Effects of Exempt Wells on Existing Water Rights

Water Management Bureau, Montana Department of Natural Resources and Conservation, Helena, Montana
February 2008

Summary

The following is a discussion of the potential effects of exempt wells on existing water rights. The concern is that exempt wells can pump water out of priority which in turn reduces the water available to senior water users during times of water shortages. This concern is elevated as exempt wells are being used for large, relatively dense subdivision development in closed basins.

Exempt wells are not reviewed by DNRC and are not subject to public notice. In contrast, permitted wells are reviewed by DNRC, and water users and the public are noticed and given an opportunity to object. Impacts caused by permitted wells are required to be identified and, if these impacts cause adverse affect to water users, must be offset through mitigation plans or aquifer recharge plans. Impacts caused by exempt wells are often offset during times of water shortages by curtailment of junior surface water right users. Even if administration or enforcement of exempt wells in priority existed, curtailment of exempt wells could be ineffective because of the delayed effect on stream flows and, therefore a call may not benefit senior surface water users.

Evaluation of streamflow records may not be an accurate way to characterize depletions by out-of-priority ground-water pumping because depletions from exempt wells can be offset by curtailed use of surface water by junior water right appropriators. At current rates of development, approximately 30,000 new exempt wells could be added in closed basins during the next 20 years resulting in an additional 20,000 acre-feet per year of water consumed. Some of this increased consumption will be offset by reduced historic consumption for agriculture where residential development is occurring on irrigated lands. However, much of the subdivision development in closed basins is occurring on lands that were not previously irrigated. In addition, there are no guarantees that historic water rights for lands developed using exempt wells will not be sold and put to new uses.

Water Rights Perspective

Ground water flow models of the Gallatin Valley by Nicklin (2005) and Kendy and Bredehoeft (2006) demonstrate how pumping and consuming ground water in closed basins can impact surface-water flows. The challenge for addressing these impacts is that depletions of surface water caused by pumping ground water, from either an exempted or permitted well, usually will take months or years to dissipate if pumping is curtailed. Ground water pumping has fallen outside of the priority system that surface water users are subject to during times of water shortages because exempt rights are not included in decrees administered by water commissioners. In any event, a call against groundwater pumping, even if enforced, may generally be futile in the short term. This can create the anomaly of a surface water right holder with a 1920 priority date for irrigation being shut off during water shortages, while a groundwater right holder with a 2007 priority date can continue pumping, even though their water use depletes stream flow. Water commissioners and district courts may increasingly be called upon to regulate exempt water uses. These exempted water users may find themselves called upon to bring

forward evidence that their exempted uses do not take surface water, or that a call by a senior surface water user would be futile.

Provisions of BH 831 codified at §85-2-360 MCA through §85-2-364 MCA provide mechanisms in addition to basic permitting criteria in §85-2-311 MCA whereby an applicant for a provisional permit for a non-exempt well in a basin closed to new surface water use can pump and use ground water if effects to senior water users, if necessary, are mitigated. Permit applicants are required under these provisions to assess potential net depletions to surface water and to offset net depletions that cause adverse effects to existing water rights through a mitigation plan or an aquifer recharge plan. The required hydrogeologic assessment generally includes a description of the properties and extent of the source aquifer to a well, the locations of surface waters connected to the source aquifer, and an evaluation of the timing and magnitude of net depletion. Most often, mitigation or aquifer recharge plans will involve retiring an existing surface water use and changing the water right to mitigate the impacts of the new use. A ground water applicant under HB 831, in conjunction with the change statute of §85-2-402 MCA, is required to demonstrate that the historic period of use and consumptive use of the right being retired will provide adequate water in priority generally during the time needed to mitigate any adverse effects of the new use. The change process ensures that the historic water right will not be expanded or used in a way that adversely affects other water users.

In contrast to permitted wells, wells pumping less than 10 acre-feet per year and less than or equal to 35 gallons per minute (gpm) maximum pumping rate do not have to meet the requirements of §85-2-360 MCA through §85-2-364 MCA or §85-2-311 MCA. These exempted wells can deplete surface water flows in the same proportion to wells that are subject to permitting requirements. For example, 100 individual wells serving a subdivision will have the same magnitude of depletion as one or more larger non-exempt wells for a public water system serving the same number of households from the same aquifer at that location. Net depletion in both cases depends on the amount of water consumed and aquifer conditions. Pumping from the permitted well should not affect senior surface water users as long as the associated mitigation or aquifer recharge plan is in effect. Depletions by the 100 exempt wells can continue unabated during periods of water shortage, affecting surface water users by decreasing the amount of available stream flow and increasing the need for some junior surface water users to curtail their use.

