Water Law and Economic Efficiency: Conflicts Under the Priority Doctrine of Water Property Rights

Chuck Howe

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Under the "priority doctrine" of water law imbedded in the constitutions of western U.S. states, each water right has a priority attached to it, the rights with earlier priority dates ("senior rights") having preference in the use of surface or groundwater. Water rights are considered personal property that can be leased or sold and the priority goes with the right if it is traded (Getches, 1997; Hobbs, 2006). If low stream flows prevent senior rights from diverting water to which they are entitled, the seniors can "put a call" on the river, requiring all upstream rights "junior" to the caller to stop diverting water until adequate streamflow is restored.

Following WWII, there was an explosion of well drilling in the alluvial valleys of the western U.S., based on improved pump technology, cheap energy and the absence of regulatory frameworks over wells. In the 1950's in the South Platte River Basin of Colorado, irrigators tapped into the huge aquifer tributary to the river with thousands of wells that provided a reliable and handy source of water (MacDonnell, 1988). During the same period, developments in hydrologic science made it clear that river flows and tributary aquifers were closely connected, e.g. that the aquifer provides water to the river in the late season but draws water from the river as pumping expands (Young & Bredehoeft, 1967; MacDonnell,1988).

With this new knowledge of river-aquifer linkage, the 1969 Colorado Legislature decided that wells tapping the tributary aquifer should be incorporated into the "priority system", i.e. awarded priorities according to the date of first use. (Colorado Revised Statutes, 1969). This made the wells very junior in the ranking of rights relative to many surface diversions for irrigation date back to the mid-19th century(Grigg, 2003). It thus appeared that the use of tributary wells during periods of low stream flow, e.g. during prolonged droughts, was likely to be prohibited just when the huge store of groundwater would be most valuable.

To avoid this clearly uneconomic result, the 1969 Act allowed the the chief administrative officer, the State Engineer, to approve temporary " substitute water supply plans"("plans of augmentation") that would allow junior wells to continue pumping when there was a "call" on the river as long as the well owners could augment surface flows to make up for current shortages attributable to their current and past pumping- a calculation requiring detailed models. The augmentation must continue while the call is "on". A common source of augmentation has been to buy or lease senior surface rights that could be left in the stream as replacement water. Under these arrangements, 2800 South Platte wells received permanent approval by the Division 1 Water Court and continued to operate while several hundred wells were permitted to operate temporarily while applications to the Water Court for permanent plans were pending. (Simpson, 2006).

During the 1970's, 1980's and early 1990's, generous streamflows meant that calls on the river were generally confined to July and August, requiring only limited augmentation by the wells.As the drought of the early 2000's became increasingly severe, surface water shortages led to increasingly frequent "calls" on the river, with almost

continuous calls from 2003 into 2006 (South Platte River Task Force, June 2007). This meant that the wells that had been operating under "substitute water supply plans" had to provide much larger volumes of augmentation water if they were to continue pumping and had to scramble for increasingly costly surface rights or leases. Most were unsuccessful throughout 2006 and the State Engineer was required to shut down 445 major wells in the early summer of 2006 through 2007, drying up 30,000 acres of prime crop land with immediate, severe impacts on the farms and associated rural communities (South Platte River Task Force, 2007). A second effect of the frequent calls on the river was that *many water users in addition to the wells* in question had to stop diverting water from the South Platte system. Those impacts will be assessed in a later section.

Direct Economic Impacts of the Well Shut-Down.

The 1969 Act provided for out-of-priority pumping by wells because of the value of groundwater during droughts. Downstream water uses were protected by the requirement for substitute water supply plans. It therefore makes sense to compare the economic losses imposed by the shut-down with the consequent benefits to parties downstream of the wells. This benefit-cost assessment would compare the *present value*[1] of losses incurred by the well users *and linked activities* (suppliers and processors) with the *present value* of the gradual income gains that would accrue to parties downstream as a result of any increase in flows downstream. For this assessment, the following questions need to be asked: (a) how much of the surface shortage that led to the calls was actually attributable to the wells' current and past pumping and, thus, how much augmentation ought to be required under the substitute water supply plans?; (b) what would be the time profile of increased flows downstream resulting from the cessation of pumping?; (c) how does the *present value* of

[1] The sum of present and discounted future values of lost incomes.

future income losses incurred by the well owners and linked activities compare with the *present value* of future downstream benefits that would be gradually generated by the increased streamflows?.

