Source Water Assessment for College Gate Baptist Church Anchorage, Alaska

A Hydrogeologic Susceptibility and Vulnerability Analysis

DRINKING WATER PROTECTION PROGRAM REPORT 759
PWSID 212623.001

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Alaska Department of Environmental Conservation

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

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

ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION: 2002

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EXECUTIVE SUMMARY

The Public Water System for College Gate Baptist Churchis a Class B (transient/non-community) water system consisting of one well in the Anchorage area. Identified potential and current sources of contaminants for the College Gate Baptist Church include residential area, sewer lines, roads, recreation trails, construction trade areas, photo laboratories, medical facilities and motor vehicle waste disposal wells. 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 source for College Gate Baptist Church received a vulnerability rating of **medium** for bacteria and viruses and nitrates and/or nitrates; and **low** for volatile organic chemicals.

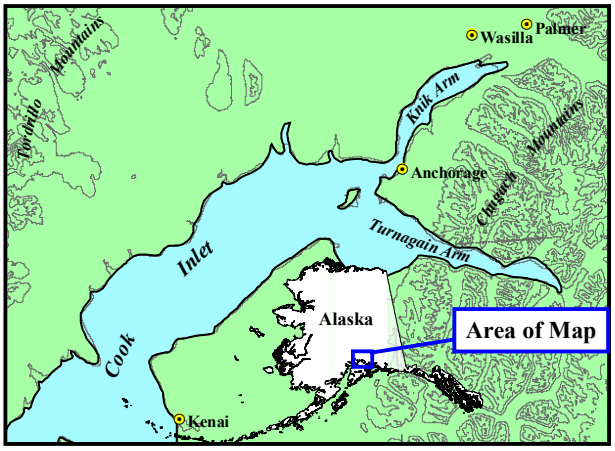

Figure 1. Index map showing the location of Anchorage, Alaska

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 the College Gate Baptist Church. 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.

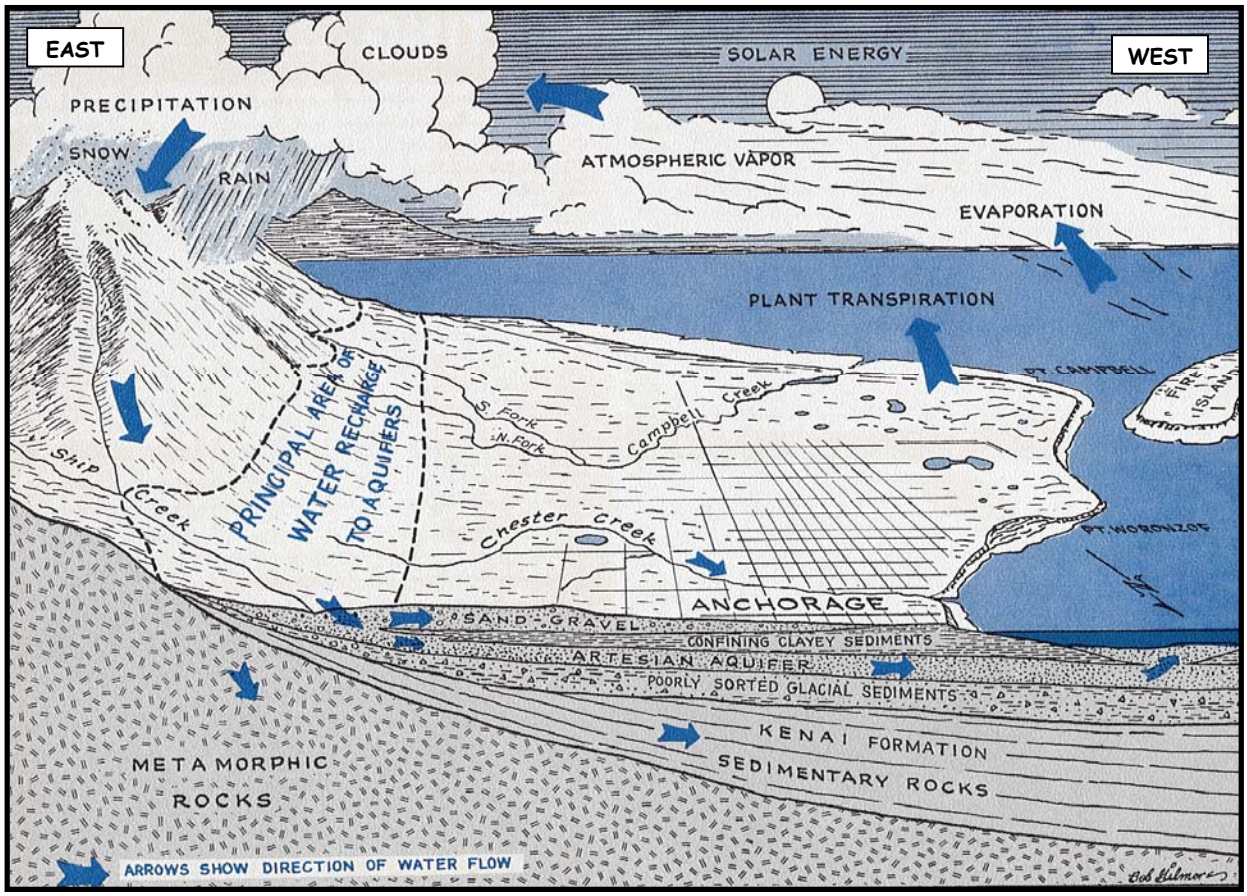

Figure 2. Generalized hydrologic cycle in the Anchorage area [*Barnwell, George, Dearborn,Weeks, and Zenone*, 1972].

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.

COLLEGE GATE BAPTIST CHURCH'S PUBLIC DRINKING WATER SYSTEM

The public water system serving College Gate Baptist Church is a Class B (transient/non-community) water system. The system consists of one well, which is located in the foothills of the Chugach Mountains off of Boniface Road. The well is located at an elevation of approximately 225 feet above sea level

According to the most recent Sanitary Survey (1998) the well was installed with a cap providing a sanitary seal. A properly installed sanitary seal may provide protection against contaminants from entering the source waters at the well casing. The Sanitary Survey also notes that the land surface is appropriately sloped to provide adequate surface water drainage. The well is not grouted according to ADEC regulations. Proper grouting provides added protection against contaminants traveling along the well casing and into source waters.

There is no well log available for the well serving College Gate Baptist Church. Well logs from wells within a ¼-mile radius of College Gate Baptist Church indicate that there is a confining layers consisting of clay from around 36 to 80 feet below land surface The confining layers may provide protection from contaminates entering the aquifer. However, the clay layers tend to thin out towards the mountains allowing contaminants that enter the subsurface near the base of the mountains to enter the confined aquifer uninhibited by the absence of any protective layer.

This system operates year-round and serves 100 non-residents through 1 service connections.

ASSESSMENT AND PROTECTION AREA FOR COLLEGE GATE BAPTIST CHURCH'S DRINKING WATER SOURCE

The Drinking Water Protection and Assessment Area that has been established for the source of drinking water serving the College Gate Baptist Church 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 College Gate Baptist Church 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 College Gate Baptist Church. This assessment 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 B 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 4 in Appendix C depict the Contaminant Source Inventory for College Gate Baptist Church. Table 1 in Appendix B lists the inventoried potential sources of contamination within Zones A through D.

RANKING OF CONTAMINANT RISKS

Once the potential and existing sources of contamination have been identified, they are assigned a ranking according to what type and level of risk they represent. Ranking of contaminant risks for a "potential" or "existing" source of contamination is a function of toxicity and volumes of specific contaminants associated with that source.

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, volatile organic chemicals, heavy metals, synthetic organic chemicals, and other organic chemicals.

VULNERABILITY OF COLLEGE GATE BAPTIST CHURCH'S DRINKING WATER SOURCE

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

- natural susceptibility; and
- contaminant risks.

Each of the three categories of drinking water contaminants 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)

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 the College Gate Baptist Church.

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

	Score	Rating
Susceptibility of the Wellhead	5	Low
Susceptibility of the Aquifer	8	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

Contaminant Risks	Score	Rating
Bacteria and Viruses	25	Medium
Nitrates and/or Nitrites	25	Medium
Volatile Organic Chemicals	12	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 College Gate Baptist Church's Public Drinking Water Source to Contamination by Category

Category	Score	Rating
Bacteria and Viruses	45	Medium
Nitrates and Nitrites	45	Medium
Volatile Organic Chemicals	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.

Bacteria and Viruses
The contaminant risk for bacteria and viruses is medium with sewer lines, roads, and residential area presenting the most significant risk to the drinking water well (See Chart 3 – Contaminant Risks for Bacteria and Viruses in Appendix D).

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

Nitrates and Nitrites
The contaminant risk for nitrates and nitrites is medium with sewer lines, roads, and residential area presenting the most significant risk to the drinking water well.

Nitrate concentrations in uncontaminated groundwater are typically less than 2 milligrams per liter (mg/L) and are derived primarily from the decomposition of organic matter in soils [Wang, Strelakos, Jokela, 2000]. Sampling history for College Gate Baptist Church indicates low concentrations of nitrates have been detected in source waters. The most recent nitrate detection occurred January 18, 2000, at approximately 6% of the Maximum contaminant Level or MCL. (See Chart 5 - Contaminant Risks for Nitrates and/or Nitrites in Appendix D).

The MCL is the maximum level of contaminant that is allowed to exist in drinking water and still be consumed by humans without harmful. Due to the high solubility and weak retnetnion by soil, nitrates are very mobile, moving at approximately the same rate as water. Though nitrates were detected at the site, concentrations remain at safe levels with respect to human health.

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

Volatile Organic Chemicals
The contaminant risk for volatile organic chemicals is low with sewer lines and roads presenting the most significant risk for volatile organic chemicals (See Chart 7 – Contaminant Risks for Volatile Organic Chemicals in Appendix D).

Recent sampling history of College Gate Baptist Church well indicates that no volatile organic chemicals have been detected in the source waters.

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

SUMMARY

A *Source Water Assessment* has been completed for the

source of public drinking water serving College Gate Baptist Church. 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 College Gate Baptist Church 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 College Gate Baptist Church's public drinking water source.

