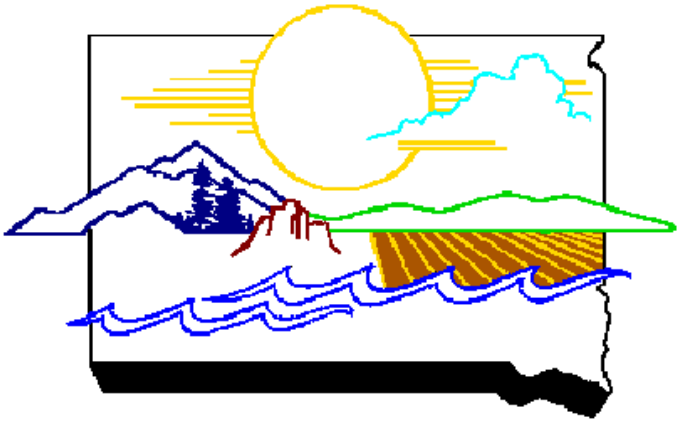
Source Water Assessment and Protection Program



Protecting South Dakota's Tomorrow...Today

Department of Environment and Natural Resources
Division of Environmental Services
Ground Water Quality Program

December 1999

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Executive Summary

This document describes South Dakota's Source Water Assessment Program (SWAP) which is designed to assist local public water supplies in protecting their drinking water from potential contamination. The document meets the requirements of the 1996 Safe Drinking Water Act Amendments, which mandated states to identify the areas contributing water to public drinking water supplies, inventory the potential sources of contamination within those contributing areas, and assess the susceptibility of each public water supply to those potential contaminant sources. In order to ensure local citizens understand and support the assessment program, states were required to emphasize public participation in program development, and were required to make the final assessment results available to the public.

Public participation in South Dakota's SWAP is an integral part of the development of the program. The public has been involved since program inception through the formation of technical and citizens advisory committees. The requirements and benefits of source water protection have been discussed at a number of seminars and workshops, in discussions with community representatives, as well as through various publications and newsletters. Two statewide public meetings, using a linked telecommunication network, were also held to gather input on the assessment process.

South Dakota's wellhead protection program, which the United States Environmental Protection Agency (EPA) approved in 1992, will serve as the basis for assessing the ground water supplied public drinking water systems in the state. Evaluation of ground water supplied systems is currently in progress. Appendix A, the South Dakota Wellhead Protection Program 1997 Biennial Report, is the most recent comprehensive report on the status of South Dakota's Wellhead Protection Program. A brief updated summary was submitted to Region VIII in November 1998 and the 1997-1999 Biennial Report was submitted to Region VIII in December 1999. Please refer to that document for recent information. The major activities recently conducted were the delineation and contaminant source inventory of all low-sensitive ground water public water supply systems (PWSS) in South Dakota. Appropriate delineation methods are being used, depending primarily on the hydrogeological complexity of the area, availability of data, and vulnerability of the system. The contaminant source inventories are based on previously approved methods, availability of information and resource constraints. Susceptibility of the wellfields to contaminants will be determined based on the relative risk to the public water supply system from the individual sources of contamination in the delineated area. Each potential contaminant source will be categorized as presenting a relatively high, moderate, or low risk of contamination to the specific public water supply system. Relative risks associated with generalized land use (non-point source contamination) in the delineated zones will also be included as part of the susceptibility analysis. The susceptibility rating for a potential contaminant source does not imply it has caused or will cause a problem for a particular drinking water supply, only that a potential exists because of characteristics of the wellfield and the contaminant source.

The assessments of public surface water supplies are based on an evaluation of the contributing watershed areas that are most likely to impact the water source. Delineated assessment areas extend 10 miles upstream of the water intake, and include major tributaries and any aquifer

surrounding the up-stream area. Additionally, a one-quarter mile contributing zone extending laterally beyond the up-stream aquifer will also be examined to provide for an adequate evaluation of potential threats to a particular surface water supply. A detailed potential contaminant source inventory will be conducted in this delineated zone. A less detailed inventory will be conducted in the watershed area outside the delineated zone. The level of detail presented will be determined by availability of information and resource constraints. The susceptibility analysis for surface water supplies will be similar to the ground water system assessments noted above.

Results of the source water assessments will be distributed to the public in either an electronic format or through paper products, depending upon the needs of the individual public water supply system. A narrative describing the general assessment activities and susceptibility work will be submitted to the public water supply systems and to local elected officials, along with maps showing the source water delineation area, inventory of contaminant sources, and susceptibility rating. To allow for wide distribution, the information will be made available on South Dakota's Internet web site. The public water supply system operator and the local official will be encouraged to distribute the source water assessment information to their citizens through various means, including Consumer Confidence Reports. Once the source water assessment information has been given to the local official and public water supplier, it becomes their responsibility to use the data to develop management tools for carrying out source water protection efforts. It is not mandatory that local communities develop protection plans. Upon request from the communities, the South Dakota Department of Environment and Natural Resources (DENR) will provide assistance with developing these protection plans.

South Dakota has requested an 18-month extension to complete the source water assessments. With the 18-month extension, the projected date for completion of the assessments would be no later than May 2003.

Information needed for the assessments will be coordinated with other local, state, tribal and federal agencies, as well as with other programs within DENR. The long range goal of the Source Water Assessment Program is to provide local public water suppliers and community leaders with a sound technical basis for managing their water source areas to ensure that contaminants will not impact the water in their wells or surface water intakes. Maintaining safe drinking water supplies for South Dakota's citizens is the ultimate program goal.

Chapter 1: Introduction to the Source Water Assessment and Protection Program

1.1 Background of Source Water Assessment and Protection Program

Comprehensive regulations designed to protect public drinking water supplies in the United States began with the enactment of the federal Safe Drinking Water Act (SDWA) in 1974. The U.S. Environmental Protection Agency (EPA), which had been established in 1970, was the federal agency charged with administering the SDWA. Specific amendments to this Act were passed in 1986 which strengthened its provisions for ground water protection by requiring states to establish wellhead protection (WHP) programs. These amendments required each state to develop a WHP program that could be used by local communities to help protect their drinking water supplies from contaminants.

The SDWA was further strengthened in 1996 with the passage of additional amendments which required states to develop a Source Water Assessment Program (SWAP) for use with all public water supplies in the state. It expanded on the 1986 SDWA Amendments by including preventative protection measures for community surface water supplies in addition to the ground water supplies which were addressed under the previous WHP program. The 1996 SDWA Amendments (Sections 1453 and 1428(b)) require states to conduct individual source water assessments for each public water supply in the state. This process includes 1) delineating the geographic area contributing water to the public water supply, 2) conducting an inventory of potential contaminant sources in that delineated area, and 3) determining the public water supply's susceptibility to contamination from the potential contaminant sources in its delineated area.

The State of South Dakota has long recognized the need for protection of its valuable water resources. The Department of Environment and Natural Resources (DENR) is the state agency primarily responsible for surface and ground water protection, both in preventative measures and remediation activities. South Dakota Codified Law 34A-2 directs DENR to conserve the waters of the state and to protect, maintain, and improve the quality of our water for drinking water supplies and other uses.

Drinking water supplies are regulated through the DENR Division of Environmental Services Drinking Water Program which was delegated primacy from EPA in 1984 to regulate public water supply systems. A system is considered a public water supply if it has at least fifteen service connections or serves at least twenty-five people.

Based on the 1986 SDWA Amendments, the 1987 South Dakota Legislature gave DENR the authority to administer a wellhead protection program. In March 1989, Governor Mickelson signed the Centennial Environmental Protection Act. This legislation included requirements to develop a state wellhead protection program, and to complete guidelines for local governments and public water suppliers to use in formulating their local wellhead protection plans. The Act also provided the authority for municipalities and counties to adopt ordinances to implement and enforce a WHP program. As a result of these state and federal requirements, DENR developed a

voluntary WHP program which was approved by EPA in September 1992, and completed a wellhead protection program guidance document in April 1995, which described the process a local public water supply can follow to develop a successful WHP program. This SWAP plan expands upon these wellhead protection program measures by including surface water assessment and protection plans, and by describing the more detailed state involvement in source water assessment and protection efforts for individual public water supplies.

1.2 Goal of Source Water Assessment and Protection Program

Protecting South Dakota's public drinking water supplies is vitally important for maintaining the quality of life for the citizens of South Dakota. The Source Water Assessment and Protection Program will play an integral part in this effort. The actual community source water assessment is not an end product. Instead, it is a first step in providing a sound technical basis for the local public water supplier and community officials to consider protection measures appropriate for its particular situation. The long-range goal of the program is drinking water protection, not simply source water assessment.

Other environmental programs, both regulatory and non-regulatory, can use information derived from the source water assessments to develop and implement their program plans. Examples where this may occur include reducing drinking water sampling requirements through the monitoring waiver program, using the potential contaminant source inventory to assist in Class V injection well identification, and using the assessments to assist a new drinking water system in developing adequate technical capacity.

1.3 Schedule to complete Source Water Assessment Program

As indicated in the EPA "State Source Water Assessment and Protection Programs Guidance" document, the State SWAP plan must be submitted within 18 months of publication of the final EPA guidance. This guidance document was published in August of 1997; therefore, the state submittal is due in February 1999. This SWAP plan is being submitted for EPA review and approval within the allotted time frame. We anticipate quick review and approval by EPA, and will complete the assessment work following approval.

South Dakota is requesting an 18-month extension to the two-year timetable for conducting the source water assessments, as allowed under Section 1453(b) of the 1996 Safe Drinking Water Act Amendments. This request is based on limited financial and personnel resources available to conduct the 760 public water supply system assessments required in South Dakota. Additional information on these resources can be found in the previously approved Drinking Water State Revolving Fund Intended Use Plan for the Source Water Assessment set-aside funds. This document is located in Appendix B. If EPA uses the allotted nine months to review and approve the SWAP document, the final date for completion of the assessments and delivery of this information to the public water supply systems, with the extension, will be May 2003. Additional information concerning the completion of required SWAP activities (formation of the technical advisory committee, public meetings, prioritizing public water supplies, source water funding mechanisms, work plan schedule, and assessment methodology) are discussed in the following chapters and appendices.

Chapter 2: Public Participation and Outreach

Public participation in the development and implementation of the Source Water Assessment and Protection Program is essential for the program to be successful. South Dakota has provided an adequate opportunity for diverse interest groups within the State to participate in the development of the program. This included establishing a Technical Advisory Committee, Citizens Advisory Committee, an interested party mailing list, participating in numerous workshops and seminars, and holding two statewide public meetings on the program.

2.1 Technical Advisory Committee

In order to obtain the technical expertise needed to develop the Source Water Assessment Program (SWAP), South Dakota established a Technical Advisory Committee. The Department of Environment and Natural Resources (DENR) requested assistance from 22 scientists and engineers from federal and state agencies, various water organizations, water development districts, Tribal representatives, cities, agriculture organizations, health group representative, and universities. The Technical Advisory Committee convened four times, on April 1, 1998, May 28, 1998, October 1, 1998, and October 22, 1998, to discuss all aspects of the program including the program's technical feasibility and effectiveness. The committee concurred with the approach presented in this document. DENR may reconvene the Technical Advisory Committee to discuss other roles as needed during the implementation of this program. The committee participants and meeting summaries are presented in Appendices C-C_5.

Due to the complex hydrogeology and interaction between ground water and surface water in the Black Hills of South Dakota, a unique assessment approach is needed for public water supply systems in this area. A technical meeting was held on July 21, 1998 to discuss the assessment approach in this region. This meeting was attended by members of the Technical Advisory Committee as well as local and county stakeholders. The participants and meeting summary are presented in Appendix C_3.

2.2 Citizens Advisory Committee

South Dakota utilized established Citizens Boards, including the Board of Water and Natural Resources and the Water Management Board, as Citizens Advisory Committees. These boards were chosen to represent the citizens of South Dakota because of their diverse backgrounds in agriculture, engineering, law, real estate, education, and insurance. These boards are policy boards created by the South Dakota State Legislature to make quasi-judicial, quasi-legislative decisions on various environmental issues in the state.

The Board of Water and Natural Resources establishes and implements the State Water Plan, establishes policies for water resources management, and has the responsibility for awarding funds from the Clean Water State Revolving Fund Program and Drinking Water State Revolving Fund Program. This board also oversees various activities of water project districts, water user districts, irrigation districts, and water development districts, and makes recommendations to the Governor and Legislature for placement of projects on the state water resources management plan.

The Water Management Board has general supervision of the waters of the state, including measurement, appropriation, and distribution. The Board regulates and controls the development, conservation, and allocation of the right to use the waters of the state according to the principles of beneficial use. This Board is also involved in regulating and protecting water quality in South Dakota through their review and approval of water quality standards, facility discharge permits, and other decisions on public interest issues regarding water quality.

Three meetings were held with each citizen's board to discuss the Source Water Assessment and Protection Program. The first meeting included an introduction to the Source Water Assessment Program. The second meeting included a presentation of the Intended Use Workplan for the Drinking Water State Revolving Fund set-aside money used to fund the program. The third meeting included a presentation and concurrence of the approach presented in this document. Citizens Advisory Committee members, meeting summaries, and an invitation list for the WMB and BWNR meetings are presented in Appendices D-D_5.

2.3 Native American Tribal Involvement

Although South Dakota is not required to assess Tribal water systems, the state will assist with completing Tribal source water assessments upon their request. South Dakota is committed to working with the Tribal community to stress the importance of developing Source Water Protection programs for their water supplies. In order to receive input and comments from the Tribes, South Dakota invited all Tribes to attend the November 18, 1998 source water public meetings and sent the draft *Source Water Assessment and Protection Program* plan to all Tribal environmental coordinators on November 24, 1998. In December 1998, South Dakota unsuccessfully attempted to schedule a meeting between DENR and Tribal representatives to discuss SWAP issues. However, DENR presented SWAP information to Tribal representatives during the January 12, 1999 South Dakota Association of Rural Water Systems Annual Technical Conference. During this presentation, DENR stated the willingness of the department to work with the Tribes on all SWAP issues. DENR will continue to attempt to schedule a meeting with all Tribes.

2.4 Public Comment on the Program

Source water information was sent to interested citizens, including local governments, professors, lawyers, federal agencies, environmental consultants, and rural water systems that expressed interest in the source water program development. This information included Technical Advisory Committee meeting summaries and the Workplan for the Source Water Assessment set-aside from South Dakota's Drinking Water State Revolving Fund. All interested parties were encouraged to submit comments on the program.

To encourage local interest in developing a Source Water Protection Program, DENR must stress the importance of source water in the state and share information on what can be done locally to protect water resources. DENR attempted to achieve this goal by encouraging wide public involvement during two Source Water Assessment and Protection Program meetings on November 18, 1998 designed to solicit comments on the draft document. These meetings were held at 11 Rural Development Telecommunication Network sites across South Dakota. To accommodate all interested individuals, meetings were held during both the afternoon and evening of November 18, 1998. The meetings were advertised on South Dakota's Internet

website and in major newspapers throughout South Dakota. Invitations and an executive summary of the program were sent to approximately 1,800 SWAP stakeholders. The public was also encouraged to view the draft Source Water Assessment and Protection Program document on South Dakota's Internet website or to request a hard copy. The advertisements and invitations encouraged stakeholders who were unable to attend the meetings to provide written comments to DENR. The list of invited stakeholders can be found in Appendix E, the list of public meeting locations and newspapers contacted can be found in Appendices F-F_1, and the meeting summaries can be found in Appendix F_2.

2.5 Workshops and Seminars

DENR presented source water information at a variety of seminars and workshops to educate the public on the importance of the Source Water Assessment and Protection Program. Over 60 individuals representing water systems, water development districts, environmental groups, and tribal coordinators, among others, attended an introductory Source Water Assessment Program Workshop in June 1997 to introduce these stakeholders to the program. DENR staff has also given numerous presentations on the development of the Source Water Assessment Program to various organizations. These include the Missouri River Corridor Action Team, Non-point Source Task Force, Safe Drinking Water Act Seminar, Water Treatment and Distribution Operators Seminar. A complete list of all presentations can be found in Appendix G.

2.6 Newsletters, Publications, and Press Releases

DENR also distributed SWAP information through various newsletters and publications. Among others, a SWAP "Fact Sheet" was sent to all community and non-transient non-community public water supply system operators and town mayors. A complete list of all publications distributed is in Appendix H.

Chapter 3: Source Water Assessment Approach

South Dakota Codified Law 34A-2 directs DENR to conserve the waters of the state and to protect, maintain, and improve the quality of water for drinking water supplies and other uses. Therefore, South Dakota will conduct a source water assessment for the protection and benefit of the water quality at every public water supply system (PWSS) in the state. A source water assessment is a three-step process that includes delineating the part of the watershed or ground water area that contributes water to the water supply; identifying the significant potential sources of drinking water contamination in those areas; and rating the water supply's susceptibility to contamination from those sources.

Source water delineations protect and benefit PWSS by determining the critical area contributing water to the system, thereby defining the area where management efforts should be focussed at the local level. Locating potential contaminant sources in source water areas protects the PWSS by informing the local community of potential threats to their water supply. Determining the susceptibility of the water supply to each potential contaminant source benefits the local community by providing the community leaders and planners a system to prioritize their management measures by identifying contaminant source risks and evaluating the system's susceptibility to contamination.

3.1 Public Water Supply System Types

South Dakota will delineate source water assessment areas according to public water supply system types and vulnerability. A PWSS is any water system that serves 15 connections or 25 people per day for a minimum of 60 days per year. There are several types of PWSS: community, non-transient non-community, transient non-community, and consecutive. Figure 3.1 illustrates the differences between PWSS types.

- Community PWSS are water systems that serve a permanent residential population and include municipalities, rural water systems, mobile home courts, and housing developments.
- Non-transient non-community PWSS are nonresidential water systems that serve the same population for at least six months per year, and include factories and schools.
- Transient, non-community PWSS serve a transient or nonresidential population and include campgrounds, rest stops, and resorts.
- A consecutive PWSS is a water system served by another public water system. For example, a municipal PWSS that maintains its own well for emergency or back-up purposes may be served by a regional rural water system.

3.2 Sensitivity of Public Water Supply Systems

The sensitivity of ground water-based PWSS is defined as the potential for the source aquifer to become contaminated based on its intrinsic hydrogeologic characteristics. Sensitivity is not dependent on land-use practices or contaminant characteristics. In 1991, the DENR conducted a *South Dakota Public Water Supply Vulnerability Study* to assess the vulnerability of both ground water and surface water-based PWSS in the state. In this study, vulnerability was defined as the degree to which a ground water source is susceptible

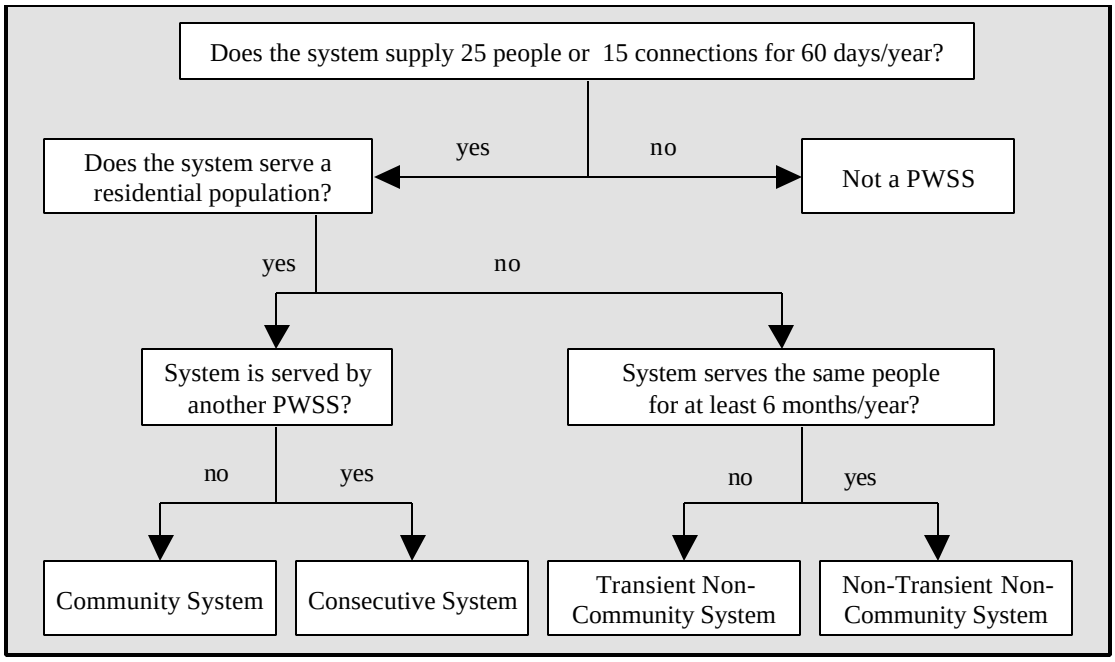


Figure 3.0.1 Public water supply system determination

to contamination. A vulnerable ground water source was defined as one that is highly susceptible to contamination. A non-vulnerable ground water source was defined as one that has little or no susceptibility to contamination. Vulnerability determinations were not made with regard to the proximity of a potential contaminant source. Vulnerability determinations were made on a case-by-case basis using the best professional judgement of individuals at the South Dakota Geological Survey who are trained in geology and hydrogeology. These determinations were made using all data available at the time, which may have included any or all of the following: depth of the well, depth to the top of the aquifer, depth to water, nitrate concentration, whether the aquifer was confined or unconfined, and the type of material in the confining layer. Confined and unconfined determinations were based on local geology, which may have included data from any or all of the following: geologic maps, nearby lithologic or borehole logs, and well logs. As noted below, PWSS ground water wells that were activated after the above-mentioned vulnerability study was conducted will initially be considered sensitive if a confining layer, such as unweathered clay, is not present. A PWSS will also initially be considered sensitive if the well appears to be confined, but the top of the aquifer is less than 100 feet below ground surface. The South Dakota Geological Survey will evaluate new wells using the above criteria to determine the vulnerability.

Source water assessment areas for sensitive PWSS will be delineated using a different delineation method than those for less sensitive PWSS. Sensitive ground water PWSS have wells in unconfined or semi-confined aquifers, or include those determined sensitive in the *1991 South Dakota Public Water Supply Vulnerability Study*. All surface water PWSS are considered sensitive.

PWSS with low-sensitivity typically have wells in confined aquifers greater than 100 feet below ground surface, or are those determined to have a low-sensitivity in the *1991 South Dakota Public Water Supply Vulnerability Study*. PWSS with low-sensitivity are those with little or no

susceptibility to contamination. The primary way PWSS with low-sensitivity can become contaminated is through contaminants entering the aquifer through poorly constructed wells. Confined aquifers less than 100 feet below ground surface will be considered sensitive until hydrogeologic information is available to DENR that indicates the aquifer is sufficiently protected and would therefore, require less stringent protection than unconfined aquifers.

