Source Water Assessment for Amazing Grace Lutheran Church Anchorage, Alaska

A Hydrogeologic Susceptibility and Vulnerability Analysis

DRINKING WATER PROTECTION PROGRAM REPORT 165
PWSID 214544.001

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ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION: 2001

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Source Water Assessment for Amazing Grace Lutheran Church's Source of Public Drinking Water, Anchorage, Alaska

A Hydrogeologic Susceptibility and Vulnerability Analysis

By Heather A. Hammond

Drinking Water Protection Program
Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

The Public Water System for Amazing Grace Lutheran Church is a Class A (non-transient/non-community) water system consisting of one well in the Anchorage area. Identified potential and current sources of contaminants for Amazing Grace Lutheran Church include: residential septic systems, paved roads, activities associated with parks and recreation trails, approximately 124 acres of residential area, a public utility corridor, and livestock stables and/or corral areas. These identified potential and existing sources of contamination are considered sources of bacteria and viruses, nitrates and/or nitrites, volatile organic chemicals, heavy metals, synthetic organic chemicals, and other organic chemicals. Overall, the public water source for Amazing Grace Lutheran Church received a vulnerability rating of **Low** for volatile organic chemicals, heavy metals, synthetic organic chemicals and other organic chemicals; **Medium** for bacteria and viruses; and **High** nitrates and/or nitrites.

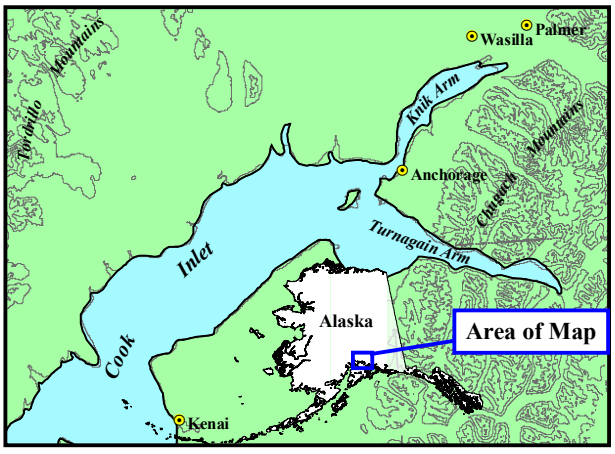

Figure 1. Index map showing the location of Anchorage, Alaska

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 Amazing Grace Lutheran 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.

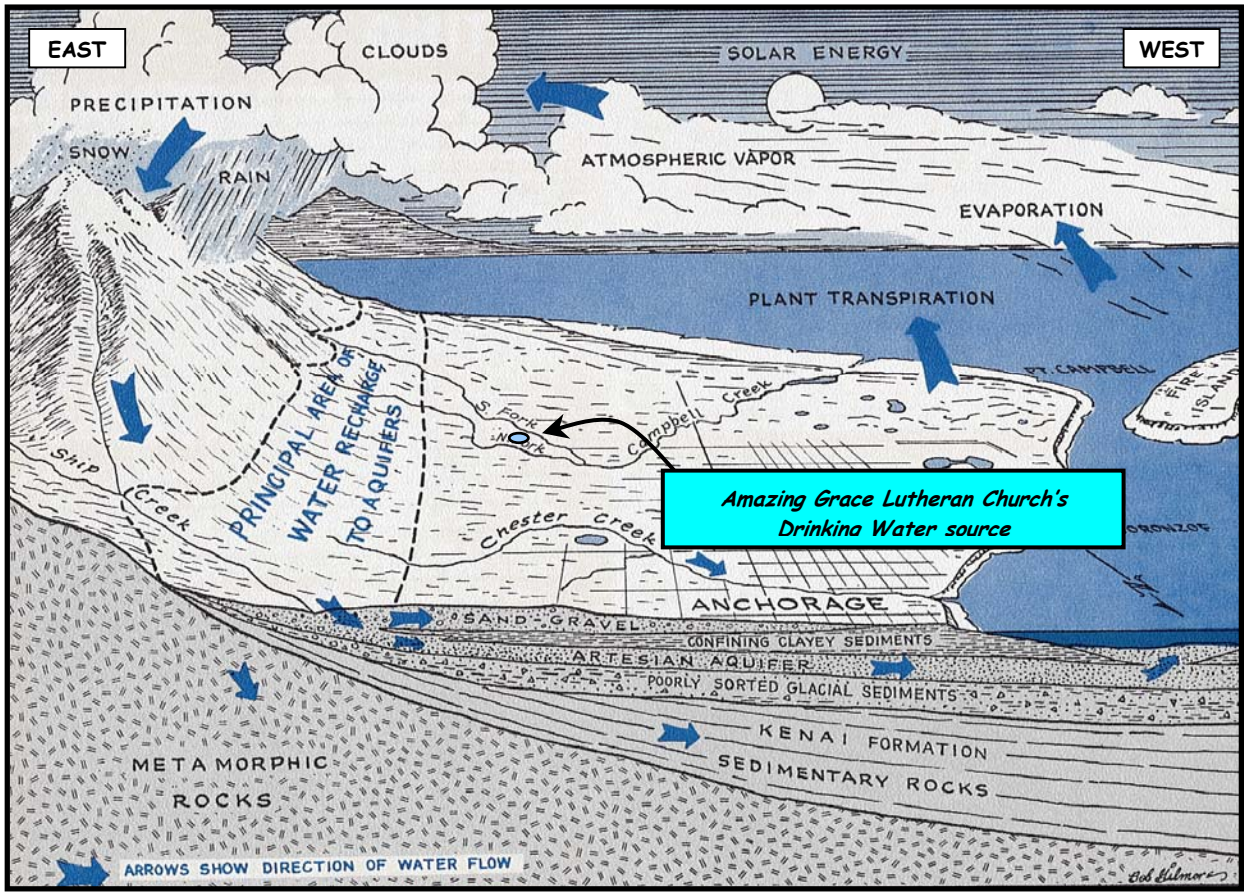

Figure 2. Generalized hydrologic cycle in the Anchorage area [*Barnwell, George, Dearborn,Weeks, and Zenone*, 1972].

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.

AMAZING GRACE LUTHERAN CHURCH'S PUBLIC DRINKING WATER SYSTEM

Amazing Grace Lutheran Church's public water system is a Class A (non-transient/non-community) water system, which is owned and operated by Amazing Grace Lutheran Church, of Anchorage. The system consists of one well, which is located near the intersection of O'Malley Road and Elmore Road (T12N, R3W, Section 22), at an elevation of approximately 500 feet above sea level (see Figure 3).

According to the most recent Sanitary Survey (06/11/98) the ground surrounding the well site slopes away from the well providing satisfactory drainage. The well was properly installed with a cap which may provide protection against contaminants from entering the source waters at the well casing. Installation of the well occurred June 21, 1975 to a total depth of 243 feet below ground surface and was completed in a 6" well casing. It is not indicated on the well log 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 410 non-residents through one service connection.

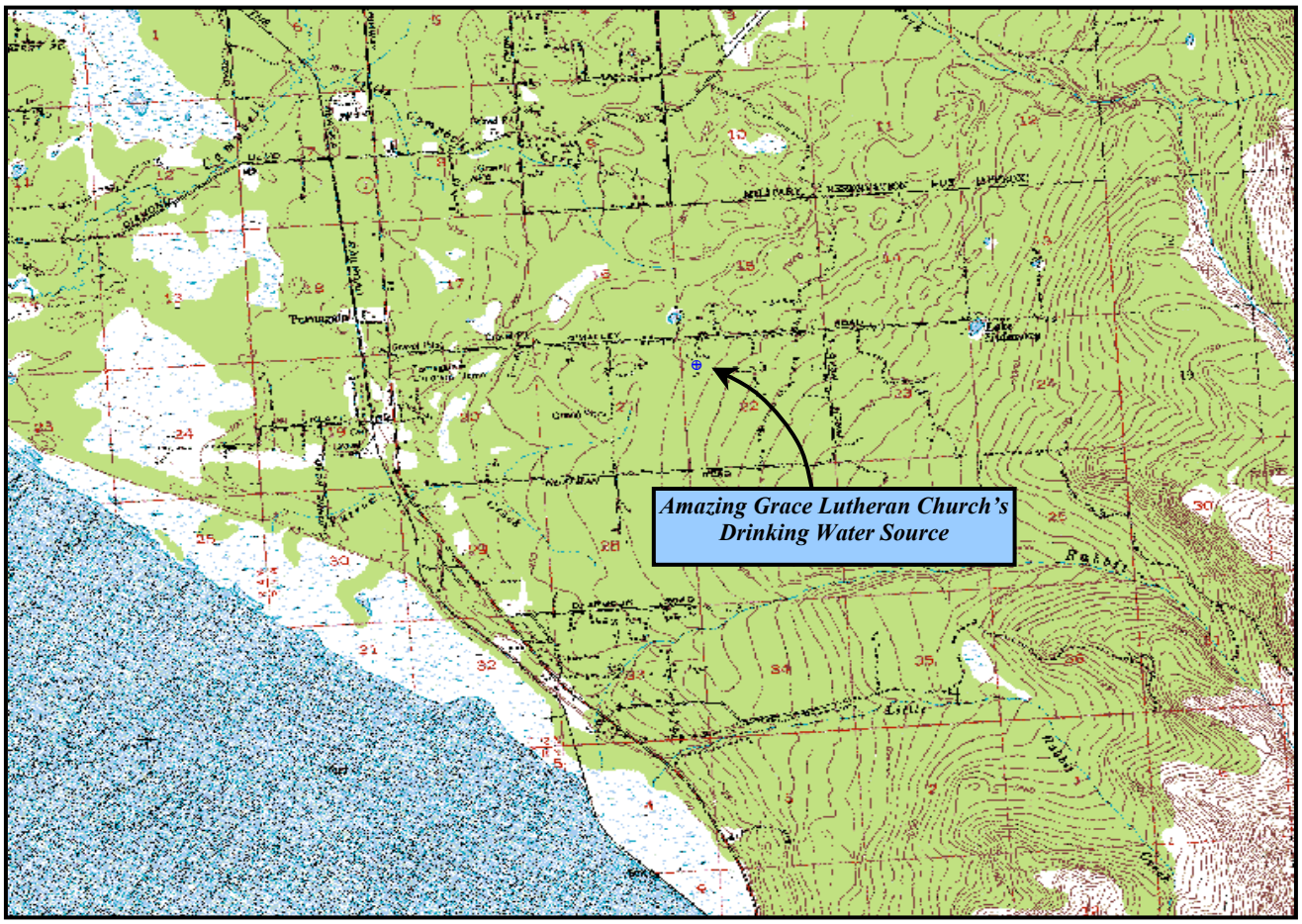

Figure 3. Map showing the location of the drinking water sources for Amazing Grace Lutheran Church [Base: USGS Anchorage A8].

ASSESSMENT AND PROTECTION AREA FOR AMAZING GRACE LUTHERAN CHURCH'S DRINKING WATER SOURCE

The Drinking Water Protection and Assessment Area that has been established for Amazing Grace Lutheran Church's source of drinking water 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 A Public Water Systems for additional information).

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

INVENTORY OF POTENTIAL AND EXISTING CONTAMINANT SOURCES

The Drinking Water Protection Program has completed an inventory of potential and existing sources of contamination within the Drinking Water Protection Area for Amazing Grace Lutheran Church. This survey was completed through a search of agency records and other publicly available information. Potential sources of contamination to drinking water supplies cover a wide range of categories and types. Potential drinking water contaminants are found within agricultural, residential, commercial, and industrial areas, but can also occur within areas that have little or no development.

For the basis of this assessment and all Class A public water system assessments, six categories of drinking water contaminants were inventoried. They include:

- Bacteria and viruses
- Nitrates and/or nitrites
- Volatile organic chemicals
- Heavy metals, cyanide, and other inorganic chemicals
- Synthetic organic chemicals
- Other organic chemicals

Maps 2 through 6 in Appendix C depict the Contaminant Source Inventory for Amazing Grace Lutheran Church. 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 Amazing Grace Lutheran Church:

- Residential septic systems;
- paved roads;
- activities associated with parks and recreation trails;
- approximately 124 acres of residential area;
- a public utility corridor;
- livestock stables and/or corrals.

These potential and existing contaminant sources present risk for all six categories of drinking water contaminants for Amazing Grace Lutheran Church's source of public drinking water.

RANKING OF CONTAMINANT RISKS

Potential and existing sources of contamination have been identified, sorted, and ranked according to what type and level of risk they represent. Ranking of contaminant risks for a "potential" or "existing" source of contamination is

a function of toxicity and volumes of specific contaminants associated with that source. Contaminant risks are further a function of the number and density of those types of contaminant sources as well as the proximity of those sources to the public drinking water wells.

VULNERABILITY OF AMAZING GRACE LUTHERAN 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 six categories of drinking water contaminants have been analyzed and an overall vulnerability score of 0 to 100 ultimately assigned:

Natural Susceptibility (0 – 50 points)

+

Contaminant Risks (0 – 50 points)

=

Vulnerability of the
Drinking Water Source to Contamination (0 – 100).

A score for the Natural Susceptibility is achieved by analyzing the properties of the well and the aquifer.

Susceptibility of the Wellhead (0 – 25 Points)
+
Susceptibility of the Aquifer (0 – 25 Points)

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

The well serving Amazing Grace Lutheran Church was completed in a confining aquifer. The depth to the top of the confining unit is approximately 86 feet below land surface. The thickness of the confining layer is suspected to be approximately 57 feet and composed of hardpan with intermittent layers of gravel. 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 confining 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 sources of public drinking water serving Amazing Grace Lutheran 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	17	High
Natural Susceptibility	22	Medium

Contaminant risks to a drinking water source depend on the type, number or density, and distribution of contaminant sources. A score (0 – 50 points) and rating of Contaminant Risks (See Appendix D) is assigned based on the findings of the Contaminant Source Inventory (See Appendix B - Table 1 – Table 7). This portion of the analysis examines any existing or historical contamination that has been detected at the drinking water sources through routine sampling. It also reviews contamination that has or may have occurred but has not arrived or been detected at the either 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	33	High
Nitrates and/or Nitrites	39	High
Volatile Organic Chemicals	12	Low
Heavy Metals, Cyanide, And Other Inorganic Chemicals	12	Low
Synthetic Organic Chemicals	12	Low
Other Organic Chemicals	12	Low

Appendix D contains fourteen charts, which together form the 'Vulnerability Analysis' for a Class A public drinking water system. Chart 1 analyzes the

'Susceptibility of the Wellhead' to contamination by looking at the construction of the well and its surrounding area. Chart 2 analyzes the 'Susceptibility of the Aquifer' to contamination by looking at the naturally occurring attributes of the water source and influences on the groundwater system that might lead to contamination. Chart 3 analyzes 'Contaminant Risks' for the drinking water source with respect to bacteria and viruses. The 'Contaminant Risks' portion of the analysis considers potential sources of contaminants as well as a review of contamination that has or may have occurred but has not arrived or been detected at the well. Lastly, Chart 4 contains the 'Vulnerability Analysis for Bacteria and Viruses'. Charts 5 through 14 contain the Contaminant Risks and Vulnerability Analysis for nitrates and nitrites, volatile organic chemicals, heavy metals, synthetic organic chemicals, and other organic chemicals, respectively.

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

Table 3. Overall Vulnerability of Amazing Grace Lutheran Church's Public Drinking Water Source to Contamination by Category

Category	Score	Rating
Bacteria and Viruses	55	Medium
Nitrates and Nitrites	60	High
Volatile Organic Chemicals	35	Low
Heavy Metals, Cyanide, and Other Inorganic Chemicals	35	Low
Synthetic Organic Chemicals	35	Low
Other Organic Chemicals	35	Low

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

Overall, contaminant risks for bacteria and viruses are high with livestock stable and/or corral areas driving the increase of contaminant risks. 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 activities associated with residential areas, septic systems, parks and recreation trails, and paved roads.

Nitrates and/or nitrites are found in natural background concentrations at the site, as elsewhere in Alaska. Historical sampling data indicate that low concentrations of nitrates and/or nitrites have been detected in Amazing Grace Lutheran Church's source waters (See Chart 5 – Contaminant Risks for Nitrates and/or Nitrites in Appendix D). Existing nitrate contamination is approximately 19% of the allowable limit (MCL) of 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. Nitrate levels have fluctuated in the source waters for Amazing Grace Lutheran Church, increasing slightly from 16% in 1996 to 19% in 2001.

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

Overall, contaminant risks for nitrates and/or nitrites are high with livestock stable and/or corral areas and activities associated with parks and green areas 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 high.

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

Overall, contaminant risk for volatile organic chemicals is low with paved 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 easement corridor.

A natural gas pipeline transverses the Zone A 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 a very 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 Amazing Grace Lutheran Church's source of public drinking water.

Overall, contaminant risks for heavy metals, cyanide and other inorganic chemicals is low with paved roads, septic systems and residential areas driving the increase of potential contaminant risks. Combining this potential contaminant risk with the natural susceptibility of the well leads to an overall vulnerability to contamination of low.

Overall, contaminant risks for synthetic organic chemicals and other organic chemicals is low with paved roads and septic systems driving the increase of potential contaminant risks for both categories. Combining this potential contaminant risk with the natural susceptibility of the well leads to an overall vulnerability to contamination of low.

Other low potential sources of contamination for synthetic organic chemicals and other organic chemicals include activities associated with residential areas and livestock stable and/or corral areas.

SUMMARY

A *Source Water Assessment* has been completed for the sources of public drinking water serving Amazing Grace Lutheran Church. The overall vulnerability of this source to contamination is **Low** for volatile organic chemicals heavy metals, synthetic organic chemicals, and other organic chemicals and **Medium** for bacteria and viruses and **High** nitrates and/or nitrites. 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 Amazing Grace Lutheran 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 Amazing Grace Lutheran Church 's public drinking water source.