Regarding the 2006 surface shortages that occasioned the continuing calls, it was estimated that out-of-priority depletions of 15,000 to 16,000 acre-feet were due to past pumping of the 445 wells[2] [Ellinghouse, 2006; Rozaklis, 2007; Simpson, 2006]. However, other causes of the surface shortage were also at work including the lingering effects of drought, increased water reuse by upstream cities and changes in irrigation practices from flood to sprinklers. Thus, even had the wells been able to meet their augmentation requirements on a continuing basis, calls would still have occurred , but less frequently. In a similar situation on the East Snake Plain Aquifer in Idaho, a study commissioned by the Idaho State Engineer found that surface shortages were 1/3 due to wells, 1/3 to drought and 1/3 to changes in irrigation techniques (Snyder and Coupal, Feb. 2005).

When the wells shut down, seasonal farm incomes were immediately lost because crops had been planted but had not matured. Direct farm income losses from the shutdown have been estimated at $ 390 per acre, while total direct and indirect income losses are estimated to be $ 690 per acre (Thorvalsdon and Pritchett, 2006). These losses will continue into the future until the wells are permitted to operate. In contrast, downstream benefits from the increased supplies would occur *only gradually* over several years as the water table recovered and streamflows increased. Also, downstream gains would be only *marginal additions* to farm income since downstream agriculture was not totally dependent on South Platte flows. The cropping patterns in the well areas and the benefiting

[2] Boulder, Colorado website, http://www.bouldercolorado.gov/, City Attorney on South Platte Background, 6/14/07.

downstream areas are roughly similar (Colorado State Water Supply Initiative, 2007). *For these reasons, the present value of losses of income due to the well shut-down logically must exceed the present value of direct downstream gains from eventual increases in flows.* . In a very similar situation in Idaho referenced above, the present value of losses to well owners called out by surface users was vastly greater than the present value of the gradual gains to the surface and spring water users even though the latter included the largest trout farms in the U.S. (Snyder and Coupal, 2005).

Other Effects of the River Call.

The calling rights on the South Platte were very senior and located far downstream on the Platte in the northeastern part of the State. As a result, many upstream juniors, in addition to the wells, were also called out for 2006, resulting in substantial additional losses to those water users. The cities of Greeley, Boulder, Englewood, Westminster and Highlands Ranch were called out, along with several irrigation ditches and water districts (Colorado Supreme Court, May 3, 2006).

The City of Boulder (upstream of the wells) estimated the value of its foregone diversions in 2006 to be at least $ 100,000 depending on how Boulder would have used the water, either by leasing it to farmers at $ 25/af if water was in surplus or by having to pay for make-up water to be imported from the Colorado Basin at a cost of about$ 100/af (Ellinghouse, 2006). Similar values per acre-foot can be attributed to the losses of the other towns involved. The aggregate losses from the call were substantial. The remaining question is, "How will the frequency and/or duration of calls be affected by the well shut-down?" Answering that question would require complicated hydrological and climatological analyses. The effects would be spread over several years as the aquifer

reached a higher equilibrium level. Because there still will be other factors reducing river flows, the shut-down will not avoid calls altogether, so *the net effect of the shut-down must be a substantial net economic loss.*

Are River Calls Generally Uneconomic?

Calling parties are unlikely to take into account the losses to affected juniors. Indeed, it is difficult for a calling senior to identify the juniors who will be affected by the call. The "Coase Theorem" suggests that upstream losers could organize to pay the downstream calling party to "subordinate" their priority if upstream losses exceed those of the downstream caller (Coase, 1960). Such organization seems unlikely at a large basin level. And thus there is a presumption that river calls will result in economic losses

The underlying priority-efficiency conflict occurs because there is a *low correlation between water right priorities and the values (net incomes) being generated by those rights.* The early uses were in agriculture and many of the senior rights remain in agriculture in spite of a century of water market activity. Many senior rights are still being applied to low marginal value uses in agriculture while urban, industrial and environmental rights typically have lower priorities because of their recent establishment. *If the seniority-value correspondence in water rights were higher, there would be fewer calls, perhaps none at all.* The challenge is to find ways within existing water laws to increase the seniority-value correlation. This is exactly the mission of our water markets, to shift higher priorities towards higher value uses.

