

Source Water Protection Plan

For

**Little Elk Creek Subdivision
PWSID #0123443**



Surface Water/Groundwater Source

Pitkin County, Colorado

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TABLE OF CONTENTS

EXECUTIVE SUMMARY

INTRODUCTION.....	1
Purpose of Source Water Protection Plan Development.....	1
Public Participation and Steering Committee Establishment.....	2
Protection Plan Development Process.....	2
Steering Committee and Participants.....	3
WATER SUPPLY SETTING.....	4
Environmental Setting.....	4
Topography and Geology.....	5
Climate.....	5
Biological Communities.....	6
Land Ownership and Use.....	7
Recreation Activities.....	9
Generalized Area Population.....	10
Groundwater.....	10
Hydrogeographic Setting.....	11
Hydrology and Water Quality Monitoring.....	12
Drinking Water Supply and Quality.....	16
Quality Analysis.....	16
Drinking Water Supply Operation.....	16
Water Supply Demands/Analysis.....	16
Growth and Land Use Projections.....	22
OVERVIEW OF COLORADO'S SWAP PROGRAM	22
Source Water Assessment Phase.....	23
Source Water Protection Phase.....	23
SOURCE WATER ASSESSMENT RESULTS.....	24
Source Water Assessment Area Delineation.....	24
Defining the Drinking Water Supply Protection Area.....	25
Contaminant Source Inventory.....	28
Contaminant Health Concerns.....	30
Source Water Protection Priority Strategy.....	32
Source Water Protection Susceptibility Analysis.....	34
Discussion of Issues of Concern.....	35
SOURCE WATER PROTECTION MEASURES.....	38
SWPA Management Approaches.....	38
Source Water Protection Plan Additional Commitments.....	48
Figures, Maps and Tables.....	48
References.....	49
Addendum 1, Generalized Goals and Objectives from the Capitol Creek Caucus....	50

EXECUTIVE SUMMARY

The Little Elk Creek HOA provides potable water for its residents and a few others. The system includes three shallow wells underlain by an impervious shale layer, a treatment and distribution system. The well water quality is high with no recent exceedances. As such, water quality needs only protection. However, water quantity issues occur during the winter months. The surface water comes mostly from Little Elk Creek, a tributary of Capitol Creek. Capitol Creek water quality is high. The watershed is well protected, exhibits steep slopes, mostly undeveloped and should remain undeveloped. A few large ranches pasture a few horses and cattle and a small amount of rural development is possible. Forest management and geologic hazards present potential hazards. Subdivision items that could compromise water quality include septic systems, augmentation ponds, residential practices, roads and fuel storage tanks. Seven primary and three secondary issues are discussed and solutions offered to protect the present and future potable water supply.

The potential financial and water supply risks related to the potential contamination of one or more of the community's water sources are a concern to the Little Elk Creek Steering Committee (Steering Committee). As a result, the Steering Committee believes the development and implementation of a source water protection plan for Little Elk Creek and our community can help to reduce the risks posed by potential contamination of its water source. This source water protection plan was developed to establish protection areas, prioritize source water protection concerns and identify local source water management approaches that can be implemented to protect the source water. A source water assessment report was accomplished by the Colorado Department of Public Health and Environment (CDPHE) in 2004 and the results were used as a starting point in developing this source water protection plan.

The Steering Committee recommended adopting a "drinking water supply protection area" that is larger than the source water protection area defined in the source water assessment report. The drinking water supply protection area was re-delineated (redefined) from the source water assessment report through discussion, on-site observation and the use of historical data, involving stakeholders and experts. The drinking water supply protection area defines the region where Little Elk Creek has chosen to implement its source water protection measures in an attempt to manage the susceptibility of their source water to potential contamination.

The Steering Committee adopted a two-step strategy recommended by the CDPHE for prioritizing the water sources and potential contaminant sources on which source water protection measures will be focused. The first step of the strategy prioritizes the water sources based on their total susceptibility and/or physical setting vulnerability scores/ratings, contained in the source water assessment report, while the second step prioritizes the potential contaminant sources based on (1) their prevalence, (2) the

potential threat they pose, or (3) how prevalent and threatening the potential contaminant sources are.

In applying this strategy, the Steering Committee recommended focusing source water protection measures on the most threatening discrete contaminant sources and the most prevalent dispersed contaminant sources. Further, those sources closest to the wells both in a surface and groundwater flow sense were of the highest priority.

The Steering Committee reviewed and discussed several possible source water management approaches that could be implemented within the drinking water supply protection area. These management approaches may help reduce the potential risks of potential contamination from the prioritized potential contaminant sources. The purpose of voluntarily implementing source water management approaches is to apply an additional level of protection to the drinking water supply by taking preventive measures at the local level (i.e., county and municipal level) to protect the source water. The Steering Committee established certain acceptance criteria as part of identifying and selecting the most feasible source water management approaches to implement locally. The Steering Committee recommends the following list of source water management tools to be implemented by Little Elk Creek and Pitkin County Planning Commission where applicable in the drinking water supply protection area:

Ultimately, the Steering Committee will:

- Educate the public via source water protection outreach materials.
- Create inspection and management programs for septic tanks and curb stops.
- Coordinate efforts with the Pitkin County Environmental Health Department, Pitkin County Community Development, White River National Forest, Basalt Rural Fire Protection District, and Pitkin County Road and Bridge.
- Maintain good communication with surrounding subdivisions and other private and public landowners in the vicinity and encourage minimal development.
- Maintain good communication with the CDPHE.
- Maintain certified operators in charge with a good continuing education program.
- Monitor changes in land use in the Little Elk Creek and Capitol Creek watersheds

The Steering Committee estimates that it will cost approximately \$13,000 in time and materials to implement these management approaches. Funding to cover these costs will come from grants, Pitkin Environmental Health Department and the HOA. Implementation of these management approaches is expected to begin in June, 2011 and will be ongoing following their establishment.

This source water protection plan includes additional voluntary commitments by Little Elk Creek to (1) track and report on the effectiveness of the source water management approaches that have been implemented, (2) apply source water assessment and protection principles to citing new water sources

and/or (3) assist the CDPHE in making future refinements to their source water assessment and to revise their source water protection plan accordingly based on any major refinements.

INTRODUCTION

Generalized Goals and Objectives of the Source Water Protection Plan Development

This SWPP finds that the goals and objectives as outlined in Addendum 1, excerpted sections of the *Snowmass/Capitol Creek Valleys Master Plan* are appropriate and necessary for protection of our well water quality and quantity.

Purpose of Source Water Protection Plan Development

Little Elk Creek Subdivision recognizes the likely financial and water supply risks related to the potential contamination of one or more of the community's water sources. In an effort to address the potential problems that could affect their untreated source water, Little Elk Creek Subdivision, with guidance from Colorado Rural Water Association (CRWA), appointed the Steering Committee. The Steering Committee advised Little Elk Creek Subdivision in identifying local source water management approaches that can be implemented to reduce the risks of potential contamination of the untreated source water. These management approaches will occur when Little Elk Creek Village Homeowners Association receives grant monies from the CDPHE for source water protection implementation. Development of this SWPP was made possible in part, by funding from neighboring Gateway Metro District's CDPHE SWPP grant monies.

The primary reason for developing and implementing source water management approaches is to apply an additional level of protection to the drinking water supply. Preventive measures at the local level (i.e., county and municipal level) may aid in the protection of the source water. These preventive measures 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.

The SWPP identifies the drinking water supply protection areas where the community has chosen to implement its source water protection measures. In addition, the SWPP established a strategy for prioritizing the water sources and potential contaminant sources to which the source water management approaches will be applied. The strategy is based on the source water assessment results that the CDPHE created as a starting point, and from which Little Elk Creek Subdivision reviewed and refined, as to how these priorities were identified. The SWPP also identifies the source water management approaches and associated tasks that will be implemented within the drinking water supply protection areas. Also included in the plan are the proposed schedule and costs for implementation. Finally, as a companion to the SWPP, an Emergency Action Plan, including emergency response, was independently developed by Little Elk Creek Subdivision. The Emergency Action Plan lays out a coordinated plan for responding rapidly, effectively, and efficiently to any emergency incident that threatens or disrupts the community water supply.

Public Participation, Steering Committee Establishment and Participation

On January 5, 2010, the Little Elk Creek HOA Board nominated George Johnson, Dan Harris, Tom Gering, Beth Hoff and John Ott to serve on the Steering Committee. George is a former Certified Soil Tester and Lake Manager dealing with surface water quality and quantity items. Dan has run the HOA water system for many years. Tom is a Journeyman plumber. Beth is the present HOA President. John is an architect and a licensed septic inspector. The Steering Committee and HOA Board worked in consort about HOA needs and plan development. Directions from both entities were shared as the process moved forward.

Protection Plan Development Process

Public Meetings

Date	Location	Purpose / Description
5/18/11	Meagers house	LEC Board meeting/LEC Board SWPP approval
6/8/11	LEC Annual meeting	LEC SWPP Homeowner review and input

The general public was notified of the public meeting schedule – location, dates and times via the Board notification via email. Also, a direct invitation to attend and participate in these public meetings was extended to the entire community and local, state, and federal officials. Final approval was adopted at the HOA annual meeting, June __.

In developing the source water protection plan, Little Elk Creek Village HOA held the following stakeholder and steering committee meetings:

Date	Meeting	Discussion
6/2/10	Stakeholder Meeting	Program Review
10/21/10	Stakeholder Meeting	Program Review
3/27/11	Steering Committee Meeting	Discuss 1 st draft
4/25/11	Steering Committee Meeting	Review draft SWPP, protection zones, Prioritize psoc's and Identify potential management measures
6/30/11	Pitkin County Environmental Health	Meet with Pitkin County Environmental Health to discuss septic system outreach approach

* psoc's = potential sources of contamination

Steering Committee and Participants

Steering Committee

Name	Role/Responsibility	Title	Affiliation
George Johnson	Committee Chairman	Resident	Little Elk Creek
Tom Gering	Committee Member	Resident	Little Elk Creek
Beth Hoff	Committee Member	Resident	Little Elk Creek
John Ott	Committee Member	Resident	Little Elk Creek
Dan Harris	Committee Member	Resident	Little Elk Creek
Support Staff			
Scott Leslie	Project Manager	Certified Water Operator	EPC
Mary Leslie	Tech & Report Support	Certified Water Operator	EPC
Gwen Leslie	Tech & Report Support	Administrative Support	EPC
Paul Hempel	Facilitator	Source Water Specialist	CRWA

Other Participants

The source water protection planning process attracted interest and participation from other key entities. Input by these entities was greatly appreciated and was instrumental in developing the source water protection plan. These participants include:

Carla Ostberg	Pitkin County Environmental Health
Cindy Houben	Pitkin County Community Development
Brian Petitt	Pitkin County Road and Bridge
Melissa Sever	Pitkin County Weed Management
Tom Grady	Pitkin County Sheriff's Office
Joseph Bauer	Pitkin County Sheriff's Office
Mary Lackner	Pitkin County GIS
Ed Van Walraven	Aspen Fire Protection District
Valerie Mac Donald	Pitkin County Office of Emergency Management

WATER SUPPLY SETTING

The following is excerpted from the *State of the Roaring Fork Watershed Report, 2008(1)*:

Environmental Setting

Capitol Creek drains a portion of the Elk Mountains in the south central part of the Roaring Fork Watershed. Capitol Creek sub-watershed contains public land, most of which is designated wilderness, along with rural residential and agricultural land uses. This sub-watershed contains an area known as "Old Snowmass," primarily a collection of residences that spreads out along the lower Snowmass and Capitol Creek Valleys from State Highway 82. The sub-watershed's ecoregions include Alpine Zone, Sedimentary Subalpine Forests, Sedimentary Mid-elevation Forests, and Foothill Shrublands. Please see Figure 1, General location of Little Elk Creek subdivision.



Map 1. General location of Little Elk Creek subdivision

Topography and Geology

Capitol Creek has its headwaters at Capitol Lake (11,560 feet). Capitol Creek has 4 small tributaries including Little Elk Creek and flows into Snowmass Creek about a mile upstream of its confluence with the Roaring Fork River.

The Elk Mountains in the upper Capitol Creek drainages are steep, with slopes greater than 30 and 45 percent. Several peaks in these mountains form the divides between the drainages of Snowmass and Capitol creeks including Snowmass, Hagerman, and Capitol peaks and Snowmass Mountain. Capitol Peak and Snowmass Mountain are both more than 14,000 feet in elevation. All of these peaks are formed by Tertiary intrusive rocks.

The glacial history of this area can be seen in the glacial deposits. Glacial lateral moraines are often deposited on oversteepened bedrock surfaces that were sculpted by the glaciers and are very prone to sliding and slumping. The predominant geologic formation in this sub-watershed is the less steep Mancos Shale, which is very susceptible to erosion, leading to mudflows, landslides, and other slope instability problems. Gravels and alluviums in the lowest part of the sub-watershed correspond to the more gently-sloped agricultural lands.

Climate

No Colorado Basin River Forecast Center SNOTEL sites, Western Regional climate stations or Colorado Collaborative Rain, Hail, and Snow Network stations occur in this Capitol Creek sub-watershed.

Most of the developed area within the Roaring Fork watershed (including municipalities and private lands) receives less than 25 inches of precipitation a year. Colder, north-facing slopes receive more snow and retain that snow well into the summer. Warmer south-facing slopes receive less snow and that melts off more quickly, leaving snow-free habitat even in winter. The watershed's north-facing Elk Mountains receive 40 to 50 inches of precipitation annually.

Climate data have been collected at the Aspen climate station since the 1890's, establishing normals for temperature and precipitation. In this same time period there has been a 30 percent increase in greenhouse gases in the atmosphere primarily due to the burning of fossil fuels has a direct effect on the local and regional climate. The future climate of the Roaring Fork Watershed is very likely to be warmer.