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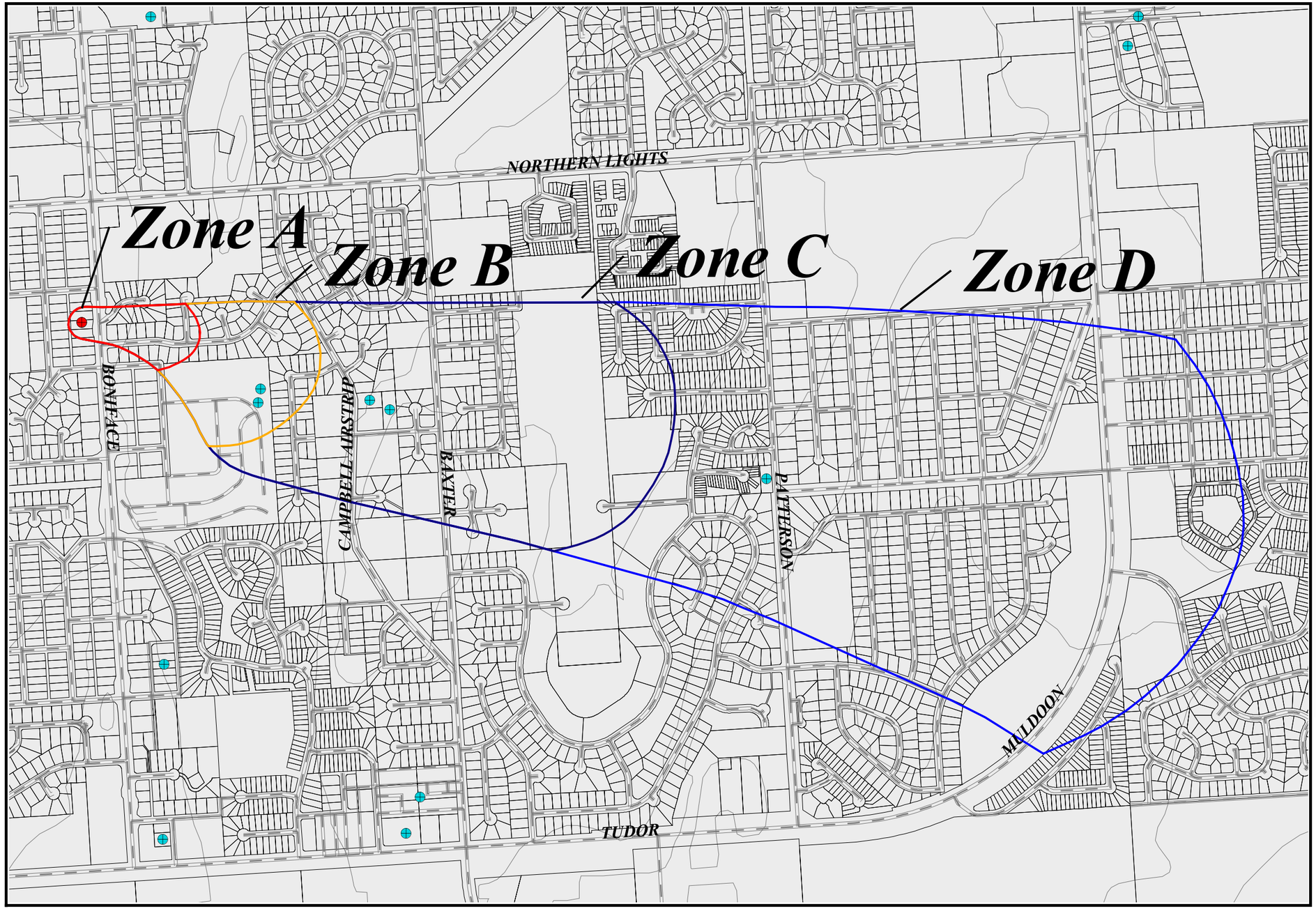
APPENDIX A

College Gate Baptist Church's
Drinking Water Protection Area

Drinking Water Protection Area for College Gate Baptist Church



Legend

- College Gate Baptist Church Well
- Private/Public Water Wells

Zone A Protection Area
- Several Months Travel Time

Zone B Protection Area
- Less than 2 Years Travel Time

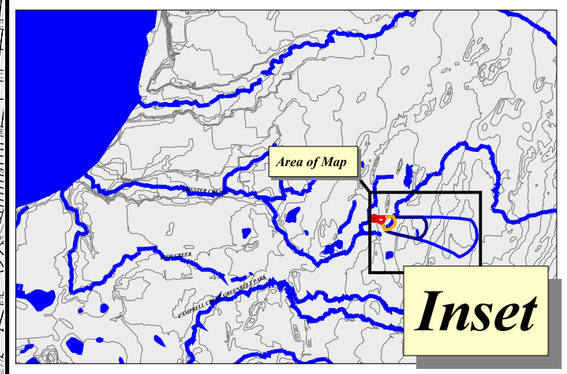
Zone C Protection Area
- Less than 2 Years Travel Time

Zone D Protection Area
- Less than 10 Years Travel Time

Roads

MOA Land Parcels

Elevation Contours



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Map 1

APPENDIX B

Contaminant Source Inventory and Risk Ranking for College Gate Baptist Church

Table 2

Contaminant Source Inventory and Risk Ranking for College Gate Baptist Church Sources of Bacteria and Viruses

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Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-1	A	Medium	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-2	A	Medium	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-3	A	Medium	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-4	A	Medium	2	
Residential Areas	R01	R1-1	A	Low	3	
Highways and roads, paved (cement or asphalt)	X20	X20-1	A	Low	2	
Highways and roads, paved (cement or asphalt)	X20	X20-2	A	Low	2	
Highways and roads, paved (cement or asphalt)	X20	X20-3	A	Low	2	
Highways and roads, paved (cement or asphalt)	X20	X20-4	A	Low	2	
Dog walking areas/foot trails	X46	X46-1	A	Low	3	
Dog walking areas/foot trails	X46	X46-2	A	Low	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-10	B	Medium	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-5	B	Medium	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-6	B	Medium	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-7	B	Medium	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-8	B	Medium	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-9	B	Medium	2	
Residential Areas	R01	R1-2	B	Low	3	
Highways and roads, paved (cement or asphalt)	X20	X20-08	B	Low	2	

Table 1

Contaminant Source Inventory for
College Gate Baptist Church

PWSID 212623.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Map Number*	*Comments*
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-1	A	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-2	A	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-3	A	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-4	A	2	
Residential Areas	R01	R1-1	A	3	
Highways and roads, paved (cement or asphalt)	X20	X20-1	A	2	
Highways and roads, paved (cement or asphalt)	X20	X20-2	A	2	
Highways and roads, paved (cement or asphalt)	X20	X20-3	A	2	
Highways and roads, paved (cement or asphalt)	X20	X20-4	A	2	
Dog walking areas/foot trails	X46	X46-1	A	3	
Dog walking areas/foot trails	X46	X46-2	A	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-10	B	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-5	B	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-6	B	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-7	B	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-8	B	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-9	B	2	
Residential Areas	R01	R1-2	B	3	
Highways and roads, paved (cement or asphalt)	X20	X20-08	B	2	

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Map Number*	*Comments*
Highways and roads, paved (cement or asphalt)	X20	X20-10	B	2	
Highways and roads, paved (cement or asphalt)	X20	X20-5	B	2	
Highways and roads, paved (cement or asphalt)	X20	X20-6	B	2	
Highways and roads, paved (cement or asphalt)	X20	X20-7	B	2	
Highways and roads, paved (cement or asphalt)	X20	X20-9	B	2	
Construction trade areas and materials	C09	C9-01	C	4	
Construction trade areas and materials	C09	C9-02	C	4	
Photography supplies/photo processing laboratories	C36	C36-01	C	4	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D01-11-29	C	4	19 Sewer lines in Zone C
Municipal or city parks (with green areas)	X04	X4-1	C	4	
Highways and roads, paved (cement or asphalt)	X20	X20-12-23	C	4	13 roads in Zone C
Medical/veterinary facilities (doctor or dentist offices, hospitals, nursing homes)	X40	X40-01	C	4	
Dog walking areas/foot trails	X46	X46-3	C	4	
Dog walking areas/foot trails	X46	X46-4	C	4	
Dog walking areas/foot trails	X46	X46-5	C	4	
Injection wells (Class V) Motor Vehicle Waste Disposal Well	D42	D42-1	D	5	
Municipal or city parks (with green areas)	X04	X4-2	D	5	

Table 2 (continued)

Contaminant Source Inventory and Risk Ranking for College Gate Baptist Church Sources of Bacteria and Viruses

PWSID 212623.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Highways and roads, paved (cement or asphalt)	X20	X20-10	B	Low	2	
Highways and roads, paved (cement or asphalt)	X20	X20-5	B	Low	2	
Highways and roads, paved (cement or asphalt)	X20	X20-6	B	Low	2	
Highways and roads, paved (cement or asphalt)	X20	X20-7	B	Low	2	
Highways and roads, paved (cement or asphalt)	X20	X20-9	B	Low	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D01-11-29	C	Medium	4	19 Sewer lines in Zone C
Highways and roads, paved (cement or asphalt)	X20	X20-12-23	C	Low	4	13 roads in Zone C
Medical/veterinary facilities (doctor or dentist offices, hospitals, nursing homes)	X40	X40-01	C	Medium	4	

Table 3

Contaminant Source Inventory and Risk Ranking for College Gate Baptist Church Sources of Nitrates/Nitrites

PWSID 212623.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-1	A	Medium	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-2	A	Medium	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-3	A	Medium	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-4	A	Medium	2	
Residential Areas	R01	R1-1	A	Low	3	
Highways and roads, paved (cement or asphalt)	X20	X20-1	A	Low	2	
Highways and roads, paved (cement or asphalt)	X20	X20-2	A	Low	2	
Highways and roads, paved (cement or asphalt)	X20	X20-3	A	Low	2	
Highways and roads, paved (cement or asphalt)	X20	X20-4	A	Low	2	
Dog walking areas/foot trails	X46	X46-1	A	Low	3	
Dog walking areas/foot trails	X46	X46-2	A	Low	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-10	B	Medium	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-5	B	Medium	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-6	B	Medium	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-7	B	Medium	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-8	B	Medium	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-9	B	Medium	2	
Residential Areas	R01	R1-2	B	Low	3	
Highways and roads, paved (cement or asphalt)	X20	X20-08	B	Low	2	

Table 3 (continued)

Contaminant Source Inventory and Risk Ranking for College Gate Baptist Church Sources of Nitrates/Nitrites

PWSID 212623.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Highways and roads, paved (cement or asphalt)	X20	X20-10	B	Low	2	
Highways and roads, paved (cement or asphalt)	X20	X20-5	B	Low	2	
Highways and roads, paved (cement or asphalt)	X20	X20-6	B	Low	2	
Highways and roads, paved (cement or asphalt)	X20	X20-7	B	Low	2	
Highways and roads, paved (cement or asphalt)	X20	X20-9	B	Low	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D01-11-29	C	Medium	4	19 Sewer lines in Zone C
Highways and roads, paved (cement or asphalt)	X20	X20-12-23	C	Low	4	13 roads in Zone C
Municipal or city parks (with green areas)	X04	X4-1	C	Medium	4	
Medical/veterinary facilities (doctor or dentist offices, hospitals, nursing homes)	X40	X40-01	C	Low	4	
Dog walking areas/foot trails	X46	X46-3	C	Low	4	
Dog walking areas/foot trails	X46	X46-4	C	Low	4	
Dog walking areas/foot trails	X46	X46-5	C	Low	4	
Municipal or city parks (with green areas)	X04	X4-2	D	Medium	5	

Table 4

Contaminant Source Inventory and Risk Ranking for College Gate Baptist Church Sources of Volatile Organic Chemicals

PWSID 212623.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-1	A	Low	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-2	A	Low	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-3	A	Low	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-4	A	Low	2	
Residential Areas	R01	R1-1	A	Low	3	
Highways and roads, paved (cement or asphalt)	X20	X20-1	A	Low	2	
Highways and roads, paved (cement or asphalt)	X20	X20-2	A	Low	2	
Highways and roads, paved (cement or asphalt)	X20	X20-3	A	Low	2	
Highways and roads, paved (cement or asphalt)	X20	X20-4	A	Low	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-10	B	Low	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-5	B	Low	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-6	B	Low	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-7	B	Low	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-8	B	Low	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-9	B	Low	2	
Residential Areas	R01	R1-2	B	Low	3	
Highways and roads, paved (cement or asphalt)	X20	X20-08	B	Low	2	
Highways and roads, paved (cement or asphalt)	X20	X20-10	B	Low	2	
Highways and roads, paved (cement or asphalt)	X20	X20-5	B	Low	2	