Improving Water Markets to Match Priorities and Values.

Making the water transfer process less costly and time-consuming (i.e. reducing *transaction costs*. See Howe et al, 1990) would reduce the frequency of economically

inefficient calls since there would be greater motivation to move lower-value-producing rights to higher-value-producing uses. Sellers could get higher returns and buyers would have to pay less. The western states, especially Colorado, have had active water markets for over a century (MacDonnell, 1989). A key is to make these markets as efficient as possible.

In Colorado, transfers of water rights and plans for augmentation go through water court review and approval in which various dimensions of the right (e.g. historic consumptive use, timing of use) are certified so that the transfer can be conditioned on *no injury* to other water users. Court review frequently requires costly legal and engineering studies by buyer and seller (MacDonnell et al, 1994). In Idaho, Wyoming and New Mexico, these reviews are carried out by the Director of Water Resources, the Water Board or the State Engineer respectively, agencies that have the needed expertise in-house, thereby reducing the costs of legal representation and expert witnesses. The Supreme Court of Idaho recently ruled that the Idaho State Engineer has broad authority to approve plans for well augmentation *and can exercise flexibility in designing those arrangements in keeping with consideration of the general public welfare:*

> "Somewhere between the absolute right to use a decreed water right and an obligation not to waste it and to protect the public's interest in this valuable commodity lies an area for the exercise of discretion by the Director" (Idaho Supreme Court, 2007 Opinion No. 40).

In Idaho, a factor facilitating water transfers and augmentation plans is that the Department of Water Resources, in cooperation with the University of Idaho, has created a surface water-groundwater computer model that has been *broadly accepted by all stakeholders* for

use in analyzing alternative plans and policies (Cosgrove and Johnson, 2005; Johnson, 2006). Broad authority for the State Engineer Office and broad acceptance of the standard model combine to reduce transaction costs and facilitate trades.

"Water banks" through which buyers, sellers, and leasers can quickly communicate facilitates both short term leases and permanent transfers. Water banks have a long history in Idaho, California, Arizona and Colorado (Howe, 1998). In Colorado, water banks have been authorized by the Legislature for all major basins (Colo. Revised Statutes, 2005). A pilot water bank authorized in 2002 for the Arkansas River failed to generate transactions partly because of long delays in the review process that ruled out useful short term reallocations (Wiener, 2008). Quick agriculture-to-agriculture, agriculture-to-urban and urban-to-agriculture leases can be highly beneficial. Again, Idaho utilizes a variety of types of water banks and rental pools that facilitate quick water transfers.

There are other steps that would reduce transactions costs of transfers. More complete public records of ownership of rights and the prices at which transfers occur would help in increasing the efficiency of water markets. Potential market participants have difficulty in identifying each other and in knowing what "the going price" should be in a particular area ("price discovery"). The Arkansas River water bank experience (Wiener, 2008) indicated that market participants had little idea of a reasonable price. Various market forms are available to establish market-clearing prices, e.g. the sealed bid-double auction procedure that maximizes benefits from transfers, but even simple "bulletin board" markets have also proved effective (MacDonnell et al, 1994; Howe, 1987).

These ideas received recognition in the report of the South Platte Task Force appointed in 2007 by the Colorado Governor and charged with finding efficient and

equitable ways of resolving the South Platte conflicts. Their recommendations (Colorado Department of Natural Resources, 2007) recognized that water court procedures needed to be streamlined to facilitate transfers and plans of augmentation. The potential for water banks was emphasized, along with other transfer mechanisms that could substitute for traditional "buy and dry" permanent transfers.

Eventually, the correlation between water right priorities and values generated will continue to increase slowly through the functioning of our water markets, but large benefits are being lost -especially in drought years- through the failure to facilitate both temporary and permanent transfers. Water transfer reform remains a priority issue.

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