Town of Basalt
Source Water Protection Plan

Eagle and Pitkin County, Colorado

December 2010

Written by Colleen Williams
Source Water Specialist
Colorado Rural Water Association

For the community water providers:
Town of Basalt: ID # CO0119134

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EXECUTIVE SUMMARY

The Town of Basalt values a clean, high quality drinking water supply and decided to work collaboratively with area stakeholders to develop a Source Water Protection Plan to protect their current water source, groundwater wells and springs. During the months of July 2010 to January 2011, five stakeholder meetings were held at the Basalt Town Hall in Basalt, Colorado to encourage local public participation. The planning process attracted interest and participation from 13 people including local citizens, water operators, government, and agency representatives. This group comprised the Basalt Source Water Protection Planning Team (the Planning Team or Team).

The Team initially reviewed the Source Water Assessment completed by the Colorado Department of Public Health and Environment. The Assessment included the delineation of the source water protection area, potential sources of contaminants, and the potential of these contaminants to degrade the water source. Using this information as a starting point, the Team requested a re-delineation of the protection area based on the updated GIS information regarding the number and location of its current wells and springs. The re-delineated area defines the region where the Team has chosen to focus its source water protection measures to reduce source water susceptibility to contamination.

To develop their management approach, the Planning Team focused on the following issues of concern within the Source Water Protection Area: fuel storage tanks, impacts from transportation on roads, irrigation ditch leaking and irrigation recharge, agricultural activities, climate change, flooding and floodplain influence, urban runoff, public land management, wildfires, residential property maintenance and facilities storing hazardous materials.

The Planning Team reviewed and discussed several possible management approaches that could be implemented within and nearby the protection area to help reduce the risks of potential contamination to the community's source water. Voluntary implementation of source water management approaches at the local level (i.e. county and municipal) applies an additional level of protection to the drinking water supply by taking preventive measures to protect the source water. The Planning Team established a "common sense" approach in identifying and selecting the most feasible source water management activities to implement locally. These management practices included in this Plan are recommended by the Team to reduce the risks of potential contaminants to the Source Water Protection Area and protect the drinking water source for the Town of Basalt.

At the completion of this plan, a Steering Committee was formed to oversee its implementation. Representatives from the Town, water providers, community, and government agencies who participated on the Planning Team volunteered to serve on the Steering Committee and meet quarterly throughout the year. The first meeting of the Steering Committee is scheduled for April 5, 2011. At this first meeting the Committee will decide which management approaches to implement during 2011.

The Colorado Rural Water Association's Source Water Protection Specialist, Colleen Williams, helped facilitate the source water protection planning process. The goal of the Association'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.

INTRODUCTION

The Town of Basalt operates a municipal supply water system that supplies drinking water to 2,000 residents of the town and surrounding adjacent area located in Eagle and Pitkin County, Colorado. They realize that in order to protect the source of their drinking water, they needed to work together to develop a protection plan to prevent possible contamination of this valuable resource. Proactive planning and implementing pollution prevention strategies are essential to protect the long-term integrity of their water supply and will limit their costs and liabilities.

Purpose of the Source Water Protection Plan

The Source Water Protection Plan (SWPP) is a tool for the Basalt community to ensure clean and high quality drinking water sources for current and future generations. This Source Water Protection Plan is designed to:

- Create an awareness of the community's drinking water sources and the potential risks to water quality within the watershed;
- Encourage education and identify voluntary solutions to alleviate pollution risks;
- Implement management practices to protect and enhance the drinking water supply;
- Provide for a contingency 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 municipal) will complement existing regulatory protection measures implemented at the state and federal governmental levels by filling protection gaps that can only be addressed at the local level.

Public Participation in the Planning Process

Public participation is vitally important to the overall success of Colorado's Source Water Assessment and Protection (SWAP) program. 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. Local support and acceptance of the plan is more likely where local stakeholders have actively participated in the development of their protection plan.

During the months of July 2010 to January 2011, five stakeholders meetings were held at the Basalt Town Hall in Basalt, Colorado to encourage local public participation in the planning process. Local stakeholders were sent letters of invitation to participate and email reminders of meeting dates. The source water protection planning process attracted interest and participation from 13 people including local citizens, water operators, government, and agency representatives. Input from the following list of Planning Team participants was greatly appreciated (Table 1).

Table 1. Basalt Source Water Protection Plan Participants

Participant	Affiliation
Robi Darcy	Town of Basalt Water Quality Specialist
Bentley Henderson	Town of Basalt Public Works Director
Leroy Duroux	Town of Basalt Major
Larry Thompson	Town of Basalt Engineer
Larry Tripp	Town of Basalt
Ray Merry	Eagle County Environmental Health
Chad Rudow	Roaring Fork Conservancy
Perry Will	Colorado Division of Wildlife
Scott Snelson	U.S. Forest Aspen-Sopris Ranger District, District Ranger
Jim Kirschvink	U.S. Forest Aspen-Sopris Ranger District
Dylan Eiler	Colorado Rural Water Association
Paul Hempel	Colorado Rural Water Association
Colleen Williams	Colorado Rural Water Association

Protection Plan Development

The source water protection planning effort consisted of public Planning Team meetings and individual meetings with water operators, government, and agency representatives. Information discussed at the meetings helped the Team develop an understanding of the issues affecting source water protection for the Town of Basalt. The Team then made recommendations for management approaches to be incorporated into a protection plan. In addition to the Planning Team meetings, data and other information pertaining to source water protection areas were gathered via public documents, internet research, phone calls, emails, and field trips to the protection area. A summary of the meetings is presented in Table 2.

PHOTO: COLLEEN WILLIAMS

Figure 1. Members of the Planning Team

Table 2. Planning Team Meetings

Date	Purpose of Meeting
7/13/10	First Planning Team meeting with presentation on the process of developing a Source Water Protection Plan for the Town of Basalt. Review of the State's Source Water Assessment and discussion of the delineation of the source water protection area.
8/17/10	Second Planning Team meeting with review of the State's re-delineation of the source water protection area for the Town's springs. Planning Team identified the potential sources of contamination around each of the Town's wells.
9/14/10	Third Planning Team meeting with discussion of issues of concern and potential source of contaminants within the springs' source water protection area. Planning Team discussed the effect of climate change and future water diversions on the Town's water sources.
10/21/10	Fourth Planning Team meeting to work on identifying issues of concern and develop management approaches to include in the Plan to address these concerns and decrease risk to the source waters.
1/25/11	Fifth Planning Team meeting to review and edit the Draft Plan; appoint a Steering Committee; set the date for the first Steering Committee meeting; and implement one of the action items on the Plan.

Steering Committee Members

At the completion of this plan, a Steering Committee was formed to implement the management approaches of this Source Water Protection Plan. Members of the Planning Team volunteered to serve on the Steering Committee and meet quarterly throughout the year. The first meeting of the Steering Committee is scheduled for April 5, 2011. At this first meeting the Committee will develop an Action Plan for management approaches to implement during 2011.

Table 3. Steering Committee Members

Name	Affiliation
Robi Darcy	Town of Basalt Water Quality Specialist
Bentley Henderson	Town of Basalt Public Works Director
Larry Tripp	Town of Basalt
Ray Merry	Eagle County Environmental Health
Chad Rudow	Roaring Fork Conservancy
Perry Will	Colorado Division of Wildlife
Jim Kirschvink	U.S. Forest Service Aspen-Sopris Ranger District
Colleen Williams	Colorado Rural Water Association

WATER SUPPLY SETTING

Location

The Town of Basalt is located in the Roaring Fork River Valley on Colorado's western slope. It is located at the confluence of the Roaring Fork and Fryingpan Rivers and is about midway between Aspen and Glenwood Springs (Fig. 2). The Town is accessed via Highway 82 that runs from Glenwood Springs to Aspen and over Independence pass to Leadville and Buena Vista. Basalt's town boundaries encompass two separate areas: the eastern area surrounding and including the original Basalt townsite (East Basalt); and West Basalt, which includes City Market, Aspen Junction, the Willits development, and several other adjacent properties (Basalt, 2007).

Basalt lies within both Pitkin and Eagle County. Pitkin County covers approximately 973 square miles, has a population of 14,872, and its County seat is located in the City of Aspen; whereas Eagle County covers approximately 1,692 square miles, has a population of 41,659, and its County seat is located in the Town of Eagle.

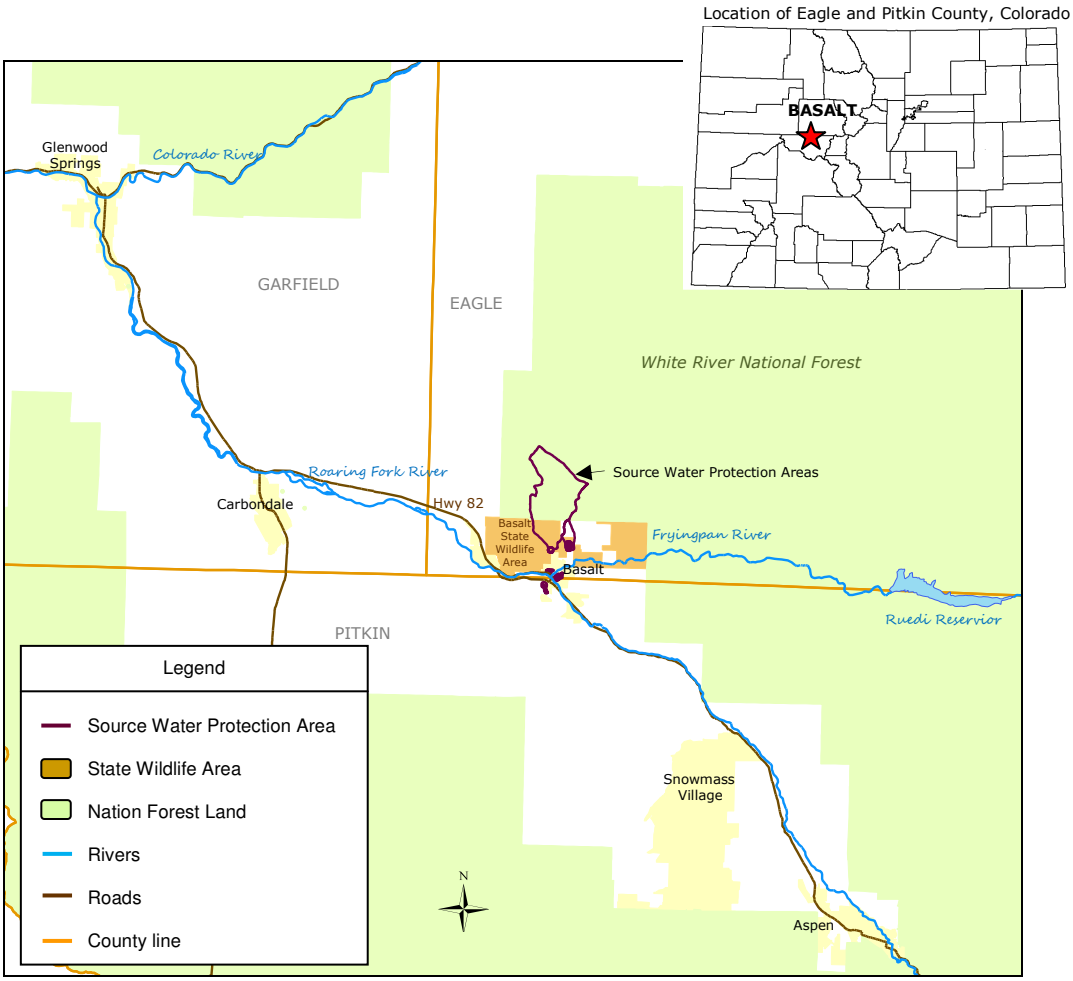


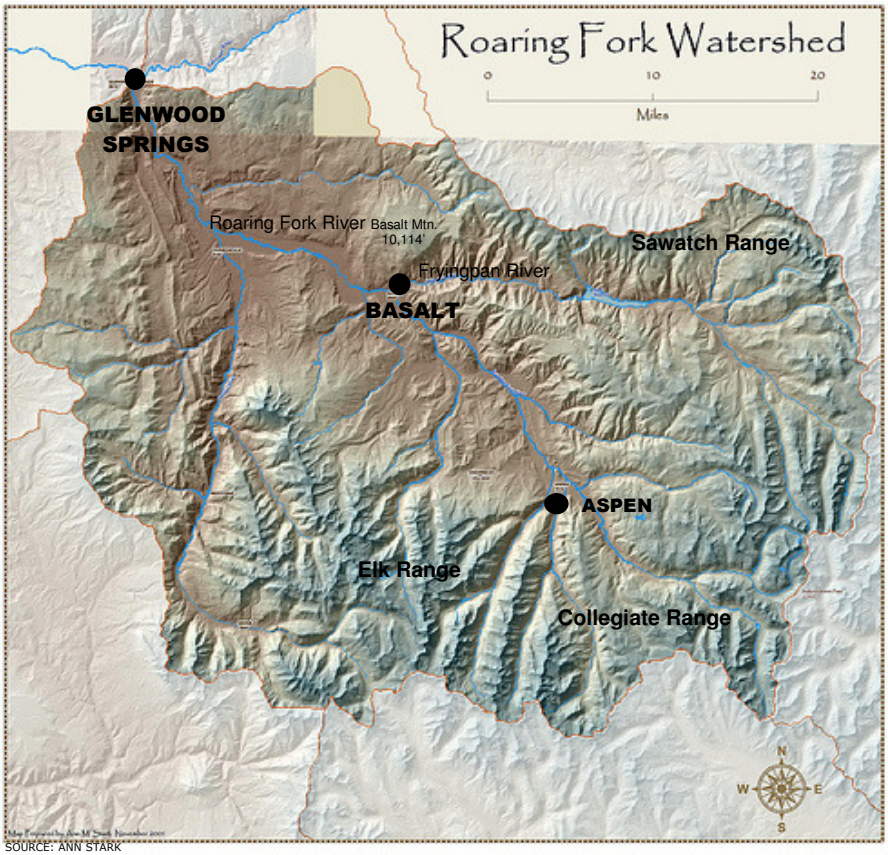
Figure 2. Regional setting map

Physical Setting

Basalt is located at Latitude 39°22’6”N, Longitude 107°2’18”W at an elevation of 6,611 feet. It lies within the southern Rocky Mountains Physiographic Province that encompasses the center of the state and runs its entire north-south length. The southern Rocky Mountain Province in Colorado is comprised of a structurally complex assortment of igneous, metamorphic, and sedimentary rocks, with igneous and metamorphic rocks predominating at higher elevations (Topper, et al, 2003).

The Roaring Fork River watershed originates within the Sawatch, Collegiate and Elk Mountain Ranges and eight 14,000 foot peaks. The Town of Basalt is surrounded by public lands including the Basalt State Wildlife Area managed by the Colorado Division of Wildlife, White River National Forest managed by the Aspen-Sopris Ranger District, and Bureau of Land Management. According to the United States Census Bureau, the town has a total area of 1.9 square miles (5.0 km²), of which most of it is land and 0.04 square miles (0.1 km²) of it (1.03%) is water.

Basalt lies mainly in the “foothills” vegetation life zone (in Colorado, about 5,500-8,000 feet). The foothills life zone has the greatest species diversity of all the life zones in Colorado because it represents a transitional region between grasslands and the higher elevation tree-dominated montane life zone (roughly 8,000-9,500 feet) (Basalt, 2007).

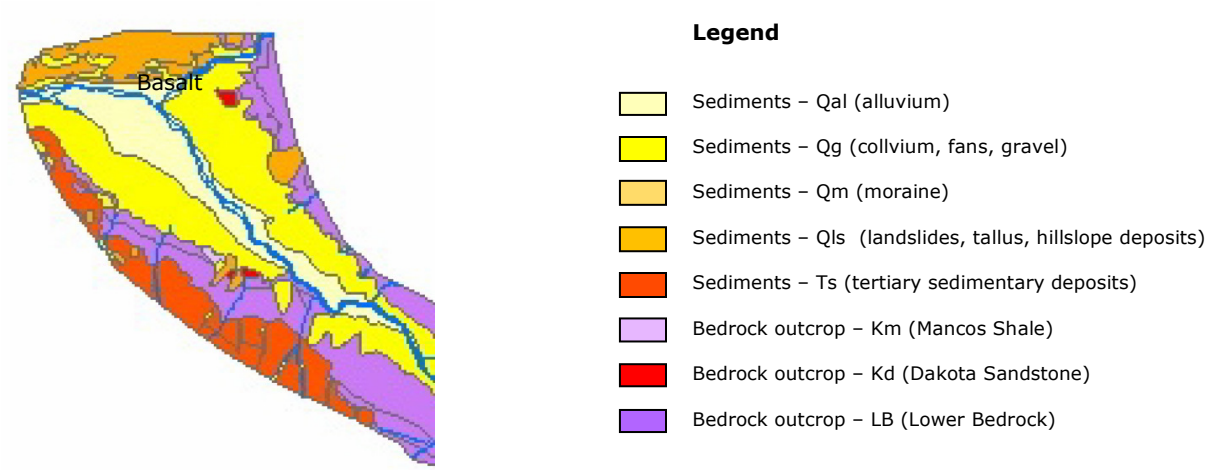


SOURCE: ANN STARK

Figure 3. Topography of the Roaring Fork River watershed

Geology

The middle Roaring Fork watershed has 4 distinct geological units: 3 bedrock units and one unconsolidated unit consisting of various Quaternary and Tertiary deposits. The bedrock units consist of Dakota, Mancos Shale, and Lower Bedrock units. The Dakota aquifer is an unconfined system near its recharge area, and a confined system at depth. The Mancos Shale and the Lower Bedrock units, consisting of Morrison and older rocks, are confining layers throughout most of the system (Fig. 4). The saturated hydrogeologic units consist of Quaternary landslide, glacial terrace, and alluvial deposits, and Tertiary sediments (Kolm, et al, 2006).



