive positive bacteria counts have been detected in the sampling period January 1999 - May 2003.

Gravel roads could serve as a possible source of bacteria.

After combining the contaminant risk for bacteria and viruses with the natural susceptibility of the source, the overall vulnerability of the source to bacteria and virus contamination becomes "medium".

Nitrates and Nitrites

The contaminant risk for nitrates and nitrites is "low" (See Chart 4 - Contaminant Risks for Nitrates and/or Nitrites in Appendix D). Nitrates are very mobile, moving at approximately the same rate as water.

Sampling history for the water source indicates that no nitrates have been detected since 5/6/1998.

The Maximum Contaminant Level (MCL) for nitrates is 10 milligrams per liter (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 (EPA, 2003).

Possible sources of nitrate/nitrites are gravel roads.

After combining the contaminant risk for nitrates and nitrites with the natural susceptibility of the source, the overall vulnerability of the source to contamination is "medium".

Volatile Organic Chemicals

The contaminant risk for volatile organic chemicals is "low" (See Chart 6 – Contaminant Risks for Volatile Organic Chemicals in Appendix D).

Chloroform and trihalomethanes were detected at levels below the MCL during sampling in 1999-2002, although both of these chemicals typically originate during the process of water treatment and not from the source waters. The MCL for chloroform is 0.2 milligrams per liter (mg/L) and the MCL for total trihalomethanes is 0.1 mg/L.

Another possible source for volatile organic compounds could be from gravel roads.

After combining the contaminant risk for volatile organic chemicals with the natural susceptibility of the source, the overall vulnerability of the source to contamination is "medium".

Heavy Metals, Cyanide, and Other Inorganic Chemicals

The contaminant risk for heavy metals is "low". Copper and lead were detected in samples collected during 1999-2002 (See Chart 8 – Contaminant Risks for Heavy Metals, Cyanide, and Other Inorganic Chemicals in Appendix D). The MCL for copper is 1.3 mg/l. and the MCL for lead is 0.015 mg/l.

The most common source of these chemicals is the infrastructure of the distribution system following the treatment process. Gravel roads can also contribute heavy metals.

After combining the contaminant risk for heavy metals with the natural susceptibility of the source, the overall vulnerability of the well to contamination is "medium".

Synthetic Organic Chemicals

The contaminant risk for synthetic organic chemicals is "low". After combining the contaminant risk with the natural susceptibility of the source, the overall vulnerability to synthetic organic chemicals of the source is "medium" (See Chart 11 – Contaminant Risks for Synthetic Organic Chemicals in Appendix D).

Review of the historical sampling data indicates that test results for ethylene dibromide and dibromochloropropane in 2002 were negative.

Other Organic Chemicals

The contaminant risk for other organic chemicals is "low". After combining the contaminant risk with the natural susceptibility of the source, the overall vulnerability to other organic chemicals of the source is

"medium" (See Chart 13 – Contaminant Risks for Other Organic Chemicals in Appendix D).

Review of the historical sampling data indicates that no other organic chemicals have been sampled recently.

REFERENCES

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

United States Forest Service – Alaska Region (USDA), 2001. Technical Publication No. R10-TP-75. Ecological Subsections of Southeast Alaska and Neighboring Areas of Canada.

United States Environmental Protection Agency (EPA), 2003 [WWW document]. URL http://www.epa.gov/safewater/mcl.html.

APPENDIX A

Hawk Inlet Facility
Drinking Water Protection Area Location Map
(Map 1)

Douglas Island

Admiralty Island

Greens Creek Mining Co. -
Drinking Water Protection Areas

Greens Creek

Area enlarged at left

Juneau
Gustavus
Hoonah
Elfin Cove
Cube Cove
Admiralty Island
Pelican
Chichagof Island
Tenakee Springs
Angoon
Hobart Bay
Baranof Island
Kake
Sitka

Map 1: Greens Creek Mining Company - Drinking Water Protection Area

PWSID: 113560 & 119205

Alaska Department of Environmental Conservation

Alaska Drinking Water Protection Program

0 5,500 11,000 22,000 33,000 44,000 Feet

1:132,000

Data Sources:
Background image
- USGS 1:63,000 mapping
Lakes, streams, & roads
- U.S. Forest Service, Tongass

Protection zones were delineated based upon streams noted on USGS 1:63,000 mapping.

Legend

- Hawk Inlet Facility - PWS Intake
- 920 Level - PWS Intake
- Zone A Protection Area
- Zone B Protection Area
- Zone C Protection Area
- Roads
- Stream
- Lake

0 10 20 40 60 Miles

September 15, 2003

APPENDIX B

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

Table 1

Contaminant Source Inventory for
Greens Creek Mining Company

PWSID 113560.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Map Number*	*Comments*
Highways and roads, dirt/gravel	X24	X24-1	A	2	From U.S. Forest Service, Tongass GIS data.

Table 2

Contaminant Source Inventory and Risk Ranking for Greens Creek Mining Company Sources of Bacteria and Viruses

PWSID 113560.001

Contaminant Source Type	***Contaminant Source ID***	***CS ID tag***	***Zone***	***Risk Ranking for Analysis***	***Map Number***	***Comments***
Highways and roads, dirt/gravel	X24	X24-1	A	Low	2	From U.S. Forest Service, Tongass GIS data.

Table 3

Contaminant Source Inventory and Risk Ranking for Greens Creek Mining Company Sources of Nitrates/Nitrites

PWSID 113560.001

Contaminant Source Type	***Contaminant Source ID***	***CS ID tag***	***Zone***	***Risk Ranking for Analysis***	***Map Number***	***Comments***
Highways and roads, dirt/gravel	X24	X24-1	A	Low	2	From U.S. Forest Service, Tongass GIS data.

Table 4

Contaminant Source Inventory and Risk Ranking for Greens Creek Mining Company Sources of Volatile Organic Chemicals

PWSID 113560.001

Contaminant Source Type	***Contaminant Source ID***	***CS ID tag***	***Zone***	***Risk Ranking for Analysis***	***Map Number***	***Comments***
Highways and roads, dirt/gravel	X24	X24-1	A	Low	2	From U.S. Forest Service, Tongass GIS data.

Table 5

Contaminant Source Inventory and Risk Ranking for Greens Creek Mining Company Sources of Heavy Metals, Cyanide and Other Inorganic Chemicals

PWSID 113560.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Highways and roads, dirt/gravel	X24	X24-1	A	Low	2	From U.S. Forest Service, Tongass GIS data.

Table 6

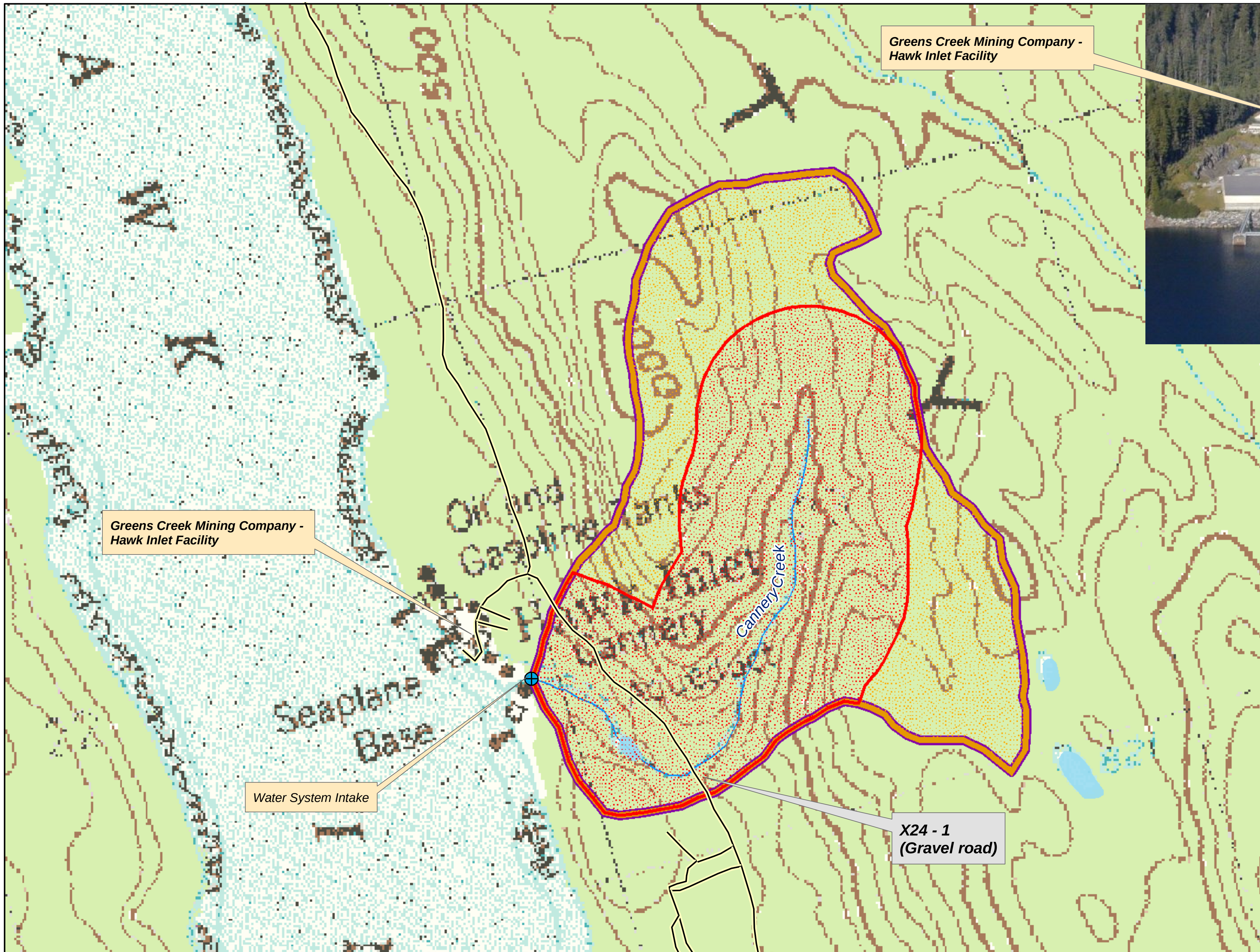
Contaminant Source Inventory and Risk Ranking for Greens Creek Mining Company Sources of Other Organic Chemicals

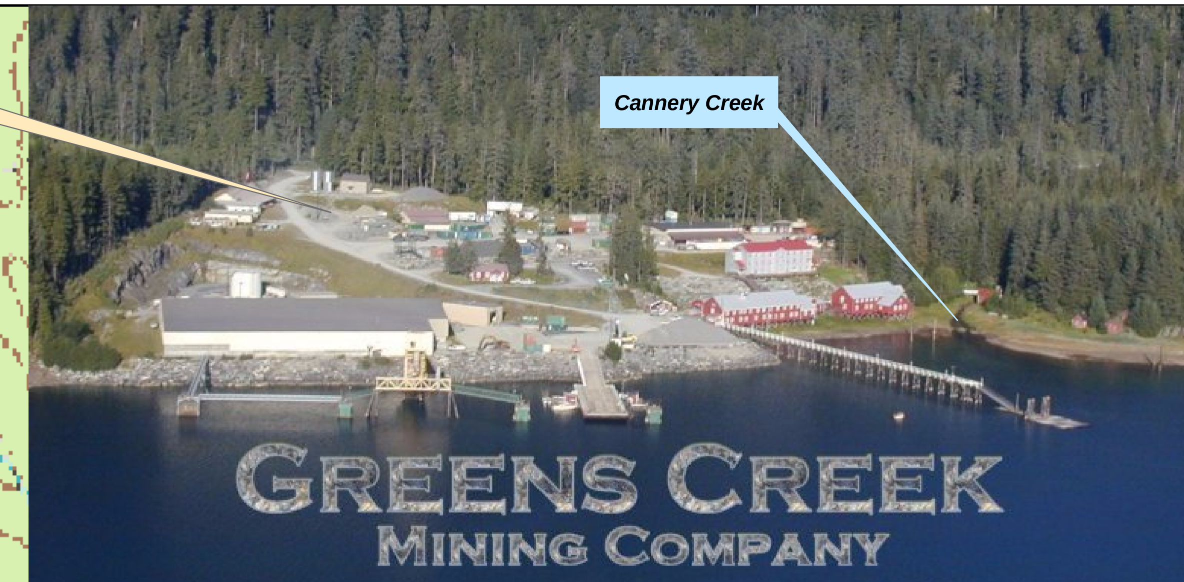
PWSID 113560.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Highways and roads, dirt/gravel	X24	X24-1	A	Low	2	From U.S. Forest Service, Tongass GIS data.

