Source Water Assessment for Alpat Water Utility Anchorage, Alaska

A Hydrogeologic Susceptibility and Vulnerability Analysis

DRINKING WATER PROTECTION PROGRAM REPORT 437
PWSID 211229.001

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By HEATHER A. HAMMOND

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The Drinking Water Protection Program is producing Source Water Assessments in compliance with the Safe Drinking Water Act Amendments of 1996. Each assessment includes a delineation of the source water area, an inventory of potential and existing contaminant sources that may impact the water, a risk ranking for each of these contaminants, and an evaluation of the potential vulnerability of these drinking water sources.

These assessments are intended to provide public water systems owners/operators, communities, and local governments with the best available information that may be used to protect the quality of their drinking water. The assessments combine information obtained from various sources, including the U.S. Environmental Protection Agency, Alaska Department of Environmental Conservation (ADEC), public water system owners/operators, and other public information sources. The results of this assessment are subject to change if additional data becomes available. If you have any additional information that may affect the results of this assessment, please contact the Program Coordinator of DWPP, (907) 269-7521.

ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION: 2002

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Source Water Assessment for Alpat Water Utility, Anchorage, Alaska

A Hydrogeologic Susceptibility and Vulnerability Analysis

By Heather A. Hammond

Drinking Water Protection Program
Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

Alpat Water Utility is a Class A (community) water system consisting of two wells in the Anchorage Area. Due to their close proximity, the wells share the same protection area and contaminant source inventory. Identified potential and current sources of contaminants that present the most significant risk to Alpat Water Utility's drinking water sources includes approximately 18 acres of residential area, sewer lines, roads, medical facilities, gasoline stations, heavy equipment storage areas, Class V motor vehicle waste disposal wells, dry cleaners, above ground fuel storage tanks, and underground fuel storage tanks (See Table 1in Appendix B for a comprehensive list of identified potential and existing contaminant sources). 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 Alpat Water Utility received a vulnerability rating of **low** for synthetic organic chemicals; **medium** for bacteria and viruses, nitrates and/or nitrites, and other organic chemicals; and **high** for volatile organic chemicals, and heavy metals.

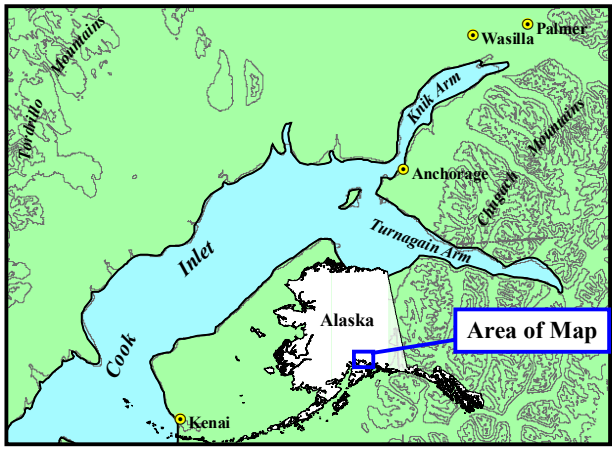

Figure 1. Index map showing the location of Anchorage, Alaska

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 sources of public drinking water serving Alpat Water Utility. This water system consists of two wells 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.

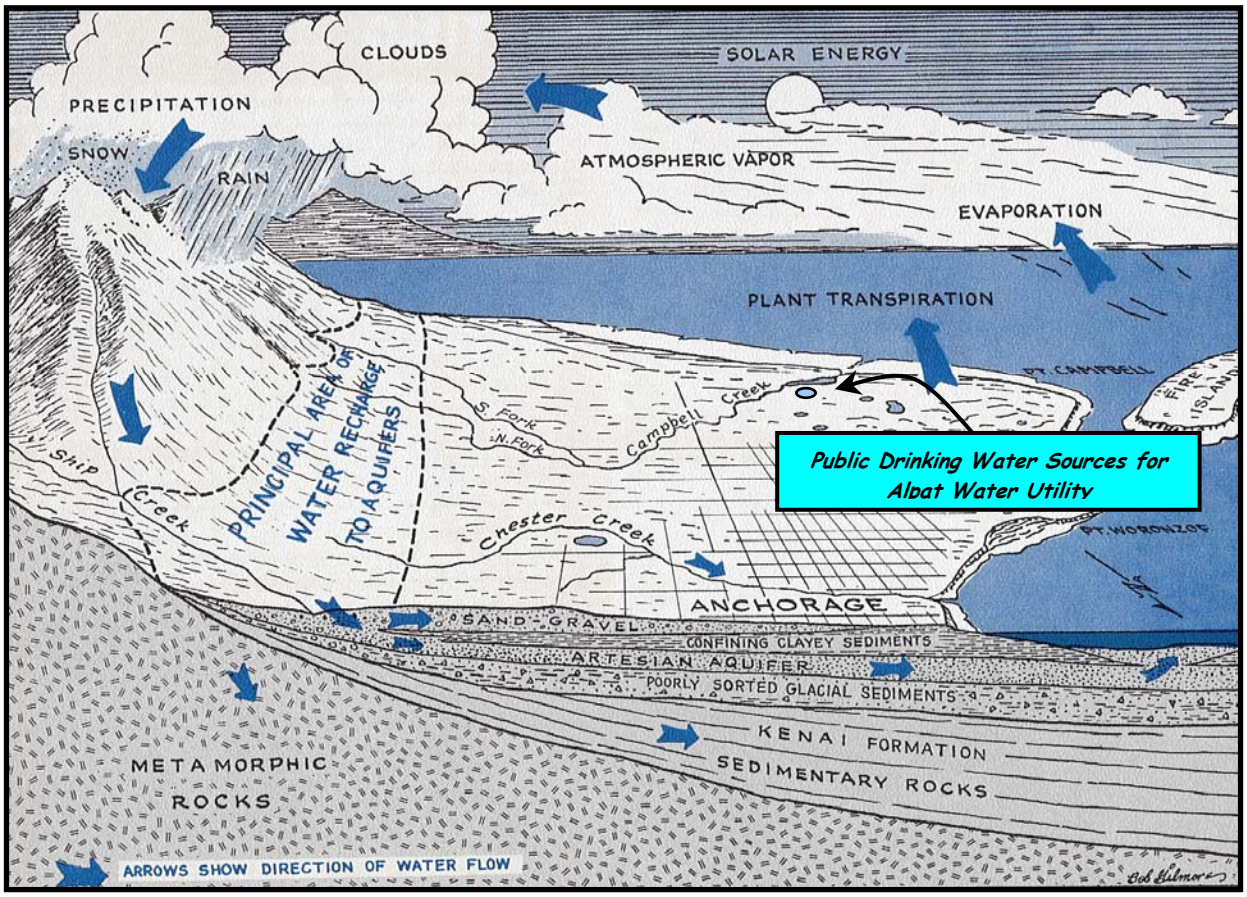

Figure 2. Generalized hydrologic cycle in the Anchorage area [*Barnwell, George, Dearborn,Weeks, and Zenone*, 1972].

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.

ALPAT WATER UTILITY'S DRINKING WATER SOURCES

Alpat Water Utility's Public Drinking Water System is a Class A (community) water system consisting of two wells. Due to the their close proximity, the wells share the same protection area and contaminant source inventory. Both wells are located off of Elim Street in the Moorehand Subdivision at an elevation of approximately 100 feet above sea level (see figure 3). According to the most recent Monitoring Waiver (12/12/95) both wells are protected by a concrete wellhouse. The most recent Sanitary Survey (09/17/96) indicates that the wells are adequately protected from foreign matter and/or surface water from entering source waters along the well casing. The well site is graded to allow proper drainage and surface water diversion to occur. Both wells are properly equipped with a sanitary seal secured by a deadbolt locks. It was not indicated on either well log whether the wells were grouted at the time of drilling. Proper grouting can provide additional protection against contaminants traveling along the surface and in the subsurface from entering source waters.

Installation of Well #1 occurred in 1972 and was drilled to a total depth of 220 feet below ground surface and was completed in an 8-inch well casing. The well is screened

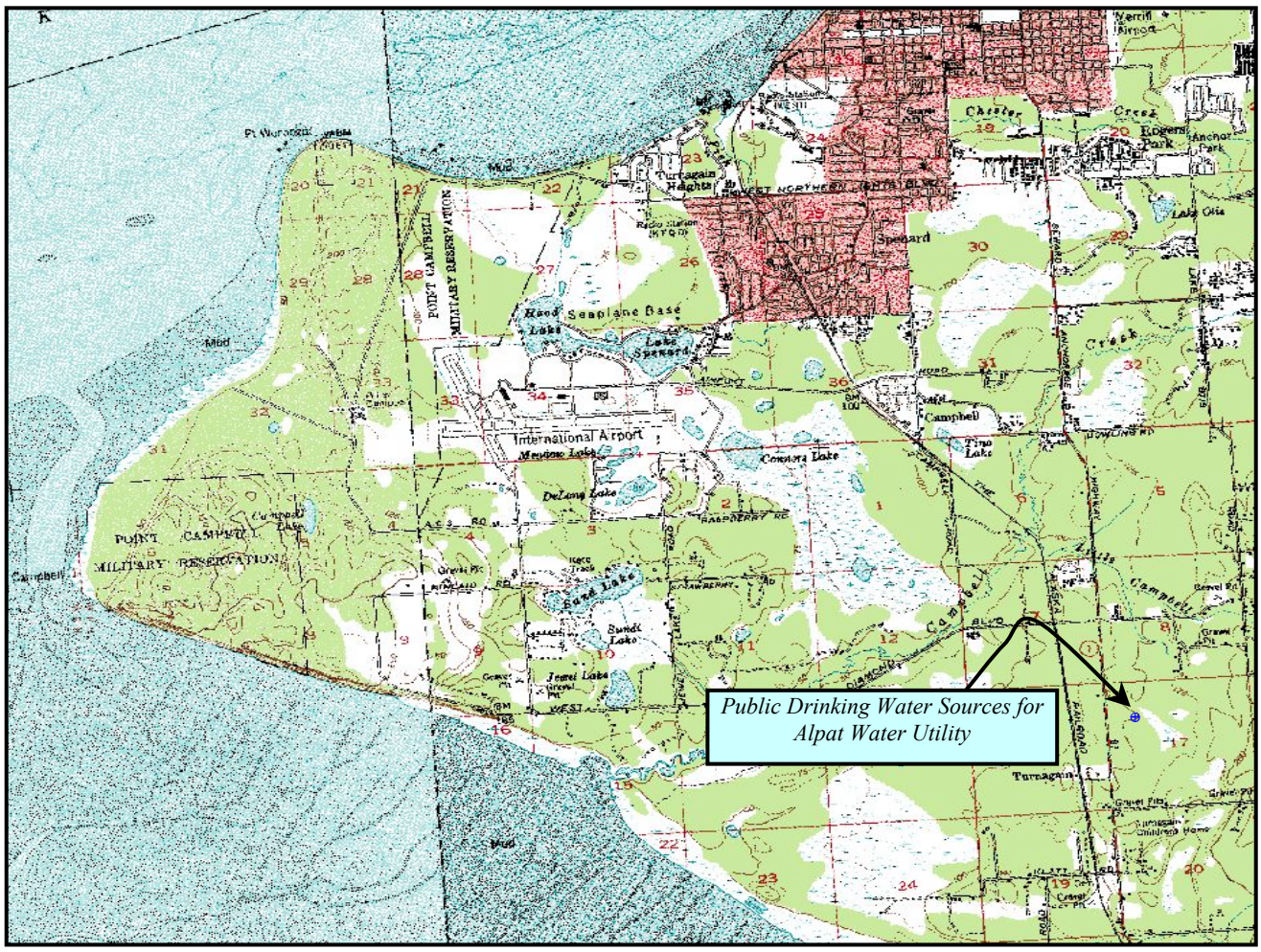

Figure 3. Map showing the location of the drinking water sources for Alpat Water Utility [Base: USGS Tyonek A1].

from 210 to 220 feet below land surface. Groundwater was first encountered at 92 feet below ground surface. The static water level for Well #1 was not recorded during the drilling procedures.

Installation of Well #2 occurred in 1973 to a total depth of 220 feet below ground surface and was completed in an 8-inch well casing. The well is screened from 210 to 220 feet below ground surface. Groundwater was first encountered at 92 feet below ground surface. The static water level for Well #2 was not recorded during the drilling procedures.

This system operates off both wells year round and serves approximately 82 residents through 76 service connections.

ASSESSMENT AND PROTECTION AREA FOR ALPAT WATER UTILITY

The Drinking Water Protection and Assessment Area that has been established for Alpat Water Utility 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 Alpat Water Utility 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 Alpat Water Utility. 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 5 in Appendix C depict the Contaminant Source Inventory for Alpat Water Utility. 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 18 acres of residential area;
- sewer lines;
- roads;
- medical/veterinary facilities;
- gasoline stations;

- heavy equipment storage facilities;
- Class V motor vehicle waste disposal wells;
- dry cleaners;
- above ground fuel storage tanks;
- underground fuel storage tanks;

These potential and existing contaminant sources present the most significant risk for all six categories of regulated drinking water contaminants, 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 ALPAT WATER UTILITY

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)

Due to their close proximity and the depths at which they were drilled both wells established within the same geological formation and were completed within a confined aquifer. Both wells were drilled to a total depth of 220 feet below ground surface. The confining layer consists of hardpan material and occurs from approximately 50 to 73 feet below ground surface. 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. Because the wells were completed within the same geological formation they share the same vulnerability.

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 Alpat Water Utility's drinking water sources.

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

	Score	Rating
Susceptibility of the Wellhead	5	Low
Susceptibility of the Aquifer	13	Medium
Natural Susceptibility	18	Low

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 Alpat Water Utility

Contaminant Risks	Score	Rating
Bacteria and Viruses	20	Medium
Nitrates and/or Nitrites	21	Medium
Volatile Organic Chemicals	50	Very High
Heavy Metals, Cyanide, And Other Inorganic Chemicals	45	Very High
Synthetic Organic Chemicals	12	Low
Other Organic Chemicals	27	Medium

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 Alpat Water Utility to Contamination by Category

Category	Score	Rating
Bacteria and Viruses	40	Medium
Nitrates and Nitrites	40	Medium
Volatile Organic Chemicals	70	High
Heavy Metals, Cyanide, and Other Inorganic Chemicals	60	High
Synthetic Organic Chemicals	30	Low
Other Organic Chemicals	45	Medium

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 is medium with residential areas, sewer lines, and a medical facility presenting the most significant risk to the drinking water well. After combining the contaminant risk for bacteria and viruses with the natural susceptibility of the well, the overall vulnerability of the well to contamiantion is medium from bacteria and viurses.

Review of the historical sampling data indicates that no bacteria and viruses have been detected in Alpat Water Utility 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 concentration at this site, as elsewhere 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 Alpat Water Utility indicates that low concentrations of nitrates have been detected in source waters (See Chart 5 – Contaminant Risks for Nitrates and/or Nitrites in Appendix D). The most recent nitrate detection occurred November 2, 1999 with a concentration of approximately 2% of the Maximum Contaminant Level or MCL. The MCL is the maximum level of contaminant that is allowed to exist in drinking water and still be consumed by humans without harmful health effects. Due to the high solubility and weak retention by soil, nitrates are very mobile, moving at

approximately the same rate as water. Though existing nitrate contamination was detected at the site, concentrations remain at very safe levels with respect to human health.

The contaminant risk for nitrates and/or nitrites is medium with residential areas, and sewer lines presenting the most significant risk to the drinking water source. After combining the contaminant risk with the natural susceptibility of the well, the overall vulnerability of the well to contamination is medium from nitrates and/or nitrates.

The contaminant risk for volatile organic chemicals is very high with Class V motor vehicle waste disposal wells, gasoline stations, underground fuel storage tanks, and a dry cleaner presenting the most significant risk to the drinking water well. Combining the contaminant risk for volatile organic chemicals with the natural susceptibility of the well, the overall vulnerability of the well to contamiantion is high from volatile organic chemicals.

There are two Class V motor vehicle waste disposal wells located within the Zone B protection area. According to the United States Environmental Protection Agency's (USEPA) Office on Water, a motor vehicle waste disposal well is a type of Class V injection well which is typically a shallow disposal system that receives or has received fluids from vehicular repair or maintenance activities, such as an auto body repair shop, automotive repair shops, new and used car dealerships, specialty repair shop (e.g., transmission and muffler repair shop), or any area where vehicular repair work is performed.

The USEPA's Office on Water describes motor vehicle waste disposal wells as floor drains or sinks in service

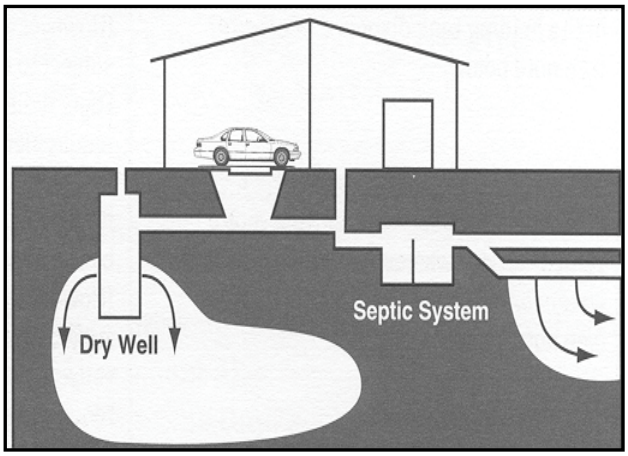

Figure 4. Motor vehicle waste disposal system

bays that are tied into a shallow disposal system (see Figure 4). Most commonly, these shallow systems are septic systems or drywells, but any underground system that receives motor vehicle waste would be considered a motor vehicle waste disposal well. A variety of names are used to describe shallow disposal systems including: cesspools, catchbasins, sink holes, underground vaults, or drain tanks (see figure 4).

Review of the historical sampling data indicates that no volatile organic chemical contamination has been detected in Alpat Water Utility's source waters (See Chart 7 – Contaminant Risks for Volatile Organic Chemicals in Appendix D).

The contaminant risk for heavy metals and other organic chemicals is very high with Class V motor vehicle waste disposal wells, underground fuel storage tanks, sewer lines, and residential areas presenting the most significant risk to the drinking water well.

Review if recent sampling history revealed that no heavy metal contamination has been detected in source waters (See Chart 9 - Contaminant Risks for Heavy Metals and Other Inorganic Chemicals in Appendix D). Combining the contaminant risk with the natural susceptibility of the well leads to an overall vulnerability to heavy metals and inorganic chemical contamination of high.

The contaminant risk for synthetic organic chemicals is low with residential areas, sewer lines, and Class V motor vehicle disposal wells presenting the most significant risk to the drinking water well. After combining the contaminant risk for synthetic organic chemicals with the natural susceptibility of the well, the overall vulnerability of the well to contamiantion from synthetic organic chemicals is low.

The contaminant risk for other organic chemicals is medium with Class V motor vehicle waste disposal wells, gasoline stations, heavy equipment storage areas, roads, and residential areas presenting the most significant risk to the drinking water well. After combining the contaminant risk for other organic chemicals the natural susceptibility of the well, the overall vulnerability of the well to contamiantion from other organic chemicals is medium.

Review of the historical sampling data indicates that no synthetic organic chemicals or other organic chemicals have been detected in Alpat Water Utility's drinking water 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 Alpat Water Utility. The overall vulnerability of this water source to contamination is **low** for synthetic organic chemicals; **medium** for bacteria and viruses, nitrates and/or nitrites, and other organic chemicals; and **high** for volatile organic chemicals, heavy metals. 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 Alpat Water Utility 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 Alpat Water Utility's drinking water sources.