SOURCE: DEVELOPMENT OF GIS-BASED GROUND WATER RESOURCES EVALUATION OF THE UPPER AND MIDDLE ROARING FORK VALLEY AREA

Figure 4. Geological map of the middle Roaring Fork watershed

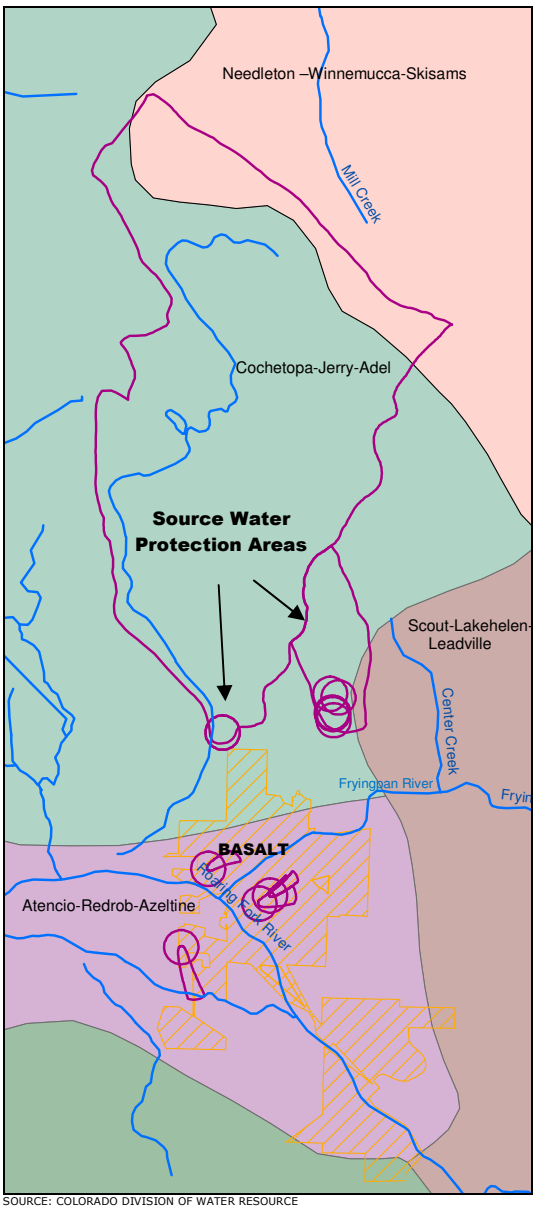
Table 4. Correlation of Geologic and Hydrogeologic Units

Layer	Unit	Unconsolidated Hydrogeologic Units
1	Qal	Quaternary Alluvium
2	Qg	Quaternary Fans and Gravels
3	Qm	Quaternary Moraine Deposits
4	Qls	Quaternary Landslide Deposits
5	Ts	Tertiary Sedimentary Deposits
		Bedrock Hydrogeologic Units
6	KM	Mancos Shale
7	Kd	Dakota Sandstone
8	LB	**Lower Bedrock Units**
	Jm	Morrison Formation
	Je	Entrada formation
	Trc	Chinle formation
	Trsb	State Bridge Formation
	PPm	Moroon formation
	Pg	Gothic Formation
	Pe	Eagle Valley Formation

SOURCE: DEVELOPMENT OF GIS-BASED GROUND WATER RESOURCES EVALUATION OF THE UPPER AND MIDDLE ROARING FORK VALLEY AREA

Soils Types

The soil types in the vicinity of the Town's wells are of the Atencio, Redrob, and Azeltine series (classification). The soil types in source water protection area for the Town's springs are mostly of the Cochetopa, Jerry, and Adel series. The upper parts of the springs include soils in the Needleton Family, Winnemucca, Skisams series. A map and description of the soils are listed below (Fig. 6):



SOURCE: COLORADO DIVISION OF WATER RESOURCE

Figure 6. Map of soil types within the source water protection areas

Atencio – Deep, well drained, sandy loam soils formed in alluvium and located in lower foothill valley areas.

Redrob – Very deep, somewhat poorly drained soils formed in mixed alluvium on low terraces and flood plains; slow or medium runoff, moderate permeability.

Azeltine – Deep, well drained soils formed in gravelly and cobbly alluvium from mixed sedimentary and igneous rocks; found on terraces, benches and fans adjacent to major drainage ways; moderate to rapid permeability.

Cochetopa – Very deep, well drained soils that formed in colluvium and alluvium derived mainly from basalt and rhyoltic tuff; negligible to very high runoff, slow permeability.

Jerry – Deep and very deep, well drained soils that formed in alluvial and colluvial sediments; found on upland hills, mountain slopes, ridges, benches, and mesa tops; rapid or medium runoff; slow to very slow permeability.

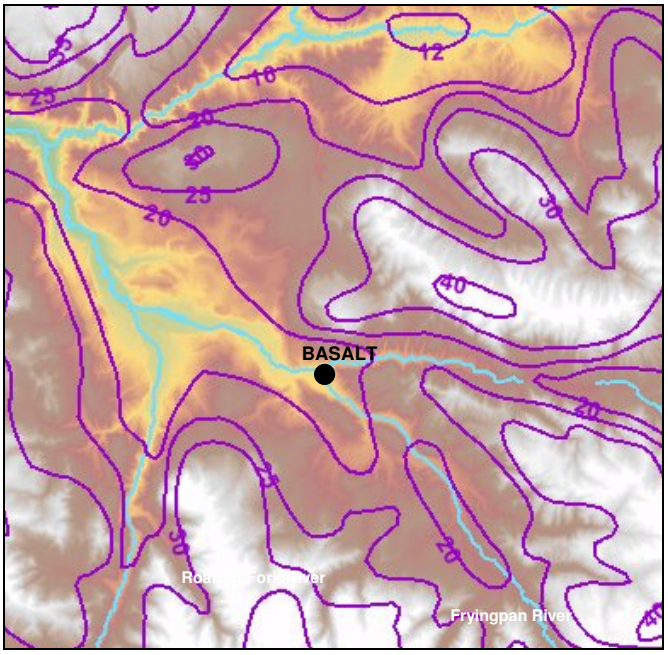
Adel – Very deep, well drained soils that formed in alluvium or colluvium; found on alluvial fans, stream terraces, hills, drainageways and swales; moderate permeability.

Needleton – Very deep, well drained soils formed in stony and cobbly slope alluvium and colluvium; located on mountain slopes; low to high runoff, moderately slow permeability.

Winnemucca – Very deep, well drained, slowly permeable soils; formed in alluvium and colluvium derived from intermediate volcanic materials on mountain meadow, mountaintops, and mountain slopes; medium runoff.

Skisams – Shallow and very shall, well drained soils formed in slope alluvium from sandstone, shale, granite, and some basalt.; located on hills, mesas, and benches; low to high runoff, moderate permeability (NRCS, 2010).

Climate



SOURCE: COLORADO DIVISION OF WATER RESOURCE

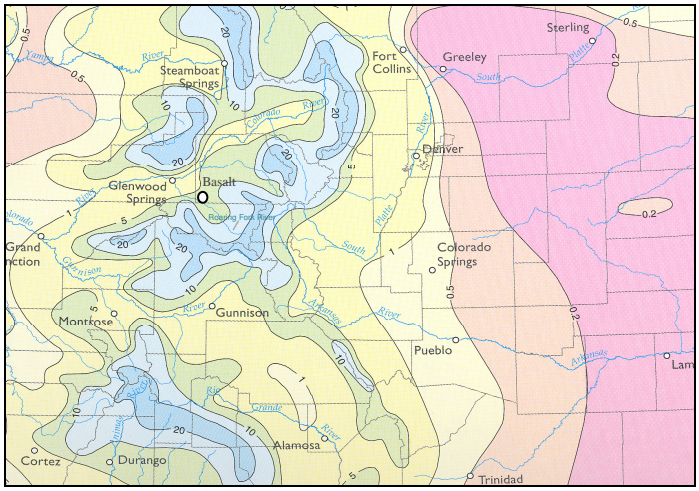
Figure 7. Map of annual average precipitation in inches

Temperature

Basalt is nestled in the foothills of Basalt Mountain and receives ample sunshine due to the orientation and width of the valley in this area. At an elevation of 6,610 feet, mild winters, relatively low humidity, and moderate summer temperatures characterize Basalt's climate. In the valley bottoms, summer high temperatures extend into the mid 80s, with cool evenings. The monthly average temperature varies from 24.2^0 F in January to 70.8^0 F in July.

Precipitation

Winter and spring storms represent the majority of the precipitation in this region. Summer thunderstorms, although brief, can often be very intense, producing 20 to 40 percent of the annual precipitation. Precipitation can vary greatly from year to year. Annual precipitation in Eagle County is 14.1 inches and Pitkin County 24.5 inches (Basalt, 2007).



SOURCE: GROUND WATER ATLAS OF COLORADO

Figure 8. Average annual water runoff in Colorado

Runoff

Most of the precipitation that falls on the land surface during snowmelt and storm events flows directly into drainages, eventually flowing into streams and rivers. Some of the water will infiltrate the soil and recharge the underlying aquifers. In the mountainous regions of the state, annual runoff is related to the greater amount of precipitation, steeper topography, thin to nonexistent soils, and cooler temperatures (Robson and Banta, 1995). The average annual runoff for the Roaring Fork River watershed is 20 inches at the top of the ridges and between 5 to 10 inches near Town of Basalt.

Land Ownership and Use

The Town of Basalt's Source Water Protection area lies within both public and private lands. The public lands include land managed by the U.S. Department of Agriculture's Forest Service and the State of Colorado's Division of Wildlife. National Forest lands within the White River National Forest are managed by the Aspen-Sopris Ranger District in Aspen, Colorado. The private land includes land within the Town of Basalt, and land within unincorporated areas of Eagle or Pitkin County (Fig. 9).

Land use on private land consists of agricultural, urban and rural residential development, recreation, and tourism. Land use on public land consists of hiking, hunting, fishing, camping, snowshoeing, cross country skiing, wildlife habitat, municipal water supply for the Town of Basalt, and other special uses.

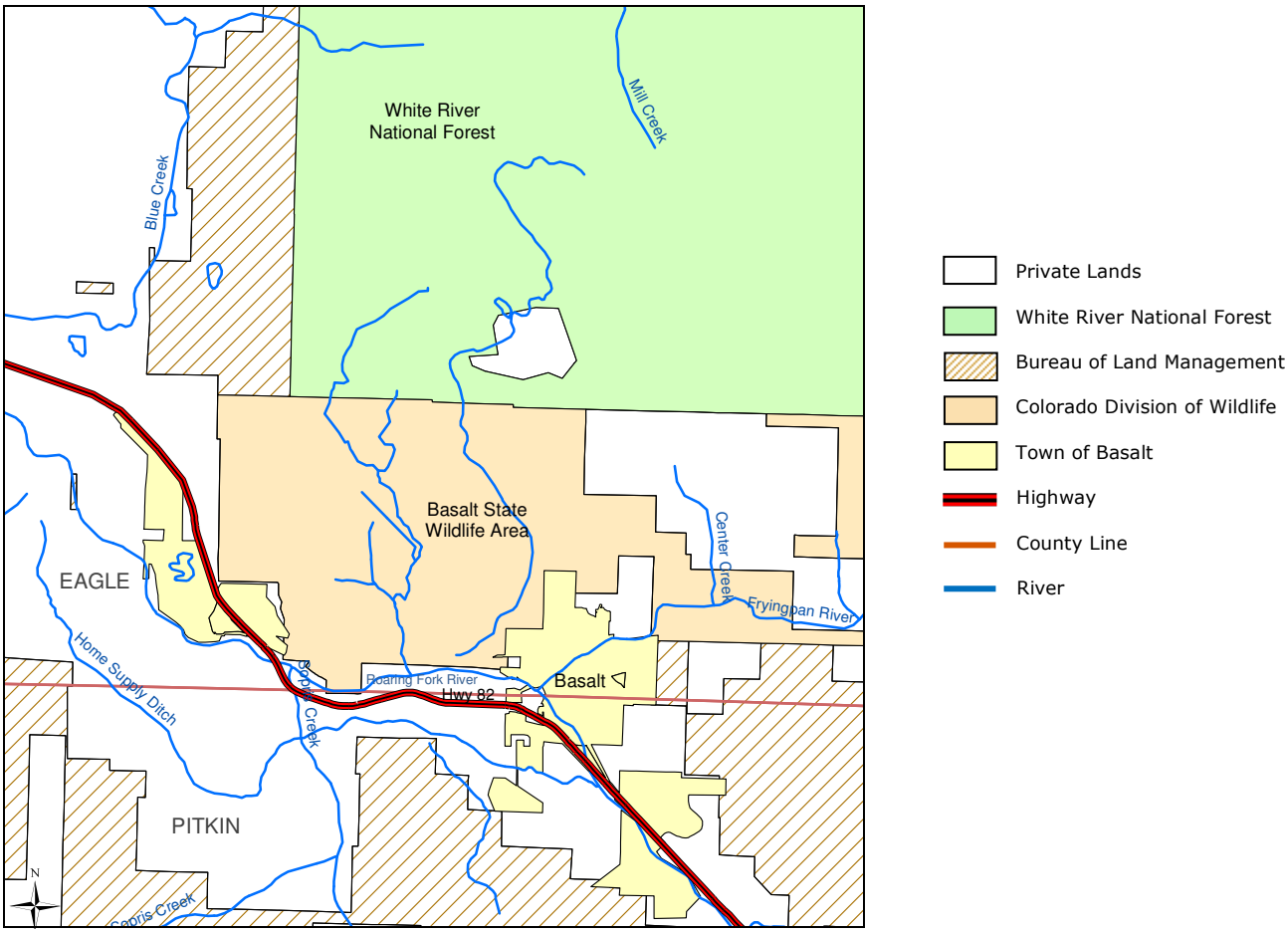


Figure 9. Land ownership and jurisdiction in the Basalt area

Land Administration

Town of Basalt

Land use decisions on private land within the Town of Basalt are made by the Town Council of Basalt with recommendations from their Planning Department staff and Planning and Zoning Commission. The planning staff also helps the Planning and Zoning Commission prepare master plans to guide the town's growth. Currently, the 2007 Master Plan is the town's signature document for outlining key planning policies. The Master Plan identifies the following goals and objectives pertaining to protecting the water sources:

> GOAL: Protect and enhance the natural environment, recognizing that it is the source of the community's physical and economic health. Minimize the adverse impacts associated with solid waste disposal, wastewater disposal, water and energy use, and noise and light pollution. Maintain the ecological integrity of the natural landscape, streams, surface waters and wildlife habitat areas, riparian areas, big game migration corridors and critical habitats such as critical winter range and production areas.
>
> OBJECTIVES:
>
> - Protect and enhance the ecological value of the Roaring Fork and Fryingpan River corridors and other significant wetlands in the area. Preservation and enhancement measures should focus on improving fish and other aquatic habitat as well as water quality, riparian habitat preservation, and revegetation;
> - Maintain and evolve water quality standards to protect rivers and all domestic water sources;
> - Establish policies and programs designed to address point and non-point source pollution and support the Roaring Fork Conservancy's efforts in this area;
> - Promote the use of native plantings, xeriscaping, raw water irrigation and other water conservation techniques in the community;
> - Support the Roaring Fork Conservancy, CDOW and other entities that establish public education programs that foster the value of the river and wildlife lands (from CDOW), that promote ways to prevent pollution and minimize the impacts of human activities on water quality, wildlife corridors and that address the benefits of wise product use, disposal and recycling;
> - Support efforts of those entities that manage the Fryingpan River to meet the optimum flow requirements for safety, ecological health and angler satisfaction;
> - Aggressively pursue improvements to the recycling program, including relocation of the collection bins. Examine ways to increase the participation of commercial and curbside residential pick up, with the goal to recycle 30% of the total solid waste generated in the community;
> - Establish and utilize best management practices to protect environmental resources, particularly water quality, from storm water run-off;
> - Strongly encourage alternatives to the use of chemicals designated as hazardous by the Environmental Protection Agency (EPA) in all Town operations and projects funded by the Town (Basalt, 2007).

