# ***Source Water Assessment*** for Tom Thumb Montessori Anchorage, Alaska

A Hydrogeologic Susceptibility and Vulnerability Analysis

DRINKING WATER PROTECTION PROGRAM REPORT 421
PWSID 215980.001

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# *Source Water Assessment* for Tom Thumb Montessori Anchorage, Alaska

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A Hydrogeologic Susceptibility and Vulnerability Analysis

By Heather A. Hammond

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**Drinking Water Protection Program**
**Alaska Department of Environmental Conservation**

## EXECUTIVE SUMMARY

The Public Water System for Tom Thumb Montessori is a Class A (non-transient/non-community) water system consisting of one well in the Anchorage area. Identified potential and current sources of contaminants that present the most significant risk to the source of public drinking water serving Tom Thumb Montessori includes approximately 31 acres of residential area, residential septic systems, sewer lines, roads, The Anchorage Golf Course, recreation trails, construction trade areas, a hardware store, a pesticide supply distributor, an asphalt and tar processing/storage area, and an ADEC recognized contaminated site. These identified potential and existing sources of contamination are considered sources of bacteria and viruses, nitrates and/or nitrites, volatile organic chemicals, heavy metals, synthetic organic chemicals, and other organic chemicals. Overall, the public drinking water source for Tom Thumb Montessori received a vulnerability rating of **medium** for bacteria and viruses, nitrates and/or nitrites, volatile organic chemicals, and heavy metals; and **low** for synthetic organic chemicals and other organic chemicals.

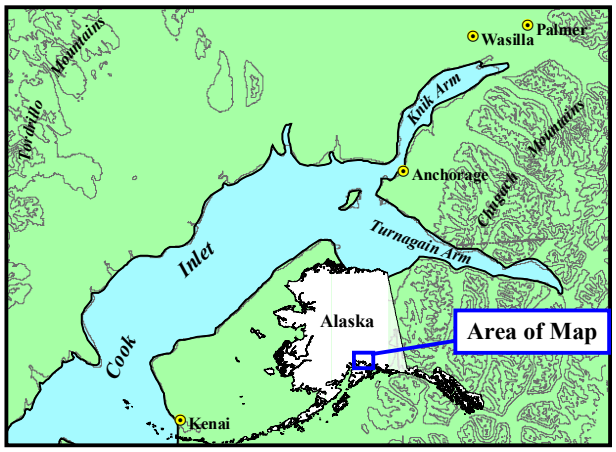


**Figure 1. Index map showing the location of Anchorage, Alaska**

## INTRODUCTION

The purpose of this environmental assessment is to provide public water system owners and/or operators, communities, and local governments with information they can use to preserve the quality of Alaska's public drinking water supplies. This assessment was completed for the source of public drinking water serving Tom Thumb Montessori. This water system consists of one well in the Anchorage area (see Figure 1). This assessment, known under the Alaska Drinking Water Protection Program as the *Source Water Assessment*, has combined a review of the natural hydrogeologic sensitivity with potential and existing contaminant risks to arrive at an overall vulnerability of the drinking water source to contamination. This assessment has been completed as a basis for local voluntary protection efforts and to assist agencies in their efforts to reduce risk to this public drinking water supply.

## DESCRIPTION OF THE ANCHORAGE AREA, ALASKA

### Location

Anchorage, located in southcentral Alaska, encompasses 1,698 square miles of land and 264 square miles of water. The area containing a majority of the urban development, commonly referred to as the Anchorage Bowl, encompasses approximately 180 square miles [*Partick, Brabets, and Glass, 1989*] and envelopes the low lands of the area. This area is bounded on the east by the Chugach Mountains and the north, west, and south by the Knik and Turnagain Arm of Cook Inlet (Figure 1). In recent times, urban development has extended eastward along the flanks of the Chugach Mountains. This area, known locally as the Anchorage Hillside, contains development at elevations exceeding 3,700 feet in elevation above sea level.

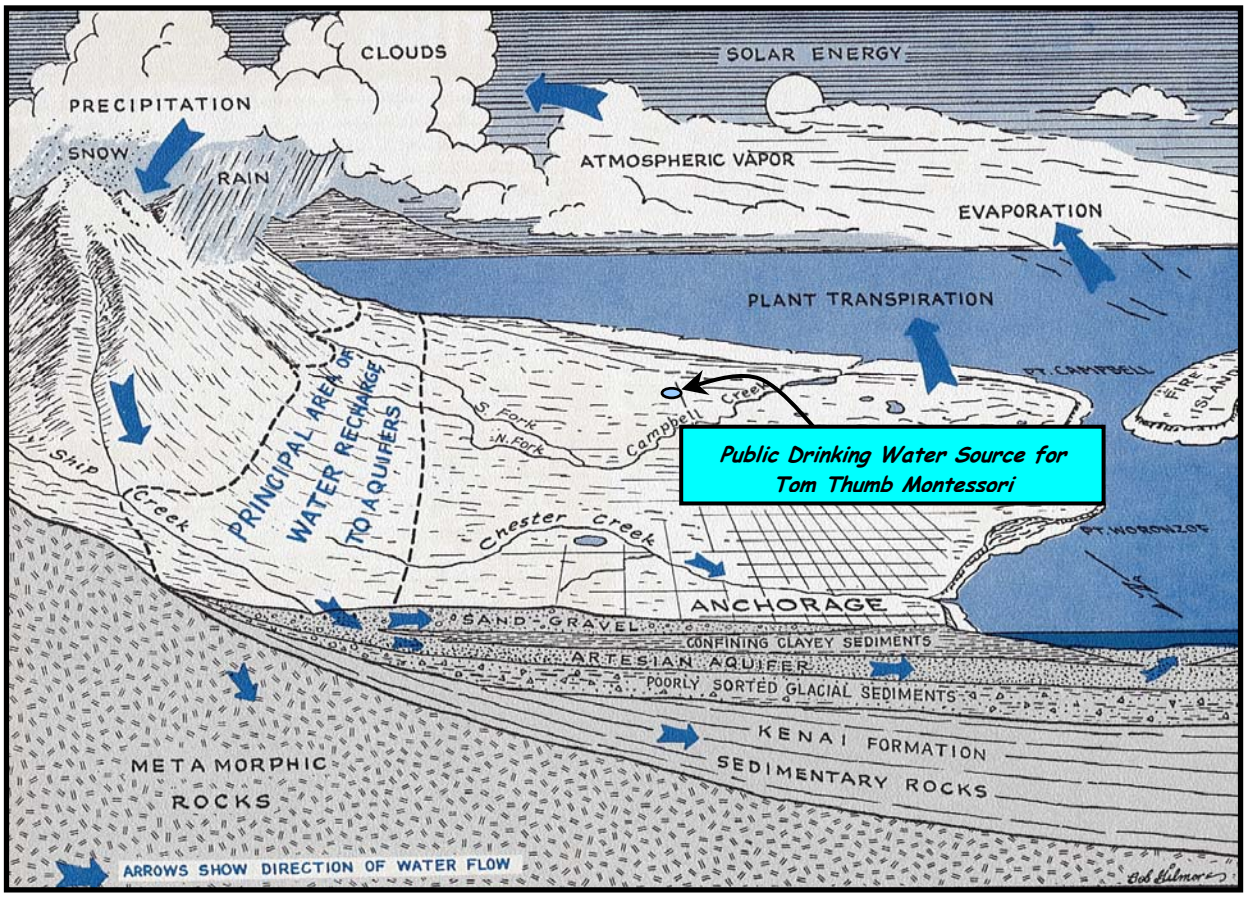


**Figure 2. Generalized hydrologic cycle in the Anchorage area [*Barnwell, George, Dearborn,Weeks, and Zenone*, 1972].**

**Climate**

The Anchorage area climate is somewhat transitional in that it does not experience large daily and annual temperature fluctuations like those experienced in the interior of Alaska nor does it experience high amounts of precipitation typified by gulf coast regions. Mean annual precipitation at the Anchorage International Airport is approximately 16 inches per year. On average, Anchorage receives a total snow accumulation of 69 inches per year. Precipitation generally increases inland toward the Chugach Mountains where annual precipitation may exceed 160 inches per year [*Barnwell, George, Dearborn, Weeks, and Zenone*, 1972]. Mean daily temperature ranges from 65$^{o}$ F during July to 8$^{o}$ F in January [*Western Regional Climate Center*, 2000].

**Physiography and Groundwater Conditions**

Surface elevations in the Anchorage area range from sea level at Knik and Turnagain Arms to well over 5,000 feet in the peaks that bound the area. Glacial moraine and outwash deposits primarily mantle the surface of the Anchorage Bowl.

The backbone of the Chugach Mountains is composed primarily of metamorphic marine and volcanic rocks (bedrock). These high peaks that bound Anchorage's east side are flanked with colluvium or slope deposits. These slope deposits eventually grade into the glacial and stream deposits at lower elevations in the Anchorage Bowl.

In the Anchorage area, two principal groundwater flow systems or aquifers exist (see Figure 2). The upper unconfined aquifer or water-table aquifer is separated from a lower confined aquifer system by layers of silty, clayey glacially derived sediments (confining layer) [*Ulery and Updike*, 1983]. The lower confined aquifer system consists of a series of hydrologically interconnected layers and lenses of gravel, sand and silt that, collectively, form the confined aquifer. The confining layer ranges from 0 to 270 feet thick throughout the Anchorage area and generally thins with increasing distance from Cook Inlet, thus pinching out at the mountain front [*Patrick, Brabets, and Glass*, 1989].

Water enters or recharges these two aquifer systems in several different ways. Along the front of the Chugach Mountains, groundwater seeps from fractures in bedrock into the sediments. At these higher elevations, rain and snowmelt also enters the sediments. This area along the

mountain front is considered the principal recharge area for wells in the Anchorage area. Precipitation in the low lands may also percolate directly into the ground. Lastly, aquifers may also be recharged by streams where surface water percolates into surrounding permeable sediments (losing reaches of streams). Groundwater flow in the confined aquifer is generally east to west from the mountain front toward Cook Inlet and Turnagain Arm, except in areas where the direction of flow is influenced by large municipal or industrial production wells. The direction of groundwater flow in the upper unconfined aquifer is more variable due to the influence from surfacial topography as well as its close connection with surface water bodies.

## PUBLIC DRINKING WATER SYSTEM SERVING TOM THUMB MONTESSORI

Tom Thumb Montessori's Public Drinking Water System is a Class A (non-transient/non-community) water system consisting of one well, which is located off of O'Malley Road (Track B-2, Green Subdivision) at an elevation of approximately 250 feet above sea level (see Figure 3).

Installation of the well occurred in 1963 to a total depth of 154 feet below ground surface and was completed in an 8-inch well casing. According to the most recent Sanitary Survey (10/11/96) the static water level was 35 feet below ground surface at the time of drilling. The well site is properly drained with the ground surface sloped as to divert surface water from entering the well along the casing. However, the Sanitary Survey notes that the well site is lacking a concrete pad and grouting was not applied at the time of drilling. A concrete pad which extends a minimum of two feet laterally in all directions from the well casing and proper grouting can provide added protection against contaminants traveling from the ground surface and along the well casing into source waters.

This system operates year round and serves approximately 2 residents and 100 non-residents through 2 service connections.

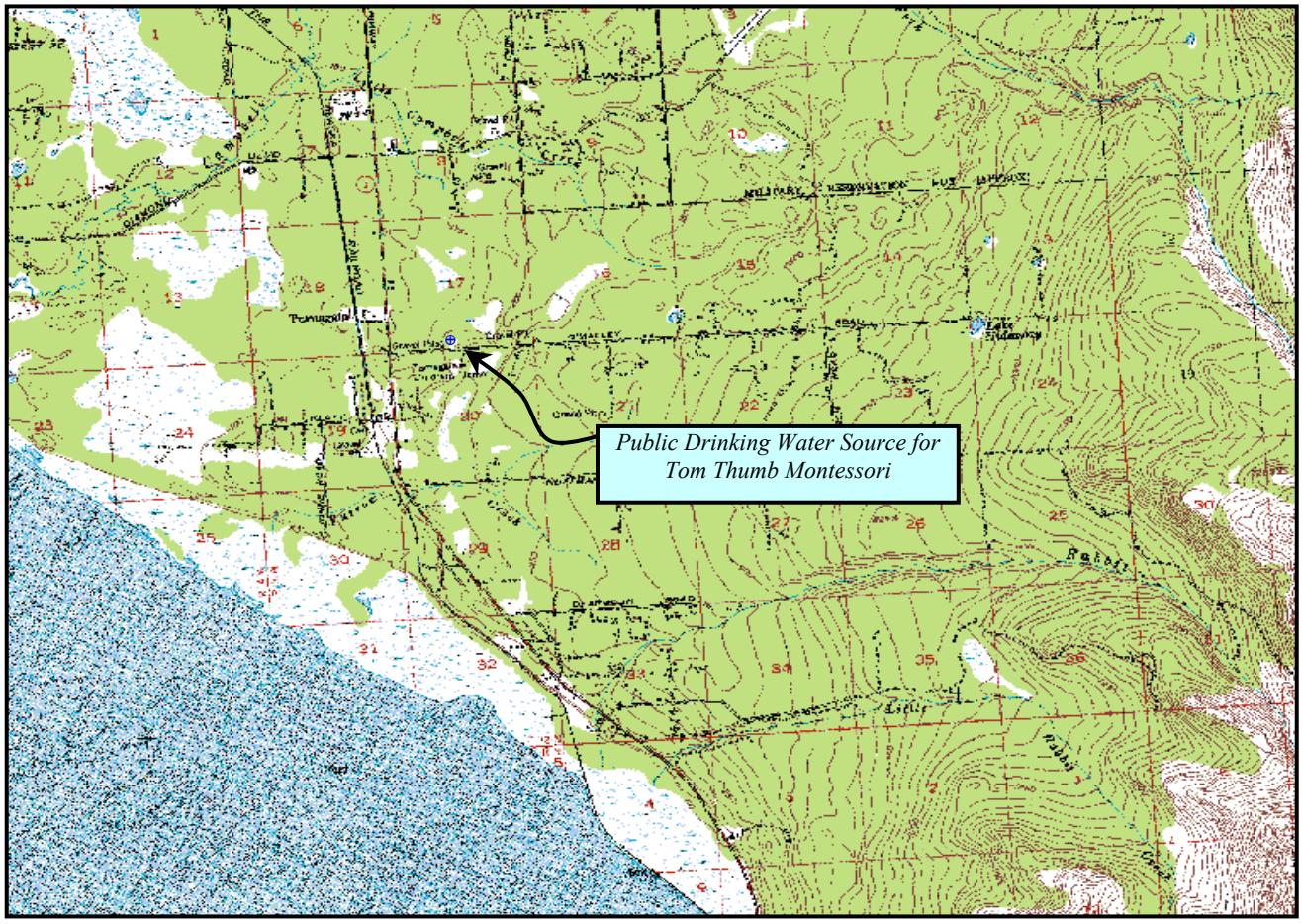


**Figure 3. Map showing the location of the drinking water sources for Tom Thumb Montessori** [Base: USGS Anchorage A8].

## ASSESSMENT AND PROTECTION AREA FOR THE PUBLIC DRINKING WATER SOURCE SERVING TOM THUMB MONTESSORI

The Drinking Water Protection and Assessment Area that has been established for the source of public drinking water serving Tom Thumb Montessori is the area that is most sensitive to contamination. This area serves as a basis for assessing the risk of the drinking water source to contamination. The zones around the drinking water source outline the most critical area for the preservation of the quality of the drinking water for this system. For simplicity, this area will be known as your Drinking Water Protection Area and will serve as the focus for voluntary protection efforts.

Conceptually, groundwater enters the aquifer systems along the front range of the Chugach Mountains (Figure 2) and flows toward Cook Inlet. An analytical calculation was used to determine the size and shape of the area that contributes water to the well. The input parameters describing the attributes of the aquifer in this calculation were adopted from the U.S. Geological Survey [*Patrick, Brabets, and Glass, 1989*]. This analytical calculation was used as a guide as the first step in establishing the protection area for each public drinking water source in Anchorage. Additional methods were further employed to take into account any uncertainties in groundwater flow and aquifer characteristics to arrive at meaningful and conservative protection areas with respect to public health (Please refer to the Guidance Manual for Class A Public Water Systems for additional information).

The Drinking Water Protection Areas established for wells by the Alaska Department of Environmental Conservation are separated into zones. These zones correspond to a time-of-travel. Time-of-travel is the time required for water to move in the saturated zone of the ground from a specific point to the well. The Drinking Water Protection Area for Tom Thumb Montessori contains four zones, Zone A through Zone D (See Map 1 in Appendix A). Zone A corresponds to the area between the wells and the distance equal to ¼ of the distance of the 2-year time-of-travel. Depending on where a contaminant source is located within Zone A, travel time for a contaminant to the wells may be on the order of several days to several hours. Zone A also extends downgradient from the wells to take into account the area of the aquifer that is influenced by pumping of the wells. Zone B corresponds to a time-of-travel of less than two years. Zones C and D correspond to those areas between 5 years and 10 years time-of-travel, respectively.

## 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 Drinking Water Protection Area for Tom Thumb Montessori. This survey was completed through a search of agency records and other publicly available information. Potential sources of contamination to drinking water supplies cover a wide range of categories and types. Potential drinking water contaminants are found within agricultural, residential, commercial, and industrial areas, but can also occur within areas that have little or no development.

For the basis of this assessment and all Class 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
- Other organic chemicals

Maps 2 through 4 in Appendix C depict the Contaminant Source Inventory for Tom Thumb Montessori. Table 1 in Appendix B lists the inventoried potential sources of contamination within Zones A through D. Below is a summary of the contaminant sources inventoried:

- Approximately 31 acres of residential area;
- residential septic systems;
- sewer lines;
- roads;
- The Anchorage Golf Course;
- recreation trails;
- construction trade areas;
- a hardware store;
- a pesticide supply distributor;
- an asphalt and tar processing storage area;
- an ADEC recognized contaminated site.

These potential and existing contaminant sources present the most significant risk for all six contaminant categories, respectively.

## RANKING OF CONTAMINANT RISKS

Potential and existing sources of contamination have been identified, sorted, and ranked according to what type and level of risk they represent. Ranking of contaminant risks for a "potential" or "existing" source of contamination is a function of toxicity and volumes of specific contaminants associated with that source. Contaminant risks are further a function of the number and density of those types of contaminant sources as well as the proximity of those sources to the public drinking water wells.

## VULNERABILITY OF THE PUBLIC DRINKING WATER SOURCE SERVING TOM THUMB MONTESSORI

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

- natural susceptibility; and
- contaminant risks.

Each of the six categories of drinking water contaminants have been analyzed and an overall vulnerability score of 0 to 100 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)

There was no well log available for the well serving Tom Thumb Montessori. Geological information in this report was gathered from well logs within ¼ of a mile from Tom Thumb Montessori's well site. According to the information gathered it is suspected that the well was completed in a confined aquifer. There is a layer of hardpan material from 8 to 15 feet below ground surface. The well was drilled to a total depth of 154 feet below ground surface. Static water level was recorded at 35 feet below ground surface at the time of drilling. This is an indication that the aquifer is confined. This confining layer may provide a protective barrier against the movement of contaminants in the subsurface. However, near the base of the Chugach Mountains, these clay layers tend to be discontinuous and thin toward the mountains. Therefore, contaminants that enter the subsurface near the base of the mountains may enter the confined aquifer uninhibited by the absence of any protective layer.

Combining the susceptibility of the wellhead and the aquifer to contamination leads to a score (0 – 50 points) and rating of overall Susceptibility of the well to contamination (See Appendix D). Table 1 depicts the overall Susceptibility score and rating for the source of public drinking water serving Tom Thumb Montessori.

