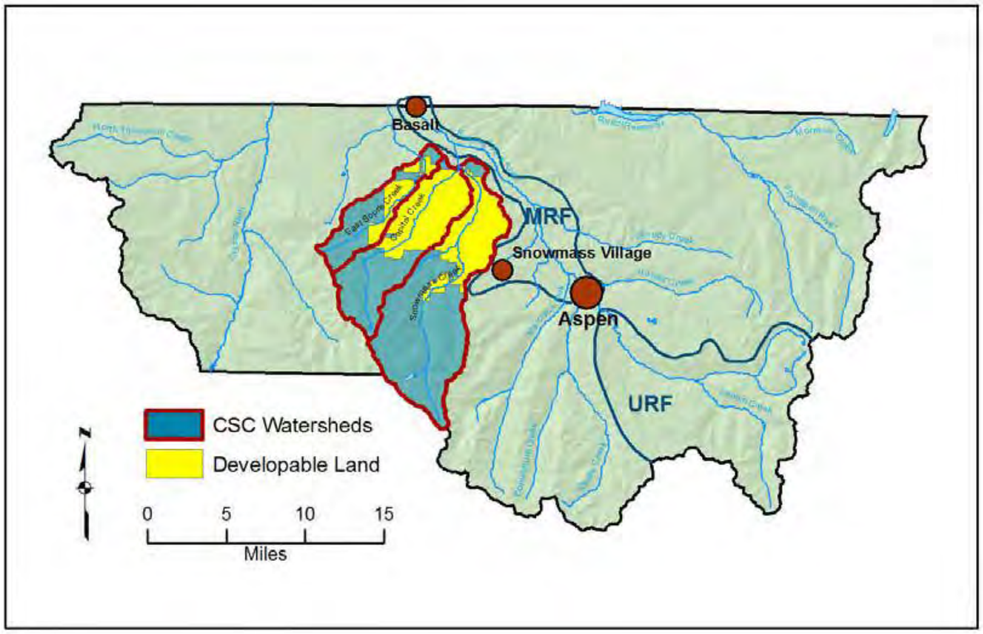
CAPITOL & SNOWMASS CREEK AREAS

Background: In 2007, Hydrologic Systems Analysis, LLC completed a GIS-based ground water resources evaluation of the non-Federal lands in the Capitol and Snowmass Creek watersheds, and in the upper reach of the East Sopris Creek watershed.[1] This study area (the "CSC Study Area") is depicted below, together with the Middle Roaring Fork (MRF) and Upper Roaring Fork (URF) Study Areas:



Roaring Fork Watershed and Capitol and Snowmass Creek Study Areas, Including the Upper Reach of East Sopris Creek

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The ground water resources evaluation completed for Pitkin County provides *only a general overview* of the factors influencing ground water availability, sustainability, and vulnerability to contamination in the CSC Study Area; it does not provide site-specific evaluations for every individual parcel of land.

What Are the Key Factors Affecting the Ground Water Supply In the Study Area?

1. Surface Water: The CSC Study Area contains three watersheds: (a) the Snowmass Creek watershed (including Hunter Creek and Wildcat Creek), (b) the Capitol Creek watershed (including Little Elk Creek and Lime Creek), and (c) the East Sopris watershed. Streams can be either replenished by ground water or losing their water to ground water, depending on local hydrology and the time of year. Springs, seeps and most wetlands indicate areas where ground water is actually being discharged to the land surface.

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[1] The GIS-Based Ground Water Resources Evaluation of the Capitol and Snowmass Creek (CSC) Study Areas, Pitkin County, Colorado is available online at: *http://www.aspenpitkin.com/depts/12/water_res.cfm*.

