Source Water Assessment for Chapel of The Cross Anchorage, Alaska

A Hydrogeologic Susceptibility and Vulnerability Analysis

DRINKING WATER PROTECTION PROGRAM REPORT 156

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Source Water Assessment for Chapel of The Cross' Source of Public Drinking Water, Anchorage, Alaska

A Hydrogeologic Susceptibility and Vulnerability Analysis

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Drinking Water Protection Program
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EXECUTIVE SUMMARY

The Public Water System for Chapel of The Cross is a Class B (transient/non-community) water system consisting of one well in the Anchorage area. Identified potential and current sources of contaminants for Chapel of The Cross include: residential septic systems, paved and dirt or gravel roads, activities associated with recreation trails, approximately 162 acres of residential area, horse stable and/or corral area, and a public utility corridor. These identified potential and existing sources of contamination are considered sources of bacteria and viruses, nitrates and/or nitrites, and volatile organic chemicals. Overall, the public water sources for Chapel of The Cross received a vulnerability rating of **Medium** for bacteria and viruses, and nitrates and/or nitrites; and **Low** for volatile organic chemicals.

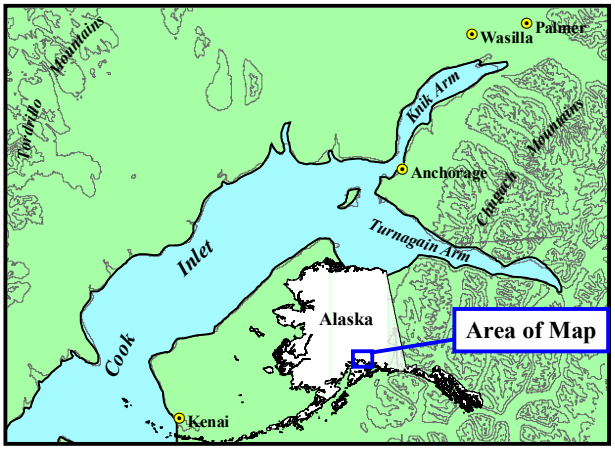

Figure 1. Index map showing the location of Anchorage, Alaska

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 Chapel of The Cross. 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 Arms 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.

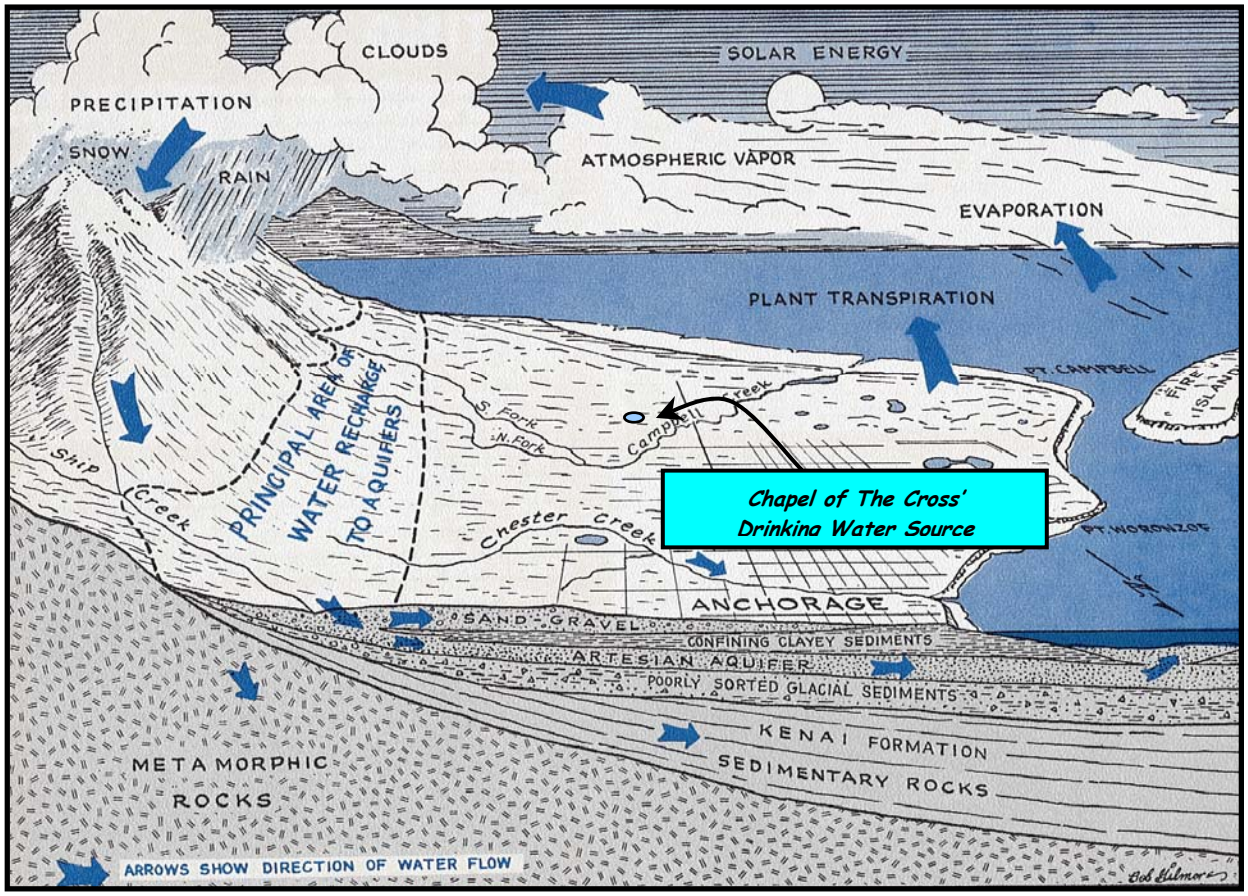

Figure 2. Generalized hydrologic cycle in the Anchorage area [*Barnwell, George, Dearborn,Weeks, and Zenone*, 1972].

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 enter 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.

CHAPEL OF THE CROSS' PUBLIC DRINKING WATER SYSTEM

The public water system serving Chapel of The Cross is a Class B (transient/non-community) water system, which is owned and operated by Chapel of The Cross, Church of Nazarene. The system consists of one well, which is located off of Hillside Drive at an elevation of approximately 1400 feet above sea level (see Figure 3).

According to the most recent Sanitary Survey (09/11/98) the well site is properly drained and protected against flooding. The Sanitary Survey also noted that a sanitary seal was properly installed which may decrease the chances of foreign matter from entering source waters. It is not indicated whether the well was properly grouted at the time of drilling. Proper grouting provides added protection against contaminants travelling along the well casing and into source waters.

This system operates year round and serves 120 non-residents through one service connection.

ASSESSMENT AND PROTECTION AREA FOR CHAPEL OF THE CROSS' DRINKING WATER SOURCE

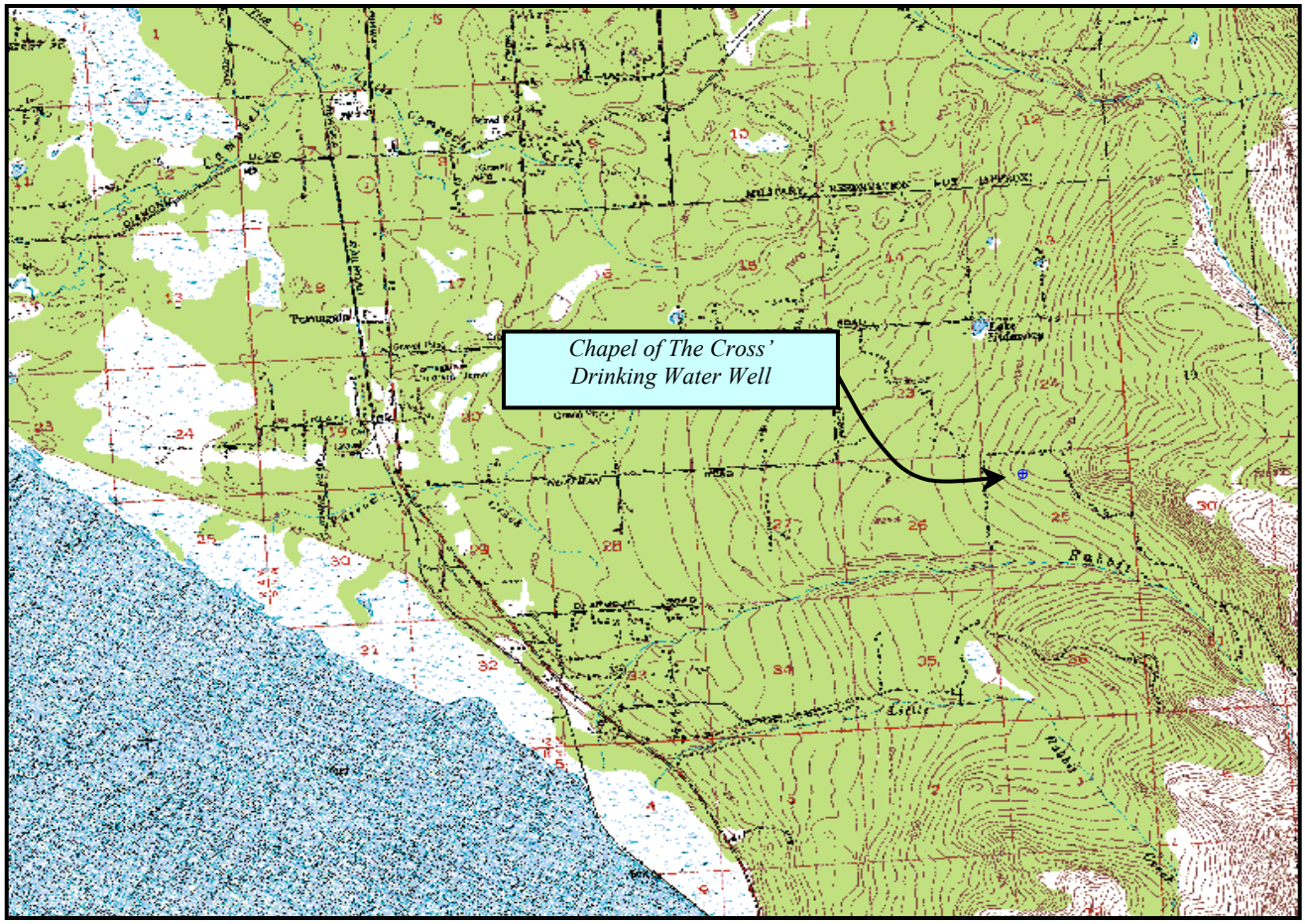

Figure 3. Map showing the location of the drinking water source for Chapel of The Cross [Base: USGS Anchorage A8].

The Drinking Water Protection and Assessment Area that has been established for the source of drinking water serving Chapel of The Cross is the area that is most sensitive to contamination. This area has served 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 B 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 Chapel of The Cross contains four zones, Zone A through Zone D (See Map 1 in Appendix A). Zone A corresponds to the area between the well 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 well may be on the order of several days to several hours. Zone A also extends downgradient from the well to take into account the area of the aquifer that is influenced by pumping of the well. 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 Chapel of The Cross. 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, three categories of drinking water contaminants were inventoried. They include:

- Bacteria and viruses
- Nitrates and/or nitrites
- Volatile organic chemicals

Maps 2 through 5 in Appendix C depict the Contaminant Source Inventory for Chapel of The Cross. 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 within the Drinking Water Protection Area for Chapel of The Cross:

- Residential septic systems;
- paved and dirt or gravel roads;
- activities associated with recreation trails;
- approximately 162 acres of residential area;
- horse stable and/or corral area;
- and a public utility corridor.

These potential and existing contaminant sources present risk for all three categories of drinking water contaminants for Chapel of The Cross' source of public drinking water.

RANKING OF CONTAMINANT RISKS

Potential and existing sources of contamination have been 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 well.

VULNERABILITY OF CHAPEL OF THE CROSS' DRINKING WATER SOURCES

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

- natural susceptibility; and
- contaminant risks.

Each of the three categories of drinking water contaminants 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)

No well log was available for Chapel of The Cross. Therefore, all of the geologic information was gathered by analyzing well logs for wells within a ½ mile radius of Chapel of The Cross. Based on the information gathered, the well serving Chapel of The Cross is suspected to be completed in a confining aquifer. The depth to the top of the confining unit is approximately 40 feet below land surface. The thickness of the confining layer is suspected to be approximately 60 feet and composed of silty clay, gravelly hardpan with intermittent layers of gravelly clay. 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 Chapel of The Cross.

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

	Score	Rating
Susceptibility of the Wellhead	5	Low
Susceptibility of the Aquifer	10	Medium
Natural Susceptibility	15	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

Contaminant Risks	Score	Rating
Bacteria and Viruses	30	High
Nitrates and/or Nitrites	35	High
Volatile Organic Chemicals	13	Low

Appendix D contains eight charts, which together form the 'Vulnerability Analysis' for a Class B 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 8 contain the Contaminant Risks and Vulnerability Analysis for nitrates and nitrites,

volatile organic chemicals, respectively.

Vulnerability of the drinking water source 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 three categories of drinking water contaminants (See Appendix D). Note: scores are rounded off to the nearest five.

Table 3. Overall Vulnerability of Chapel of The Cross' Public Drinking Water Source to Contamination by Category

Category	Score	Rating
Bacteria and Viruses	45	Medium
Nitrates and Nitrites	50	Medium
Volatile Organic Chemicals	30	Low

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

Overall, contaminant risks for bacteria and viruses are high with the horse stable and/or corral area driving the increase of contaminant risk. Combining this potential bacteria and viruses contamination risk with the natural susceptibility of the well leads to an overall vulnerability to contamination of medium.

Other low potential and existing sources of contamination for bacteria and viruses include residential septic systems, paved and dirt or gravel roads, residential areas and activities associated with recreation trails.

Throughout Alaska it is common to find nitrate and/or nitrites concentrations in natural background levels. Sampling history of Chapel of The Cross' source waters indicate that nitrates were detected in the sources waters serving Chapel of The Cross in amounts exceeding natural background concentration (See Chart 5 – Contaminant Risks for Nitrates and/or Nitrites in Appendix D). Nitrates and/or nitrites tend to increase and decrease naturally. However, the elevated concentrations found in Chapel of The Cross' source waters could be due in part to activities associated with the horse stable and/or corral area located approximately 360 feet from the well and an increase in urban development and the installation of residential septic systems..
Existing nitrate contamination is approximately 48.6% of the allowable limit (MCL) for this contaminant. The Maximum Contaminant Level or 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. Since the late 1990's, nitrate levels in Chapel of The Cross' source waters have showed a slight increase (from 3.13 mg/L in 1997 to 4.86 mg/L in 2001).

Though existing contamination was detected at the site in background concentrations for nitrates, the amount detected remains at safe levels with respect to human health.

Overall, contaminant risks for nitrates and/or nitrites are high with the horse stable/corral area driving the increase of contaminant risks. Combining this potential nitrates and/or nitrites contamination risk with the natural susceptibility of the well leads to an overall vulnerability to contamination of medium.

