Source Water Assessment

A Hydrogeologic Susceptibility and Vulnerability Assessment for White Birch Apartments Drinking Water System,
North Pole, Alaska
PWSID 313233

March 2004

DRINKING WATER PROTECTION PROGRAM REPORT Report 1474
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 White Birch Apartments Source of Public Drinking Water, North Pole, Alaska

Drinking Water Protection Program
Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

This source water assessment provides an evaluation of the vulnerability of the public water system serving the White Birch Apartments to potential contamination. This Class A (community) water system consists of one well on Otter Drive near its intersection with Voyager Street in North Pole, Alaska. The well received a natural susceptibility rating of **Medium**. This rating is a combination of a **Low** rating for the actual wellhead and a **Very High** rating for the aquifer in which the well is drawing water from. Identified potential and current sources of contamination for the White Birch Apartments public water system include: roads, residential area, and septic systems. These are considered as sources of bacteria and viruses, nitrates and/or nitrites, volatile organic chemicals, heavy metals and other inorganic chemicals, synthetic organic chemicals, and other organic chemicals. Combining the natural susceptibility of the well with the contaminant risk, the public water system for White Birch Apartments received an overall vulnerability rating of **Medium** for nitrates and/or nitrites, and volatile organic chemicals, and a **High** for bacteria and viruses, heavy metals and other inorganic chemicals, synthetic organic chemicals, and other organic chemicals.

WHITE BIRCH APARTMENTS PUBLIC DRINKING WATER SYSTEM

White Birch Apartments public water system is a Class A (community) water system. The system consists of one well on Otter Drive near its intersection with Voyager Street in North Pole, Alaska. (T2S, R2E, Section 3) (See Map 1 of Appendix A North Pole is located southeast of the town of Fairbanks which is located in the Fairbanks North Star Borough near the center of Alaska (Please see the inset of Map 1 in Appendix A for location). The Borough's current population is 82,840 making it the second-largest population center in the state (ADCED, 2002). Communities located within the Borough include : College, Eielson Air Force Base, Ester, Fairbanks, Fox, Harding Lake, Moose Creek, North Pole, Pleasant Valley, Salcha, and Two Rivers.

North Pole Utilities provides piped water and sewer collection to part of North Pole; other areas use individual wells and septic systems. Electricity for the city is provided by Golden Valley Electric Association. The majority of residents use heating oil (typically stored in both above and below ground 275 to 500-gallon tanks) to heat homes and buildings. Garbage collection services are proved by the city, and refuse is transported to the Fairbanks North Star Borough Class I Landfill on South Cushman Street in Fairbanks.

This overall area includes two distinct topographic areas: the alluvial plain between the Tanana River and the Chena River, and the uplands north of this alluvial plain. The White Birch Apartments water system is located in the alluvial plain at an elevation of approximately 500 feet above sea level.

According to the 9/18/01 Sanitary Survey for this water system, the depth of the well is approximately 90 feet below the ground surface. Most of the wells in this area are screened in a combination of gravel and sand, and it is assumed that these are also. The alluvial plain consists of alternating layers of sand and gravel up to over 500 feet thick, in some locations overlain by 1 to 10 feet of silt or sandy silt or a few feet of peat (Glass and others, 1996). Discontinuous permafrost (perennially frozen areas) is also common in the alluvial plain. The depth to permafrost in these areas ranges between 2 and 45 feet below the ground surface with the thickness of the permafrost ranging between 5 and 265 feet (Pewe, T.L. 1958). Areas with discontinuous permafrost may locally affect the ground water flow directions.

Primarily the Tanana River, but also the Chena River contribute water to this alluvial aquifer. The Chena River typically only contributes water when its stage is high and the Tanana is low (Nelson, 1978). The Tanana River gets approximately 85% of its water from snowmelt of the Alaska Range and 15% from the Yukon-Tanana uplands (Anderson, 1970).

The White Birch Apartments public drinking water system serves approximately 72 residents through 2 service connections.

WHITE BIRCH APARTMENTS DRINKING WATER PROTECTION AREA

The pathways most likely for surface contamination to reach the groundwater are identified as the first step in determining a drinking water system's risk. 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 capture zone. The groundwater capture zone is located in the area circling the well (the area influenced by pumping) and also the area of the water table upgradient of the well, usually forming a parabola shape.

There are many different methods for calculating the size of capture zones. This assessment uses a combination of two simple groundwater flow equations, the Thiem and uniform flow equations for all groundwater wells screened in unconsolidated material. The orientation of the capture zone is then drawn using a water table elevation map (if available) or a land surface elevation map of the area. The capture zone calculated in this assessment is an estimate using the available information and resources, and may differ slightly from the actual capture zone.

The parameters used to calculate the shape of this capture zone are general for the whole alluvial plain and were obtained from various United States Geological Survey (USGS) reports, area well logs, and the Groundwater textbook by Freeze and Cherry (Freeze and Cherry, 1979).

The water table in the area of the White Birch Apartments, the area between the Tanana and the Chena Rivers, is primarily influenced by the level of water flow in each river. The capture zones were drawn based on three separate configurations of the water table during various stages of the rivers: a period of high stage in the Chena River (October 14-17, 1986), high stage in the Tanana River (July 16-17, 1987), and low stages in both rivers (March 30-April 3, 1988) (Glass and others, 1996). High water levels in the Chena usually occur in the spring due to runoff from the uplands and in late summer due to rainstorms (Nelson, 1978). The Tanana usually experiences high flow during the hot, dry periods of mid-summer when maximum snowmelt from the Alaska Range occurs (Nelson, 1978). Groundwater in this area generally flows toward the northwest, from the Tanana River to the Chena River, however flow is reversed very near the Chena River during its high stage periods (Glass and others, 1996). These flow reversals are of short duration (i.e. days versus months) and of limited extent, generally within 1000 feet of the river (Nakanishi, et all, 1998).

Because of uncertainties and changing site conditions, a factor of safety is added to the groundwater capture zone to form the drinking water protection area for the well.

The protection areas established for wells are usually separated into four zones, limited by the watershed. These zones correspond to times-of-travel (TOT) of the water moving through the aquifer to the well (plus the factor of safety).

The following is a summary of the four zones for wells and the calculated time-of-travel for each:

Table 1. Definition of Zones

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

The time of travel for contaminants within the water varies with their unique physical and chemical characteristics.

The drinking water protection area outlined for the White Birch Apartments on Map 1 of Appendix A will serve as the focus for voluntary protection efforts.

INVENTORY OF POTENTIAL AND EXISTING CONTAMINANT SOURCES

The Drinking Water Protection Program (DWPP) has completed an inventory of potential and existing sources of contamination within the White Birch Apartments protection area. This inventory was completed through a search of agency records and other publicly available information. 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 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.

The sources are displayed on Maps 2 through 6 of Appendix C and summarized in Table 1 of Appendix B.

RANKING OF CONTAMINANT RISKS

Once the potential and existing sources of contamination have been identified, they are each

assigned a ranking according to what type and level of risk they represent. Ranking of contaminant risks for a "potential" or "existing" source of contamination is a combination of toxicity and volume associated with that source. Rankings include:

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

Bacteria and Viruses are only inventoried in Zones A and B because of their short life span. Only "Very High" and "High" rankings are inventoried within the outer Zone D due to the probability of contaminant dilution by the time the contaminants get to the well.

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

VULNERABILITY OF WHITE BIRCH APARTMENTS DRINKING WATER SYSTEM

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

- Natural susceptibility; and
- Contaminant risks.

Appendix D contains fourteen 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 properties of the aquifer and the presence of other wells or boreholes in the area. 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 the water system's contaminant sample results. Lastly, Chart 4 combines the results of the first three charts to produce the 'Vulnerability Analysis for Bacteria and Viruses'. Charts 5 through 14 contain the Contaminant Risks and Vulnerability Analyses for nitrates and nitrites, volatile organic chemicals, heavy metals and other inorganic chemicals, synthetic organic chemicals, and other organic chemicals, respectively.

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

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

+

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

=

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

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

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

The wellhead for the White Birch Apartments received a Low Susceptibility rating. The 9/18/01 Sanitary Survey indicates the well is capped with a sanitary seal, the land surface is sloped away from the well; and it is unknown whether the well is grouted. A sanitary seal prevents potential contaminants from entering the well from the inside while sloping the land surface away from the well and grouting help to prevent potential contaminants from traveling down the outside of the well casing.

The aquifer the White Birch Apartments well is completed in received a Very High Susceptibility rating. The highly transmissive aquifer material (sand and gravel) in the area allows contaminants to travel downward from the surface with the precipitation and surface water runoff. The shallow water table allows potential contaminants to come into contact with the water table with little natural filtering where they can disperse quickly. Wells in the area can also provide a quick pathway for contaminants to travel down into the aquifer if the wells are not grouted correctly. Table 2 summarizes the Susceptibility scores and ratings for White Birch Apartments.

Table 2. Susceptibility

	Score	**Rating**
Susceptibility of the Wellhead	5	Low
Susceptibility of the Aquifer	20	Very High
Natural Susceptibility	25	Medium

The Contaminant Risk has been derived from an evaluation of the routine sampling results of the water system and the presence of potential sources of contamination. Contaminant risks to a drinking water source depend on the type and distribution of contaminant sources. Flow charts are used to assign a point score, and ratings are assigned in the same way as for the natural susceptibility:

Contaminant Risk Ratings	
40 to 50 pts	Very High
30 to < 40 pts	High
20 to < 30 pts	Medium
< 20 pts	Low

Table 3 summarizes the Contaminant Risks for each category of drinking water contaminants.

Table 3. Contaminant Risks

Category	Score	Rating
Bacteria and Viruses	10	Low
Nitrates and/or Nitrites	20	Medium
Volatile Organic Chemicals	25	Medium
Heavy Metals, Cyanide, and Other Inorganic Chemicals	10	Low
Synthetic Organic Chemicals	10	Low
Other Organic Chemicals	10	Low

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

Natural Susceptibility (0 – 50 points)
+
Contaminant Risks (0 – 50 points)
=
Vulnerability of the
Drinking Water Source to Contamination (0 – 100).

Again, rankings are assigned according to a point score:

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

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

Table 4. Overall Vulnerability

Category	Score	Rating
Bacteria and Viruses	35	Low
Nitrates and Nitrites	45	Medium
Volatile Organic Chemicals	50	Medium
Heavy Metals, Cyanide, and Other Inorganic Chemicals	35	Low
Synthetic Organic Chemicals	35	Low
Other Organic Chemicals	35	Low

Bacteria and Viruses

The residential septic systems represent the greatest risk of Bacteria and Viruses to the White Birch Apartments drinking water system.

Only a small amount of bacteria and viruses are required to endanger public health. Coliforms are found naturally in the environment and although they aren't necessarily a health threat, it is 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 (EPA, 2002). Harmful bacteria can cause diarrhea, cramps, nausea, headaches, or other symptoms (EPA, 2002). Coliforms have not recently been detected in this water system.

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

Nitrates and Nitrites

The septic systems also represent the greatest risk to to nitrates and nitrites for this source of public drinking water.

Nitrates are very mobile, moving at approximately the same rate as water. Nitrates have not been detected during routine sampling in the White Birch Apartments well.

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

Volatile Organic Chemicals

The residential heating oil tanks represent the greatest risk of volatile organic chemical contamination to the White Birch Apartments water system.

Both underground and above ground residential heating oil tanks are common in North Pole. The most common causes of fuel leaks of these heating oil systems are overfilling the tank, ruptured fuel lines, leaking storage tanks, damaged or faulty valves and vandalism. Regular system maintenance and proper decommissioning can help prevent many of these harmful fuel leaks.

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

Heavy Metals, Cyanide, and Other Inorganic Chemicals

Again, the septic systems represent the greatest risk to Heavy Metals, Cyanide, and Other Inorganic Chemicals for this source of public drinking water.

Barium and Fluoride were detected in extremely small concentrations with respect to their MCLs. No other inorganic chemicals have recently been detected.

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

Synthetic Organic Chemicals

The septic systems represent the greatest risk to Synthetic Organic Chemicals for this source of public drinking water.

Synthetic Organic Chemicals have not recently been sampled for (within the past 5 years).

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

Other Organic Chemicals

The residential septic systems and heating oil tanks represent the greatest risk to Other Organic Chemicals for White Birch Apartments public drinking water system.

Other Organic Chemicals have not recently been sampled for (within the past 5 years).

