Source Water Assessment

A Hydrogeologic Susceptibility and Vulnerability Assessment for

The Hutch

Drinking Water System,

Cooper Landing, Alaska

PWSID # 248315.001

DRINKING WATER PROTECTION PROGRAM REPORT # 384
Alaska Department of Environmental Conservation

Source Water Assessment for The Hutch Drinking Water System, Cooper Landing, Alaska PWSID # 248315.001

By URS Corporation

DRINKING WATER PROTECTION PROGRAM REPORT # 384

CONTENTS

TABLES

ILLUSTRATIONS

APPENDICES

Source Water Assessment for The Hutch Source of Public Drinking Water, Cooper Landing, Alaska

By URS Corporation

Drinking Water Protection Program
Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

The Hutch is a Class B (transient/non-community) water system consisting of one well located in Cooper Landing, Alaska. Identified potential and current sources of contaminants for The Hutch public drinking water source include: 12.55 acres of residential areas and logging activities. 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 The Hutch received a vulnerability rating of **Medium** for nitrates and nitrites, bacteria and viruses, and volatile organic chemicals.

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. URS Corporation has been contracted to perform these assessments under the supervision of ADEC.

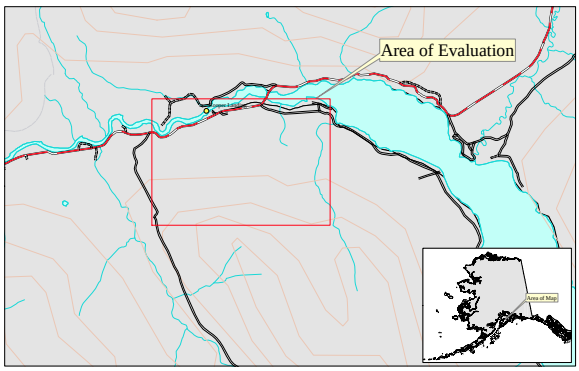
This source water assessment combines a review of the natural conditions at the site and the potential and existing contaminant risks. These are combined to determine the overall vulnerability of the drinking water source to contamination.

DESCRIPTION OF COOPER LANDING, ALASKA

Location

Cooper Landing is part of the Kenai Peninsula Borough, which is located directly south of the city of Anchorage. The borough encompasses 25,600 square miles, only 15,700 square miles, which is land. (Kenai Peninsula Borough, 2002) The Kenai Peninsula is broken into two distinct geographic areas; the Kenai Mountains and the Kenai Lowland. Towns located within the Kenai Mountains include Moose Pass, Cooper Landing, Crown Point, and Seward. The Kenai Lowlands are located in the west and comprise about 2,900 square miles and include the towns of Sterling, Soldotna, Kenai, Clam Gulch, Ninilchik and Homer. Two main highways divide the peninsula; the Seward Highway begins in Anchorage and ends in Seward, connecting the Turnagain Arm to the peninsula. The Sterling Highway splits off from Seward Highway at Tern Lake Junction and runs east and west to Kenai, where it then turns south and ends in Homer. The peninsula is bordered by the Prince William Sound in the east, Gulf of Alaska in the south and the Cook Inlet in the west. The Kenai River, located in the Kenai Mountains, is the largest stream within the peninsula, beginning at Kenai Lake and draining into the Cook Inlet through the Kenai Lowlands (*USGS, 1915*).

Figure 1



Glaciers occupied the Kenai Peninsula during the early Quaternary time, however the exact date is unknown. During that time, the entire Kenai Mountains area was covered by a system of glaciers (*USDA, 1962*).

Precipitation

The community of Cooper Landing averages about 20 inches of precipitation every year, with the most precipitation occurring in the fall.

Topography and Drainage

The Kenai Peninsula area topography varies from about 3000 feet to 5000 feet above sea level in the Kenai Mountains, the highest point being about 6,400 feet above sea level. The Kenai Peninsula is dotted with many lakes and small streams, including three large lakes (Kenai Lake, Skilak Lake and Tustumena Lake) and three substantial rivers (Kenai River and Kasilof River) (*USGS, 1915*).

Kenai Lake is a one of the best-known fishing areas in the Kenai Peninsula. It is a popular trout and Dolly Varden fishing area. It is also known for its unusual color, which is caused by glacial silt (*Milepost, 2000*). This lake is located on the Sterling Highway, just after the Tern Lake Junction and before Cooper Landing, approximately 43 miles northeast of Seward. It is the source of the Kenai River at about 470 feet above sea level.

Skilak Lake is larger than Kenai Lake and about 300 feet lower in altitude. The Kenai River connects Kenai Lake to Skilak Lake before continuing onto the Cook Inlet. Skilak Lake is known for good salmon, rainbow trout and Dolly Varden fishing. This lake is located off of the Sterling Highway on Skilak Loop Road, about 15 miles west of the Kenai Lake (*Milepost, 2000*).

The ***Kenai River*** watershed covers over 2,200 square miles and runs over 80 miles in length. This watershed includes the towns of Cooper Landing, Sterling, Soldotna and Kenai. Several tributaries flow into the river, including the Snow River, Trail Creek, Killey River and Funny River. Glaciers along the path of the river continually supply the waters with sediment, keeping the waters turbid (*http://www.kenai-watershed.org/ - Kenai River Watershed and USGS, 1915*).

Groundwater

Although the quality can vary significantly in a short distance, groundwater supplies are abundant in the area. The Kenai River Center, GW Scientific, and Restoration Science and Engineering are currently investigating the interactions that occur between the Kenai River Watershed and groundwater in the Lower Kenai area (Soldotna)(*http://www.kenai-watershed.org/spawning /kenai_river/kenai_river.html, 2002*).

The Kenai Peninsula area has a central water system, and several subdivisions have private water systems. Many homes and businesses in the area, however, rely on individual wells for their water supply. Most of these wells are deep with depths between 50 and 200 feet. Static water levels in many of these wells are between 10 and 30 feet below the surface.

Geology and Soils

The Kenai Mountains in this area are composed of the Valdez Group, a widely distributed flysch in southcentral Alaska. The group is predominantly dark gray mudstone, siltstone, argillite, and slate, with sandstone (mostly greywacke) interbeds. The rocks are locally calcareous and highly deformed, showing cleavage development, disrupted beds, and folding. Where sedimentary features are preserved, the sandstones are typically turbidites. The age of the Valdez Group is considered late Cretaceous. The formation consists of clastic debris that is likely shed from an uplifted arc and deposited by turbidity flows in an elongate trench (Crossen, 1992).

The Valdez Group is one of the two rock units making up the Chugach terrane, which is one of the four tectonostratigraphic terranes found in southcentral Alaska. The Kenai Mountains and Kenai Peninsula lie in the present arc-trench gap, between the volcanoes of the Aleutian Range arc and the Aleutian trench. The Kenai-Chugach Range is underlain by an oceanic flysch and mélange accretion complex that records convergent margin history extending back to Triassic time. The Kenai-Chugach Range is largely underlain by subduction rocks and is one of the main topographic features that flank the seaward edge of the forearc basin in southcentral Alaska (Crossen, 1992).

Various Quaternary-age surficial deposits are found in the general area. The origin of these deposits is predominantly glacial, with components of alluvial, colluvial, and lacustrine deposition (Winkler, 1992). The glacier ice mass deposited silt, sand, gravel, cobbles and boulders during multiple glacial advancements and recessions. The soils deposited during the glacial advancements were consolidated by the weight of the ice. During the recessional phase of glaciation, soils consolidated by the ice mass were probably eroded to some degree by melt water, and unconsolidated alluvial materials were deposited.

THE HUTCH
PUBLIC DRINKING WATER SYSTEM

The Hutch is a Class B (transient/non-community) water system. The system consists of one well located on Lot 1 of the Winkler property in Cooper Landing, Alaska (T5N, R3W, Section 29). This area is at an elevation of approximately 500 feet above sea level.

According to the well log completed for the water system, installation of the well occurred on April 16, 1986, to a total depth of approximately 124 feet below ground surface in a clay formation. The diameter of the well casing is unknown. It is unknown if the well was installed with a cap providing a sanitary seal. A properly installed sanitary seal may provide protection against contaminants from entering the source waters at the well casing. It is also unknown if the land surface is also appropriately sloped away from the well providing adequate surface water drainage. It is not known if the well has been grouted according to ADEC regulations. Proper grouting provides added protection against contaminants traveling along the well casing and into source waters.

This system operates year-round and serves 2 resident and 25 non-residents through one service connection.