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

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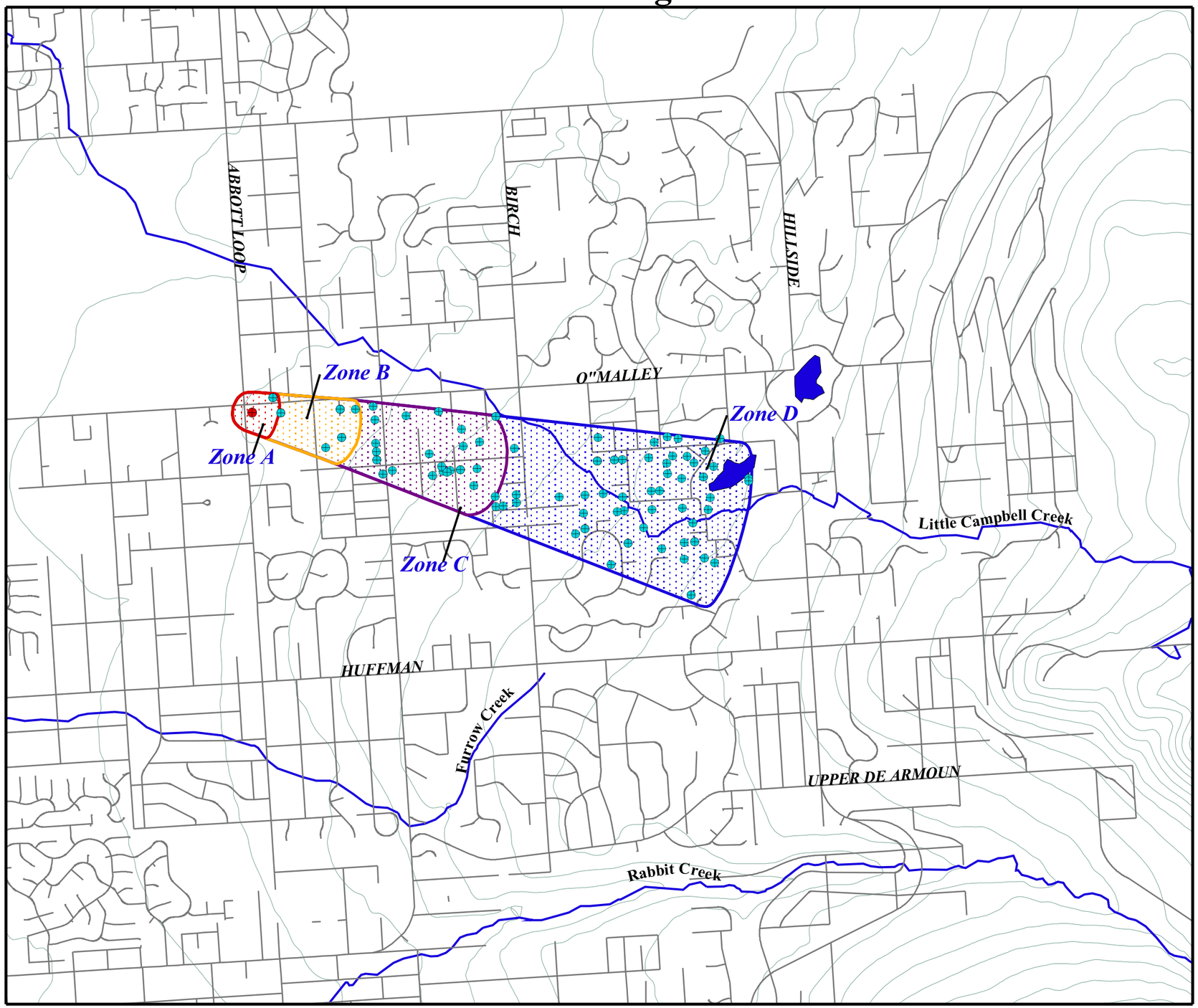
APPENDIX A

Amazing Grace Lutheran Church's
Drinking Water Protection Area

Drinking Water Protection Area for Amazing Grace Lutheran Church



- Amazing Grace Lutheran DW Well
- Private and Public DW Wells

Zone A Protection Area
- Several Months Travel Time

Zone B Protection Area
- Less Than 2 Years Travel Time

Zone C Protection Area
- Less Than 5 Years Travel Time

Zone D Protection Area
- Less Than 10 Years Travel Time

- Roads
- Anchorage Lakes
- Anchorage Streams
- Elevation Contours

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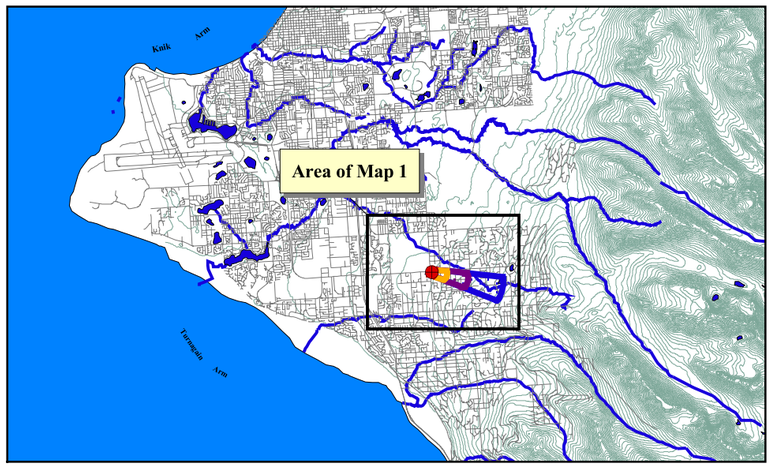

4000 0 4000 8000 Feet

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Map 1

APPENDIX B

Contaminant Source Inventory and Risk Ranking for Amazing Grace Lutheran Church

Table 1

Contaminant Source Inventory for
Amazing Grace Lutheran Church

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Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Location	Map Number	Comments
Residential Areas	R01	R1-1	A	Residential areas located within Zone A	2	
Septic systems (serves one or more single-family homes)	R02	R2-1	A	Along Elmore Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-2	A	Along Elmore Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-3	A	Along Abbott Loop Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-4	A	Along O'Malley Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-5	A	Along O'Malley Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-6	A	Along Whimbrel Drive	4	
Septic systems (serves one or more single-family homes)	R02	R2-7	A	Along O'Malley Road	4	
Highways and roads, paved (cement or asphalt)	X20	X20-1	A	Elmore Road	2	
Highways and roads, paved (cement or asphalt)	X20	X20-2	A	O'Malley Road	2	
Highways and roads, paved (cement or asphalt)	X20	X20-3	A	Abbott Loop Road	2	
Highways and roads, paved (cement or asphalt)	X20	X20-4	A	Whimbrel Drive	2	
Municipal or city parks (with green areas)	X04	X4-1	A	Municipal or City park within Zone A	2	
Public utility easements/corridors	X42	X42-1	A	Pipeline intersecting Zone A	2	Pipeline serves dual purpose and has trasported oil in the past. Currently it's transporting natural gas.
Dog walking areas/foot trails	X46	X46-1	A	Trail along the south side of O'Malley Road	2	
Dog walking areas/foot trails	X46	X46-2	A	Trail along the east side of Abbott Loop and Elmore Road	2	
Dog walking areas/foot trails	X46	X46-3	A	Trail along the west side of Elmore Road	2	
Dog walking areas/foot trails	X46	X46-4	A	Trail along the north side of O'Malley Road	2	
Livestock stables/corrals	A09	A9-1	B	Along O'Malley Road	4	
Residential Areas	R01	R1-2	B	Residential areas located within Zone B	2	
Septic systems (serves one or more single-family homes)	R02	R2-10	B	Along O'Malley Road	4	

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Location*	*Map Number*	*Comments*
Septic systems (serves one or more single-family homes)	R02	R2-11	B	Along O'Malley Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-12	B	Along O'Malley Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-13	B	Along Lipscomb Street	4	
Septic systems (serves one or more single-family homes)	R02	R2-14	B	Along Lipscomb Street	4	
Septic systems (serves one or more single-family homes)	R02	R2-15	B	Along Lipscomb Street	4	
Septic systems (serves one or more single-family homes)	R02	R2-16	B	Along Lipscomb Street	4	
Septic systems (serves one or more single-family homes)	R02	R2-17	B	Along Lipscomb Street	4	
Septic systems (serves one or more single-family homes)	R02	R2-18	B	Along Lipscomb Street	4	
Septic systems (serves one or more single-family homes)	R02	R2-19	B	Along Lipscomb Street	4	
Septic systems (serves one or more single-family homes)	R02	R2-20	B	Along Lipscomb Street	4	
Septic systems (serves one or more single-family homes)	R02	R2-21	B	Along Lipscomb Street	4	
Septic systems (serves one or more single-family homes)	R02	R2-22	B	Along Clare Circle	4	
Septic systems (serves one or more single-family homes)	R02	R2-23	B	Along Clare Circle	4	
Septic systems (serves one or more single-family homes)	R02	R2-24	B	Along O'Malley Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-25	B	Along O'Malley Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-8	B	Along O'Malley Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-9	B	Along O'Malley Road	4	
Highways and roads, paved (cement or asphalt)	X20	X20-5	B	Tahneeta Drive	2	
Highways and roads, paved (cement or asphalt)	X20	X20-6	B	Pacer Place	2	
Highways and roads, paved (cement or asphalt)	X20	X20-7	B	Lipscomb Street	2	
Highways and roads, paved (cement or asphalt)	X20	X20-8	B	Clare Circle	2	
Livestock stables/corrals	A09	A9-2	C	Along Totem Road	5	
Residential Areas	R01	R1-3	C	Residential areas located within Zone C	3	
Septic systems (serves one or more single-family homes)	R02	R2-26-87	C	All septic systems located within Zone C	5	
Highways and roads, paved (cement or asphalt)	X20	X20-9-17	C	All roads located within Zone C	3	

Table 2

Contaminant Source Inventory and Risk Ranking for Amazing Grace Lutheran Church Sources of Bacteria and Viruses

PWSID 214544.001

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	B	Medium	1	Along O'Malley Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-1	A	Low	2	Along Elmore Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-2	A	Low	3	Along Elmore Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-3	A	Low	4	Along Abbott Loop Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-4	A	Low	5	Along O'Malley Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-5	A	Low	6	Along O'Malley Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-6	A	Low	7	Along Whimbrel Drive	4	
Septic systems (serves one or more single-family homes)	R02	R2-7	A	Low	8	Along O'Malley Road	4	
Residential Areas	R01	R1-1	A	Low	9	Residential areas located within Zone A	2	
Residential Areas	R01	R1-2	B	Low	10	Residential areas located within Zone B	2	
Highways and roads, paved (cement or asphalt)	X20	X20-1	A	Low		Elmore Road	2	
Highways and roads, paved (cement or asphalt)	X20	X20-2	A	Low		O'Malley Road	2	
Highways and roads, paved (cement or asphalt)	X20	X20-3	A	Low		Abbott Loop Road	2	
Highways and roads, paved (cement or asphalt)	X20	X20-4	A	Low		Whimbrel Drive	2	
Municipal or city parks (with green areas)	X04	X4-1	A	Medium		Municipal or City park within Zone A	2	
Dog walking areas/foot trails	X46	X46-1	A	Low		Trail along the south side of O'Malley Road	2	
Dog walking areas/foot trails	X46	X46-2	A	Low		Trail along the east side of Abbott Loop and Elmore Road	2	

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Overall Rank after Analysis*	*Location*	*Map Number*	*Comments*
Dog walking areas/foot trails	X46	X46-3	A	Low		Trail along the west side of Elmore Road	2	
Dog walking areas/foot trails	X46	X46-4	A	Low		Trail along the north side of O'Malley Road	2	
Septic systems (serves one or more single-family homes)	R02	R2-10	B	Low		Along O'Malley Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-11	B	Low		Along O'Malley Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-12	B	Low		Along O'Malley Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-13	B	Low		Along Lipscomb Street	4	
Septic systems (serves one or more single-family homes)	R02	R2-14	B	Low		Along Lipscomb Street	4	
Septic systems (serves one or more single-family homes)	R02	R2-15	B	Low		Along Lipscomb Street	4	
Septic systems (serves one or more single-family homes)	R02	R2-16	B	Low		Along Lipscomb Street	4	
Septic systems (serves one or more single-family homes)	R02	R2-17	B	Low		Along Lipscomb Street	4	
Septic systems (serves one or more single-family homes)	R02	R2-18	B	Low		Along Lipscomb Street	4	
Septic systems (serves one or more single-family homes)	R02	R2-19	B	Low		Along Lipscomb Street	4	
Septic systems (serves one or more single-family homes)	R02	R2-20	B	Low		Along Lipscomb Street	4	
Septic systems (serves one or more single-family homes)	R02	R2-21	B	Low		Along Lipscomb Street	4	
Septic systems (serves one or more single-family homes)	R02	R2-22	B	Low		Along Clare Circle	4	
Septic systems (serves one or more single-family homes)	R02	R2-23	B	Low		Along Clare Circle	4	

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Overall Rank after Analysis*	*Location*	*Map Number*	*Comments*
Septic systems (serves one or more single-family homes)	R02	R2-24	B	Low		Along O'Malley Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-25	B	Low		Along O'Malley Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-8	B	Low		Along O'Malley Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-9	B	Low		Along O'Malley Road	4	
Highways and roads, paved (cement or asphalt)	X20	X20-5	B	Low		Tahneeta Drive	2	
Highways and roads, paved (cement or asphalt)	X20	X20-6	B	Low		Pacer Place	2	
Highways and roads, paved (cement or asphalt)	X20	X20-7	B	Low		Lipscomb Street	2	
Highways and roads, paved (cement or asphalt)	X20	X20-8	B	Low		Clare Circle	2	
Livestock stables/corrals	A09	A9-2	C	Medium		Along Totem Road	5	
Residential Areas	R01	R1-3	C	Low		Residential areas located within Zone C	3	
Septic systems (serves one or more single-family homes)	R02	R2-26-87	C	Low		All septic systems located within Zone C	5	
Highways and roads, paved (cement or asphalt)	X20	X20-9-17	C	Low		All roads located within Zone C	3	

Table 3

Contaminant Source Inventory and Risk Ranking for Amazing Grace Lutheran Church Sources of Nitrates/Nitrites

PWSID 214544.001

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	B	Medium	1	Along O'Malley Road	4	
Residential Areas	R01	R1-1	A	Low	2	Residential areas located within Zone A	2	
Septic systems (serves one or more single-family homes)	R02	R2-1	A	Low	3	Along Elmore Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-2	A	Low	4	Along Elmore Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-3	A	Low	5	Along Abbott Loop Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-4	A	Low	6	Along O'Malley Road	4	
Municipal or city parks (with green areas)	X04	X4-1	A	Medium	7	Municipal or City park within Zone A	2	
Dog walking areas/foot trails	X46	X46-1	A	Low	8	Trail along the south side of O'Malley Road	2	
Dog walking areas/foot trails	X46	X46-2	A	Low	9	Trail along the east side of Abbott Loop and Elmore Road	2	
Dog walking areas/foot trails	X46	X46-3	A	Low	10	Trail along the west side of Elmore Road	2	
Septic systems (serves one or more single-family homes)	R02	R2-5	A	Low		Along O'Malley Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-6	A	Low		Along Whimbrel Drive	4	
Septic systems (serves one or more single-family homes)	R02	R2-7	A	Low		Along O'Malley Road	4	
Highways and roads, paved (cement or asphalt)	X20	X20-1	A	Low		Elmore Road	2	
Highways and roads, paved (cement or asphalt)	X20	X20-2	A	Low		O'Malley Road	2	
Highways and roads, paved (cement or asphalt)	X20	X20-3	A	Low		Abbott Loop Road	2	
Highways and roads, paved (cement or asphalt)	X20	X20-4	A	Low		Whimbrel Drive	2	

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Overall Rank after Analysis*	*Location*	*Map Number*	*Comments*
Dog walking areas/foot trails	X46	X46-4	A	Low		Trail along the north side of O'Malley Road	2	
Residential Areas	R01	R1-2	B	Low		Residential areas located within Zone B	2	
Septic systems (serves one or more single-family homes)	R02	R2-10	B	Low		Along O'Malley Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-11	B	Low		Along O'Malley Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-12	B	Low		Along O'Malley Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-13	B	Low		Along Lipscomb Street	4	
Septic systems (serves one or more single-family homes)	R02	R2-14	B	Low		Along Lipscomb Street	4	
Septic systems (serves one or more single-family homes)	R02	R2-15	B	Low		Along Lipscomb Street	4	
Septic systems (serves one or more single-family homes)	R02	R2-16	B	Low		Along Lipscomb Street	4	
Septic systems (serves one or more single-family homes)	R02	R2-17	B	Low		Along Lipscomb Street	4	
Septic systems (serves one or more single-family homes)	R02	R2-18	B	Low		Along Lipscomb Street	4	
Septic systems (serves one or more single-family homes)	R02	R2-19	B	Low		Along Lipscomb Street	4	
Septic systems (serves one or more single-family homes)	R02	R2-20	B	Low		Along Lipscomb Street	4	
Septic systems (serves one or more single-family homes)	R02	R2-21	B	Low		Along Lipscomb Street	4	
Septic systems (serves one or more single-family homes)	R02	R2-22	B	Low		Along Clare Circle	4	
Septic systems (serves one or more single-family homes)	R02	R2-23	B	Low		Along Clare Circle	4	

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Overall Rank after Analysis*	*Location*	*Map Number*	*Comments*
Septic systems (serves one or more single-family homes)	R02	R2-24	B	Low		Along O'Malley Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-25	B	Low		Along O'Malley Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-8	B	Low		Along O'Malley Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-9	B	Low		Along O'Malley Road	4	
Highways and roads, paved (cement or asphalt)	X20	X20-5	B	Low		Tahneeta Drive	2	
Highways and roads, paved (cement or asphalt)	X20	X20-6	B	Low		Pacer Place	2	
Highways and roads, paved (cement or asphalt)	X20	X20-7	B	Low		Lipscomb Street	2	
Highways and roads, paved (cement or asphalt)	X20	X20-8	B	Low		Clare Circle	2	
Livestock stables/corrals	A09	A9-2	C	Medium		Along Totem Road	5	
Residential Areas	R01	R1-3	C	Low		Residential areas located within Zone C	3	
Septic systems (serves one or more single-family homes)	R02	R2-26-87	C	Low		All septic systems located within Zone C	5	
Highways and roads, paved (cement or asphalt)	X20	X20-9-17	C	Low		All roads located within Zone C	3	

Table 4

Contaminant Source Inventory and Risk Ranking for Amazing Grace Lutheran Church Sources of Volatile Organic Chemicals

PWSID 214544.001

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	Elmore Road	2	
Highways and roads, paved (cement or asphalt)	X20	X20-2	A	Low	2	O'Malley Road	2	
Highways and roads, paved (cement or asphalt)	X20	X20-3	A	Low	3	Abbott Loop Road	2	
Highways and roads, paved (cement or asphalt)	X20	X20-4	A	Low	4	Whimbrel Drive	2	
Septic systems (serves one or more single-family homes)	R02	R2-1	A	Low	5	Along Elmore Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-2	A	Low	6	Along Elmore Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-3	A	Low	7	Along Abbott Loop Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-4	A	Low	8	Along O'Malley Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-5	A	Low	9	Along O'Malley Road	4	
Residential Areas	R01	R1-1	A	Low	10	Residential areas located within Zone A	2	
Septic systems (serves one or more single-family homes)	R02	R2-6	A	Low		Along Whimbrel Drive	4	
Septic systems (serves one or more single-family homes)	R02	R2-7	A	Low		Along O'Malley Road	4	
Public utility easements/corridors	X42	X42-1	A	Low		Pipeline intersecting Zone A	2	Pipeline serves dual purpose and has trasported oil in the past. Currently it's transporting natural gas.
Residential Areas	R01	R1-2	B	Low		Residential areas located within Zone B	2	
Septic systems (serves one or more single-family homes)	R02	R2-10	B	Low		Along O'Malley Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-11	B	Low		Along O'Malley Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-12	B	Low		Along O'Malley Road	4	

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Overall Rank after Analysis*	*Location*	*Map Number*	*Comments*
Septic systems (serves one or more single-family homes)	R02	R2-13	B	Low		Along Lipscomb Street	4	
Septic systems (serves one or more single-family homes)	R02	R2-14	B	Low		Along Lipscomb Street	4	
Septic systems (serves one or more single-family homes)	R02	R2-15	B	Low		Along Lipscomb Street	4	
Septic systems (serves one or more single-family homes)	R02	R2-16	B	Low		Along Lipscomb Street	4	
Septic systems (serves one or more single-family homes)	R02	R2-17	B	Low		Along Lipscomb Street	4	
Septic systems (serves one or more single-family homes)	R02	R2-18	B	Low		Along Lipscomb Street	4	
Septic systems (serves one or more single-family homes)	R02	R2-19	B	Low		Along Lipscomb Street	4	
Septic systems (serves one or more single-family homes)	R02	R2-20	B	Low		Along Lipscomb Street	4	
Septic systems (serves one or more single-family homes)	R02	R2-21	B	Low		Along Lipscomb Street	4	
Septic systems (serves one or more single-family homes)	R02	R2-22	B	Low		Along Clare Circle	4	
Septic systems (serves one or more single-family homes)	R02	R2-23	B	Low		Along Clare Circle	4	
Septic systems (serves one or more single-family homes)	R02	R2-24	B	Low		Along O'Malley Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-25	B	Low		Along O'Malley Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-8	B	Low		Along O'Malley Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-9	B	Low		Along O'Malley Road	4	
Highways and roads, paved (cement or asphalt)	X20	X20-5	B	Low		Tahneeta Drive	2	

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Overall Rank after Analysis*	*Location*	*Map Number*	*Comments*
Highways and roads, paved (cement or asphalt)	X20	X20-6	B	Low		Pacer Place	2	
Highways and roads, paved (cement or asphalt)	X20	X20-7	B	Low		Lipscomb Street	2	
Highways and roads, paved (cement or asphalt)	X20	X20-8	B	Low		Clare Circle	2	
Livestock stables/corrals	A09	A9-2	C	0		Along Totem Road	5	
Residential Areas	R01	R1-3	C	Low		Residential areas located within Zone C	3	
Septic systems (serves one or more single-family homes)	R02	R2-26-87	C	Low		All septic systems located within Zone C	5	
Highways and roads, paved (cement or asphalt)	X20	X20-9-17	C	Low		All roads located within Zone C	3	

Table 5

Contaminant Source Inventory and Risk Ranking for Amazing Grace Lutheran Church
Sources of Heavy Metals, Cyanide and Other Inorganic Chemicals