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

| | Score | Rating |
|---|---|---|
| Susceptibility of the Wellhead | 5 | Low |
| Susceptibility of the Aquifer | 17 | High |
| Natural Susceptibility | 22 | Medium |

Contaminant risks to a drinking water source depend on the type, number or density, and distribution of contaminant sources. A score (0 – 50 points) and rating of Contaminant Risks (See Appendix D) is assigned based on the findings of the Contaminant Source Inventory (See Appendix B - Table 1 – Table 7). This portion of the analysis examines any existing or historical contamination that has been detected at the drinking water source through routine sampling. It also reviews contamination that has or may have occurred but has not arrived or been detected at the well. Table 2 summarizes the Contaminant Risks for each category of drinking water contaminants.

**Table 2. Contaminant Risks to the Public Drinking Water Source**

| Contaminant Risks | Score | Rating |
|---|---|---|
| Bacteria and Viruses | 22 | Medium |
| Nitrates and/or Nitrites | 22 | Medium |
| Volatile Organic Chemicals | 22 | Medium |
| Heavy Metals, Cyanide, And Other Inorganic Chemicals | 22 | Medium |
| Synthetic Organic Chemicals | 12 | Low |
| Other Organic Chemicals | 12 | Low |

Appendix D contains fourteen charts, which together form the 'Vulnerability Analysis' for a Class A public drinking water system. 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 14 contain the Contaminant Risks and Vulnerability Analysis for nitrates and nitrites, volatile organic chemicals, heavy metals, synthetic organic chemicals, and other organic chemicals, respectively.

Vulnerability of drinking water sources to contamination is the combination of susceptibility of the aquifer and the well with contaminant risks. Table 3 contains the overall vulnerability scores (0 – 100) and ratings for each of the six categories of drinking water contaminants (See Appendix D). Note: scores are rounded off to the nearest five.

**Table 3. Overall Vulnerability of Tom Thumb Montessori's Public Drinking Water Source to Contamination by Category**

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

Tables 2 through 7 in Appendix B contain the ranking of potential and existing sources of contamination with respect to bacteria and viruses, nitrates and/or nitrites, heavy metals, synthetic organic chemicals, and other organic chemicals, respectively.

The contaminant risk for bacteria and viruses and nitrates and/or nitrites is low with residential areas, sewer lines, septic systems, and The Anchorage Golf Course presenting the most significant risk to the drinking water source. After combining the contaminant risk for bacteria and viruses and nitrates and/or nitrites with the susceptibility of the well, the overall vulnerability of the well to contamiantion is medium from bacteria and viurses and nitrates and/or nitrtites.

Review of the historical sampling data indicates that no bacteria and viruses have been detected in Tom Thumb Montessori's drinking water within the past 5 years (See Chart 3 – Contaminant Risks for Bacteria and Viruses in Appendix D).

Nitrates and/or nitrites are found in natural background throughout Alaska. Nitrate concentrations in uncontaminanted 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 Tom Thumb Montessori indicates that nitrates have not been detected in source waters within the past 5 years (See Chart 5 – Contaminant Risks for Nitrates and/or Nitrites in Appendix D).

The contaminant risk for volatile organic chemicals is medium with residential areas, roads, a construction trade area and an ADEC recognized contaminated site (located

within the Zone D protection area) presenting the most significant risk to the drinking water well. After combining the contaminant risk for volatile organic chemicals with the susceptibility of the well, the overall vulnerability of the well to contamiantion is medium from volatile organic chemicals.

In February of 1994 a Site Assessment report prepared by Shannon and Wilson for the Municipality of Anchorage related to the Lake Otis Parkway Improvement Project identified gasoline and diesel range contamination within and adjacent to the roadway (CS ID Tag U4-1). The report noted the presence of groundwater contamination and soils contaminated with high levels of diesel and gasoline. The sources of the contamination have been related to two regulated underground storage tanks which were removed from an adjacent property and to the spraying of roads ways for dust control. Although this site rated as a high potential source of contamination from volatile organic chemicals the exposure risk is relatively low due to distant proximity to the well.

Review of the historical sampling data indicates that no volatile organic chemical contamination has been detected in Tom Thumb Montessori's source waters within the past 5 years (See Chart 7 – Contaminant Risks for Volatile Organic Chemicals in Appendix D).

The contaminant risk for heavy metals is medium with residential areas, roads, sewer lines, a construction trade area, and a hardware store presenting the most significant risk to the drinking water well. After combining the contaminant risk for heavy metals with the susceptibility of the well, the overall vulnerability of the well to contamination from heavy metals is medium.

Sampling history for Tom Thumb Montessori indicates that heavy metals have not been detected in source waters within the past 5 years (See Chart 9 – Contaminant Risks for Heavy Metals, Cyanide and Other Inorganic Chemicals in Appendix D).

The contaminant risk for synthetic organic chemicals and other organic chemicals is low with residential areas, residential septic systems, sewer lines, The Anchorage Golf Course, a pesticide supply distributor, construction trade areas, a hardware store and an asphalt and tar processing/storage area presenting the most significant risk to the drinking water well. After combining the contaminant risk for synthetic organic chemicals and other organic chemicals with the susceptibility of the well, the overall vulnerability of the well to contamiantion from contaminants is low.

Sampling history for Tom Thumb Montessori indicates that nitrates have not been detected in source waters within the past 5 years (See Charts 11 and 13 – Contaminant Risks for Synthetic Organic Chemicals and Other Organic Chemicals in Appendix D, respectively).

**SUMMARY**

A *Source Water Assessment* has been completed for the source of public drinking water serving Tom Thumb Montessori. The overall vulnerability of this water source to contamination is **medium** for bacteria and viruses, nitrates and/or nitrites, volatile organic chemicals, and heavy metals; and **low** for synthetic organic chemicals and other organic chemicals. This assessment of contaminant risks can be used as a foundation for local voluntary protection efforts as well as a basis for continuous efforts on the part of Tom Thumb Montessori to protect public health. It is anticipated that *Source Water Assessments* will be updated every five years to reflect any changes in the vulnerability and/or susceptibility of the public drinking water source serving Tom Thumb Montessori.

# REFERENCES CITED

Barnwell, W.W., George, R.S., Dearborn, L.L., Weeks, J.B., and Zenone, C., 1972, Water for Anchorage: an atlas of the water resources of the Anchorage area, Alaska: U.S. Geological Survey Open-File Report, 76 p.

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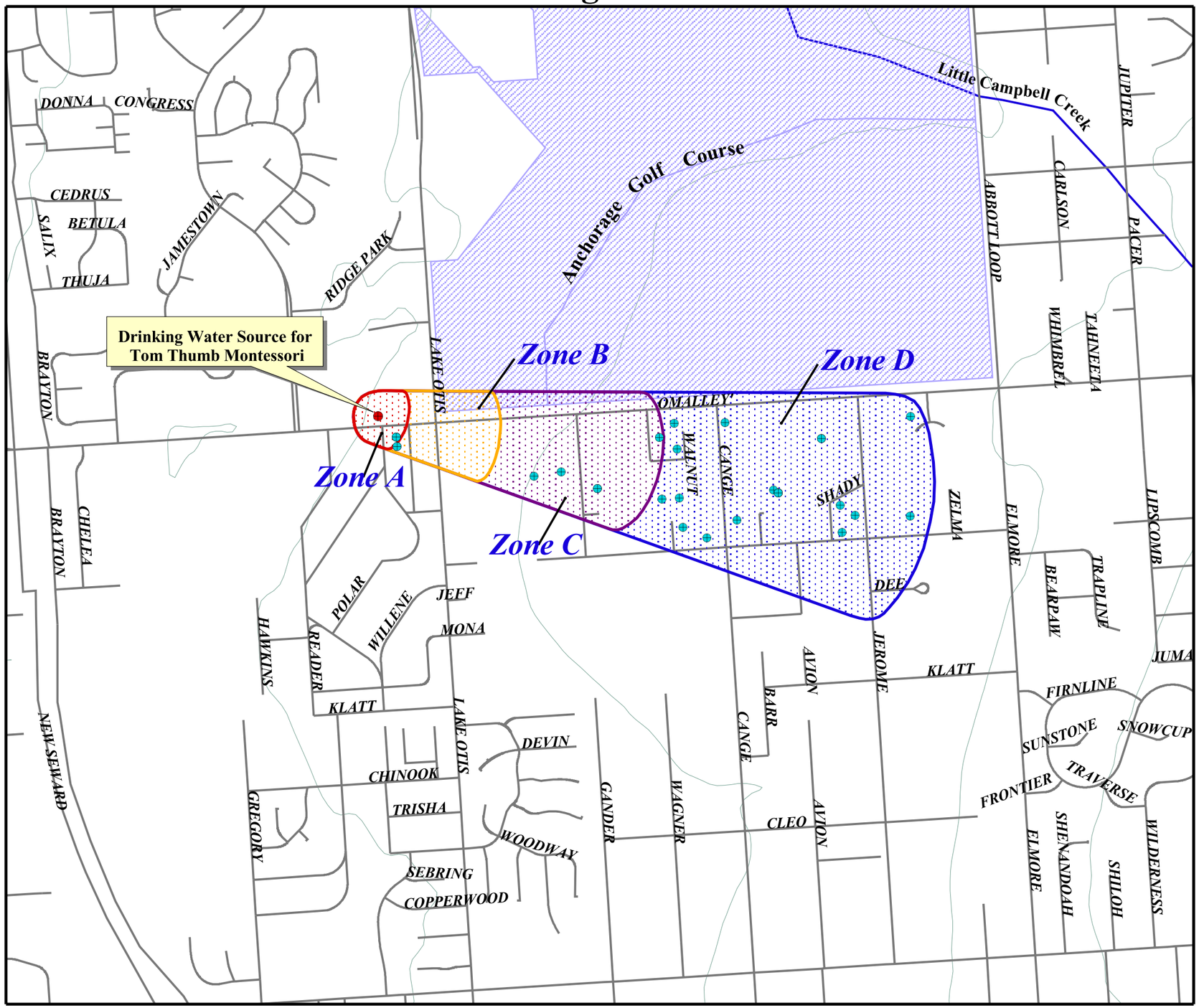
Western Regional Climate Center, 2000, August 24, Web extension to the *Western Regional Climate Center* [WWW document]. URL http://www.wrcc.dri.edu/index.html

# APPENDIX A

## Drinking Water Protection Area for Tom Thumb Montessori

# Drinking Water Protection Area and
# Potential & Existing Contaminant Sources for Tom Thumb Montessori




- Tom Thumb Montessori's Drinking Water Well
- Private and Public DW Wells

**Zone A Protection Area**
- Several Months Travel Time

**Zone B Protection Area**
- Less Than 2 Years Travel Time

**Zone C Protection Area**
- Less Than 5 Years Travel Time

**Zone D Protection Area**
- Less Than 10 Years Travel Time
- Anchorage Golf Course (X2)
- Roads
- Streams
- Elevation Contours

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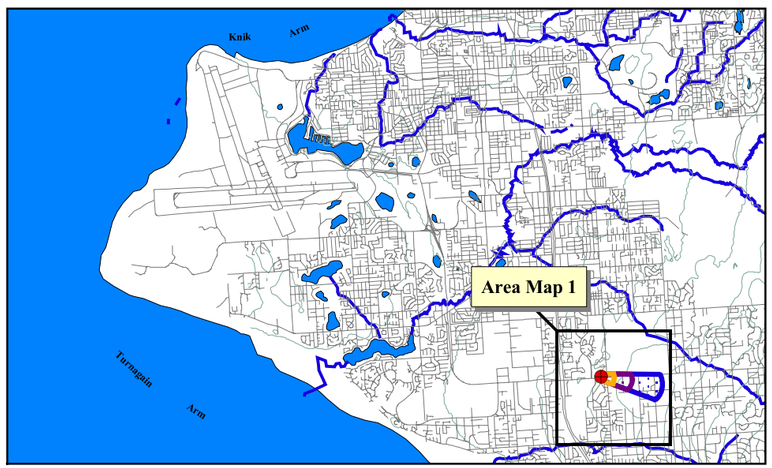


2000 0 2000 4000 Feet

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# *Map 1*

# APPENDIX B

# Contaminant Source Inventory and Risk Ranking for Tom Thumb Montessori

***Table 1***

# *Contaminant Source Inventory for* ***Tom Thumb Montessori***

***PWSID 215980.001***

| *Contaminant Source Type* | *Contaminant Source ID* | *CS ID tag* | *Zone* | *Location* | *Map Number* | *Comments* |
|---|---|---|---|---|---|---|
| Residential Areas | R01 | R1-1 | A | Residential areas located within Zone A | 3 | |
| Septic systems (serves one single-family home) | R02 | R2-1 | A | Off of O'Malley Road | 3 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-1 | A | O'Malley Road | 2 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-2 | A | Forest Drive | 2 | |
| Dog walking areas/foot trails | X46 | X46-1 | A | Trail along the north side of O'Malley Road | 2 | |
| Dog walking areas/foot trails | X46 | X46-2 | A | Trail along the south side of O'Malley Road | 2 | |
| Construction trade areas and materials | C09 | C9-1 | B | Along Lake Otis Parkway | 2 | |
| Domestic wastewater collection systems (sewer lines or lift stations) | D01 | D1-1 | B | Sewer Line running along Lake Otis Parkway | 2 | |
| Residential Areas | R01 | R1-2 | B | Residential areas located wtihin Zone B | 3 | |
| Septic systems (serves one single-family home) | R02 | R2-2 | B | Off of Forest Drive | 3 | |
| Septic systems (serves one single-family home) | R02 | R2-3 | B | Off of O'Malley Road | 3 | |
| Septic systems (serves one single-family home) | R02 | R2-4 | B | Off of O'Malley Road | 3 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-3 | B | Cinnamon Drive | 2 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-4 | B | Lake Otis Parkway | 2 | |
| Dog walking areas/foot trails | X46 | X46-3 | B | Trail along the west side of Lake Otis Parkway | 2 | |
| Dog walking areas/foot trails | X46 | X46-4 | B | Trail along the west side of Lake Otis Parkway | 2 | |
| Dog walking areas/foot trails | X46 | X46-5 | B | Trail along the north side of O'Malley Road | 2 | |
| Dog walking areas/foot trails | X46 | X46-6 | B | Trail along Lake Otis Parkway | 2 | |
| Dog walking areas/foot trails | X46 | X46-7 | B | Trail along the east side of Lake Otis Parkway | 2 | |
| Hardware stores | C17 | C17-1 | C | Off of Livinston Street | 3 | |
| Pest extermination services/pesticide sales | C33 | C33-1 | C | Off of Michigan Ave. | 3 | |

| *Contaminant Source Type* | *Contaminant Source ID* | *CS ID tag* | *Zone* | *Location* | *Map Number* | *Comments* |
|---|---|---|---|---|---|---|
| Construction trade areas and materials | C09 | C9-2 | C | Off of Hane Street | 3 | |
| Residential Areas | R01 | R1-3 | C | Residential areas located within Zone C | 3 | |
| Septic systems (serves one single-family home) | R02 | R2-5-20 | C | Septic Systems located within Zone C | 3 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-5 | C | Hane Street | 3 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-6 | C | Chris Circle | 3 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-7 | C | Livingston Street | 3 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-8 | C | Michigan Ave | 3 | |
| Asphalt and tar processing/storage | I03 | I3-1 | D | Off of One-hundred-twelfth Ave. | 4 | |
| Contaminated sites, DEC recognized, non-Superfund, non-RCRA | U04 | U4-1 | D | Off of One-hundred-twelfth Ave. | 4 | |
| Golf courses | X02 | X2-1 | D | Off of O'Malley Road | 4 | |

**Table 2**

# *Contaminant Source Inventory and Risk Ranking for Tom Thumb Montessori Sources of Bacteria and Viruses*

**PWSID 215980.001**

| *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 | R1-1 | A | Low | 1 | Residential areas located within Zone A | 3 | |
| Septic systems (serves one single-family home) | R02 | R2-1 | A | Low | 2 | Off of O'Malley Road | 3 | |
| Septic systems (serves one single-family home) | R02 | R2-2 | B | Low | 3 | Off of Forest Drive | 3 | |
| Residential Areas | R01 | R1-2 | B | Low | 4 | Residential areas located wtihin Zone B | 3 | |
| Septic systems (serves one single-family home) | R02 | R2-3 | B | Low | 5 | Off of O'Malley Road | 3 | |
| Septic systems (serves one single-family home) | R02 | R2-4 | B | Low | 6 | Off of O'Malley Road | 3 | |
| Septic systems (serves one single-family home) | R02 | R2-5-20 | C | Low | 7 | Septic Systems located within Zone C | 3 | |
| Domestic wastewater collection systems (sewer lines or lift stations) | D01 | D1-1 | B | Medium | 8 | Sewer Line running along Lake Otis Parkway | 2 | |
| Dog walking areas/foot trails | X46 | X46-1 | A | Low | 9 | Trail along the north side of O'Malley Road | 2 | |
| Dog walking areas/foot trails | X46 | X46-2 | A | Low | 10 | Trail along the south side of O'Malley Road | 2 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-1 | A | Low | | O'Malley Road | 2 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-2 | A | Low | | Forest Drive | 2 | |
| Residential Areas | R01 | R1-2 | B | Low | | Residential areas located wtihin Zone B | 3 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-3 | B | Low | | Cinnamon Drive | 2 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-4 | B | Low | | Lake Otis Parkway | 2 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-4 | B | Low | | Lake Otis Parkway | 2 | |
| Dog walking areas/foot trails | X46 | X46-3 | B | Low | | Trail along the west side of Lake Otis Parkway | 2 | |
| Dog walking areas/foot trails | X46 | X46-4 | B | Low | | Trail along the west side of Lake Otis Parkway | 2 | |
| Dog walking areas/foot trails | X46 | X46-5 | B | Low | | Trail along the north side of O'Malley Road | 2 | |

| *Contaminant Source Type* | *Contaminant Source ID* | *CS ID tag* | *Zone* | *Risk Ranking for Analysis* | *Overall Rank after Analysis* | *Location* | *Map Number* | *Comments* |
|---|---|---|---|---|---|---|---|---|
| Dog walking areas/foot trails | X46 | X46-6 | B | Low | | Trail along Lake Otis Parkway | 2 | |
| Dog walking areas/foot trails | X46 | X46-7 | B | Low | | Trail along the east side of Lake Otis Parkway | 2 | |
| Residential Areas | R01 | R1-3 | C | Low | | Residential areas located within Zone C | 3 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-5 | C | Low | | Hane Street | 3 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-6 | C | Low | | Chris Circle | 3 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-7 | C | Low | | Livingston Street | 3 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-8 | C | Low | | Michigan Ave | 3 | |

