Water Rights and Beneficial Use of Coal Bed Methane Produced Water in Colorado

By

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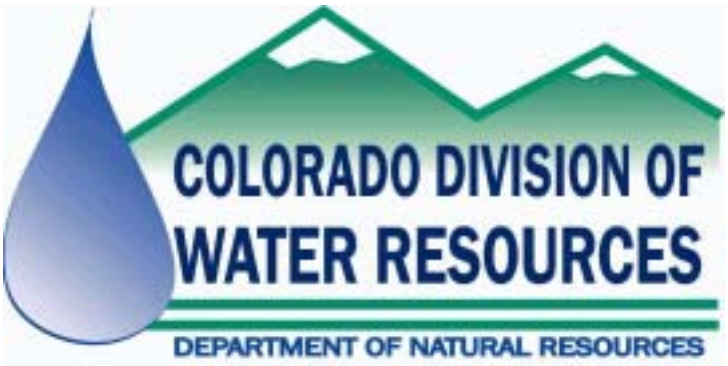

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1.0 Objective

Water is a scarce and valuable resource in Colorado. Any activity that appears to waste it or that may waste it creates challenges as well as potential opportunities. The beneficial use of produced water from coal bed methane (CBM) wells is one such potential opportunity that also raises challenges. This paper explores the state laws and regulations in Colorado governing the use of produced water. This paper does not attempt to address county or local laws and regulations, which are beyond its scope.

2.0 Types of Ground Water

In Colorado, there are basically five types of ground water that are administered by the Colorado Division of Water Resources (CDWR) and the Colorado Ground Water Commission (CGWC). The CGWC has primary authority over the administration of designated ground water. The five types are as follows:

Tributary

Ground water that is hydrologically connected to a natural stream system either by surface or underground flows.

Nontributary

Ground water located outside the boundaries of any designated ground water basin. The withdrawal of this ground water by a well will not, within 100 years, deplete the flow of a natural stream at an annual rate greater than one-tenth of one percent of the annual rate of withdrawal.

Not-nontributary

Ground water located within those portions of the Dawson, Denver, Arapahoe, and Laramie-Fox Hills aquifers that are outside of any designated ground water basin in existence on January 1, 1985, the withdrawal of which will, within 100 years, deplete the flow of a natural stream at an annual rate greater than one-tenth of one percent of the annual rate of withdrawal.

Designated

Ground water that, in its natural course, is not available to or required for the fulfillment of decreed surface rights, or ground water in areas not adjacent to a continuously flowing natural stream, wherein ground water withdrawals have constituted the principal water usage for at least 15 years preceding the date of the first hearing on the proposed designation of the basin, and which is within the geographic boundaries of a designated ground water basin.

Geothermal

Ground water that contains geothermal energy.

3.0 Geologic Factors Affecting Water Production

CBM gas in Colorado is produced from coal seams that were created by the deposition of large amounts of organic material in fluvial and marginal marine environments adjacent to the western margin of the Western Interior Cretaceous Seaway during late Cretaceous and early Tertiary time.

The coals are interbedded with mudstones or claystones and sandstones, and are predominately lenticular in cross section and laterally discontinuous. These coal seams vary in thickness from a fraction of an inch to several feet. In a few limited areas, individual beds may be more than 10 feet thick. The individual beds may be spread vertically over several hundred feet of stratigraphic section. The coal bearing sequences are found cropping out on the surface or as deep as 5,000 feet below the surface. At this time, most CBM production in Colorado is from coal seams that are less than about 3,000 feet below the surface.

Some of the geologic formations containing existing or potential CBM resources in Colorado are the Raton and Vermejo formations in the Raton Basin; the Denver and Laramie formations in the Denver Basin; and formations within the Mesa Verde Group, found in several basins on the western slope of the state.

CBM gas is molecularly adsorbed on crystal surfaces of the coal, and is held there under the hydrostatic pressure of the water contained in the coal beds and the adjacent sandstones. In order for the CBM gas to be liberated or desorbed from the crystalline structure of the coal, the hydrostatic head, or the reservoir pressure in the coal seam, must first be reduced. This pressure reduction is accomplished by dewatering the coal seams. To further enhance the productive ability of the coals, hydraulic fracturing techniques are used to increase the permeability of the coal seams.

A typical CBM well is drilled and cased through the potential productive interval. Selected intervals containing the coal seams are perforated and hydraulically fractured, and a down-hole pump designed to remove large quantities of water is installed. When first placed on-line, a CBM well will produce significant amounts of water with little or no gas production. Ideally, within a month or two of being placed on-line gas production will start to increase and water production will start to decrease as the coal seams become dewatered. After a year or two of production, water production rates can fall to as little as a few barrels of water per day for individual wells, while daily gas production rates will increase from essentially nothing to several hundred thousand cubic feet or more per day.