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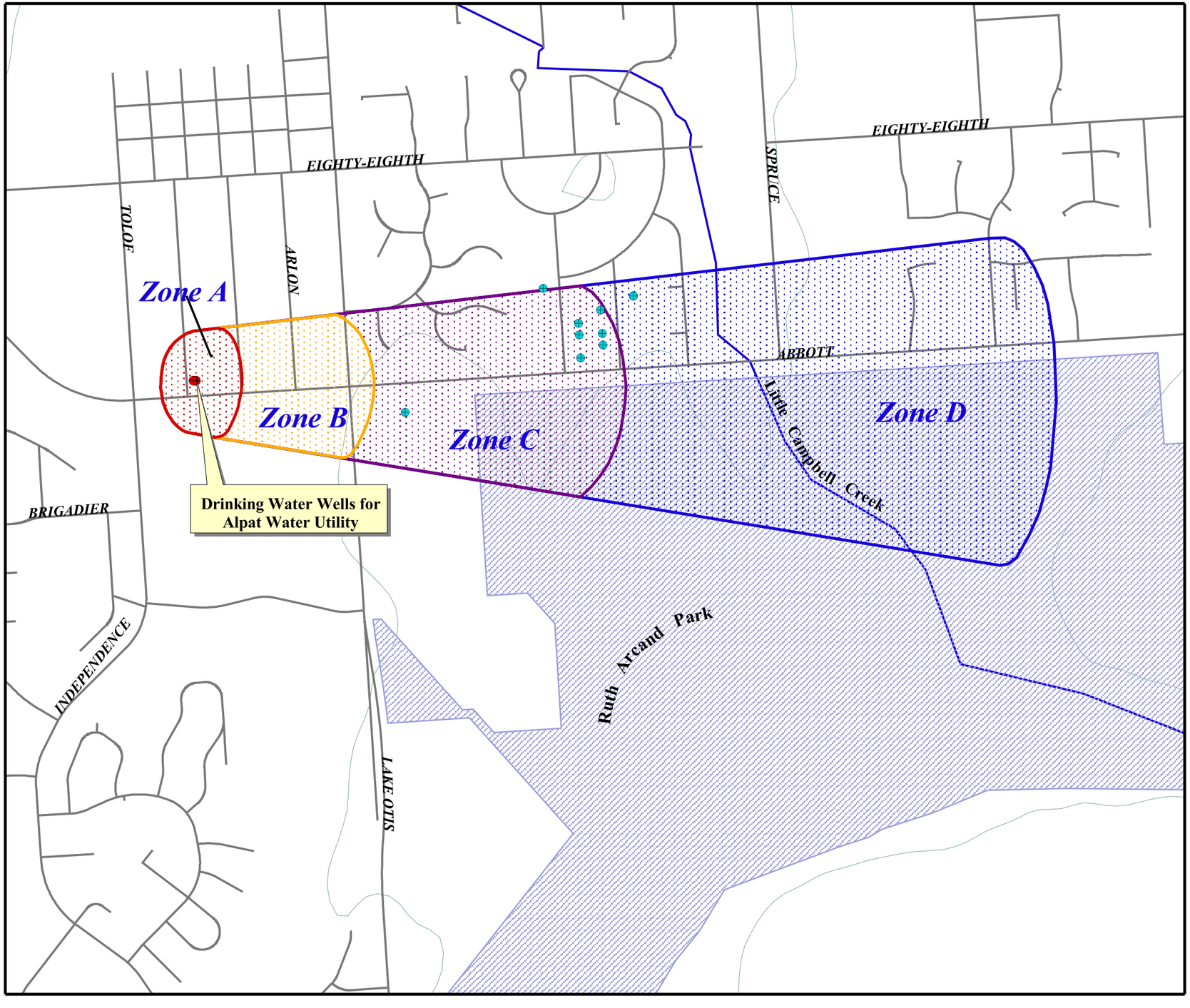
APPENDIX A

Drinking Water Protection Area for Alpat Water Utility

Drinking Water Protection Area and
Potential & Existing Contaminant Sources for Alpat Water Utility



- Drinking Water Wells
- Private and Public Wells

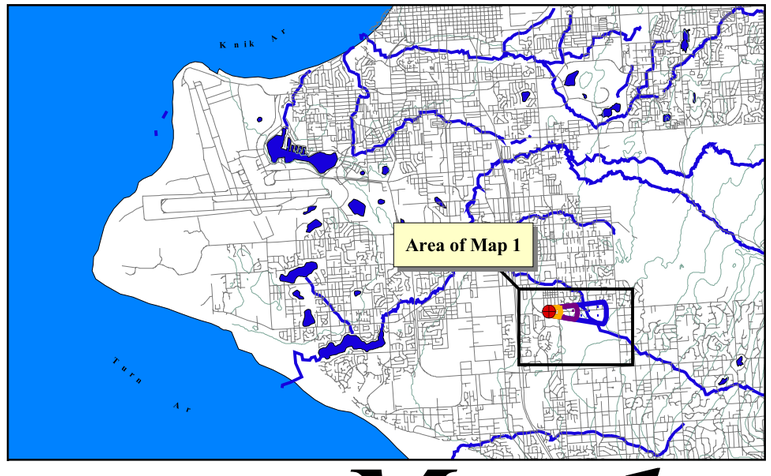
Zone A Protection Area
- Several Months Travel Time

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 Parks (X4)
- Anchorage Roads
- Anchorage Streams
- Elevation Contours

N W E S



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Map 1

APPENDIX B

Contaminant Source Inventory and Risk Ranking for Alpat Water Utility

Table 1

Contaminant Source Inventory for
Alpat Water Utility

PWSID 211229.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Location*	*Map Number*	*Comments*
Florists	C12	C12-1	A	Off of Abbott Loop Road	3	
Gasoline stations (without repair shop)	C15	C15-1	A	Off of Abbott Loop Road	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-1	A	Along Elim Street	2	
Residential Areas	R01	R1-1	A	Residential areas located within Zone A	2	Approximately 3.2 acres of residential area.
Tanks, gasoline (underground)	T12	T21-1	A	Off of Abbott Loop Road	3	
Tanks, diesel (underground)	T08	T8-1	A	Off of Abbott Loop Road	3	
Closed Leaking Underground Fuel Storage Tank (LUST) Sites	U08	U8-1	A	Off of Abbott Loop Road	3	A UST system was taken out of service in December 1997. System removed in March 1998. Soil contamination found, groundwater was not encountered. Contaminated soil was excavated and hauled off site for thermal remediation. Site was closed 4/14/00.
Closed Leaking Underground Fuel Storage Tank (LUST) Sites	U08	U8-2	A	Off of Abbott Loop Road	3	A 300 gallon wasteoil tank was removed from ground. Excavation did not exceed 4 feet and groundwater was not encountered during or after tank removal. Contaminated soil was excavated from the site and the site was closed 4/14/00.
Highways and roads, paved (cement or asphalt)	X20	X20-1	A	Elim street	2	
Highways and roads, paved (cement or asphalt)	X20	X20-2	A	Abbott Loop Road	2	
Highways and roads, paved (cement or asphalt)	X20	X20-3	A	Golovin Street	2	
Medical/veterinary facilities (doctor or dentist offices, hospitals, nursing homes)	X40	X40-1	A	Off of Abbott Loop Road	3	
Dog walking areas/foot trails	X46	X46-1	A	Trail along south side of Abbott Loop Road	2	
Dry cleaners	C10	C10-1	B	Off of Abbott Loop Road	3	
Gasoline stations (without repair shop)	C15	C15-2	B	Off of Abbott Loop Road	3	
Gasoline stations (with repair shop)	C16	C16-1	B	Off of Lake Otis Parkway	3	
Heavy equipment rental/storage	C18	C18-1	B	Off of Arlon Street	3	

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Location*	*Map Number*	*Comments*
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-2	B	Along Golovin Street	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-3	B	Along Arlon Street	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-4	B	Connecting Arlon Street to Lake Otis Parkway	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-5	B	Along Lake Otis Parkway	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-6	B	Crossing Lake Otis Parkway	2	
Injection wells (Class V) Motor Vehicle Waste Disposal Well	D42	D42-1	B	Off of Golovin Street	3	
Injection wells (Class V) Motor Vehicle Waste Disposal Well	D42	D42-2	B	Off of Lake Otis Parkway	3	
Residential Areas	R01	R1-2	B	Residential areas located within Zone B	2	Approximately 1 acre of residnetial area.
Tanks, gasoline (above ground)	T10	T10-1	B	Off of Abbott Loop Road	3	
Tanks, gasoline (above ground)	T10	T10-2	B	Off of Abbott Loop Road	3	
Tanks, gasoline (above ground)	T10	T10-2	B	Off of Abbott Loop Road	3	
Tanks, gasoline (underground)	T12	T12-2	B	Off of Lake Otis Parkway	3	
Tanks, gasoline (underground)	T12	T12-3	B	Off of Lake Otis Parkway	3	
Tanks, diesel (above ground)	T06	T6-1	B	Off of Abbott Loop Road	3	
Tanks, diesel (above ground)	T06	T6-2	B	Off of Abbott Loop Road	3	
Tanks, diesel (above ground)	T06	T6-3	B	Off of Abbott Loop Road	3	
Closed Leaking Underground Fuel Storage Tank (LUST) Sites	U08	U8-3	B	Off of Abbott Loop Road	3	Gasoline contaminated soil was discovered during a UST upgrade.
Closed Leaking Underground Fuel Storage Tank (LUST) (lubicants or other petroleum products)	U08	U8-4	B	Off of Abbott Loop Road	3	A petroleum release was discovered from an emergency generator UST. The tanks and contaminated soils were removed and the site was closed 1/18/97.
Highways and roads, paved (cement or asphalt)	X20	X20-4	B	Arlon Street	2	
Highways and roads, paved (cement or asphalt)	X20	X20-5	B	Lake Otis Parkway	2	
Medical/veterinary facilities (doctor or dentist offices, hospitals, nursing homes)	X40	X40-2	B	Off of Abbott Loop Road	3	

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Location*	*Map Number*	*Comments*
Dog walking areas/foot trails	X46	X46-2	B	Trails near Lake Otis Parkway	2	
Dog walking areas/foot trails	X46	X46-3	B	Trails near Lake Otis Parkway	2	
Dog walking areas/foot trails	X46	X46-4	B	Trails near Lake Otis Parkway	2	
Dog walking areas/foot trails	X46	X46-5	B	Trails near Lake Otis Parkway	2	
Dog walking areas/foot trails	X46	X46-6	B	Trails near Lake Otis Parkway	2	
Dog walking areas/foot trails	X46	X46-7	B	Trails near Lake Otis Parkway	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-7-11	C	Sewer lines located within Zone C	4	
Residential Areas	R01	R1-3	C	Residential areas located within Zone C	4	Approximately 14 acres of residential area.
Septic systems (serves one single-family home)	R02	R2-1-7	C	Septics located within Zone C	4	
Highways and roads, paved (cement or asphalt)	X20	X20-6-10	C	Roads located within Zone C	4	
Municipal or city parks (with green areas)	X04	X4-1	C	Ruth Arcan Park intersecting Zone C and D	4 & 5	

Table 2

Contaminant Source Inventory and Risk Ranking for Alpat Water Utility
Sources of Bacteria and Viruses

PWSID 211229.001

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	2	Approximately 3.2 acres of residential area.
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-1	A	Medium	2	Along Elim Street	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-2	B	Medium	3	Along Golovin Street	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-3	B	Medium	4	Along Arlon Street	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-4	B	Medium	5	Connecting Arlon Street to Lake Otis Parkway	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-5	B	Medium	6	Along Lake Otis Parkway	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-6	B	Medium	7	Crossing Lake Otis Parkway	2	
Medical/veterinary facilities (doctor or dentist offices, hospitals, nursing homes)	X40	X40-1	A	Medium	8	Off of Abbott Loop Road	3	
Residential Areas	R01	R1-2	B	Low	9	Residential areas located within Zone B	2	Approximately 1 acre of residnetial area.
Medical/veterinary facilities (doctor or dentist offices, hospitals, nursing homes)	X40	X40-2	B	Medium	10	Off of Abbott Loop Road	3	
Highways and roads, paved (cement or asphalt)	X20	X20-1	A	Low		Elim street	2	
Highways and roads, paved (cement or asphalt)	X20	X20-2	A	Low		Abbott Loop Road	2	
Highways and roads, paved (cement or asphalt)	X20	X20-3	A	Low		Golovin Street	2	
Dog walking areas/foot trails	X46	X46-1	A	Low		Trail along south side of Abbott Loop Road	2	
Dry cleaners	C10	C10-1	B	Low		Off of Abbott Loop Road	3	
Injection wells (Class V) Motor Vehicle Waste Disposal Well	D42	D42-1	B	Low		Off of Golovin Street	3	
Injection wells (Class V) Motor Vehicle Waste Disposal Well	D42	D42-2	B	Low		Off of Lake Otis Parkway	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	X20-4	B	Low		Arlon Street	2	
Highways and roads, paved (cement or asphalt)	X20	X20-5	B	Low		Lake Otis Parkway	2	
Dog walking areas/foot trails	X46	X46-2	B	Low		Trails near Lake Otis Parkway	2	
Dog walking areas/foot trails	X46	X46-3	B	Low		Trails near Lake Otis Parkway	2	
Dog walking areas/foot trails	X46	X46-4	B	Low		Trails near Lake Otis Parkway	2	
Dog walking areas/foot trails	X46	X46-5	B	Low		Trails near Lake Otis Parkway	2	
Dog walking areas/foot trails	X46	X46-6	B	Low		Trails near Lake Otis Parkway	2	
Dog walking areas/foot trails	X46	X46-7	B	Low		Trails near Lake Otis Parkway	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-7-11	C	Medium		Sewer lines located within Zone C	4	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-7-11	C	Medium		Sewer lines located within Zone C	4	
Residential Areas	R01	R1-3	C	Low		Residential areas located within Zone C	4	Approximately 14 acres of residential area.
Septic systems (serves one single-family home)	R02	R2-1-7	C	Low		Septics located within Zone C	4	
Highways and roads, paved (cement or asphalt)	X20	X20-6-10	C	Low		Roads located within Zone C	4	
Highways and roads, paved (cement or asphalt)	X20	X20-6-10	C	Low		Roads located within Zone C	4	
Municipal or city parks (with green areas)	X04	X4-1	C	Medium		Ruth Arcan Park intersecting Zone C and D	4 & 5	

Table 3

Contaminant Source Inventory and Risk Ranking for Alpat Water Utility
Sources of Nitrates/Nitrites

PWSID 211229.001

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	2	Approximately 3.2 acres of residential area.
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-1	A	Medium	2	Along Elim Street	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-2	B	Medium	3	Along Golovin Street	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-3	B	Medium	4	Along Arlon Street	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-4	B	Medium	5	Connecting Arlon Street to Lake Otis Parkway	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-5	B	Medium	6	Along Lake Otis Parkway	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-6	B	Medium	7	Crossing Lake Otis Parkway	2	
Residential Areas	R01	R1-2	B	Low	8	Residential areas located within Zone B	2	Approximately 1 acre of residnetial area.
Municipal or city parks (with green areas)	X04	X4-1	C	Medium	9	Ruth Arcan Park intersecting Zone C and D	4 & 5	
Septic systems (serves one single-family home)	R02	R2-1-7	C	Low	10	Septics located within Zone C	4	
Florists	C12	C12-1	A	Low		Off of Abbott Loop Road	3	
Highways and roads, paved (cement or asphalt)	X20	X20-1	A	Low		Elim street	2	
Highways and roads, paved (cement or asphalt)	X20	X20-2	A	Low		Abbott Loop Road	2	
Highways and roads, paved (cement or asphalt)	X20	X20-3	A	Low		Golovin Street	2	
Dog walking areas/foot trails	X46	X46-1	A	Low		Trail along south side of Abbott Loop Road	2	
Dry cleaners	C10	C10-1	B	Low		Off of Abbott Loop Road	3	
Highways and roads, paved (cement or asphalt)	X20	X20-4	B	Low		Arlon Street	2	
Highways and roads, paved (cement or asphalt)	X20	X20-5	B	Low		Lake Otis Parkway	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	X46-2	B	Low		Trails near Lake Otis Parkway	2	
Dog walking areas/foot trails	X46	X46-3	B	Low		Trails near Lake Otis Parkway	2	
Dog walking areas/foot trails	X46	X46-4	B	Low		Trails near Lake Otis Parkway	2	
Dog walking areas/foot trails	X46	X46-5	B	Low		Trails near Lake Otis Parkway	2	
Dog walking areas/foot trails	X46	X46-6	B	Low		Trails near Lake Otis Parkway	2	
Dog walking areas/foot trails	X46	X46-7	B	Low		Trails near Lake Otis Parkway	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-7-11	C	Medium		Sewer lines located within Zone C	4	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-7-11	C	Medium		Sewer lines located within Zone C	4	
Residential Areas	R01	R1-3	C	Low		Residential areas located within Zone C	4	Approximately 14 acres of residential area.
Highways and roads, paved (cement or asphalt)	X20	X20-6-10	C	Low		Roads located within Zone C	4	
Highways and roads, paved (cement or asphalt)	X20	X20-6-10	C	Low		Roads located within Zone C	4	

Table 4

Contaminant Source Inventory and Risk Ranking for Alpat Water Utility Sources of Volatile Organic Chemicals

PWSID 211229.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Overall Rank after Analysis*	*Location*	*Map Number*	*Comments*
Gasoline stations (without repair shop)	C15	C15-1	A	High	1	Off of Abbott Loop Road	3	
Tanks, gasoline (underground)	T12	T21-1	A	High	2	Off of Abbott Loop Road	3	
Tanks, diesel (underground)	T08	T8-1	A	High	3	Off of Abbott Loop Road	3	
Injection wells (Class V) Motor Vehicle Waste Disposal Well	D42	D42-1	B	High	4	Off of Golovin Street	3	
Injection wells (Class V) Motor Vehicle Waste Disposal Well	D42	D42-2	B	High	5	Off of Lake Otis Parkway	3	
Gasoline stations (with repair shop)	C16	C16-1	B	High	6	Off of Lake Otis Parkway	3	
Gasoline stations (without repair shop)	C15	C15-2	B	High	7	Off of Abbott Loop Road	3	
Dry cleaners	C10	C10-1	B	High	8	Off of Abbott Loop Road	3	
Tanks, gasoline (underground)	T12	T12-2	B	High	9	Off of Lake Otis Parkway	3	
Tanks, gasoline (underground)	T12	T12-3	B	High	10	Off of Lake Otis Parkway	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-1	A	Low		Along Elim Street	2	
Residential Areas	R01	R1-1	A	Low		Residential areas located within Zone A	2	Approximately 3.2 acres of residential area.
Closed Leaking Underground Fuel Storage Tank (LUST) Sites	U08	U8-1	A	High		Off of Abbott Loop Road	3	A UST system was taken out of service in December 1997. System removed in March 1998. Soil contamination found, groundwater was not encountered. Contaminated soil was excavated and hauled off site for thermal remediation. Site was closed 4/14/00.
Closed Leaking Underground Fuel Storage Tank (LUST) Sites	U08	U8-2	A	High		Off of Abbott Loop Road	3	A 300 gallon wasteoil tank was removed from ground. Excavation did not exceed 4 feet and groundwater was not encountered during or after tank removal. Contaminated soil was excavated from the site and the site was closed 4/14/00.
Highways and roads, paved (cement or asphalt)	X20	X20-1	A	Low		Elim street	2	
Highways and roads, paved (cement or asphalt)	X20	X20-2	A	Low		Abbott Loop Road	2	