**Table 3**

# *Contaminant Source Inventory and Risk Ranking for Tom Thumb Montessori Sources of Nitrates/Nitrites*

**PWSID 215980.001**

| *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 | R1-1 | A | Low | 1 | Residential areas located within Zone A | 3 | |
| Septic systems (serves one single-family home) | R02 | R2-1 | A | Low | 2 | Off of O'Malley Road | 3 | |
| Septic systems (serves one single-family home) | R02 | R2-2 | B | Low | 3 | Off of Forest Drive | 3 | |
| Residential Areas | R01 | R1-2 | B | Low | 4 | Residential areas located wtihin Zone B | 3 | |
| Septic systems (serves one single-family home) | R02 | R2-3 | B | Low | 5 | Off of O'Malley Road | 3 | |
| Septic systems (serves one single-family home) | R02 | R2-4 | B | Low | 6 | Off of O'Malley Road | 3 | |
| Golf courses | X02 | X2-1 | D | Medium | 7 | Off of O'Malley Road | 4 | |
| Domestic wastewater collection systems (sewer lines or lift stations) | D01 | D1-1 | B | Medium | 8 | Sewer Line running along Lake Otis Parkway | 2 | |
| Dog walking areas/foot trails | X46 | X46-1 | A | Low | 9 | Trail along the north side of O'Malley Road | 2 | |
| Dog walking areas/foot trails | X46 | X46-2 | A | Low | 10 | Trail along the south side of O'Malley Road | 2 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-1 | A | Low | | O'Malley Road | 2 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-2 | A | Low | | Forest Drive | 2 | |
| Residential Areas | R01 | R1-2 | B | Low | | Residential areas located wtihin Zone B | 3 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-3 | B | Low | | Cinnamon Drive | 2 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-4 | B | Low | | Lake Otis Parkway | 2 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-4 | B | Low | | Lake Otis Parkway | 2 | |
| Dog walking areas/foot trails | X46 | X46-3 | B | Low | | Trail along the west side of Lake Otis Parkway | 2 | |
| Dog walking areas/foot trails | X46 | X46-4 | B | Low | | Trail along the west side of Lake Otis Parkway | 2 | |
| Dog walking areas/foot trails | X46 | X46-5 | B | Low | | Trail along the north side of O'Malley Road | 2 | |

| *Contaminant Source Type* | *Contaminant Source ID* | *CS ID tag* | *Zone* | *Risk Ranking for Analysis* | *Overall Rank after Analysis* | *Location* | *Map Number* | *Comments* |
|---|---|---|---|---|---|---|---|---|
| Dog walking areas/foot trails | X46 | X46-6 | B | Low | | Trail along Lake Otis Parkway | 2 | |
| Dog walking areas/foot trails | X46 | X46-7 | B | Low | | Trail along the east side of Lake Otis Parkway | 2 | |
| Hardware stores | C17 | C17-1 | C | Low | | Off of Livinston Street | 3 | |
| Residential Areas | R01 | R1-3 | C | Low | | Residential areas located within Zone C | 3 | |
| Septic systems (serves one single-family home) | R02 | R2-5-20 | C | Low | | Septic Systems located within Zone C | 3 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-5 | C | Low | | Hane Street | 3 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-6 | C | Low | | Chris Circle | 3 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-7 | C | Low | | Livingston Street | 3 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-8 | C | Low | | Michigan Ave | 3 | |

**Table 4**

# *Contaminant Source Inventory and Risk Ranking for Tom Thumb Montessori Sources of Volatile Organic Chemicals*

**PWSID 215980.001**

| *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 | R1-1 | A | Low | 1 | Residential areas located within Zone A | 3 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-1 | A | Low | 2 | O'Malley Road | 2 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-2 | A | Low | 3 | Forest Drive | 2 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-3 | B | Low | 4 | Cinnamon Drive | 2 | |
| Residential Areas | R01 | R1-2 | B | Low | 5 | Residential areas located wtihin Zone B | 3 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-4 | B | Low | 6 | Lake Otis Parkway | 2 | |
| Septic systems (serves one single-family home) | R02 | R2-5-20 | C | Low | 7 | Septic Systems located within Zone C | 3 | |
| Construction trade areas and materials | C09 | C9-1 | B | Low | 8 | Along Lake Otis Parkway | 2 | |
| Hardware stores | C17 | C17-1 | C | Low | 9 | Off of Livinston Street | 3 | |
| Contaminated sites, DEC recognized, non-Superfund, non-RCRA | U04 | U4-1 | D | High | 10 | Off of One-hundred-twelfth Ave. | 4 | |
| Septic systems (serves one single-family home) | R02 | R2-1 | A | Low | | Off of O'Malley Road | 3 | |
| Domestic wastewater collection systems (sewer lines or lift stations) | D01 | D1-1 | B | Low | | Sewer Line running along Lake Otis Parkway | 2 | |
| Residential Areas | R01 | R1-2 | B | Low | | Residential areas located wtihin Zone B | 3 | |
| Septic systems (serves one single-family home) | R02 | R2-2 | B | Low | | Off of Forest Drive | 3 | |
| Septic systems (serves one single-family home) | R02 | R2-3 | B | Low | | Off of O'Malley Road | 3 | |
| Septic systems (serves one single-family home) | R02 | R2-4 | B | Low | | Off of O'Malley Road | 3 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-4 | B | Low | | Lake Otis Parkway | 2 | |
| Pest extermination services/pesticide sales | C33 | C33-1 | C | Low | | Off of Michigan Ave. | 3 | |
| Construction trade areas and materials | C09 | C9-2 | C | Low | | Off of Hane Street | 3 | |
| Residential Areas | R01 | R1-3 | C | Low | | Residential areas located within Zone C | 3 | |

| *Contaminant Source Type* | *Contaminant Source ID* | *CS ID tag* | *Zone* | *Risk Ranking for Analysis* | *Overall Rank after Analysis* | *Location* | *Map Number* | *Comments* |
|---|---|---|---|---|---|---|---|---|
| Highways and roads, paved (cement or asphalt) | X20 | X20-5 | C | Low | | Hane Street | 3 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-6 | C | Low | | Chris Circle | 3 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-7 | C | Low | | Livingston Street | 3 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-8 | C | Low | | Michigan Ave | 3 | |

**Table 5**

# *Contaminant Source Inventory and Risk Ranking for Tom Thumb Montessori*

## *Sources of Heavy Metals, Cyanide and Other Inorganic Chemicals*

**PWSID 215980.001**

| *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 | R1-1 | A | Low | 1 | Residential areas located within Zone A | 3 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-1 | A | Low | 2 | O'Malley Road | 2 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-2 | A | Low | 3 | Forest Drive | 2 | |
| Residential Areas | R01 | R1-2 | B | Low | 4 | Residential areas located wtihin Zone B | 3 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-3 | B | Low | 5 | Cinnamon Drive | 2 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-4 | B | Low | 6 | Lake Otis Parkway | 2 | |
| Septic systems (serves one single-family home) | R02 | R2-1 | A | Low | 7 | Off of O'Malley Road | 3 | |
| Domestic wastewater collection systems (sewer lines or lift stations) | D01 | D1-1 | B | Low | 8 | Sewer Line running along Lake Otis Parkway | 2 | |
| Construction trade areas and materials | C09 | C9-1 | B | Low | 9 | Along Lake Otis Parkway | 2 | |
| Hardware stores | C17 | C17-1 | C | Low | 10 | Off of Livinston Street | 3 | |
| Residential Areas | R01 | R1-2 | B | Low | | Residential areas located wtihin Zone B | 3 | |
| Septic systems (serves one single-family home) | R02 | R2-2 | B | Low | | Off of Forest Drive | 3 | |
| Septic systems (serves one single-family home) | R02 | R2-3 | B | Low | | Off of O'Malley Road | 3 | |
| Septic systems (serves one single-family home) | R02 | R2-4 | B | Low | | Off of O'Malley Road | 3 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-4 | B | Low | | Lake Otis Parkway | 2 | |
| Pest extermination services/pesticide sales | C33 | C33-1 | C | Low | | Off of Michigan Ave. | 3 | |
| Construction trade areas and materials | C09 | C9-2 | C | Low | | Off of Hane Street | 3 | |
| Residential Areas | R01 | R1-3 | C | Low | | Residential areas located within Zone C | 3 | |
| Septic systems (serves one single-family home) | R02 | R2-5-20 | C | Low | | Septic Systems located within Zone C | 3 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-5 | C | Low | | Hane Street | 3 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-6 | C | Low | | Chris Circle | 3 | |

| *Contaminant Source Type* | *Contaminant Source ID* | *CS ID tag* | *Zone* | *Risk Ranking for Analysis* | *Overall Rank after Analysis* | *Location* | *Map Number* | *Comments* |
|---|---|---|---|---|---|---|---|---|
| Highways and roads, paved (cement or asphalt) | X20 | X20-7 | C | Low | | Livingston Street | 3 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-8 | C | Low | | Michigan Ave | 3 | |

**Table 6**

# *Contaminant Source Inventory and Risk Ranking for Tom Thumb Montessori Sources of Synthetic Organic Chemicals*

**PWSID 215980.001**

| *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 | R1-1 | A | Low | 1 | Residential areas located within Zone A | 3 | |
| Residential Areas | R01 | R1-2 | B | Low | 2 | Residential areas located wtihin Zone B | 3 | |
| Residential Areas | R01 | R1-3 | C | Low | 3 | Residential areas located within Zone C | 3 | |
| Septic systems (serves one single-family home) | R02 | R2-1 | A | Low | 4 | Off of O'Malley Road | 3 | |
| Septic systems (serves one single-family home) | R02 | R2-2 | B | Low | 5 | Off of Forest Drive | 3 | |
| Septic systems (serves one single-family home) | R02 | R2-3 | B | Low | 6 | Off of O'Malley Road | 3 | |
| Septic systems (serves one single-family home) | R02 | R2-4 | B | Low | 7 | Off of O'Malley Road | 3 | |
| Domestic wastewater collection systems (sewer lines or lift stations) | D01 | D1-1 | B | Low | 8 | Sewer Line running along Lake Otis Parkway | 2 | |
| Golf courses | X02 | X2-1 | D | High | 9 | Off of O'Malley Road | 4 | |
| Pest extermination services/pesticide sales | C33 | C33-1 | C | Low | 10 | Off of Michigan Ave. | 3 | |
| Residential Areas | R01 | R1-2 | B | Low | | Residential areas located wtihin Zone B | 3 | |
| Septic systems (serves one single-family home) | R02 | R2-5-20 | C | Low | | Septic Systems located within Zone C | 3 | |

**Table 7**

# *Contaminant Source Inventory and Risk Ranking for Tom Thumb Montessori*
## *Sources of Other Organic Chemicals*

**PWSID 215980.001**

| *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 | R1-1 | A | Low | 1 | Residential areas located within Zone A | 3 | |
| Residential Areas | R01 | R1-2 | B | Low | 2 | Residential areas located wtihin Zone B | 3 | |
| Residential Areas | R01 | R1-3 | C | Low | 3 | Residential areas located within Zone C | 3 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-1 | A | Low | 4 | O'Malley Road | 2 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-2 | A | Low | 5 | Forest Drive | 2 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-3 | B | Low | 6 | Cinnamon Drive | 2 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-4 | B | Low | 7 | Lake Otis Parkway | 2 | |
| Construction trade areas and materials | C09 | C9-1 | B | Low | 8 | Along Lake Otis Parkway | 2 | |
| Hardware stores | C17 | C17-1 | C | Low | 9 | Off of Livinston Street | 3 | |
| Asphalt and tar processing/storage | I03 | I3-1 | D | High | 10 | Off of One-hundred-twelfth Ave. | 4 | |
| Septic systems (serves one single-family home) | R02 | R2-1 | A | Low | | Off of O'Malley Road | 3 | |
| Domestic wastewater collection systems (sewer lines or lift stations) | D01 | D1-1 | B | Low | | Sewer Line running along Lake Otis Parkway | 2 | |
| Residential Areas | R01 | R1-2 | B | Low | | Residential areas located wtihin Zone B | 3 | |
| Septic systems (serves one single-family home) | R02 | R2-2 | B | Low | | Off of Forest Drive | 3 | |
| Septic systems (serves one single-family home) | R02 | R2-3 | B | Low | | Off of O'Malley Road | 3 | |
| Septic systems (serves one single-family home) | R02 | R2-4 | B | Low | | Off of O'Malley Road | 3 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-4 | B | Low | | Lake Otis Parkway | 2 | |
| Construction trade areas and materials | C09 | C9-2 | C | Low | | Off of Hane Street | 3 | |
| Septic systems (serves one single-family home) | R02 | R2-5-20 | C | Low | | Septic Systems located within Zone C | 3 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-5 | C | Low | | Hane Street | 3 | |

# *Contaminant Source Inventory and Risk Ranking for Tom Thumb Montessori*

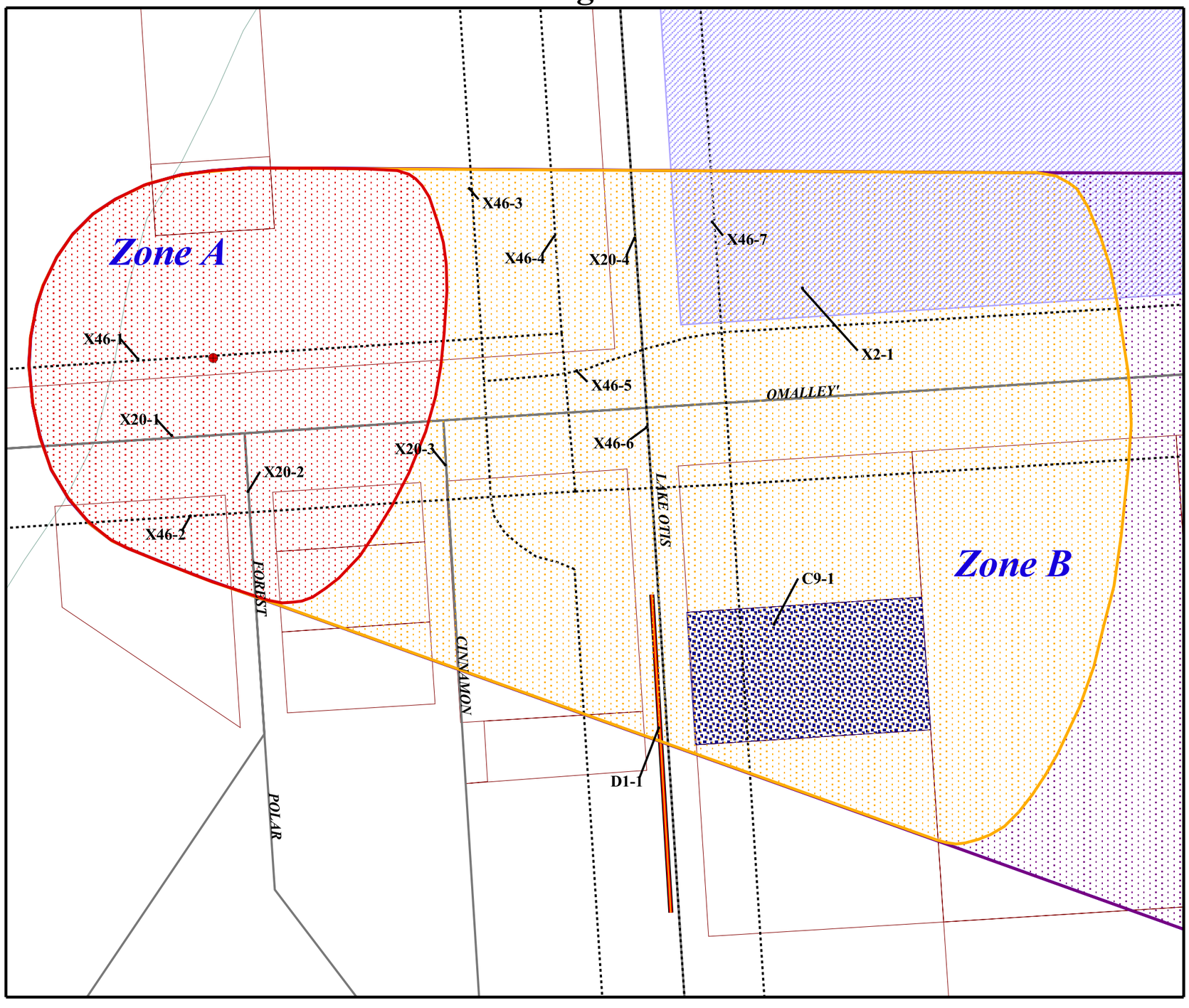
## *Sources of Other Organic Chemicals*

| *Contaminant Source Type* | *Contaminant Source ID* | *CS ID tag* | *Zone* | *Risk Ranking for Analysis* | *Overall Rank after Analysis* | *Location* | *Map Number* | *Comments* |
|---|---|---|---|---|---|---|---|---|
| Highways and roads, paved (cement or asphalt) | X20 | X20-6 | C | Low | | Chris Circle | 3 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-7 | C | Low | | Livingston Street | 3 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-8 | C | Low | | Michigan Ave | 3 | |

# APPENDIX C

## Drinking Water Protection Area and Potential & Existing Contaminant Sources for Tom Thumb Montessori

# Drinking Water Protection Area and
# Potential & Existing Contaminant Sources for Tom Thumb Montessori




- Tom Thumb Montessori's Drinking Water Well

**Zone A Protection Area**
- Several Months Travel Time

**Zone B Protection Area**
- Less Than 2 Years Travel Time

**Zone C Protection Area**
- Less Than 5 Years Travel Time

**Zone D Protection Area**
- Less Than 10 Years Travel Time
- Anchorage Golf Course (X2)
- Trails (X46)
- Sewer Lines (D1)
- Construction Trade Areas and Materials (C9)
- Roads (X20)
- Anchorage Land Parcels
- Elevation Contours

N
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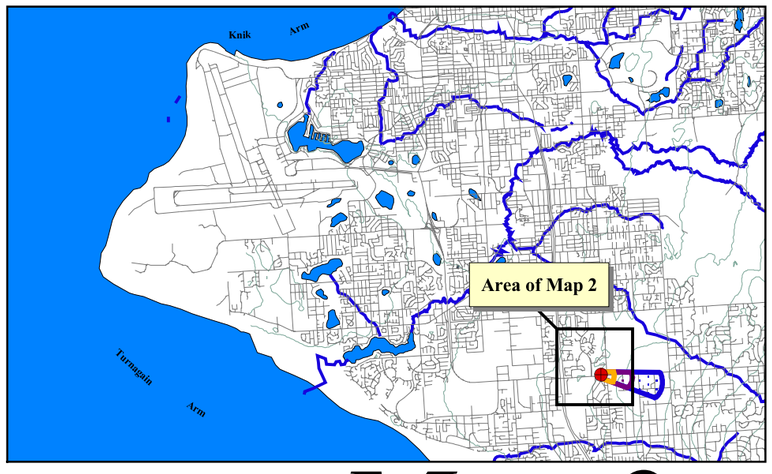
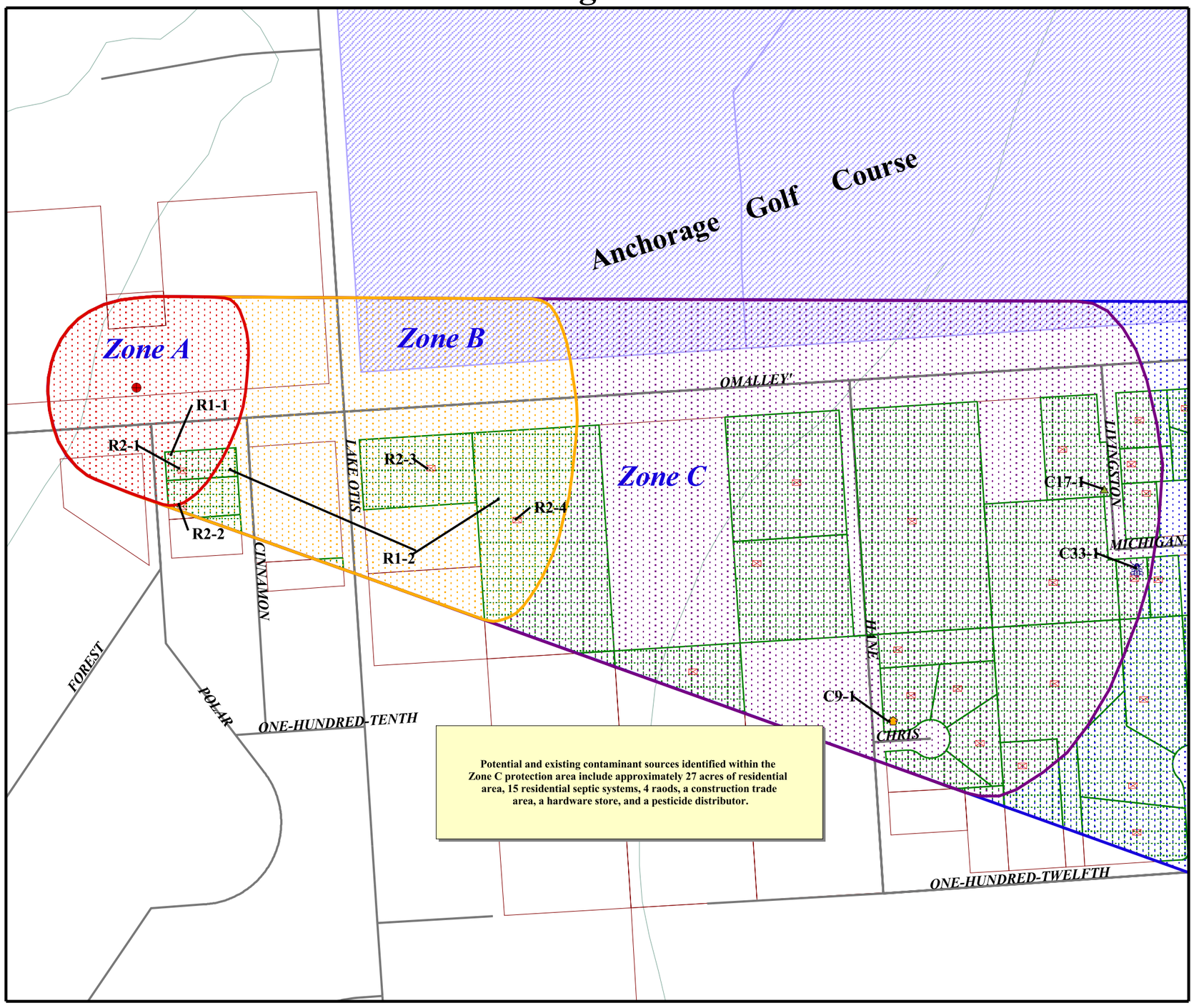