APPENDIX C

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





Map 2: Potential and Existing Contaminant Sources

PWSID: 113560.001

0 500 1,000 2,000 3,000 4,000 Feet

1:12,000

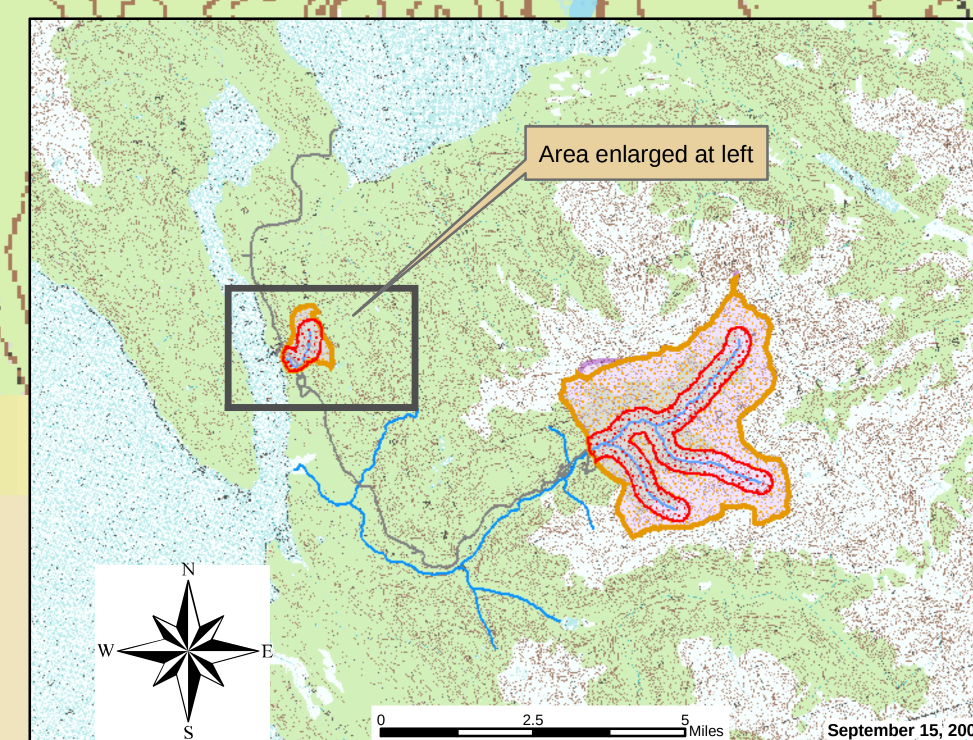
Data Sources:

Hawk Inlet photo - http://www.greenscreek.com/
Background image - USGS 1:63,000 mapping
Lakes, streams, & roads - U.S. Forest Service

Protection zones were delineated based upon streams noted on USGS 1:63,000 mapping.

Legend

- Cannery Creek Intake
- Zone A Protection Area
- Zone B Protection Area
- Zone C Protection Area
- Lake
- Roads
- Stream



September 15, 2003

APPENDIX D

Vulnerability Analysis and Contaminant Risks
(Charts 1-13)

Chart 1. Susceptibility of the Surface Water Source - Greens Creek Mining, Hawk Inlet Facility

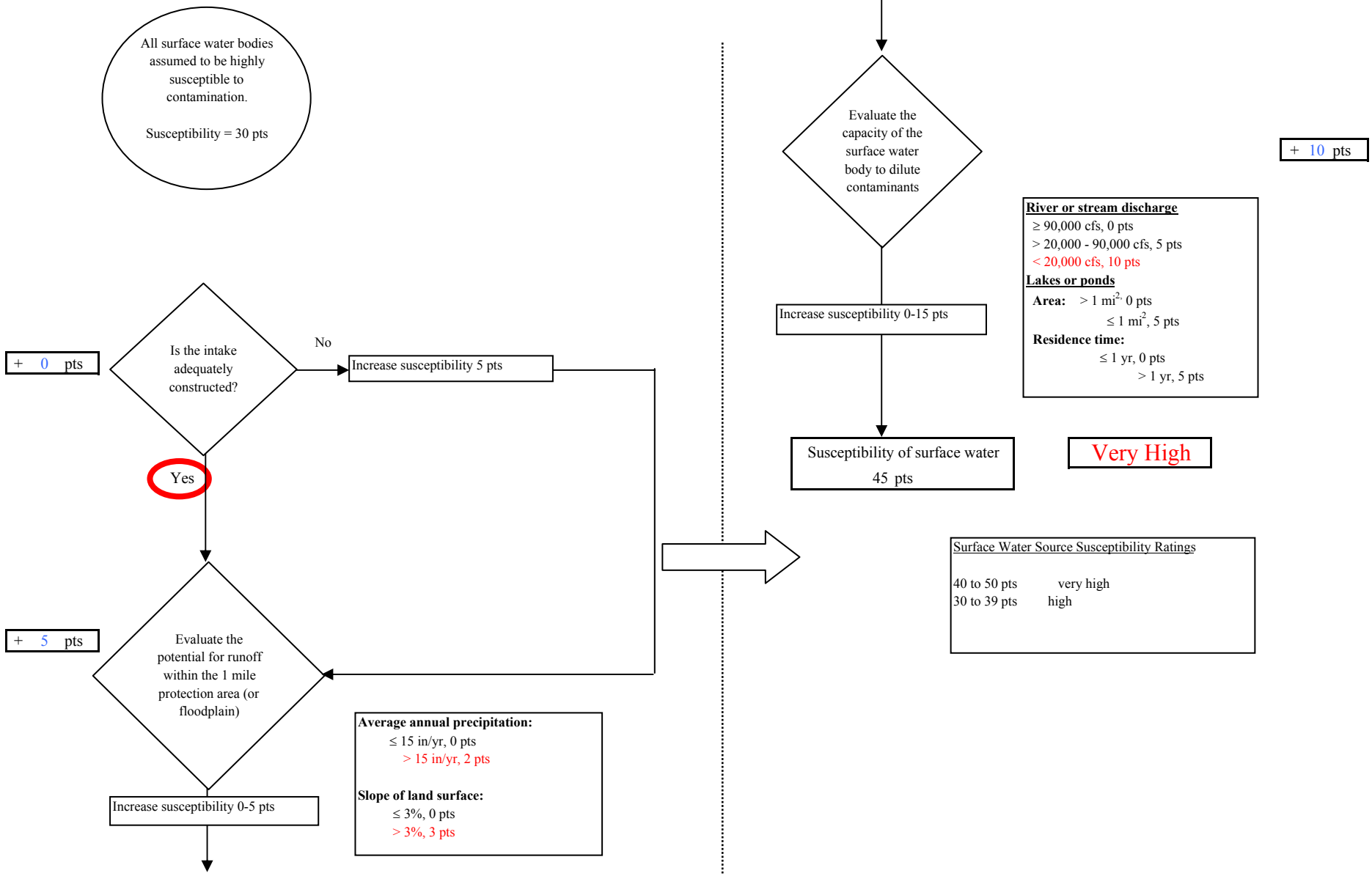
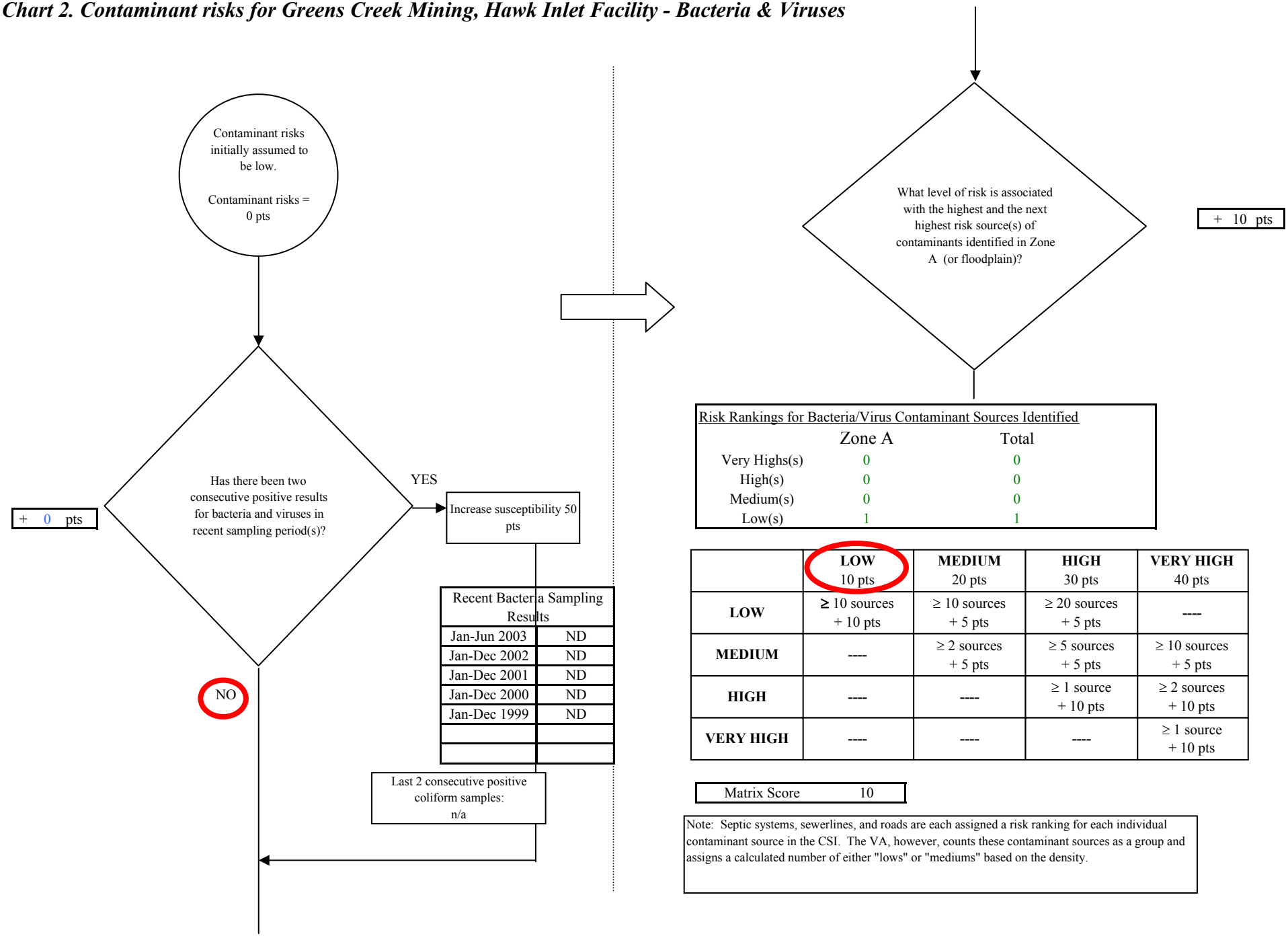


Chart 2. Contaminant risks for Greens Creek Mining, Hawk Inlet Facility - Bacteria & Viruses



Risk Rankings for Bacteria/Virus Contaminant Sources Identified

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

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

Matrix Score 10

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

Chart 2. Contaminant risks for Greens Creek Mining, Hawk Inlet Facility - Bacteria & Viruses