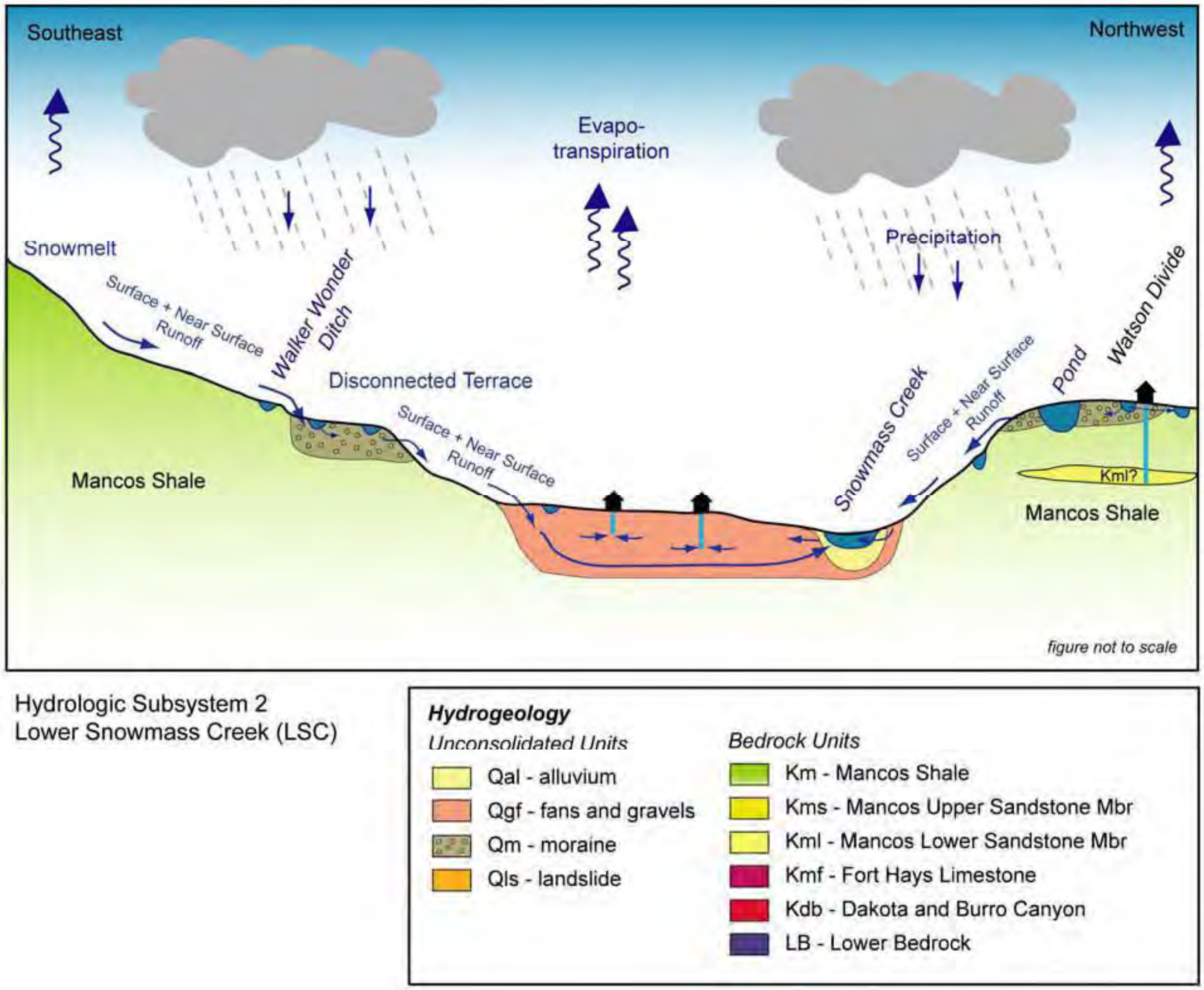
2. Climate/Topography/Geomorphology: The CSC Study Area includes steep hill slopes and low gradient valley bottoms and terrace levels. Topographic gradient is useful to consider when estimating the surface of water tables and the amount of water infiltration (versus overland flow) experienced in a given area. Typically, the south and west facing steep hill slopes are hotter and drier and have less winter moisture and snow pack available for ground water recharge during the spring melt. They will also have higher evapotranspiration by plant life during the growing seasons. Additionally, winter winds are typically westerly, redistributing snow pack to the east facing slopes.

3. Hydrogeology: The CSC Study Area is divided into five regional subsystems, as described below.

- **Upper Snowmass Creek (USC) Area:** In the USC area (near the White River National Forest boundary) unconsolidated materials (predominantly glacial gravel as well as colluvial and alluvial deposits) overly Mancos Shale (which is a bedrock confining layer). Locally, thinly-bedded Mancos Shale units (primarily on the shale hilltops between Snowmass and Capitol Creeks) may serve as minor aquifers in areas where glacial gravels are inadequate for water supply. Several wells have been drilled (or were deepened) to reach these units when shallow drilling failed to yield a sustainable water supply. The Hunter Creek drainage consists primarily of fan and landslide materials on Mancos Shale. Shallow unconsolidated materials without a natural protective cover (e.g., Mancos Shale – which has minimal transmissivity) are more vulnerable to the infiltration of contaminants.

  Two other bedrock units – the Ft. Hays Limestone unit and the Dakota/Burro Canyon unit – may be sources of water underneath the Mancos Shale. Most wells in this area have not tapped these potential aquifers. It is possible that these underlying aquifers connect to unconsolidated materials around the Snowmass Creek Fault Zone – a major fault zone that may be transmitting ground water downward.