300 0 300 600 Feet

**PWSID 215980.001**

# *Map 2*

# Drinking Water Protection Area and Potential & Existing Contaminant Sources for Tom Thumb Montessori




- Tom Thumb Montessori's Drinking Water Well

Zone A Protection Area
- Several Months Travel Time

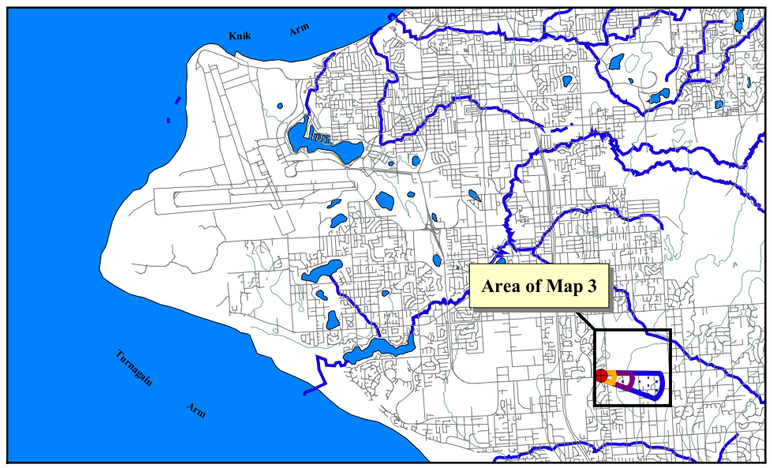
Zone B Protection Area
- Less Than 2 Years Travel Time

Zone C Protection Area
- Less Than 5 Years Travel Time

Zone D Protection Area
- Less Than 10 Years Travel Time
- Septic Systems (R2)

Potential Contaminant Sources
- Hardware Stores (C17)
- Pest Etermination Services/Pesticide Sales (C33)
- Construction Trade Areas and Materials (C9)
- Asphalt and Tar Processing/Storage (I3)
- Contaminated Sites, DEC Recognized (U4)
- Residential Areas (R1)
- Anchorage Golf Course (X2)
- Roads (X20)
- Anchorage Land Parcels
- Elevation Contours

N W E S

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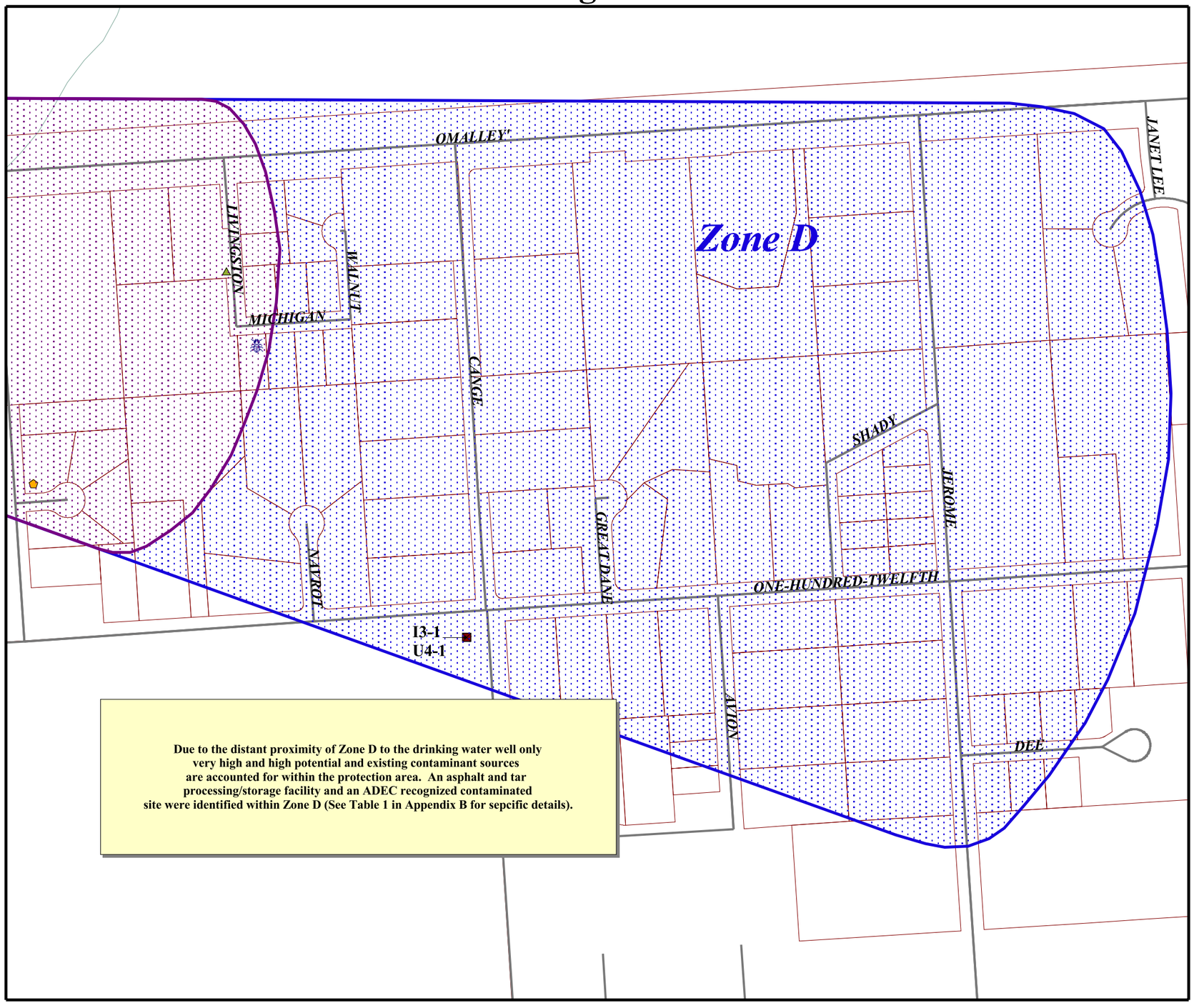
PWSID 215980.001

# Map 3

# Drinking Water Protection Area and
# Potential & Existing Contaminant Sources for Tom Thumb Montessori




Tom Thumb Montessori 's Drinking Water Well

Zone A Protection Area
- Several Months Travel Time

Zone B Protection Area
- Less Than 2 Years Travel Time

Zone C Protection Area
- Less Than 5 Years Travel Time

Zone D Protection Area
- Less Than 10 Years Travel Time

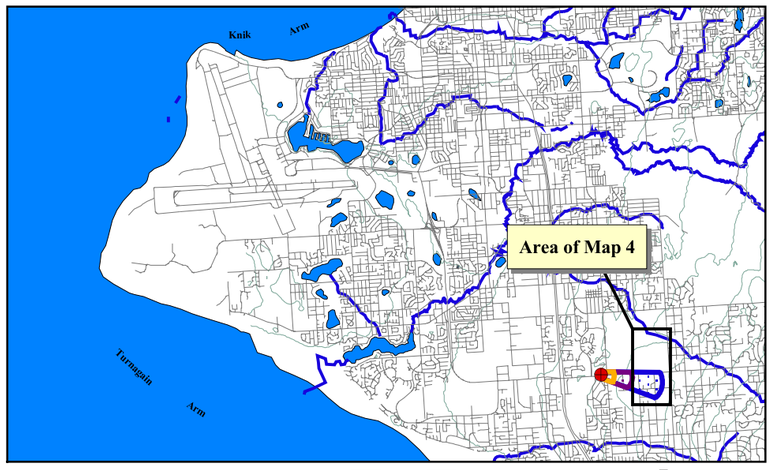
Potential Contaminant Sources
- Hardware Stores (C17)
- Pest Etermination Services/Pesticide Sales (C33)
- Construction Trade Areas and Materials (C9)
- Asphalt and Tar Processing/Storage (I3)
- Contaminated Sites, DEC Recognized (U4)

Roads (X20)

Anchorage Land Parcels

Elevation Contours

N W E S

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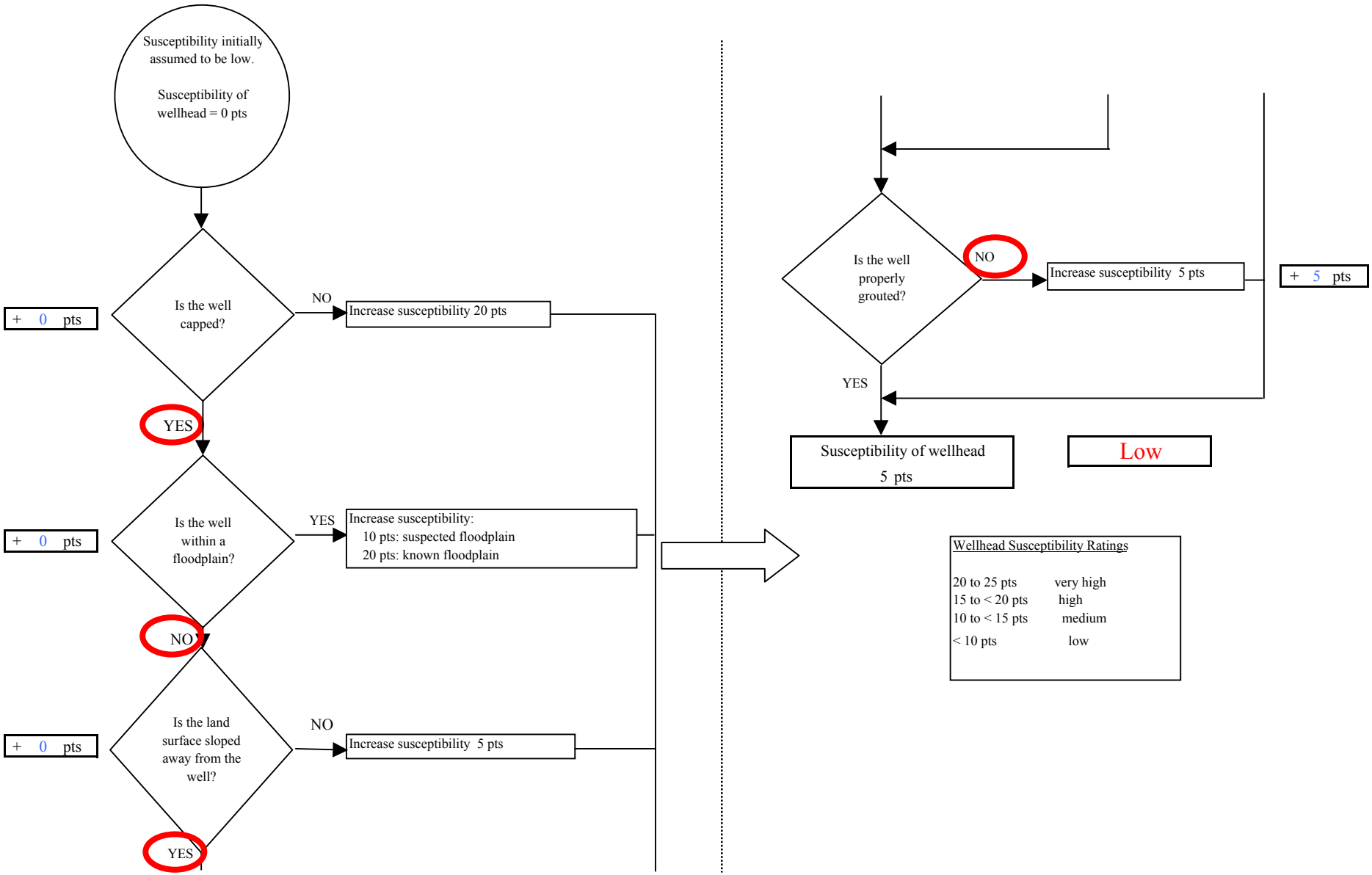
PWSID215980.001

# Map 4

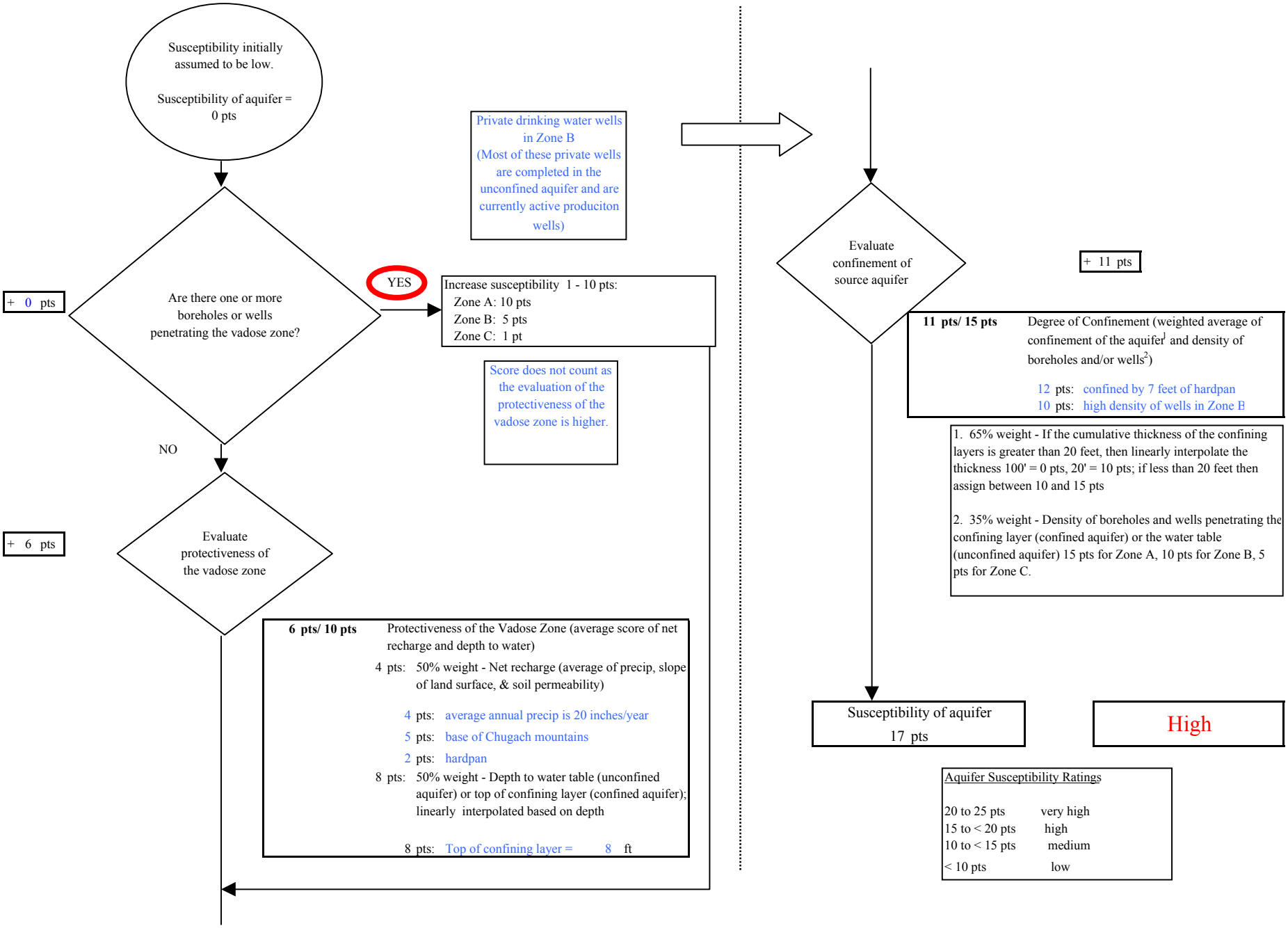
# APPENDIX D

# Vulnerability Analysis for
# Tom Thumb Montessori

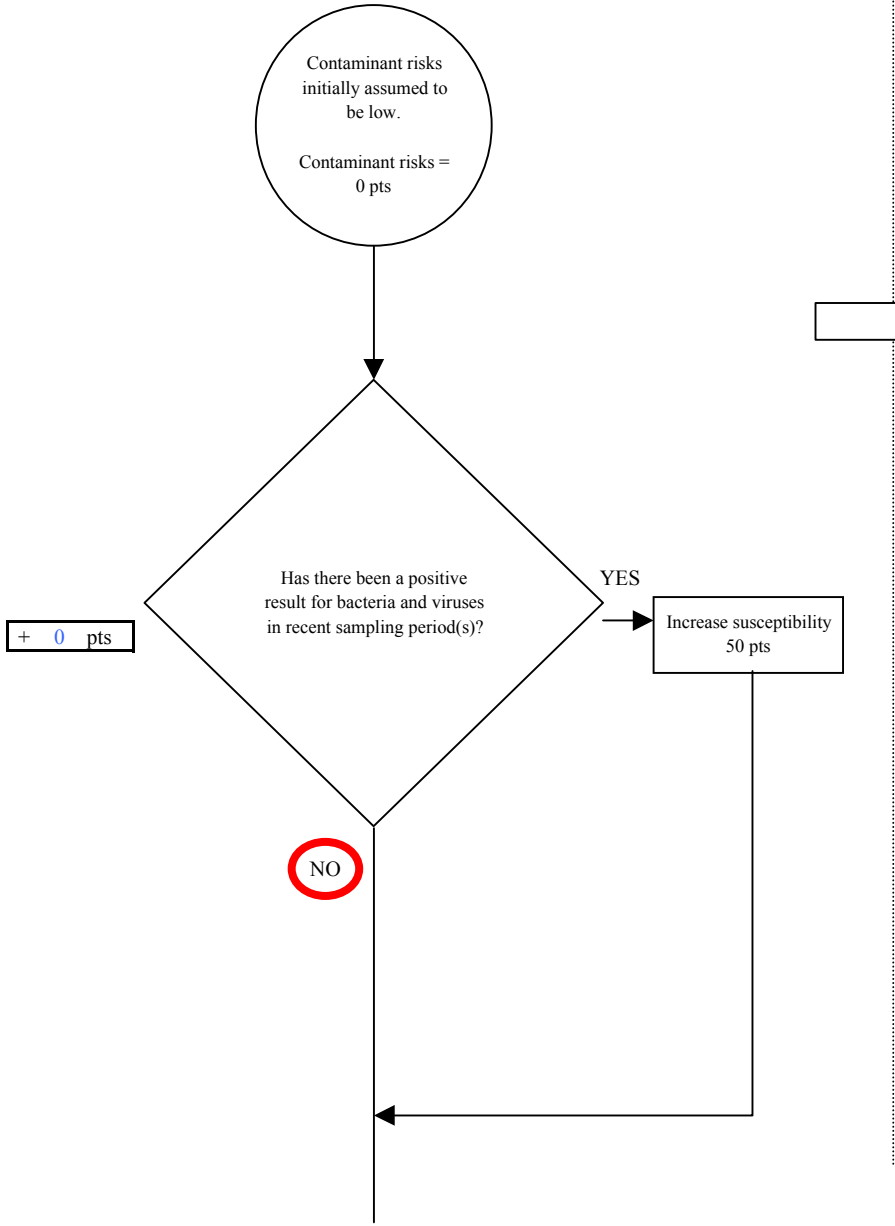
## *Chart 1. Susceptibility of the wellhead - Tom Thumb Montessori*