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	X20-3	A	Low		Golovin Street	2	
Medical/veterinary facilities (doctor or dentist offices, hospitals, nursing homes)	X40	X40-1	A	Low		Off of Abbott Loop Road	3	
Heavy equipment rental/storage	C18	C18-1	B	Medium		Off of Arlon Street	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-2	B	Low		Along Golovin Street	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-3	B	Low		Along Arlon Street	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-4	B	Low		Connecting Arlon Street to Lake Otis Parkway	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-5	B	Low		Along Lake Otis Parkway	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-6	B	Low		Crossing Lake Otis Parkway	2	
Residential Areas	R01	R1-2	B	Low		Residential areas located within Zone B	2	Approximately 1 acre of residnetial area.
Tanks, gasoline (above ground)	T10	T10-1	B	Medium		Off of Abbott Loop Road	3	
Tanks, gasoline (above ground)	T10	T10-2	B	Medium		Off of Abbott Loop Road	3	
Tanks, gasoline (above ground)	T10	T10-2	B	Medium		Off of Abbott Loop Road	3	
Tanks, diesel (above ground)	T06	T6-1	B	Medium		Off of Abbott Loop Road	3	
Tanks, diesel (above ground)	T06	T6-2	B	Medium		Off of Abbott Loop Road	3	
Tanks, diesel (above ground)	T06	T6-3	B	Medium		Off of Abbott Loop Road	3	
Closed Leaking Underground Fuel Storage Tank (LUST) Sites	U08	U8-3	B	High		Off of Abbott Loop Road	3	Gasoline contaminated soil was discovered during a UST upgrade.
Closed Leaking Underground Fuel Storage Tank (LUST) (lubicants or other petroleum products)	U08	U8-4	B	High		Off of Abbott Loop Road	3	A petroleum release was discovered from an emergency generator UST. The tanks and contaminated soils were removed and the site was closed 1/18/97.
Highways and roads, paved (cement or asphalt)	X20	X20-4	B	Low		Arlon Street	2	

Contaminant Source Inventory and Risk Ranking for Alpat Water Utility

Sources of Volatile Organic Chemicals

Contaminant Source Type	***Contaminant Source ID***	***CS ID tag***	***Zone***	***Risk Ranking for Analysis***	***Overall Rank after Analysis***	***Location***	***Map Number***	***Comments***
Highways and roads, paved (cement or asphalt)	X20	X20-5	B	Low		Lake Otis Parkway	2	
Medical/veterinary facilities (doctor or dentist offices, hospitals, nursing homes)	X40	X40-2	B	Low		Off of Abbott Loop Road	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-7-11	C	Low		Sewer lines located within Zone C	4	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-7-11	C	Low		Sewer lines located within Zone C	4	
Residential Areas	R01	R1-3	C	Low		Residential areas located within Zone C	4	Approximately 14 acres of residential area.
Septic systems (serves one single-family home)	R02	R2-1-7	C	Low		Septics located within Zone C	4	
Highways and roads, paved (cement or asphalt)	X20	X20-6-10	C	Low		Roads located within Zone C	4	
Highways and roads, paved (cement or asphalt)	X20	X20-6-10	C	Low		Roads located within Zone C	4	

Table 5

Contaminant Source Inventory and Risk Ranking for Alpat Water Utility

Sources of Heavy Metals, Cyanide and Other Inorganic Chemicals

PWSID 211229.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Overall Rank after Analysis*	*Location*	*Map Number*	*Comments*
Injection wells (Class V) Motor Vehicle Waste Disposal Well	D42	D42-1	B	High	1	Off of Golovin Street	3	
Injection wells (Class V) Motor Vehicle Waste Disposal Well	D42	D42-2	B	High	2	Off of Lake Otis Parkway	3	
Tanks, gasoline (underground)	T12	T21-1	A	Medium	3	Off of Abbott Loop Road	3	
Tanks, gasoline (underground)	T12	T12-2	B	Medium	4	Off of Lake Otis Parkway	3	
Tanks, gasoline (underground)	T12	T12-3	B	Medium	5	Off of Lake Otis Parkway	3	
Residential Areas	R01	R1-1	A	Low	6	Residential areas located within Zone A	2	Approximately 3.2 acres of residential area.
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-1	A	Low	7	Along Elim Street	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-2	B	Low	8	Along Golovin Street	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-3	B	Low	9	Along Arlon Street	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-4	B	Low	10	Connecting Arlon Street to Lake Otis Parkway	2	
Florists	C12	C12-1	A	Low		Off of Abbott Loop Road	3	
Gasoline stations (without repair shop)	C15	C15-1	A	Low		Off of Abbott Loop Road	3	
Closed Leaking Underground Fuel Storage Tank (LUST) Sites	U08	U8-1	A	Low		Off of Abbott Loop Road	3	A UST system was taken out of service in December 1997. System removed in March 1998. Soil contamination found, groundwater was not encountered. Contaminated soil was excavated and hauled off site for thermal remediation. Site was closed 4/14/00.
Highways and roads, paved (cement or asphalt)	X20	X20-1	A	Low		Elim street	2	
Highways and roads, paved (cement or asphalt)	X20	X20-2	A	Low		Abbott Loop Road	2	
Highways and roads, paved (cement or asphalt)	X20	X20-3	A	Low		Golovin Street	2	

Contaminant Source Inventory and Risk Ranking for Alpat Water Utility

Sources of Heavy Metals, Cyanide and Other Inorganic Chemicals

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Overall Rank after Analysis*	*Location*	*Map Number*	*Comments*
Medical/veterinary facilities (doctor or dentist offices, hospitals, nursing homes)	X40	X40-1	A	Low		Off of Abbott Loop Road	3	
Gasoline stations (without repair shop)	C15	C15-2	B	Low		Off of Abbott Loop Road	3	
Gasoline stations (with repair shop)	C16	C16-1	B	Low		Off of Lake Otis Parkway	3	
Heavy equipment rental/storage	C18	C18-1	B	Low		Off of Arlon Street	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-5	B	Low		Along Lake Otis Parkway	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-6	B	Low		Crossing Lake Otis Parkway	2	
Residential Areas	R01	R1-2	B	Low		Residential areas located within Zone B	2	Approximately 1 acre of residnetial area.
Tanks, gasoline (above ground)	T10	T10-1	B	Medium		Off of Abbott Loop Road	3	
Tanks, gasoline (above ground)	T10	T10-2	B	Medium		Off of Abbott Loop Road	3	
Tanks, gasoline (above ground)	T10	T10-2	B	Medium		Off of Abbott Loop Road	3	
Highways and roads, paved (cement or asphalt)	X20	X20-4	B	Low		Arlon Street	2	
Highways and roads, paved (cement or asphalt)	X20	X20-5	B	Low		Lake Otis Parkway	2	
Medical/veterinary facilities (doctor or dentist offices, hospitals, nursing homes)	X40	X40-2	B	Low		Off of Abbott Loop Road	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-7-11	C	Low		Sewer lines located within Zone C	4	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-7-11	C	Low		Sewer lines located within Zone C	4	
Residential Areas	R01	R1-3	C	Low		Residential areas located within Zone C	4	Approximately 14 acres of residential area.
Septic systems (serves one single-family home)	R02	R2-1-7	C	Low		Septics located within Zone C	4	
Highways and roads, paved (cement or asphalt)	X20	X20-6-10	C	Low		Roads located within Zone C	4	

Contaminant Source Inventory and Risk Ranking for Alpat Water Utility

Sources of Heavy Metals, Cyanide and Other Inorganic 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	X20-6-10	C	Low		Roads located within Zone C	4	

Table 6

Contaminant Source Inventory and Risk Ranking for Alpat Water Utility
Sources of Synthetic Organic Chemicals

PWSID 211229.001

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	2	Approximately 3.2 acres of residential area.
Residential Areas	R01	R1-2	B	Low	2	Residential areas located within Zone B	2	Approximately 1 acre of residnetial area.
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-1	A	Low	3	Along Elim Street	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-2	B	Low	4	Along Golovin Street	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-3	B	Low	5	Along Arlon Street	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-4	B	Low	6	Connecting Arlon Street to Lake Otis Parkway	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-5	B	Low	7	Along Lake Otis Parkway	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-6	B	Low	8	Crossing Lake Otis Parkway	2	
Injection wells (Class V) Motor Vehicle Waste Disposal Well	D42	D42-1	B	Low	9	Off of Golovin Street	3	
Injection wells (Class V) Motor Vehicle Waste Disposal Well	D42	D42-2	B	Low	10	Off of Lake Otis Parkway	3	
Medical/veterinary facilities (doctor or dentist offices, hospitals, nursing homes)	X40	X40-1	A	Low		Off of Abbott Loop Road	3	
Medical/veterinary facilities (doctor or dentist offices, hospitals, nursing homes)	X40	X40-2	B	Low		Off of Abbott Loop Road	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-7-11	C	Low		Sewer lines located within Zone C	4	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-7-11	C	Low		Sewer lines located within Zone C	4	
Residential Areas	R01	R1-3	C	Low		Residential areas located within Zone C	4	Approximately 14 acres of residential area.
Septic systems (serves one single-family home)	R02	R2-1-7	C	Low		Septics located within Zone C	4	

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Overall Rank after Analysis*	*Location*	*Map Number*	*Comments*
Municipal or city parks (with green areas)	X04	X4-1	C	Low		Ruth Arcan Park intersecting Zone C and D	4 & 5	

Table 7

Contaminant Source Inventory and Risk Ranking for Alpat Water Utility
Sources of Other Organic Chemicals

PWSID 211229.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Overall Rank after Analysis*	*Location*	*Map Number*	*Comments*
Injection wells (Class V) Motor Vehicle Waste Disposal Well	D42	D42-1	B	Medium	1	Off of Golovin Street	3	
Injection wells (Class V) Motor Vehicle Waste Disposal Well	D42	D42-2	B	Medium	2	Off of Lake Otis Parkway	3	
Gasoline stations (with repair shop)	C16	C16-1	B	Medium	3	Off of Lake Otis Parkway	3	
Heavy equipment rental/storage	C18	C18-1	B	Medium	4	Off of Arlon Street	3	
Residential Areas	R01	R1-1	A	Low	5	Residential areas located within Zone A	2	Approximately 3.2 acres of residential area.
Residential Areas	R01	R1-2	B	Low	6	Residential areas located within Zone B	2	Approximately 1 acre of residnetial area.
Highways and roads, paved (cement or asphalt)	X20	X20-1	A	Low	7	Elim street	2	
Highways and roads, paved (cement or asphalt)	X20	X20-2	A	Low	8	Abbott Loop Road	2	
Highways and roads, paved (cement or asphalt)	X20	X20-3	A	Low	9	Golovin Street	2	
Highways and roads, paved (cement or asphalt)	X20	X20-4	B	Low	10	Arlon Street	2	
Gasoline stations (without repair shop)	C15	C15-1	A	Low		Off of Abbott Loop Road	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-1	A	Low		Along Elim Street	2	
Closed Leaking Underground Fuel Storage Tank (LUST) Sites	U08	U8-1	A	Low		Off of Abbott Loop Road	3	A UST system was taken out of service in December 1997. System removed in March 1998. Soil contamination found, groundwater was not encountered. Contaminated soil was excavated and hauled off site for thermal remediation. Site was closed 4/14/00.
Gasoline stations (without repair shop)	C15	C15-2	B	Low		Off of Abbott Loop Road	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-2	B	Low		Along Golovin Street	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-3	B	Low		Along Arlon Street	2	

Contaminant Source Inventory and Risk Ranking for Alpat Water Utility

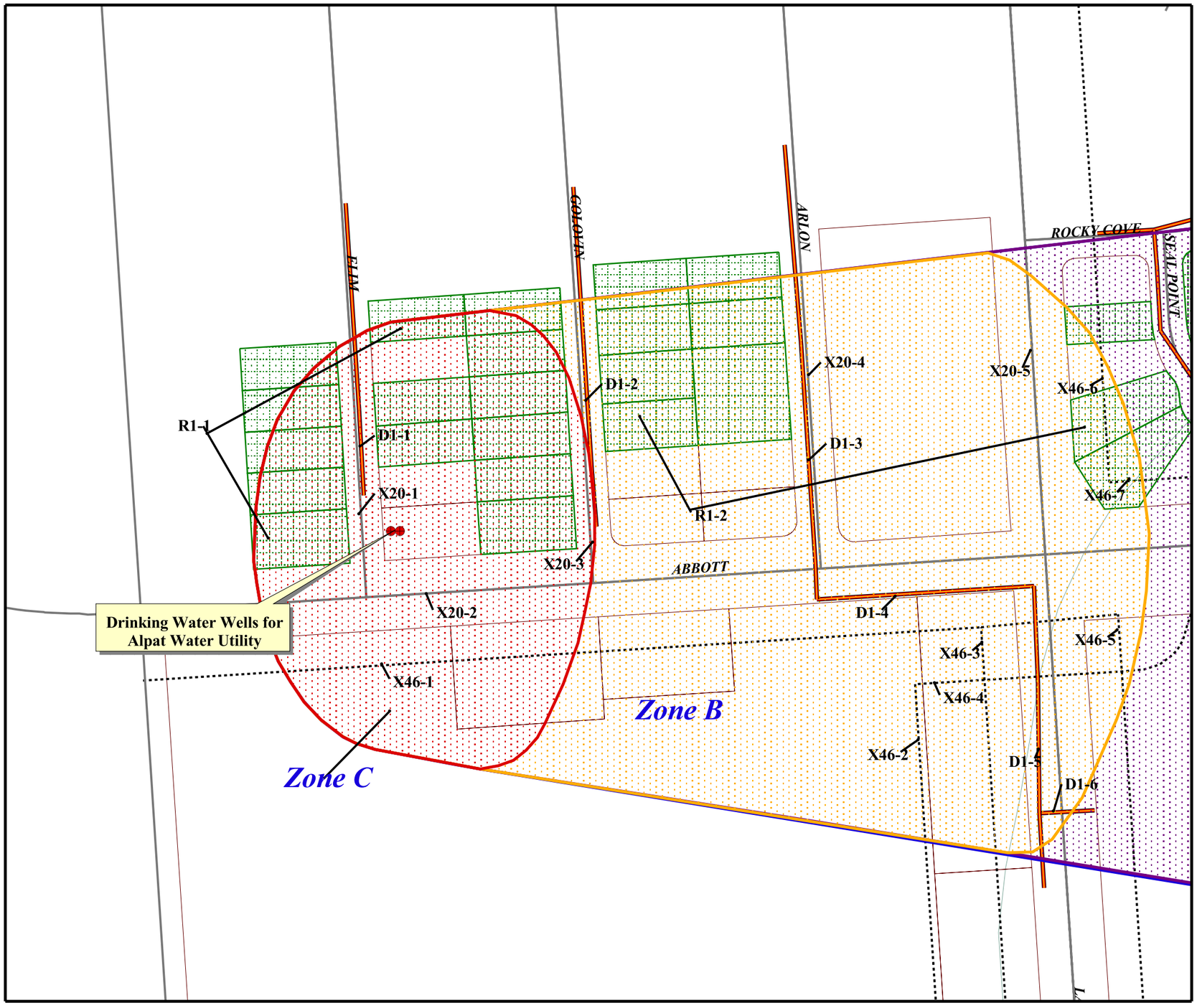
Sources of Other Organic Chemicals

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Overall Rank after Analysis*	*Location*	*Map Number*	*Comments*
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-4	B	Low		Connecting Arlon Street to Lake Otis Parkway	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-5	B	Low		Along Lake Otis Parkway	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-6	B	Low		Crossing Lake Otis Parkway	2	
Closed Leaking Underground Fuel Storage Tank (LUST) Sites	U08	U8-3	B	Low		Off of Abbott Loop Road	3	Gasoline contaminated soil was discovered during a UST upgrade.
Closed Leaking Underground Fuel Storage Tank (LUST) (lubicants or other petroleum products)	U08	U8-4	B	Low		Off of Abbott Loop Road	3	A petroleum release was discovered from an emergency generator UST. The tanks and contaminated soils were removed and the site was closed 1/18/97.
Highways and roads, paved (cement or asphalt)	X20	X20-5	B	Low		Lake Otis Parkway	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-7-11	C	Low		Sewer lines located within Zone C	4	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-7-11	C	Low		Sewer lines located within Zone C	4	
Residential Areas	R01	R1-3	C	Low		Residential areas located within Zone C	4	Approximately 14 acres of residential area.
Septic systems (serves one single-family home)	R02	R2-1-7	C	Low		Septics located within Zone C	4	
Highways and roads, paved (cement or asphalt)	X20	X20-6-10	C	Low		Roads located within Zone C	4	
Highways and roads, paved (cement or asphalt)	X20	X20-6-10	C	Low		Roads located within Zone C	4	

APPENDIX C

Drinking Water Protection Area and Potential & Existing Contaminant Sources for Alpat Water Utility

Drinking Water Protection Area and
Potential & Existing Contaminant Sources for Alpat Water Utility



- Drinking Water 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
- Lawns and Gardens (R1)
- Sewer Lines (D1)
- Anchorage Roads (X20)
- Trails (X46)
- Anchorage Land Parcels
- Elevation Contours

