SOURCE WATER ASSESSMENT
FOR
Douglas

June 30, 2004

PROJECT: 424-001

ASSESSMENT COMPLETED BY: TRIHYDRO CORPORATION

1252 Commerce Drive, Laramie, WY 82070

Introduction

People who live in or visit the state of Wyoming enjoy pristine natural resources. One of the most important of these resources is drinking water. In 1973, the Wyoming legislature passed the Environmental Quality Act and directed the Wyoming Department of Environmental Quality (DEQ) to both preserve the surface and groundwater resources of the state, and to prevent, reduce, and eliminate water pollution.

In 1996, the United States Congress passed the Safe Drinking Water Act Amendments that required all states having the responsibility for administering the federal rules and regulations of this Act, or "primacy", to develop a Source Water Assessment and Protection (SWAP) Program. Although Wyoming is the only state that does not have primacy, DEQ recognized the value and benefit of SWAP to help protect public water systems (PWSs). During the 1998 legislative session, the Wyoming Legislature authorized DEQ to set aside 10%, or $1.2 million, of the 1997 federal Drinking Water State Revolving Fund monies to develop a SWAP program and to complete Source Water Assessments.

The SWAP Program is a two-part program consisting of source water assessments and source water protection plans. The completion of a source water assessment involves determining a source water area for each PWS, assessing the sources of contamination within this source water area that have the potential to affect the drinking water supply, evaluating the susceptibility of the water supply to contamination by each of these potential sources of contamination, and finally, writing an assessment report that contains a summary of all the information gathered during the assessment. Due to Wyoming's unique primacy status, the completion of source water assessments for all PWSs is voluntary. The DEQ has completed a source water assessment for each PWS that has requested one. Local governments, PWSs, and citizens can then use these assessment reports to develop a source water protection plan that outlines the measures that the community or PWS believes are appropriate to protect their drinking water supply. These measures may include management plans, clean up efforts, public education, or zoning changes.

DEQ Coordination

DEQ contracted and worked closely with the Trihydro Corporation (Trihydro) and Lidstone and Associates, Inc. (Lidstone) to complete the source water assessments. Trihydro and Lidstone were selected because of their geologic experience, Geographic Information System (GIS) expertise, and their knowledge of many PWSs in Wyoming. PWS delineations were completed by the firm most familiar with the geology/hydrology of the area.

The Wyoming Association of Rural Water Systems (WARWS) also provided a great deal of assistance. WARWS published newsletters, helped sign up PWSs for assessments, and helped operators understand and review draft assessments. They also provided valuable input throughout the development and implementation of the SWAP program.

Source Water Area Delineation

The first step in completing the Source Water Assessment was to delineate, or determine, the source water area, or the area that contributes water to the well or intake. In order to protect public water supplies, community leaders, planners, and PWS operators must have information regarding the land area that contributes water to the PWS's wells or intakes. Potential sources of contamination located upstream or upgradient from a water source could reach and possibly impact the water system and its customers. Trihydro and Lidstone delineated three contaminant inventory zones within each source water area for the purpose of inventorying possible sources of contaminants that could affect drinking water quality. The following listing of the three zones provides additional information on their intent:

- **Zone 1** is called the "Accident Prevention" or "Sanitary Protection Zone" and is located within a 100 foot radius of the well or intake. The potential for contaminants released within this zone to affect the quality of PWS water is highest.

- **Zone 2** lies immediately beyond Zone 1 and is called the "Attenuation Zone." Contaminants released within this zone are within close proximity of the well or intake and the chances of their reaching the well or intake is still high. Zone 2 for surface water systems included an area 1000 feet on either side of the perennial streams that extended upstream of the intake for a distance of 15 miles, or the distance from the intake to the headwaters of the drainage contributing water to that intake. Zone 2 for groundwater systems represented a 2-yr time of travel (TOT) that was determined using the best, and most conservative hydrogeologic data available.

- **Zone 3** is the area farthest from the well or intake. Contaminant sources within this zone are less likely to reach the well or intake in quantities that could affect water quality. Zone 3 for surface water sources includes the entire stream drainage basin from Zone 2 to the basin headwaters. Zone 3 for groundwater sources extends from the edge of Zone 2 and represented the estimated 5-yr TOT.

Trihydro and Lidstone used readily available information to determine the locations of each well, spring, infiltration gallery, or surface water intake. No fieldwork or site visits to individual PWSs were conducted to verify the accuracy of the location data. The location of each water source was initially obtained from DEQ or United States Environmental Protection Agency (EPA) databases. Information received from the respective PWS operators on their well information sheets, photographs of individual water sources, the Wyoming State Engineers (SEO) well information database, Wyoming Water Development Commission reports, and Trihydro/Lidstone company experience were also used to locate each water source as accurately as possible.