There is greater uncertainty about annual precipitation change. It is likely, however, that more of the annual precipitation will fall as rain rather than snow, influencing the timing and amount of spring runoff. This will alter and will impact the Roaring Fork

Watershed's ecosystems, agriculture, and the socioeconomic patterns related to outdoor recreation. As regional demand for water increases, it is probable that warming will add additional stress to water availability in the Southern Rockies and the entire Southwest.

Biological Communities

Throughout the Capitol Creek drainages, upland plant communities vary with elevation, aspect, and soil type. At Capitol Lake, uplands are characterized by alpine tundra ecosystems. Below the lakes, subalpine plant communities include dense stands of spruce-fir forests interspersed with aspen groves and herbaceous meadows. Montane plant communities begin at approximately 9,000 feet with aspen forests intermixing with spruce-fir forests, sage shrublands, and herbaceous meadows. As the geology becomes dominated by shale at around 7,500 feet, the upland plant community shifts to a mosaic of oak serviceberry and sage shrublands intermixed with pinion-juniper forest and, where soil moisture increases in drainages on north-facing slopes, by aspen groves and patches of Douglas fir forest. The subalpine riparian habitat is mainly dense spruce-fir forest with an understory of willow and alder. In flatter canopy openings, it is made up of sedge meadows and willow carrs. Upper montane riparian ecosystems are characterized by riparian aspen-alder forests intermixed with conifer forests, wet meadows, and willow carrs. Further downstream, in the Montane Life Zone, plant community's transition to narrowleaf cottonwood-blue spruce forests interspersed with wide willow carr communities dominated by thinleaf alder, willow, red-osier dogwood, twinberry honeysuckle, gooseberry, currant, and Wood's rose.

A typical mix of native mammals is found in the undeveloped areas of the sub-watershed. The Stream Health Initiative observed mammals or signs/tracks of species including marmot, pika, mountain lion, pine marten, elk, mule deer, black bear, and beaver. Also documented is the presence of bobcat, mountain lion, pine marten, long-tailed weasel, black bear, and fox, and small mammals such as montane, long-tailed, and Southern red-backed vole.

Bald eagle wintering range includes the lower part of Capitol creek. The bald eagle is designated at the state level as threatened. The Colorado Division of Wildlife (CDOW) has identified occurrence of the following fish species: Colorado River cutthroat (CRCT), brook, brown, and rainbow trout; and mottled sculpin.

In the higher reaches of the Capitol Creek sub-watershed, upland habitat is designated wilderness (within the Maroon Bells-Snowmass Wilderness Area) that is in fairly pristine condition. However, historic and present grazing activities in wilderness areas have altered native plant communities, enabled the spread of weeds, and changed soil characteristics in portions of the sub-watershed. Trees and shrubs are dominated by mature-aged growth and seedlings and saplings have been reduced by grazing. The

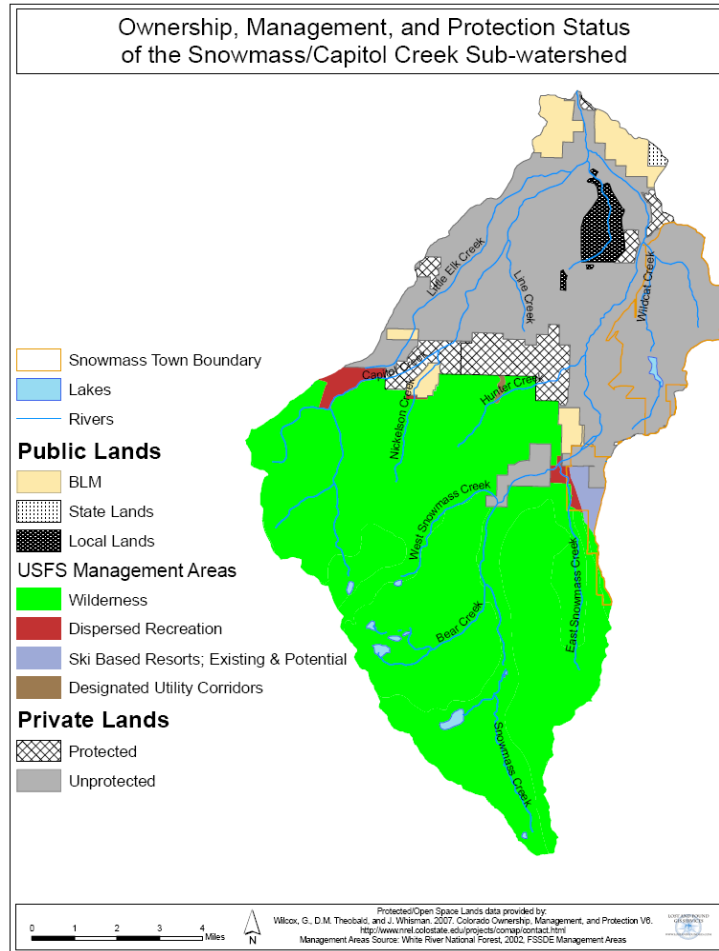
herbaceous layer is dominated by low to-the-ground or disturbance-tolerant species such as dandelion, wild strawberry, pussytoes, and clover. Recreational trails are heavily used by hikers and pack horses causing erosion and enabling the spread of weeds in some areas.

A fairly recent study compared wildlife diversity on recreational trails with diversity away from trails for the Hay Park Trail area in the upper Capitol Creek drainage. The results indicated that bird and mammal communities along trails differ from the communities more than 50 meters (165 feet) away from trails, with human tolerant species more prevalent near trails and sensitive species more prevalent away from trails.

Land Ownership and Use

Public lands that make up about half of this sub-watershed are federally managed. The upper portion is within the White River National Forest, managed by the U.S. Forest Service (USFS). Several Bureau of Land Management open space parcels lie within and below the Capitol Creek sub-watershed. The lower half of the sub-watershed is predominantly in private ownership.

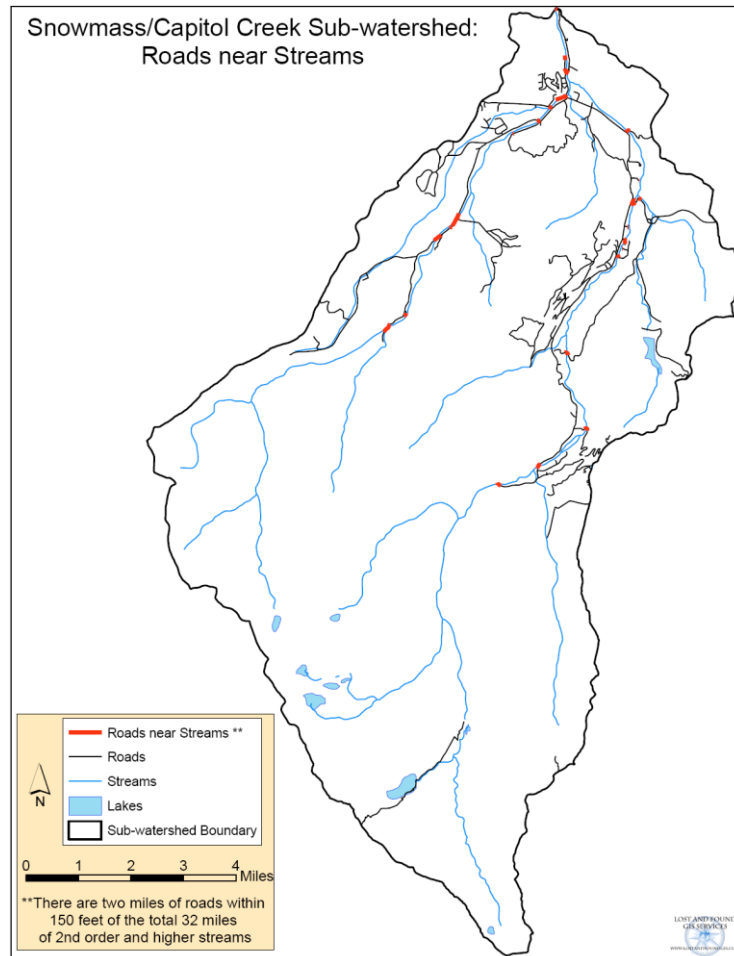
Predominant land uses in higher elevation reaches include forest, grazing, and recreation. At lower elevations, land uses shift to agriculture including irrigated hay fields and pastures for grazing, and to a small extent, rural residential use. Please see Map 2, Ownership and protection status of the Snowmass/Capitol Creek Sub-watershed.



Map 2. Ownership and protection status of the Snowmass/Capitol Creek Sub-watershed

The sub-watershed is located entirely within Pitkin County. The Snowmass-Capitol Creek Caucus (SCCC), made up of landowners and residents of the sub-watershed, was formed and officially recognized in 1974. The caucus makes recommendations to Pitkin County regarding all matters directly affecting the caucus area. The SCCC concerns itself with the privately-owned areas in the sub-watershed as well as with water use in nearby Snowmass Village. In September 2003, the SCCC Board approved its Master Plan, which was subsequently forwarded to the county. The plan includes goals, objectives, and implementation measures for seven areas: land use, environment, growth, infrastructure and essential community facilities, transportation, recreation and tourism, and mineral exploration/extraction. Several objectives relate directly to watershed issues and resources. As examples, the caucus stresses the importance of protection of the natural environment in the Snowmass and Capitol Creek valleys through land preservation, noxious weed control, and only allowing development that does not harm water availability and quality. Its master plan also contains detailed measures for protecting riparian and aquatic ecosystems and for monitoring and assuring adequate stream flows and water quality in Snowmass and Capitol creeks and their tributaries.

Map 3 shows the roads in the sub-watershed and identifies roads within 150 feet of second order and higher streams (approximately 6 percent of the streams). No major roads parallel streams within the sub-watershed. County roads follow along the lower parts of Capitol Creek. These rural roads do not present much if any water quality or quantity threat.



Map 3. Roads near streams in the Snowmass/Capitol Creek Sub-watershed

Recreation Activities

No developed campgrounds are found in the sub-watershed. Camping occurs intermittently during the summer and Elk hunting seasons. USFS trails follow Capitol Creek and the Hay Park trail traverses to Dinkle Lake. Capitol lake trail is a popular hiking/backpacking destination.

Horse riding is popular in the summer on the Hay Park trail and at the Saint Benedicts Monastery.

Fishing is limited. Colorado River and Pikes Peak Cutthroat trout have been stocked in Capitol Lake.

Generalized area population

Little Elk Creek Subdivision has less than 200 people year around population. The remainder of the upper watershed has less than 100 year around residents. Seasonal residency is very small. More than half of the watershed servicing the Subdivision is in National Forest.

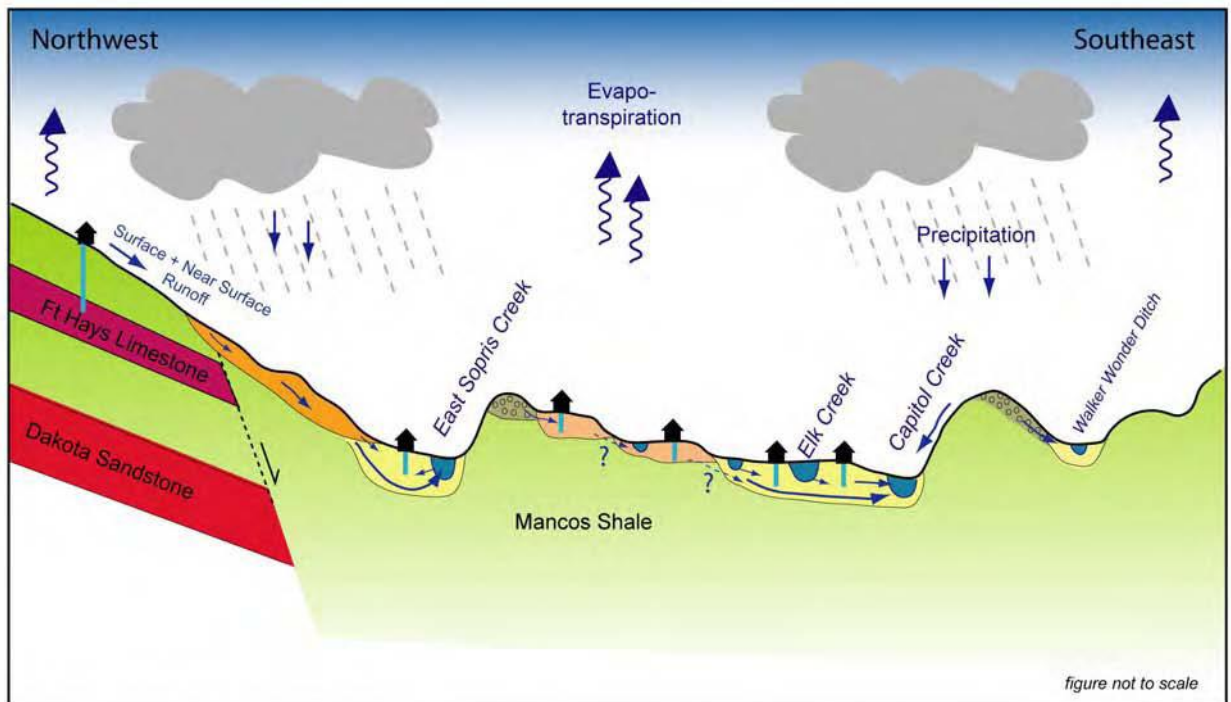
Groundwater

The following is excerpted from *GIS-BASED GROUND WATER RESOURCES EVALUATION OF THE CAPITOL AND SNOWMASS CREEK (CSC) STUDY AREAS, PITKIN COUNTY, COLORADO(2)*:

Groundwater may be locally available in the Quaternary unconsolidated materials, and to a lesser extent, in the Ft. Hayes and Dakota/Burro Canyon bedrock units. Groundwater in the lower Capitol Creek areas may be locally available in the Quaternary and Recent unconsolidated materials. The groundwater in these materials is locally and variably sustainable depending on climate processes, slope steepness and aspect, connection to creeks, and anthropogenic land use (notably irrigation ditches). However, these shallow units are vulnerable depending on natural protective cover or from leaking into the aquifers from irrigation ditches or the creeks. Sufficient Information about size, quality and flow patterns of groundwater aquifers is lacking.