Other low potential and existing sources of nitrates and/or nitrites include residential septic systems, residential areas, activities associated with recreation trails, and paved and dirt or gravel roads.

Overall, contaminant risk for volatile organic chemicals is low with paved and dirt or gravel roads and residential septic systems driving the increase of contaminant risks. Combining this potential volatile organic chemical contamination risk with the natural susceptibility of the well leads to an overall vulnerability to contamination of low.

Other low potential and existing sources of volatile organic chemicals include activities associated with residential areas and a public utility corridor.

A natural gas pipeline transverses the Zone B Protection Area. Natural gas does not pose a threat to drinking water supplies. However, this area is an active public utility corridor. This utility corridor, though not heavily used represents low contamination risk from volatile organic chemicals due to activities along the corridor. Overall, this corridor ranks as a low potential source of contamination due to its proximity to Chapel of The Cross' sources of public drinking water.

SUMMARY

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

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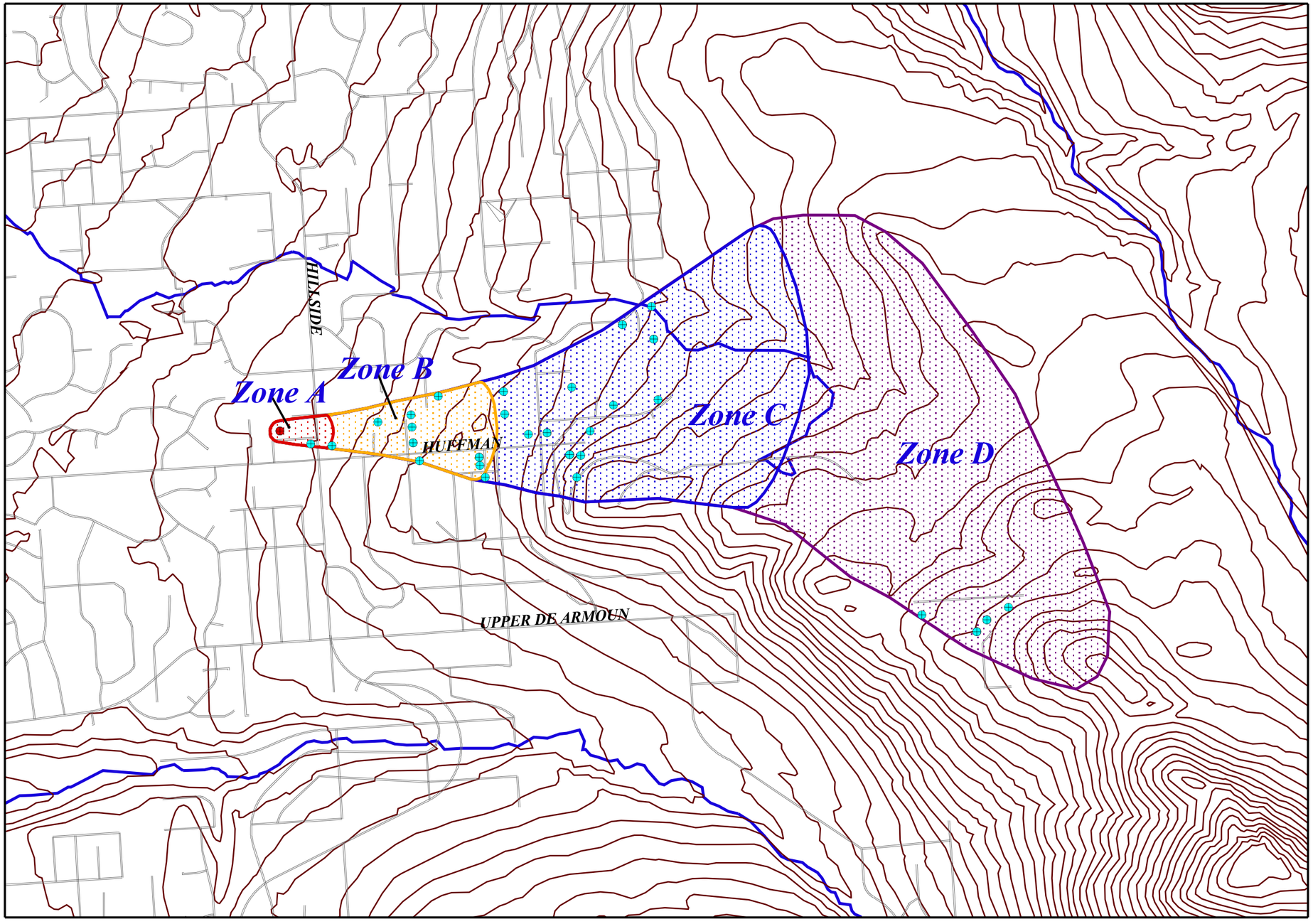
APPENDIX A

Chapel of The Cross'
Drinking Water Protection Area

Drinking Water Protection Area for Chapel of The Cross



- Chapel of the Cross Well
- Private & 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 Roads
- Elevation Contours
- Anchorage Streams

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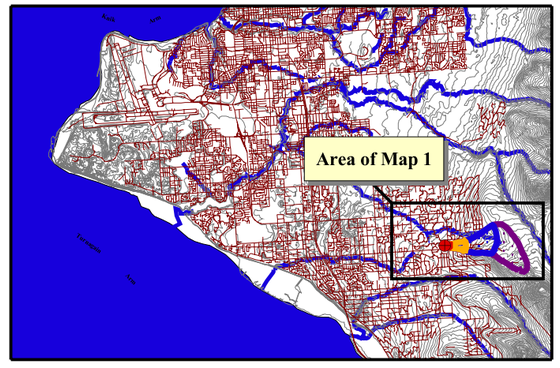

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PWSID 217259.001

Map 1

APPENDIX B

Contaminant Source Inventory and Risk Ranking for Chapel of The Cross

Table 1

Contamiant Source Inventory for Chapel of The Cross

PWSID 217259.001

Contaminant Source Category	Contaminant Source ID	CD ID Tag	Zone	Location	Map	Comments
Livestock stables/corrals	A09	A9-1	A	Horse stables located off of Hillside Drive	2	
Residential Areas	R01	R1-1	A	Residential areas located within Zone A	2	1.5 Acres of residential area located within Zone A
Septic systems (serves one or more single-family homes)	R2	R2-1	A	Along Holman Ave.	3	
Septic systems (serves one or more single-family homes)	R2	R2-2	A	Along Holman Ave.	3	
Septic systems (serves one or more single-family homes)	R2	R2-3	A	Along Hillside Drive	3	
Highways and roads, paved (cement or asphalt)	X20	X20-1	A	Holman Ave.	2	
Highways and roads, paved (cement or asphalt)	X20	X20-2	A	Hillside Drive	2	
Dog walking areas/foot trails	X46	X46-1	A	Trail along west side of Hillside Drive	2	
Dog walking areas/foot trails	X46	X46-2	A	Trail along east side of Hillside Drive	2	
Residential Areas	R01	R1-2	B	Residential areas located within Zone B	2	37 Arcres of residential area located within Zone B
Septic systems (serves one or more single-family homes)	R2	R2-10	B	Near Windy Circle	3	
Septic systems (serves one or more single-family homes)	R2	R2-11	B	Along Windy Circle	3	
Septic systems (serves one or more single-family homes)	R2	R2-12	B	Along Windy Circle	3	
Septic systems (serves one or more single-family homes)	R2	R2-13	B	Along Cottontail Drive	3	
Septic systems (serves one or more single-family homes)	R2	R2-14	B	Along Hillside Drive	3	
Septic systems (serves one or more single-family homes)	R2	R2-15	B	Along Windy Circle	3	
Septic systems (serves one or more single-family homes)	R2	R2-16	B	Along Windy Circle	3	
Septic systems (serves one or more single-family homes)	R2	R2-17	B	Along Windy Circle	3	
Septic systems (serves one or more single-family homes)	R2	R2-18	B	Along Graiff Street	3	
Septic systems (serves one or more single-family homes)	R2	R2-19	B	Along Graiff Street	3	
Septic systems (serves one or more single-family homes)	R2	R2-20	B	Near Windy Circle	3	

Septic systems (serves one or more single-family homes)	R2	R2-21	B	Near Windy Circle	3	
Septic systems (serves one or more single-family homes)	R2	R2-22	B	Near Windy Circle	3	
Septic systems (serves one or more single-family homes)	R2	R2-23	B	Along Huffman Drive	3	
Septic systems (serves one or more single-family homes)	R2	R2-24	B	Along Huffman Drive	3	
Septic systems (serves one or more single-family homes)	R2	R2-25	B	Along Huffman Drive	3	
Septic systems (serves one or more single-family homes)	R2	R2-26	B	Along Huffman Road	3	
Septic systems (serves one or more single-family homes)	R2	R2-27	B	Along Huffman Road	3	
Septic systems (serves one or more single-family homes)	R2	R2-28	B	Along Huffman Drive	3	
Septic systems (serves one or more single-family homes)	R2	R2-29	B	Along Benjamin Road	3	
Septic systems (serves one or more single-family homes)	R2	R2-30	B	Along Benjamin Road	3	
Septic systems (serves one or more single-family homes)	R2	R2-31	B	Along Huffman Drive	3	
Septic systems (serves one or more single-family homes)	R2	R2-32	B	Along Huffman Drive	3	
Septic systems (serves one or more single-family homes)	R2	R2-33	B	Along Huffman Drive	3	
Septic systems (serves one or more single-family homes)	R2	R2-34	B	Along Huffman Drive	3	
Septic systems (serves one or more single-family homes)	R2	R2-35	B	Near Graiff Street	3	
Septic systems (serves one or more single-family homes)	R2	R2-4	B	Along Hillside Drive	3	
Septic systems (serves one or more single-family homes)	R2	R2-5	B	Along Huffman Road	3	
Septic systems (serves one or more single-family homes)	R2	R2-6	B	Along Huffman Road	3	
Septic systems (serves one or more single-family homes)	R2	R2-7	B	Along Cottontail Drive	3	
Septic systems (serves one or more single-family homes)	R2	R2-8	B	Along Cottontail Drive	3	
Septic systems (serves one or more single-family homes)	R2	R2-9	B	Near Cottontail Drive	3	
Highways and roads, paved (cement or asphalt)	X20	X20-10	B	Ridge Place	2	

Highways and roads, paved (cement or asphalt)	X20	X20-3	B	Cottontail Drive	2	
Highways and roads, paved (cement or asphalt)	X20	X20-4	B	Huffman Road	2	
Highways and roads, paved (cement or asphalt)	X20	X20-5	B	Windy Circle	2	
Highways and roads, paved (cement or asphalt)	X20	X20-6	B	Turks Turn	2	
Highways and roads, paved (cement or asphalt)	X20	X20-7	B	Graiff Street	2	
Highways and roads, paved (cement or asphalt)	X20	X20-8	B	Huffman Road	2	
Highways and roads, paved (cement or asphalt)	X20	X20-9	B	Benjamin Road	2	
Dog walking areas/foot trails	X46	X46-3	B	Trail along Huffman Road	2	
Residential Areas	R01	R1-3	C	Residential areas located within Zone C	4	123 Acres of residential area located within Zone C
Septic systems (serves one or more single-family homes)	R2	R2-36-107	C	Septic systems located within Zone C	4	
Highways and roads, paved (cement or asphalt)	X20	X20-11- 15	C	Paved roads within Zone C	4	
Highways and roads, dirt/gravel	X24	X24-1-5	C	Dirt or gravel roads within Zone C	4	
Public utility easement/corridor	X42	X42-1	B	Dual purpose pipline and public utilty easement corridor	2	Intersecting Zone B
Dog walking areas/foot trails	X46	X46-4	C	Trail along Ginami Street	4	
Dog walking areas/foot trails	X46	X46-5	C	Trail along Sultana Drive	4	

Table 2

Contaminant Source Inventory and Risk Ranking for
Chapel of The Cross
Sources of Bacteria and Viruses

PWSID 217259.001

Contaminant Source Type	Contaminant Source ID	CS ID Tag	Zone	Risk Ranking for Analysis	Overall Rank After Analysis	Location	Map Number	Comments
Livestock stables/corrals	A09	A9-1	A	Medium	1	Horse stables located off of Hillside Drive	2	
Septic systems (serves one or more single-family homes)	R2	R2-1	A	Low	2	Along Holman Ave.	3	
Septic systems (serves one or more single-family homes)	R2	R2-2	A	Low	3	Along Holman Ave.	3	
Residential Areas	R01	R1-1	A	Low	4	Residential areas located within Zone A	2	1.5 Acres of residential area located within Zone A
Septic systems (serves one or more single-family homes)	R2	R2-4	B	Very Low	5	Along Hillside Drive	3	
Septic systems (serves one or more single-family homes)	R2	R2-5	B	Very Low	6	Along Huffman Road	3	
Septic systems (serves one or more single-family homes)	R2	R2-6	B	Very Low	7	Along Huffman Road	3	
Dog walking areas/foot trails	X46	X46-1	A	Low	8	Trail along west side of Hillside Drive	2	
Dog walking areas/foot trails	X46	X46-3	B	Low	9	Trail along Huffman Road	2	
Residential Areas	R01	R1-2	B	Low	10	Residential areas located within Zone B	2	37 Arcres of residential area located within Zone B
Septic systems (serves one or more single-family homes)	R2	R2-3	A	Low		Along Hillside Drive	3	
Highways and roads, paved (cement or asphalt)	X20	X20-1	A	Very Low		Holman Ave.	2	
Highways and roads, paved (cement or asphalt)	X20	X20-2	A	Very Low		Hillside Drive	2	
Dog walking areas/foot trails	X46	X46-29	A	Low		Trail along east side of Hillside Drive	2	
Septic systems (serves one or more single-family homes)	R2	R2-10	B	Very Low		Near Windy Circle	3	
Septic systems (serves one or more single-family homes)	R2	R2-11	B	Very Low		Along Windy Circle	3	
Septic systems (serves one or more single-family homes)	R2	R2-12	B	Very Low		Along Windy Circle	3	
Septic systems (serves one or more single-family homes)	R2	R2-13	B	Very Low		Along Cottontail Drive	3	
Septic systems (serves one or more single-family homes)	R2	R2-14	B	Very Low		Along Hillside Drive	3	
Septic systems (serves one or more single-family homes)	R2	R2-15	B	Very Low		Along Windy Circle	3	
Septic systems (serves one or more single-family homes)	R2	R2-16	B	Very Low		Along Windy Circle	3	
Septic systems (serves one or more single-family homes)	R2	R2-17	B	Very Low		Along Windy Circle	3	
Septic systems (serves one or more single-family homes)	R2	R2-18	B	Very Low		Along Graiff Street	3	
Septic systems (serves one or more single-family homes)	R2	R2-19	B	Very Low		Along Graiff Street	3	
Septic systems (serves one or more single-family homes)	R2	R2-20	B	Very Low		Near Windy Circle	3	