To determine the source water area(s) for each well or surface water intake, Trihydro and Lidstone reviewed a variety of geologic, hydrologic, and hydrogeologic sources, and incorporated that data into a Geographical Information System (GIS). For PWSs utilizing surface water sources, Hydrologic Unit Codes (HUC) and 7.5-minute U.S. Geological Survey (USGS) topographic maps were used to identify the basin perimeters that contribute water to the surface

water intake. For those systems utilizing groundwater sources, Trihydro and Lidstone reviewed information from the following sources to develop source water areas: the EPA's sanitary surveys, the EPA's early 1980s reports on the occurrence and characteristics of groundwater in each basin of the state, the Wyoming State Engineer's Office (SEO) water rights database, University of Wyoming Master's theses, USGS geologic and hydrogeologic reports, Driscoll's Groundwater and Wells book, Wyoming Water Development Commission reports, Wyoming Water Research Institute reports, and previous delineations completed by other consultants, the Wyoming Geologic Survey and WARWS.

The methods and techniques that were used to delineate the contaminant inventory zones within each source water area were consistent for all surface water systems. However, for groundwater systems, professional geologists for Trihydro and Lidstone considered aquifer type (confined, unconfined, alluvial, etc.), flow system type (porous, or conduit), and PWS type to determine which delineation method was appropriate for each well, as shown on **Figure 1**. For groundwater sources, Trihydro and Lidstone geologists used the most appropriate conservative methodology, which closely followed the EPA-approved Wyoming Wellhead Protection Program Guidance Document.

Contaminant Inventory

An inventory of contaminant sources that lie within the source water areas and have the potential to adversely impact the quality of the water supply was conducted within each contaminant inventory zone. Knowledge of potential contaminants may encourage communities to implement and manage a source water protection area, and enable a PWS to plan for necessary improvements in treatment capabilities, develop emergency response plans, or allow time to remediate the source of contamination. The principal contaminants of concern include those regulated under the Safe Drinking Water Act in addition to microorganisms such as *Cryptosporidium,* and exposure to nitrates.

Contaminant inventories for Potential Sources of Contamination (PSOCs) used information obtained from EPA, DEQ Water Quality Division, DEQ Solid and Hazardous Waste Division, DEQ Land Quality Division, DEQ Abandoned Mine Lands, Wyoming Oil and Gas Conservation Commission, the Wyoming State Geological Survey, the U.S. Department of Transportation, and the Wyoming Department of Agriculture Technical Services databases. Examples of regulated activities or facilities include wastewater treatment plants; confined animal feeding operations; underground injection wells; chemical or hazardous waste use, production, or storage sites; and landfills. These permitted contamination sources produce materials that are regulated by state or federal laws. These databases are also tabulated according to contaminant type in the susceptibility section. Information from citizens and PWS operators played a vital role in verifying land uses and locations of regulated PSOCs.

There are two basic types of contaminant sources, point and non-point, that were evaluated based on their proximity to the water source. Point sources are usually associated with a single location, like an underground storage tank, underground injection well, oil and gas well, coal bed

methane (CBM) well, a solid/hazardous waste facility or a National Pollutant Discharge Elimination System (NPDES) outfall. Point sources are usually regulated and are required to have permits.

In contrast, non-point source pollution results from land use patterns and transportation corridors. Urban land use was considered of greatest concern followed by irrigated agriculture, non-irrigated agriculture, and then forested areas. Forested areas were included to evaluate the potential risks of increased runoff and water quality problems following forest fires. Transportation corridors, including pipelines, railroads, and highways, are a high concern because of the nature of the materials being transported. All remaining land uses were considered low risk.

To evaluate the potential impact of these contaminants, an extensive inventory was conducted in Zones 1, 2, and 3 for both surface and groundwater sources. As part of the inventory, the assistance of local representatives and PWS operators was requested to verify the locations of regulated and non-regulated potential sources, land use boundaries, and to identify any historical sources of contamination.

The Susceptibility Analysis Process

The final step in developing the source water assessment for each PWS was to analyze the susceptibility of each water source with respect to the identified PSOCs. DEQ defines the susceptibility of a PWS as the potential for each well or surface water intake to draw water that has been contaminated by pollutants at concentrations that would pose concern. Susceptibility must be determined for each water supply well or intake used by the PWS. Contaminants may reach the intake or well by infiltration through geologic strata and overlying soil, direct discharge into surface or groundwater, overland flow, or contamination of upgradient groundwater. Contaminants may also enter the water source at the well, intake, or the conveyance. A conveyance is defined as the pipe, canal, or aqueduct between the well or intake and the first form of treatment, or where the water enters the distribution system if there is no treatment.

Water system susceptibility is related to three factors that were evaluated as part of this source water assessment. The first was the physical integrity of the well, intake, and conveyances. The second factor was the sensitivity of the land area through which potential contaminants may reach the well or intake. This included the geologic, hydrologic, and land cover characteristics of the watershed, well location, or aquifer source area. The third factor was the nature of the potential contaminants. Potential contaminants include specific point sources and any land uses that may contribute contaminants to the water supply. For point sources, the type of potential contaminants, the location of the contaminant sources relative to the well or intake, and confirmation of a contaminant release were also considered.

Data that were used to quantitatively evaluate the susceptibility of each water source to potential contaminants were acquired from sources of data readily available for all PWS in the state. The susceptibility of each PWS is based on delineated source water areas, DEQ contaminant

inventories, 1:500,000 scale land use maps compiled by the University of Wyoming, EPA sanitary surveys, EPA's Safe Drinking Water Information System database, and DEQ and Wyoming SEO well or intake permits.