3.3 Delineation Methods

3.3.1 Data Available for Delineations

The most important information needed to delineate a source water assessment area accurately is the location of the wells or intakes. South Dakota has identified these locations along with reservoirs and other water distribution structures using Global Positioning System equipment. The South Dakota Geological Survey has completed or is actively conducting county studies of 41 counties in the state. Geological and water resources studies are available for approximately 150 individual public water supplies in South Dakota. These studies contain information on the geology, lithology, water quality, water levels, and aquifer characteristics for these areas. In addition, the Black Hills Hydrology Study is being conducted by the United States Geological Survey with the cooperation of the West Dakota Water Development District and DENR. This study is scheduled for completion in 2000 and will provide valuable information on the quantity, quality, and distribution of surface and ground water resources of the Black Hills region.

South Dakota will use the U.S. Geological Survey 8-digit Hydrologic Unit Code to delineate watershed boundaries, as illustrated in Appendix I. More detailed watershed boundaries will be used where available, such as the Big Sioux River basin, James River basin, Vermillion River basin, Red River basin, and Minnesota River basin. A 1:24,000 topographic map will also be used to delineate watershed boundaries when needed.

3.3.2 Ground Water Public Water Supply Systems Outside of the Black Hills Region

In order to protect ground water supplies, community leaders and planners must have information regarding the surface and subsurface area surrounding a well or wellfield that contributes water to their public water supply system. Hydrogeologic conditions vary across the state and well depths range from tens to thousands of feet below the land surface. The types and thicknesses of overlying materials that may protect the aquifer from contamination also vary. Because of the great range in hydrogeologic settings across South Dakota, the intrinsic sensitivity of ground water public water supplies to contaminants varies greatly. Variations in individual PWSS ground water delineation methods and criteria will need to reflect these hydrogeologic differences. The surficial glacial aquifers east of the Missouri River, alluvial aquifers throughout the state, and bedrock aquifers exposed at or near the surface, primarily in the Black Hills, are the most sensitive to contamination from activities at the land surface and have the greatest need for source water protection.

Depending on the type of PWSS, South Dakota will utilize a combination of the EPA-approved wellhead protection delineation methods to define source water assessment areas. The delineation approach applied to sensitive systems will be based on the type of hydrogeological information available.

The delineation methods listed below for each type of ground water system will most likely to be used. However, if sufficient hydrogeological information is available, and as time, money, and resources allow, an alternative delineation method described herein may be used.

3.3.2.1 Sensitive Community and Non-Transient Non-Community Ground Water Public Water Supply Systems

Approximately 85% of South Dakota's population is served by community and non-transient non-community public water supply systems. Community and non-transient non-community systems serve the same population daily. Because the served population uses water from the same water source throughout much of their lives, community and non-transient non-community PWSS require greater protection measures. A comprehensive effort using available hydrogeologic information will be applied to assess these systems. However, the amount and quality of available hydrogeologic information will dictate the delineation method used. The delineation method for these systems may include one or a combination of the following: hydrogeologic mapping, analytical methods, or calculated fixed radius. A comprehensive potential contaminant source inventory, as described in Section 3.4, will be conducted in the delineated area. A list of all sensitive community and non-transient non-community PWSS can be found in Appendix K.

Hydrogeologic Mapping: South Dakota will delineate source water assessment areas using hydrogeologic mapping where sufficient data are available to identify aquifer and flow boundaries. Surface observations and the evaluation of subsurface data which indicate geologic changes, can be used to identify the aquifer boundaries and other areas possibly contributing water to the aquifer. Many aquifer boundaries have been mapped and are available in county reports prepared by the United States and South Dakota Geological Surveys. Hydrogeologic mapping is especially well suited for narrow, shallow glacial and alluvial aquifers, as well as bedrock aquifer recharge areas. This method may be more applicable where identifiable surface features control the ground water flow and recharge-discharge balance in aquifers. Figure 3.2 illustrates the hydrogeologic mapping delineation method.

Analytical Method: South Dakota may also use the analytical method to define source water assessment areas by solving mathematical ground water flow equations to delineate the 10 year time-of-travel area of contribution to a pumping well. This includes the area surrounding a pumping well that supplies water to the well. Aquifer characteristics are used to calculate the farthest down-gradient distance from which the well draws water, and the width of the area of contribution. These characteristics are also used to determine the area upgradient of the well that will contribute water to the well in a given period of time. The time frame used for this method is a 10- year time-of-travel. For back up wells that will only be used occasionally, a 2-year time-of-travel will be used. Should the PWSS indicate the well will be used regularly, more than 4 months per year, the 10-year time-of-travel criteria will be used. Site-specific hydrogeologic information is necessary for each well

site, including pumping rate, hydraulic gradient, hydraulic conductivity and saturated thickness of the aquifer. This method can be applied to aquifers with a sloping or flat water table. Figure 3.3 illustrates the analytical delineation method.

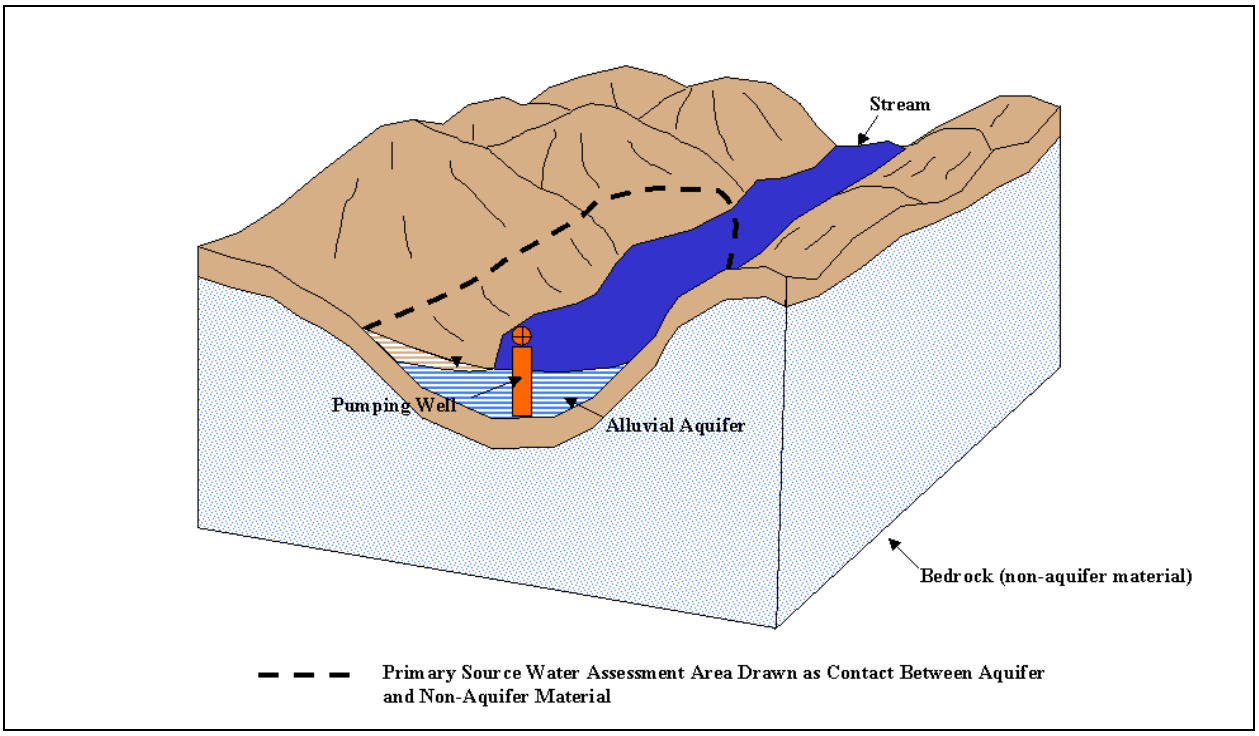
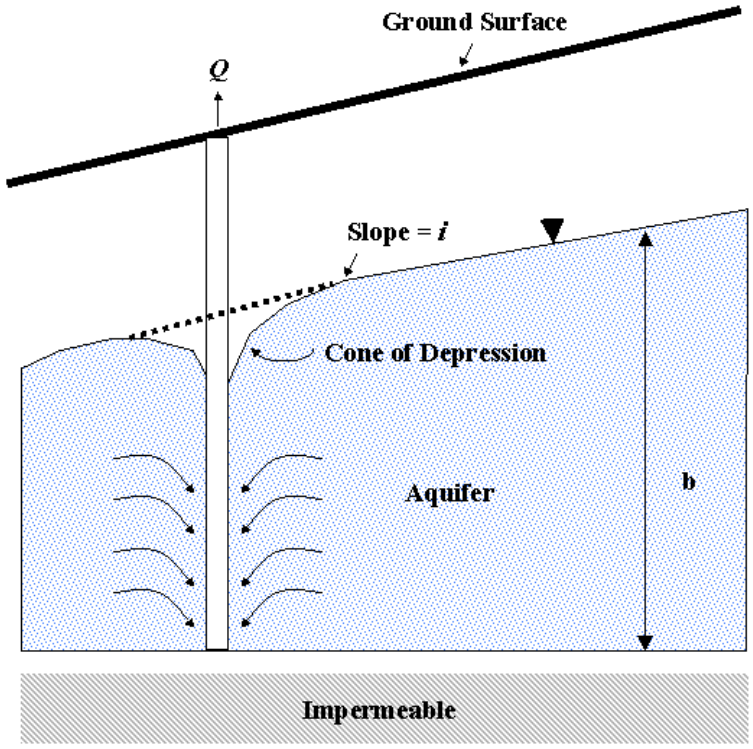
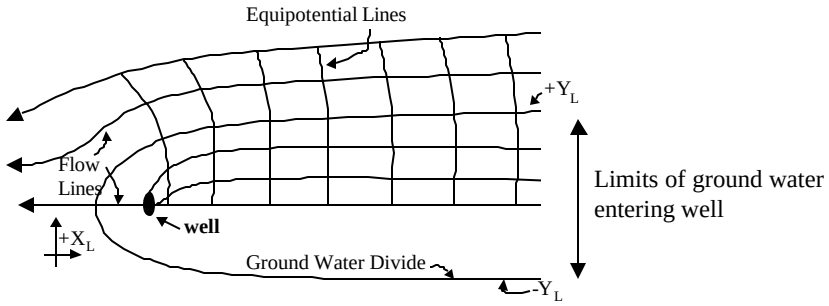


Figure 3.2 Hydrogeologic mapping delineation method

Calculated Fixed Radius: If the available hydrogeologic information on PWSS is insufficient for use of the analytical or hydrogeologic mapping methods, South Dakota may utilize the calculated fixed radius method. The calculated fixed radius method is a circle drawn around a well, the size of which is calculated using aquifer, well, and pumping rate information. The radius of the circle is dependent on aquifer porosity, screen length, pumping rate, and desired time of travel. A minimum 10-year time-of-travel will be used to calculate the fixed radius for South Dakota's community and non-transient-non-community source water area delineations unless the well being delineated is a back-up well, in which case a 2-year time-of-travel assessment area will be used. Figure 3.4 illustrates the calculated fixed radius delineation method.





$$-\frac{Y}{X} = \tan\left(\frac{2pKib}{Q}Y\right)$$

Uniform Flow Equation

$$X_l = -\frac{Q}{2pKib}$$

Distance to down-gradient null point

$$Y_l = \pm\frac{Q}{2Kib}$$

Boundary Limit

WHERE:

Q = well pumping rate

K = hydraulic conductivity

b = saturated thickness

i= hydraulic gradient

π = 3.1416

Figure 3.3 Analytical ground water delineation method

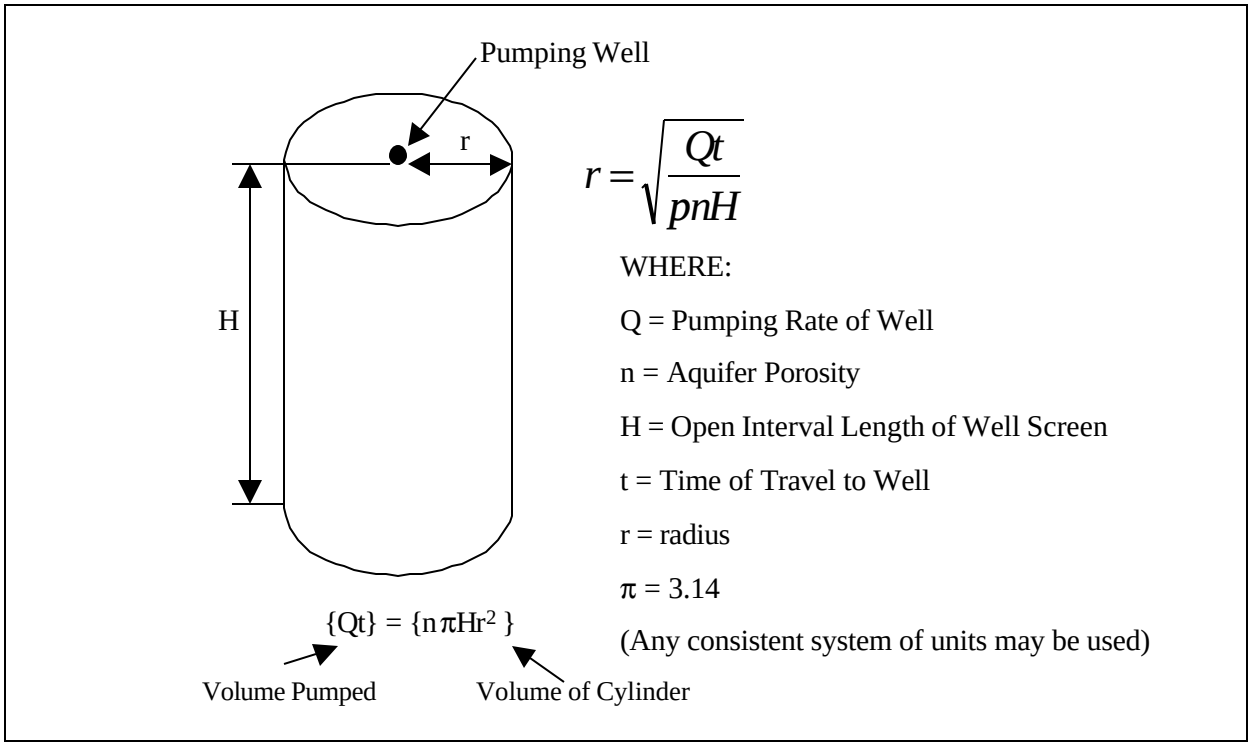


Figure 3.4 Calculated fixed radius delineation method

3.3.2.2 Sensitive Transient, Non-Community Ground Water Public Water Supply Systems

South Dakota will most likely use the calculated fixed radius method to delineate a 5-year time-of-travel source water assessment area around sensitive transient, non-community PWSS provided sufficient information is available. There are approximately 65 transient, non-community systems located outside the Black Hills region of South Dakota. A more advanced delineation method is not necessary for these systems because the water is not used consistently by individuals on a daily basis, as most individuals are at these sites for a short period of time. However, if sufficient data are available and time and resources allow, a more advanced delineation method may be used. If data are not available to use the calculated fixed radius delineation method, a 0.5-mile arbitrary fixed radius will be delineated around the wellhead. A comprehensive potential contaminant source inventory, as described in Section 3.4, will be conducted in the delineated area. A list of all sensitive, transient, non-community PWSS in South Dakota can be found in Appendix L.

3.3.2.3 Sensitive Consecutive Ground Water Public Water Supply Systems

In addition to their regular source of water, cities and communities may keep and maintain back-up or emergency wells as an alternate source of water. Although back-up wells can be found at any type of PWSS, this situation occurs most often in consecutive systems where the community purchases water from another entity, such as a rural water system, but maintains the existing water system for back-up or emergency purposes. Because of the limited use of these wells, South Dakota does not believe these systems warrant the same assessment effort as active systems. If a PWSS uses back up wells for drinking water purposes, DENR will delineate a 2-year time-of travel using the calculated fixed radius method. A two-year time-of–travel

coincides with the set back protection area set forth in the proposed *Ground Water Disinfection Rule*. A comprehensive contaminant source inventory will be conducted in the delineated area.

If a PWSS indicates in writing that the wells or intakes are no longer used for drinking water purposes, South Dakota will consider these wells or intakes inactive, and will not conduct a source water assessment. Should the wells or intakes be reactivated, a source water assessment will be conducted. A list of all consecutive systems in South Dakota can be found in Appendix M.

3.3.2.4 Ground Water Public Water Supply Systems with Low Sensitivity

Ground water public water supply systems with low sensitivity require less stringent protective measures from potential contaminant sources due to the confined nature of the aquifer, which makes the aquifer less sensitive to pollution. However, the area adjacent to the well should be protected primarily to prevent potential runoff of surface contaminants into or around the well. Therefore, South Dakota will use the arbitrary fixed radius delineation method for such systems. A minimum radius of 500 feet will be used for systems in confined aquifers that are greater than 100 feet below ground surface with a relatively extensive, low permeability confining layer or those determined to exhibit low-sensitivity in the *1991 South Dakota Public Water Supply System Vulnerability Study.* If sufficient data are available and if time and resources allow, South Dakota may use an alternative delineation method. A comprehensive potential contaminant source inventory will be conducted in the delineated area. Figure 3.5 illustrates the arbitrary fixed radius delineation method. A list of all PWSS with low sensitivity in South Dakota can be found in Appendix N.

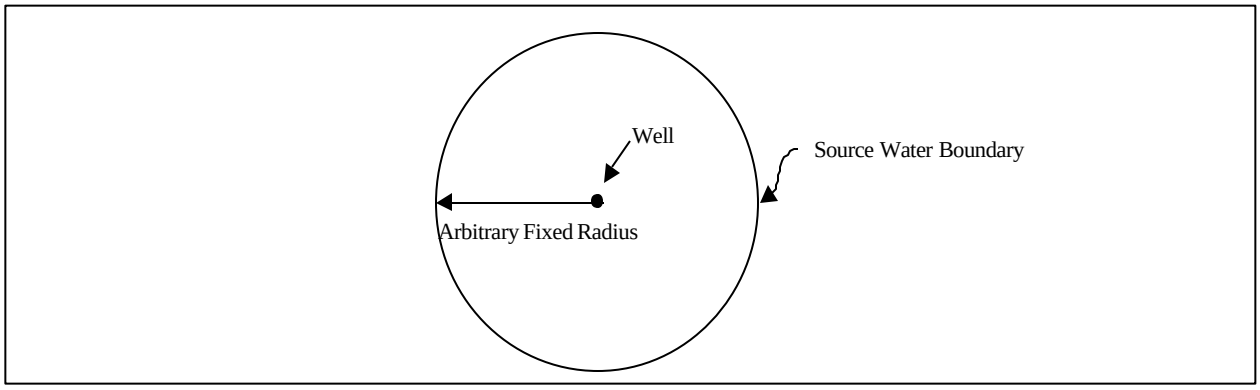


Figure 3.5 Arbitrary fixed radius delineation method

3.3.3 Surface Water Public Water Supply Systems

Although there are only 32 surface water PWSS in the state, approximately 22% of South Dakotans receive their water from surface water systems. Therefore, a significant portion of the population is dependent on surface water as a source of drinking water. In order to protect surface water supplies, community leaders and planners must have information regarding the area contributing water to the PWSS intake. However, unlike ground water systems, the area of contribution for surface water systems may encompass a large surface area.

The delineation methods listed below for each type of surface water system will most likely be used; however, if sufficient hydrological information is available and if time and resources allow, the delineation method may be altered to meet local needs. Lists of all surface water

PWSS, ground water PWSS under the direct influence of surface water, and PWSS using both ground water and surface water in South Dakota are found in Appendix O.

3.3.3.1 Non-Black Hills Region Surface Water Assessment Methods

The delineation area for surface water PWSS will include the watershed area upstream of the public water supply intake up to the watershed boundary, the Tribal border, or to South Dakota's state border, whichever is closest. An illustration of the generalized surface water delineation approach is shown in Figure 3.6.

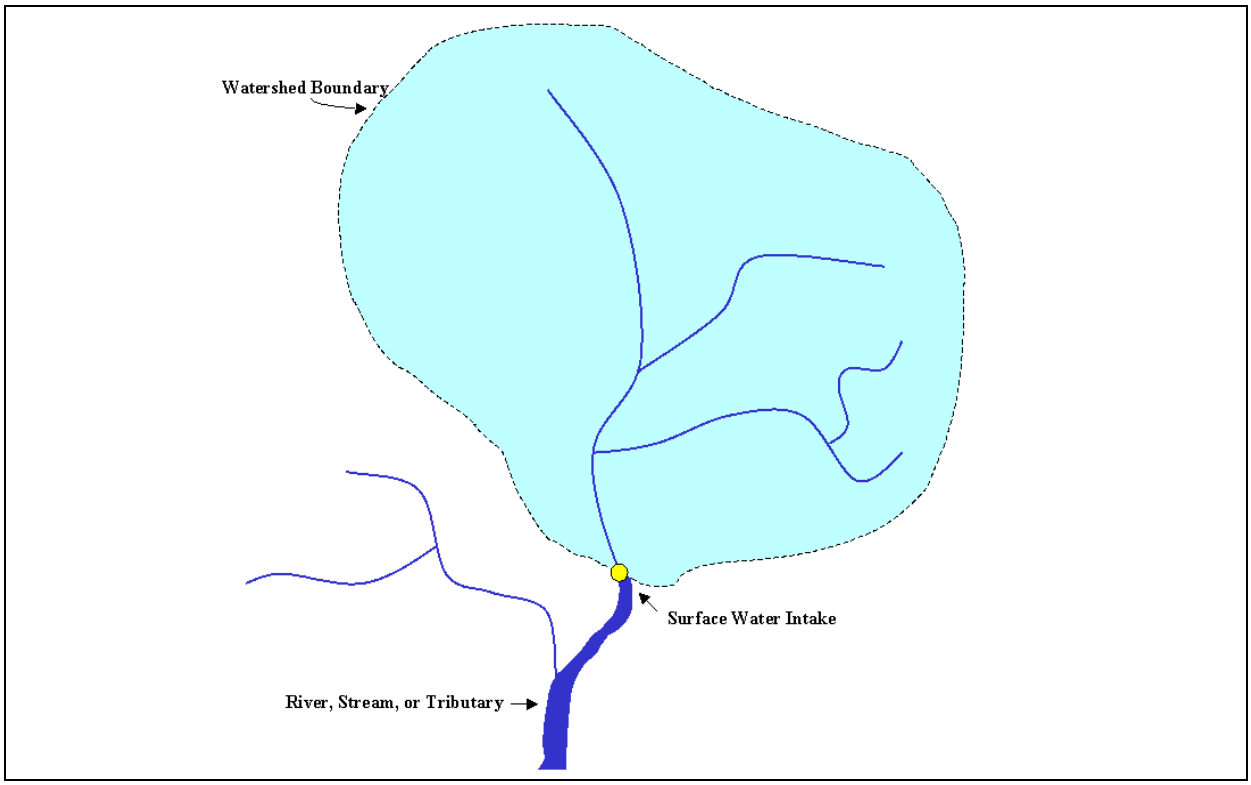


Figure 3.6 Generalized surface water assessment approach

The surface water assessment area, in which a potential contaminant source inventory will be conducted, consists of two or three zones within the delineated watershed: Zone A, Zone B, and Zone C.