Septic systems (serves one or more single-family homes)	R2	R2-21	B	Very Low		Near Windy Circle	3	
Septic systems (serves one or more single-family homes)	R2	R2-22	B	Very Low		Near Windy Circle	3	
Septic systems (serves one or more single-family homes)	R2	R2-23	B	Very Low		Along Huffman Drive	3	
Septic systems (serves one or more single-family homes)	R2	R2-24	B	Very Low		Along Huffman Drive	3	
Septic systems (serves one or more single-family homes)	R2	R2-25	B	Very Low		Along Huffman Drive	3	
Septic systems (serves one or more single-family homes)	R2	R2-26	B	Very Low		Along Huffman Road	3	
Septic systems (serves one or more single-family homes)	R2	R2-27	B	Very Low		Along Huffman Road	3	
Septic systems (serves one or more single-family homes)	R2	R2-28	B	Very Low		Along Huffman Drive	3	
Septic systems (serves one or more single-family homes)	R2	R2-29	B	Very Low		Along Benjamin Road	3	
Septic systems (serves one or more single-family homes)	R2	R2-30	B	Very Low		Along Benjamin Road	3	
Septic systems (serves one or more single-family homes)	R2	R2-31	B	Very Low		Along Huffman Drive	3	
Septic systems (serves one or more single-family homes)	R2	R2-32	B	Very Low		Along Huffman Drive	3	
Septic systems (serves one or more single-family homes)	R2	R2-33	B	Very Low		Along Huffman Drive	3	
Septic systems (serves one or more single-family homes)	R2	R2-34	B	Very Low		Along Huffman Drive	3	
Septic systems (serves one or more single-family homes)	R2	R2-35	B	Very Low		Near Graiff Street	3	
Septic systems (serves one or more single-family homes)	R2	R2-7	B	Very Low		Along Cottontail Drive	3	
Septic systems (serves one or more single-family homes)	R2	R2-8	B	Very Low		Along Cottontail Drive	3	
Septic systems (serves one or more single-family homes)	R2	R2-9	B	Very Low		Near Cottontail Drive	3	
Highways and roads, paved (cement or asphalt)	X20	X20-10	B	Very Low		Ridge Place	2	
Highways and roads, paved (cement or asphalt)	X20	X20-3	B	Very Low		Cottontail Drive	2	
Highways and roads, paved (cement or asphalt)	X20	X20-4	B	Very Low		Huffman Road	2	
Highways and roads, paved (cement or asphalt)	X20	X20-5	B	Very Low		Windy Circle	2	
Highways and roads, paved (cement or asphalt)	X20	X20-6	B	Very Low		Turks Turn	2	
Highways and roads, paved (cement or asphalt)	X20	X20-7	B	Very Low		Graiff Street	2	
Highways and roads, paved (cement or asphalt)	X20	X20-8	B	Very Low		Huffman Road	2	
Highways and roads, paved (cement or asphalt)	X20	X20-9	B	Very Low		Benjamin Road	2	

Residential Areas	R01	R1-3	C	Low		Residential areas located within Zone C	4	123 Acres of residential area located within Zone C
Septic systems (serves one or more single-family homes)	R2	R2-36-107	C	Very Low		Septic systems located within Zone C	4	
Highways and roads, paved (cement or asphalt)	X20	X20-11- 15	C	Very Low		Paved roads within Zone C	4	
Highways and roads, dirt/gravel	X24	X24-1-5	C	Very Low		Dirt or gravel roads within Zone C	4	
Dog walking areas/foot trails	X46	X46-4	C	Low		Trail along Ginami Street	4	
Dog walking areas/foot trails	X46	X46-5	C	Low		Trail along Sultana Drive	4	

Table 3

Contaminant Source Inventory and Risk Ranking for
Chapel of The Cross
Sources of Nitrates/Nitrites

PWSID 217259.001

Contaminant Source Type	Contaminant Source ID	CS ID Tag	Zone	Risk Ranking for Analysis	Overall Rank After Analysis	Location	Map Number	Comments
Livestock stables/corrals	A09	A9-1	A	Medium	1	Horse stables located off of Hillside Drive	2	
Septic systems (serves one or more single-family homes)	R2	R2-1	A	Low	2	Along Holman Ave.	3	
Septic systems (serves one or more single-family homes)	R2	R2-2	A	Low	3	Along Holman Ave.	3	
Residential Areas	R01	R1-1	A	Low	4	Residential areas located within Zone A	2	1.5 Acres of residential area located within Zone A
Septic systems (serves one or more single-family homes)	R2	R2-4	B	Very Low	5	Along Hillside Drive	3	
Septic systems (serves one or more single-family homes)	R2	R2-5	B	Very Low	6	Along Huffman Road	3	
Septic systems (serves one or more single-family homes)	R2	R2-6	B	Very Low	7	Along Huffman Road	3	
Dog walking areas/foot trails	X46	X46-1	A	Low	8	Trail along west side of Hillside Drive	2	
Dog walking areas/foot trails	X46	X46-3	B	Low	9	Trail along Huffman Road	2	
Residential Areas	R01	R1-2	B	Low	10	Residential areas located within Zone B	2	37 Arcres of residential area located within Zone B
Septic systems (serves one or more single-family homes)	R2	R2-3	A	Low		Along Hillside Drive	3	
Highways and roads, paved (cement or asphalt)	X20	X20-1	A	Very Low		Holman Ave.	2	
Highways and roads, paved (cement or asphalt)	X20	X20-2	A	Very Low		Hillside Drive	2	
Dog walking areas/foot trails	X46	X46-29	A	Low		Trail along east side of Hillside Drive	2	
Septic systems (serves one or more single-family homes)	R2	R2-10	B	Very Low		Near Windy Circle	3	
Septic systems (serves one or more single-family homes)	R2	R2-11	B	Very Low		Along Windy Circle	3	
Septic systems (serves one or more single-family homes)	R2	R2-12	B	Very Low		Along Windy Circle	3	
Septic systems (serves one or more single-family homes)	R2	R2-13	B	Very Low		Along Cottontail Drive	3	
Septic systems (serves one or more single-family homes)	R2	R2-14	B	Very Low		Along Hillside Drive	3	
Septic systems (serves one or more single-family homes)	R2	R2-15	B	Very Low		Along Windy Circle	3	
Septic systems (serves one or more single-family homes)	R2	R2-16	B	Very Low		Along Windy Circle	3	
Septic systems (serves one or more single-family homes)	R2	R2-17	B	Very Low		Along Windy Circle	3	
Septic systems (serves one or more single-family homes)	R2	R2-18	B	Very Low		Along Graiff Street	3	

Septic systems (serves one or more single-family homes)	R2	R2-19	B	Very Low		Along Graiff Street	3	
Septic systems (serves one or more single-family homes)	R2	R2-20	B	Very Low		Near Windy Circle	3	
Septic systems (serves one or more single-family homes)	R2	R2-21	B	Very Low		Near Windy Circle	3	
Septic systems (serves one or more single-family homes)	R2	R2-22	B	Very Low		Near Windy Circle	3	
Septic systems (serves one or more single-family homes)	R2	R2-23	B	Very Low		Along Huffman Drive	3	
Septic systems (serves one or more single-family homes)	R2	R2-24	B	Very Low		Along Huffman Drive	3	
Septic systems (serves one or more single-family homes)	R2	R2-25	B	Very Low		Along Huffman Drive	3	
Septic systems (serves one or more single-family homes)	R2	R2-26	B	Very Low		Along Huffman Road	3	
Septic systems (serves one or more single-family homes)	R2	R2-27	B	Very Low		Along Huffman Road	3	
Septic systems (serves one or more single-family homes)	R2	R2-28	B	Very Low		Along Huffman Drive	3	
Septic systems (serves one or more single-family homes)	R2	R2-29	B	Very Low		Along Benjamin Road	3	
Septic systems (serves one or more single-family homes)	R2	R2-30	B	Very Low		Along Benjamin Road	3	
Septic systems (serves one or more single-family homes)	R2	R2-31	B	Very Low		Along Huffman Drive	3	
Septic systems (serves one or more single-family homes)	R2	R2-32	B	Very Low		Along Huffman Drive	3	
Septic systems (serves one or more single-family homes)	R2	R2-33	B	Very Low		Along Huffman Drive	3	
Septic systems (serves one or more single-family homes)	R2	R2-34	B	Very Low		Along Huffman Drive	3	
Septic systems (serves one or more single-family homes)	R2	R2-35	B	Very Low		Near Graiff Street	3	
Septic systems (serves one or more single-family homes)	R2	R2-7	B	Very Low		Along Cottontail Drive	3	
Septic systems (serves one or more single-family homes)	R2	R2-8	B	Very Low		Along Cottontail Drive	3	
Septic systems (serves one or more single-family homes)	R2	R2-9	B	Very Low		Near Cottontail Drive	3	
Highways and roads, paved (cement or asphalt)	X20	X20-10	B	Very Low		Ridge Place	2	
Highways and roads, paved (cement or asphalt)	X20	X20-3	B	Very Low		Cottontail Drive	2	
Highways and roads, paved (cement or asphalt)	X20	X20-4	B	Very Low		Huffman Road	2	
Highways and roads, paved (cement or asphalt)	X20	X20-5	B	Very Low		Windy Circle	2	

Highways and roads, paved (cement or asphalt)	X20	X20-6	B	Very Low		Turks Turn	2	
Highways and roads, paved (cement or asphalt)	X20	X20-7	B	Very Low		Graiff Street	2	
Highways and roads, paved (cement or asphalt)	X20	X20-8	B	Very Low		Huffman Road	2	
Highways and roads, paved (cement or asphalt)	X20	X20-9	B	Very Low		Benjamin Road	2	
Residential Areas	R01	R1-3	C	Low		Residential areas located within Zone C	4	123 Acres of residential area located within Zone C
Septic systems (serves one or more single-family homes)	R2	R2-36-107	C	Very Low		Septic systems located within Zone C	4	
Highways and roads, paved (cement or asphalt)	X20	X20-11- 15	C	Very Low		Paved roads within Zone C	4	
Highways and roads, dirt/gravel	X24	X24-1-5	C	Very Low		Dirt or gravel roads within Zone C	4	
Dog walking areas/foot trails	X46	X46-4	C	Low		Trail along Ginami Street	4	
Dog walking areas/foot trails	X46	X46-5	C	Low		Trail along Sultana Drive	4	

Table 4

Contaminant Source Inventory and Risk Ranking for
Chapel of The Cross
Sources of Volatile Organic Chemicals

PWSID 217259.001

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	X20-1	A	Low	1	Holman Ave.	2	
Highways and roads, paved (cement or asphalt)	X20	X20-2	A	Low	2	Hillside Drive	2	
Residential Areas	R01	R1-1	A	Low	3	Residential areas located within Zone A	2	1.5 Acres of residential area located within Zone A
Septic systems (serves one or more single-family homes)	R2	R2-1	A	Low	4	Along Holman Ave.	3	
Septic systems (serves one or more single-family homes)	R2	R2-2	A	Low	5	Along Holman Ave.	3	
Septic systems (serves one or more single-family homes)	R2	R2-3	A	Low	6	Along Hillside Drive	3	
Public utility easements/corridors	X42	X42-1	B	Low	7	with public utlity easement intersecting	2	
Septic systems (serves one or more single-family homes)	R2	R2-4	B	Very Low	8	Along Hillside Drive	3	
Highways and roads, paved (cement or asphalt)	X20	X20-3	B	Low	9	Cottontail Drive	2	
Septic systems (serves one or more single-family homes)	R2	R2-7	B	Very Low	10	Along Cottontail Drive	3	
Residential Areas	R01	R1-2	B	Low		Residential areas located within Zone B	2	37 Arcres of residential area located within Zone B
Septic systems (serves one or more single-family homes)	R2	R2-10	B	Very Low		Near Windy Circle	3	
Septic systems (serves one or more single-family homes)	R2	R2-11	B	Very Low		Along Windy Circle	3	
Septic systems (serves one or more single-family homes)	R2	R2-12	B	Very Low		Along Windy Circle	3	
Septic systems (serves one or more single-family homes)	R2	R2-13	B	Very Low		Along Cottontail Drive	3	
Septic systems (serves one or more single-family homes)	R2	R2-14	B	Very Low		Along Hillside Drive	3	
Septic systems (serves one or more single-family homes)	R2	R2-15	B	Very Low		Along Windy Circle	3	
Septic systems (serves one or more single-family homes)	R2	R2-16	B	Very Low		Along Windy Circle	3	
Septic systems (serves one or more single-family homes)	R2	R2-17	B	Very Low		Along Windy Circle	3	
Septic systems (serves one or more single-family homes)	R2	R2-18	B	Very Low		Along Graiff Street	3	
Septic systems (serves one or more single-family homes)	R2	R2-19	B	Very Low		Along Graiff Street	3	
Septic systems (serves one or more single-family homes)	R2	R2-20	B	Very Low		Near Windy Circle	3	
Septic systems (serves one or more single-family homes)	R2	R2-21	B	Very Low		Near Windy Circle	3	