Ideally, the water produced by the CBM extraction process is water that was contained in only the coal seams, and not water contained in other parts of the stratigraphic column. Because of the highly layered or interbedded and lenticular nature of the geologic formations that contain CBM resources, there are significant barriers to the vertical movement of water. Given the amount of water being produced during the early life of a CBM well, there has been some concern that there may be some impact to water bearing zones that might be of suitable quality to be a source of water for residential, stock watering or irrigation purposes. At this point in time in Colorado, no documented incidents of direct impact on existing water wells from nearby production of CBM gas have been reported to CDWR.

Another concern identified is the possible effect on stream systems that flow across the outcrop areas of coal-bearing formations. Again, the highly interbedded and lenticular nature of these geologic formations may limit or effectively disconnect the stream systems from the zones from which the water is being produced. This is an area where further study is certainly warranted.

Historically, CBM produced water in Colorado has typically not been of suitable quality for any beneficial use, and only recently has some of this produced water been of good enough quality for some limited beneficial uses. For the most part, beneficial use of produced water in the San Juan Basin has not been proposed, because the quality of produced water in that area is too poor for

most uses, but some concerns have been raised regarding potential effects on surface water flows. In the Raton Basin of southern Colorado, approximately 5 Mgal/day of ground water is produced from CBM wells. Of this amount, approximately 30% is discharged to natural streams, 30% is reinjected and 40% is discharged to evaporation pits. The 1.5 Mgal/day that is discharged to the natural streams is done under discharge permits issued by the Colorado Water Quality Control Division (CWQCD) of the Colorado Department of Public Health and Environment (CDPHE) via approximately 40 discharge points (equal to approximately 26 gpm on average per discharge point). Proponents of the use of this produced water should keep in mind that the volume of water being produced will typically decline quite rapidly during the first year or so of production, and may approach nothing after a few years. Further, the economic life of a CBM well may not exceed 10 years.

Other basins in the state are being evaluated for CBM potential, but no development has occurred to this point in time. Those basins are the southeast part of the Piceance Basin in Delta County, the southeast part of the Greater Green River Basin, and the Denver Basin.

In addition to the physical limitations described above, there presently are significant legal and institutional barriers to the beneficial use of CBM produced water.

4.0 Jurisdiction Over Produced Ground Water

4.1 Historical Perspective

The desire to use water from CBM wells has only recently surfaced because the quality of water from CBM wells has never been good enough for most uses. Multiple agencies regulate and monitor various aspects of produced ground water, yet no agency oversees and integrates all aspects. Each agency has its own jurisdiction as established by enabling laws. At least three different agencies (the Colorado Oil and Gas Conservation Commission (COGCC), CDWR, and CWQCD) have authority as it relates to the withdrawal, use, and/or disposal of water from a CBM well, and the relationships between the constitutional provisions, statutory language, and various rules are extremely complex.

CDWR is aware of overlapping jurisdictional issues between the COGCC and CWQCD. COGCC has authority over all oil and gas operations, including the generation, transportation, storage, treatment, or disposal of exploration and production wastes. Water removed from a CBM well is considered a waste product. The CDPHE rules provide that no person shall discharge CBM produced water into waters of the state without first having obtained a permit from CWQCD for such discharge.

4.2 Allowed Beneficial Uses and Restrictions of Ground Water

Whether a use is beneficial is a question of fact and depends on the circumstances of each case. However, the following uses have been recognized as beneficial uses by CDWR: agriculture, mining, domestic, manufacturing, stock watering, wildlife watering, irrigation, industrial, mechanical, commercial, municipal, recreation, minimum stream flows, fire protection, and dust suppression.

CDWR has jurisdiction over appropriations of water. An appropriation is defined as the application of a specified portion of the waters of the state to a beneficial use pursuant to the procedures prescribed by law. Waters of the state in this context means all surface and underground water tributary to natural streams, except designated ground water as designated by

the CGWC. The statutory and case law vests CDWR with jurisdiction over water withdrawn from a CBM well that is beneficially used.

If an operator or another person wants to beneficially use water from a CBM well, that operator or person must comply with the Water Right Determination and Administration Act and the Ground Water Management Act (Water Rights Acts). The person could apply for a water right in water court and/or file for a well permit. If the person applies for a well permit for water from a CBM well, that water is presumed tributary, but the person may submit evidence such as engineering documentation that the water is nontributary. Regardless of whether the water withdrawn from a CBM well is nontributary or tributary, there are certain statutory requirements that the water user must meet before obtaining a well permit and/or a water court decree. Any water discharged into waters of the state (as defined by the Water Quality Control Act) is subject to appropriation under the Water Rights Acts.

