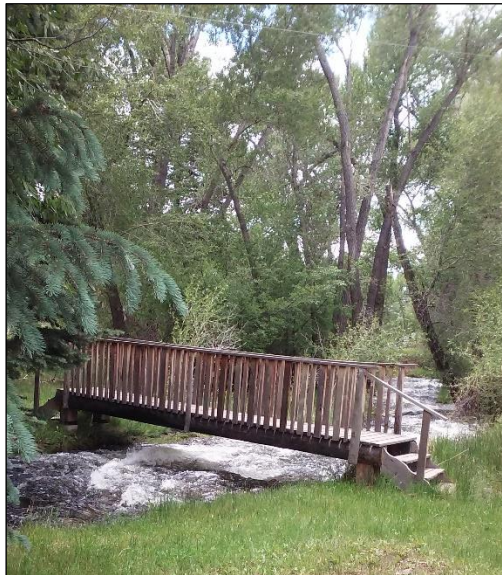


# **Town of Crestone Source Water Protection Plan**

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**Saguache County, Colorado  
August 1, 2017**



Written by: Colleen Williams  
Source Water Specialist  
Colorado Rural Water Association



For the Water Provider:  
Town of Crestone: ID # CO0155188

Cover photo by Ann Bunting

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## ACRONYMS

AF	Acre-Feet
AMCD	Alamosa Mosquito Control Division
BPCC	Backflow Prevention and Cross-Connection Control
BLM	Bureau of Land Management
BMP	Best Management Practice
CCR	Consumer Confidence Report
CDPHE	Colorado Department of Public Health and Environment
CRWA	Colorado Rural Water Association
CWCB	Colorado Water Conservation Board
CWPP	Community Wildfire Protection Plan
DOC	Dissolved Organic Carbon
DOLA	Department of Local Affairs
DWR	Division of Water Resources
EPA	Environmental Protection Agency
GIS	Geographic Information System
LUST	Leaky Underground Storage Tank
MOU	Memorandum of Understanding
MRDS	Minerals Resource Data System
NRCS	Natural Resource Conservation Service
NSFPD	Northern Saguache Fire Protection District
OEM	Office of Emergency Management
OWTS	Onsite Wastewater Treatment System
PSOC	Potential Source of Contamination
SWAA	Source Water Assessment Area
SWAP	Source Water Assessment and Protection
SWPA	Source Water Protection Area
SWPP	Source Water Protection Plan
USFS	United States Forest Service
UST	Underground Storage Tank
WUI	Wildland Urban Interface

## EXECUTIVE SUMMARY

There is a growing effort in Colorado to protect community drinking water sources from potential contamination. Many communities are taking a proactive approach to preventing the pollution of their drinking water sources by developing a source water protection plan. A source water protection plan identifies a source water protection area, lists potential contaminant sources and outlines best management practices to implement to decrease risks to the water source. Implementation of a source water protection plan provides an additional layer of protection at the local level beyond drinking water regulations.

The Town of Crestone values a clean, high quality drinking water supply and decided to work collaboratively with area stakeholders to develop a source water protection plan (SWPP). The source water protection planning effort consisted of public planning meetings and individual meetings with the water operator during the months of July 2016 and June 2017 at the Crestone Community Building in Crestone, Colorado. During the development of this SWPP, a steering committee was formed to develop and implement this SWPP. The Colorado Rural Water Association was instrumental in this effort by providing technical assistance in the development of this SWPP.

The Town of Crestone obtains their drinking water from groundwater in the N. Crestone Creek and Burnt Gulch alluvial aquifer. The source water protection area (SWPA) includes the North Crestone Creek and Burnt Gulch watersheds that most likely recharges the groundwater source. This SWPA is the area that Town of Crestone has chosen to focus its source water protection measures to reduce source water susceptibility to contamination.

The steering committee conducted an inventory of potential contaminant sources and identified other issues of concern within the SWPA that may impact the drinking water sources. The steering committee prioritized the list of issues of concern as active and abandoned wells, gas station, security and vandalism, roads and spills, wildfire and wildfire suppression, septic systems, water scarcity and resulting water quality, residential practices, forest health and post-fire effects, commercial operations, abandoned mines, and mosquito abatement.

The steering committee developed several best management practices (BMPs) that may help reduce the risks from the potential contaminant sources and other issues of concern. The BMPs are centered on the themes of building partnerships with community members and local decision makers; raising awareness of the value of protecting community drinking water supplies; and empowering local communities to become stewards of their drinking water supplies by taking actions to protect their water sources.

At the completion of this plan, members of the steering committee will meet to develop an action plan of BMPs to implement during 2017. It is recommended that the SWPP be reviewed at a frequency of once every three years or if circumstances change resulting in the development of new water sources and source water protection areas, or if new risks are identified.

## **OVERVIEW OF COLORADO'S SWAP PROGRAM**

Source water assessment and protection came into existence in 1996 because of Congressional reauthorization and amendment of the Safe Drinking Water Act. The 1996 amendments required each state to develop a source water assessment and protection (SWAP) program. The Water Quality Control Division, an agency of the Colorado Department of Public Health and Environment (CDPHE), assumed the responsibility of developing Colorado's SWAP program. Colorado's SWAP program is a two-phased process designed to assist public water systems in preventing potential contamination of their untreated drinking water supplies.

### **Source Water Assessment Phase**

The Assessment Phase for all public water systems consists of four primary elements:

1. Delineating the source water assessment area for each of the drinking water sources;
2. Conducting a contaminant source inventory to identify potential sources of contamination within each of the source water assessment areas;
3. Conducting a susceptibility analysis to determine the potential susceptibility of each public drinking water source to the different sources of contamination;
4. Reporting the results of the source water assessment to the public water systems and the public.

The Assessment Phase involves understanding where the Town of Crestone's source water comes from, what contaminant sources potentially threaten the water source, and how susceptible the water source is to potential contamination.

### **Source Water Protection Phase**

The Protection Phase is a voluntary, ongoing process in which all public water systems have been encouraged to voluntarily employ preventative measures to protect their water supply from the potential sources of contamination to which it may be most susceptible. The Protection Phase can be used to take action to avoid unnecessary treatment or replacement costs associated with potential contamination of the untreated water supply. Source water protection begins when local decision-makers use the source water assessment results and other pertinent information as a starting point to develop a protection plan. The source water protection phase for all public water systems consists of four primary elements:

1. Involving local stakeholders in the planning process;
2. Developing a comprehensive protection plan for all their drinking water sources;
3. Implementing the protection plan on a continuous basis to reduce the risk of potential contamination of the drinking water sources; and
4. Monitoring the effectiveness of the protection plan and updating it accordingly as future assessment results indicate.

## INTRODUCTION

The Town of Crestone operates a municipal supply water system that supplies drinking water to 150 residents of the town located in Saguache County, Colorado. Town of Crestone obtains their drinking water from groundwater in the N. Crestone Creek and Burnt Gulch alluvial aquifer. They recognize the potential for contamination of the source of their drinking water, and realize that it is necessary to develop a protection plan to prevent the contamination of this valuable resource. Proactive planning and implementing contamination prevention strategies are essential to protect the long-term integrity of their water supply and to limit their costs and liabilities.<sup>1</sup>

Table 1. Primary Contact Information for the Town of Crestone

PWSID	PWS Name	Name	Address	Phone
CO0155188	Town of Crestone	Ann Bunting	P.O. Box 64 Crestone, CO 81131	719-256-4313

### Purpose of the Source Water Protection Plan

The Source Water Protection Plan is a tool for the Town of Crestone to ensure clean and high-quality drinking water sources for current and future generations. This SWPP Plan is designed to:

- Create an awareness of the community's drinking water sources and the potential risks to surface water and/or groundwater quality within the watershed;
- Encourage education and voluntary solutions to alleviate pollution risks;
- Promote management practices to protect and enhance the drinking water supply;
- Provide for a comprehensive action plan in case of an emergency that threatens or disrupts the community water supply.

Developing and implementing source water protection measures at the local level (i.e., county and community) will complement existing regulatory mandates implemented at the state and federal governmental levels by filling any gaps through local management strategies that are collaboratively developed.

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<sup>1</sup> The information contained in this Plan is limited to that available from public records and the Town of Crestone at the time that the Plan was written. Other potential contaminant sites or threats to the water supply may exist in the source water protection area that are not identified in this Plan. Furthermore, identification of a site as a "potential contaminant site" should not be interpreted as one that will necessarily cause contamination of the water supply.



## Protection Plan Development

The Colorado Rural Water Association's (CRWA) Source Water Protection Specialists, Dylan Eiler and Colleen Williams, helped facilitate the source water protection planning process. The goal of the CRWA's Source Water Protection Program is to assist rural and small communities served by public water systems to reduce or eliminate the potential risks to drinking water supplies through the development of source water protection plans, and provide assistance for the implementation of prevention measures.

The source water protection planning effort consisted of a series of public planning meetings and individual meetings (Table 2). Information discussed at the meetings helped the Town of Crestone develop an understanding of the issues affecting source water protection for the community. The steering committee then made recommendations for management approaches to be incorporated into the SWPP. In addition to the planning meetings, data and other information pertaining to the SWPA was gathered via public documents, internet research, phone calls, emails, and field trips to the SWPA. A summary of the meetings is represented below.

Table 2. Planning Meetings

Date	Purpose of Meeting
April 11, 2016	Provided a presentation to the Town of Crestone Board of Directors on Colorado Rural Water Association's Source Water Protection Program and developing a source water protection plan.
July 7, 2016	<u>First Planning Meeting</u> – Presentation on the process of developing a source water protection plan for the Town of Crestone. Overview of Crestone's water system; delineation of a source water protection area; inventory of potential sources of contamination; and began to prioritize issues of concern.
August 16, 2016	<u>Second Planning Meeting</u> – Finalized delineation of the source water protection area; potential sources of contaminants; final prioritizations of issues of concern; and developed best management practices to include in the source water protection plan.
June 19, 2017	<u>Third Planning Meeting</u> – Review plan process and draft source water protection plan. Discuss public land in source water protection area with land managers. Set date for the final edits and first plan implementation meeting.

## Stakeholder Participation in the Planning Process

Source water protection was founded on the concept that informed citizens, equipped with fundamental knowledge about their drinking water source and the threats to it, will be the most effective advocates for protecting this valuable resource. The Town of Crestone's source water protection planning process attracted interest and participation from 18 stakeholders including landowners, water operators, local and county governments, and agency representatives (Table 3). During the months of July 2016 – June 2017, three stakeholder meetings were held at the Crestone Community Building in Crestone, Colorado to encourage local stakeholder participation in the planning process. Input from these participants was greatly appreciated.

Table 3. Table of Stakeholders Who Participated on the Steering Committee

Stakeholder	Title	Affiliation
Kairina Danforth	Mayor	Town of Crestone
Kizzen Laki	Town Trustee	Town of Crestone
Diane Bairstow	Town Trustee	Town of Crestone
Adam Kinney	Town Trustee	Town of Crestone
John Grotenhuis	Town Trustee	Town of Crestone
Terry Georgon	Town Trustee	Town of Crestone
Mark Talbot	Town Trustee (Former)	Town of Crestone
Gwynn Busby	Treasurer	Town of Crestone
Allyson Ransom	Town Clerk	Town of Crestone
Ann Bunting	Water System ORC	Town of Crestone
Jim Vanderpool	Public Works (Former)	Town of Crestone
JoAnn Slivka	District Manager	Baca Grande Water & Sanitation District
Michael Scully	President, Board of Directors	Baca Grande Water & Sanitation District
Tristram Post	District Ranger	U.S. Forest Service Saguache Ranger District
Melissa Garcia	Field Manager	BLM San Luis Valley Field Office
Ginger Stringer	Public Health Director	Saguache County
Dylan Eiler	Source Water Specialist	Colorado Rural Water Association
Colleen Williams	Senior Source Water Specialist	Colorado Rural Water Association

## WATER SUPPLY SETTING

### Location and Description

The Town of Crestone is a small rural community located at the base of the Sangre de Cristo Mountains, in the northern part of the San Luis Valley in southcentral Colorado (Fig. 2). The town is accessed via County Road T, approximately twelve miles east of Highway 17 at Moffat, Colorado. This small rural community is located at Latitude 37°59'40"N, Longitude 105°41'47"W at an elevation of 7,923 feet. As an incorporated statutory town, its municipal affairs are governed by the Crestone Town Council. According to the U.S. 20110 Census bureau, the town has a total area of 0.2 square miles (0.52km<sup>2</sup>), 107 residential dwellings, and a population of 127 residents. The population in 2000 was 73 and has increased 73.97% by 2010 (DOLA, 2012).

Crestone is located in southwest Saguache County which covers a total area of 3,170 square miles. The county seat is located in the town of Saguache.

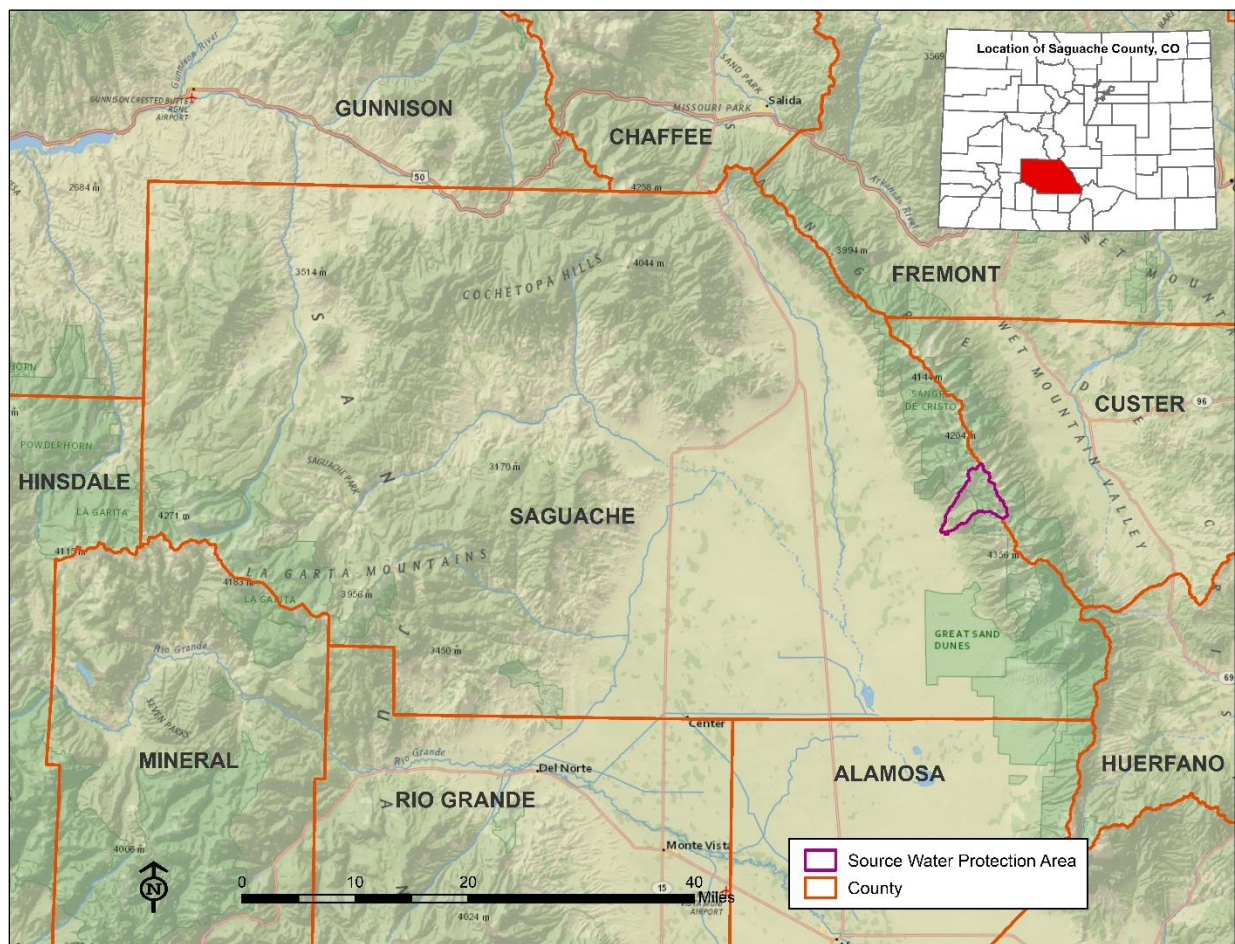


Figure 2. Regional setting map.