The underlying bedrock units may be sustainable for smaller quantities of ground water. However they are separate from the upper groundwater by a rather impervious layer of Mancos Shale

There are numerous ditches in the area. These are mostly unlined. When carrying water, the ditches may leak. The ditch system in the study area contain two types of ditches: 1) primary ditches, carrying water during most of the growing season; and 2) secondary ditches, carry water only during an actual irrigation cycle. The water leaking from the ditches may be used by vegetation discharging as evapotranspiration, or it may recharge the ground water forming a local ground water mound. Ditch leakage may contribute significantly to the local water balance, increase the water table elevation, and alter ground water flow directions. Please see Figure 1, Conceptual Model of the Lower Capitol Creek (LCC) Subsystem.



Hydrologic Subsystem 4
Lower Capitol Creek (LCC)

Hydrogeology	
Unconsolidated Units	Bedrock Units
Qal - alluvium	Km - Mancos Shale
Qgf - fans and gravels	Kms - Mancos Upper Sandstone Mbr
Qm - moraine	Kml - Mancos Lower Sandstone Mbr
Qls - landslide	Kmf - Fort Hays Limestone
	Kdb - Dakota and Burro Canyon
	LB - Lower Bedrock

Figure 1. Conceptual Model of the Lower Capitol Creek (LCC) Subsystem

Hydrogeographic Setting

The water quality of the untreated source water is measured against various use classifications and water quality standards that are established and periodically re-assessed by the Colorado Department of Public Health and Environment and the Water Quality Control Commission for Colorado's rivers and streams. Currently all of the stream segments located above Little Elk Creek Village HOA's intakes are classified to protect drinking water use. For the stream segments with a drinking water use classification, drinking water standards have been established for. These stream standards are a reflection of known water quality conditions, as well as historic land uses within the Roaring Fork River watershed. Drinking water classifications and associated water quality standards provide public water systems and communities with a mechanism for monitoring and protecting the quality of their source water.

**Table 1: Stream Classifications and Water Quality Standards,
Upper Colorado River Basin**

REGION:12

Roaring Fork River

3a. Mainstream of the Roaring Fork River, from a point immediately below the confluence with Hunter Creek, to a point immediately below the confluence with the Fryingpan River. All tributaries to the Roaring Fork River, including wetlands, from a point immediately below the confluence with Hunter Creek to the confluence with the Colorado River.

Classifications	Numeric Standards					
	<u>physical/biological</u>	<u>inorganic mg/L</u>			<u>metals ug/l</u>	
Aq Life Cold 1	T=TVS(CS-I)oC	NH3(ac/ch)=TVS	S=0.002	As(ac)=340	Fe(ch)=WS(dis)	Ni(ac/ch)=TVS
Recreation E	D.O.=6.0 mg/l	Cl2(ac)=0.019	B=0.75	As(ch)=0.02(Tre)	Fe(ch)=1000(Trc)	Se(ac/ch)=TVS
Water Supply	D.O.(sp)=7.0 mg/l	Cl2(ch)=0.011	NO2=0.05	Cd(ac)=TVS(tr)	Pb(ac/ch)=TVS	Ag(ac)=TVS
Agriculture	pH=6.5-9.0	CN=0.005	NO3=10	Cd(ch)=TVS	Mn(ch)=WS	Ag(ch)=TVS(tr)
	E.Coli=126/100ml		Cl=250	CrIII(ac)=50(Trc)	Mn(ac/ch)=TVS	Zn(ac/ch)=TVS
			SO4=WS	CrVI(ac/ch)=TS	Hg(ch)=0.01(tot)	
				Cu(ac/ch)=TVS		

Hydrology and Water Quality Monitoring

Little Elk Creek is about six miles long. It is mapped as intermittent stream by the USGS. It is tributary to and joins Capitol Creek below the Subdivision. Presently, it is not flashy or turbid and is flatter than Capitol Creek watershed. No water quality is available for Little Elk Creek.

Most of the Little Elk Creek annual flow comes from groundwater arising from irrigation. Some of its warm weather flow is wastewater from ditches above the Subdivision. The Little Elk Creek irrigation water source is Capitol Creek. Little Elk Creek water quality entering the Subdivision should be similar to or better than Capitol Creek being that most of it is groundwater. However, it is a more human impacted watershed.

The following is excerpted from the *State of the Roaring Fork Watershed Report, 2008*:

Capitol Creek is a perennial stream about 12 miles long and a few small tributaries. It is flashy and turbid for about two months in the spring because of its steep watershed and natural source erosion. Less pasturing and grazing but about the same number of residential properties occur as in the Little Elk Creek watershed.

From Capitol Creek pH varies from 7.02 to 8.68 and its median pH value is 8.44. Water temperature rarely exceeded 20C (68 F) with median values ranging from 6.5C (43.7F) to 7C (44.6 F). Median dissolved oxygen concentration is 9.8 mg/L, indicating generally well-oxygenated conditions.

Capitol Creek in general has high water quality, no major pollution sources but only some marginal riparian habitat. Nutrient data were too limited to provide a detailed characterization of seasonal or spatial trends. Un-ionized ammonia, nitrate/nitrite, and total phosphorous were collected biannually or annually on Snowmass and Capitol creeks from 2001 through 2007. Most of the nutrient samples were censored and available concentrations are generally low.

Total recoverable aluminum, total recoverable iron, and selenium were found either in higher concentrations or exceeded the water quality standard. Total recoverable aluminum concentrations were found to have concentrations greater than 750 g/L in five of 19 samples from Capitol Creek. Of the 156 total recoverable iron concentrations, 12 exceedances of the chronic standard were observed where concentrations were three and four times the chronic standard of 1,000 g/L. On several sampling occasions, the elevated aluminum and iron concentrations were found in the same sample, suggesting a relationship between these two trace elements. Selenium exceeded the chronic standard 16 times in 127 samples, with concentrations ranging from 1.2 g/L to 10 g/L. Exceedances of the chronic table value standard (TVS) for selenium in Capitol Creek occurred from March through October and are most likely related to irrigation of land underlain by Mancos Shale. This again would be related to the geology in the sub-watershed, where Mancos Shale is a known source of selenium and salt. Arsenic, cadmium, copper, manganese, lead, and zinc were sampled and concentrations did not exceed applicable TVS levels.

Sulfate concentrations were found to exceed the sulfate water quality standard of 250 mg/L three times on Capitol Creek. Exceedances occurred in February, May, and December of 2002-03, and 2005. During winter months, stream flow is likely dominated by groundwater inflows. Sulfate concentrations in groundwater are often higher due to longer residence time of the groundwater in contact with geologic units that contain sulfate salts (Roaring Fork Conservancy, 2008).

Median hardness 440 mg/L on Capitol Creek indicates very hard water. This combination of high sulfate and hardness are indicative of the geology of the area, where Capitol creek is underlain by Mancos Shale.

Suspended sediment concentrations averaged from 7.05 mg/L for Capitol Creek. Ten samples were collected. Based on the limited available data, suspended sediment concentrations are generally low (Roaring Fork Conservancy, 2008).

Seven irrigation diversions occur off Capitol Creek of 10 or greater cfs. Many other diversions under 10 cfs have been adjudicated. Severe flow shortages in the late summer and early fall are rare because of irrigation return flow, springs, and voluntary agreements between water-right holders.

Missing or poor understanding items for Capitol Creek water quality include:

- Water-quality for the upper portion of the sub-watershed
- Specific conductance – to establish sources of dissolved material and help to describe other water-quality conditions
- Suspended sediment – to evaluate the potential for ecosystem impairment from habitat disruption, temperature changes, or increased runoff of sediment-bound chemicals
- Emerging contaminants – to help establish a baseline for understanding occurrence in the rest of the watershed
- Riparian and instream habitat assessment of the Capitol Creek drainage

The surface water quality is high although some exceedances occur that do not affect the quality or quantity of the potable water supply.

No direct water quality data is available for Little Elk Creek. It is tributary to and its water quality is included as a small contributor to the Capitol Creek water quality.

Two of the three augmentation ponds are above the Little Elk Creek HOA domestic water supply wells. These ponds are fed by Capitol Creek via Boram and White ditch and Little Elk Creek. Capitol Creek via Boram and White ditch provides about 2/3 of that flow for warmer five to six months. All the flow to the pond for the remaining six to seven months comes from Little Elk Creek, most of it being groundwater. We estimate that Little Elk Creek direct discharge provides about 72% flow on an annual basis.

From Holmes, Aqua Sierra, Inc. 2010(3), Water and sediment depths were collected at six randomly selected locations in each of the augmentation ponds. The upper pond had the most sedimentation as suspected. This pond is the first in a series of three augmentation ponds similar in size. The maximum water depth of this pond is three feet six inches with a maximum sludge depth of thirteen inches found near the outlet. The middle pond is the deepest pond with a water depth of five feet near the middle. Sedimentation in this pond appears to be minimal with less than three inches of sludge found at each sample site. The lower pond is the smallest and shallowest with a maximum water depth of three feet five inches. Sedimentation also appeared minimal in this pond with one inch or less found across the basin.

A sediment sample was collected in the middle pond. The sample site location was near the outlet. Due to the fact that sludge accumulation is minimal in this pond, the texture is sandy loam. The sample was comprised of 74% sand, 14% silt, and 12% clay. The results show no impact on potable water quality. Results of the basic soil analysis are below in Table 2.

Table 2: Little Elk Creek Sediment Analysis, May 2010

PARAMETER	RESULT (mg/kg)
Aluminum	0.05
Boron	<0.01
Barium	0.45
Cadmium	<0.01
Chromium	0.37
Copper	0.42
Iron	252
Potassium	33.4
Magnesium	73.4
Manganese	2.9
Molybdenum	0.06
Sodium	41.6
Nickel	0.25
Phosphorous	0.6
Lead	<0.01
Silicon	0.65
Strontium	0.35
Titanium	0.21
Vanadium	0.29

The water input to the augmentation ponds above the Little Elk Creek wells is about 1.5 cfs year around. The diversion is adequate during the warmer months but less adequate for the cooler months.

Drinking Water Supply and Quality, Little Elk Creek Subdivision

The wells in Capitol Creek serve domestic water supply needs; their individual influence on the ground water system is limited. However, when they are clustered, their accumulated effect on the ground water system may be significant, resulting in a possible lowering of the water table, changes in flow direction, decreasing discharge to streams or increasing stream loss to ground water, draining of wetlands or even depletion of local aquifers.

Quality analysis

A Consumer Confidence Report is issued annually for Little Elk Creek Subdivision's drinking water quality as required by the Colorado Department of Public Health and Environment. The wells are considered as groundwater under the influence of surface water. The water is tested for bacteria, organics, inorganics, turbidity, lead, copper, radionuclides, synthetic and volatile organic compounds and sodium.

The existing potable water quality is high with no recent exceedances. Worthy of note is that the Sodium, nitrate and nitrite forms are very low, sodium is consistently less than 6/1000 than of the maximum contaminant level and the nitrogen forms is consistently less than 0.5 ppm, about 1/20 of the maximum contaminant level. This indicates that fertilizer runoff, erosion and septic system leaching is not a concern at this time. Sodium and the nitrogen forms tend not to be removed as they to move through the groundwater. Also, selenium range is around 7 ppm, about 1/7 the maximum contaminant level. This indicates the watershed that is higher in selenium, is not reaching the drinking water to any appreciable extent. The system has been granted an exemption for Glyphosate ("Round Up" brand herbicide), nitrite, cyanide and asbestos. As such, protection is warranted.

Drinking Water Supply Operation

Water Supply Demands/Analysis

The Little Elk Creek Village HOA water system is operated by employees of Environmental Process Control (EPC) whose offices are located in Carbondale, CO. The water service area includes the Subdivision and four other homes.

The Subdivision uses about 12,000 gallons per day as the base level for winter use. The wells can produce 15,000 to 20,000 gallon per day during a normal winter. Standard use in the summer is harder to estimate since use varies greatly. The wells can produce about 100,000 gallons per day in the summer. Usually water use peaks in late May and early June before the owners get their sprinkler systems on to the ditch water. Use in this period without leaks, can be as much as 40,000 gallons per day or more. Once mid-June hits, use drops slightly and levels off. In a good year, we might be in the mid 30,000 gallon range for most of the summer. However, we have had summers with consistent use in the 40,000 range. This higher use may be attributed to a leak or random sprinkler use. Use usually starts to drop in late September.

The Subdivision has a water storage capacity of 105,000 gallons. This includes the water mains and a 100,000 gallon tank. The Subdivision has about 8,400 linear feet of water main. This does not include the line from the Subdivision to the storage tank. This line is relatively new (1991 or so) and the ductile iron pipe should not present a replacement issue in the foreseeable future. The lines within the subdivision have been installed at different times and are different sizes. They are plastic but so far no repairs have been made on the lines.

The water supply consists of four groundwater wells, one of which is capped as a reserve well. These wells are shallow, around 35 feet deep. They are drilled to the top of the underlying and impervious shale layer. These wells are located in the northwestern corner of the subdivision. The wells are located in close proximity to three augmentation ponds, which help to stabilize the water table in the aquifer during the winter when the water is the lowest. Two of the three pond surfaces are above the wellheads. These ponds are of concern because they probably are in direct contact with the water table. Surface water contamination could result in ground water contamination.