Contaminant Source Inventory and Risk Ranking for College Gate Baptist Church Sources of Volatile Organic Chemicals

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Highways and roads, paved (cement or asphalt)	X20	X20-6	B	Low	2	
Highways and roads, paved (cement or asphalt)	X20	X20-7	B	Low	2	
Highways and roads, paved (cement or asphalt)	X20	X20-9	B	Low	2	
Photography supplies/photo processing laboratories	C36	C36-01	C	Medium	4	
Construction trade areas and materials	C09	C9-01	C	Low	4	
Construction trade areas and materials	C09	C9-02	C	Low	4	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D01-11-29	C	Low	4	19 Sewer lines in Zone C
Highways and roads, paved (cement or asphalt)	X20	X20-12-23	C	Low	4	13 roads in Zone C
Medical/veterinary facilities (doctor or dentist offices, hospitals, nursing homes)	X40	X40-01	C	Low	4	
Injection wells (Class V) Motor Vehicle Waste Disposal Well	D42	D42-1	D	High	5	

Table 5

Contaminant Source Inventory and Risk Ranking for College Gate Baptist Church

Sources of Heavy Metals, Cyanide and Other Inorganic Chemicals

PWSID 212623.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Residential Areas	R01	R1-1	A	Low	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-10	B	Low	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-6	B	Low	2	
Residential Areas	R01	R1-2	B	Low	3	
Highways and roads, paved (cement or asphalt)	X20	X20-08	B	Low	2	
Highways and roads, paved (cement or asphalt)	X20	X20-10	B	Low	2	
Highways and roads, paved (cement or asphalt)	X20	X20-9	B	Low	2	
Photography supplies/photo processing laboratories	C36	C36-01	C	Medium	4	
Construction trade areas and materials	C09	C9-01	C	Low	4	
Construction trade areas and materials	C09	C9-02	C	Low	4	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D01-11-29	C	Low	4	19 Sewer lines in Zone C
Highways and roads, paved (cement or asphalt)	X20	X20-12-23	C	Low	4	13 roads in Zone C
Medical/veterinary facilities (doctor or dentist offices, hospitals, nursing homes)	X40	X40-01	C	Low	4	
Injection wells (Class V) Motor Vehicle Waste Disposal Well	D42	D42-1	D	High	5	

Table 6

Contaminant Source Inventory and Risk Ranking for College Gate Baptist Church Sources of Synthetic Organic Chemicals

PWSID 212623.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Residential Areas	R01	R1-1	A	Low	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-10	B	Low	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-6	B	Low	2	
Residential Areas	R01	R1-2	B	Low	3	
Photography supplies/photo processing laboratories	C36	C36-01	C	Low	4	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D01-11-29	C	Low	4	19 Sewer lines in Zone C
Medical/veterinary facilities (doctor or dentist offices, hospitals, nursing homes)	X40	X40-01	C	Low	4	
Injection wells (Class V) Motor Vehicle Waste Disposal Well	D42	D42-1	D	Low	5	
Municipal or city parks (with green areas)	X04	X4-2	D	Low	5	

Table 7

Contaminant Source Inventory and Risk Ranking for College Gate Baptist Church Sources of Other Organic Chemicals

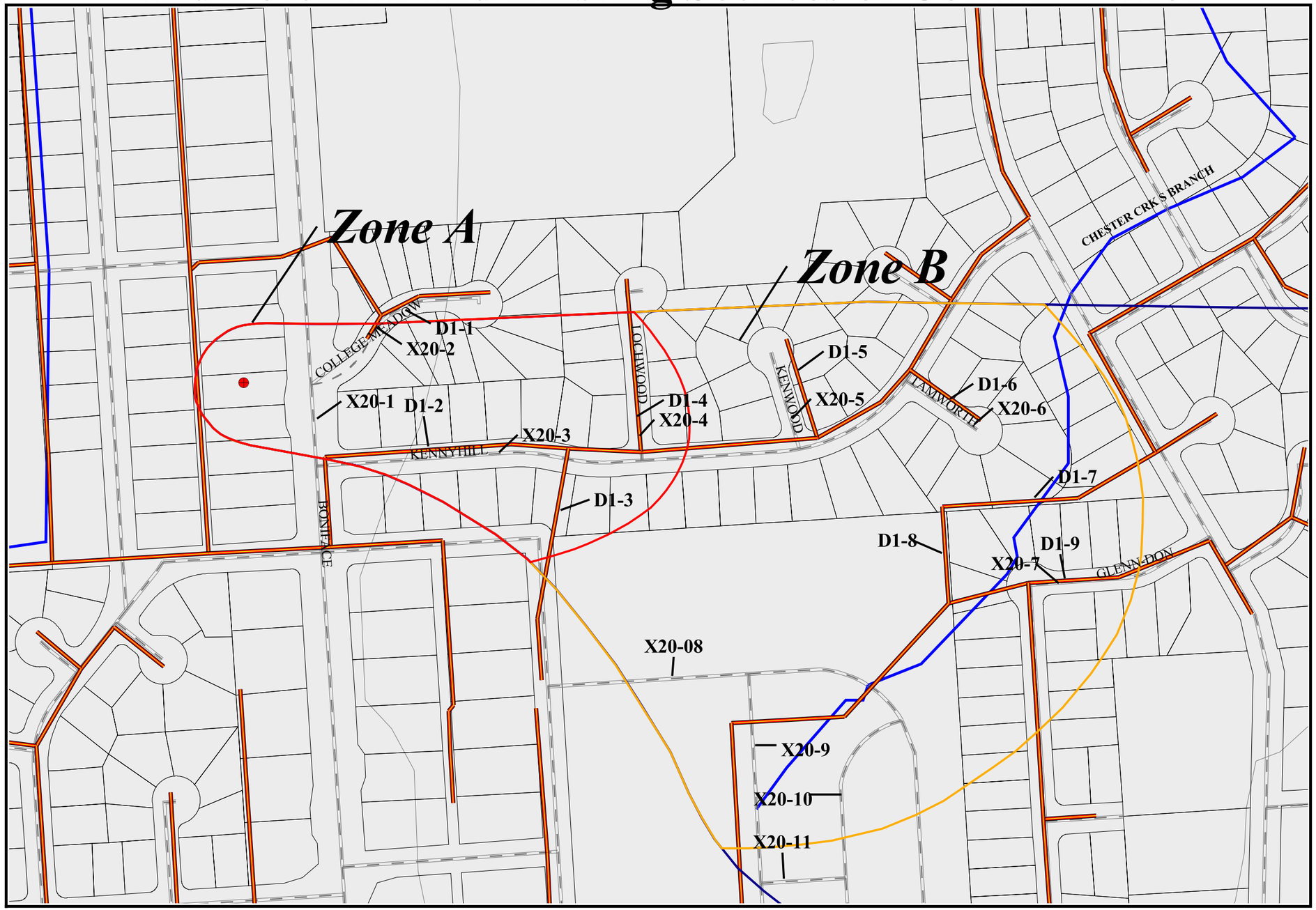
PWSID 212623.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Residential Areas	R01	R1-1	A	Low	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-10	B	Low	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-6	B	Low	2	
Residential Areas	R01	R1-2	B	Low	3	
Highways and roads, paved (cement or asphalt)	X20	X20-08	B	Low	2	
Highways and roads, paved (cement or asphalt)	X20	X20-10	B	Low	2	
Highways and roads, paved (cement or asphalt)	X20	X20-9	B	Low	2	
Photography supplies/photo processing laboratories	C36	C36-01	C	Low	4	
Construction trade areas and materials	C09	C9-01	C	Low	4	
Construction trade areas and materials	C09	C9-02	C	Low	4	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D01-11-29	C	Low	4	19 Sewer lines in Zone C
Highways and roads, paved (cement or asphalt)	X20	X20-12-23	C	Low	4	13 roads in Zone C
Injection wells (Class V) Motor Vehicle Waste Disposal Well	D42	D42-1	D	High	5	

APPENDIX C

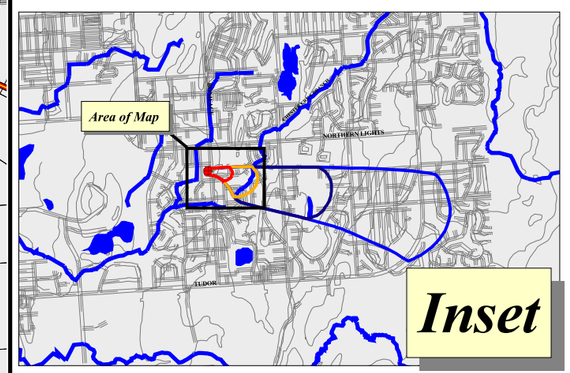
College Gate Baptist Church's
Drinking Water Protection Area
and Potential & Existing Contaminant Sources

Drinking Water Protection Area for College Gate Baptist Church and Potential and Existing Sources of Contamination



Legend

- College Gate Baptist Church 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 2 Years Travel Time
- Zone D Protection Area
  - Less than 10 Years Travel Time
- Potential and Exisitng Sources of Contamination
  - Closed tanks, diesel (underground)
  - Closed tanks, gasoline (underground)
  - Construction trade areas and materials
  - Contaminated sites, DEC recognized, non-Superfund, non-RCRA
  - Heavy equipment rental/storage
  - Injection wells (Class V) Motor Vehicle Waste Disposal Well
  - Medical/veterinary facilities (doctor or dentist offices, hospitals, nursing homes)
  - Photography supplies/photo processing laboratories
- Sewers (D1)
- Roads
- Lakes
- Streams
- Cook Inlet
- MOA Land Parcels
- Elevation Contours