- Zone A includes the most sensitive area surrounding the public water supply intake; therefore, South Dakota will concentrate potential contaminant source inventory identification efforts in this area. Zone A extends 10 river miles upstream from the intake and 0.25 lateral miles beyond each stream bank or alluvial aquifer boundary, whichever is wider. The alluvial aquifer associated with the stream is also included in Zone A. The minimum 0.5-mile wide assessment area will also include perennial streams or tributaries extending 10 river miles from the intake that contribute water to the public water supply system. A comprehensive potential contaminant source inventory will be conducted in Zone A, as described in Section 3.4.

A few aquifers, including the Big Sioux, Missouri, and Elm, among others, are very wide in South Dakota. These aquifers can extend many miles in width, which in most cases is beyond what needs to be protected for surface water sources. In these known large aquifers, South Dakota will use a 10-year TOT to determine the extent of the lateral delineation area needed to protect the surface water body. South Dakota will use the smaller delineation area as illustrated in Figure 3.6a and Figure 3.6b below. If the aquifer is relatively small, the aquifer will most likely terminate before it reaches the 10-year TOT distance. In these situations, the Zone A assessment area will extend 0.25 miles beyond the aquifer. However, if the aquifer is large and extends beyond the 10-year TOT, the Zone A assessment area will terminate at the 10-year TOT boundary.

The Zone A criteria, 10 river miles upstream of the public water supply intake and 0.25 mile setback along the stream and aquifer, were determined to be the most critical source water assessment areas by the Technical Advisory Committee (TAC). Most activities that would affect the water quality of the public water supply system are located in these areas. The TAC, which included representatives from DENR, water development districts, United States Geological Survey (USGS), and EPA, has many years of technical experience in ground water protection, surface water management, watershed protection, and geology. The TAC concluded, using best professional judgement, that the proposed Zone A criteria are appropriate for surface water PWSS in South Dakota.

Information supplied by the USGS indicated that the major rivers in South Dakota have an average velocity of between 0.5 to 2.5 miles per hour. These velocities can vary significantly within a particular river or stream, depending on the reach of the stream considered, general flow volumes, flood incidents, ice impacts, etc. Based on time-of-travel values, the 10-mile delineation distance corresponds to travel times from 20 hours to 4 hours. South Dakota believes this is sufficient time for emergency response teams to prevent major contamination at PWSS intakes if a release occur beyond the 10-mile delineated area. Some reservations were expressed concerning the reliability of using stream travel times due to the variable velocities, lack of knowledge in regard to flow rates in some streams and tributaries, and the reliability of using this information to manage the PWSS. The TAC felt the most manageable way to delineate surface water systems was to set a standard distance upstream that would be workable, but also be sufficient to protect against potential problems beyond the delineated area.

- Zone B includes a 25-mile radius within the delineated watershed area extending from the PWSS intake. The TAC concluded, using best professional judgement and the criteria noted above, that potential contaminant sources identified in Zone B will be less likely to affect the water quality of the public water supply system; therefore, a limited contaminant source inventory will be conducted in this area. A limited contaminant source inventory is described in Section 3.4.

- Zone C, for PWSS **not** located on the Missouri River, includes the remaining delineated watershed beyond 25 miles from the intake. A limited potential contaminant source inventory that includes "major" potential contaminant sources defined by the state will be conducted in this area.

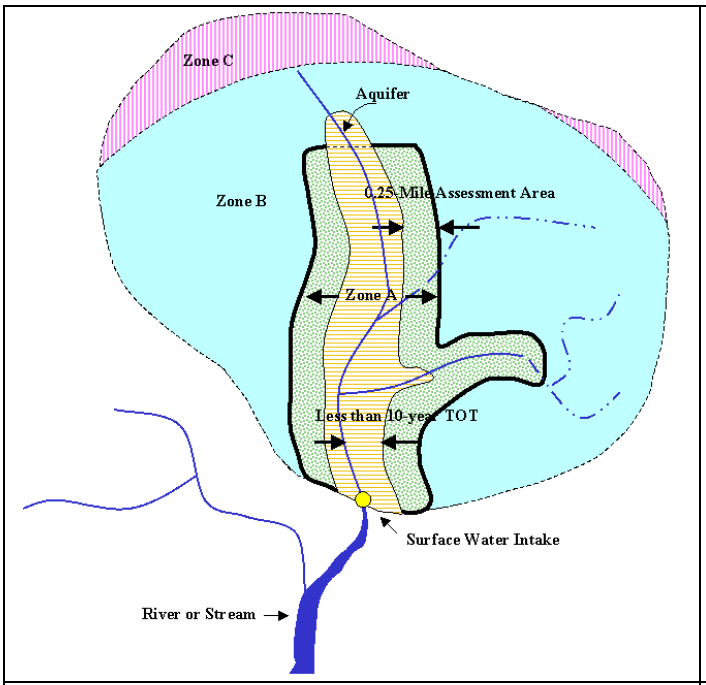


Figure 3.6a Generalized surface water assessment approach.

Aquifer is smaller than the 10-year TOT distance; therefore, Zone A extends 0.25 miles beyond the aquifer.

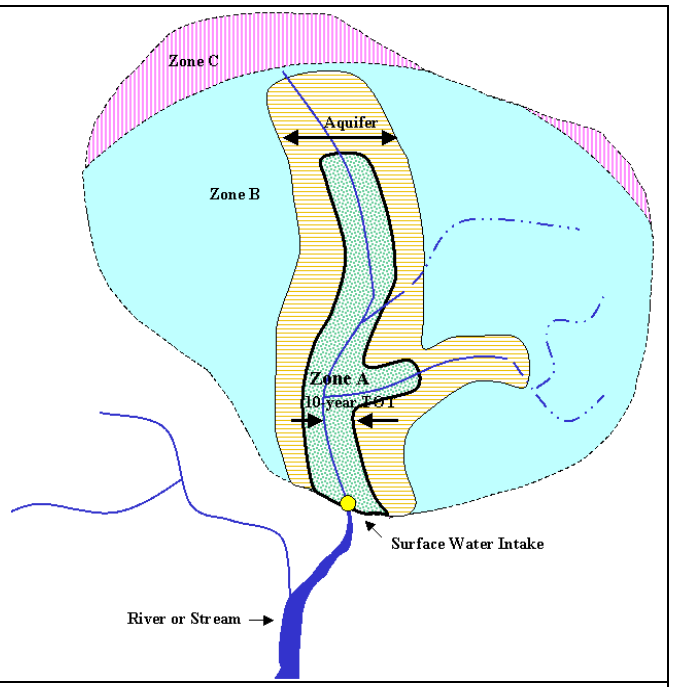


Figure 3.6b Generalized surface water assessment approach

Aquifer is larger than the 10-year TOT distance; therefore, Zone A extends to the 10-year TOT boundary.

- Zone C, for PWSS located on the Missouri River, includes the remaining delineated watershed beyond 25 miles from the intake. The TAC concluded, using best professional judgement, the distance (i.e., travel time) from the intake, and dilution that would occur with contaminant events far from the surface water intake, that a potential contaminant source inventory will not be conducted in this area. It is unlikely any potential contaminant sources identified in this area would affect the water quality of the public water supply system.

This assessment method will provide for the protection and benefit of surface water supplies by delineating the area contributing water to the system and identifying sources of potential contaminants that may impact the water system through overland flow. The assessment approach varies for surface water systems depending on the location of the intake, such as on a river or lake. The various assessment approaches are described in the following sections and illustrated in the following figures.

3.3.3.1a Surface Water Assessment Approach for Non-Missouri River Watershed Basin Rivers and Streams

The contaminant source inventory for rivers and streams will consist of two areas of assessment. Zone A includes the surface area 10 river miles upstream of the public water supply intake, and extends 0.25 lateral miles beyond the river or stream bank or alluvial aquifer boundary, whichever is wider. Alluvial aquifers in South Dakota can be many miles wide; therefore, in order to allow for a manageable Zone A assessment area and be consistent with the ground water delineation method for sensitive systems, this zone will not extend laterally beyond a 10-year time-of–travel distance in the aquifer. Zone B will include a 25-mile radius within the delineated watershed area extending from the public water supply intake. Zone C will include the

remaining delineated watershed. A comprehensive potential contaminant source inventory will be conducted in Zone A, and a limited potential contaminant source inventory will be conducted in Zone B, as described in Section 3.4. A limited potential contaminant source inventory that includes "major" potential contaminant sources defined by the state will be conducted in Zone C. An illustration of this method is shown in Figure 3.7.

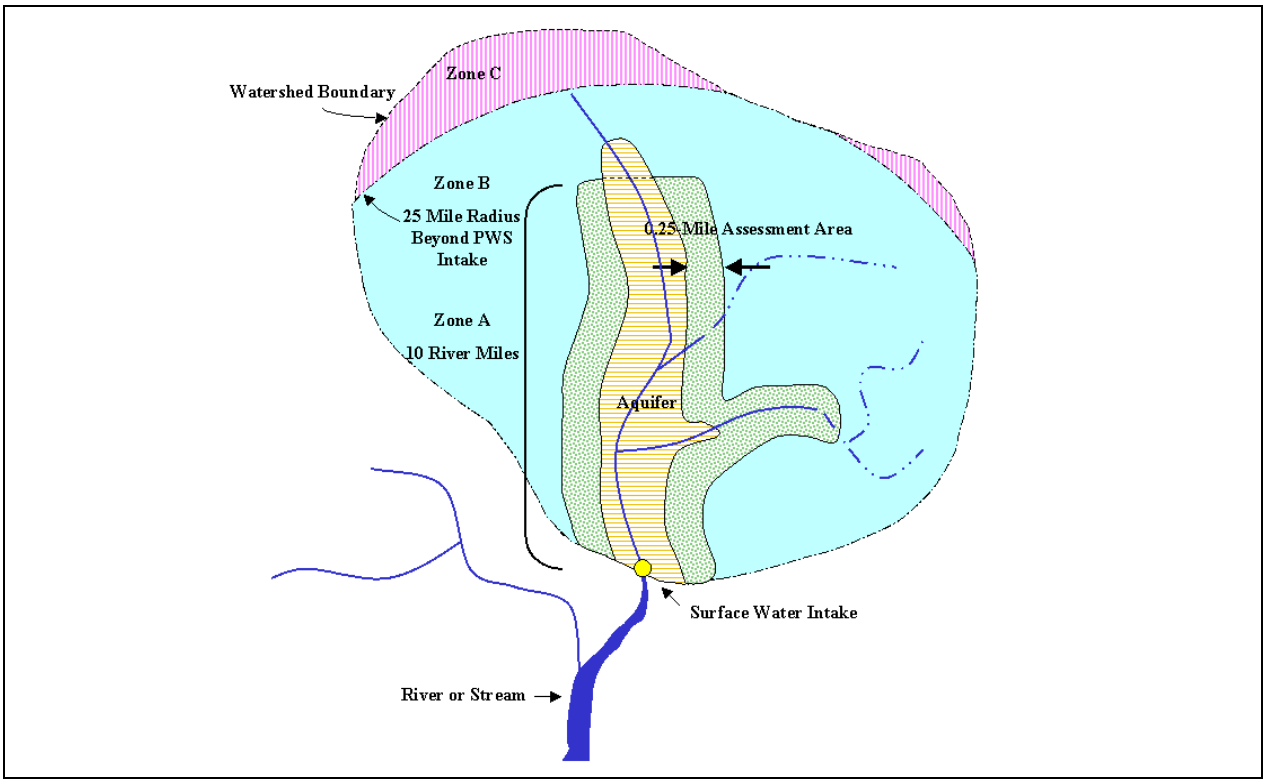


Figure 3.7 Source water assessment surface water public water supply system located on a river or stream

3.3.3.1b Surface Water Assessment Approach for Non-Missouri River Watershed Basin Lakes or Reservoirs

The assessment method for public water supply intakes located near lakes or reservoirs is similar to the method described previously for rivers and streams. However, Zone A will include a 0.25-mile wide assessment area around the lake or reservoir, if the lake or reservoir is within 10 river miles of the surface water intake. This assessment approach is illustrated in Figure 3.8. If the surface water intake is located directly on a lake or reservoir, Zone A will include a 0.25-mile wide assessment area 10 river miles upstream from the surface water intake. A 0.25-mile wide Zone A assessment area will also encompass the entire lake as illustrated in Figure 3.9. Although not illustrated on Figures 3.8 or 3.9, if an aquifer is present by the stream or lake it will also be included in Zone A. Zone A will not extend laterally beyond a 10-year time-of-travel distance in the aquifer. Zone B will include a 25-mile radius within the delineated watershed area extending from the public water supply intake. Zone C will include the remaining delineated watershed. A comprehensive potential contaminant source inventory will be conducted in Zone A, and a limited potential contaminant source inventory will be conducted in Zone B, as described in Section 3.4. A limited potential contaminant source inventory that includes "major" potential contaminant sources defined by the state will be conducted in Zone C.

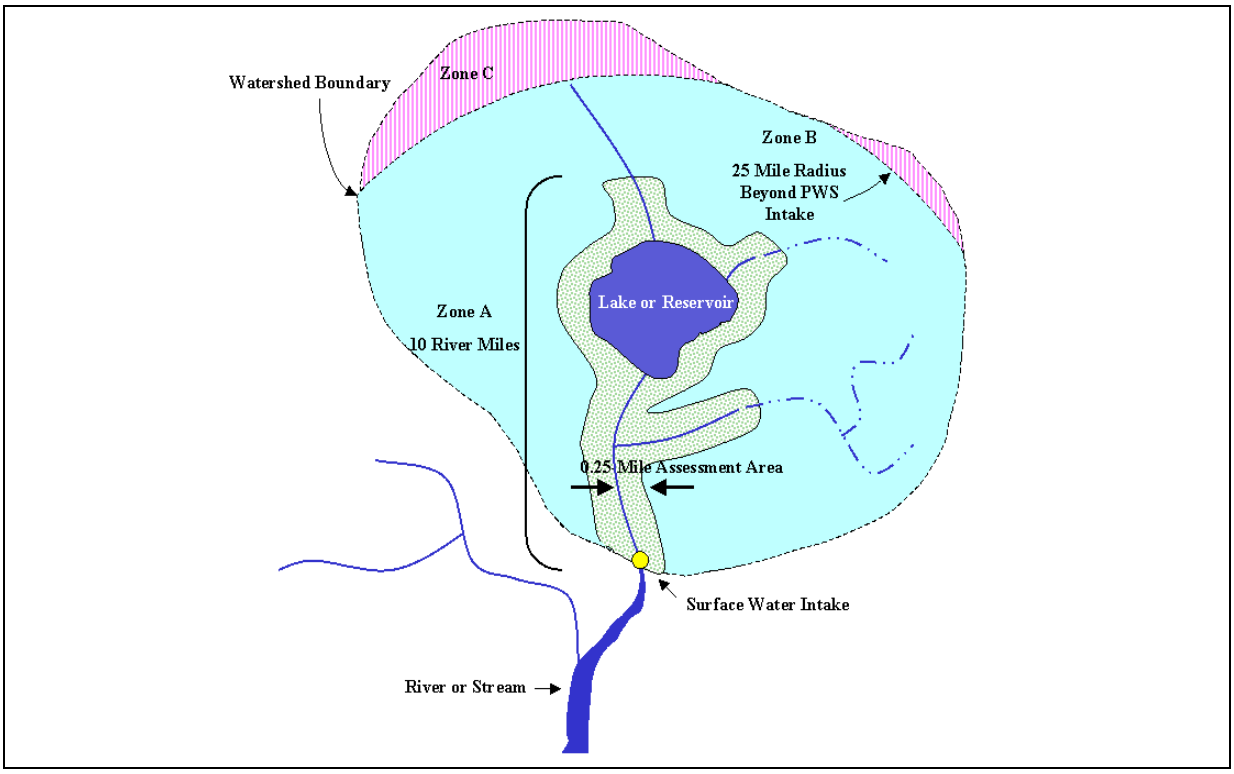


Figure 3.8 Source water assessment method for a surface water public water supply system located downstream from a lake or reservoir

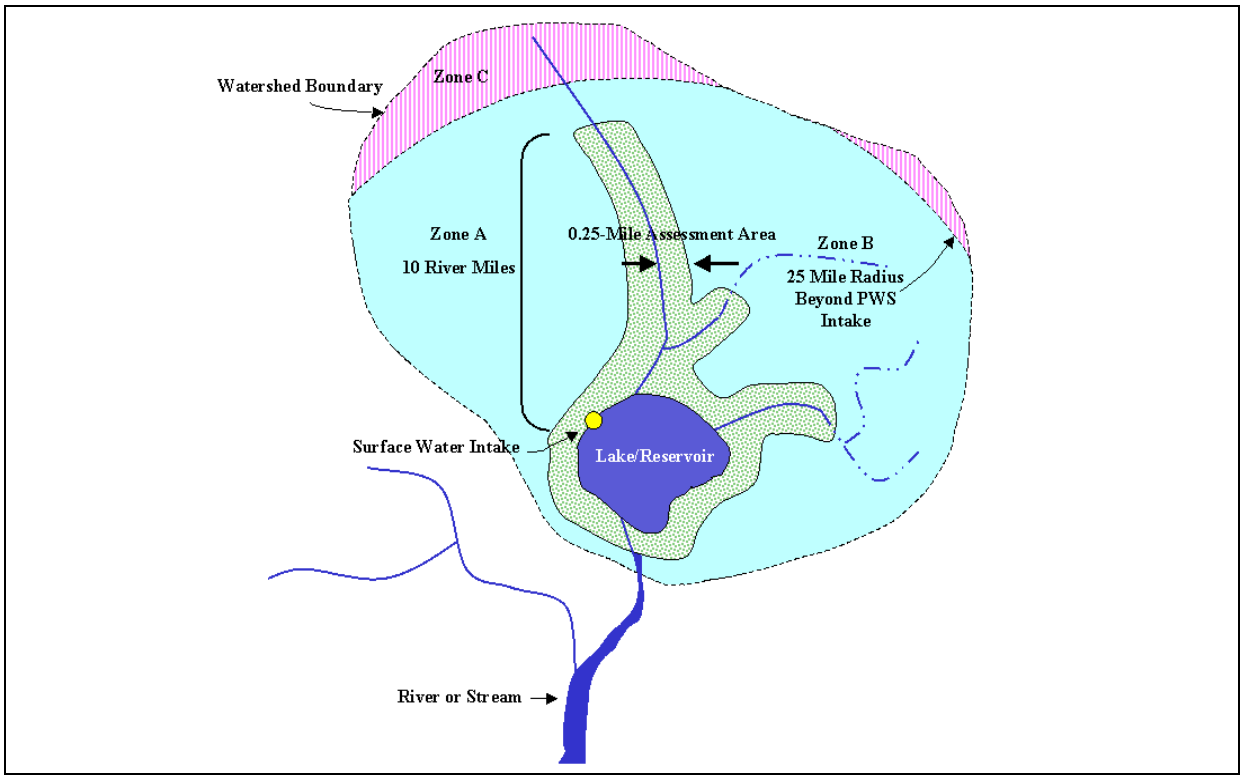


Figure 3.9 Source water assessment method for a surface water public water supply system located on a lake or reservoir

3.3.3.2 Missouri River Surface Water Assessment Methods

Due to the large surface area in the Missouri River watershed basin, distance to the PWSS intake, and dilution potential due to the tremendous amount of water flowing through this area of South Dakota, the TAC concluded that the inventory area for the Missouri River should not extend beyond a 25-mile radius within the delineated watershed area from the public water supply intake. The contaminant source inventory in this area will consist of three areas of assessment. Zone A will include the surface area 10 river miles upstream of the public water supply intake, and extend laterally 0.25-miles beyond the Missouri River, or alluvial aquifer boundary, whichever is wider. Alluvial aquifers in South Dakota can be many miles wide; therefore, in order to allow for a manageable Zone A assessment area and be consistent with the ground water delineation method for sensitive systems, this zone will not extend laterally beyond a 10-year time-of–travel distance in the aquifer. Zone B will include the area within a 25-mile radius within the delineated watershed area extending from the public water supply intake. Zone C will include the remaining delineated watershed. A comprehensive potential contaminant source inventory will be conducted in Zone A, and a limited potential contaminant source inventory will be conducted in Zone B, as described in Section 3.4. A potential contaminant source inventory will not be conducted in Zone C. An illustration of the Missouri River assessment method is shown in Figure 3.10.