PWSID 214544.001

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	Elmore Road	2	
Highways and roads, paved (cement or asphalt)	X20	X20-2	A	Low	2	O'Malley Road	2	
Highways and roads, paved (cement or asphalt)	X20	X20-3	A	Low	3	Abbott Loop Road	2	
Highways and roads, paved (cement or asphalt)	X20	X20-4	A	Low	4	Whimbrel Drive	2	
Residential Areas	R01	R1-1	A	Low	5	Residential areas located within Zone A	2	
Residential Areas	R01	R1-2	B	Low	6	Residential areas located within Zone B	2	
Septic systems (serves one or more single-family homes)	R02	R2-1	A	Low	7	Along Elmore Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-2	A	Low	8	Along Elmore Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-3	A	Low	9	Along Abbott Loop Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-4	A	Low	10	Along O'Malley Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-5	A	Low		Along O'Malley Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-6	A	Low		Along Whimbrel Drive	4	
Septic systems (serves one or more single-family homes)	R02	R2-7	A	Low		Along O'Malley Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-10	B	Low		Along O'Malley Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-11	B	Low		Along O'Malley Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-12	B	Low		Along O'Malley Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-13	B	Low		Along Lipscomb Street	4	

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Overall Rank after Analysis*	*Location*	*Map Number*	*Comments*
Septic systems (serves one or more single-family homes)	R02	R2-14	B	Low		Along Lipscomb Street	4	
Septic systems (serves one or more single-family homes)	R02	R2-15	B	Low		Along Lipscomb Street	4	
Septic systems (serves one or more single-family homes)	R02	R2-16	B	Low		Along Lipscomb Street	4	
Septic systems (serves one or more single-family homes)	R02	R2-17	B	Low		Along Lipscomb Street	4	
Septic systems (serves one or more single-family homes)	R02	R2-18	B	Low		Along Lipscomb Street	4	
Septic systems (serves one or more single-family homes)	R02	R2-19	B	Low		Along Lipscomb Street	4	
Septic systems (serves one or more single-family homes)	R02	R2-20	B	Low		Along Lipscomb Street	4	
Septic systems (serves one or more single-family homes)	R02	R2-21	B	Low		Along Lipscomb Street	4	
Septic systems (serves one or more single-family homes)	R02	R2-22	B	Low		Along Clare Circle	4	
Septic systems (serves one or more single-family homes)	R02	R2-23	B	Low		Along Clare Circle	4	
Septic systems (serves one or more single-family homes)	R02	R2-24	B	Low		Along O'Malley Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-25	B	Low		Along O'Malley Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-8	B	Low		Along O'Malley Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-9	B	Low		Along O'Malley Road	4	
Highways and roads, paved (cement or asphalt)	X20	X20-5	B	Low		Tahneeta Drive	2	
Highways and roads, paved (cement or asphalt)	X20	X20-6	B	Low		Pacer Place	2	
Highways and roads, paved (cement or asphalt)	X20	X20-7	B	Low		Lipscomb Street	2	

Contaminant Source Inventory and Risk Ranking for Amazing Grace Lutheran Church

Sources of Heavy Metals, Cyanide and Other Inorganic Chemicals

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Overall Rank after Analysis*	*Location*	*Map Number*	*Comments*
Highways and roads, paved (cement or asphalt)	X20	X20-8	B	Low		Clare Circle	2	
Residential Areas	R01	R1-3	C	Low		Residential areas located within Zone C	3	
Septic systems (serves one or more single-family homes)	R02	R2-26-87	C	Low		All septic systems located within Zone C	5	
Highways and roads, paved (cement or asphalt)	X20	X20-9-17	C	Low		All roads located within Zone C	3	

Table 6

Contaminant Source Inventory and Risk Ranking for Amazing Grace Lutheran Church Sources of Synthetic Organic Chemicals

PWSID 214544.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Overall Rank after Analysis*	*Location*	*Map Number*	*Comments*
Residential Areas	R01	R1-1	A	Low	1	Residential areas located within Zone A	2	
Residential Areas	R01	R1-2	B	Low	2	Residential areas located within Zone B	2	
Septic systems (serves one or more single-family homes)	R02	R2-1	A	Low	3	Along Elmore Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-2	A	Low	4	Along Elmore Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-3	A	Low	5	Along Abbott Loop Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-4	A	Low	6	Along O'Malley Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-5	A	Low	7	Along O'Malley Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-6	A	Low	8	Along Whimbrel Drive	4	
Septic systems (serves one or more single-family homes)	R02	R2-7	A	Low	9	Along O'Malley Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-8	B	Low	10	Along O'Malley Road	4	
Municipal or city parks (with green areas)	X04	X4-1	A	Low		Municipal or City park within Zone A	2	
Livestock stables/corrals	A09	A9-1	B	Low		Along O'Malley Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-10	B	Low		Along O'Malley Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-11	B	Low		Along O'Malley Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-12	B	Low		Along O'Malley Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-13	B	Low		Along Lipscomb Street	4	

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Overall Rank after Analysis*	*Location*	*Map Number*	*Comments*
Septic systems (serves one or more single-family homes)	R02	R2-14	B	Low		Along Lipscomb Street	4	
Septic systems (serves one or more single-family homes)	R02	R2-15	B	Low		Along Lipscomb Street	4	
Septic systems (serves one or more single-family homes)	R02	R2-16	B	Low		Along Lipscomb Street	4	
Septic systems (serves one or more single-family homes)	R02	R2-17	B	Low		Along Lipscomb Street	4	
Septic systems (serves one or more single-family homes)	R02	R2-18	B	Low		Along Lipscomb Street	4	
Septic systems (serves one or more single-family homes)	R02	R2-19	B	Low		Along Lipscomb Street	4	
Septic systems (serves one or more single-family homes)	R02	R2-20	B	Low		Along Lipscomb Street	4	
Septic systems (serves one or more single-family homes)	R02	R2-21	B	Low		Along Lipscomb Street	4	
Septic systems (serves one or more single-family homes)	R02	R2-22	B	Low		Along Clare Circle	4	
Septic systems (serves one or more single-family homes)	R02	R2-23	B	Low		Along Clare Circle	4	
Septic systems (serves one or more single-family homes)	R02	R2-24	B	Low		Along O'Malley Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-25	B	Low		Along O'Malley Road	4	
Septic systems (serves one or more single-family homes)	R02	R2-9	B	Low		Along O'Malley Road	4	
Livestock stables/corrals	A09	A9-2	C	Low		Along Totem Road	5	
Residential Areas	R01	R1-3	C	Low		Residential areas located within Zone C	3	
Septic systems (serves one or more single-family homes)	R02	R2-26-87	C	Low		All septic systems located within Zone C	5	

Table 6 (continued)

Contaminant Source Inventory and Risk Ranking for Amazing Grace Lutheran Church Sources of Synthetic Organic Chemicals

PWSID 214544.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Overall Rank after Analysis*	*Location*	*Map Number*	*Comments*

Table 7

Contaminant Source Inventory and Risk Ranking for Amazing Grace Lutheran Church Sources of Other Organic Chemicals

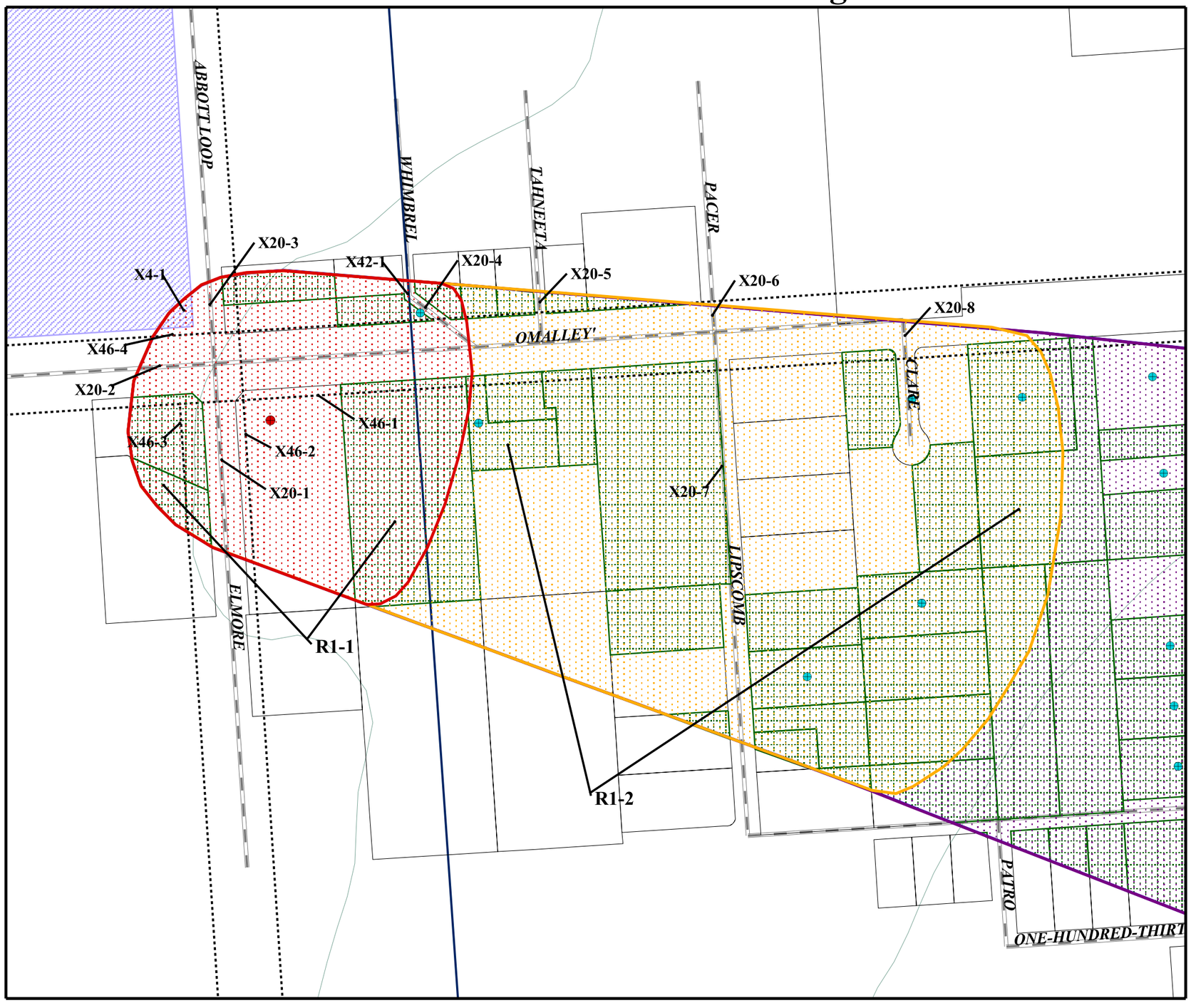
PWSID 214544.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Overall Rank after Analysis*	*Location*	*Map Number*	*Comments*
Residential Areas	R01	R1-1	A	Low	1	Residential areas located within Zone A	2	
Residential Areas	R01	R1-2	B	Low	2	Residential areas located within Zone B	2	
Highways and roads, paved (cement or asphalt)	X20	X20-1	A	Low	3	Elmore Road	2	
Highways and roads, paved (cement or asphalt)	X20	X20-2	A	Low	4	O'Malley Road	2	
Highways and roads, paved (cement or asphalt)	X20	X20-3	A	Low	5	Abbott Loop Road	2	
Highways and roads, paved (cement or asphalt)	X20	X20-4	A	Low	6	Whimbrel Drive	2	
Highways and roads, paved (cement or asphalt)	X20	X20-5	B	Low	7	Tahneeta Drive	2	
Highways and roads, paved (cement or asphalt)	X20	X20-6	B	Low	8	Pacer Place	2	
Highways and roads, paved (cement or asphalt)	X20	X20-7	B	Low	9	Lipscomb Street	2	
Highways and roads, paved (cement or asphalt)	X20	X20-8	B	Low	10	Clare Circle	2	
Residential Areas	R01	R1-3	C	Low		Residential areas located within Zone C	3	
Highways and roads, paved (cement or asphalt)	X20	X20-9-17	C	Low		All roads located within Zone C	3	

APPENDIX C

Amazing Grace Lutheran Church's Drinking Water Protection Area and Potential & Existing Contaminant Sources

Drinking Water Protection Area for Amazing Grace Lutheran Church and Potential & Existing Contaminant Sources



- Amazing Grace Lutheran DW Well
- Private and Public DW Wells

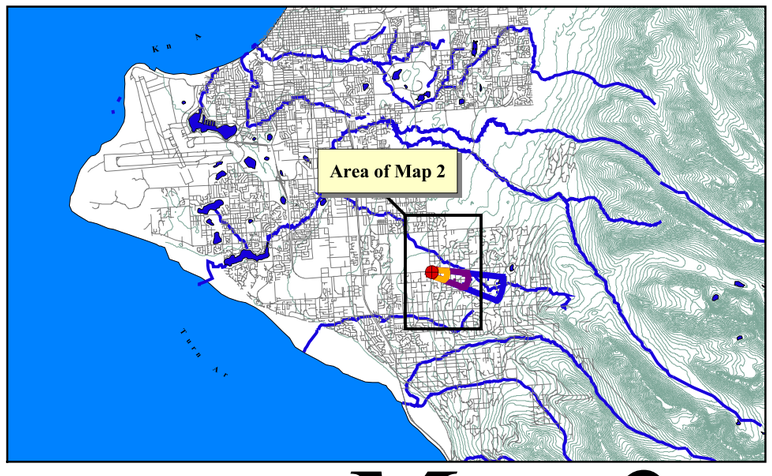
Zone A Protection Area
- Several Months Travel Time

Zone B Protection Area
- Less Than 2 Years Travel Time

Zone C Protection Area
- Less Than 5 Years Travel Time

Zone D Protection Area
- Less Than 10 Years Travel Time
- Residential Areas (R1)
- Anchorage Parks (X4)
- Anchorage Land Parcels
- Public Utility Easements/Corridors (X42)
- Trails (X46)
- Raods (X20)
- Anchorage Streams
- Elevation Contours

N W E S

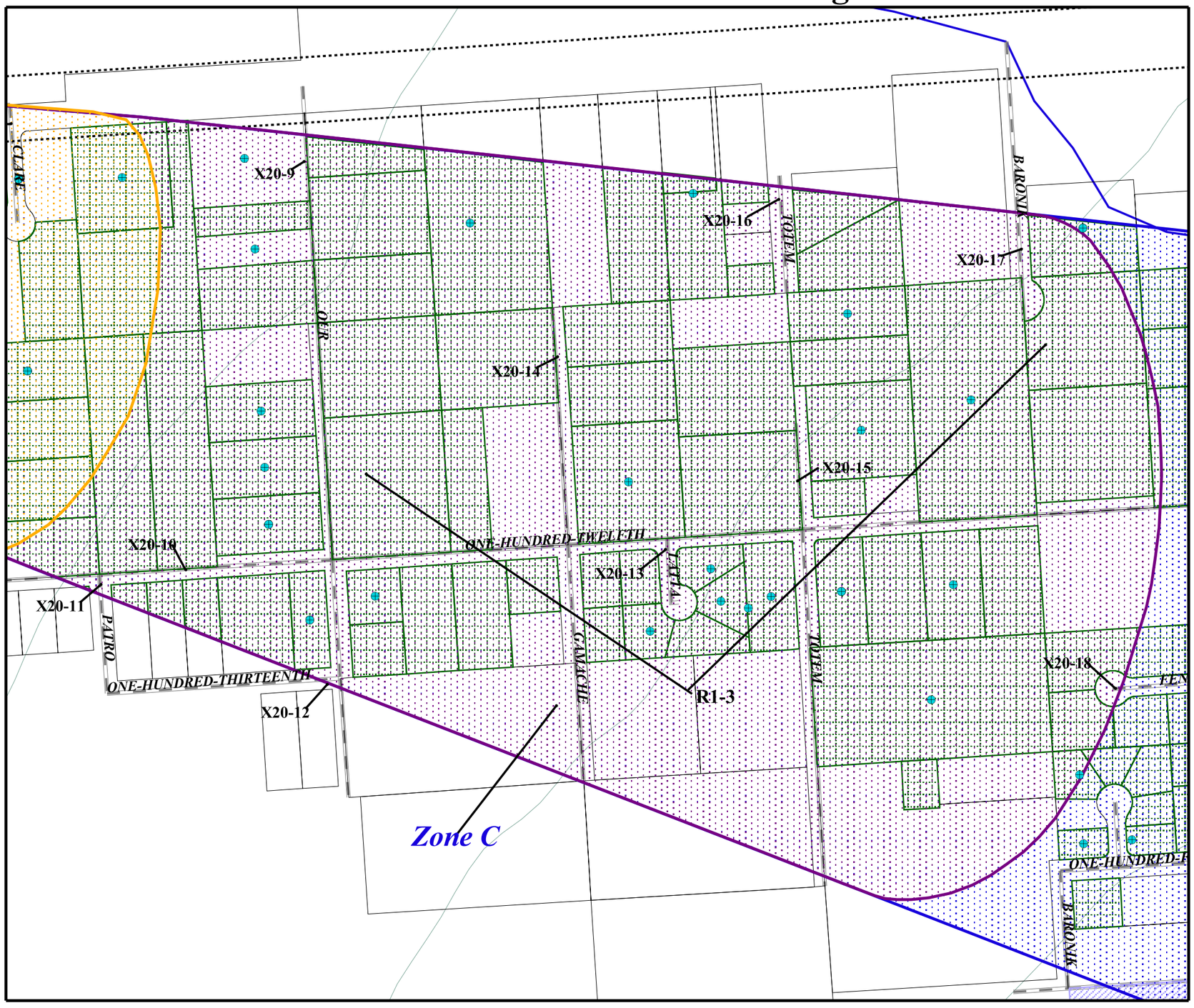


500 0 500 1000 Feet

PWSID 214544.001

Map 2

Drinking Water Protection Area for Amazing Grace Lutheran Church and Potential & Existing Contaminant Sources



500 0 500 1000 Feet

- Amazing Grace Lutheran DW Well
- Private and Public DW Wells

Zone A Protection Area
- Several Months Travel Time

Zone B Protection Area
- Less Than 2 Years Travel Time

Zone C Protection Area
- Less Than 5 Years Travel Time

Zone D Protection Area
- Less Than 10 Years Travel Time
- Residential Areas (R1)
- Anchorage Parks (X4)
- Anchorage Land Parcels
- Trails (X46)
- Raods (X20)
- Anchorage Streams
- Elevation Contours