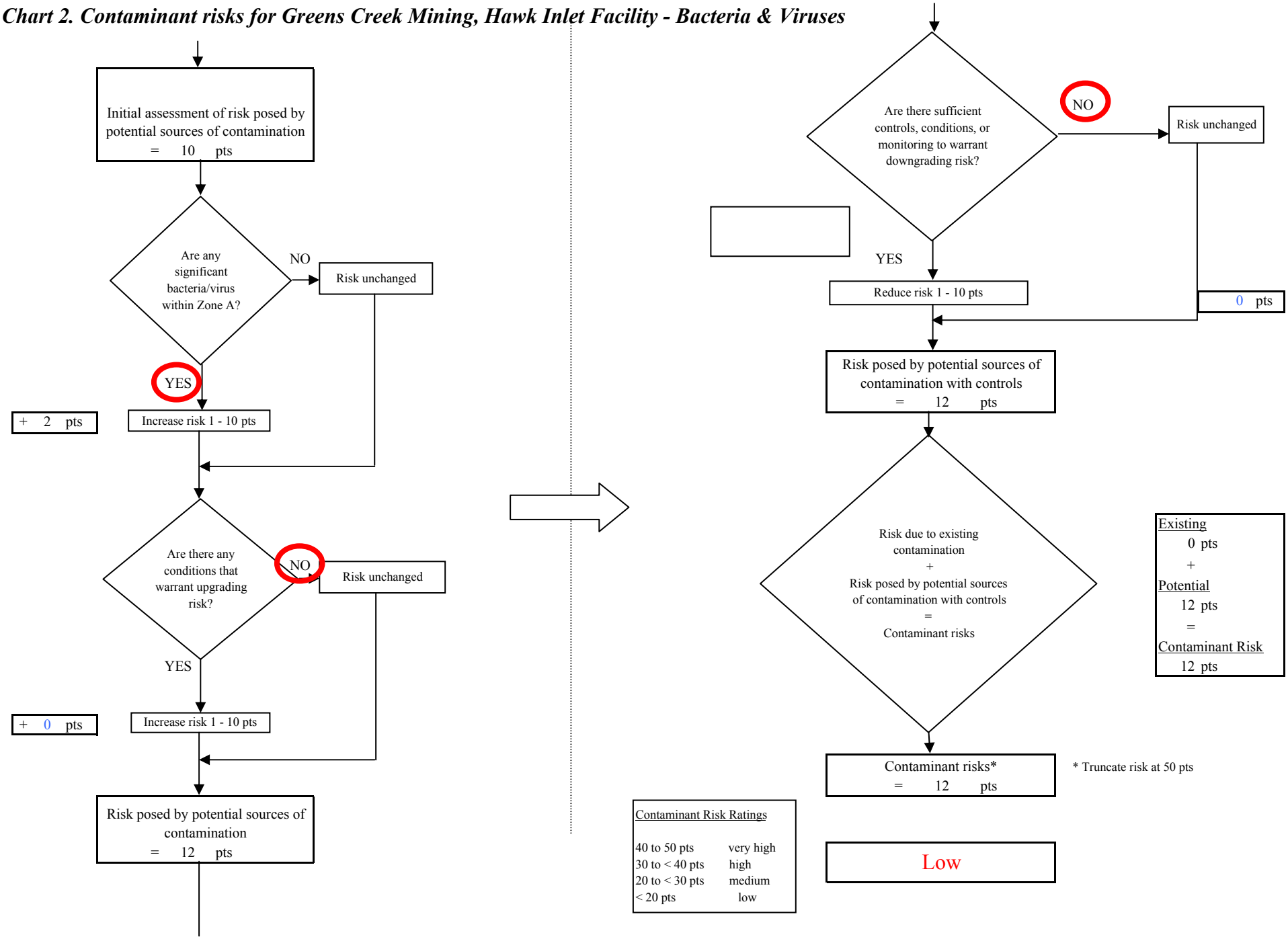


Chart 3. Vulnerability analysis for Greens Creek Mining, Hawk Inlet Facility - Bacteria & Viruses

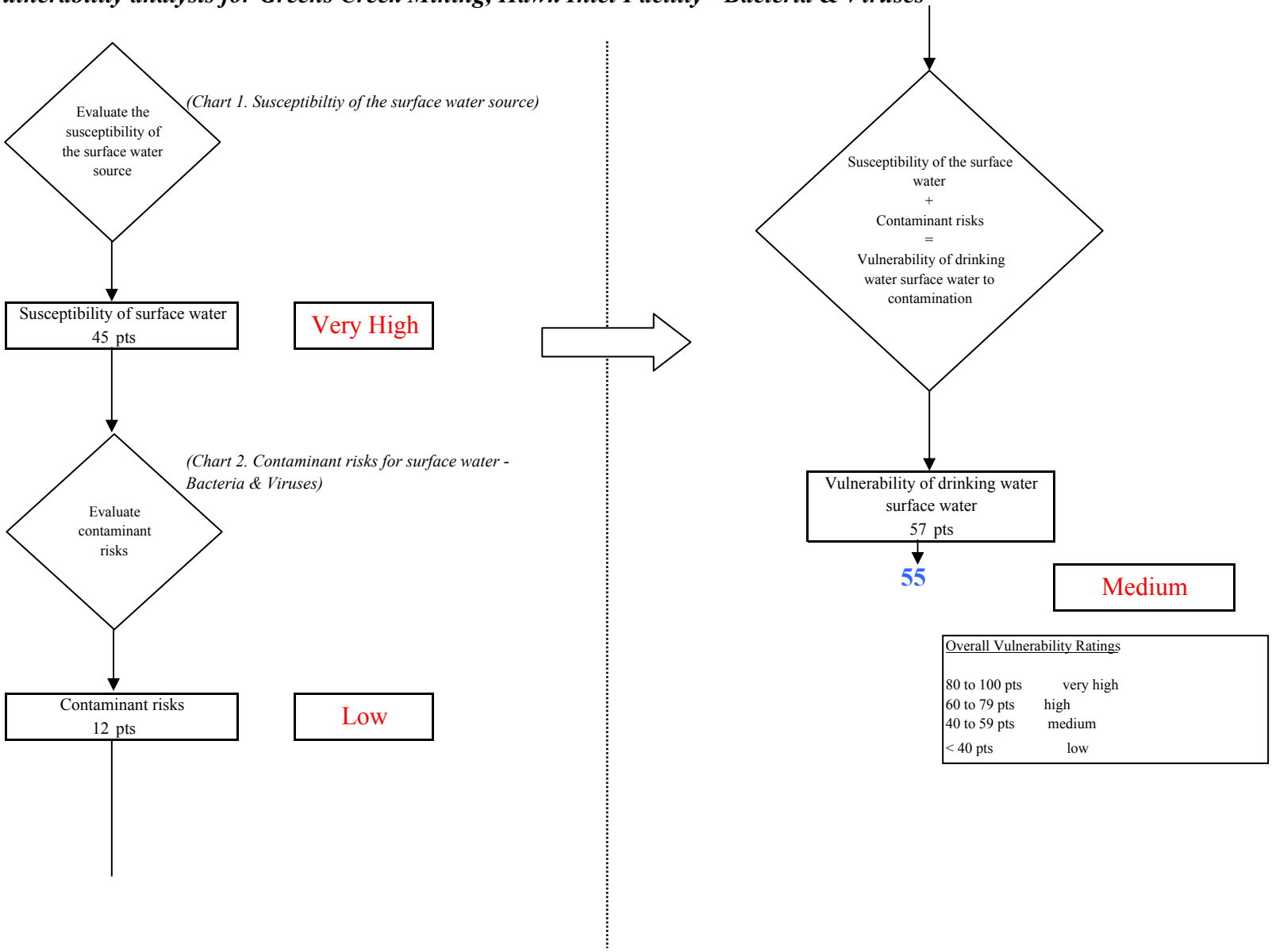


Chart 4. Contaminant risks for Greens Creek Mining, Hawk Inlet Facility - Nitrates and Nitrites

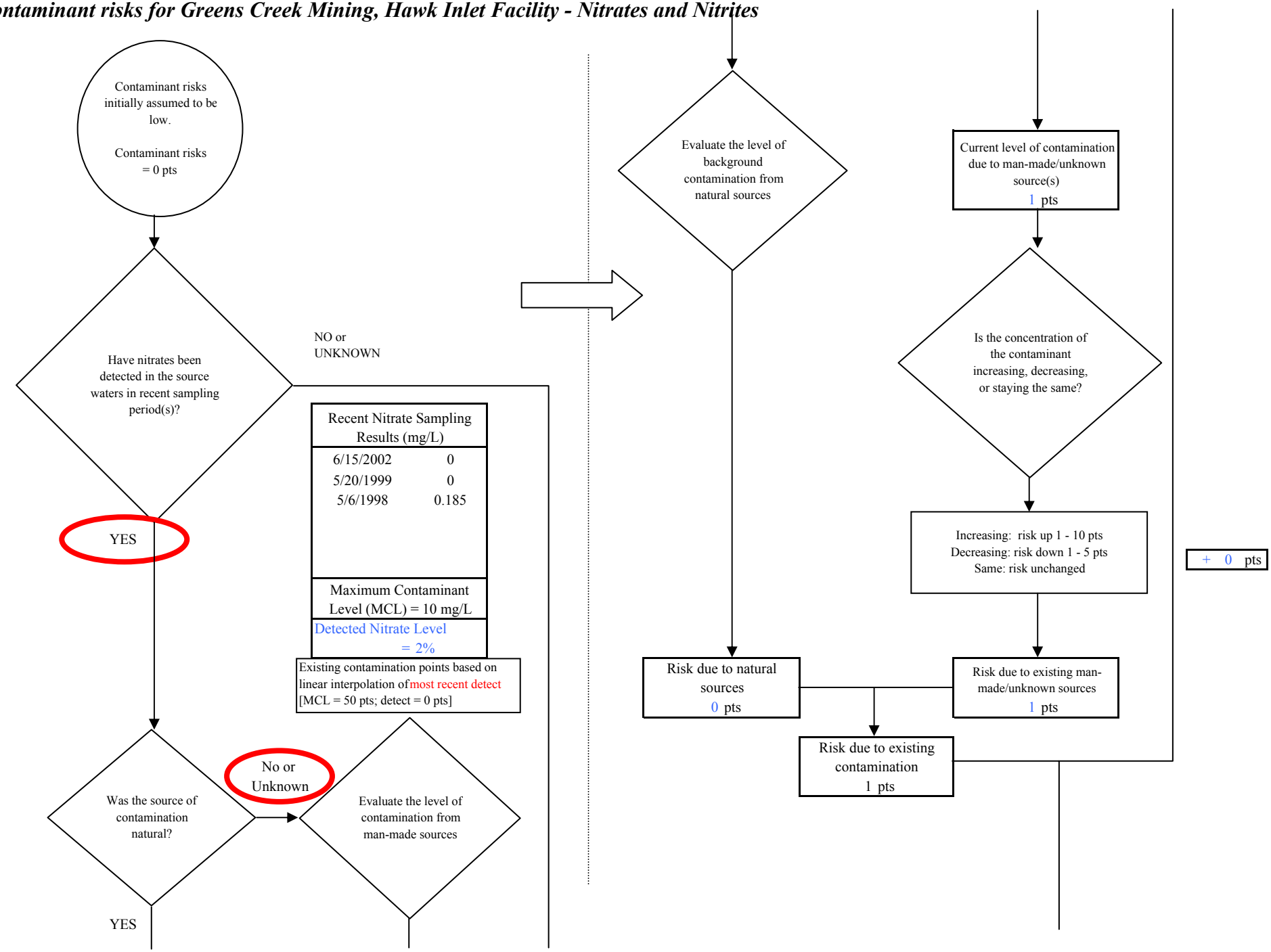


Chart 4. Contaminant risks for Greens Creek Mining, Hawk Inlet Facility - Nitrates and Nitrites

+ 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

Are any significant nitrate/nitrite sources in Zone A?

NO → Risk unchanged

YES → Increase risk 1 - 10 pts

+ 2 pts

Risk Levels for Nitrate/Nitrite 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)	1		1

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

Matrix Score 10

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

Chart 4. Contaminant risks for Greens Creek Mining, Hawk Inlet Facility - Nitrates and Nitrites