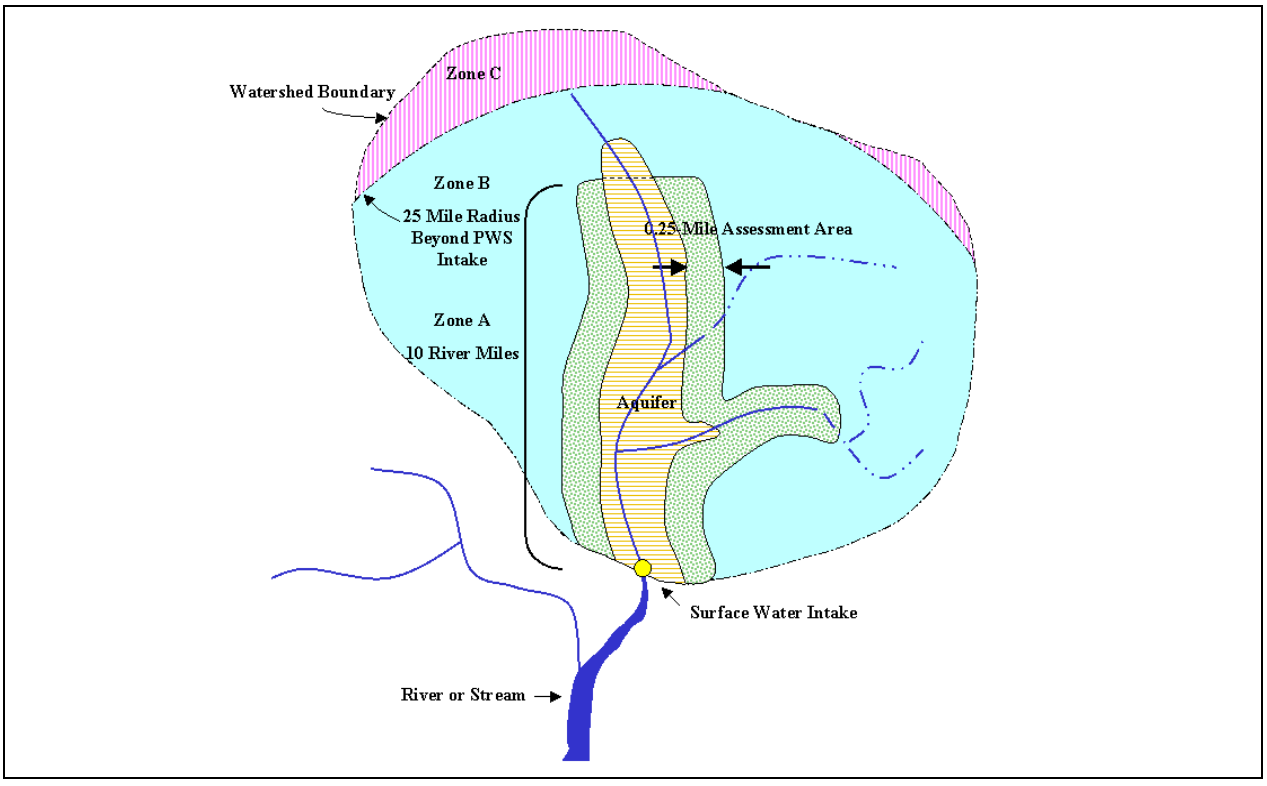


Figure 3.10 Source water assessment method for a surface water public water supply system located on the Missouri River

3.3.4 Conjunctive Assessment Method

The hydrology and hydrogeology of some public water supply systems are such that the systems may receive water from both surface and ground water sources. This includes ground water systems under the direct influence of surface water, and wells or intakes that receive water from both ground and surface sources. Therefore, a conjunctive delineation method that includes both ground and surface water is needed. A conjunctive delineation will be conducted for surface water systems under the direct influence of ground water and for all systems that the DENR Drinking Water Program has defined as ground water under the direct influence of surface water. If a PWSS has not already been designated by the DENR Drinking Water Program as ground water under the direct influence of surface water, and if sufficient data, such as dye tests, water quality information, water level changes, pumping tests, or the presence of microorganisms, are available to indicate that a PWSS is using ground water under the direct influence of surface water, DENR will assist the PWSS with modifying its delineation to the include the surface water source.

South Dakota will delineate the source water areas for these systems using both ground water and surface water delineation methods. The area contributing ground water to surface water intakes will be assessed using methods previously described in *Section 3.3.3.1 Non Black Hills Region Surface Water Assessment Methods* and *Section 3.3.3.2 Missouri River Surface Water Assessment Methods*. The area contributing ground water to the well(s) will be assessed using methods described previously for sensitive public water supply systems: hydrogeologic mapping, analytical methods, and/or calculated fixed radius. The area contributing surface water to the well(s) will be delineated using the surface water assessment methods described previously. This method allows for the protection of public water supply systems by assessing both the ground water and surface water used by a public water supply system. Figure 3.11 illustrates the conjunctive delineation method.

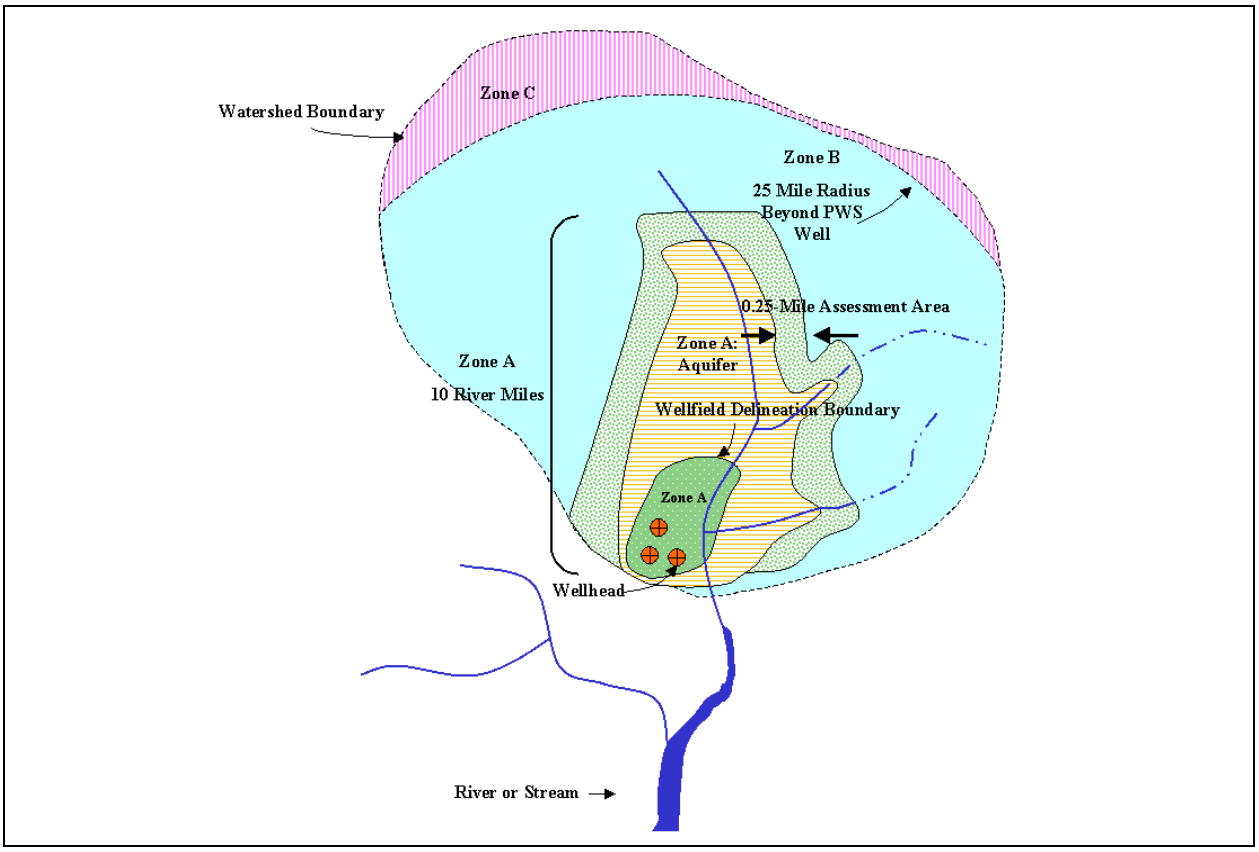


Figure 3.11 Conjunctive delineation method

3.3.5 Black Hills Public Water Supply Systems

The Black Hills region of South Dakota represents an uplifted area with metamorphic and igneous rocks in the central core, and sandstone, limestone, and shale on the flanks of the uplift. Sedimentary formations on the flanks of the Black Hills, such as the Madison, Minnelusa, and Inyan Kara aquifers, dip away from the central core and plunge into the subsurface at the perimeter of the uplift where they are utilized as ground water sources. Other major sources of ground water in the Black Hills include fractured crystalline rocks in the central core and shallow alluvial deposits throughout the region.

A significant aspect of the Black Hills region hydrology is the direct connection between surface water and highly permeable formations, such as the Madison and Minnelusa aquifers. In this setting, water can flow directly into cavernous, fractured limestone through sinkholes located along major streams. Once water has entered the cavernous limestone, it can move downgradient, often within a few hours or days, to wellheads on the flanks of the Black Hills where it is consumed. Flow pathways within these limestone aquifers are complex and poorly understood, posing unique challenges to the design of a source water assessment approach for this setting. Due to the hydrogeologic setting, which includes significant nearby recharge areas and fast moving ground water (and potential contaminants) in cavernous limestones, the Black Hills region was determined to be sensitive in the 1991 *SD Public Water Supply System Study*. Figure 3.11 illustrates the hydrogeologic setting of the Black Hills region.

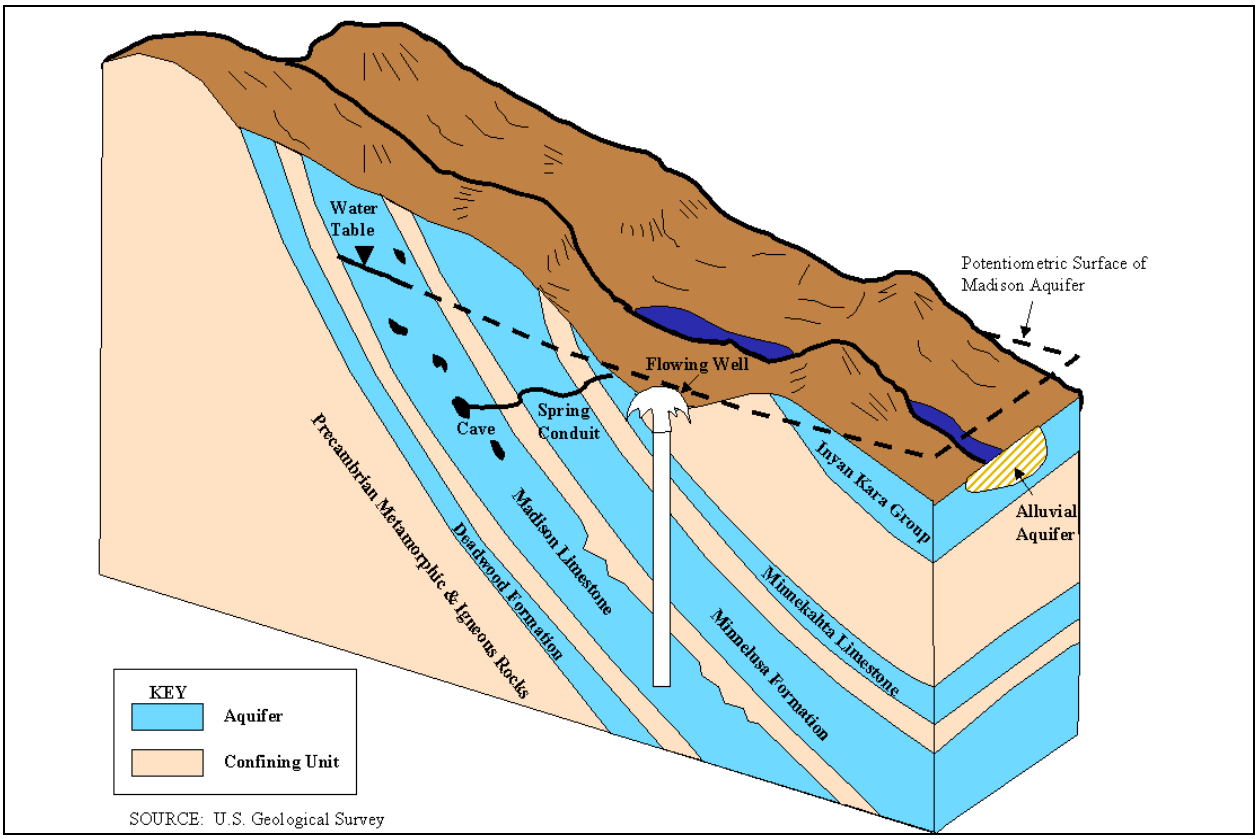


Figure 3.12 Hydrogeologic setting of the Black Hills region

The subsurface flow in the Black Hills region is very complex, resulting in overlapping source water assessment areas for public water supply systems throughout the Black Hills region. The direct connection between surface and ground water and the rapid ground water flow rates in large carbonate aquifers in the Black Hills region require conjunctive delineation methods to adequately assess these source water areas. The 10-year time-of-travel standard used for delineating ground water systems in eastern South Dakota is not appropriate for systems in the Black Hills region which can have travel times in the range of a few days to a few weeks, from recharge to consumption. In addition, it is not possible to accurately delineate all ground water flow paths.

Therefore, a holistic approach to source water assessments in the Black Hills region will be conducted in order to encompass the many interconnected hydrologic processes affecting the source of local ground water supplies. The approach will consider the entire Black Hills uplift as a single, hydrologically interconnected area, and assessment efforts will be concentrated in aquifer recharge areas for large sensitive aquifers and along all perennial streams within the Black Hills. These hydrologically sensitive areas will be Zone A assessment areas, and will receive a comprehensive contaminant source inventory. The remaining delineated watershed will be Zone B assessment areas; a limited contaminant source inventory will be conducted in this area, as described in Section 3.4.

The delineation methods listed below for Black Hills region public water supply systems will most likely be used; however, depending on the amount of hydrogeological information, time,

and resources available, the delineation method may be altered to meet local needs. A list of all Black Hills region systems in South Dakota can be found in Appendix P. Black Hills region PWSS include systems located in the Black Hills uplift, and systems located outside the Black Hills, approximately 10 miles beyond the Minnekahta Limestone outcrop that may be recharged by the Black Hills uplift.

3.3.5.1 Black Hills Region Ground Water Public Water Supply Systems in Confined Aquifers

South Dakota will use the arbitrary fixed radius and hydrogeologic mapping methods to delineate public water supply systems located in the Madison, Minnelusa, and other confined aquifers. A 500-foot arbitrary fixed radius will be used to delineate the area around the confined wellhead. Watersheds that may potentially contribute water to the wellfield will also be delineated, along with the Madison, Minnelusa, and other aquifer recharge areas upgradient from the wellfield.

Zone A includes the Madison and Minnelusa aquifer recharge areas within the zone of ground water contribution to the public water supply well. Zone A also includes 0.25-mile assessment areas along each perennial stream bank above the recharge areas, and a 500-foot arbitrary fixed radius around the wellhead. A comprehensive contaminant source inventory will be conducted in Zone A. Zone B will include the remaining delineated watershed; a limited contaminant source inventory will be conducted in this area. An illustration of this assessment method is shown in Figure 3.13.

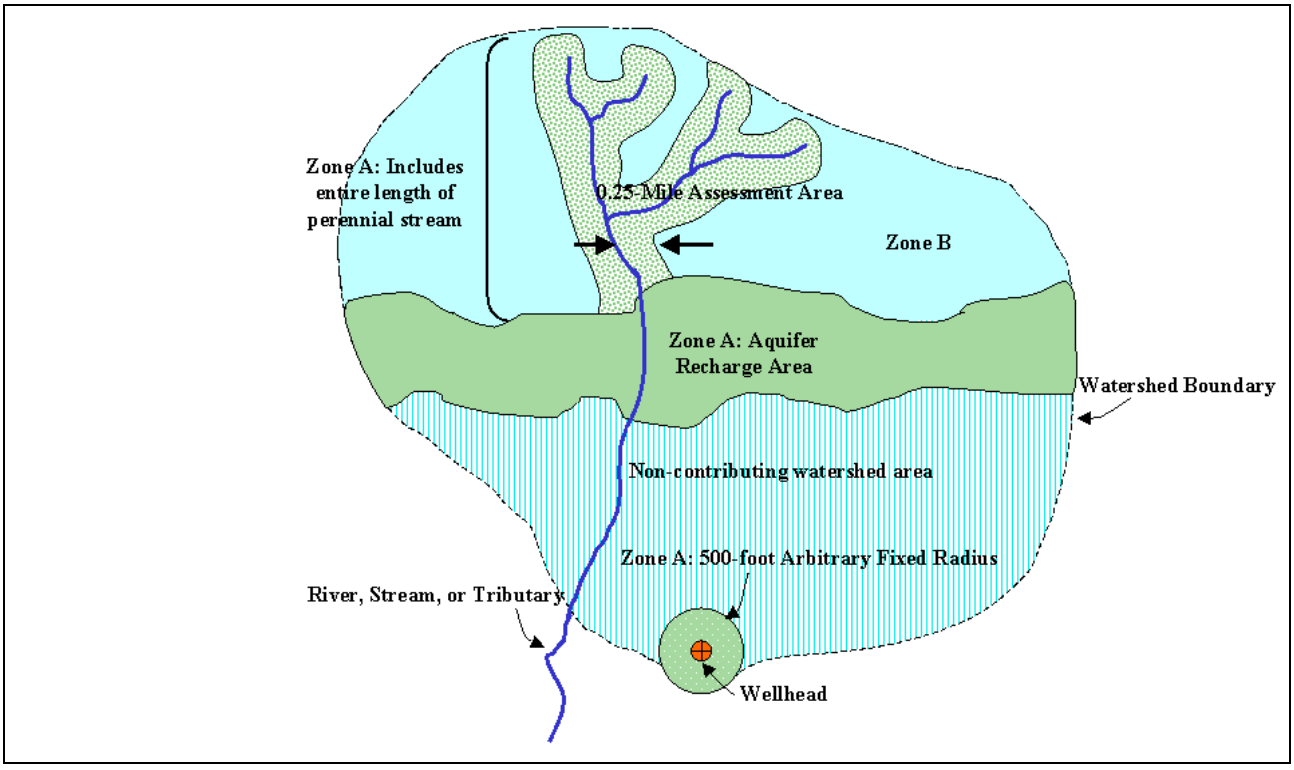


Figure 3.13 Source water assessment approach for a ground water public water supply system located in a confined aquifer in the Black Hills region

3.3.5.2 Black Hills Region Ground Water Public Water Supply Systems in Unconfined Alluvial Aquifers

South Dakota will utilize the arbitrary fixed radius and hydrogeologic mapping methods to delineate public water supply systems located in unconfined alluvial aquifers in the Black Hills region. Zone A will consist of a 0.25-mile arbitrary fixed radius around the wellhead, and a 0.25-mile lateral assessment area on each side of the perennial stream or alluvium, whichever is wider, for the entire perennial length of the stream. If headwater springs discharge from carbonate aquifers upgradient from the public water supply, then the recharge areas for these springs will also be included within Zone A. A 0.25-mile arbitrary fixed radius around the wellhead, in conjunction with the noted delineation of the lateral and upstream areas, will provide sufficient protection for unconfined, alluvial systems due to the narrow, alluvial stream channels in the Black Hills region. A comprehensive contaminant source inventory will be conducted in Zone A. Zone B will include the remaining delineated watershed; a limited contaminant source inventory will be conducted in this area. An illustration of this assessment method is shown in Figure 3.14.

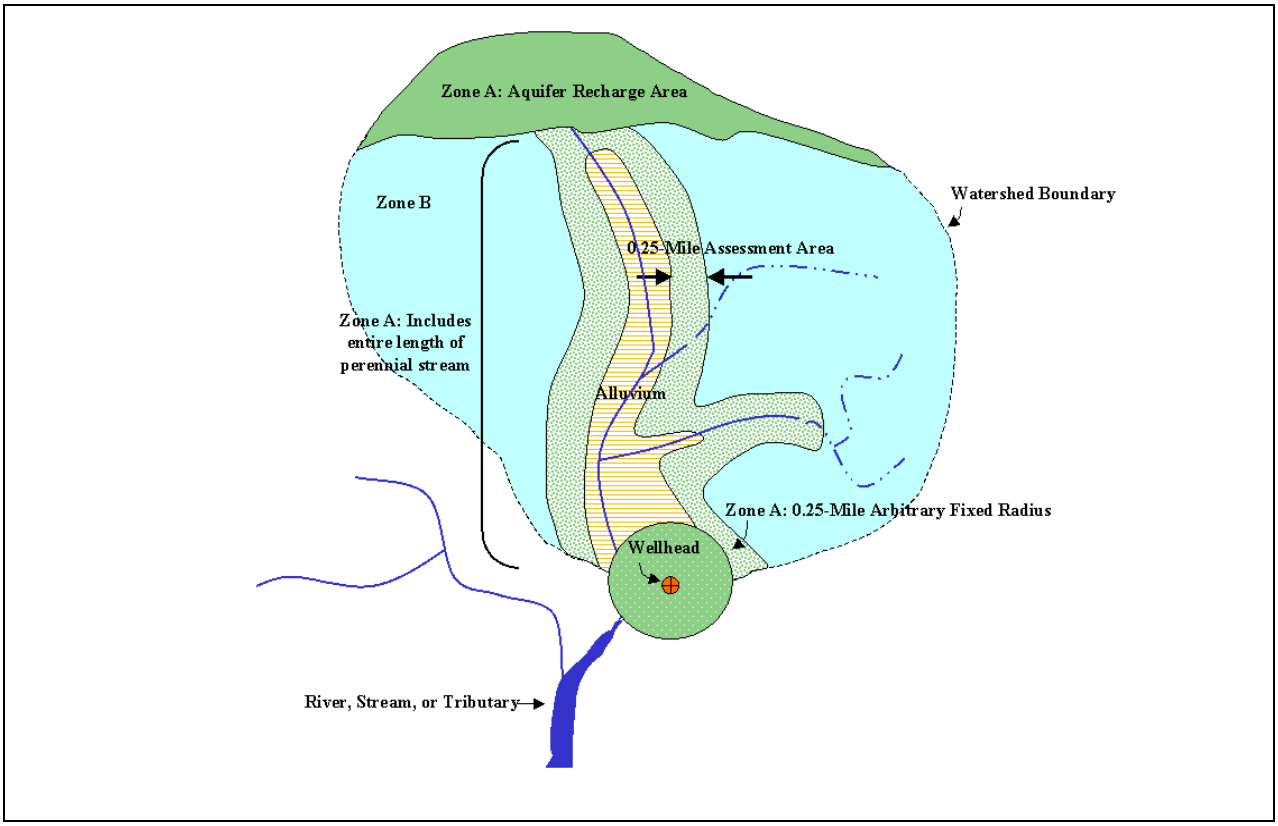


Figure 3.14 Source water assessment approach for a ground water public water supply system located in an unconfined, alluvial aquifer in the Black Hills region

3.3.5.3 Black Hills Region Ground Water Public Water Supply Systems in Fractured Precambrian Bedrock

South Dakota will utilize arbitrary fixed radius and hydrogeologic mapping methods to delineate systems in sensitive fractured Precambrian metamorphic and igneous bedrock. This method is similar to the delineation method that will be used for Black Hills systems located in unconfined alluvial aquifers. However, Zone A will include a 0.5-mile arbitrary fixed radius around the wellhead. A more protective arbitrary fixed radius around the wellhead is needed due to the extensive fracture system in this region. If a perennial stream is present, Zone A will include a 0.25-mile assessment area along each side of the stream beyond any aquifer that may be present, up to the point where the stream becomes intermittent. If headwater springs discharge from carbonate aquifers upgradient from the public water supply, then the recharge areas for these springs will also be included within Zone A. If information concerning ground water flow direction within local fractures is available, it will be used to adjust the delineation of the assessment area around the wellhead. A comprehensive contaminant source inventory will be conducted in Zone A. Zone B will include the remaining delineated watershed; a limited contaminant source inventory will be conducted in this area. An illustration of this assessment method without showing the presence of an aquifer is shown in Figure 3.15.