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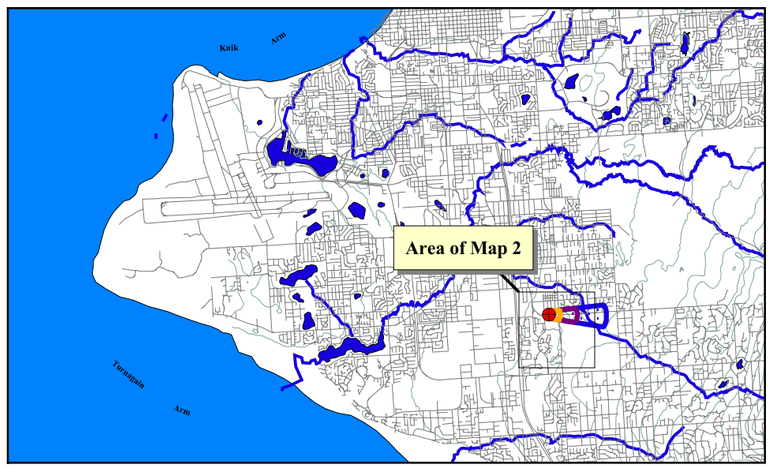
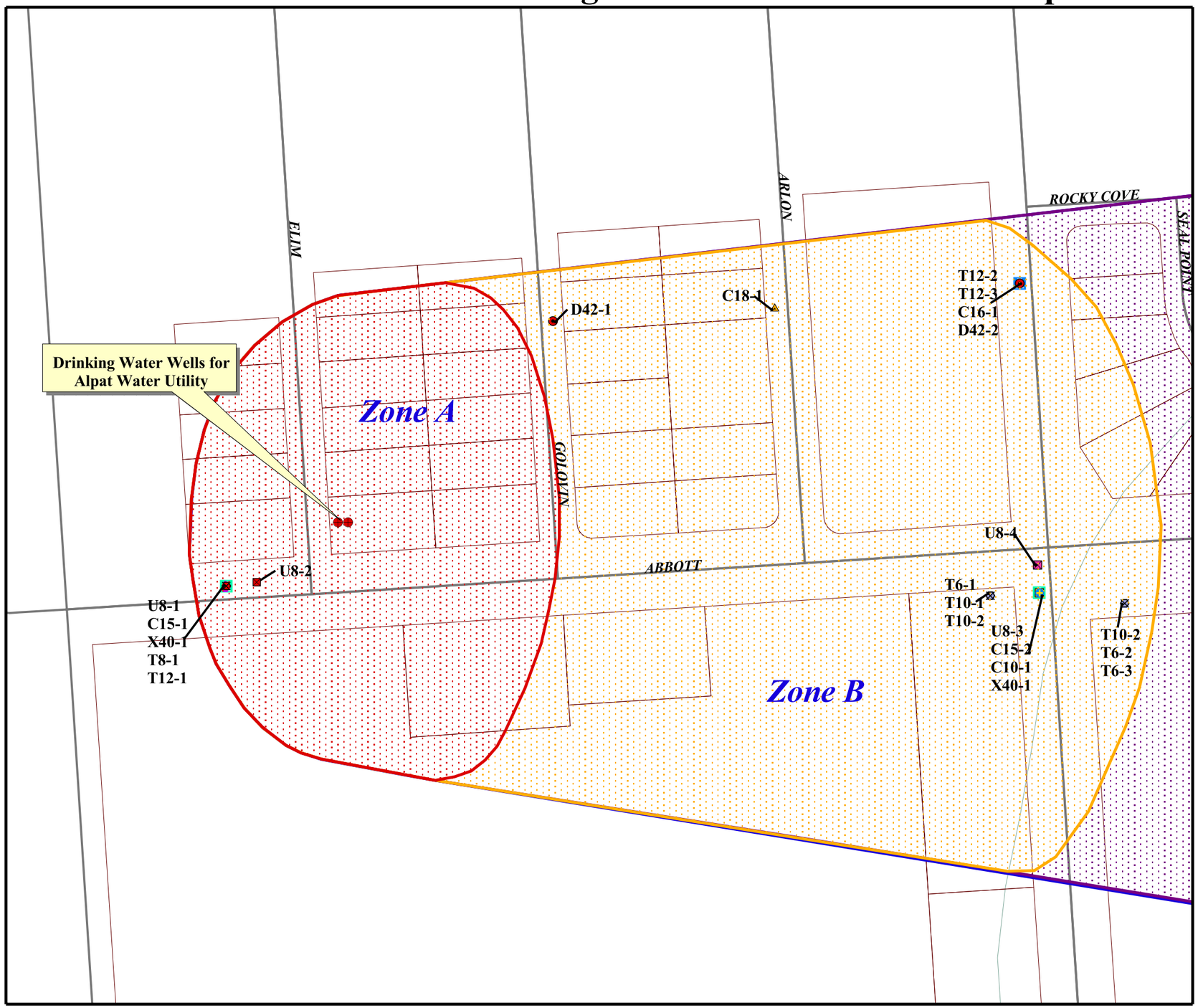


200 0 200 400 Feet

PWSID 211229.001

Map 2

Drinking Water Protection Area and Potential & Existing Contaminant Sources for Alpat Water Utility



- Drinking Water Wells

Zone A Protection Area
- Several Months Travel Time

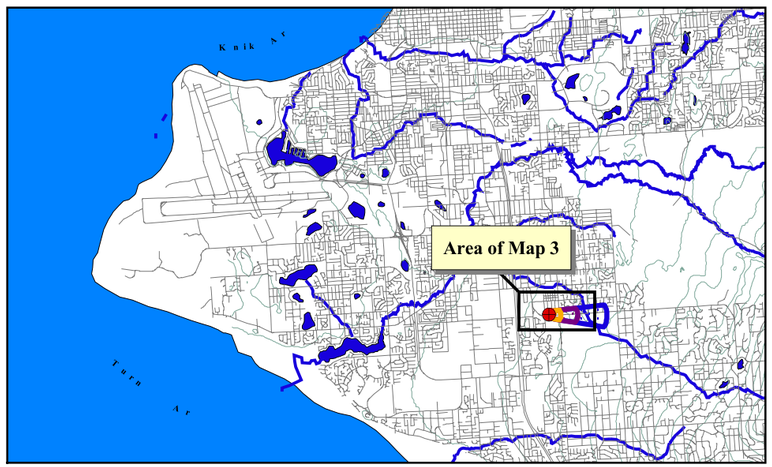
Zone B Protection Area
- Less Than 2 Years Travel Time

Zone C Protection Area
- Less Than 5 Years Travel Time

Zone D Protection Area
- Less Than 10 Years Travel Time

Potential Contaminant Sources
- Dry Cleaners (C10)
- Florists (C12)
- Gasoline stations - without repair shop (C15)
- Gasoline stations - with repair shop (C16)
- Heavy equipment rental/storage (C18)
- Class V injection well - motor vehicle waste (D42)
- Gasoline tanks - above ground (T10)
- Gasoline tanks - underground (T12)
- Diesel tanks - above ground (T6)
- Diesel tanks - underground (T8)
- Closed leaking underground tank - petroleum products (U8)
- Medical/veterinary facilities (X40)
- Anchorage Roads (X20)
- Anchorage Land Parcels
- Elevation Contours

N W E S

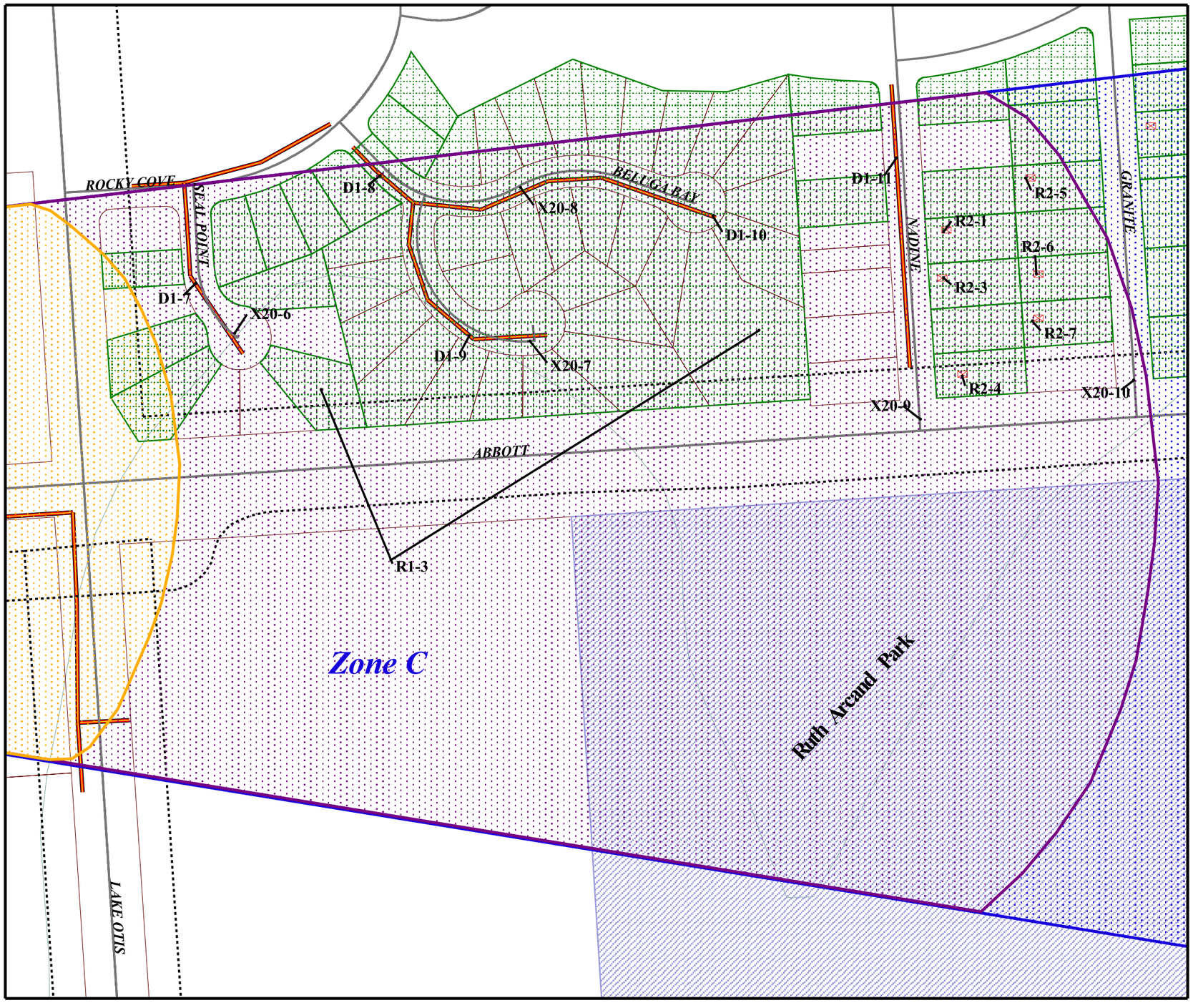


300 0 300 600 Feet

PWSID 211229.001

Map 3

Drinking Water Protection Area and
Potential & Existing Contaminant Sources for Alpat Water Utility



- Drinking Water 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
- Septic Systems (R2)
- Lawns and Gardens (R1)
- Anchorage Parks (X4)
- Anchorage Roads (X20)
- Trails (X46)
- Sewer Lines (D1)
- Anchorage Land Parcels
- Anchorage Streams
- Elevation Contours

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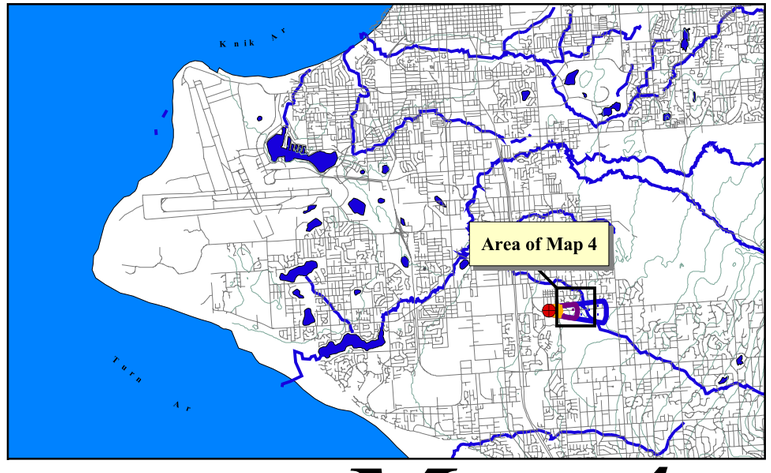
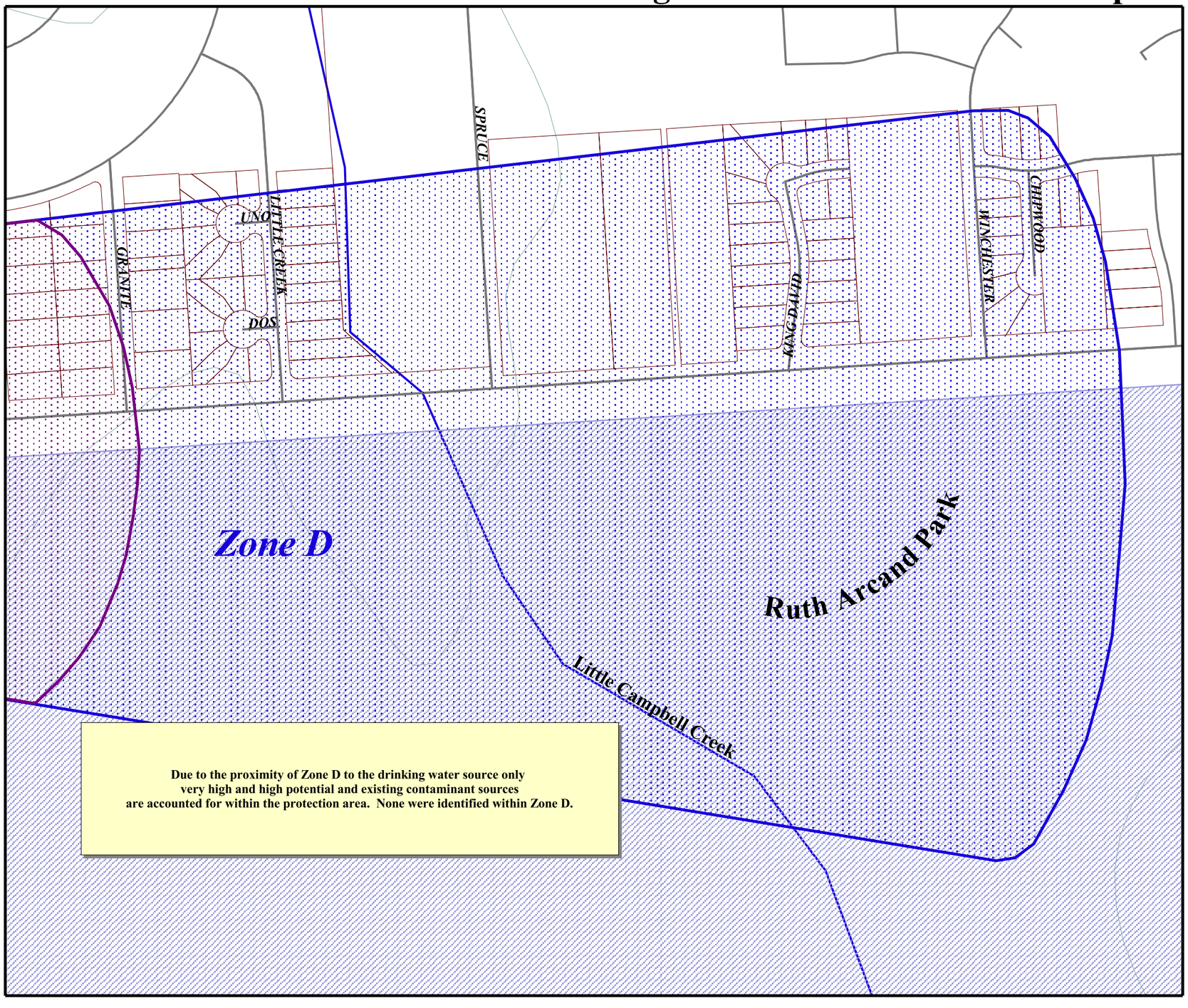
S



PWSID 211229.001

Map 4

Drinking Water Protection Area and
Potential & Existing Contaminant Sources for Alpat Water Utility



500 0 500 1000 Feet

- Drinking Water Wells

Zone A Protection Area
- Several Months Travel Time

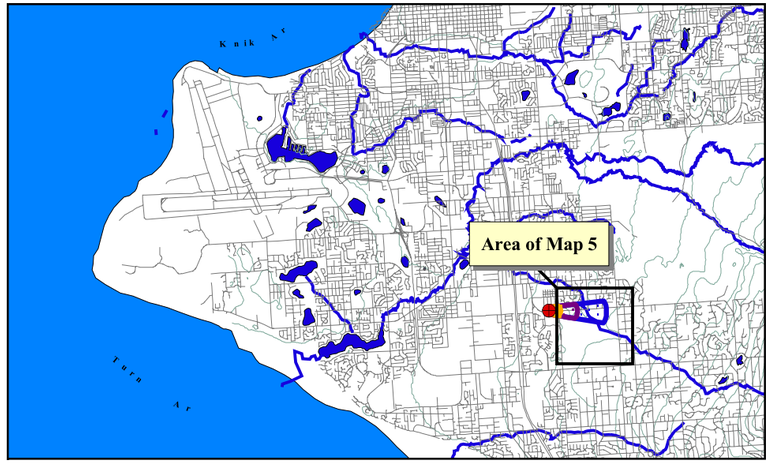
Zone B Protection Area
- Less Than 2 Years Travel Time

Zone C Protection Area
- Less Than 5 Years Travel Time

Zone D Protection Area
- Less Than 10 Years Travel Time

Potential Contaminant Sources
- Dry Cleaners (C10)
- Florists (C12)
- Gasoline stations - without repair shop (C15)
- Gasoline stations - with repair shop (C16)
- Heavy equipment rental/storage (C18)
- Class V injection well - motor vehicle waste (D42)
- Gasoline tanks - above ground (T10)
- Gasoline tanks - underground (T12)
- Diesel tanks - above ground (T6)
- Diesel tanks - underground (T8)
- Closed leaking underground tank - petroleum products (U8)
- Medical/veterinary facilities (X40)
- Anchorage Parks (X4)
- Anchorage Roads (X20)
- Anchorage Land Parcels
- Anchorage Streams
- Elevation Contours