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

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APPENDIX A

White Birch Apartments
Drinking Water Protection Area Location Map
(Map 1)

PLACK ROAD
BADGER ROAD
FLIGHT STREET
ERMINE DRIVE
OTTER DRIVE
DAWSON ROAD
TANADA ROAD
LAKEWOOD LOOP
YELLOWSTONE ROAD
ONYX ROAD
PETER HAWK AVENUE
GLACIER STATE DRIVE
White Birch Apartments well
ARLENE DRIVE
MOOSEWALK ROAD
PLANTERS LANE
SHARON ROAD
NELSON ROAD
HURST ROAD
LOLLY DRIVE
NEW RICHARDSON HIGHWAY
MISSION ROAD
NEWBY ROAD
ROUTE 66
DUBIA ROAD
BLESSING AVENUE
GORDON ROAD
GOLD STREET
SILVER STREET
JUDY LANE
KALTAG DRIVE
LYLE AVENUE
CONIFER DRIVE
OLD RICHARDSON HIGHWAY

Zone A
Zone B
Zone C
Zone D

Map 1: White Birch Apartments Drinking Water Protection Area

PWSID: 313233

Alaska Department of Environmental Conservation

Alaska Drinking Water Protection Program

0 775 1,550 3,100 4,650 Feet

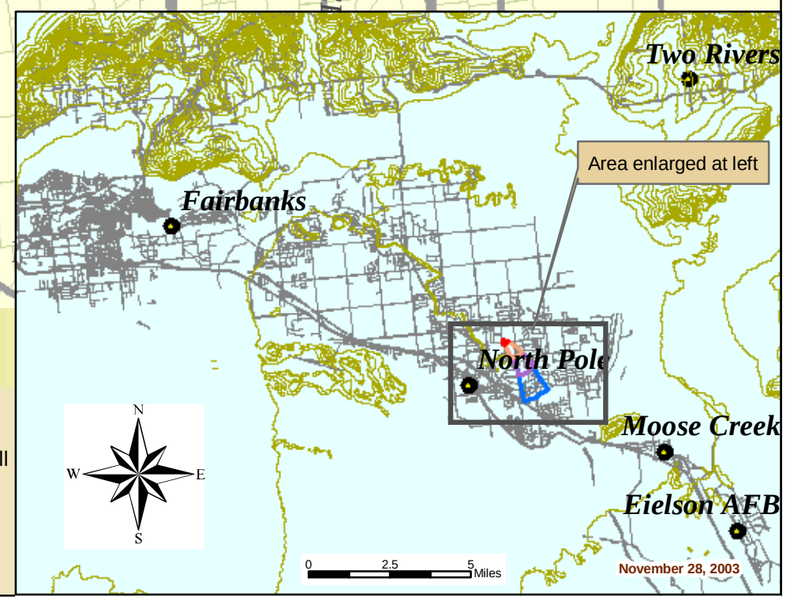
1:18,600

Data Sources:

Parcel, roads, water bodies - Fairbanks North Star Borough
Railroad - Geographic Data Technology
Elevation contours - USGS digital elevation models (DEMs)

Legend

- Zone A *Several months travel time*
- Zone B *Less than 2 years travel time*
- Zone C *Less than 5 years travel time*
- Zone D *Less than 10 years travel time*
- White Birch Apartments well
- Towns
- Roads
- Parcels



APPENDIX B

Contaminant Source Inventory and Risk Ranking for White Birch Apartments (Tables 1-7)

Table 1

Contaminant Source Inventory for ***White Birch Apartments***

PWSID 313233.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Map Number*	*Comments*
Highways and roads, paved (cement or asphalt)	X20		A	2	Voyager Road, Arlene Street
Residential Areas	R01		B	2	Approximately 35 acres of residential area in Zone B
Septic systems (serves one single-family home)	R02		B	2	Assumed 12 septics based on number of tax parcels designated as residential
Tanks, heating oil, residential (above ground)	R08		B	2	Assumed 12 tanks based on number of tax parcels designated as residential
Tanks, heating oil, nonresidential (underground)	T16	T16-1	B	2	3288 Hurst Road
Highways and roads, paved (cement or asphalt)	X20		B	2	Sharon Road, Dawson Road
Firehouses	X38	X38-1	B	2	3288 Hurst Road
Construction trade areas and materials	C09	C09-1	C	2	3329 Lineman Way
Residential Areas	R01		C	2	Approximately 75 acres of residential area in Zone C
Septic systems (serves one single-family home)	R02		C	2	Assumed 53 septic based on number of tax parcels designated as residential
Tanks, heating oil, residential (above ground)	R08		C	2	Assumed 53 tanks based on number of tax parcels designated as residential
Highways and roads, paved (cement or asphalt)	X20		C	2	10 roads in Zone C

Table 2

Contaminant Source Inventory and Risk Ranking for White Birch Apartments Sources of Bacteria and Viruses

PWSID 313233.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Highways and roads, paved (cement or asphalt)	X20		A	Low	2	Voyager Road, Arlene Street
Residential Areas	R01		B	Low	2	Approximately 35 acres of residential area in Zone B
Highways and roads, paved (cement or asphalt)	X20		B	Low	2	Sharon Road, Dawson Road
Septic systems (serves one single-family home)	R02		B	Low	2	Assumed 12 septics based on number of tax parcels designated as residential
Residential Areas	R01		C	Low	2	Approximately 75 acres of residential area in Zone C
Highways and roads, paved (cement or asphalt)	X20		C	Low	2	10 roads in Zone C
Septic systems (serves one single-family home)	R02		C	Low	2	Assumed 53 septic based on number of tax parcels designated as residential

Table 3

Contaminant Source Inventory and Risk Ranking for White Birch Apartments Sources of Nitrates/Nitrites

PWSID 313233.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Highways and roads, paved (cement or asphalt)	X20		A	Low	2	Voyager Road, Arlene Street
Highways and roads, paved (cement or asphalt)	X20		B	Low	2	Sharon Road, Dawson Road
Residential Areas	R01		B	Low	2	Approximately 35 acres of residential area in Zone B
Septic systems (serves one single-family home)	R02		B	Low	2	Assumed 12 septics based on number of tax parcels designated as residential
Residential Areas	R01		C	Low	2	Approximately 75 acres of residential area in Zone C
Highways and roads, paved (cement or asphalt)	X20		C	Low	2	10 roads in Zone C
Septic systems (serves one single-family home)	R02		C	Low	2	Assumed 53 septic based on number of tax parcels designated as residential

Table 4

Contaminant Source Inventory and Risk Ranking for White Birch Apartments Sources of Volatile Organic Chemicals

PWSID 313233.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Highways and roads, paved (cement or asphalt)	X20		A	Low	2	Voyager Road, Arlene Street
Septic systems (serves one single-family home)	R02		B	Low	2	Assumed 12 septics based on number of tax parcels designated as residential
Tanks, heating oil, residential (above ground)	R08		B	Medium	2	Assumed 12 tanks based on number of tax parcels designated as residential
Residential Areas	R01		B	Low	2	Approximately 35 acres of residential area in Zone B
Highways and roads, paved (cement or asphalt)	X20		B	Low	2	Sharon Road, Dawson Road
Tanks, heating oil, nonresidential (underground)	T16	T16-1	B	Low	2	3288 Hurst Road
Firehouses	X38	X38-1	B	Low	2	3288 Hurst Road
Highways and roads, paved (cement or asphalt)	X20		C	Low	2	10 roads in Zone C
Tanks, heating oil, residential (above ground)	R08		C	Medium	2	Assumed 53 tanks based on number of tax parcels designated as residential
Septic systems (serves one single-family home)	R02		C	Low	2	Assumed 53 septic based on number of tax parcels designated as residential
Residential Areas	R01		C	Low	2	Approximately 75 acres of residential area in Zone C
Construction trade areas and materials	C09	C09-1	C	Low	2	3329 Lineman Way

Table 5

Contaminant Source Inventory and Risk Ranking for White Birch Apartments

Sources of Heavy Metals, Cyanide and Other Inorganic Chemicals

PWSID 313233.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Highways and roads, paved (cement or asphalt)	X20		A	Low	2	Voyager Road, Arlene Street
Highways and roads, paved (cement or asphalt)	X20		B	Low	2	Sharon Road, Dawson Road
Septic systems (serves one single-family home)	R02		B	Low	2	Assumed 12 septics based on number of tax parcels designated as residential
Residential Areas	R01		B	Low	2	Approximately 35 acres of residential area in Zone B
Tanks, heating oil, nonresidential (underground)	T16	T16-1	B	Low	2	3288 Hurst Road
Firehouses	X38	X38-1	B	Low	2	3288 Hurst Road
Highways and roads, paved (cement or asphalt)	X20		C	Low	2	10 roads in Zone C
Residential Areas	R01		C	Low	2	Approximately 75 acres of residential area in Zone C
Septic systems (serves one single-family home)	R02		C	Low	2	Assumed 53 septic based on number of tax parcels designated as residential
Construction trade areas and materials	C09	C09-1	C	Low	2	3329 Lineman Way

Table 6

Contaminant Source Inventory and Risk Ranking for White Birch Apartments Sources of Synthetic Organic Chemicals

PWSID 313233.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Septic systems (serves one single-family home)	R02		B	Low	2	Assumed 12 septics based on number of tax parcels designated as residential
Residential Areas	R01		B	Low	2	Approximately 35 acres of residential area in Zone B
Septic systems (serves one single-family home)	R02		C	Low	2	Assumed 53 septic based on number of tax parcels designated as residential
Residential Areas	R01		C	Low	2	Approximately 75 acres of residential area in Zone C

Table 7

Contaminant Source Inventory and Risk Ranking for White Birch Apartments
Sources of Other Organic Chemicals

PWSID 313233.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Highways and roads, paved (cement or asphalt)	X20		A	Low	2	Voyager Road, Arlene Street
Residential Areas	R01		B	Low	2	Approximately 35 acres of residential area in Zone B
Highways and roads, paved (cement or asphalt)	X20		B	Low	2	Sharon Road, Dawson Road
Septic systems (serves one single-family home)	R02		B	Low	2	Assumed 12 septics based on number of tax parcels designated as residential
Residential Areas	R01		C	Low	2	Approximately 75 acres of residential area in Zone C
Highways and roads, paved (cement or asphalt)	X20		C	Low	2	10 roads in Zone C
Septic systems (serves one single-family home)	R02		C	Low	2	Assumed 53 septic based on number of tax parcels designated as residential
Construction trade areas and materials	C09	C09-1	C	Low	2	3329 Lineman Way

APPENDIX C

White Birch Apartments
Drinking Water Protection Area
and Potential and Existing Contaminant Sources
(Map 2)

White Birch Apartments well

Zone A

Zone B

Zone C

Zone D

T16-1

X38-1

C09-1

VOYAGER STREET

4-D DRIVE

ARLENE DRIVE

MILES STREET

HURST ROAD

MOOSEWALK ROAD

PLANTERS LANE

SHARON ROAD

INDEPENDENCE PARK

PENNY LANE

BLUE JAY WAY

FREEDOM DRIVE

ONYX ROAD

VIRGINIA STREET

DURHAM CIRCLE

OUTSIDE HURST BOULEVARD

BROOKVIEW LANE

OUTSIDE HURST BOULEVARD

OUTSIDE BOULEVARD

RALPH TURNAROUND

DAWSON ROAD

FUGARWE COURT

EDSSON AVENUE

EIRE STREET

NEVIN AVENUE

MAHLEN COURT

MCCONNELL WAY

NEWBY ROAD

SPRINGS BOULEVARD

SADY LU LANE

MISSION ROAD

CACHE WAY

ARCTIC CACHE

JONY DAN LANE

JUNE TURNAROUND

ROUTE 66

LINEMAN AVENUE

BARRETT CO

JOSHUA

MICAH RO

YAKU

OUGHCHEE AVENUE

Map 2: White Birch Apartments Potential Contaminant Sources

PWSID: 313233

Alaska Department of Environmental Conservation

Alaska Drinking Water Protection Program

0 287.5 575 1,150 Feet

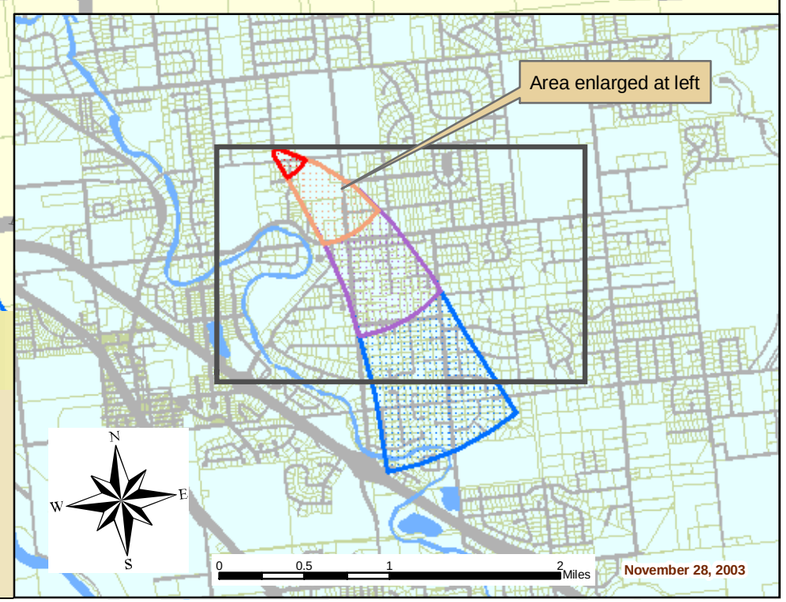
1:8,400

Data Sources:

Parcel, roads, water bodies - Fairbanks North Star Borough
Railroad - Geographic Data Technology
Elevation contours - USGS digital elevation models (DEMs)

Legend

- R02, Residential septic systems
- R08, Residential heating oil tanks
- C09, Construction trade area
- T16, Underground heating oil tank
- X38, Firehouse
- R01, Residential area
- Roads
- Surface water
- Parcels



APPENDIX D

Vulnerability Analysis for White Birch Apartments Public Drinking Water Source

(Charts 1-14)

Chart 1. Susceptibility of the wellhead - White Birch Apartments

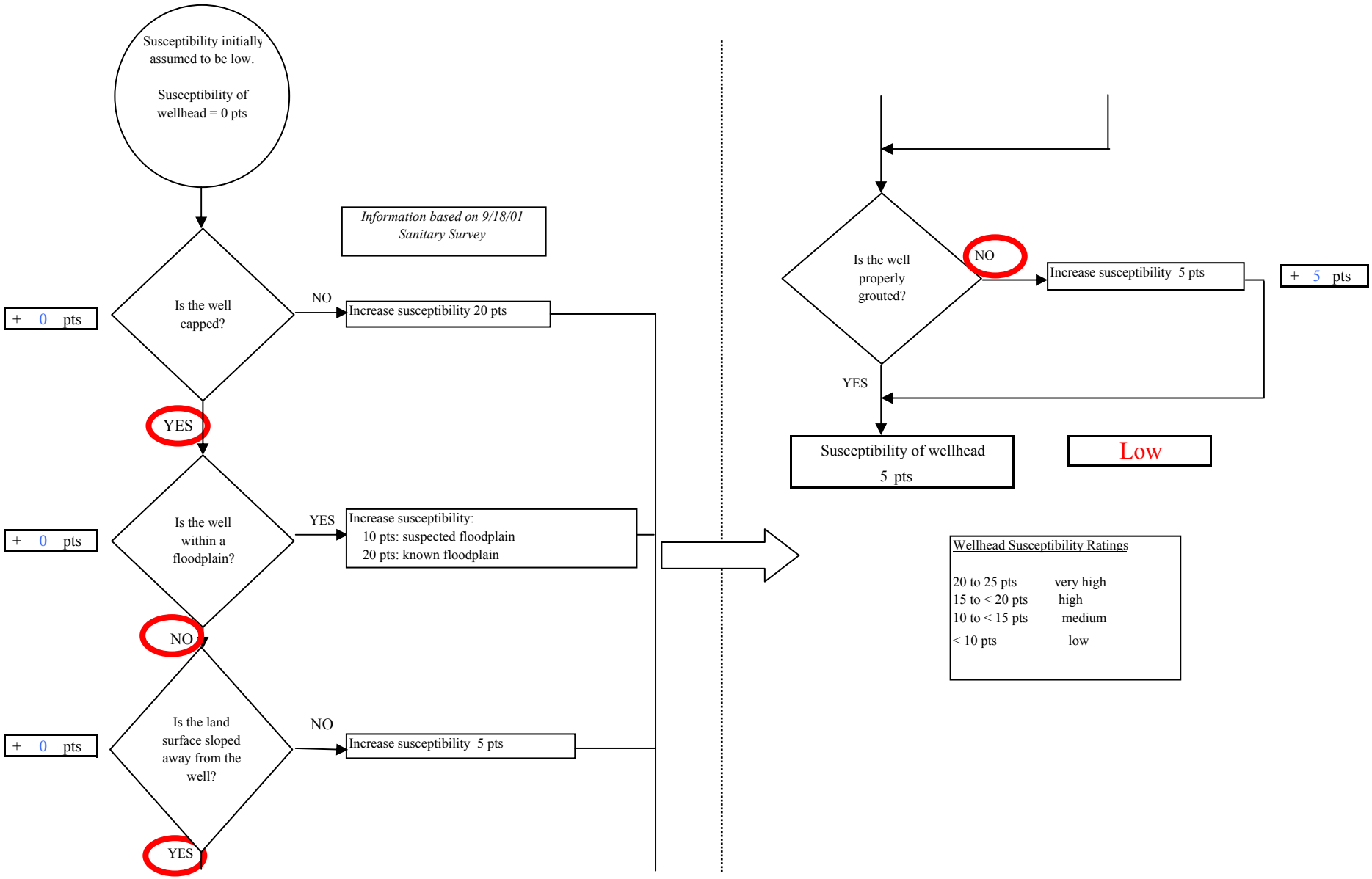


Chart 2. Susceptibility of the aquifer - White Birch Apartments

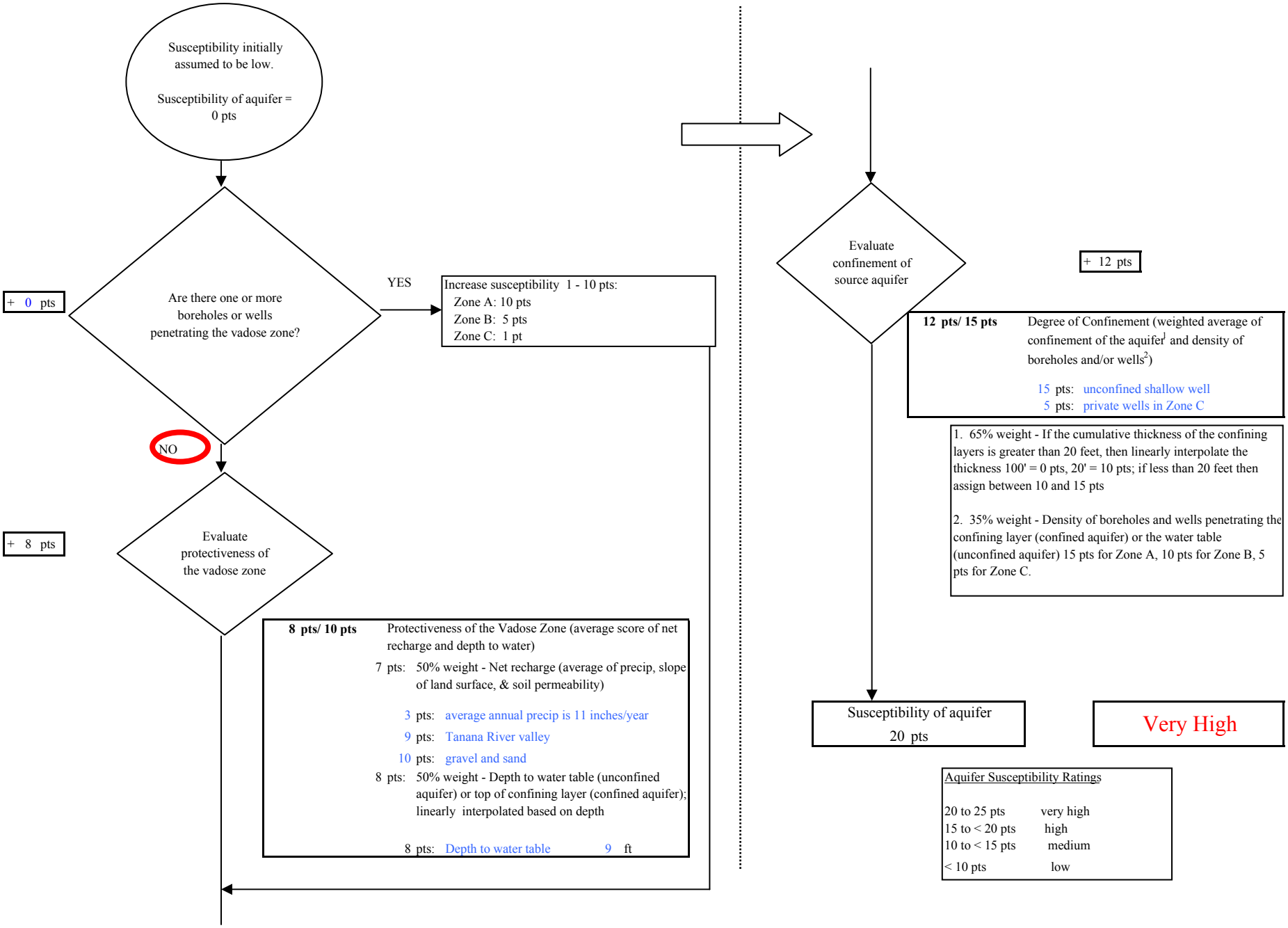
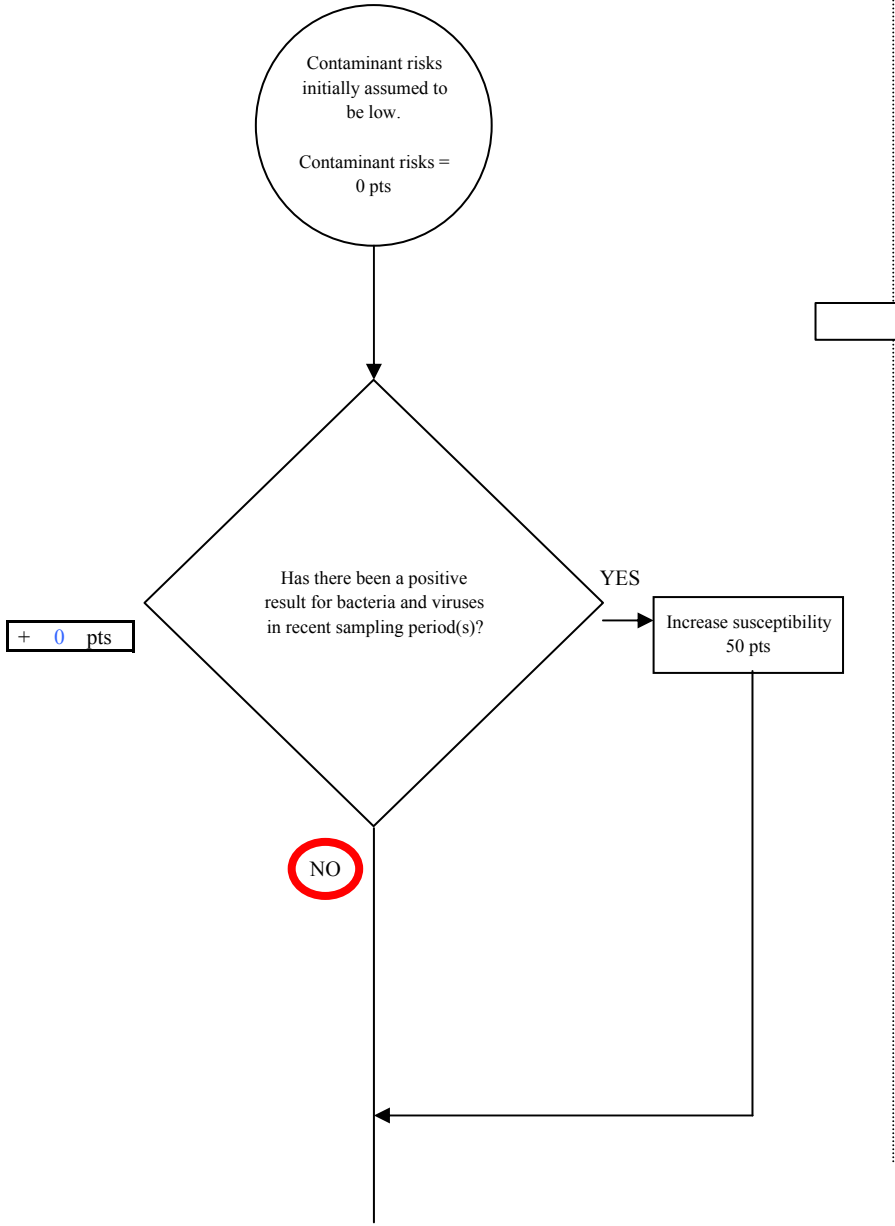
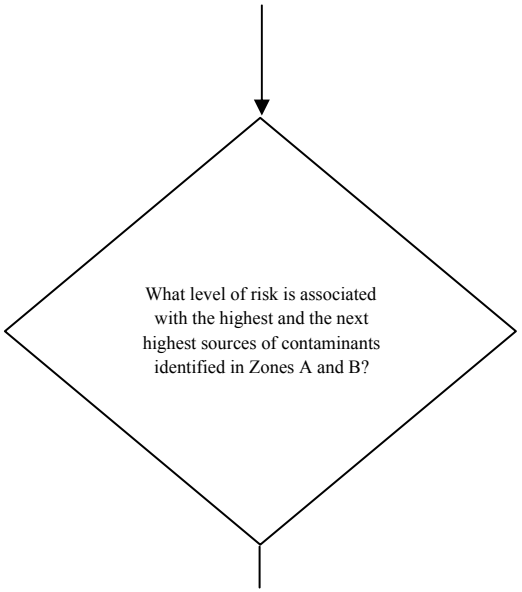