Eagle County

Land use decisions for Eagle County are made by the Eagle County Board of County Commissioners with recommendations from their Planning Commission. The Department of Planning administers Eagle County's land use regulatory system. The Eagle County Comprehensive Plan, adopted in 2005, provides a framework for decision making and serves as a guide for all decisions regarding land use, the environment, the economy, transportation, housing or any other topic of potential impact to the quality of life enjoyed by the people of Eagle County (Eagle County, 2005). Eagle County also adopted a Mid Valley Subarea Plan in 1991 which is currently undergoing revisions. The Comprehensive Plan identifies the following goals, policies, and strategies pertaining to water resources:

GOALS:

1) Source water in Eagle County is protected, and contributors of surface and groundwater pollution are identified and eliminated to the fullest extent possible.

2) Sufficient domestic water is available to all developed areas so long as requirements for maintaining healthy natural riparian and aquatic ecosystems are being met.

POLICIES:

- The long term viability of both ground and surface water sources should be protected.
- Water conservation efforts by all water users in Eagle County should be implemented.
- New water diversions and water storage projects should result in positive impacts to Eagle County's economy and environmental quality.
- Collaborative efforts on regional land and water use planning efforts to address future growth, water supply, and stream flow protection should be encouraged.
- Water quality in Eagle County should meet the highest applicable standards.
- Surface and groundwater supplies should be protected from agricultural, industrial and development related impacts.
- A comprehensive approach to watershed planning and decision-making should be utilized.

STRATEGIES:

- Oppose additional out-of-basin diversions
- Require developers to demonstrate that a legal and physical water supply exists for their development
- Protect source water areas and reduce the potential for source water contamination
- Use pervious surfaces instead of impermeable surfaces when possible
- Dispose of hazardous materials properly and keep all potential pollutants away from streams and groundwater recharge areas
- Ensure that development does not adversely affect the recharge of groundwater resources
- Consider the creation and implementation of a wellhead protection program

Pitkin County

Land use decisions for Pitkin County are made by the Board of Commissioners with recommendations from their Planning commission and department staff**.** The Planning and Zoning Department administers Pitkin County's land use regulatory system. The Pitkin County Comprehensive Plan was adopted in 2002 and consists of several sub-plans covering different areas of the County. The area around Basalt lies within the Down Valley Comprehensive Plan area. The Plan identifies the following goals and objects to protect the environmental quality.

GOAL: Preserve environmentally sensitive areas and the quality of soil, air and water sheds.

OBJECTIVES:

- Identify environmentally sensitive areas based on the mapping within the Existing Conditions Report and discourage development from occurring in environmentally sensitive and hazardous areas.
- Protect riparian areas from development.
- Monitor air, water and soil quality and investigate programs to protect these resources (Pitkin County, 2002).

In 2008, Pitkin County voters authorized funding to establish a Healthy Rivers and Streams Fund. The Healthy Rivers and Streams Citizen Advisory Board assists the Board of County Commissioners in administering this program. The specific objectives for the fund include:

- Maintaining and improving water quality and quantity within the Roaring Fork watershed;
- Purchasing, adjudicating changes of, leasing, using, banking, selling, and protecting water rights for the benefit of the Roaring Fork watershed;
- Working to secure, create and augment minimum stream flows in conjunction with non-profits, grant agencies, and appropriate State and Federal agencies to ensure ecological health, recreational opportunities, and wildlife and riparian habitat; promoting water conservation;
- Improving and constructing capital facilities that contribute to the objectives listed above (Pitkin County, 2010).

Population and Growth

Growth in Basalt and the entire Mid-Valley area has created concern regarding the potential loss of the "small-town" feel and the agricultural lands and lifestyle that have been part of the Roaring Fork Valley for generations. Since 1990 the Town of Basalt's population grew from 1,128 to 2,681 people in 2000, a 137.67% increase. The increase in population during this period may be attributed to the annexation of the West Basalt property and the Roaring Fork Club which more than doubled the land area in Basalt's jurisdiction (Basalt, 2007).

From 1990 to 2000, the number of people in Eagle County nearly doubled, from 21,928 to 42,986 (revised Census figures). During the first seven years of the new century, that nearly 10% growth per year has slowed to about 3% per year overall (ECEC, 2009). The average of 24.6 people per square mile is low compared to the State average of 41.4. Population concentrations include Avon, Vail, Red Cliff, Gypsum, Basalt, Eagle, and Minturn.

From 1990 to 2000, the number of people in Pitkin County increased from 12,661 to 14,872 people between 1990 to 2000, a 17.5% increase in population. The County averages 15 people per square mile compared to the State average of 41.4. Population concentrations include Aspen, Basalt, Redstone, Snowmass, and Snowmass Village.

In a study completed by the Colorado Department of Local Affairs (DOLA), the population in Eagle County will increase by 84% from 2010 to 2040 (Table 6). In Pitkin County, the protected population increase for this period of time is 74% (DOLA, 2010).

Table 5. Table of Population in the Roaring Fork Valley

Jurisdiction	1990	1997	2000	2009
Eagle County	21,928	35,206	42,986*	54,721
Basalt	1,128	1,869	2,681	3,339
Unincorporated Area	3,157	4,844		
Pitkin County	12,661	14,787	14,872	17,489
Aspen	5,049	5,650	6,317	6,846
Snowmass Village	1,449	1,706	2,278	2,613
Carbondale	3,004	4,413	5,196	7,026
Unincorporated Area	6,163	7,029		

SOURCE: COLORADO DIVISION OF LOCAL AFFAIRS *Revised Census – Economic Council of Eagle County Report, February 2009

Table 6. Projected Growth Estimates

County	2010	2015	2020	2025	2030	2035	2040
Eagle	56,124	64,070	72,227	77,278	84,905	94,238	103,287
Pitkin	17,686	19,494	21,731	24,009	26,315	28,586	30,783

SOURCE: COLORADO DIVISION OF LOCAL GOVERNMENT

WATER QUALITY – HYDROLOGIC SETTING

Hydrology

The Town of Basalt obtains its drinking water from two separate sources: groundwater wells and springs. The groundwater wells are completed in the alluvial aquifer of the Roaring Fork River; whereas the Town's springs originate from a hillslope area on Basalt Mountain. All of the groundwater sources are located in the subregions of the Colorado River basin; Hydrologic Unit Codes 1401000402, 1401000403, and 1401000402. The Colorado River basin encompasses approximately 9,830 square miles within Colorado and drains part of the Southern Rocky Mountains and the Colorado Plateau physiographic provinces (Fig. 10). Principal tributaries of the Colorado River basin are the Fraser, Blue, Eagle, and Roaring Fork Rivers.

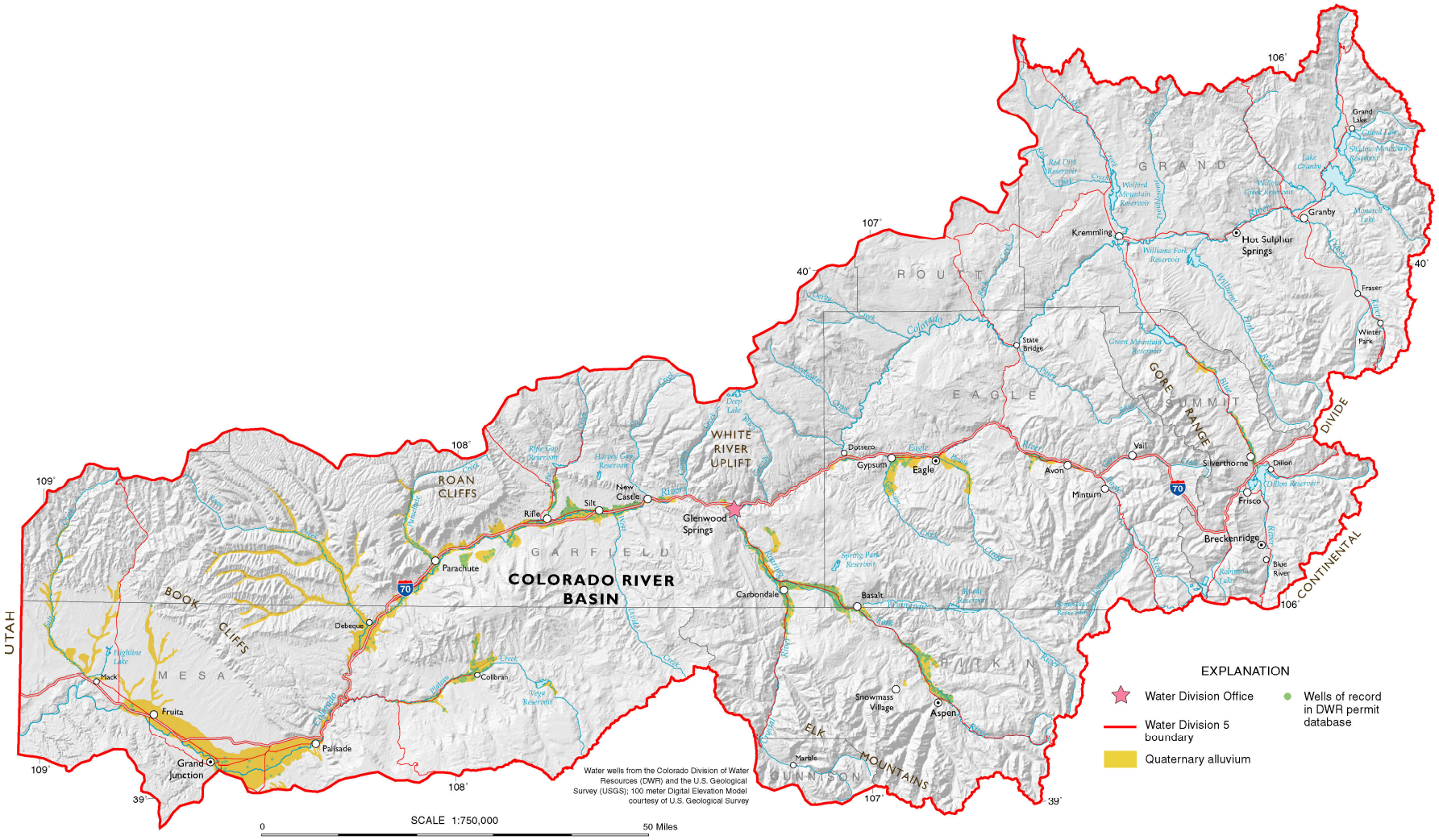
The headwaters for the Colorado River originate within Rocky Mountain National Park and flows southwest some 230 miles through Grand, Eagle, Garfield, and Mesa counties before exiting the state at the Utah border. The elevation of the drainage basin range from greater than 13,000 feet in the headwater mountainous area of central Colorado to about 4,300 feet where the Colorado River exits the state.

Surface water is the principal water resource in the basin. The Colorado River represents the largest surface-water outflow in the state with over 4.6 million acre-feet of water leaving the state annually. Alluvial ground-water resources are used for public water supply and agricultural irrigation, and represent an important resource in rural areas for domestic supplies (Topper, et al, 2003). Alluvial groundwater wells are considered tributary to the stream system and managed by the State as if they were surface water diversions. Management of these waters is under the jurisdiction of the Colorado Division of Water Resources, Division 5 of the State Engineer's Office and Water Court located in Glenwood Springs.

<u>Roaring Fork Watershed</u>
The Roaring Fork watershed is located in Pitkin, Eagle, Garfield, and a small portion of Gunnison Counties, in west-central Colorado, comprising an area of high glaciated mountainous terrain and deep intervening valleys. Altitudes in the watershed range from 14,265 feet along the continental divide and within the Maroon Bells/Snowmass Wilderness, to 5,800 feet at Glenwood Springs. The drainage area for the entire watershed (to Glenwood Springs) is approximately 929,000 acres.

The Roaring Fork, with headwaters in the Independence Pass area, drains most of Pitkin County, flowing northwest to its confluence with the Colorado River at Glenwood Springs. Principal tributaries to the Roaring Fork include Castle and Conundrum Creeks, flowing north to Aspen; Brush Creek, flowing east through the Snowmass Ski areas to its confluence with the Roaring Fork River at the Town of Woody Creek; the Fryingpan River, flowing westward to Basalt; and the Crystal River, flowing north to Carbondale. The Roaring Fork River contributes more water to the Colorado River than any other stream in Colorado except for the Gunnison, yielding an average of almost 1,000,000 acre-feet per year.

The three major rivers in the watershed, the Roaring Fork, the Crystal, and the Fryingpan, contribute approximately 54%, 32%, and 14% of the flow in the watershed (NWCCOG, 2002).



SOURCE: GROUND WATER ATLAS OF COLORADO

Figure 10. Map of the Colorado River Basin

Alluvial Aquifer

The valley-fill deposits or alluvium in the Colorado River basin consist generally of unconsolidated boulders, cobbles, gravel, sand, silt, and clay. The thickness of the alluvium can be extremely variable depending on location. Alluvium in the upper reaches of the basin tends to be thin due to increased slopes and higher flow velocities. Thicker deposits tend to accumulate in the lower reaches. The reported alluvial saturated thickness for the Roaring Fork River ranges from 19 to 62 feet, with an average of 41 feet.

Static water levels in alluvial deposits are related to the adjacent river or creek stage. Generally, the alluvial water levels will be high in the spring and early summer due to snowmelt and increased runoff, dropping through the summer and fall, and will remain low throughout the winter. Reported water levels in the Roaring Fork alluvium range from 1 to 30 feet below the ground surface, with an average of 19 feet (Topper, et al., 2003). The Roaring Fork alluvium in the area of the Basalt well field is shown in Figure 8 below.

The Roaring Fork River and Fryingpan River confluence is located within the boundaries of the Town of Basalt. As the Fryingpan River flows from upstream to downstream, the chemical concentrations increases, especially sulfate, calcium, and dissolved solids. The lower reaches drain the Maroon Formation and various siltstone and sandstone layers, which yield calcium sulfate water. Also, there is an increased amount of flow from ground water stored in alluvial deposits in the lower reaches of the Fryingpan River. Because of this, there is a greater mineral content discharged to the stream, as compared to upstream. The dissolved-solids concentration averages about 200 mg/L and suspended solids average less than 10 mg/L (NWCCOG, 2002).