N W E S



PWSID 211229.001

Map 5

APPENDIX D

Vulnerability Analysis for Alpat Water Utility

Chart 1. Susceptibility of the wellhead - Alpat Water Utility

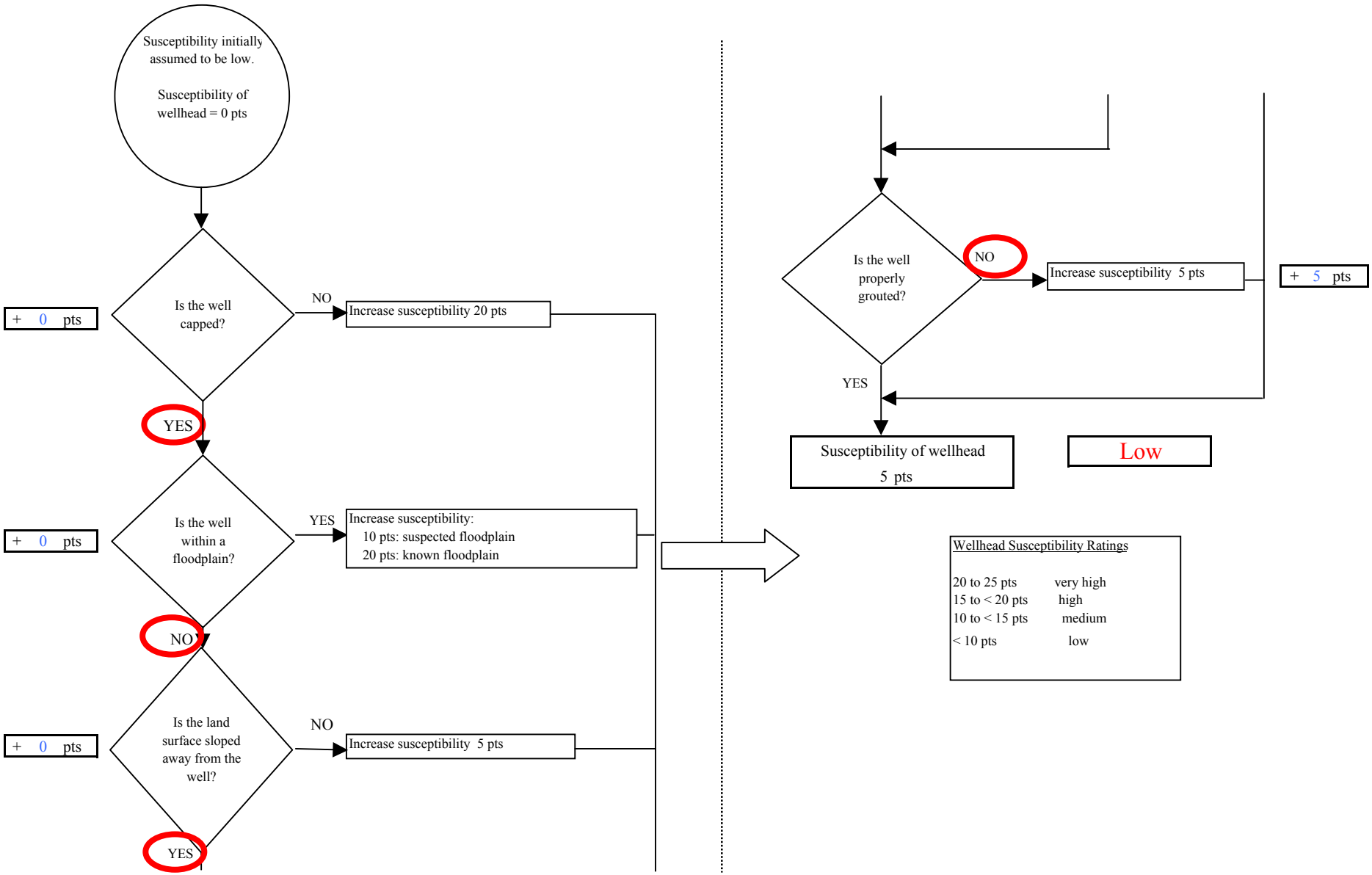


Chart 2. Susceptibility of the aquifer - Alpat Water Utility

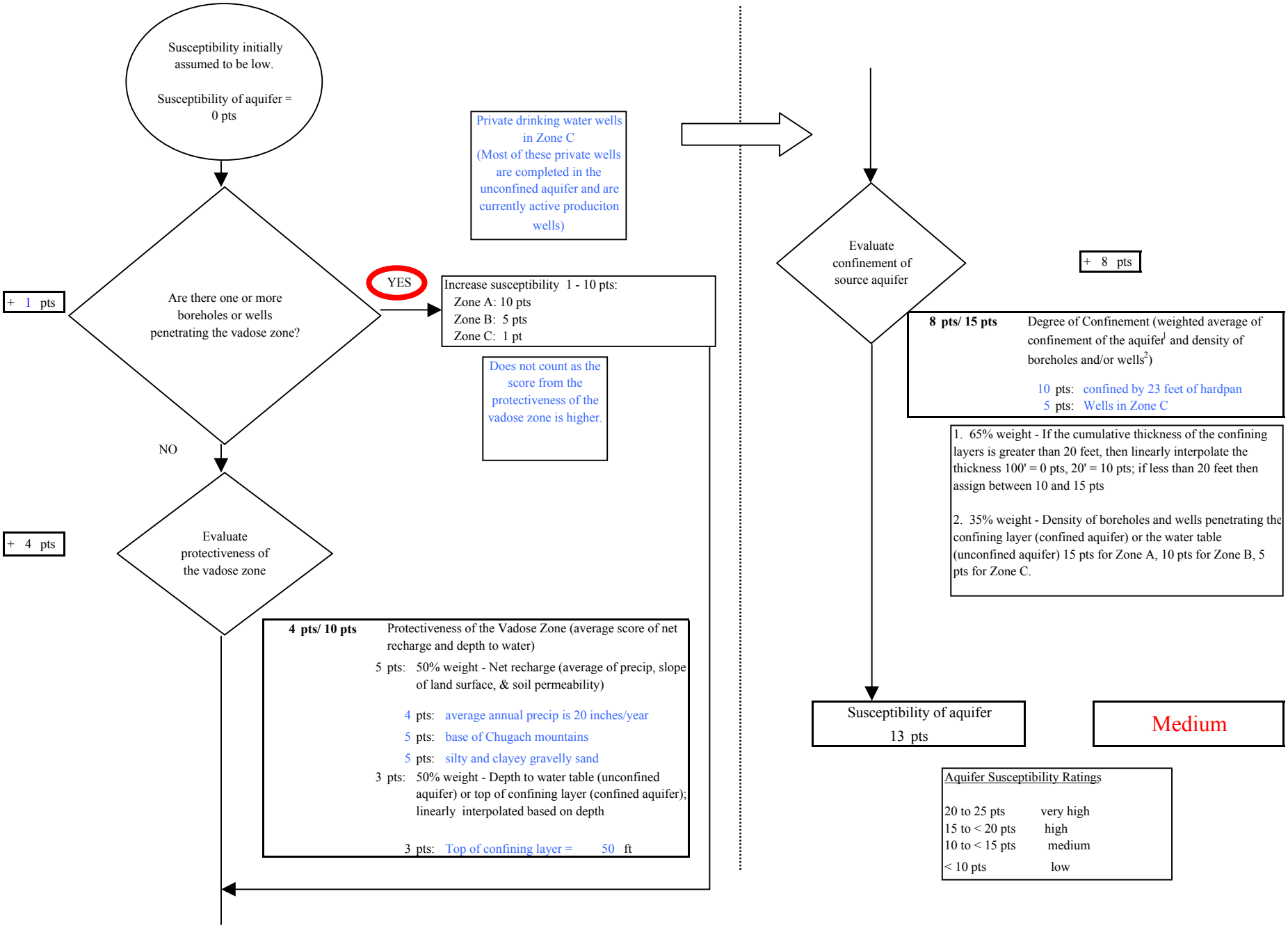
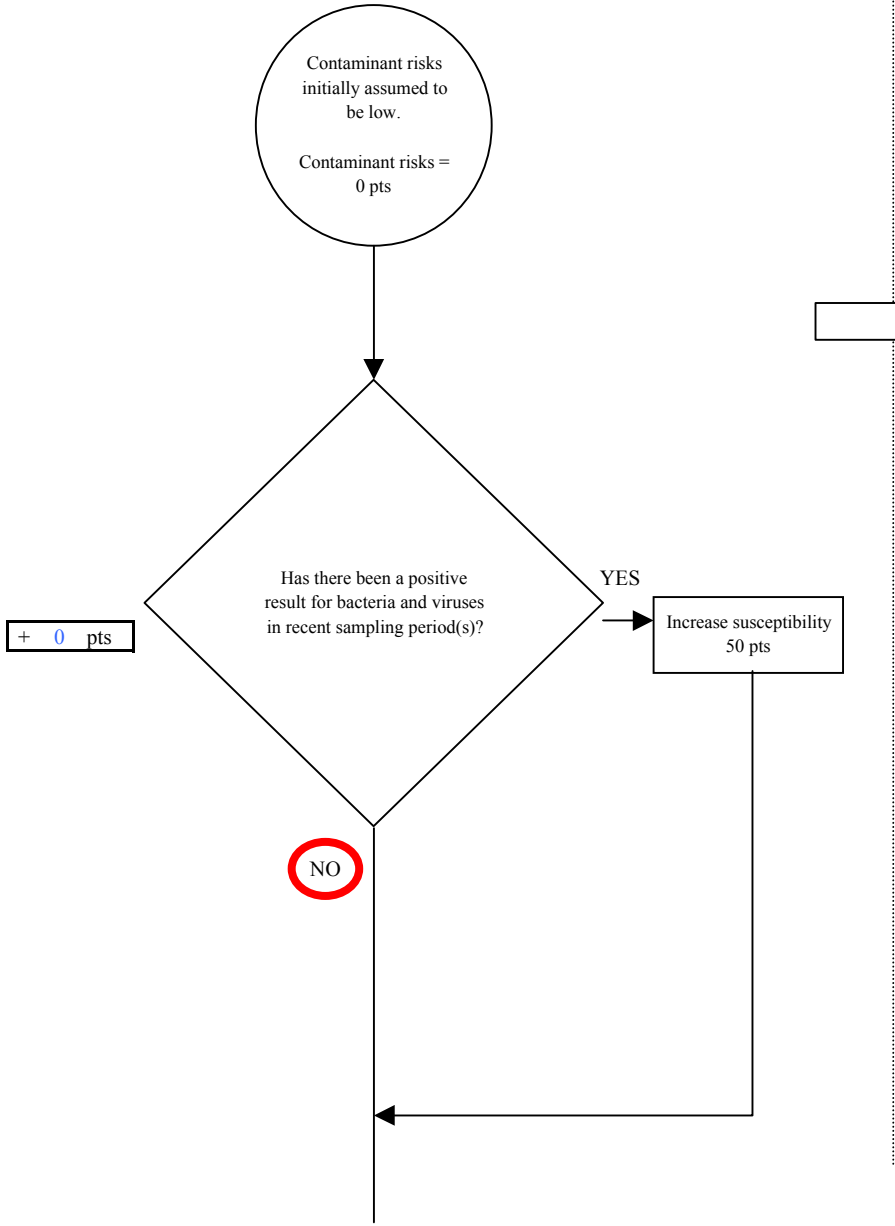
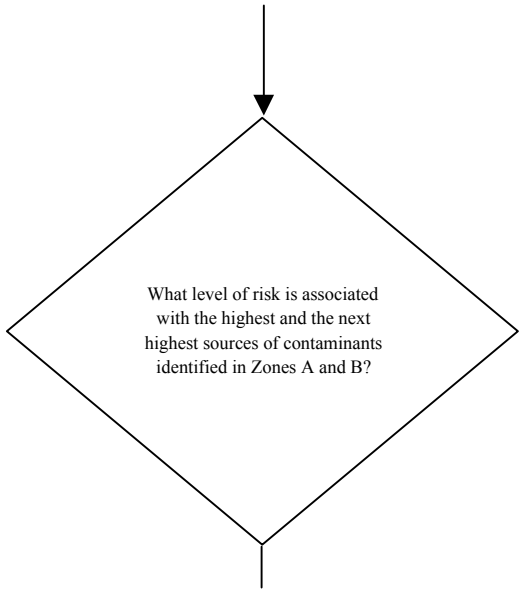


Chart 3. Contaminant risks for Alpat Water Utility - Bacteria & Viruses





+ 25 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)	2	1	3
Low(s)	3	12	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 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.

Chart 3. Contaminant risks for Alpat Water Utility - Bacteria & Viruses

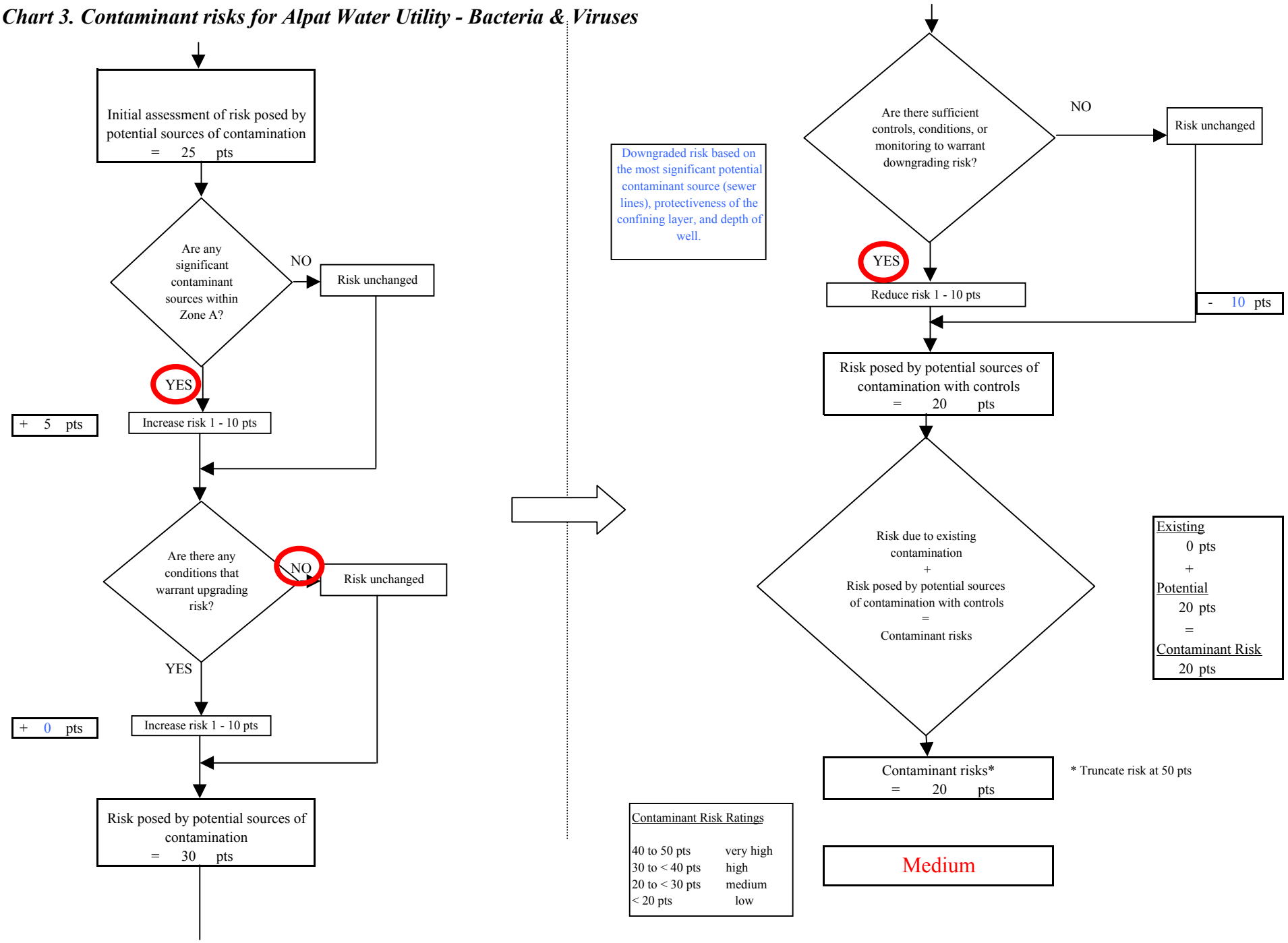


Chart 4. Vulnerability analysis for Alpat Water Utility - Bacteria & Viruses

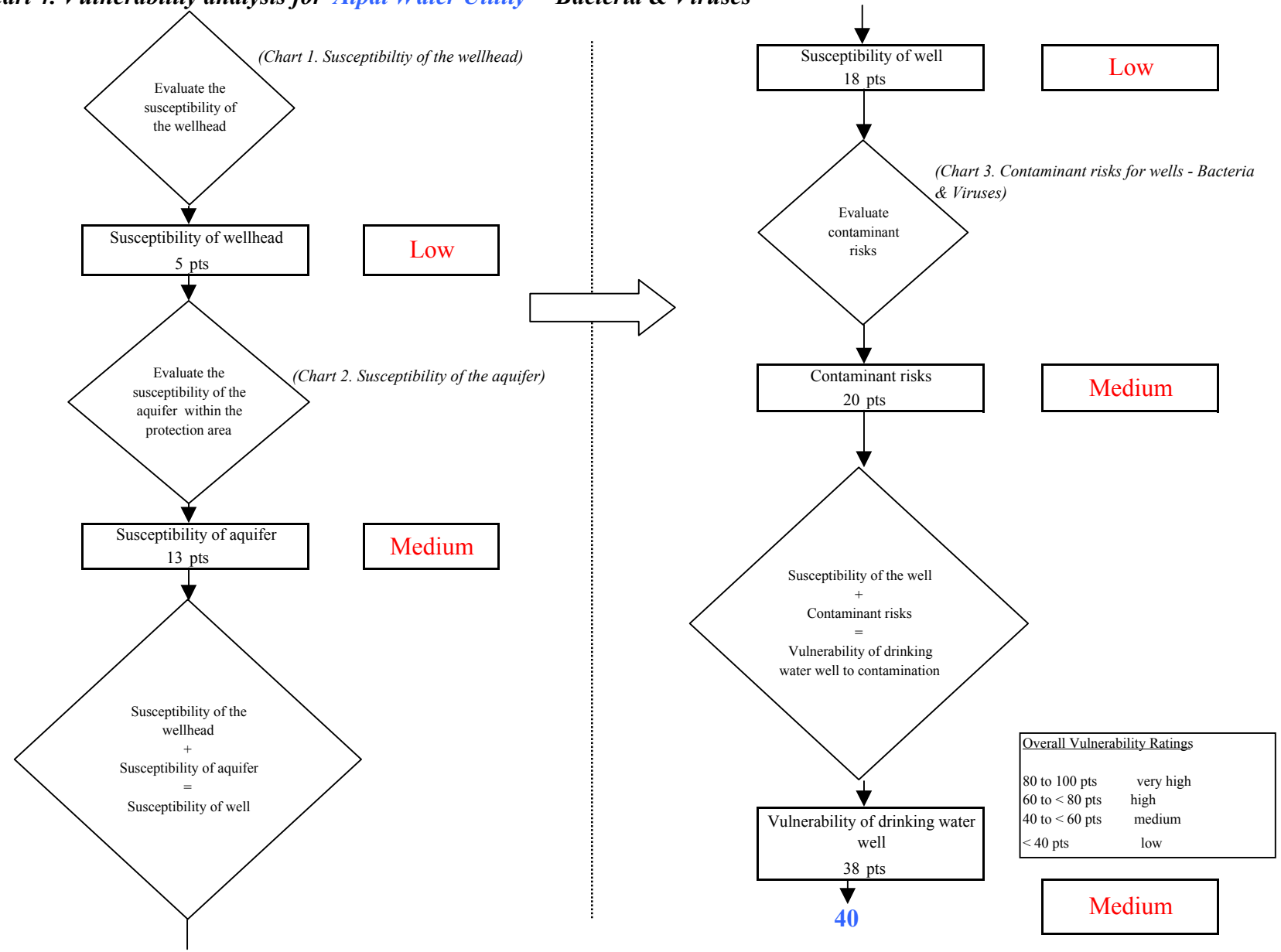


Chart 5. Contaminant risks for Alpat Water Utility - Nitrates and Nitrites

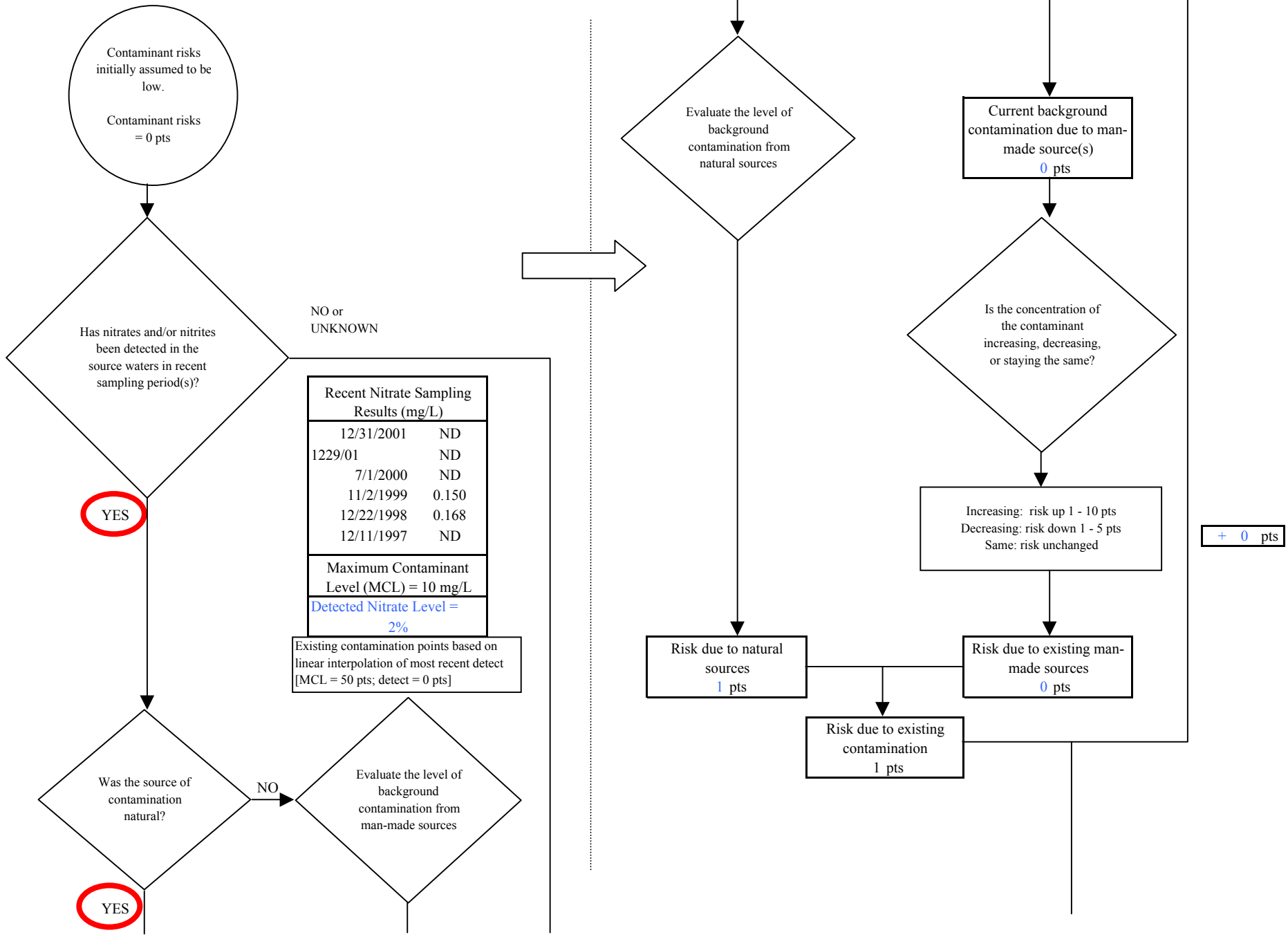


Chart 5. Contaminant risks for Alpat Water Utility - Nitrates and Nitrites

+ 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)	1	1	2
Low(s)	4	12	16

	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 = 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