## Physical Characteristics

The Town of Crestone's source water protection area, the North Crestone Creek and Burnt Gulch watershed, lies within Southern Rocky Mountains physiographic province area that encompasses the center of the state and runs its entire north-south length. The N. Crestone Creek and Burnt Gulch watershed is in the northern part of the San Luis Valley. The San Luis Valley is approximately 122 miles long and 74 miles wide, extending from the Continental Divide on the northwest rim into the state of New Mexico on the south. In Colorado, the San Luis Valley covers approximately 3,200 square miles over five counties (Topper, et al, 2003).

Headwaters for the North Crestone River originate in the Sangre de Cristo Mountain range that flanks the watershed to the east. The watershed is surrounded by high mountain peaks including Eureka Mountain (13,507 feet), Venable Peak (13,334), Comanche Peak (13,272), fluted Peak (13,554), and Mount Adams (13,931) (Fig. 3). Kit Carson (renamed "Challenger Peak") is the dominant mountain that provides water. The Sangre de Cristo Mountains run north and south along the east side of the Rio Grande Rift (fault).

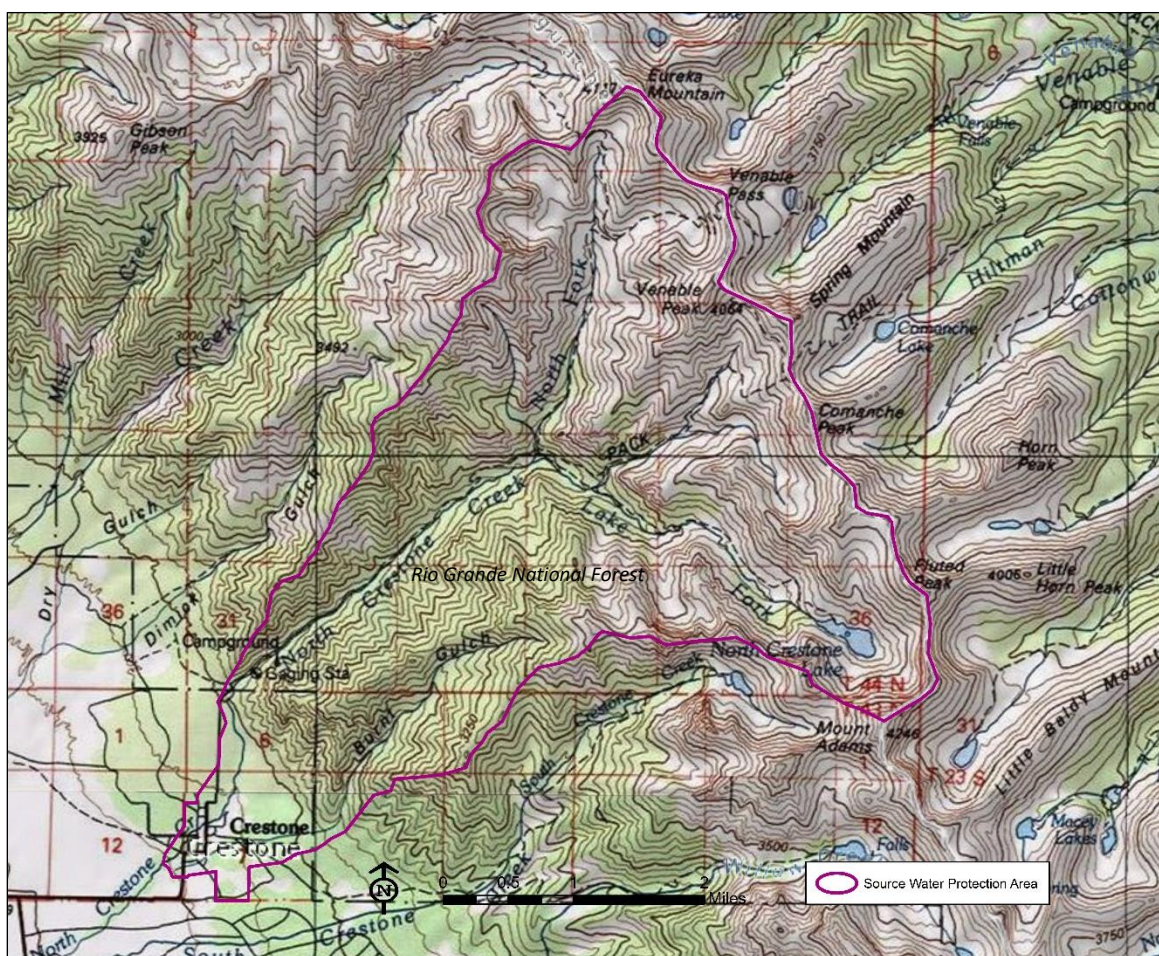
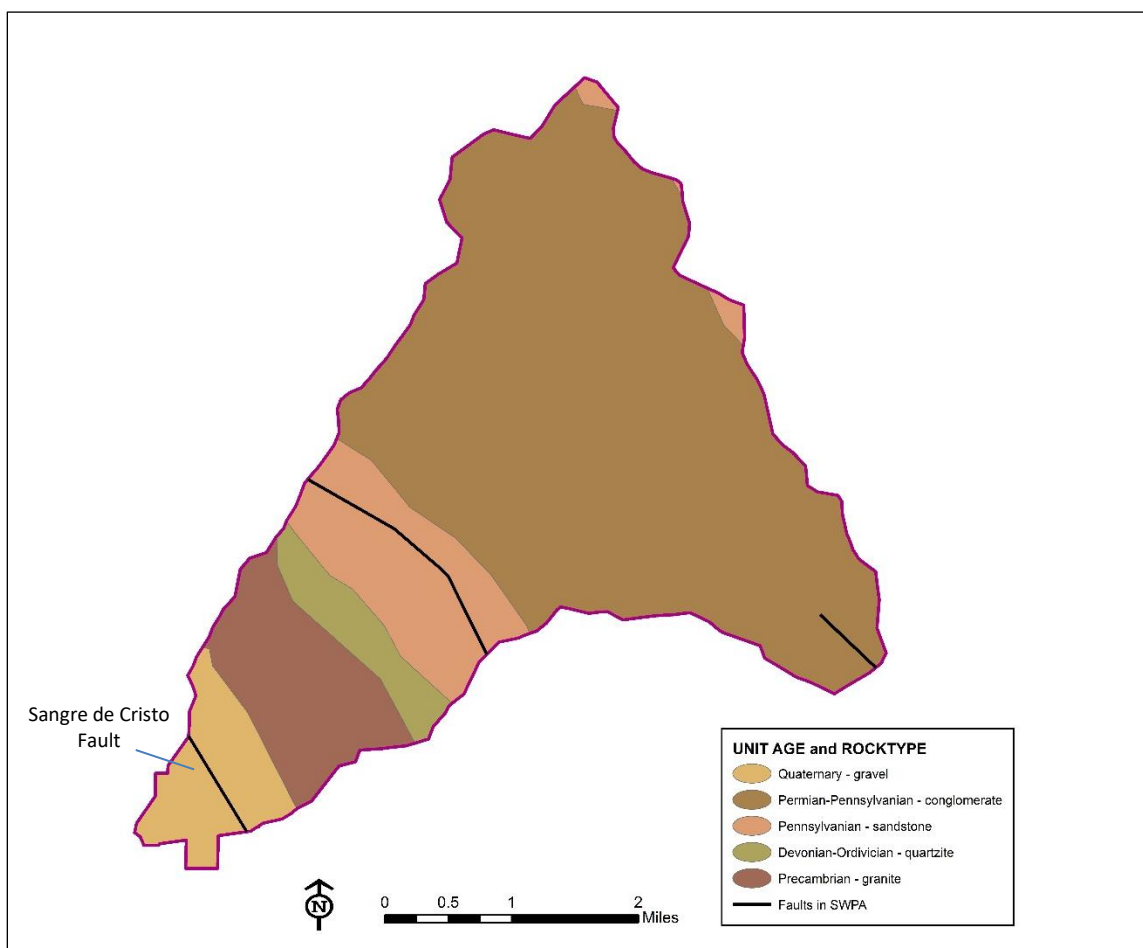


Figure 3. Topographic map of the Source Water Protection Area.

## Geology

The Precambrian age granite, the oldest formation in the source water protection area, form the flanking uplift of the San Luis Valley along the western side of the Sangre de Cristo Range. Ordovician and Devonian aged rocks of the early Paleozoic era overly the Precambrian age granite and are comprised of a thick quartzite and dolomite rocks. The Pennsylvanian and Permian rocks of the late Paleozoic era is composed of conglomerates, sedimentary rock made up of chunks of rock broken off other rocks by physical force and bound together by smaller rock particles. The Quaternary age rocks of the Cenozoic era comprise the valley floor gravel deposits (Fig. 4.) (McCalpin,1996).

The Crestone section of the northern Sangre de Cristo fault zone is the main structure that bounds the eastern margin of the Rio Grande rift from Poncha Pass to Great Sand Dunes National Park (Ruleman and Machette, 2007). A fault is a fracture in rock along which there has been an observable amount of displacement from extensive tectonic forces (Whitten, 1974).



SOURCE: U.S. GEOLOGICAL SURVEY

Figure 4. Geologic map of the Buffalo Creek watershed.

## Climate

The climate within the North Crestone Creek and Burnt Gulch watershed is dependent on elevation and location, with precipitation increasing moderately with altitude. Average annual precipitation ranges from about 11 inches in the lowest reaches to 43 inches in the highest reaches (Fig. 5). Much of the precipitation in the higher elevations is in the form of snow during the winter and spring.

Most of the precipitation that falls on the land surface during spring and late summer storm events flows directly into drainages, streams, and rivers as runoff. Some of the water will infiltrate the soil and recharge the underlying aquifers. The average runoff for the watershed is 5.0 to 10.0 inch depending on elevation (Topper et al, 2003).

Temperatures also vary depending on elevations with average high temperatures during summer in the town of Crestone around 79 degrees Fahrenheit and winter lows around 35-degree Fahrenheit. Saguache County receives 285 days of sunshine per year.

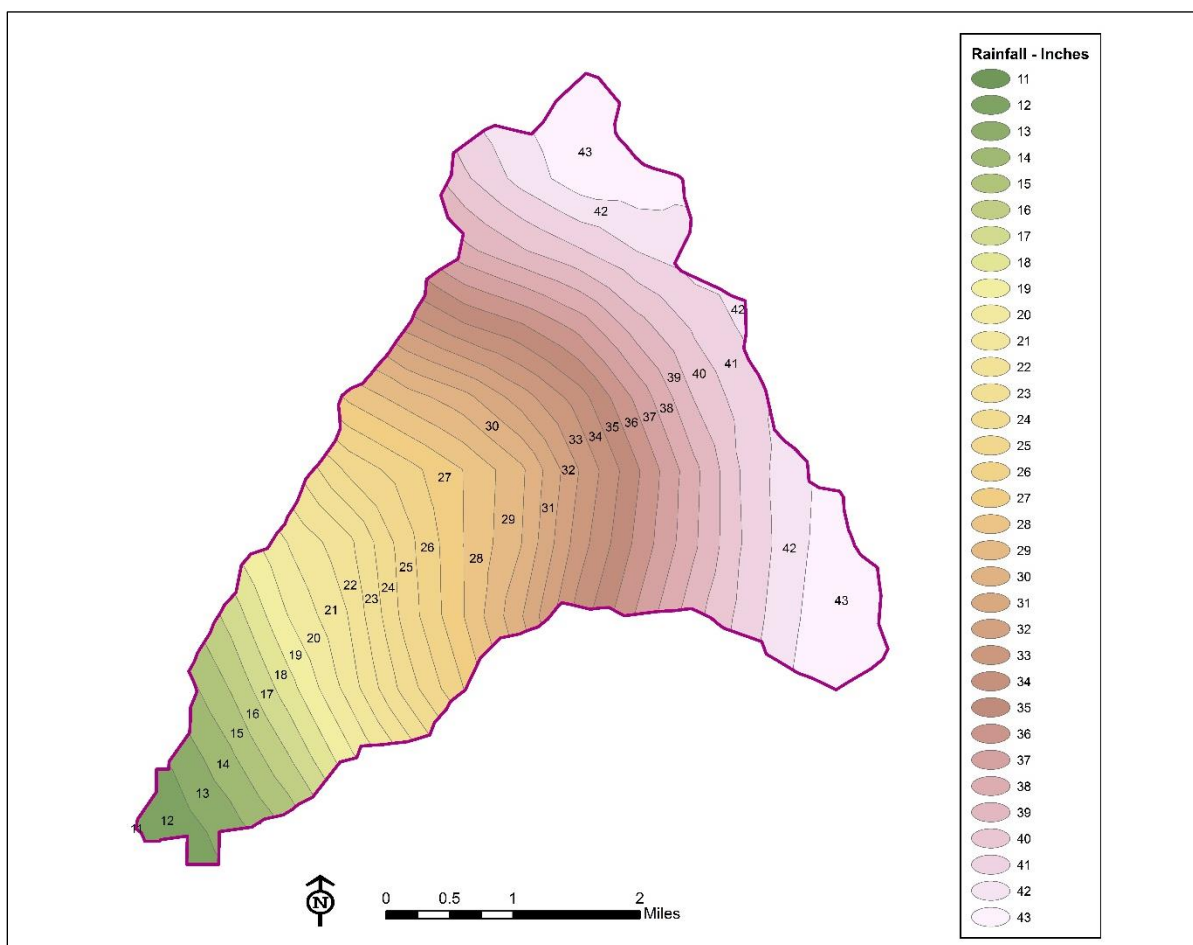


Figure 5. Average annual precipitation map of the Source Water Protection Area (1981-2010).