Raw water is diverted from the wells and is sent to the water treatment plant buildings where it is filtered through four 1-micron bag filters. It is then treated with Chlorine bleach before it is pumped to a 100,000 gallon storage tank on the hill. From there it is distributed to the drinking water system's customers. The treatment system has the maximum capacity to treat 151,000 gallons of drinking water per day. Please see Figure 2, Water System Schematic and Figure 3, Little Elk Creek HOA well locations.

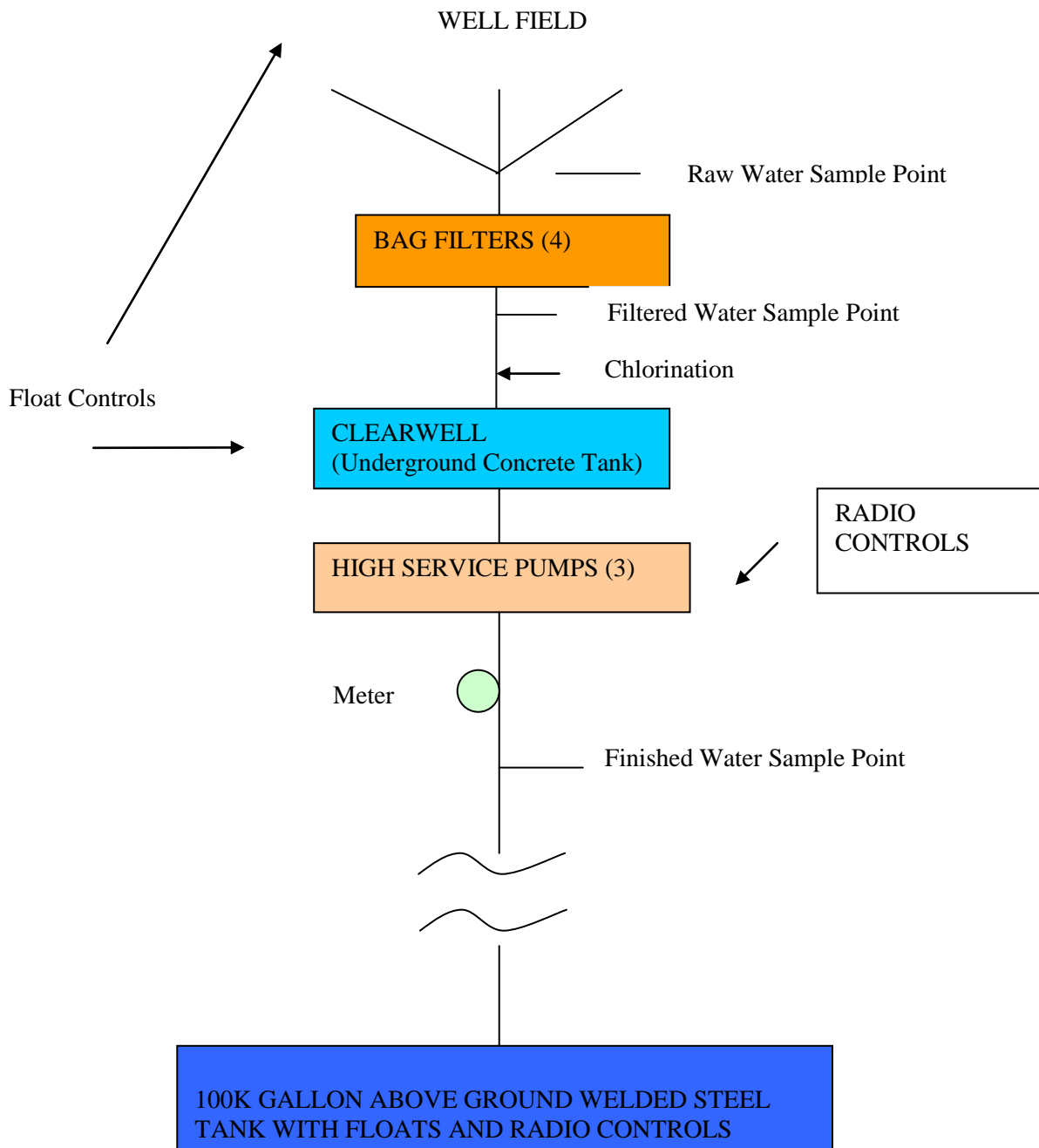


Figure 2: Water System Schematic



Figure 3: Little Elk Creek HOA well locations

The water system serves an estimated 77 connections and approximately 200 residents and other users in the service area annually. The water system currently has the capacity of meeting a peak (i.e., maximum) daily demand of 151,000 gallons per day. Current estimates by the water system indicate that the average daily demand by the water system's customers is approximately 25,309 gallons per day, and that the average peak daily demand is approximately 37,466 gallons per day. Using these estimates, the water system has a surplus average daily demand capacity of 125,891 gallons per day and a surplus average peak daily demand capacity of 113,734 per day. Using the surplus estimates above, Little Elk Creek Village HOA has evaluated its ability to meet the average daily demand and the average peak daily demand of its customers in the event the water supply from one or more of its water sources becomes disabled for an extended period of time due to potential contamination. The evaluation indicated that Little Elk Creek Village HOA may not be able to meet the average daily demand of its customers if as few as two of the water sources became disabled for an extended period of time. The evaluation also indicated that Little Elk Creek Village HOA may not be able to meet the average peak daily demand of its customers if as few as one of the water sources became disabled for an extended period of time or if leaks in the system occur. The ability of Little Elk Creek Village HOA to meet either of these demands for an extended period of time is also affected by the amount of treated water

the water system has in storage at the time a water sources becomes disabled. In the event of well failure, water could be hauled and put in the wet well.

Little Elk Creek Village HOA recognizes that potential contamination of its ground water sources could potentially result in having to treat the ground water and/or abandon the water source if treatment proves to be ineffective or too costly. To understand the potential financial costs associated with such an accident, Little Elk Creek Village HOA evaluated what it might cost to replace one of its water sources (i.e., replacement of the intake structure and the associated infrastructure) if this occurs. The evaluation did not attempt to estimate treatment costs, which can be variable depending on the type of contaminant(s) that need(s) to be treated. The evaluation indicated that it could cost \$18-25,000 in today's dollars to replace one of its water sources.

The potential financial and water supply risks related to the long-term disablement of one or more of the community's water sources are a concern to the Steering Committee. As a result, the Steering Committee believes the development and implementation of a source water protection plan for Little Elk Creek Village HOA can help to reduce the risks posed by potential contamination of its water sources.

Leaks have occurred in the household water service lines beyond the main. The homeowner is responsible for all his service line, including the tap to the main. The HOA has created a repair fund for future water system repair or replacement.

Dan Harris has recorded 34 leaks that have been repaired since 1994. Three homes have had multiple repairs. These are older houses with older piping. The range of leaks has been from lows of about 5,000 gallons per day to as much as 40,000 gallons per day. The smaller leaks are usually found by alert homeowners. The larger leaks are usually found in the winter when water surfaces. People have had leaks as large as 33,000 gallons per day and not notice a change in their water delivery.

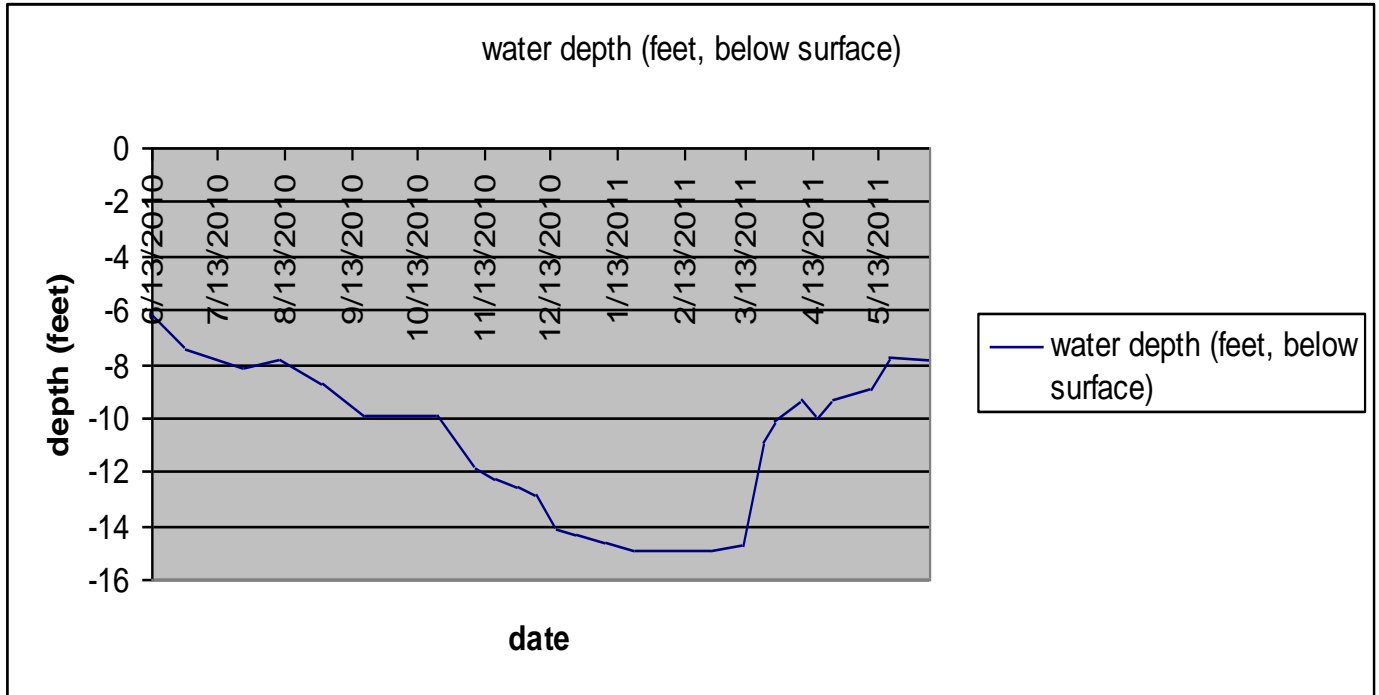
Two water leaks occurred in the winter of 2010/2011. The recent leaks resulted in a situation where the water wells ran continuously and ultimately could not keep up with demand. Graph 1 shows the seasonal drop in the water table from June 2010 to April 2011. It exhibits a dramatic water table drop and recovery.

This drop corresponds to the period of the leaks and the water table recovery once the leaks were fixed. We do not know when the leaks started but the two leaks were estimated to be 19,000 gallons which was fixed in early February and 16,000 gallons in early March.

It is hard to isolate the leaks being different sections of the water distribution system have to be shut down and monitored in order to find the errant section. Once identified the individual homes are assessed. Not all homes have curb stops which when turned off, can easily detect an individual home service line leak.

It appears that the water table drops in the well head area during the winter. This causes the well production to drop. Additional water flow to the augmentation ponds is needed during the cooler months may help increase the water table around the wells (Table 3).

Table 3. Water table depth near Little Elk Creek Subdivision Wells.



The lower cooler season water table indicates that the water supply is more from the groundwater than influenced by the ponds. However, it is wise and prudent to consider protection of both surface and groundwater well sources.

Recommendations:

- Continue funding the water system repair fund
- Install or find the missing curb stops
- Access the integrity of the water line segments
- Monitor individual well volumes and repair or replace poorly producing wells
- Investigate the idea of digging the ponds to increase well capacity
- Investigate the possibility augmenting the wells by treating and using surface water from the third pond in an emergency situation
- Provide protective fencing for the wells

Growth and Land Use Projections

The Subdivision only has a few lots yet to be developed. Outside the Subdivision, three homes use the Subdivision potable water and one of those homes has another home that can be developed. As such, only about 10 more taps may be required.

The latest community census estimated a population of 200 for the Little Elk Creek Village HOA subdivision. Based on development pattern information, Little Elk Creek Village HOA has been experiencing a leveling in growth within the community over the last 10-20 years. Future projections estimate that growth will increase a small amount and then level off in the future as the remaining lots in the subdivision are filled.

Currently, Little Elk Creek Village HOA estimates that 50% of the land area within the watershed is currently undeveloped and under Federal protection. The remainder of the watershed is currently zoned for some residential and mostly agricultural uses.

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 SWAP program. The Water Quality Control Division, an agency of the CDPHE, assumed the responsibility of developing Colorado's SWAP program. The SWAP program protection plan will be integrated with the existing Colorado Wellhead Protection Program that was established in amendments made to the federal Safe Drinking Water Act (SDWA, Section 1428) in 1986. Wellhead protection is a preventative concept that aims to protect public groundwater wells from contamination. The Wellhead Protection Program and the SWAP program have similar goals and will combine protection efforts in one merged program plan.

Colorado's SWAP program is an iterative, two-phased process designed to assist public water systems in preventing potential contamination of their untreated drinking water supplies. The two phases include the Assessment Phase and the Protection Phase as depicted in the upper and lower portions of Figure 4, below.

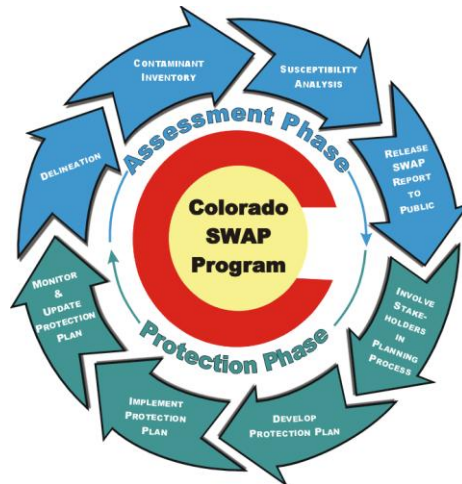


Figure 4: SWAP Diagram

Source Water Assessment Phase

As depicted in the upper portion of Figure 4, 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; and
3. Reporting the results of the source water assessment to the public water systems and the general public.