Nicklin (2007) argues in part that the effects of exempt wells in the Gallatin Valley are inconsequential because in-home consumption is small and because most of the consumption associated with these wells is for lawn and garden irrigation that balance consumption of surface water that was historically used to irrigate agricultural crops on the same land. Nicklin further argues that, because the number of acres irrigated for crops in the Gallatin Valley has declined, less water is now consumed than in the past. Essentially, Nicklin argues that the effects of exempt wells are mitigated ad hoc similar to formal procedures under §85-2-360 MCA through §85-2-364 MCA by merely replacing the previous irrigation uses of water with exempt uses of water.

There are many exempt wells in the Gallatin Valley that supply residential needs on lands that were previously irrigated, however, the effects of the new uses may not be mitigated. The water right for the previous irrigation use might have been severed from the land and

changed to a new use (e.g. mitigation of a permitted well), or placed of use (e.g. sold to another irrigator for use on different lands). Surface water that is supplied from storage by a ditch or canal company, as is much of the irrigation water in the Gallatin Valley is difficult to track and may simply provide expanded service to another tract. In addition, the historic irrigation on a parcel can be for the early portion of the irrigation season in the case of grains, or for flood irrigation with a lower depletion rate as compared to sprinkler irrigation, or as a result of being so junior that curtailment by a water commissioner occurs yearly. In these cases, historic consumption by agricultural irrigation may be less than summer-long lawn and garden irrigation that replaced the agricultural use. Most importantly, development in the Gallatin Valley and in other valleys in western Montana is increasing and occurring in areas that have not been historically irrigated and where increased consumption by new exempt well use is not being offset by decreased historic consumption for irrigation. Regardless of the location or past land use, the safeguard provisions of §85-2-360 MCA through §85-2-364 MCA and §85-2-402 MCA that ensure the effectiveness of mitigation for permitted ground-water uses do not cover exempt wells.

Depletions by exempt well use may not be discernible by basin-scale water balances or analysis of hydrographs of gross basin inflows and outflows, in part because these depletions are small relative to annual flows. In addition, records of consumption by exempt well use may be masked during periods of water shortage by curtailment of junior surface water uses. Low-flow measurements in July to September (Figure 1) and water commissioner records demonstrate that water shortages occur in the Gallatin River and other closed basins nearly every year and that junior surface water use is curtailed or reduced through informal sharing among surface water users. For example, surface water users with priority dates back to the 1890s are curtailed in the Gallatin during most years and, if not for voluntary reductions, the Gallatin River at Amsterdam Road Bridge and the I-90 Bridge would go dry (Compton, 2007) (Figure 2). Depletion of surface water by exempt well use continues during these periods of shortages and ultimately increases the need to curtail more junior surface water rights or the need for more voluntary reductions. The net effect is that depletions by ground-water pumping do not show up in records of total basin water outflow because they are offset by curtailed use by junior surface water users. Figure 1 also indicates that the appropriate place in the Gallatin Valley to discern water shortages is not near the mouth, but farther upstream in the vicinity of Amsterdam and the I-90 bridge. Irrigation return flow and the East Gallatin River increase flows substantially downstream.