## Ecological Zones

The source water protection area lies within the Alpine, Subalpine, and Montane ecological life zones (Fig. 6). Life zones are determined by elevation, latitude, climate, and exposure to sunlight. Vegetation type and density (land cover) varies with altitude, topography, and slope aspect. The Alpine Zone, the highest mountain zone above 11,000 feet, includes treeless meadows as well as steep, exposed rock and glaciated peaks.

The Subalpine zone lies immediately below treeline, generally found between 10,000 and 11,000 feet. The subalpine forest is a transition zone from dense forest below to alpine tundra above treeline. A typical subalpine forest may consist mostly of subalpine fir, Engelmann spruce and Limber pine. (USP, 2015). The Montane zone or mid-elevation ecosystem ranges from 8,000 to 10,000 feet and is dominated by pines, Douglas fir and aspen. Ponderosa pine is more common on dry south-facing slopes. On north facing slopes Douglas fir may be the more dominant plant. Lodgepole pine and aspen are common at the upper elevation of the Montane (CSU, 2016)

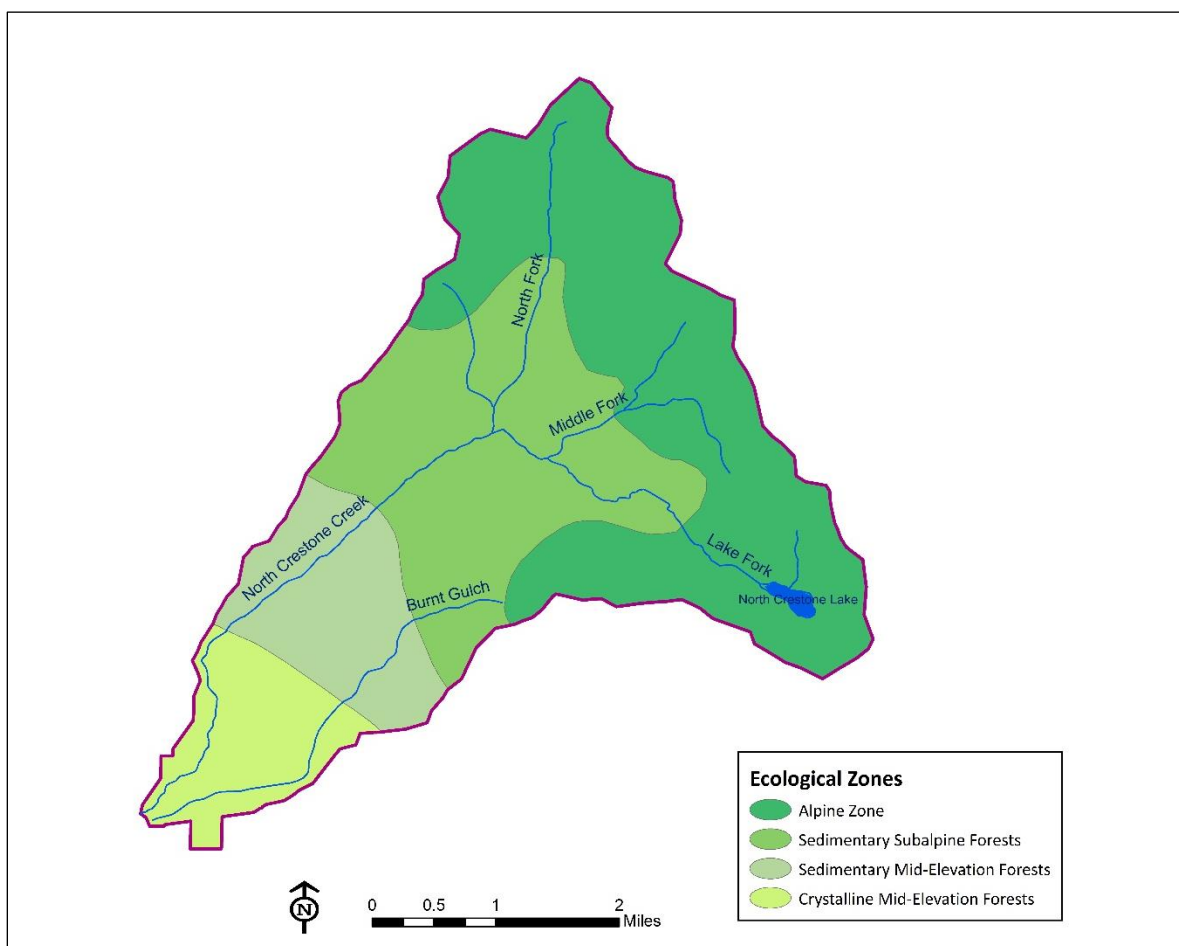


Figure 6. Ecological zones within the source water protection area.

## Soil

Information about the soil types in the lower portion of the source water protection area was available from the Natural Resource Conservation Service Web Soil Survey (Fig. 7). No digital data is available for the upper reaches of the watershed.

- Comodore very stony loam, found on ridges and mountain slopes, is well drained soil with very high runoff capacity. The Ksat (capacity to transmit water) is moderately low to moderately high (0.06 – 0.20 in/hr.).
- Mount Home – Saguache complex soil, found on alluvial terraces and fans, is very cobbly well drained sandy loam. The runoff potential is low and the Ksat is high (2 – 6 in/hr.).
- Jodero-Lolo soil is loam found in drainageways and stream terraces of the alluvium. This soil is well drained with a moderately high to high Ksat (0.60 – 6 in/hr.).
- Cotopaxi sand is found on the ridges and hills of the valley floor of the alluvium. It is excessively drained, has low runoff, and a Ksat high to very high (6 – 20 in/hr.).
- Uracca soil is very cobbly loam is found in the gravelly alluvium. This soil is well drained, has high runoff, and Ksat moderately high (0.2 – 0.6 in/hr.) (NRCS, 2017)

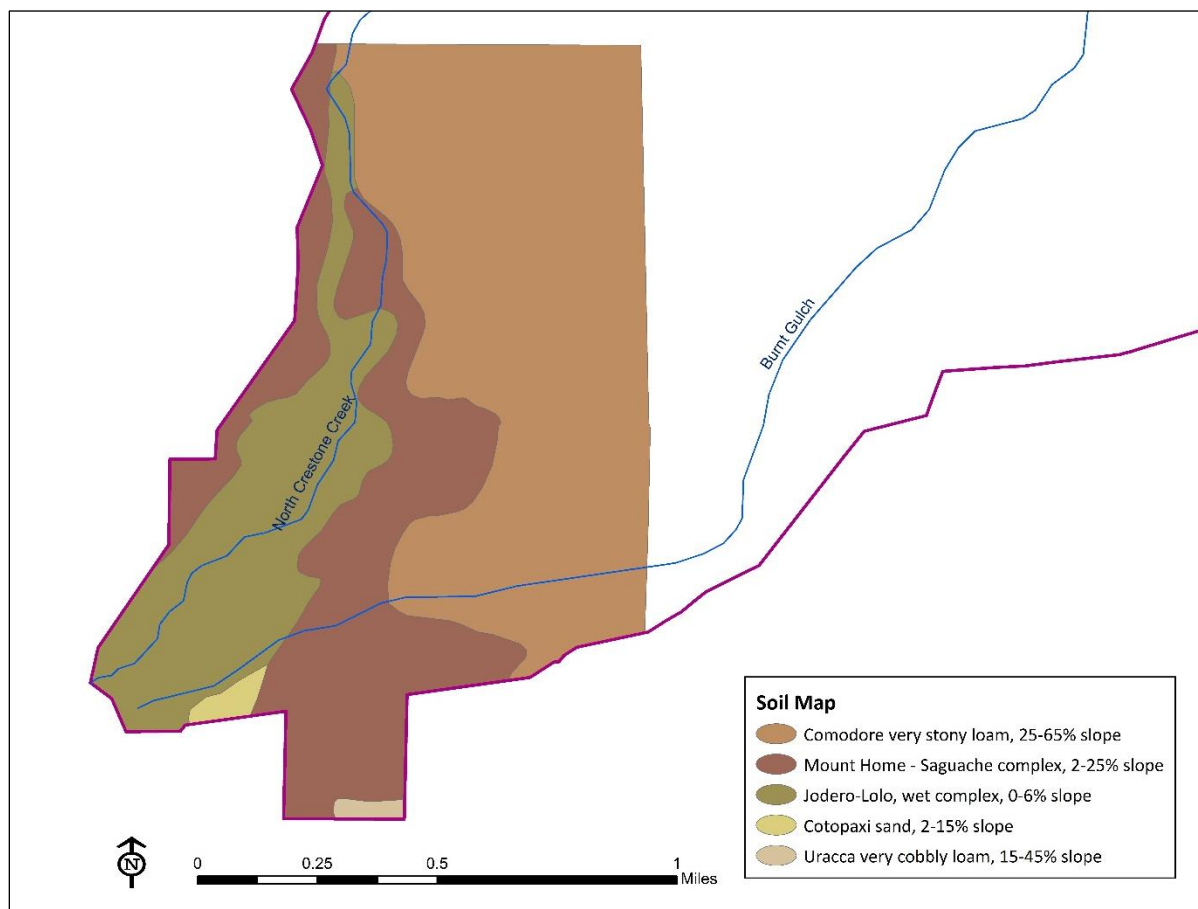


Figure 7. Soil map of the lower portion of the source water protection area.



## Land Owners and Managers

### Private Land

The Source Water Protection Area lies within both public and private lands (Fig. 8). The private land lies with the town of Crestone and the unincorporated areas of Saguache County. Land use decisions on private land within the town of Crestone are made by the Town Board of Crestone. Land use decisions on private land within the unincorporated areas of Saguache County are made by the Saguache County Board of County Commissioners with recommendations from their Planning Commission. The Department of Land Use administers Saguache County's land use regulatory system.

Current land use includes rural residential development, commercial, water supply, hiking, tourism, hunting, fishing, camping, skiing and wildlife habitat.

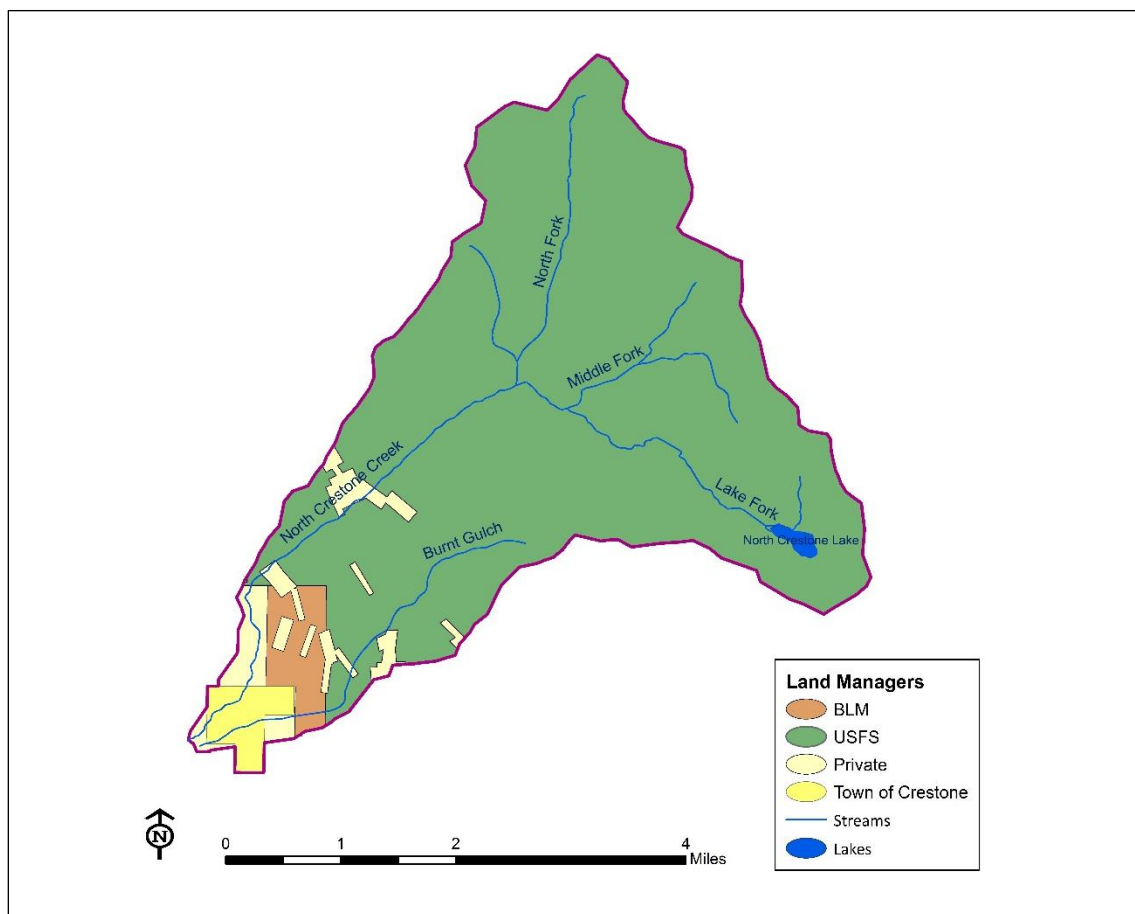


Figure 8. Land owners/managers in the Source Water Protection Area.

## Public Lands

The public lands include land managed by the U.S. Department of Agriculture's Forest Service (USFS) and the U.S. Department of the Interior Bureau of Land Management (BLM). The Rio Grande National Forest land is managed by the Saguache Ranger District whose office is in Saguache, Colorado. The BLM land is managed by the San Luis Valley Field Office located at 1313 U.S. Highway 160, Monte Vista, Colorado.