The Assessment Phase involves understanding where the source water comes from, what contaminant sources potentially threaten the water sources, and how susceptible each water source is to potential contamination. The susceptibility of an individual water source is analyzed by examining the properties of its physical setting and potential contaminant source threats.

Source Water Protection Phase

The Protection Phase is a voluntary, ongoing process in which Little Elk Creek Village HOA has been encouraged to voluntarily employ preventive measures to protect their water supply from the potential sources of contamination to which it may be most susceptible. The Protection Phase can be used to take action to avoid unnecessary treatment or replacement costs associated with potential contamination of the untreated water supply. Source water protection begins when local decision-makers use the source water assessment results and other pertinent information as a starting point to develop a protection plan. As depicted in the lower portion of Figure 4, 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; and
4. Monitoring the effectiveness of the protection plan and updating it accordingly as future assessment results indicate.

The water system and the community recognize that the Safe Drinking Water Act grants no statutory authority to the CDPHE or to any other state or federal agency to force the adoption or implementation of source water protection measures. This authority rests solely with local communities and governments. The source water protection phase is an iterative process as indicated in Figure 4. The evolution of the SWAP program is to incorporate any new assessment information provide by the public water supply systems and update the protection plan accordingly.

SOURCE WATER ASSESSMENT RESULTS

The CDPHE assumed the lead role in conducting the source water assessments for public water systems in Colorado. Little Elk Creek Village HOA received their *source water assessment report in November, 2004(4)* and has reviewed the report along with the Steering Committee. The Steering Committee used these assessment results as a starting point in the plan development process. Little Elk Creek Village HOA and the Steering Committee then further analyzed and refined the CDPHE assessment in order to guide the development of appropriate management approaches to protect the source water of Little Elk Creek Village HOA from potential contamination. A copy of the source water assessment summary report for Little Elk Creek Village HOA can be obtained by contacting Environmental Process Control (EPC) at 970-963-8393 or by downloading a copy from the CDPHE's SWAP program web site located at: www.cdphe.state.co.us/wq/sw/swaphom.html.

Source Water Assessment Area Delineation

Ground Water Systems under the Influence of Surface Water

The source water assessment area for Little Elk Creek Village HOA's three ground water sources consists of a specified measured area overlying the Snowmass Creek Basin Aquifer. The source water assessment area for these water sources is approximately

five square miles in size (based on calculated square mile geometry from agreed upon drinking water supply protection areas).

The drinking water supply protection area was recreated from the original source water assessment by conducting an onsite survey of land uses within the drinking water supply protection area and topographic mapping. The redelineated drinking water supply protection areas maintain groundwater recharge for the respective intakes and other hydrologic factors.

The original source water assessment area not only provided the basis for understanding where the community's source water and potential contaminant threats originate, but it also provided the basis for establishing the drinking water supply protection areas under this source water protection plan.

Defining the Drinking Water Supply Protection Areas

The drinking water supply protection area defines the watershed region and the surface area overlying the local aquifer where Little Elk Creek Village HOA has chosen to implement its source water protection measures in an attempt to manage the susceptibility of their source water to potential contamination.

The Steering Committee defined the drinking water supply protection area based on the geomorphology of the land, immediacy of the potential contamination sources to the source water, existing and proposed land uses and the type of potential contaminants. Figure 5 depicts Zone 1, Developed Lots of Greatest Importance, and Figure 6 depicts Zone 2.



**Figure 5: Drinking Water Supply Protection Area Zone 1,
Developed Lots of Greatest Importance**

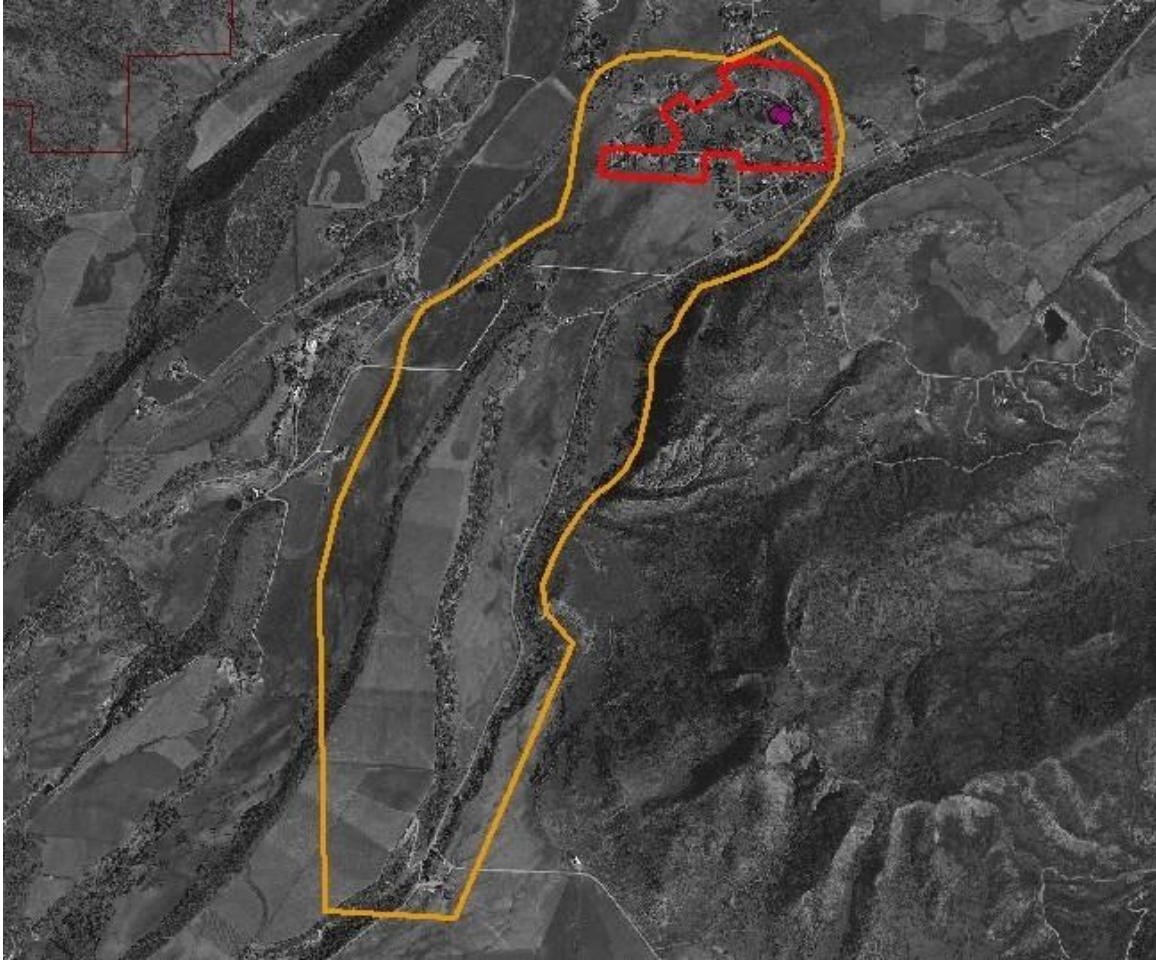


Figure 6: Drinking Water Supply Protection Area Zone 2

Zone 1 encompasses an area of approximately .09 square miles and has 20 lots within the Subdivision. This area is of critical concern because of its proximity to the wells. This includes all the wells and augmentation ponds. Most of Zone 1 is currently developed and is zoned for residential use. This zone contains a number of possible dispersed contaminant sources, but it is the septic tanks, roads, lawns and ponds within a hundred feet of the wells that are of the most concern.

Zone 2 encompasses an area of 1.24 square miles. This area encircles Zone 1 and includes the area between Capitol Creek and Little Elk Creek just upstream of Little Elk Creek Village HOA subdivision. Zone 2 contains several working ranches that graze cattle and horses. Some of these ranches also use their land to make hay. Most of the ranches have above ground fuel storage tanks, which could possibly leak into the surface and/or groundwater if not properly maintained. It is these fuel storage tanks, the roads, septic systems and land use practices that are of most concern to Zone 2.

Contaminant Source Inventory

The information contained in this source water protection plan was collected from public records, and research and investigations from Little elk Creek and the water supplier. Although other "potential contaminant sites" or threats to the water supply may have been identified in the original source water assessment area, all potential sources of contamination were field verified during the development of the 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.

The contaminant source inventory was conducted to identify whether or not selected potential sources of contamination might be present within the source water assessment area. The CDPHE inventoried discrete contaminant sources using selected state and federal regulatory databases. Dispersed contaminant sources were inventoried using a 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 CDPHE provided Little Elk Creek Village HOA with a draft map, a summary of the discrete contaminant sources mapped within their source water assessment area and a summary of the dispersed contaminant sources inventoried within the source water assessment area. Little Elk Creek Village HOA was asked to voluntarily review the inventory information, field verify selected information about existing and new discrete contaminant sources, and provide feedback on the accuracy of the inventory.

Through this report, Little Elk Creek Village HOA is reporting to the CDPHE its findings and how it would proceed in the event of contamination of its water source.

Potential water quality impacts upstream of the Little Elk Creek Subdivision wells:

The major land owners and ranch managers of parcels greater than 500 acres within the Capitol Creek watershed were interviewed regarding, land use information pertaining to real and potential water quality impacts. They were specifically interviewed regarding discrete and dispersed contaminant sources, land use, animal units (cows and horses), herbicide use and developmental potential. The combined acreage represents the majority of the developed watershed contributory to Capitol Creek:

Name	title	interview date	acreage
Brother Raymond	ranch manager	January 21, 2011	3800
Connie Harvey	owner	January 21, 2011	1850
Dwight Maurin	owner	January 25, 2011	640
Steve Child	owner	January 26, 2011	1500
Brad Day	ranch manager	February 16, 2011	850
John McBride	owner	February 20, 2012	<u>2000</u>
			10640

None interviewed had any knowledge of discrete contaminant source problems (superfund, hazardous waste, toxic release, wastewater discharge, mines or quarry sites; leaking storage tanks, confined feedlots and so on). They also no knowledge of dispersed contaminant sources (quarries, failing septic systems, urban developmental issues and so on).

Approximately 58% of the lands (6200 acres) are in pasture/hay and 42% (4440 acres) in mixed forest. About 1200 acres are irrigated in the summer.

Four ranches are either fully developed or protected by or in the process of conservation easements. Those with current easements have the right to add three to seven more homes. This represents 58% of the lands (6200 acres). Two parcels are not protected by easement. This represents 42% of the land (4440 acres). It is highly unlikely that these parcels will be subdivided in the near future.

Approximately 81 horses are present in the warmest three to six month period and nine reside year around. Approximately 937 cattle reside in the warmest three to six month period and 340 reside year around. The maximum density of horses plus cattle pastured is in warmest three to six month period and average around 5 acres per animal.

All parcels use a limited amount of herbicides. Those herbicides include 2,4D, Banville, Round Up and Milestone. All these herbicides are nonrestricted, sold over the counter and generally not considered to be harmful to the environment if used per label instructions. The herbicides are used on a spot treatment basis for noxious weed and brush control.

Two items worthy of consideration is that two parcels totaling 480 acres were recently developed with a build out total of nine homes. One more 240 acre parcel exists without any conservation easement.

Recommendations

Encourage conservation easements or other mechanisms to discourage additional development and monitor change in and encourage proper animal husbandry practices.

Discrete Potential Sources of Contamination

Discrete contaminant sources are characterized by distinct points of contamination, which can be traced to an exact location. The contaminant source inventory results for Little Elk Creek Village HOA indicate the following types of discrete contaminant sources were identified within the drinking water supply protection areas for all of the ground water sources analyzed.

- Fuel Storage Tanks

Dispersed Potential Sources of Contamination

In contrast to discrete contaminant sources, dispersed contaminant sources are spread out over a certain area, and cannot be traced to an exact location. Dispersed contaminant sources are related more to land use and vegetation than specific site hazards. The contaminant source inventory results for Little Elk Creek Village HOA indicate the following types of dispersed contaminant sources were identified within the drinking water supply protection areas for all of the ground water sources analyzed:

- Augmentation Ponds
- Septic Systems
- Low Intensity Residential
- Roads
- Pasture / Hay
- Mixed Forest (Fire)
- Geologic Hazards (earthquakes, floods)

Contaminant Health Concerns

Discrete and dispersed sources of contaminants can cause acute and chronic health concerns. Table 4-A and 4-B, below, contains information on contaminants relevant to the discrete and dispersed potential sources of contamination identified in the drinking water supply protection area:

**TABLE 4-A
CONTAMINANT TYPES ASSOCIATED WITH REGULATED
DISCRETE CONTAMINANT SOURCES**

Discrete Contaminant Source Type	Acute Health Concerns						Chronic Health Concerns								Aesthetic Concerns		
	Miroorganisms	Nitrate/Nitrite	Pesticides	Other Organic Compounds	Volatile Organic Compounds	Lead	Ammonia / Nitric Acid	Herbicides	Pesticides	Volatile Organic Compounds (VOCs)	Non-metal Inorganic Compounds	Metals - Primary Drinking Water (other than lead)	Radionuclides	Turbidity	Other Inorganic Compounds	Other Organic Compounds	Secondary Drinking Water Contaminants
Aboveground, underground and leaking storage tank sites					x					x							

TABLE 4-B

CONTAMINANT TYPES ASSOCIATED WITH DISPERSED CONTAMINANT SOURCES

Dispersed Contaminant Source Type	Acute Health Concerns						Chronic Health Concerns								Aesthetic Concerns		
	Miroorganisms	Nitrate/Nitrite	Pesticides	Semi-volatile Organic Compounds (SVOCs)	Volatile Organic Compounds (VOCs)	Lead	Ammonia / Nitric Acid	Herbicides	Pesticides	Volatile Organic Compounds (VOCs)	Non-metal Inorganic Compounds	Metals - Primary Drinking Water (other than lead)	Radiumclides	Turbidity	Other Inorganic Compounds	Other Organic Compounds	Secondary Drinking Water Contaminants
LAND USES:																	
Augmentation Ponds	x		x					x	x	x				x	x	x	x
Septic Systems	x	x	x				x	x	x						x		
Low Intensity Residential	x	x	x					x	x					x	x	x	
Roads	x	x	x	x	x		x	x	x	x	x		x	x	x	x	x
Pasture / Hay	x	x					x	x	x					x			
Mixed Forest (Fires)	x							x	x						x		
Geologic Hazards														x			x

Source Water Protection Priority Strategy

After reviewing the source water assessment results for Little Elk Creek Village HOA, the Steering Committee had the following observation: They felt that the assessment done in 2004 by the CDPHE was partially inaccurate and because there are so few sources of contamination in Little Elk Creek Village HOA’s drinking water supply protection area, the susceptibility analysis falls short of this water system’s needs. The primary job of the Steering Committee is to create the best possible source water protection plan for their water system. The Steering Committee created a better analysis through discussion, on-site observation, and review of historical data involving stakeholders and experts.