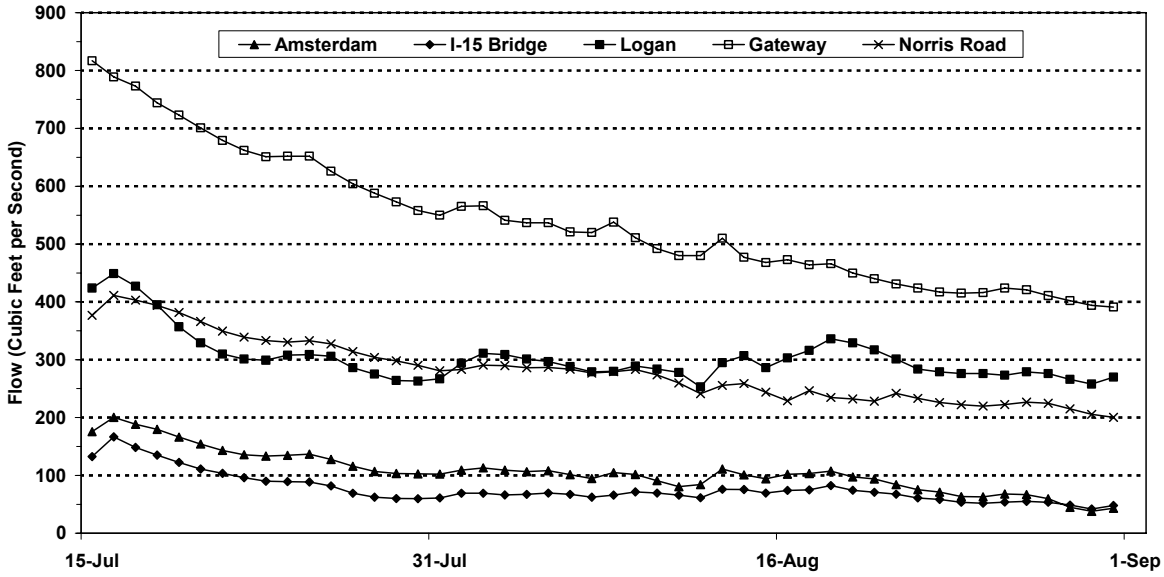

Figure 1. Flows in Gallatin River from Gallatin Gateway to Logan during the late summer of 2006.

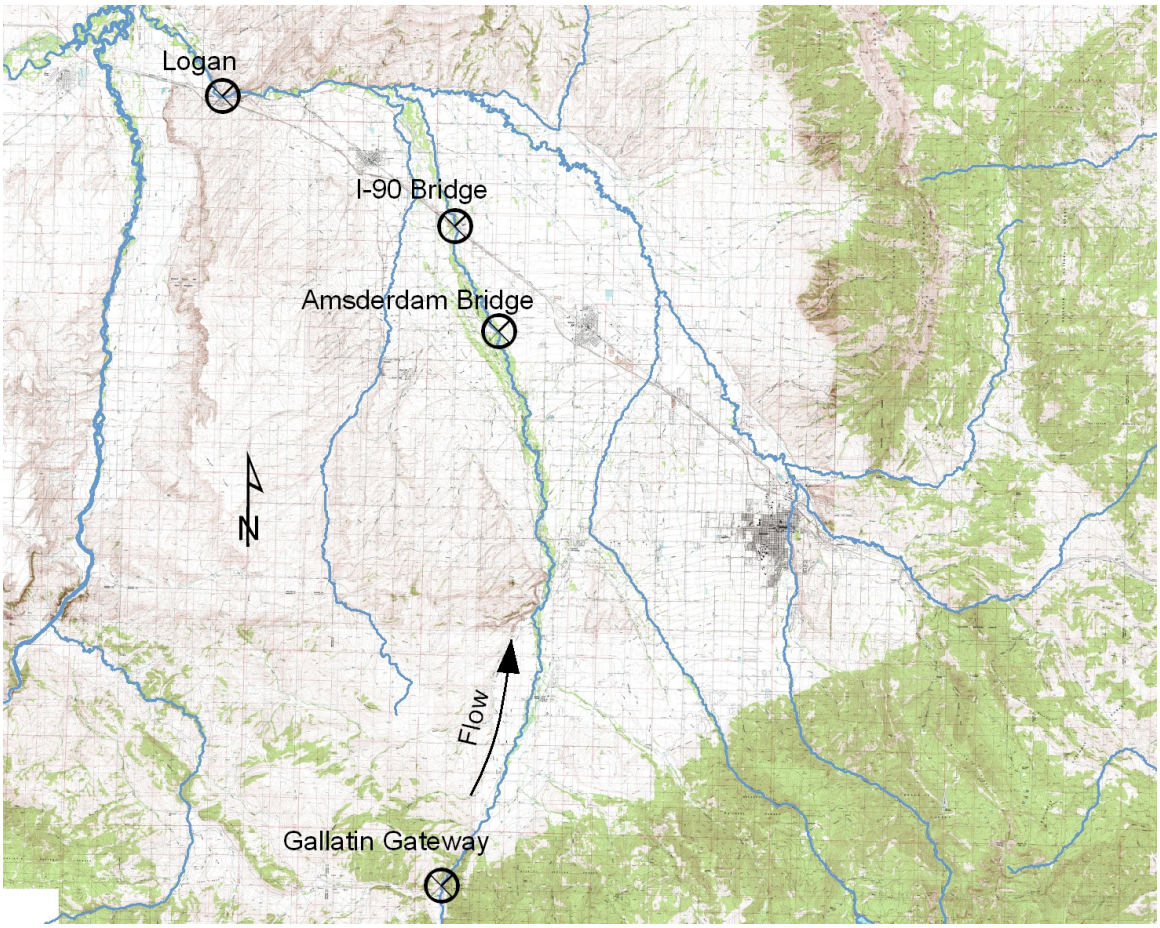

Figure 2. Locations of gauging stations on Gallatin River.