Step 1: Well or Intake Integrity Score

The first step in the susceptibility analysis was to determine the integrity score for each well or intake. The well or intake was assigned a score after being evaluated for a series of factors. The factors and the points associated with them are described below. Each well or intake received a score between 1 and 13. If sanitary surveys, permits, or completion records were not available or did not contain the appropriate information, a maximum score was assigned for that particular factor as a default. Scores for each PWS water source are listed in the Well or Intake Integrity tables located at the back of this document.

If the well or intake was constructed prior to 1983, it was assigned 3 points, between 1983 and 1993, 2 points, and 1 point if constructed after 1993. The points assigned to completion dates reflect DEQ's confidence in the standards applied to the design, construction, and completion of wells and intakes at the time of construction. Conveyance structures were scored based on the length, the risk of damage, and the degree to which the transported water is exposed to contaminants. Short conveyances, less than 1 mile, received a score of 0 points, while conveyances greater than 1 mile received 1 point. Open conveyances and conveyances at risk to structural damage received 1 point.

Well integrity was also evaluated on the basis of four additional factors. The first and most critical of these was the presence of a surface seal that is in good condition. DEQ believes that the surface seal is a good indicator of the overall well condition. Wells that had a surface seal were assigned a score of 0 points and wells that did not have a surface seal were assigned a score of 5 points. The second factor was the presence of a good annular seal. However, this information is less easily obtained, so an assumption about the annular seal was made based on the presence of a surface seal. If a well had an annular seal it was assigned a score of 0 points, wells without an annular seal received 1 point. The third factor was the protection of the vicinity immediately around the wellhead from contaminant sources. This is usually accomplished by enclosing the wellhead in a well or pump house, or a fenced off area. If the wellhead was protected, the well received 0 points, but unprotected wells were assigned 1 point. The fourth factor is the protection of the wellhead from flooding. For instance, the ground around the wellhead should be sloped away from well to encourage water and any water-borne contaminants to move away from rather than towards the well. Wells that were considered protected from flooding were assigned 0 points, wells not protected were assigned 1 point.

The integrity of surface water systems was also evaluated based on three additional criteria. The first of these was the presence of a screen. A screen, or series of screens, will prevent debris from interfering with the water treatment process. The presence of a screen yielded 0 points, while intakes without a screen scored 3 points. Secondly, screens must be inspected and cleared of debris regularly to remain effective. Intakes that were not inspected regularly scored 2 points. Finally, access to the area immediately surrounding the screen location should be restricted. If the area around the intake was not protected, the intake scored an additional 2 points.

Step 2: Water Source Sensitivity

The second step in the susceptibility analysis was to determine the well or intake sensitivity score on the basis of aquifer or watershed conditions and the confirmed detection of chemical contaminants in raw or treated water. Wells were assigned a score between one and ten. Intakes were assigned a score of five or ten. Scores for each PWS water source are listed in the attached Water Source Sensitivity scoring tables located in the back of this document.

The inherent sensitivity of the aquifer or watershed was combined with indicators of contamination observed within the last five years. If no information was available, the maximum score was assigned as a default for that particular scoring criterion. Documented chemical detections at a well or intake within the last 5 years scored an additional 5 points. A chemical detection indicates that a pathway exists for contaminants to enter the system.

DEQ assumed that all surface water systems were highly sensitive to contamination (default score of 5 points) due to the fact that streams, rivers, and open conveyances directly and rapidly convey released contaminants. A maximum total of 10 points was possible for surface water intakes.

For groundwater systems, Trihydro and Lidstone determined the sensitivity of each groundwater source based on the type of aquifer in which the wells were completed. Porous flow confined aquifers were considered to be the least vulnerable type. Shallow alluvial, fractured, karst, and some unconfined aquifers are more vulnerable to contamination from surface contaminant sources. To evaluate the sensitivity of unconfined aquifers throughout the state, Trihydro and Lidstone used a statewide map of uppermost aquifer sensitivity that was developed using depth to water, recharge and overlying soil characteristics, land slope, vadose zone characteristics, and other hydrogeologic characteristics. Aquifer sensitivity, based on the map, ranged from 1-5 points. Wells that were completed in fractured rock or limestone aquifers received a score of 5 points. Shallow wells completed in alluvium (less than 65 feet deep), could be under the influence of surface water, and received a score of 5 points. Confined aquifers under normal porous flow conditions received a score of 1 point. Groundwater source sensitivity scores ranged from 1 to 10 points.

Step 3: Well or Intake Rating

A well or intake rating was developed from the integrity and sensitivity scores. A water source sensitivity score was determined by adding the well or intake integrity score to the water source sensitivity score. A well or intake rating of low, medium, or high was assigned based on the total number of points scored; low (2-8 points), medium (9-15 points), high (16-23 points). The rating for each well or intake was then combined with the contaminant ratings to determine the final susceptibility for each respective well or intake.