Chart 3. Contaminant risks for White Birch Apartments - Bacteria & Viruses





+ 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	4	5

	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 3. Contaminant risks for White Birch Apartments - Bacteria & Viruses

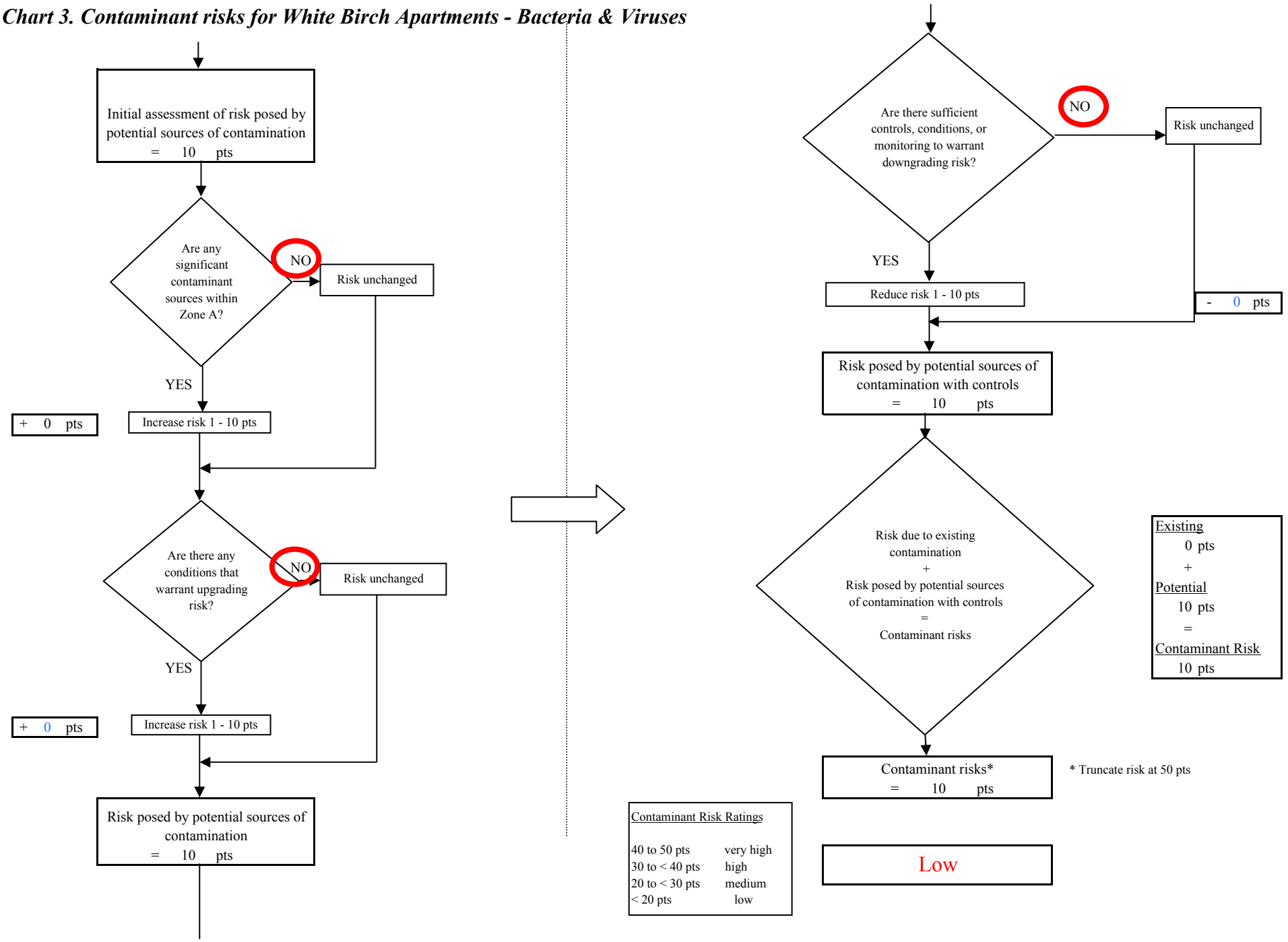


Chart 4. Vulnerability analysis for White Birch Apartments - Bacteria & Viruses

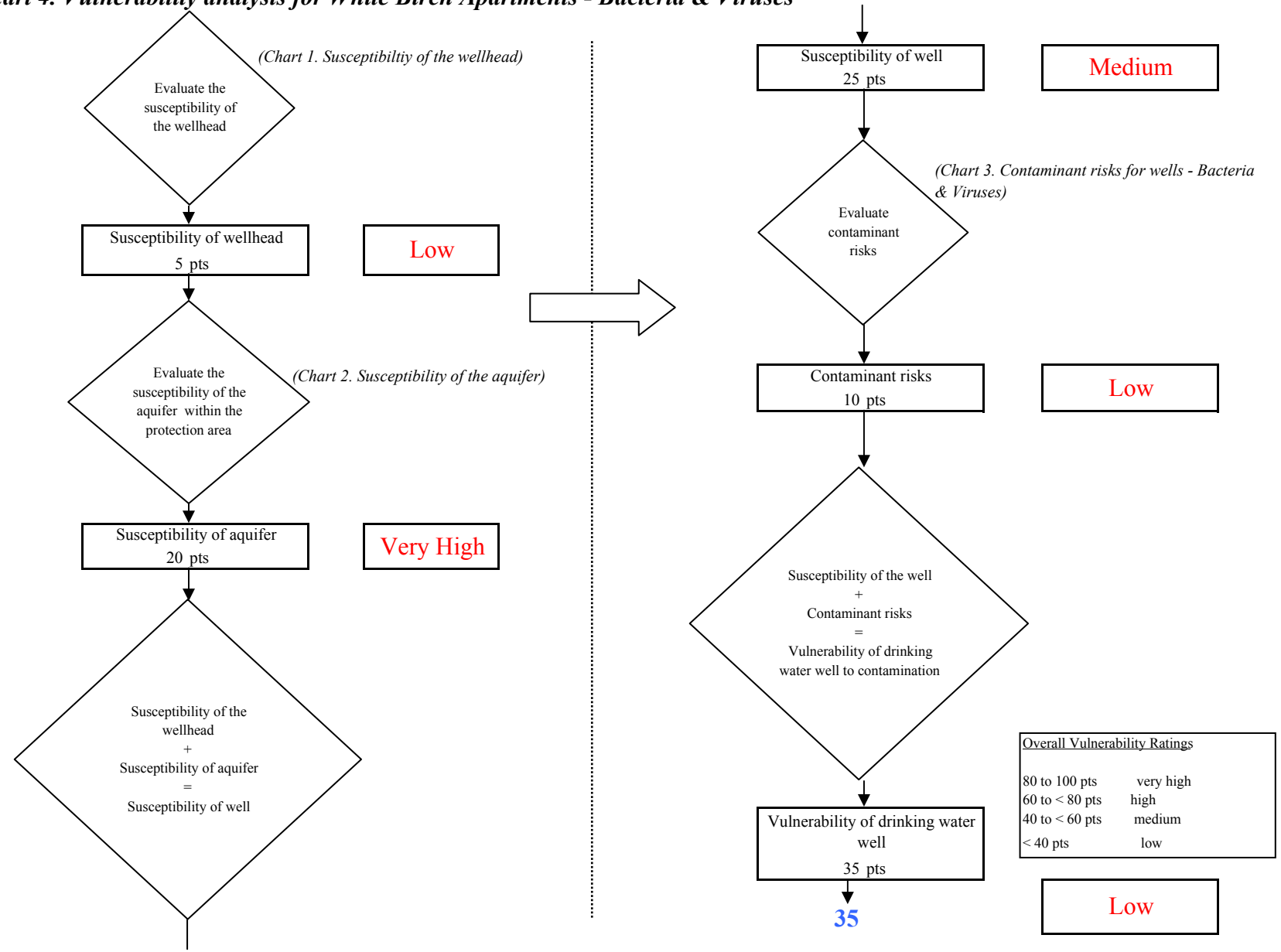


Chart 5. Contaminant risks for White Birch Apartments - Nitrates and Nitrites

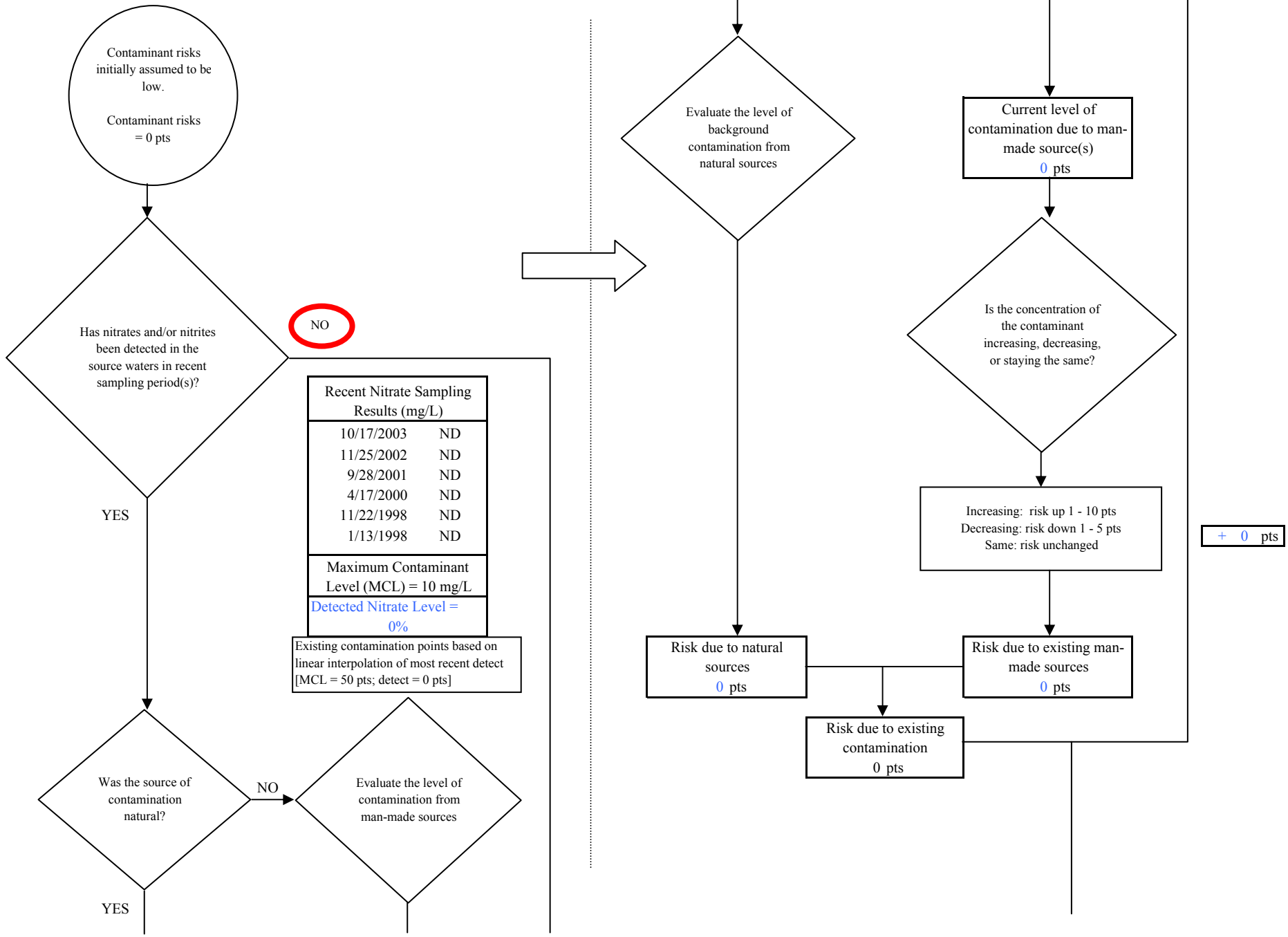


Chart 5. Contaminant risks for White Birch Apartments - Nitrates and Nitrites

+ 20 pts

What level of risk is associated with the highest and the next highest risk sources(s) of contaminants identified in Zones A, 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)	1	10	11

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

Matrix Score 20

Note: Septic systems, sewerlines, and roads are each assigned a risk ranking for each individual contaminant source in 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 = 20 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