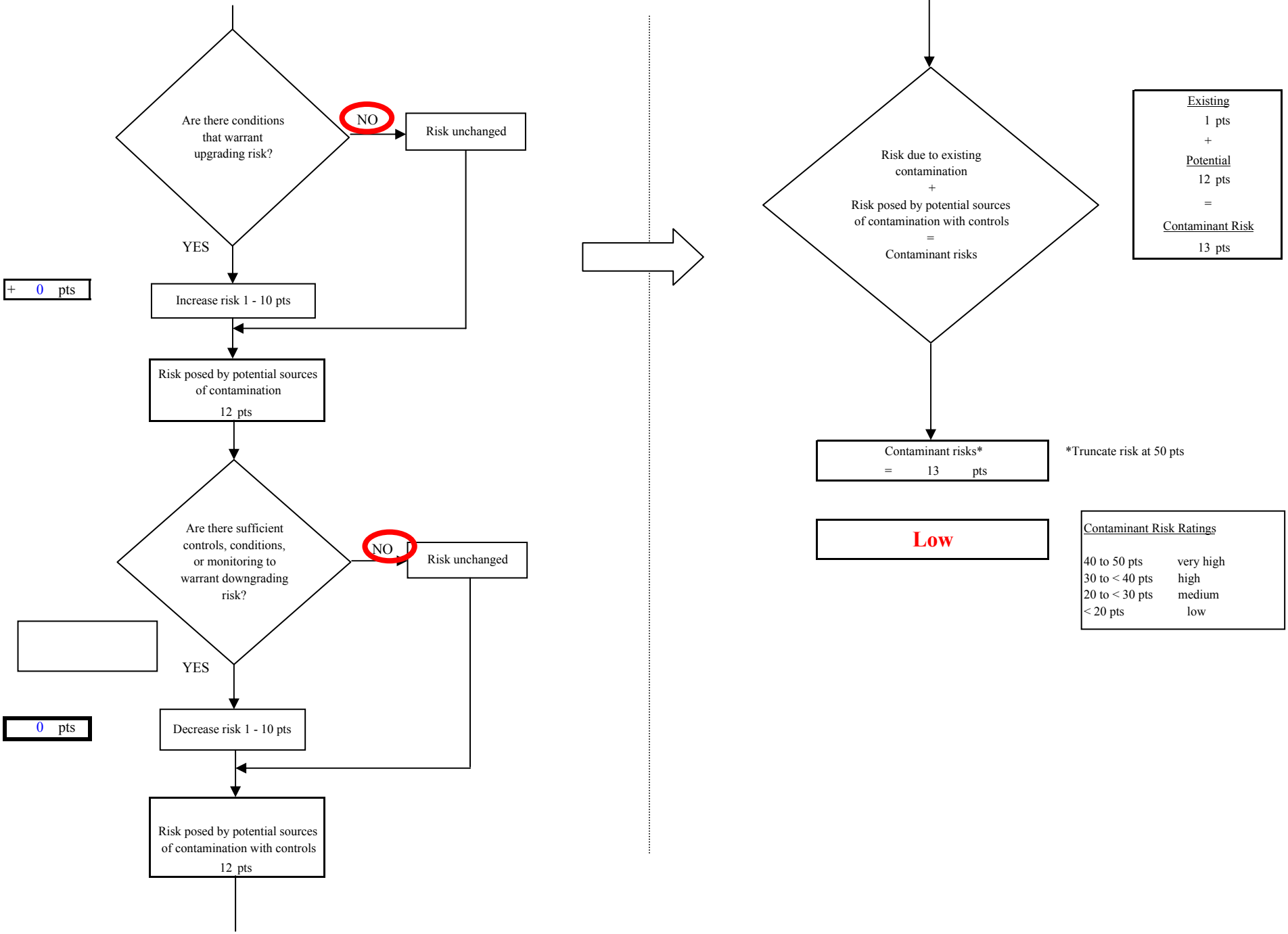


Chart 5. Vulnerability analysis for Greens Creek Mining, Hawk Inlet Facility - Nitrates and Nitrites

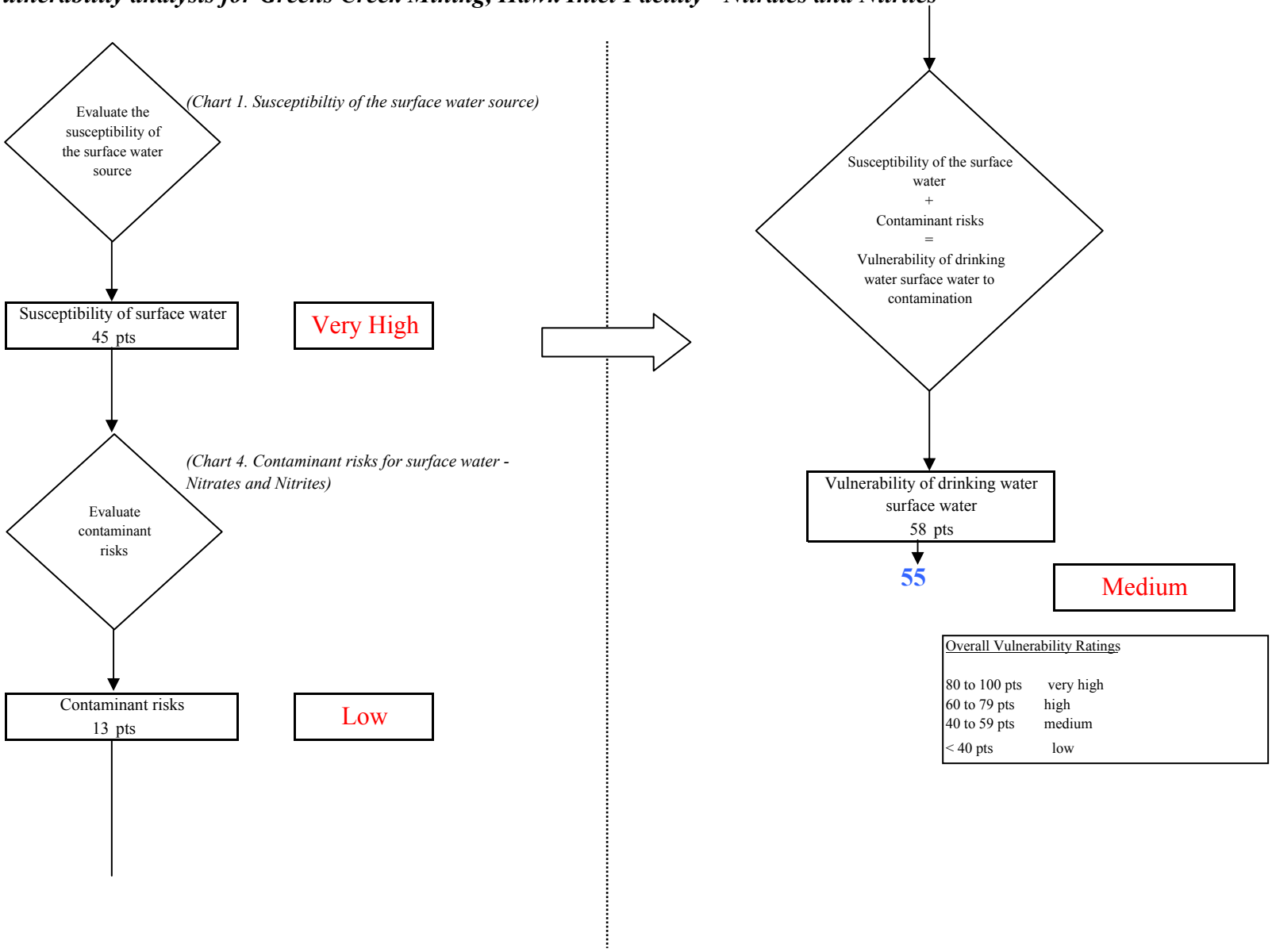


Chart 6. Contaminant risks for Greens Creek Mining, Hawk Inlet Facility - Volatile Organic Chemicals

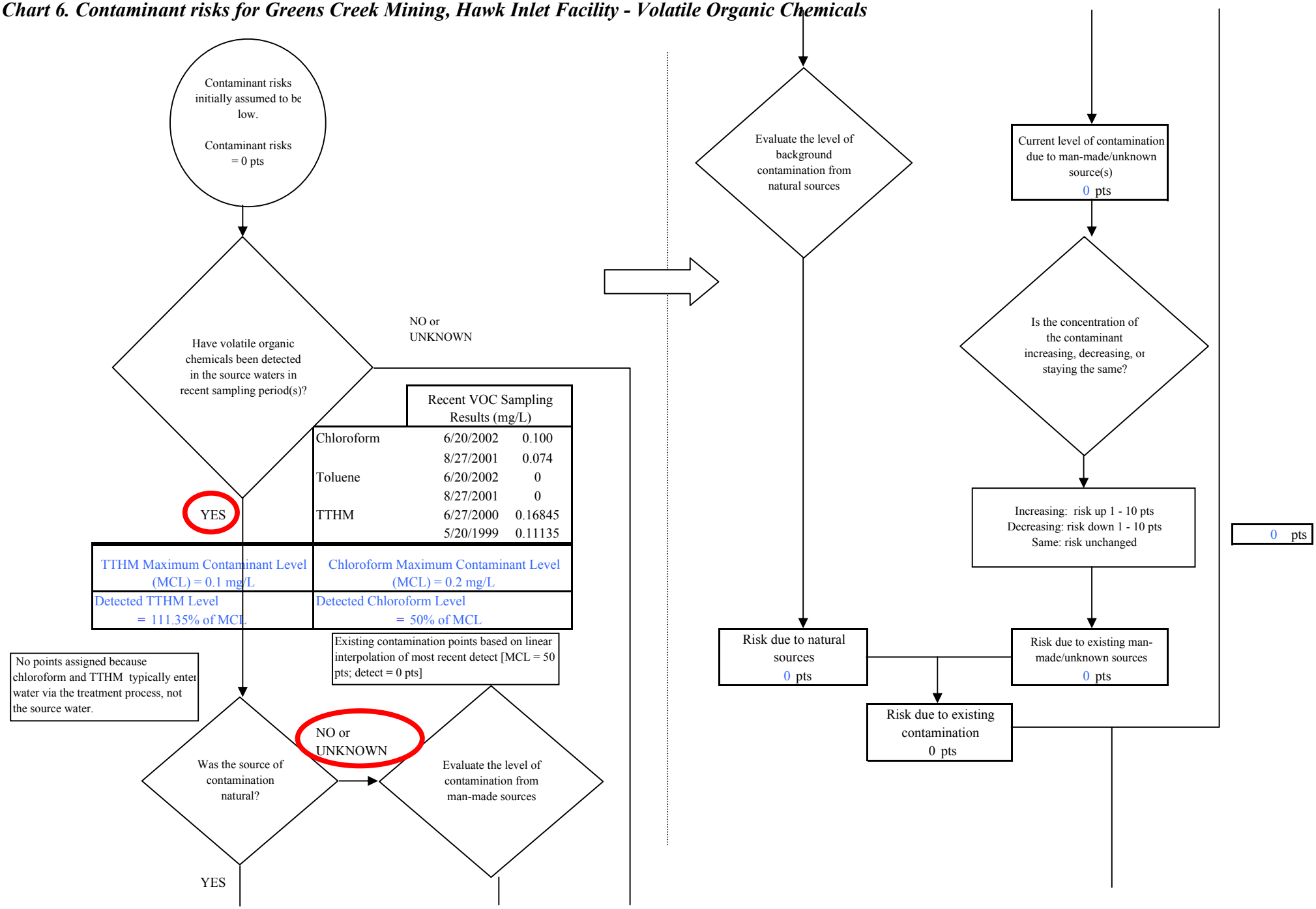
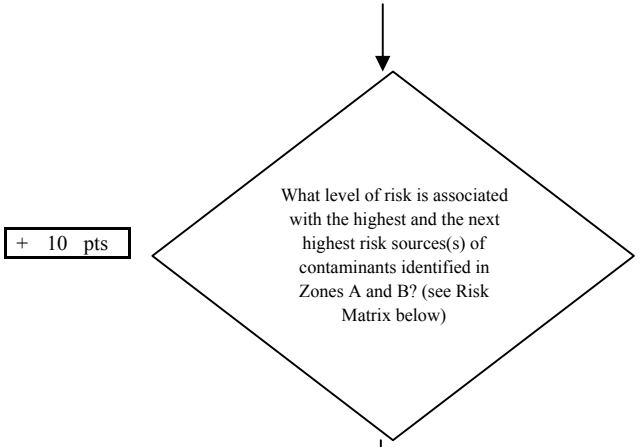


Chart 6. Contaminant risks for Greens Creek Mining, Hawk Inlet Facility - Volatile Organic Chemicals