A principal purpose for which the Forest Reserves (predecessor to the National Forest System) were established was to "secure favorable conditions of water flows" (Organic Act of 1897). Throughout its history, the U.S. Forest Service has had a very diverse and broad mission of multiple use management outlined by the Federal Land Policy and Management Act. The Act requires a balance of outdoor recreation and preservation of wildlife habitat, air and water, and other scenic and historical values with environmentally responsible commercial development of the land and its resources. The USFS mandate to manage lands for multiple-use requires balancing present and future resource use with domestic water supply needs as well as many other needs.

One of the long-term management goals of the Rocky Mountain Region is to manage the forest for water resources:

*"Protect the resource. Maintain, and where opportunities exist, restore watershed and forest health to ensure full watershed function exhibiting high geomorphic, hydrologic, and biotic integrity. Ensure that forest management activities occur in a manner that will adequately protects the integrity of watersheds" (USFS, 2010).*

In October 2009, the Forest Service Rocky Mountain Region and the State of Colorado Department of Public Health and Environment (CDPHE) signed a Memorandum of Understanding (MOU) to establish a framework to work together on issues regarding the management and protection of water quality on state defined Source Water Assessment Areas on National Forest System lands in Colorado. Under this agreement, the Forest Service recognizes a CDPHE-delineated Source Water Area as a "Municipal Supply Watershed" per definition in USFS Manual 2542 (FSM, 2007). Municipal watersheds are to be managed under multiple use prescriptions as specified in the Rio Grande National Forest Land and Resource Management Plan (Forest Plan). The need to protect public water supplies is to be recognized when developing management area prescriptions. The MOU was updated in 2014 and included in the Appendices of this report (MOU, 2014).

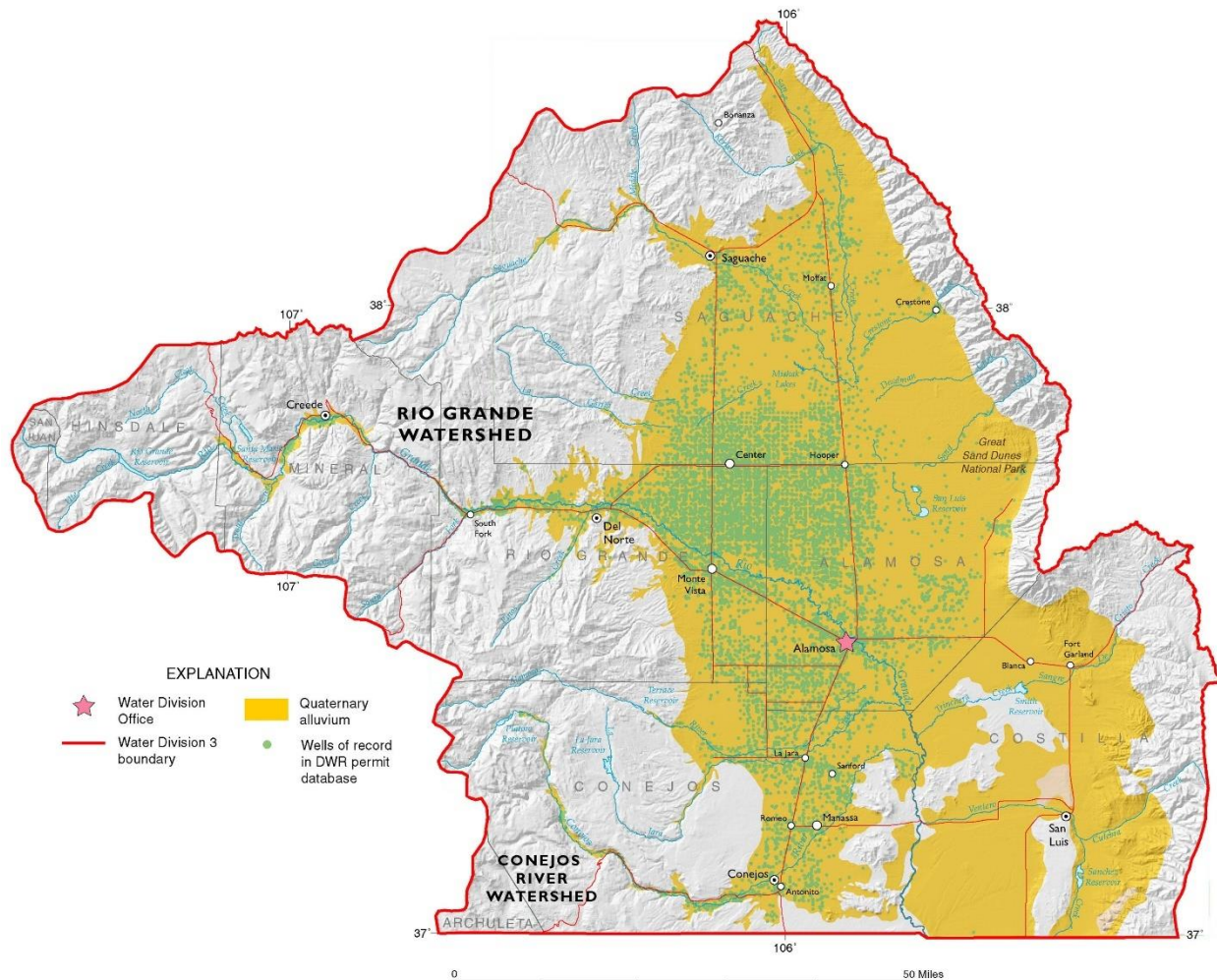
## Management Plans

At the district level, the Saguache Ranger District adheres to the management directives established under the 1996 Revised Land and Resource Management Plan (currently under revision) for the Rio Grande National Forest. The San Luis Valley Field Office adheres to the management directives under the 1991 San Luis Resource Area Resource Management Plan.

# WATER QUALITY

## Hydrologic Setting

The Town of Crestone obtains its drinking water supply from ground water wells in the North Crestone Creek and Burnt Gulch alluvium. The source water protection area lies within the subregions of the Rio Grande watershed in the San Luis Valley (Hydrologic Unit Code 130100030501) which drains approximately 15.7 square miles (10,048 acres). The Rio Grande River basin encompasses approximately 7,500 square miles within Colorado. Management of waters within this basin is under the jurisdiction of the Colorado Division of Water Resources, Division 3 of the State Engineer's Office and Water Court located in Alamosa, Colorado (Fig. 9). (DWR, 2017).



SOURCE: GROUND WATER ATLAS OF COLORADO

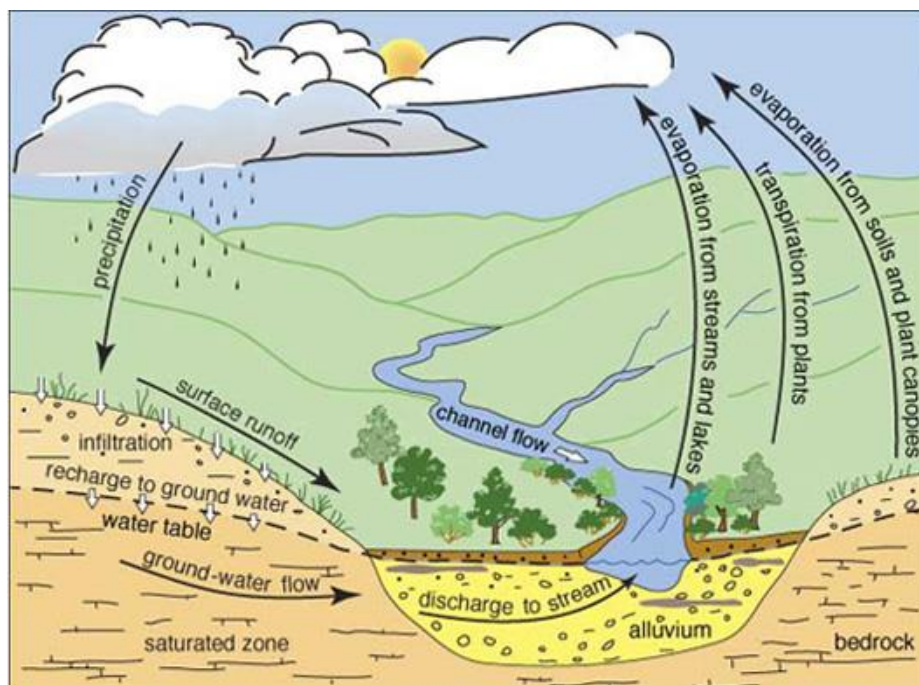
Figure 9. Map of the Rio Grande River Basin in Colorado.

## Ground Water Source: North Crestone Creek and Burnt Gulch Aquifer

The Town of Crestone's drinking water source is from ground water from the North Crestone Creek and Burnt Gulch watersheds. Headwaters for North Crestone Creek and Burnt Gulch originate in the eastern slopes of the Sangre de Cristo Mountains and flow westward into the northern San Luis Valley's closed basin.

Runoff from the North Crestone Creek and Burnt Gulch watersheds recharges the groundwater in the alluvial aquifer which supplies the Town of Crestone's wells. An aquifer is a groundwater reservoir composed of soil and rock that are saturated with water and sufficiently permeable to yield water in a usable quantity to wells and springs. Aquifers provide two principal functions: 1) they transmit ground water from areas of recharge to areas of discharge, and 2) they provide a storage medium for useable quantities of ground water. An alluvial aquifer is an aquifer with materials deposited by a stream over geologic time and that retains a hydrologic connection with the depositing stream. Alluvial aquifers (alluvium) are generally composed of clay, silt, sand, gravel or similar unconsolidated material.

The alluvial aquifer of North Crestone Creek and Burnt Gulch is an unconfined aquifer. An unconfined aquifer is open to receive water from the surface, and whose water table surface is free to fluctuate depending on the recharge and discharge rate. There is no overlying "confining beds" to physically isolate the groundwater system (Fig. 10).



SOURCE: HEITMAN, 2016.

Figure 10. An alluvial aquifer is an aquifer with geologic materials deposited by a stream and that retains a hydrologic connection with the depositing stream.



## Groundwater Protection

Groundwater protection is managed as two separate issues of quantity and quality in Colorado. Quantity issues are managed through the Colorado Division of Water Resources/Office of the State Engineer. The Division of Water Resources administers and enforces all surface and groundwater rights throughout the State of Colorado, issues water well permits, approves construction and repair of dams, and enforces interstate compacts. The Division of Water Resources is also the agency responsible for implementing and enforcing the statutes of the Groundwater Management Act passed by the Legislature as well as implementing applicable rules and policies adopted by the Colorado Groundwater Commission and the State Board of Examiners of Water Well Construction and Pump Installation Contractors.

Under the Clean Water Act, every state must adopt water quality standards to protect, maintain and improve the quality of the nation's surface waters. Water quality is protected under the Colorado Water Quality Control Act through several state agencies. The Colorado Department of Public Health and Environment is the lead agency. The Colorado Water Quality Control Commission is responsible for promulgating groundwater and surface water classifications and standards. Colorado's Water Quality Control Commission has established basic standards for groundwater regulations that apply a framework for groundwater classifications and water quality standards for all waters within their jurisdictions

### Groundwater Contaminants

Many types of land uses have the potential to contaminate source waters: spills from tanks, trucks, and railcars; leaks from buried containers; failed septic systems; buried or injection of wastes underground; use of fertilizers, pesticides, and herbicides; road salting; as well as urban and agricultural runoff (Fig. 11). While catastrophic contaminant spills or releases can wipe out a water resource, groundwater degradation can result from a plethora of small releases of harmful substances. According to the U.S. EPA, nonpoint-source pollution (when water runoff moves over or into the ground picking up pollutants and carrying them into surface and groundwater) is the leading cause of water quality degradation (GWPC, 2008).

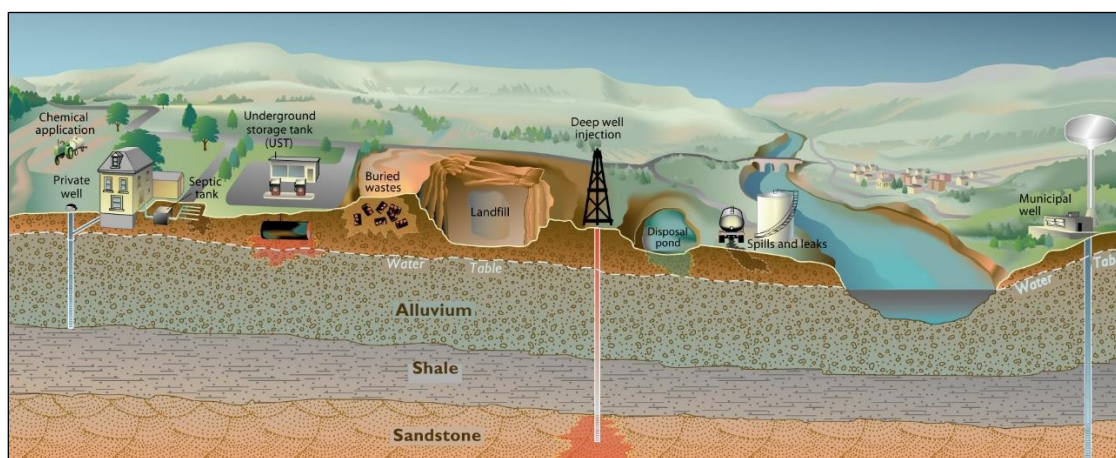


Figure 11. Schematic drawing of the potential source of contamination to surface and groundwater.

## Drinking Water Supply Operations

### Water System Information

The Town of Crestone operates a municipal water supply system that provides drinking water to the 150 residents, visitors, and 1200 commercial users of Crestone, Colorado. Additional visiting consumers increase in the summer and lessen in the winter season. The Town's water system consists of three groundwater wells, water treatment, storage, and distribution facilities. The size of the service area is approximately 0.38 square miles.



Figure 12. Crestone is a small rural incorporated town established in 1902.

The Town has seven groundwater wells, four of which are used as drinking water sources. Three of the wells are part of the Town's water system (Wells 2, 3, 2RA). Wells #2 and #3 are drilled into the North Crestone Creek alluvial aquifer. Well #2RA is drilled into the Burnt Gulch alluvial aquifer. Well #1 supplies water to the Community Center only and is not connected to the Town's delivery system. Well #5 was an open well and recently capped. Well casings have perforated pipes at intervals (Table 4). This is the level that water from the alluvium is drawn into the well. The cone of depression, the area around each well that water is drawn from when pumping occurs, is typically a 200-foot diameter around each wellhead. The cone of depression expands outward from a pumped well until it reaches the nearest point at which ground water recharge is encountered (a "recharge boundary"). The closed recharge boundary for wells 2 and 3 is North Crestone Creek, while well 2RA is Burnt Gulch.