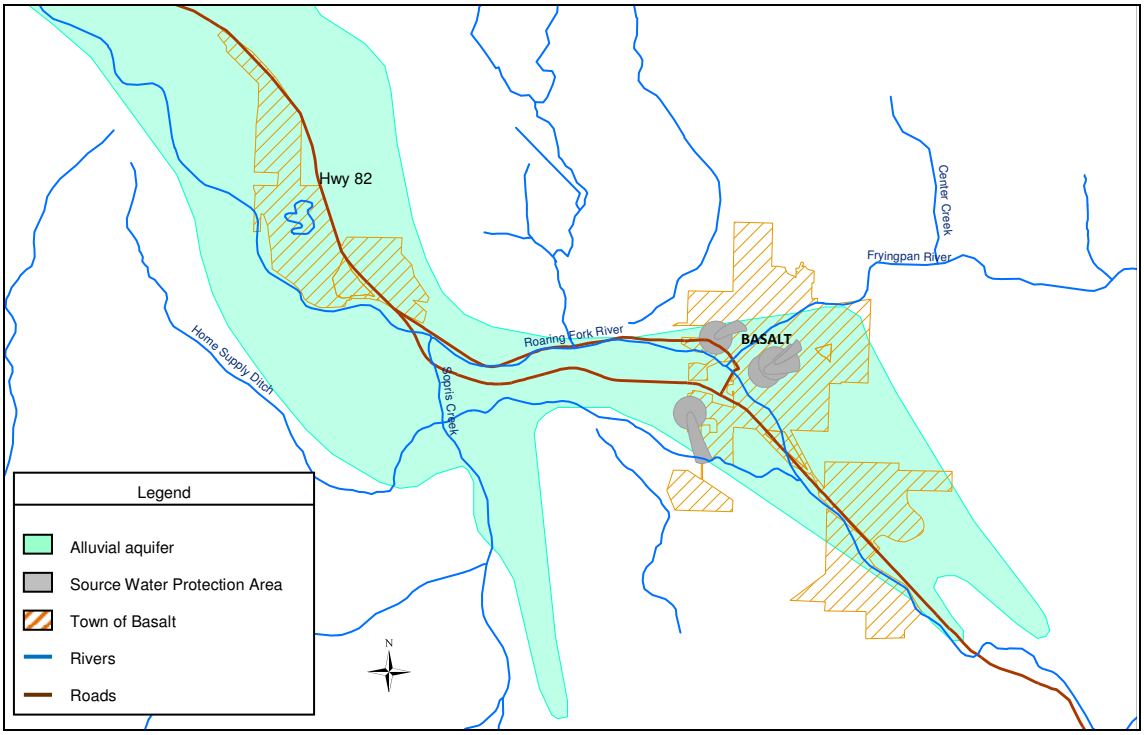
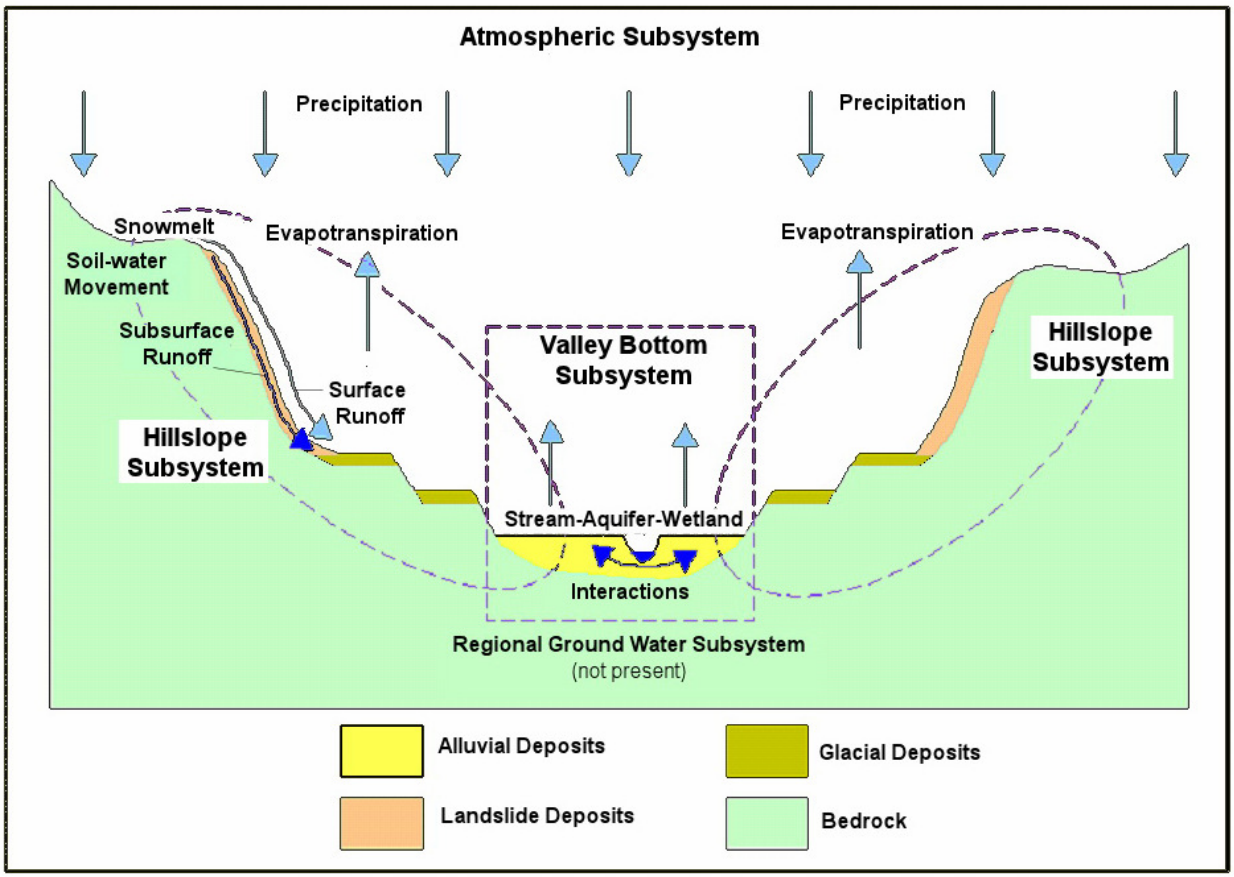


Figure 11. Map of the Roaring Fork River's alluvial aquifer

GIS-Based Groundwater Resources Evaluation

In 2006, Pitkin County created a GIS-based groundwater resource evaluation procedure for the Upper and Middle Roaring Fork areas. The Town of Basalt's wells are located in the Middle Roaring Fork study area. Within this study area, no regional groundwater flow system has been identified, and subregional and local scale groundwater flow systems dominate. A conceptual model was developed for the Middle Roaring Fork groundwater flow system (Fig. 12).



SOURCE: DEVELOPMENT OF GIS-BASED GROUND WATER RESOURCES EVALUATION OF THE UPPER AND MIDDLE ROARING FORK VALLEY AREA

Figure 12. Conceptual model of middle Roaring Fork groundwater flow system.

The regional hydrologic inputs include infiltration of precipitation as rain and snowmelt, areas of losing streams and water bodies, and upland irrigation areas. The hillslope subsystem consists of the hydrologic processes of surface and near surface runoff (interflow or through flow – light blue arrows on left slope in Figure 12), saturated groundwater flow in some areas (dark blue arrows in Figure 12), and discharge to surface springs and by plants as evapotranspiration. The Valley Bottom subsystems, where stream-aquifer-wetland interactions occur, are areas of both groundwater recharge and discharge.

The Valley Bottom subsystem material is recharged by infiltration from precipitation that is non-uniformly distributed due to the location of open areas, buildings, and parking lots, highway and airport location, irrigation ditch location, and position in the landscape. The estimates of hydraulic conductivity range generally between 1 to 100 ft per day (Kolm, et al, 2006).

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 by the Colorado Water Quality Control Act through a number of 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. Standards are designed to protect the associated classified uses of water or a designated use. The groundwater classifications are applied to groundwaters within a specified area based upon use, quality and other information as indicated in Regulation No. 41, "The Basic Standards for Ground Water'"(CDPHE, 2008). Statewide standards have been adopted for organic chemicals and radionuclides. Significant areas of the state have been classified for site specific use classification and the remainder of the state's groundwater is protected by interim narrative standards.

Classifications and standards are implemented by seven separate state agencies through their rules and regulations for activities that they regulate. Regulated activities include: mining and reclamation, oil and gas production, petroleum storage tanks, agriculture, Superfund sites, hazardous waste generation and disposal, solid waste disposal, industrial and domestic wastewater discharges, well construction and pump installation, and water transfers.

Colorado has proactive groundwater protection programs that include monitoring groundwater for agricultural chemicals and pesticides, issuing groundwater discharge permits; voluntary cleanup program, permitting for large hog farm operations, and educational programs. Also, water wells must have a permit and meet minimum standards of construction and pump installation.

Drinking Water Supply Operation

Town of Basalt

The Town of Basalt is a rural community located in Eagle and Pitkin Counties, between Aspen and Glenwood Springs on Highway 82. It is 23 miles southeast of the city of Glenwood Springs at Latitude 39°22'6"N, Longitude 107°2'18"W.

The Town of Basalt is situated in the Roaring Fork River valley at the confluence of the Fryingpan and Roaring Fork River's. Basalt's elevation is 6,611 feet. The Town has approximately 1600 residential dwellings, a population of 3722 residents, and a western town charm. As an incorporated town, its municipal affairs are governed by the Basalt Town Council.

The Town's water system provides service to the area within East Basalt. The Basalt water service area is the same as the East Basalt Town Boundary with the exception of a few out-of-town taps that continue to be served. West Basalt is served by Mid-Valley Metro Water District. The water sources for the Town of Basalt water system include the Basalt Springs, along with three wells located near the Basalt Elementary and Middle School campuses, the Basalt Town Hall, and the Town's Public Works Department (Table 7). The municipal water system is operated by the Town's Public Works Department.

Raw water from the springs is transported to the water treatment plant via underground pipelines. Spring water is filtered at the microfiltration plant. The treated spring water is gravity fed into the distribution system and into four aboveground storage tanks with a total of 1.26 million gallons capacity The wells are treated at the source and pumped into the distribution system including the tanks and distributed to Basalt residents via a network of underground pipes to 860 taps.

The average daily demand is 0.4 million gallons. Peak usage is during the months of July, August and September with an average of 0.7 million gallons per day. The lowest usage quarter is January, February, and March with an average of 0.2 million gallons consumed per day. The system has the design capacity for providing 2.15 million gallons per day. The Town of Basalt provides a State required Annual Drinking Water Quality Report to the public which provides information on the results of their water quality monitoring program. The annual report is available at the Basalt Town Hall or by calling (970) 927-9013.

The Town's water system is maintained and funded through the Town's Water Fund, an enterprise fund within the Town's budget. Future capital expenses are planned and budgeted with tap fees and special surcharges (Darcy, 2011).

Table 7. Springs and Wells Water Sources

Lucksinger Springs*	Basalt Springs 6
Basalt Springs 1	Basalt Well RE-1**
Basalt Springs 2	Basalt Well # 9
Basalt Springs 3	Basalt Well # 11
Basalt Springs 4	Basalt Well # 13
Basalt Springs 5	

*Seasonal emergency source only
** Currently used as raw water irrigation only

OVERVIEW OF COLORADO's SWAP PROGRAM

Source water assessment and protection came into existence in 1996 as a result 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. The SWAP program protection plan is integrated with the Colorado Wellhead Protection Program that was established in amendments made to the federal Safe Drinking Water Act (SDWA, Section 1428) in 1986.

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 drinking water source;
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 general public.

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

Source Water Protection Phase

The Protection Phase is a voluntary, ongoing process to employ preventive measures to protect water supplies 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 of 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;
4. Monitoring the effectiveness of the protection plan and updating it accordingly as future assessment results indicate.

SOURCE WATER ASSESSMENT RESULTS

The Town of Basalt received their source water assessment report in November 2004. The Town found that the report identified the delineation for the Town's wells as the entire Roaring Fork River watershed upstream from the Town. The Town requested that CDPHE re-delineate their protection area to zones that would have direct influence on water quality, surrounding the groundwater wells and springs. Therefore, the original Source Water Assessment and Protection (SWAP) report was not available to the public on the CDPHE website.

In 2010, the Town provided CDPHE updated GIS information regarding the number and location of its current wells and springs. The CDPHE re-delineated both protection areas based on the updated information and provided this to the Town. The re-delineated areas were used as a starting point to guide the development of appropriate management approaches to protect their source water from potential contamination (Fig. 13).

Revised Source Water Assessment Area Delineation

A source water protection area is the surface and subsurface areas from which contaminants are reasonably likely to reach a water source. Delineation is the process used to identify and map the drainage basin that supplies water to a surface water intake. The purpose of delineating a Source Water Protection Area is to determine the recharge area that supplies water to a public water source. The delineated source water assessment area provides the basis for understanding where the community's source water and potential contaminant threats originate, and where the community has chosen to implement its source water protection measures in an attempt to manage the susceptibility of their source water to potential contamination.

<u>Groundwater Sources</u>
The Town of Basalt's source waters are from groundwater sources within two different locations: the wells in the Roaring Fork River alluvium and the springs at the base of Basalt Mountain. The location of potential contaminant sources to the groundwater sources was evaluated using Geographic Information System technology to determine its proximity relative to three sensitivity zones defined as:

1) **Zone 1** is a 500-foot radius around the water source intake.

2) **Zone 2** is defined by calculating the distance from the water intake source through which a parcel of water travels over a two-year time period or 2 year time of travel (TOT).

3) **Zone 3** is defined by estimating the distance from the water intake source through which a parcel of water travels over a five-year time period or 5 year time of travel (TOT).

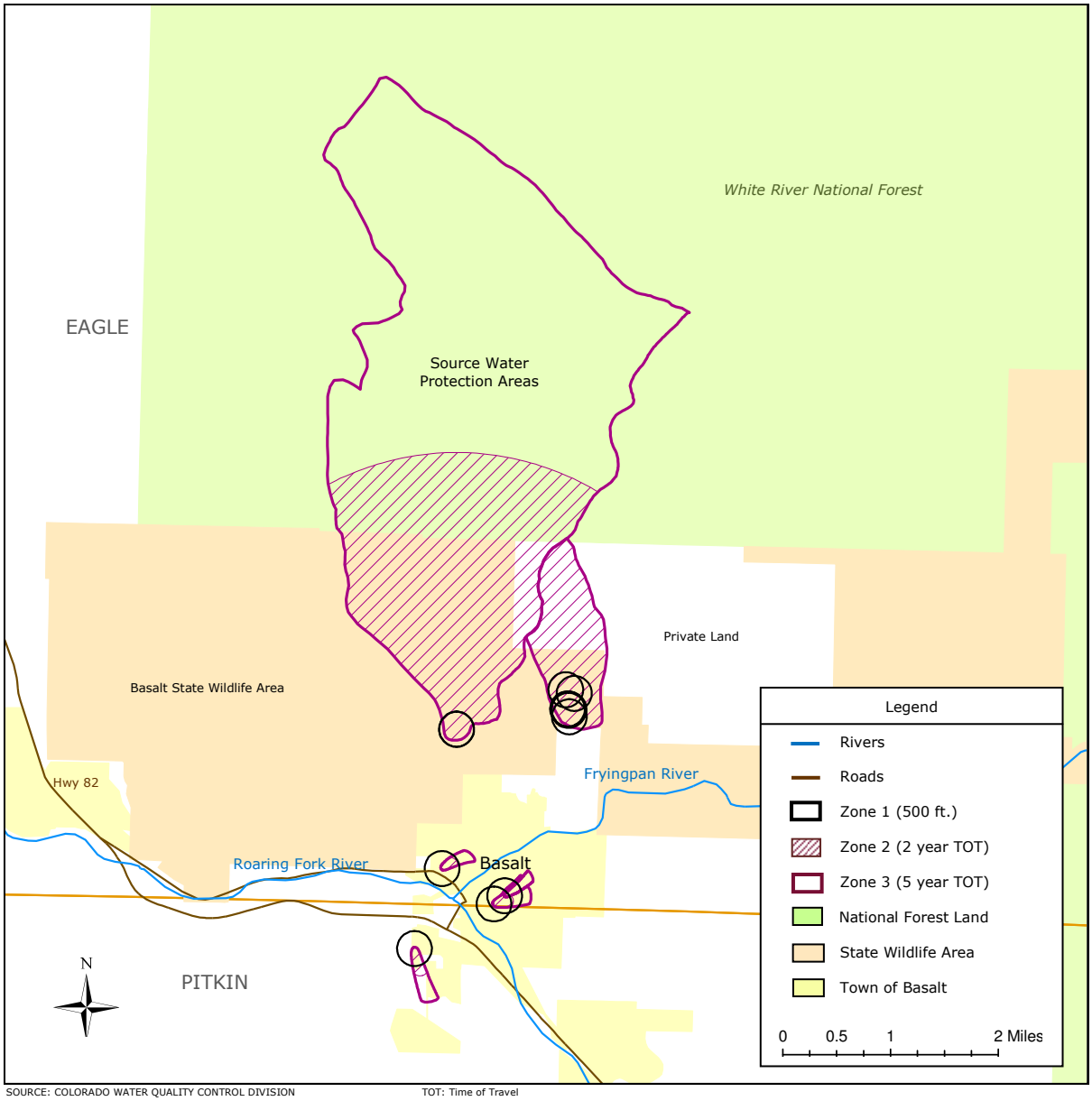


Figure 13. Map of the Town of Basalt's re-delineated Source Water Protection Area

Contaminant Source Inventory

Notice
The information contained in this "Plan" is limited to that available from public records and the water supplier. Other "potential contaminant sites" or threats to the water supply may exist in the source water assessment area that are not identified in this "Plan." Identification of a site as a "potential contaminant site" should not be interpreted as one that will necessarily cause contamination of the water supply.

In 2010, the CDPHE provided the Town of Basalt GIS information on potential contaminant sources located within the newly re-delineated protection areas. The Town Source Water Protection Planning Team field-checked this existing information, added additional potential sources of contaminant based on local knowledge, and developed a current inventory. This inventory identifies selected potential sources of contamination that might be present within the source water assessment areas. Discrete contaminant sources were inventoried using selected state and federal regulatory databases including: mining and reclamation, oil and gas production, above and underground petroleum tanks, Superfund sites, hazardous waste generators, solid waste disposal, industrial and domestic wastewater dischargers, and water well permits. Dispersed contaminant sources were inventoried using recent land use/land cover and transportation maps of Colorado, along with selected state regulatory databases. The contaminant inventory was completed by mapping the potential contaminant sources with the aid of a Geographic Information System (GIS).

The WQCD's assessment process used the terms "discrete" and "dispersed" potential sources of contamination. A discrete source is a facility that can be mapped as a point, while a dispersed source covers a broader area such as a type of land use (crop land, forest, residential, etc.).

Discrete Potential Sources of Contamination
The revised contaminant source inventory includes storage tanks and facilities.

Dispersed Potential Sources of Contamination
The contaminant source inventory indicates the following types of dispersed contaminant sources were identified within the source water assessment areas analyzed:

Land uses:

- Pasture/Hay
- Mixed Forests
- Road Miles
- Residential
- Agricultural activities

Susceptibility Analysis

The susceptibility analysis for the original SWAP report identified how susceptible an untreated water source could be to contamination from potential sources of contamination inventoried within its source water assessment area. CDPHE did not provide a new susceptibility report based on the re-delineated protection area.

Contaminants Health Concerns

The discrete and dispersed sources of contaminants can cause acute and chronic health concerns as indicated below. These categories of contaminants are most likely associated with the most prevalent sources identified in Table 8.

Acute Health Concerns

Acute health concern contaminants include individual contaminants and categories of constituents that pose the most serious immediate health concerns resulting from short-term exposure to the constituent. Many of these acute health concern contaminants are classified as potential cancer-causing (i.e., carcinogenic) constituents or have a Maximum Contaminant Level Goal (MCLG) set at zero (0).

