Executive Summary

Evaluation of Montana's Water Resources: Using a Water Budget Approach

We as Montanans have a relatively abundant supply of surface water and groundwater. From a volume perspective, most water use in Montana is appropriated from surface water. More recently, there has been an increasing demand for groundwater for a variety of purposes including agriculture, municipal, and private water supplies. However, the amount of consumptive groundwater use for municipal and private water supplies is presently very small when compared to the availability of water resources in Montana's watersheds.

Nonetheless, there is a growing concern that increasing demand for groundwater supply associated with development is causing, or will cause, adverse impacts to others who depend upon surface water. These concerns appear to be predicated on experiences in other states – in particular semi-arid or arid western states. Policymakers must be cautious in analogizing Montana's water availability to other states simply because there are typically substantial differences in hydrology, population, and water demands from state to state or even region to region. In order to properly evaluate the degree of significance and impact of groundwater development in Montana, any scientific evaluation must focus strictly on Montana conditions.

One means of objectively evaluating the relative significance of changes in water demands in Montana is to employ *water budget methodology*. Nicklin Earth & Water of Bozeman conducted water budget evaluations at the state level and for four high growth areas of Montana. In all of these evaluations, the water budgeting methodology described by the United States Geological Survey was employed. This methodology is expressed as follows:

$$P + Q_{in} = ET + \Delta S + Q_{out}$$

where

P	is precipitation;
Q_{in}	is water flow into the watershed;
ET	is evapotranspiration (the sum of evaporation from soils, surface water bodies, and plants);
ΔS	is change in water storage; and
Q_{out}	is water flow out of the watershed.

Water Budget Evaluation Results

Applying the water budget methodology at the state and local scales, the results were generally universal. At the state scale, the current consumptive use of groundwater is very small compared to the availability of water resources in Montana's watersheds. For example, the total consumptive use from individual wells in Montana is about 0.05 percent of the overall combined consumptive use associated with agriculture and reservoirs/lakes. As another comparison, the total annual consumptive use from individual wells in Montana is about 0.005 percent of all surface water leaving the state of Montana each year.

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The four high growth areas examined were the Gallatin Valley, Bitterroot Valley (Ravalli County), Lewis and Clark County, and Missoula County. All of these areas show increases in groundwater development associated with population growth. The primary conclusions of the local scale analyses proved to be a microcosm of the statewide observations. In effect, overall water use by housing and municipalities is currently a very small percentage of available groundwater resources and is projected to remain so through at least 2030.

More specifically, results common to all the high growth areas are as follows:

- Streamflow is dominated by the influence of mountain snowpack. Other factors having a substantial impact to streamflow are agricultural irrigation diversions and evaporative loss from surface water reservoir storage.

- Consumptive use associated with the current level of groundwater development is very small when compared to total available water within the areas examined. For example, compared to streamflows, the relative amounts of combined consumption from public water supply wells and individuals wells in each of the areas evaluated are as follows:
    - *Gallatin Valley* – 5,000 acre-ft ("AF") of consumption versus 518,000 AF of measured streamflow leaving the valley each year.
    - *Ravalli County* – 6,930 AF of consumption versus 1,551,000 AF of measured streamflow leaving the valley each year.
    - *Lewis and Clark County* – 11,700 AF of consumption versus 3,862,000 AF of measured streamflow at the Missouri River gaging station below Holter Dam.
    - *Missoula County* – 19,300 AF of consumption versus 3,831,000 AF of measured streamflow at Clark Fork River below Missoula.

- The above comparisons demonstrate that consumptive use as a percentage of total streamflow leaving the areas each year ranges from 0.3 percent (Lewis and Clark) to 1 percent (Gallatin Valley). The impact from groundwater consumption due to new development is simply too small to be detectable or measurable at streamflow gaging stations that neighbor the high growth areas. This conclusion is also verified when evaluating the data for seasonally low streamflows and for periods of drought.

- Another factor that requires more evaluation is the nature of land use transitions. There are clear indications that significant proportions of both irrigated and non-irrigated farm land have been replaced by subdivisions. The key issue that needs to be resolved is whether these changes have led to either a net increase or decrease in consumptive use of water resources.

- Except for responses associated with climatic variations such as drought, groundwater levels and aquifer storage in high growth areas have remained relatively constant over time. These conclusions were also verified in the Montana Bureau of Mines and Geology ("MBMG") watershed case studies.

Recommendations

Based upon the above evaluations, our recommendations are as follows:

- Recognize that the water budget in Montana is overwhelmingly dominated by climatic factors and agricultural surface water use. In effect, changes in groundwater use associated with housing that

currently exists or that is projected over the next 20 years will not measurably change this water budget.

- Assess the viability of water banking options. For instance, it may be appropriate to encourage those who wish to develop land to place irrigation water currently used on the land to be developed in a water bank. That water could then be drafted upon for public water supply and fishery and wildlife uses.

- Regular delineation of water use, including monitoring changes in irrigated areas, could assist in understanding potential trends, or lack thereof, in the overall water budget. Information could then be coupled with the water budgeting process to provide information at the state and local levels to assist decision makers, water users, and their representatives.

- Use the results from the basin or subwatershed evaluations to determine if there are conjunctive surface water-groundwater management measures that could be implemented. For instance, the possibility exists that groundwater pumping (e.g., supplemental irrigation) could be coupled with leaving surface water instream during critical low streamflow periods.

- Complete the adjudication process so that Montanans can have a clear picture of what the actual demands on existing water supplies are.

- Complete the MBMG hydrogeologic study of closed basins in Montana as proposed by the 2007-2008 Water Policy Interim Committee.

- The process for obtaining new beneficial use permits should observe the legislative policy declarations set forth in Mont. Code Ann. § 85-1-101 and Article IX, Section 3 of the Montana Constitution, facilitating permitting for new beneficial uses.

Conclusion

Montana is poised to grow steadily in the decades to come. Thankfully, Montana is blessed with abundant and clean water resources that are sufficient to sustain the level of growth projected into the future. We must proceed cautiously with policies that balance the need to protect this resource with the need to grow and prosper. Mont. Code Ann. §85-1-101(2) clearly articulates the balance set by the Legislature for water use:

> The public policy of the state is to promote the conservation, development, and beneficial use of the state's water resources to secure the maximum economic and social prosperity for its citizens.

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