Table 4. Well Data

Well Name	State Engineers Permit No.	WDID No.	Total Depth of Well (ft.)	Perforated Pipe (ft.)	Year Drilled
Well #1 (Community Center Well)	59487-F	2505444	42	15-42	1988
Well #2	62140-F (58135-F)	2505510	150	35-50; 110-150	2003
Well #3 (Merc Well)	45333-F-R	2505005	170	140-170	1999
Well #2RA (Abrams Well)	65046-F	2505508	222	170-222	2006
Well #4 (Town Hall)	156839-A		200	180-200	2004
Well #5 (Little Pearl Park)	221170		15		1970
Well #6 (Black Bear Park)	47564-F		25	15-25	1988

Raw water from the Wells # 2, #2RA, and #3 is pumped to the well house and disinfected with liquid sodium hypochlorite (bleach). Treated water is pumped through transmission line to the Town's storage tanks. The Town has one storage tank with the capacity of approximately 116,000 gallons.

The treated water is distributed via gravity, and with added pressure from a 2 horsepower pump to maintain distribution system pressure between 30-40 psi as it leaves the Water Treatment Plant. From the storage tank to customers, water is delivered via a network of 2.16 miles of underground pipes to 42 service connections or taps, including restaurants and the school.

The Town of Crestone provides an Annual Drinking Water Quality Report to the public that provides information on the results of their water monitoring program. The Consumer Confidence Report for calendar year 2016 will be posted outside at the Town Hall and at the Post Office.

#### Water Supply Demand Analysis

The Town of Crestone water system currently has the capacity to produce about 76,320 gallons per day. Water usage in 2016 was 2,326,500 gallons (7.14-acre foot), with an average daily demand of 5,872 gallons per day. Peak use is during the summer with a highest of 15,000 gallons per day and lowest in winter with 4,500 gallons per day (Bunting, 2017).

The Town of Crestone has evaluated its ability to meet the average daily demand of its customers in the event the water supply, or its water source, becomes disabled for an extended period due to potential contamination. The Town of Crestone may not be able to meet the average daily demand of its customers if its water source became disabled for an extended period, depending on the groundwater supply as well as the amount of treated water in storage at the time a water source becomes disabled.

The Town of Crestone recognizes that potential contamination of its groundwater source could potentially result in having to significantly increase the treatment of the water and/or abandon the water source if treatment proves to be ineffective or too costly. The potential financial costs associated with such an accident could cost funds beyond what the town has at this time.

The potential financial and water supply risks related to the long-term disablement of the community's water source are a concern to the steering committee. As a result, the steering committee believes the development and implementation of a source water protection plan for Town of Crestone can help to reduce the risks posed by potential contamination of its water source. Additionally, the Town of Crestone will develop a contingency plan to coordinate rapid and effective response to any emergency incident that threatens or disrupts the community water supply.

#### Water Supply Protection District

In 2009, the Town of Crestone passed an ordinance establishing a water supply protection district to protect the municipal water supply. The purpose of establishing the District is to protect the municipal waterworks from injury and the municipal supply from pollution, pursuant to the authority granted to municipalities by Section 31-15-707(1)(b), C.R.S. The boundaries of the District include a five-mile area that contributes to the well field supplying the Town's waterworks (Crestone, 2009).

# SOURCE WATER PROTECTION PLAN DEVELOPMENT

## Source Water Assessment Report Review

The Town of Crestone received their Source Water Assessment Report from the Colorado Department of Public Health and Environment in November 2004. During the Source Water Protection stakeholder meetings, the assessment report was reviewed and used as a starting point to guide the development of this Source Water Protection Plan. A copy of the Source Water Assessment Report for the Town of Crestone can be obtained by downloading a copy from the CDPHE's SWAP program website located at:  
<http://www.colorado.gov/cs/Satellite/CDPHE-WQ/CBON/1251596793639>.

## Defining the Source Water Protection Area

The State's Assessment Report included a delineated source water assessment area for the Town of Crestone's ground water sources. Delineation is the process used to identify and map the area around a pumping well that supplies water to the well or spring, or the drainage basin that supplies water to a surface water intake. The size and shape of the area depends on the characteristics of the aquifer and the well, or the watershed. The delineated source water assessment area provides the basis for understanding where the community's source water and potential contaminant threats originate.

The steering committee reviewed the state's delineated source water assessment area for the Town of Crestone's groundwater source and decided to add additional protection areas to include the watersheds recharging their groundwater wells. The source water protection area includes the North Crestone Creek and Burnt Gulch watersheds (15.7 square miles) and Crestone's Town boundary. This protection area is where the community has chosen to implement its source water protection measures to decrease risk to their source water from potential contamination.

## Source Water Protection Zones

The source water protection area includes the following protection areas (Fig. 13 and 14):

1. **Zone 1** – This area includes a 500-foot radius around each of the groundwater source. This is the most sensitive and critical area to protect from potential sources of contamination.
2. **Zone 2** – This area includes the town boundaries for the Town of Crestone.



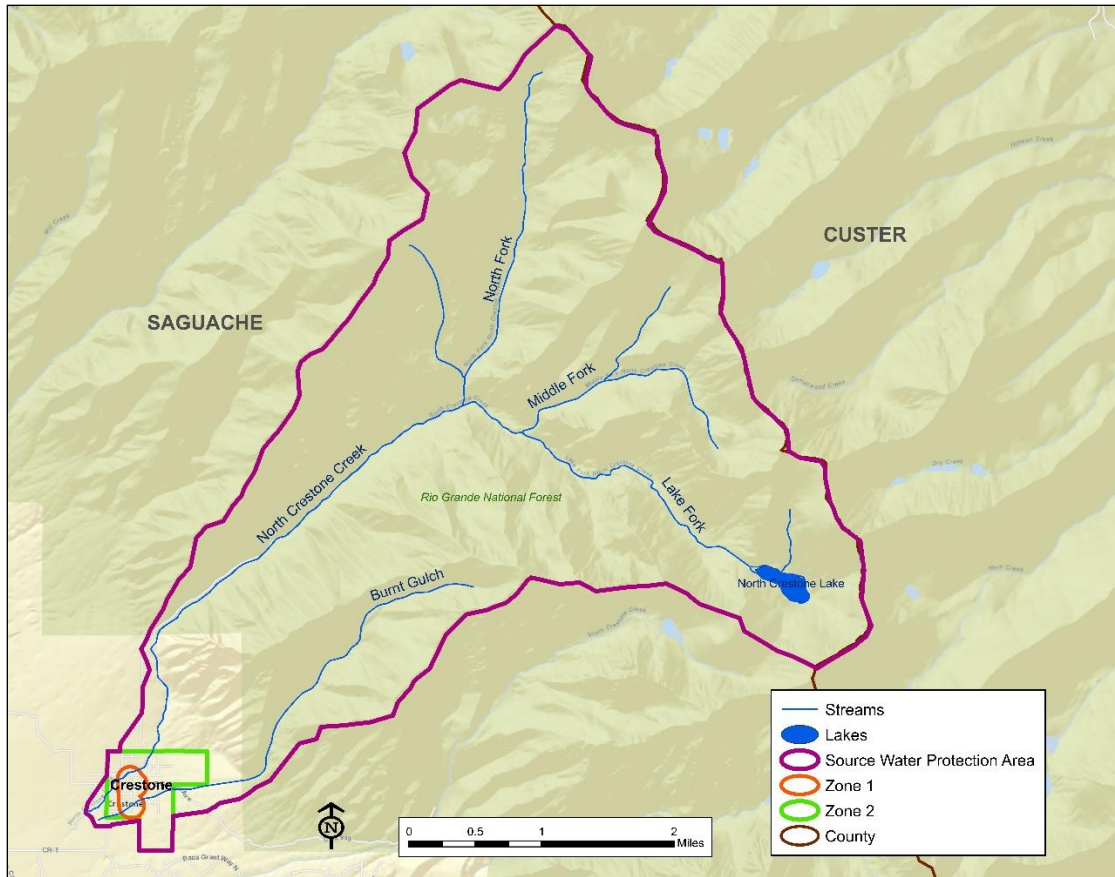


Figure 13. Map of the Town of Crestone's Source Water Protection Area.

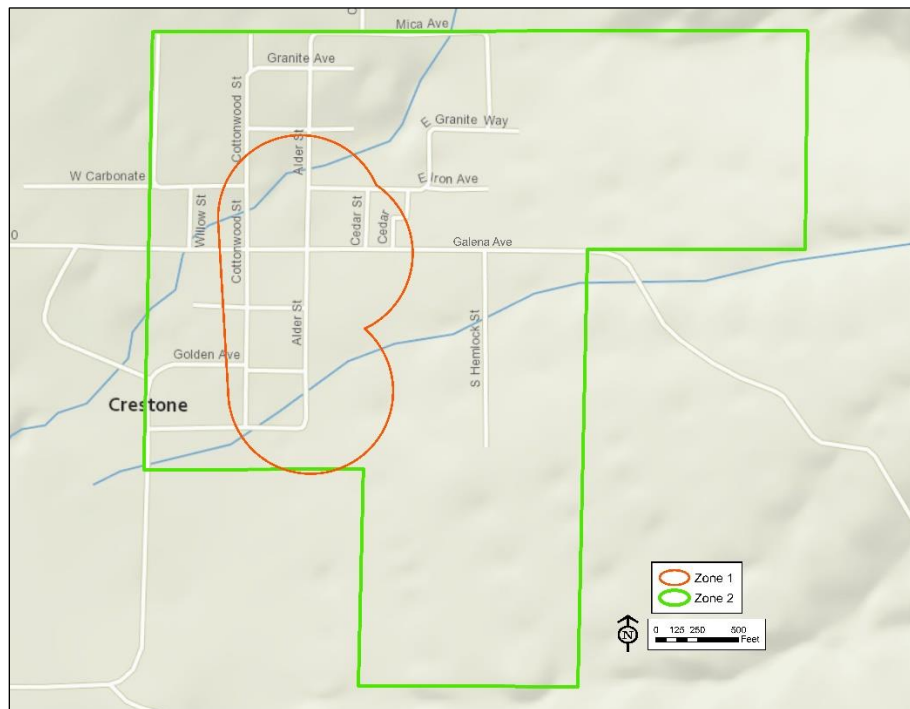


Figure 14. Map of the Source Water Protection Area within the Town of Crestone.

## Potential Contaminant Source Inventory

The State's Source Water Assessment Report identified potential sources of contamination (PSOCs) that might be present within the source water assessment area. The steering committee conducted a more accurate and current contaminant source inventory of the source water protection area. This report will only reflect the current inventory.

Discrete contaminant sources (point sources) were inventoried using selected state and federal regulatory databases including: mining and reclamation, oil and gas operations, above and underground petroleum tanks, Superfund sites, hazardous waste generators, solid waste disposal, industrial and domestic wastewater dischargers, solid waste sites, and water well permits. Dispersed contaminant sources (nonpoint sources) were inventoried using recent land use, land cover and transportation maps of Colorado. A table of Contaminants Associated with Common PSOCs is included in the Appendices of this report. The steering committee identified the following potential contaminant source that may impact the Town of Crestone's wells: active and abandoned wells, gas station, security and vandalism, roads and spills, wildfire and wildfire suppression, water scarcity and resulting water quality, residential practices, septic systems, forest health and post-fire effects, commercial operations, abandoned mines, and mosquito abatement

## Priority Strategy

The steering committee used the SWAP Risk Assessment Matrix developed by CRWA to prioritize the potential contaminant sources and issues of concern (Fig. 15).

		Risk				
Probability of Impact	Certain	Low	Moderate	High	Very High	Very High
	Likely	Low	Moderate	High	High	Very High
	Possible	Low	Moderate	Moderate	High	High
	Unlikely	Very Low	Low	Moderate	Moderate	Moderate
	Rare	Very Low	Very Low	Low	Low	Low
		Impact to Water System				
		Insignificant	Minor	Significant	Major	Catastrophic

Figure 15. CRWA's SWAP Risk Assessment Matrix.

Using SWAP Risk Assessment Matrix, the steering committee considered the following criteria when estimating the risk of each issue of concern.

1. **Impact to the Public Water System** – The risk to the source waters increases as the impact to the water system increases. The impact is determined by evaluating the human health concerns and potential volume of the contaminant source. The following descriptions provide a framework to estimate the impact to the public water system.

- **Catastrophic** - irreversible damage to the water source(s). This could include the need for new treatment technologies and/or the replacement of existing water source(s).
- **Major** - substantial damage to the water source(s). This could include a loss of use for an extended period and/or the need for new treatment technologies.
- **Significant** - moderate damage to the water source(s). This could include a loss of use for an extended period and/or the need for increased monitoring and/or maintenance activities.
- **Minor** - minor damage resulting in minimal, recoverable, or localized efforts. This could include temporarily shutting off an intake or well and/or the issuance of a boil order.
- **Insignificant** - damage that may be too small or unimportant to be worth consideration, but may need to be observed for worsening conditions. This could include the development of administrative procedures to maintain awareness of changing conditions.

2. **Probability of Impact** – The risk to the source waters increases as the relative probability of damage or loss increases. The probability of impact is determined by evaluating the number of contaminant sources, the migration potential or proximity to the water source, and the historical data. The following descriptions provide a framework to estimate the relative probability that damage or loss would occur within one to ten years.

- **Certain:** >95% probability of impact
- **Likely:** >70% to <95% probability of impact
- **Possible:** >30% to <70% probability of impact
- **Unlikely:** >5% to <30% probability of impact
- **Rare:** <5% probability of impact

The steering committee determined where each issue of concern is located within the source water protection area (i.e., Zone 1, 2, 3). This determination of location in conjunction with the estimation of risk to the source water, helped guide the prioritization of the issues of concern in a way that best fits the needs and resources of the community.

### Priority Ranking

The Steering Committee ranked the potential contaminant source inventory and issues of concern in the following way (Table 4).