Step 4: Contaminant Ratings

The fourth step in the susceptibility analysis was to rate potential sources of contamination that were located within the contaminant inventory zones delineated for each well or intake. Three categories of contaminants were developed for this rating process: regulated point sources, non-point sources including land uses, and transportation corridor sources.

Point sources were evaluated using the following three critical pieces of information: the contaminant type; the location of the potential source of contamination in relation to the well or intake; and the contaminant release status. For the purposes of the susceptibility analysis, contaminants have been grouped into the following two types on the basis of their DEQ facility or contaminant codes: 'Serious Contaminants' and 'Other Contaminants.' Microorganisms, nitrates/nitrites and carcinogens are considered 'Serious Contaminants,' while 'Other Contaminants' includes the remainder of the contaminants listed in the federal drinking water standards. Point sources identified in the contaminant inventory will have one or both types of potential contaminants. The most serious contaminant type present was assigned a contaminant rating. This process was completed for each point source identified in the contaminant source inventory.

The point source contaminants were also rated on the location of the potential source of contamination in relation to the well or intake (Zone 1, 2, or 3). The last factor in determining a contaminant rating is the contaminant release status. This factor is an indication of whether a potential source of contamination has released contaminants into the environment. Documented releases are typically found with potential sources of contamination like facilities with permitted discharges, groundwater pollution control sites, and leaking storage tanks.

All Serious or Other contaminants that were identified within Zone 1 and Zone 2, regardless of whether a documented release of those contaminants had occurred, were considered a high risk to the well or intake. A known release of a contaminant identified in Zone 3 was considered a medium risk to the well or intake. Contaminants identified in Zone 3 that were classified as a no known release, were considered a low risk to the well or intake.

All point source PSOCs are shown on the source water area delineation map(s). The General Point Source Contaminant Rating Matrix located in the general tables section at the back of this document, shows how the point source PSOCs were rated. The point source PSOCs that are located within the contaminant inventory zones are tabulated in the Point Source Susceptibility Table along with these final contaminant ratings, also located at the back of this document. For further details on any of these sources of contamination, contact the appropriate agency listed in Appendix A

Non-point sources of contamination were evaluated on the basis of the percentage of land use in the source water area for various activities. The General Land Use Rating Matrix is located in the general tables section of this document. For groundwater systems with modeled, calculated fixed radius (CFR) delineations, and delineations that were hydrogeologically mapped, the percentage of land use in Zones 1, 2, and 3 was evaluated. For all other delineations, including surface water watersheds, groundwater under the influence of surface water, and area-wide aquifer delineations, only Zones 1 and 2 were evaluated. The percent land use, the land use

contaminant rating, and the land use susceptibility ratings for each well/intake are also shown in the Land Use Susceptibility Table, located at the back of this document..

The transportation corridor contaminant ratings were determined by counting the number of each transportation corridor contaminant type within each contaminant inventory zone. The General Transportation Corridor Contaminant Rating Matrix shows how the transportation corridor contaminants were rated and is located in the general tables section. The transportation corridor contaminant rating and the transportation corridor contaminant susceptibility ratings are shown in the Transportation Corridor Susceptibility Table located at the back of this document.

Susceptibility Rating Implications

The susceptibility ratings developed during this assessment project are intended to show the PWS areas where contaminants have the greatest potential to impact their water supply.

High susceptibility ratings should be used to assist the PWS in future planning efforts. A source water protection plan is recommended regardless of a PWS's susceptibility ratings. Please contact WARWS at 307-436-8636 or Kim Parker, DEQ, at 307-777-7781 for additional guidance. There are also consulting firms like Trihydro and Lidstone that are available to help you complete your source water protection plans.

In many cases, high susceptibility ratings were caused by lack of data. As mentioned in the scoring process, whenever well or intake data were unknown, the highest score possible was assigned. One way to reduce the susceptibility would be to replace the unknown conditions with the known conditions associated with the particular well or intake in question. Restricting access to wells and intakes, ensuring well or intake physical integrity, enclosing wells and intakes, and enclosing and protecting conveyances are also ways to reduce your systems well or intake rating and reduce susceptibility to potential sources of contamination. Another way to reduce susceptibility would be to remove or mitigate existing PSOCs and prevent new sources from locating within your source water area.

It is possible that regulated point sources appear within your source water area when they should not or appear in the wrong location. It is very important to have regulated point sources located correctly. Regulated point sources in close proximity to your water source greatly affect your susceptibility ratings. Likewise, please keep in mind that your source water area map may be missing regulated point sources that should appear. Your system is potentially susceptible to these sources and they should be included in any future assessments and protection plans. Please contact Kim Parker, DEQ, at 307-777-7781 for assistance in alerting the appropriate regulatory programs if any errors in point sources are discovered.

Lastly, non-regulated or historical potential sources of contamination should not be overlooked when doing assessment updates and protection plans. For example, septic systems and dry cleaners are not regulated and therefore were not included in this assessment, but can have substantial impacts on water quality. Thorough local contaminant inventories that include such

historical and non-regulated potential contaminant sources should be conducted in conjunction with regulatory database inventories.