N
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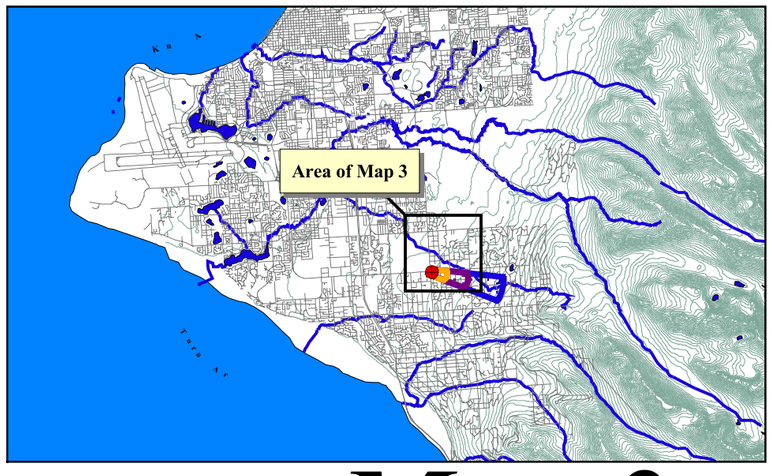
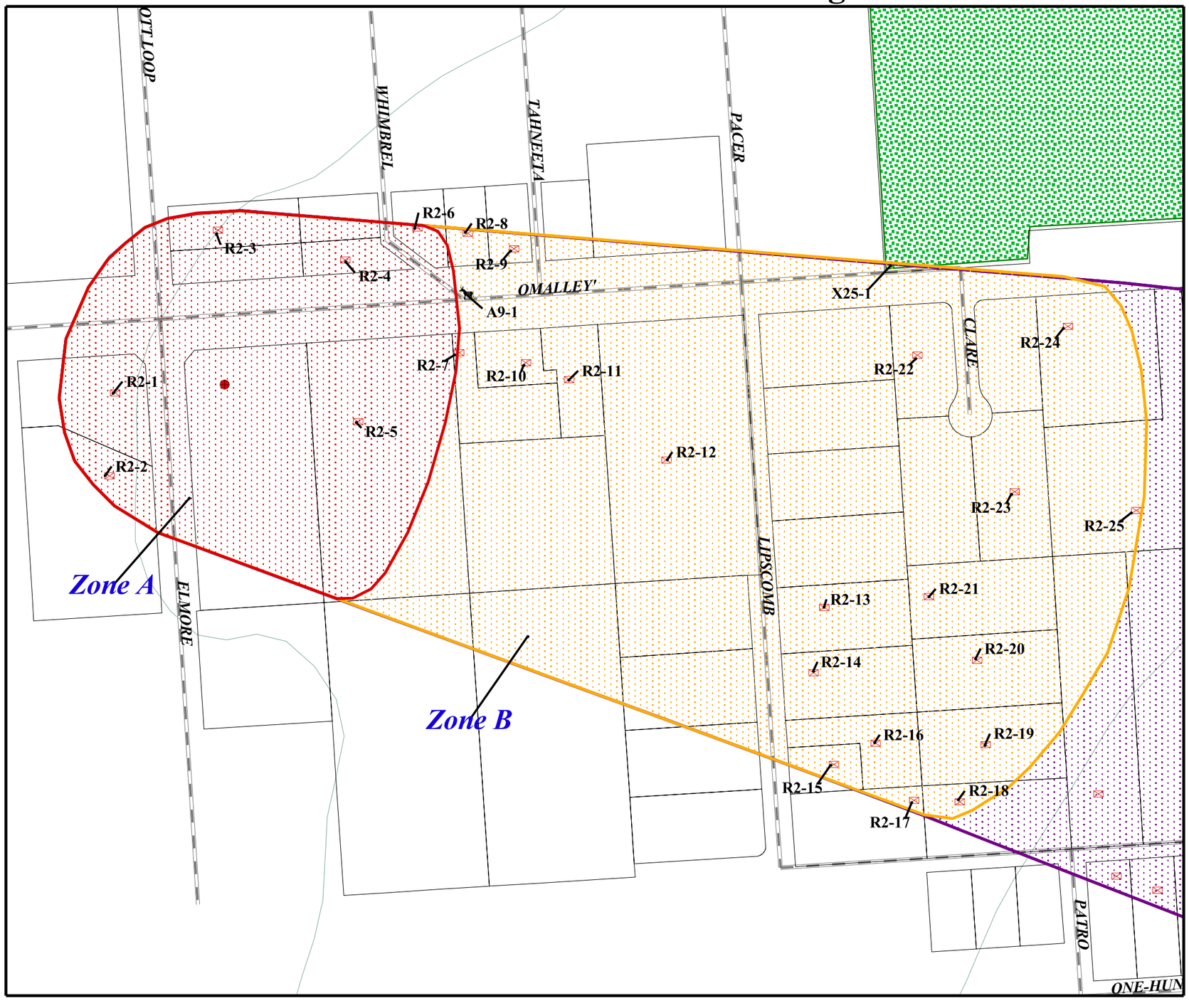
S



PWSID 214544.001

Map 3

Drinking Water Protection Area for Amazing Grace Lutheran Church and Potential & Existing Contaminant Sources



- Amazing Grace Lutheran DW Well

Zone A Protection Area
- Several Months Travel Time

Zone B Protection Area
- Less Than 2 Years Travel Time

Zone C Protection Area
- Less Than 5 Years Travel Time

Zone D Protection Area
- Less Than 10 Years Travel Time
- Anchorage Land Parcels
- Septic Systems (R2)
- Alaska Zoo (X52)

Potential and Existing Contaminant Sources
- Livestock Stables/Corrals (A9)
- Motor/Motor Vehicle Repair Shops (C31)
- Construction Trade Areas and Materials (C9)
- MedicalVeterinary Facilities (X40)
- Raods (X20)
- Anchorage Streams
- Elevation Contours

N
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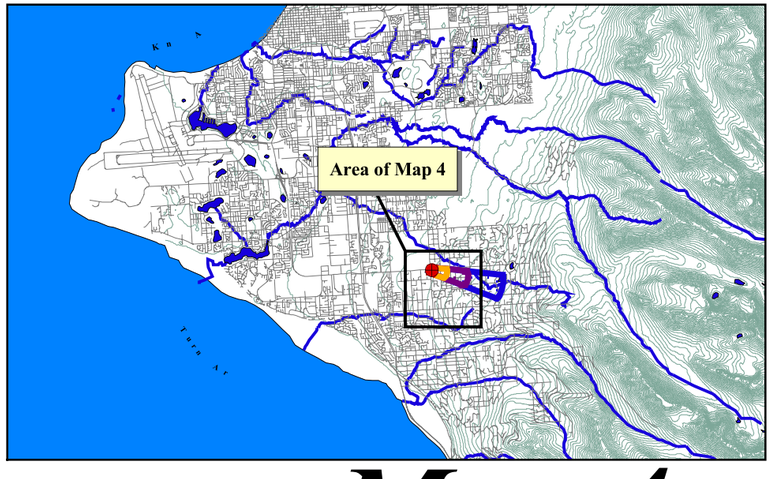
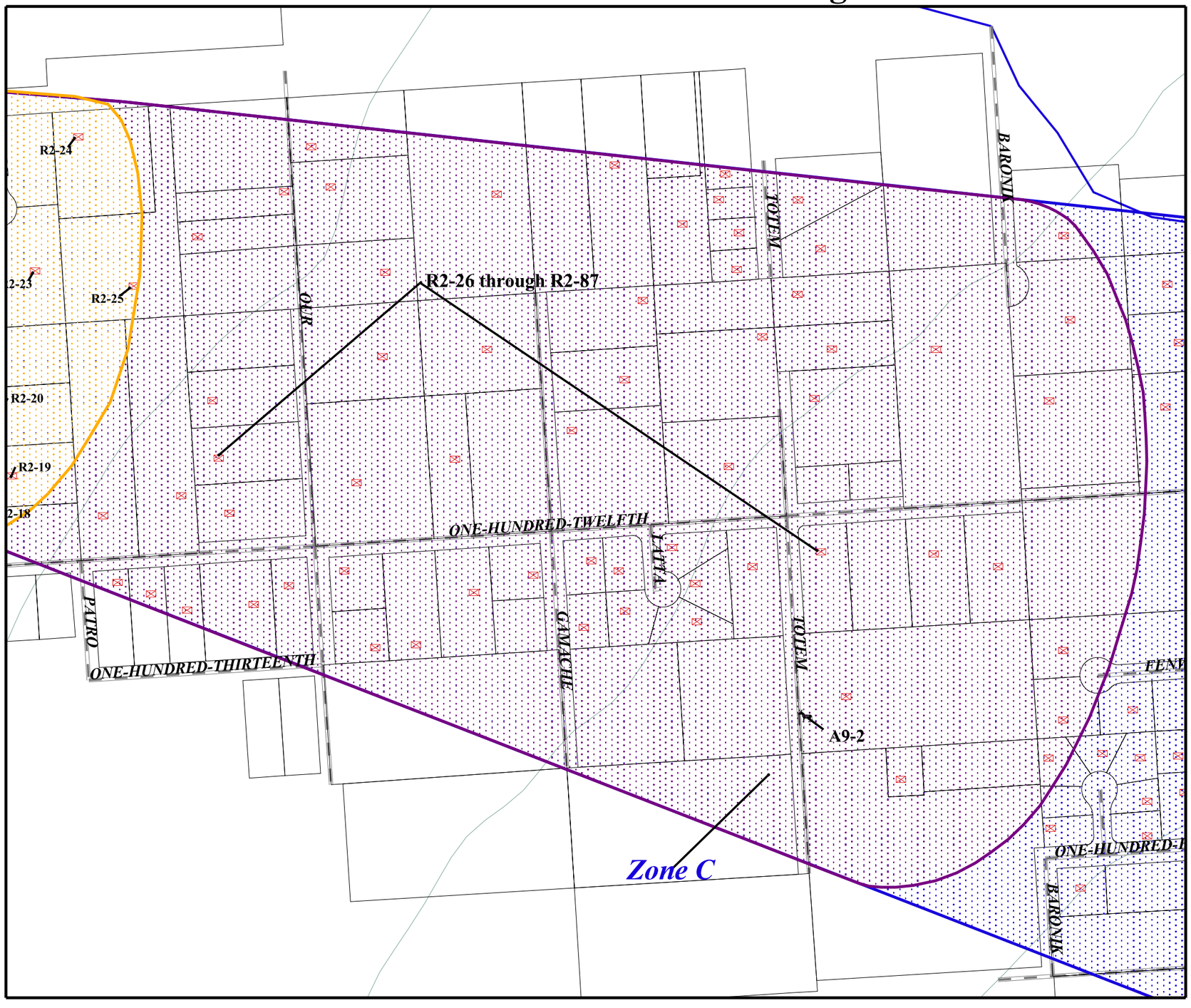


400 0 400 800 Feet

PWSID 214544.001

Map 4

Drinking Water Protection Area for Amazing Grace Lutheran Church and Potential & Existing Contaminant Sources



- Amazing Grace Lutheran DW Well

Zone A Protection Area
- Several Months Travel Time

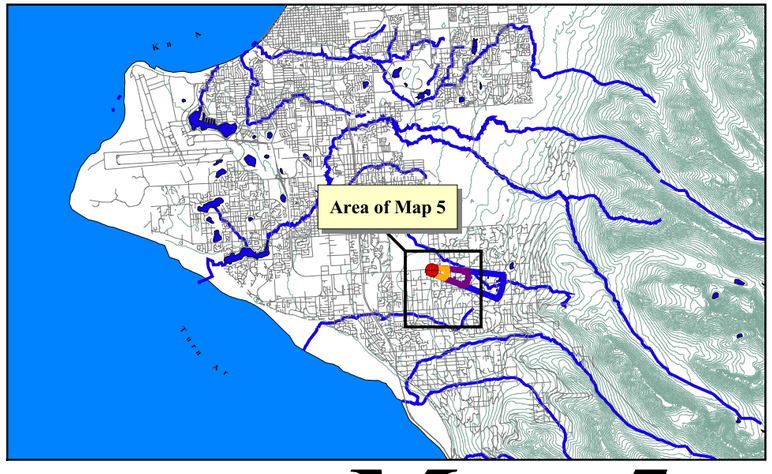
Zone B Protection Area
- Less Than 2 Years Travel Time

Zone C Protection Area
- Less Than 5 Years Travel Time

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

Potential and Existing Contaminant Sources
- Livestock Stables/Corrals (A9)
- Motor/Motor Vehicle Repair Shops (C31)
- MedicalVeterinary Facilities (X40)
- Raods (X20)
- Anchorage Streams
- Elevation Contours

N W E S

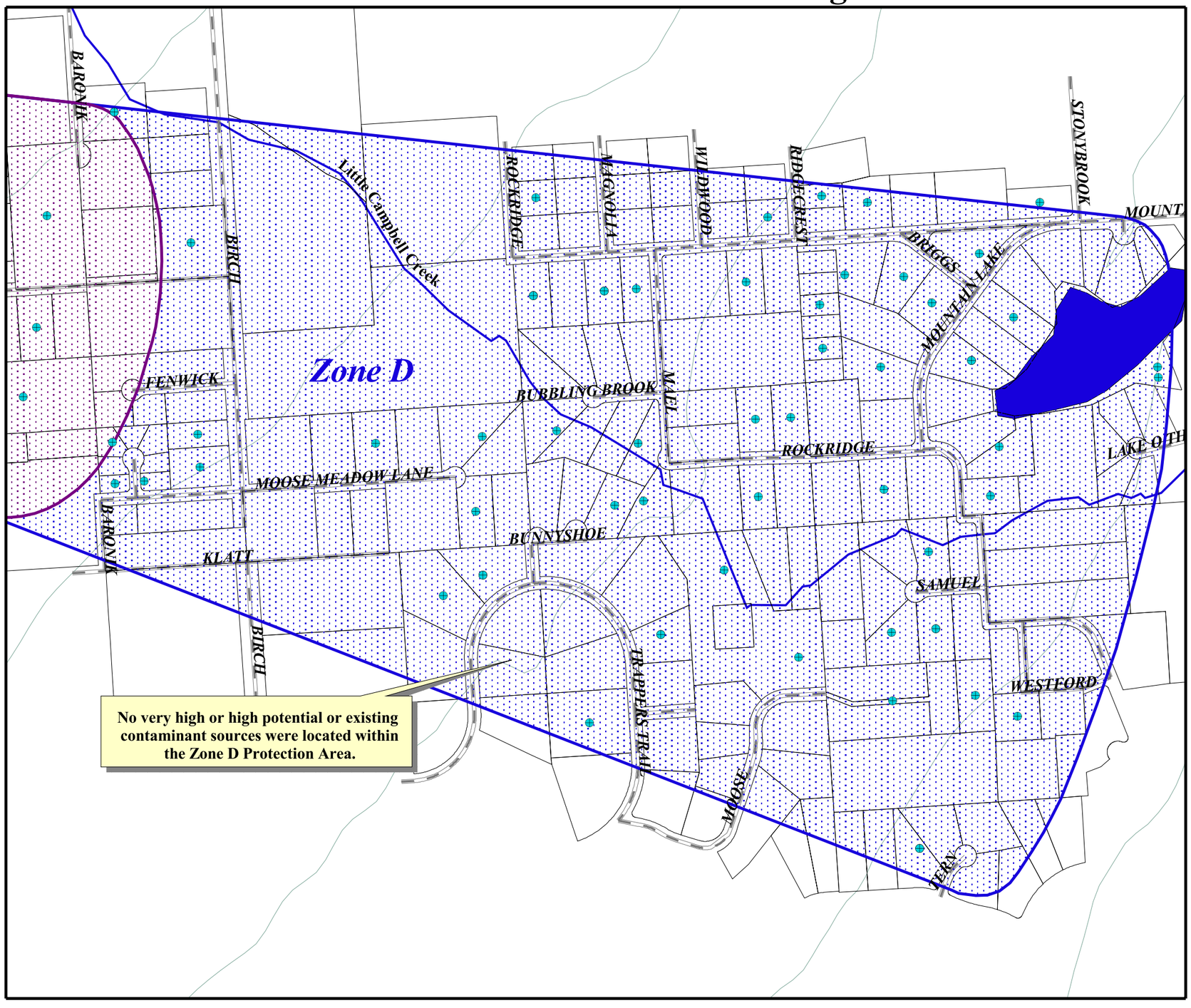


500 0 500 1000 Feet

PWSID 214544.001

Map 5

Drinking Water Protection Area for Amazing Grace Lutheran Church and Potential & Existing Contaminant Sources



1000 0 1000 2000 Feet

- Amazing Grace Lutheran DW Well
- Private and Public DW Wells

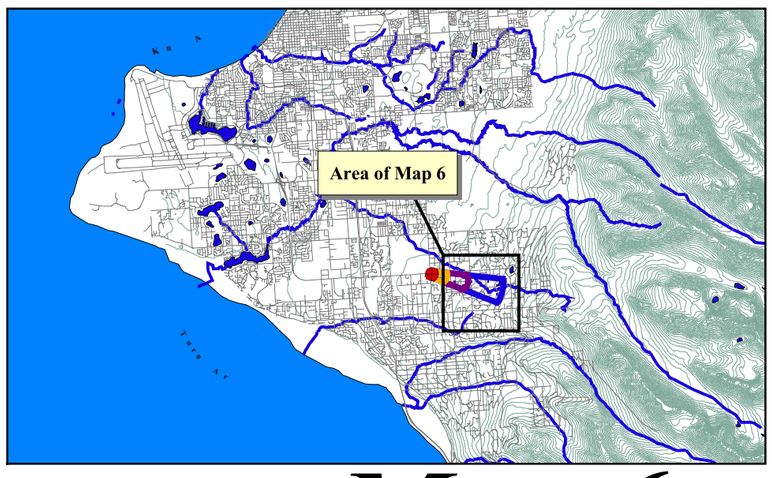
Zone A Protection Area
- Several Months Travel Time

Zone B Protection Area
- Less Than 2 Years Travel Time

Zone C Protection Area
- Less Than 5 Years Travel Time

Zone D Protection Area
- Less Than 10 Years Travel Time
- Anchorage Land Parcels
- Raods (X20)
- Anchorage Lakes
- Anchorage Streams
- Elevation Contours

N
W E
S



PWSID 214544.001

Map 6

APPENDIX D

Vulnerability Analysis for Amazing Grace Lutheran Church's Public Drinking Water Source