THE HUTCH DRINKING WATER PROTECTION AREA

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

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

An analytical calculation was used to determine the size and shape of the DWPA. The input parameters describing the attributes of the aquifer in this calculation were adopted from the U.S. Geological Survey (*Patrick, Brabets, and Glass, 1989*), and State of Alaska Department of Water Resources (*Jokela et. al., 1991*). Additional methods were also used to take into account any uncertainties in groundwater flow and aquifer characteristics to arrive at a meaningful DWPA

The DWPAs established for wells by the ADEC are usually separated into four zones, limited by the watershed. These zones correspond to differences in the time-of-travel (TOT) of the water moving through the aquifer to the well. An analytical calculation was used to determine the size and shape of the DWPA. The input parameters describing the attributes of the aquifer in this calculation were adopted from the U.S. Geological Survey (Patrick, Brabets, and Glass, 1989), and State of Alaska Department of Water Resources (Jokela et. al., 1991). Additional methods were also used to take into account any uncertainties in groundwater flow and aquifer characteristics to arrive at a meaningful DWPA (Please refer to the Guidance Manual for Class Bs for additional information).

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

Table 1. Definition of Zones

Zone	Definition
A	¼ the distance for the 2-yr. TOT
B	Less than the 2 year TOT
C	Less Than the five year TOT
D	Less than the 10 year TOT

As an example, water moving through the aquifer in Zone B will reach the well in less than 2 years from the time it crosses the outer limit of Zone B.

Zone A also incorporates the area downgradient from the well to take into account the area of the aquifer that is influenced by pumping of the well. Water within the aquifer in Zone A will reach the well in several hours to several months.

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 Hutch DWPA. This inventory was completed through a search of agency records and other publicly available information. Potential sources of contamination to the drinking water aquifer include a wide range of categories and types. Potential drinking water contaminants are found within agricultural, residential, commercial, and industrial areas, but can also occur within areas that have little or no development.

For the basis of all Class B 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 and B were associated with residential and light industrial 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 well.

VULNERABILITY OF THE HUTCH 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 well and the aquifer.

Susceptibility of the Wellhead (0 – 25 Points)

+

Susceptibility of the Aquifer (0 – 25 Points)

=

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

The well for The Hutch is completed in an unconfined aquifer setting. Because an unconfined aquifer is recharged by surface water and precipitation that migrates downward from the surface, contaminants at the surface have the potential to adversely impact this aquifer. Table 2 shows the Overall Susceptibility score and rating for The Hutch.

Table 2. Natural Susceptibility - Susceptibility of the Wellhead and Aquifer to Contamination

	Score	Rating
Susceptibility of the Wellhead	25	Very High
Susceptibility of the Aquifer	11	Medium
Natural Susceptibility	36	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	12	Low
Nitrates and/or Nitrites	17	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 Analyses for nitrates and nitrites and volatile organic chemicals, respectively.

Table 3 contains the overall vulnerability scores (0 – 10) 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 The Hutch to Contamination by Category

Category	Score	Rating
Bacteria and Viruses	50	Medium
Nitrates and Nitrites	55	Medium
Volatile Organic Chemicals	50	Medium

Tables 2 and 3 in Appendix B contain the ranking of potential and existing sources of contamination with respect to nitrates and/or nitrites, and volatile organic chemicals. A table ranking bacteria and viruses is not included as there are no sources in the area.

The residential areas and logging activities create a risk increase for the nitrates and nitrites, and volatile organic chemicals contaminant categories.

Only a small amount of bacteria and viruses are required to endanger public health. Bacteria and viruses have not been detected during recent water sampling of the system at The Hutch.

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 [Wang, Strelakos, Jokela, 2000].

Sampling history for The Hutch well indicates that low concentrations of nitrate have been detected (See Chart 5 - Contaminant Risks for Nitrates and/or Nitrites in Appendix D). Existing nitrate concentration is approximately 1.0 mg/L or 10% of the Maximum Contaminant Level (MCL) of 10mg/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. Due to the high solubility and weak retention by soil, nitrates are very mobile, moving at approximately the same rate as water. Though existing nitrate contamination was detected at the site, concentrations remain at very safe levels with respect to human health.

SUMMARY

A *Source Water Assessment* has been completed for the sources of public drinking water serving The Hutch. The overall vulnerability of this source to contamination is **Medium** for nitrates and nitrites, bacteria and viruses, and volatile organic chemicals. This assessment of contaminant risks can be used as a foundation for local voluntary protection efforts as well as a basis for the continuous efforts on the part of The Hutch 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 Hutch public drinking water source.

REFERENCES CITED

Alaska Department of Community and Economic Development, 2001 [WWW document]. URL http://www.dced.state.ak.us/mra/CF_BLOCK.cfm.

Alaska Department of Labor, State of Alaska 2001 [WWW document]. URL http://146.63.75.45/census2000/.

Balding, G.O. 1976. Water Availability, Quality, and Use in Alaska. U.S Geological Survey Open File Report 76-513.

Brabets, T., 1997, Precipitation map of Alaska, Web extension to the U.S. Geological Survey Water Resources for Alaska GIS datasets. <URL:http://agdc.usgs.gov/data/usgs/water> .

Crossen, K. J. 1992. Guide to the Little Ice Age Landforms and Glacial Dynamics in Portage Valley and Portage Pass. Alaska Geological Society, Anchorage, Alaska.

Guide to the Bedrock Geology along the Seward Highway north of Turnagain Arm, 1981

Guide to the Geology of the Kenai Peninsula, Alaska, 1997

Hartman, C.W. and Johnson, P.R., 1978. Environmental Atlas of Alaska. University of Alaska, Institute of Water Resources, Second Edition.

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.

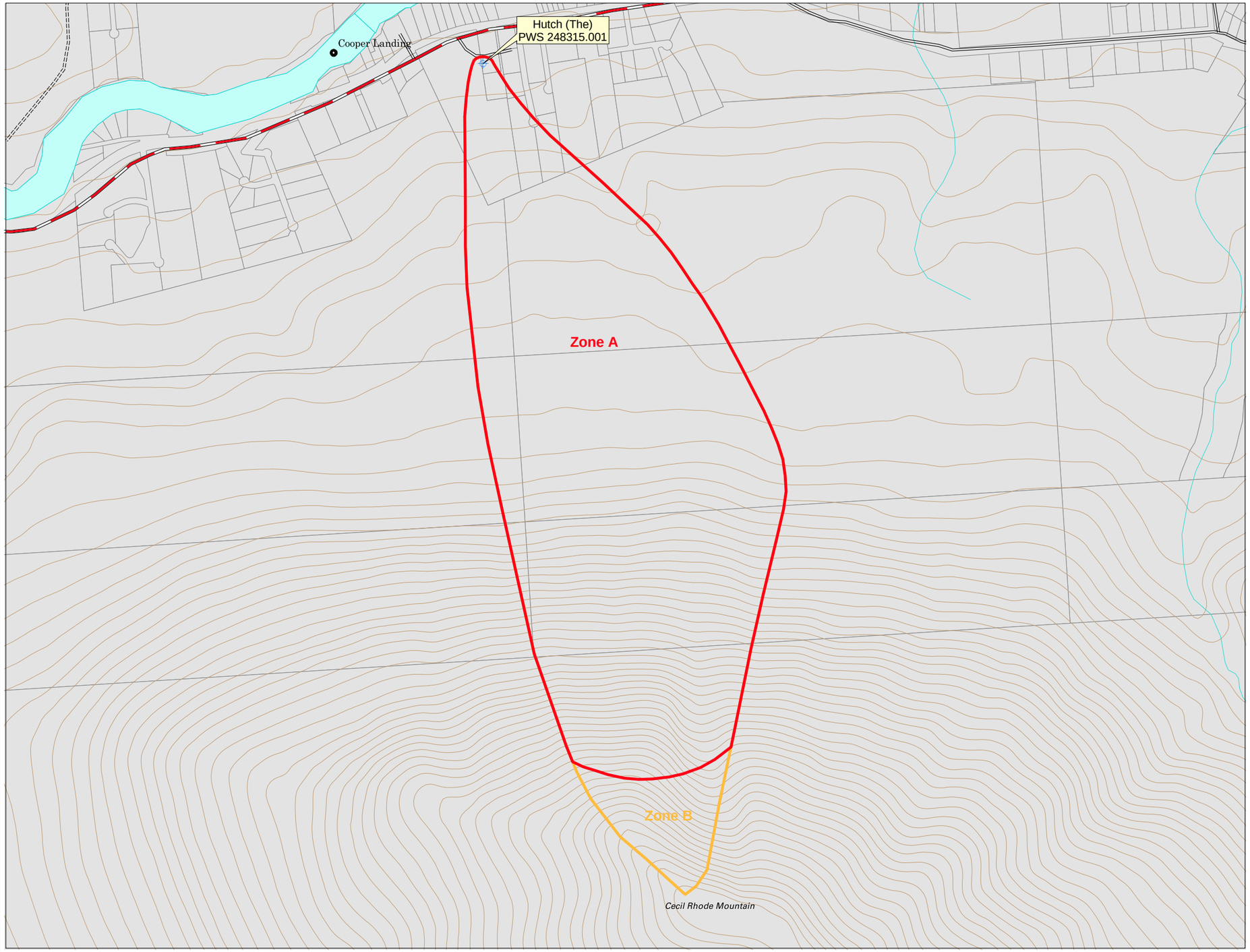
Western Regional Climate Center, 2000, August 24, Web extension to the *Western Regional Climate Center* [WWW document]. URL http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?akmatv

Winkler, G.R. 1992. Geologic Map and Summary Geochronology of the Anchorage 1^{o} x 3^{o} Quadrangle, Southern Alaska. Prepared by the U.S. Department of the Interior, Geological Survey in cooperation with the State of Alaska Division of Geological and Geophysical Surveys.