Table 8. Acute Health Concerns

Acute Health Concern	Discrete Contaminants	Dispersed Contaminants
Microorganisms	x	x
Nitrate/Nitrite	x	x
Pesticides	x	x
Semi-volatile organic compounds (SVOCs)	x	
Volatile organic compounds (VOCs)	x	
Lead	x	
Ammonia or nitric acid	x	x

SOURCE: COLORADO WATER QUALITY CONTROL DIVISION

Chronic Health Concerns

Chronic health concern contaminants include categories of constituents that pose potentially serious health concerns due to long-term exposure to the constituent. Most of these chronic health concern contaminants include the remaining primary drinking water contaminants.

Table 9. Chronic Health Concerns

Chronic Health Concern	Discrete Contaminants	Dispersed Contaminants
Herbicides	x	x
Pesticides		x
Volatile organic compounds (VOCs)	x	
Non-metal inorganic compounds		
Metals – Primary Drinking Water (other than lead)	x	
Turbidity	x	x
Other inorganic compounds	x	x
Other organic compounds	x	

SOURCE: COLORADO WATER QUALITY CONTROL DIVISION

DISCUSSION OF ISSUES OF CONCERN

The Planning Team reviewed the information presented in the State's assessment, discussed other potential sources of contaminants not included in the assessment, and identified areas of concern within the source water protection areas in which to focus their management approaches.

Issues of concern include:

- Fuel Storage tanks
- Impacts from transportation on roads
- Irrigation ditch leaking and irrigation recharge
- Agricultural activities
- Climate change
- Flooding and floodplain influence
- Urban runoff
- Public land management
- Wildfires
- Residential property maintenance
- Facilities storing hazardous materials

Surface and 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. 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 USEPA, 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).

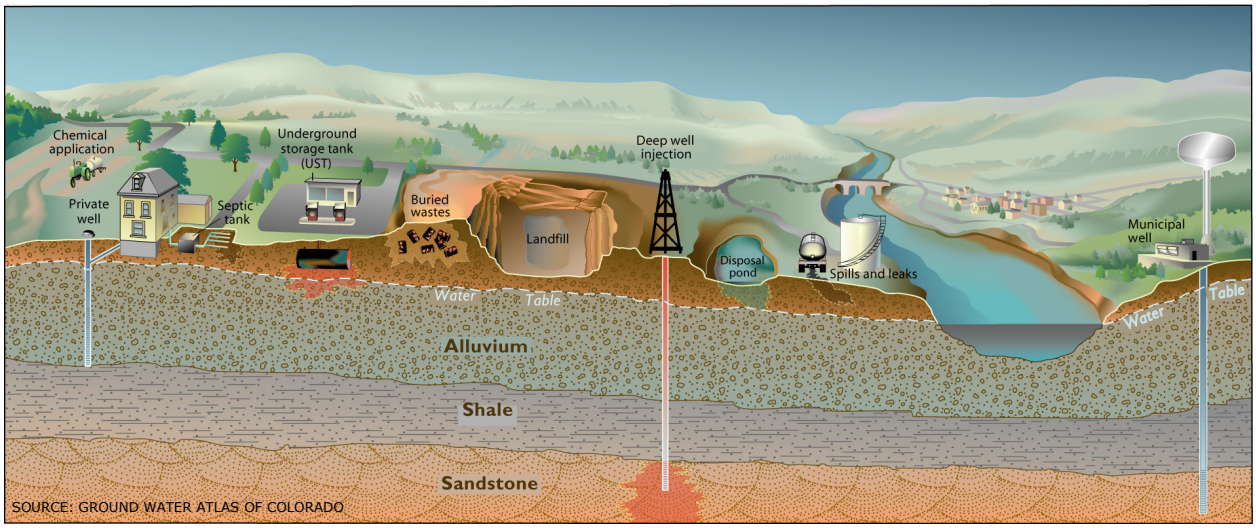


Figure 14. Schematic drawing of the potential sources of contaminants to surface and groundwater.

Fuel Storage Tanks: Above, Underground, and Leaking

There are 12 permitted fuel storage tank sites (6 active and 6 inactive) within the source water protection area (SWPA) or in close proximity (Fig. 15). Information of the current status of Aboveground Storage Tanks (AST) and Underground Storage Tanks (UST) within the source water protection area 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

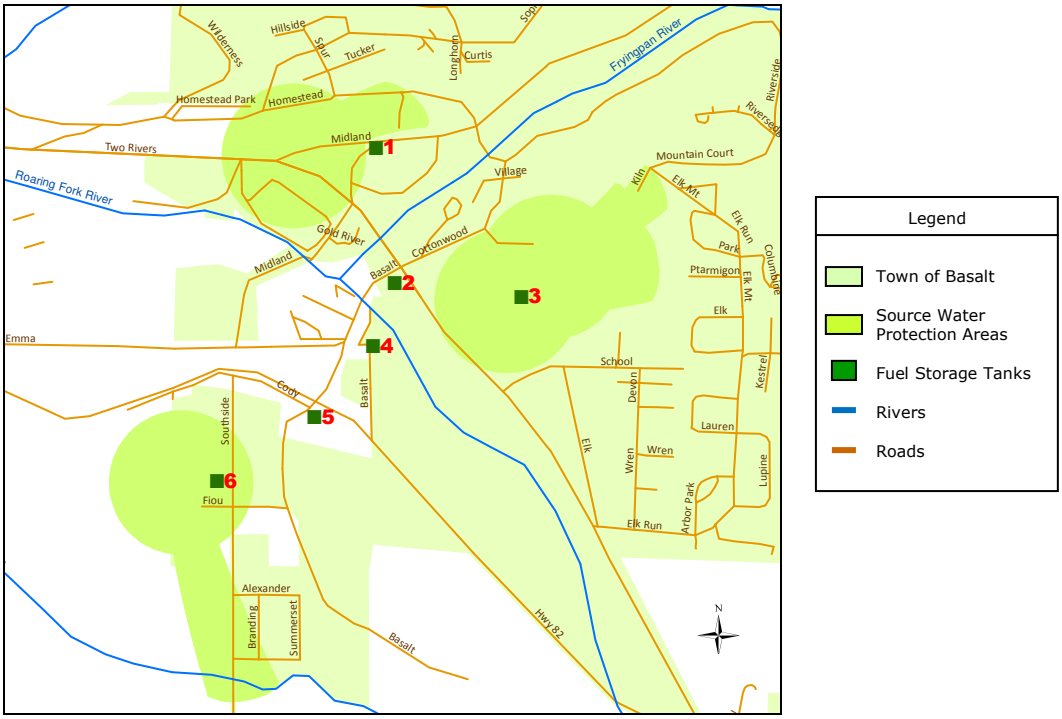


Figure 15. Location of active fuel storage tanks

Table 10. Active Fuel Storage Tanks in or Near the Protection Areas

No.	Storage Tank Facilities & Numbers	Information
1	Basalt Center Fuel (Conoco Phillips 66) 122 Midland Avenue #3891	3- UST and 1 LPG AST in use; 5 UST closed in 1991.
2	7-Eleven 23250 Two Rivers Rd. #9129	3 UST in use; each gasoline tank 12,000 gallons.
3	Roaring Fork School District Bus Barn 151 Cottonwood Drive #2646	1 AST Diesel 6000 gallon tank in use.
4	Basalt Store 136 Emma Road #6477	2 UST in use, 20,000 gallons ad 6,000 gallons; 3 Confirmed Release events: 2006 and 2007 both tanks closed, July 2010 event still open.
5	Valley Commercial Fueling (Shell Gasoline) 545 Basalt Avenue #14327	3 UST in use; each gasoline tank 10,000 gallons.
6	Town of Basalt 200 Fiou Lane #14450	1 AST Diesel/gasoline 2000 gallon tank in use.

SOURCE: COLORADO DEPARTMENT OF LABOR AND EMPLOYMENT DIVISION OF OIL AND PUBLIC SAFETY

Storage Tank Spills

Fifty percent of the storage tank facilities have had leaking underground storage tanks, recorded as Confirmed Released. There have been 7 Confirmed Release spills of which 6 have been cleaned up and 1 underground tank spill in the process of review (Tables 10 & 11). 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 7 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.

Table 11. Inactive Storage Tanks

Storage Tank Facilities & Numbers	**Information**
Roaring Fork School District 151 E. Cottonwood Drive #1678	1 inactive UST. 1995 Confirmed Release, Leaking Underground Storage Tank (LUST) cleanup completed 1997 .
Sashae Floral Arts & Crafts 132 Midland Avenue #5419	2 UST closed.
Town of Basalt 120 W. Homestead #9025	1 UST closed; 1993 Confirmed Release, LUST cleanup completed 1994.
Town of Basalt 138 Homestead Drive #5540	1 UST closed.
Eagle Basalt Shop 165 W. Sopris Drive #5387	2 UST closed; 1996 Confirmed Release, 2008 cleanup completed.
Basalt Fire Station 20 School Street #1753	2 UST & 1 AST closed; 1996 Confirmed Release, no further action required.

SOURCE: COLORADO DEPARTMENT OF LABOR AND EMPLOYMENT DIVISION OF OIL AND PUBLIC SAFETY

The leaky underground storage tank 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). 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.

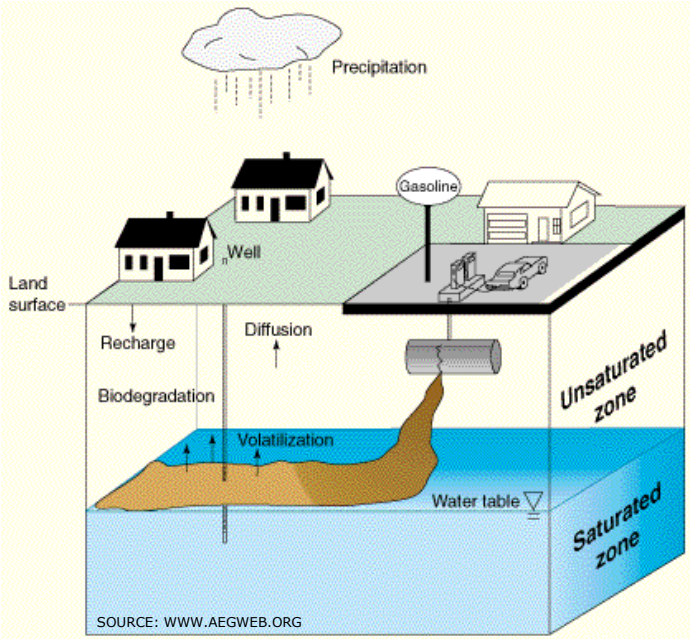


Figure 16. Schematic of a LUST spill site

Spills from leaking underground storage tanks (LUST) sites can contaminate the groundwater and also present other hazards. Because gasoline is lighter than water, gasoline floats on the water table and remains relatively close to the land surface. The most hazardous compounds in groundwater(the BTEX compounds) are quite volatile and carcinogenic. Besides the potential for being consumed in drinking water, volatile compounds can enter nearby buildings. In poorly ventilated buildings, the compounds can accumulate and present a health risk through inhalation. In buildings, the volatile compounds can also present an explosion hazard (Ryan, 2006).

Residential Storage Tanks

Rural residents within the source water protection area may have private aboveground or underground storage tanks containing gasoline for vehicles or heating fuel. These private tanks are excluded from the Colorado Department of Labor and Employment Division of Oil and Public Safety's regulations if the UST system is 110 gallons or less or if the AST is less than 660 gallons. The private aboveground storage tanks are a concern because they may be old and subject to leakage. Storage tank releases can result from corrosion of parts, improper installation, failure of piping systems, spills and overfills that occur during fuel transfers, and improper operation and maintenance of the system.

It only takes a small amount of petroleum to contaminate the ground or surface water. In order to protect groundwater within the source water protection area petroleum product storage practices should be implemented. The location of the fuel tanks within a floodway or areas where the water table is close to the surface is a concern. Aboveground storage tanks should be located over a secondary containment area, such as an impermeable liner made of concrete and there should be a collection device for spills. The containment area should be able to hold 125% of the tank capacity. A manually controlled sump pump should be used to collect rain water that may accumulate in the secondary containment area.

Storage Tank Recommendations:

1. Maintain a current inventory and information on the status of regulated above and underground storage tanks in the source water protection area using the Colorado Storage Tank Information (COSTIS) website at http://costis.cdle.state.co.us. Storage tank information from this site includes: facility, tank, owner, and events.

2. Identify Leaking Underground Storage Tank (LUST) events that have occurred within the SWPA using the State's database COSTIS. Contact the Colorado Department of Labor and Employment Division of Oil and Public Safety (303-318-8000) for information regarding LUST events within the SWPA. Contact the Public Records Center for a file review at (303) 318-8521 or (303) 318-8522. Monitor progress on any remedial action conducted for the known contamination sites.

3. Develop an inventory of residential or farm unregulated storage tanks within the source water protection area.

4. Provide information to tank owners on how they can implement storage tank practices to prevent petroleum products from leaking onto the ground.

5. Research funding opportunities to assist private unregulated tank owners with constructing secondary containment areas under their storage tanks.

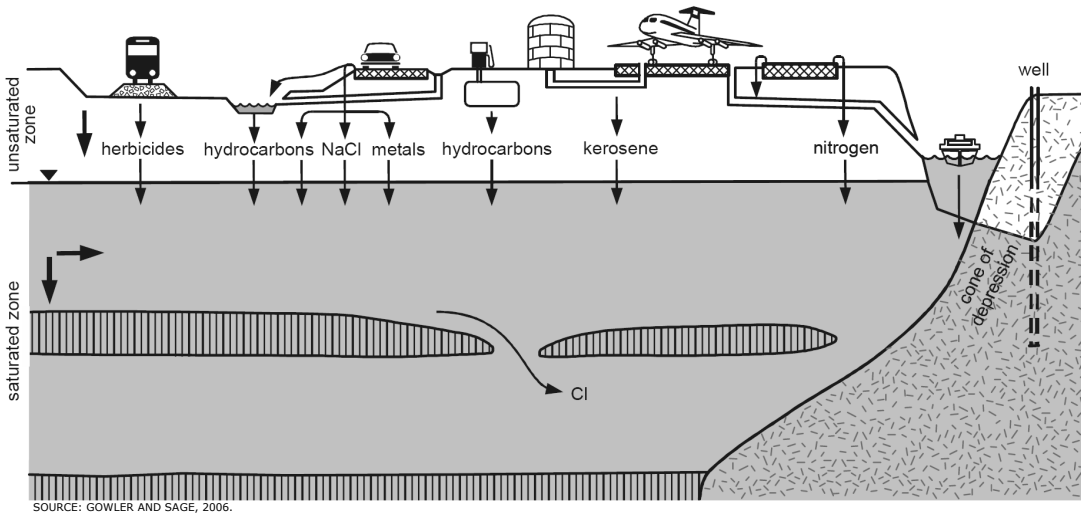
Impacts from Transportation on Roads

The source water protection area for the Town's wells is mostly located within the boundaries of the Town and is served by a network of two-lane paved local roads. Main roads within this protection area include: Midland Avenue, Two Rivers Road, Cottonwood Drive, and Fiou Lane. Midland Avenue is a connector route between Emma Road and Highway 82 and the Fryingpan Road, which provides the sole winter roadway access to Ruedi Reservoir and the residential uses and recreational needs of the Fryingpan Valley. Traffic to and from the Fryingpan Valley travel almost exclusively through the Midland Avenue Business District. Two Rivers Road intersects Highway 82 at both the east and west end; and provides an alternative access to Highway 82 for residents of the Elk Run neighborhood. The roads within the protection area are maintained by the Colorado Department of Transportation (CDOT) and the Town of Basalt.

Groundwater Contaminant Pathways

Motor vehicles, roads and parking facilities are a major source of water pollution to both surface and groundwater. An estimated 46% of US vehicles leak hazardous fluids, including crankcase oil, transmission, hydraulic, and brake fluid, and antifreeze, as indicated by oil spots on roads and parking lots, and rainbow sheens of oil in puddles and roadside drainage ditches. An estimated 30-40% of the 1.4 billion gallons of lubricating oils used in automobiles are either burned in the engine or lost in drips and leaks, and another 180 million gallons are disposed of improperly onto the ground or into sewers. Runoff from roads and parking lots has a high concentration of toxic metals, suspended solids, and hydrocarbons, which originate largely from automobiles (Gowler and Sage, 2006). Storm water runoff over these roads can deliver contaminants from the road surface into the nearby groundwater. Figure 17 below illustrates groundwater contamination pathways from traffic and transport.

Vehicular spills may occur along the transportation route within the source water protection areas from trucks that transport fuels, waste, and other chemicals that have a potential for contaminating the groundwater. Chemicals from accidental spills are often diluted with water, potentially washing the chemicals into the soil and infiltrating into the groundwater. Roadways are also frequently used for illegal dumping of hazardous or other potentially harmful wastes.



SOURCE: GOWLER AND SAGE, 2006.