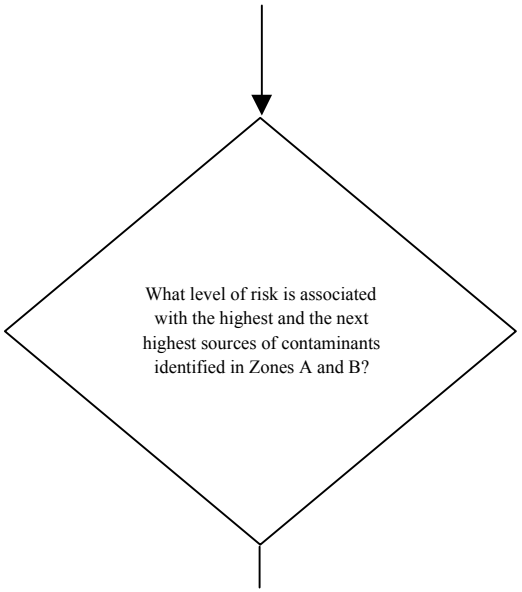


## *Chart 2. Susceptibility of the aquifer - Tom Thumb Montessori*



## *Chart 3. Contaminant risks for Tom Thumb Montessori - Bacteria & Viruses*




+ 20 pts

Risk Rankings for Contaminant Sources Identified in Zones A and B

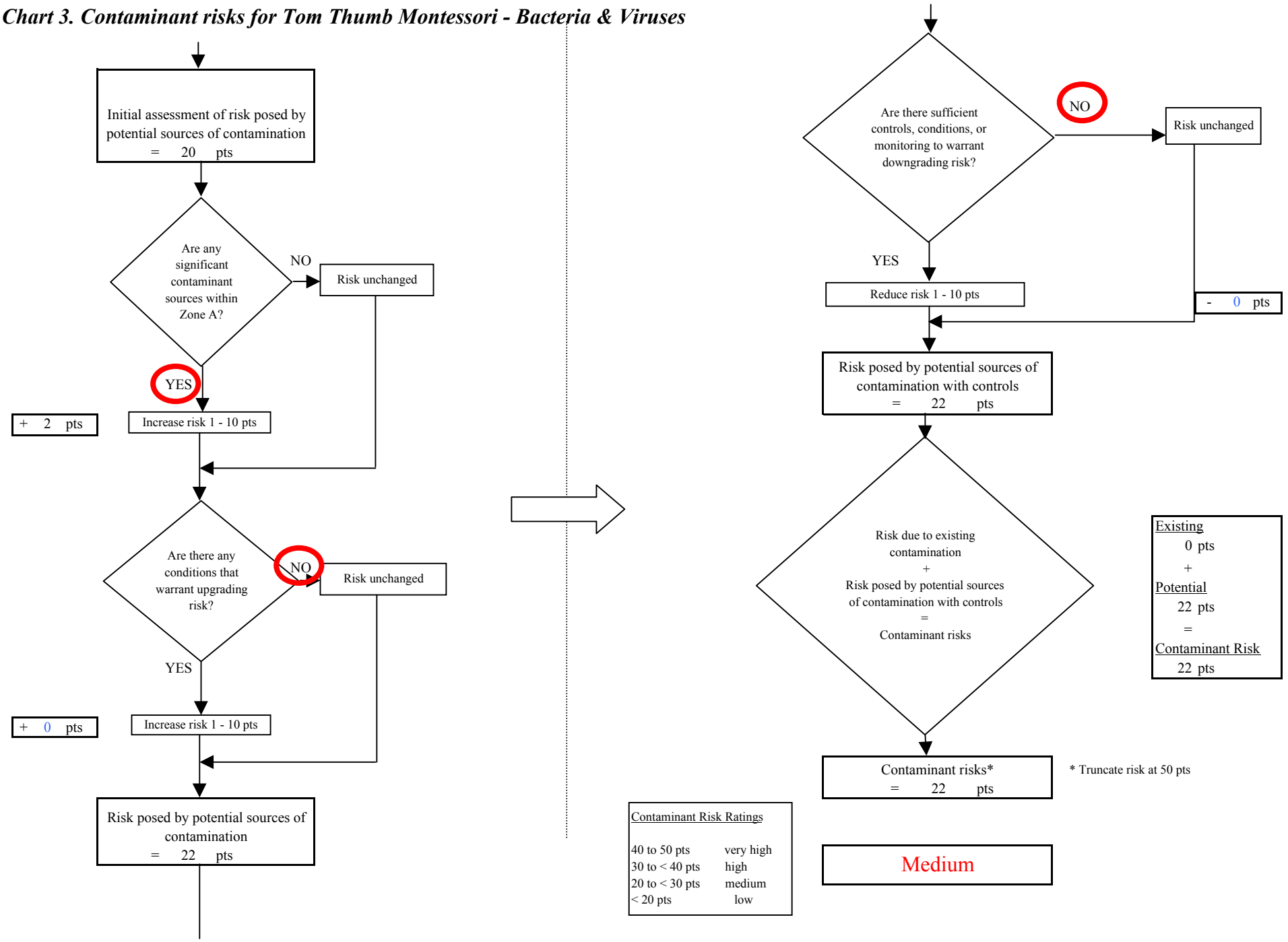
| | Zone A | Zone B | Total |
|---|---|---|---|
| Very Highs(s) | 0 | 0 | 0 |
| High(s) | 0 | 0 | 0 |
| Medium(s) | 0 | 0 | 0 |
| Low(s) | 5 | 10 | 15 |

| | **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 |

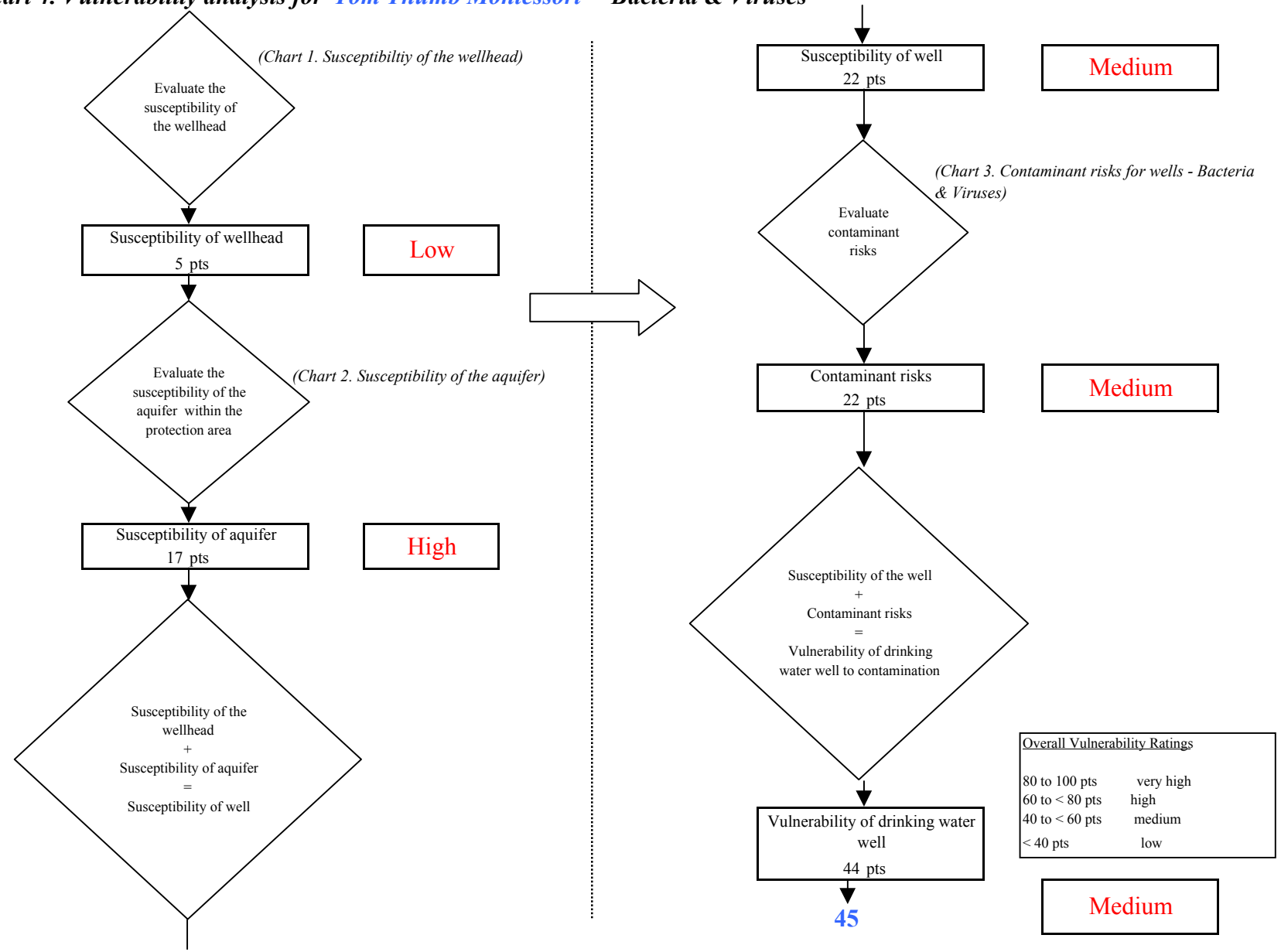
Matrix Score 20

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.

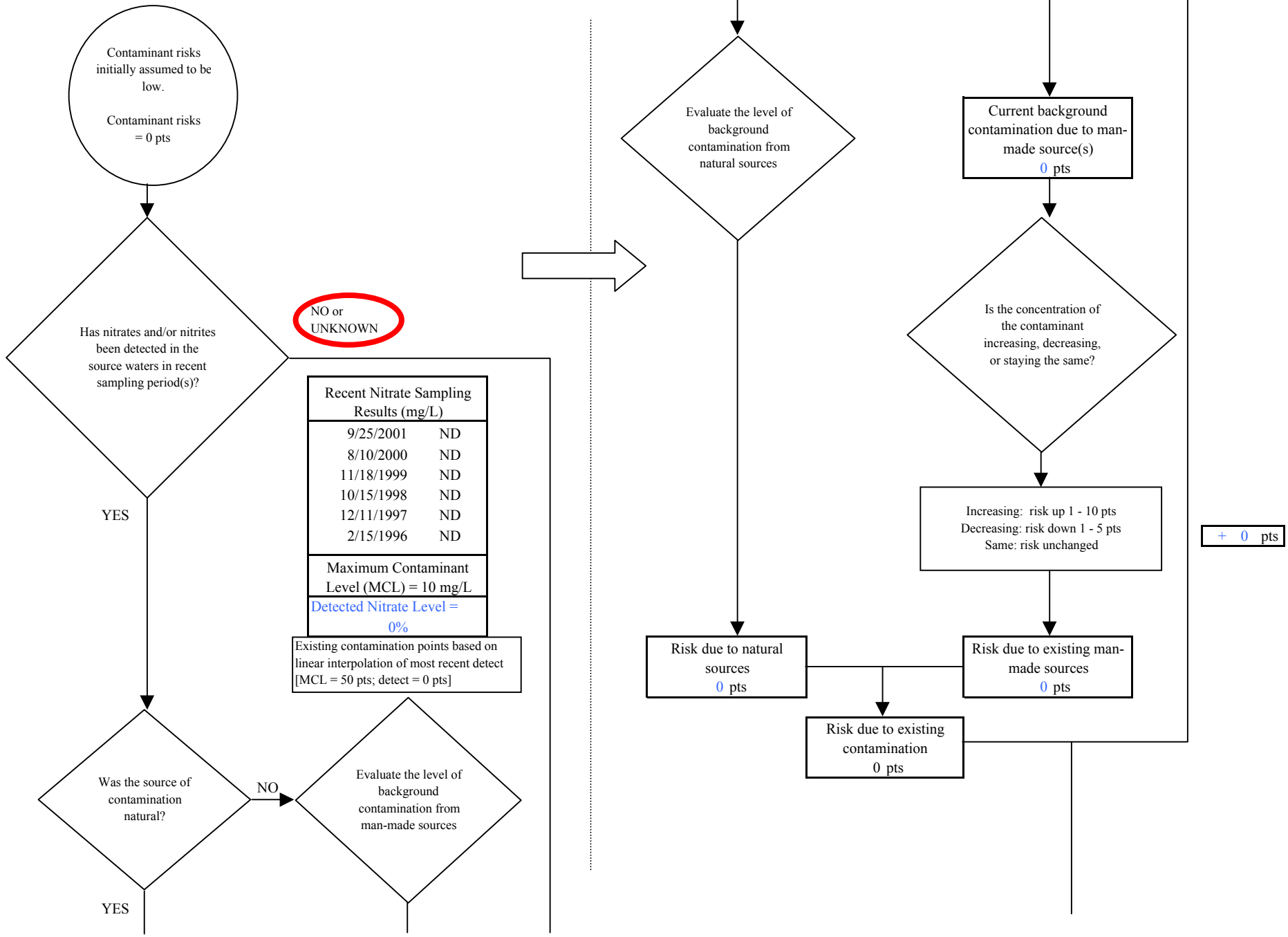
## *Chart 3. Contaminant risks for Tom Thumb Montessori - Bacteria & Viruses*



## *Chart 4. Vulnerability analysis for Tom Thumb Montessori - Bacteria & Viruses*



## *Chart 5. Contaminant risks for Tom Thumb Montessori - Nitrates and Nitrites*



## *Chart 5. Contaminant risks for Tom Thumb Montessori - 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) | 5 | 12 | 17 |