+ 0 pts

Chart 5. Contaminant risks for White Birch Apartments - Nitrates and Nitrites

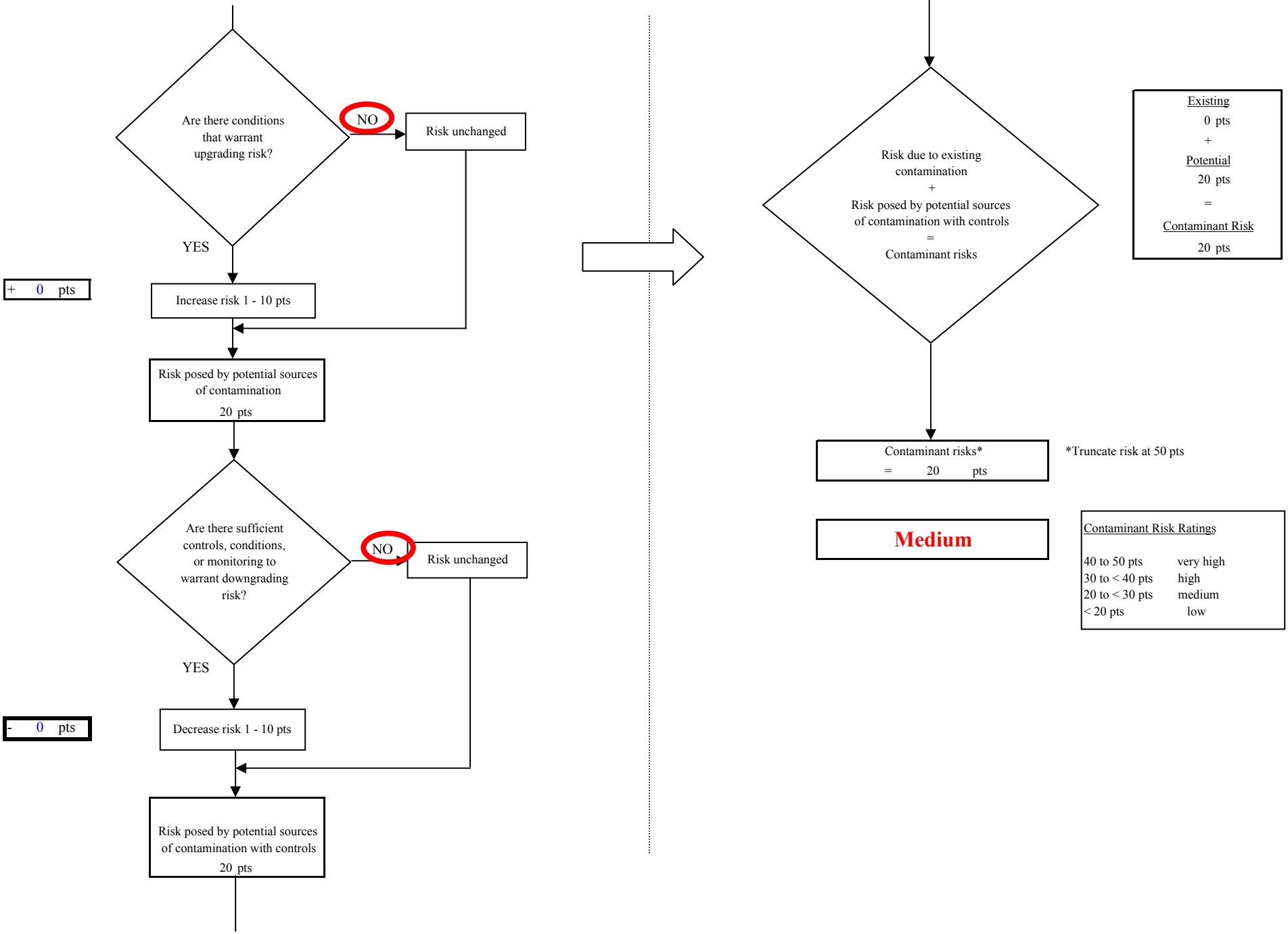


Chart 6. Vulnerability analysis for White Birch Apartments - Nitrates and Nitrites

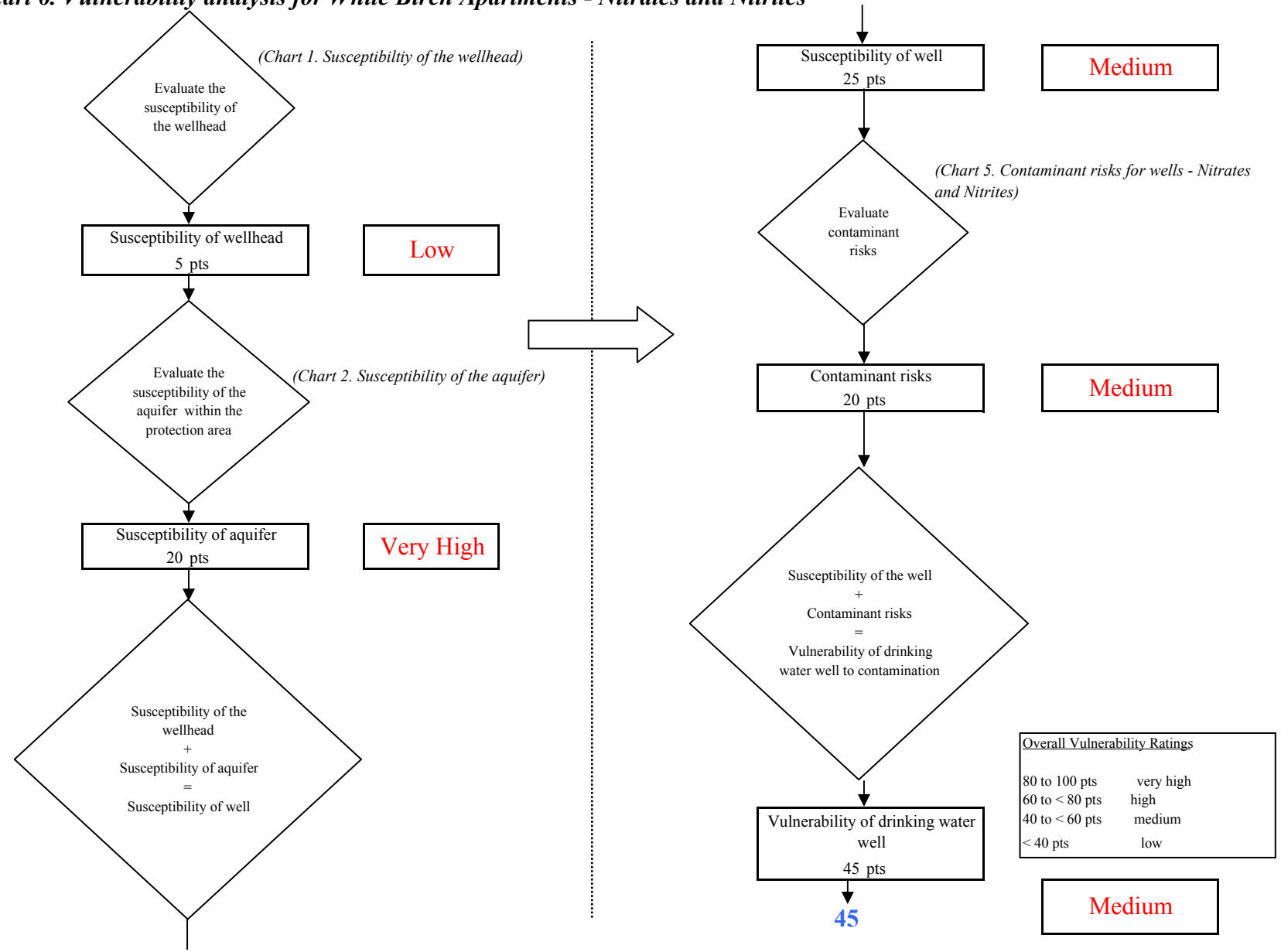


Chart 7. Contaminant risks for White Birch Apartments - Volatile Organic Chemicals

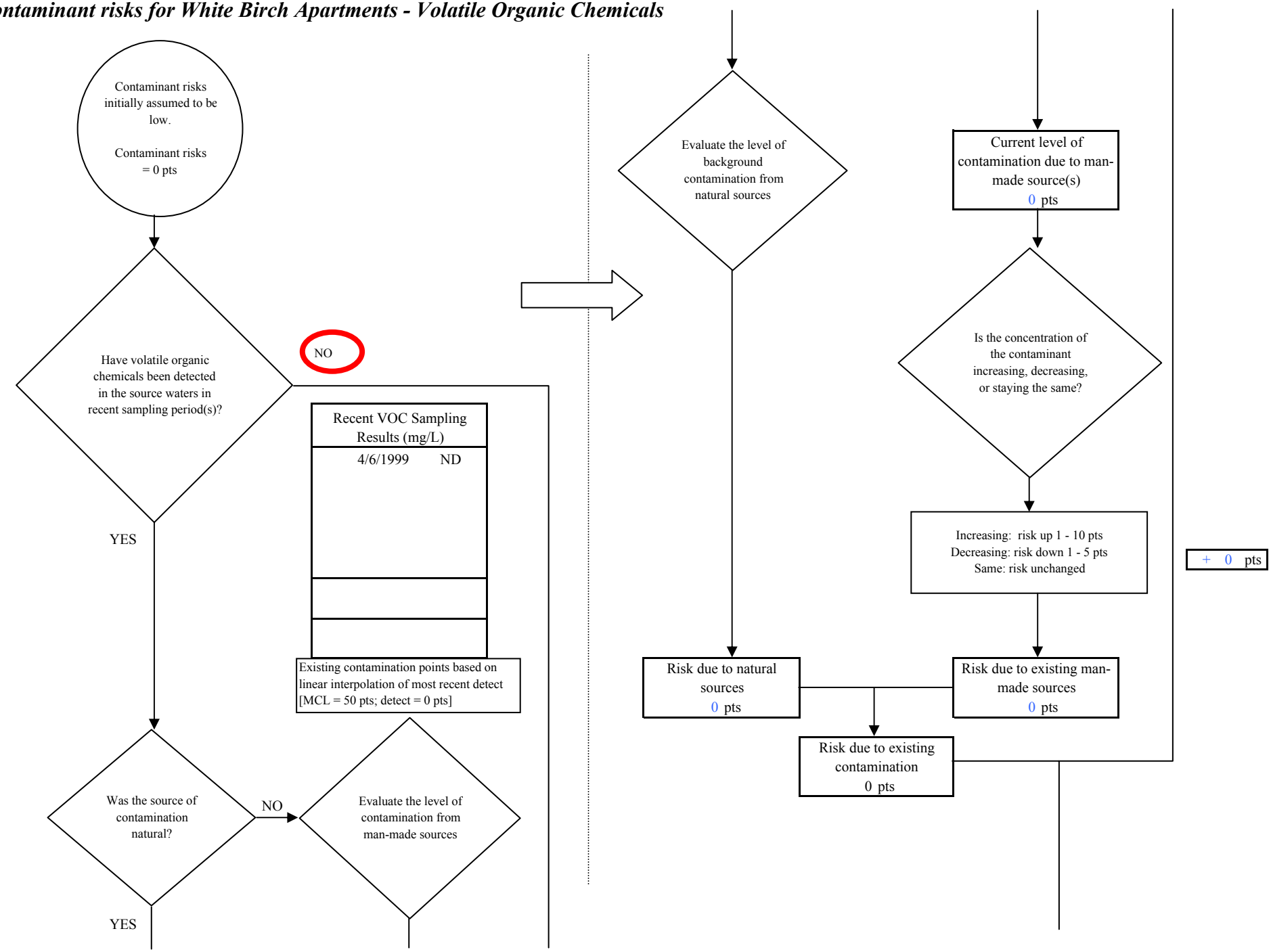


Chart 7. Contaminant risks for White Birch Apartments - Volatile Organic Chemicals

+ 25 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	67	67
Low(s)	1	7	8

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

Matrix Score 25

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

Initial assessment of risk posed by potential sources of contamination = 25 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

+ 0 pts

Chart 7. Contaminant risks for White Birch Apartments - Volatile Organic Chemicals