Figure 17. Most important groundwater contamination pathways from traffic and transport

Chemical Applications

During the winter season CDOT applies a salt-sand mixture and de-icer (magnesium chloride, M1000, or Ice Slicer) to highways along routes within the source water protection areas. Surface and groundwater quality problems resulting from the use of road de-icers are causing concern among federal, state, and local governments. Salt from the highway is introduced into the groundwater through a number of ways:

1) When runoff occurs from highways, flows are sometimes carried to ditches and unlined channels through which the water infiltrates into the soil and eventually into the groundwater.

2) Also, when snow is plowed together with the salt, the pile that is accumulated on the roadside melts during warmer weathers. The water that results contains dissolved salt which can also infiltrate. Plowing and splashing of salt causes the salt to deposit along the pavement, especially near the shoulders where it melts causing runoff to enter drainage ways and then the groundwater system (Seawell, et al, 1998).

Salt contributes to increased chloride levels in groundwater through infiltration of runoff from roadways. Unlike other contaminants, such as heavy metals or hydrocarbons, chloride is not naturally removed from water as it travels through soil and sediments and moves towards the water table. Once in the groundwater, it may remain for a long time if groundwater velocity is slow and it is not flushed away. Chloride may also be discharged from groundwater into surface water and can account for elevated levels of chloride throughout the year, not just in winter. Thus, regardless of the path that the runoff takes, salt poses a water quality problem.

Transportation Corridor Recommendations:

1. Educate the public on how to respond to a hazardous spill.
2. Work with local emergency response teams to ensure that any spill within the protection areas can be effectively contained.
3. Provide the Colorado Department of Transportation and Town of Basalt Road Department with a map of the protection area.
4. Encourage the use of proper road BMPs to prevent the transport of road materials into the source waters. Recommendations for application of road deicing materials include:
    - applying minimum amounts necessary;
    - apply only when removal of snow and ice cannot be accomplished by blading, plowing or sanding;
    - minimize use of chemicals in and adjacent to streams, aquifers, and flood prone areas; and
    - avoid dumping or storing chemically treated or sanded snow where it can melt and infiltrate groundwater or flow into surface waters.

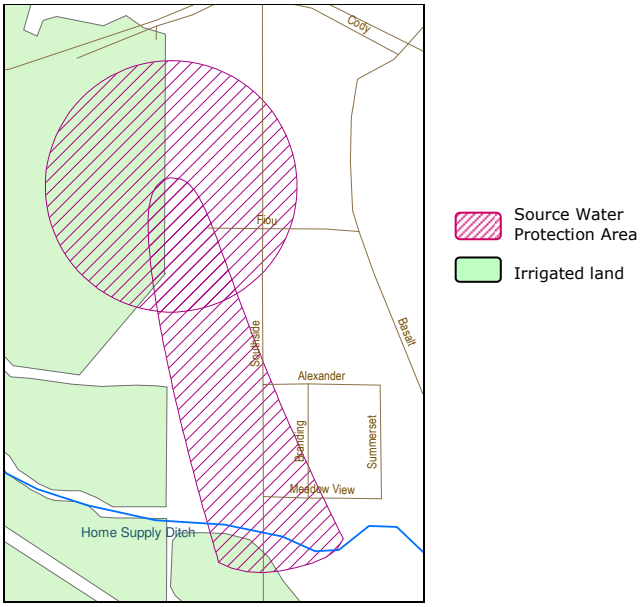
PHOTO: COLLEEN WILLIAMS

Figure 18. Placing signage along the road corridor within the source water protection area is one way of educating travelers on how to notify emergency personnel if a contamination should occur.

Irrigation Ditch Leaking and Irrigation Recharge

The Town of Basalt's Municipal Well 9 (MW-9) is located adjacent to agricultural land that is irrigated with water diverted from the Roaring Fork River via the Home Supply Ditch. These irrigated lands lie within the 500 foot Zone 1 protection area surrounding the well (Fig. 19). Well test data has shown that surface recharge events, such as irrigation, can influence the level of the groundwater table in the vicinity of the well. Static water level (depth to groundwater from the top of the well casing) measurements in MW-9 generally rises during the late spring/summer due to run-off effects and recharge from local irrigation (Goin, 2010).

The Home Supply Ditch lies within the MW-9 wells' source water protection area upgradient from the well. Water from this unlined ditch can leak into the soil and also recharge the alluvial aquifer.



SOURCE: COLORADO DIVISION OF WATER RESOURCES

Figure 19. Location of irrigated land in the MW-9 source water protection area.

The surficial geologic materials surrounding the Town's wells consist of sandy loam, gravel, and cobble which are very porous alluvial deposits. These soils have a high transmissivity and saturated hydraulic conductivity. The transmissivity is the measure of the volume of water that can be transmitted horizontally by the fully saturated thickness of an aquifer. Saturated hydraulic conductivity refers to the ease with which pores in a saturated soil transmit water. Since water from the surface can easily move through the soil and recharge the groundwater, it would be prudent to limit any potential sources of surface contamination within the source water protection areas surrounding the Town's wells.

Ditch and Irrigation Recommendations:

1. Maintain an open communication with land owner within the source water protection area surrounding MW-9.
2. Encourage proper irrigation techniques to decrease the risk of surface contaminants from entering the groundwater.
3. Encourage proper maintenance of the ditch and/or lining the ditch with an impermeable liner to prevent the leakage of ditch water.

Agricultural Activities

Nationally, states rank agriculture as the second most prevalent and threatening potential source of contamination for both ground and surface water sources of drinking water. Many studies have shown that water quality guidelines and standards have been exceeded as a result of agricultural activities.

Fertilizer and Weed Abatement

The use of fertilizer and weed abatement on both the land surrounding MW-9, RE-1, and MW-13 has the potential to affect the source waters. The two main components of fertilizer that are of greatest concern to source water quality are nitrogen and phosphorus. Nitrogen fertilizer is biologically transformed to nitrate that is highly soluble in water and can readily be absorbed and used by plants. Soluble nitrate is highly mobile and can move with water through the soil. Excess fertilizer use and poor application methods on these fields can cause fertilizer movement into surface and groundwater.

The goal is to minimize nutrient losses from agricultural lands. This can be achieved by developing a comprehensive nutrient management plan and using only the types and amounts of nutrients necessary to produce the crop, applying nutrients at the proper times and with proper methods, and following proper procedures for fertilizer storage and handling.

Livestock Practices

While there are no grazing allotments on the public lands in the source water protection areas, livestock operations occur on the private land within the 500 foot Zone 1 protection area of Basalt's Municipal Well 9. Livestock practices on this land that have a potential for adding contaminants into the groundwater include density and location of livestock near the well, management of the livestock, and waste management and disposal. The primary water quality concerns are pathogens (e.g., E. coli and Cryptosporidium). Pathogens are a risk to the raw water supply, because they pose an acute health threat and existing treatment cannot effectively remove or eliminate many pathogens. Pathogens can enter the groundwater through runoff and infiltration over livestock waste into the porous land surface surrounding this alluvial well.

Agricultural Practices Recommendations:

1. Public education to encourage best management practices for agricultural operations to minimize detrimental impacts on the land and water within the source water protection areas. Agricultural BMPs may include the proper application and storage of fertilizers, irrigation techniques that minimize runoff, the placement of manure piles away from water sources, and creating a buffer zone between livestock areas and water sources.

2. Research funding opportunities to create a buffer zone surrounding the Town's well to keep livestock contained through the use of BMPs (i.e. fencing).

Climate Change

Global warming from greenhouse gas emissions and land use changes affects the temperature, precipitation, and stream flow of the Roaring Fork Watershed and the greater Colorado River Basin. These physical climate changes will impact the ecosystems and socioeconomics of the Roaring Fork Watershed. A recent review of six major studies on the Colorado River finds that stream flows will likely be reduced due to climate change. This has major significance for resource management: although demand is increasing, supply is projected to decrease. High-elevation tributaries such as the Roaring Fork River provide 85 percent of the total Colorado River Basin flow.

Key direct effects of climate change projected for the Roaring Fork Watershed are:

- Warmer temperatures,
- More precipitation as rain, with less as snow,
- Decreased snow cover and snowpack,
- Earlier snowmelt and runoff, and
- Decreased runoff.

These changes will drive secondary changes within the watershed, such as:

- Earlier drying of soil moisture and riparian habitats;
- Increase in evapotranspiration and water demand;
- Increase in fire risk and insect outbreaks;
- Elevational shifts in plant and animal communities and reduction or loss of alpine tundra;
- Shifts in the geographic ranges, reproductive timing, competitive interactions, and relative abundances of aquatic species;
- Potential for more extreme weather events (e.g. droughts and floods); and
- Less insulating snow cover leading to greater risk of frost exposure to roots and soil organisms.

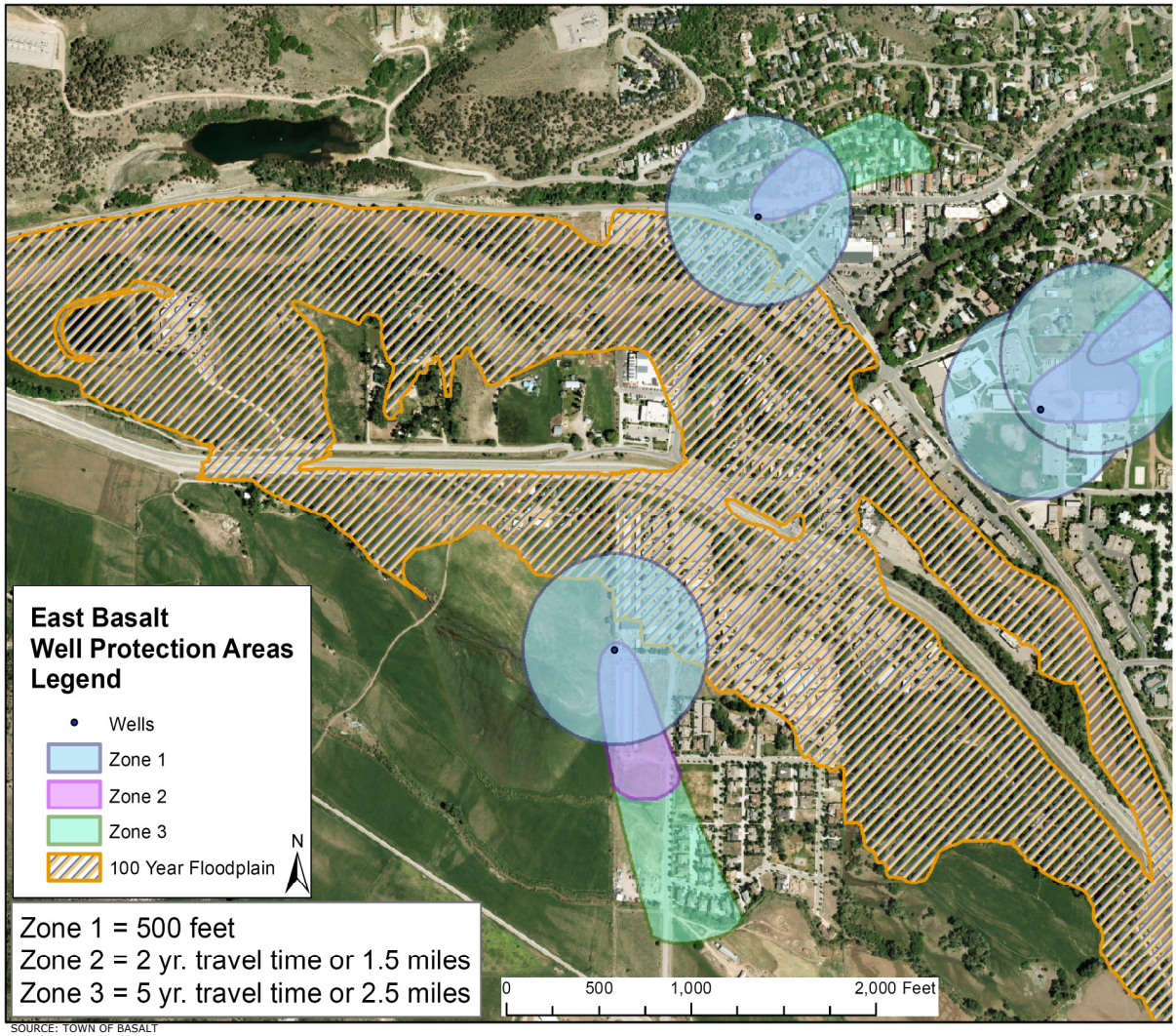
Future warming in the West could result in substantial water supply shortages for Colorado River Basin communities. Communities within this basin anticipate an increase demand on municipal water that will reduce flows below instream flow designations. Although the total annual water supply available to municipal users in the watershed is not projected to change significantly under global warming, seasonal availability will likely shift. Anticipated warmer temperatures leading to increased snowmelt in winter would alleviate surface water demand during winter months. However, surface water availability would decline in June due to earlier runoff. For communities who rely on groundwater from alluvial wells in the Basin, additional use may occur during summer months. Tapping this underground source may lower the instream flow of the Roaring Fork River.

Overall, competing demand from East Slope diversions, urban growth in the western part of the state, and Colorado's growing energy industries, compounded by warmer and drier conditions stemming from climate change, will further drive water prices up and availability down (Clark, et al, 2008).

Flooding and Floodplain Influence

Portions of the source water protection areas for Basalt Municipal Wells # 9 and # 11 lie within the floodplain (Fig. 20). "Floodplain" refers to the 100-year floodplain which is a term used by the Federal Emergency Management Agency (FEMA) and refers to lands adjacent to a waterway that have at least a one percent chance of being covered by a flood in any one year. This also means that there is a 100% chance that these lands will experience flooding over a 100-year period. Figure 20 depicts the 100-year floodplain boundary that applies to the area near the confluence of the Roaring Fork and Fryingpan Rivers at the time this Plan was prepared.

Flood flows on the Roaring Fork and Fryingpan Rivers typically result from rapid melting of the mountain snowpack during the period from May to early July. Snowmelt runoff is characterized by sustained periods of high flows and marked diurnal fluctuation. Although Ruedi Reservoir acts as a flood control reservoir for major runoff events, high flows in the Roaring Fork continue to raise public safety and infrastructure concerns. Climate-driven changes to the hydrological system may likely increase the frequency, magnitude, and cost of extreme weather events.



SOURCE: TOWN OF BASALT

Figure 20. Map of the 100-year floodplain boundary for the Town of Basalt

The historic flooding events of 1957 and 1995 were partially the result of encroachments into the Roaring Fork floodplain. Encroachments are activities or construction within the floodway including fill, new construction, substantial improvements, and other development (FEMA, 2011). Valley-wide development has placed an increasing number of structures in the floodplain. These encroachments tend to reduce the availability of floodplains and increase flow velocities in the constricted channel (Basalt, 2000).

Addressing Flooding Concerns

After the flooding of the Roaring Fork River in 1995, the Colorado legislators introduced legislation funding a multi-objective study of the Roaring Fork and Fryingpan River to address the watershed's flood-related concerns. The Roaring Fork and Fryingpan Rivers Multi-Objective Study was completed in June 1999 and identified areas of high flood hazards, areas and causes of instability, and infrastructure at risk along the Roaring Fork River below Aspen and on the Fryingpan River below Ruedi Reservoir.

The Town of Basalt, recognizing its vulnerability to flooding, made river management and flood control an ongoing Town priority. In 1999, the Town included into their Master Plan an Action Item which called for the preparation and adoption of a "River Master Plan to address flood issues, river erosion and development near rivers". In July and August 2000, the Basalt Town Council and the Basalt Planning and Zoning Board addressed a number of river management issues. Among these were consideration of new floodplain maps prepared by Matrix Design Group and the findings of the "Evaluation of Reach II of the Roaring Fork River" by McLaughlin Water Engineers. In September 2000, The Town adopted Ordinance No. 25 which addressed criteria for development in the floodplain. This Ordinance prohibits development which would result in any rise in flood elevations and puts the burden of proof on developers and landowners to verify that their proposals would not add to existing flood hazards.

At the same time, the Town began the process of creating a River Master Plan and authorized the creation of a River Stewardship roundtable to be made up of local business owners, property owners, interested citizens and technical consultants. The Roaring Fork River Stewardship Master Plan, completed in 2002, included recommendations to address issues including public safety, infrastructure protection, river stability, and protection and restoration of the river environment.

The Town is currently a member of the National Flood Insurance Program. They have periodically updated their floodplain regulations to keep them current with FEMA standards. In 2007, the Town adopted Ordinance No. 23, Series of 2007 which incorporated the new flood insurance study and maps to be used for floodplain regulations as well as insurance purposes. Also in 2007, the Town revised their Master Plan which acknowledges the floodplain as an important factor in the design of the future land use pattern for the Town. The Future Land Use Map show significant areas of open space along the river, in part, for this reason.

Floodway Practices Recommendations:

1. Develop and support regulation that limit development within the 100-year floodplain.
2. Ensure that development within the floodplain is limited to protecting and restores the river and riparian environment.
3. Encourage implementing projects that were identified in the River Master Plan.
4. Include flood issues in the Emergency Management Plan.