CBM wells are not "wells" as defined in the Water Rights Acts, and operators do not need to obtain a permit from CDWR to withdraw water from these wells as part of the CBM extraction process. However, if water from a CBM well is put to beneficial use other than those uses allowed under COGCC Rule 907 (see below), then CDWR has certain jurisdiction over the water and the well, and the well is subject to the *Rules and Regulations for Water Well Construction, Pump Installation, and Monitoring and Observation Hole/Well Construction (2CCR 402-2).*

4.2.1 COGCC Rule 907

The COGCC statute (COGCC Act) grants certain authority to COGCC to promote oil and gas conservation, and rescinds any authority of any other agency as it relates to the conservation of oil and gas. CBM produced water is considered a waste product by operators and must be properly disposed of to prevent adverse environmental impacts. Pursuant to COGCC rules, an operator may dispose of water from a CBM well in any of the following ways: 1) inject into a disposal well; 2) place it in a properly permitted lined or unlined pit for evaporation and or percolation; 3) dispose the water at a permitted commercial facility; 4) dispose of the water by road spreading on lease roads outside sensitive areas for produced waters; 5) discharge the water into waters of the state in accordance with the Water Quality Control Act and the rules and regulations promulgated thereunder; 6) reuse the water for enhanced recovery, recycling, and drilling; or 7) mitigation to provide an alternate domestic water supply to surface owners within the oil and gas field.

4.2.2 Ground Water Permitting by CDWR

Under Colorado law, CBM operators are not required to obtain a permit from the State Engineer when withdrawing nontributary water unless the produced water is put to a beneficial use. The State Engineer has authority to issue permits outside designated basins in accordance with section 37-90-137(7), CRS (2002), which is restated as follows:

In the case of dewatering of geologic formations by removing nontributary ground water to facilitate or permit mining of minerals: (a) No well permit shall be required unless the nontributary ground water being removed will be beneficially used; and, (b) In the issuance of any well permit pursuant to this subsection (7), the provisions of subsection (4) of this section shall not apply. The provisions of subsections (1), (2), and (3) of this section shall apply; except that, in considering whether the permit shall issue, the requirement that the state engineer find that there is unappropriated water available for withdrawal and the six-hundred-foot spacing requirement in subsection (2) of this section shall not apply. The state engineer shall allow the

rate of withdrawal stated by the applicant to be necessary to dewater the mine; except that, if the state engineer finds that the proposed dewatering will cause material injury to the vested water rights of others, the applicant may propose, and the permit shall contain, terms and conditions which will prevent such injury. The reduction of hydrostatic pressure level or water level alone does not constitute material injury.

In the context of this section, the State Engineer considers CBM gas a mineral. As stated above, if ground water produced from a CBM well is determined to be nontributary, the amount of water claimed is not based on overlying land ownership. If nontributary ground water is produced to the surface and discharged, it may be subject to CWQCD regulation.

For water rights purposes, all ground water in Colorado is presumed to be tributary unless there has been a ruling by the water court or a permit issued by the State Engineer that ground water from a certain aquifer in a specific area is declared nontributary. Any beneficial use of tributary ground water is subject to section 37-90-137(1) and (2), CRS (2002). Any use of tributary ground water requires a well permit and a determination by the State Engineer as to whether or not the exercise of the requested permit will materially injure the vested water rights of others. Also, the requirement that the State Engineer find that there is unappropriated water available for withdrawal and the six-hundred-foot spacing requirement in subsection (2) of this section shall apply.

5.0 Conclusions

A rough assessment of the opportunities to use produced water from CBM wells is that they are limited at best. Much of the water is too poor in quality to be legally discharged. Because most basins are over-appropriated, senior water rights claims complicate the issue. Because water production rates from CBM wells decline as gas is produced, CBM wells are unreliable as long-term sources of water. In limited areas where produced water quality is sufficient and vested water rights owners would not be injured, there may be some opportunities for beneficially using water produced from CBM wells in the short term. Such opportunities are not without cost or legal and technical complication.

Due to the complex and overlapping regulatory authority of state agencies, many companies are collaboratively working with local residents, concerned citizens, and state agencies to mitigate and minimize impacts of CBM production. It has been only recently that the CDPHE, COGCC, and the CDWR have coordinated efforts to understand and minimize the conflicts in regulatory authority and decision-making. These efforts have resulted in many public awareness meetings with both the general public and legislative committees on oil and gas. New rules and regulations were adopted by the COGCC to clarify jurisdictional uses of CBM produced water. The state must continue to educate and communicate with citizens and industry representatives to understand the impacts of CBM development and the statutory and regulatory environment in which it occurs.