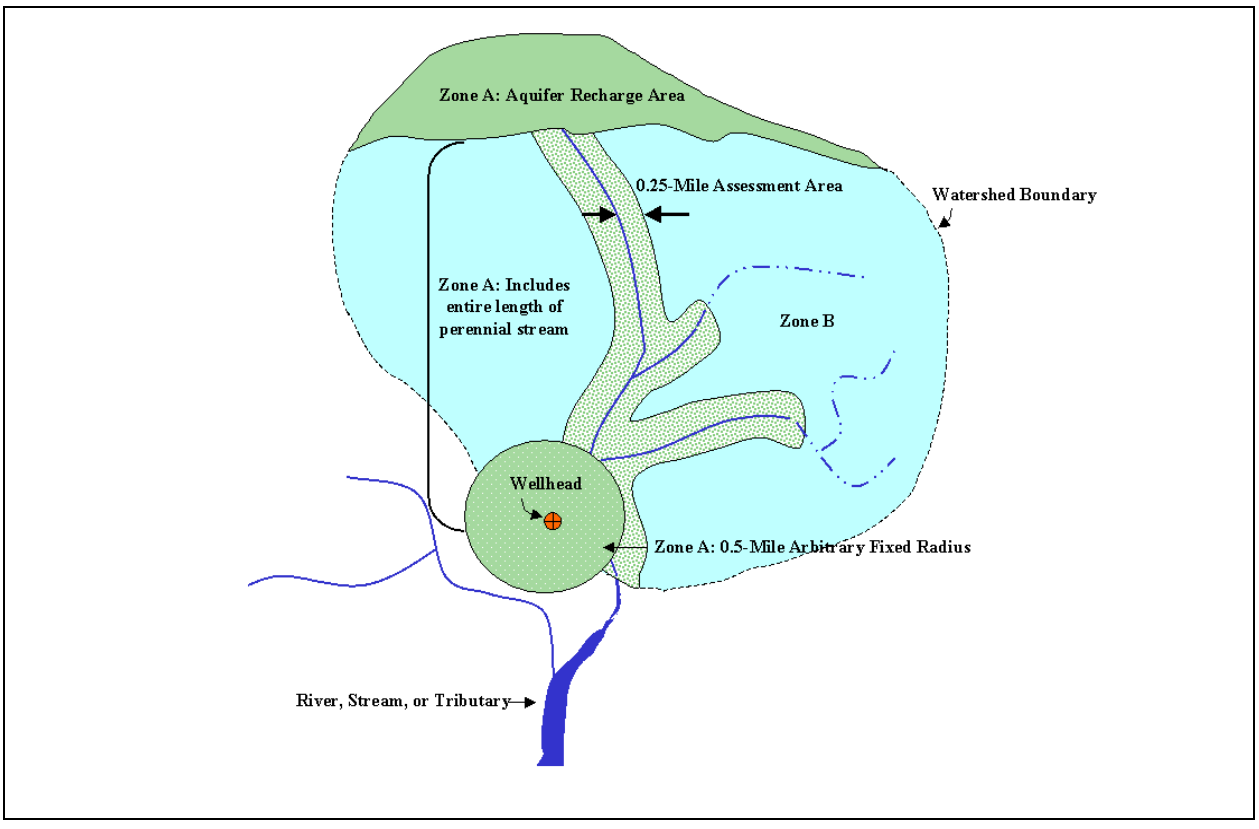


Figure 3.15 Source water assessment approach for a ground water public water supply system located in fractured Precambrian bedrock in the Black Hills region

3.3.5.4 Black Hills Region Surface Water Public Water Supply System Delineation Method

South Dakota will use two zones of assessment to delineate the two surface water PWSS in the Black Hills region. Zone A will consist of a 0.25-mile lateral assessment area on each side of the perennial stream or alluvium, whichever is wider, for the entire length of the perennial stream. This assessment method is different than the assessment method proposed for non-Black Hills surface water systems (10-miles upstream of the PWSS intake), due to the faster velocities and shorter travel times of streams in the Black Hills region. If headwater springs discharge from carbonate aquifers upgradient from the public water supply, then the recharge areas for these springs will also be included within Zone A. A comprehensive contaminant source inventory will be conducted in Zone A. Zone B will include the remaining delineated watershed; a limited contaminant source inventory will be conducted in this area. An illustration of this assessment method is shown in Figure 3.16.

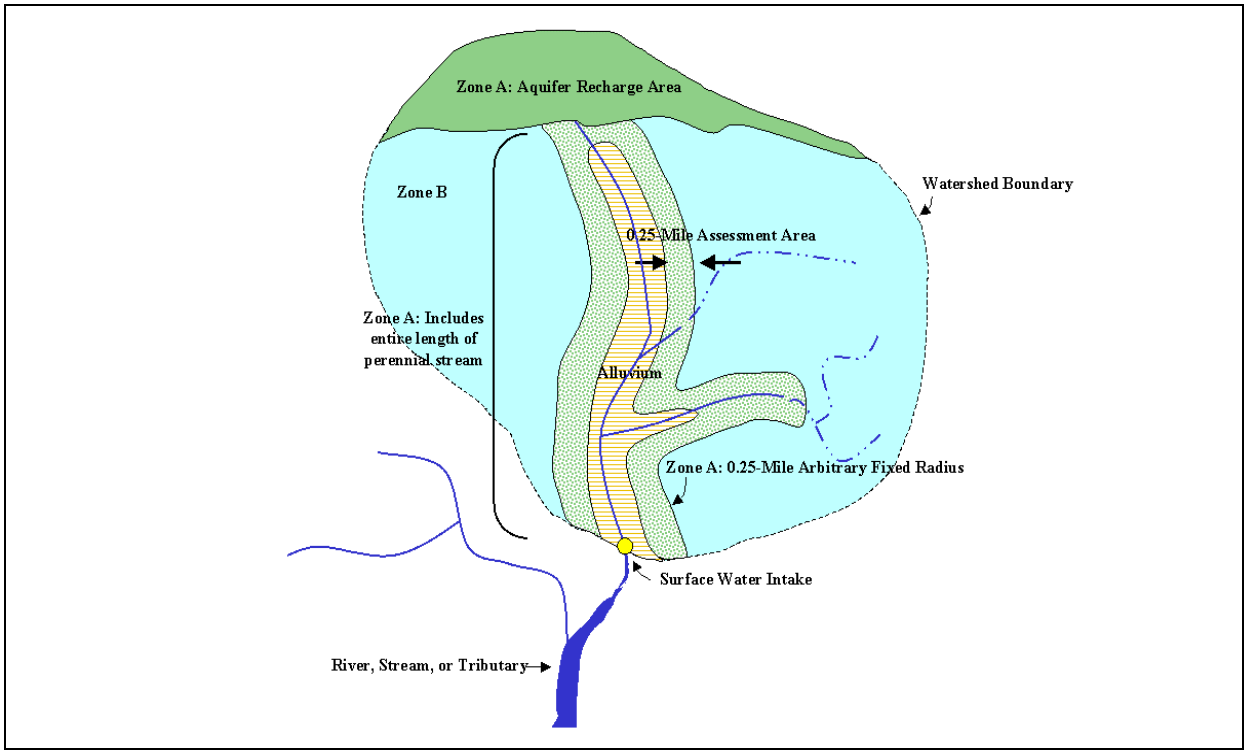


Figure 3.16 Source water assessment approach for a surface water public water supply system located in the Black Hills region

3.3.6 Intrastate and Interstate Delineation Method

The required watershed delineation boundary for all surface water public water supply systems must extend upgradient of the intake to the watershed boundary, tribal border, or South Dakota border. Watershed boundaries may cross state or tribal lines into Wyoming, Montana, North Dakota, Minnesota, Nebraska, or Iowa and into a number of in-state Native American reservations. Ground water system assessment areas may also cross these boundaries. In these situations, South Dakota will notify the adjacent state or Tribe and ask for assistance when conducting source water assessments. Assistance may include extending the assessment area across the state or Tribal borders and identifying potential contaminant sources in these areas. If South Dakota does not receive assistance from adjacent states or Tribes, source water assessment areas will terminate at the South Dakota border or reservation border.

3.4 Potential Contaminant Source Inventory

An inventory of potential contaminant sources located within source water assessment areas is necessary for proper source water protection, management, and planning. With this information, a community can manage its source water protection area with a better understanding of the potential impacts to its drinking water supply. The level of effort for the potential contaminant source inventory will be based on geographic location relative to the drinking water well or intake, and the available resources including time, money, and personnel. To help manage the potential contaminant source identification, local governments and community leaders will be encouraged to assist with their inventory.

The significant types of potential contaminant sources in South Dakota include wastewater treatment systems, on-site waste disposal systems, land application sites for wastes, livestock feedlots and waste storage facilities, chemical storage (mostly petroleum and agricultural) facilities, sites where agricultural chemicals were improperly applied, businesses and industries using hazardous materials, road salt and de-icing chemicals, and landfills. Table 3.1 is a list of the potential contaminant sources that are likely to be found in South Dakota grouped by category based on the type of operation that may produce the contaminants. Not all potential contaminant sources will pose a threat to water resources. Appendix Q lists the types of chemicals or products that may be found at many of the potential contaminant sources. Generalized land use categories will also be identified to evaluate some of the potential risks to PWSS from non-point source pollution. These categories may include unsewered urban areas, forests, wetlands, row crops, and pastures. Potential contaminant source information will be useful for the local community leaders and planners for correlating the potential contaminants with the sources identified in the inventory.

3.4.1 Data Available for Potential Contaminant Source Inventories

Local, state, and federal offices have information concerning facility operations within a community. These sources may provide data on historical and current potential contaminant sources. In addition, data concerning environmental permits, such as National Pollutant Discharge Elimination System and Animal Waste Management System permits, as well as drinking water waivers including Volatile Organic Carbon and Pesticide Waivers, are available in DENR databases. Potential sources of contamination regulated by DENR and by other state and federal agencies are listed in Table 3.2. A description of each database can be found in Appendix R.

3.4.2 Differential Levels of Potential Contaminant Source Inventories

The level of effort for inventorying potential contaminant sources will be based on the geographic location of the potential contaminant source relative to the drinking water well or intake. The differential effort will consist of three contaminant source inventory zones: Zone A, Zone B, and Zone C. A comprehensive effort will be conducted in Zone A source water assessment areas. Zone A includes the most sensitive area surrounding the public water supply well or intake; therefore, South Dakota will concentrate potential contaminant source inventory identification efforts in this area. A less intense effort will be applied in Zone B and Zone C source water assessment areas due to the location of potential contaminant sources farther from the drinking water supply. It is expected that the potential contaminant sources identified in these areas would be less likely to affect the water quality of the nearby public water supply

system than those in Zone A. If deemed necessary to get critical site-specific information for a particular system, some detailed contaminant source inventories may be conducted in areas of Zone B. Due to the distance from the PWSS intake, the large amount of water flowing through the Missouri River watersheds, and the potential for dilution, potential contaminant sources in Zone C source water assessment areas located in Missouri River watersheds are not expected to affect the water quality of the nearby public water supply system and therefore, will not be identified.

3.4.2.1 Comprehensive Potential Contaminant Source Inventory

A comprehensive contaminant source inventory conducted in Zone A source water assessment areas will consist of using data extracted from DENR and outside agency databases listed in Table 3.2. As resources, time, and money allow, a more detailed inventory will be conducted, as described in Section 3.4.3. Priority for inventories will be given to sensitive community and non-transient non-community PWSS. The contaminant source inventory will provide for the protection and benefit of public water supply systems by identifying any potential contaminants that may impact the water system through overland and underground flow.

3.4.2.2 Limited Potential Contaminant Source Inventory

A limited potential contaminant source inventory will be conducted in Zone B source water assessment areas. The inventory in this area will only include regulated facilities or major nonpoint source potential contaminant sources. A limited potential contaminant source inventory will also be conducted in Zone C source water assessment areas. The inventory in this area will only include "major" potential contaminant sources. Potential contaminant sources in Zone B and Zone C will be examined on a watershed by watershed basis.

3.4.3 Field Verification of Potential Contaminant Source Inventories

In addition to using existing information from the databases listed in Table 3.2 to conduct a potential contaminant source inventory in the assessment area, the department will also employ the assistance of a local representative, such as a water system operator and/or a community leader. For each assessment area, after the department has compiled and mapped the potential contaminant sources identified through the information in the databases, the mapped inventory will be sent to the local representative(s). The local representative will be asked, based on their knowledge of the local area, to verify the presence and locations of the potential contaminant sources and to identify the location of any additional sources that were not identified through the database search.

South Dakota has already identified and recorded the locations of potential contaminant sources within a 500-foot radius around all public water supply systems with low sensitivity using global positioning system equipment. As time and resources allow, DENR will arrange to perform field verifications in Zone A areas for other systems, which will include the identification of potential contaminant sources and locations by driving through the source water assessment area. South Dakota may also enter into agreements with other public agencies or private firms to conduct the field verification of contaminant source inventories using global positioning system equipment or maps. As indicated in Section 3.4.2.1, priority for field verification will generally be given to sensitive community and non-transient non-community PWSS.

Table 3.1 Potential Contaminant Sources Listed by Category

Commercial

Airports
Automobile repair shops
Boat yards
Construction areas
Car washes
Cemeteries
Dry Cleaning Establishments
Educational institutions (e.g., labs, lawns, chemical storage areas)
Gas stations
Golf courses (chemical application)
Jewelry and metal plating
Laundromats
Material transports (trucks and railroads)
Medical institutions
Paint shops
Photography establishments/printers
Railroad tracks and yards/maintenance facilities
Research laboratories
Stormwater drains, retention basins
Road deicing operations (e.g. road salt)
Road maintenance depots
Scrap and junkyards
Septage lagoons and sludge
Septic systems, cesspools, water softeners
Storage tanks and pipes (above-ground, below-ground, underground)

Industrial

Asphalt plants
Automobile service station disposal wells
Chemical manufacture, warehousing, and distribution activities
Construction excavations
Detonation Sites
Electrical and electronic products and manufacturing
Electroplaters and metal fabricators
Foundaries
Industrial process water disposal wells
Machine and metalworking shops
Manufacturing and distribution sites for cleaning supplies
Mineral extraction disposal wells
Mining(surface and underground) and mine drainage and waste piles
Oil and gas disposal wells
Petroleum product production, storage, and distribution centers
Pipelines (e.g. oil, gas, slurry)
Radioactive disposal sites
Septage lagoons and sludge
Septic systems, cesspools, water softeners
Storage tanks (above ground and underground)
Toxic and hazardous spills
Wastewater disposal wells
Wells - operating and abandoned (e.g. oil, gas, water supply, injection, monitoring, and exploration)
Wood preserving facilities

Residential

Fuel storage systems
Furniture and wood strippers/refinishers
Household hazardous products
Household lawns (chemical application)
Septic systems, cesspools, water softeners
Sewer lines
Swimming pools (e.g. chlorine)

Waste Management

Fire training facilities
Hazardous waste management units (e.g. landfills, land treatment areas, surface impoundments, waste piles, incinerators, and treatment tanks)
Municipal incinerators
Municipal landfills
Municipal wastewater and sewer lines
Open burning sites
Recycling and reduction facilities

Agricultural

Animal burial areas
Agricultural drainage wells
Animal feedlots (operating and abandoned)
Chemical application areas (for pesticides, fungicides, and fertilizers)
Chemical storage areas
Irrigation
Manure spreading and storage areas

Source: US-EPA 1989, Wellhead Protection Programs: Tools for Local Governments. EPA 440/6-89-00

Table 3.2 Potential Contaminant Source Inventory Databases	
Government Agency	**Databases**
South Dakota Department of Environment and Natural Resources (SD DENR) - Ground Water Quality Program	Superfund Amendments and Reauthorization Act (SARA) Title III Community Right-to-Know Toxic Release Inventory Underground and Aboveground Storage Tanks Underground Injection Control (Class II Underground Injection Wells) Regulated Substance Releases
SD DENR - Surface Water Quality Program	Septic Tanks Animal Waste Management Systems Land Application Areas
SD DENR - Minerals and Mining Program	Construction Aggregate / Mining Licenses Exploration / Life-of-Mine Abandoned Mines Inventory
SD DENR - Waste Management Program	Hazardous Waste Storage Facilities and Generators Solid Waste Disposal Facilities
SD DENR - Water and Waste Funding Program	Waste Water Treatment Facilities
SD Department of Agriculture	Fertilizer and Pesticide Inventory Fertilizer Enforcement Commercial Applicator Pesticide Use
US Environmental Protection Agency	STORET LandView II Envirofacts Warehouse Underground Injection Control (Class V Injection Wells) SDWIS
US Geological Survey	BASINS
US Department of Agriculture – Natural Resources Conservation Service	Natural Resources Inventory

3.4.4 Contaminants of Concern

The contaminants of concern include the raw water contaminants and microorganisms regulated under the Safe Drinking Water Act and additional microorganisms such as Cryptosporidium. Microorganisms not currently regulated under the Safe Drinking Water Act are included as contaminants of concern for South Dakota's Source Water Assessment and Protection Program in anticipation of the following upcoming rules. Cryptosporidium is included in the proposed Enhanced Surface Water Treatment Rule, while pathogenic viruses and bacteria will be addressed under the proposed Ground Water Disinfection Rule. South Dakota will identify the potential sources of contaminants in the source water assessment area. A list of contaminants of concern can be found in Appendix S.

3.5 Susceptibility Analysis

After the potential contaminant sources have been identified, information regarding the risk posed to the water supply is needed so that protection measures can be applied where they are most needed. The determination of the susceptibility of the public water supply to contamination by an identified potential contaminant source will be conducted to provide this information. The ratings resulting from the susceptibility analysis will provide the water system operators, community leaders, and planners with a system to prioritize their management measures.

3.5.1 Definition of Susceptibility

"Susceptibility of a PWSS" is defined as the potential for a PWSS (as determined at the point immediately preceding treatment or, if no treatment is provided, at the entry point to the distribution system) to draw water contaminated by a pollution source at concentrations that would pose concern, through any of the following pathways:

1) geologic strata and overlying soil;
2) direct discharge;
3) overland flow;
4) upgradient water (in the case of surface water sources only); and
5) cracks/fissures, etc., in the physical well or surface-water intake and/or the pipe between the well/intake and the water-distribution system.

The degree of susceptibility is, therefore, related to:

1) the physical integrity of the well/intake and the connection between the well/intake and the distribution system (up to the first form of treatment, if any);
2) the physical, chemical, geologic, hydrologic and biological characteristics of the area over which, or through which, the contaminant(s) will move;
3) the nature and amount of contaminant(s) present at the well/intake or in upgradient water; and
4) the nature and amount of contaminant(s) present at a potential contaminantsource(s) and the likelihood of significant contaminant release from the potential contaminantsource(s) based, in part, on the effectiveness of pollution-prevention measures at the sites of potential source(s) of contamination.

3.5.2 Intra-System Susceptibility Analysis Approach and Method

In South Dakota, susceptibility analyses will be performed to determine intra-system susceptibility, or the susceptibility of a PWSS to each of the potential sources of contamination identified within the Source Water Assessment Area. The proposed intra-system susceptibility approach will be applied consistently statewide and will provide community leaders and public water system operators with consistent information regarding the relative risk posed by potential contaminant sources to the public water supply. The intra-system susceptibility analyses will provide an overall relative rating of the susceptibility of a public drinking water source to contamination by a specific potential contaminant source. The ratings are meant to provide the water system operators and community leaders and planners with a state-wide system to prioritize their management measures and are not meant to be absolute risk ratings. In other words, a low rating to a potential contaminant source does not necessarily mean that the public water supply system is not susceptible to contamination from a potential contaminant source. Instead, a low rating means that, compared to a potential contaminant source with a moderate rating, this facility poses less of a threat to the drinking water source. Additionally, a high rating does not mean the potential contaminant source has caused or is expected to cause contamination, only that it is more likely to be a concern than a facility with a lower rating. There are thousands of potential contaminant sources across the state with many located near drinking water supplies, and except for a small number of localized problems, South Dakota's public drinking water is contaminant free.

South Dakota's conceptual approach to intra-system susceptibility analyses is loosely based on the Hazard Ranking System (HRS), a scoring system used by EPA's Superfund program to assess the relative threat associated with actual and potential releases of hazardous substances *from a site.* South Dakota's susceptibility analysis method will be used to assess the relative threat associated with actual and potential releases of contaminants from a source *to a public water supply system*. The specific scoring method has been significantly simplified to fit the needs of South Dakota.

The scoring method was developed to provide consistent results. In addition, to further ensure consistent results from the susceptibility analyses, DENR staff will review the susceptibility analyses performed by outside agencies and contractors. Relative to each PWSS, each potential contaminant source will be assigned a score based on several risk factors. The risk factors will be categorized as "intrinsic" and "induced." Intrinsic risk factors are the risk factors that exist by virtue of the hydrogeologic and physical setting which control transport of contaminants from the source to the public water supply system well or intake. Induced risk factors are risk factors that exist due to human activities at the PWSS and at the various potential contaminant sources. The individual risk factors within each of the two categories are presented in section 3.5.3. South Dakota has designated pre-assigned risk factor values, based on site-specific conditions. The use of pre-assigned risk factor values minimizes subjectiveness and potential inconsistencies of evaluations by different people. If information on a risk factor is not available or not applicable, the affected risk factor is excluded from the analysis.

The individual risk factors will be evaluated and the factor values will be combined by addition and normalized to 100 to produce intrinsic and induced risk scores. A regulated facility that is in compliance with local, State and Federal environmental regulations is less likely to cause pollution than an unregulated facility, due to regulatory controls. Therefore, South Dakota's susceptibility analysis includes a provision for a regulatory compliance credit ($S_{compliance}$) that would be applied where appropriate. The potential contaminant source score (S_{PCS}), which represents the susceptibility of the public water supply system to an individual potential contaminant source, will be obtained by combining the intrinsic ($S_{intrinsic}$) and induced ($S_{induced}$) risk scores using the root-mean-square equation in combination with the compliance credit:

$$S_{PCS} = \sqrt{\frac{S_{intrinsic}^2 + S_{induced}^2}{2}} - S_{compliance}$$

Under this equation, the higher scoring risk factor category will have a greater relative impact on the overall site score than the lower scoring risk factor category. Examples of this method are presented in section 3.5.5.

The possible scores under this system will be divided into high, moderate and low ranges. The individual potential contaminant source will be presented in the Source Water Assessment as a high, moderate or low risk to the subject public water supply system, depending on the resulting potential contaminant source score.

This susceptibility method could also be used for source water protection by community leaders for management and planning purposes. This method could be applied to proposed facilities to determine the appropriateness of siting or construction issues as they pertain to the protection of drinking water sources.

3.5.3 Intrinsic and Induced Risk Factors

South Dakota will include the following intrinsic risk factors in its Source Water Assessment susceptibility analyses:

- Depth to water table or aquifer top at the public water supply source;
- Water Source or aquifer type at the public water supply source;
- For public water supply wells in confined aquifers, aquifer characteristics, such as karst, presence of fractures;
- Distance of the public water supply system well to recharge areas;
- Distance of the public water supply system well or intake to the perennial surface water body nearest the potential contaminant source (for surface water and unconfined ground water systems);
- Flood plain conditions around the public water supply well or intake; and
- Existing concentrations of similar categories of contaminants at the PWSS well or intake.