APPENDIX A

The Hutch
Drinking Water Protection Area
(Map 1)

Drinking Water Protection Areas for the Public Water Well System for PWS # 248315.001 The Hutch



LEGEND

Public Water System Well

Groundwater Protection Zones

Zone A – Several Months Travel Time

Zone B – Less Than 2 Years Travel Time

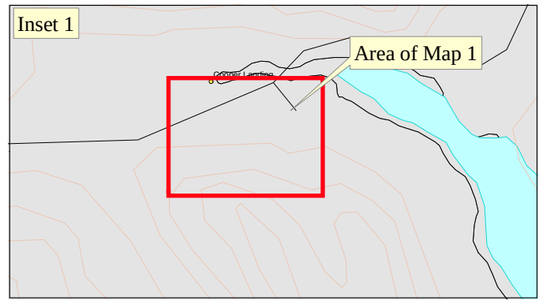
Data Sources:
Contaminant Sources, Public Water System Wells, Contours
Alaska Department of Environmental Conservation (ADEC)

Parcels
Kenai Peninsula Borough

All other data
United States Geological Survey (USGS)

Drinking Water Protection Areas based on ADEC
Calculation Spreadsheet.

URS Corporation does not guarantee the accuracy or validity of the data provided.



0 850 1,700 3,400 5,100 6,800 Feet

The Hutch PWS 248315.001

APPENDIX B

Contaminant Source Inventory and Risk Ranking for The Hutch

(Tables 1-4)

Table 1 *Contaminant Source Inventory for* ***PWSID 248315.001***

Hutch (The)

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Location*	*Map Number*	*Comments*
Logging (active)	E02	E2-01	A	TOWLE DRIVE	1	
Logging (active)	E02	E2-02	A	TOWLE DRIVE	1	
Logging (active)	E02	E2-03	A	TOWLE DRIVE	1	
Logging (active)	E02	E2-04	A	TOWLE DRIVE	1	
Residential Areas	R01	R01-01	A		1	12.55 Acres

Table 2

Contaminant Source Inventory and Risk Ranking for Hutch (The)

Sources of Bacteria and Viruses

PWSID 248315.001

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	R01-01	A	Low	1		1	12.55 Acres

Table 3

Contaminant Source Inventory and Risk Ranking for Hutch (The)

Sources of Nitrates/Nitrites

PWSID 248315.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Overall Rank after Analysis*	*Location*	*Map Number*	*Comments*
Logging (active)	E02	E2-03	A	Low	1	TOWLE DRIVE	1	
Logging (active)	E02	E2-04	A	Low	2	TOWLE DRIVE	1	
Logging (active)	E02	E2-01	A	Low	3	TOWLE DRIVE	1	
Logging (active)	E02	E2-02	A	Low	4	TOWLE DRIVE	1	
Residential Areas	R01	R01-01	A	Low	5		1	12.55 Acres

Table 4

Contaminant Source Inventory and Risk Ranking for Hutch (The)

Sources of Volatile Organic Chemicals

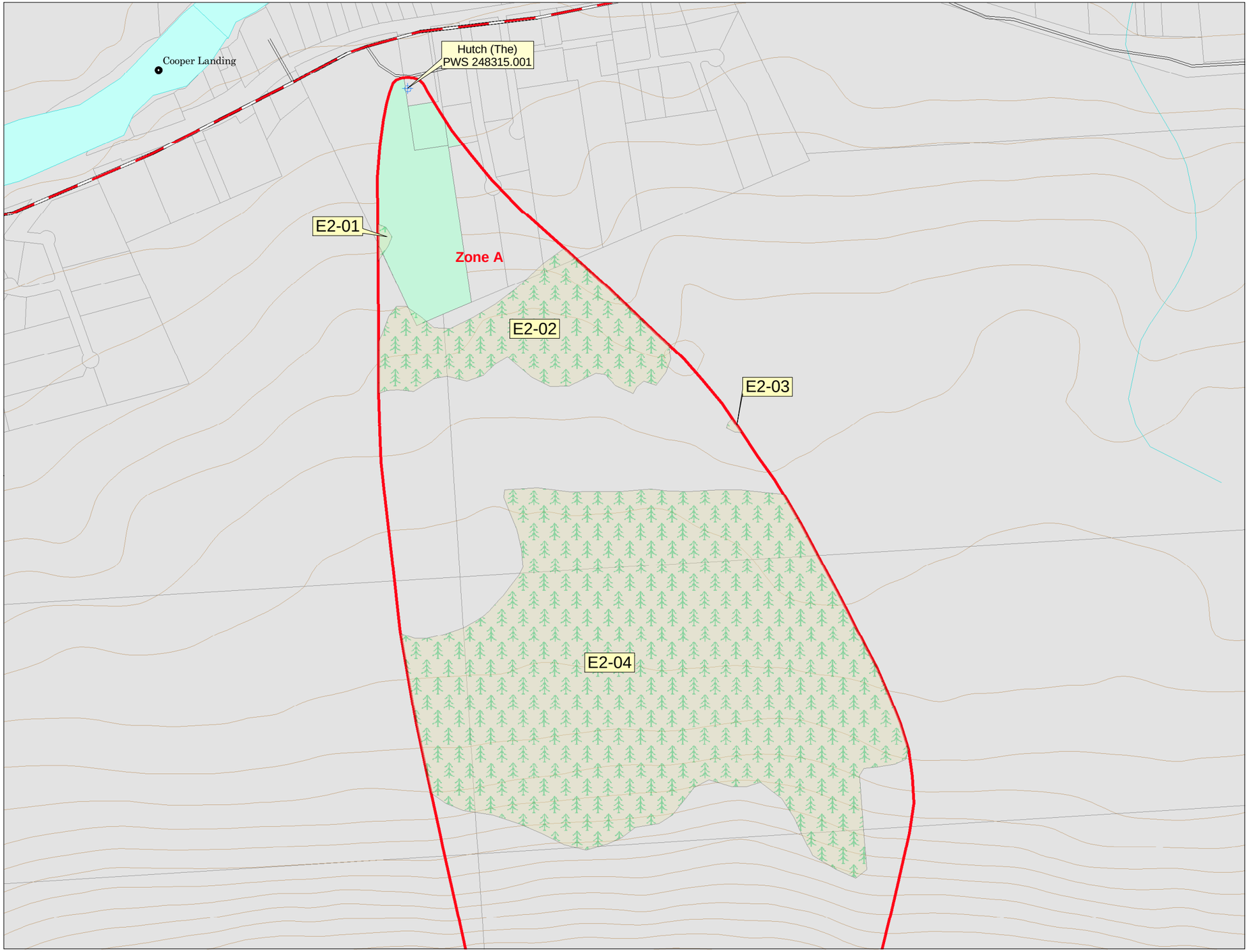
PWSID 248315.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Overall Rank after Analysis*	*Location*	*Map Number*	*Comments*
Logging (active)	E02	E2-03	A	Low	1	TOWLE DRIVE	1	
Logging (active)	E02	E2-04	A	Low	2	TOWLE DRIVE	1	
Logging (active)	E02	E2-01	A	Low	3	TOWLE DRIVE	1	
Logging (active)	E02	E2-02	A	Low	4	TOWLE DRIVE	1	
Residential Areas	R01	R01-01	A	Low	5		1	12.55 Acres

APPENDIX C

The Hutch
Drinking Water Protection Area
and Potential and Existing Contaminant Sources
(Map 2)

Drinking Water Protection Areas for the Public Water Well System for PWS # 248315.001 The Hutch
Showing Potential and Existing Sources of Contamination



LEGEND

- Public Water System Well

Groundwater Protection Zones

- Zone A – Several Months Travel Time
- Zone B – Less Than 2 Years Travel Time

Contaminant Sources

- Logging (E2)
- Residential Areas (R1)

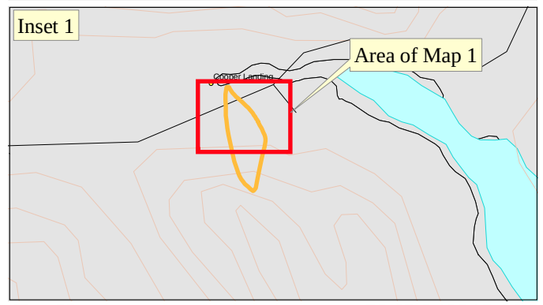
Data Sources:
Contaminant Sources, Public Water System Wells, Contours
Alaska Department of Environmental Conservation (ADEC)

Parcels
Kenai Peninsula Borough

All other data
United States Geological Survey (USGS)

Drinking Water Protection Areas based on ADEC
Calculation Spreadsheet.