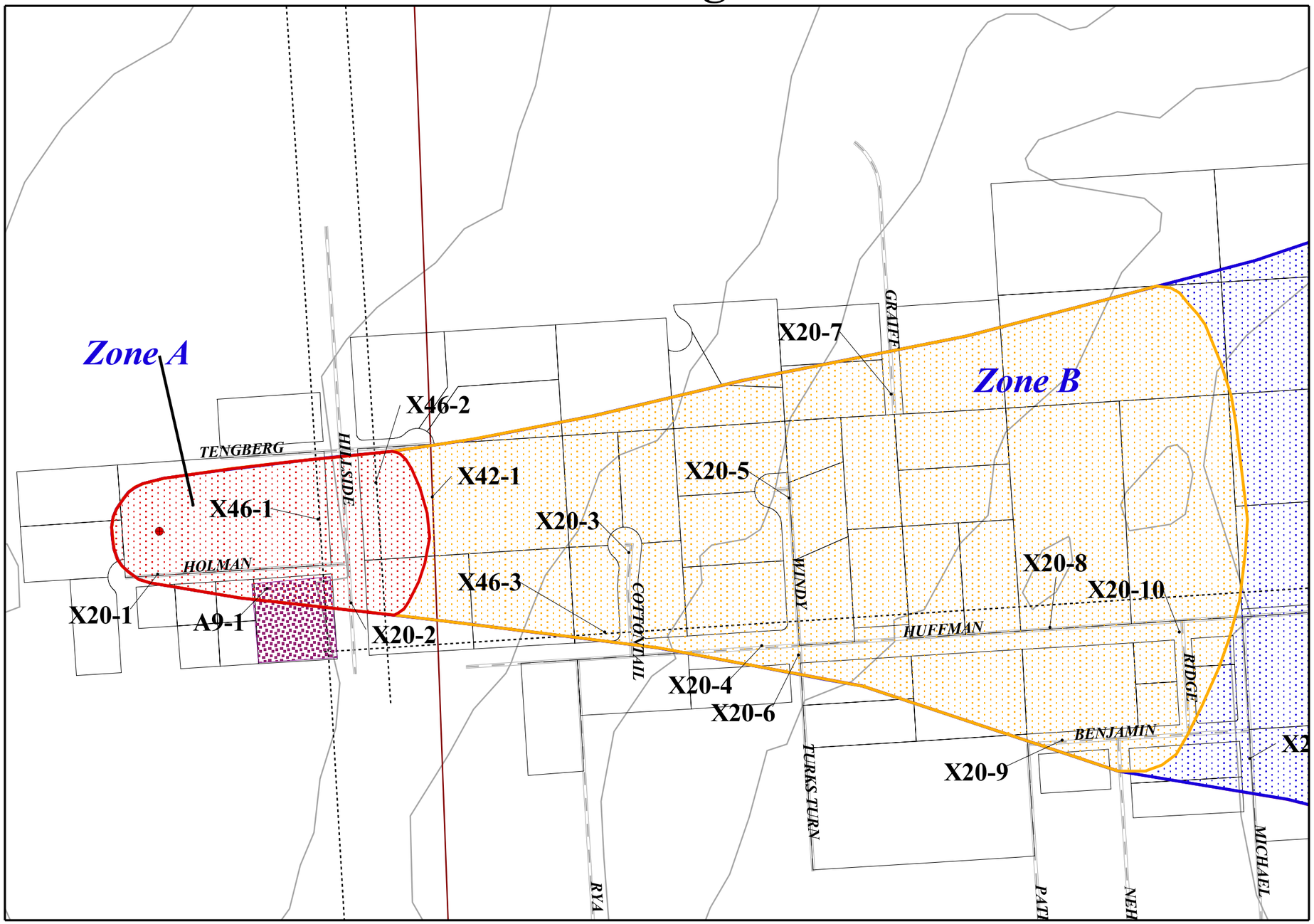
Septic systems (serves one or more single-family homes)	R2	R2-22	B	Very Low		Near Windy Circle	3	
Septic systems (serves one or more single-family homes)	R2	R2-23	B	Very Low		Along Huffman Drive	3	
Septic systems (serves one or more single-family homes)	R2	R2-24	B	Very Low		Along Huffman Drive	3	
Septic systems (serves one or more single-family homes)	R2	R2-25	B	Very Low		Along Huffman Drive	3	
Septic systems (serves one or more single-family homes)	R2	R2-26	B	Very Low		Along Huffman Road	3	
Septic systems (serves one or more single-family homes)	R2	R2-27	B	Very Low		Along Huffman Road	3	
Septic systems (serves one or more single-family homes)	R2	R2-28	B	Very Low		Along Huffman Drive	3	
Septic systems (serves one or more single-family homes)	R2	R2-29	B	Very Low		Along Benjamin Road	3	
Septic systems (serves one or more single-family homes)	R2	R2-30	B	Very Low		Along Benjamin Road	3	
Septic systems (serves one or more single-family homes)	R2	R2-31	B	Very Low		Along Huffman Drive	3	
Septic systems (serves one or more single-family homes)	R2	R2-32	B	Very Low		Along Huffman Drive	3	
Septic systems (serves one or more single-family homes)	R2	R2-33	B	Very Low		Along Huffman Drive	3	
Septic systems (serves one or more single-family homes)	R2	R2-34	B	Very Low		Along Huffman Drive	3	
Septic systems (serves one or more single-family homes)	R2	R2-35	B	Very Low		Near Graiff Street	3	
Septic systems (serves one or more single-family homes)	R2	R2-5	B	Very Low		Along Huffman Road	3	
Septic systems (serves one or more single-family homes)	R2	R2-6	B	Very Low		Along Huffman Road	3	
Septic systems (serves one or more single-family homes)	R2	R2-8	B	Very Low		Along Cottontail Drive	3	
Septic systems (serves one or more single-family homes)	R2	R2-9	B	Very Low		Near Cottontail Drive	3	
Highways and roads, paved (cement or asphalt)	X20	X20-10	B	Low		Ridge Place	2	
Highways and roads, paved (cement or asphalt)	X20	X20-4	B	Low		Huffman Road	2	
Highways and roads, paved (cement or asphalt)	X20	X20-5	B	Low		Windy Circle	2	
Highways and roads, paved (cement or asphalt)	X20	X20-6	B	Low		Turks Turn	2	
Highways and roads, paved (cement or asphalt)	X20	X20-7	B	Low		Graiff Street	2	
Highways and roads, paved (cement or asphalt)	X20	X20-8	B	Low		Huffman Road	2	

Highways and roads, paved (cement or asphalt)	X20	X20-9	B	Low		Benjamin Road	2	
Residential Areas	R01	R1-3	C	Low		Residential areas located within Zone C	4	123 Acres of residential area located within Zone C
Septic systems (serves one or more single-family homes)	R2	R2-36-107	C	Very Low		Septic systems located within Zone C	4	
Highways and roads, paved (cement or asphalt)	X20	X20-11- 15	C	Low		Paved roads within Zone C	4	
Highways and roads, dirt/gravel	X24	X24-1-5	C	Very Low		Dirt or gravel roads within Zone C	4	
Public utility easements/corridors	X42	X42-1	C	Low		Intersecting Zone B	2	

APPENDIX C

Chapel of The Cross'
Drinking Water Protection Area
and Potential & Existing Contaminant Sources

Drinking Water Protection Area for Chapel of The Cross and Potential & Existing Sources of Contamination



- Chapel of the Cross Well

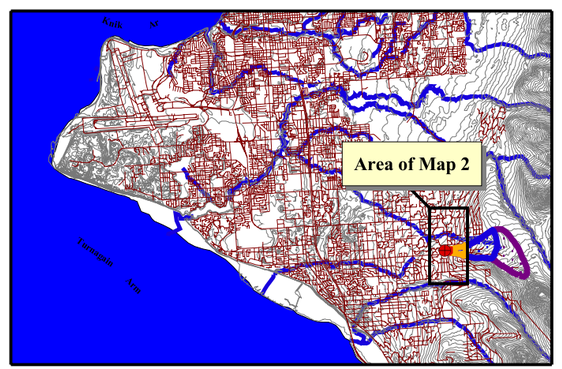
Zone A Protection Area
- Several Months Travel Time

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
- Horse stables/corrals (A9)
- MOA Land Parcels
- Roads (X20)
- Trails (X46)
- 12" Pipline (X42)
- Elevation Contours
- Anchorage Streams

N W E S

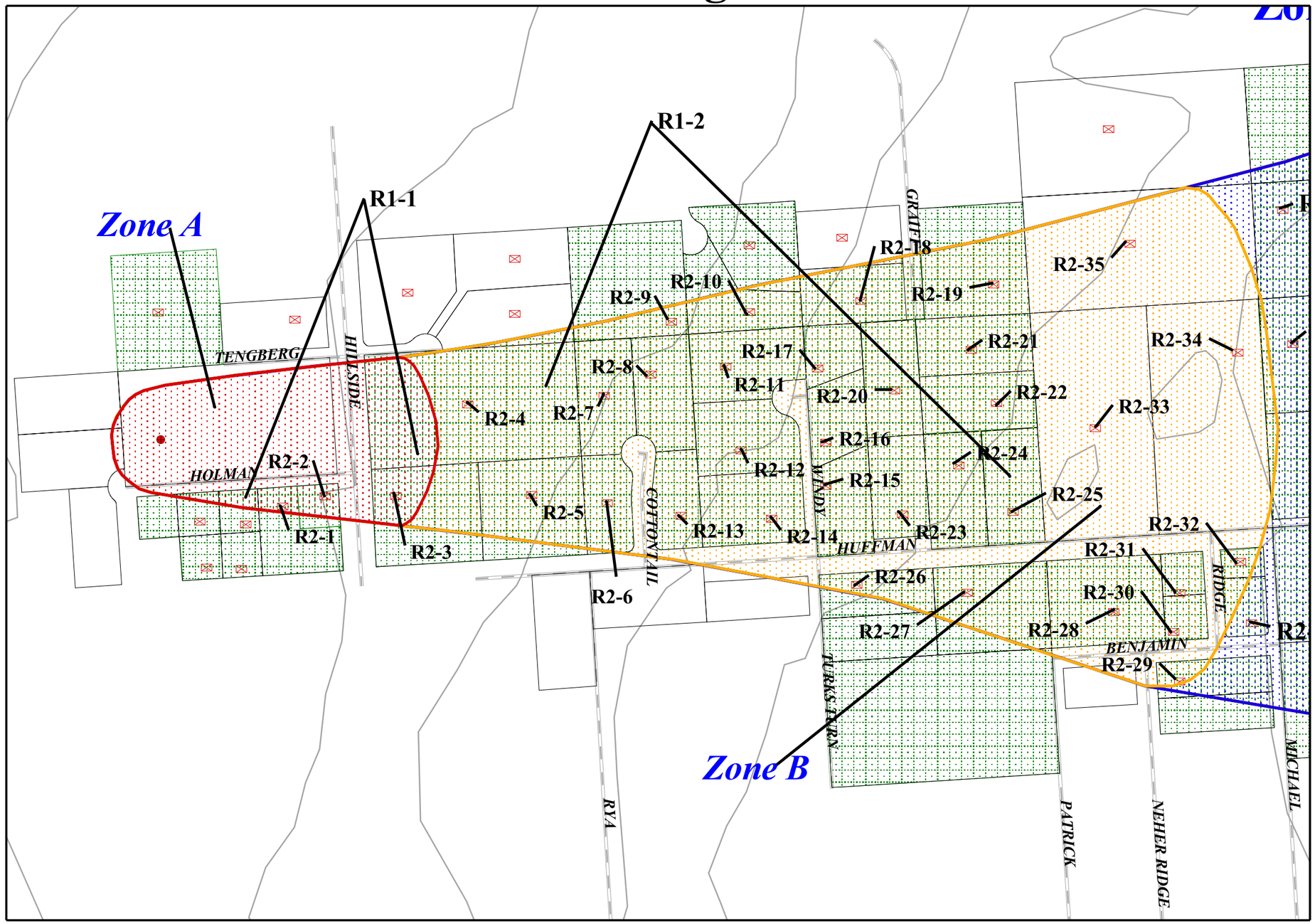


1000 0 1000 Feet

PWSID 217259.001

Map 2

Drinking Water Protection Area for Chapel of The Cross and Potential & Existing Sources of Contamination



- Chapel of the Cross Well

Zone A Protection Area
- Several Months Travel Time

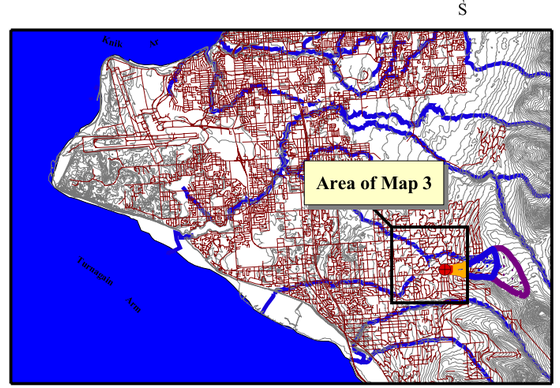
Zone B Protection Area
- Less Than 2 Years Travel Time

Zone C Protection Area
- Less Than 5 Years Travel Time

Zone D Protection Area
- Less Than 10 Years Travel Time
- MOA Land Parcels

Anchorage Land Use
- Lawns and gardens (R1)
- Septic Ssytems (R2)
- Roads (X20)
- Chugach State Park
- Anchorage Streams
- Elevation Contours

N
W E
S



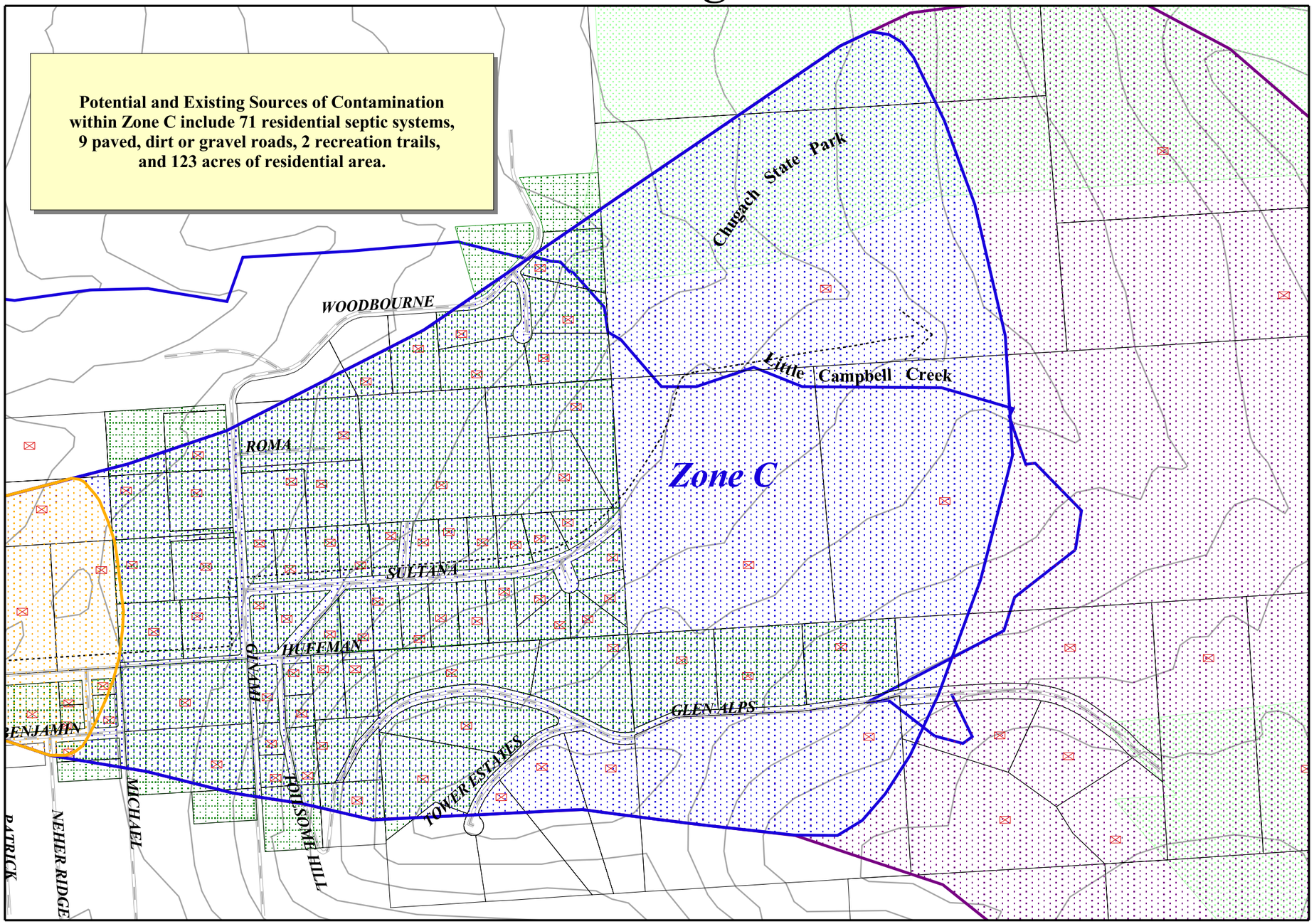
1000 0 1000 Feet

PWSID 217259.001

Map 3

Drinking Water Protection Area for Chapel of The Cross and Potential & Existing Sources of Contamination

Potential and Existing Sources of Contamination within Zone C include 71 residential septic systems, 9 paved, dirt or gravel roads, 2 recreation trails, and 123 acres of residential area.