| | **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

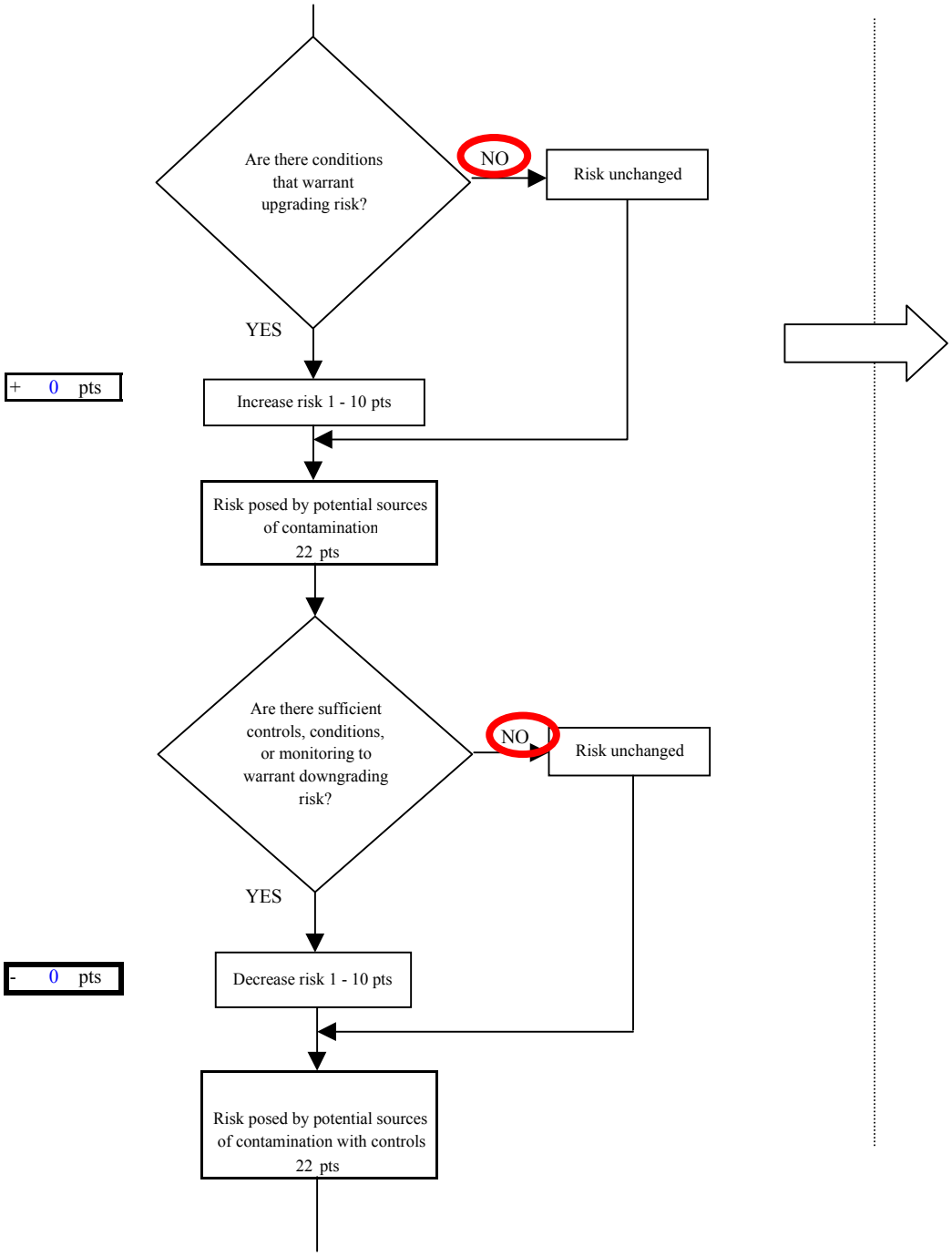
Risk unchanged

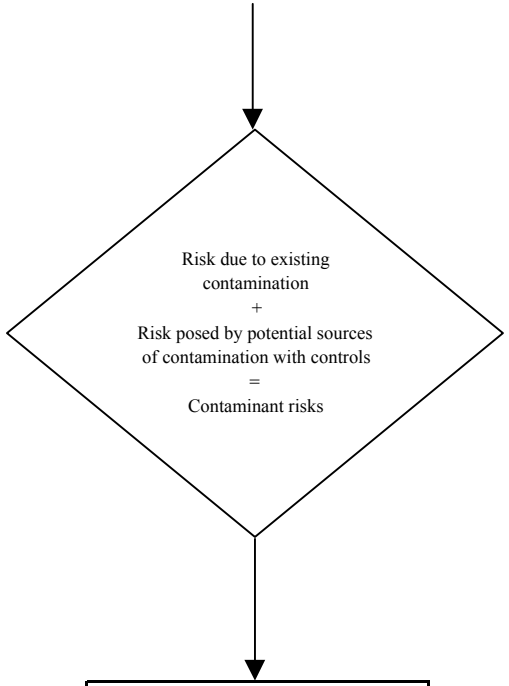
YES

Increase risk 1 - 10 pts

+ 2 pts

## *Chart 5. Contaminant risks for Tom Thumb Montessori - Nitrates and Nitrites*




Existing
0 pts
+
Potential
22 pts
=
Contaminant Risk
22 pts

Contaminant risks*
= 22 pts

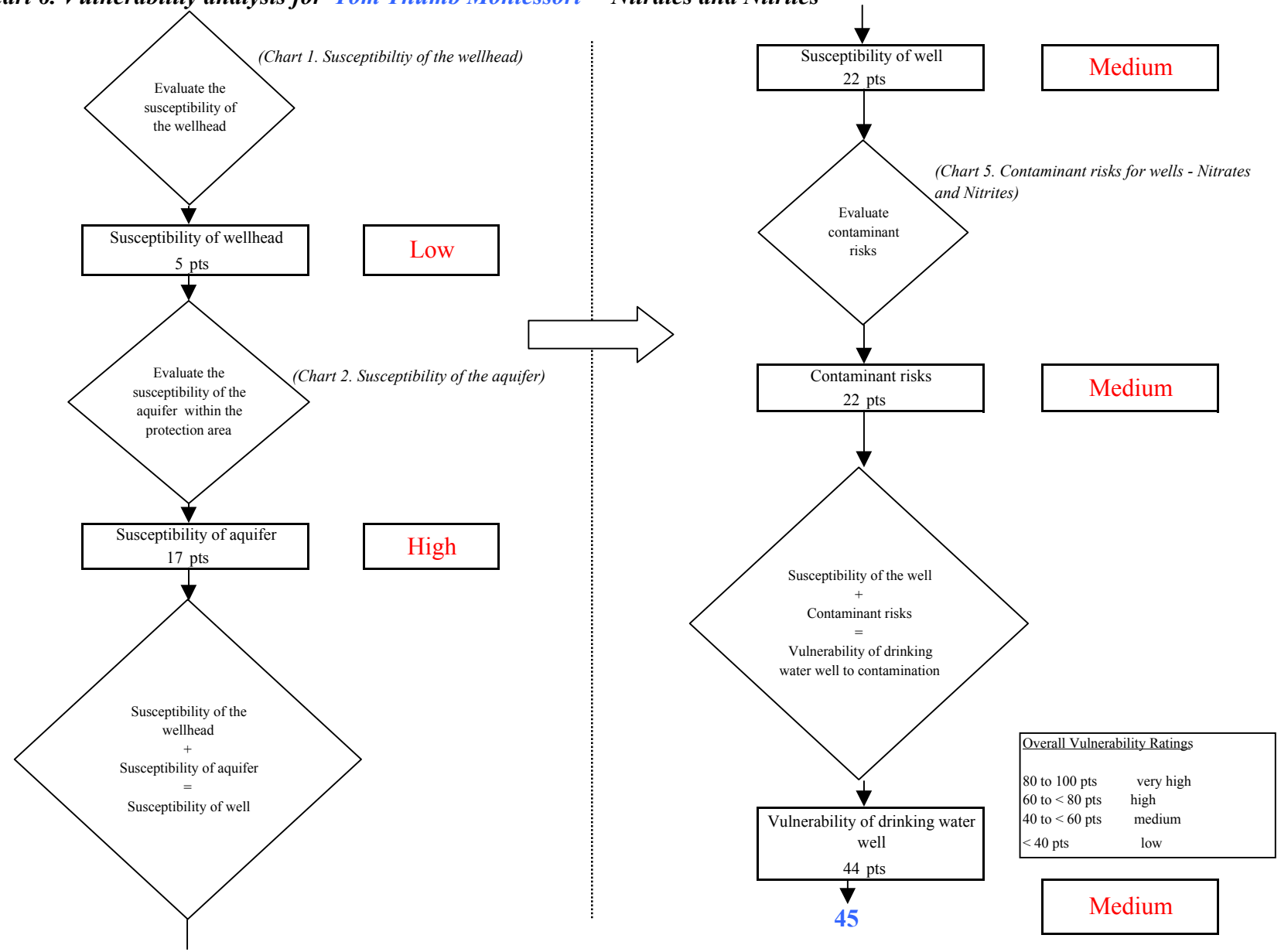
*Truncate risk at 50 pts

**Medium**

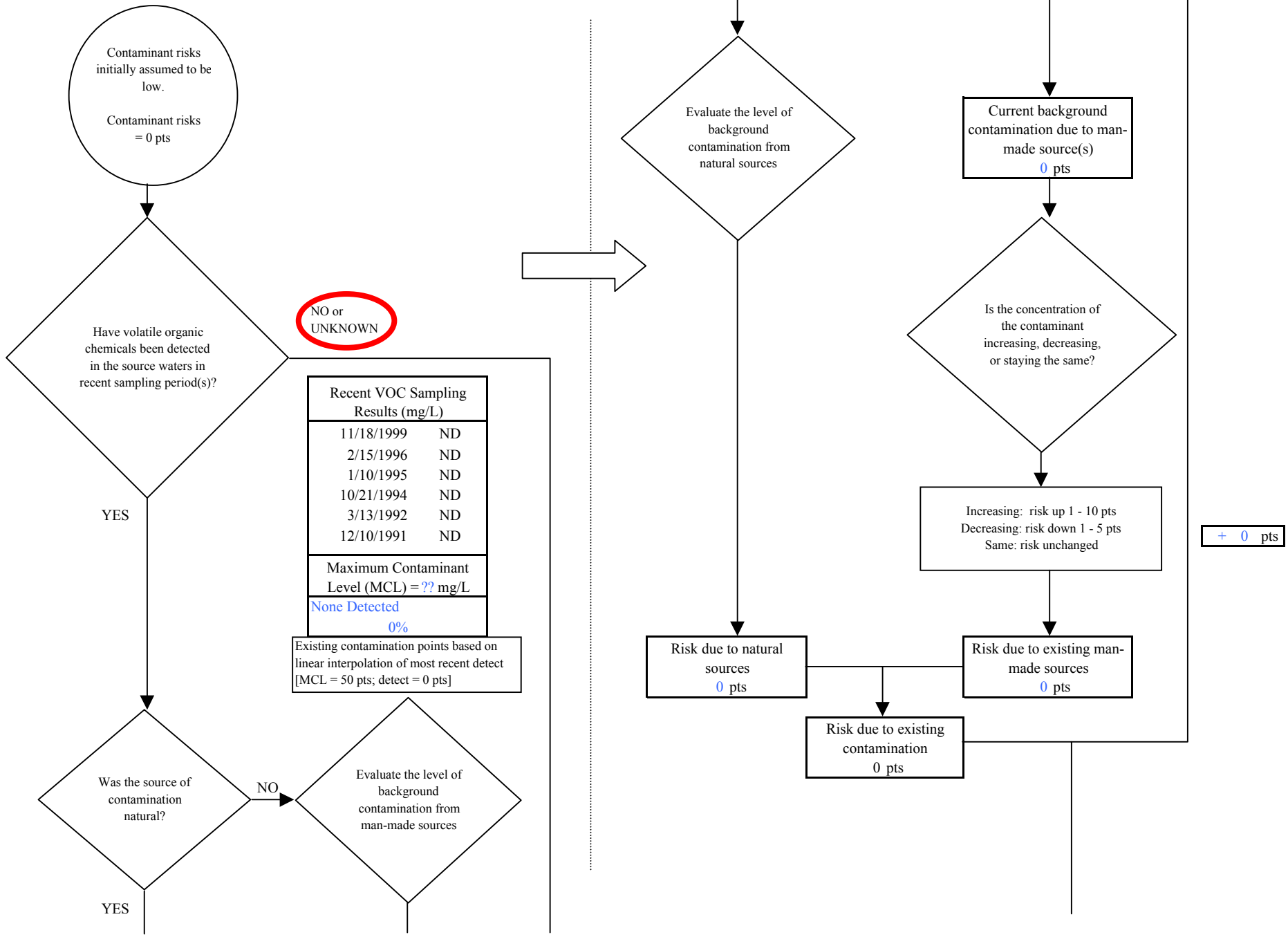
Contaminant Risk Ratings

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

## *Chart 6. Vulnerability analysis for Tom Thumb Montessori - Nitrates and Nitrites*



## *Chart 7. Contaminant risks for Tom Thumb Montessori - Volatile Organic Chemicals*



## *Chart 7. Contaminant risks for Tom Thumb Montessori - Volatile Organic Chemicals*

+ 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) | 3 | 9 | 12 |

| | **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

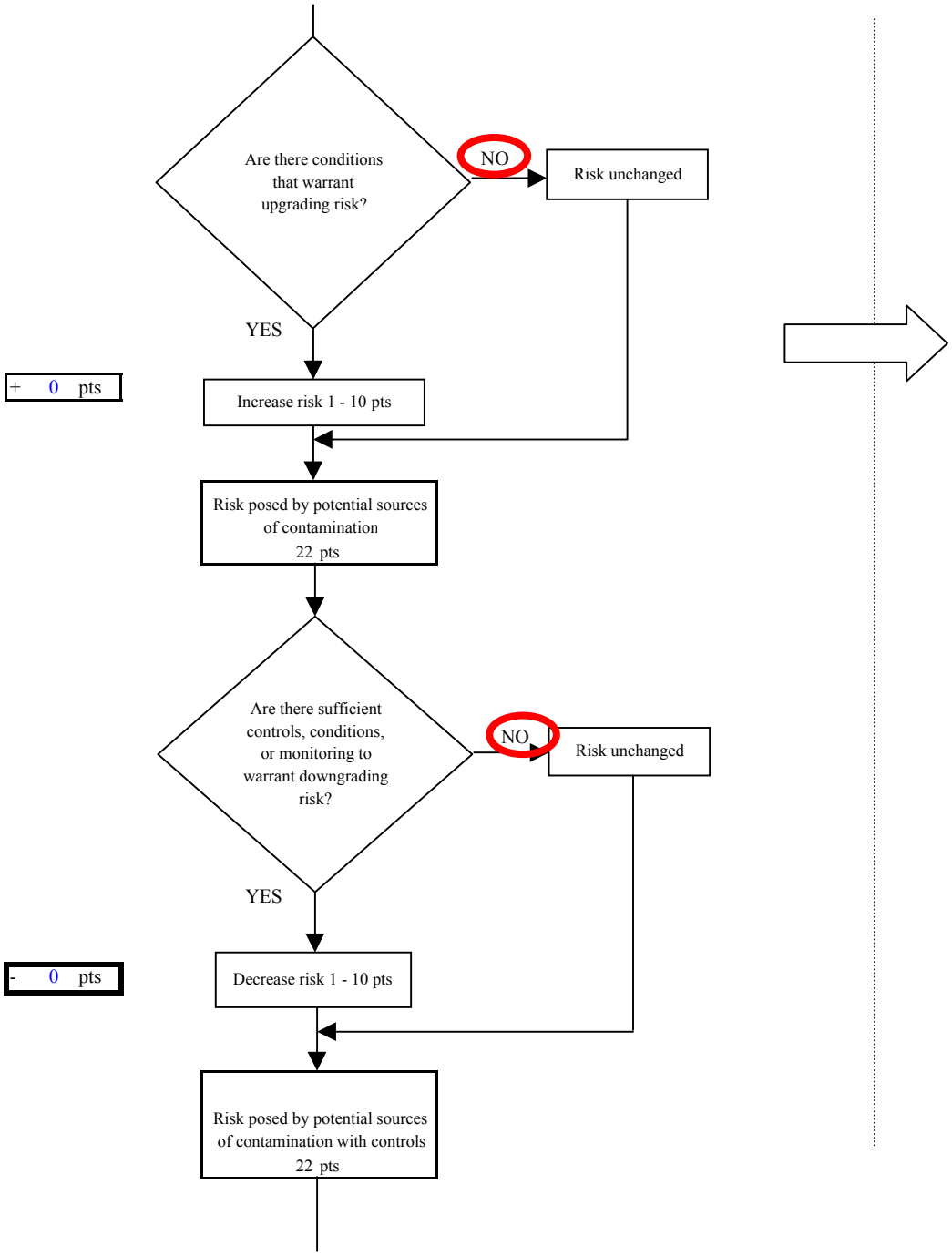
Risk unchanged

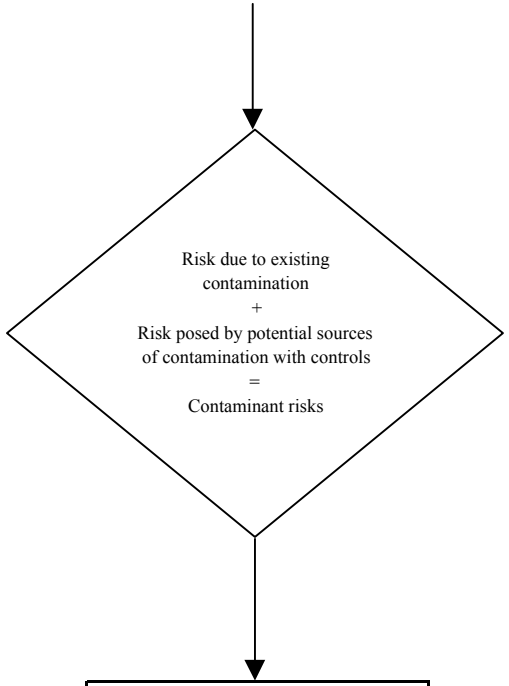
YES

Increase risk 1 - 10 pts

+ 2 pts

## *Chart 7. Contaminant risks for Tom Thumb Montessori - Volatile Organic Chemicals*




Existing
0 pts
+
Potential
22 pts
=
Contaminant Risk
22 pts

Contaminant risks*
= 22 pts

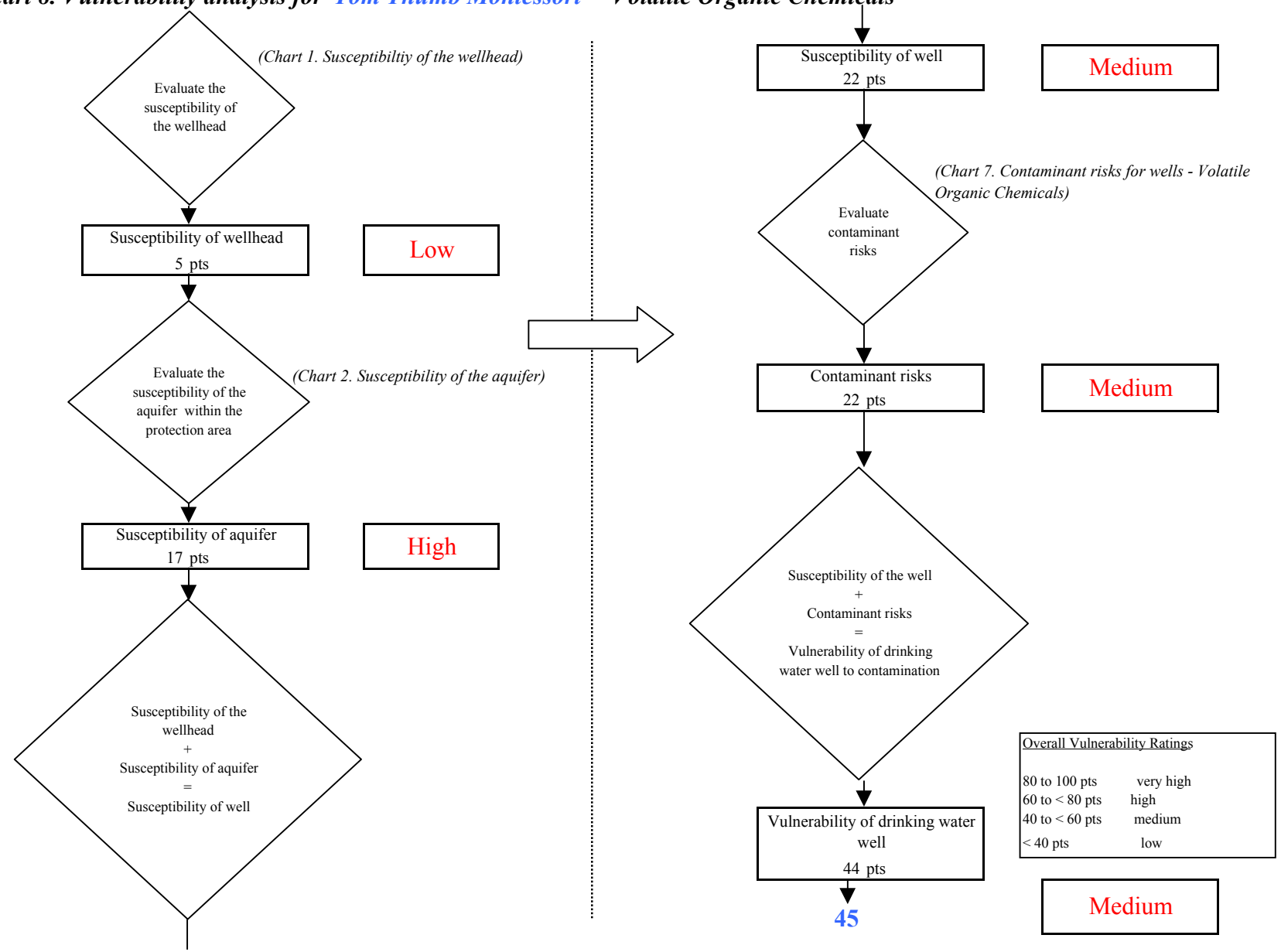
*Truncate risk at 50 pts

**Medium**

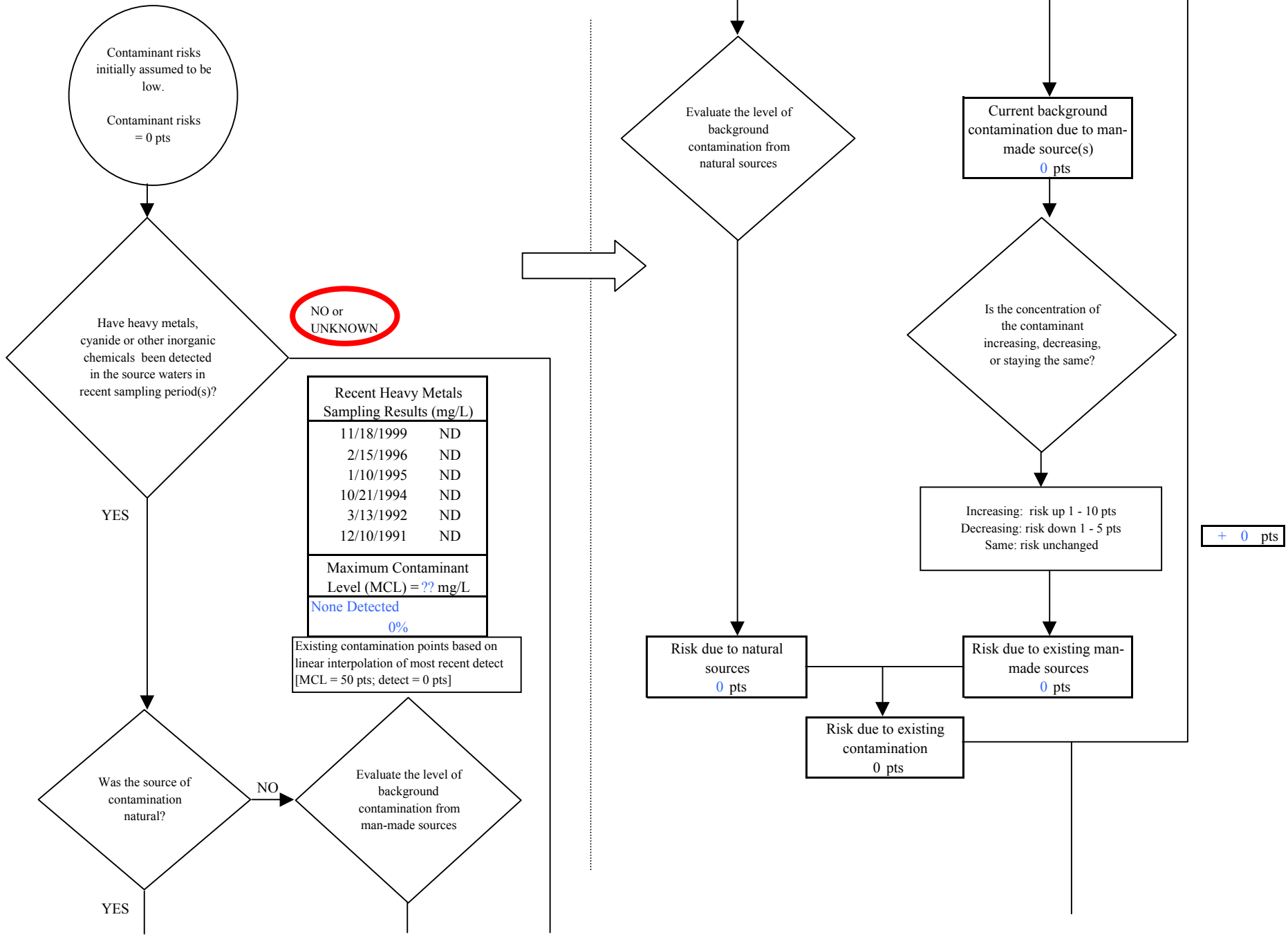
Contaminant Risk Ratings

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