URS Corporation does not guarantee the accuracy or validity of the data provided.



0 485 970 1,940 2,910 3,880 Feet

The Hutch PWS 248315.001

APPENDIX D

Vulnerability Analysis for The Hutch Public Drinking Water Source

(Charts 1-8)

Chart 1. Susceptibility of the wellhead - The Hutch (248315.001)

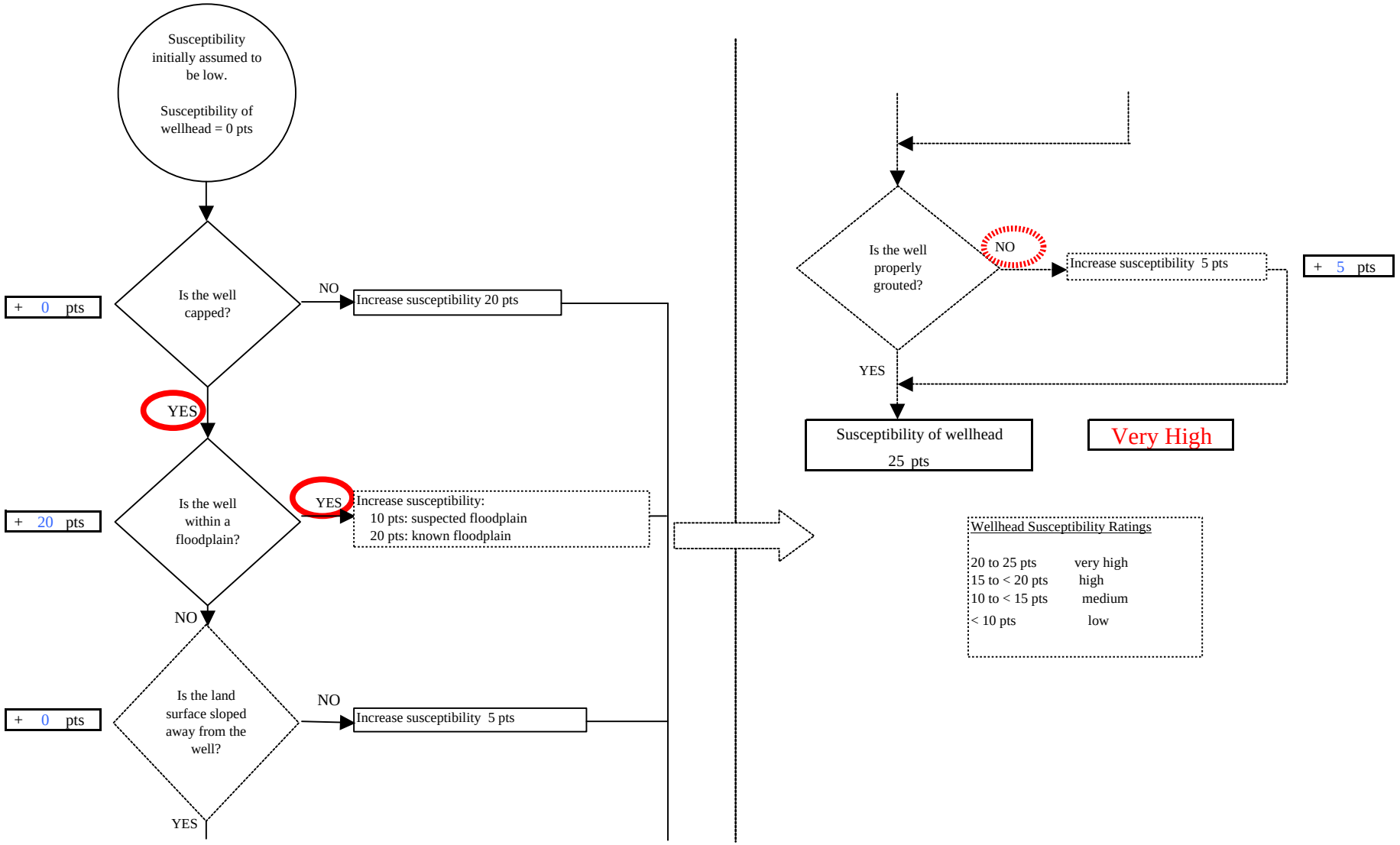


Chart 2. Susceptibility of the aquifer - The Hutch (248315.001)

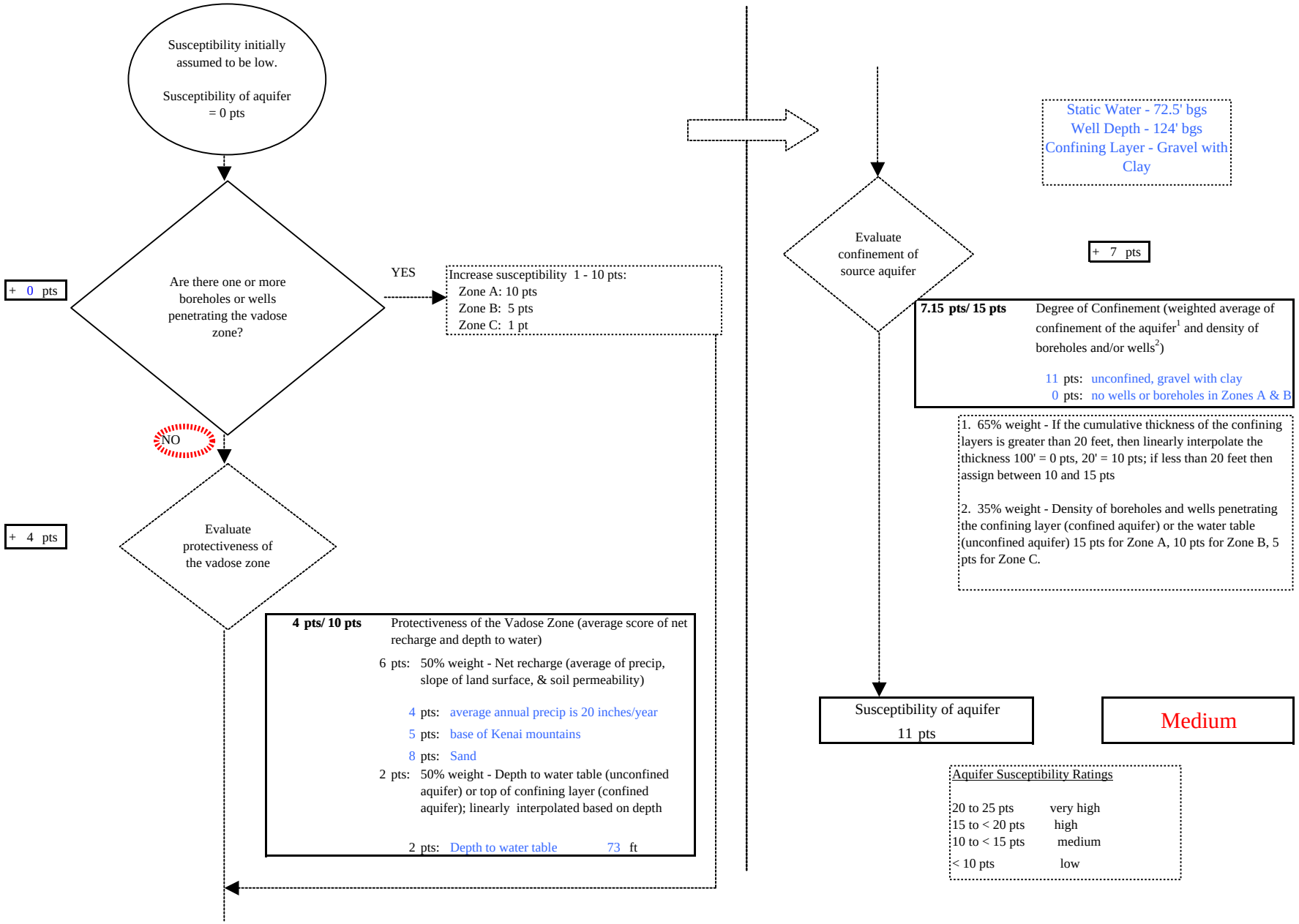
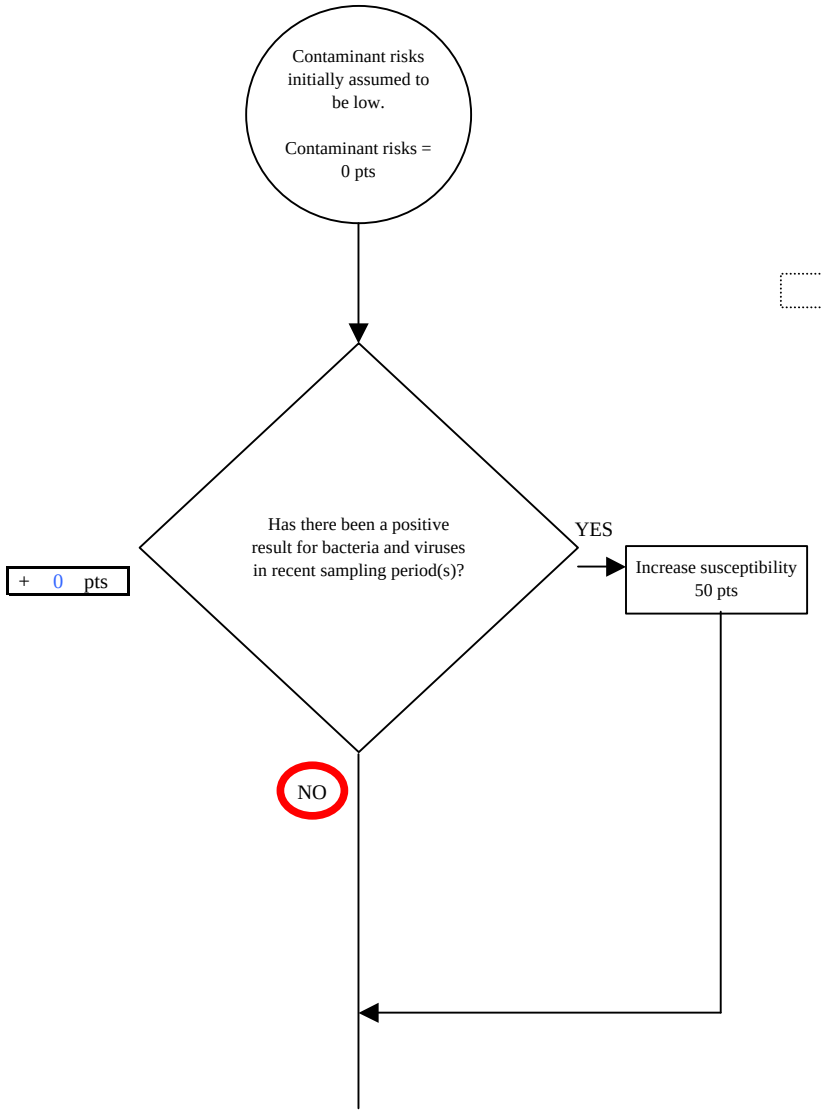
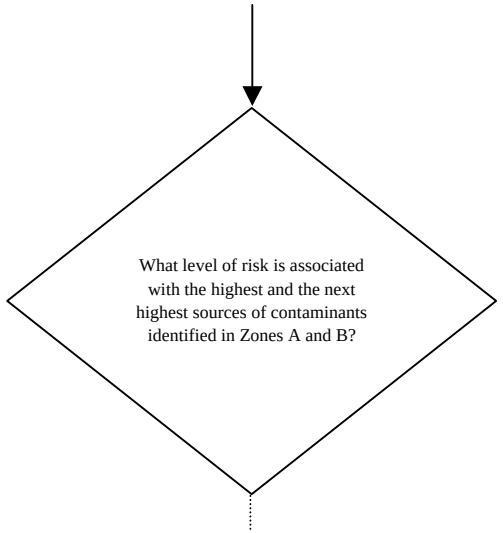