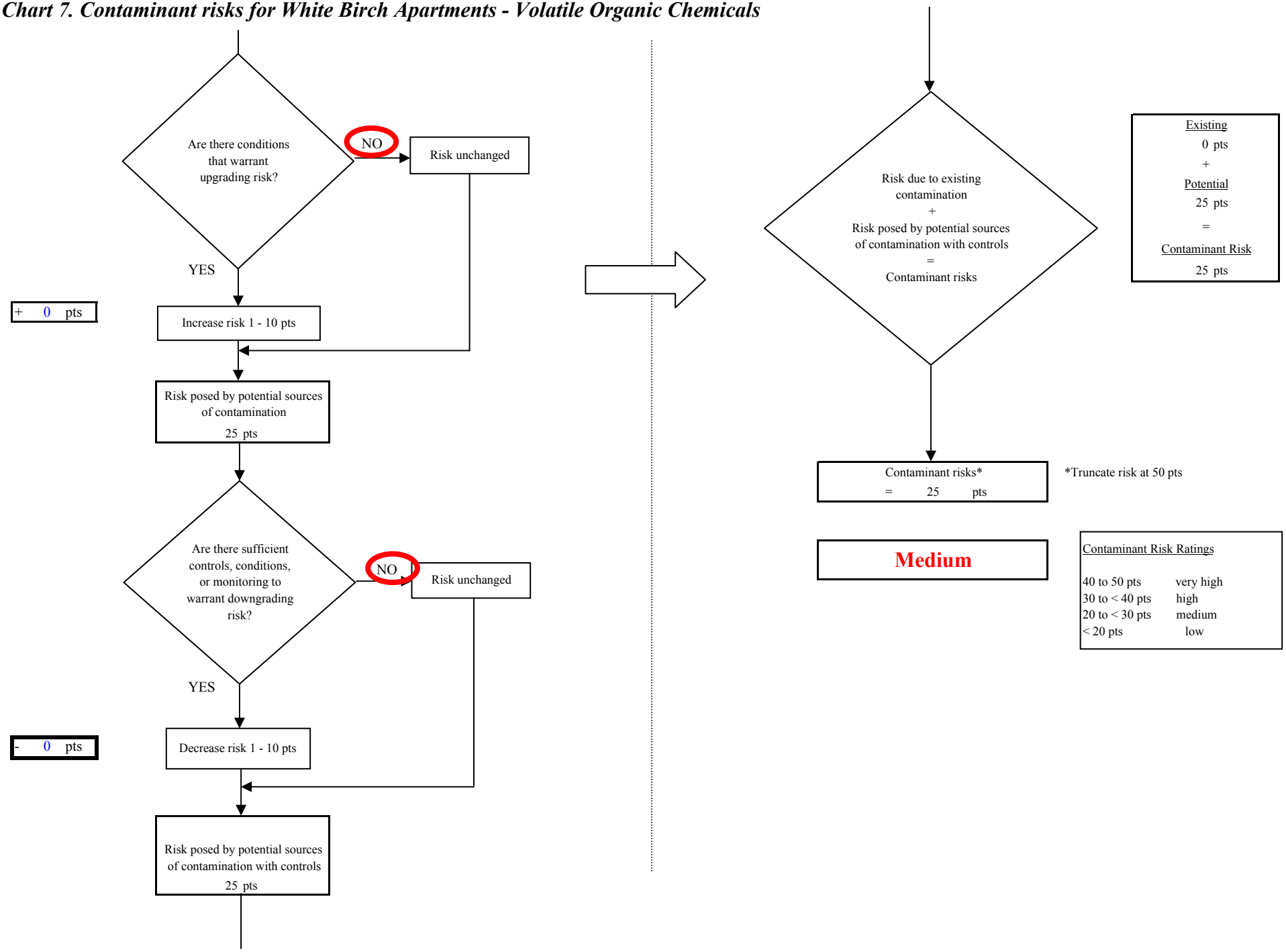


Chart 8. Vulnerability analysis for White Birch Apartments - Volatile Organic Chemicals

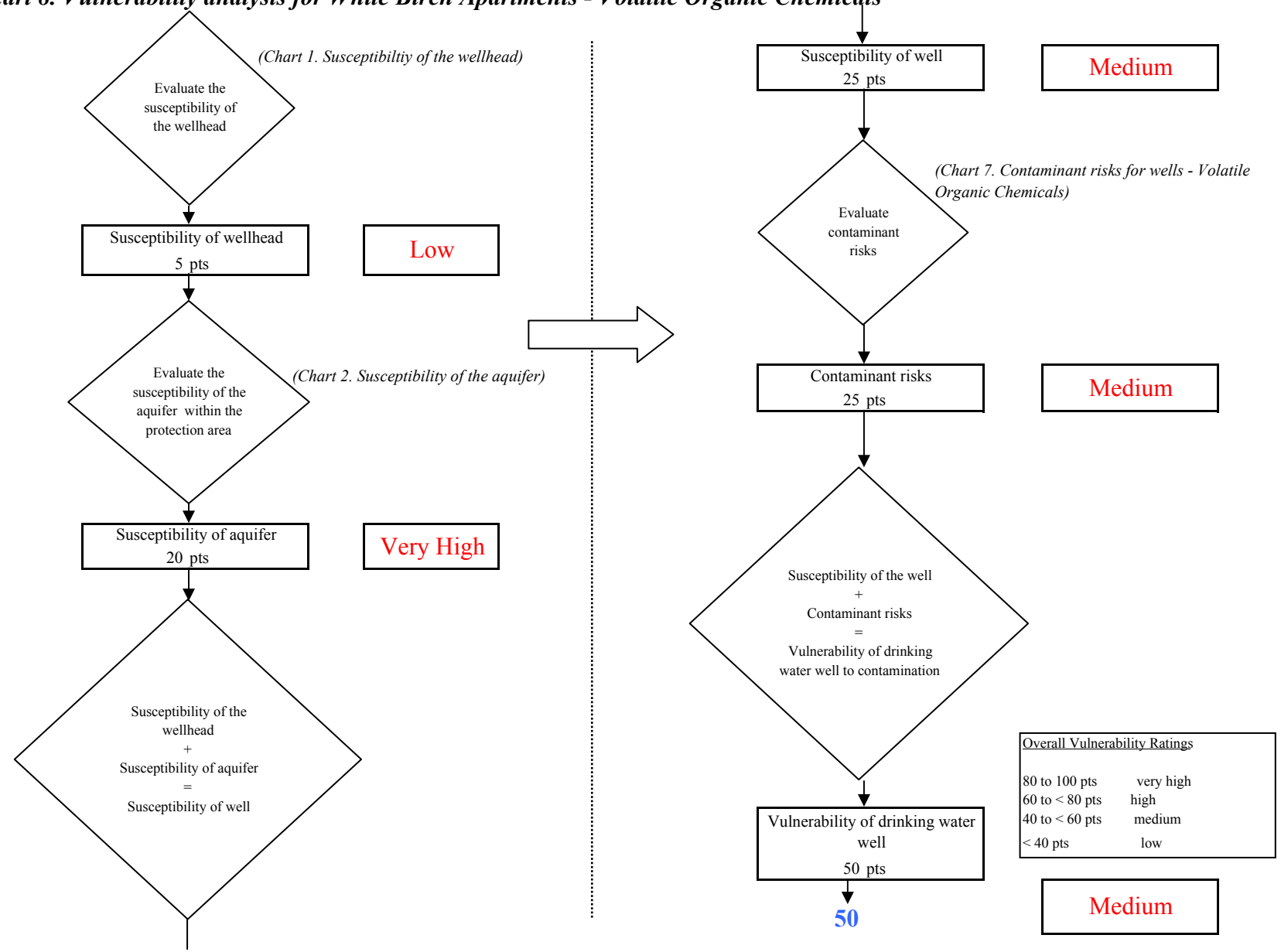


Chart 9. Contaminant risks for White Birch Apartments - Heavy Metals, Cyanide and Other Inorganic Chemicals

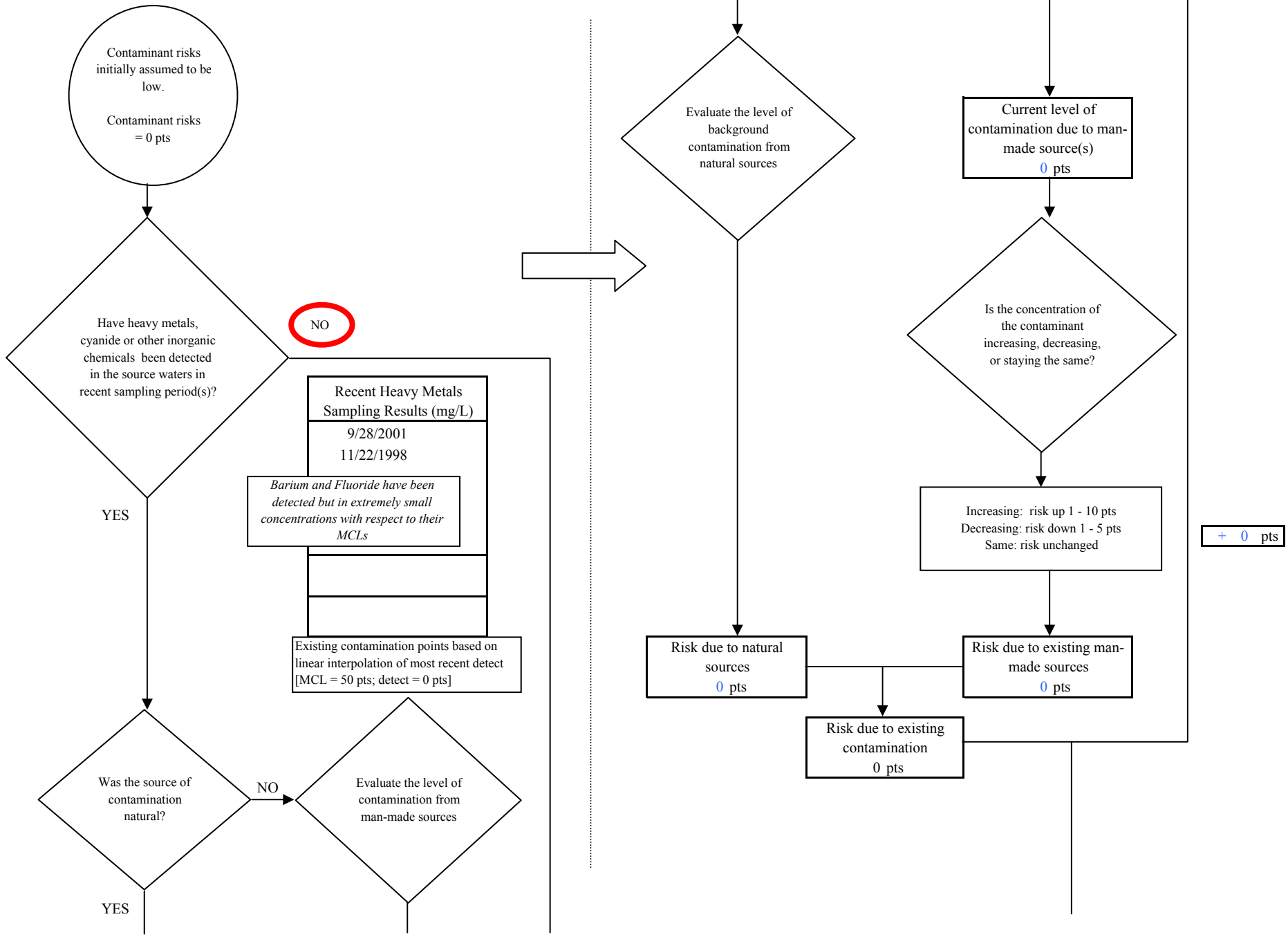


Chart 9. Contaminant risks for White Birch Apartments - Heavy Metals, Cyanide and Other Inorganic Chemicals

+ 10 pts

What level of risk is associated with the highest and the next highest risk sources(s) of contaminants identified in Zones A, 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)	1	6	7

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

Matrix Score 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

+ 0 pts

Chart 9. Contaminant risks for White Birch Apartments - Heavy Metals, Cyanide and Other Inorganic Chemicals

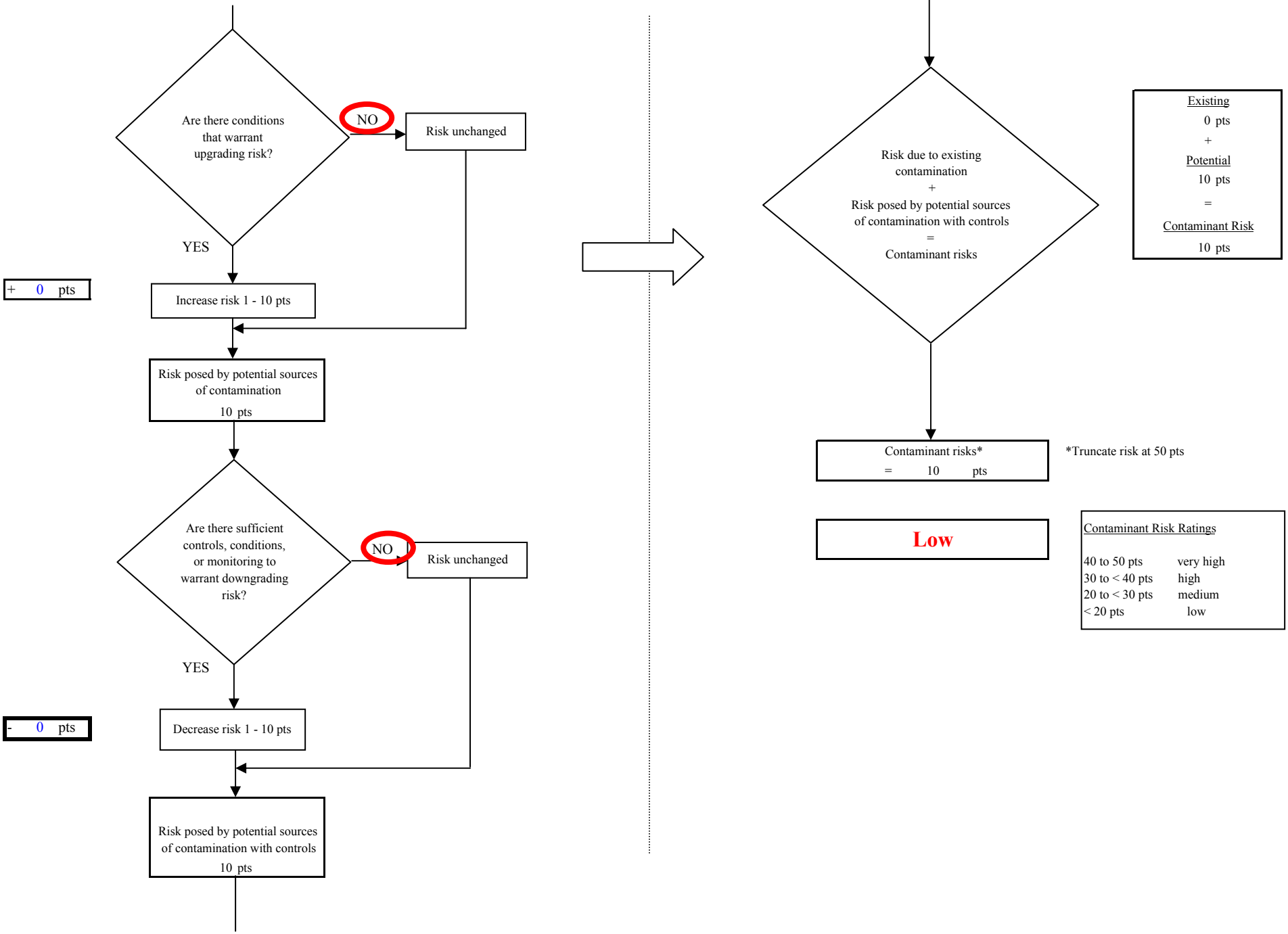


Chart 10. Vulnerability analysis for White Birch Apartments - Heavy Metals, Cyanide and Other Inorganic Chemicals