Zone B Protection Area
- Less Than 2 Years Travel Time

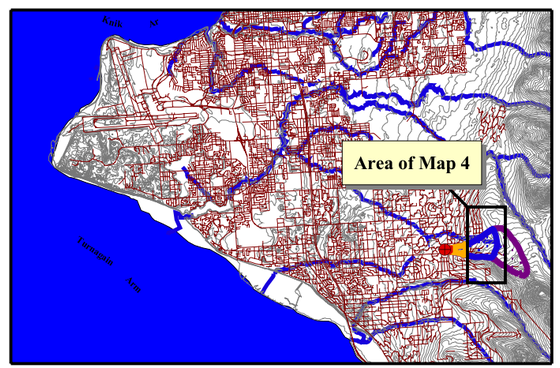
Zone C Protection Area
- Less Than 5 Years Travel Time

Zone D Protection Area
- Less Than 10 Years Travel Time

MOA Land Parcels

Anchorage Land Use
- Lawns and gardens (R1)
- Septic Ssytems (R2)
- Trails (X46)
- Roads (X20)
- Chugach State Park
- Anchorage Streams
- Elevation Contours

N
W E
S

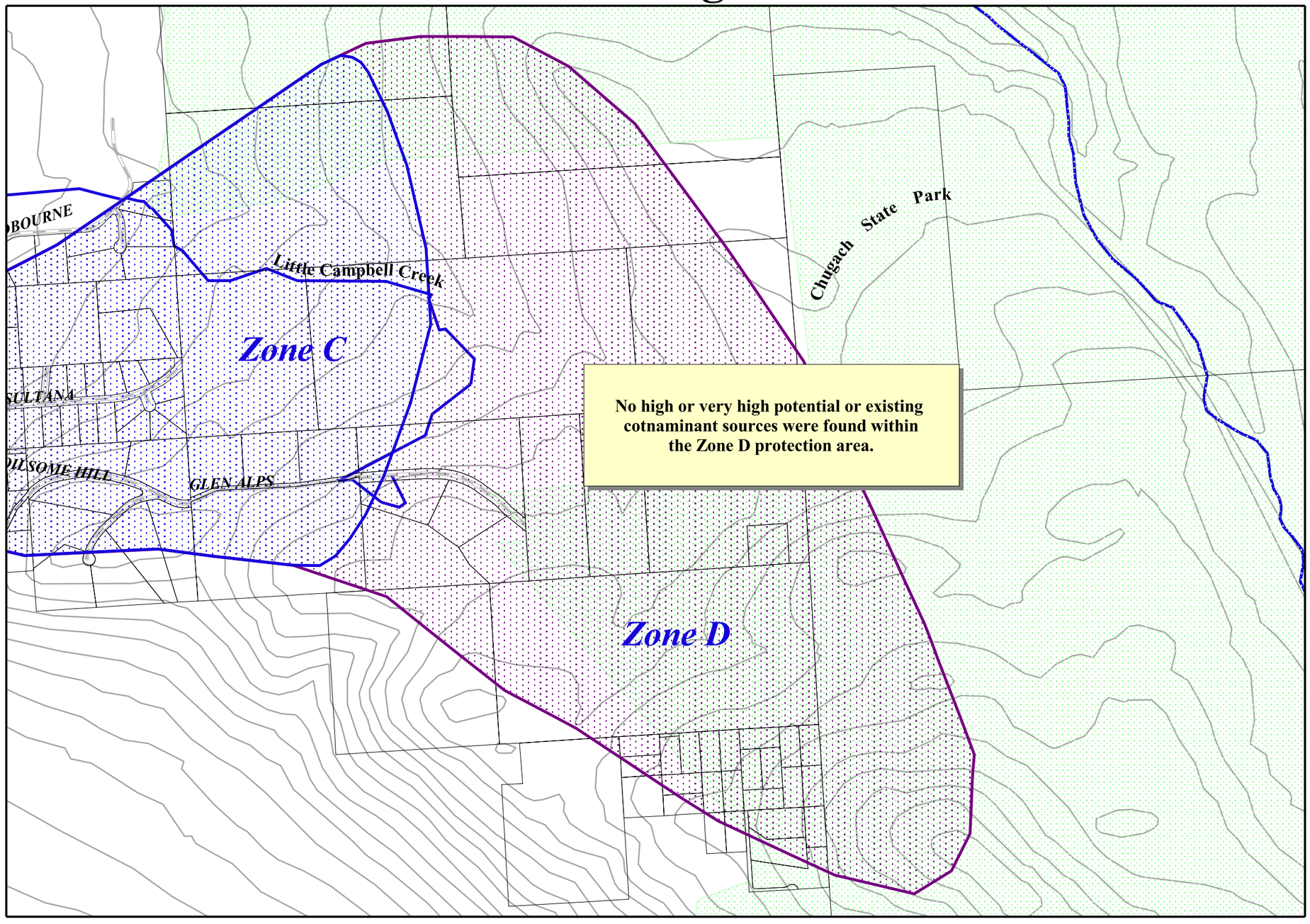


2000 0 2000 Feet

PWSID 217259.001

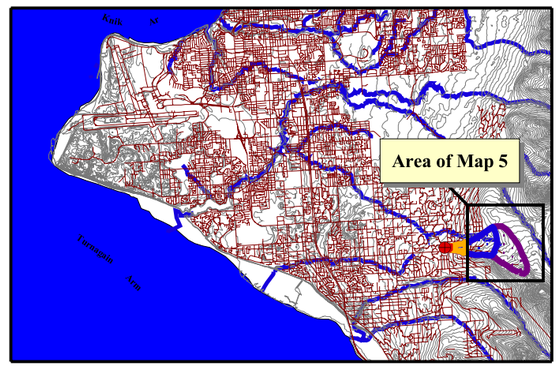
Map 4

Drinking Water Protection Area for Chapel of The Cross and Potential & Existing Sources of Contamination



Zone C Protection Area
- Less Than 5 Years Travel Time

Zone D Protection Area
- Less Than 10 Years Travel Time
- MOA Land Parcels
- Chugach State Park
- Roads (X20)
- Anchorage Streams
- Elevation Contours



3000 0 3000 Feet

PWSID 217259.001

Map 5

APPENDIX D

Vulnerability Analysis for Chapel of The Cross' Public Drinking Water Sources

Chart 1. Susceptibility of the wellhead – Chapel of the Cross

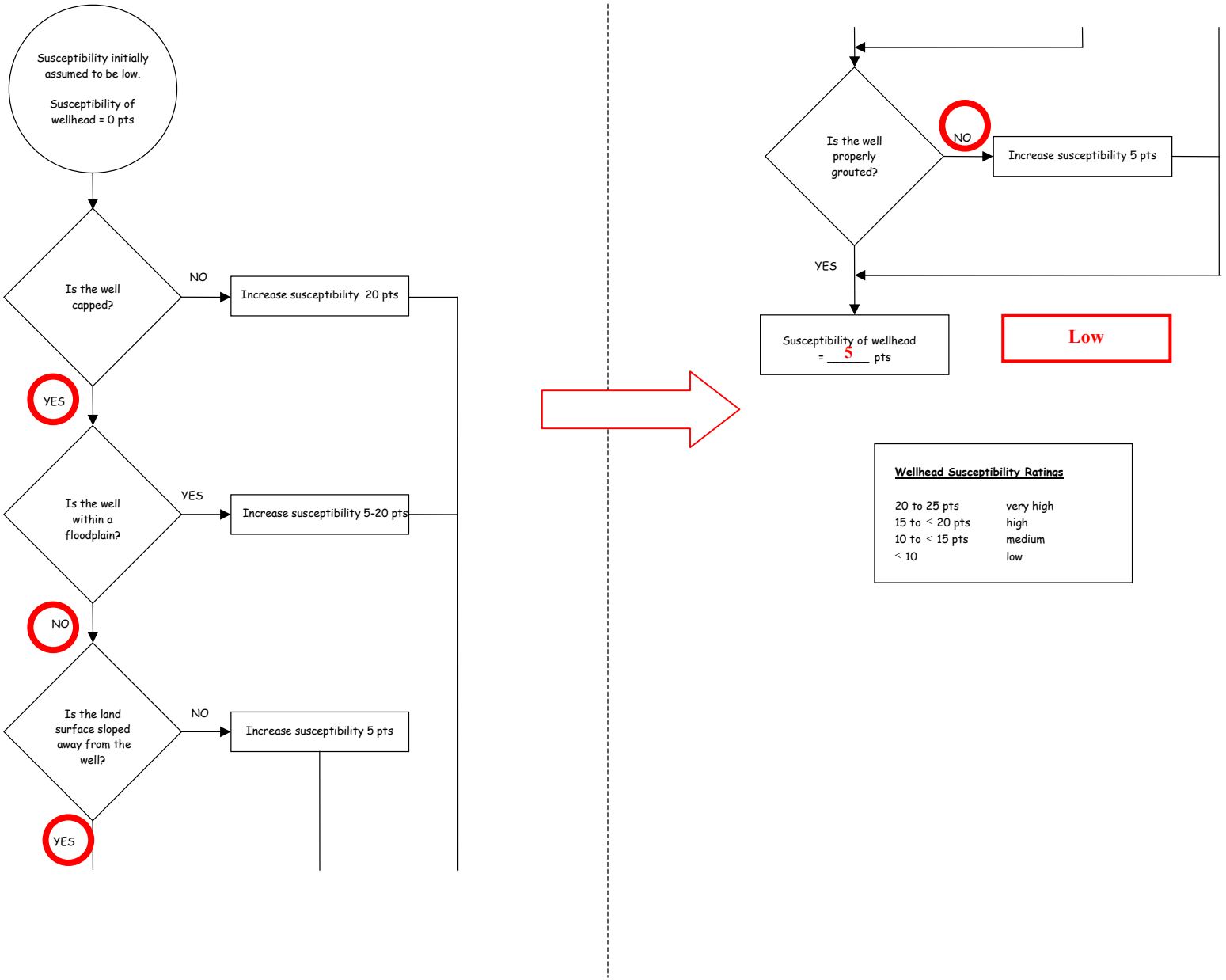
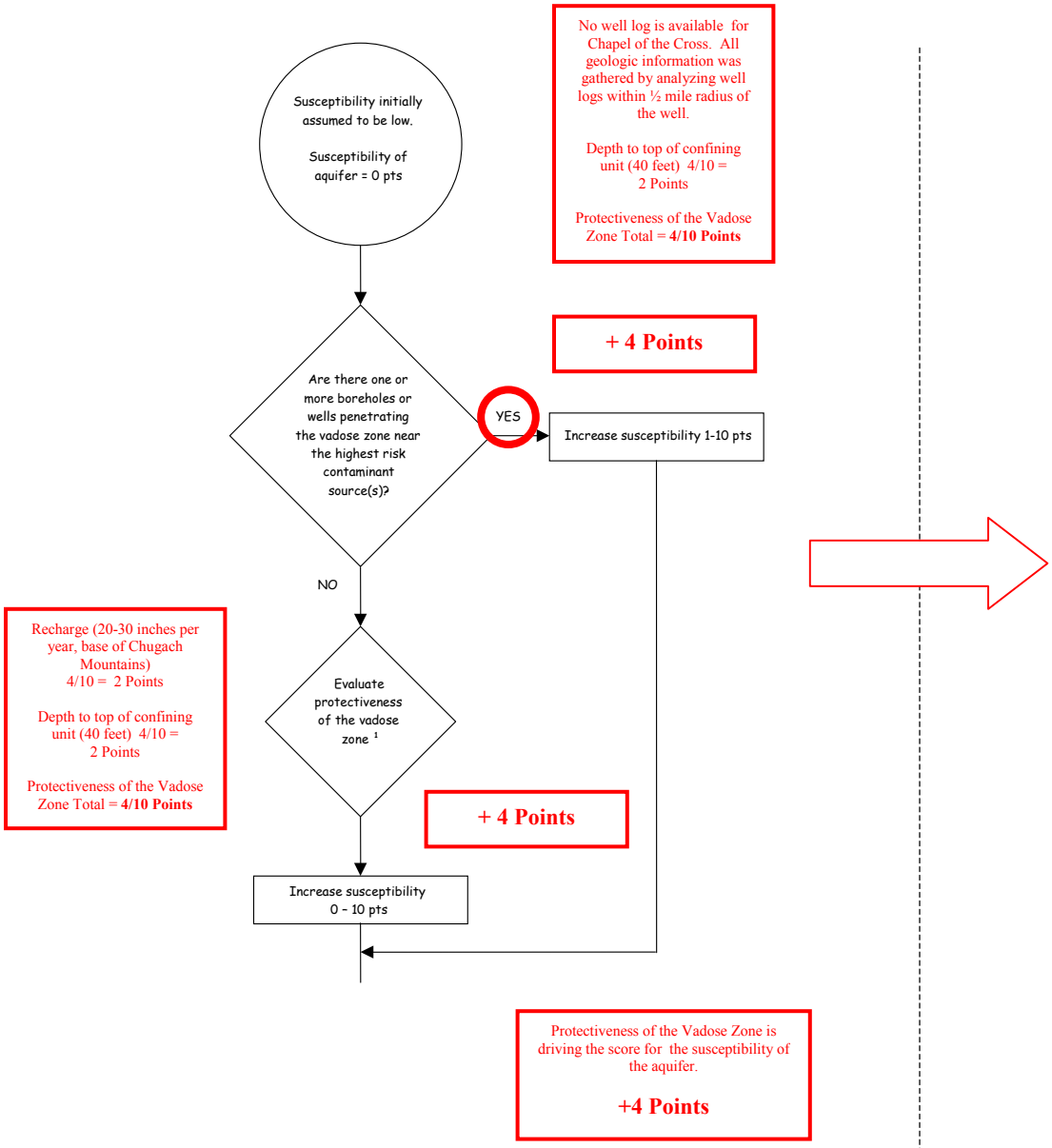