Chart 3. Contaminant risks for The Hutch (248315.001) - Bacteria & Viruses





+ 10 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)	0	0	0
Low(s)	1	0	1

	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.

Chart 3. Contaminant risks for The Hutch (248315.001) - Bacteria & Viruses

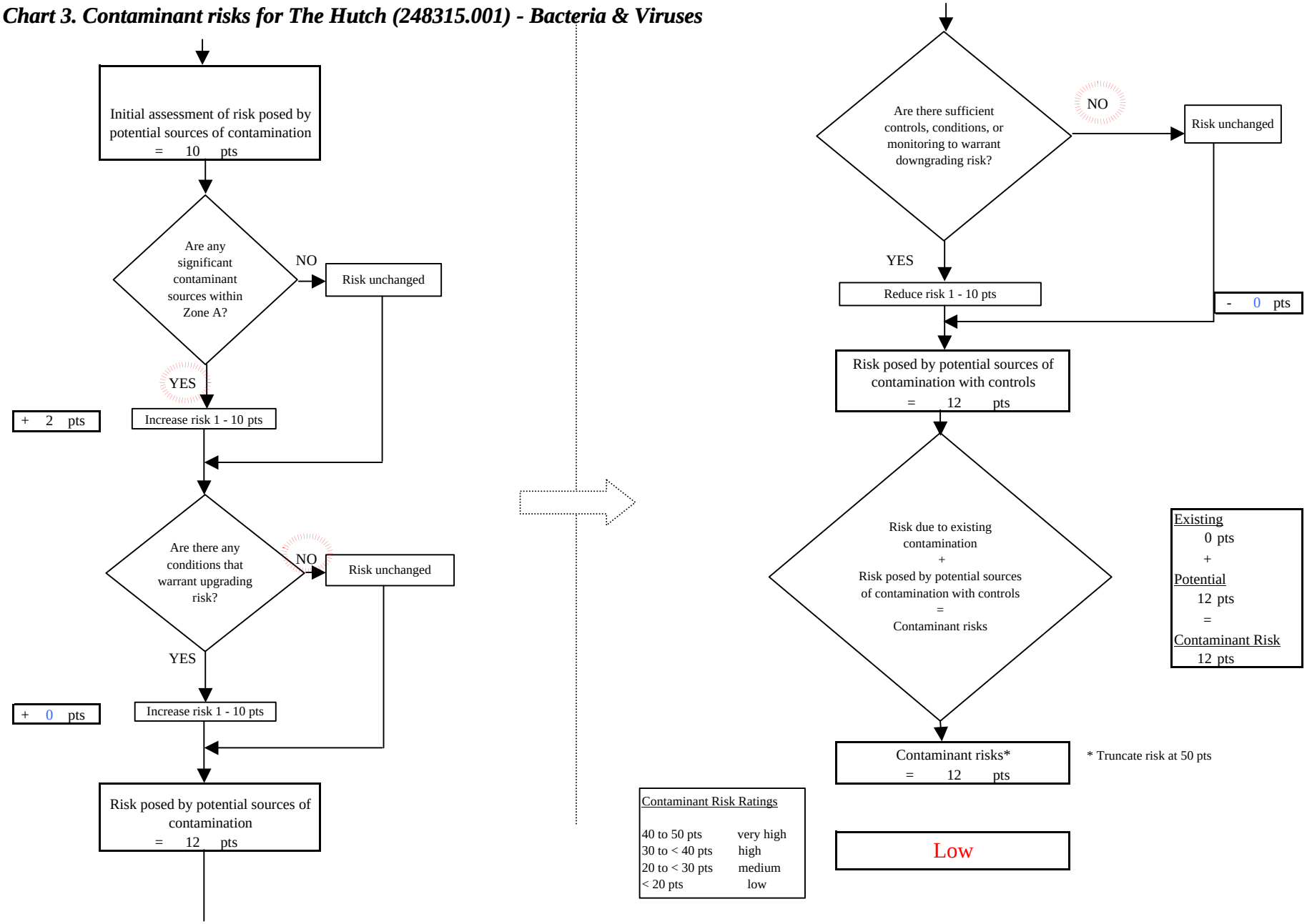


Chart 4. Vulnerability analysis for The Hutch (248315.001) - Bacteria & Viruses

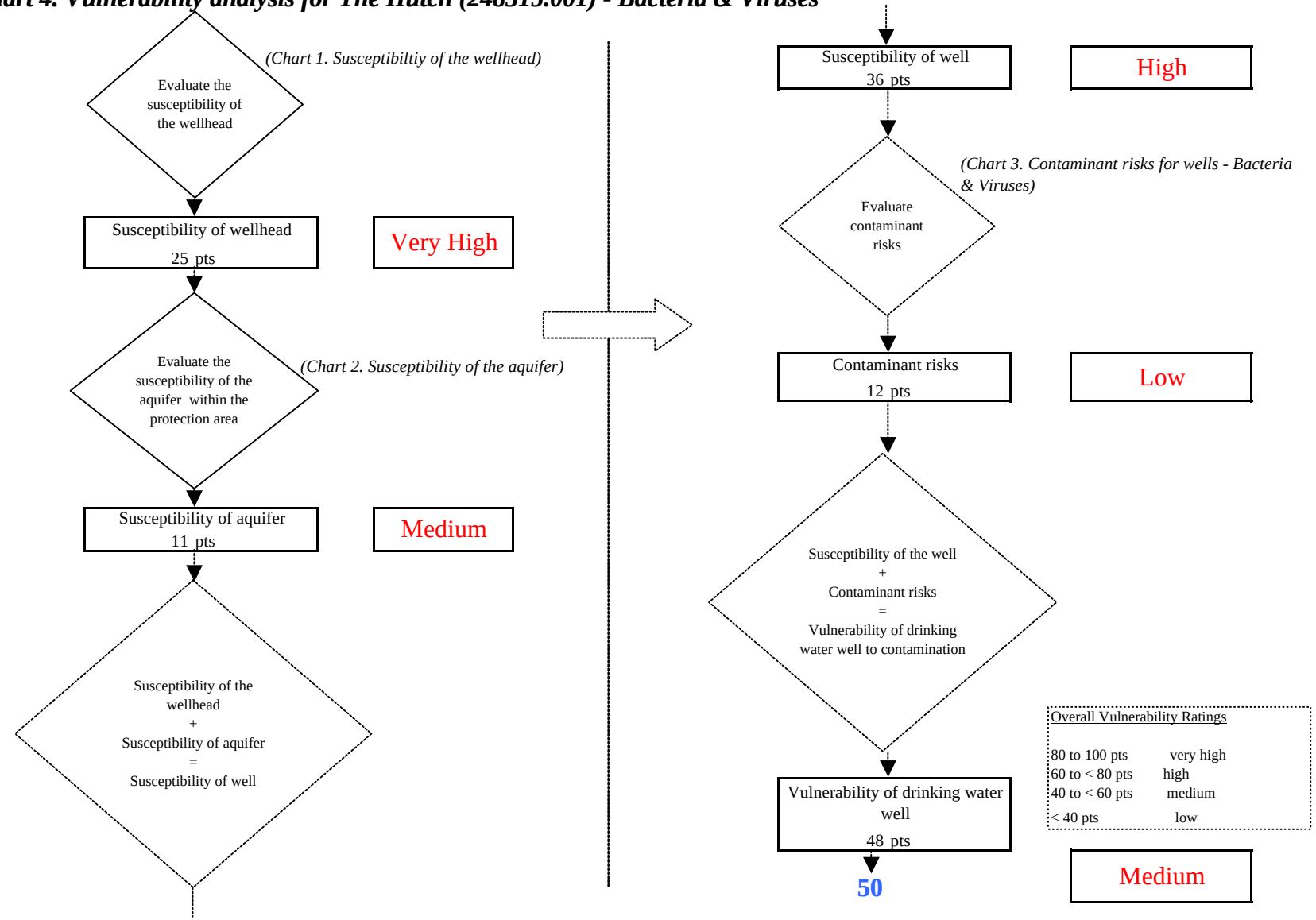