Water sources with high percentages of forested land in their watershed can experience significant water qulaity impacts if a larger portion of the landscape is burned. Surface water systems can expect high sediment loads and elevated levels of nitrates, phosphorus, heavy metals, organic carbon, and other chemicals. Forest fires can also cause water to have a smokey flavor.

All surface water systems, groundwater under the influence of surface water, and groundwater systems that rely on alluvial aquifers are vulnerable to drought conditions. PWSs should develop contingency plans that include water storage, water rationing, etc. that are adequate to sustain the PWS through drought cycles.

Technical Assistance

Management of the source water protection area involves knowledge of the resources available for protection efforts. Local planning teams, WARWS, and consultants such as Trihydro and Lidstone can assist with identifying the methods and means available to the community to achieve the desired land use changes necessary to protect the drinking water source. The process of developing management strategies for regional aquifer watershed protection areas may require the collaboration of all municipalities, counties, and land management agencies affected by the protection area.

In addition, DEQ may be able to support protection plan activities by providing financial and technical assistance to PWSs. For instance, low-interest loans may be available through the State Revolving Fund program. These monies may be used for the acquisition of land critical to source water protection, the remediation of contaminant sources, or other protection plan development or implementation activities. For additional information on potential funding opportunities, contact Brian Mark of the DEQ at (307) 777-6371. Local planning teams may also request technical assistance from DEQ while developing protection plans. DEQ will provide assistance to local planning committees to the extent possible given personnel and budgetary constraints. For technical assistance, contact Kim Parker of the DEQ at (307) 777-7781.

DEQ is currently working with EPA to develop a waiver program for volatile and synthetic organic chemicals. The EPA will likely require the PWS to have a completed source water assessment in order to apply for this type of waiver. The EPA may also require the development of a protection plan to be eligible for these waivers. A developed protection plan may also aid the PWS by reducing costs associated with upcoming proposed regulations such as the Groundwater Rule.

Source Water Protection Plans

This Source Water Assessment is the necessary first step toward developing a Source Water Protection Plan. This assessment provides the technical basis for future protection measures. DEQ considers the protection of drinking water resources and the development of source water protection plans to be the long-term goal of the program.

In addition to the information provided in this assessment, DEQ requires three other components in a protection plan. A contingency plan, a section discussing management strategies for all potential sources of contamination inventoried within the source water area, and some method to update the protection plan on a regular basis are required components of a protection plan.

Contingency plans describe how a PWS would handle a contamination event or the loss or interruption of a water supply. Examples of components that local planning teams can include in a contingency plan are: options for replacing a water source; customer notification plans; emergency response plans; water storage plans; and measures to promote water conservation, if necessary.

The process of developing effective management strategies is the most important aspect of preventing drinking water contamination. Management strategies can also be the most difficult and time-consuming step when developing a source water protection plan. Each PWS must balance the responsibility of protecting the water supply with past, current and future land uses to determine what management strategies are appropriate and can be supported by the community.

DEQ also requires the regular review and update of the source water protection plans. Regular reviews will help the local planning team constructively deal with new trends, issues, and activities within the community.

This assessment is not the end product. Please use the information in this assessment as a tool to develop a protection plan for your PWS. Once a drinking water supply becomes contaminated, a community or PWS is faced with the difficult and costly task of upgrading treatment facilities or locating an alternative drinking water source. DEQ believes that preventing contamination is the key to keeping Wyoming's drinking water supplies safe.

SOURCE WATER ASSESSMENT SUMMARY
FOR Douglas

PWS Source Water Assessment Summary

The Town of Douglas is a community public water system located in Converse County. The system serves 5,050 people through 2,345 service connections year-round. Facilities include a water treatment plant, three steel treated water storage tanks, and the interconnecting transmission system. The town sells water to three other systems, two of which are located within the town limits and the third located on the south edge of the town. (Ridgewater Imp. Dist. #5600285, Lone Tree Village # 5601343, Frye's TC # 5601367). The system is supplied by a spring and a well that draw water from the Casper formation and a surface water intake that draws water from the North Platte River. All three sources scored high with respect to the combined integrity and sensitivity ratings. The well and spring were not susceptibile to potential contaminants. However, the North Platte intake scored high with respect to all three contaminant types: land use, point sources, and transportation corridors.

Delineation Methods

This water system is a community system that uses water from both surface water and groundwater sources. The groundwater sources draw water from a fractured bedrock aquifer. Hydroeologic mapping and surface water mapping methods were implemented to determine the 2-year and 5-year time of travel capture zones for Douglas's water supply.

Hydrogeologic mapping techniques use surface observations in combination with subsurface geologic and hydrogeologic data to identify aquifer boundaries and areas that contribute water to the aquifer. These techniques were used when a PWS's source was derived from a spring, fractured bedrock, or from a limestone or dolomite aquifer. Conduit flow aquifers have extremely variable flow patterns and rates, making the calculation of time of travel difficult. In some instances, only one contaminant inventory zone was identified beyond Zone 1 due to the inherent difficulty in attempting to assign a particular time of travel to a given area. Because of this issue, aquifer vulnerability mapping techniques were also used as part of the hydrogeologic mapping effort to identify and delineate vulnerable areas. These areas (faults, fractures, exposed bedrock, etc.) are anticipated to be more susceptible to the rapid infiltration of contaminants released at the ground surface.