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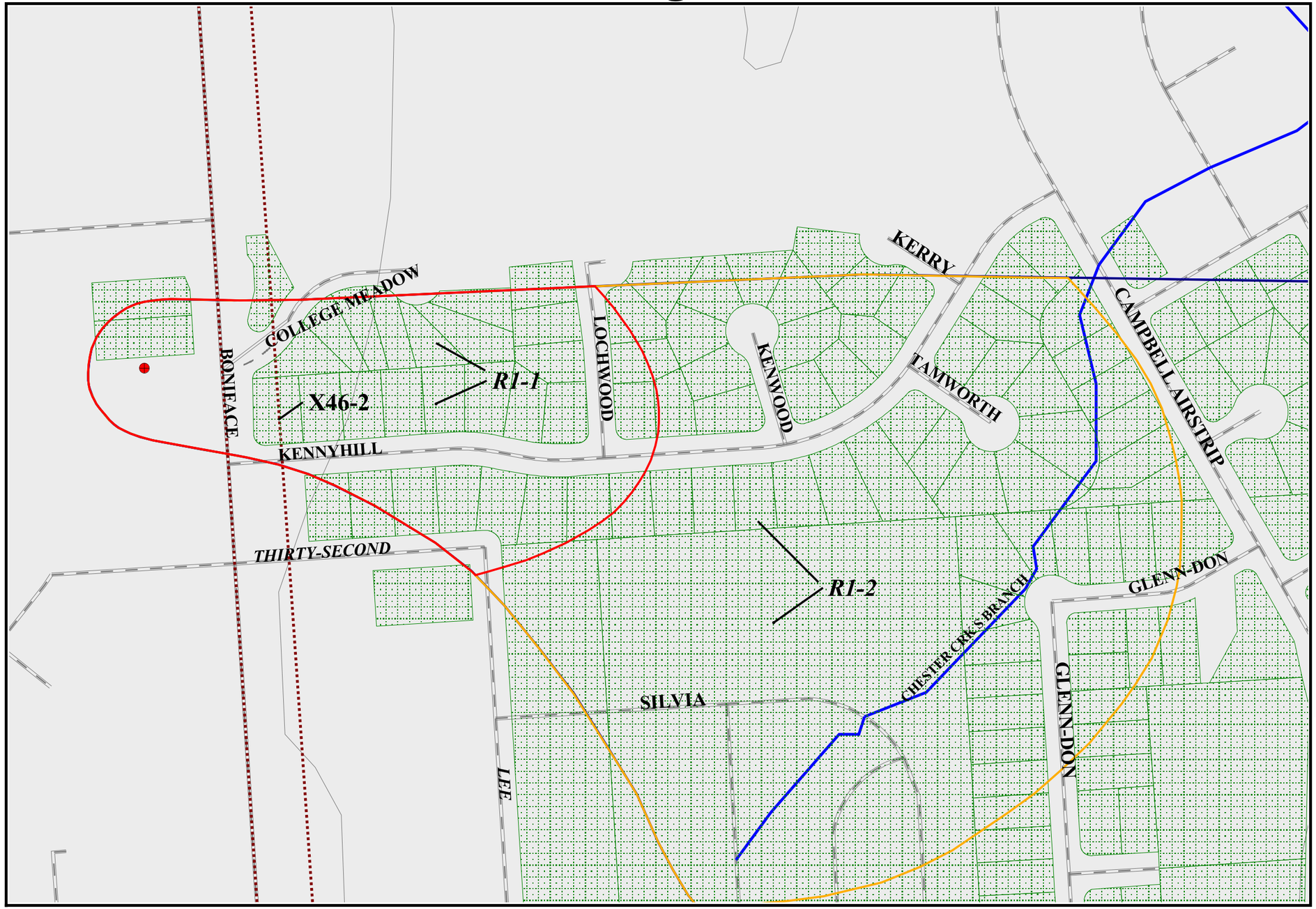
PWSID 212623.001

Map 2

Drinking Water Protection Area for College Gate Baptist Church and Potential and Existing Sources of Contamination



Legend

- College Gate Baptist Church Well

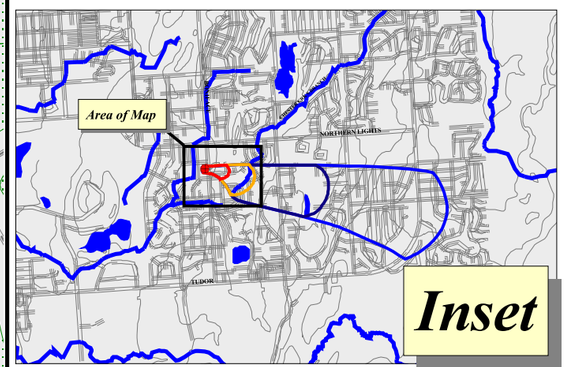
Zone A Protection Area
- Several Months Travel Time

Zone B Protection Area
- Less than 2 Years Travel Time

Zone C Protection Area
- Less than 2 Years Travel Time

Zone D Protection Area
- Less than 10 Years Travel Time

Landuse
- Residential Areas (R1)
- Parks (X4)
- Trails (X46)
- Cook Inlet
- Lakes
- Streams
- Roads
- Elevation Contours



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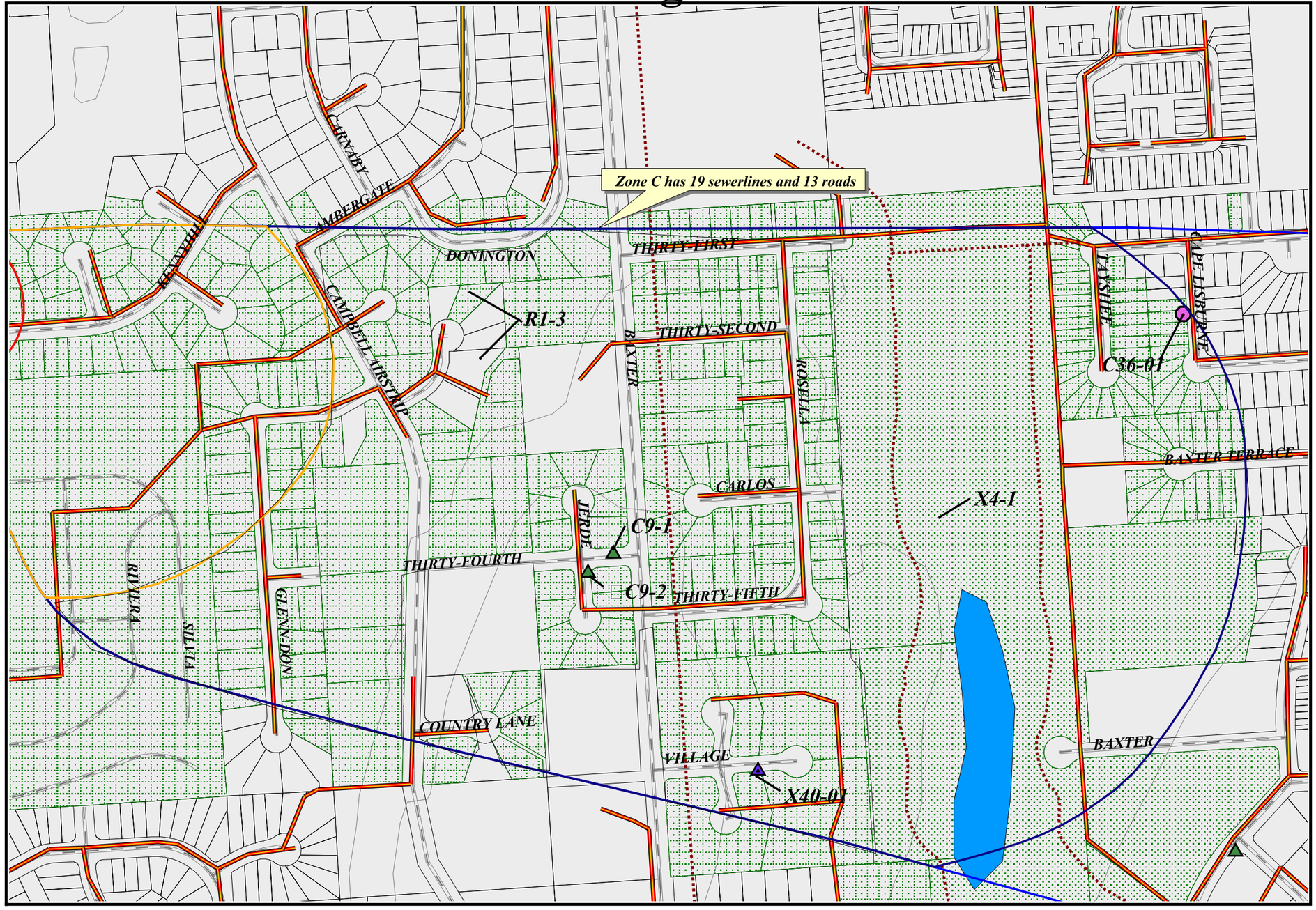
Map 3

Drinking Water Protection Area for College Gate Baptist Church and Potential and Existing Sources of Contamination



Legend

- College Gate Baptist Church Well

Zone A Protection Area
- Several Months Travel Time

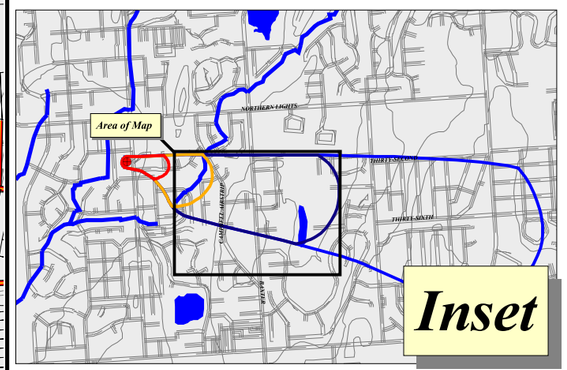
Zone B Protection Area
- Less than 2 Years Travel Time

Zone C Protection Area
- Less than 2 Years Travel Time

Zone D Protection Area
- Less than 10 Years Travel Time
- Trails (X46)
- Sewers (D1)

Potential and Exisitng Sources of Contamination
- Construction trade areas and materials
- Medical/veterinary facilities (doctor or dentist offices, hospitals, nursing homes
- Photography supplies/photo processing laboratories
- Roads
- Lakes

Landuse
- Residential Gardens (R1)
- Parks (X4)
- MOA Land Parcels
- Elevation Contours



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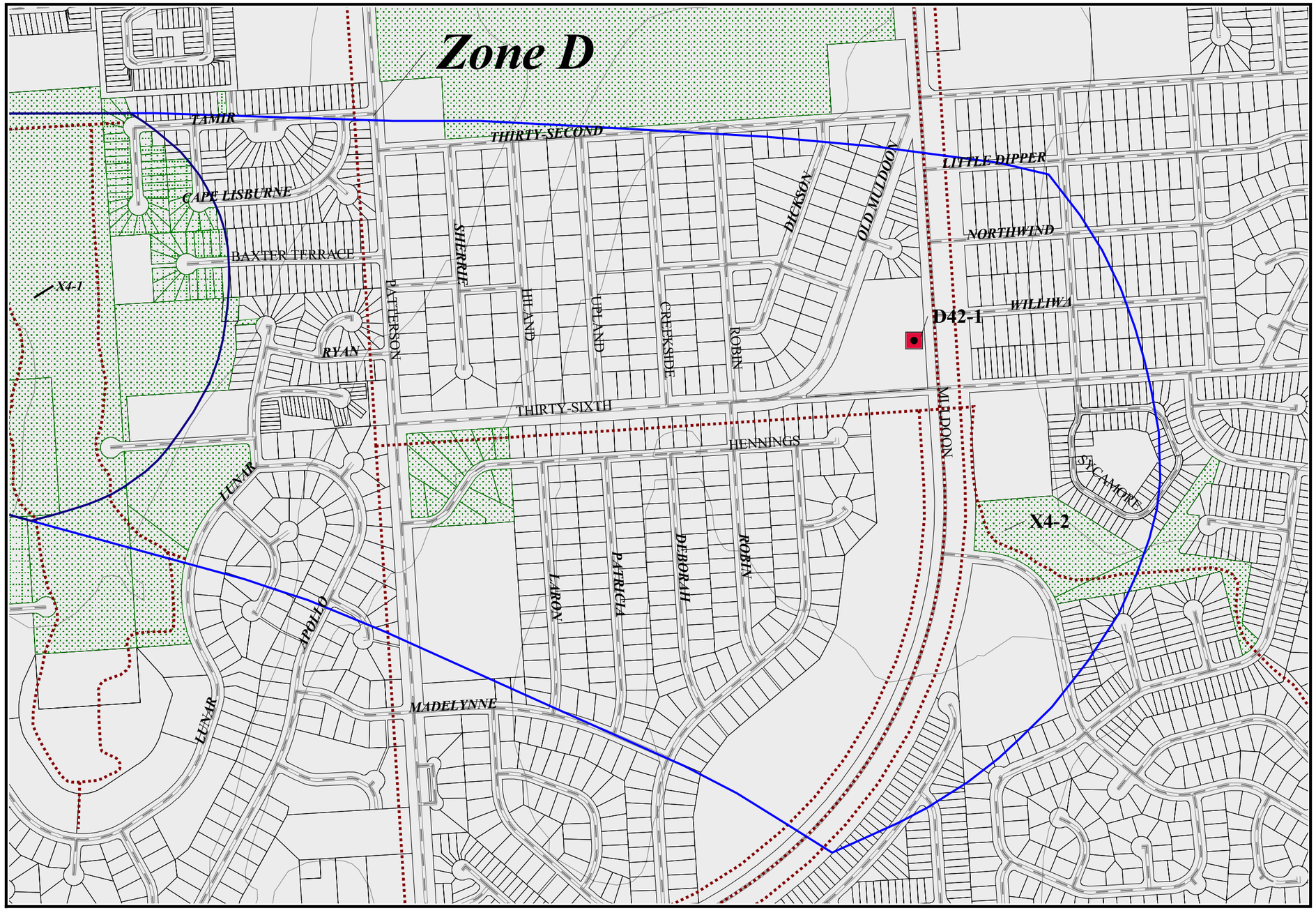
Map 4