+ 5 pts

Chart 5. Contaminant risks for Alpat Water Utility - Nitrates and Nitrites

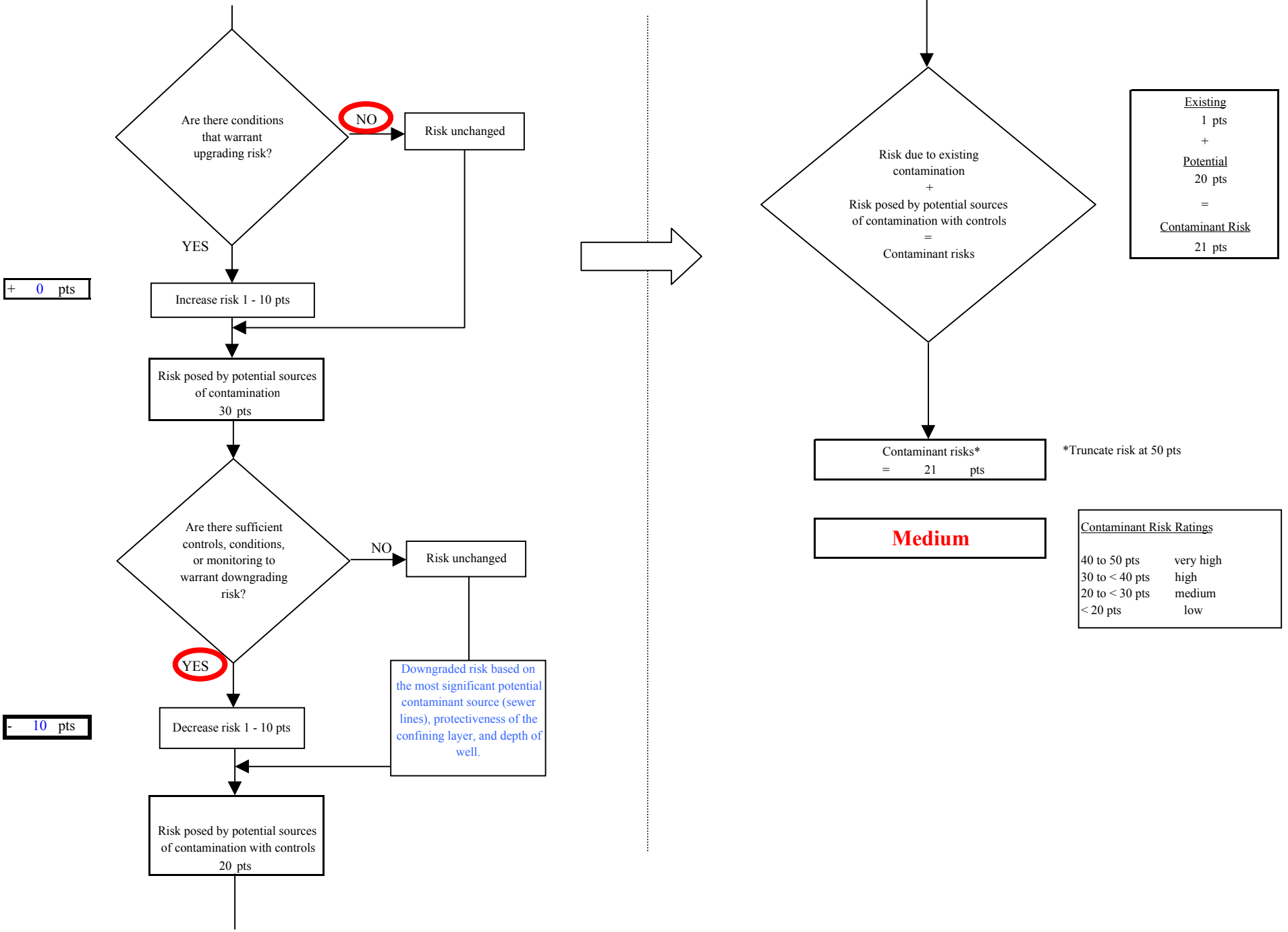


Chart 6. Vulnerability analysis for Alpat Water Utility - Nitrates and Nitrites

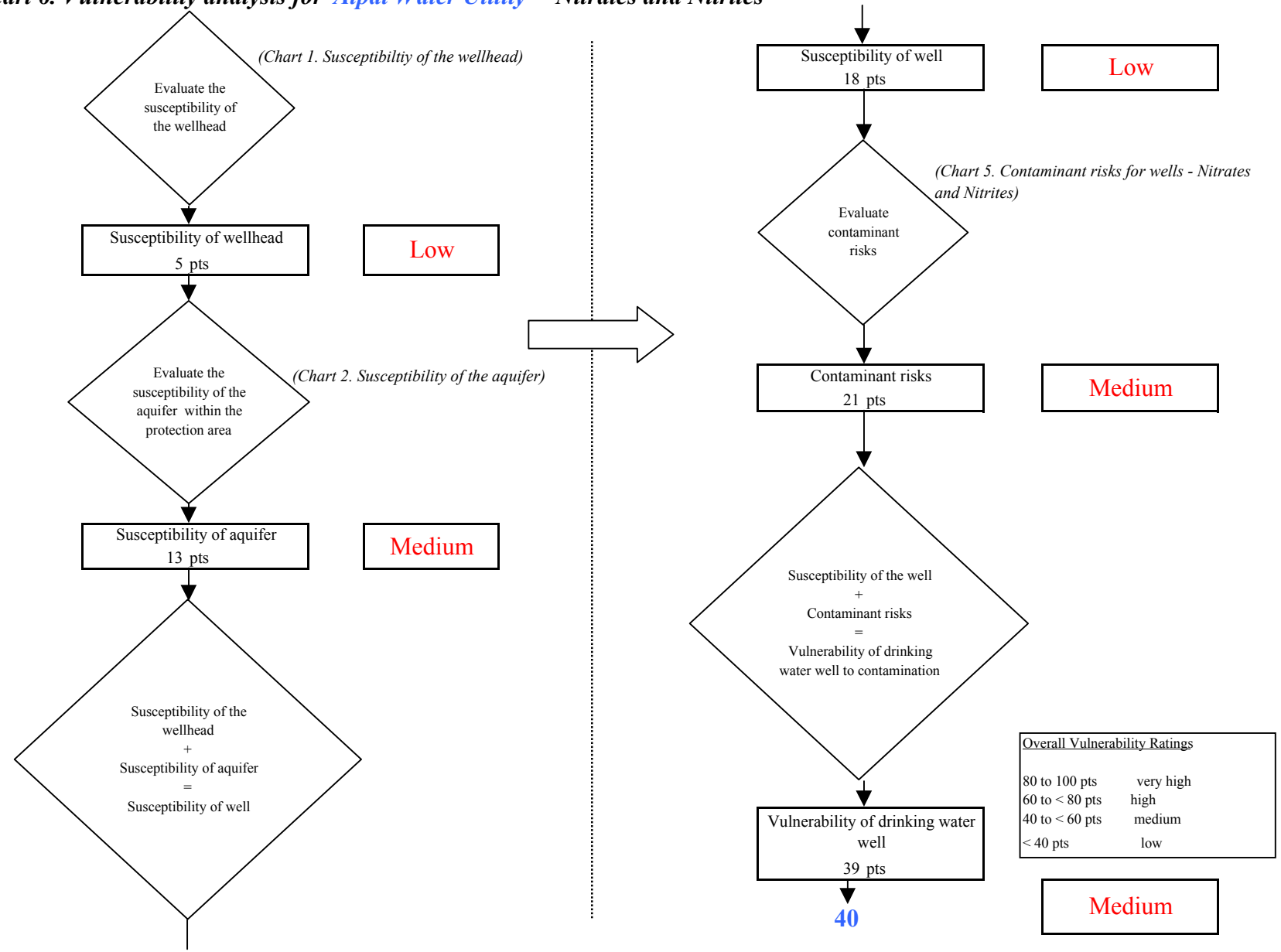


Chart 7. Contaminant risks for Alpat Water Utility - Volatile Organic Chemicals

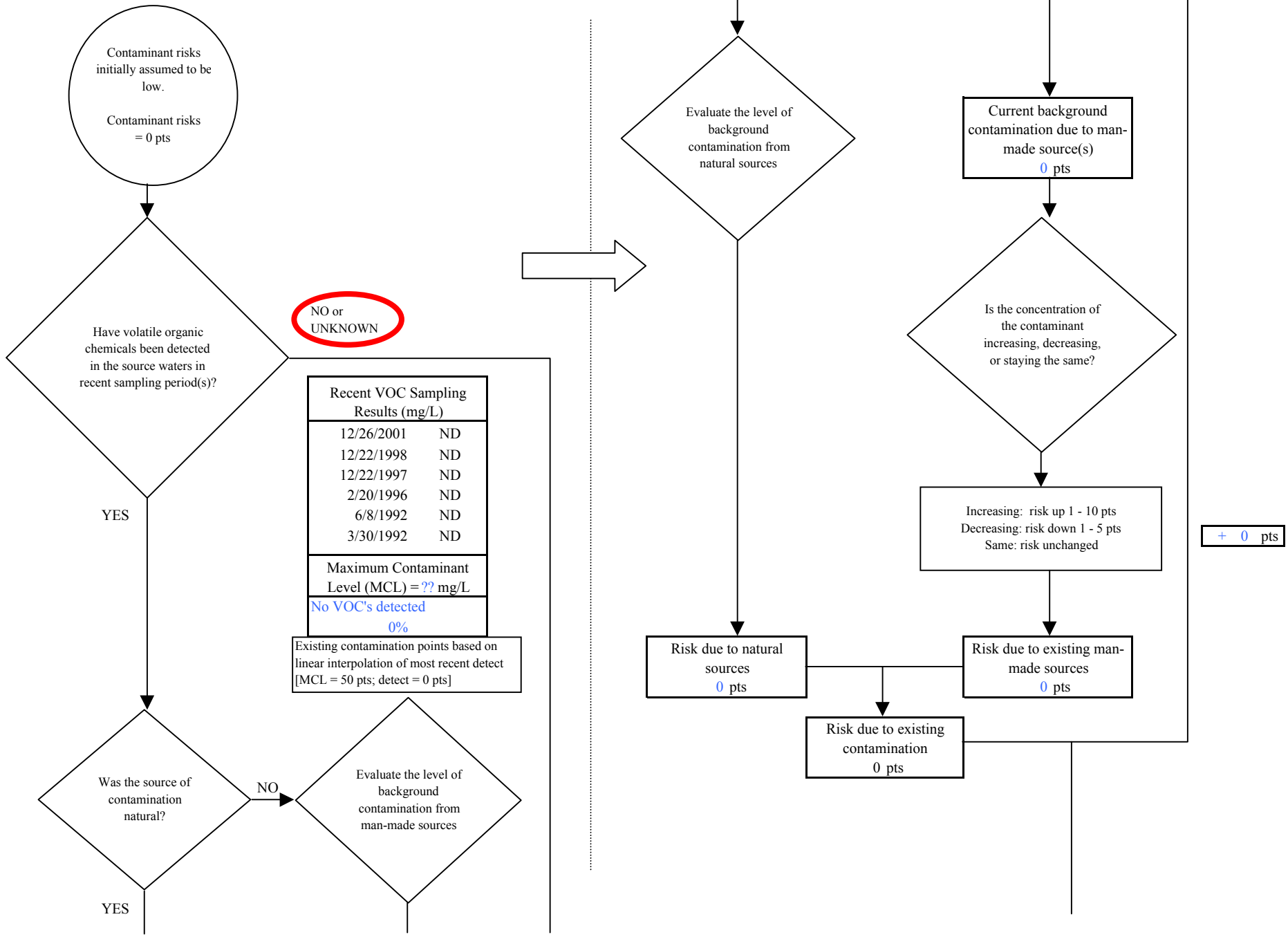


Chart 7. Contaminant risks for Alpat Water Utility - Volatile Organic Chemicals

+ 40 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)	5	9	14
Medium(s)	0	7	7
Low(s)	4	5	9

	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 40

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 = 40 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

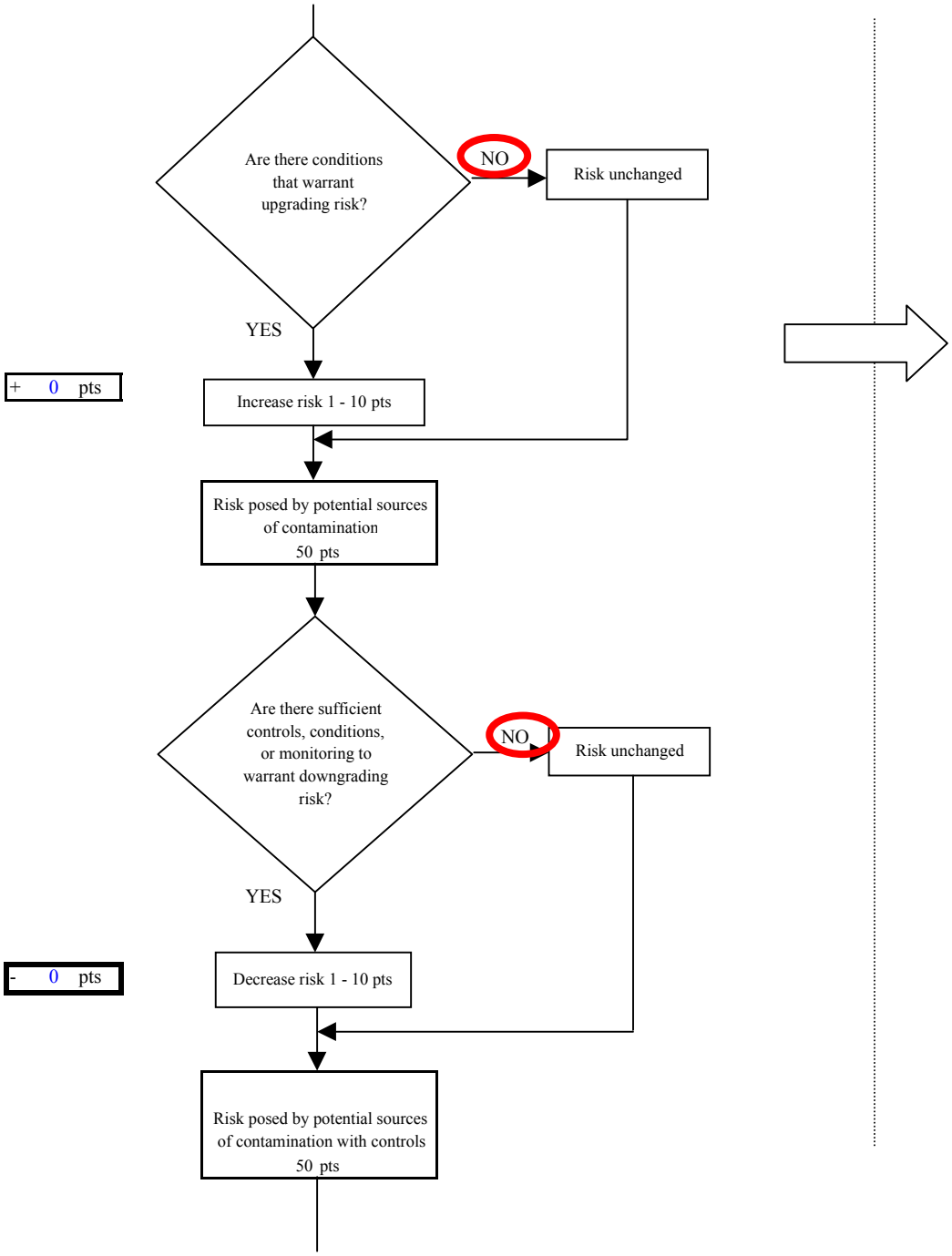
Risk unchanged

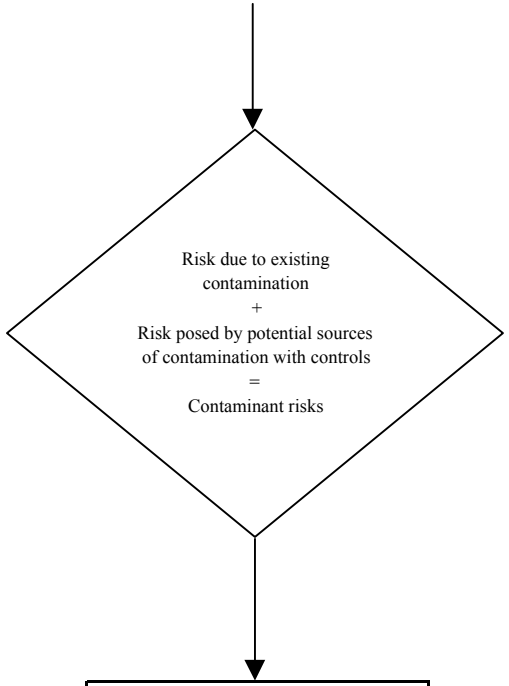
YES

Increase risk 1 - 10 pts

+ 10 pts

Chart 7. Contaminant risks for Alpat Water Utility - Volatile Organic Chemicals





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

Contaminant risks*
= 50 pts

*Truncate risk at 50 pts

Very High

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 Alpat Water Utility - Volatile Organic Chemicals