## *Chart 8. Vulnerability analysis for Tom Thumb Montessori - Volatile Organic Chemicals*



## *Chart 9. Contaminant risks for Tom Thumb Montessori - Heavy Metals, Cyanide and Other Inorganic Chemicals*



## *Chart 9. Contaminant risks for Tom Thumb Montessori - Heavy Metals, Cyanide and Other Inorganic Chemicals*

+ 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) | 3 | 9 | 12 |

| | **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

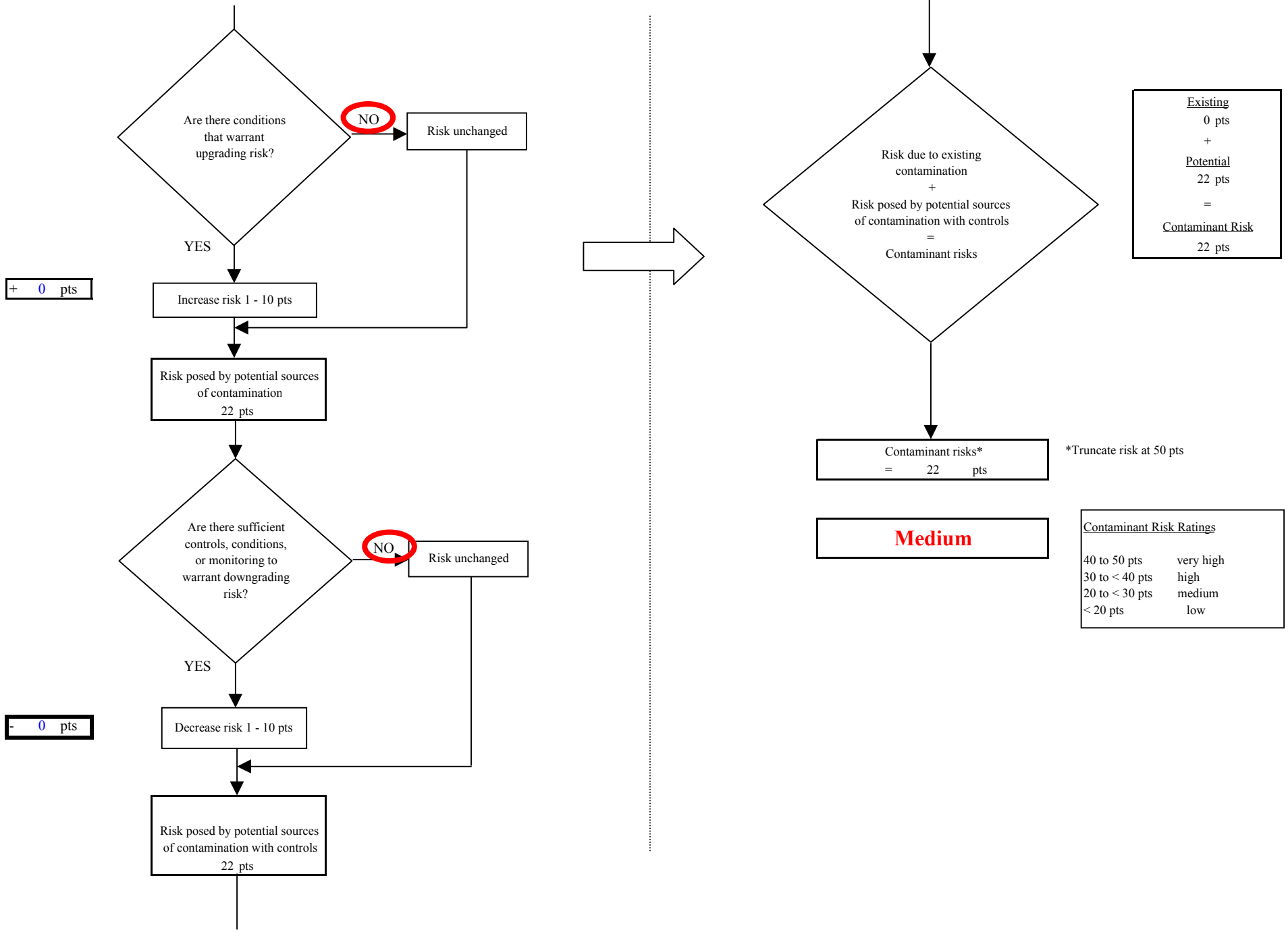
Risk unchanged

YES

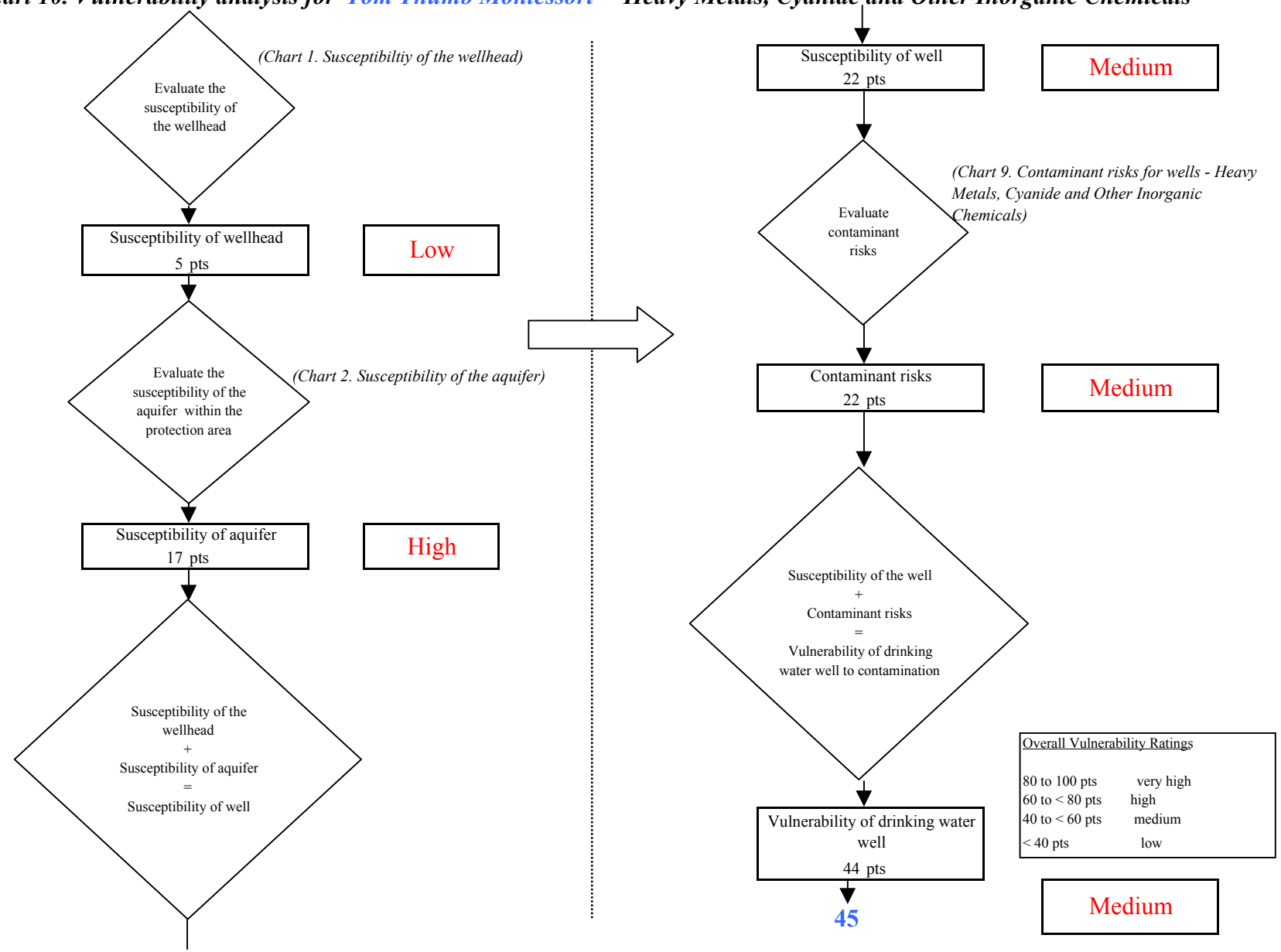
Increase risk 1 - 10 pts

+ 2 pts

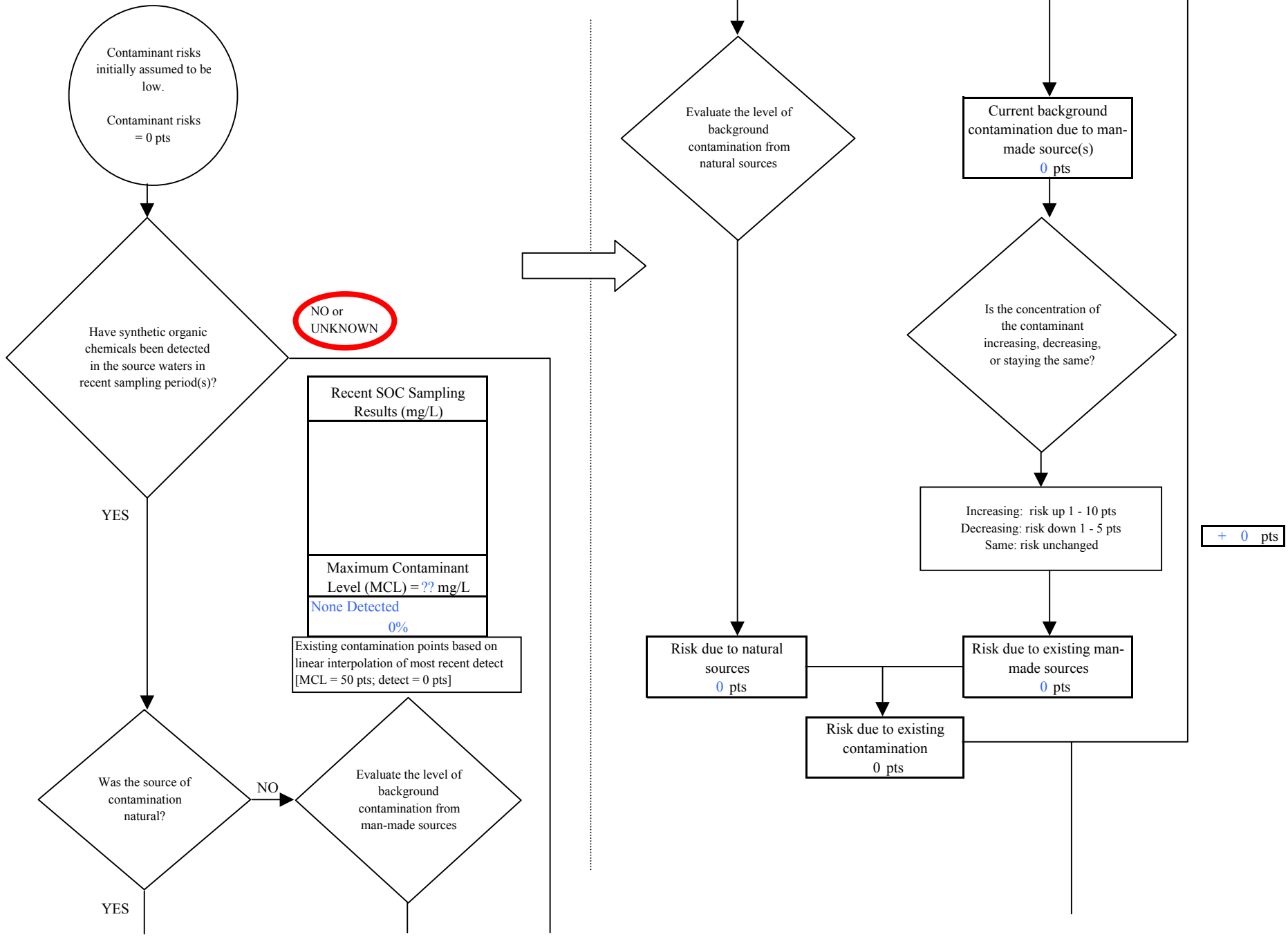
## *Chart 9. Contaminant risks for Tom Thumb Montessori - Heavy Metals, Cyanide and Other Inorganic Chemicals*



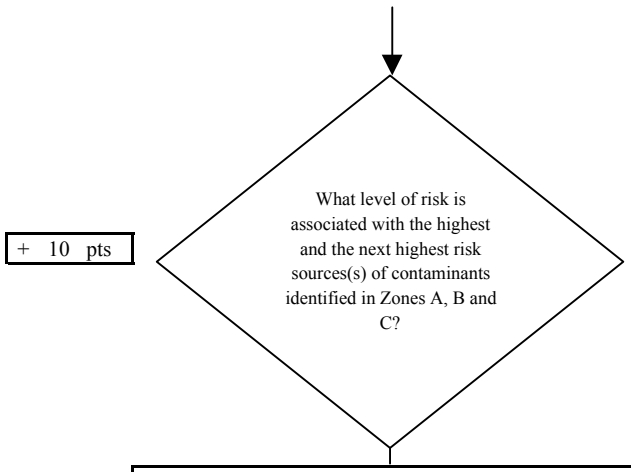
## *Chart 10. Vulnerability analysis for Tom Thumb Montessori - Heavy Metals, Cyanide and Other Inorganic Chemicals*



## *Chart 11. Contaminant risks for Tom Thumb Montessori - Synthetic Organic Chemicals*



## *Chart 11. Contaminant risks for Tom Thumb Montessori - Synthetic Organic Chemicals*




+ 10 pts

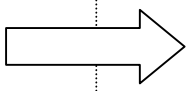
Risk Levels for Contaminant Sources identified in Zones A, B and C

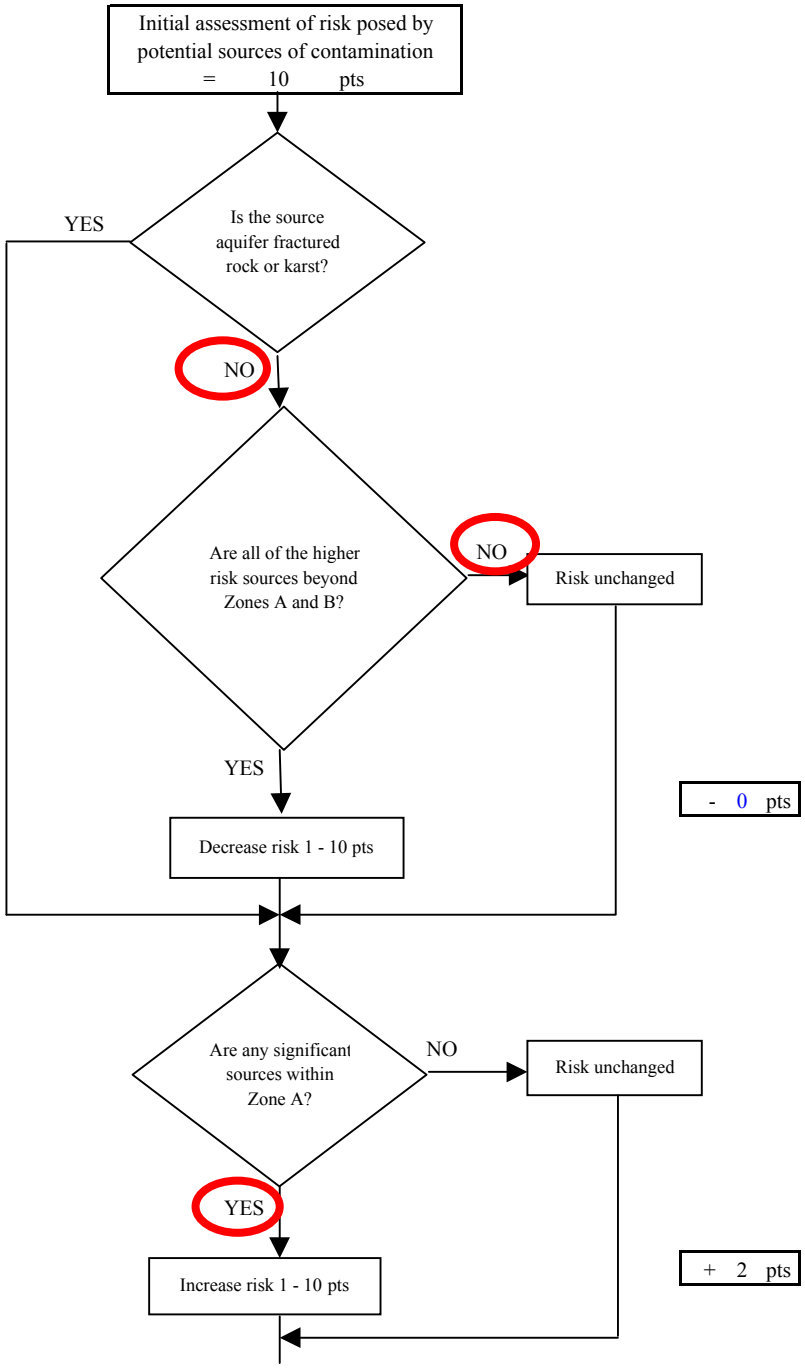
| | Zone A | Zones B&C | Total |
|---|---|---|---|
| Very Highs(s) | 0 | 0 | 0 |
| High(s) | 0 | 0 | 0 |
| Medium(s) | 0 | 0 | 0 |
| Low(s) | 2 | 5 | 7 |

| | **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 |

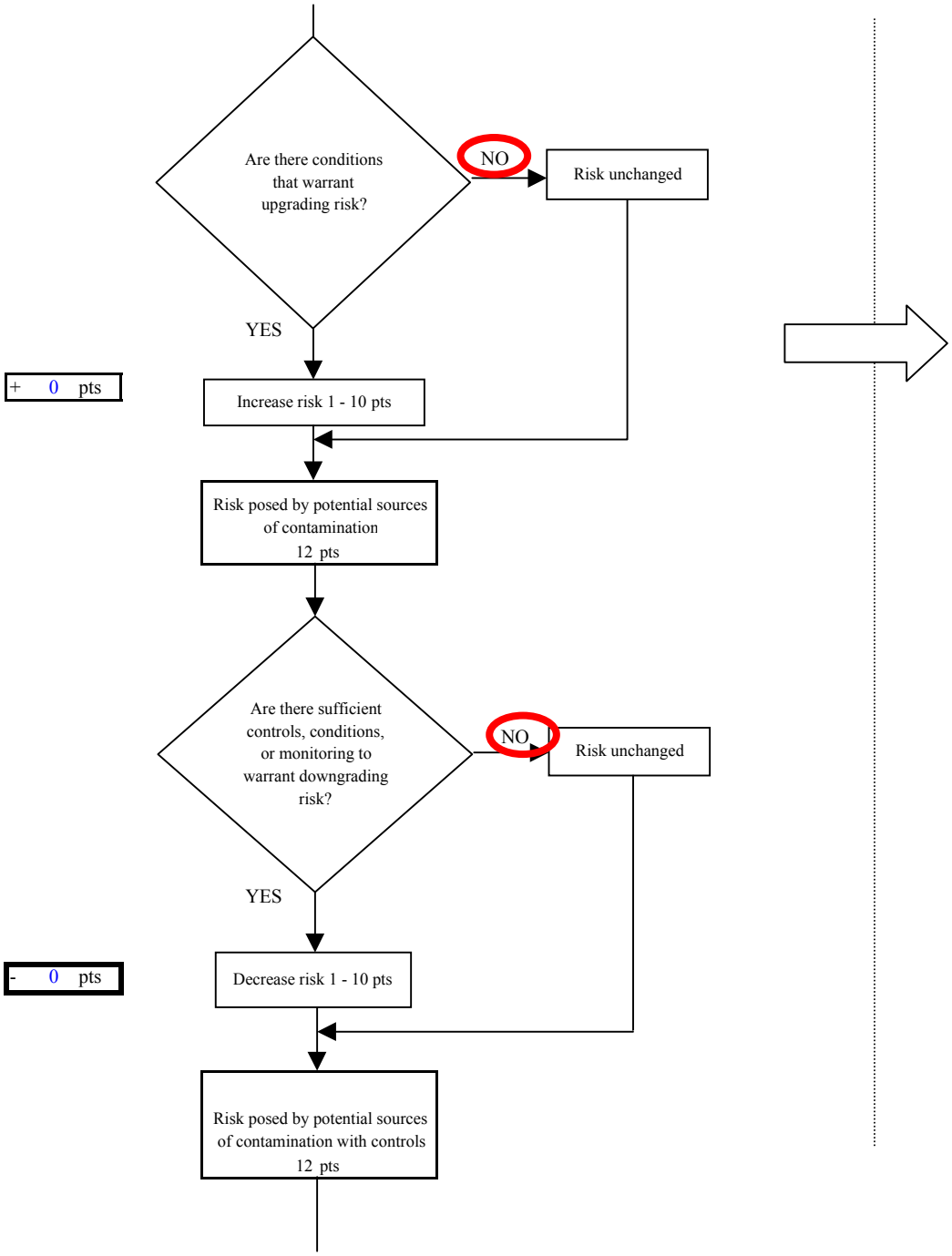
Matrix Score 10

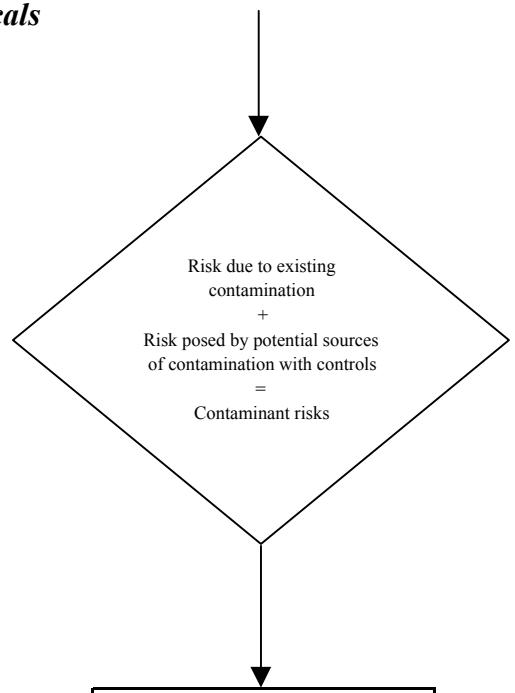
Note: Septic systems, sewerlines, and roads are each assigned a risk ranking for each individual contaminant source in the CSI. The VA, however, counts these contaminant sources as a group and assigns a calculated number of either "lows" or "mediums" based on the density.