Future Exempt Well Growth and Consumption

Estimates of water consumption are presented in Table 1. Trends in the number of water right certificates issued by DNRC are presented in Table 2. These tables demonstrate the potential future effects of exempt wells. Estimates of household water use and consumption are based on the following assumptions.

- In-house water use is 187.5 gallons per day per household (75 gallons per day per person with 2.5 persons per household) based on published use (Kimsey and Flood, 1987).
- Total consumption of water used indoors and during wastewater treatment is 5 percent of the water used indoors. This rate of consumption is intermediate between an estimate by Kimsey and Flood (1987) of 2 percent for households served by municipal wastewater treatment plants and an estimate by Vanslyke and Simpson (1974) of 12 percent for households with individual septic systems. More recent site-specific research in Colorado found a combined consumption rate for indoor use and sewage disposal of about 15.6 percent (Paul, Poeter, and Laws, 2007).
- Net irrigation requirement for lawn and garden use is 16 inches per year on average based on net irrigation demand for turf for various stations in closed basins obtained from the Montana Irrigation Guide.
- Lawn and garden irrigation efficiency is 70 percent.
- Future number of exempt wells in closed basins is projected from the linear growth rate the occurred between 1991 and 2006.

Table 1. Calculated water diversion and net consumption per household.

	Acre-Feet Per Year		
	Household	**Irrigation**	**Total**
Household + 1/4 acre lawn			
Diversion	0.21	0.48	0.54
Consumption	0.01	0.33	0.34
Household + 1/2 acre lawn			
Diversion	0.21	0.95	1.16
Consumption	0.01	0.67	0.68

The number of acres typically irrigated by exempt wells is estimated by evaluating infrared aerial photography for lots associated with exempt wells the Bitterroot Valley, Helena Valley area, and Gallatin Valley. DNRC geographic information specialists delineated irrigated portions of selected properties associated with exempt wells by randomly selecting 100 exempt wells from each basin and compiled statistics presented in Table 2. Averages of estimates of irrigated acreage vary from 0.38 acres in the Helena Valley to 0.93 acres in the Gallatin Valley with an overall average of 0.67 acres and median of 0.50 acres. The intensity of irrigation varied between sites; but the data indicate that the consumption estimate for a ½ acre parcel provided in Table 1 probably is representative value for predicting overall consumption from future exempt well use.

Table 2. Estimates of irrigated acreage associated with exempt wells for the Bitterroot Valley, Helena Valley area, and Gallatin Valley.

Basin	Average (acres)	Median (acres)	Max (acres)	Min (acres)	25th Percentile	75th Percentile
Bitterroot	0.7	0.43	3.86	0.07	0.25	0.87
Helena	0.38	0.27	2.02	0.025	0.18	0.45
Gallatin	0.93	0.8	5.06	0.14	0.49	1.04

The number of exempt wells filed in the closed basins listed in Table 3 has increased steadily at a rate of approximately 1,400 per year. Based on this trend and assuming ½ acre of irrigation per residence, the number of exempt wells will increase by approximately 30,000 and consumption by these exempt wells will increase by approximately 20,000 acre-feet per year by 2030 (Table 4). Further, the number of exempt wells will increase by approximately 70,000 from current numbers and an additional 47,000 acre-feet of water will be consumed per year by 2060. From Table 1, approximately 300 homes using exempt wells with ½ acre of lawn and garden irrigation will consume about 204 acre-feet of water. This is roughly equivalent to the amount of water consumed by one center pivot irrigating 138 acres of alfalfa with a full-service net irrigation requirement of 18 inches. This calculation is provided for comparison purposes and is not an estimate of effects that will occur during the irrigation season.

Table 3. Cumulative number of filed exempt wells (minus exempt stock wells) beginning in 1991, the first year for the 35 gpm / 10 acre-foot exemption.

