

**SOURCE WATER ASSESSMENT
EXECUTIVE SUMMARY
FOR
Laramie**

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PROJECT: 424-001

ASSESSMENT COMPLETED BY: TRIHYDRO CORPORATION

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SOURCE WATER ASSESSMENT SUMMARY FOR Laramie

PWS Source Water Assessment Summary

This source water delineation is meant to augment the aquifer protection plan which presently exists. The City of Laramie relies on groundwater and surface water sources to supply approximately 25,000 residents through 7,138 service connections. Facilities include nine wells, one surface water intake, one raw water storage reservoir, one water treatment plant, four large treated water storage tanks, and the interconnecting distribution system. Surface water is collected from the Laramie River and tributaries that contribute water from the Medicine Bow Mountains. Water from these sources is piped to the Laramie Treatment plant.

Laramie wells have been constructed to meet the more stringent construction standards and therefore received low integrity scores. However, the wells are screened with the Casper Formation which is faulted and fractured, and thus received a high sensitivity rating. Therefore, the wells were assigned an overall well rating of medium. The Turner and Spur wells scored high for point source susceptibility while wells in the other two well fields scored low. In general, the well fields scored low with respect to land use susceptibility. However, the land around the Turner well field is a mix of urban and residential and could be susceptible in relation to certain land use practices. All of the city's wells received a high transportation corridor susceptibility rating due to the close proximity of highways and interstates to the well fields. The Big Laramie River surface water intake scored high with respect to the combined integrity and sensitivity ratings. The city also scored high for land uses susceptibility, point source susceptibility and transportation corridor susceptibility.

Delineation Methods

The City of Laramie is a community water system that obtains its water supply from fractured bedrock. Hydrogeologic mapping techniques were implemented by the Laramie/Albany County Environmental Advisory Committee to identify source water areas for the wells. In addition to information obtained from a previous delineation completed for the system in 2002, TriHydro used topographic mapping techniques to delineate the surface water source area.

The Laramie Regional Drinking Water Protection Plan for the Casper aquifer was developed in 2002. The plan was developed by a local Environmental Advisory Committee and various subcommittees which were comprised of engineers, geologists, local government officials, and concerned citizens. An extensive delineation was developed to characterize the groundwater sources that supply the City of Laramie. TriHydro found that the groundwater source water area delineation that was completed using hydrogeologic mapping techniques characterized the aquifer's vulnerability in great detail and therefore was incorporated directly into this source water assessment without revision.

Laramie also relies on surface water from the Laramie River. A surface water delineation was developed characterizing the Laramie River and the open conveyance connecting the river with the Sodergreen Lake reservoir where water is drawn and transported via pipeline to the Laramie water treatment plant.

Groundwater Sources

The City of Laramie owns and operates nine water wells from four well fields in and around the Laramie city limits. The primary groundwater source for the four well fields is the Casper Aquifer.

The Laramie municipal well fields are located within the Laramie structural basin. The basin is a broad, north-plunging, asymmetrical syncline that is bounded on the west by the Medicine Bow Mountains, on the east by the Laramie Range and on the south by the Front Range. To the north the Laramie basin is bounded by a series of anticlines rather than by mountain ranges. As a result of uplift of the Laramie Range, immediately east of the City limits, rocks dip generally to the west between 3 and 5 degrees. A set of faults and folds locally occur within the gently dipping rocks in the vicinity of the Laramie area. Several normal and reverse fault systems have been mapped in the Laramie area. Folding in the Laramie area predominantly occurs as east-west trending, west-plunging anticlines and monoclines. The Laramie well fields are associated with these structural features.

The Spur well field is located along the northwest-southeast trending Spur Anticline which plunges to the northwest. The flanks of the anticline dip from 4 to 50 degrees and the structure is cored by a high-angle reverse fault. The City Springs well field is associated with the City Springs fault system. The City Springs Fault is a northeast-southwest trending normal fault with displacements of 20 to 150 feet. The City Springs well field is located at the western terminus of the City Springs fault. The Pope Springs well field is located near the western end of the Pope Fault. The Soldier Springs well field is located along the east-west trending Soldier Fault. Both the Pope Fault (unknown displacement) and the Soldier Fault (up to 40 feet of displacement) are normal faults.

The main water bearing formation supplying the Laramie well fields is the Pennsylvanian-Permian age Casper Formation. The Casper Formation is comprised mainly of marine and eolian sandstones, interbedded with marine limestone and minor amounts of shale. The Casper Formation is approximately 700 feet thick and is locally known as the Casper aquifer. The unconformable Permian Satanka Shale overlies the Casper Formation and is comprised mainly of 250 to 320 feet of red shale with interbedded sandstone and siltstone layers. The Satanka Shale is a regional confining layer overlying the Casper Aquifer. The relatively impermeable, unconformable igneous rocks of the Sherman Granite, which lie beneath the Casper Formation, function as a lower confining unit.