- **Lower Snowmass Creek (LSC) Area:** As indicated in the following illustration, the hydrogeologic framework of the LSC portion of the study area (generally, the Watson Divide area) consists of two significant units – unconsolidated materials (predominantly glacial terrace gravels and modern alluvium) overlying Mancos Shale (the bedrock confining layer). Ground water may be locally available in the unconsolidated materials. Shallow unconsolidated materials without a natural protective cover (e.g., Mancos Shale) are more vulnerable to the infiltration of contaminants.



<u>Conceptual Model of the Lower Snowmass Creek Subsystem</u>

- **<u>Upper Capitol Creek (UCC) Area</u>:** There are two significant hydrogeologic units in the UCC area – unconsolidated materials (primarily glacial terrace gravels and moraines, and modern alluvium) overlying a confining bedrock unit of Mancos Shale. Within the UCC area, the Lime Creek watershed consists primarily of alluvium on top of Mancos Shale with landslide and fan deposits at the lower surrounding slopes. Ground water does not flow from the East Sopris Creek watershed directly into the Capitol Creek watershed due to the presence of a Mancos Shale ridge; however, both surface water and ground water may flow between Little Elk Creek and Capitol Creek.

Ground water in the UCC may be locally available in the unconsolidated materials. Because the shallow unconsolidated materials in the UCC area lack a natural protective cover (e.g., Mancos Shale), they are more vulnerable to the infiltration of contaminants.

- **<u>Lower Capitol Creek (LCC) Area</u>:** There are two significant hydrogeologic units in the LCC area – unconsolidated materials (primarily glacial terrace gravels, mass wasting deposits and modern alluvium) overlying a confining bedrock unit of Mancos Shale. Ground water in the UCC may be locally available in unconsolidated materials. The shallow unconsolidated materials in the LCC area lack a natural protective cover (e.g., Mancos Shale); thus, they are more vulnerable to the infiltration of contaminants.

- **Ft. Hays/Dakota-Burro Canyon Bedrock (FDB) Area:** In the FDB area the two significant hydrogeologic units are Ft. Hays Limestone bedrock and Dakota/Burro Canyon sandstone bedrock. Confining Mancos Shale underlies and overlies these bedrock units. The FDB aquifers are recharged by precipitation, primarily at the outcrop areas. The existence of a natural protective cover of Mancos Shale means that the FDB aquifers are less vulnerable to contaminants, except at outcrop areas where recharge is occurring. Ground water flow in the FDB aquifers follows the downward slope of the aquifer and discharges outside of the CSC Study Area.

4. Land Use:

- **Irrigation:** A number of irrigation ditches run through the study area. Some of the ditches provide trans-boundary transport of water (e.g., water may enter the Capitol Creek basin from the Snowmass Creek basin due to irrigation ditch diversion, as observed at the Walker Wonder Ditch). Some of these ditches carry water during most of the growing season; others operate only during an actual irrigation cycle. Most of these ditches are unlined and may leak when carrying water. This ditch leakage may be recharging local ground water systems and may even influence ground water flow direction. Leaking ponds may also be contributing to ground water recharge and affecting flow direction. Similarly, the ground water supply may be recharged by irrigation return flows in some areas. Taking irrigated land out of production may result in lowering of the water table and reduction in ground water flow velocities.

- **Onsite Wastewater Treatment Systems:** Onsite wastewater treatment systems are also recharging the ground water system in the study area.

- **Wells:** Wells in the CSC Study Area are clustered along Snowmass Creek, the lower reach of Capitol Creek, in the development above the confluence of Capitol and Snowmass Creeks, and on the ridge between the upper Capitol and Snowmass Creek watersheds. Most of the wells are for domestic water supply and, individually, these wells do not have much impact on the ground water system. However, where wells are clustered, there may be a significant affect on the ground water supply. Well records for the study area indicate that there has been local depletion requiring significant deepening of wells.

How Do You Put All Of This Information Together?

Generally, modeling a ground water system consists of identifying and quantifying all the inputs and outputs from climate (precipitation and snowmelt), stream functions (water gains/losses), vegetation (loss to evapotranspiration), topography (e.g., slope steepness and aspect), soils and geomorphology, geology, and human activity (e.g., ditches, wells, irrigation). Over time, even on a large scale, it is easy to see how difficult this process can be – as we go through periods of drought, water rights are bought and sold, and land uses change.

The study conducted for Pitkin County provides only a very “high-level” overview of a very complex system. However, it is a good starting point for every land owner concerned about their water supply. Certainly the study demonstrates how tenuous some local water supplies may be in the CSC Study Area.