Chart 2. Susceptibility of the aquifer – Chapel of the Cross



1. **Protectiveness of the Vadose Zone**
   - net recharge (function of precipitation, slope of land surface, & permeability of soils) [0 – 10 pts; 50% weight]
   - depth to water table (unconfined aquifer) or top of confining layer (confined aquifer) [interpolate linearly: 100' – 20', 0 – 5 pts; 20' – 0', 5 – 10 pts; 50% weight]

2. **Degree of Confinement**
   - confined verses unconfined aquifer [confined: K ≤ 10^{-6} cm/s, minimum thickness of at least one layer = 20 ft, interpolate linearly 100' – 20', 0 – 10 pts; unconfined = 15 pts; 65% weight]
   - density of boreholes and wells penetrating the confining layer (confined aquifer) or the water table (unconfined aquifer) [confined: 0 – 15 pts; unconfined = 15 pts; 35% weight]

Aquifer Susceptibility Ratings

20 to 25 pts	very high
15 to < 20 pts	high
10 to < 15 pts	medium
< 10	low

Chart 3. Contaminant risks for Chapel of the Cross – Bacteria & Viruses

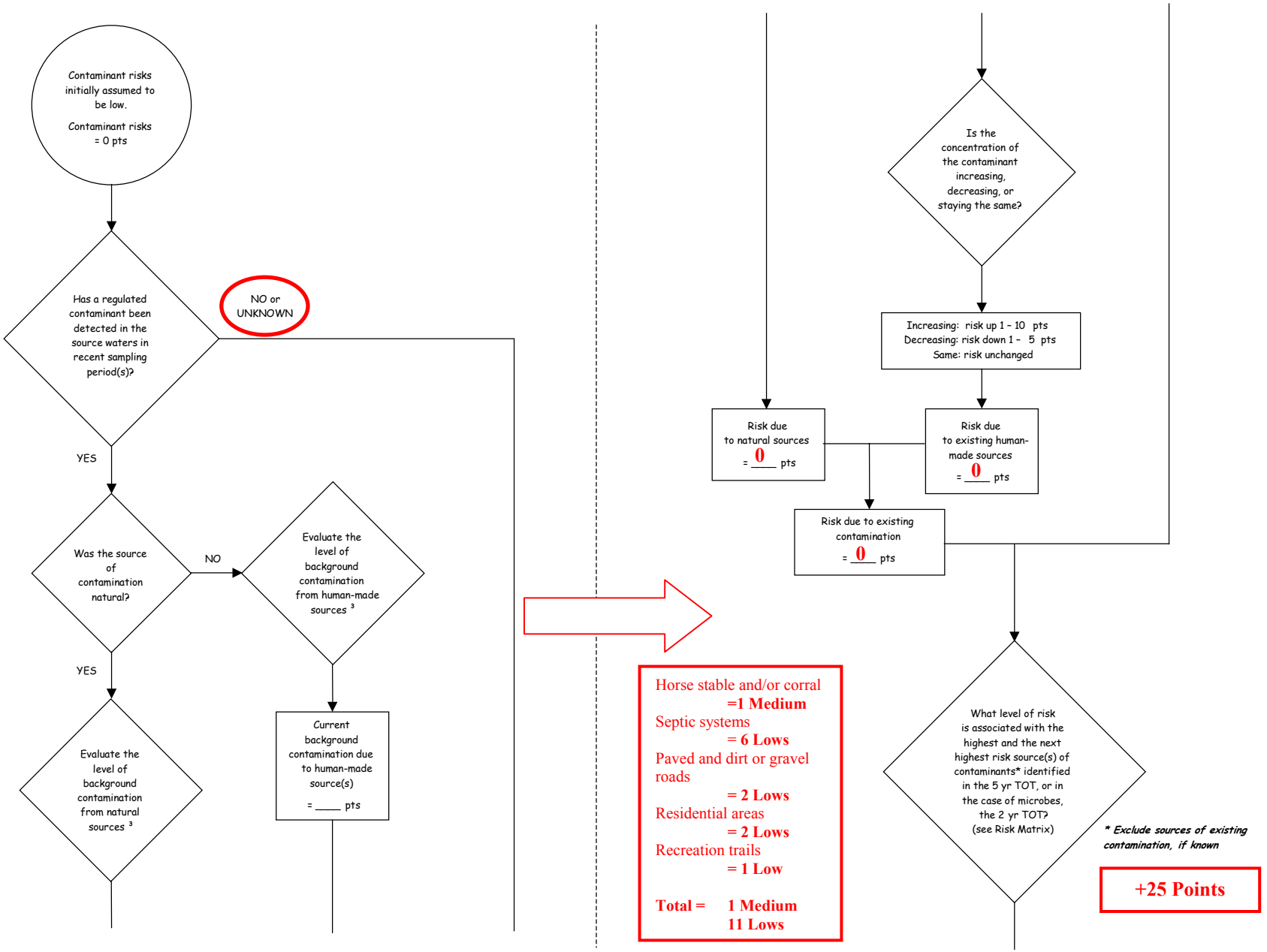


Chart 3. Contaminant risks for Chapel of the Cross – Bacteria & Viruses (Continued)

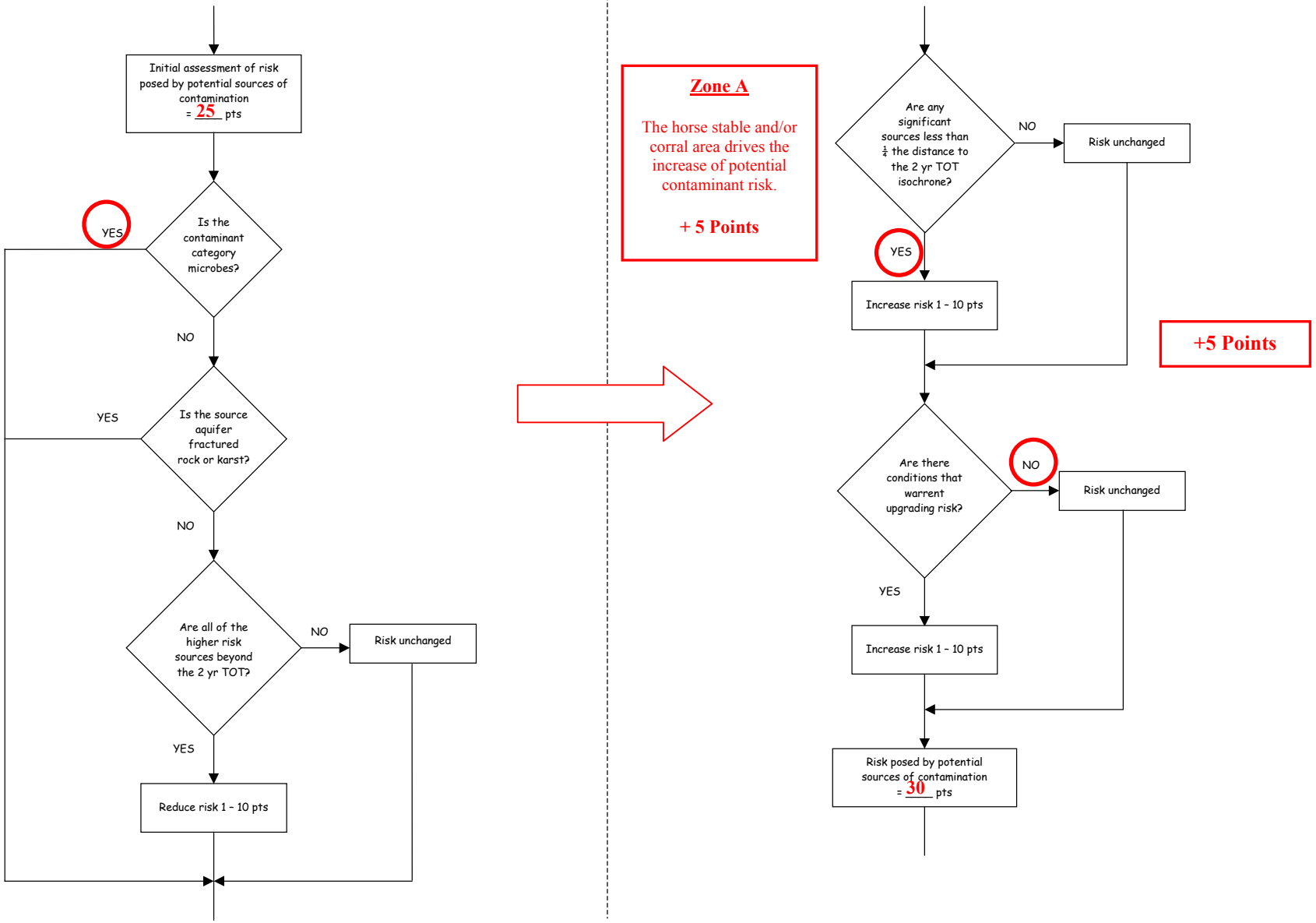
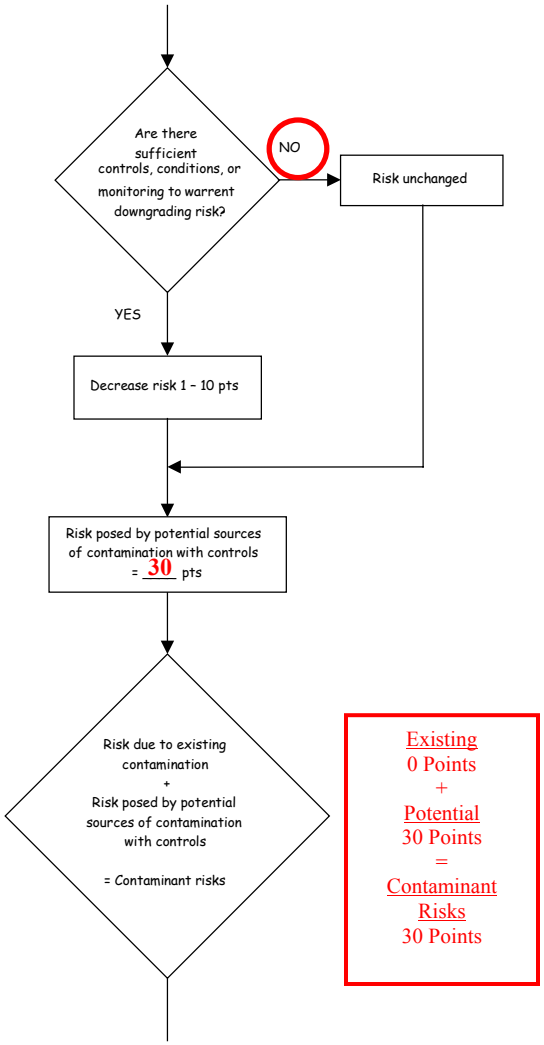
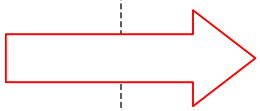
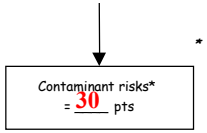


Chart 3. Contaminant risks for Chapel of the Cross – Bacteria & Viruses (Continued)



Existing
0 Points
+
Potential
30 Points
=
Contaminant Risks
30 Points





** Truncate risk at 50 pts*

High

3. Level of Background Contamination

> MCL	21 - 50 pts
0.5 MCL to < MCL	11 - 20 pts
0.2 MCL to < 0.5 MCL	6 - 10 pts
'detect' to < 0.2 MCL	0 - 5 pts

Contaminant Risk Ratings

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

Table 1. Risk Matrix for Contaminant Sources for Chapel of the Cross – Bacteria & Viruses

Level of Risk Associated with the Highest Risk Sources

Next Highest Risk Sources(s)	Horse stable and/or corral area, septic systems, paved or dirt and roads, residential areas, recreation trails	**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