+ 10 pts

Risk Levels for VOC 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)	1		1

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

Matrix Score 10

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

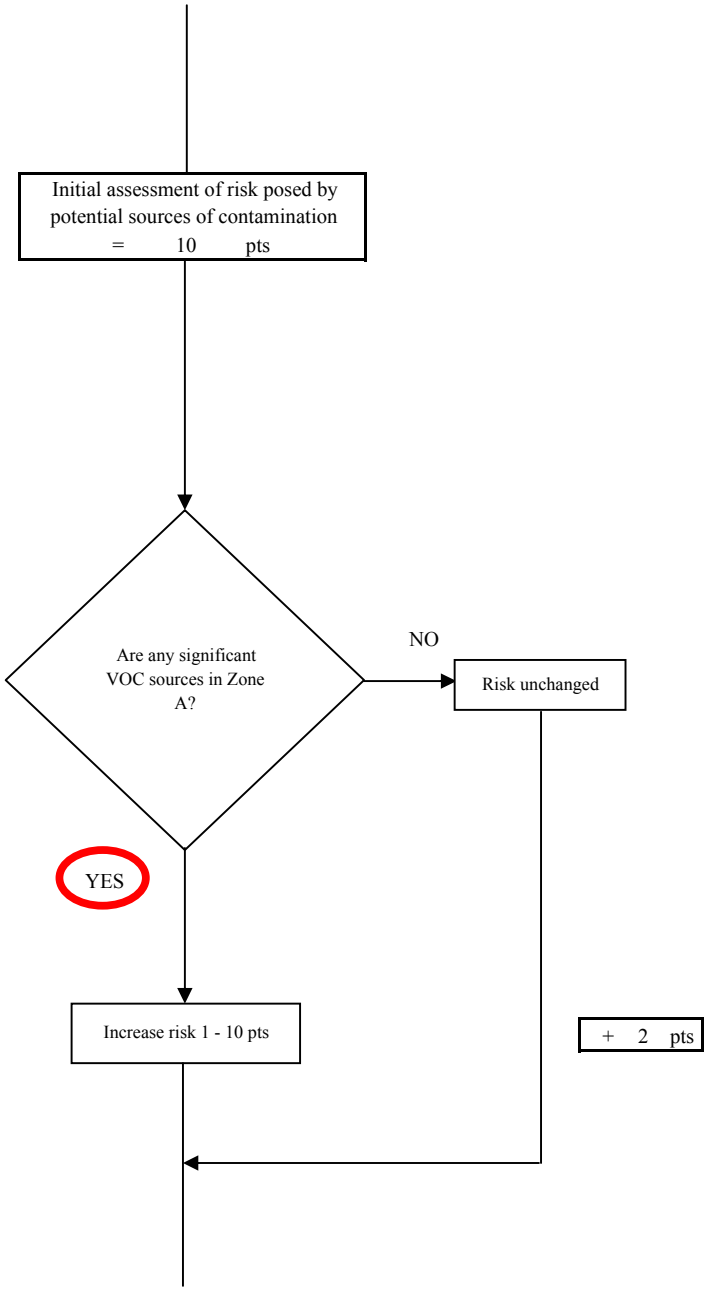


Chart 6. Contaminant risks for Greens Creek Mining, Hawk Inlet Facility - Volatile Organic Chemicals

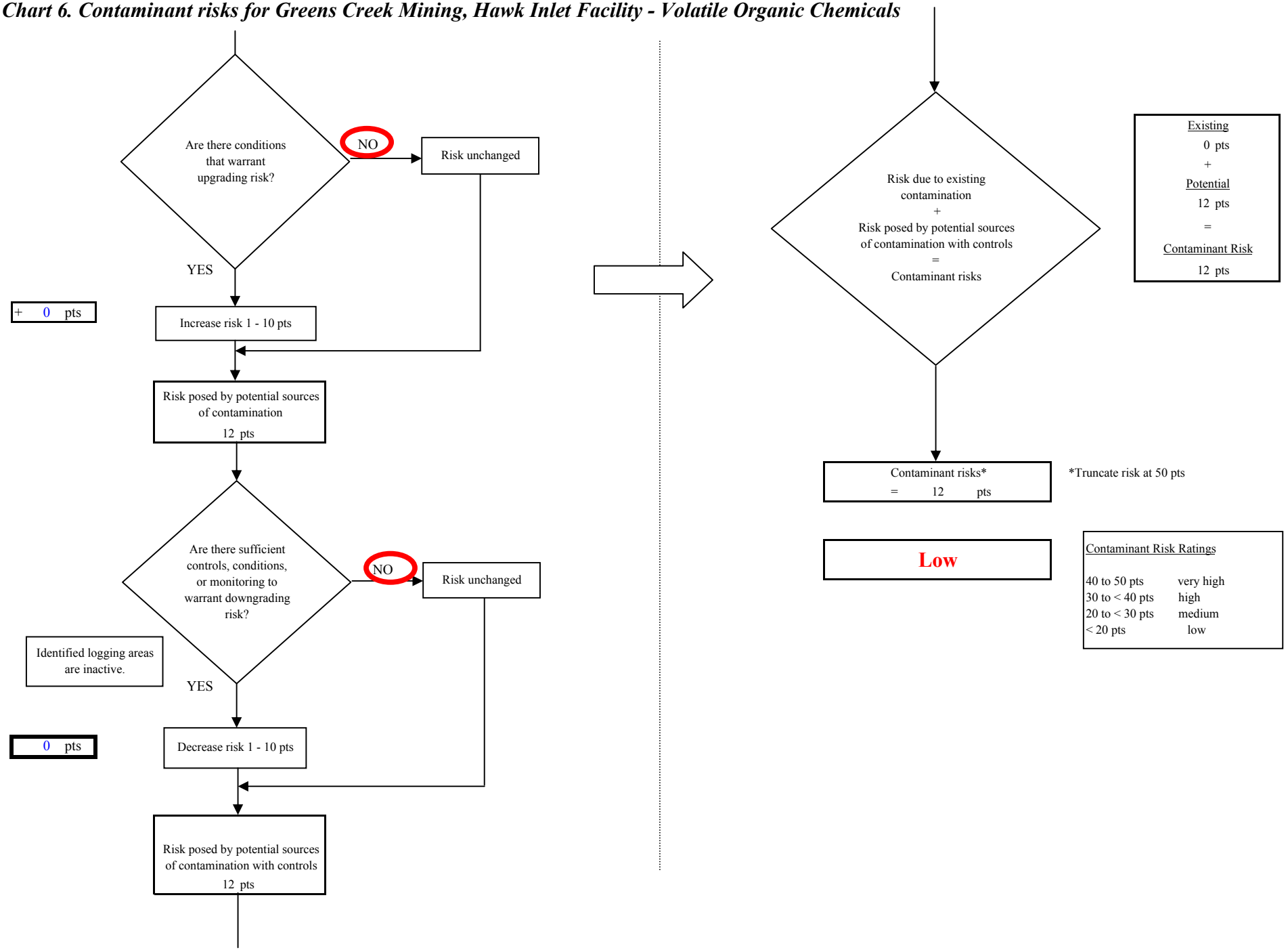


Chart 7. Vulnerability analysis for Greens Creek Mining, Hawk Inlet Facility - Volatile Organic Chemicals

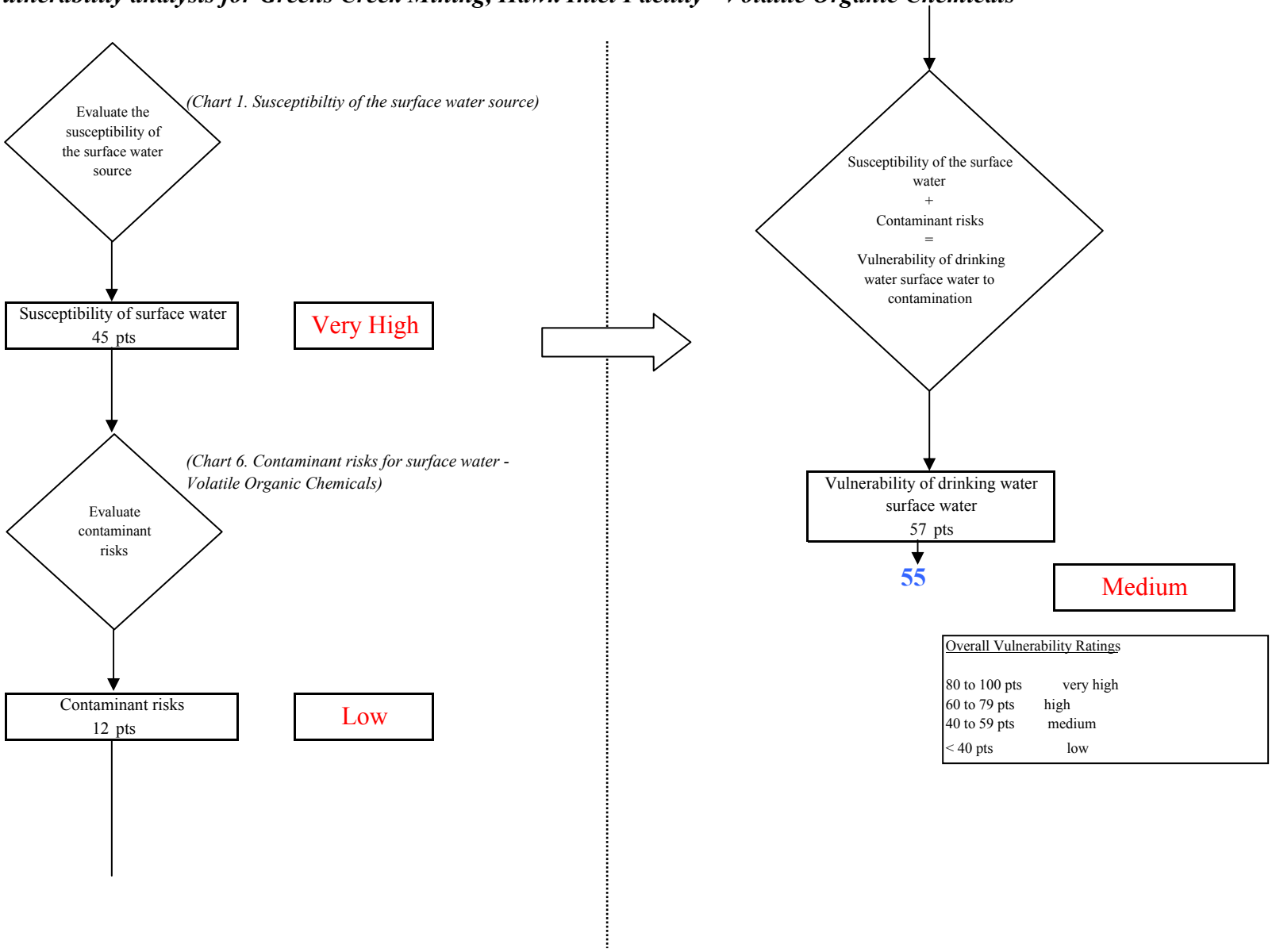


Chart 8. Contaminant risks for Greens Creek Mining, Hawk Inlet Facility - Heavy Metals, Cyanide and Other Inorganic Chemicals

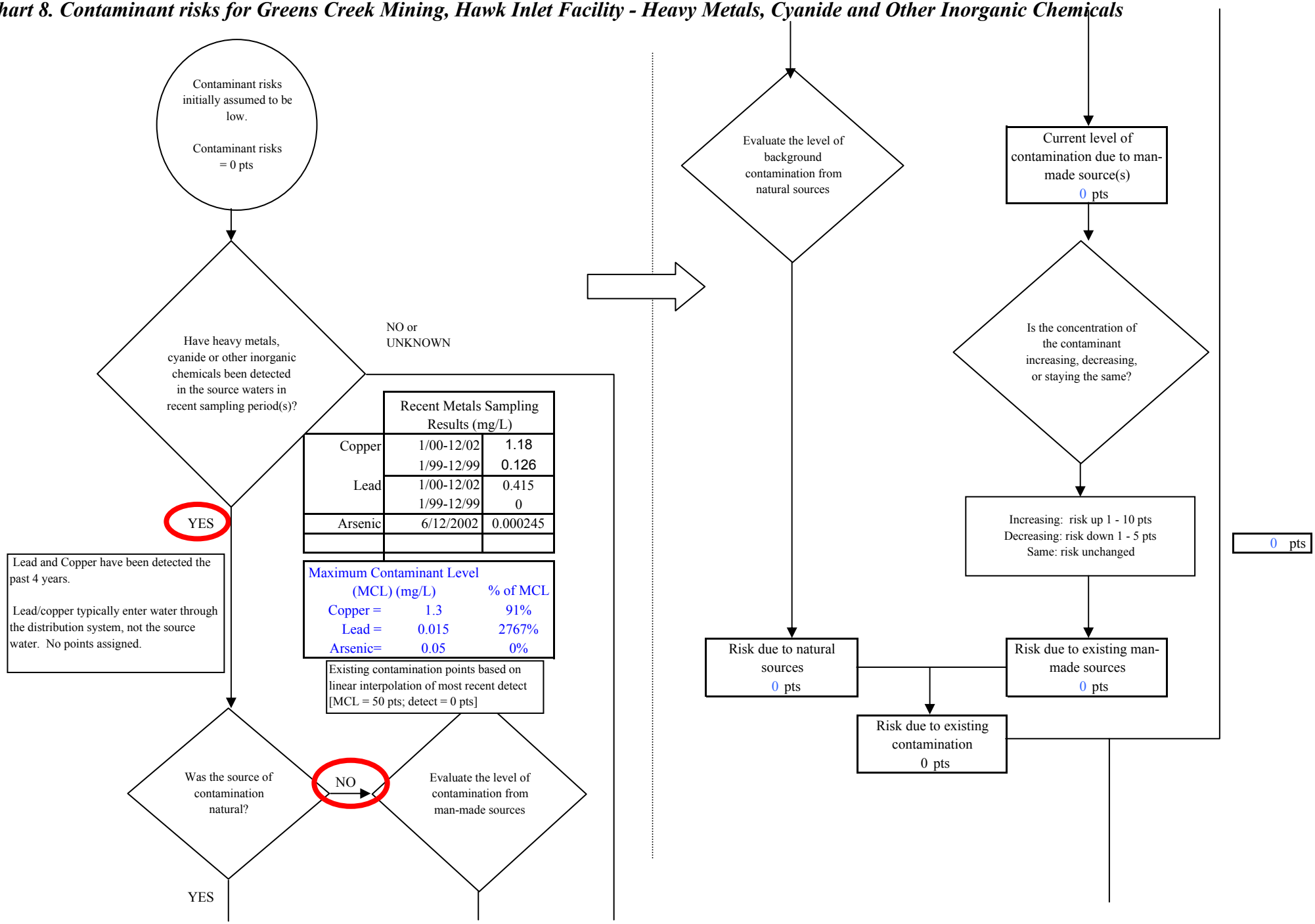


Chart 8. Contaminant risks for Greens Creek Mining, Hawk Inlet Facility - Heavy Metals, Cyanide and Other Inorganic Chemicals

+ 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

Are any significant HM, Cyanide, or OIC sources in Zone A?