Drinking Water Protection Area for College Gate Baptist Church and Potential and Existing Sources of Contamination



Legend

- College Gate Baptist Church Well

Zone A Protection Area
- Several Months Travel Time

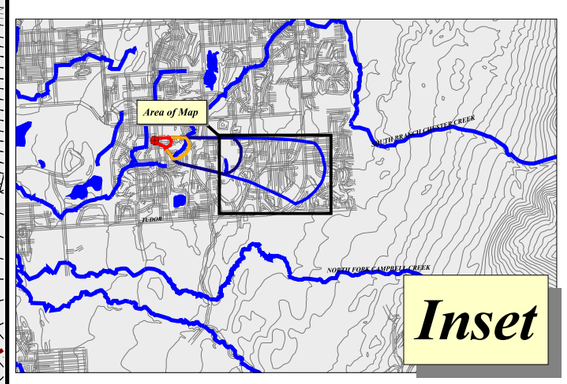
Zone B Protection Area
- Less than 2 Years Travel Time

Zone C Protection Area
- Less than 2 Years Travel Time

Zone D Protection Area
- Less than 10 Years Travel Time
- Trails (X46)

Potential and Exisitng Sources of Contamination
- Injection wells (Class V) Motor Vehicle Waste Disposal Well

Landuse
- Residential Gardens (R1)
- Parks (X4)
- MOA Land Parcels
- Elevation Contours
- Roads



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PWSID 212623.001

Map 5

APPENDIX D

Vulnerability Analysis for College Gate Baptist Church's Public Drinking Water Source