The presence of existing concentrations of contaminants at a well or intake may be due to naturally occurring conditions or from contamination by an unnatural source. Because the net effect to the public water supply is the same, whether or not the source of existing contaminants at a PWSS well or intake is naturally occurring will not be considered.

The following intrinsic risk factors are not included:

- Net Recharge – accurate estimation of net recharge requires extensive collection and evaluation of data on precipitation and surface/ground water flow for the watershed;
- Soil media – soil media potentially can change numerous times between a potential contaminant source and the public water supply well or intake, thereby complicating the risk evaluation, especially where the distances are great;
- Topography (slope) – the slope between a potential contaminant source and the public water supply well or intake is not naturally consistent, thereby complicating the risk evaluation, especially where the distances are great;
- Impact to vadose zone; and
- Hydraulic conductivity.

Due to limited available time and resources, these factors will not be included in the susceptibility analyses to be performed under South Dakota's source water assessment program.

South Dakota will be considering the following induced risk factors:

- Hydraulic distance of the potential contaminant source to the wells or intake;
- Shortest distance of the potential contaminant source to the nearest down- or cross-slope perennial surface water body (not applicable to confined ground water-based PWSS;
- PWSS well or intake condition/construction;
- Known open release cases attributed to the potential contaminant source;
- Volume of contaminant(s) stored or size of facility (in the case of landfills and animal feedlots) – use SARA Title III minimum reporting limits as the lower threshold, where available;

- Whether or not physical pollution prevention barriers are in place and if the measures meet current regulations, if applicable. For example, underground storage tank facilities meeting the tank upgrade requirements (December 1998 deadline) would be assigned a lower induced risk score than those not meeting the requirements; and
- Potential source category or land use.

South Dakota will not be considering the following induced risk factors:

- A risk factor based on the toxicity of the potential contaminants is not part of this evaluation. The toxicity of chemicals generated, used, or stored at these facilities are not considered on an individual basis in this approach. Instead, the risk associated with the toxicity of the chemicals is built into the overall risk score for each potential source category and land use.
- In the event that a facility is a potential source for more than one contaminant, the induced risk will not be additive. Only the contaminant which results in the higher risk factor would be used for the evaluation.
- Except for general non-point source land use evaluations, the cumulative effects of multiple sources of similar contaminants and density effects are not included as part of the assessment. Instead, South Dakota recommends the evaluation of the cumulative effects of multiple sources as part of the protection process.

3.5.4 Risk Factor Values

For each potential contaminant source, each risk factor (RF) will be assigned a value based on site-specific conditions according to Appendix T. The risk factors and risk factor values in Appendix T may be modified by the DENR, as new information becomes available, to streamline the susceptibility analysis procedure, and to correct errors and omissions that may exist in the table. Therefore, the risk factor values presented in Appendix T are not necessarily final. However, if there are changes made to the risk factor values, those changes are to be applied consistently to the susceptibility analyses performed across the state.

A smaller risk factor value indicates a lower risk to the public water supply. The intrinsic and induced risk factors will each be summed and normalized to 100. Where a risk factor is not applicable, the risk factor will not be included in the calculation. In the event that information regarding a risk factor is missing or unknown and no reasonable estimate can be made, the risk factor also will not be included in the calculation. The number of unknown risk factors will be noted with the final results for each potential contaminant source. Additional research, which may include interviews and site visits, will be performed to minimize the number of unknown risk factors, as time and resources allow. However, it is South Dakota's goal to have no more than three unknown risk factors for each susceptibility analysis.

Based on the values listed in Appendix T, the highest possible normalized scores for a facility is 100 for intrinsic risk factors and 100 for induced risk factors, while the lowest compliance score would be zero. As a result, the highest possible susceptibility score for a potential contaminant source is:

$$S_{PCS} = \sqrt{\frac{S_{intrinsic}^2 + S_{induced}^2}{2}} - S_{compliance} = \sqrt{\frac{100^2 + 100^2}{2}} - 0 = 100$$

Based on the values listed in Appendix T, the lowest possible normalized scores for a facility is 9 for intrinsic risk factors and 9 for induced risk factors, while the highest compliance score would be 15. As a result, the lowest possible susceptibility score for a potential contaminant source is:

$$S_{PCS} = \sqrt{\frac{S_{intrinsic}^2 + S_{induced}^2}{2}} - S_{compliance} = \sqrt{\frac{9^2 + 9^2}{2}} - 15 = -6 \text{ (or less than zero)}$$

Each potential contaminant source will be presented in the final source water assessment as a high, moderate, or low risk to the public water supply system, depending on its potential contaminant source score. The risk ranges will be defined as shown in Table 3.3.

Table 3.3 Potential Contaminant Source Intra-system Susceptibility Determination

Relative Risk	Score (S_{PCS}) Range
High	76-100
Moderate	51-75
Low	Less than 50

The relative risk ranges were set using the TAC's professional judgement based on their knowledge of hydrogeology, well construction, and fate and transport mechanisms for contaminants. The lack of impacts to South Dakota PWSS by potential contaminant sources with known releases was also considered. The relative risk ranges were also set by evaluating the sensitivity of the intra-system susceptibility method using the values in Appendix T.

It is possible that a potential contaminant source may consist of more than one category or land use. In such cases, the category or land use with the higher risk factor value would be used.

Example 3.1: An automotive repair shop ($RF_{\text{potential source category, automobile repair shop}}$ =10) may also sell gasoline ($RF_{\text{potential risk category, gas station}}$=10) and have an automatic car wash facility ($RF_{\text{potential source category, car wash}}$=3). The risk factor value of 10 would be used for the potential source category.

If a public water supply has more than one intake or well, the most conservative (highest) risk factor values would be used to evaluate the risk posed by a potential contaminant source.

Example 3.2: A large public water supply system has a surface water intake, a confined well, and an unconfined well. The surface water intake and confined well are located within the 100-year floodplain, but the unconfined well is located outside of the 100-year floodplain. From surface observations and information provided by the water system operator, it is known that the surface water intake and confined well are in good condition, but the unconfined well is in poor condition. An automotive repair shop that also sells gasoline and has an automatic car wash facility is located 0.25 miles from the surface water intake, 600 feet from the confined well, and 1 mile from the unconfined well. There is no open release case on record regarding this facility and the facility owners have upgraded the underground storage tank and appurtenances as required by Federal law before December 22, 1998 and is in compliance with all applicable

regulatory requirements. The automotive repair shop and car wash waste go to the local sanitary sewer system. No other information is available.

The following intrinsic risk factor values would be used:

$RF_{\text{depth to water}}$ = unknown
$RF_{\text{source water/aquifer type}}$ = 20 (surface water source)
$RF_{\text{aquifer characteristics}}$ = not applicable
$RF_{\text{distance of PWSS to recharge areas}}$ = not applicable
$RF_{\text{distance of PWSS to surface water body}}$ = 10 (surface water source)
$RF_{\text{floodplain conditions}}$ = 8 (within 100-year floodplain)
$RF_{\text{existing concentrations of contaminants}}$ = unknown

The following induced risk factors would be used:

$RF_{\text{distance of PCS to PWSS well or intake}}$ = 10 (0.25 mi. from the surface water intake)
$RF_{\text{distance of PCS to recharge areas}}$ = unknown
$RF_{\text{distance of PCS to surface water body}}$ = 1 (> 200 feet)
$RF_{\text{PWSS construction standards}}$ = unknown
$RF_{\text{well or intake conditions}}$ = 10 (poor)
$RF_{\text{open release case}}$ = 1 (no)
$RF_{\text{volume of contaminants}}$ = unknown
$RF_{\text{physical pollution prevention barriers}}$ = 1 (yes)
$RF_{\text{potential source category}}$ = 10 (gas station or automobile repair shop)

Therefore the sum of the risk factors are:

$$\sum RF_{intrinsic} = 20 + 10 + 8 = 38$$

$$\sum RF_{induced} = 10 + 1 + 10 + 1 + 1 + 10 = 33$$

The highest possible sum of the intrinsic risk factors for this example is 38 because risk factors that are not applicable or where the information is unknown are not included in the normalization calculation. The highest possible sum of the induced risk factors is 70. Therefore, the normalized risk scores are:

$$S_{intrinsic} = 38 \times \left[\frac{100}{38} \right] = 100 \quad \textit{(rounded to the nearest whole number)}$$

$$S_{induced} = 33 \times \left[\frac{100}{70} \right] = 47 \quad \textit{(rounded to the nearest whole number)}$$

The potential contaminant source score for the facility is:

$$S_{PCS} = \sqrt{\frac{S_{intrinsic}^2 + S_{induced}^2}{2}} - S_{compliance} = \sqrt{\frac{100^2 + 47^2}{2}} - 15 = 63 \quad \textit{(rounded to the nearest whole number)}$$

As a result, the automobile repair shop/gas station/car wash facility would be designated as a relatively moderate risk to the public water supply system.

3.5.5 Susceptibility Analysis Examples

The following examples show how South Dakota's susceptibility analysis method would be applied for various types of public water supply systems with various potential contaminant sources. The examples are described first and the summary of the susceptibility analyses for each example is presented in Table 3.4.

Example 3.3a: A permitted feedlot with a maximum capacity for 1,500 animal units is located over a shallow, unconfined aquifer located two miles from a PWSS with wells in the unconfined aquifer. The depth to water at the PWSS well is 30 feet below ground surface. The facility is equipped with a manure management system. The feedlot facility has been monitoring the ground water as required by the regulatory agency and nitrate concentrations have been increasing, suggesting that a release has occurred. Except for the increasing nitrate concentrations, the facility is otherwise in compliance with applicable regulatory requirements. The PWSS has had problems with perchloroethylene in the source water which is not attributable to the feedlot. No contaminants attributable to the feedlot have been detected in the water supply. No other information is available. The susceptibility of the PWSS to potential contamination by this facility is moderate.

Example 3.3b: A manure land application area is located 0.25 miles from a PWSS well and 50 feet from the nearest perennial stream. The manure application is performed in compliance with all applicable regulatory requirements. The depth to groundwater is greater than 50 feet below ground surface at the unconfined PWSS well and the well is located outside of the 100 year flood plain, approximately five miles to the perennial stream that meanders closest to the land application area. The volume of contaminants is unknown. The PWSS has been testing for and has not detected nitrates or coliform bacteria. However, petroleum constituents, which are not attributable to the manure application practice, have been detected in the water at concentrations greater than the maximum contaminant levels (MCLs). The PWSS construction standards are unknown, but the well condition is good. The susceptibility of the PWSS to potential contamination by this potential contaminant source is low.

Example 3.3c: An agricultural chemical facility with a known release of chemical fertilizer is located one mile from a PWSS. The facility is otherwise in compliance with applicable regulatory requirements. The PWSS has a well located within the unconfined aquifer and depth to water at the PWSS well is 10 feet below ground surface. Flood plain conditions are unknown around the well. No chemicals have been detected in the water supply. The quantity of fertilizer stored at the facility is greater than 1,000,000 pounds. The liquid fertilizer tanks do not have secondary containment. No other information is available. The susceptibility of the PWSS to potential contamination by this facility is moderate.

Example 3.3d: A gas station is located 30 miles upstream from a new surface water intake. The PWSS system is constructed to current standards and the intake is in good condition. The gas station is required to report the quantities of petroleum products stored under the SARA Title III

reporting requirements. The amount of gasoline stored is 30,000 pounds. Petroleum has not been detected in the water supply. The gas station has upgraded the tanks to meet the new underground storage tank requirements and is in compliance with all applicable regulatory requirements. There are no known releases at this gas station. The susceptibility of the PWSS to potential contamination by this facility is low.

Example 3.3e: A storm water drainage outfall discharges seven miles upstream from a PWSS surface water intake. Concentrations of contaminants greater than MCLs have been detected in the water at the surface water intake. The intake is in good condition, but it was originally built 50 years ago and the original construction specifications do not meet current standards of construction. The susceptibility of the PWSS to potential contamination by this potential contaminant source is high.

Example 3.3f: A dry cleaner is located 300 feet from a PWSS well completed in a confined, fractured aquifer. The depth to the top of the aquifer is 400 feet. The distance of the dry cleaner and that of the PWSS well to the aquifer recharge area is approximately two miles. The well is located within an area with no significant flooding risk. The PWSS well and system have been constructed to current standards, however, the condition of the well is unknown. The quantity of chlorinated solvents stored at the dry cleaner reported under SARA Title III is 300 pounds. There have not been any detections of chlorinated solvents in the PWSS well water samples and there is no known release from the dry cleaning establishment. The dry cleaning facility is in compliance with all applicable regulatory requirements. The susceptibility of the PWSS to potential contamination by this facility is low.

Example 3.3g: A feedlot is located 10 miles from a PWSS which has an intake at a lake. The feedlot is also located 20 feet from the nearest perennial stream that drains into the lake. The PWSS well and system have been constructed to current standards and the condition of the intake is good. The feedlot has a maximum capacity of 200 animal units but is not equipped with a manure management system and does not have a water pollution control permit with the regulatory agency. There has not been a documented release attributed to this specific feedlot, but there are numerous other feedlots in the vicinity and sampling of ground water in monitoring wells within the area have verified that high concentrations of coliforms exist in the ground water. There have been recurring detections of fecal coliforms, as well as taste and odor problems with the water drawn through the intake. The susceptibility of the PWSS to potential contamination by this facility is high.

Example 3.3h: A PWSS surface water intake is proposed for a location along a river nine miles downstream of a major mechanical wastewater treatment facility. The wastewater facility is located ½ mile from the river, but it is located directly over the aquifer. In addition, the facility land applies biosolids (stabilized sludge) on agriculture land located adjacent to the facility grounds, which is also directly over the aquifer. The wastewater treatment facility and land application area will be permitted with the State and presumably will be operated/performed in compliance with the applicable environmental regulations. The susceptibility of the PWSS to the wastewater treatment facility and land application area will be moderate.

Example 3.3i: A community PWSS consists of two shallow wells (25 feet to water table) in an unconfined aquifer located within the 100 year flood plain of a river. The community's wastewater treatment facility is considered "minor" because of the town's population and the treatment facility consists of a three cell lined stabilization pond system. Ground water monitoring wells have been installed around the facility as required by the regulatory agency and no impacts to the shallow ground water have been detected at the wastewater treatment facility. The facility is operated in compliance with the applicable regulatory requirements. The wastewater facility is located two miles from the community well, but the facility is located over the aquifer. There have not been detections of chemicals typical of wastewater discharge in the water from the PWSS wells. The susceptibility of the PWSS to the wastewater treatment facility is low.

Example 3.3j: A community PWSS has a single well with the following characteristics: 75 feet to aquifer top; unconfined aquifer; outside of FEMA's 100 year flood plain but still at some risk of flooding impacts. The community has a minor mechanical wastewater treatment facility 0.25 mile from the well and located above the aquifer. Ground water monitoring wells have been installed around the facility as required by the regulatory agency and no impacts to the shallow ground water have been detected at the wastewater treatment facility. The facility is operated in compliance with the applicable regulatory requirements. The susceptibility of the PWSS to the wastewater treatment facility is low.

Example 3.3k: A community PWSS has a single well with the following characteristics: 75 feet to aquifer top; unconfined aquifer; outside of FEMA's 100 year flood plain but still at some risk of flooding impacts. There have not been detections of regulated chemicals in the water from the PWSS well. The community has a storm sewer system that drains into the river. The PWSS well is located approximately 0.5 mile from the storm sewer outfall. The susceptibility of the PWSS to non-point sources of pollution through the storm sewer system is moderate.

Example 3.3l: A community PWSS has a single well with the following characteristics: 75 feet to aquifer top; unconfined aquifer; outside of FEMA's 100 year flood plain but still at some risk of flooding impacts. The well is located approximately 0.5 mile from the river. The community does not have a central sewage collection system, so all residences and businesses operate septic systems. The extent of the community comprises 20% of the source water assessment area. There have not been detections of regulated chemicals in the water from the PWSS wells. The susceptibility of the PWSS to the septic systems is moderate.

Table 3.4 Summary of Susceptibility Analyses for Examples 3.3

Risk Factor	Highest Possible Score	Example Number											
		3.3a	**3.3b**	**3.3c**	**3.3d**	**3.3e**	**3.3f**	**3.3g**	**3.3h**	**3.3i**	**3.3j**	**3.3k**	**3.3l**
Depth to Water/Aquifer Top	10	10	8	10	NA	NA	2	10	10	10	8	8	8
Water Source/Aquifer Type	20	20	20	20	20	20	1	20	20	20	20	20	20
Aquifer Characteristics	10	NA	NA	NA	NA	NA	10	NA	NA	NA	NA	NA	NA
Distance of PWSS Well to Recharge Areas	8	NA	NA	NA	NA	NA	1	NA	NA	NA	NA	NA	NA
Shortest Distance of PWSS Well/Intake to Nearest Perennial Surface Water Body	10	UN	1	UN	UN	10	UN	10	10	UN	UN	4	4
Flood Plain Conditions	8	UN	4	UN	8	8	0	8	8	8	4	4	4
Existing Concentrations at PWSS	10	1	1	1	1	10	1	10	UN	1	1	1	1
Distance of Potential Contaminant Source to PWSS	10	1	7	4	1	1	10	5	7	1	7	7	10
Distance of Potential Contaminant Source to Recharge Areas	10	NA	NA	NA	NA	NA	1	NA	NA	NA	NA	NA	NA
Distance of Potential Contaminant Source to Nearest Perennial Surface Water Body	10	UN	7	UN	UN	10	UN	10	1	UN	UN	10	10
PWSS System Construction to Current Standards?	10	UN	UN	1	1	10	1	1	1	UN	UN	UN	UN
PWSS Well/Intake Conditions	10	UN	1	UN	1	1	UN	1	1	UN	UN	UN	UN
Known Releases	10	10	1	10	1	1	1	1	UN	1	1	1	NA
Volume/Capacity	10	10	UN	10	4	UN	6	5	5	4	2	UN	1
Physical Pollution Prevention Barriers	20	1	NA	20	1	NA	UN	20	NA	NA	NA	NA	NA
Potential Source Category or Land Use	10	8	8	10	10	4	10	8	10	10	10	4	8
Regulatory Permit/Compliance	--	5	15	5	15	0	15	0	15	15	15	0	0
Potential Contaminant Source Score	**--**	**60**	**39**	**73**	**42**	**78**	**23**	**81**	**62**	**49**	**39**	**60**	**68**
Susceptibility Rating	**--**	**M**	**L**	**M**	**L**	**H**	**L**	**H**	**M**	**L**	**L**	**M**	**M**

"NA" denotes that the risk factor is not applicable for the noted example.
"UN" denotes that there is no information regarding the risk factor provided.
"L" denotes that the susceptibility rating is low.
"M" denotes that the susceptibility rating is moderate.
"H" denotes that the susceptibility rating is high.

The following examples show the effects of varying the risk factor values and how the resulting susceptibility rating may be affected by management practices. A summary of the susceptibility analyses for example 3.4 is presented in Table 3.5.

Example 3.4a: An unpermitted feedlot with a maximum capacity for 1,500 animal units is located 20 feet from a perennial stream and 500 feet from a PWSS with wells in the unconfined aquifer. The depth to water at the PWSS wells is 10 feet below ground surface. The PWSS well is located within the 100-year floodplain and 200 feet from the perennial stream. The PWSS well is 50 years old, not constructed to current standards, but the well is in good condition. However, nitrates have been detected at concentrations above the maximum contaminant levels in the PWSS well water. The facility is not equipped with a manure management system. No other information is available. The susceptibility of the PWSS to potential contamination by this facility is high.

Example 3.4b: Same situation as example 3.4a, except the PWSS well is located two miles from the feedlot. The susceptibility of the PWSS to potential contamination by this facility is high.

Example 3.4c: Same situation as example 3.4a, except the feedlot is located 0.25 mile from the same stream. The susceptibility of the PWSS to potential contamination by this facility is high.

Example 3.4d: Same situation as example 3.4a, except the PWSS system has been updated to meet current standards. The susceptibility of the PWSS to potential contamination by this facility is moderate.

Example 3.4e: Same situation as example 3.4a, except the maximum capacity is 450 animal units. The susceptibility of the PWSS to potential contamination by this facility is high.

Example 3.4f: Same situation as example 3.4a, except the facility has a manure management system. The susceptibility of the PWSS to potential contamination by this facility is moderate.

Example 3.g: Same situation as example 3.4a, except the facility has voluntarily obtained a General Water Pollution Control Permit, is in compliance with applicable regulations, and there is a manure management plan in place as required under the permit. The susceptibility of the PWSS to potential contamination by this facility is moderate.

Example 3.4h: Same situation as example 3.4a, except the PWSS is located approximately two miles from the feedlot, while the feedlot is located 0.25 miles from the same stream. The susceptibility of the PWSS to potential contamination by this facility is moderate.

Example 3.4i: Same situation as example 3.4a, except for the following: the feedlot is located two miles from a PWSS constructed to current standards. The distance between the feedlot and nearest perennial stream is 0.25 mile. The facility is operating under the General Water Pollution Control Permit for Concentrated Animal Feeding Operations and is operating in compliance with the applicable regulatory requirements. As required under the permit, the facility is equipped with a manure management system. The feedlot facility has been monitoring the ground water as required under the permit and there is no reason to suspect that a release has

occurred. No other information is available. The susceptibility of the PWSS to potential contamination by this facility is low.

Examples 3.4*(a-i)* also show how various induced risk factors associated with a potential contaminant source, which are controllable, can be managed to reduce the potential risk to South Dakota's drinking water supply.