Urban Runoff

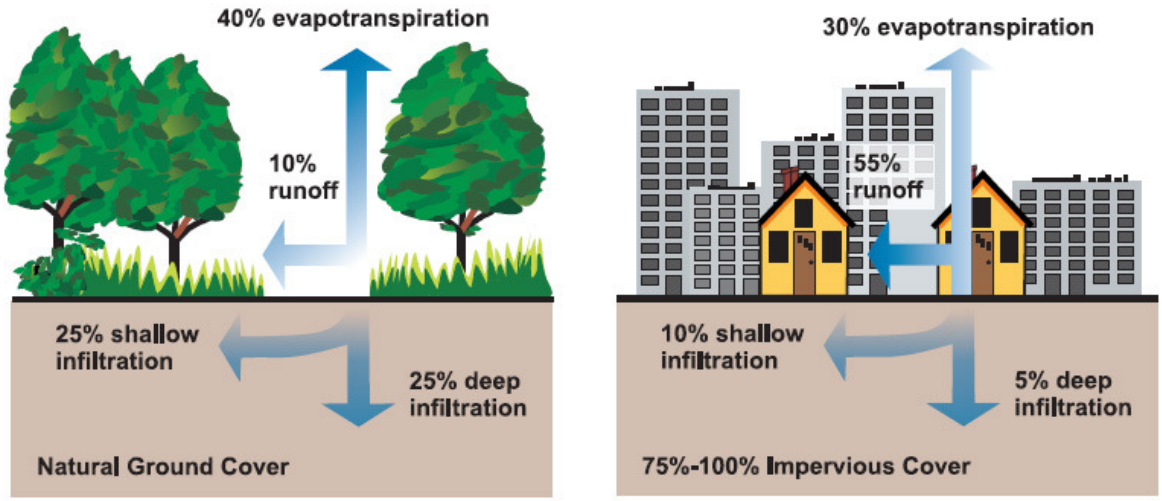
The Town of Basalt is experiencing the effects from urban runoff from the increasing trends in population growth and land development. Development dramatically alters the local hydrologic cycle. During construction, trees, meadow grasses, and agricultural crops that intercept and absorb rainfall are removed and natural depressions that temporarily pond water are graded to a uniform slope. Cleared and graded sites are often severely compacted which prevents storm water from infiltrating into the ground surface. Construction and development results in an increase in impervious surfaces like roof tops, driveways, parking lots, and streets which also prevents the stormwater from naturally soaking into the ground (Fig. 21).

Urban runoff occurs when water from rain, snowmelt flows, or irrigation over the ground over streets, lawns, farms, and other construction and industrial sites. Urban runoff can pick up fertilizers, dirt, pesticides, oil and grease, and many other pollutants and flow into waterbodies used for swimming, fishing and providing drinking water.

Runoff over urban areas can affect the stream hydrology, morphology, water quality and aquatic ecology. Water quality problems include turbid water, nutrient enrichment, bacterial contamination, organic matter loads, metals, salts, temperature increases, and increased trash and debris. Urbanization affects stormwater runoff by increasing the following:

- The volumes and rates of surface runoff,
- The concentrations and the types of pollutants,
- The amount of pollutants carried to receiving waters.

Within the Town of Basalt activities that contribute to urban runoff include construction and use of transportation corridors; filling of the river channel and floodplain; degradation and removal of natural vegetation; property development; increased residential and commercial improvements along the river; and a growing number of contributors to non-point source pollution runoff (Matrix, 2001).



SOURCE: ENVIRONMENTAL PROTECTION AGENCY

Figure 21. An increase in impervious coverage increases stormwater runoff

Addressing Stormwater Concerns

In 1999 the Town of Basalt formed a partnership with the Roaring Fork Conservancy to work on evaluating urban runoff sources and developing recommendations of Best Management Practices to address these sources. The "Stormwater Evaluation and Recommendations Report" was completed in 2001 and outlines the current assessment and recommendations for urban improvements in the Town of Basalt (Matrix, 2001). The Report helped to define the physical characteristics of urban runoff in Basalt and to develop strategies for evaluating and improving runoff water quality. Recommendations included the use of retention ponds, detention ponds, disconnecting impervious surfaces, use of wetland and riparian buffer systems, isolating potential contaminants from mixing with stormwater, establishment of a stormwater quality control program, and the incorporation of new runoff drainage ordinances.

The Report recommended that the following items should be undertaken to improve the quality of stormwater discharges and prevent periodic flooding and damage caused by urban runoff:

1. Develop a Drainage Infrastructure Master Plan that specifically identifies deficiencies in the drainage system and proposes new infrastructure.
2. Prioritize the proposed infrastructure improvements.
3. Develop a Budget and Funding mechanism to implement the Drainage Infrastructure Master Plan.
4. Educate the community on the implications of urban runoff and better stormwater management techniques.

The Roaring Fork Conservancy developed a brochure to educate the general public about practices that minimize or improve stormwater runoff. The brochure titled, "Keeping our Waters Clean: A guide to helping you reduce non-point source pollution".

In 2009, the Town of Basalt passed Ordinance No. 11 that adds sustainable building regulations to their municipal code. This ordinance requires a builder to recycle storm water from buildings by providing a grading plan which illustrates the principle and construct swales to maximize distribution of surface drainage to planted areas on site, or direct surface drainage to a larger, neighborhood eco-system (Basalt, 2009).

Urban Runoff Recommendations:

1. Develop and enforce erosion control regulations related to urban and construction activities. Provide brochures to builders on how to use Best Management Practices (BMPs) to prevent storm water runoff from construction sites.

2. Develop and/or support local storm water runoff regulations for areas within both the floodway and source water protection area. Conduct visits to building sites to ensure regulations are being implemented.

3. Contact gas stations within the protection area, obtain their spill prevention plan, and educate them about the importance of preventing petroleum products from washing off their property into the groundwater.

4. Clean the sediment collection pond at Old Pond Park as needed.

Public Land Management

Public lands within the Source Water Protection Area for the Town's springs are managed by the U.S. Department of Agriculture's Forest Service and the State of Colorado's Division of Wildlife. National Forest lands within the White River National Forest are managed by the Aspen-Sopris Ranger District with offices in both Carbondale and Aspen, Colorado.

National Forest Management

A principal purpose for which the Forest Reserves (predecessor to the National Forest System) were established was to "secure favorable conditions of water flows". Throughout its history, the Forest Service has had a very diverse and broad mission of multiple use management outlined by the Federal Land Policy and Management Act. This means that they balance 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.

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 adequately protects the integrity of watersheds (USFS, 2010)."

At the District level, the Aspen-Sopris Ranger District adheres to the management directives established under the Revised Land and Resource Management Plan (2002 Forest Plan) for the White River National Forest. The management area prescriptions within the source water protection area includes: 5.4 – Forested Flora & Fauna Habitats and 5.41 - Deer & Elk Winter Range (Fig. 22). The generally allowed activities within both of these management area prescriptions include: timber harvesting, mechanized recreation and grazing.

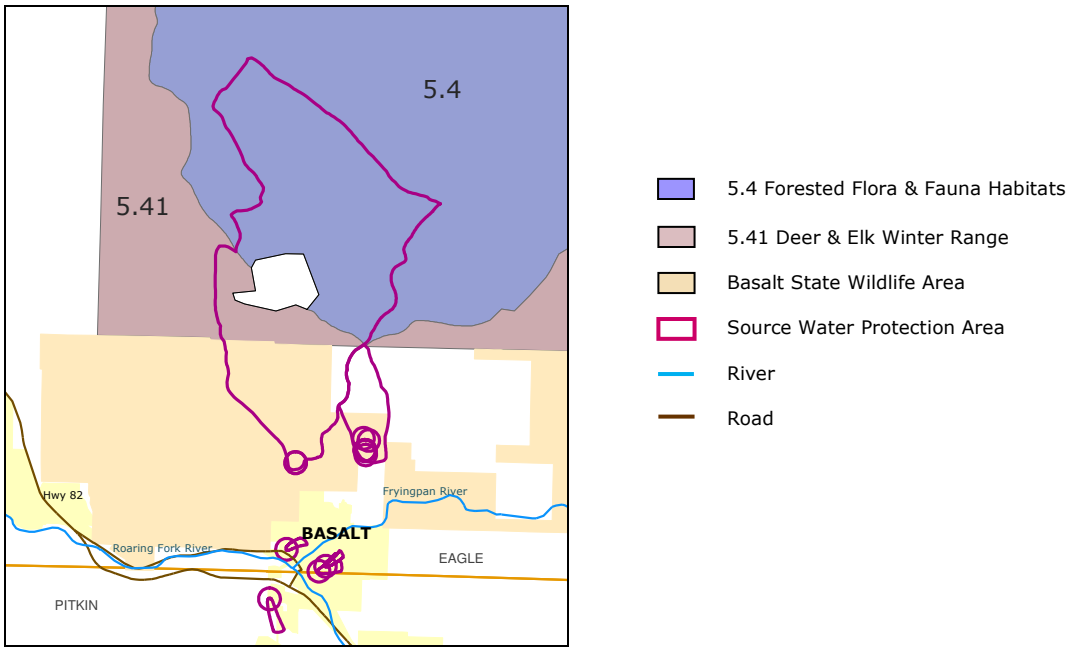


Figure 22. Map of the management area prescriptions within the source water protection area for the Town's springs.

In October 2009, the Forest Service Rocky Mountain Region and the State of Colorado Department of Public Health and Environment 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 FSM 2542 (MOU, 2009). The source water protection area for the Town of Basalt that lies within these National Forest lands, will be included in future Revised Forest Plans as a municipal supply watershed.

Water Quality Concerns

As a drinking water supplier, the Town of Basalt has the greatest potential to be directly affected by land use or public land management activities. Water quality degradation can result from wildfires, timber harvesting, recreation, and transportation.

Wildfires

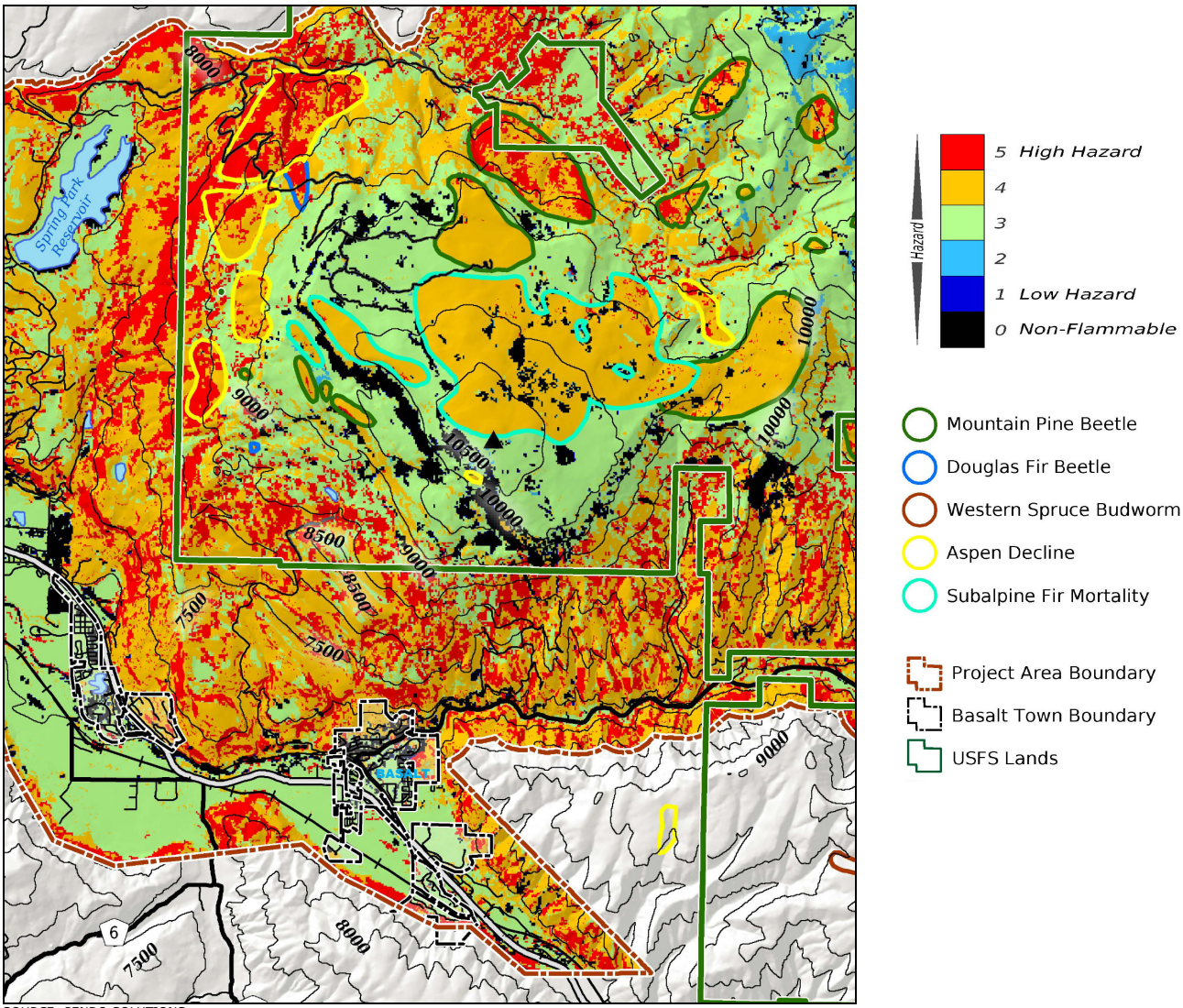
The forest in the watershed is overly dense with fuel build-up from a century of fire suppression and thus more vulnerable to high-intensity fires than it was historically. Past management practices and fire exclusion have allowed over-dense stand structures to develop on the forested landscape across Colorado. History shows that most of Colorado's wildfires are caused by lightning strikes from the many thunderstorms that pass through the state on a regular basis during the summer months. Many of the storms fail to produce rain, and the lightning strikes sometimes create hotspots of fire that have the potential to grow into larger full-fledged fires. The hotspots can spread over a large area and are very challenging for fire crews to locate and control.

The potential for wildfire is fairly uniform across the source water protection area. The current State of Colorado mitigation plan ranks 130,464.21 of Pitkin County's 621,026.9 acres as falling within the moderate- to high-risk range, or 21% of total State acreage. An estimated 319,184 acres of Eagle County's 1,088,545 acre total, or 29.32%, falls within the moderate to high risk range.

The potential of a watershed to deliver sediments following wildfire depends on forest and soil conditions, the physical configuration of the watersheds, and the sequence and magnitude of rain fall on the burned area. High-severity fires can cause changes in watershed conditions that are capable of dramatically altering runoff and erosion processes in watersheds. Water and sediment yields may increase as more of the forest floor is affected by fire.

During 2001 and 2002, the Colorado State Forest Service compiled a Wildland Urban Interface (WUI) Hazard Assessment for the purpose of mapping the residential areas throughout the State that lie in Wildland Fire Hazard Areas. In 2005, the Multi-Jurisdictional All-Hazards Pre-Disaster Mitigation Plan was completed for Pitkin and Eagle Counties. The Town of Basalt actively participated in the Plan development and has adopted this Plan. This Plan identifies strategies to mitigate wildfire risk within the wildland urban interface (DOLA, 2003). The Basalt and Rural Fire Depart has a map which identifies the fuels hazards within the protection area (Fig. 23).

The pre-fire treatment of hazardous fuels or fuels reduction can reduce wildfire intensity, thereby reducing erosion potential and sediment pollution. Fuel treatments can cause additional sediment, but only a small fraction of the sediment pulse that follows high intensity wildfire. The Aspen-Sopris Ranger District is currently working on a fuel mitigation plan draft concept for the forest lands they manage.



SOURCE: PENDO SOLUTIONS

Figure 23. Basalt and Rural Fire Protection District fuels hazard analysis map

Timber Harvesting

Forest management activities, such as timber harvesting and fuels management, can potentially generate several forms of non-point pollution. Disturbance of land surfaces from road construction, log landings, and skid trails is the primary cause of sediment transport into streams from this activity. Other potential impacts include: debris from timber harvesting ending up in the stream, oils and fuels used in machinery washing into streams, and an increase in temperature levels as a result of clearing timber along stream banks. Implementing Water Conservation Practices, BMPs, guidelines, and proper design criteria are typically effective in preventing or reducing sediment delivery to water bodies (SJNF, 2008). Timber sales in the source water protection area for the Town's springs are not expected and would require an Environmental Assessment prior to any timber harvesting (Snelson, 2010)

Recreation and Transportation

The US Forest Service has identified unmanaged off-road-vehicle use as a threat to forested lands and grasslands. Some undesirable impacts include severely eroded soils, user-created unplanned roads, disrupted wetland ecosystems, as well as general habitat destruction and degraded water quality throughout forested lands. There is only one forest system route (Kelly Lake Road) located in the source water protection area for the Town's springs. There may be some user-created routes that are not identified on the Motor Vehicle Use Map for the area.