NO → Risk unchanged

YES → Increase risk 1 - 10 pts

+ 2 pts

Risk Levels for HM, Cyanide, or OIC 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)	1		1

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

Matrix Score 10

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

Chart 8. Contaminant risks for Greens Creek Mining, Hawk Inlet Facility - Heavy Metals, Cyanide and Other Inorganic Chemicals

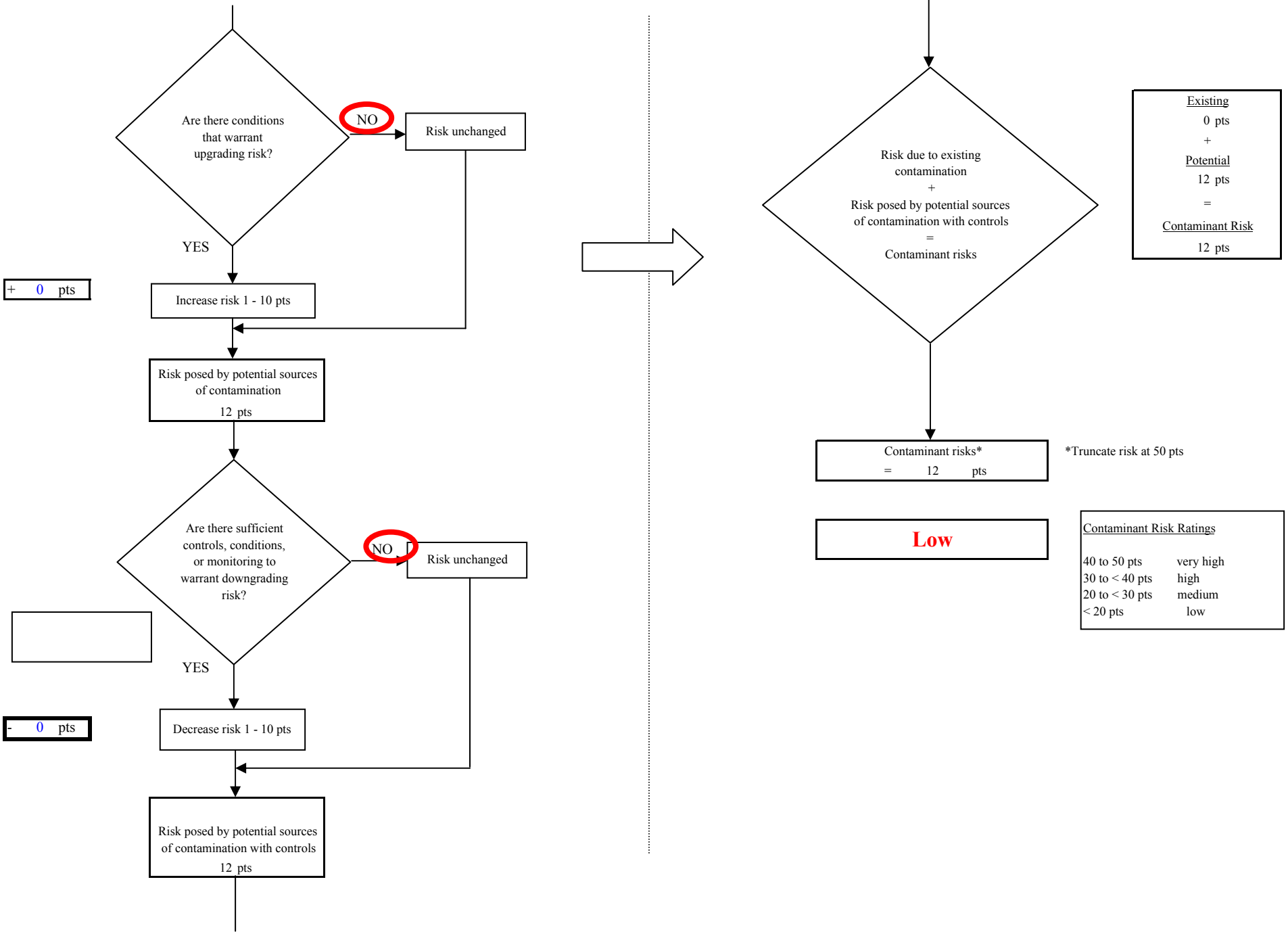


Chart 9. Vulnerability analysis for Greens Creek Mining, Hawk Inlet Facility - Heavy Metals, Cyanide and Other Inorganic Chemicals

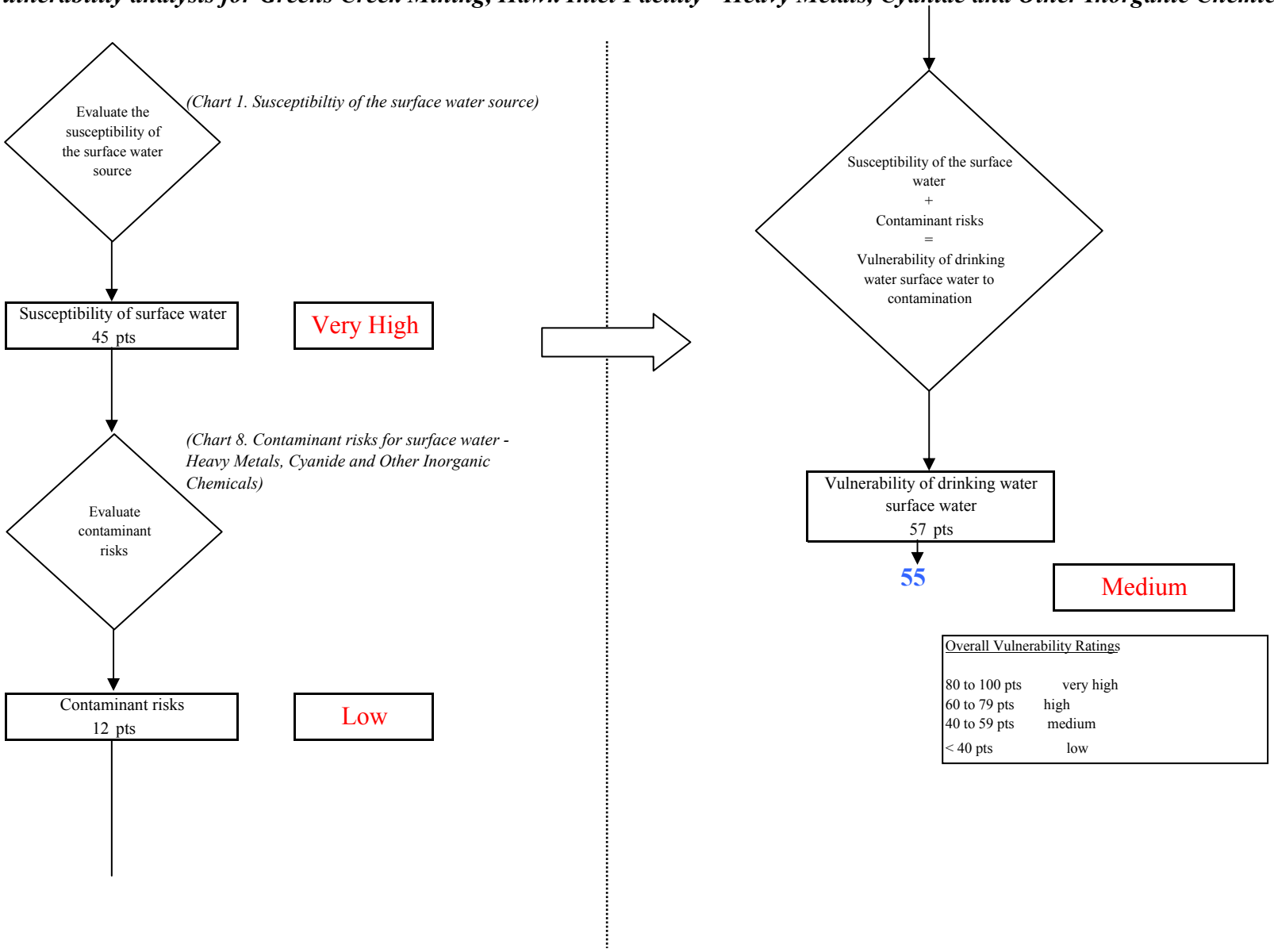


Chart 10. Contaminant risks for Greens Creek Mining, Hawk Inlet Facility - Synthetic Organic Chemicals

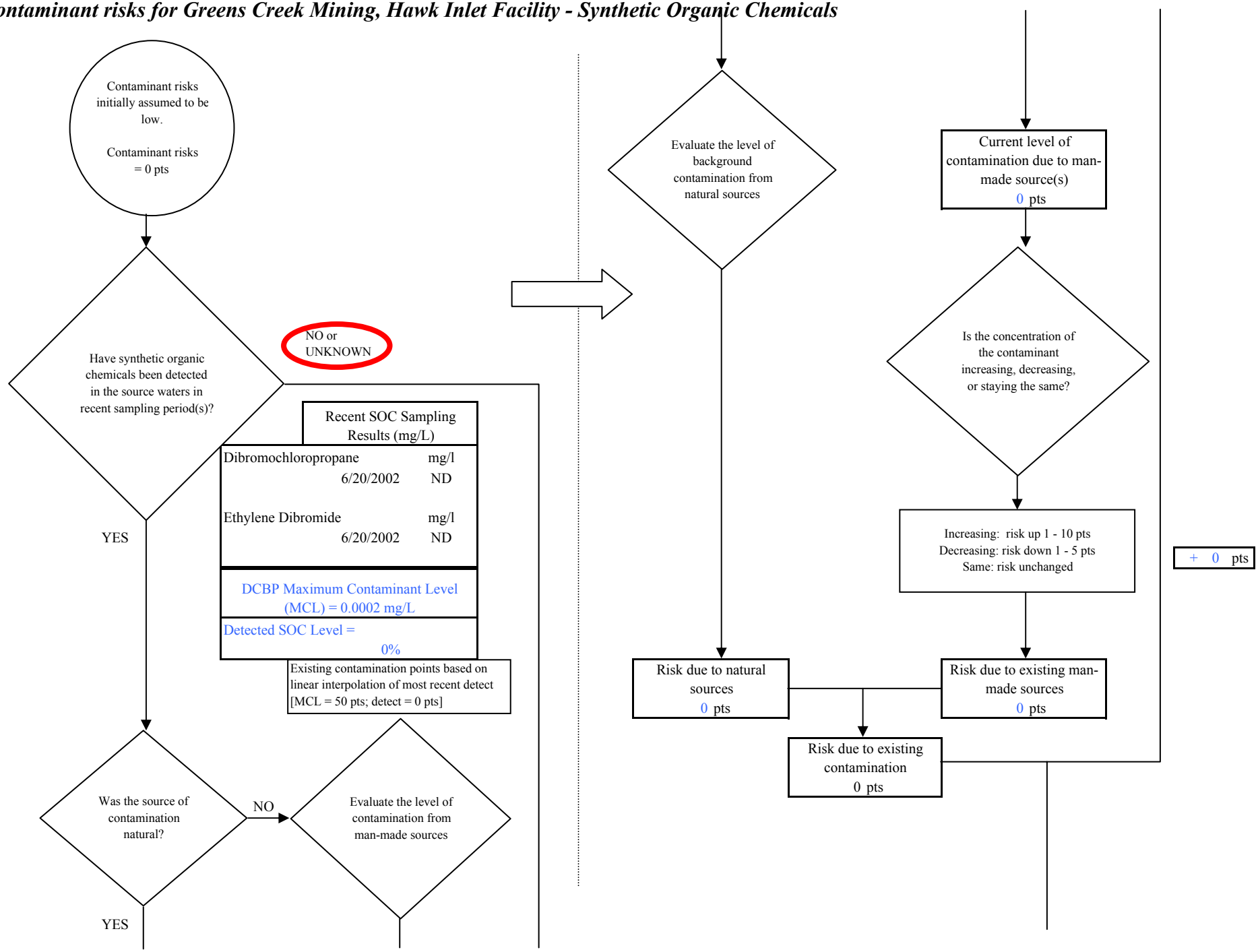
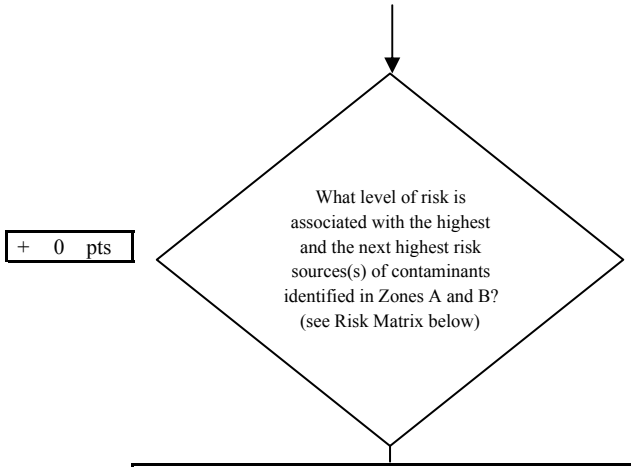