Chart 1. Susceptibility of the wellhead - Amazing Grace Lutheran Church

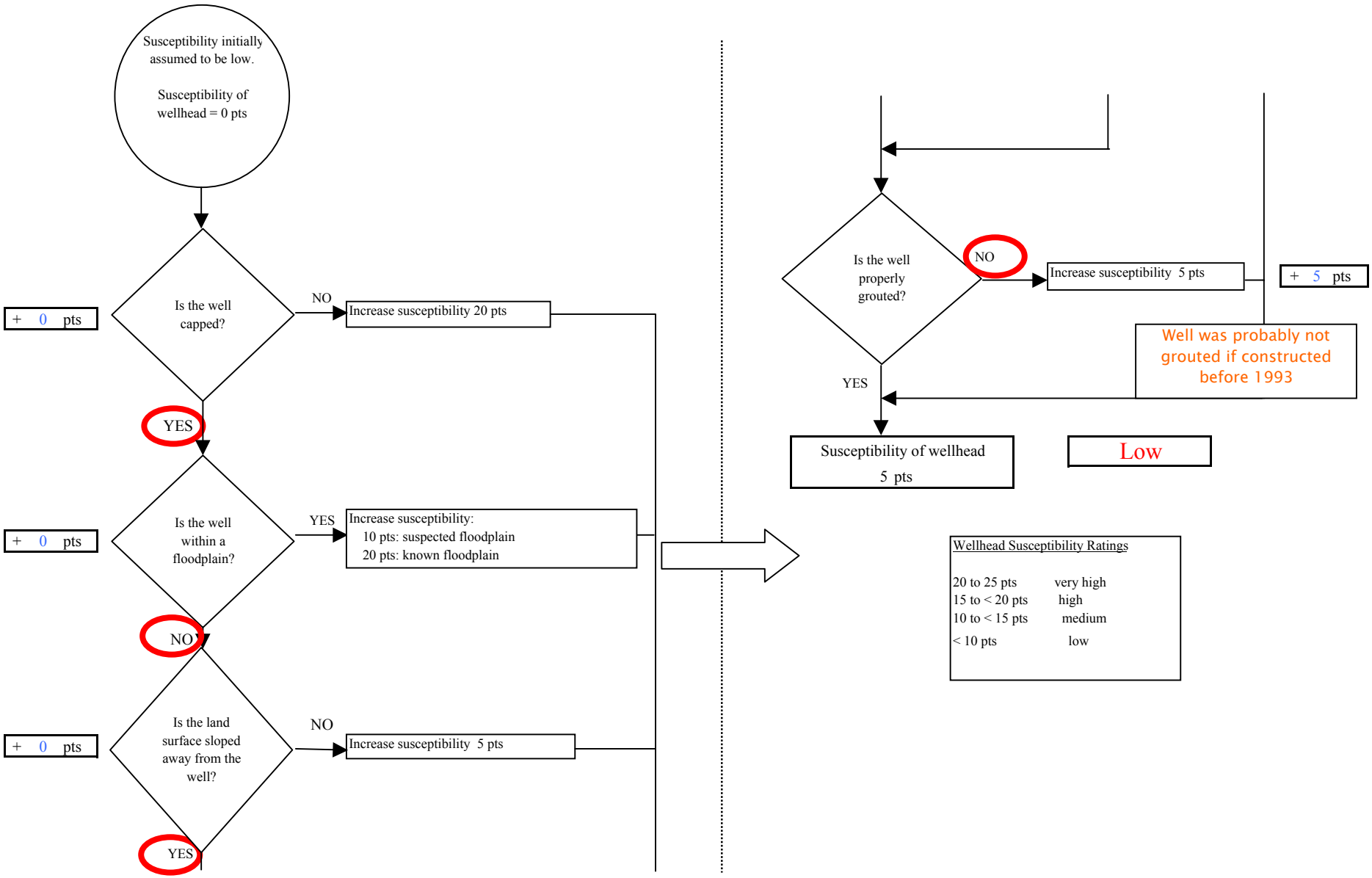


Chart 2. Susceptibility of the aquifer - Amazing Grace Lutheran Church

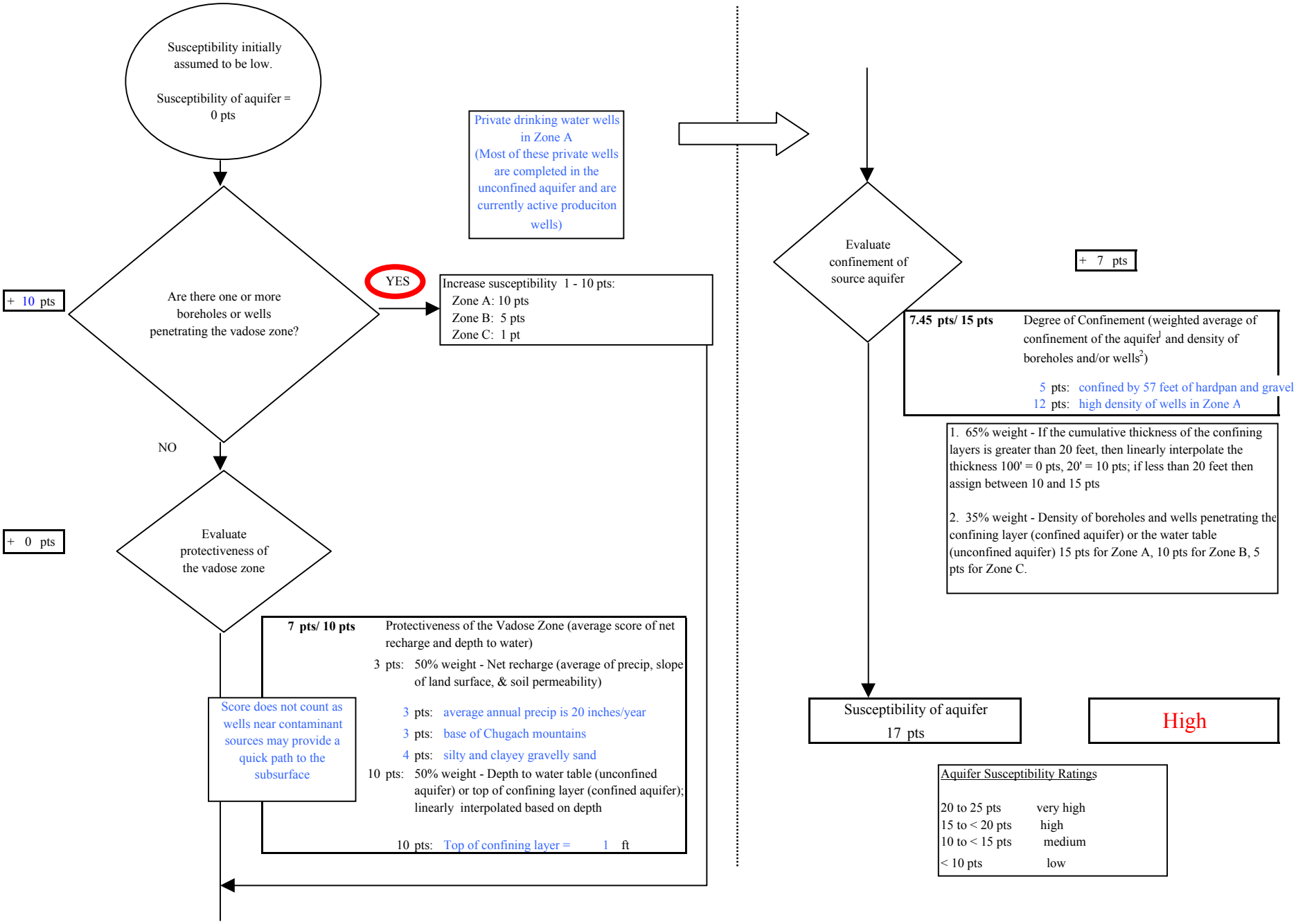
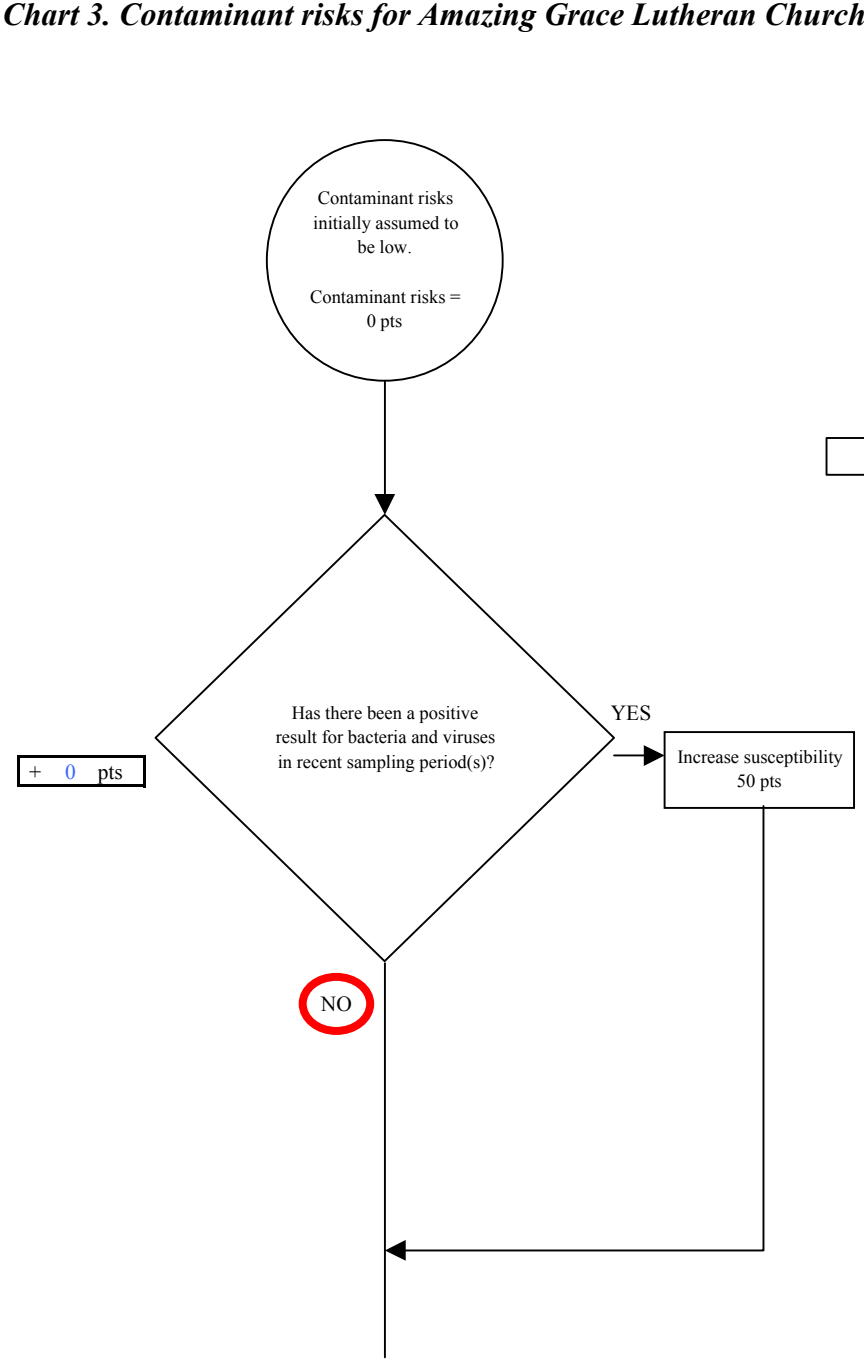
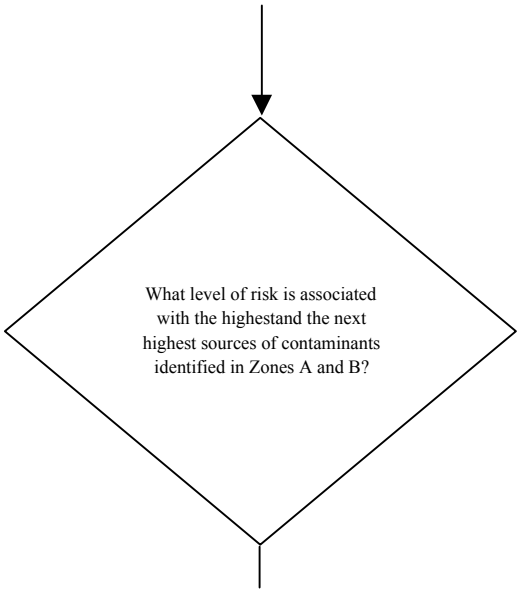


Chart 3. Contaminant risks for Amazing Grace Lutheran Church - Bacteria & Viruses





+ 25 pts

Risk Rankings for Contaminant Sources Identified in Zones A and B

	Zone A	Zone B	Total
Very Highs(s)	0	0	0
High(s)	0	0	0
Medium(s)	1	1	2
Low(s)	13	4	17

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

Matrix Score 25

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

Chart 3. Contaminant risks for Amazing Grace Lutheran Church - Bacteria & Viruses

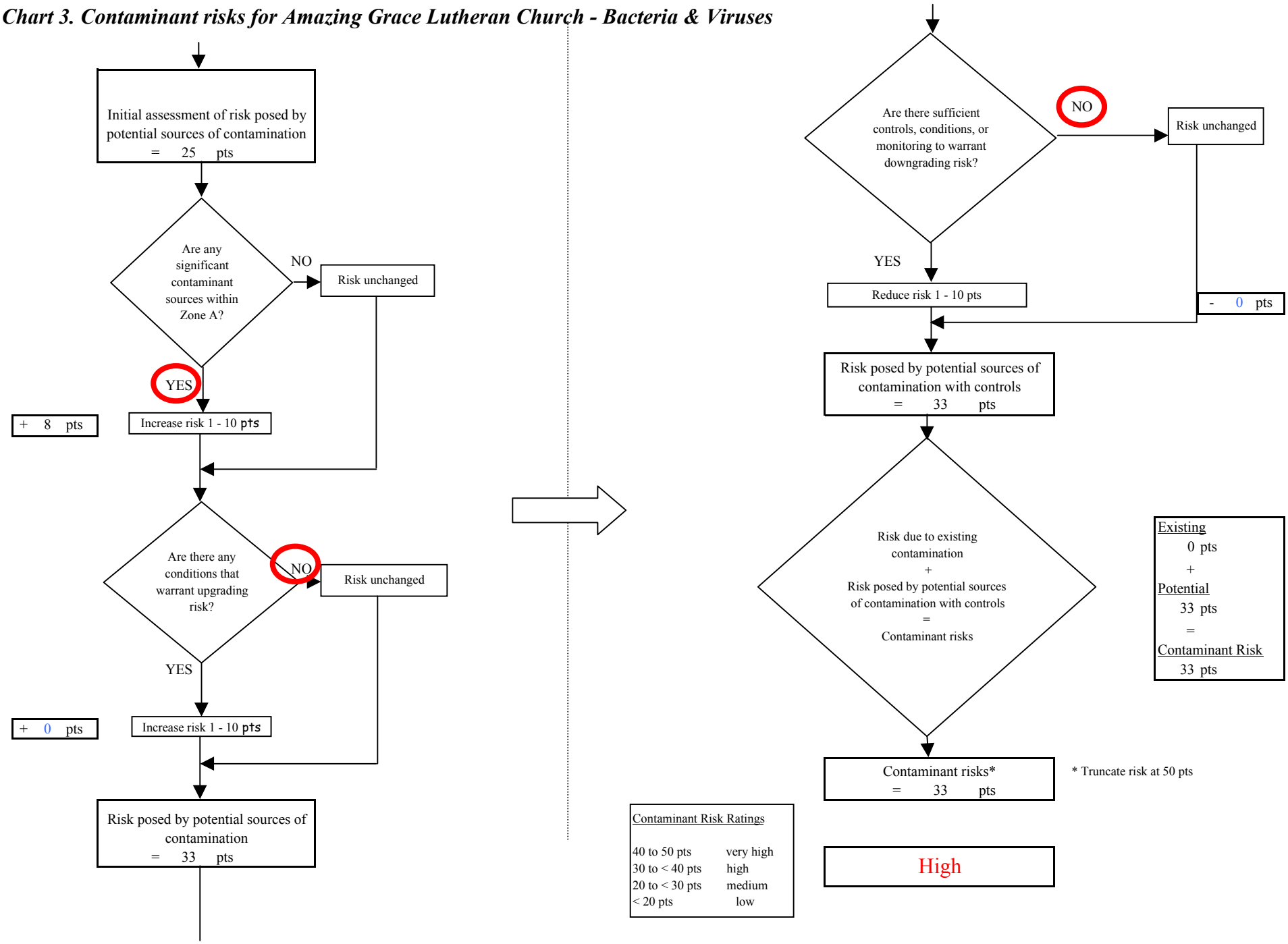


Chart 4. Vulnerability analysis for Amazing Grace Lutheran Church - Bacteria & Viruses

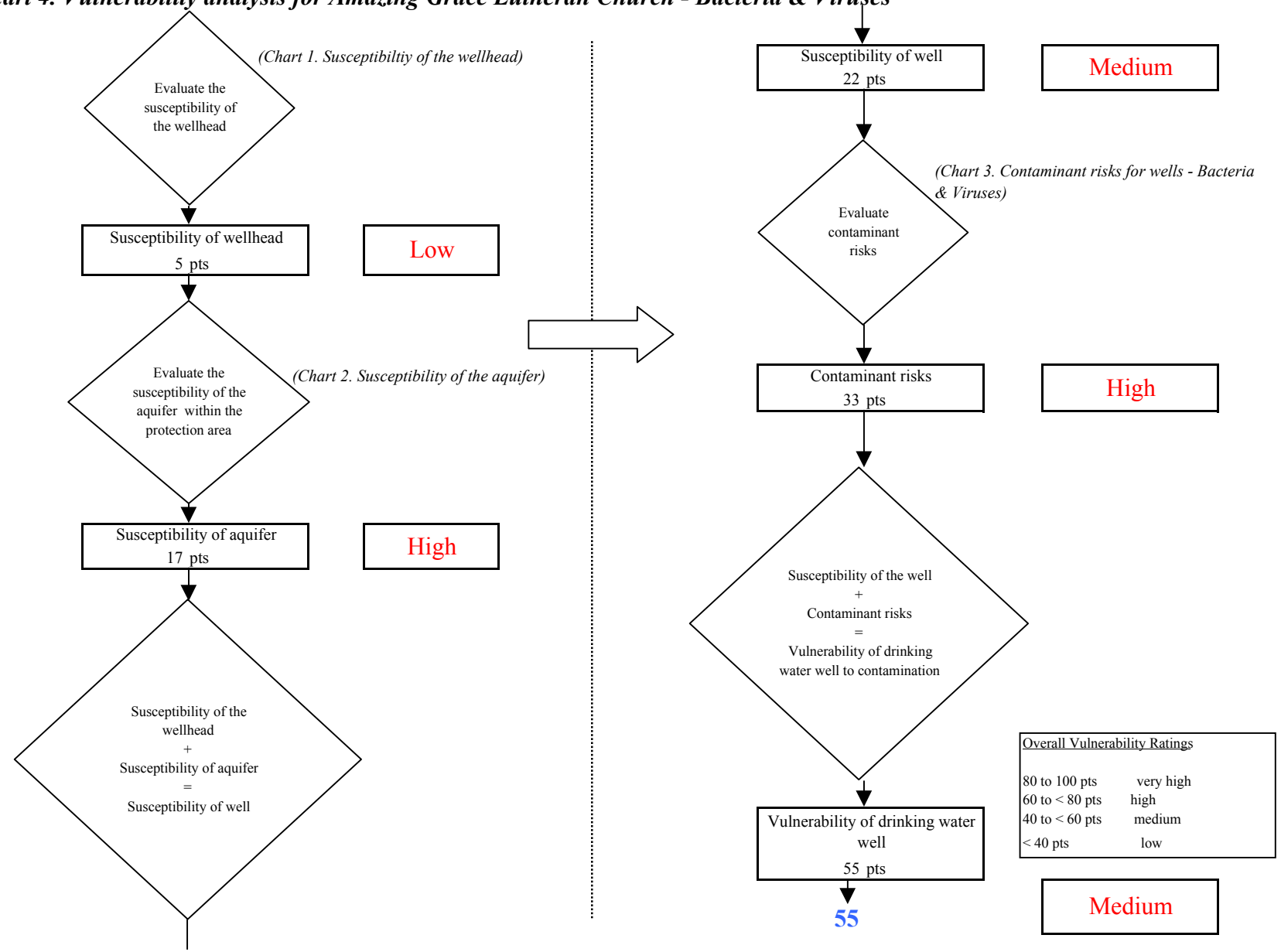


Chart 5. Contaminant risks for Amazing Grace Lutheran Church - Nitrates and Nitrites

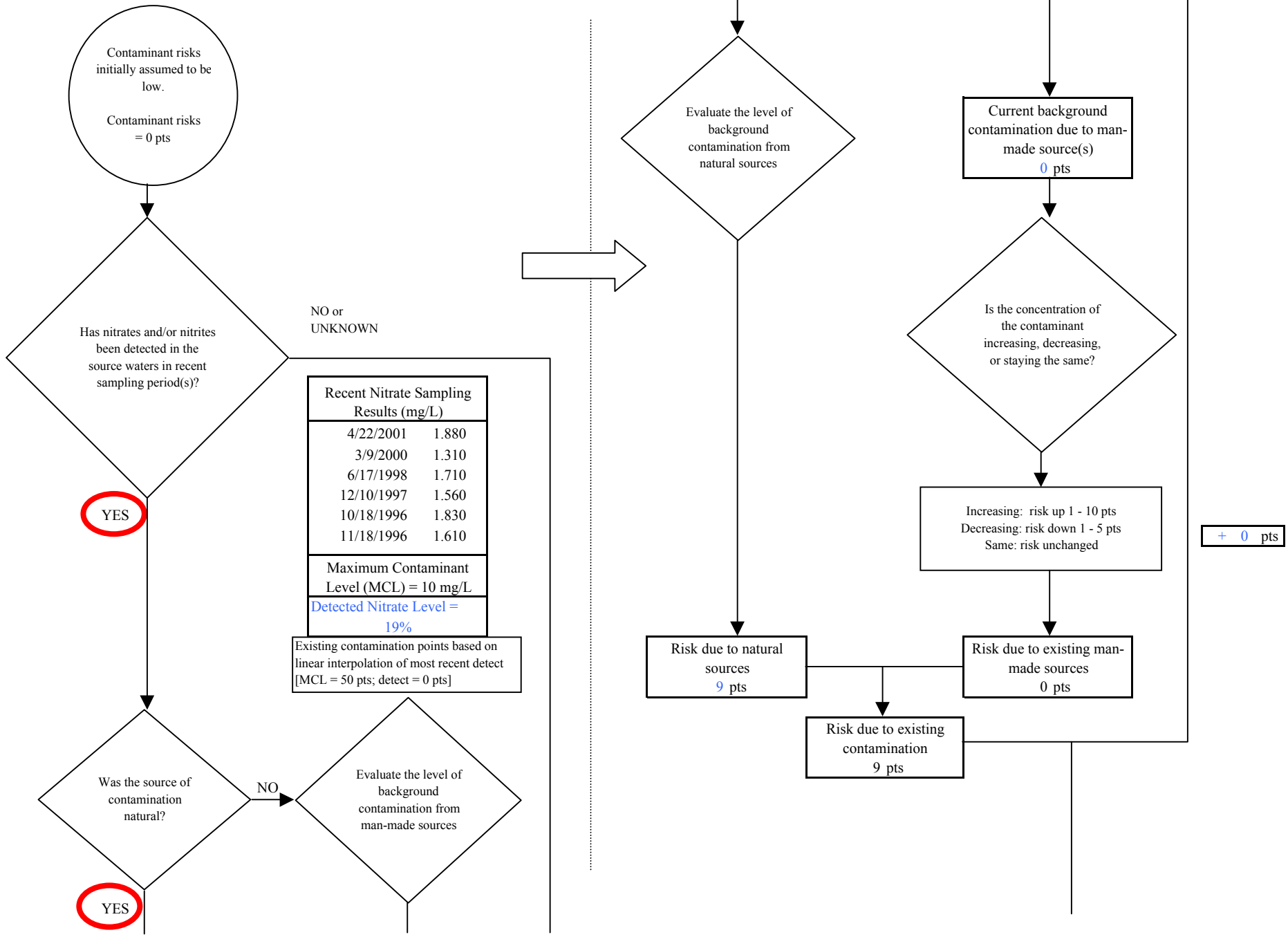


Chart 5. Contaminant risks for Amazing Grace Lutheran Church - Nitrates and Nitrites

+ 25 pts

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

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

	Zone A	Zones B&C	Total
Very Highs(s)	0	0	0
High(s)	0	0	0
Medium(s)	1	1	2
Low(s)	6	11	17

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

Matrix Score 25

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

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

Is the source aquifer fractured rock or karst?