Table 3.5 Summary of Susceptibility Analyses for Example 3.4

Risk Factor	Highest Possible Score	3.4a	3.4b	3.4c	3.4d	3.4e	3.4f	3.4g	3.4h	3.4i
Depth to Water/Aquifer Top	10	10	10	10	10	10	10	10	10	10
Water Source/Aquifer Type	20	20	20	20	20	20	20	20	20	20
Aquifer Characteristics	10	NA	NA	NA	NA	NA	NA	NA	NA	NA
Distance of PWSS Well to Recharge Areas	8	NA	NA	NA	NA	NA	NA	NA	NA	NA
Shortest Distance of PWSS Well/Intake to Nearest Perennial Surface Water Body	10	10	10	10	10	10	10	10	10	10
Flood Plain Conditions	8	8	8	8	8	8	8	8	8	8
Existing Concentrations at PWSS	10	1	1	1	1	1	1	1	1	1
Distance of Potential Contaminant Source to PWSS	10	10	1	10	10	10	10	10	1	1
Distance of Potential Contaminant Source to Recharge Areas	10	NA	NA	NA	NA	NA	NA	NA	NA	NA
Distance of Potential Contaminant Source to Nearest Perennial Surface Water Body	10	10	10	1	10	10	10	1	1	1
PWSS System Construction to Current Standards?	10	10	10	10	1	10	10	10	10	1
PWSS Well/Intake Conditions	10	1	1	1	1	1	1	1	1	1
Known Releases	10	UN	UN	UN	UN	UN	UN	UN	UN	1
Volume/Capacity	10	10	10	10	10	5	10	10	10	10
Physical Pollution Prevention Barriers	20	20	20	20	20	20	1	1	20	1
Potential Source Category or Land Use	10	8	8	8	8	8	8	8	8	8
Regulatory Permit/Compliance	--	0	0	0	0	0	0	15	0	15
Potential Contaminant Source Score	**--**	**85**	**80**	**80**	**80**	**82**	**74**	**55**	**75**	**48**
Susceptibility Rating	**--**	**H**	**H**	**H**	**H**	**H**	**M**	**M**	**M**	**L**

"NA" denotes that the risk factor is not applicable for the noted example.
"L" denotes that the susceptibility rating is low.
"M" denotes that the susceptibility rating is moderate.
"H" denotes that the susceptibility rating is high.

3.5.6 Inter-System Susceptibility Determination and Prioritization

States are not required to determine the relative susceptibility of the PWSS within the state as part of the source water assessment program. Inter-system susceptibility is the overall susceptibility of one PWSS compared to that of another. A determination of inter-system susceptibility would be necessary to develop priorities for staffing and funding of more detailed assessments or the implementation of protection measures throughout South Dakota. After a number of source water intra-system susceptibility analyses have been completed, South Dakota may classify each PWSS as having an overall high, moderate, or low susceptibility. The inter-system susceptibility method will build upon the intra-system susceptibility analysis method described in the previous sections. To determine the inter-system susceptibility of a PWSS, the overall susceptibility scores of each potential contaminant source identified within the source water assessment area will be summed and divided by the total number of potential contaminant sources. The resultant numbers will be segregated into high, moderate, and low risk ranges, possibly as shown in Table 3.3. However, the final inter-system risk range may be modified to take into consideration the differences in size between ground water- and surface water-based systems, and thus the number of contaminant sources.

3.6 Source Water Assessment Dispute Resolution Process

A draft of the potential contaminant source inventory and susceptibility analyses, including the values used in the analyses, will be provided to the water supply operator and/or community leader for review and comments prior to issuance of the source water assessment report. In addition, local participants will be encouraged to refine these susceptibility analyses by providing new, correctional or additional information regarding risk factors. Additional information or corrections obtained from the water supply operator or community leader will be reviewed and incorporated into the source water assessment report. South Dakota DENR encourages the PWSS operators and/or community leaders to let their constituents/customers know of the draft document so they can voice their concerns and the DENR can address those concerns prior to publication. It is anticipated that some owners of potential contaminant sources will question the susceptibility rating of their facility.

An owner of a potential contaminant source or other concerned citizens may dispute the results of the susceptibility analysis. It is expected, however, that most disputes will not arise until the community has entered into the source water protection and management process. The source water assessment report will indicate how to initiate the dispute resolution process. South Dakota will encourage the local community leaders and planners to review the method and the risk factors values used to evaluate the PWSS susceptibility with the complainant. If the complainant provides evidence that a risk factor value was inappropriately assigned or not considered, the local community leaders and planners will be encouraged to recalculate the risk scores and evaluate the change in the overall risk rating.

The local community leaders and planners will be asked to inform the public water supply operator and the South Dakota Department of Environment and Natural Resources of the changes, along with justification for the change. The South Dakota Department of Environment and Natural Resources may also recalculate the risk scores, at the request of the local community leaders. If the South Dakota Department of Environment and Natural Resources recalculates the risk scores, the results will be provided as an amendment to the original source water assessment

report to the individuals who requested the revision, and to the public water supply operator. The Department of Environment and Natural Resources has the responsibility of making the final decision on the susceptibility rating for a potential contaminant source.

Chapter 4: Distributing Source Water Assessment Information to the Public

Section 1453 (a) (7) of the 1996 Safe Drinking Water Act Amendments requires states to make the results of the source water assessments available to the public. A number of different formats and options will be available to the public to receive this information. The method employed to reach the various PWSS will vary depending upon the capability and needs of the individual systems. One significant factor will be the ability and desire of the PWSS to accept the assessment information in electronic form. Discussed below are the source water documents that will be produced and the means by which DENR will provide information to the public.

4.1 Source Water Assessment Reports

Information derived from the assessments will include a delineated source water area around the wellfield or surface water intake, an inventory of potential contaminant sources, and an analysis of the susceptibility of the public water supply to contaminant sources in the delineated zone. This information will be compiled into a full assessment report which will include the ancillary information used to conduct the assessment. However, DENR will also present the information for the general public in a brief, non-technical report consisting of a narrative describing the overall system assessment and susceptibility results, and maps showing the delineated source water areas, contaminant source inventory, and susceptibility rating. The brief assessment report will also indicate that a full assessment report is available through a written request to DENR. This brief, non-technical report will be suitable for inclusion in a Consumer Confidence Report (CCR).

The PWSS operators will have the option of including all or portions of the brief assessment report in the CCR. However, the Drinking Water Program will only require in the CCR those elements noted in Volume 60, Number 160 of the Federal Register, dated August 19, 1998. The CCR must indicate that the public can contact the PWSS operator, community leader, or DENR for a hard copy of the assessment. The CCR will also indicate that a full assessment report is available from the DENR. It is the responsibility of the PWSS to notify their consumers of the availability of the SWAP for their PWSS through the CCR. However, following the completion of all source water assessments in South Dakota, DENR will issue a press release and advertise the availability of the assessment reports in the major regional newspapers. DENR will also include the brief assessment reports of all source water assessments available to the public on the DENR website.

The primary deliverable products will be the assessment maps. In electronic format, United States Geological Survey digital base maps will be used to plot the assessment results. Public water supply wells, surface water intakes, delineated source water areas and potential contaminant sources will be plotted on 1:100,000 scale and 1:24,000 scale digital maps. The layers on the 1:100,000 map will include section lines, roads, political boundaries, hydrography, and in some cases contour lines. The 1:24,000 scale base maps are 7.5 minute scanned topographic maps known as digital raster graphs. Where available and needed to show more detailed information, 1:12,000 scale digital orthophotoquads, essentially photographic maps, will also be used as base maps.

The locations of all public water supply system wellheads, surface water intakes, pretreatment facilities, treatment plants, pumping facilities, storage facilities, and entry points into distribution systems for South Dakota's public water supply systems have been identified using Global Positioning System (GPS) equipment. Potential contaminant sources have also been identified using GPS within a 500-foot radius around all confined, low-sensitive PWSS wells. As time and resources allow, additional potential contaminant sources located in delineated areas of the remaining PWSS, will be located using GPS.

The size of the delineated zone, complexity of the potential contaminant source inventory, and availability of various maps will dictate the products that will be distributed to the public water supply system. For example, in most cases, the delineated zone for a surface water system will encompass a larger area than the delineated zone for a ground water system. This may require the source water information be mapped using a 1:100,000-scale map to reduce the number and size of maps needed. Sites with a high density of potential contaminant sources will require a larger scale, more detailed map. Ancillary information, such as the delineation method used, potential contaminant sources inventoried, and susceptibility rating derived, will be available upon request.

The collected source water assessment information will become part of South Dakota's Geographical Information System. Results of the assessments will be linked via the Internet with other ground water and watershed databases to form a comprehensive data system. All information will be available in digital form. The assessment information will be linked with DENR databases containing information on contaminant spills, underground and above ground petroleum storage tank sites, SARA Title III facilities, permitted discharging facilities, the EPA 305(b) report, the biennial wellhead protection program report and others. Databases outside DENR will also be incorporated where applicable, such as the EPA *Surf your Watershed* database.

4.1.1 Presentation of Susceptibility Analysis in the Source Water Assessment Report

A map will be provided to each public water supply system showing the locations of the potential contaminant sources within the source water assessment area. The source water assessment report will also include a table referencing each potential contaminant source shown on the map. The table will identify the type of potential contaminant source represented on the map. An evaluation of non-point source risks in the delineated areas will also be included, based on a general evaluation of area land uses. In addition, the table will also include the number of risk factors that were designated as "unknown" in the susceptibility analysis. This number will be included to indicate the degree of uncertainty associated with the susceptibility analysis.

The availability of the susceptibility analysis method and the risk factor values used to evaluate each potential contaminant source will be noted in the source water assessment report.

Identities and ownership of the potential contaminant sources will not be presented in the Source Water Assessment reports. In addition, precise locations of the public water supply system wells and intakes also will not be presented in the Source Water Assessment reports. This information, however, may be available upon written request subject to the rules and mandates of the

Freedom of Information Act through the South Dakota Department of Environment and Natural Resources.

4.2 Procedure for Making Results Available to the Public

During the assessment process for each individual public water supply system, DENR will submit a draft copy of the PWSS assessment to each individual system approximately two months before the assessment is finalized to solicit comments on the draft assessment. Additionally, DENR will meet with any community that wishes to discuss the results of the assessment, including the procedures used to derive the assessments, and discuss implementation options. Because the Source Water Assessment Program is a state responsibility, the state will make the final decisions regarding the assessment information. Contractors may also be hired to conduct source water assessments, with the state reviewing these assessments to ensure they meet the requirements of the approved SWAP.

When the assessment is finalized, DENR will send the prescribed information to the local public water supply officials. Assessment results will be available in both electronic and paper formats. This includes both the narrative and map portions of the assessments.

DENR will also make all necessary assessment information available over South Dakota's Internet web page, therefore making the information available to all citizens. Because Internet access may not be available to all individuals and communities, maps and reports will be available in paper format for communities and/or individuals that request the information in this form. Assessment information will be sent directly to public water supply operators, city mayors or councilmen, and interested citizens. DENR will encourage each local community to make the source water information available to county officials, local emergency planning commissioners, and to all citizens in the community. For example, a notice can be placed in customer water bills, in the system's consumer confidence report, or presented in some other outreach format which describes the availability of the source water assessment information and how it can be acquired.

4.3 Future Updating of Source Water Assessments for Local Public Water Supply Systems

New public water supply wells are being drilled and others inactivated on a continual basis. Surface water intake locations also change periodically. DENR will rely on database information from the Water Rights and Drinking Water Programs to keep abreast of changes that will affect the Source Water Assessment Program. DENR will also request information from the public water supplies or other local agencies, including water districts and the Association of Rural Water Systems, to supply updated information.

Changes to the number and location of potential contaminant sources may occur on a daily basis across South Dakota. Some of the same agencies noted above will be used to update the potential contaminant source inventory list. Keeping current of these changes is a daunting task and will require a great deal of financial and personnel resources.

It will be the local community's responsibility to update their source water assessments for use in their protection programs. DENR will assist with this work within budgetary and resource constraints. The list of regulated facilities in DENR databases will continue to change, and can be

used to assist in updating contaminant source inventories. The department will continue to provide technical assistance in delineation and susceptibility analysis when requested, as resources are available.

DENR suggests local communities revisit their assessments when new water sources are added or removed, and reevaluate their potential contaminant source inventory on a regular basis as changes in their communities appear to warrant.

Chapter 5: Implementation of the Source Water Assessment and Protection Program

5.1 Timetable for Completing the Source Water Assessment Program

The following table shows South Dakota's timetable for developing and implementing the Source Water Assessment Program. The implementation and performance of assessments must be completed no more than two years after EPA approves a state program. However, Section 1453(b) of the Safe Drinking Water Act allows EPA to grant a state's request for an extension of up to 18 months after the original two-year period. South Dakota requested and received the 18-month extension. The request for an extension was made based on the difficulty for the small environmental staff available at the state level to coordinate and conduct sound source water assessments on the 760 PWSS in South Dakota in the shorter time frame with the funding available. The expected shortfall in funding and personnel is discussed in Section 5.2. In addition, the extension was requested because South Dakota recently experienced several natural disasters from which the state is still recovering, including widespread flooding in the northeast portion of the state and storm damage, including a tornado which devastated the Town of Spencer, South Dakota. As a result, South Dakota had the need to focus environmental efforts in other departmental programs. Therefore, South Dakota's timetable includes the 18-month extension, showing a period of 3.5 years from the expected date of EPA approval of South Dakota's program.

Table 5.1 South Dakota Source Water Assessment Program Schedule

ACTIVITY	DEADLINE
Organize Technical Advisory Committee	March 15, 1998
Prioritize public water supplies for assessments	April 1, 1998
Submit the Intended Use Plan work plan to EPA for approval	May 18, 1998
Hold meetings for groups of water users such as Missouri River and Black Hills area users	August 14, 1998
Complete delineations and potential contaminant source inventories at low-sensitive public water supply systems	September 30, 1998
Draft source water assessment program plan	October 2, 1998
Hold public meetings on draft source water assessment program plan	November 30, 1998
Present draft source water assessment program plan to DENR citizen boards	December 10, 1998
Submit final source water assessment program plan to EPA for review and approval	February 6, 1999
Obtain EPA approval of source water assessment program	November, 1999
Negotiate contracts as needed to complete assessments	January, 2000
Complete one-third of all source water assessments and provide assessment results to the public	January, 2001
Complete one-third of all source water assessments and provide assessment results to the public	January, 2002
Complete all source water assessments and provide assessment results to the public	May, 2003

Because South Dakota already has an EPA-approved Wellhead Protection Program, South Dakota's timetable includes delineating and collecting potential contaminant source information around ground water PWSS prior to EPA approval of South Dakota's Source Water Assessment and Protection Program.

5.1.1 Resources Available to Complete the Source Water Assessment Program

South Dakota currently has 3.5 full time employees to complete the source water assessments. However, South Dakota may delegate part of the source water assessments to outside entities. South Dakota will review all delegated work, if any, to ensure they meet the requirements of the approved SWAP. The publication of the source water assessments, however, will be a responsibility retained by South Dakota. Outside agencies may include qualified public water supply systems, cities, water development districts, planning districts, federal agencies, environmental consulting firms, or others hired by DENR. These agencies must have the available resources to complete the assessments.

In the summer of 1998, South Dakota hired three environmental consulting firms and one planning district to collect global positioning system information at all PWSS wellheads and intakes, entry points, pumping facilities, pretreatment facilities, and storage facilities in the state. The contractors also gathered adjacent land use information, such as commercial, residential, industrial, or agricultural, around all PWSS wells and intakes. Potential contaminant source information was collected in a 500-foot radius around all PWSS with low sensitivity. These entities demonstrated to the DENR the feasibility of delegating source water assessment efforts to outside agencies. All work conduced by outside agencies must meet the requirements of South Dakota's approved Source Water Assessment and Protection Program.

5.1.2 Prioritization for Completing the Source Water Assessment Program

In order to complete the approximately 760 PWSS source water assessments in an orderly and timely fashion, a prioritization scheme was developed. Public water supply systems were ranked based on their source of drinking water. This included two prioritization lists: one for ground water sources and one for surface water sources. All aquifers were initially sorted by their vulnerability, followed by the population served by the system. Therefore, ground water PWSS with the highest population in sensitive aquifers will be assessed first. Surface water PWSS were sorted according to the population served by the system. Surface water PWSS with the highest population will be assessed first. If a particular PWSS has a need or desire to conduct a source water assessment quickly, DENR will try to accommodate such a request and work on that system. Future regulatory or environmental concerns may warrant adjustments to the prioritization scheme. The prioritization scheme is meant as a guideline and is designed to be flexible.

The process for completing the entire assessments, from delineation through susceptibility analysis, may vary from system to system. This will be dependent upon how much of the work is contracted out, and the desires and abilities of the contractors. For example, one firm or agency may have expertise in delineating the source water areas, but not have the time, desire or expertise to conduct the contaminant source inventory, and may be available to only work in one area of the state. It may be desirable to have other firms complete the entire source water assessment. Flexibility must be built into this process, but DENR will ensure that all work

conducted, whether by DENR or other outside contractors, conforms to specific requirements that ensure all system assessments will be conducted according to the program guidance.

5.2 Financial Resources Available to Complete Assessments

5.2.1 Drinking Water State Revolving Fund

The Safe Drinking Water Act (SDWA) Amendments of 1996 authorized a Drinking Water State Revolving Fund to assist public water systems to finance the costs of infrastructure needed to achieve or maintain compliance with SDWA requirements and to protect human health objectives of the Act. In addition to authorizing the infrastructure fund, the SDWA Amendments also establish a new emphasis on preventing contamination problems through source water protection and enhanced water systems management.

The 1996 SDWA amendments allow states to set aside up to ten percent of their state revolving fund allotment for public water supply source water assessments. South Dakota has set aside the full ten percent of its 1997 fiscal year Drinking Water Revolving Fund allotment for the performance of source water assessments. This portion of the allotment is $1,255,880. Funds set aside for this purpose were available only in the 1997 fiscal year and must be obligated within four fiscal years after South Dakota receives its grant.

However, South Dakota's estimated cost for developing the Source Water Assessment Program and completing the Source Water Assessments totals $2,230,000. The estimated cost exceeds the funds available through the Drinking Water State Revolving Fund by approximately $974,000. As a result, other financial resources, including General Funds and Federal Performance Partnership Grants, must also be used to complete these assessments.

5.2.2 Other Financial Options

5.2.2.1 Ground Water 106, Public Water Supply Supervision, Nonpoint Source 319

Other funding sources will be used to supplement the Source Water Assessment and Protection Programs. South Dakota will use other EPA funds, such as Public Water System Supervision funds. South Dakota may also use a portion of the grants available from Section 319 of the Clean Water Act and the Clean Water State Revolving Fund for assessment and protection of source waters from nonpoint sources of pollution. In addition, South Dakota will continue to use Clean Water Act Section 106 funds for completing source water assessments related to wellhead protection activities.

5.2.2.2 Partnerships with Other Agencies

South Dakota may also pursue partnerships with local, state, federal, and private agencies to complete the Source Water Assessments. The partnerships may include monetary matches, or in-kind services.

5.3 Coordination with Other Government Programs

5.3.1 Coordination with Local Programs

Several communities in South Dakota have already implemented wellhead protection plans. The wellhead protection program is initiated with local public participation and may culminate in local zoning ordinances or other programs developed to limit the threat of contamination of drinking water sources from potential sources of contamination.

These community wellhead protection plans have been provided to the DENR and are generally consistent with the source water assessment approaches described in Chapter 3. In addition, several communities and rural water systems are in the process of delineating their respective wellhead protection areas. Under the wellhead protection program, DENR actively assists communities in the development of their wellhead protection areas and subsequent management strategies. The DENR is actively working with the South Dakota Association of Rural Water Systems which has received grants from EPA to facilitate the development of wellhead protection plans with the association's member water suppliers. The DENR is currently working with the South Dakota Association of Rural Water Systems to develop a standardized wellhead protection delineation report format and procedures that will be compatible with the source water assessment delineation reports and procedures.

Where a local wellhead protection area has already been delineated, DENR will review the wellhead protection area delineation method for conformance to the methods described in Chapter 3. In addition, DENR will evaluate whether the PWSS relies on surface water for its source, or if the groundwater source is under the direct influence of surface water. If DENR determines that the source includes or is influenced by surface water, DENR will amend the wellhead protection area to include the source area for surface water and create a new delineated source water area. If DENR determines there is no surface water component and the wellhead protection area delineation method sufficiently conforms to the source water delineation methods described in Chapter 3, the wellhead protection area will become the delineated source water area under the Source Water Assessment Program. In the unlikely event that DENR determines that the wellhead protection area delineation method does not conform to the methods described in Chapter 3, DENR will work with the respective communities to determine the delineation method best suited to the community's needs and, if necessary, redefine their wellhead protection/source water area.

DENR will review and update the information regarding potential contaminant sources within a previously delineated wellhead protection area. In addition, for previously delineated wellhead protection areas that have been amended to create a new delineated source water area, DENR will expand the information regarding potential contaminant sources to include those sources in the area added to the wellhead protection area.

The susceptibility analyses, required as part of the source water assessment program, was not included in the previously approved wellhead protection program. Therefore, DENR will work with communities that have existing wellhead protection plans to upgrade their programs by assisting with the susceptibility analyses and making the local programs compatible with the source water program requirements.

In addition, DENR will continue to assist with the promotion and review of other portions of a wellhead protection program, such as management and contingency plans, if asked by local community representatives.

5.3.1.1 Black Hills Hydrology Study

Many of the hydrologic interpretations and delineations which will be made regarding the Source Water Assessment Program in the Black Hills area will be based on information resulting from the Black Hills Hydrology Study and other studies conducted in the Black Hills. The Black Hills Hydrology Study is a long-term, cooperative, regional investigation of the major hydrogeologic characteristics of the Black Hills area. Specific objectives of the study include the evaluation of precipitation, streamflow, potentiometric relationships, and water quality. Another objective is to estimate the hydrologic budget of the surface water and ground water resources in the Black Hills. The end product of the study will be to provide a characterization of the major aquifers of the region. Products resulting from this study, which will be directly utilized in source water assessment, include potentiometric surface maps, structure contour maps, hydrogeologic unit maps, and information pertaining to aquifer characteristics, water quality, and the overall mechanics of the hydrogeologic system of the Black Hills. These products will represent the latest body of knowledge on the hydrology of the Black Hills, and they will be utilized along with other information for tasks such as delineation of ground water zones of contribution for individual public water supply systems throughout the Black Hills.

5.3.2 Coordination with Other State Programs

5.3.2.1 Wellhead Protection Program

The Wellhead Protection Program is a voluntary program that is the predecessor to the Source Water Assessment Program. The 1996 Safe Drinking Water Act Amendments expanded the wellhead protection program into the source water assessment and protection program by adding provisions to consider surface water sources and including a requirement to evaluate the susceptibility of the source water to potential contaminant sources.

In 1992, EPA approved South Dakota's Wellhead Protection Program. The Wellhead Protection Program will provide a "head start" in undertaking the source water assessments required under the 1996 SDWA Amendments. The Wellhead Protection Program is an ongoing program. South Dakota will continue to provide assistance to new and ongoing local wellhead protection program activities. Locally developed plans will be reviewed to assure they meet the needs of the source water assessment program. Where possible, the locally developed wellhead delineations will be used as the source water delineations for the source water assessment program.

The contaminant source inventories, where not completed under the Wellhead Protection Program, and the susceptibility analyses to be performed under the Source Water Assessment Program will be combined with the existing or redefined wellhead protection/source water delineations to produce a complete source water assessment.