Chart 5. Contaminant risks for The Hutch (248315.001) - Nitrates and Nitrites

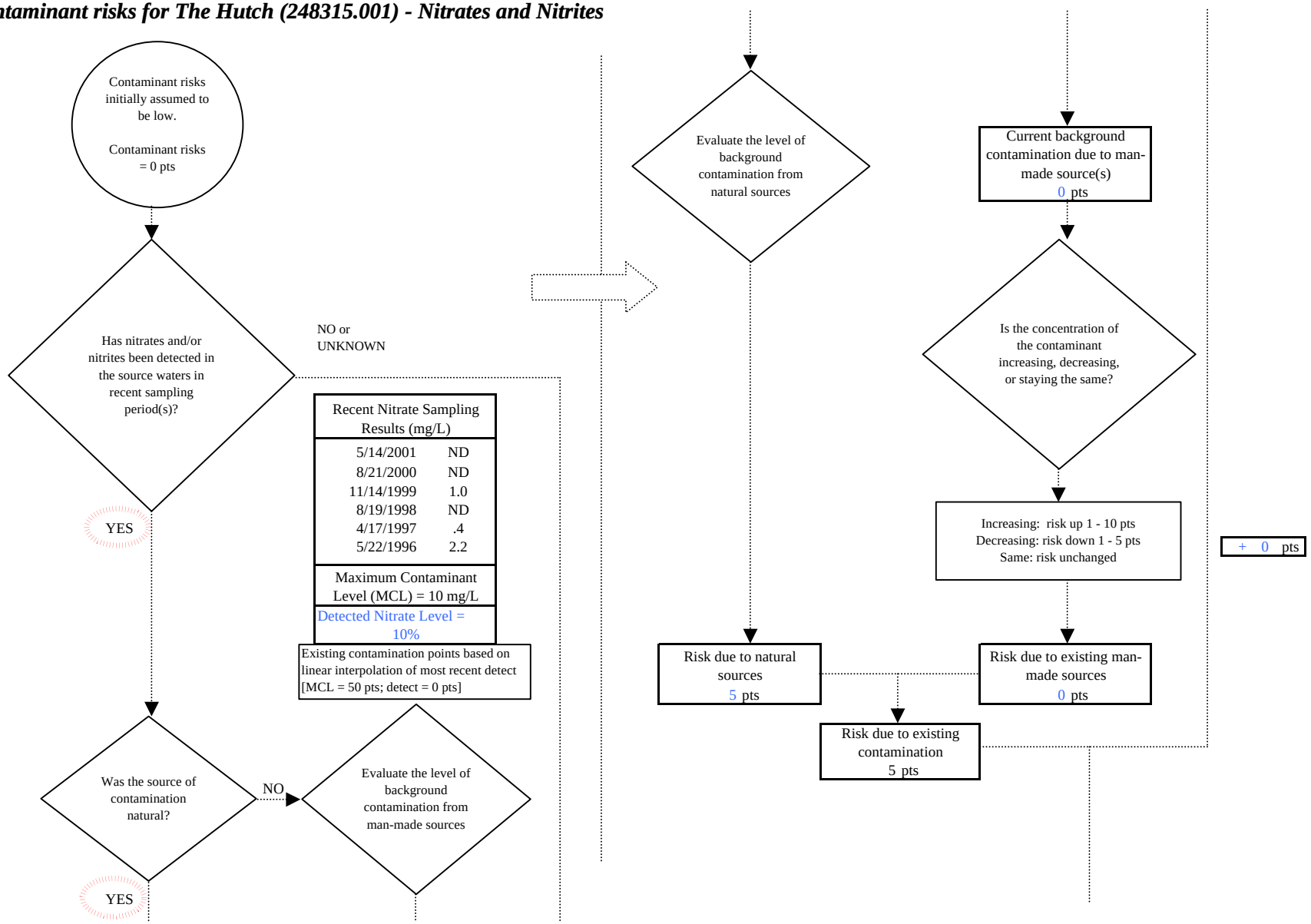


Chart 5. Contaminant risks for The Hutch (248315.001) - Nitrates and Nitrites

+ 10 pts

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

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

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

	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.