Chart 1. Susceptibility of the wellhead - College Gate Baptist Church

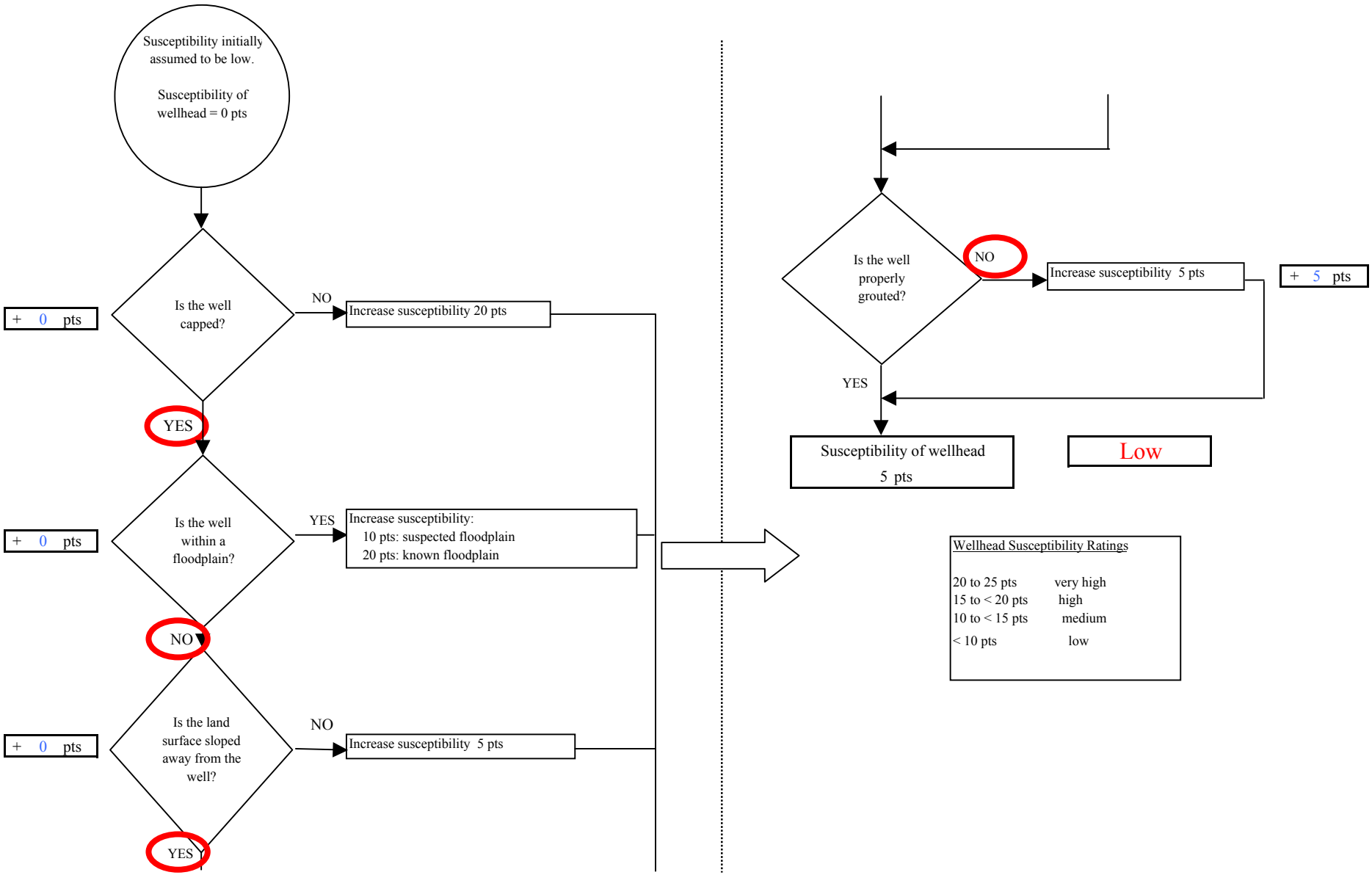


Chart 2. Susceptibility of the aquifer - College Gate Baptist Church

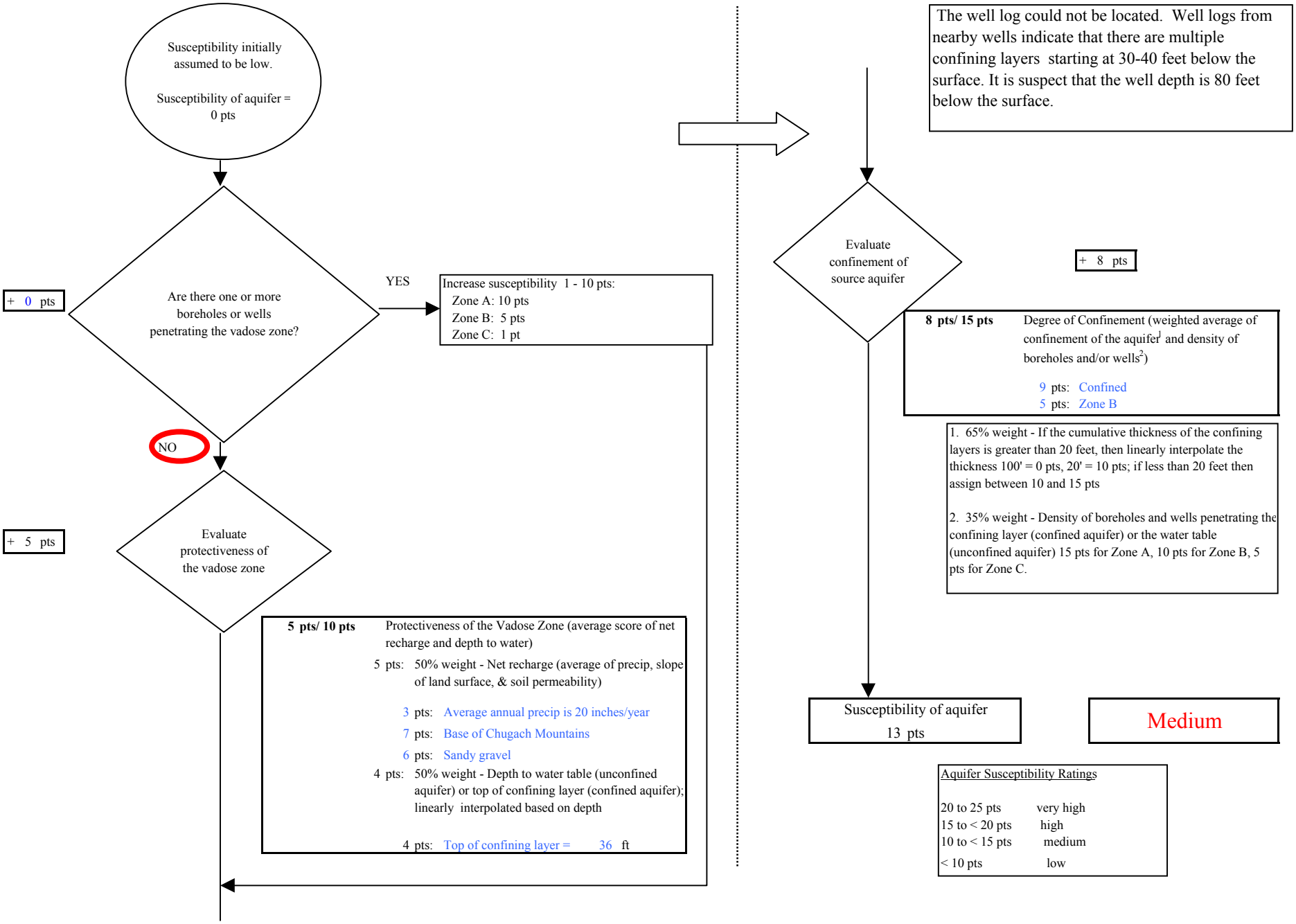
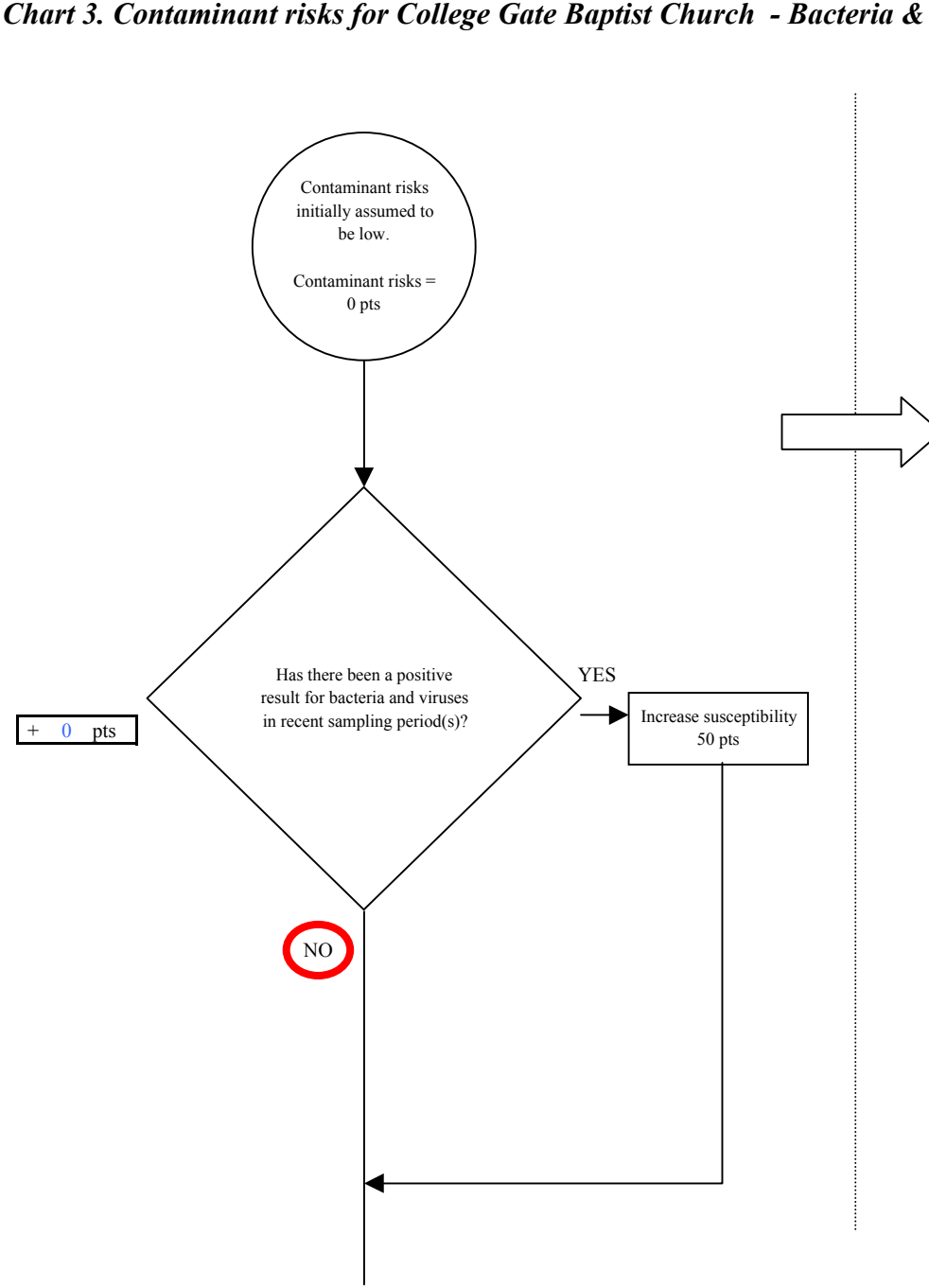
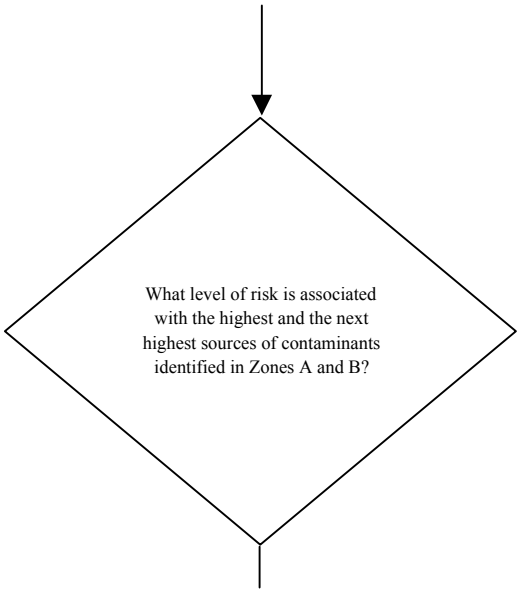


Chart 3. Contaminant risks for College Gate Baptist Church - Bacteria & Viruses





+ 20 pts

Risk Rankings for Contaminant Sources Identified in Zones A and B

	Zone A	Zone B	Total
Very Highs(s)	0	0	0
High(s)	0	0	0
Medium(s)	1	0	1
Low(s)	4	3	7

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

Matrix Score 20

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

Chart 3. Contaminant risks for College Gate Baptist Church - Bacteria & Viruses

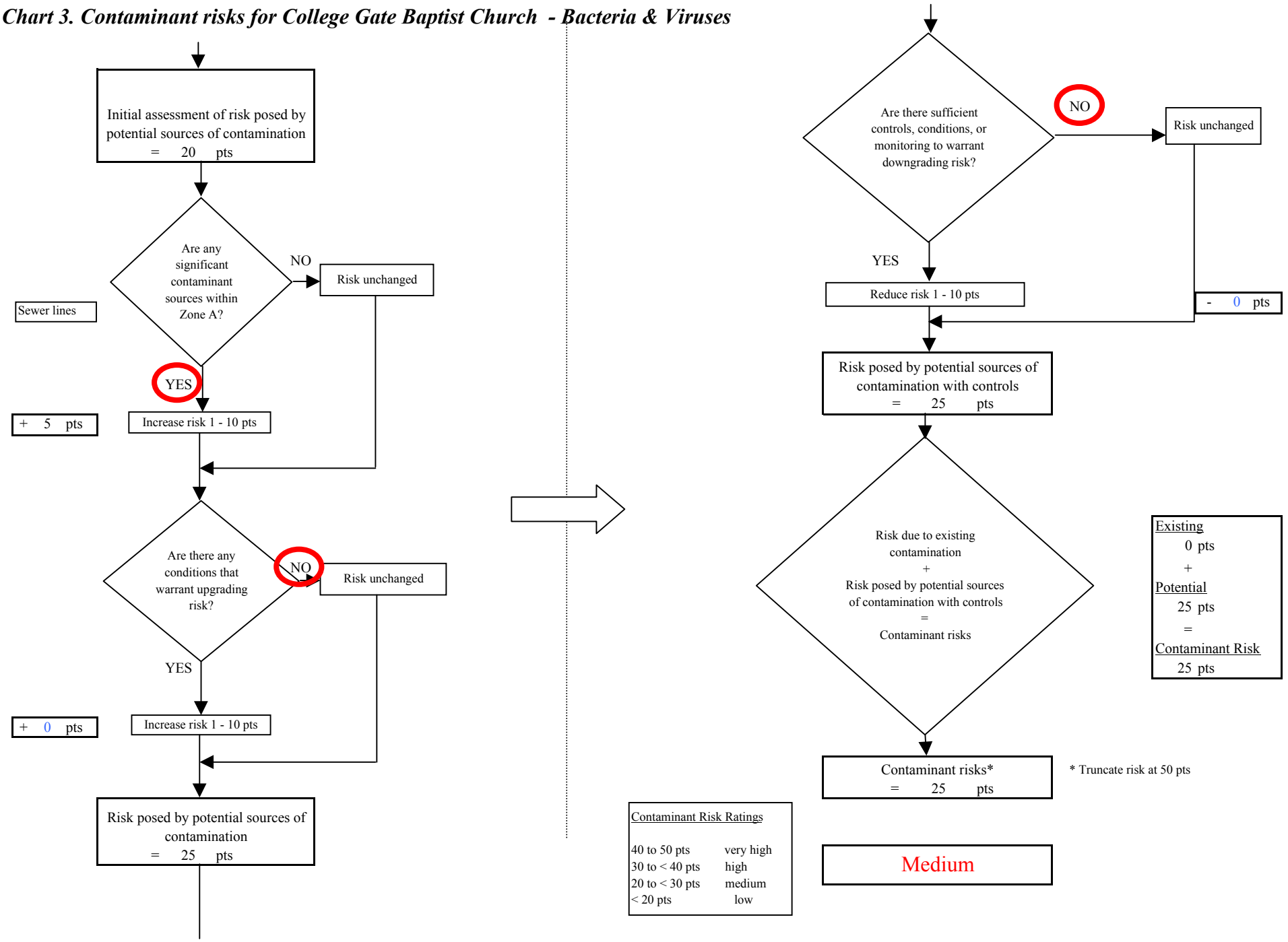


Chart 4. Vulnerability analysis for College Gate Baptist Church - Bacteria & Viruses