The Steering Committee decided to update and refine the 2004 CDPHE assessment and adopt the two-step strategy recommended by the CDPHE for prioritizing the water

sources and potential contaminant sources on which source water protection measures were focused.

The strategy calls for water sources with total susceptibility ratings or physical setting vulnerability ratings of Moderately High or High to be prioritized as the first step in the process. A Moderately High or High total susceptibility rating indicates that the water source is proportionately more susceptible to potential contamination overall when compared to other similar types of water sources around the state. Higher total susceptibility ratings most typically result for water sources with highly vulnerable physical settings and a source water assessment area containing several potential contaminant sources that pose a significant threat to potential contamination. A Moderately High or High physical setting rating indicates a diminished ability of the physical setting of the source water assessment area to buffer contaminant concentrations in the source water below acceptable levels and, therefore it is more vulnerable to potential contamination. Even in cases where few if any potential contaminant sources are currently present, a water source with a highly vulnerable physical setting could be very susceptible to future contamination depending on the type of potential contaminant source(s) that might be introduced.

The original SWAP report for Little Elk Creek Village HOA conducted by the CDPHE showed that one ground water source received a moderately low total susceptibility rating to potential sources of contamination and the two other groundwater sources received a moderate total susceptibility rating to potential sources of contamination. The SWAP report also indicated that all three ground water sources received a moderate physical setting vulnerability rating.

The strategy also outlines three options for prioritizing discrete and dispersed potential contaminant sources for source water protection measures as the second step of the process. These options include prioritizing source water protection measures based on:

1. Most prevalent contaminant sources. Under this option, protection measures would be focused on the discrete and dispersed contaminant sources that occur most frequently in the water system's drinking water supply protection area(s), regardless of the individual susceptibility ratings they may have received.
2. Most threatening contaminant sources. Under this option, protection measures would be focused on the individual discrete and dispersed contaminant sources in the water system's drinking water supply protection area(s) to which the water source(s) is most susceptible. The most threatening contaminant sources are defined as any potential contaminant source receiving a Moderately High or High individual susceptibility rating.
3. Most prevalent and threatening contaminant sources. Under this option, protection measures would be focused on the most frequently occurring discrete and dispersed contaminant sources in the water system's drinking water supply

protection area(s) that received a Moderately High or High individual susceptibility rating.

In applying this strategy, the Steering Committee recommended focusing source water protection measures on most threatening discrete contaminant sources and the most prevalent dispersed contaminant sources. Further, those sources closest to the wells both in a surface and groundwater flow sense were of the highest priority.

Source Water Protection Susceptibility Analysis

The susceptibility analysis provides a screening-level evaluation of the likelihood that a potential contamination problem could occur rather than an indication that a potential contamination problem has or will occur. The analysis is NOT a reflection of the current quality of the untreated source water, nor is it a reflection of the quality of the treated drinking water that is supplied to the public.

The susceptibility analysis was conducted by the Steering Committee to identify how susceptible the untreated water sources could be to contamination from potential sources of contamination inventoried within its source water assessment area. The analysis looked at the susceptibility posed by individual potential contaminant sources and the collective or total susceptibility posed by all of the potential contaminant sources in the drinking water supply protection area. The CDPHE developed a susceptibility analysis model for surface water sources and ground water sources under the influence of surface water, and another model for ground water sources. Both models provided an objective analysis based on the best available information at the time of the analysis. The CDPHE provided Little Elk Creek Village Homeowners Association with a final source water assessment report that included the supporting analysis information.

The subjective susceptibility analysis provided by the CDPHE was then reviewed, verified and updated by Little Elk Creek Village Homeowners Association to identify how susceptible their untreated water source could be to contamination from potential sources of contamination inventoried within its drinking water supply protection area. Table 5 presents the priority strategy and the susceptibility analysis results for all three of Little Elk Creek Village Homeowners Association's intakes. The table summarizes the total susceptibility and physical setting vulnerability results for the intakes associated with the discrete and dispersed contaminant sources that have been prioritized for source water protection measures under this plan. These water sources have been prioritized based on the source water protection priority strategy recommended by the Steering Committee.

Table 5: Source Water Protection Priority Strategy and Susceptibility Analysis

Source ID	149476 – 1,2,3,4
Source Name	Intakes 1, 2, 3 & 4
Source Type	GWUI
Total Susceptibility Rating	Moderate
Physical Setting Vulnerability Rating	Moderate
DICRETE CONTAMINANT SOURCES	
Underground fuel (gas) storage sites (estimate)	66
TOTAL	66
DISPERSED CONTAMINANT SOURCES	
Low Intensity Residential	X
Septic Systems	X
Roads	X
Pasture/Hay	X
Mixed Forests	X
Augmentation Ponds	X
Geological Hazards	X
TOTAL	7

Discussion of Issues of Concern

The Steering Committee decided that augmentation ponds, septic systems, residential practices, underground storage tank and water supply were the primary issues to be addressed by the Source Water Protection Plan. Pasture/livestock, residential development, roads and forest fire hazards were deemed not as prevalent of threats, and therefore are considered secondary issues. Each are addressed below:

Potential water quality impacts in close proximity to the Little Elk Creek Subdivision wells:

Septic systems

The Little Elk Creek Subdivision has 77 lots. Five lots are vacant. The home on one lot is unoccupied and possibly to be demolished in the future. Three lots are infrequently or seasonally occupied. All lots are serviced by Onsite Wastewater Treatment Systems (OWTS). The following is from Ostrberg, 2010:

The OWTS in the Subdivision vary in age from greater than 30 years old to installations and repairs that have occurred last year. There are various types of systems in the Subdivision. System type is usually determined by an examination of site constraints. Different types of systems are more appropriate than others for constraints such as

high ground water or close proximity to a stream or ditch. The major system types in Little Elk Creek Subdivision include pipe and gravel, lined evaporation/transpiration (ET) beds, gravel less chamber systems and mound systems.

The OWTS serving older homes may be nearing or have exceeded their expected "life". It is unknown how well the Subdivision OWTSs are functioning. Failures are usually only discovered when effluent surfaces in the yard or backs up into the house. These failures may be in the form of leaking tanks or saturated soil conditions in the absorption area. Systems may be malfunctioning or not properly treating the wastewater if there is not 4' of suitable soil between and the absorption area and groundwater.

In general, the water table flows in a similar direction as the land surface and toward open water courses. Most of the Subdivision lies above the wells, so failing OWTS or improperly treated wastewater could impact well water quality. However, the lots along Alexander Avenue may be downstream of the well water supply aquifer or improperly treated wastewater would be intercepted by Little Elk Creek below the wells.

There is a potential for improper treatment of wastewater because of the age of the existing OWTS, high seasonal groundwater, proximity of some systems to the creek and ditches and existing subsoil conditions. In general, the water table is "perched" on a more impermeable layer below. This perched condition is influenced by runoff and irrigation in the area above the Subdivision.

The parent subsoil is an outwash plain above an impervious layer of Mancos shale. It contains a considerable amount of rock and rubble that makes it rather porous and reduces soil contact or purification time as the OWTS effluent moves from OWTS absorption areas to the groundwater. Little or no purification occurs once deleterious materials reach the groundwater; only dilution occurs.

Recommendations:

- Educate homeowners about how their OWTS function and what they can do to provide proper maintenance and use. EPA document 832-B-02-006, "A Homeowners Guide to Septic Systems" will be utilized. Also, the below website provides a wealth of information on wells and OWTS. Video #2 gives a great overview of how systems work and how they should be maintained:[http://waterquality.montana.edu/docs/WELL_EDUCATED/Well and Septic DVD/Educational Videos2.shtml](http://waterquality.montana.edu/docs/WELL_EDUCATED/Well_and_Septic_DVD/Educational_Videos2.shtml)

* The above will be accomplished as implementation for the current source water protection grant (with no associated costs) which was awarded to neighboring Gateway MD. Funds from that grant will be utilized for the implementation phase of Gateway MD's source water protection plan.

* The below represents potential activities that will occur when Little Elk Creek applies for an "implementation" source water protection grant

- Recommend homeowners install effluent filters on the outlet side of their septic tanks to assure solids are not traveling to the absorption area.
- Implement a "septic system inspection program" or create a maintenance district for homes within the Subdivision with assistance with the Pitkin County Department of Environmental Health. A regular inspection process will assure all systems are working properly and any minor or major repair needs can be addressed.
- Pumping "as needed" will assure people that don't normally get their tanks pumped are attending to that need and those that pump too frequently may save some money. Tanks should be pumped when the sludge and scum layer total >20-25% of the tank capacity. System inspections should occur more frequently than tank pumping to assure system components are in place and working properly.
- Encourage State Legislation whereas Municipal wastewater treatment plants must accept Septic tank effluent at a reasonable cost.
- Check the raw water supply (the water that has not yet been treated) for constituents such as nitrate, BOD, TSS, and coliform bacteria. These constituents are currently checked frequently by the water system operator for the treated and distributed within the Subdivision. If levels are increasing or higher than desirable, requiring secondary treatment or advanced secondary treatment then check the new and existing Subdivision OWTS on either all lots in the or select lots that may have a greater influence on well water quality. Work should be done with Pitkin County to determine if this step is recommended, necessary and whether any such mandates should come from the county or subdivision level.
- Implement a home water conservation program. Reducing wastewater increases septic field and well life.

Other Subdivision concerns:

Horses are allowed in the Subdivision. Approximately five horses are year around residents and seven horses reside during the warmer months. They are large producers of nitrogen and concern to water quality because the nitrogen forms are not absorbed by the unsaturated interstitial porous space of the unsaturated soils.

Weed control is done on a spot treatment bases by the residents, Pitkin County and private contractors. If used properly, these herbicides should not a water quality problem if applied per label instructions.

Recommendations:

- Horses should be fenced out of stream and ditch water courses and preferably not allowed in the area described in Map 2.

- Review all herbicide activity.
- Investigate the one underground storage tank was noted in the area of lots of greater importance.

SOURCE WATER PROTECTION MEASURES

Primary, Secondary Issues and SWPA Management Approaches

The Steering Committee reviewed and discussed several possible source water management approaches that could be implemented within the drinking water supply protection area to help reduce the potential risks of contamination of the community's source water. The purpose of voluntarily implementing source water management approaches is to apply an additional level of protection to the drinking water supply by taking preventive measures at the local and county levels to protect the source water. These local preventive measures will compliment regulatory protection measures already being implemented at the state and federal governmental levels by filling protection gaps that can only be addressed at the local level. The Steering Committee is confident that applying these management approaches is a cost-effective and common sense approach in helping to reduce the risks of costly service disruptions resulting from potential contamination of the source water.

The Steering Committee, via consensus, has identified and selected the most feasible source water management approaches to implement locally. These management approaches will occur when Little Elk Creek Village Homeowners Association receives grant monies from the CDPHE for source water protection implementation. The drinking water issues were both for drinking water quantity and quality protection felt to pose the greatest threat.

The Steering Committee recommends the following water management tools to be implemented by the Little Elk Creek Village HOA subdivision, and suggested to Pitkin County Environmental Health, Pitkin County Community Development, Pitkin County Road and Bridge Department, Basalt Rural Fire Protection District, the White River National Forest, Natural resources Conservation Service (NRCS) and other landowners where applicable in the drinking water supply protection area. The list is prioritized in the order of importance to the Steering Committee. In order to provide some resources for defining applicable best management approaches, the steering committee utilized the CD produced by CRWA and CDPHE entitled "A Guide to Best Management Practices: The Colorado Source Water Protection Planning Toolkit of Resources".

The following are the primary and secondary issues and management practices agreed upon by the Steering Committee. The chief education tool is an all inclusive education publication titled ***Little Elk Creek Drinking Water Handbook*** given to each

homeowner and renter. The cost of the publication for drafting, printing and distribution is about \$1500.*

* The *Little Elk Creek Drinking Water Handbook* represents a potential activity that will occur when Little Elk Creek applies for an “implementation” source water protection grant.

Primary Issues

1. Augmentation Ponds

There are three augmentation ponds close Little Elk Creek Village HOA’s wells. One well in particular, is less than 20 feet from the lower augmentation pond. These ponds help to stabilize the water table in the colder months when there is less ground water in the aquifer. If these ponds were to become contaminated by poor watershed land use practices, septic tanks, lawn fertilizers or vehicle accidents, the effects could be catastrophic to Little Elk Creek Village HOA’s drinking water.

The Steering Committee recommends a multi-faceted educational approach to protecting these ponds from contamination, which involves paying close attention to possible sources of contamination via ***Little Elk Creek Drinking Water Handbook***. The ponds could also be protected through proper signage and restrictions regarding use. The Steering Committee estimates the cost is estimated to be \$200 for information/warning signs.