Chart 10. Contaminant risks for Greens Creek Mining, Hawk Inlet Facility - Synthetic Organic Chemicals



+ 0 pts

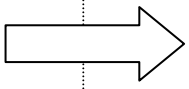
Risk Levels for SOC Sources identified in Zones A and C

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

	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 0

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.



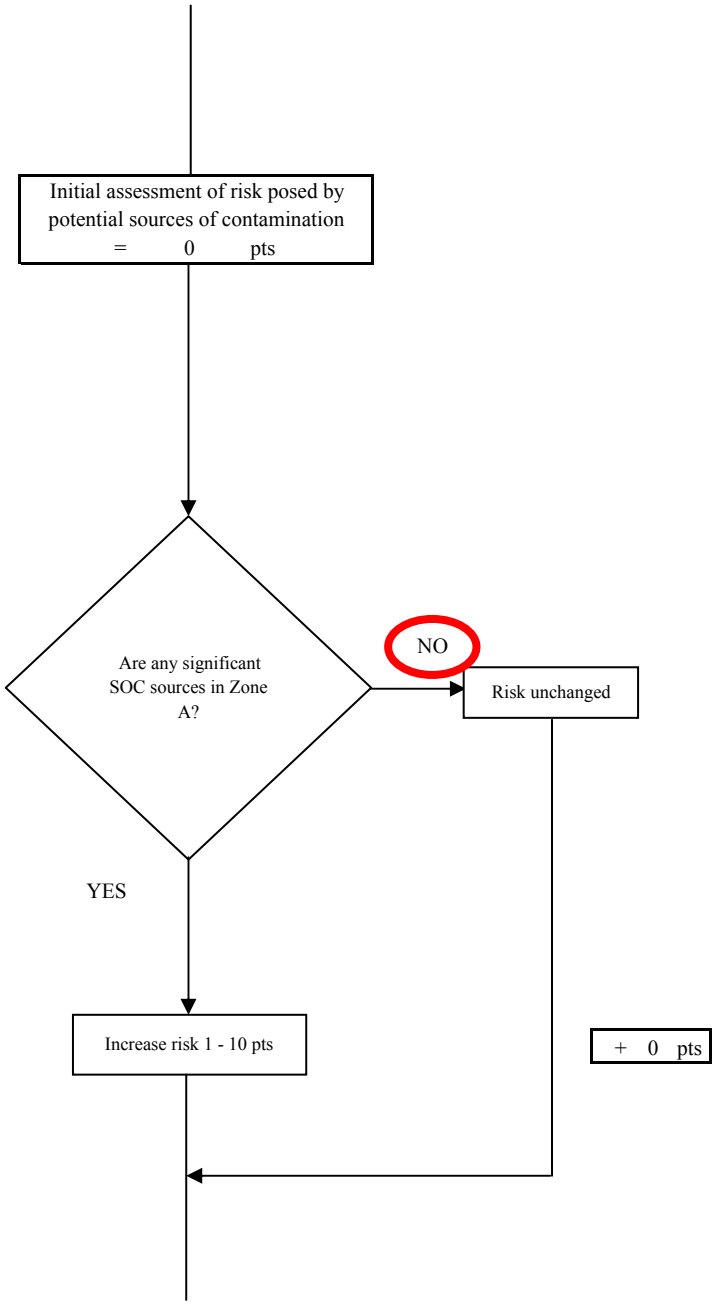


Chart 10. Contaminant risks for Greens Creek Mining, Hawk Inlet Facility - Synthetic Organic Chemicals

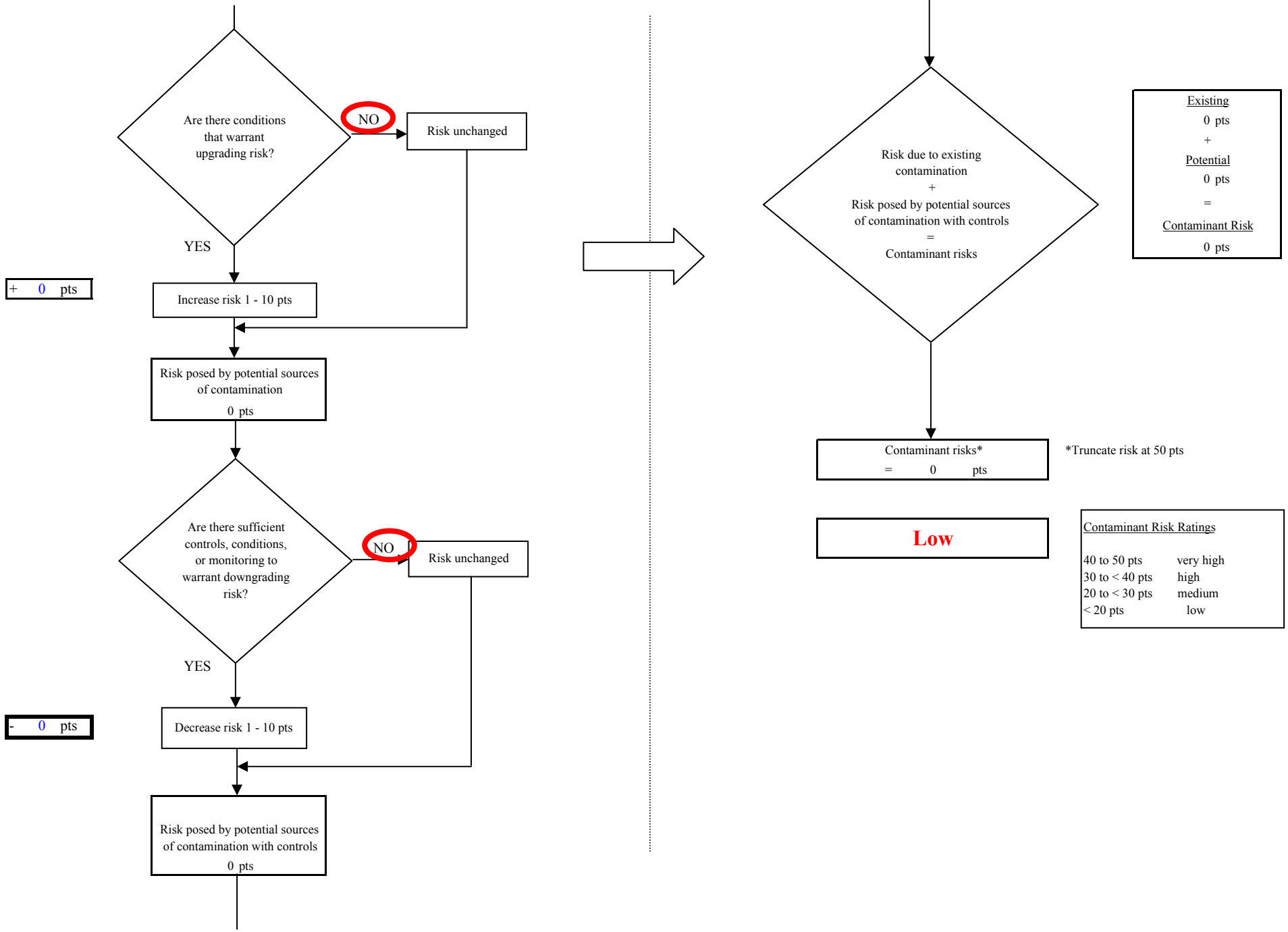


Chart 11. Vulnerability analysis for Greens Creek Mining, Hawk Inlet Facility - Synthetic Organic Chemicals

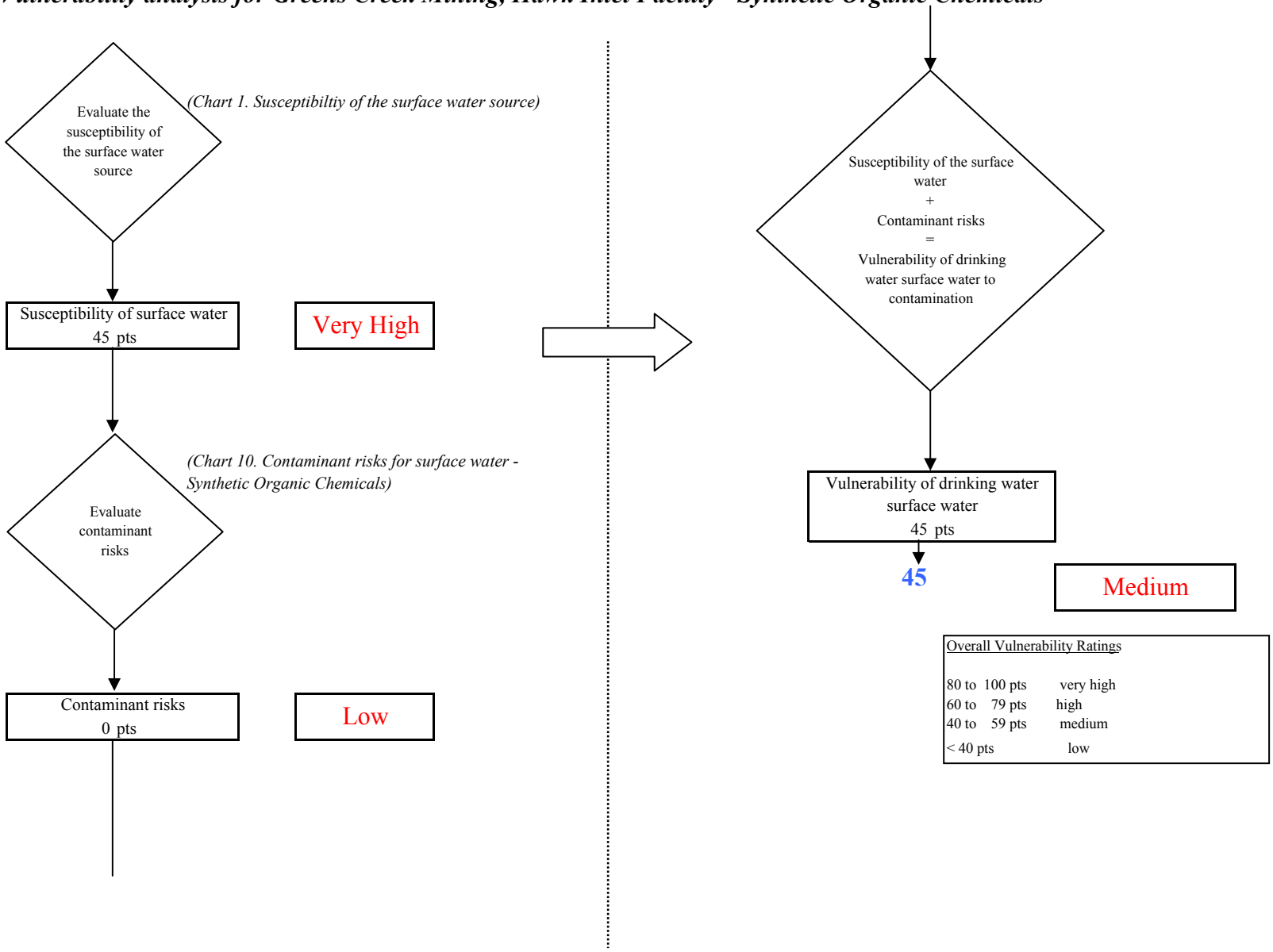


Chart 12. Contaminant risks for Greens Creek Mining, Hawk Inlet Facility - Other Organic Chemicals