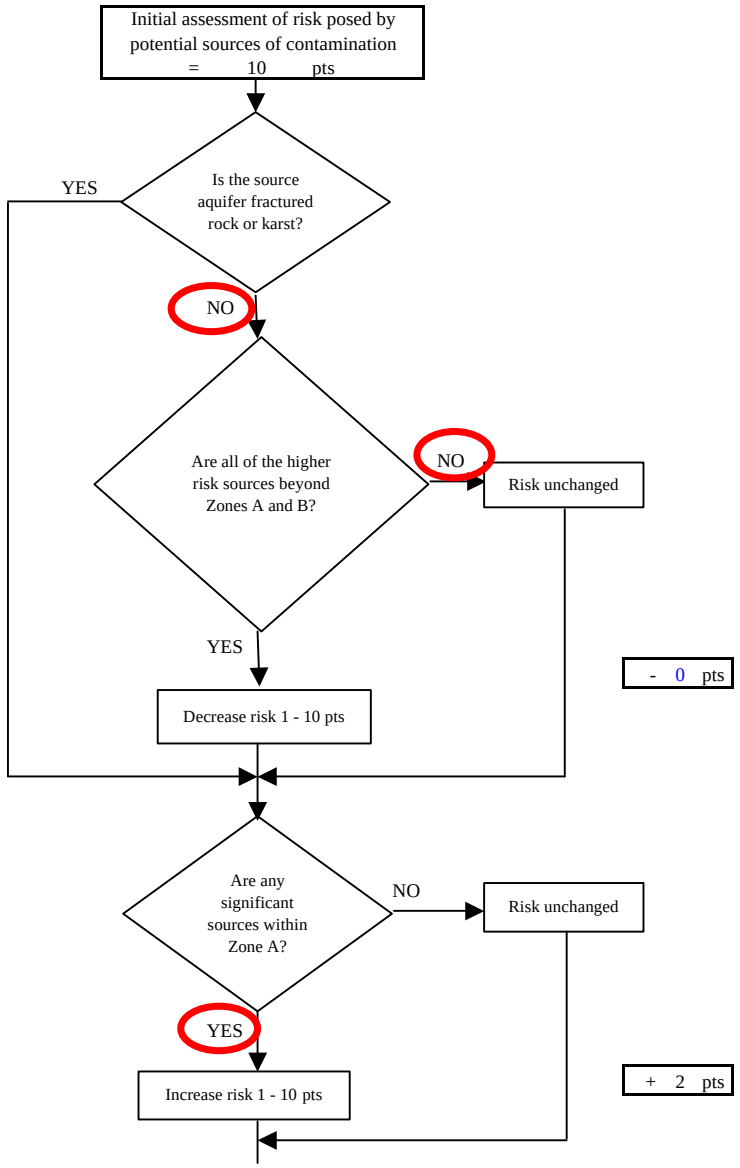
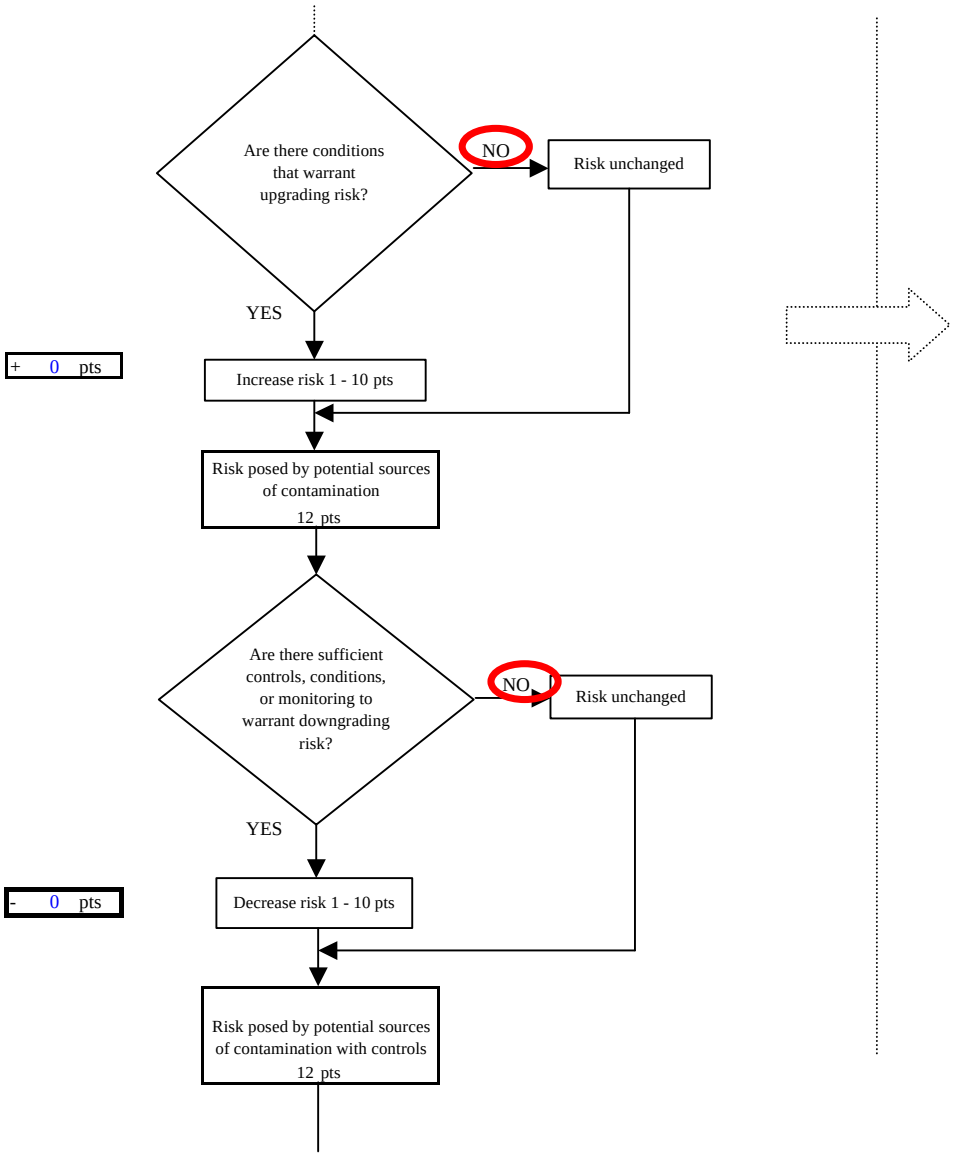
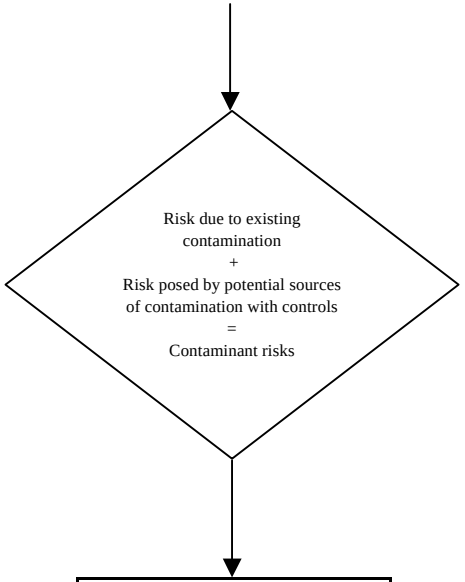


Chart 5. Contaminant risks for The Hutch (248315.001) - Nitrates and Nitrites





Existing
5 pts
+
Potential
12 pts
=
Contaminant Risk
17 pts

Contaminant risks*
= 17 pts

*Truncate risk at 50 pts

Low

Contaminant Risk Ratings

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

Chart 6. Vulnerability analysis for The Hutch (248315.001) - Nitrates and Nitrites

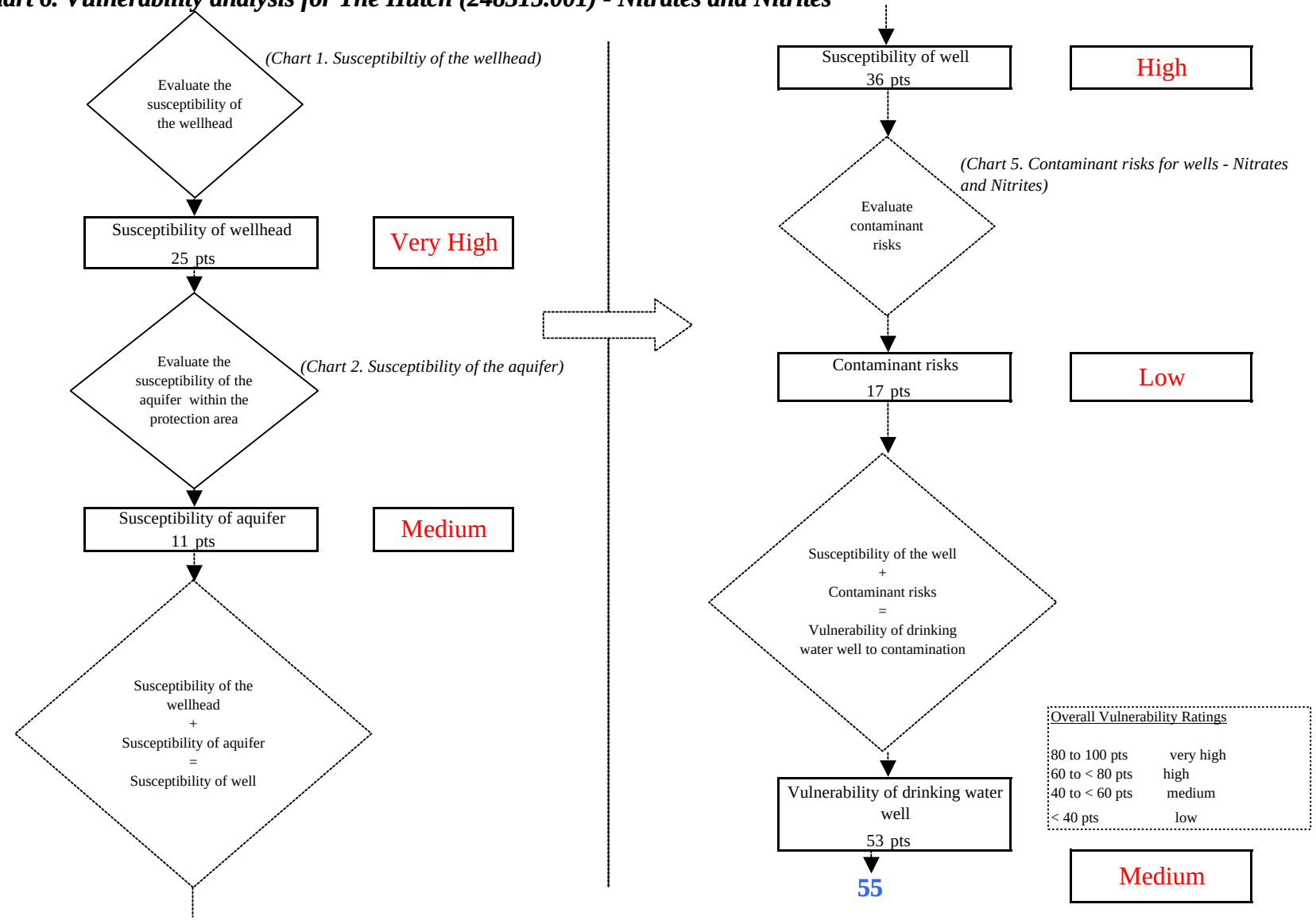


Chart 7. Contaminant risks for The Hutch (248315.001) - Volatile Organic Chemicals