The surface water source area was delineated using surface topographic techniques. Zone 2 for included an area 1,000 feet on either side of the North Platte River and its perennial streams that extended upstream of the intake for a distance of 15 miles. Zone 3 for the intake includes the entire stream drainage basin from Zone 2 to the basin headwaters.

Groundwater Sources

The Town of Douglas draws water from the Casper Formation via the Box Elder Spring and one municipal water well. Based on information in the Douglas Water Supply Rehabilitation Project Level II Study the Boxelder Spring draws water from the Casper Formation along faults in the vicinity of Boxelder Creek approximately 15 miles west of Douglas. The overlying Goose Egg

and White River formations serve as a regional confining layer. Groundwater flow within the Casper is generally to the north. Recharge occurs as infiltration of precipitation in the Laramie Mountains, immediately west of the spring and along the local drainage patterns that flow to the north. Additional information on these sources are included on the Well and Spring Information Sheets.

Surface Water Sources

Douglas obtains surface water supplies for its municipal system from a surface water intake on the North Platte River. Additional information on this surface water source is included in the attached Surface Water Information Sheet. As shown on the enclosed source water area maps, contaminant inventory zones 2 and 3 were delineated for the surface water source on the North Platte River. For the surface water intake, Zone 2 includes a 1,000 foot buffer on both banks of the river and perennial tributaries a distance of 15 river miles upstream from each intake, while Zone 3 includes the remaining perennial streams within the North Platte drainage which also includes the Sweetwater River watershed.

Integrity Summary

The Town of Douglas utilizes three sources of water for its municipal water supply; one spring, one well, and one surface water intake. The Sheep Mountain well is approximately 300 feet deep and draws water from the Casper Formation. As shown on the Integrity Summary Table, the town's spring and surface water intake both received integrity scores of 6 and 5, respectively. The spring and surface water intake both received these scores primarily because they were constructed prior to 1983, when less stringent construction standards were required by the State of Wyoming. They also lack adequate protection around the spring and surface water intake. The town's well received an integrity score of 4. The well received the integrity score of 4 because it was constructed between 1983 and 1993, has a conveyance structure length greater than one mile, and may lack an annular seal.

Water Source Sensitivity Summary

As shown on the Source Sensitivity Table, the Sheep Mountian well, the North Platte River intake and the Boxelder Spring all scored 10 points for source sensitivity. Fractured bedrock sources and surface water sources were assigned a score of 5 and all three sources scored an additional 5 points for documented chemical detections in the water supply.

Water System Susceptibility Rating

The well and spring scored low with respect to land use susceptibility but the intake scored high because much of the land surrounding the intake is urban or irrigated cropland. The North Platte River intake scored high for susceptibility to point sources but no point sources were identified within the contaminant inventory zones for the well and spring. The intake scored high for transportation corridor contaminants because of the presence of pipline and railroad corridors along the North Platte River.

are considered contaminants in drinking water were detected at some time within the last five years. Chemical detections have a large impact on your PWS's sensitivity score because it may indicate that there is a pathway for contaminants to reach the water supply. However, it is likely that these chemicals are present only in small amounts and are not a danger to your health. Some of these chemicals may also occur naturally in water.

For more information about which chemicals were detected, please contact the PWS for a copy of the most recent Consumer Confidence Report or water analysis results. Chemical detections at levels that are a concern to human health are reported on the EPA's website: <http://www.epa.gov/enviro/html/sdwis/sdwis_query.html>. To see if your PWS has exceeded the federal primary or secondary drinking water standards, just click on the State of Wyoming and then type in the name of your PWS. Consumer Confidence Reports are prepared by the PWS on a yearly basis. The reports should include information about any chemicals found in the water, even those found at very low levels. Please contact Kim Parker at DEQ, 307-777-7781, or WARWS for assistance. You may also contact EPA to find out what contaminants were detected. You may have to fill out a Freedom of Information Act request to obtain the water test results for your PWS. Please call EPA's Safe Drinking Water Hotline at 1-800-426-4791.

The table below illustrates the decision rules used to categorize each system's Integrity and Susceptibility scores described in Step 3.

Well or Intake Rating Scoring

	Low	Medium	High
Combined Integrity and Sensitivity Scores	2 - 8	9 - 15	16 - 23

The decision matrix below illustrates how each land use type receives a contaminant rating based on the percentage of land usage that corresponds to each contaminant inventory zone.

General Land Use Rating Matrix

		Land Use Contaminant Rating		
		Low	Medium	High
% Land Use	Urban	<5%	5-10%	>10%
	Irrigated Cropland	<20%	20-40%	>40%
	Non-Irrigated Cropland	<40%	40-80%	>80%
	Forested Land	<20%	20-40%	>40%

The point source contaminant susceptibility rating is determined for each well or intake using the decision matrix below. The well/intake rating is compared with the point source contaminant rating for each contaminant inventory zone to produce each susceptibility rating.