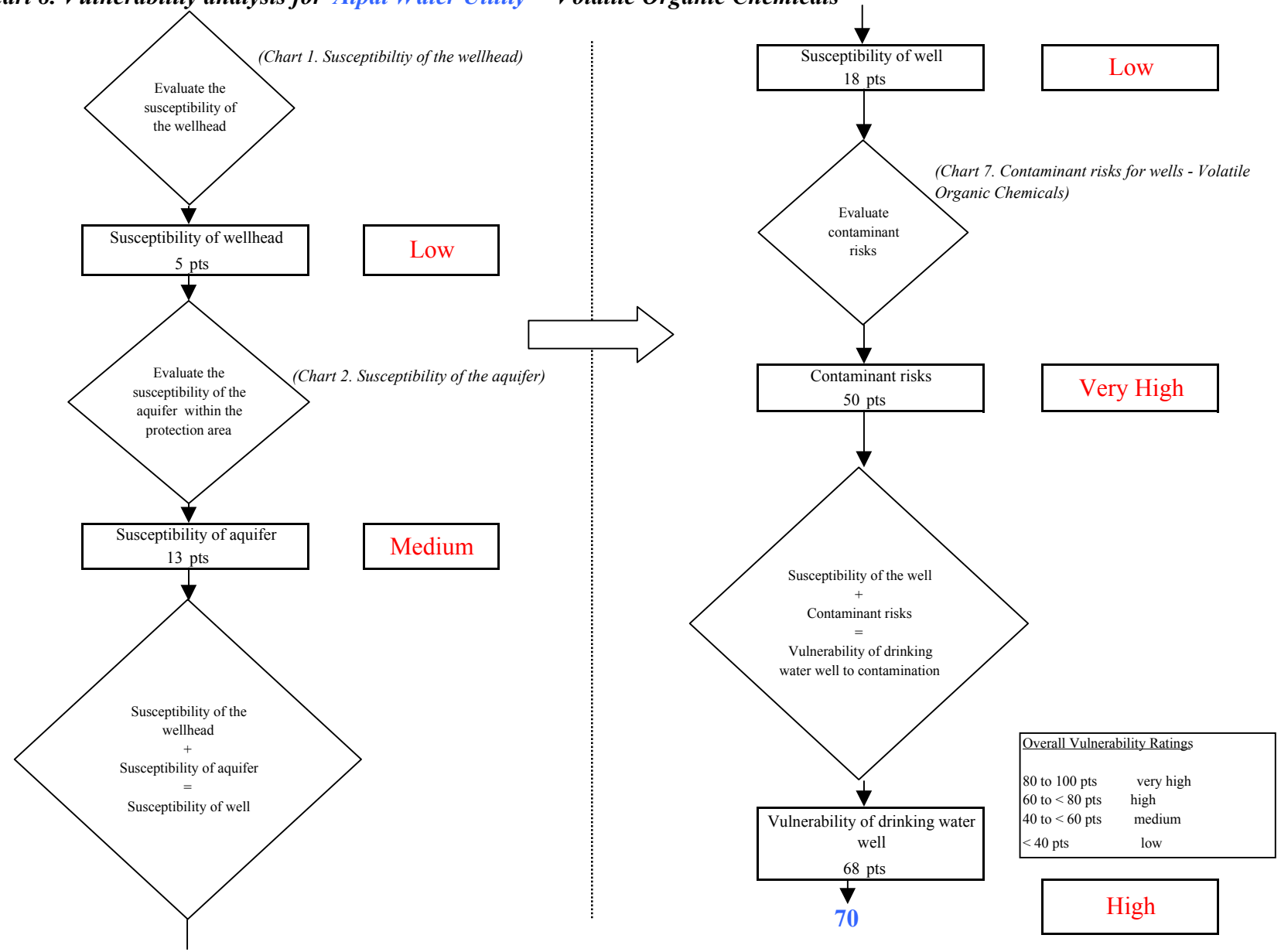


Chart 9. Contaminant risks for Alpat Water Utility - Heavy Metals, Cyanide and Other Inorganic Chemicals

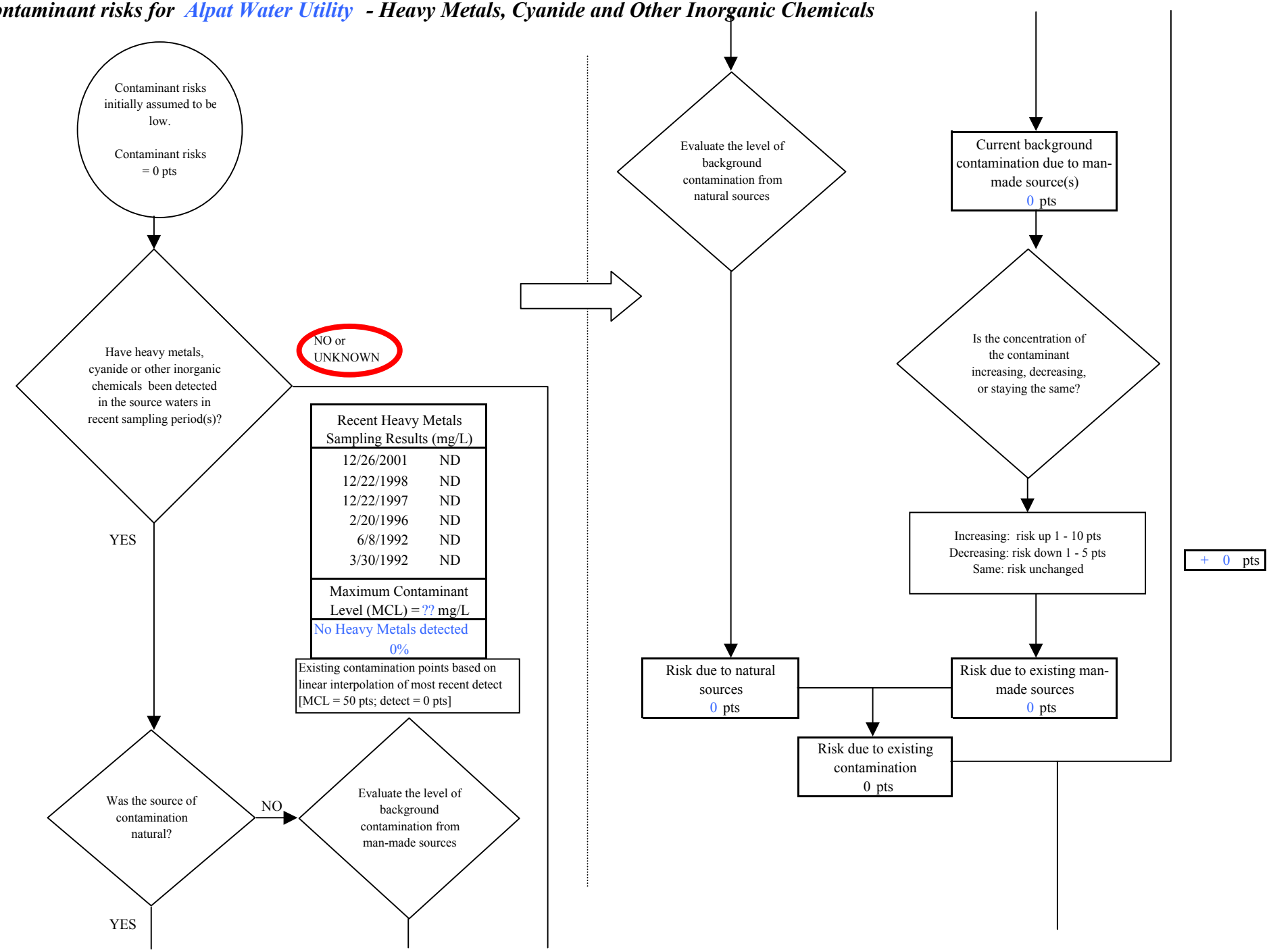


Chart 9. Contaminant risks for Alpat Water Utility - Heavy Metals, Cyanide and Other Inorganic Chemicals

+ 40 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	2	2
Medium(s)	1	5	6
Low(s)	7	8	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 40

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 = 40 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

- 0 pts

Decrease risk 1 - 10 pts

Are any significant sources within Zone A?

NO

Risk unchanged

YES

+ 5 pts

Increase risk 1 - 10 pts

Chart 9. Contaminant risks for Alpat Water Utility - Heavy Metals, Cyanide and Other Inorganic Chemicals

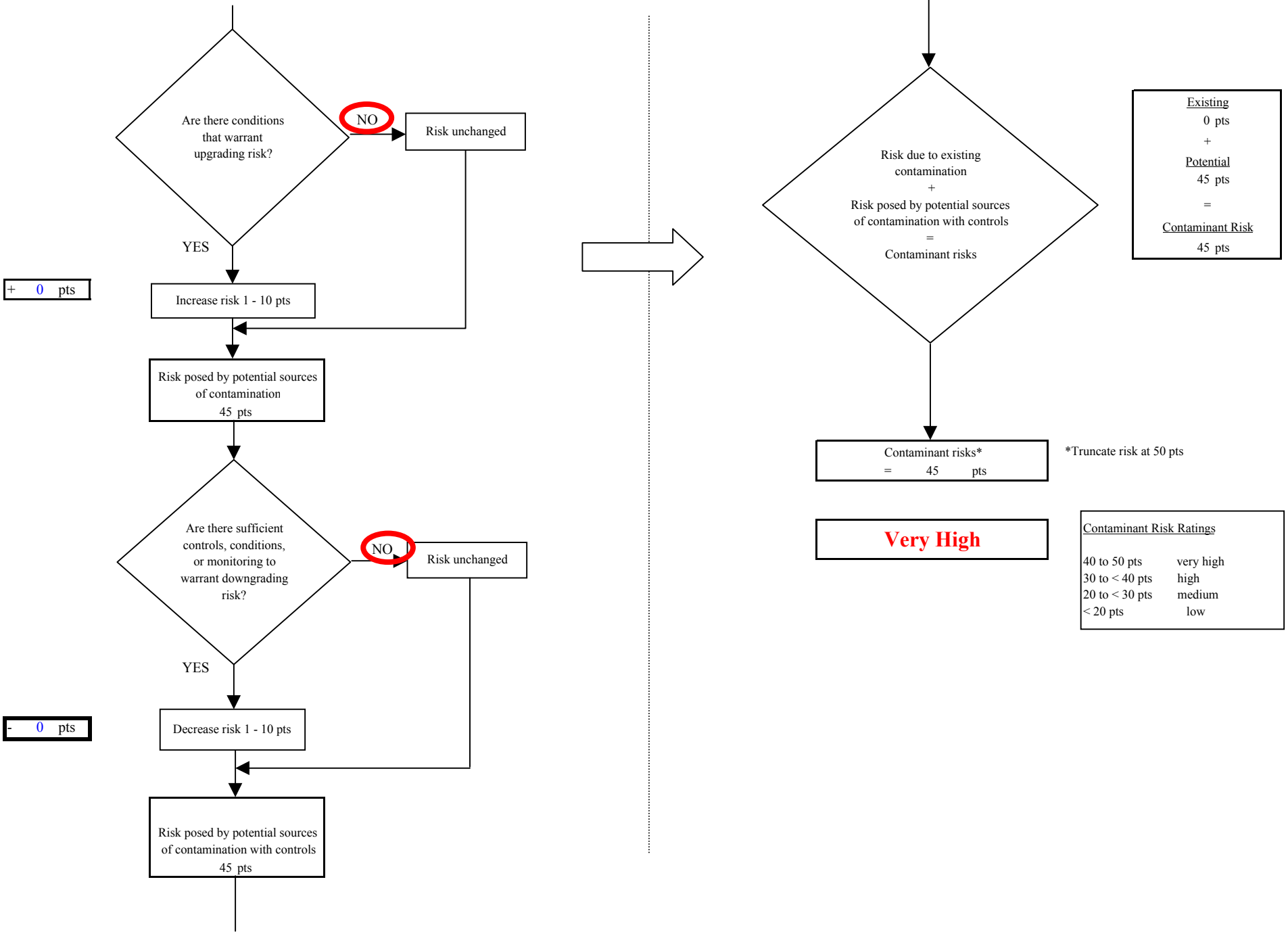


Chart 10. Vulnerability analysis for Alpat Water Utility - Heavy Metals, Cyanide and Other Inorganic Chemicals

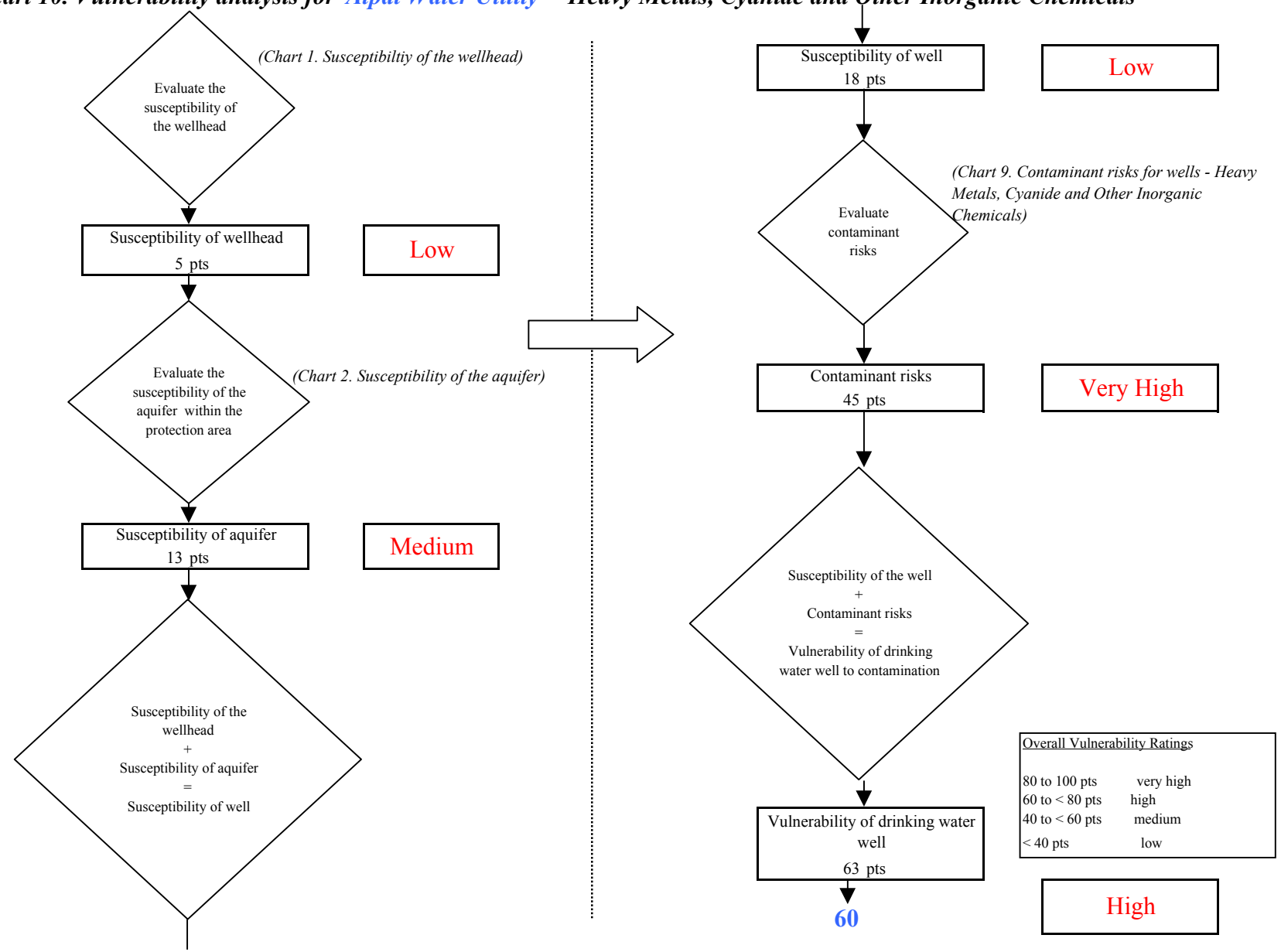


Chart 11. Contaminant risks for Alpat Water Utility - Synthetic Organic Chemicals

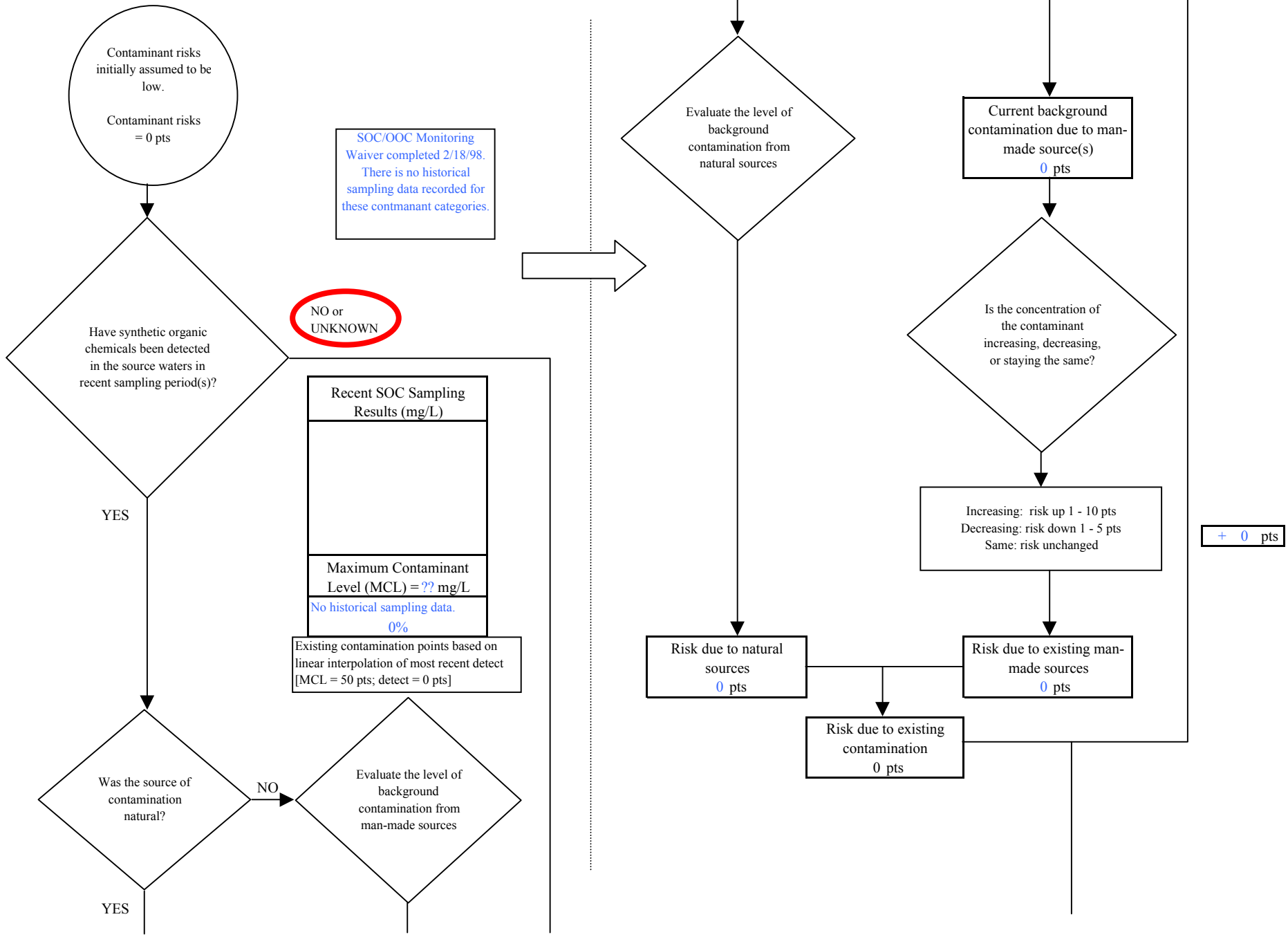


Chart 11. Contaminant risks for Alpat Water Utility - Synthetic Organic Chemicals

+ 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)	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.