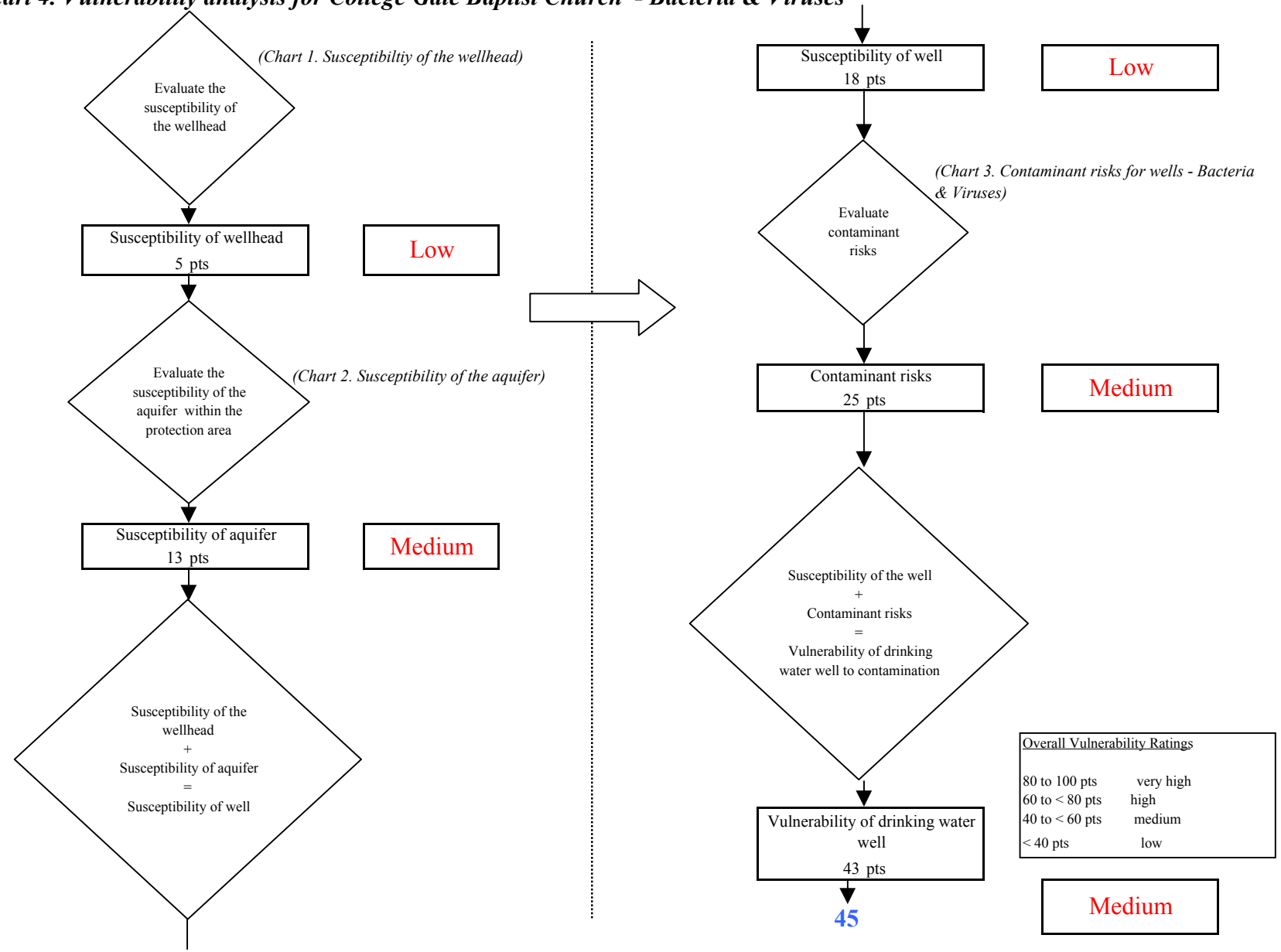


Chart 5. Contaminant risks for College Gate Baptist Church - Nitrates and Nitrites

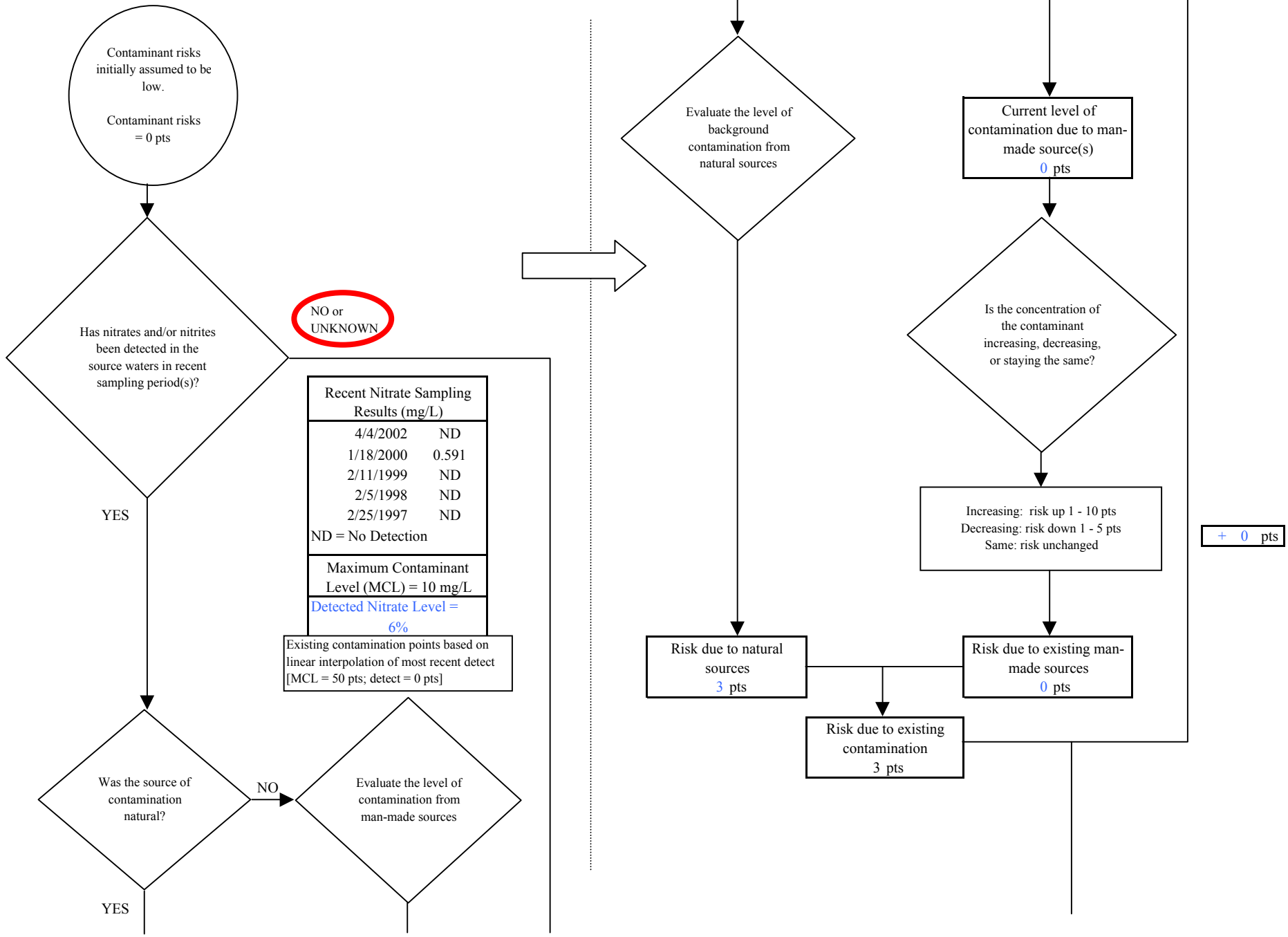


Chart 5. Contaminant risks for College Gate Baptist Church - Nitrates and Nitrites

+ 20 pts

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

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

	Zone A	Zones B&C	Total
Very Highs(s)	0	0	0
High(s)	0	0	0
Medium(s)	1	1	2
Low(s)	4	9	13

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

Matrix Score 20

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

Initial assessment of risk posed by potential sources of contamination = 20 pts

Is the source aquifer fractured rock or karst?

YES

NO

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

NO

Risk unchanged

YES

Decrease risk 1 - 10 pts

- 0 pts

Are any significant sources within Zone A?

NO

Risk unchanged

YES

Sewer lines

Increase risk 1 - 10 pts

+ 5 pts

Chart 5. Contaminant risks for College Gate Baptist Church - Nitrates and Nitrites

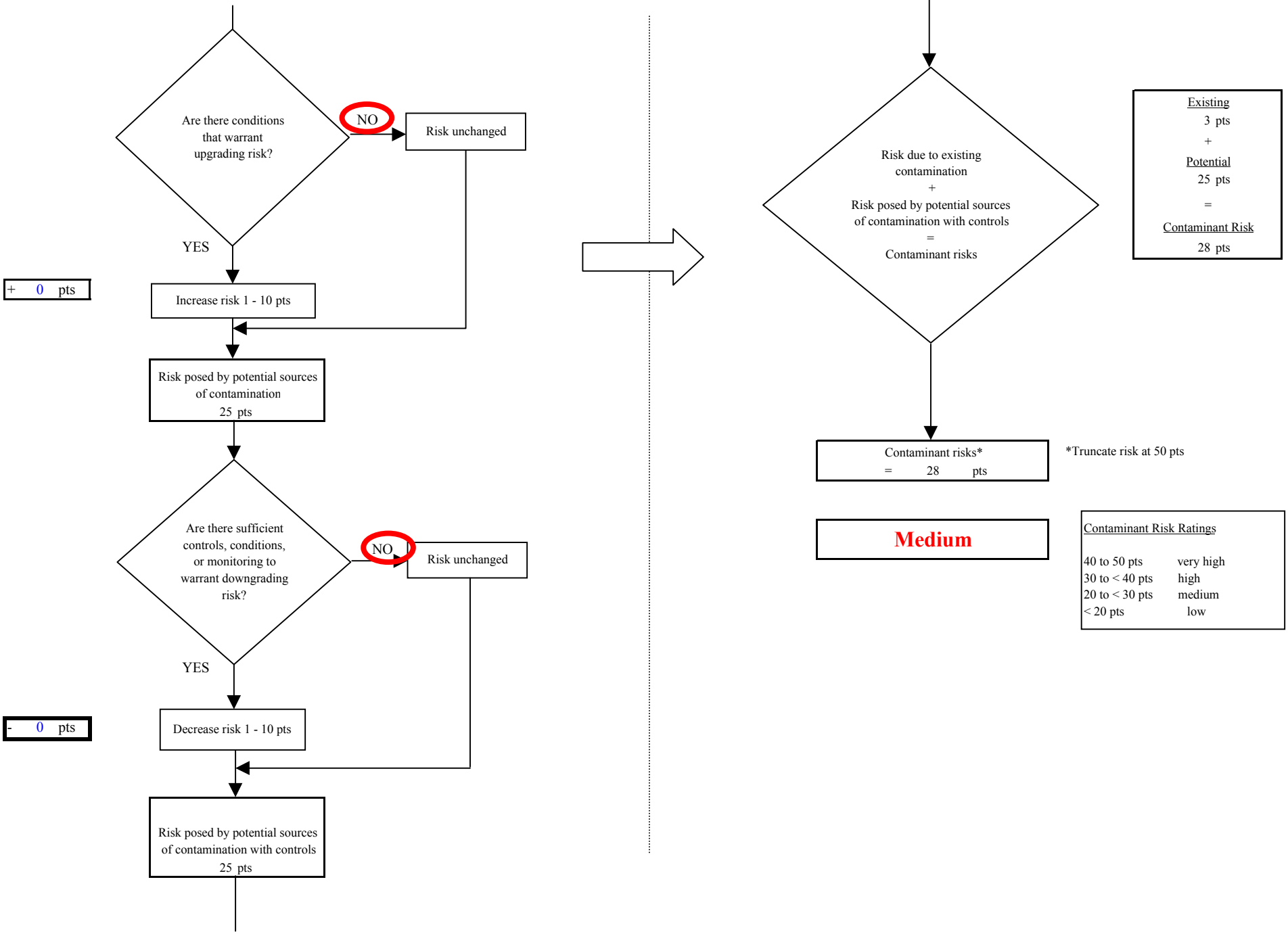


Chart 6. Vulnerability analysis for College Gate Baptist Church - Nitrates and Nitrites