Table 4. Potential Contaminant Source Prioritization using SWAP Risk Assessment Matrix

Potential Source of Contamination or Issue of Concern	Proximity (SWPA Zone)	Impact to Water System (Insignificant, Minor, Significant, Major, Catastrophic)	Probability of Impact (Rare, Unlikely, Possible, Likely, Certain)	Risk (Very Low, Low, Moderate, High, Very High)	Priority Ranking
Active/Abandoned Wells	1, 2, 3	Major	Possible	High	High
Gas Station	1	Catastrophic	Possible	High	High
Security/Vandalism and Physical Protection of wells	1	Catastrophic	Possible	High	High
Roads and Spills	1, 2, 3	Catastrophic	Unlikely	Moderate	High
Wildfire and Wildfire Suppression	2, 3	Minor	Possible	Moderate	High
Septic Systems	1, 2	Major	Possible	High	High
Water Scarcity and Resulting Water Quality	1, 2, 3	Catastrophic	Possible	High	Medium
Residential Practices	1, 2	Significant	Unlikely	Moderate	Medium
Forest Health and Post Fire Effects	2, 3	Significant	Possible	Moderate	Low
Commercial Operations	1, 2	Minor	Unlikely	Low	Low
Abandoned Mines	2, 3	Insignificant	Rare	Very Low	Low
Mosquito Abatement	1, 2	Insignificant	Rare	Very Low	Low

## DISCUSSION OF POTENTIAL CONTAMINANTS AND ISSUES OF CONCERN

The following section provides a description of the potential contaminant sources or issues of concern that have been identified in this plan, describes the way in which they threaten the water sources and outlines best management practices. The purpose of this section is as a guidance document to understand the issues.

### Roads and Spills

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The source water protection area is accessed by a network of paved and gravel rural roads. The town's wells are in close proximity to these roads as well as a commercial parking lot. Vehicular spills may occur along the transportation routes within the protection area from trucks that transport fuels, waste and other chemicals that have a potential for contaminating the groundwater. Parked vehicles within the protection area may leak hazardous fluids onto the ground, including oil, brake fluid and antifreeze. Runoff from roads and parking areas has a high concentration of toxic metals, suspended solids, and hydrocarbons, which originate largely from vehicles (Gowler and Sage, 2006). Storm water runoff over these roads can deliver contaminants from the road surface into the nearby groundwater.

Accidental spills of small amounts of contaminants may not be detected or reported and are often diluted with rainwater or snowmelt, potentially washing the chemicals into the soil or nearby waterways. Large spills require immediate emergency response from the local fire department to ensure contaminants do not enter the source waters.

A release of any chemical, oil, petroleum product, sewage, etc., which may enter waters of the state of Colorado (which include surface water, ground water and dry gullies and storm sewers leading to surface water) must be reported immediately to CDPHE. Spills and incidents that have or may result in a spill along a highway must be reported to the nearest law enforcement agency immediately. The Colorado State Patrol and CDPHE must also be notified as soon as possible (CDPHE, 2009).

#### **Roads and Spills Recommendations:**

1. Develop an Emergency Notification card and share with Emergency Responders and other transit companies to ensure that the Crestone Water Department is notified of spills quickly enough to shut off the wells to minimize impacts from the spill
2. Maintain current PWS contact information, on an annual basis, with Emergency Responders to improve notification of spill response activities.
3. Install "Source Water Protection Area" signs at strategic locations throughout the source water protection area.

## Wildland Fire

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The forests throughout Colorado are dense with fuel build-up from a century of fire suppression and thus more vulnerable to high-intensity fires than it was historically. The entire Rocky Mountain region has been plagued with wildfires in the past several years and has consistently ranked as the most severe problem facing the state's counties. The wildfire situation has been exacerbated by the onset of severe drought conditions for much of this decade throughout the western U.S.

There are three major factors that sustain wildfires and predict a given area's potential to burn. These factors are fuel, topography, and weather. Fuel is the material that feeds a fire and is a key factor in wildfire behavior. Fuel is generally classified by type and by volume. Fuel sources are diverse and include everything from dead tree debris to live trees, brush and dried grasses. Topography, or an area's terrain and land slopes, affects its susceptibility to wildfire spread. Both fire intensity and rate of fire spread increases as slope increases due to the convection of heat. Weather components such as temperature, relative humidity, wind, and lightning also affect the potential for wildfire. High temperatures and low relative humidity dry out the fuels that feed the wildfire creating a situation where fuel will more readily ignite and burn more intensely (Saguache County, 2010).

### Community Wildfire Protection Plan

The Town of Crestone lies within the Northern Saguache Fire Protection District (NSFPD). In 2007, NSFPD completed a Community Wildfire Protection Plan (CWPP) to address issues such as wildfire response, hazard mitigation, community preparedness, and structure protection. The Plan identifies fifteen Wildland Urban Interface (WUI) areas within the NSFPD. The wildland urban interface is another term describing the geographical area where structures and other human development meet or intermingle with wildland vegetative fuels. Each of these WUIs was ranked by risk for wildfire. The Town of Crestone was ranked as a high-risk wildfire hazard area based on slope, aspect and vegetation (Fig. 10) (NSFPD, 2007). The Plan identifies mitigation strategies for the Town of Crestone to implement to decrease risk from wildfire.

### Water Quality Effects from Fire

The degree to which wildfire degrades water quality and supply depends on wildfire extent and intensity, post-wildfire precipitation, watershed topography, and local ecology. Wildfires create hydrophobic soils, a hardening of the earth's surface that prevents rainfall from being absorbed into the ground.

Potential effects of wildfire on municipal water supplies include the following:

- Increase in runoff over devegetated slopes and reduced infiltration rates,
- Changes in magnitude and timing of groundwater recharge of the aquifer,
- Increased loading of nutrients (nitrogen and phosphorus), dissolved organic carbon (DOC), major ions, and metals,

- Post-fire erosion and transport of sediment and debris to water resources, and
- Changes in source-water chemistry that can alter drinking water quality (Writer & Murphy, 2012).

Post-fire impacts to water quality occurred during “first flush” storm events, snowmelt, and high intensity thunderstorms. Thunderstorms can transport substantial amounts of sediment and debris from hillslopes of the burned area into the source waters. Even though the Town of Crestone’s drinking water source is from the alluvial aquifer, there may be a potential for impact to the shallow groundwater from a catastrophic wildland fire in the nearby watershed.

The chemicals used in fire retardants can also be a source of contamination should they migrate through runoff into drinking water supplies. The degree of contamination is controlled by the size of the burned area, distance to surface water, remaining vegetation cover, terrain, soil erosion potential, and subsequent precipitation and intensity (Walsh Environmental, 2012).

#### **Wildland Fire Recommendations:**

1. Work with the fire department to determine if defensible space should be increased around all Crestone water system structures.
2. Provide a copy of the final Source Water Protection Plan along with GIS shapefiles of the source water protection area to US Forest Service, BLM, the local Fire Protection District, and the Saguache County Office of Emergency Management for consideration during fire suppression as well as when planning and implementing wild land fire mitigation projects.
3. During a fire event, provide the Incident Commander with source water protection area maps to allow them to apply fire retardant according to the US Forest Service’s “Implementation Guide for Aerial Application of Fire Retardant” and the “Aerial Application of Fire Retardant and Foam: Avoidance Areas.” The Fire Manager will:
  - Maintain a minimum 300-foot avoidance area on either side of all intermittent and perennial streams where water is flowing.
  - Avoid aerial application of fire retardant or foam within 300 feet of waterways. A waterway is defined as a body of water including lakes, rivers, streams and ponds whether or not they contain aquatic life.
4. Participate in fire suppression efforts and communicate source water protection goals with the Incident Commander to adjust suppression tactics to minimize post-fire effects (erosion control, reseeding, debris traps).
5. Collaborate with Federal Land Agencies on post fire mitigation projects to minimize the impact of a fire to the Town water system.

## Water Scarcity

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Water scarcity or drought is shortage of water associated with a deficiency of precipitation, and occurs when a normal amount of moisture is unavailable to satisfy an area's usual water consumption. Drought occurs slowly, over a multi-year period and its effects can last for years. Drought is a regional event, sometimes impacting multiple states simultaneously.

The 2015 calendar year was the warmest on record globally, the second warmest on record nationally and the third warmest on record in Colorado. Colorado ended the year 2.9 degrees Fahrenheit above the 100-year average for temperature (CWCB, 2016). Climate models project Colorado will warm by four degrees by 2050. This, combined with a seasonal shift in precipitation, warmer spring temperatures, and increase evaporation rates, will result in an impact to Colorado's water resources (CWCB, 2008). Variability in weather is projected to increase due to climate change. More frequent extreme weather events such as drought, flood and early runoff are expected. This will put a strain on infrastructure and require different policies than with the more consistent climate that Colorado has experienced in the past (DiNatale, 2014).

Drought conditions may result in both short term and long-term impacts. To appropriately address and reduce drought-related impacts, it is imperative for community water providers throughout the state to anticipate and plan for droughts and a loss of drinking water supply. The Colorado Water Conservation Board recommends that water providers develop a Drought Mitigation Plan to preserve essential public services and minimize the adverse effect of a water supply emergency. The drought plan would identify actions and procedures for responding to a drought-related water supply shortage before an actual water supply emergency occurs.

### **Water Scarcity Recommendations:**

1. Develop a process to measure and track static water levels in the Town's wells.
2. Work with local agencies and neighboring water systems to observe for worsening conditions (aquifer levels and water quality).
3. Stay informed on the effects of future climate changes and impacts to the water sources
4. Prepare plans for rapid response to severe drought and implement water conservation measures as needed.



## Gas Station: Underground Storage Tanks

There is one permitted active fuel storage tank site with two underground storage tanks (UST) within Zone 1 of the source water protection area (Table 5). Information on the status of the Underground Storage Tank was obtained from the Colorado Department of Labor and Employment Division of Oil and Public Safety's database via their Colorado Storage Tank Information (COSTIS) website at <http://costis.cdle.state.co.us>.

Table 5. Storage Tank Site Information

Tank Site	Tank ID	Owner	Spill Event	Information
Crestone General Store 200 Cottonwood Street	391	Pi Energy	2008	2 UST currently in use

### Storage Tank Spills

The underground storage tank site in the source water protection area had a spill in 2008 which was recorded by COSTIS as a Confirmed Release. The spill was caused from corrosion of the dispenser at the site. After the spill, a site characteristic report and monitoring report was completed and the case closed in 2011. A release means any spilling, leaking, emitting, discharging, escaping, leaching, or disposing of a regulated substance from a storage tank into groundwater, surface water or soils. The owner/operator must report a suspected release within 24 hours and investigate suspected releases within seven days. After confirming a release and conducting the initial response and abatement, the owner/operator must continue further source investigation, site assessment, characterization and corrective actions.

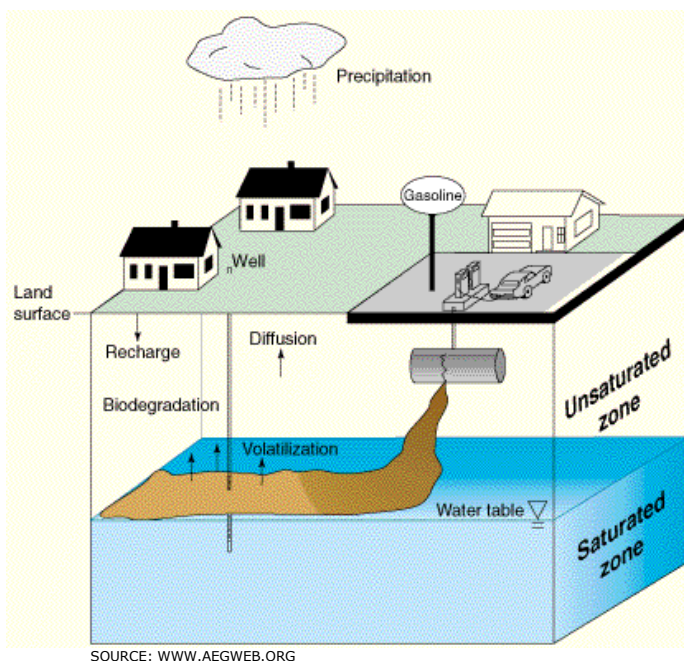


Figure 16. Schematic of a LUST spill site

The leaky underground storage tank (LUST) releases gasoline or "liquid phase hydrocarbon." The gasoline descends through the unsaturated soil zone to float on the water table (gasoline is lighter than water) (Fig. 16). The gasoline releases compounds like benzene, toluene, ethylbenzene, and xylenes (BTEX) and methyl tert-butyl ether (MTBE) to the groundwater and they are carried in the direction of groundwater flow. The extent of contamination is defined by the concentration of benzene (from 10 to 10,000 parts per billion) in the groundwater. The most hazardous compounds in groundwater (the BTEX compounds) are quite volatile and carcinogenic.

**Gas Station Recommendations:**

1. Share maps, shapefiles, and contact information with the Division of Oil and Public Safety and the Colorado Department of Public Health and Environment so that the public water system can be notified of spill events in a timely manner.
2. Meet with the owner of the local gas station to distribute maps of the source water protection area and to open channels of communication to facilitate timely notification in the event of a spill.

## Security and Vandalism

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The security of the Town of Crestone's wells and potential for vandalism has been identified as a risk by the Steering Committee. Vandalism could endanger the water supply even though measures have been taken to protect the area. No incidents of this nature have ever occurred; however, it is a potential that should be considered.

Bioterrorism or chemical attacks could deliver widespread contamination with small amounts of microbiological agents or toxic chemicals, and could endanger the public health. While some experts believe that risks to water systems are small, because it would be difficult to introduce sufficient quantities of agents to cause widespread harm, heightened awareness of the potential is a prudent source water protection practice. Factors that are relevant to a biological agent's potential as a weapon include its stability in a drinking water system, virulence in the quantity required, and resistance to detection and treatment (Copeland, 2010).

**Security and Vandalism Recommendations:**

1. Look for ways to improve security on all wellheads, storage tank, and critical equipment (e.g. locks on wellheads, fencing around the tank, security cameras).
2. Consider placing boulders near the wellheads for physical protection.
3. Remain vigilant to recognize if/when vandalism/tampering occurs.
4. Install Drinking Water Protection Area signs at strategic locations throughout source water protection area.
5. Share Source Water Protection Plan and maps with local law enforcement and request regular patrol of the area around the wells.

## Septic Systems

Household wastewater in Crestone is disposed of by either the wastewater collection system or individual sewage disposal system. There are about 24 private residential properties within the SWPA that rely on onsite wastewater treatment systems (OWTS) to dispose of their sewage. A septic system is a type of OWTS consisting of a septic tank that collects all the sewage and a leach field that disperses the liquid effluent onto a leach field for final treatment by the soil (Fig. 17).

Some older properties may have cesspools, the forerunners to the modern septic system. “Cesspool” means an unlined or partially lined underground pit or underground perforated receptacle into which raw household wastewater is discharged and from which the liquid seeps into the surrounding soil. Cesspool does not include a septic tank (Jefferson County, 2014).