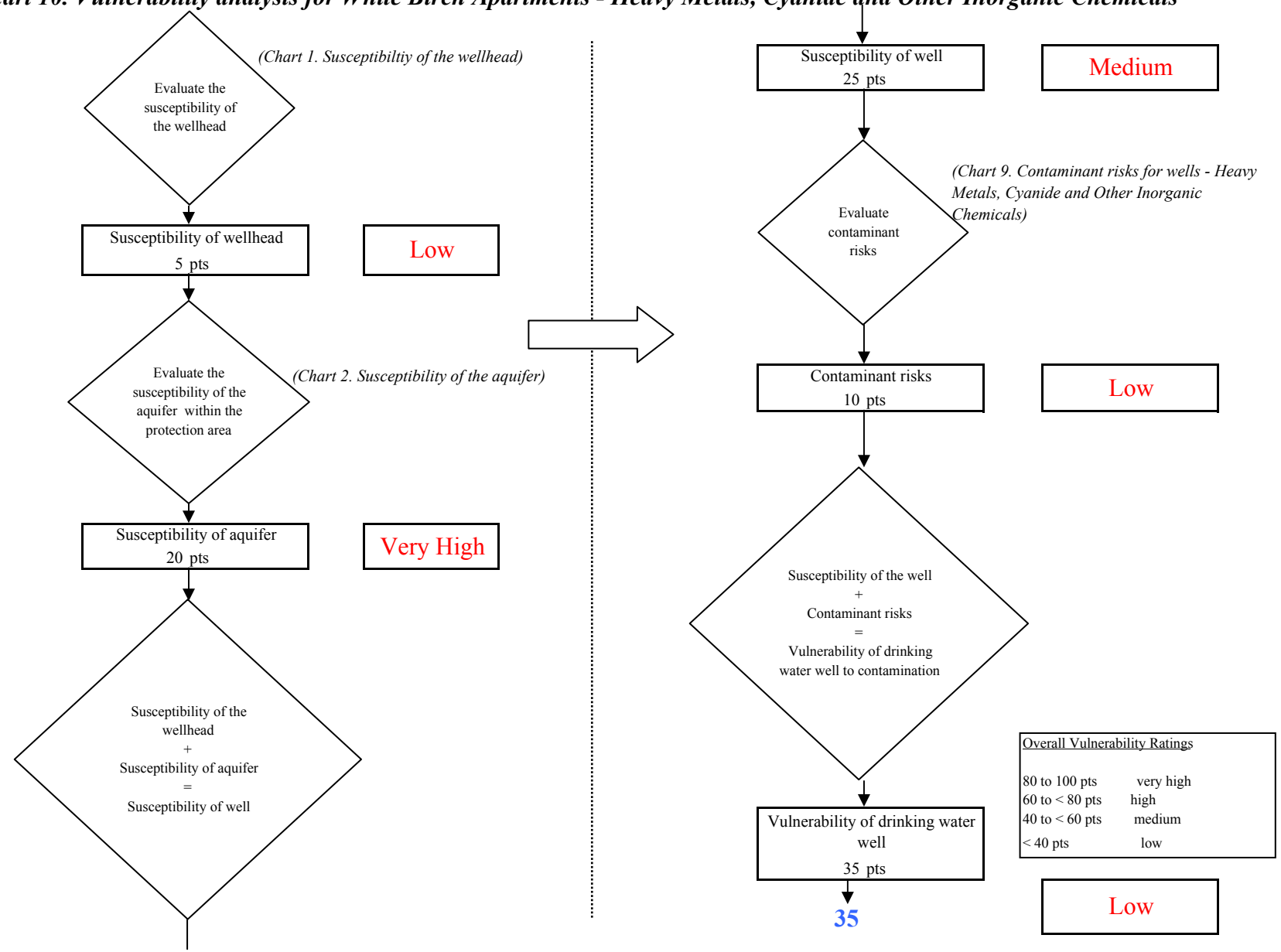


Chart 11. Contaminant risks for White Birch Apartments - Synthetic Organic Chemicals

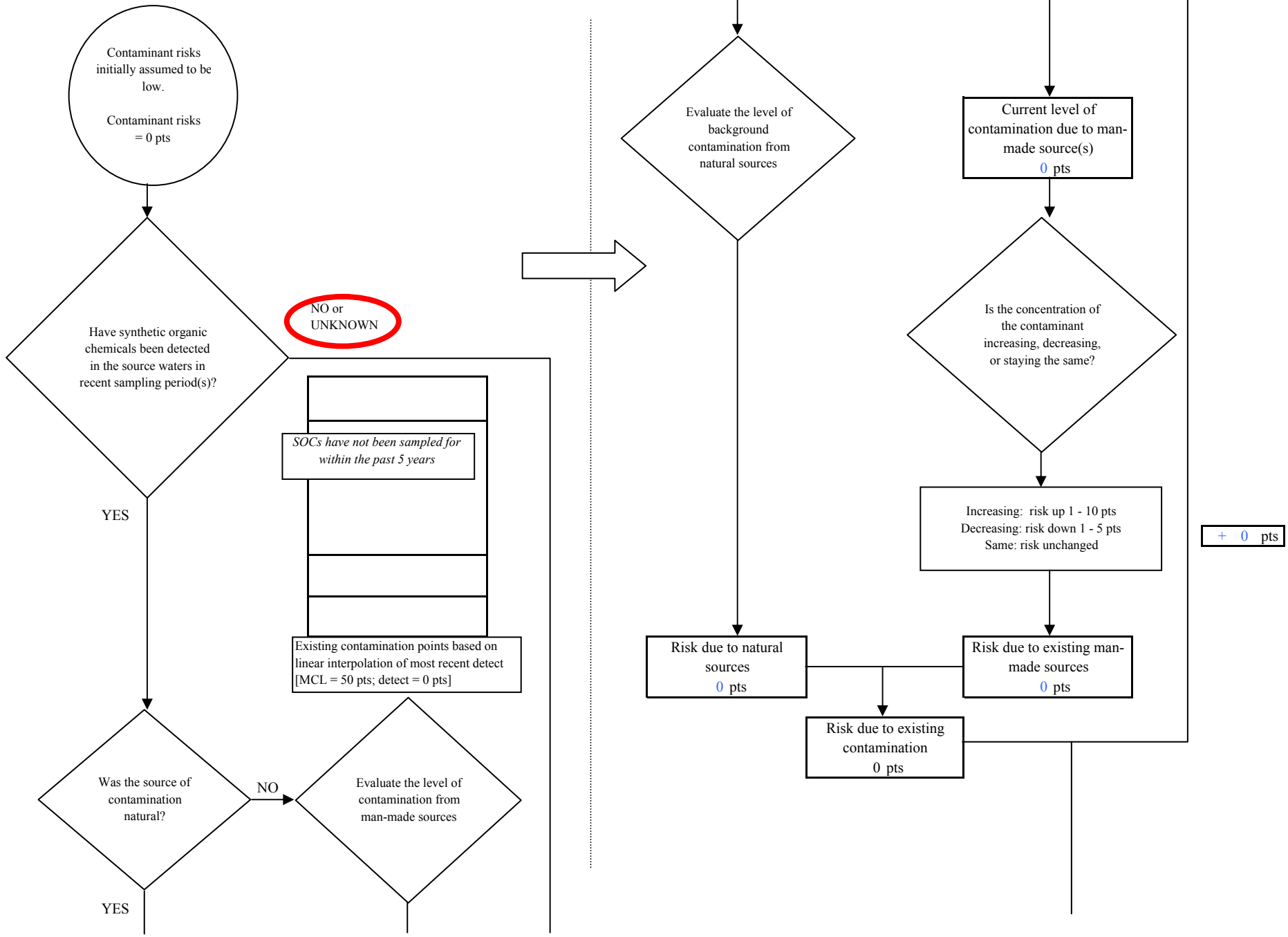


Chart 11. Contaminant risks for White Birch Apartments - Synthetic Organic Chemicals

+ 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)	0	2	2

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

Matrix Score 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

+ 0 pts

Chart 11. Contaminant risks for White Birch Apartments - Synthetic Organic Chemicals

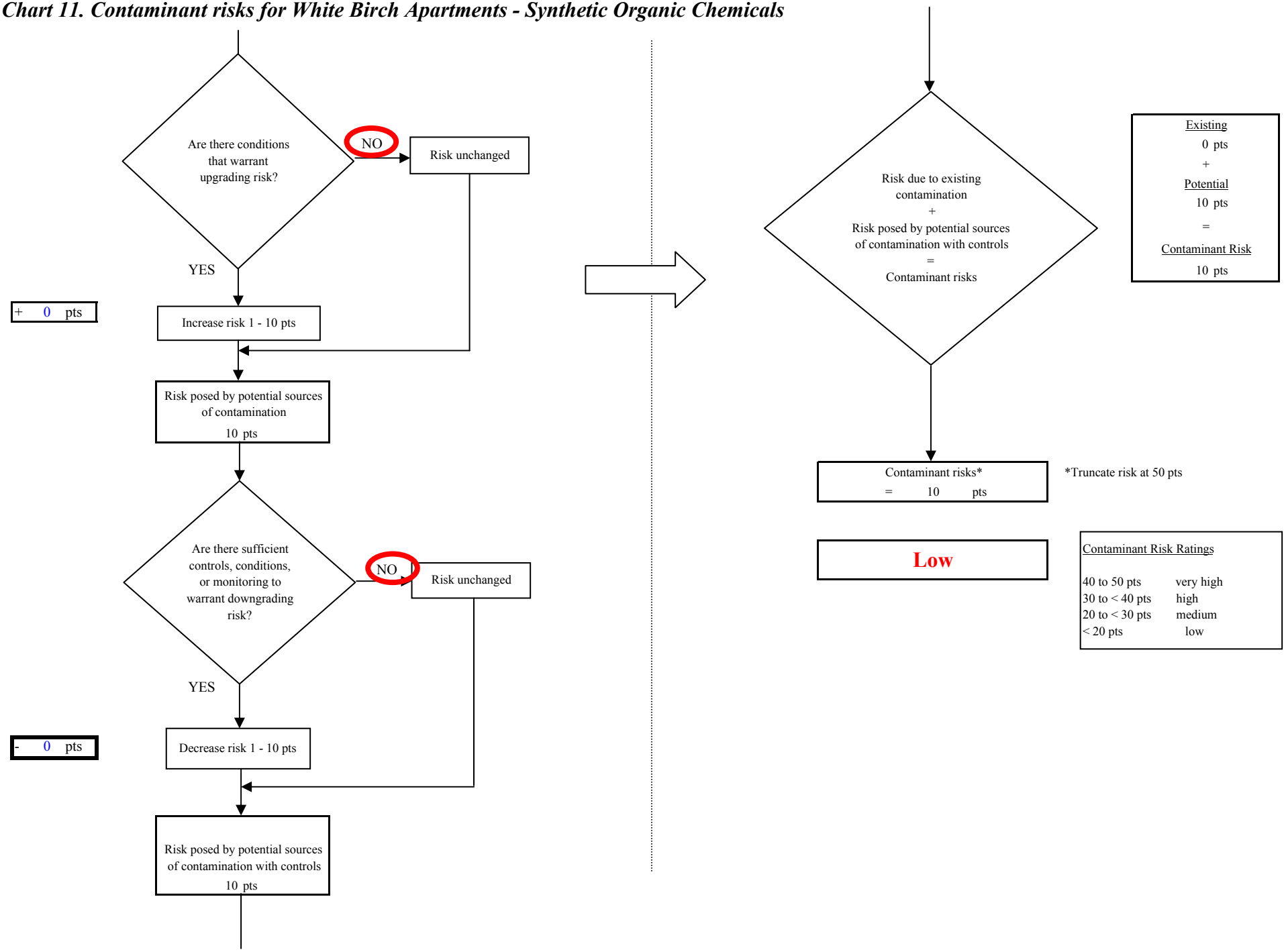


Chart 12. Vulnerability analysis for White Birch Apartments - Synthetic Organic Chemicals