Basalt State Wildlife Area

The Town of Basalts springs are located on Basalt State Wildlife Area land managed by the Colorado Division of Wildlife's Glenwood Springs Office in Glenwood Springs, Colorado. The Basalt State Wildlife Area is approximately 4,806 acres (7.5 sq. miles) and ranges from 6,514 ft to 8,777 ft in elevation. This State Wildlife Area is divided into the following separate units: Watson Divide Unit, Christine Unit, and Basalt Unit. The Town's springs are located on the Christine Unit of the Basalt SWA. The Christine Unit is home to Lake Christine and the Basalt SWA shooting range. It also provides public angler access to the popular Fryingpan River.

This State Wildlife Area offers the following recreational activities:

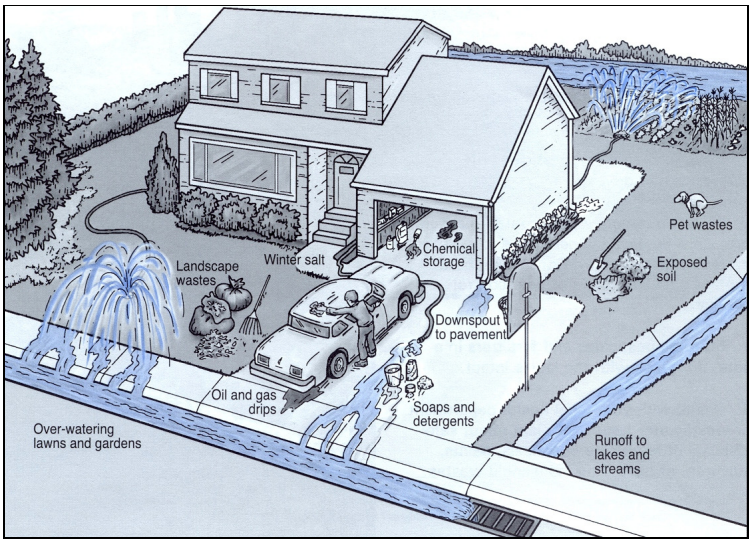
- Fishing: Coldwater stream and coldwater lake
- Hunting: deer, elk, bighorn sheep and dusky (blue) grouse
- Recreation: hunting, fishing, picnicking and wildlife viewing
- Facilities: shooting range

Public Land Recommendations:

1. Keep informed on public land management issues within the source water protection area.
2. Participate in public land planning activities at the district and regional level including: Forest Plan Revisions, Fuels Reduction Plan, Timber Management Plan, and other outreach opportunity.
3. Provide written comments to public land managers on source water protection concerns.
4. Develop partnerships with public land managers.
5. Support efforts to improve watershed conditions (i.e. fuels reduction activities, wildfire assessment, and other reclamation projects).
6. Develop an inventory of user-created routes within the Forest Service lands and construct signage to close routes.

Residential and Business Property Maintenance

The Town of Basalt's Source Water Protection Area includes rural residential dwellings and business facilities that use chemicals in their home or operations. Facilities within the protection area include: schools, pools, and paint shops. Common household practices may cause pollutants to runoff residential property and enter the surface or groundwater as indicated in the picture below. 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.



SOURCE: COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT

Figure 24. Common household practices may cause pollutants to runoff residential property and enter the surface or groundwater.

Recommendations for Residents:

1. Properly Dispose of Chemicals and Motor Oil – Never pour on the ground, down the drain, or toilet. Participate in household hazardous waste collection events.

2. Use Fertilizers, Herbicides and Pesticides Properly - Apply chemicals according to label instructions and avoid runoff. Do not exceed recommended application rates. Use only if necessary.

3. Properly Dispose of Drugs and Personal Care Products – Pour medications into a sealable plastic bag and add kitty litter, sawdust, coffee grounds, or glue and deposit in the trash along with unused personal care products. Participate in medication drop off campaigns.

4. Dispose of Pet Waste Properly – Flush pet waste down the toilet, put into the garbage, or bury under 8 inches of soil. Pick up your pet waste when walking your dog.

5. Use Water Wisely **–** Check for plumbing leaks, use water-saving showerheads and faucets, water laws morning or evenings, avoid over watering, and direct runoff onto vegetative buffers.

6. Purchase Safer Alternative Products – Choose natural alternatives or Green Products.

SOURCE WATER PROTECTION MEASURES

Management Approaches

The Planning Team reviewed and discussed several possible management approaches 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 Planning Team 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 this project.

The Planning Team recommends the management practices listed in Table 12, "Source Water Protection Best Management Practices" be considered for implementation by:

- Town of Basalt
- Eagle County
- Colorado Division of Wildlife
- Aspen-Sopris Ranger District
- Roaring Fork Conservancy
- Colorado Rural Water Association
- Citizens of the Town of Basalt

Evaluating Effectiveness of Management Approaches

The Town of Basalt is committed to developing a tracking and reporting system to gauge the effectiveness of the various source water management approaches that have been implemented. The purpose of tracking and reporting the effectiveness of the source water management approaches is to update water system managers, consumers, and other interested entities on whether or not the intended outcomes of the various source water management approaches are being achieved, and if not, what adjustments to the protection plan will be taken in order to achieve the intended outcomes. It is further recommended that this Plan be revised at a frequency of once every 3-5 years or if circumstances change resulting in new source water protection areas or new risks are identified (new water source developed or changes in land use).

The Town of Basalt is committed to applying source water assessment and protection principles to find and protect new water sources in the future. This is part of the larger ongoing commitment to providing the highest quality drinking water to their consumers.

The Town of Basalt is committed to assisting the Colorado Department of Public Health and Environment in making future refinements to their source water assessment and to revise the Source Water Protection Plan accordingly based on any major refinements.

Table 12. Source Water Protection Best Management Practices (BMPs)

Issue	Management Approach	Implementer
Fuels Storage Tanks		
Information and Public Outreach	1. Maintain a current inventory and information on the status of regulated above and underground storage tanks in the source water protection area using the Colorado Storage Tank Information (COSTIS) website at http://costis.cdle.state.co.us. Storage tank information from this site includes: facility, tank, owner, and events.	Steering Committee
	2. Identify Leaking Underground Storage Tank (LUST) events that have occurred within the SWPA using the State's database COSTIS. Contact the Colorado Department of Labor and Employment Division of Oil and Public Safety (303-318-8000) for information regarding LUST events within the SWPA. Contact the Public Records Center for a file review at (303) 318-8521 or (303) 318-8522. Monitor progress on any remedial action conducted for the known contamination sites.	Steering Committee
	3. Field check active sites.	Steering Committee
	4. Develop an inventory of residential or farm unregulated storage tanks within the source water protection area.	Steering Committee
	5. Provide information to tank owners on how they can implement storage tank practices to prevent petroleum products from leaking onto the ground.	Steering Committee
	6. Encourage private unregulated tank owners to construct secondary containment areas under their storage tanks.	Steering Committee
Irrigation Ditch & Recharge		
	1. Maintain an open communication with land owner within the source water protection area surrounding MW-9.	Town of Basalt
	2. Encourage irrigation techniques, fertilizer use and storage, and manure placement that decrease the risk of surface contaminants from entering the groundwater.	Steering Committee
	3. Encourage maintenance of the ditch and/or lining the ditch with an impermeable liner to prevent the leakage of ditch water.	Steering Committee

Table 12. Source Water Protection Best Management Practices

Issue	Management Approach	Implementer
Transportation on Roads		
Road Maintenance	1. Become informed on the road maintenance practices and schedules within the Source Water Protection Area (SWPA) including: grading, de-icing, dust abatement and Best Management Practices used.	Steering Committee
	2. Provide a copy of the Source Water Protection Plan and map of the protection area to CDOT, CDOW, and Town of Basalt. Encourage them to use road Best Management Practices to prevent road materials from entering the source waters. Recommendations for application of road deicing materials include: • applying minimum amounts necessary; • apply only when removal of snow and ice cannot be accomplished by blading, plowing or sanding; • minimize use of chemicals in and adjacent to streams, aquifers, and flood prone areas; and • avoid dumping or storing chemically treated or sanded snow where it can melt and infiltrate groundwater or flow into surface waters.	Steering Committee CDOT CDOW Town of Basalt
Vehicular spills	1. Meet with the Basalt and Rural Fire Protection District Hazmat Team to discuss their emergency response plans for responding to vehicular spills within the SWPA. Include this information in the emergency plans for the water system and emergency responders.	Steering Committee Town of Basalt
	2. Provide information to the local fire departments: • Importance of the Source Water Protection Plan • Location of the intakes and Source Water Protection Area • Overview of the Emergency Contingency Plan • Personnel to be notified in the event of an emergency	Steering Committee
	3. Provide the local highway departments with a map of the SWPA and education about source water protection in the area.	Steering Committee
Public Education	1. Provide public education to residents and visitors to the SWPA including: • Call "911" to report any spills or illegal dumping within the SWPA on both public and private lands (i.e. signage or brochures) • Proper disposal of vehicular motor oil during oil changes	Steering Committee Town of Basalt
	2. Encourage the community to participate in local hazardous waste disposal events in Carbondale or at the Landfill.	Town of Basalt

Table 12. Source Water Protection Best Management Practices

Issue	Management Approach	Implementer
Land Use		
Land Use Planning and Controls	1. Town of Basalt and County land use planners will be encouraged to overlay the Town of Basalt's SWPA on their land use map and to refer to it during decisions on land use in the protection area. 2. Town of Basalt and County Commissioners will be encouraged to consider source water protection when making land use decisions or zoning laws. Land use controls may include: subdivision growth controls, zoning, and land use restrictions. 3. The Town of Basalt will request to be notified by Eagle and Pitkin County officials of land use hearings or meetings regarding land within the SWPA and will have the opportunity to participate in the process. 4. Steering Committee will provide Eagle and Pitkin Counties a copy of the Source Water Protection Plan and mapping GIS data of the protection area.	Town of Basalt Eagle & Pitkin County Town of Basalt Eagle & Pitkin County Commissioners Town of Basalt Steering Committee
Land Acquisitions	1. Steering Committee will keep informed of land acquisitions within the SWPA and provide information to new residents on the source water protection area.	Steering Committee
Land Conservation	1. Provide information to landowners within the SWPA to educate them on the opportunities of placing a conservation easement on their land.	Steering Committee
Watershed Protection District	1. Provide information to the Basalt Town Council on the opportunity of protecting the drinking water source for the Town through the use of an ordinance that develops a watershed district.	Colorado Rural Water Association

Table 12. Source Water Protection Best Management Practices

Issue	Management Approach	Implementer
Agricultural Activities		
Public Outreach and Communication	1. Maintain an open dialog with the agricultural users within the protection area in order to encourage stewardship of their lands to protect the quality of the surface and groundwater.	Town of Basalt
	2. Public education to encourage best management practices for agricultural operations to minimize detrimental impacts on the land and water within the source water protection areas. Agricultural BMPs may include the proper application and storage of fertilizers, irrigation techniques that minimize runoff, the placement of manure piles away from water sources, and creating a buffer zone between livestock areas and water sources.	Steering Committee NRCS and Farm Organizations
	3. Education techniques may include: workshops, mailings and community meetings/workshops, and demonstration projects.	Steering Committee
	4. The local Natural Resource Conservation Service (NRCS) Field Office and the local Conservation District will be encouraged to provide site visits (upon request) to residents within the SWPA to evaluate their agricultural practices and provide educational outreach.	NRCS
Funding Opportunities	1. Explore funding opportunities and provide residents within the SWPA with information on funding opportunities for cost sharing to implement the agricultural BMPs on their land (i.e. Environmental Quality Incentive Program).	Steering Committee NRCS
	2. Provide information to agricultural users on the opportunity of conserving their lands under the Conservation Reserve Program.	Steering Committee Farm Service Agency
Flooding/Floodplain Influence		
	1. Develop and support regulation that limit development within the 100-year floodplain.	Town of Basalt
	2. Ensure that development within the floodplain is limited to protecting and restores the river and riparian environment.	Town of Basalt Pitkin County
	3. Encourage implementing projects that were identified in the River Master Plan.	
	4. Include flood issues in the Emergency Management Plan.	

Table 12. Source Water Protection Best Management Practices

Issue	Management Approach	Implementer
Residential Practices		
Public Education and Outreach	1. Conduct public education and outreach programs for SWPA residents to encourage practices that will protect their drinking water source. Topics may include: source water protection, household hazardous waste storage and disposal, fertilizer usage, pet waste cleanup, water conservation, car washing, and secondary containment for above ground fuel storage tanks.	Steering Committee Roaring Fork Conservancy
	2. Opportunities for public education include: newspaper articles, poster displays at local utility offices and public buildings, water bill inserts, flyers, creek festivals, public forums, workshops and community events.	Steering Committee Roaring Fork Conservancy
Hazardous Materials	1. Educate the community about proper disposal of any hazardous materials including: local waste oil, solvents, lubricants, and degreasers, etc., and encourage collection and recycling of used oil, batteries, tires, and agricultural chemical containers.	Town of Basalt
	2. Encourage participation in local household hazardous water collection program for residents within the SWPA.	Town of Basalt
Facilities Practices		
	1. Develop an inventory of facilities within the SWPA that use hazardous chemicals in their operations.	Steering Committee
	2. Provide facilities with information about the source water protection plan, the location of their facility within the protection area, and how they can use BMPs to prevent chemicals from contaminating the groundwater source.	Steering Committee
Urban Runoff		
	1. Develop and enforce erosion control regulations related to urban and construction activities. Provide brochures to builders on how to use BMPs to prevent storm water runoff from construction sites.	Town of Basalt
	2. Develop and/or support local urban runoff regulations for areas within both the floodway and source water protection area. Conduct visits to building sites to ensure regulations are being implemented.	Town of Basalt
	3. Contact gas stations within the protection area, obtain their spill prevention plan, and educate them about the importance of preventing petroleum products from washing off their property into the groundwater.	Steering Committee
	4. Clean the sediment collection pond at Old Pond Park as needed.	

Table 12. Source Water Protection Best Management Practices

Issue	Management Approach	Implementer
Municipal Utility		
Water Supply Intakes	1. Perform regular inspection of wells and springs. 2. Protect areas around intakes with fencing and signage.	System Operators System Managers
Water Operations	1. Ensure that the water treatment plant is properly managed, operated and maintained to prevent contamination of the drinking water. 2. Store chemicals properly at the treatment plant. Establish practice and policy at the water works department to not store or mix chemicals within the 200 foot sanitary setback area of its wells. 3. Ensure that all employees are familiar with the Source Water Protection Plan, emergency and contingency plan, and hazardous spill response. 4. Encourage the placement of Federal Offense Warning signs at the treatment plant.	System Managers System Managers System Managers System Managers
Public Education	1. Develop a mailing list of land owners and residents within the protection area. 2. Provide Information concerning the SWPP in the annual Consumer Confidence Report (CCR). Insert an additional letter or paragraph in the CCR of their presence within the protection area and information on how they can help prevent pollutants from entering the source waters.	Steering Committee Town of Basalt
Water Quality Monitoring	1. Gather information on water quality monitoring of the wells and springs in the source water protection area.	System Managers

Table 12. Source Water Protection Best Management Practices

Issue	Management Approach	Implementer
Public Lands Management		
Wildfires	1. Fuels Reduction – Continue to implement the National Fire Plan to reduce fuels within the National Forest lands within the watershed. 2. Fire Prevention – Continue to implement their fire prevention plan which includes public education programs: Fire Wise & Project Learning Tree. 3. Meet with the Basalt and Rural Fire Protection District Hazmat Team to discuss their emergency response plans for responding to fires within the SWPA. Include this information in the emergency plans for the water system and emergency responders. 4. Provide information to the local fire departments: • Importance of the Source Water Protection Plan • Location of the intakes and Source Water Protection Area • Overview of the Emergency Contingency Plan • Personnel to be notified in the event of an emergency	Aspen-Sopris Ranger District Aspen-Sopris Ranger District Steering Committee Steering Committee
Timber Harvesting	1. Implement Water Conservation Practices, BMPs, guidelines, and proper design criteria to prevent or reduce sediment delivery to water bodies within the watershed.	Aspen-Sopris Ranger District
Recreational Activities	1. Minimize the effects of recreational activities within the SWPA from both motorized and non-motorized activities. Continue to provide multiple uses while restricting motorized vehicles to system authorized roads that are signed. Prevent OHV damage to stream banks and upland areas and restore or close areas degraded by OHV usage.	Aspen-Sopris Ranger District
Public Outreach and Participation	1. Keep informed on public land management issues within the source water protection area. 2. Participate in public land planning activities at the district and regional level including: Forest Plan Revisions, Fuels Reduction Plan, Timber Management Plan, and other outreach opportunity. 3. Provide written comments to public land managers on source water protection concerns. 4. Develop partnerships with public land managers. 5. Support efforts to improve watershed conditions (i.e. fuels reduction activities, wildfire assessment, and other reclamation projects).	Steering Committee Town of Basalt Steering Committee Steering Committee Town of Basalt Steering Committee

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APPENDICES

Emergency/Contingency Plan *

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*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.*