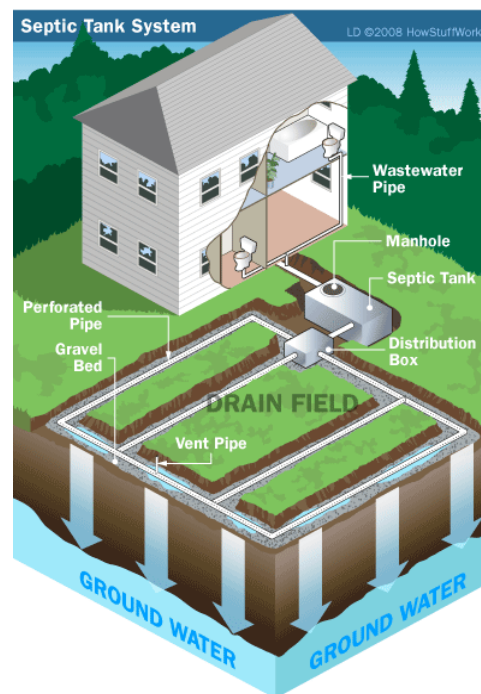


Figure 17. Septic system

Septic systems are the second most frequently cited source of groundwater contamination in our country. Unapproved, aging, and failing septic systems have a significant impact on the quality and safety of the water supply. The failure to pump solids that accumulate in the septic tank will also eventually clog the lines and cause untreated wastewater to back up into the home, to surface on the ground, or to seep into groundwater. If managed improperly, these residential septic systems can contribute excessive nutrients, bacteria, pathogenic organisms, and chemicals to the groundwater.

In Saguache County, onsite wastewater treatment systems are permitted by their Land Use Department. The County administers and enforces the minimum standards, rules, and regulations outlined in the state of Colorado’s Revised Statutes (CRS 25-10-105).

### Septic System Recommendations:

1. Collaborate with the County to provide educational materials to property and residents within the SWPA on the proper use and maintenance of their septic systems and how the source of their drinking water can be affected by an inadequate functioning septic system.
2. Consider sampling raw well water on a regular basis to detect significant events and changing conditions.
3. Collaborate with the County Land Use Department to locate and map all the active (and potentially inactive) septic systems within the Town. Perhaps this will be done at the same time that active/abandoned wells are inventoried.

## Waste Water System

Most of the Town of Crestone is hooked up to a wastewater collection system which is piped to the Baca Grande Water and Sanitation District's Wastewater Treatment Plant outside of the Town's limits. The wastewater collection system in Crestone was constructed in 2002 and is hooked up to about 79 households and buildings (74 currently in use).

Sanitary sewer systems are designed to collect and transport to wastewater treatment facilities the municipal and industrial wastewaters from residences and commercial buildings. Over the years, many of these systems have experienced major infrastructure deterioration due to inadequate preventative maintenance and replacement programs. These conditions have resulted in deteriorated pipes, manholes, and pump stations that allow sewage to exit the systems (exfiltration) and contaminate adjacent ground and surface waters (Fig. 18). Untreated sewage often contains high levels of suspended solids, pathogenic microorganisms, toxic pollutants, nutrients (nitrogen), oxygen-demanding organic compounds, oil and grease, and other pollutants (Amick and Burgess, 2000).

Sewer leaks can occur from tree root invasion, soil slippage, seismic activity, loss of foundation due to washout, flooding and sewage back up, among other events. High pressure systems will push leaks to the soil surface where they can be easily detected by sight or odor. Systematic inspection of sewer lines, exclusion of hazardous waste, and adherence to modern construction and maintenance specifications are necessary preventative measures for protection of groundwater sources from sewer leaks.

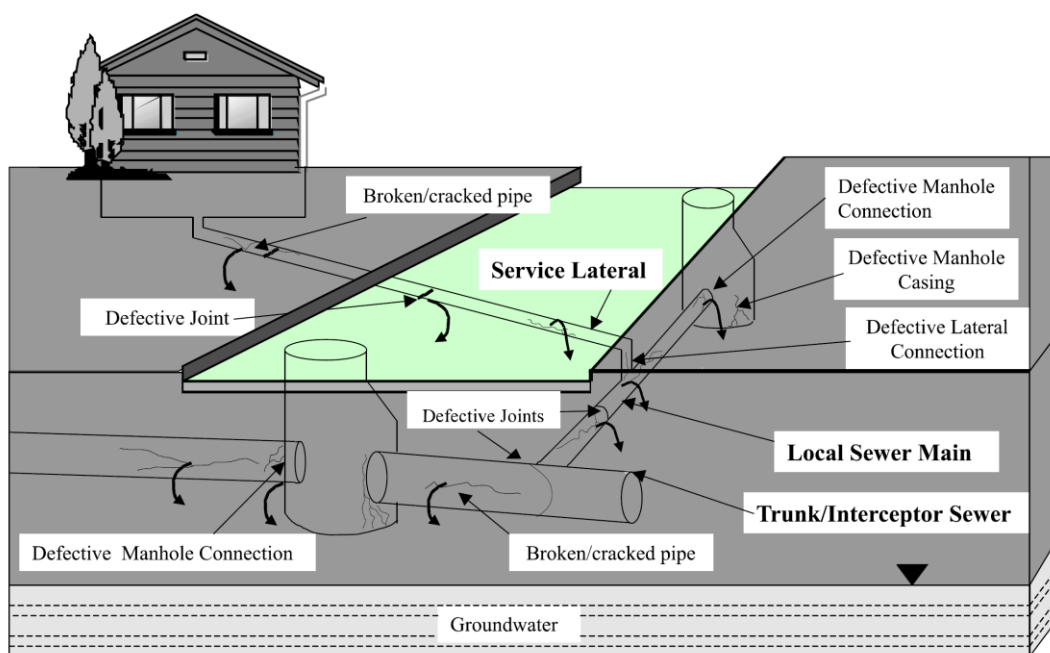


Figure 18. Sanitary sewer system components and exfiltration sources.

## Mosquito Abatement

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Mosquitoes can be bothersome pests, but they can also carry diseases like West Nile virus. West Nile virus has been identified in some mosquitoes tested by the Alamosa Mosquito Control District (AMCD). The AMCD conducts mosquito monitoring and control.

Many communities in Colorado use Integrated Pest Management techniques to reduce pest populations to a tolerable level. Integrated Pest Management is the balanced use of cultural, biological, and chemical procedures that are environmentally compatible and economically feasible to reduce pest populations to a tolerable level.

Cultural or physical control involves practices which attempt to reduce mosquito breeding habitat. Efforts include preventing water from standing for more than four days by: repairing ditches to prevent seepage, clearing ditches of vegetation to promote rapid flow, improving drainage channels in irrigated fields, and dumping containers of standing water around the home. Biological control includes using naturally occurring organisms to control pests. Bacteria called Bti, which is toxic only to mosquito and black fly larvae, and is not toxic to beneficial insects and can be used to control the larval stage of mosquitoes. Chemical control involves using Permethrin, a man-made version of Pyrethrin which is derived from plants in the Chrysanthemum family, is used as a last resort, and only when nuisance threshold values have been exceeded. Nuisance threshold values (mosquito numbers above 100 per trap) are determined by trapping adult mosquitoes in annoyance areas.

Chemical control with the use of pesticides (insecticides) can result in water quality degradation if used improperly. The development of extremely sensitive detection methods has led to the discovery that commonly used management practices may lead to small amounts of pesticide that contaminate ground and surface water supplies. Since we depend on these water supplies for drinking water, pesticide users need to exercise a high level of care and sound pesticide use management to avoid contamination. Contamination from normal pesticide application is typically considered nonpoint contamination. These chemicals can enter the water source through direct application, runoff, and wind transport.

### **Mosquito Abatement Recommendations:**

1. Consider using physical and biological control methods prior to using chemical control.
2. Ensure that pesticides are not used in a 50-ft buffer area around the town's wells.
3. Maintain contact with the Town Planning Commission on the details of the planned Mosquito Abatement program to consider source water protection in their goals.

## Active and Abandoned Water Wells

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Approximately 47 of the properties in Crestone have private drinking water wells. The other properties are currently hooked up to the Town's water supply system or have paid for a tap and not currently connected. There are also residences that have both town water and old wells on their property. The Town is currently working with the Colorado Division of Water Resources to inventory the number of private wells within the town limits of Crestone. This will include mapping the existing permitted and decreed wells.

Wells can be a direct route for contaminants to enter the groundwater if not properly cased and maintained. Contaminants that infiltrate from the surface are more likely to pollute old, shallow, uncased or abandoned wells.

Contaminants can also enter the Town's water system from an uncontrolled cross connection that allows backflow into the distribution system. The Colorado Department of Public Health and Environment's Water Quality Control Division's Regulation 11, the Backflow Prevention and Cross-Connection Control (BPCCC) rule, requires that water suppliers develop and implement a written BCCCC program. The supplier is required to survey its waterworks and identify if there are any direct connections to the public water system's distribution system such as irrigation systems, maintenance shops, fire suppression systems, agricultural uses, water fill stations or other hazards (CDPHE, 2017). It is important to ensure that residential properties that are connected to the Town's water system and also have a private well are not cross-connected.

### **Active and Abandoned Water Wells Recommendations:**

1. Conduct an inventory of all private wells within the Town of Crestone and the status of these wells. Collaborate with the Colorado Division of Water Resources to plot, locate and map all wells within the Town of Crestone.
2. Consult with the Colorado Division of Water Resources to determine if any of the active/abandoned wells should be designated as high priority due to the potential threat to the aquifer and the Town of Crestone's wells.
3. Pursue funding through the Source Water Protection Grant and other potential funding sources to properly plug and abandon any high priority wells that are no longer in use.
4. For high priority active wells, the Town will work to educate the well owner and potentially explore funding opportunities to properly seal and protect the wells.
5. Provide private water well owners with information on how to maintain their wells to prevent contamination of the groundwater.
6. Explore opportunities and funding to conduct a private well testing program.

## Abandoned Mines

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The source water protection area lies within the Crestone District, one of the several districts aligned along the western slopes of the Sangre de Cristo range on the eastern edge of Saguache County. The district was also known as the Eldorado District and the Baca Grant district. Several prospectors began mining operations in the area during the gold rush era of 1874 – 1904. In 1879 high grade ore was found in Burnt Gulch above Crestone. The tent city of mines grew into the Town of Crestone. The commodities mined include gold, silver, copper, lead, uranium, and manganese (CGS, 2017)).

### Permitted Mines

Thousands of unpatented claims and small exploratory mining operations throughout Colorado exist, most of which were never recorded in state or local government offices. It was not until 1973 that the State of Colorado required mines to be permitted. Mining permit data obtained from the Colorado Division of Mines, Reclamation, and Safety showed there are no active or inactive permitted mines in the source water protection area. In Colorado, the BLM manages the surface of public land and the Forest Service manages the surface of National Forest System (NFS) land. The BLM is responsible for the subsurface on both public and NFS land and handles issuing permits including unpatented claims.

### Abandoned Mine Land

Mining practices during the early days allowed the mine owners to simply abandon their mines without consideration of the impact on streams, water quality, slope stability and safety. Many old mining properties contain abandoned mine workings, mine waste and/or mill tailings. Active and inactive mining operations have a potential to contaminate drinking water supplies from either point source discharges (i.e. mine drainage tunnels or flowing adits) or nonpoint source discharges from run-off over waste rock or tailing piles. Acidic, metal-laden water emanating from inactive mines and waste rock piles has a potential to impair the water quality of streams. Mine data obtained from the U.S. Geological Survey's Mineral Resource Data System (MRDS) showed five abandoned mine sites within the source water protection area (Fig. 19, Table 6).

Table 6. Abandoned Mine Land

Mines	MRDS ID Number	Commodities Mined
Horn Peak Claims	DO008874	Uranium
Crestone Mineral Company Claims	DO008973	Gold, copper, lead, silver
Elartan Manganese Deposits	DO10579	Manganese
Unknown		Gold
Crestone District	DO08979	Silver, lead, copper, gold



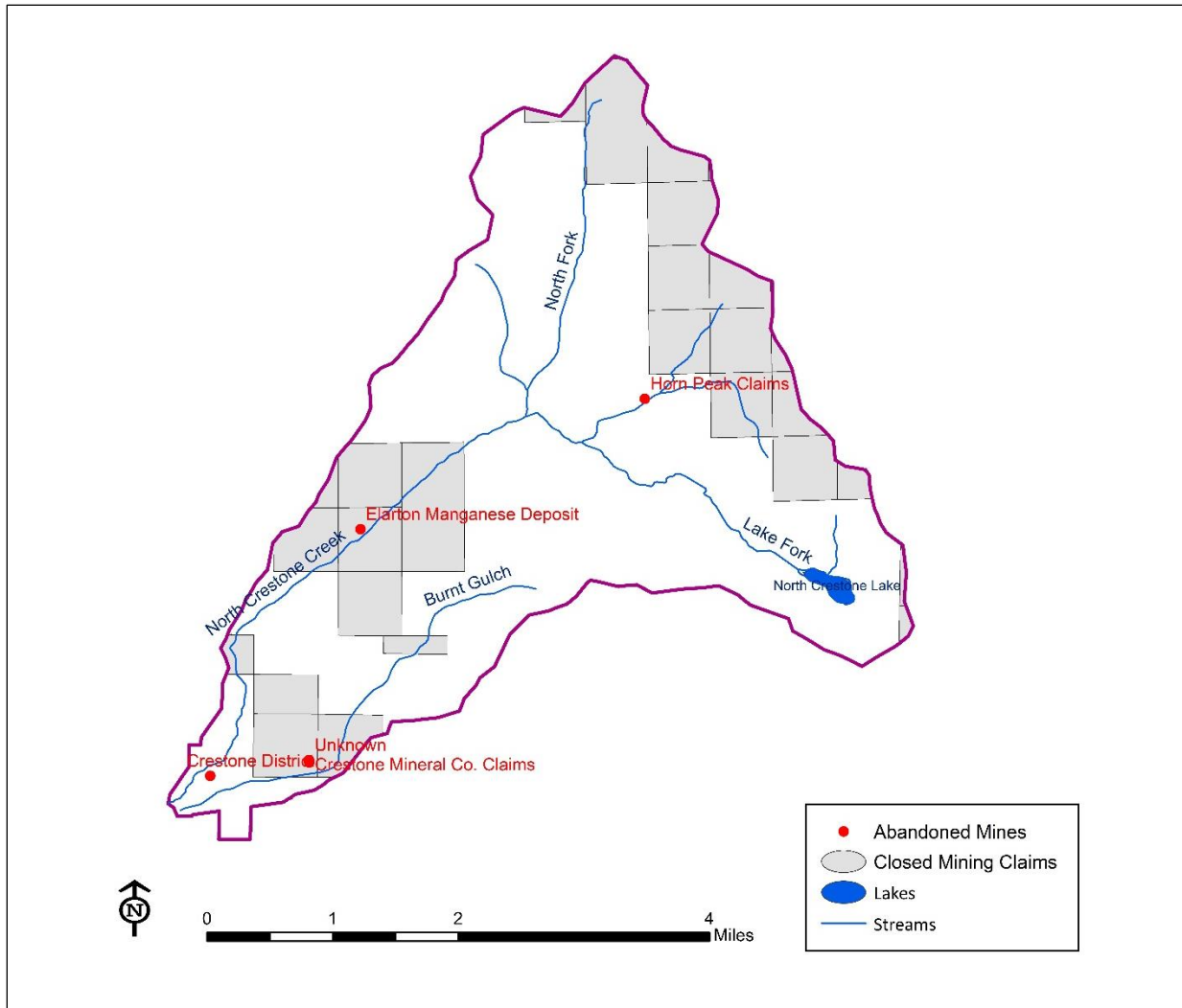


Figure 19. Abandoned mines within the source water protection area.