YES

NO

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

NO

Risk unchanged

YES

Decrease risk 1 - 10 pts

- 0 pts

Are any significant sources within Zone A?

NO

Risk unchanged

YES

Increase risk 1 - 10 pts

+ 5 pts

Chart 5. Contaminant risks for Amazing Grace Lutheran Church - Nitrates and Nitrites

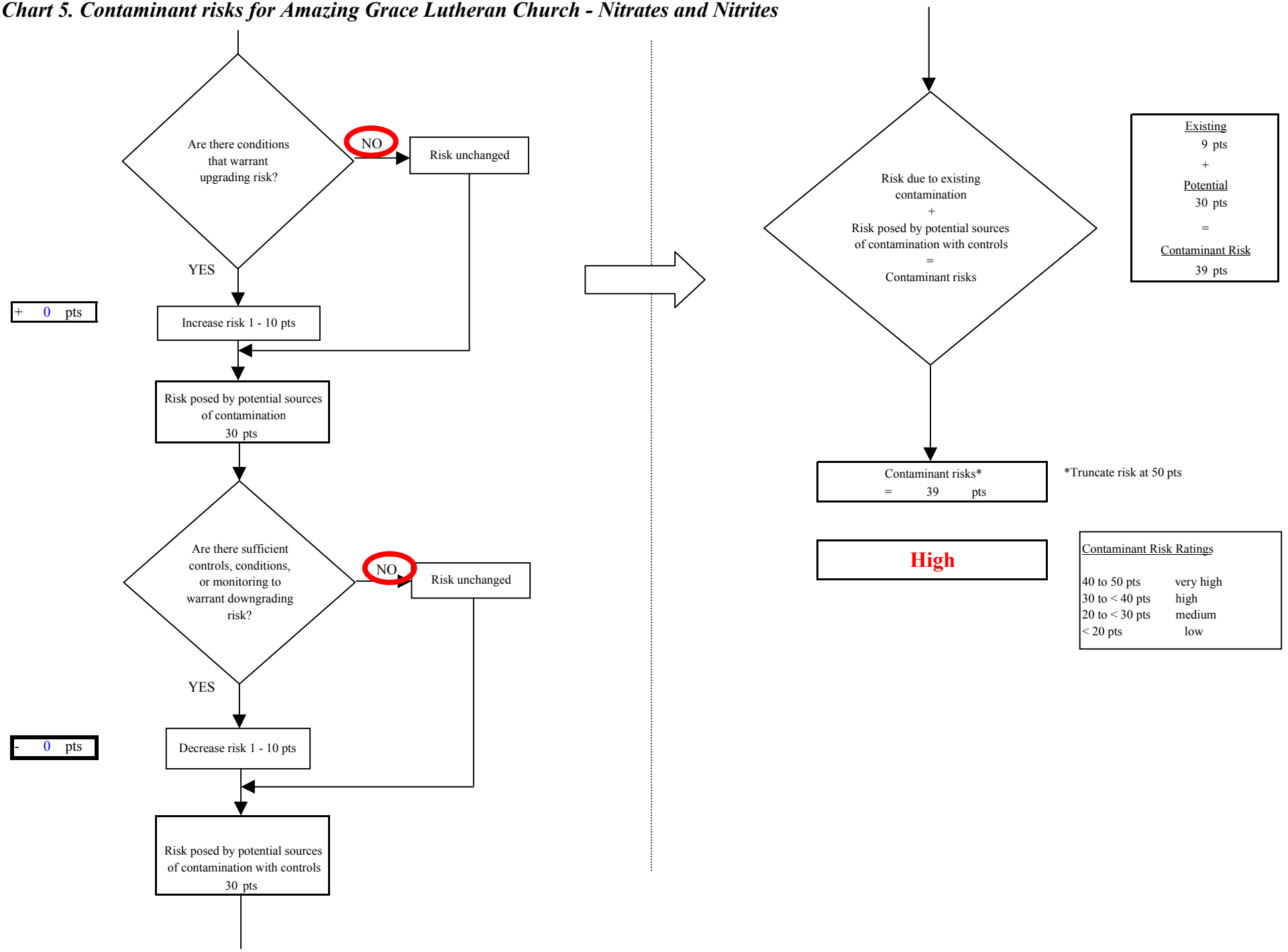


Chart 6. Vulnerability analysis for Amazing Grace Lutheran Church - Nitrates and Nitrites

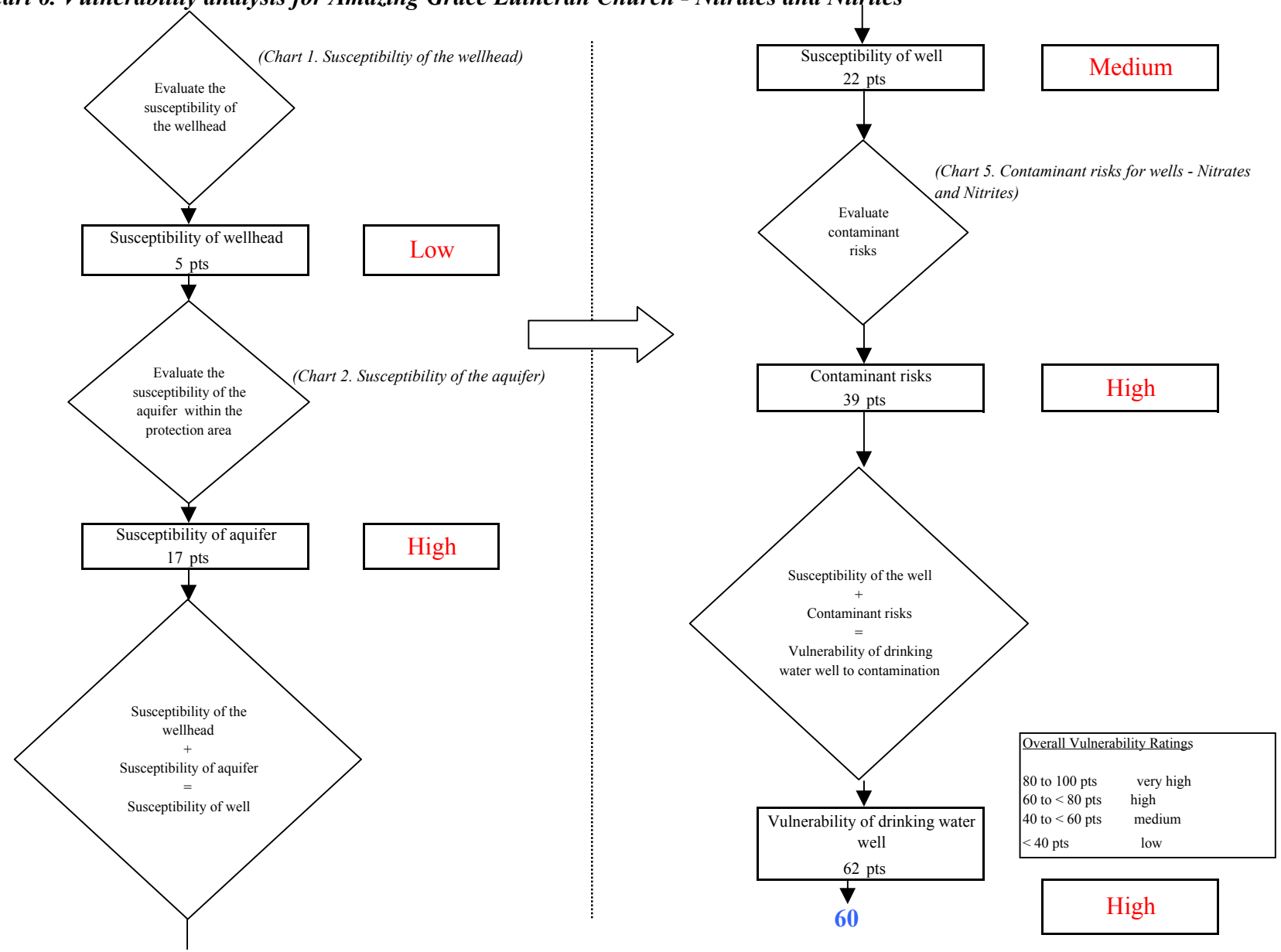


Chart 7. Contaminant risks for Amazing Grace Lutheran Church - Volatile Organic Chemicals

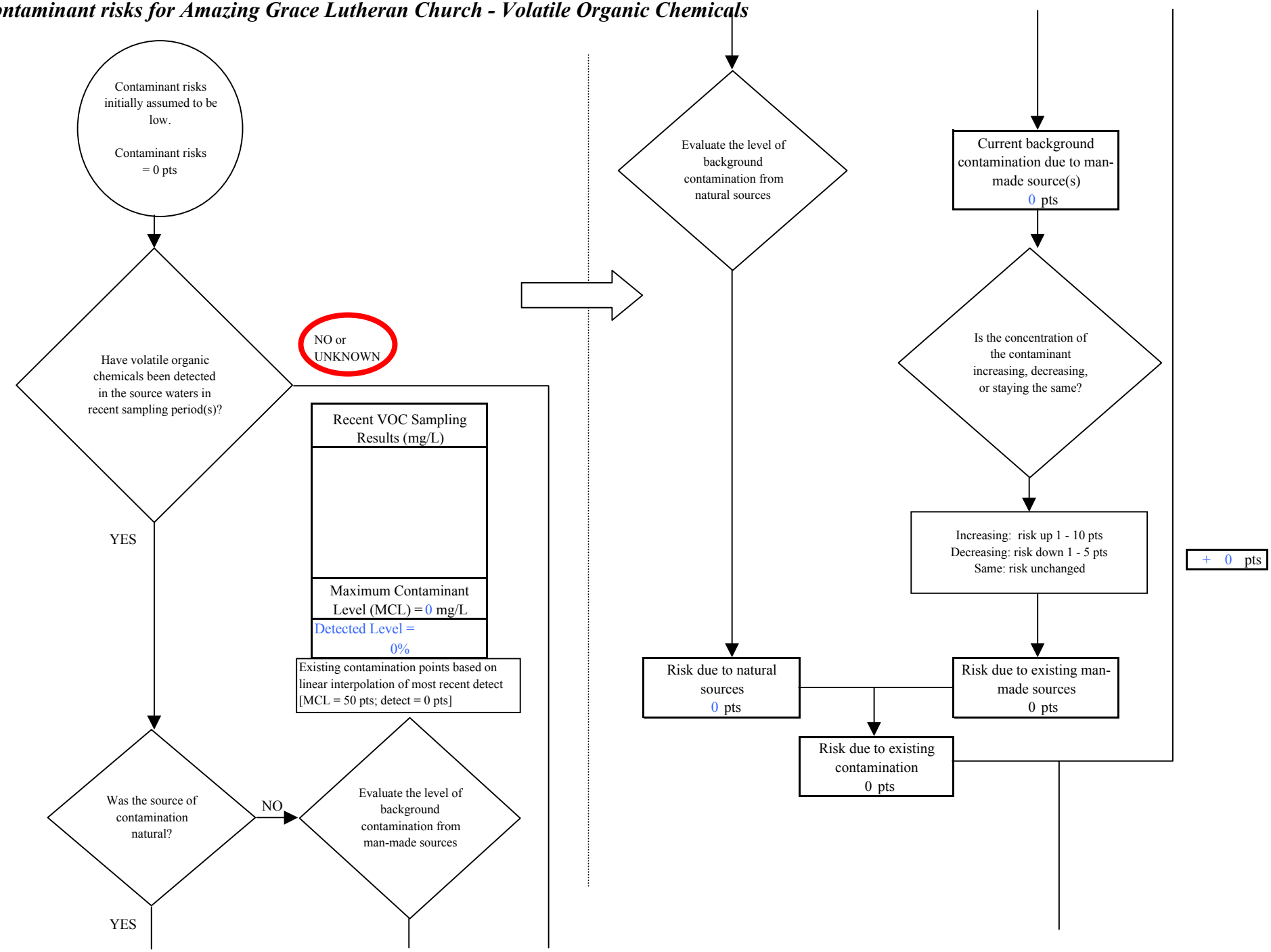


Chart 7. Contaminant risks for Amazing Grace Lutheran Church - Volatile Organic Chemicals

+ 10 pts

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

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

	Zone A	Zones B&C	Total
Very Highs(s)	0	0	0
High(s)	0	0	0
Medium(s)	0	0	0
Low(s)	4	4	8

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

Matrix Score 10

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

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

Is the source aquifer fractured rock or karst?

YES

NO

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

NO → Risk unchanged

YES

Decrease risk 1 - 10 pts

- 0 pts

Are any significant sources within Zone A?

NO → Risk unchanged

YES

Increase risk 1 - 10 pts

+ 2 pts

Chart 7. Contaminant risks for Amazing Grace Lutheran Church - Volatile Organic Chemicals

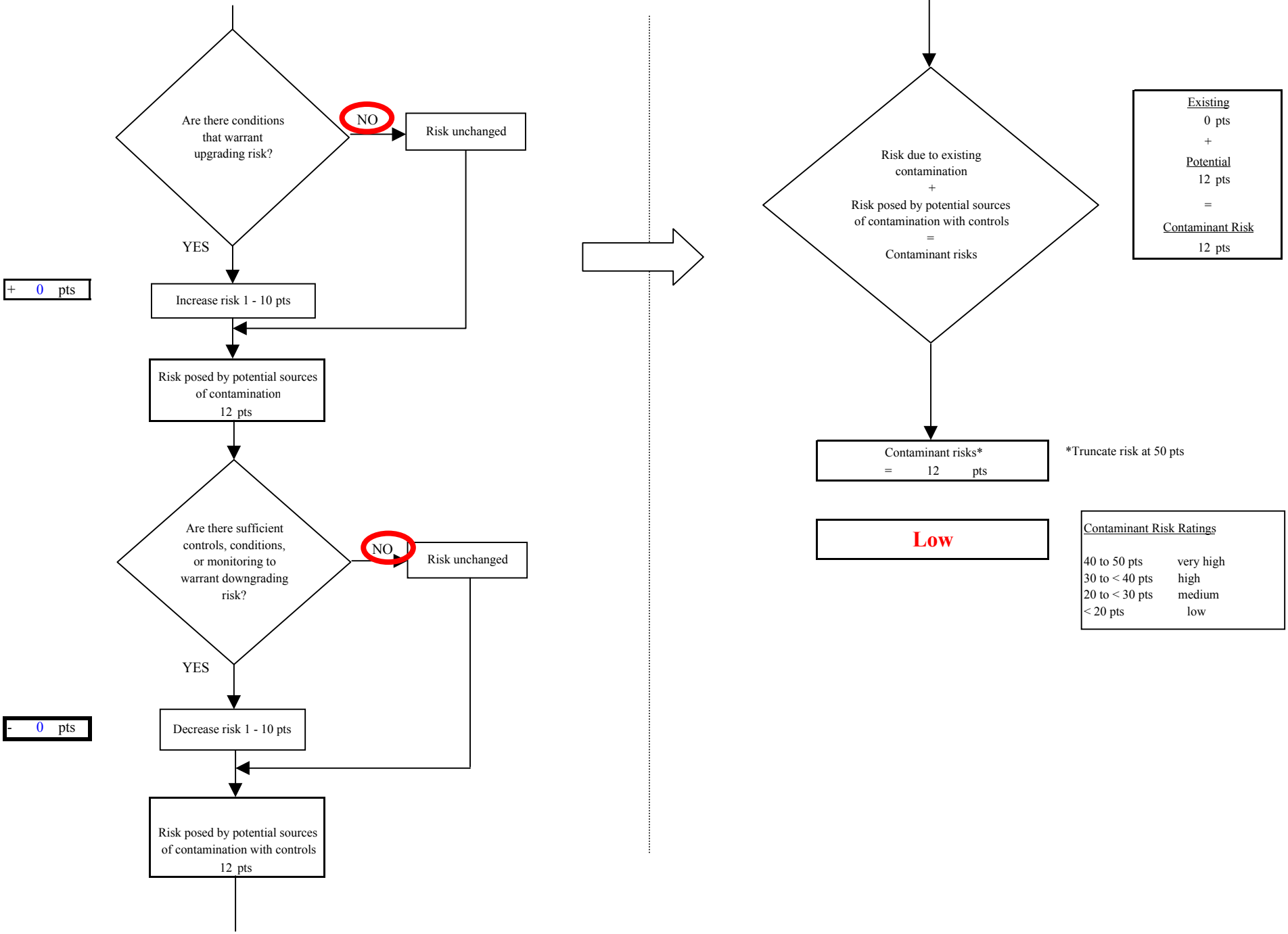


Chart 8. Vulnerability analysis for Amazing Grace Lutheran Church - Volatile Organic Chemicals

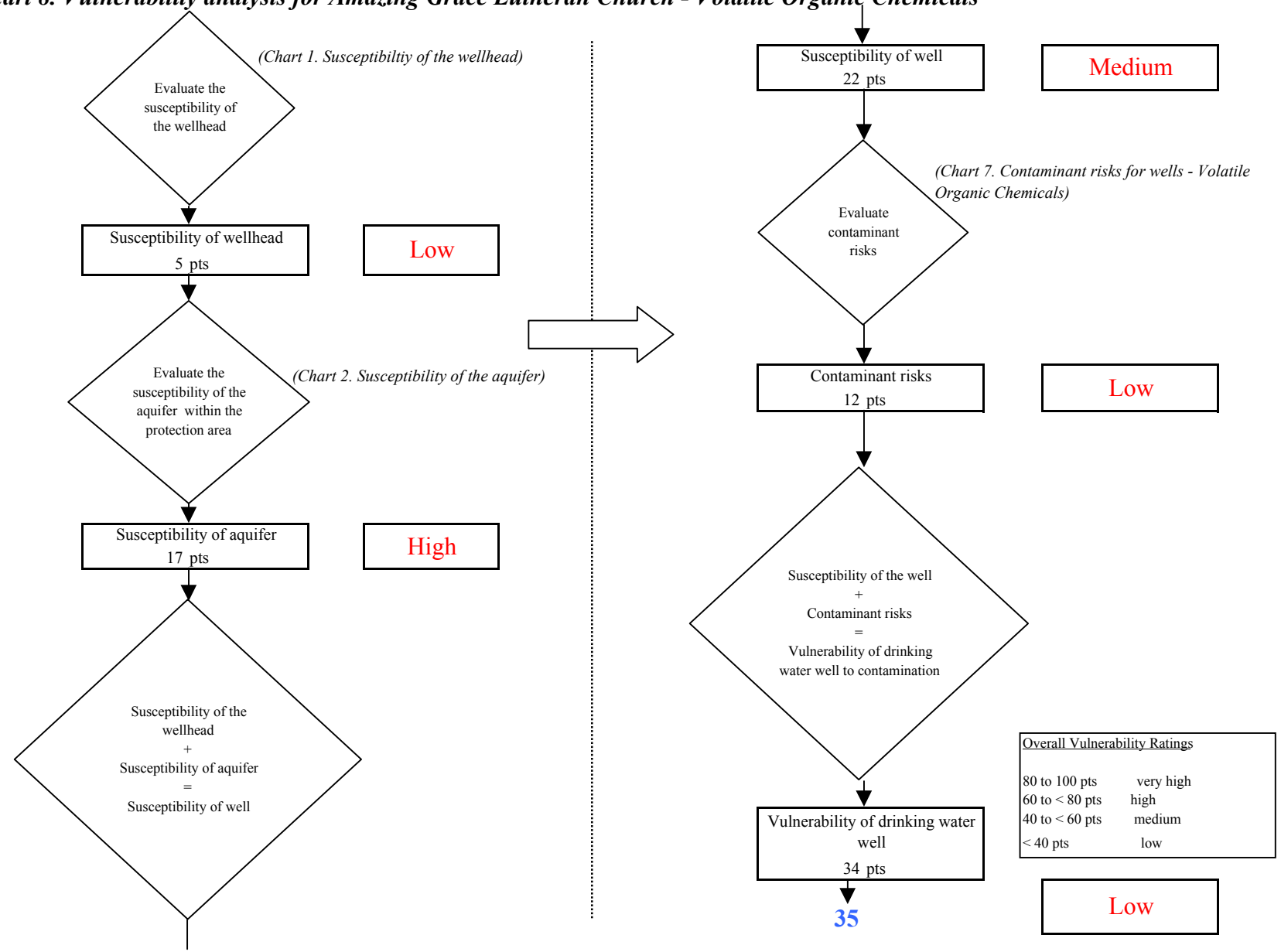


Chart 9. Contaminant risks for Amazing Grace Lutheran Church - Heavy Metals, Cyanide and Other Inorganic Chemicals