2. Septic Tanks

Currently, all residences within the drinking water supply protection area have septic systems. If managed improperly, these residential septic systems can contribute excessive nutrients, bacteria, pathogenic organisms and chemicals to the groundwater.



Figure 7. Typical septic system failure

The Steering Committee recommends developing an inventory of owners of septic systems in the protection area, providing public education via ***Little Elk Creek Drinking Water Handbook*** on proper septic maintenance, and working closely with the Pitkin County Health Department. It also recommends septic tank pumping and inspections.

The Pitkin County Environmental Health Department will implement an optional Septic System Inspection Program upon request of the property owner. The Health Department will also use this opportunity to educate the property owner on the link between good septic practices and protecting source water.

The septic systems located on lots bordering the ditches and the augmentation ponds are of particular concern (Zone 1). If these septic systems were to malfunction, unprocessed waste could contaminate one of the augmentation ponds, pass through the water table and contaminate the drinking water supply for Little Elk Creek Village HOA. The Steering Committee recommends that these systems are checked every other year, and that the landowners are provided extra information on proper septic system maintenance. The Committee also recommends that the systems on the lots of greater importance be inspected on a voluntary basis with the cost split between the HOA and residents. The total cost is estimated to be \$2000. Other Subdivision lots would be afforded this program subsidy assuming funding availability.

3. Residential Practices

Little Elk Creek Village HOA's drinking water supply protection area includes about 75 residential dwellings. Common household practices may cause pollutants to runoff

residential property and enter the surface or ground water. Prevention of ground water contamination requires education via ***Little Elk Creek Drinking Water Handbook***, public involvement, and people motivated to help in the effort. Educating the community and decision-making is one of the challenges and cornerstone of this protection plan. Public education will help people understand the potential threats to their drinking water sources and motivate them to participate as responsible citizens to protect their valued resources.

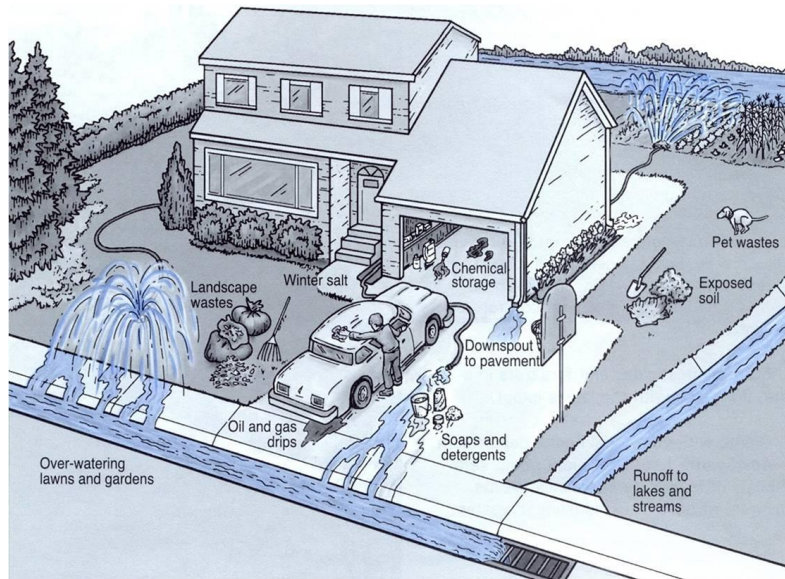


Figure 8. Residential Practices

It is the lawns and gardens that border the augmentation ponds and ditches that are of particular concern. If these lawns and/or gardens may be used by horses and treated with pesticides, herbicides or fertilizers, chemicals that could run off into the ponds and contaminate the aquifer. The Steering Committee recommends suggesting that landowners who own properties bordering the ponds not use these chemicals, or create a “buffer zone” or small wetland along these ponds and ditches. Wetlands can naturally filter water entering the ponds and furthermore protect Little Elk Creek Village HOA’s groundwater supply.

The Committee needs to redefine the HOA emergency response plan. This plan should be distributed to the Subdivision residents.

4. Roads

Little Elk Creek Village HOA’s drinking water supply protection area is served by a small network of paved and natural surface roads. The Pitkin County Road and Bridge

Department maintains the local road systems and the HOA maintains the Subdivision roads. During the winter season the county applies a salt-sand mix to de-ice the roads but the HOA does not apply these substances. De-icing compounds can contaminate both surface water and ground water. Storm water runoff from paved and unpaved roads can deliver contaminants from the road surface into the nearby surface waters. Additionally, many spills occur in Colorado each year on the highways and local roads. Chemicals from accidental spills are often diluted with water, potentially washing the chemicals into the soil and increasing the potential for contamination of the ground water. The Steering Committee is concerned with vehicular spills contaminating the protection area.

The Steering Committee recommends educating the residents via the ***Little Elk Creek Drinking Water Handbook*** on how to respond to a hazardous spill as well as working with local emergency response teams to ensure that any spills within the protection areas be effectively contained and mitigated. Storm runoff and de-icing chemicals on the road are also of concern. The Steering Committee recommends providing the Pitkin County Road and Bridge Department and the Office of Emergency Management with a map of the drinking water supply protection area and encourages the use of Best Management Practices to prevent road materials from entering the source waters.



Figure 9. A view of the roads near the LECV HOA wells. The well house is to the right and the wells are located behind the tall stand of trees.

5. Watershed development and land use

Future development within Little Elk Creek Village HOA's drinking water supply protection area may occur over the next ten years. The Steering Committee recommends that the HOA encourage conservation easements or similar actions to discourage development and all land use decision-makers within the drinking water supply protection area be encouraged to consider source water protection of Little Elk Creek Village HOA's wells when making land use decisions and that these decisions

minimize the impacts to the water quality of the alluvial aquifer. The Steering Committee suggests working closely with the Pitkin County Community Development staff and aims to provide them with a map of the protection area, GIS map data layers, and a copy of the final plan. It is suggested that the Steering Committee is notified when a special use permit is applied for and permitted to review the application.

The Steering Committee should talk to the two owners of large tracts of land to encourage Conservation Easements of other mechanism to prevent the land from development and encourage proper animal husbandry practices. This should cost about \$200.

6. Underground Storage tanks

There is one known underground fuel oil tank and most if not all homes in Little Elk Creek Village HOA's drinking water supply protection area Zone 1 possess underground propane fuel storage tanks. Most of the other homes in Zone 2 also contain underground propane tanks. The Steering Committee recommends that an inventory of the fuel tanks be taken within the Subdivision including service address, material stored, above or below ground, cathodic protection, actively used and age. The inventory cost is estimated at \$400. Underground storage tanks are required to have cathodic protection. A zinc or magnesium rod is installed to the tank and is sacrificed instead of the metal tank. A homeowner inspection and cathodic rod instillation cost is estimated to be \$1000 where the homeowner would pay half.

Previously noted in Zone 1 is an underground fuel oil tank close to the wells. A measurement of the volume via a "stick test" can determine if the tank is failing. Also, the tank should be tested for integrity if it fails the stick test.

It also suggests providing landowners with a list of Best Management Practices via the ***Little Elk Creek Drinking Water Handbook*** such as providing a spill containment device.

7. Water supply and quality

The Steering Committee recommends that the HOA to continue funding the water system repair fund, install or find the missing curb stops, access the integrality of the water line segments, monitor individual well volumes and repair or replace poorly producing wells, investigate the idea of dredging the ponds to raise water level to increase hydrostatic head, investigate the possibility augmenting the wells by treating and using surface water from the third pond in an emergency situation and provide protective fencing for the wells.

The Committee recommends education via ***Little Elk Creek Drinking Water Handbook***, fencing for well protection and a home water conservation program. The fencing is estimated to be \$2400. The home water conservation program will be addressed in the handbook. The sampling of the pond water quality for the nitrogen forms and fecal bacteria twice per summer would cost about \$300.

Secondary Issues

1. Pasture/Livestock

There are several small-scale ranches within the drinking water supply protection area on which cattle and horses graze year round. Cattle are also grazed seasonally on the public lands bordering the drinking water supply protection area. 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. Pathogens that can be carried in animal waste include E. coli, salmonella, cryptosporidium, and giardia. To provide for increased protection against microbial pathogens in public water systems that use ground water source, USEPA issued its Ground Water Rule in November 2006. Community water systems will be required to perform additional monitoring for total coliform-positive samples, correct significant deficiencies identified in the system's sanitary survey, and take corrective actions after certain triggers are exceeded. Systems must begin to comply with the new requirements by December 1, 2009. For more information on the Ground Water Rule see: <http://www.epa.gov/safewater/disinfection/grw/index.html>.



Figure 10. Horse and chickens

Environmental Process Control takes total coliform bacteria samples, as per state regulations for Little Elk Creek Village HOA's drinking water system every month. As mentioned above, periodic water testing should be done for bacteria and nitrogen

forms. Also, the Steering Committee will collaborate with the Natural Resources Conservation Service (NRCS) to conduct outreach activities into the implementation phase of the project. This will include the creation of a mailing list of residents within Zone 2 of the drinking water supply protection area. Additional activities will be to develop and conduct a survey on the current grazing and ranching practices, identify potential sources of contaminants and issues of concern based on the results of the public survey and check areas of concern if access to area is possible. Using the information from the survey, develop a public education campaign for area residents within SWPP drinking water supply protection area Zone 2 on the relationship of their lands to the public and private drinking water supply.

Provide land owners with information on agricultural Best Management Practices for handling manure, pesticide/herbicide/fertilizer application, and chemical use and storage. Farmers using land near the wells or intakes will be contacted explaining the hazard and/or prohibition of mixing chemicals near the wells.

Provide land owners with information on the water quality impacts of grazing within the creeks and on stream banks. Education material will encourage the use of Best Management Practices on: alternative stock watering, livestock exclusion fencing, creating a buffer zone between the cattle and the creek, and bioengineering stream bank stabilization practices.

Education techniques may include: workshops, mailings and community meetings/workshops, and demonstration projects. Cost is about \$200 which includes management approaches 2 and 3 below.

Contact the local NRCS Field Office and the local Conservation District to request their services in providing site visits (upon request) to residents with the drinking water supply protection area to evaluate their agricultural practices and provide educational outreach.

2. Forest Management

The upper reaches of Little Elk Creek Village HOA's drinking water supply protection area include sub-alpine mixed forests of cottonwood, aspen, oak, spruce, fir and pine trees. Most of these forests lie within the White River National Forest. Because fire has been suppressed for nearly a century in the Capitol Creek drainage basin, fuel has built up unnaturally in the forest, which could result in a fire of unusually high intensity. If a fire were to pass through the drinking water supply protection area, water quality could decrease significantly and a number of structures could be destroyed. The Steering Committee recommends providing the public with education about fire management and safety, and in particular to encourage landowners to take part in thinning practices, which may help to reduce fuel buildup.

Educate the public on fire prevention with the help of Basalt Rural Fire Protection district. Send out flyers in the mail during the fire season. (June-Sept) Encourage the public to reduce water use so enough water is on hand in case a fire does occur in or near the drinking water supply protection area.

With aid from the United States Forest Service, Colorado State Forest Service and Basalt Fire Protection District, design and implement a fuels reduction program in the surrounding area. Compile a list of contractors available, which may help with forest reduction. Obtain a copy of the fire management plan for fire protection in the White River National Forest in or near the drinking water supply protection area.

3. Geologic Hazards

It is unlikely that a geologic hazard such as an earthquake, a mass-wasting event or 100-year flood could occur in Little Elk Creek Village HOA's drinking water supply protection area. However, if such an event were to occur, the results could endanger Little Elk Creek Village HOA's drinking water supply.

Little Elk Creek Village HOA's ground water sources lie in a mountain valley. The rocks that comprise the hill slopes in this valley are predominantly shale and sandstone dipped to the south, and under certain circumstances (excessive precipitation, snowmelt, earthquakes, etc) these already unstable slopes could fail. Slumps and debris flows from a mass-wasting event could drastically change the quality (in this case turbidity) of Capitol Creek and tributaries. Debris flows could also temporarily dam the creek, which may result in a catastrophic flood if the dam failed. If this were to happen, the augmentation ponds could be contaminated, which could in turn affect water quality. In that case Little Elk Creek Village HOA would have to rely on stored water supplies, hauled water, and conservation.

Educate land owners on BMP's to reduce erosion on their land in the case of a large flood event. Educate land owners on emergency response procedures to a geologic event such as earthquake, flood or debris flow.

The following table is a tally of perspective costs that will be addressed by Little Elk Creek Village when applying for the source water protection grant for implementation of Best Management Practices as highlighted in this plan.

Cost summary

Task	grant funded	HOA funded	HOA resident funded	County funded
Homeowner handbook	1500			
Pond signs	200			
Septic inspections (20 @ \$100)	1000		1000	
Emergency tank pumping (4 @ \$500)	1000		1000	
County assistance records, staff and mileage				6022
Conservation easement effort	200			
Fuel tank inventory cathodic rod instillation	400	500	500	
Well fencing	1200	1200		
Water sampling		300		
Watershed meeting with upstream residents		200		
Contingency	<u>.....</u>	<u>2300</u>	<u>.....</u>	<u>.....</u>
Total	5000	5000	2500	6022

Total grant funding = \$5000, total in-kind funding = \$13522

Source Water Protection Plan Additional Commitments

1. Little Elk Creek Village HOA 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.
2. Little Elk Creek Village HOA is voluntarily committed to applying source water assessment and protection principles to siting and protecting new water sources in the future. This is part of the larger ongoing commitment to providing the highest quality drinking water to Little Elk Creek Village HOA's consumers.
3. Little Elk Creek Village HOA is voluntarily committed to assisting the CDPHE in making future refinements to their source water assessment and to revise the source water protection plan accordingly based on any major refinements. By making this commitment, Little Elk Creek Village HOA is assuring that future assessment results are consistent with the available data and that source water management approaches are appropriate for the susceptibility concerns.