The saturated thickness of the Casper Aquifer varies from a featheredge along the outcrops on the western slope of the Laramie Range to approximately 700 feet near the Spur well field. Published potentiometric maps indicate that flow within the Casper aquifer generally flows from east to west under both porous and conduit flow conditions. Flow within the Casper is under both confined and unconfined conditions depending upon the proximity to the ground surface, the saturated thickness, and the thickness of the overlying Satanka Shale. Recharge to the aquifer occurs along the entire surface exposure of the Casper Formation as infiltration of rainfall and snowmelt.

Individual well yields in the Spur, Turner, Pope, and Soldier well fields are dependent upon the

local permeability of the Casper Aquifer. Well yields in these well fields range from 220 to 1,750 gallons per minute. The wide range in yield within these respective well fields is due in large part to the location and orientation of the fold and fault structures in the Casper aquifer. Transmission rates in these well fields range from 640,000 to 68,000 gallons per day per foot. Basic data on each well in these well fields is included in the attached Well Information Sheets.

As shown on the enclosed source water area delineation maps, contaminant inventory zones in the Spur, Turner, Pope, and Soldier well fields generally extend from the outcrop of the Casper Formation along the crest of the Laramie Range to where the Satanka Shale is thick enough to protect the aquifer from infiltration of contaminants from the ground surface. Maps and information used to summarize the groundwater sources supplying the City of Laramie were taken directly from the Laramie Regional Drinking Water Protection Program document.

Surface Water Sources

As shown on the surface water delineation map, the City of Laramie derives its surface water from the Laramie River and its tributaries upstream of the point of diversion approximately 18 miles southwest of the city limits. Contaminant inventory Zone 2 extends from the water treatment plant intake, along the open conveyance to the Laramie River diversion structure, upstream along the Laramie River approximately 14 miles to the Colorado border. Zone 2 also encompasses numerous perennial drainages of the Laramie River that have their headwaters in the Medicine Bow Mountains.

Integrity Summary

The City of Laramie supplies water from nine wells and one surface water intake. As shown on the Integrity Summary Table, all of the wells that supply water to Laramie received low integrity scores. The Pope wells received the highest integrity scores of 4 because their conveyance structure lengths are greater than one mile. The Turner wells integrity scores of 3 because they were constructed prior to 1983 when less stringent construction standards were required by the State of Wyoming. The Spur wells received the lowest scores of 2 due to their long conveyance structure lengths and well completion dates. The City's surface water intake received the highest integrity score of 12. The intake was constructed prior to 1983 and has a conveyance structure length greater than one mile. Available data indicate that the city's intake is not screened, protected or inspected regularly.

Water Source Sensitivity Summary

As shown on the Source Sensitivity Summary Table, Laramie's surface water intake and wells received sensitivity scores of 10. They received the maximum sensitivity score for two reasons. The first reason is that the wells and intakes are more vulnerable to contamination due to unpredictable flow pathways and their proximity to the ground surface. The second reason is that there is documented chemical detections in the groundwater. The city's nine wells scored the maximum 5 or aquifer sensitivity due to drawing water through conduit flow in a fractured aquifer. The wells also scored the maximum of 5 for chemical sensitivity due to documented chemical detections in the groundwater.

Water System Susceptibility Rating

Susceptibility is defined as the potential for a public water supply to draw contaminated water at concentrations that would pose a threat or concern to human health. In general, the City of Laramie scored low for land use susceptibility because much of the land surrounding the water sources is undeveloped with the exception of the land surrounding the Turner well field. The point source contaminant susceptibility ratings are high for zones 2 of the Turner wells and the Spur #2 well due to three underground storage tanks and one solid and hazardous waste site. The Big Laramie River intake also scored high for point source contaminant susceptibility due to two underground storage tanks and one underground injection system located within Zone 2. All of the City of Laramie's water sources scored high for transportation corridor contaminant susceptibility. The wells are in close proximity to highways and interstates while the surface water intake is in close proximity to railroads. Susceptibility ratings for each type of potential contaminant source are summarized on the attached susceptibility tables.

A review of your PWS's routine water analysis results revealed that one or more chemicals that 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.

**POINT SUSCEPTIBILITY SUMMARY TABLE
FOR Laramie**

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	6	N/A
Underground Tank	N/A	12	11
Underground Injection	N/A	N/A	1
Sol/Haz Waste Site	N/A	N/A	3

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