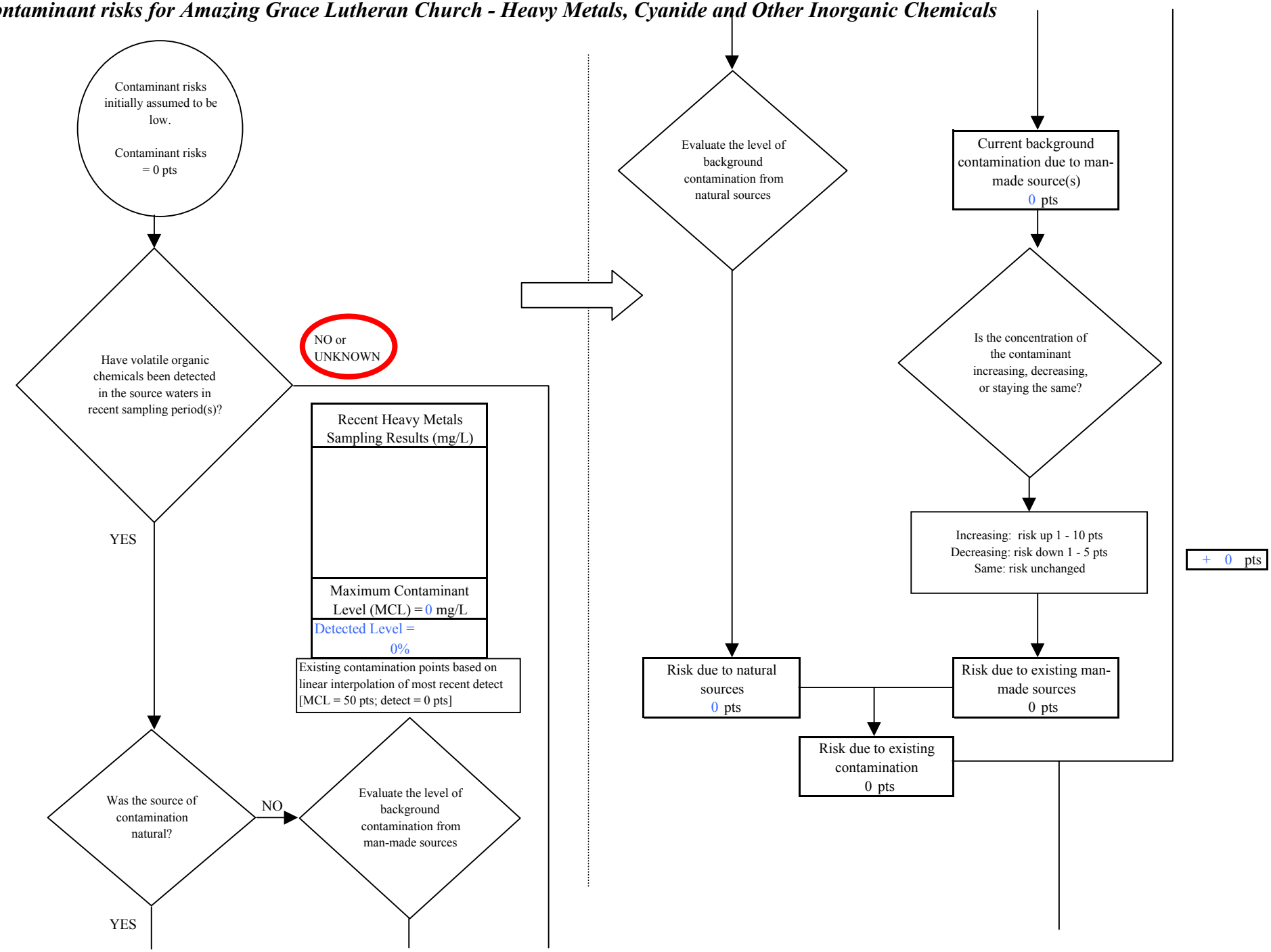


Chart 9. Contaminant risks for Amazing Grace Lutheran Church - Heavy Metals, Cyanide and Other Inorganic Chemicals

+ 10 pts

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

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

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

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

Matrix Score 10

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

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

Is the source aquifer fractured rock or karst?

YES

NO

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

NO

Risk unchanged

YES

Decrease risk 1 - 10 pts

- 0 pts

Are any significant sources within Zone A?

NO

Risk unchanged

YES

Increase risk 1 - 10 pts

+ 2 pts

Chart 9. Contaminant risks for Amazing Grace Lutheran Church - Heavy Metals, Cyanide and Other Inorganic Chemicals

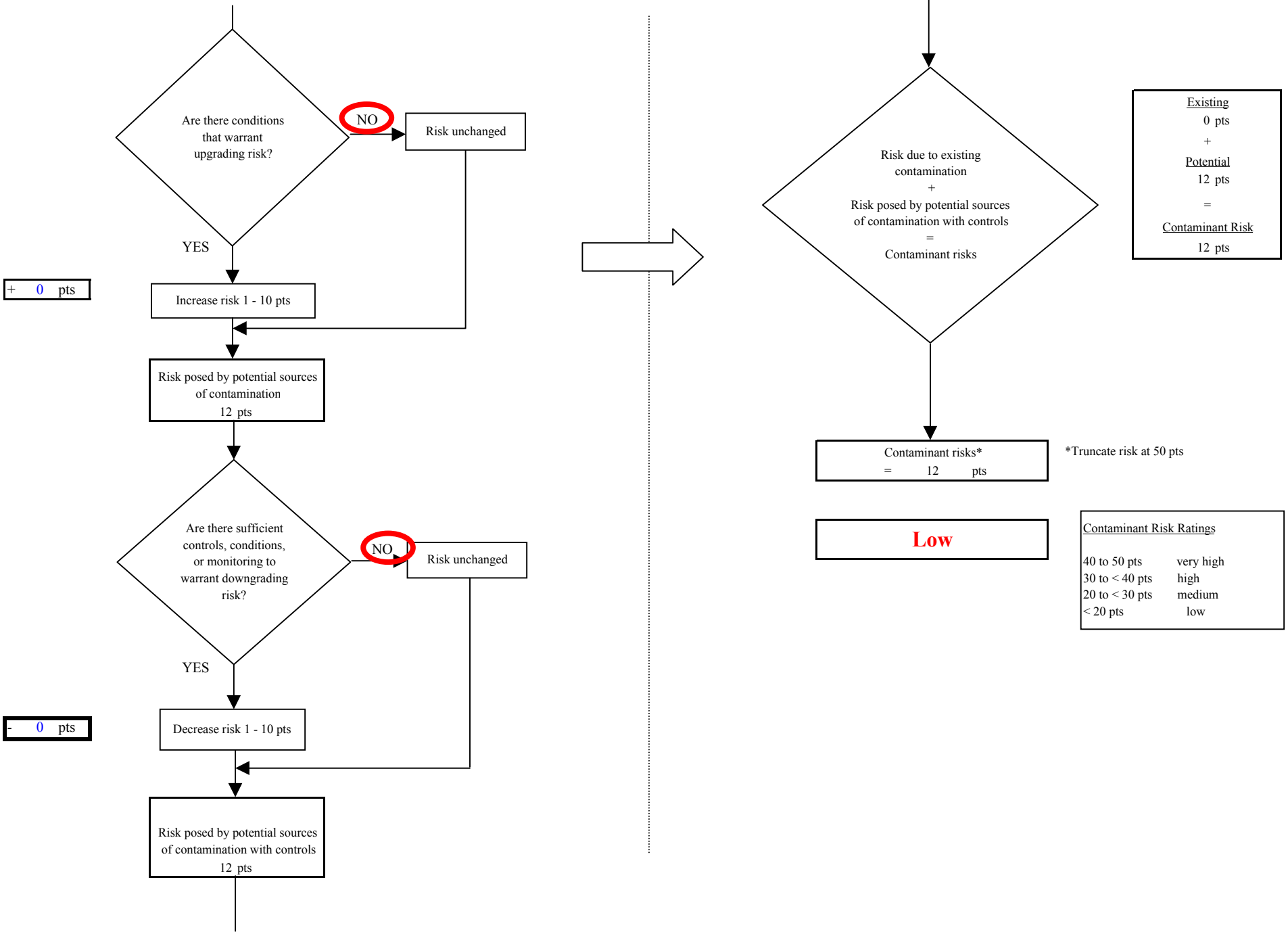


Chart 10. Vulnerability analysis for Amazing Grace Lutheran Church - Heavy Metals, Cyanide and Other Inorganic Chemicals

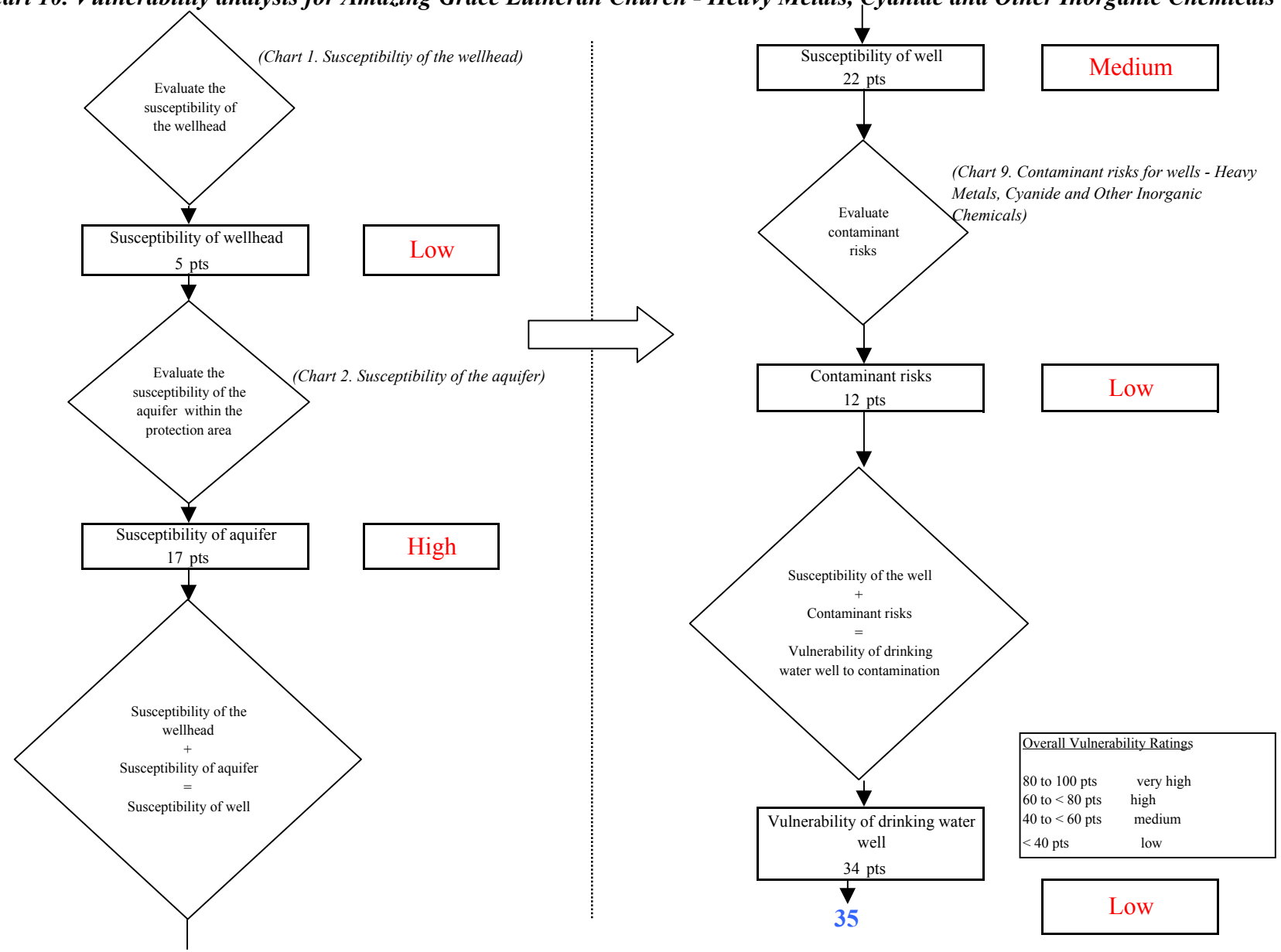


Chart 11. Contaminant risks for Amazing Grace Lutheran Church - Synthetic Organic Chemicals

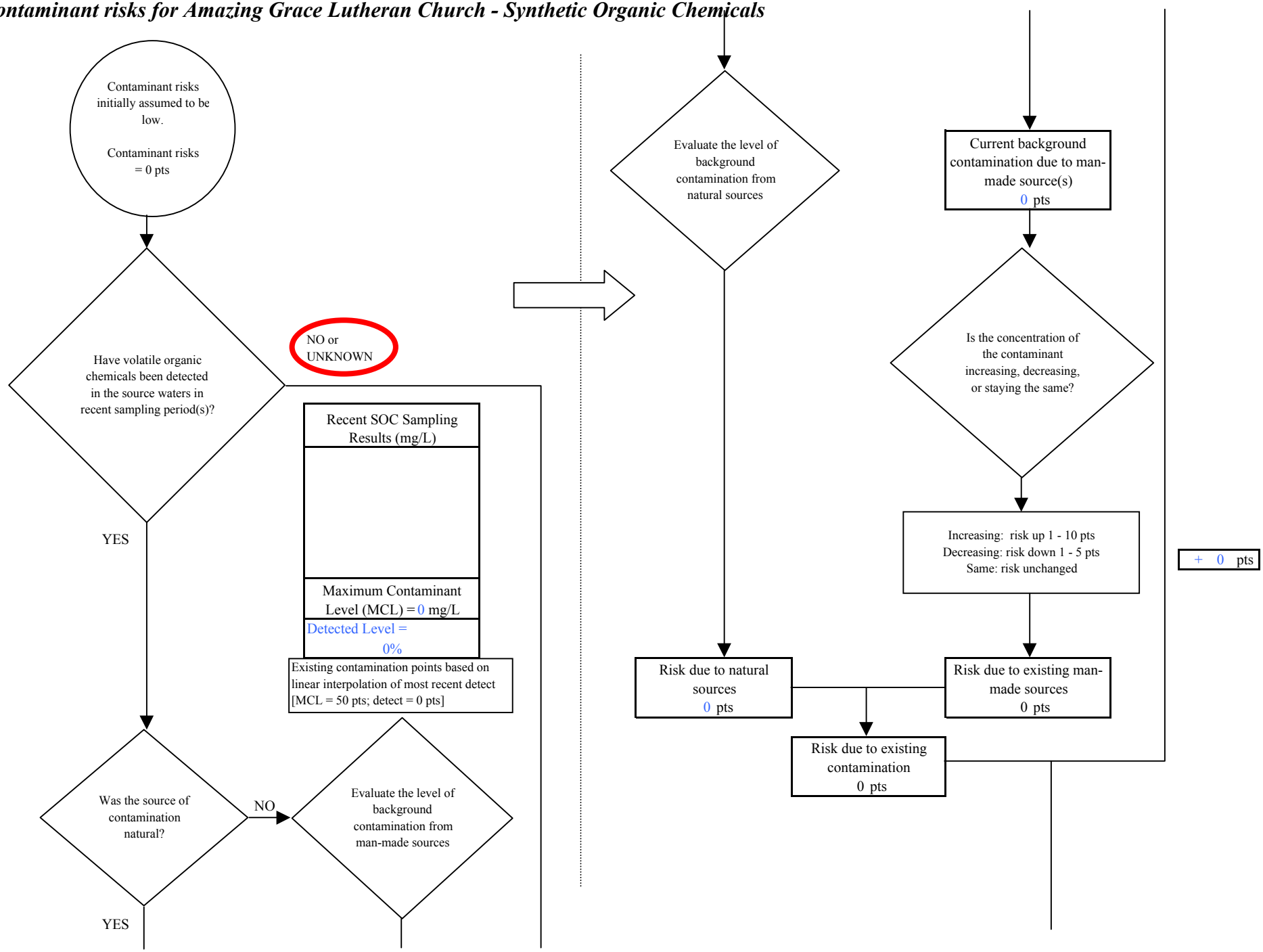


Chart 11. Contaminant risks for Amazing Grace Lutheran Church - Synthetic Organic Chemicals

+ 10 pts

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

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

	Zone A	Zones B&C	Total
Very Highs(s)	0	0	0
High(s)	0	0	0
Medium(s)	0	0	0
Low(s)	3	5	8

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

Matrix Score 10

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

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

Is the source aquifer fractured rock or karst?

YES

NO

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

NO

Risk unchanged

YES

Decrease risk 1 - 10 pts

- 0 pts

Are any significant sources within Zone A?