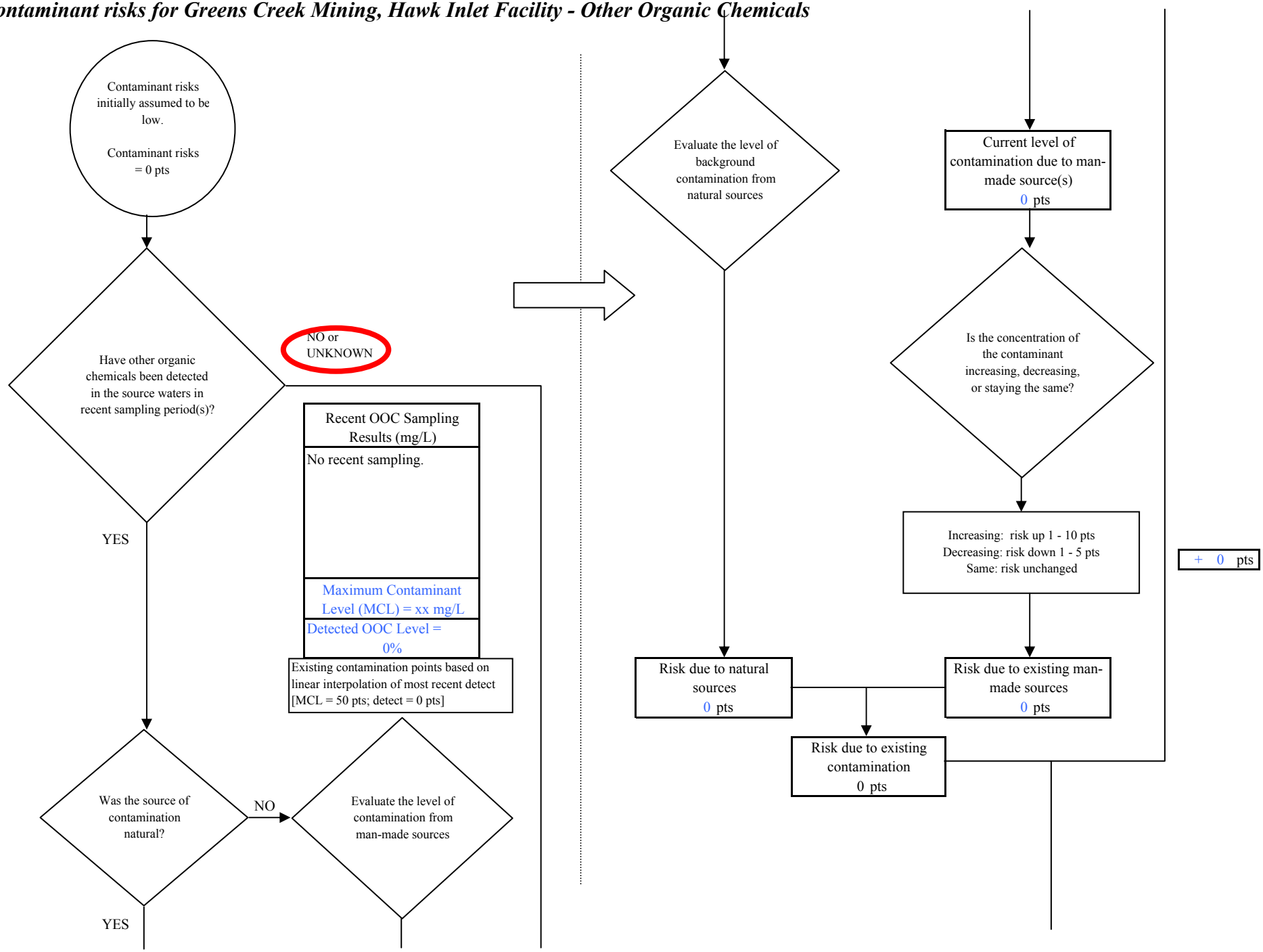
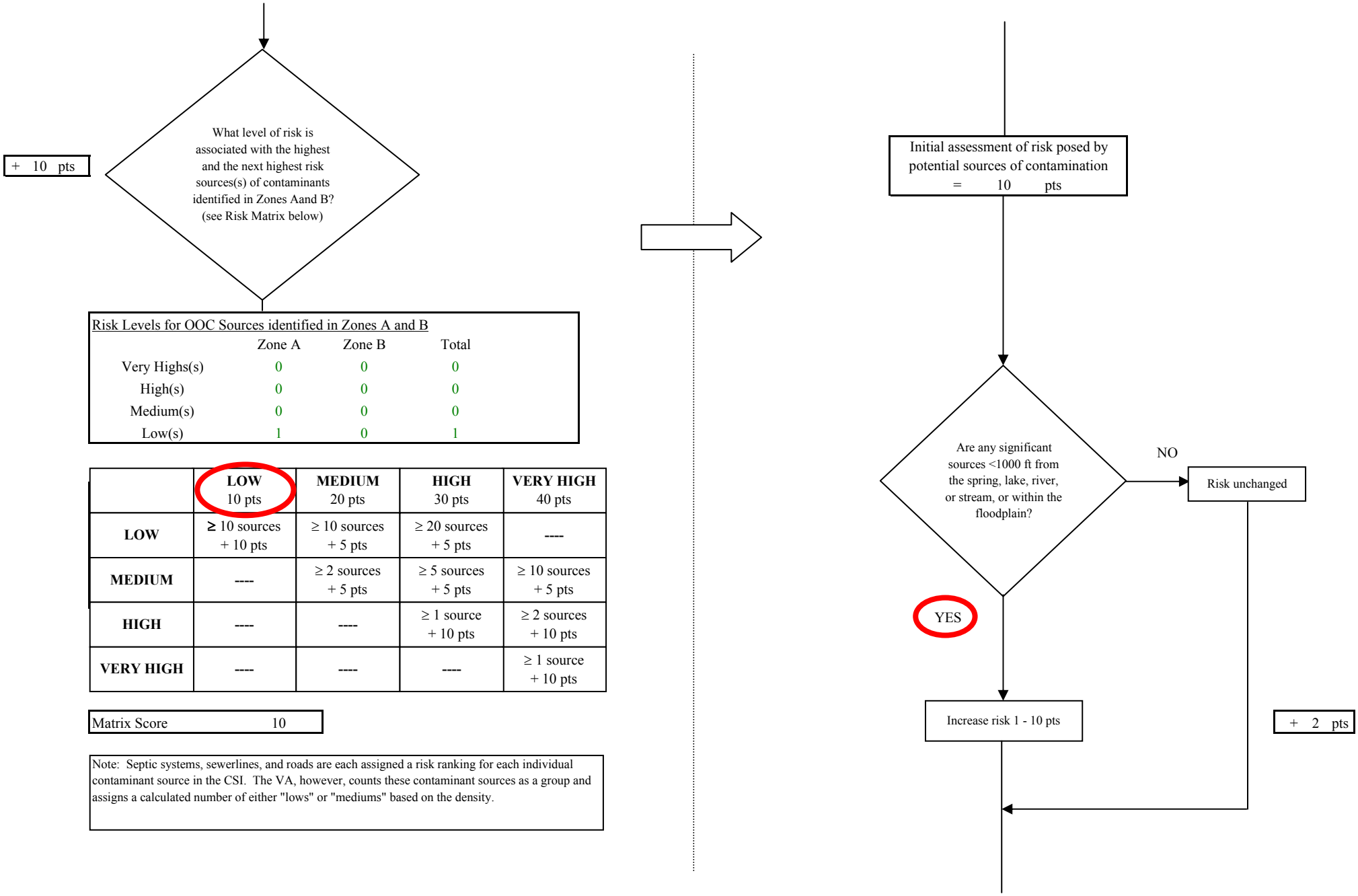


Chart 12. Contaminant risks for Greens Creek Mining, Hawk Inlet Facility - Other Organic Chemicals



Risk Levels for OOC Sources identified in Zones A and B

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

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

Matrix Score 10

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

Chart 12. Contaminant risks for Greens Creek Mining, Hawk Inlet Facility - Other Organic Chemicals

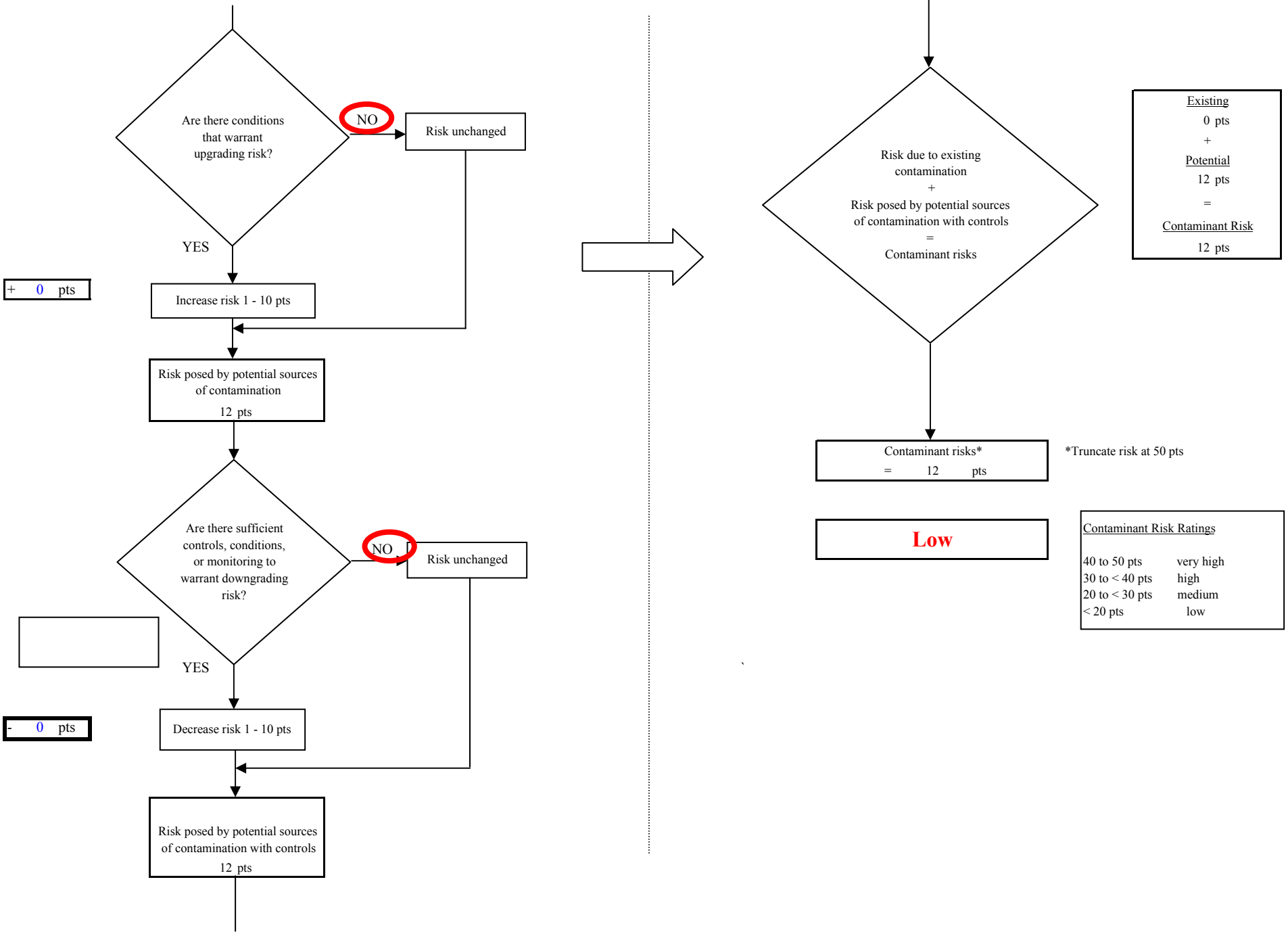


Chart 13. Vulnerability analysis for Greens Creek Mining, Hawk Inlet Facility - Other Organic Chemicals