5.3.2.2 Public Water Supply Supervision Programs

Many established programs in the Public Water Supply Supervision Program, which is used to regulate and administer activities related to public drinking water systems, can benefit from Source Water Assessment and Protection Program efforts, including the Interim Monitoring Relief Program and Alternative Monitoring Program. The purpose of the Source Water Assessment and Protection Program is to prevent contamination of source waters for drinking water supplies. By reducing or preventing the chemical or microbiological contamination of

source waters for drinking water supplies, public water supplies can avoid costly treatment or minimize monitoring requirements.

Under section 1418(b) of the Safe Drinking Water Act, states with an approved Source Water Assessment and Protection Program may adopt "tailored alternative monitoring requirements" where the alternative monitoring would comply with published EPA guidelines. Under alternative monitoring, states may allow reductions in monitoring frequency for most chemical contaminants. Alternative monitoring does not apply to microbial contaminants, disinfection by-products, or corrosion by-products. The decision to offer alternative monitoring would be based on data concerning susceptibility, use, occurrence, and other information that would be available from a wellhead protection area delineation or source water assessment. For a PWSS to be eligible for alternative monitoring, a source water assessment must be completed.

Under the surface water treatment rule, a PWSS is eligible for a waiver from filtering their surface water supply only if a series of water quality and disinfection criteria are met, and the system maintains a watershed control program that minimizes the potential for microbial contamination. Source water delineations and an inventory of potential sources of pathogens in the watershed, as provided through the Source Water Assessment and Protection Program, will be essential for PWSS seeking filtration waivers. The Source Water Assessments could provide South Dakota, local communities, and PWSS with tools to identify problems and prevent contamination that could ultimately trigger filtration requirements.

5.3.2.3 Total Maximum Daily Load Program

The Clean Water Act requires states to identify and list lakes, rivers, and streams that do not or are not expected to meet applicable water quality standards, even after the implementation of nationally required levels of pollution control technology. For each of those water bodies, a state is required to establish a total maximum daily load (TMDL) for each non-attainment pollutant at a level needed to ensure that water quality standards are met. A TMDL is the amount of pollution a water body can absorb and still support beneficial uses, such as drinking water, aquatic life, and recreation.

Under Section 303(d) of the Clean Water Act, states are required to prioritize the water bodies listed as impaired for TMDL analysis. The prioritization must take into account the pollutant severity and designated uses of the waters. After identification and priority ranking of impaired water bodies have been completed, states are to develop TMDLs at levels necessary to achieve the applicable state water quality standards. TMDLs must allow for seasonal variations and a margin of safety that accounts for any lack of knowledge concerning the relationship between effluent limits and water quality.

TMDL issues are critical to source water assessments and protection. The development and implementation of effective TMDLs will result in improvement of the quality of South Dakota's waters, including sources of drinking water. South Dakota has a total of approximately 140 different water bodies included in the 1998 list required under Section 303(d) of the Clean Water Act. The TMDL list of water bodies may change with time due to local interest in water quality improvements, new data, or other factors. It is important to recognize that the list is merely a tool to guide the department and other organizations and stakeholders in efforts towards improving

water quality in South Dakota. It will not be possible to develop TMDLs for every listed water body within the time frame of the Source Water Assessment Program. The time frame to develop TMDLs for each listed water body is 13 years, in accordance with EPA guidelines. The TMDL list provides information regarding non-attainment pollutants or stressors which will be helpful for identifying contaminants of concern and susceptibility for source waters. TMDLs for particular water bodies generally provide more detailed information about the sources of pollution and can be used to develop allocation scenarios for pollutant loadings among pollution sources in a watershed. For water serving as a source for a public water supply, the data developed as part of the TMDL assessment can provide a basis for implementing local source water protection programs.

The system of prioritization developed by South Dakota considers factors that may directly impact drinking water sources. These factors include imminent human health problems associated with the water quality. In addition, South Dakota's priority ranking scheme places priority on water bodies with impairments believed to be largely human-induced and, therefore, water quality may be improved by local management and planning activities under the Source Water Protection Program.

5.3.2.4 Non-point Source Pollution Program

Non-point source pollution, as the name implies, results from diffuse sources such as road construction, logging, urban lot development, agricultural runoff from pesticides, and agricultural runoff from both animal waste and commercial chemical fertilizers. It is caused by rainfall or snowmelt moving over and through the ground, carrying natural and human-made pollutants into water bodies. In terms of total pollutant loads, number of sources, areal extent, and number of persons contributing, non-point source pollution is a large and complex problem. In South Dakota, it is estimated that non-point sources cause over 85% of the water pollution. The primary parameters of concern are sediment, nitrogen, phosphorous, and bacteria. The Clean Water Act Amendments of 1987 authorized Section 319 which provided for non-point source water pollution control strategies and funding for implementation. Congress did not appropriate money for Section 319 until 1990. South Dakota and Delaware were the first states to implement a non-point source program in 1988 to fund activities under Section 319. This gave South Dakota a two-year head start over most states. Since then, South Dakota has been a consistent regional and national leader in non-point source pollution control.

The South Dakota non-point source program is built on voluntary participation and local leadership. The program is designed to reduce and prevent water pollutant loading to rivers, lakes, wetlands, and ground waters, so that water quality standards are met and the assigned beneficial uses are supported. The goals of South Dakota's non-point source program are consistent with those of South Dakota's source water protection program. As stated in earlier sections, South Dakota may use a portion of the non-point source section 319 grants for the assessment and protection of source waters from non-point sources of pollution.

5.3.2.5 Pesticides and Ground Water State Management Plan

The pesticides state management plans allow South Dakota to tailor prevention measures in a given area to reflect local characteristics. Without state management plans, EPA's policy for pesticides that pose an unreasonable threat to ground water despite national labeling and

restricted use designations would have been to cancel them nationally (in the case of pesticides currently in use) or not register them (for pesticides not yet in use). National prohibition based on a national risk/benefit assessment may not always fully consider local variability in the use, value, and vulnerability of ground water. The goal of the state management plans is to prevent contamination of groundwater resources. Adverse effects to human health and the environment resulting from the normal, registered use of pesticides will be prevented by taking actions outlined in the state management plans within the sensitive areas where such risks occur. The development of state management plans allows South Dakota the opportunity to continue to use a pesticide that would otherwise be unavailable due to national cancellation or lack of registration.

There are two types of state management plans: voluntary Generic State Management Plans that address the state management plan components in generalized terms and mandatory Pesticide-specific State Management Plans that address specific pesticides.

The South Dakota Department of Agriculture, in cooperation with the South Dakota Department of Environment and Natural Resources and South Dakota State University, has voluntarily prepared a *Generic Pesticides and Ground Water State Management Plan* to establish the framework for the subsequent mandatory management plans to address specific pesticides. The goal of South Dakota's *Generic Pesticides and Ground Water State Management Plan* is to manage the use of pesticides in ways that protect South Dakota's ground water resources. The state management plans will emphasize the prevention of contamination over remedial treatment. Through the implementation of state management plans, South Dakota will promote the environmentally sound use of pesticides that might otherwise pose an unreasonable risk to ground water resources. In developing the state management plans, South Dakota will address: local ground water vulnerability; current use and value of ground water; future trends of ground water use for various locations; and social and economic values of alternative preventive strategies.

The goal of the state management plans is consistent with that of the Source Water Assessment and Protection Program – pollution prevention. Information collected through the Source Water Assessment Program will be useful for developing the mandatory pesticide-specific state management plans. In addition, source water protection may be implemented through measures outlined in the pesticide-specific state management plans.

5.3.2.6 Underground Injection Control Program

The Federal Safe Drinking Water Act protects all sources of drinking water, including underground sources of drinking water or aquifers. The underground injection control program regulates any injection of waste into the subsurface through five classes of wells.

Class I and Class IV injection wells are used for the disposal of hazardous, non-hazardous, radioactive, municipal and some industrial wastes, and wastewater. Class I wells dispose of the wastewater below the lower most underground source of drinking water, while Class IV wells dispose of the wastewater into or above underground sources of drinking water. Class IV wells are banned nationally and both Class I and Class IV are banned in South Dakota. Class II injection wells are used for the disposal of wastes generated in the production of oil and gas, or

for the injection of materials into the ground to enhance the recovery of hydrocarbons. Class III wells are used to inject materials into the ground for the purpose of extracting minerals such as sulfur, salts, and uranium.

Class V wells include all other types of injection wells. Typical Class V wells in South Dakota include geothermal return wells, domestic wastewater disposal wells, septic systems and sumps used in various types of industrial/commercial businesses, and wells used in ground water remediation projects.

South Dakota has primary enforcement authority to regulate Class II injection wells. EPA currently regulates Class III and Class V wells in South Dakota. The department will notify EPA of all Class III and Class V wells identified in the state, if encountered during the contaminant source inventory process. For more information on the UIC Program please refer to the following website: http://www.epa.gov/safewater/uic.html

5.4 Coordination with Native American Tribes

South Dakota maintains a working relationship with the various Native American Tribes within the state. DENR unsuccessfully attempted to schedule a meeting with the Native American Tribes to offer information and assistance with the Source Water Assessment Program. DENR will continue to attempt to schedule this meeting. South Dakota will work with the respective Native American Tribes to exchange information regarding source water areas and potential contaminant sources for source water areas which cross over the Tribal/Non-Tribal property boundaries. In an effort to receive comments and suggestions, South Dakota sent the draft *Source Water Assessment and Protection Program* plan to all Tribal environmental coordinators on November 24, 1998. DENR presented an overview of the state Source Water Assessment and Protection Program to a session on Tribal Implementation of the Safe Drinking Water Act at a South Dakota Rural Water Systems' Technical Conference in January 1999 to inform the tribes of the state source water assessment effort and to offer assistance.

5.5 Coordination with Neighboring States

South Dakota maintains excellent working relationships with its neighboring states. During the program development process, South Dakota has participated in several regularly scheduled interstate conference calls organized by EPA Region VIII to discuss each state's Source Water Assessment Program. During these conference calls, each state provided progress reports and exchanged information regarding their respective approaches to each step of the source water assessments. The neighboring states, North Dakota, Minnesota, Iowa, Nebraska, Wyoming, and Montana received a copy of South Dakota's draft *Source Water Assessment and Protection Program* plan on November 12, 1998. All states were asked to submit comments on South Dakota's proposed program approach.

South Dakota has assisted other states by providing copies of its work plan for the Source Water Assessment set-aside from the Drinking Water State Revolving Fund. As the assessments are completed, South Dakota will continue to work with the respective neighboring states to exchange information regarding source water areas, potential contaminant sources, and susceptibility analyses for source water areas which cross over the State boundaries.

5.6 Reporting Program Progress to EPA

South Dakota will continue to report PWSS information through the Federal *Safe Drinking Water Information System* quarterly. South Dakota will submit a Source Water Assessment Program biennial report to EPA to provide information regarding the progress of the source water assessment effort. The Source Water Assessment Program biennial report will replace the existing Wellhead Protection Program biennial report. The biennial report will describe the progress of the program and, to show that South Dakota is moving toward completion of the Source Water Assessment Program, the biennial report will include summaries of the following:

- Total number of PWSS categorized as being dependent on ground water, surface water, or both;
- The number of PWSS with completed source water area delineations, potential contaminant source inventories, and susceptibility determinations (by category);
- The population served by the PWSS in the delineated source water areas;
- Distribution of completed local assessments to the public; and
- Summary of problems encountered during the assessment process

5.7 Updating Source Water Assessments

South Dakota anticipates that the Source Water Assessments will need to be updated due to changes that may occur in the future. Future rules which may affect the assessments, such as Chemical Monitoring Reform, Alternative Monitoring, and Ground Water Disinfection, Class V Underground Injection, and Enhanced Surface Water Treatment rules are expected to become effective before February of 2003. Therefore, these future rules may become effective during the time period when South Dakota will be completing the assessments. In addition, new PWSS will be constructed and current PWSS will be modified, either with new wells/intakes or existing wells/intakes will be abandoned or destroyed. Changes in land use may also occur which would affect the susceptibility of a water system to potential contaminant sources. Therefore, South Dakota has devised procedures for updating the assessments.

For source water assessments completed prior to the effective dates of new rules, the completed assessments will be updated to consider the impacts of the new rules as time and resources allow. However, through May 2003, priority will generally be given to completing new source water assessments over updating existing assessments.

As new PWSS are approved and as wells or intakes are constructed or abandoned/destroyed, the staff responsible for completing the source water assessments will be notified by the local PWSS representatives. Through May 2003, if a source water assessment has been completed prior to the construction or abandonment of a well or intake, the completed assessments will be updated to consider the impacts of the change in water source. However, priority will generally be given to completing new source water assessments over updating existing assessments.

Changes within the community and within the delineated source water area, such as land use changes, may also affect the susceptibility and other aspects of the source water assessment. As part of the assessment process, maps and questionnaires will be sent to PWSS operators to identify land use and potential contaminant sources within the delineated area. After May 2003, depending on EPA funding and available grants, individual assessments will be updated by the

DENR upon request by a community or as needed to better align with emerging regulatory flexibilities and requirements. A continued source of funding will be necessary if the State is to assist local communities in keeping their source water assessments current.

5.8 Source Water Protection and Management

The 1996 Safe Drinking Water Act Amendments require the performance of source water assessments and encourage the implementation of protection and management practices. As a result, at this time, source water protection and management is not a required element of South Dakota's Source Water Assessment Program. However, preventing contamination is the key to keeping South Dakota's drinking water supplies safe. Once a drinking water supply becomes contaminated, a community is faced with the difficult and costly task of installing treatment facilities or locating an alternative source.

South Dakota considers the source water assessments to be tools for the eventual protection and management of drinking water resources and not an end product. The assessments are the first step in providing a sound technical basis for the future protection measures. South Dakota considers the protection of the drinking water resources to be the long-range goal of the program, not simply the source water assessments.

South Dakota has already been promoting regulatory, non-regulatory, and multiple-jurisdiction management strategies through its wellhead protection program. Regulatory options may include zoning, subdivision control, and health regulations. Non-regulatory options include actions such as public education, the encouragement of water conservation, land acquisition, collection of hazardous waste, and water quality monitoring. Legislative authorities for multiple jurisdiction cooperation may be used by communities in cases where the source water area encompasses more than one jurisdictional area, thereby requiring actions to establish where legal authority lies. South Dakota Codified Law Chapter 1-24 under the Joint Power Act allows public agencies (such as counties, townships or water development districts) to jointly exercise any governmental power they could exercise individually.

South Dakota, through the wellhead protection program, has already been promoting the assembly of planning teams of responsible individuals from the community to manage the potential sources of contamination within the wellhead protection areas. As an extension of the wellhead protection program, the source water protection program will continue to be used to promote management of the source water areas. The process of managing potential contaminant sources in the source water protection area is the most important aspect of prevention of contamination to drinking water sources. It is also difficult and time consuming. The difficulty lies in balancing the fundamental rights of private property ownership with the responsibility of protecting the citizens of the community from possible drinking water contamination. Management of the source water protection area also involves knowledge of the local personnel and financial resources. Local planning teams must be aware of the legal authority available to the community to require the desired land use changes, taxes, or fees. The regulatory management tools, such as zoning and compliance standards, are the means of environmental protection most often used at all levels of government.

As indicated in earlier sections, South Dakota encourages the regular review and update of the source water assessments. South Dakota also encourages the regular review and update of source water protection plans. Regular reviews will help the local planning team deal constructively with new trends and activities within the community. Contingency planning is the development and implementation of both long and short-term drinking water supply replacement strategies for supplying safe drinking water to the consumer in the event of contamination or physical disruption. South Dakota will assist the local water supply operator and local community team with the development of contingency plans. South Dakota will also encourage the local planning teams to include the already developed emergency response procedures as part of the contingency plan. These emergency response procedures are the steps that would be implemented as soon as possible following a release of contaminants into the environment.

South Dakota has conducted public outreach of the Source Water Assessment and Protection Program by presenting information at various workshops and seminars, articles and newsletters, and holding two public meetings to gather comments on the program. South Dakota has offered, and will continue to offer assistance to communities and all PWSS, in all aspects of the source water program. These may include technical assistance, funding, and management options.

South Dakota may submit a voluntary *Source Water Petition Program* to EPA giving communities the opportunity to request assistance from the state for support of local, incentive-based partnerships among interested parties for the protection of the community drinking water supply.

A State may fund activities to assist development and implementation of local drinking water protection initiatives utilizing Drinking Water SRF set-aside funds. A state may set-aside up to 15% of its capitalization grant to provide low-interest loans to public water systems for the acquisition of land or conservation easements for source water protection and loans to community water systems to implement voluntary, incentive-based source water quality protection measures. During development of the annual intended use plan, South Dakota will consider setting aside funds for these activities based on the projects identified by local sponsors. As required by the Drinking Water State Revolving Fund guidelines, South Dakota will develop a separate project priority list of systems to receive these local source water protection loans.

Acronyms

BASINS	Better Assessment Science Integrating Point and Nonpoint Sources
CRP	Conservation Reserve Program
DENR	Department of Environment and Natural Resources
EHS	Extremely Hazardous Substance
EPA	Environmental Protection Agency
FEMA	Federal Emergency Management Agency
GPS	Global Positioning System
MCL	Maximum Contaminant Level
MGD	Million Gallons per Day
NA	Not Applicable
PWSS	Public Water Supply System
RF	Risk Factor
SARA	Superfund Amendments and Reauthorization Act
SD	South Dakota
SDWA	Safe Drinking Water Act
SDWIS	Safe Drinking Water Information System
SWAP	Source Water Assessment Program
TAC	Technical Advisory Committee
TMDL	Total Maximum Daily Load
US	United States
USGS	United States Geological Survey
WHP	Wellhead Protection

Glossary

alluvium: A general term for clay, silt, sand, gravel, or similar unconsolidated material deposited during comparatively recent geologic time by a stream or body of running water as a sorted or semi-sorted sediment in the bed of the stream or on its floodplain or delta, or as a cone or fan at the base of a mountain slope.

aquifer: A formation, group of formations, or part of a formation that contains sufficient saturated permeable material to yield sufficient, economical quantities of water to wells and springs.

bedrock: a general term for the consolidated rock that underlies soils or other unconsolidated surficial materials.

community public water supply system: water systems that serve a permanent residential population and include municipalities, rural water systems, mobile home courts, and housing developments.

confined aquifer: An aquifer bounded above and below by confining units of distinctly lower permeability than the aquifer media; or one containing confined ground water. An aquifer in which ground water is under pressure significantly greater than atmospheric and its upper limit is the bottom of a bed of distinctly lower hydraulic conductivity than that of the aquifer itself.

consecutive public water supply system: a water system that is served by another public water supply system.

contaminant: An undesirable substance not normally present, or an unusually high concentration of a naturally occurring substance in water, soil, or other environmental medium.

contamination: The degradation of natural water quality as a result of man's activities. There is no implication of any specific limits, since the degree of permissible contamination depends on the intended end use or uses of the water.

contaminant source inventory: the process of identifying and inventorying contaminant sources within delineated source water assessment areas through recording existing data, describing sources within the source water assessment area, targeting likely sources for further investigation, and verifying accuracy and reliability of the information gathered.

drawdown: the vertical distance ground water elevation is lowered, or the amount pressure head is reduced, due to the removal of ground water. Also the decline in potentiometric surface caused by the withdrawal of water from a hydrogeologic unit.

Drinking Water State Revolving Fund (DWSRF): under section 1452 of the SDWA, EPA awards capitalization grants to states to develop drinking water revolving loan funds to help finance drinking water system infrastructure improvements and finance source water protection

efforts to enhance operations and management of drinking water systems, an other activities to encourage PWSS compliance and protection of public health.

ground water: The water contained in interconnected pores located below the water table in an unconfined aquifer or located in a confined aquifer.

hydraulic conductivity (K): Proportionality constant relating hydraulic gradient to specific discharge, which for an isotropic medium and homogeneous fluid, equals the volume of water at the existing kinematic viscosity that will move in unit time under a unit hydraulic gradient through a unit area measured at right angles to the direction of flow.

hydraulic gradient (*i*): slope of the water table or potentiometric surface.

igneous rock: a rock that solidified from molten or partly molten material.

induced risk factor: a risk factor that exists due to human activities at a public water supply system or at a potential contaminant source, e.g. volume of potential contaminant stored.

intrinsic risk factor: a risk factor that exists by virtue of the hydrogeologic and physical setting of a public water supply system, e.g. aquifer characteristics.

karst: a landscape or region characterized by rock dissolution.

metamorphic rock: a rock formed when preexisting rocks undergo mineralogical, chemical, and structural changes caused by high temperature, pressure, and other factors.

non-transient non-community public water supply system: nonresidential water systems that serve the same population for at least six months per year and includes factories and schools.

permeability: ability of a porous medium to transmit fluids under hydraulic gradient.

porosity: ratio of the total volume of voids available for fluid transmission to the total volume of a porous medium. Also the ratio of the volume of the voids of a soil or rock mass that can be drained by gravity to the total volume of the mass.

potentiometric surface: an imaginary surface representing the level to which water will rise in a well.

public water supply system (PWSS): system for provision to the public of piped water for human consumption, if such system has at least 15 service connections or regularly serves at least 25 individuals daily for at least 60 days out of the year.

pumping rate: the rate at which water is withdrawn from the well.

radius of influence: the radial distance from the center of a well bore to the point where there is no lowering of the water table or potentiometric surface.

recharge area: area in which water reaches the zone of saturation by surface infiltration. An area in which there are downward components of hydraulic head in the aquifer. Infiltration moves downward into the deeper parts of an aquifer in a recharge area.

semiconfined aquifer: an aquifer that has a "leaky" confining unit and displays characteristics of both confined and unconfined aquifers.

sensitivity: the potential for an aquifer to become contaminated based on the intrinsic hydrogeologic characteristics of the water source.

source water assessment area: the area delineated by the state for a public water supply, whether the source is ground water or surface water or both, as part of the state SWAP approved by EPA under section 1452 of the SDWA.

source water assessment: three step process which includes delineating the part of the watershed or ground water area that contributes water to the water supply system; identifying the potential sources of pollution in the delineated area; and conducting a susceptibility analysis of the water supply to potential contaminant sources.

susceptibility: the potential for a public water supply system to draw water contaminated at concentrations that would pose concern, through geologic strata and overlying soil, direct discharge, overland flow, or cracks/fissures in the physical well or surface-water intake.

transient, non-community public water supply system: water systems that serve a transient or nonresidential population and includes campgrounds, rest stops, and resorts.

time-of travel: the time required for a contaminant to move in the saturated zone from a specific point to a well.

unconfined aquifer: conditions in which the upper surface of the zone of saturation forms a water table under atmospheric pressure.

watershed area: a topographic area that is within a line drawn connecting the highest points uphill of a drinking water intake, from which overland flow drains to the intake.

wellhead protection area: a designated area around a public water supply well(s) that is to be protected from contaminants that may adversely affect human health.

Wellhead Protection Program: A program to protect wellhead protection areas within a states jurisdiction from contaminants that may have any adverse effects on the heath of persons (SDWA, subsection 1428(a)).

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