Year	Bitterroot	Jefferson / Madison	Teton	Upper Clark Fork	Upper Missouri	Total
1991	0	256	12	324	846	1,438
1992	455	391	18	559	1,361	2,784
1993	879	526	27	706	1,890	4,028
1994	1,274	698	30	889	2,451	5,342
1995	1,620	857	33	1,094	3,084	6,688
1996	2,027	1,008	35	1,264	3,534	7,868
1997	2,346	1,133	37	1,429	4,003	8,948
1998	2,697	1,272	39	1,598	4,551	10,157
1999	3,049	1,461	41	1,791	5,155	11,497
2000	3,355	1,605	57	2,006	5,856	12,879
2001	3,645	1,724	65	2,151	6,533	14,118
2002	3,957	1,882	71	2,267	7,142	15,319
2003	4,311	2,039	82	2,411	7,620	16,463
2004	4,682	2,226	90	2,578	8,222	17,798
2005	5,160	2,444	97	2,772	8,870	19,343
2006	5,797	2,785	145	3,056	9,847	21,630
2010*	6,900	3,200	140	3,700	12,000	26,000
2020*	11,000	4,800	230	5,400	18,000	39,000
2030*	14,000	6,400	320	7,200	24,000	52,000
2040*	18,000	8,000	410	8,900	29,000	64,000
2050*	21,000	10,000	500	11,000	35,000	77,000
2060*	25,000	11,000	590	12,000	41,000	90,000

* cumulative numbers of exempt wells for future years are estimated by linear regression

Table 4. Projected cumulative consumption in acre-feet annually for certificate wells with ½ acre of irrigation after 2006 (calculated from data in tables 1 and 2).

Year	Bitterroot	Jefferson / Madison	Teton	Upper Clark Fork	Upper Missouri	Total
2010	800	300	0	400	1,300	3,000
2020	3,000	1,400	60	1,600	5,000	12,000
2030	6,000	2,000	120	3,000	9,000	20,000
2040	8,000	4,000	180	4,000	13,000	29,000
2050	10,000	5,000	240	5,000	17,000	38,000
2060	13,000	6,000	300	6,000	21,000	47,000

Summary

The following are the main points of the preceding discussion.

- Groundwater pumping and use in closed basins has been shown through modeling to deplete surface water flows.
- Exempt wells can cumulatively deplete surface water flows proportionally to permitted wells.
- Ground-water use is difficult to curtail to avoid impacts to surface water users during water shortages under a prior appropriations system. However, water commissioners and district courts may increasingly be called upon to regulate exempted water users, so exempted water users may find themselves called to bring forward evidence that their exempted uses do not take surface water, or that a call on their exempted right by as senior surface water user would be futile.
- Provisions of HB831 provide a mechanism for authorizing permitted wells to pump out of priority with the implementation of mitigation or aquifer recharge plans.
- Provisions of HB831 and §85-2-402 MCA ensure that valid historic water rights will be used to mitigate adverse effects caused by a permitted well.
- New exempt wells are not subject to the provisions of HB831 and, therefore, can pump out of priority without mitigating adverse effects to senior water right users.
- Historic irrigation water rights that are displaced by new residential developments that use exempt wells can be severed and sold (and changed to a new place of use or a new use).
- Pumping from exempt wells can increase the need to curtail more junior surface water right uses or for more voluntary reductions during perennial periods of water shortage in closed basins.
- Depletions by exempt well use do not show up in records of total basin water outflow because they are offset by curtailed use by junior surface water users.
- Approximately 300 homes using exempt wells with ½ acre irrigation will consume 204 acre-feet of water each year, which is about equivalent to an estimated 207 acre-feet consumed by one center pivot used to irrigate 138 acres of alfalfa.
- If current trends continue, there will be a total increase of 70,000 exempt wells and 47,000 acre-feet per year of water consumption in closed basins by 2060.

References

Compton, S. 2007. Personal communication.

Kendy, E. and J.D. Bredehoeft, 2006. Transient effects of groundwater pumping and surface-water irrigation returns on stream flow. Water Resources Research, V. 42, 11 p.

Kimsey, D.W. and P.K. Flood, 1987. Domestic consumptive use, technical memorandum to the Chief Engineer of the State of Colorado, 16 p.

Nicklin, M., 2005. Testimony is water rights hearing, DNRC hearing records for application 41H-30012025.

Paul, W., Poeter, E., and R Laows, 2007. Consumptive loss from and individual sewage disposal system in a semi-arid mountain environment. Colorado Water, Newsletter of the Water Center of Colorado State University, August/September 2007, Volume 24, Issue 4.

Vanslyke, G. and H. Simpson, 1974. Consumptive use of water by homes utilizing leach fields for sewage disposal, technical memorandum by the Colorado Division of Water Resources, 5 p.