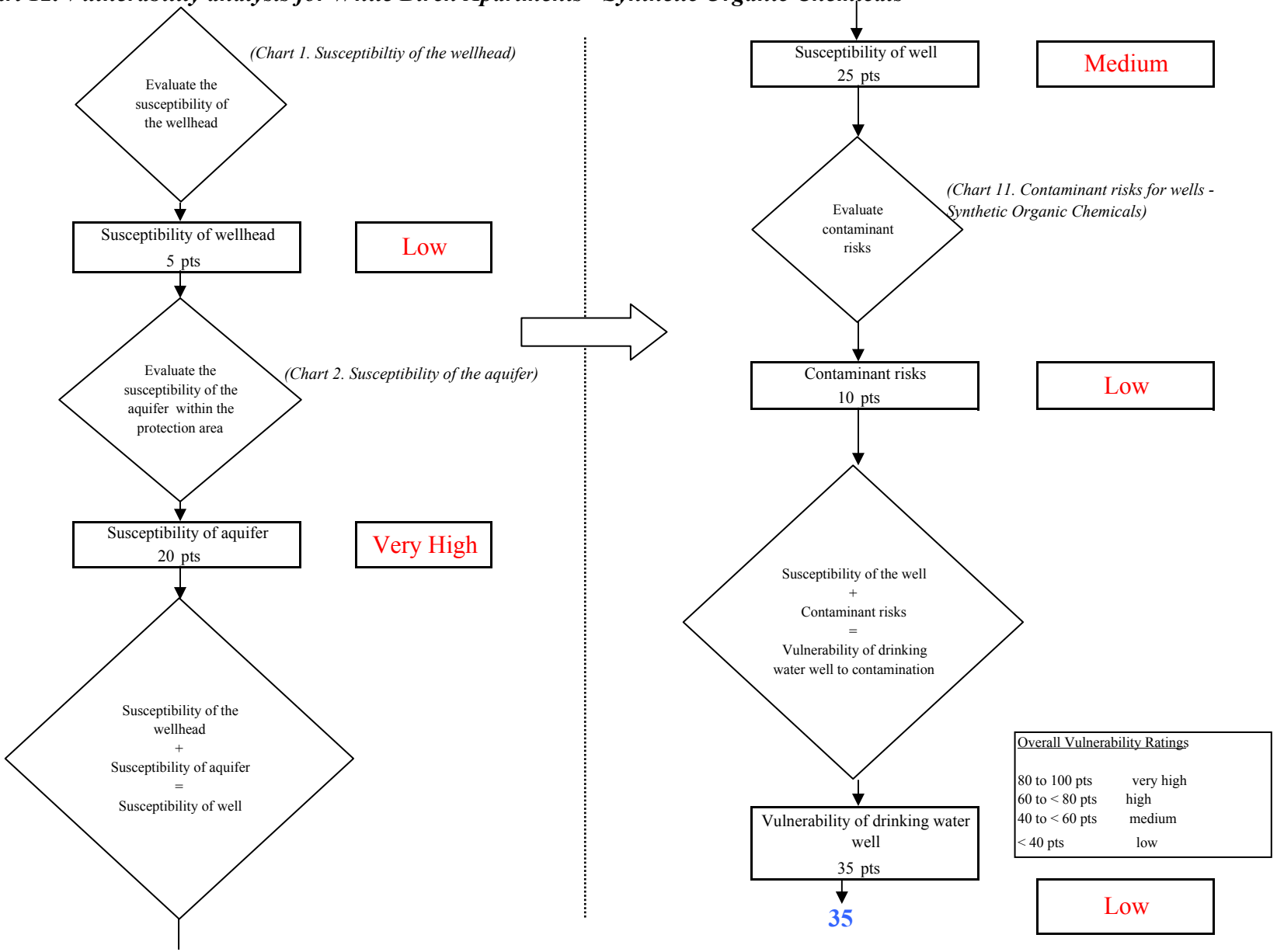


Chart 13. Contaminant risks for White Birch Apartments - Other Organic Chemicals

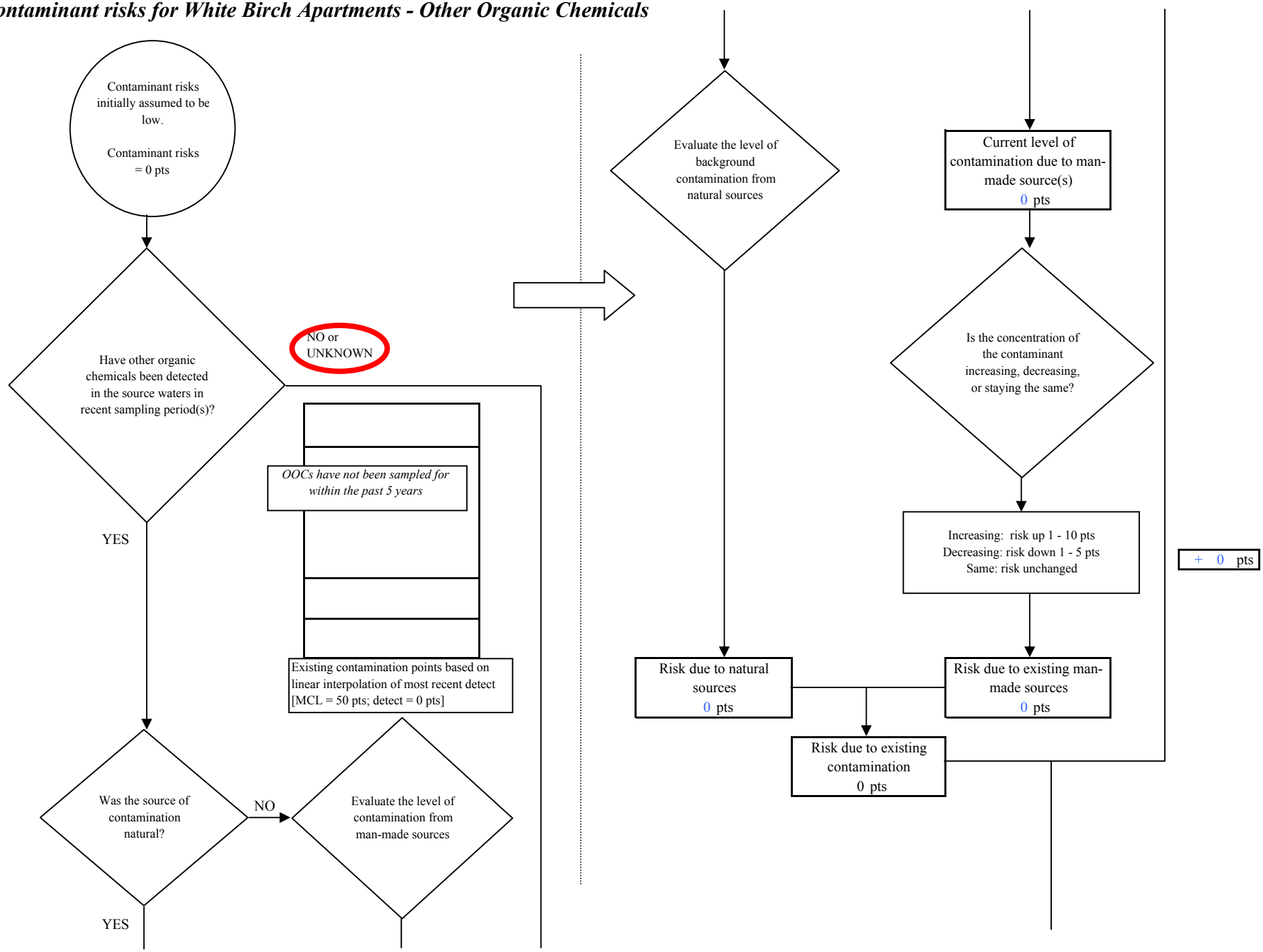


Chart 13. Contaminant risks for White Birch Apartments - Other Organic Chemicals

+ 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)	1	4	5

	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.

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

+ 0 pts

Chart 13. Contaminant risks for White Birch Apartments - Other Organic Chemicals

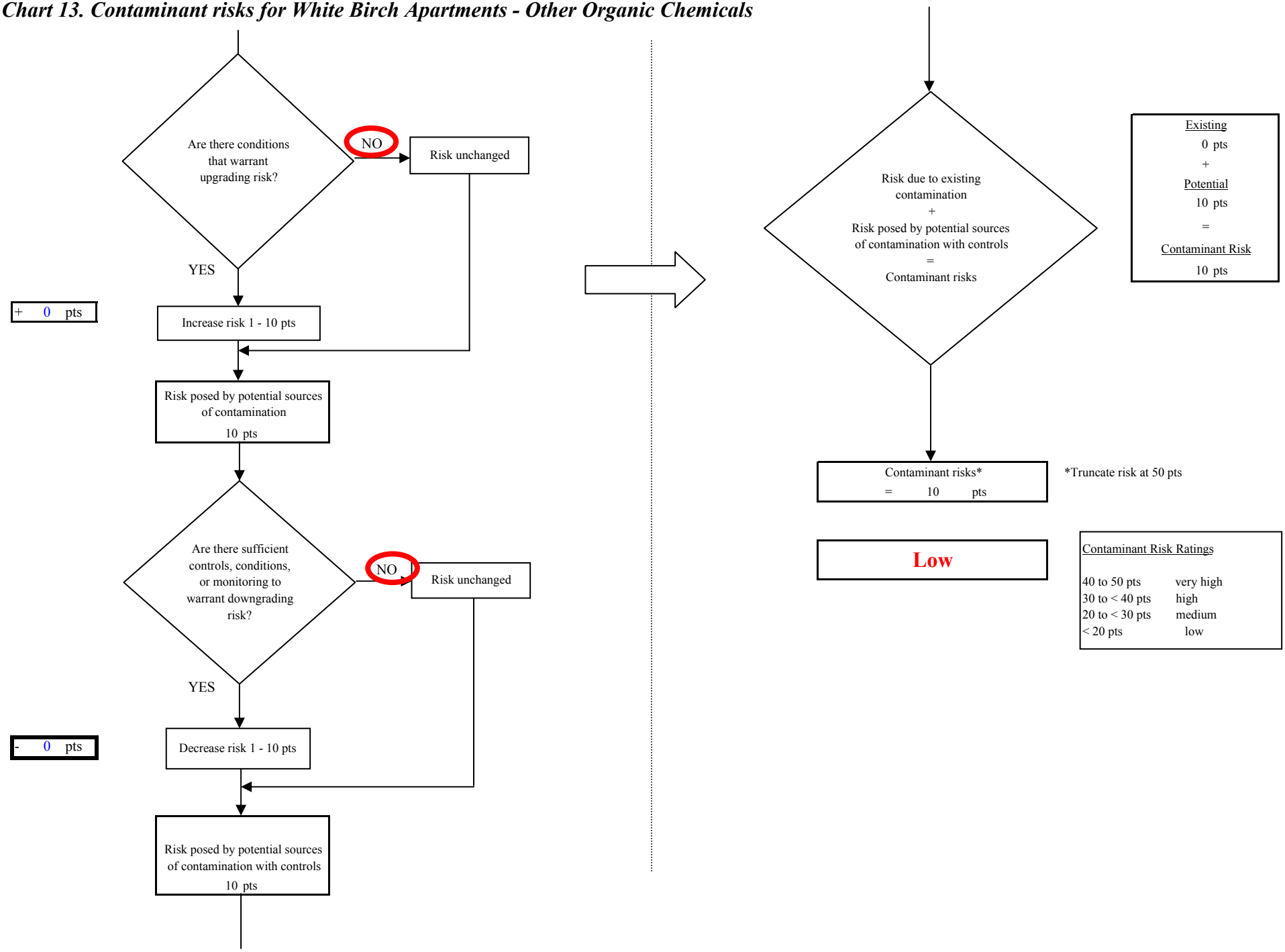


Chart 14. Vulnerability analysis for White Birch Apartments - Other Organic Chemicals