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

Is the source aquifer fractured rock or karst?

YES

NO

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

NO

Risk unchanged

YES

Decrease risk 1 - 10 pts

- 0 pts

Are any significant sources within Zone A?

NO

Risk unchanged

YES

Increase risk 1 - 10 pts

+ 2 pts

Chart 11. Contaminant risks for Alpat Water Utility - Synthetic Organic Chemicals

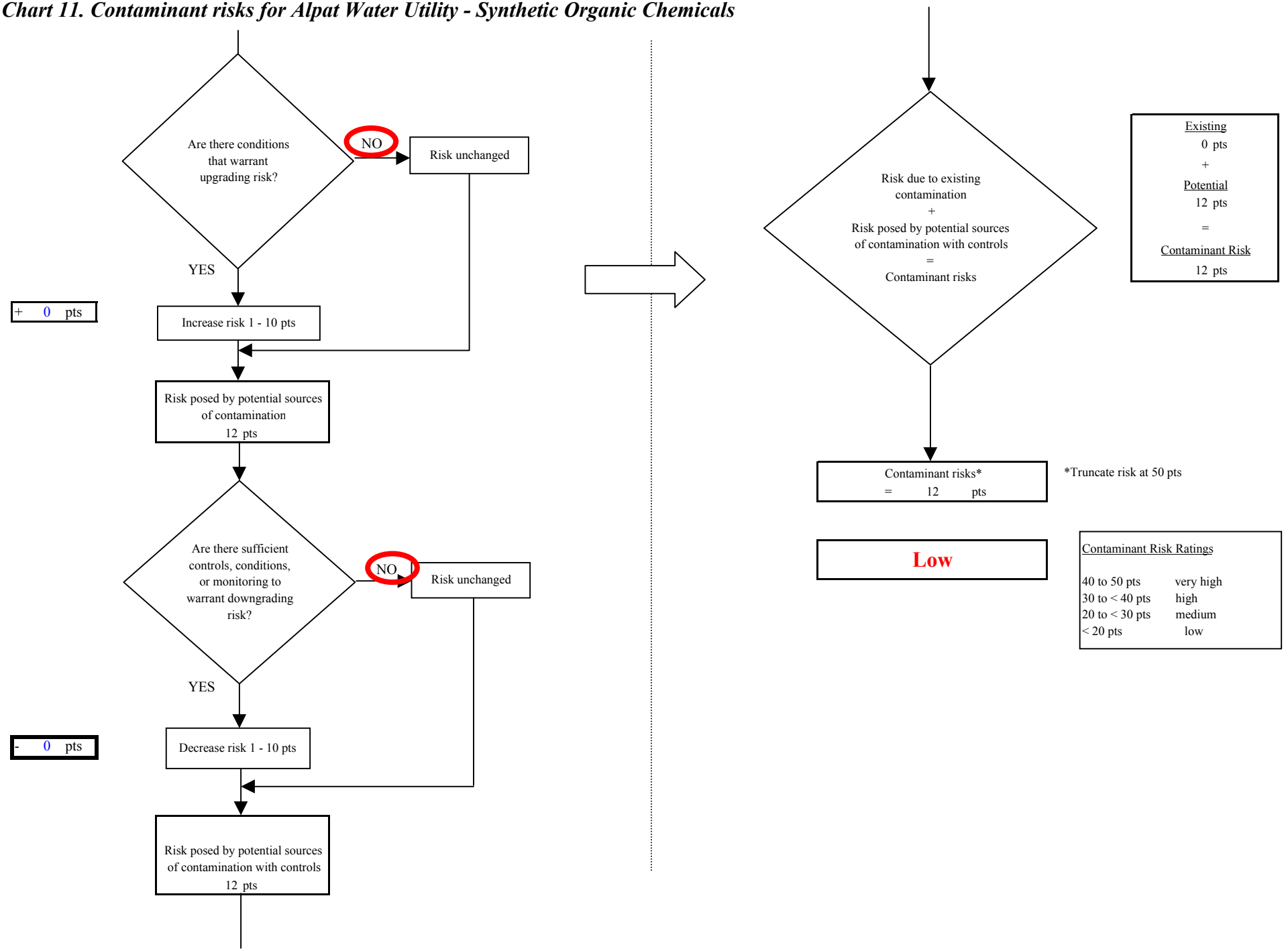


Chart 12. Vulnerability analysis for Alpat Water Utility - Synthetic Organic Chemicals

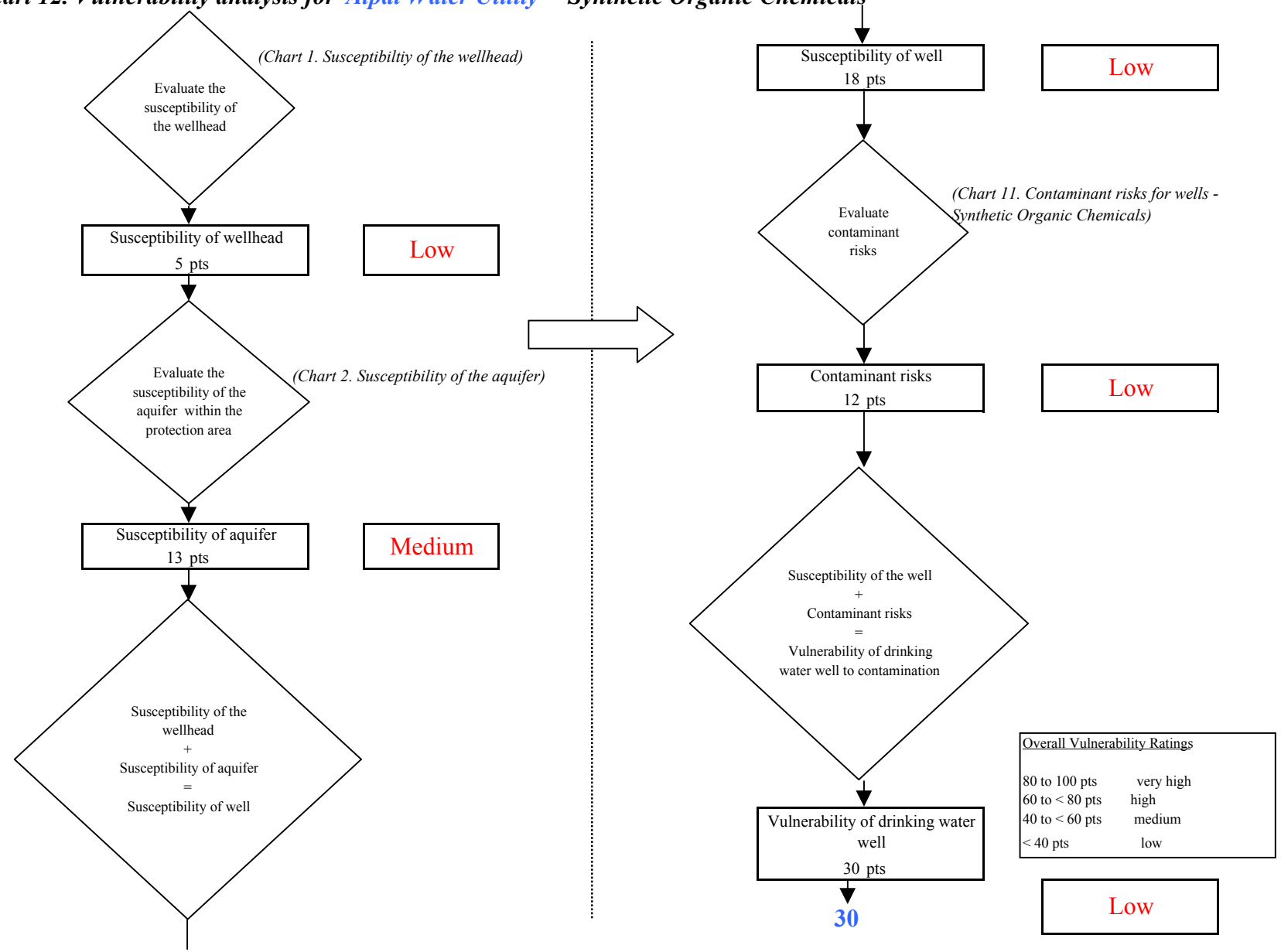


Chart 13. Contaminant risks for Alpat Water Utility - Other Organic Chemicals

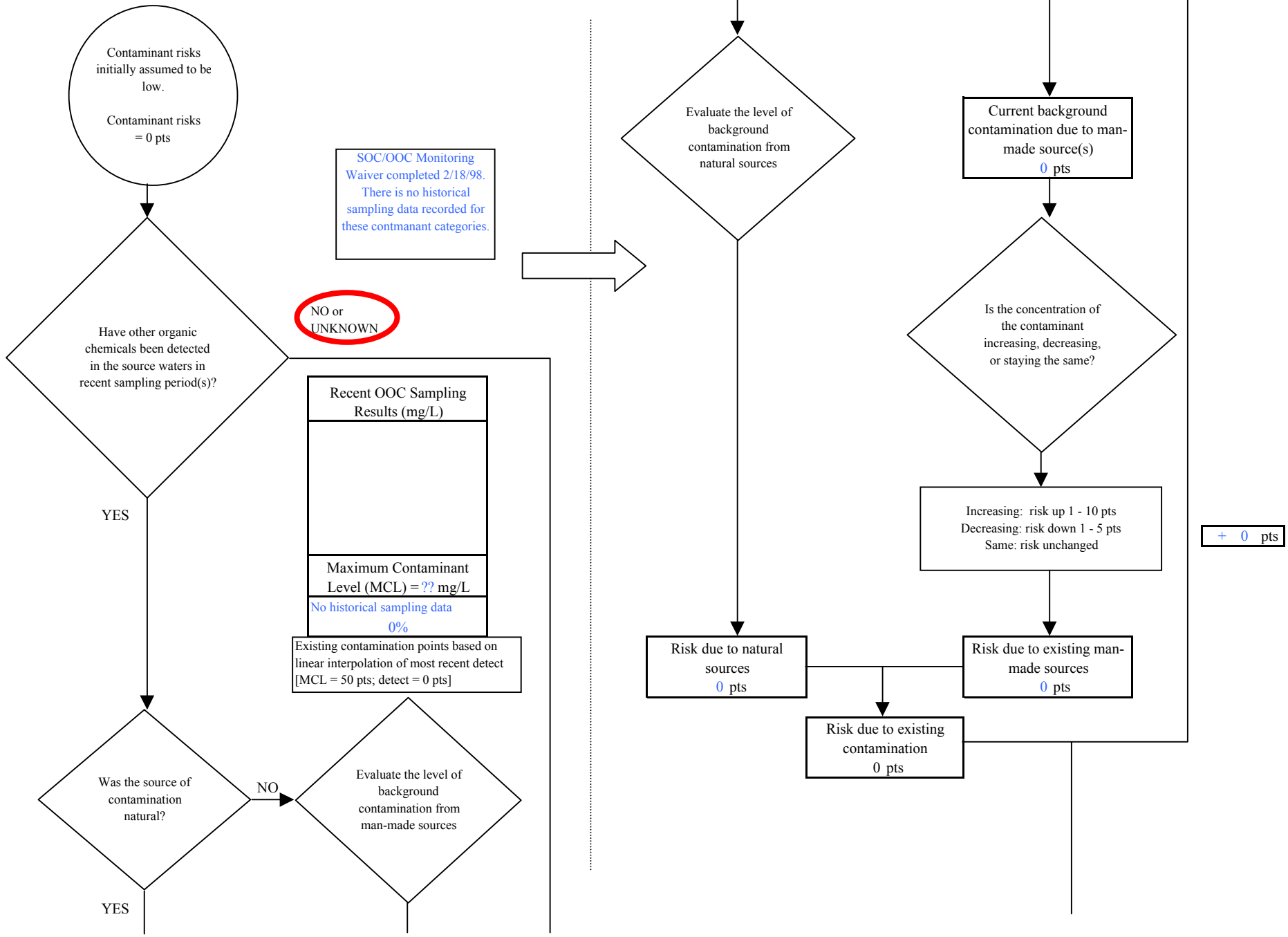


Chart 13. Contaminant risks for Alpat Water Utility - Other Organic Chemicals

+ 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	4	4
Low(s)	5	6	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 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

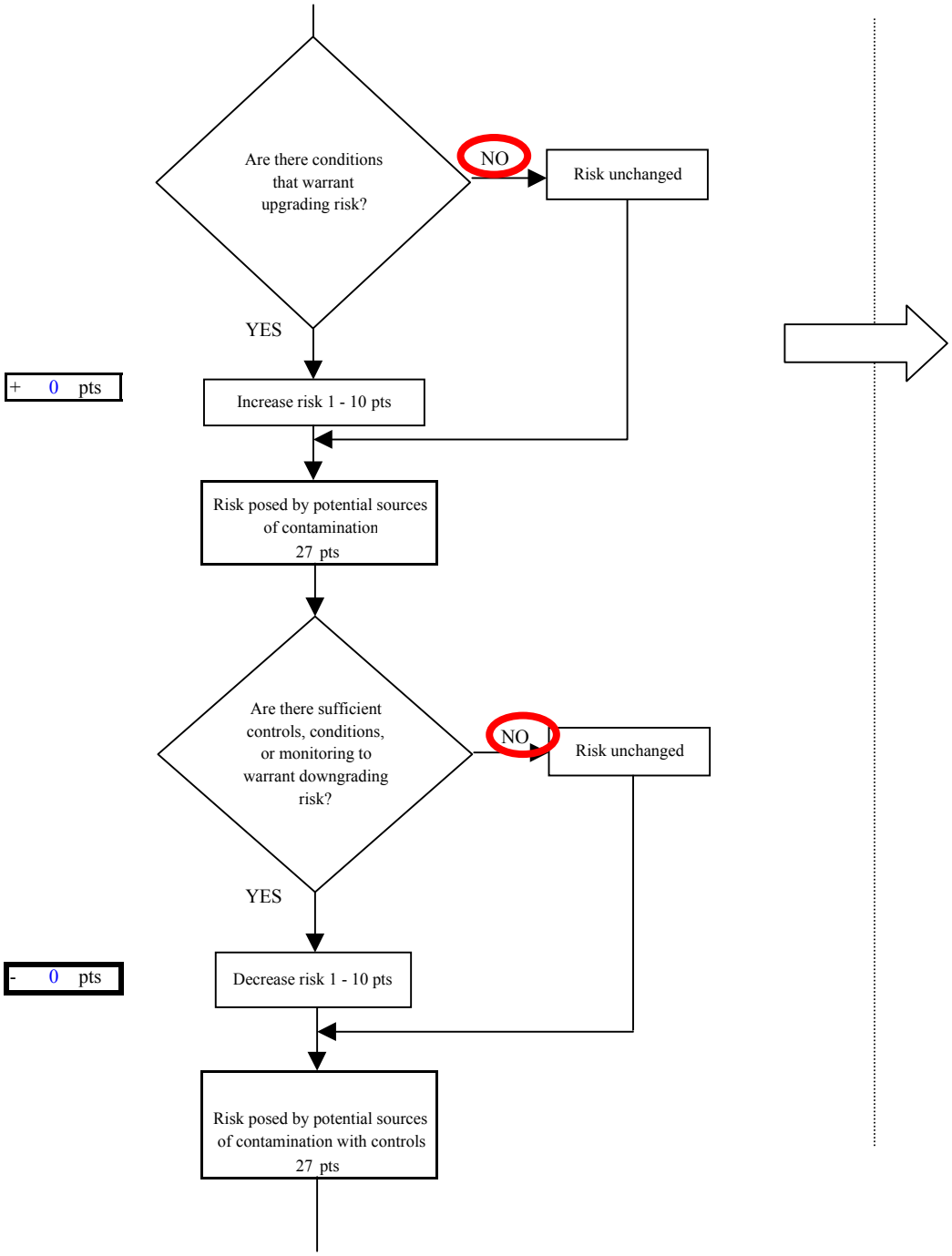
Risk unchanged

YES

Increase risk 1 - 10 pts

+ 2 pts

Chart 13. Contaminant risks for Alpat Water Utility - Other Organic Chemicals



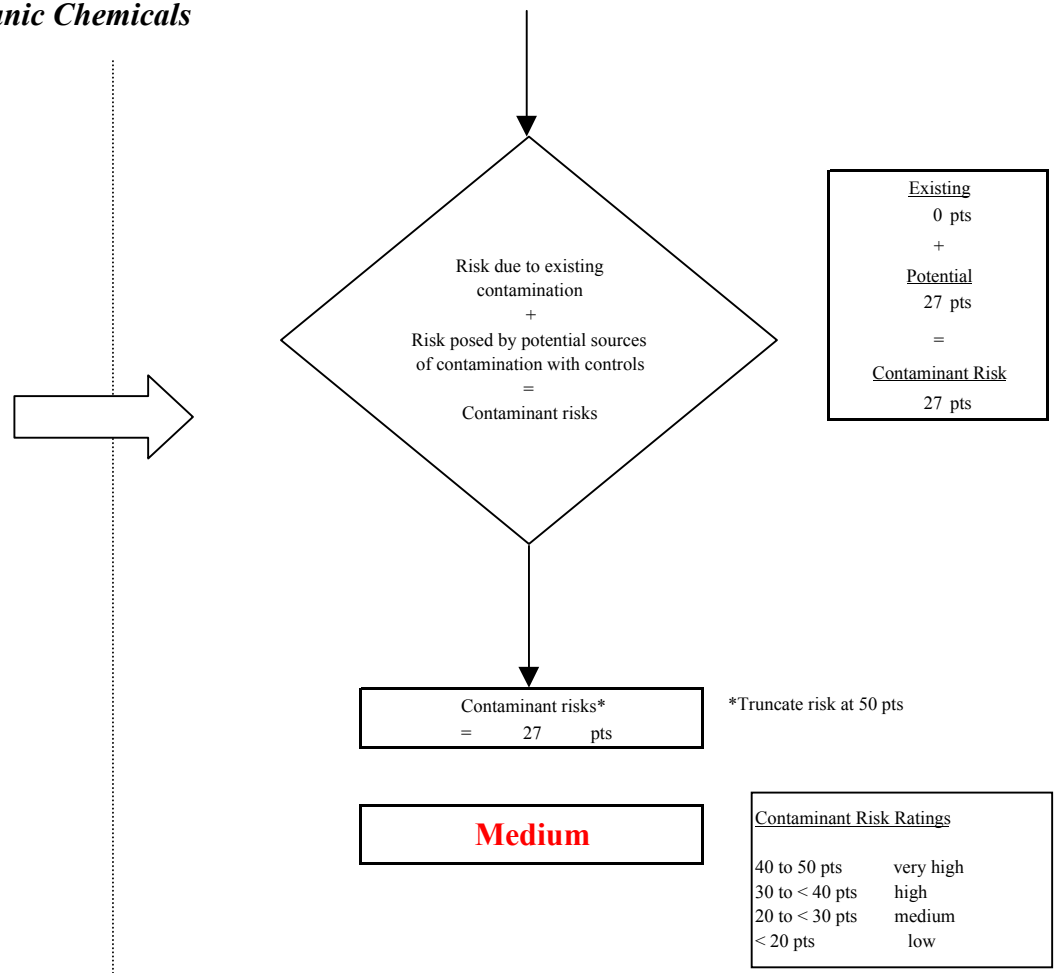


Chart 14. Vulnerability analysis for Alpat Water Utility - Other Organic Chemicals