Figures:

- Figure 1. Conceptual model of the lower Capitol Creek subsystem
- Figure 2. Water system schematic
- Figure 3. Little Elk Creek well locations
- Figure 4. SWAP Diagram
- Figure 5. Drinking Water Supply Protection Area Zone 1,
Developed Lots of Greatest Importance
- Figure 6. Drinking water supply protection area Zone 2
- Figure 7. Typical septic system failure
- Figure 8. Residential Practices
- Figure 9. Roads
- Figure 10. Horse and chickens

Maps:

- Map 1. General location of Little Elk Creek subdivision
- Map2. Ownership and protection status of the Snowmass/Capitol Creek
sub watersheds
- Map 3. Roads near streams in the Snowmass/Capitol Creek Sub-watershed

Tables:

- Table 1. Stream Classifications and Water Quality Standards,

Upper Colorado River Basin

Table 2. Little Elk Creek Sediment Analysis, May 2010

Table 3. Water table depth near Little Elk Creek Subdivision Wells

Table 4a. Contaminants Associated with Regulated Discrete Contaminant Sources

Table 4b. Contaminants Associated with Regulated Dispersed Contaminant Sources

Table 5. Source Water Protection Priority Strategy and Susceptibility Analysis

References:

Carla Ostberg, MPH, REHS
Environmental Health Manager
Pitkin County Environmental Health, 2010
Email communication

Paul Hempel
Source Water Specialist
Colorado Rural Water Association
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1. Roaring Fork Watershed
State of the Roaring Fork Watershed Report, 2008
<http://www.roaringfork.org/sitepages/pid272.php>

2. GIS-BASED GROUND WATER RESOURCES EVALUATION OF THE CAPITOL
AND SNOWMASS CREEK (CSC) STUDY AREAS, PITKIN COUNTY, COLORADO
Kolm and van der Heijde, May 2002

3. Little Elk Creek Pond Assessment Results, Holmes, 2010

4. Source Water Assessment Report(s) Colorado Department of Health (various years)

Addendum 1, Generalized Goals and Objectives from the Capitol Creek Caucus

Generalized Goals and Objectives of the Source Water Protection Plan Development

Below are excerpted sections of the *Snowmass/Capitol Creek Valleys Master Plan*. The SWPP Little Elk Creek Steering Committee agrees that these goals and objectives are appropriate and necessary for protection of our well water quality and quantity:

VISION STATEMENT

The unique qualities of our area should be preserved and the existing character should remain substantially unchanged. The valued qualities include the natural watersheds, water quality and quantity in Snowmass and Capitol Creeks and their tributaries, undisturbed expanses of native vegetation and riparian corridors, and wildlife habitat..... Agriculture is recognized as a valued resource and a means to preserve the open space character of our valleys and we support using a range of techniques to ensure its continued presence and viability. In particular, we look to land conservation tools to implement protection of the open space of our area..... We support limiting growth in our valleys, consistent with the core values outlined above.

RURAL AND AGRICULTURAL HERITAGE GOAL

It is the principal goal of this master plan, endorsed by the overwhelming majority of caucus members, that the dominant agricultural and rural residential character of the Snowmass/Capitol Creek valleys be enhanced and preserved.

OBJECTIVES:

- Ensure that zoning promotes and protects the agricultural and rural residential character of the area, providing incentives for the preservation of open, agricultural and other natural resource lands and allowing for very low density development of sensitively sited single- family homes and disallowing additional multi-family homes, townhouses, apartments or condominiums.
- Preserve agricultural lands consistent with the Future Land Use Map through the use of a palette of methods including conservation easements, conservation tax credits, open space acquisition, limited development regulations, and the use of the transferable development rights (TDR's).
- Recommend that Pitkin County offer qualified large-tract landowners' eligibility for significant technical assistance, both staff time and funding for outside expertise,

in order to create and pursue family-specific and parcel-specific land preservation strategies.

- Consider amendments which reward landowners who permanently conserve over 90% of the total acreage of their property and preserve a vast majority of open space, historically irrigated lands, and all wetlands, critical habitat and other environmentally sensitive lands. Those well conceived applications which would contain realistic plans for the preservation of large tracts of land and which demonstrate compliance with the goals and objectives of this Master Plan should receive rewards which could include, but need not be limited to, a streamlined and accelerated land use approval process (including priority attention from the Community Development Department, Planning Commission and Board of County Commissioners), eliminated or reduced processing fees, longer vesting and other tangible acknowledgments of the public benefits conferred by voluntary conservation actions.
- Consider the development of code amendments which allow appropriate, alternative, small-scale commercial uses on properties with agricultural and other open lands of 70 acres or larger where the proposed commercial use is determined to be fully compatible with the historic use of the property and the surrounding rural residential land uses. For this purpose, develop a list of uses by special review and prohibited uses. A set of performance standards should also be developed to ensure that allowed and special review uses are developed and operated in manner that minimizes their impacts on the surrounding area, the region and the natural environment. All special review uses should be measured against the performance standards. Special review uses should be allowed only if the scale is fully compatible with the surrounding land uses and the special review procedures, including regular reporting and periodic monitoring. Performance standards should evaluate whether the proposed use reflects sensitivity to the natural and built rural character of Caucus area and is sustainable with respect to the physical carrying capacity of the parcel and associated roads, utilities, etc. Performance standards should also address, but need not be limited to, noise impacts, air pollution, light pollution, wildlife impacts, and impacts to surface and ground water. Off-site impacts shall be given considerable weight in the review process. The benchmark of compatibility of a proposed use will ultimately be whether it meets the goals and objectives of the Snowmass/Capitol Creek Master Plan.
- The list of special review and prohibited uses such as the following should be considered:

SPECIAL REVIEW PROHIBITED

Nordic Skiing Commercial Snowmobiling
Small Lodge or B & B Commercial Motorcycling & ATVs
Guest Ranch
Equestrian Activities, Horse Boarding, Training
Arts and Crafts
Children's Camp

In addition to these uses, commercial uses, which legally existed on the date this Master Plan was adopted, should be considered grandfathered uses provided

they continue to be operated in manner consistent with the performance standards and the goals and objectives of this plan and the Pitkin County Land Use Code.

- Increase vesting time significantly, and in proportion to the approved application's achievement of preservation and conservation objectives and conformity to the Master Plan, in order to give added incentives to large landholders to resist sale or development in favor of preserving family lands.
- Recommend that the County establish legislation to enable landowners to voluntarily exchange a renewable non-development agreement with the County for preservation of the regulatory status quo. Such legislation should be crafted to encourage and facilitate continued preservation of open lands; careful and unhurried exploration of the techniques, strategies and resources for the preservation of and/or conservation planning for such lands.

RESIDENTIAL DEVELOPMENT GOAL

It is the goal of this master plan, in keeping with the Caucus opinion survey, that all future residential development in Snowmass/Capitol Creek Valleys be consistent with and complimentary to the rural character of the area. The natural environment should dominate a person's experience of the valleys. To this end, we strongly recommend extremely low density, single-family residential housing of moderate size and bulk.

OBJECTIVES:

- There shall be no multi-family, condominium, apartments, or townhouses allowed, except for on-site employee housing approved by special review.
- The Caucus strongly supports the existing house size (floor area) limitation of 5,750 square feet (as "floor area" is defined in the Land Use Code). Under exceptional circumstances, house size can be increased to a maximum of 8,250 square feet of floor area through the growth management competition process or through the use of TDR's...
- Develop methods for reducing the impacts of larger houses including visual impacts, energy consumption, materials consumption, light pollution, and traffic. Encourage people to build homes under the current 5,750 square foot limitation.
- Encourage year round occupancy of homes to help preserve neighborhoods that are vital and foster community.

WATER USE, QUANTITY AND QUALITY GOAL

Strict protection of all creeks and tributaries, and of all adjacent wetlands and riparian areas, is an absolute priority against which any development activity and every development application shall be measured. Preservation of water quantity, including established minimum instream flows, and protection of water quality are equally high priorities. Efforts should also be made to promote the preservation of fish and other aquatic habitat, shoreline integrity and vegetation.

OBJECTIVES:

- Establish a long-term, sustainable solution for protecting water quality and quantity maintaining...in order to protect the ecosystem of the Valley and preserve a thriving trout population and precious wetlands and wildlife habitat.
- Protect streams, riparian areas, ponds, lakes, wetlands and other surface water bodies through diligent administration of the current County policies and provisions of the Pitkin County Land Use Code regarding surface water resources.
- Protect Capitol Creek.....and other streams within the Caucus Area by seeking an amendment to the required minimum stream setback...of 50 feet from the ordinary high water mark.
- Gather information regarding state and/or federal programs for funding fencing to help protect stream banks, riparian areas and water quality from impacts related to livestock.
- Work to ensure the protection of ground water, particularly domestic wells, from potential pollution by poorly designed, inadequate or failing septic systems.
- Prohibit buildings in flood plains, wetlands, washes and riparian areas.
- Recommend that the County establish a system for analyzing the adequacy of a proposed water supply for all purposes associated with a development proposal including all domestic or commercial uses and other associated uses such as landscaping and fire fighting.
- Recommend that Pitkin County study the possibility of incentives for the reuse of gray water for domestic irrigation and establish effective and workable regulations governing gray water reuse in order to eliminate environmental impacts and health, safety concerns related to such reuse.
- Establish public education programs to foster the value of rivers and surface waters in order to prevent pollution and minimize the impacts of human activities on water quality. Special emphasis should be placed on education regarding the critical importance of maintaining in-stream flows particularly during dry years.
- Install monitoring stations to monitor water quality and quantity in ...Capitol Creek.

GENERAL ENVIRONMENTAL GOALS

Because of the unique and abundant natural resources of these valleys (e.g. wildlife habitat, riparian corridors, air quality, and intact ecosystems), this Master Plan recommends preserving this natural environment to the maximum extent possible.

OBJECTIVES:

- Only allow development that does no harm to water quality or quantity and that actively promotes the protection of environmental and natural resources.
- Support actively the land preservation efforts of the Pitkin County Open Space and Trails Program and the land preservation programs and activities of other conservation groups in order to foster, encourage and facilitate the continued

acquisition of conservation easements and similar techniques promoting land conservation.

- Support a County initiative or referendum providing sufficient funding for the purchase of conservation easements on the “Crown Jewel” parcels within the Caucus area and throughout Pitkin County.
- Recommend that Pitkin County design and distribute pamphlets to educate citizens about the need of all residents to take simple and thoughtful steps to encourage tolerance of agricultural practices and to protect: abundant wildlife through habitat preservation and restrictions on dogs, noise andsuperior water quality through stream setbacks and other requirements that minimize degradation and sedimentation.
- Aggressively pursue the control of noxious weeds within the Caucus Area.

GROWTH GOAL

Ensure that future growth reflects sensitivity to the natural environment occurs at a slow rate consistent with the concept of economic and community sustainability and is consistent with the other goals and objectives contained in this Master Plan, particularly those related to land use, and environment.

OBJECTIVES:

- Revise growth control policies, land use criteria and modify GMQS scoring system to support and incentivize development that reflects and enhances the rural character of the Caucus area as well as prohibiting development that compromises rural character, reduces agricultural productivity or impairs the water, air, wildlife and other natural resources and values of the area.
- Work to preserve agricultural lands and the associated open space within the Caucus Area through the use of a palette of methods including conservation easements, conservation tax credits, open space acquisition, limited development regulations, and the use of the transferable development rights (TDR's).
- Recommend the establishment of policies, programs and relationships with appropriate government agencies that would minimize the potential for the exchange of public lands within the Caucus Area and set a “no net loss” standard with respect to public lands.
- Recommend no further annexations of the Town of Snowmass Village within the Caucus Area.

ROADS GOAL

It is the goal of this Master Plan to keep the rural character of the Caucus Area intact by maintaining the County roads in their current condition allowing minimal improvements as necessary for safety.

OBJECTIVE:

- Support Pitkin County Policy with respect to County roads, which reads as follows: *“Where practical, the County seeks to retain existing unpaved roads as a reflection of our rural character. The County also seeks to preclude winter maintenance extending farther into remote areas of the County. The safety and rural character impacts likely from increased winter maintenance is avoidable and undesirable.”*
- Keep roads in their current condition with regular maintenance to eliminate washboards and other safety hazards but without further widening, straightening, or changing the type of surface (except where safety is an issue). Improvements to Watson Divide Road should be timed to coordinate with improvements to Highway 82 in the area of the Watson Divide Road intersection.
- Recommend elimination of the use of magnesium chloride on all roads within the caucus area and recommend that the County seek environmentally less impactful solutions for road deicing in winter and dust suppression in summer.
- Recommend that the County improve maintenance procedures to create road crowning, drainage ditches and adequate vegetation management.
- Strongly recommend the requirement and strict enforcement of construction management plans to reduce construction traffic impacts associated with new developments and major redevelopments within the Caucus Area.

MINERAL EXPLORATION/EXTRACTIO GOAL

Protect lands within the Caucus area from the environmental impacts of mining, mineral exploration, oil and gas drilling and exploration, sand and gravel pits, rock crushers, concrete batch plants, and other extractive operations.

OBJECTIVES AND IMPLEMENTATION MEASURES:

- Seek to improve the existing regulations governing mining, mineral exploration and other extractive operations in the Pitkin County Land Use Code to prevent such activities from occurring on private lands within the Caucus Area and, to the extent possible, discourage such activities on public lands.
- Seek strict enforcement of all existing local, state and federal regulations governing mining, mineral exploration, oil and gas exploration and drilling, sand and gravel pits and all other extractive operations when such operations are proposed within the Caucus Area.