General Point Source - Contaminant Matrix

	Zone 1		Zone 2		Zone 3	
	Known Release	No Known Release	Known Release	No Known Release	Known Release	No Known Release
Serious Contaminants Microorganisms, nitrates/ nitrites, carcinogens	High	High	High	High	Medium	Low
Other Contaminants Remaining primary and secondary drinking water contaminants	High	High	High	Medium	Medium	Low

The transportation corridor susceptibility rating is determined for each well or intake using the decision matrix below. The well/intake rating is compared to the transportation corridor contaminant rating for each contaminant inventory zone to produce the final susceptibility ratings. The ratings for each zone were determined regardless of the length that each pipeline, railroad line, or highway intersected each contaminant inventory zone.

General Transportation Corridor - Contaminant Rating Matrix

		Contaminant Inventory Zone		
		Zone 1	**Zone 2**	**Zone 3**
Transportation Corridor	**Pipeline**	High	High	Low
	Railroads	High	High	Low
	State Highways	High	High	Low
	Interstate Highways	High	High	Low

A final susceptibility rating was determined for each type of contaminant by comparing the contaminant rating with the well or intake rating, using the decision matrix below. A final susceptibility rating was determined for each type of potential contaminant, land use, point source, and non-point source.

General Susceptibility Rating Matrix

		Contaminant Rating Matrix		
		High	**Medium**	**Low**
Well or Intake Integrity Rating	**High**	High	High	Medium
	Medium	High	Medium	Low
	Low	Medium	Low	Low

PWS-Specific Tables

The following tables, specific to each well or intake, summarize your system's susceptibility using the scoring matrices described above. A specific PSOC susceptibility table may be missing because that type of PSOC was not found within your source water delineation area.

Douglas Water Sources

Water Source Type*	PWS Well ID	Source Name
GW	5600137-101	LITTLE BOXELDER SPRING
GW	5600137-102	SHEEP MOUNTAIN WELL #1
SW	5600137-103	NORTH PLATTE RIVER

* GW - Groundwater
* SW - Surface Water
* GU - Groundwater under the influnce of surface water

Well or Intake LITTLE BOXELDER SPRING (5600137-101)

Surface Water / Spring
Integrity & Sensitivity Scores for Douglas (5600137)

Step 1:

Score Type: Well or Intake Integrity

Water Source: White River Fm

Criterion	Condition	Score
Conveyance open or closed?	CLOSED	0
Risk of conveyance structure damage?	LOW	0
Conveyance structure length?	LONG	1
Area around intake restricted?	Unprotected	2
Intake inspected regularly?	YES	0
Intake screened?	YES	0
Intake completion date	BEFORE 1983	3
	Total Integrity Score	**6**

Step 2:

Score Type: Water Source Sensitivity

Water Source: White River Fm

Criterion	Condition	Score
Confirmed chemical contaminant detection?	Yes	5
Sensitivity	Surface Water Intake	5
	Total Sensitivity Score	**10**

Step 3:

Final Well or Intake Rating: LITTLE BOXELDER SPRING (5600137-101)

Well or Intake Rating for LITTLE BOXELDER SPRING	**HIGH**	**16 (Integrity + Sensitivity)**

Well Or Intake LITTLE BOXELDER SPRING (5600137-101)

Step 4:

Score Type: Land Use Susceptibility

SWZone 1

Land Use Type	Land Use Percentage	Land Use Contaminant Rating	Land Use Susceptibility Rating
Urban Land	0	Low	Medium
Irrigated Cropland	0	Low	Medium
Non-Irrigated Cropland	0	Low	Medium
Forested Land	0	Low	Medium
Other Land Uses	100	Low	Low

SWZone 2

Land Use Type	Land Use Percentage	Land Use Contaminant Rating	Land Use Susceptibility Rating
Urban Land	0	Low	Medium
Irrigated Cropland	2	Low	Medium
Non-Irrigated Cropland	0	Low	Medium
Forested Land	0	Low	Medium
Other Land Uses	98	Low	Low

SWZone 3

Land Use Type	Land Use Percentage	Land Use Contaminant Rating	Land Use Susceptibility Rating
Urban Land	0	Low	Medium
Irrigated Cropland	3	Low	Medium
Non-Irrigated Cropland	0	Low	Medium
Forested Land	15	Low	Medium
Other Land Uses	82	Low	Low

Well or Intake SHEEP MOUNTAIN WELL #1 (5600137-102)

Groundwater

Integrity & Sensitivity Scores for SHEEP MOUNTAIN WELL #1 (5600137-102)

Step 1:

Score Type: Well or Intake Integrity

Water Source: Casper Fm and Madison Limestone

Criterion	Condition	Score
Risk of conveyance structure damage?	LOW	0
Conveyance structure length	LONG	1
Annular seal present?	NO	1
Well protected from flooding?	YES	0
Wellhead protected (enclosed, fenced)?	Fenced	0
Surface seal present	YES	0
Well completion date	BETWEEN 1983 AND 1993	2
	Total Integrity Score	**4**

Step 2:

Score Type: Water Source Sensitivity

Water Source: Casper Fm and Madison Limestone

Criterion	Condition	Score
Confirmed chemical contaminant detection?	Yes	5
Sensitivity	KARST, FRACTURE FLOW	5
	Total Sensitivity Score	**10**