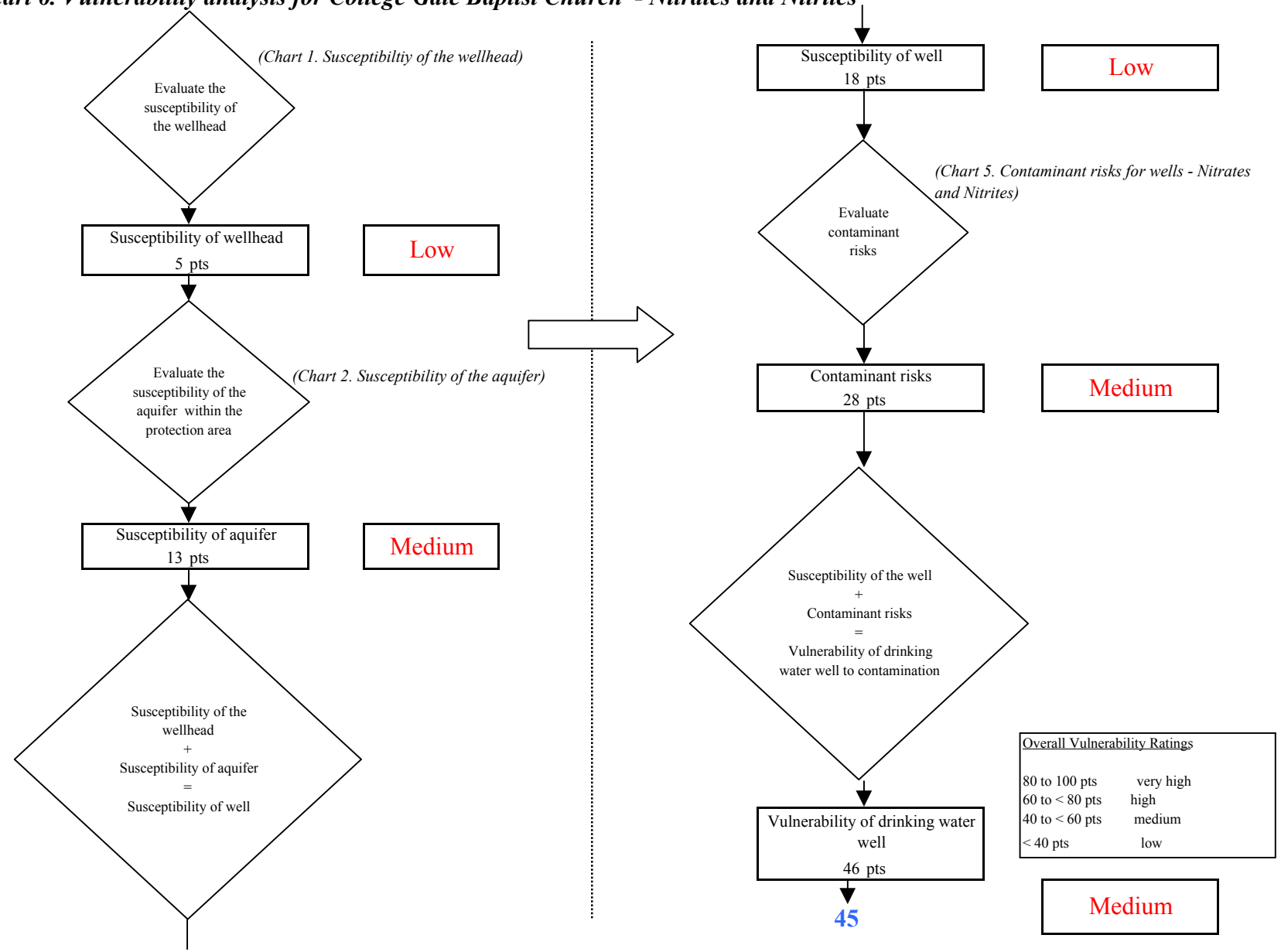


Chart 7. Contaminant risks for College Gate Baptist Church - Volatile Organic Chemicals

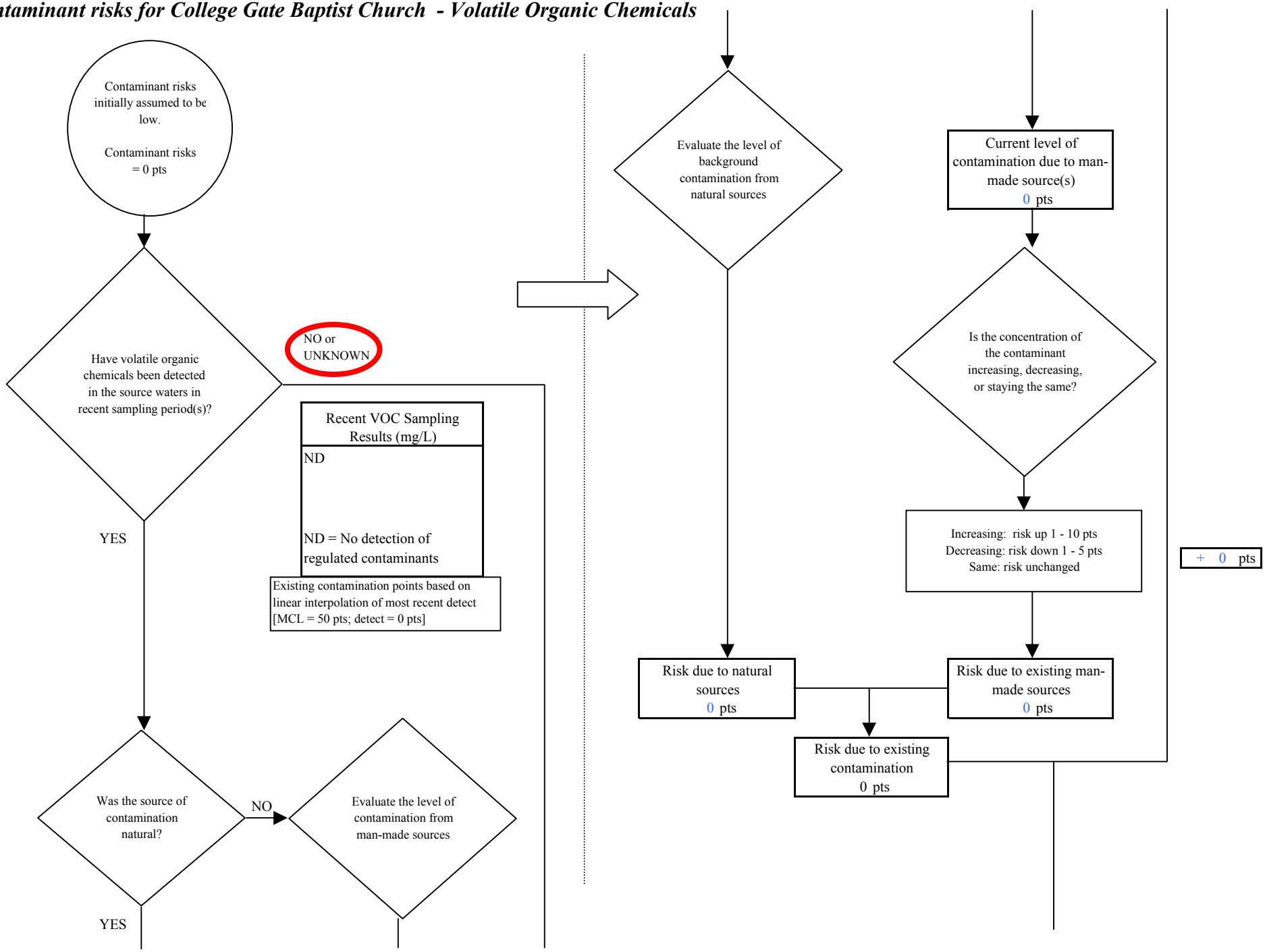


Chart 7. Contaminant risks for College Gate Baptist Church - Volatile Organic Chemicals

+ 25 pts

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

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

	Zone A	Zones B&C	Total
Very Highs(s)	0	0	0
High(s)	0	0	0
Medium(s)	0	1	1
Low(s)	4	6	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 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

Sewer lines

YES

Increase risk 1 - 10 pts

+ 2 pts

Chart 7. Contaminant risks for College Gate Baptist Church - Volatile Organic Chemicals

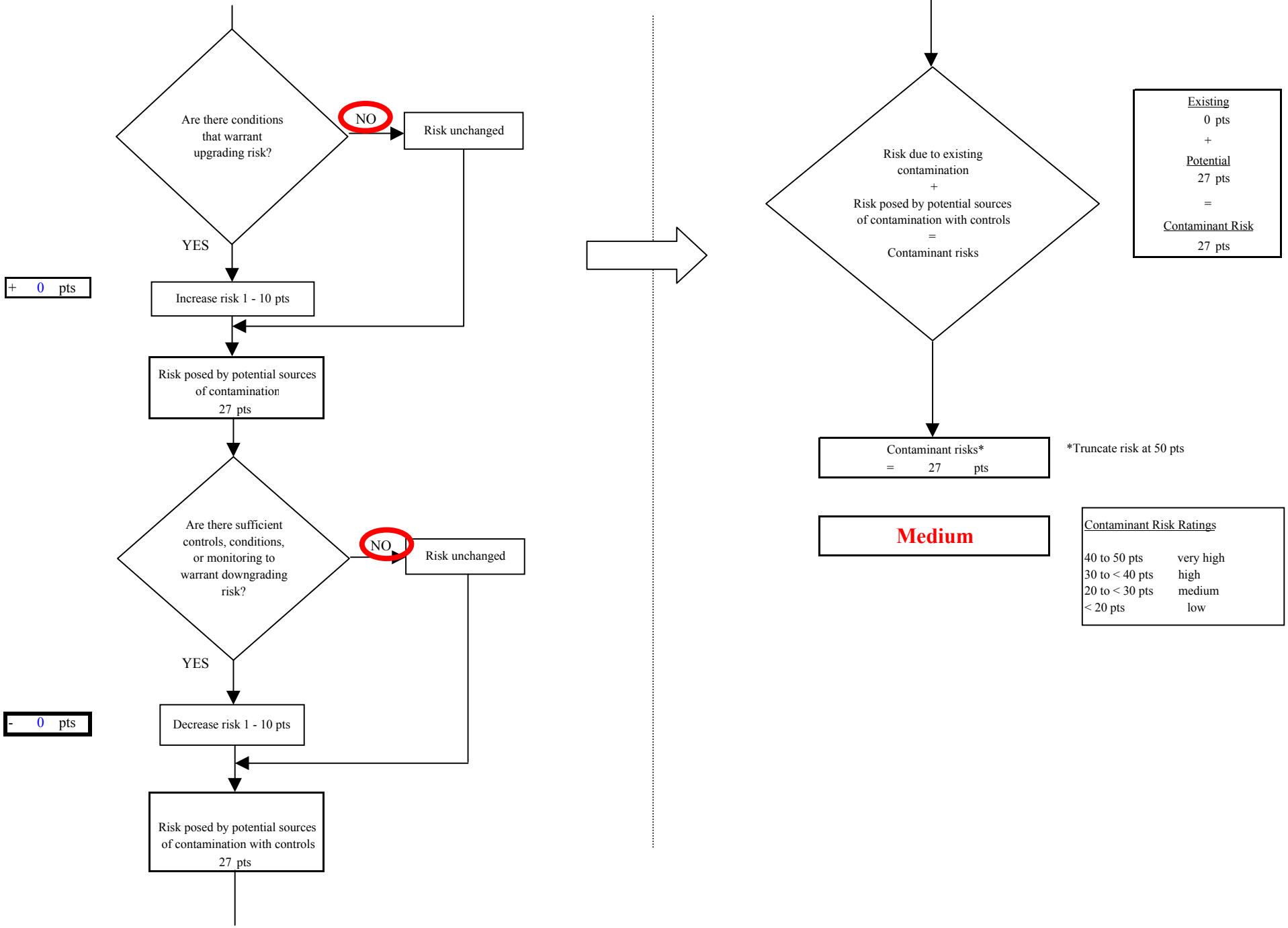


Chart 8. Vulnerability analysis for College Gate Baptist Church - Volatile Organic Chemicals