Chart 4. Vulnerability analysis for Chapel of the Cross – Bacteria & Viruses

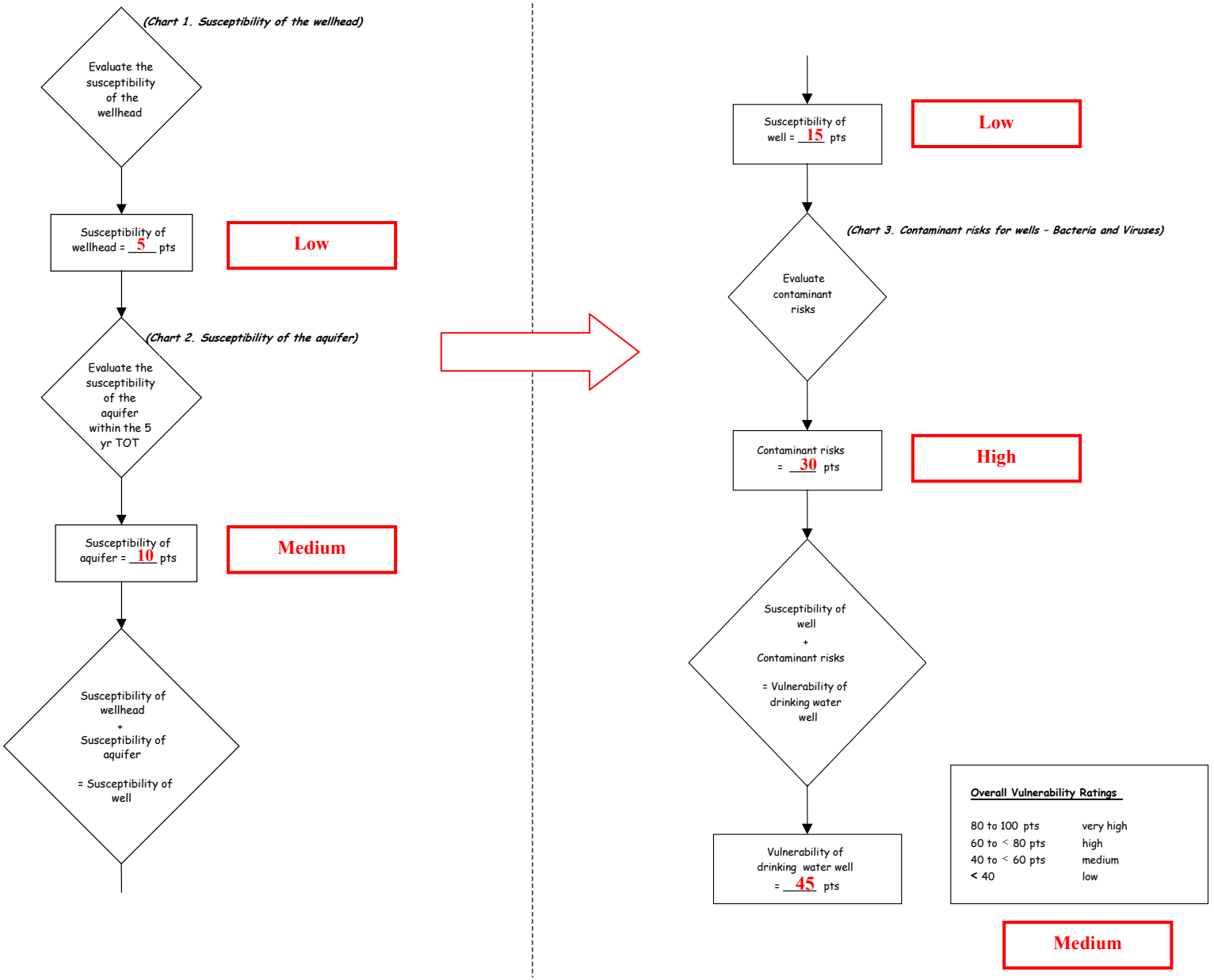


Chart 5. Contaminant risks for Chapel of the Cross – Nitrates and Nitrites

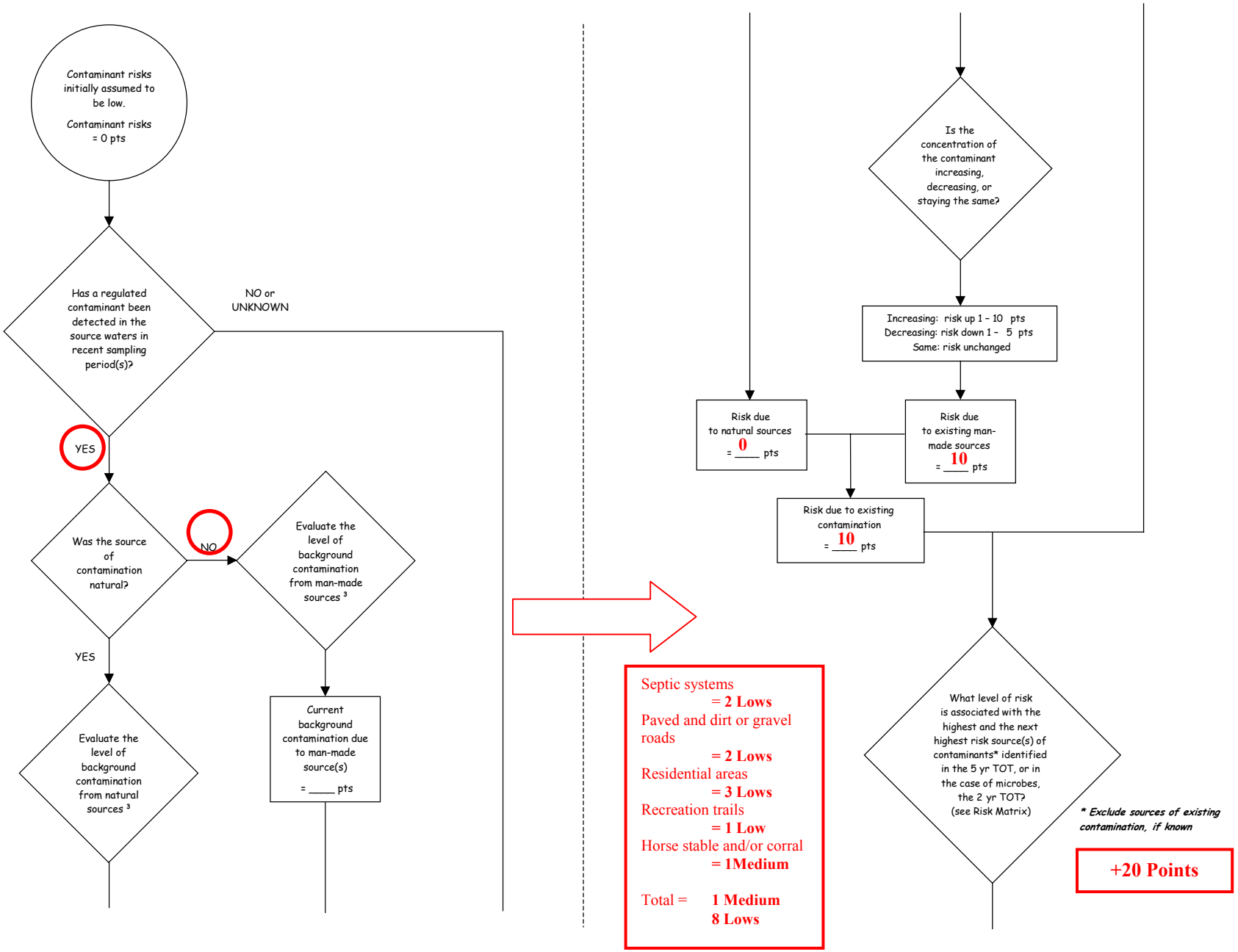


Chart 5. Contaminant risks for Chapel of the Cross – Nitrates and Nitrites (Continued)

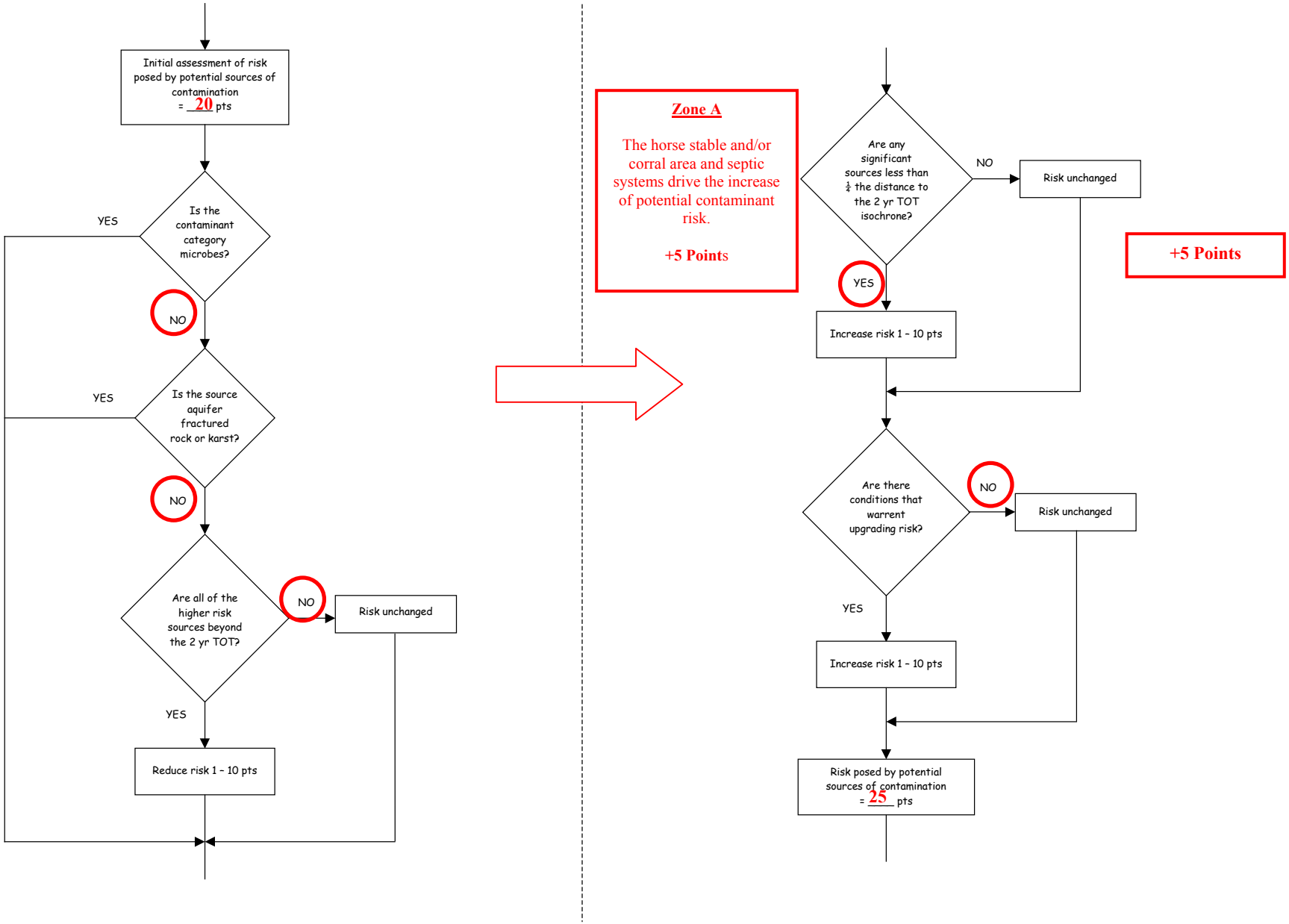
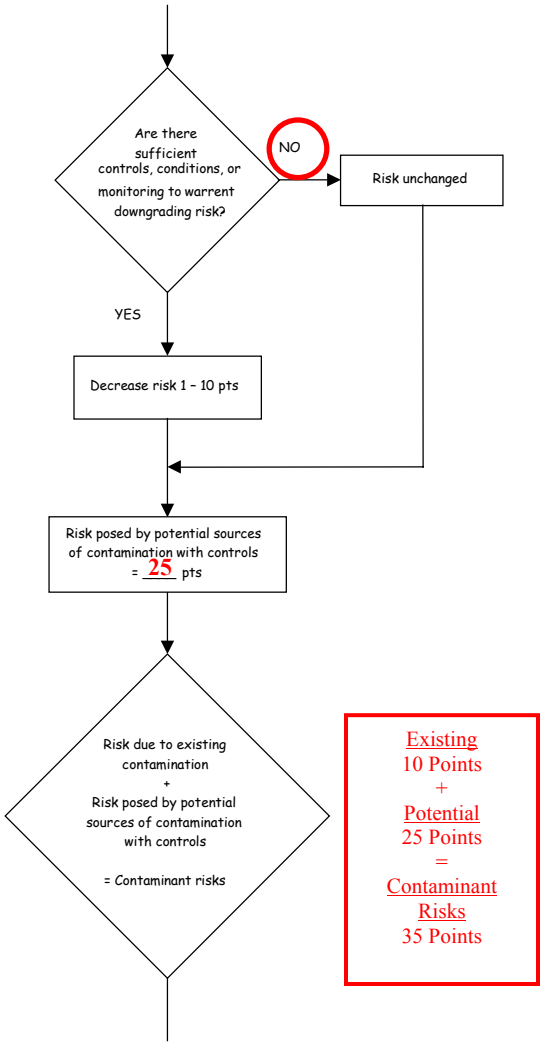
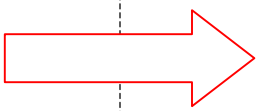


Chart 5. Contaminant risks for Chapel of the Cross – Nitrates and Nitrites (Continued)



Existing
10 Points
+
Potential
25 Points
=
Contaminant Risks
35 Points



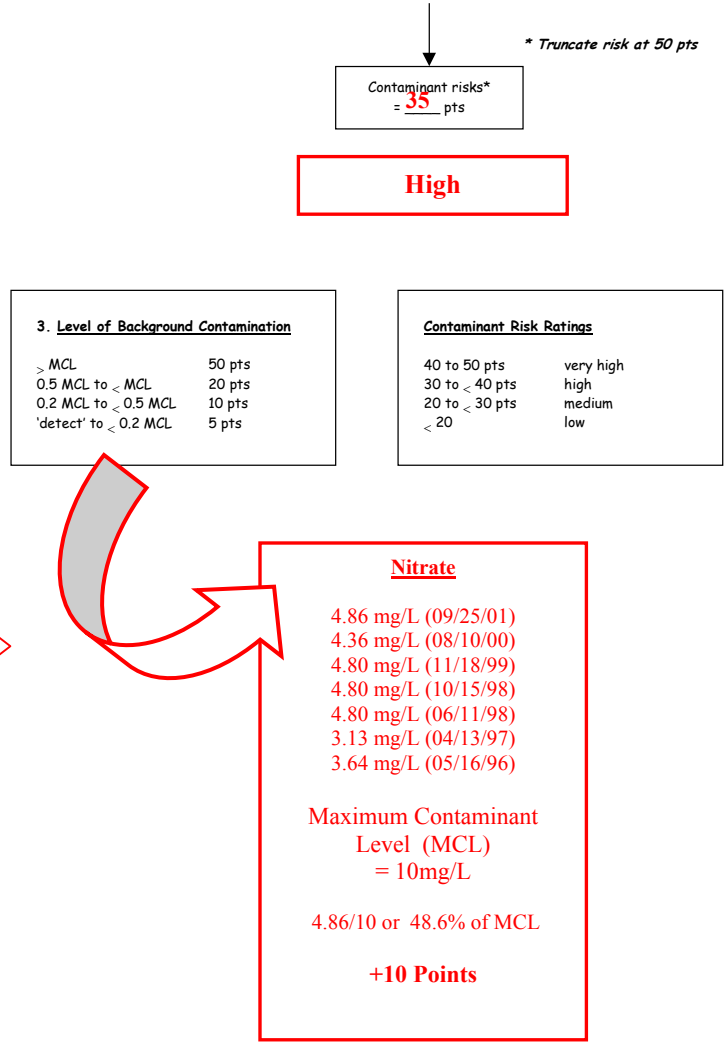


Table 2. Risk Matrix for Contaminant Sources for Chapel of the Cross – Nitrates and Nitrites

Level of Risk Associated with the Highest Risk Sources

Next Highest Risk Sources(s)	Septic systems, highways and roads, residential areas, recreation trails, horse stables/corrals	**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