NO

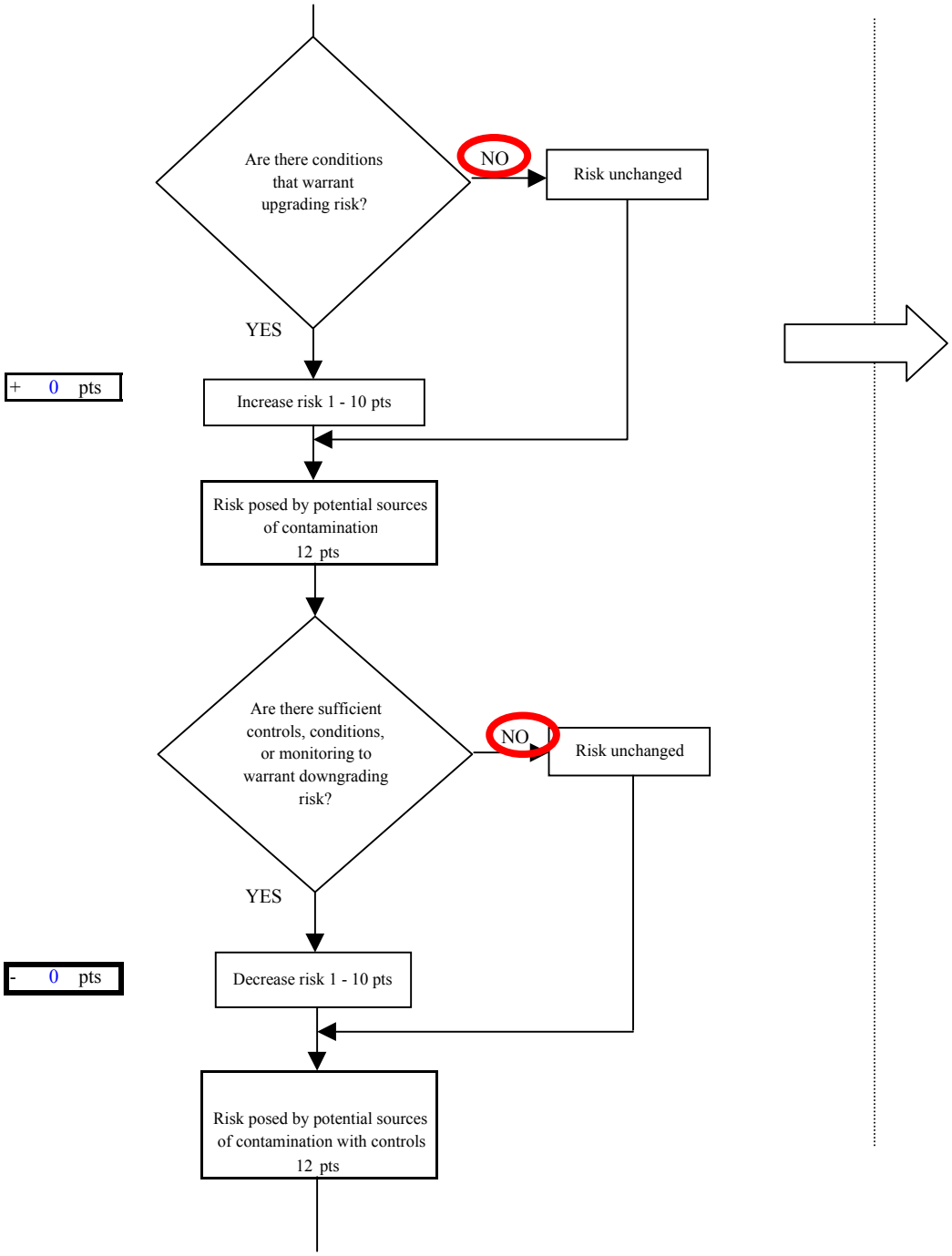
Risk unchanged

YES

Increase risk 1 - 10 pts

+ 2 pts

Chart 11. Contaminant risks for Amazing Grace Lutheran Church - Synthetic Organic Chemicals



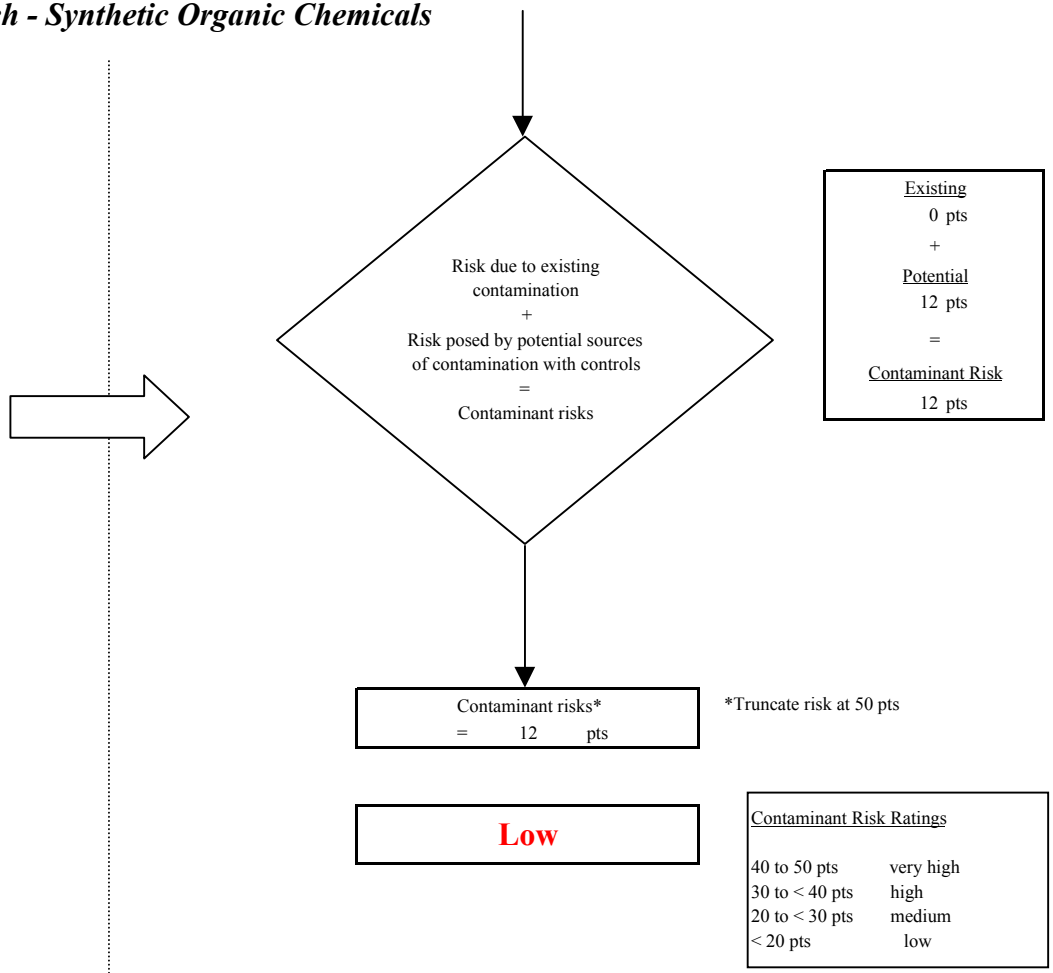


Chart 12. Vulnerability analysis for Amazing Grace Lutheran Church - Synthetic Organic Chemicals

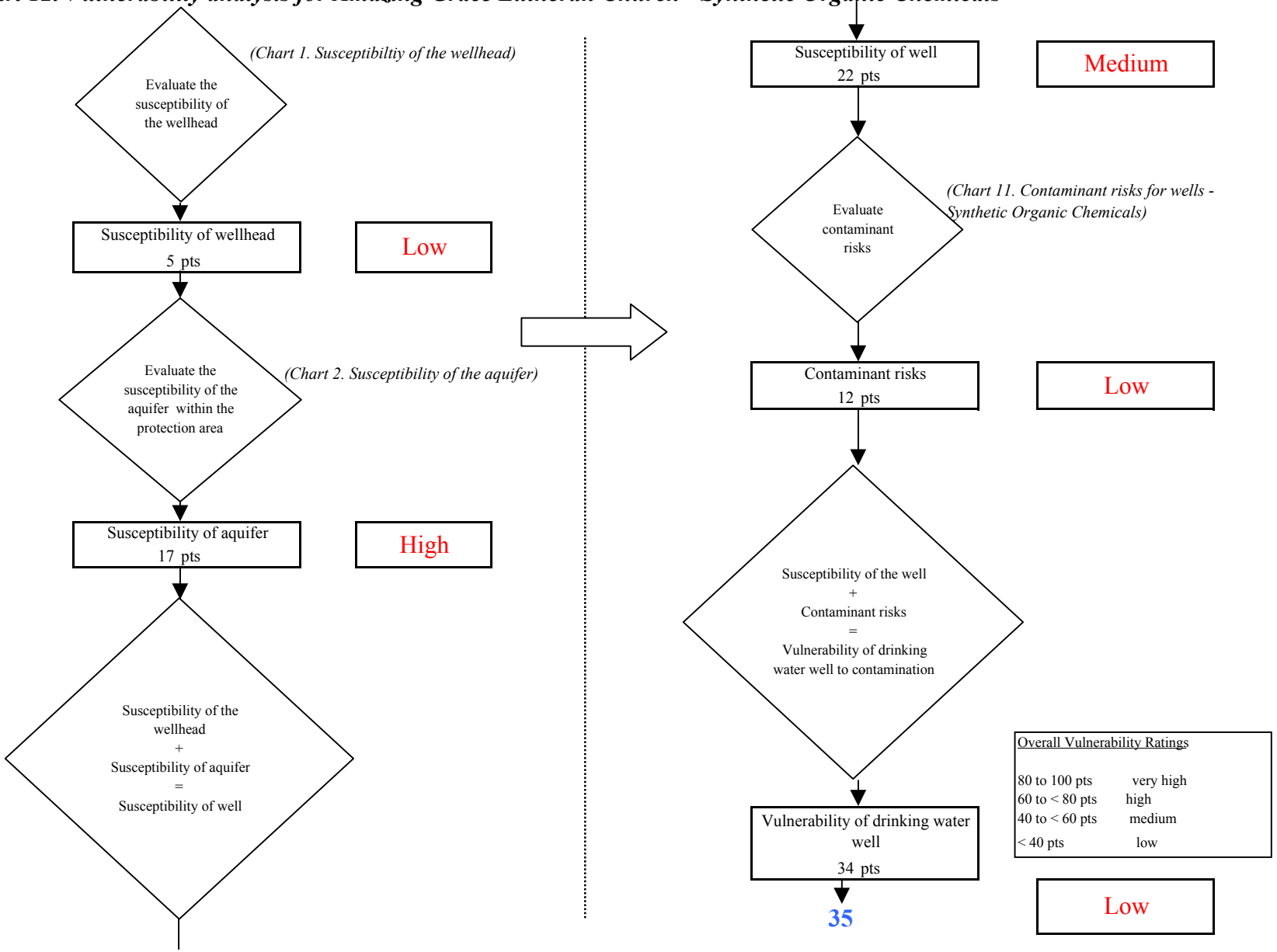


Chart 13. Contaminant risks for Amazing Grace Lutheran Church - Other Organic Chemicals

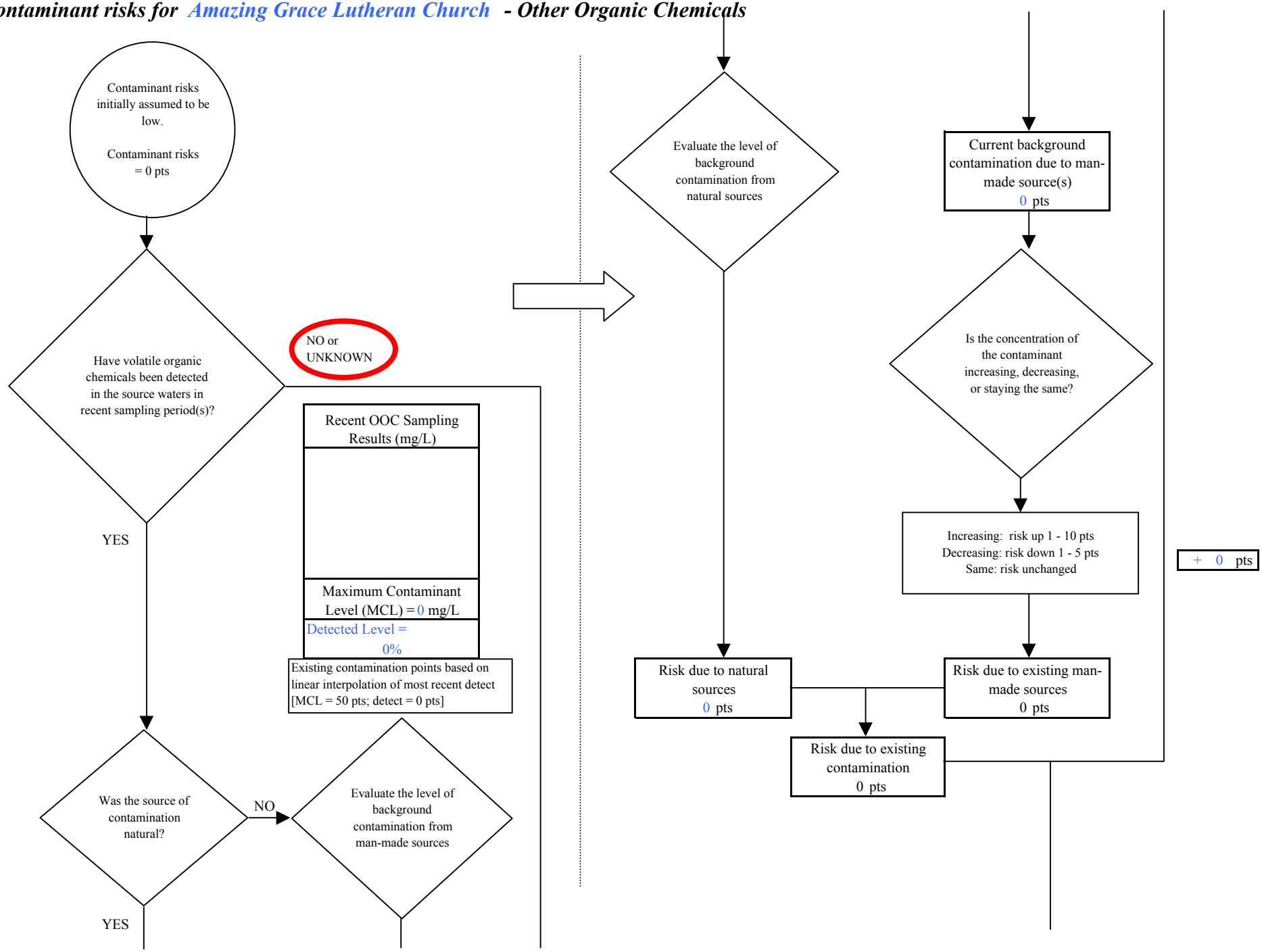


Chart 13. Contaminant risks for Amazing Grace Lutheran Church - Other Organic Chemicals

+ 10 pts

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

Risk Levels for Contaminant Sources identified in Zones A, B and C			
	Zone A	Zones B&C	Total
Very Highs(s)	0	0	0
High(s)	0	0	0
Medium(s)	0	0	0
Low(s)	2	4	6

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

Matrix Score 10

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

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

Is the source aquifer fractured rock or karst?

YES

NO

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

NO

Risk unchanged

YES

Decrease risk 1 - 10 pts

- 0 pts

Are any significant sources within Zone A?

NO

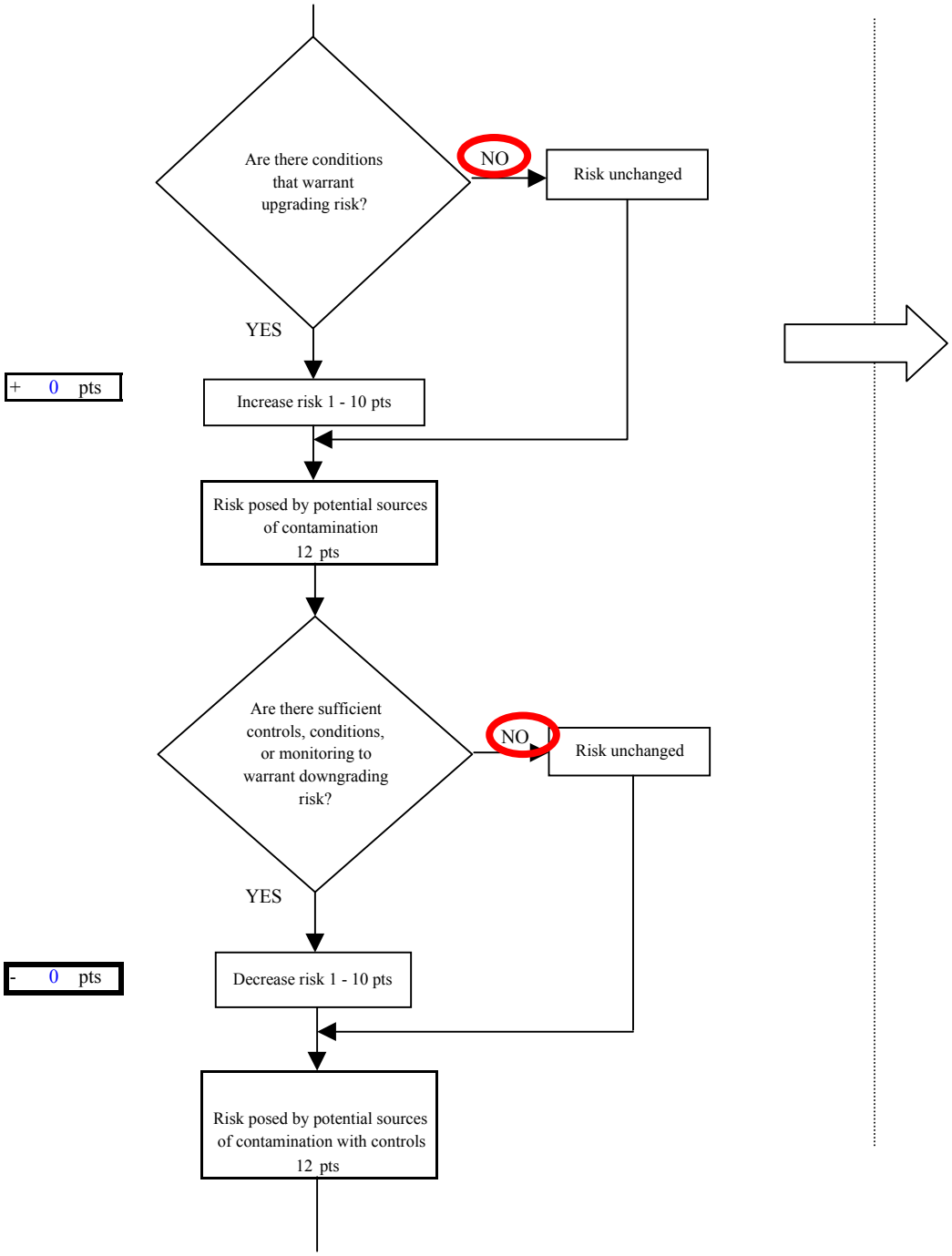
Risk unchanged

YES

Increase risk 1 - 10 pts

+ 2 pts

Chart 13. Contaminant risks for Amazing Grace Lutheran Church - Other Organic Chemicals



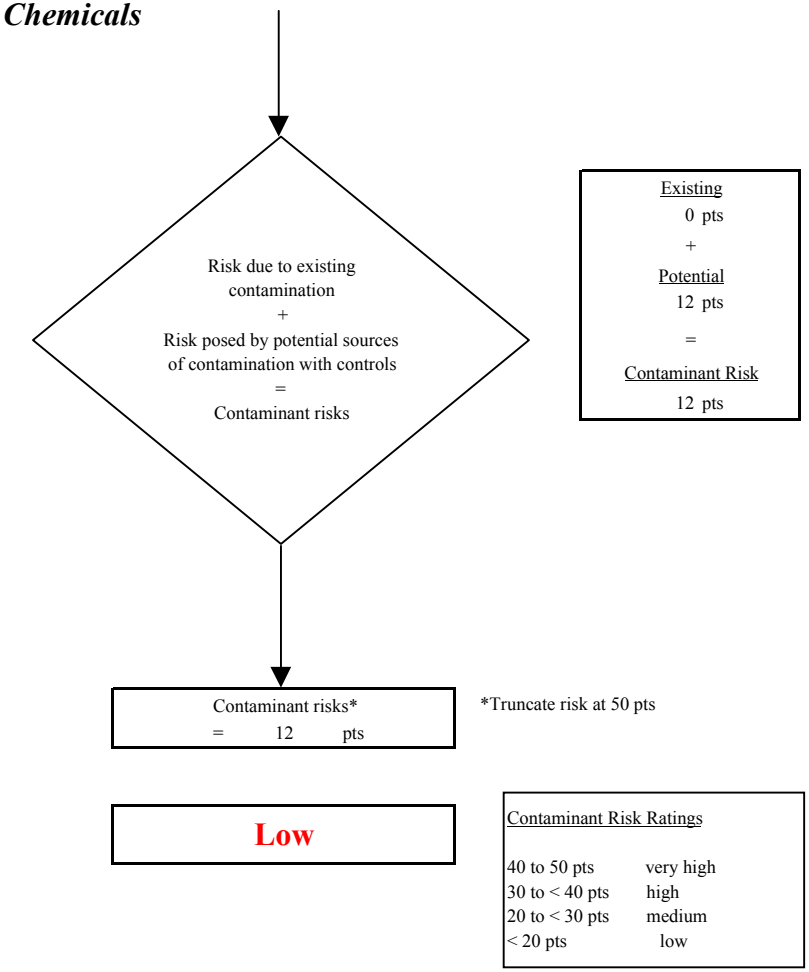


Chart 14. Vulnerability analysis for Amazing Grace Lutheran Church - Other Organic Chemicals