## *Chart 11. Contaminant risks for Tom Thumb Montessori - Synthetic Organic Chemicals*




Existing
0 pts
+
Potential
12 pts
=
Contaminant Risk
12 pts

Contaminant risks*
= 12 pts

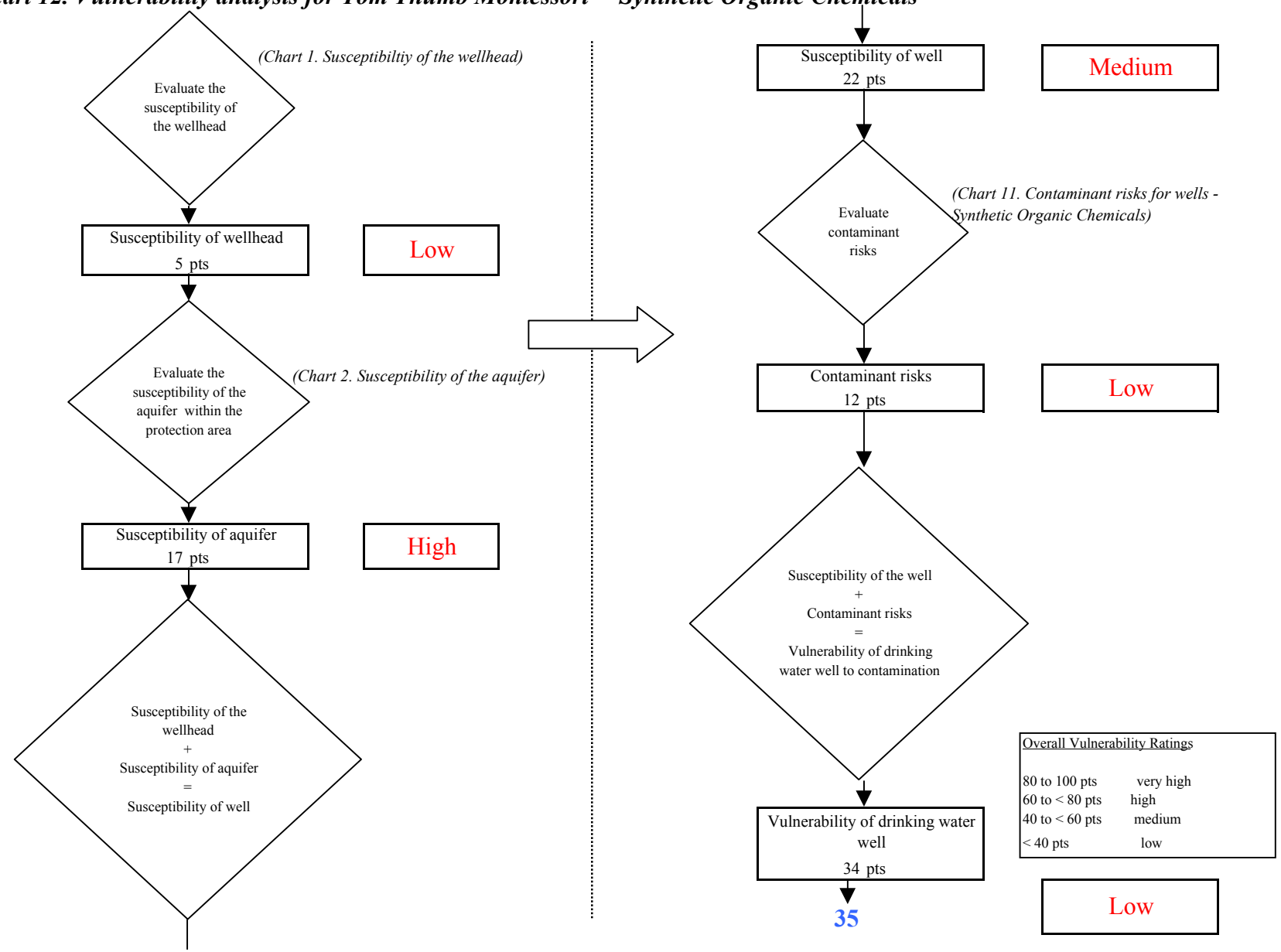
*Truncate risk at 50 pts

**Low**

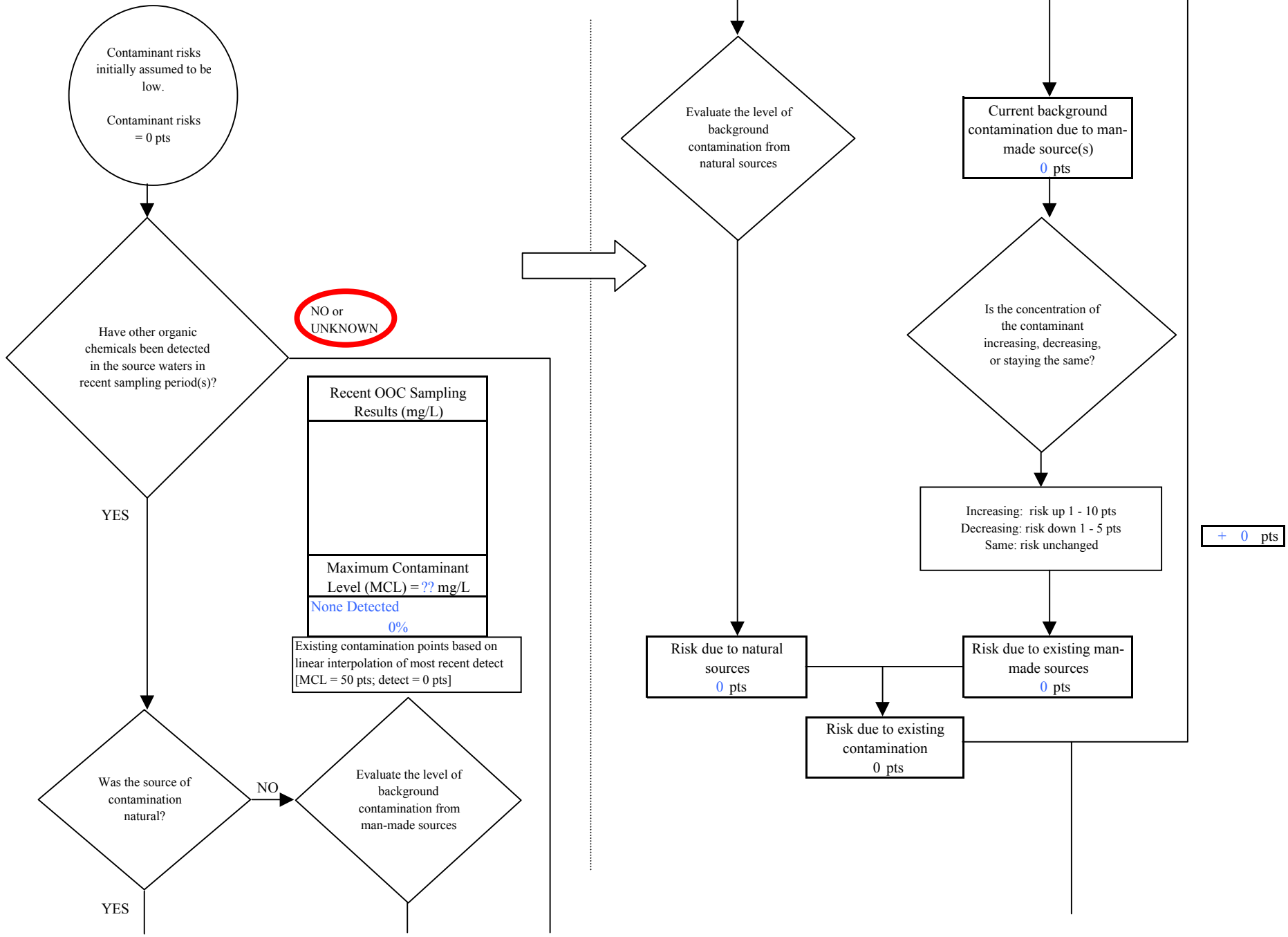
Contaminant Risk Ratings

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

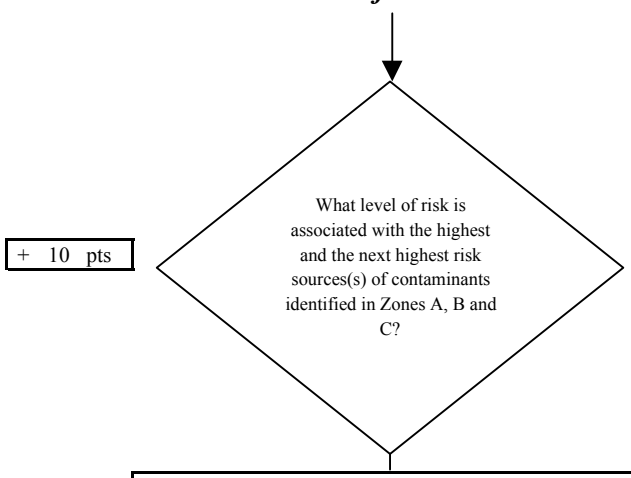
## *Chart 12. Vulnerability analysis for Tom Thumb Montessori - Synthetic Organic Chemicals*



## *Chart 13. Contaminant risks for Tom Thumb Montessori - Other Organic Chemicals*



## *Chart 13. Contaminant risks for Tom Thumb Montessori - Other Organic Chemicals*




+ 10 pts

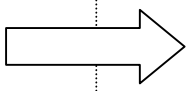
Risk Levels for Contaminant Sources identified in Zones A, B and C

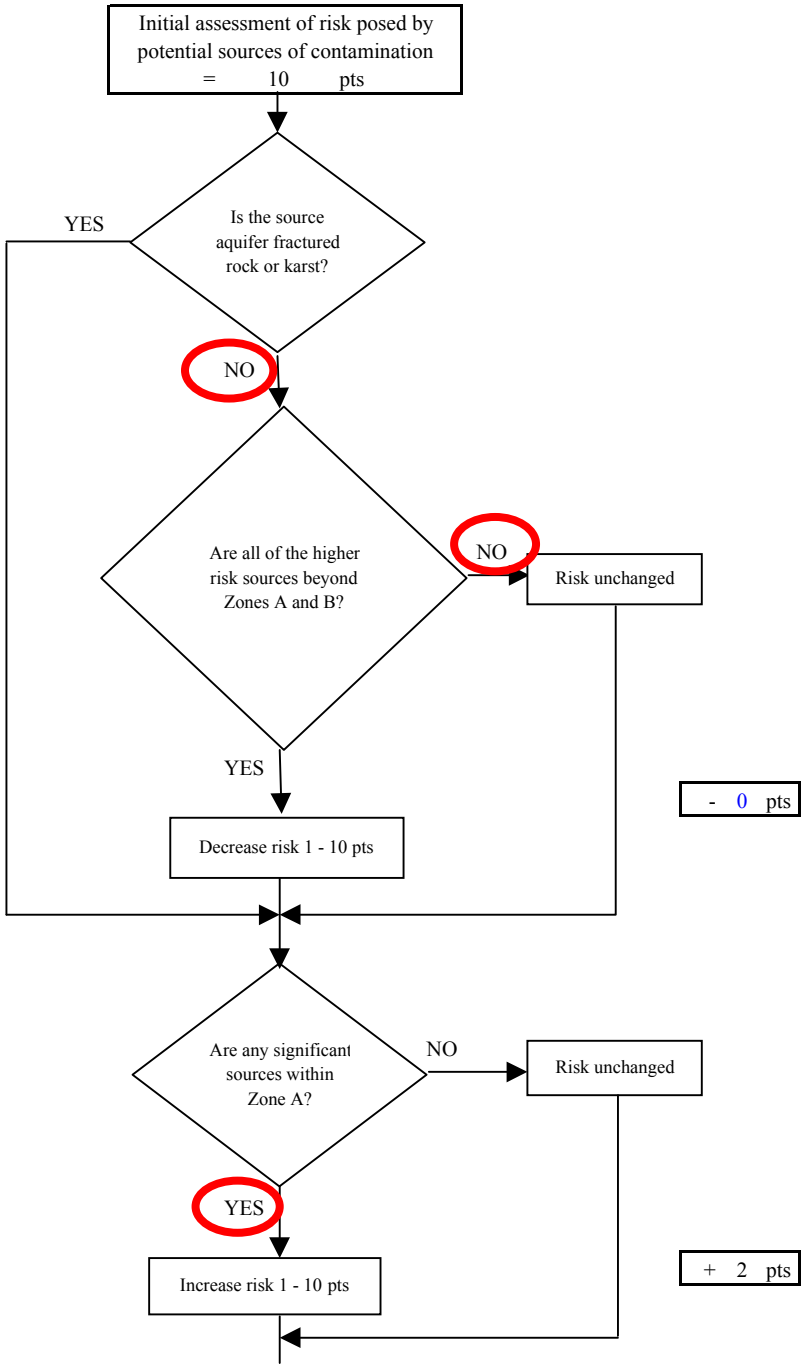
| | Zone A | Zones B&C | Total |
|---|---|---|---|
| Very Highs(s) | 0 | 0 | 0 |
| High(s) | 0 | 0 | 0 |
| Medium(s) | 0 | 0 | 0 |
| Low(s) | 3 | 7 | 10 |

| | **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 |

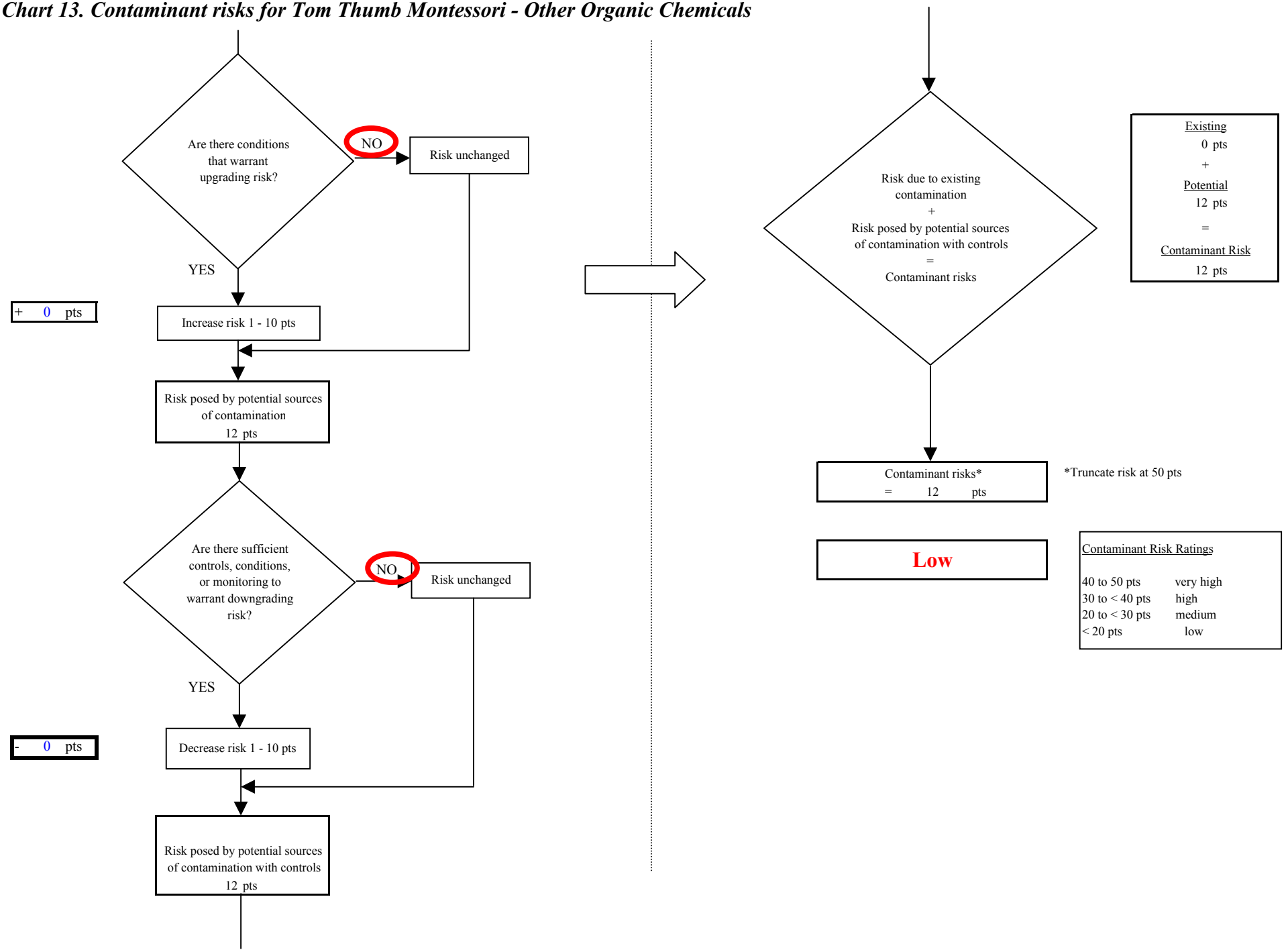
Matrix Score 10

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 13. Contaminant risks for Tom Thumb Montessori - Other Organic Chemicals*



## *Chart 14. Vulnerability analysis for Tom Thumb Montessori - Other Organic Chemicals*