Chart 6. Vulnerability analysis for Chapel of the Cross – Nitrates and Nitrites

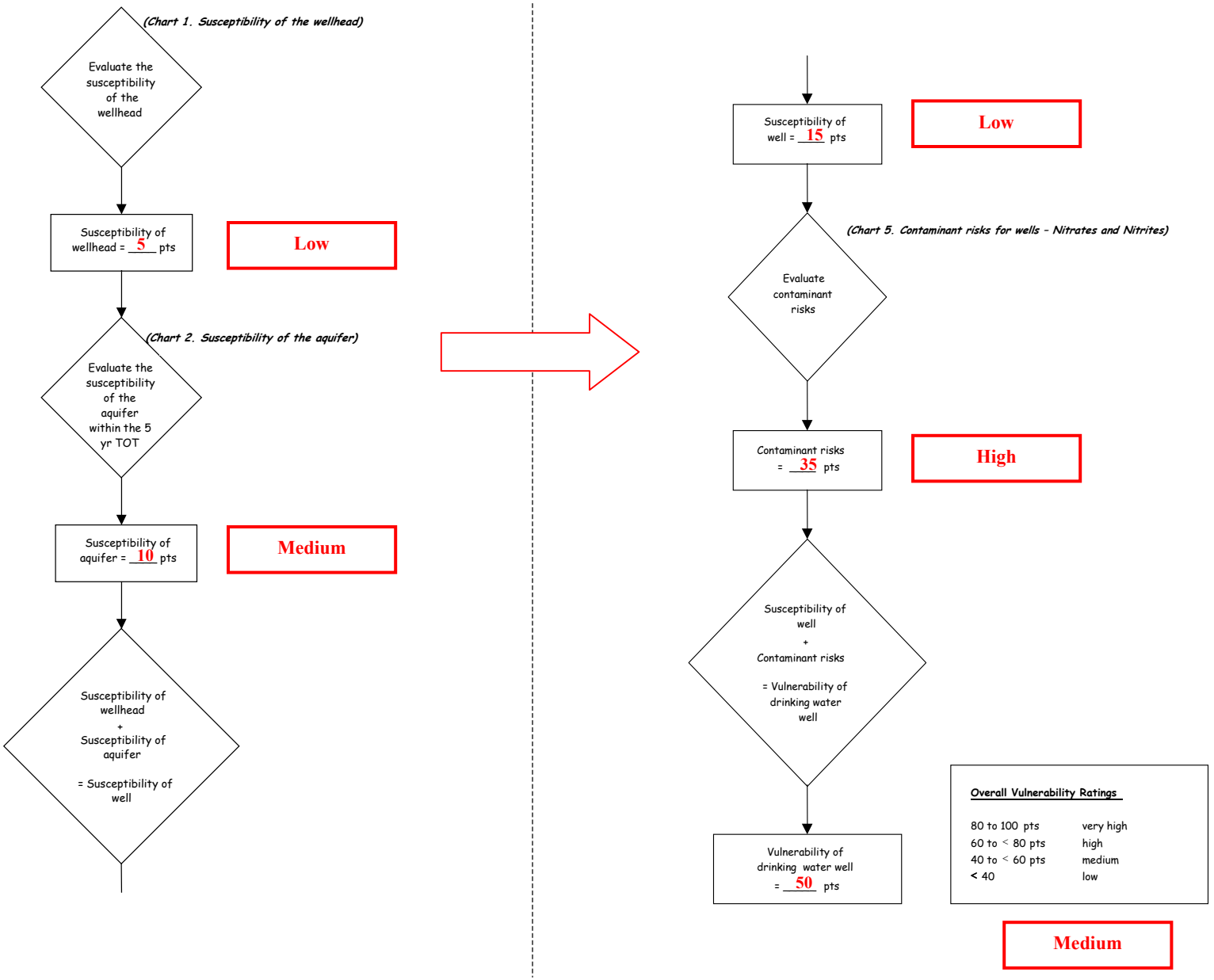


Chart 7. Contaminant risks for Chapel of the Cross – Volatile Organic Chemicals

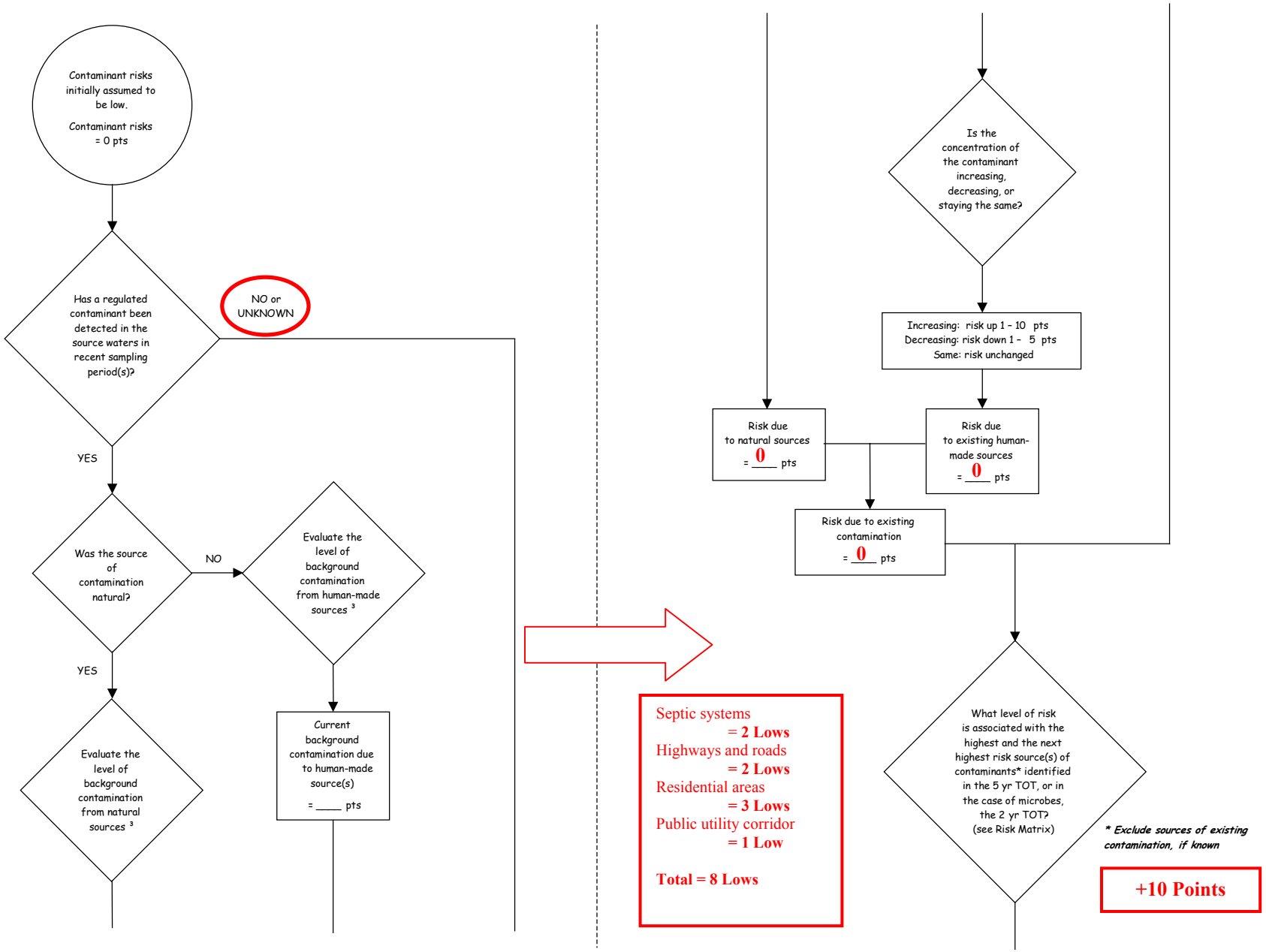
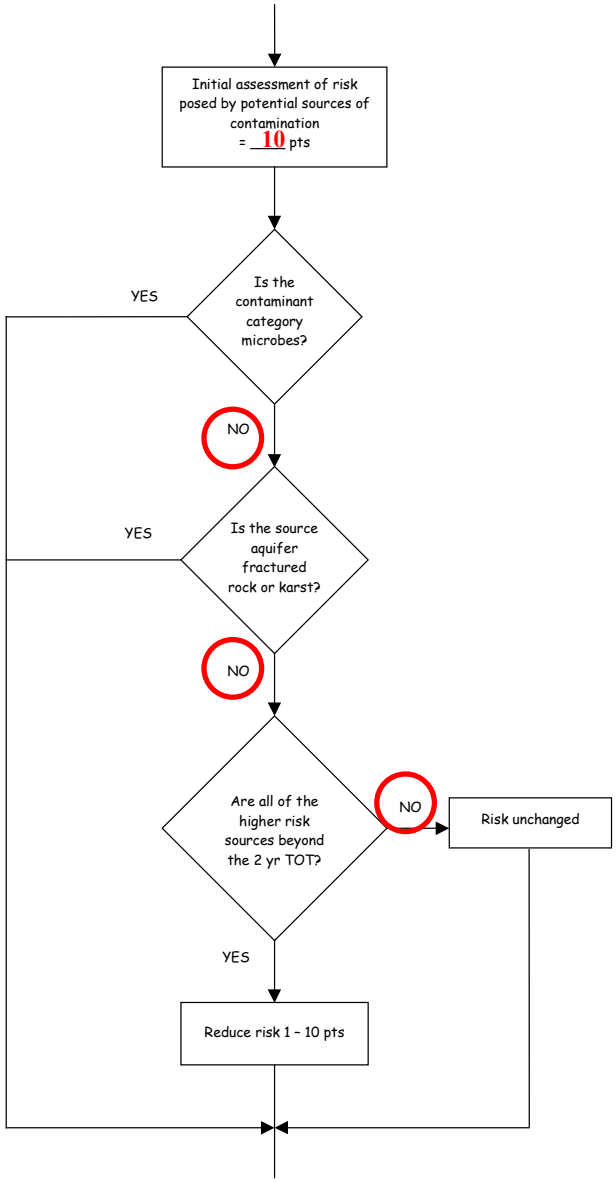


Chart 7. Contaminant risks for Chapel of the Cross – Volatile Organic Chemicals (Continued)



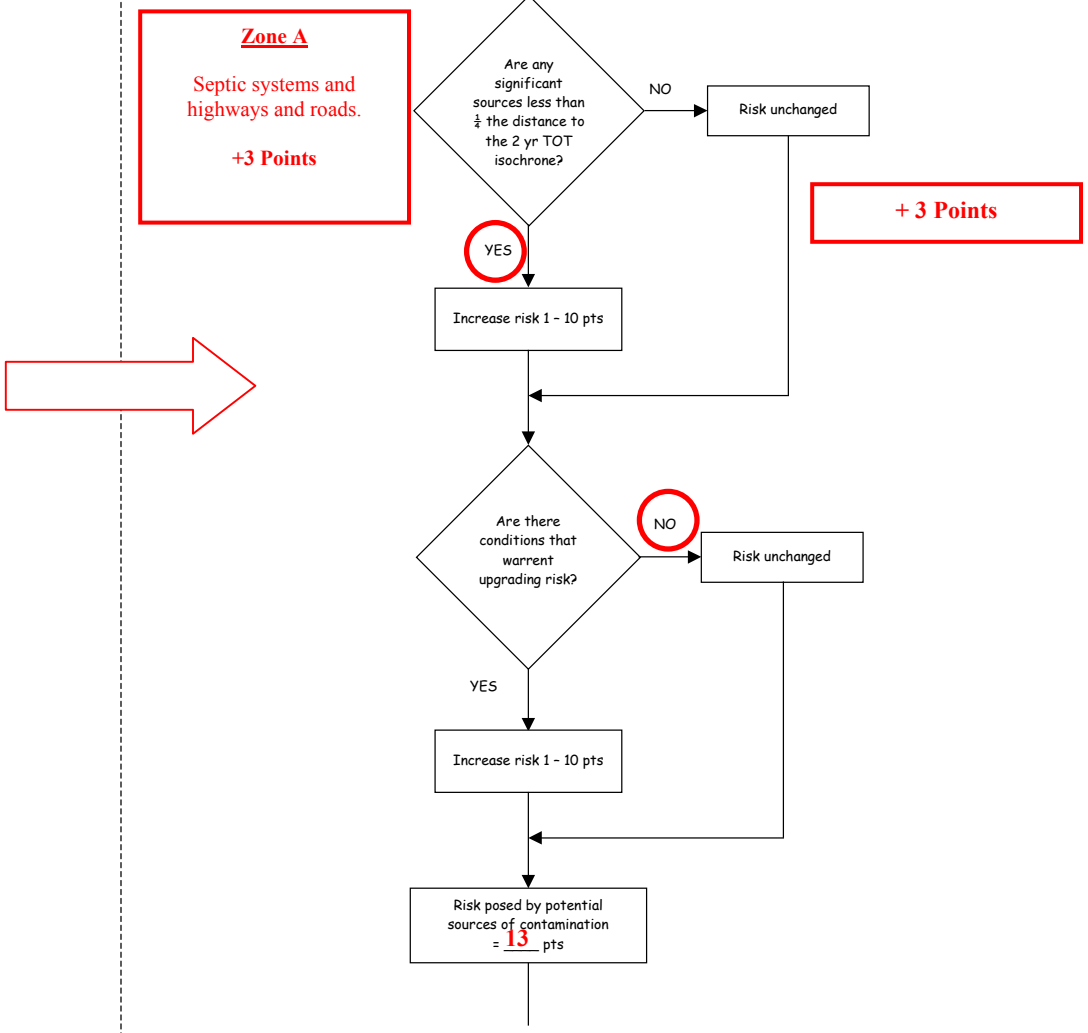
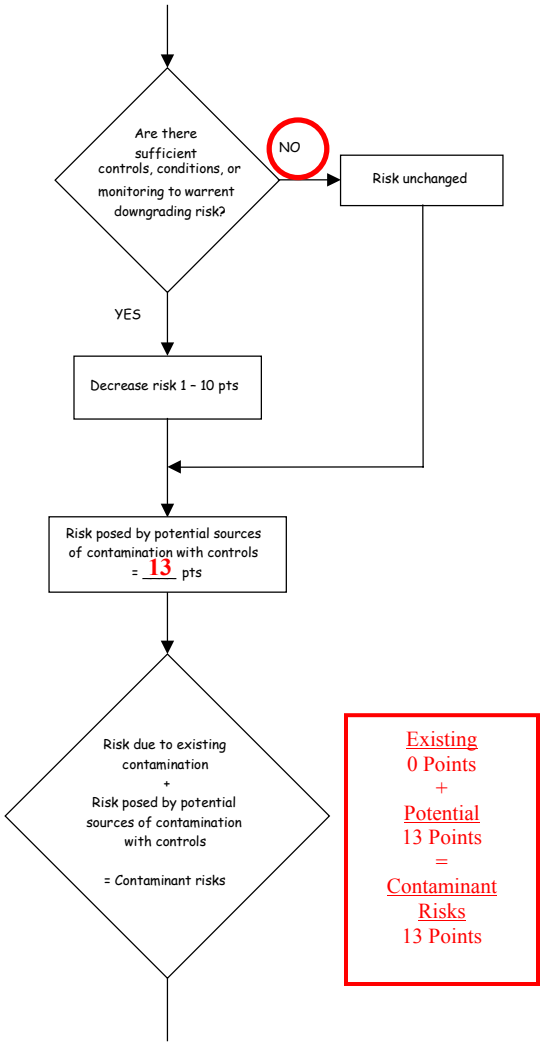
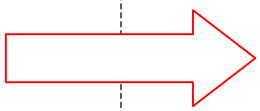
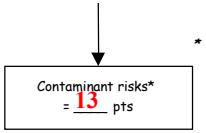


Chart 7. Contaminant risks for Chapel of the Cross – Volatile Organic Chemicals (Continued)



Existing
0 Points
+
Potential
13 Points
=
Contaminant Risks
13 Points





** Truncate risk at 50 pts*

Low

3. Level of Background Contamination

> MCL	21 - 50 pts
0.5 MCL to < MCL	11 - 20 pts
0.2 MCL to < 0.5 MCL	6 - 10 pts
'detect' to < 0.2 MCL	0 - 5 pts

Contaminant Risk Ratings

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

Table 3. Risk Matrix for Contaminant Sources for Chapel of the Cross – Volatile Organic Chemicals

Level of Risk Associated with the Highest Risk Sources

Next Highest Risk Sources(s)

Septic systems, highways and roads, residential areas, public utiltiy easement/corridor	**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

Chart 8. Vulnerability analysis for Chapel of the Cross – Volatile Organic Chemicals