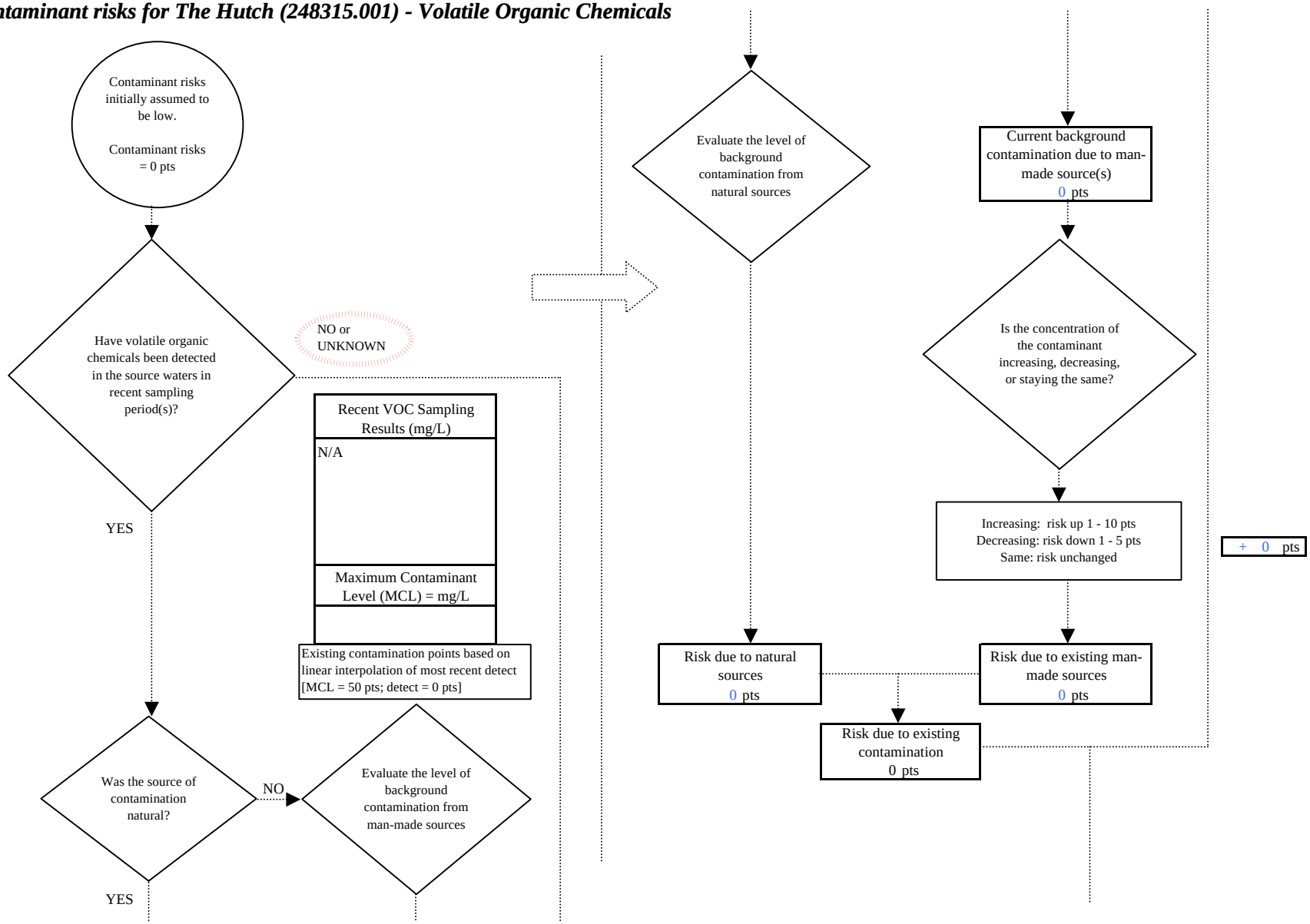


Chart 7. Contaminant risks for The Hutch (248315.001) - Volatile Organic Chemicals

+ 10 pts

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

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

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

	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.

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

Is the source aquifer fractured rock or karst?

YES

NO

Are all of the higher risk sources beyond Zones A and B?

NO

Risk unchanged

YES

Decrease risk 1 - 10 pts

- 0 pts

Are any significant sources within Zone A?

NO

Risk unchanged

YES

Increase risk 1 - 10 pts

+ 2 pts

Chart 7. Contaminant risks for The Hutch (248315.001) - Volatile Organic Chemicals

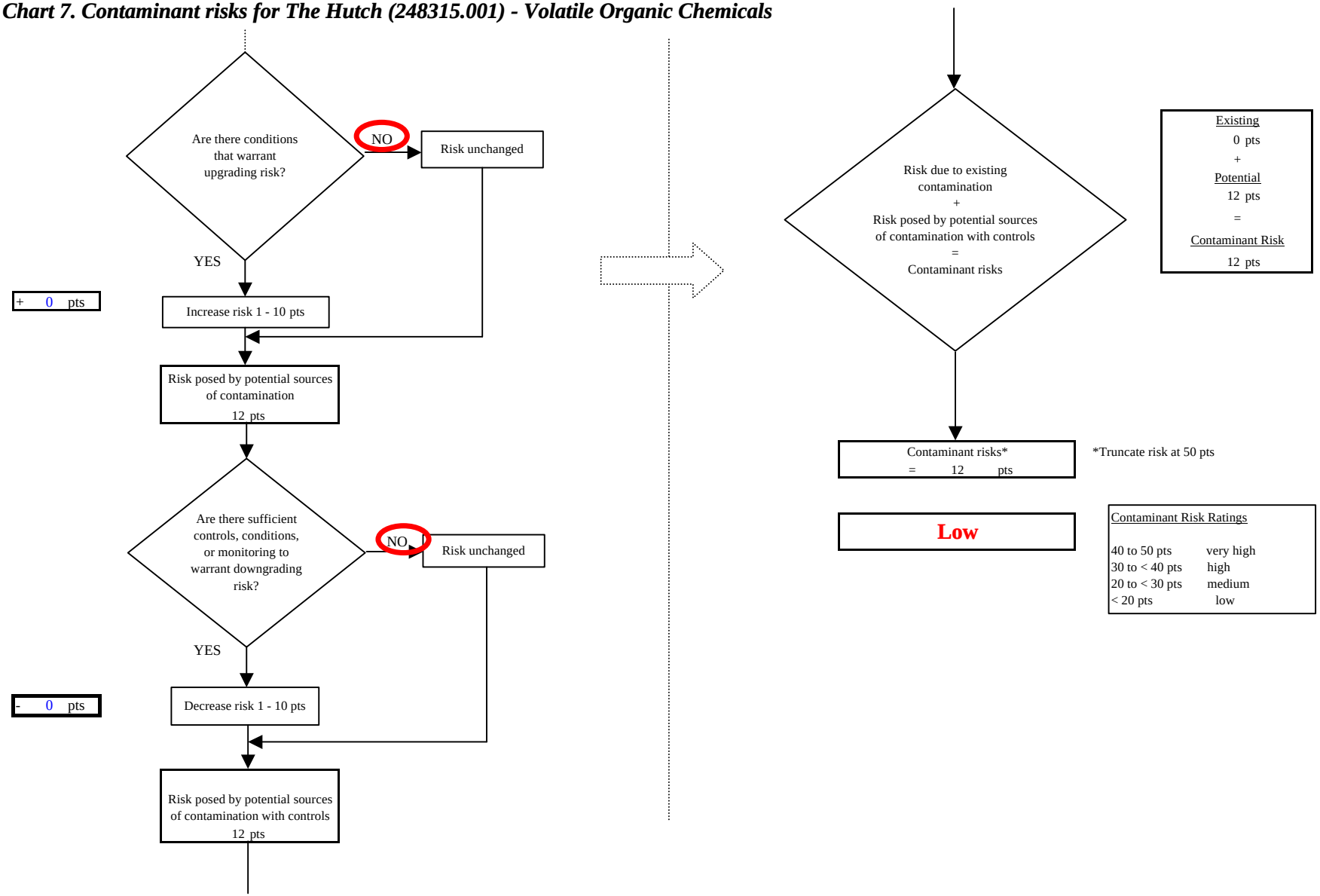


Chart 8. Vulnerability analysis for The Hutch (248315.001) - Volatile Organic Chemicals