#### Recommendations for Abandoned Mines:

1. Create an educational and outreach tool to encourage local residents to report any issues to the Colorado Division of Reclamation Mining and Safety with abandoned mines in the watershed that could potentially affect the water quality of source waters.



## Residential and Commercial Properties

The Town of Crestone's source water protection area includes residential and commercial properties. Residential property owner frequently use and store chemicals on their properties. Common household practices may cause pollutants to runoff property and enter the surface or groundwater as indicated in the picture below (Fig. 20). The steering committee identified the activities that may increase risks to the groundwater including livestock, private grows, pesticides and herbicides use, and pharmaceutical disposal.

Commercial properties within the source water protection (restaurant, laundromat, hardware store, etc.) may also use chemicals in their operations. Prevention of groundwater contamination requires education, public involvement, and people motivated to help in the effort. Public education will help people understand the potential threats to their drinking water source and motivate them to participate as responsible citizens to protect their valued resources.

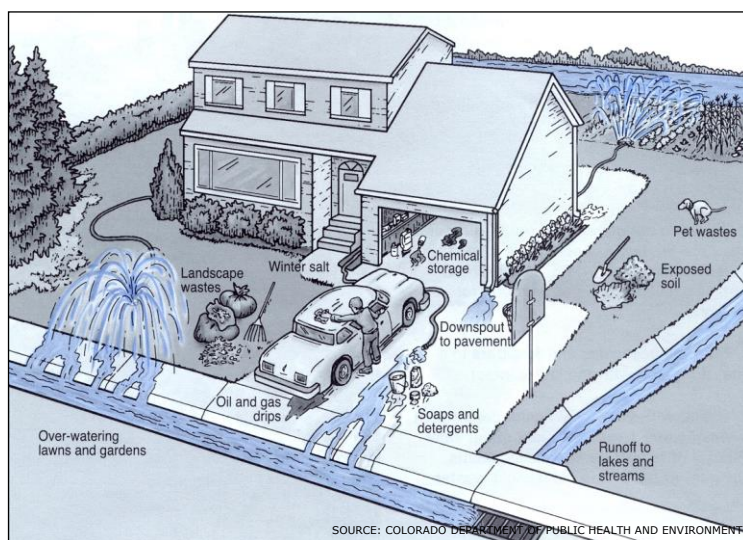


Figure 20. Common household practices may cause pollutants to runoff residential property and enter the surface or groundwater.

### Recommendations for Residents and Commercial Operations:

1. Conduct public education and outreach programs for landowners and residents in the source water protection area to report issues and to encourage practices that will protect their drinking water source from potential contamination. This could include the installation of drinking water protection area signs at strategic locations throughout the source water protection area, water bill inserts, public presentations, website links, school presentations, etc.
2. Meet with various commercial operations within the SWPA to raise awareness about source water protection and to distribute Emergency Response Cards.

## **SOURCE WATER PROTECTION MEASURES**

### **Best Management Practices**

The steering committee reviewed and discussed several possible best management practices that could be implemented within the Source Water Protection Area to help reduce the potential risks of contamination to the community's source water. The steering committee established a "common sense" approach in identifying and selecting the most feasible source water management activities to implement locally. The focus was on selecting those protection measures that are most likely to work for the community. The best management practices were obtained from multiple sources including: Environmental Protection Agency, Colorado Department of Public Health and Environment, Natural Resources Conservation Service, and other source water protection plans.

The steering committee recommends the best management practices listed in Table 7, "Source Water Protection Best Management Practices" be considered for implementation by:

- Town of Crestone
- Saguache County
- U.S. Forest Service Saguache Ranger District
- San Luis Valley BLM
- Fire Protection District
- Colorado Rural Water Association
- Commercial Operators
- Visitors to the Source Water Protection Area

### **Evaluating Effectiveness of Best Management Practices**

The Town of Crestone is committed to evaluating the effectiveness of the various source water best management practices that have been implemented. The public will be informed by updates at community meetings on the outcomes of the various source water best management practices implemented. The Steering Committee recommends that this Plan be reviewed annually every summer when the Consumer Confidence Report is generated, or sooner if circumstances change (i.e. the development of new water sources and source water protection areas, or if new risks are identified).

Table 7. Source Water Protection Best Management Practices

Issue	Management Approach	Partners
<i>Roads and Spills</i>	<ol style="list-style-type: none"> <li>1. Develop an Emergency Notification card and share with Emergency Responders and other transit companies to ensure that the Crestone Water Department is notified of spills quickly enough to shut off the wells to minimize impacts from the spill</li> <li>2. Maintain current PWS contact information, on an annual basis, with Emergency Responders to improve notification of spill response activities.</li> <li>3. Install “Source Water Protection Area” signs at strategic locations throughout the source water protection area.</li> </ol>	<p>Town of Crestone</p> <p>Town of Crestone</p> <p>Town of Crestone</p>
<i>Water Scarcity</i>	<ol style="list-style-type: none"> <li>1. Develop a process to measure and track static water levels in the Town’s wells.</li> <li>2. Work with local agencies and neighboring water systems to observe for worsening conditions (aquifer levels and water quality).</li> <li>3. Stay informed on the effects of future climate changes and impacts to the water sources</li> <li>4. Prepare plans for rapid response to severe drought and implement water conservation measures as needed.</li> </ol>	<p>Town of Crestone</p> <p>Town of Crestone Baca Grande Water and Sanitation Town of Crestone</p> <p>Town of Crestone</p>
<i>Gas Station</i>	<ol style="list-style-type: none"> <li>1. Share maps, shapefiles, and contact information with the Division of Oil and Public Safety and the Colorado Department of Public Health and Environment so that the public water system can be notified of spill events in a timely manner.</li> <li>2. Meet with the owner of the local gas station to distribute maps of the source water protection area and to open channels of communication to facilitate timely notification in the event of a spill.</li> </ol>	<p>Town of Crestone Colorado Rural Water Association</p> <p>Town of Crestone Gas Station Owner</p>

Table 7. Source Water Protection Best Management Practices

Issue	Management Approach	Partners
<i>Wildland Fire</i>	<ol style="list-style-type: none"> <li>1. Work with the fire department to determine if defensible space should be increased around all Crestone water system structures.</li> <li>2. Provide a copy of the final Source Water Protection Plan along with GIS shapefiles of the source water protection area to US Forest Service, BLM, the local Fire Protection District, and the Saguache County Office of Emergency Management for consideration during fire suppression as well as when planning and implementing wild land fire mitigation projects.</li> <li>3. During a fire event, provide the Incident Commander with source water protection area maps to allow them to apply fire retardant according to the US Forest Service's "Implementation Guide for Aerial Application of Fire Retardant" and the "Aerial Application of Fire Retardant and Foam: Avoidance Areas." The Fire Manager will: <ul style="list-style-type: none"> <li>• Maintain a minimum 300-foot avoidance area on either side of all intermittent and perennial streams where water is flowing.</li> <li>• Avoid aerial application of fire retardant or foam within 300 feet of waterways. A waterway is defined as a body of water including lakes, rivers, streams and ponds whether or not they contain aquatic life.</li> </ul> </li> <li>4. Participate in fire suppression efforts and communicate source water protection goals with the Incident Commander to adjust suppression tactics to minimize post-fire effects (erosion control, reseeding, debris traps).</li> <li>5. Collaborate with Federal Land Agencies on post fire mitigation projects to minimize the impact of a fire to the Town water system.</li> </ol>	<p>Town of Crestone Fire District</p> <p>Town of Crestone Colorado Rural Water Association</p> <p>Town of Crestone Fire District</p> <p>Town of Crestone Fire District</p> <p>Town of Crestone</p>
<i>Abandoned Mines</i>	<ol style="list-style-type: none"> <li>1. Create an educational and outreach tool to encourage local residents to report any issues to the Colorado Division of Reclamation Mining and Safety with abandoned mines in the watershed that could potentially affect the water quality of source waters.</li> </ol>	<p>Town of Crestone</p>

Table 7. Source Water Protection Best Management Practices

Issue	Management Approach	Partners
<i>Security and Vandalism</i>	<ol style="list-style-type: none"> <li>1. Look for ways to improve security on all wellheads, storage tank, and critical equipment (e.g. locks on wellheads, fencing around the tank, security cameras).</li> <li>2. Consider placing boulders near the wellheads for physical protection.</li> <li>3. Remain vigilant to recognize if/when vandalism/tampering occurs.</li> <li>4. Install Drinking Water Protection Area signs at strategic locations throughout source water protection area.</li> <li>5. Share Source Water Protection Plan and maps with local law enforcement and request regular patrol of the area around the wells.</li> </ol>	<p>Town of Crestone</p> <p>Town of Crestone</p> <p>Town of Crestone</p> <p>Town of Crestone</p> <p>Town of Crestone</p>
<i>Septic Systems</i>	<ol style="list-style-type: none"> <li>1. Collaborate with the County to provide educational materials to property and residents within the SWPA on the proper use and maintenance of their septic systems and how the source of their drinking water can be affected by an inadequate functioning septic system.</li> <li>2. Consider sampling raw well water on a regular basis to detect significant events and changing conditions.</li> <li>3. Collaborate with the County Land Use Department to locate and map all the active (and potentially inactive) septic systems within the Town. Perhaps this will be done at the same time that active/abandoned wells are inventoried.</li> </ol>	<p>Town of Crestone Saguache County</p> <p>Town of Crestone</p> <p>Town of Crestone Saguache County Division of Water Resources</p>
<i>Mosquito Abatement</i>	<ol style="list-style-type: none"> <li>1. Consider using physical and biological control methods prior to using chemical control.</li> <li>2. Ensure that pesticides are not used in a 50-ft buffer area around the town's wells.</li> <li>3. Maintain contact with the Town Planning Commission on the details of the planned Mosquito Abatement program to consider source water protection in their goals.</li> </ol>	<p>Town of Crestone</p> <p>Town of Crestone</p> <p>Town of Crestone</p>

Table 7. Source Water Protection Best Management Practices

Issue	Management Approach	Partners
<i>Active and Abandoned Water Wells</i>	<ol style="list-style-type: none"> <li>1. Conduct an inventory of all private wells within the Town of Crestone and the status of these wells. Collaborate with the Colorado Division of Water Resources to plot, locate and map all wells within the Town of Crestone.</li> <li>2. Consult with the Colorado Division of Water Resources to determine if any of the active/abandoned wells should be designated as high priority due to the potential threat to the aquifer and the Town of Crestone's wells.</li> <li>3. Pursue funding through the Source Water Protection Grant and other potential funding sources to properly plug and abandon any high priority wells that are no longer in use.</li> <li>4. For high priority active wells, the Town will work to educate the well owner and potentially explore funding opportunities to properly seal and protect the wells.</li> <li>5. Provide private water well owners with information on how to maintain their wells to prevent contamination of the groundwater.</li> <li>6. Explore opportunities and funding to conduct a private well testing program.</li> </ol>	<p>Town of Crestone Division of Water Resources</p> <p>Town of Crestone Division of Water Resources</p> <p>Town of Crestone Colorado Rural Water Association Town of Crestone</p> <p>Town of Crestone</p> <p>Town of Crestone</p>
<i>Residents and Commercial Operations</i>	<ol style="list-style-type: none"> <li>1. Conduct public education and outreach programs for landowners and residents in the source water protection area to report issues and to encourage practices that will protect their drinking water source from potential contamination. This could include the installation of drinking water protection area signs at strategic locations throughout the source water protection area, water bill inserts, public presentations, website links, school presentations, etc.</li> <li>2. Meet with various commercial operations within the SWPA to raise awareness about source water protection and to distribute Emergency Response Cards.</li> </ol>	<p>Town of Crestone</p> <p>Town of Crestone Commercial Operators</p>



Table 7. Source Water Protection Best Management Practices

Issue	Management Approach	Partners
<i>Public Land</i>	<ol style="list-style-type: none"> <li>1. Keep informed and participate in public land management issues/activities at the district and regional level including: Forest Plan revisions, fuels reduction plans, environmental analysis documents for vegetation management projects, wilderness designations, timber management plans, travel management and other outreach opportunities. Provide written comments to public land managers on source water protection concerns.</li> <li>2. Provide the Saguache Ranger District and San Luis Valley BLM with a copy of SWPP and GIS shape files on the location of source water protection area.</li> </ol>	<p>Town of Crestone Saguache Ranger District San Luis Valley BLM</p> <p>Town of Crestone Colorado Rural Water Association</p>
<i>Water Utilities</i>	<ol style="list-style-type: none"> <li>1. Inspect and protect the water system; develop a contingency plan; and provide Information concerning the SWPP and implementation measures in the annual Consumer Confidence Report (CCR).</li> <li>2. Conduct water quality monitoring according to a monitoring plan.</li> <li>3. Implement contingency plan in the event of a disruption in the water source.</li> <li>4. Remove the underground structure located adjacent to Well #3 and fill in the hole.</li> <li>5. Use alternative power source in the event of a power outage (i.e., generator).</li> </ol>	<p>Town of Crestone</p> <p>Town of Crestone</p> <p>Town of Crestone</p> <p>Town of Crestone</p> <p>Town of Crestone</p>

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## APPENDICES

- A. Contingency Plan\*
- B. Source Water Assessment Report and Appendices
- C. Contaminant Health Concerns
- D. Additional Resource

*Notice: This public document will only include information that is not deemed sensitive to the safety and operation of the individual community's water plan operation. Appendices marked with a \* are only included in the Public Utility's report or kept on file at their office. All other documents are included on the CD located in the back pocket of this report. All documents can be reprinted.*