Step 3:

Final Well or Intake Rating: SHEEP MOUNTAIN WELL #1 (5600137-102)

Well or Intake Rating for SHEEP MOUNTAIN WELL #1	**MEDIUM**	**14 (Integrity + Sensitivity)**

Well Or Intake SHEEP MOUNTAIN WELL #1 (5600137-102)

Step 4:

Score Type: Land Use Susceptibility

GEO Zone 1

Land Use Type	Land Use Percentage	Land Use Contaminant Rating	Land Use Susceptibility Rating
Urban Land	0	Low	Low
Irrigated Cropland	0	Low	Low
Non-Irrigated Cropland	0	Low	Low
Forested Land	0	Low	Low
Other Land Uses	100	Low	Low

GEO Zone 2

Land Use Type	Land Use Percentage	Land Use Contaminant Rating	Land Use Susceptibility Rating
Urban Land	0	Low	Low
Irrigated Cropland	0	Low	Low
Non-Irrigated Cropland	0	Low	Low
Forested Land	0	Low	Low
Other Land Uses	100	Low	Low

GEO Zone 3

Land Use Type	Land Use Percentage	Land Use Contaminant Rating	Land Use Susceptibility Rating
Urban Land	0	Low	Low
Irrigated Cropland	1	Low	Low
Non-Irrigated Cropland	0	Low	Low
Forested Land	0	Low	Low
Other Land Uses	99	Low	Low

Well or Intake NORTH PLATTE RIVER (5600137-103)

Surface Water / Spring
Integrity & Sensitivity Scores for Douglas (5600137)

Step 1:

Score Type: Well or Intake Integrity

Water Source: North Platte River

Criterion	Condition	Score
Conveyance open or closed?	CLOSED	0
Risk of conveyance structure damage?	LOW	0
Conveyance structure length?	SHORT	0
Area around intake restricted?	Unprotected	2
Intake inspected regularly?	YES	0
Intake screened?	YES	0
Intake completion date	BEFORE 1983	3
	Total Integrity Score	**5**

Step 2:

Score Type: Water Source Sensitivity

Water Source: North Platte River

Criterion	Condition	Score
Confirmed chemical contaminant detection?	Yes	5
Sensitivity	Surface Water Intake	5
	Total Sensitivity Score	**10**

Step 3:

Final Well or Intake Rating: NORTH PLATTE RIVER (5600137-103)

Well or Intake Rating for NORTH PLATTE RIVER	**MEDIUM**	**15 (Integrity + Sensitivity)**

Well Or Intake NORTH PLATTE RIVER (5600137-103)

Step 4:

Score Type: Land Use Susceptibility

SWZone 1

Land Use Type	Land Use Percentage	Land Use Contaminant Rating	Land Use Susceptibility Rating
Urban Land	100	High	High
Irrigated Cropland	0	Low	Low
Non-Irrigated Cropland	0	Low	Low
Forested Land	0	Low	Low
Other Land Uses	0	Low	Low

SWZone 2

Land Use Type	Land Use Percentage	Land Use Contaminant Rating	Land Use Susceptibility Rating
Urban Land	6	Medium	Medium
Irrigated Cropland	45	High	High
Non-Irrigated Cropland	0	Low	Low
Forested Land	3	Low	Low
Other Land Uses	47	Low	Low

These regulated contaminant sources appeared within Zones 1 and 2. The PSOC ID# can be used to located the PSOC on the delineation Map.

Point Source Susceptibility for NORTH PLATTE RIVER (5600137-103)

Step 4:

Score Type: Point Source Susceptibility

Zone: SWZone 2

PSOC ID#	PSOC Name	PSOC Type	PSOC Contaminant Rating	PSOC Susceptibility Rating
62854	Smith Sheep Company Feedlot	Wastewater Discharge	HIGH	HIGH
41188	Richardson Operating Co - Orpha	Oil & Gas Well	HIGH	HIGH

Transportation Corridor Susceptibility for NORTH PLATTE RIVER (5600137-103)

Step 4:

Rating Type: Transportation Corridor Susceptibility

Zone: SWZone 2

Transportation Corridor Contaminant Type	Low	Medium	High
Pipeline	0	0	6
Railroad	0	0	16
State Hwy	0	0	0
Interstate Hwy	0	0	0

POINT SUSCEPTIBILITY SUMMARY TABLE
FOR Douglas

Point Source Susceptibility Summary

It may appear from the results of this point source susceptibility summary table that your system has too many PSOCs influencing the final ratings. In some cases, a specific PSOC falls within a specific contaminant inventory zone shared by multiple wells or intakes. When this is the case, that PSOC will be scored for each intake. For example, an underground storage tank may appear within a contaminant inventory zone shared by four different wells. This would cause that single storage tank to be entered into the table four times, or once for each well or intake.

Point Source Type	Low	Medium	High
Wastewater Discharge	N/A	N/A	1
Oil & Gas Well	N/A	N/A	1

* Illustrates the number of PSOCs in a particular rating class for all water sources
* N/A - Not Applicable