Non-Binding Arbitration initiated August 21, 2009

pursuant to

Decree of May 19, 2003, 538 U.S. 720

Kansas v. Nebraska & Colorado,

No. 126 Orig., U.S. Supreme Court

Report of David W. Barfield

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Kansas Department of Agriculture

Republican River Compact

Colorado Compliance Pipeline

Response to reports prepared on behalf of Colorado, dated May 24, 2010

June 22, 2010

I. Introduction and Qualifications.

From late 1992 until becoming Chief Engineer in 2007, a principal part of my professional work was dedicated to the study and assessment of the hydrology and water infrastructure of the Republican River Basin ("Basin"). Central to that work was my understanding of the Republican River Compact ("Compact"). This work engaged the many technical challenges of administering the Compact before, during, and after the litigation that produced the Final Settlement Stipulation of 2003 ("FSS"). As part of these duties, I was involved in all of the technical discussions related to the negotiation of the FSS, its Accounting Procedures, the RRCA Groundwater Model ("Model"), and all joint sessions of the various negotiation teams. After the adoption of the FSS, my work focused on implementing that agreement.

Since 2007, I have served as the Chief Engineer of the Division of Water Resources, Kansas Department of Agriculture. In that capacity, I have two principal duties. My first duty is that of a professional engineer specializing in water resources. This duty includes the analysis of water supplies, water resources management, surface water and groundwater hydrology, groundwater modeling, and the assessment of water structures. My second duty is that of the Chief Engineer. As Chief Engineer, I have the duty to administer and enforce the laws relating to water supply for the State of Kansas. These consist principally of the Kansas Water Appropriation Act, the four interstate compacts to which Kansas is a party, and numerous other laws and implementing regulations related to special water districts in Kansas, dams and dams safety, floodplain activities, and more. It is my duty to ensure that my administration of these laws and regulations accords with the realities of the State of Kansas—most importantly, the realities of its water supplies and of its water needs. As the Kansas commissioner to the Republican River Compact Administration ("RRCA"), I am responsible for all Compact-related matters. As a technical expert for Kansas leading up to and during the 1998-2003 litigation and settlement, and now as Chief Engineer, I have served in the administration of the Compact for more than fifteen years.

I have been involved in every facet of Kansas' work with the states of Colorado and Nebraska to resolve concerns with Colorado's proposed "Compact Compliance Pipeline" augmentation plan. This involvement includes an analysis of the expert reports submitted by Colorado in this arbitration.

This report summarizes my technical and administrative review of the Colorado Proposal as it was submitted to the RRCA in August, 2009 ("Colorado's RRCA Proposal"), and as it became the subject of this arbitration. This report rests upon my three areas of expertise. First, it rests upon my role as Compact Commissioner for Kansas. Second, it rests upon my expertise in administering the Compact, the FSS, and its Accounting Procedures. I necessarily follow the rules, tests, and procedures set forth by these documents, and apply facts to them, using my own expertise. Finally, it rests upon my expertise in evaluating the hydrology and water resources of the Basin.

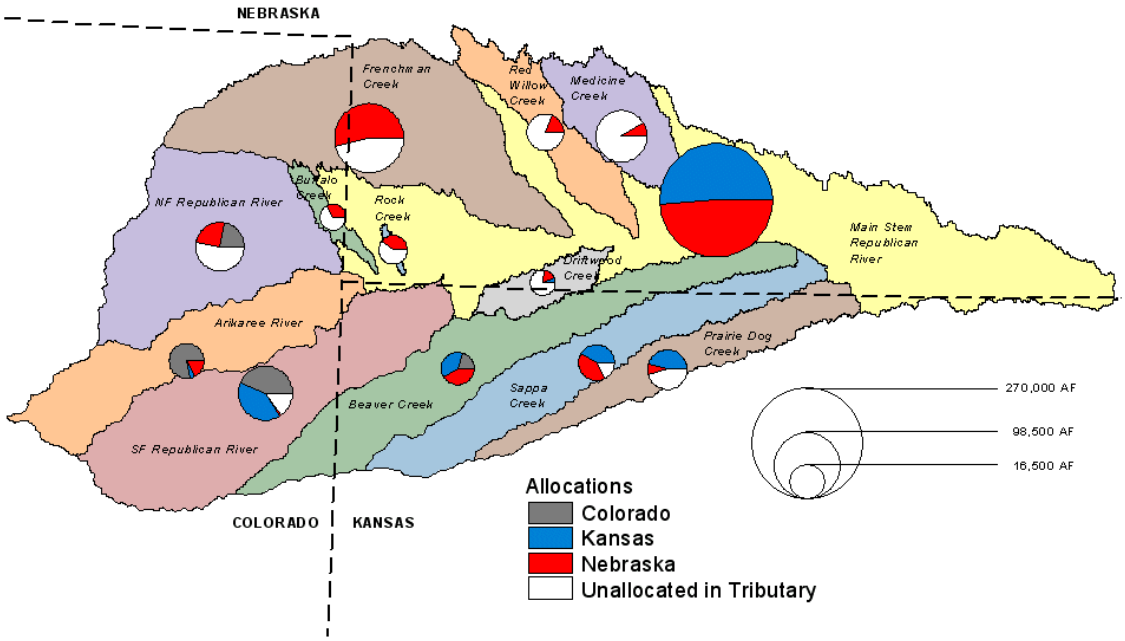
I must note that there are important inconsistencies between Colorado's RRCA Proposal and Colorado's most updated version of that proposal, based on Mr. Wolfe's and Mr. Slattery's reports and their depositions. Throughout this Report, I will refer to this latter proposal as "Colorado's Arbitration Proposal," to distinguish it from Colorado's RRCA Proposal of August,

2009. (I will refer to the Colorado augmentation plan generally as "Colorado's Proposal.") Colorado's updates apparently derive from the May 5, 2010 stipulation with Nebraska and from a partial response to Kansas' concerns. Colorado has refused to provide Kansas with a copy of this stipulation. Thus neither I nor the other Kansas experts have been able to review the most updated version of Colorado's Proposal: there is no comprehensive document that sets forth Colorado's current and still-evolving plan. I will comment on these changes in a general way. However, these comments must be viewed as preliminary, in light of Colorado's failure both to produce the stipulation with Nebraska and to update its proposal accordingly.

II. Administering the Compact: the basics of quantification and allocation.

Essentially, the Compact is an allocation framework for the water supply of the Basin. Article III of the Compact determines the Basin's water supply by sub-basin and the main stem Republican River, and Article IV allocates that supply, again by sub-basin and to the main stem in Nebraska and Kansas. Figure 1 illustrates the Compact's allocation framework. For each sub-basin, states are allocated a quantity of water from that sub-basin's total supply. In all but two sub-basins, a portion of the water supply is known as "unallocated water" – a quantity of water that is unallocated to a particular sub-basin. However, this "unallocated water" is in fact allocated—it is reserved for use in the main stem, which flows through Nebraska and Kansas. See Figure 1 below for a graphic summary of the Compact's Allocations.

Figure 1 - Republican River Compact Allocations



At the time of its approval in 1943, the Compact's quantification of the water supply of the Basin was based on limited records. The framers of the Compact compensated for this known deficiency by including, in Article III, a provision for adjusting each State's allocations in proportion to the actual water supply that the States determined to be available for any

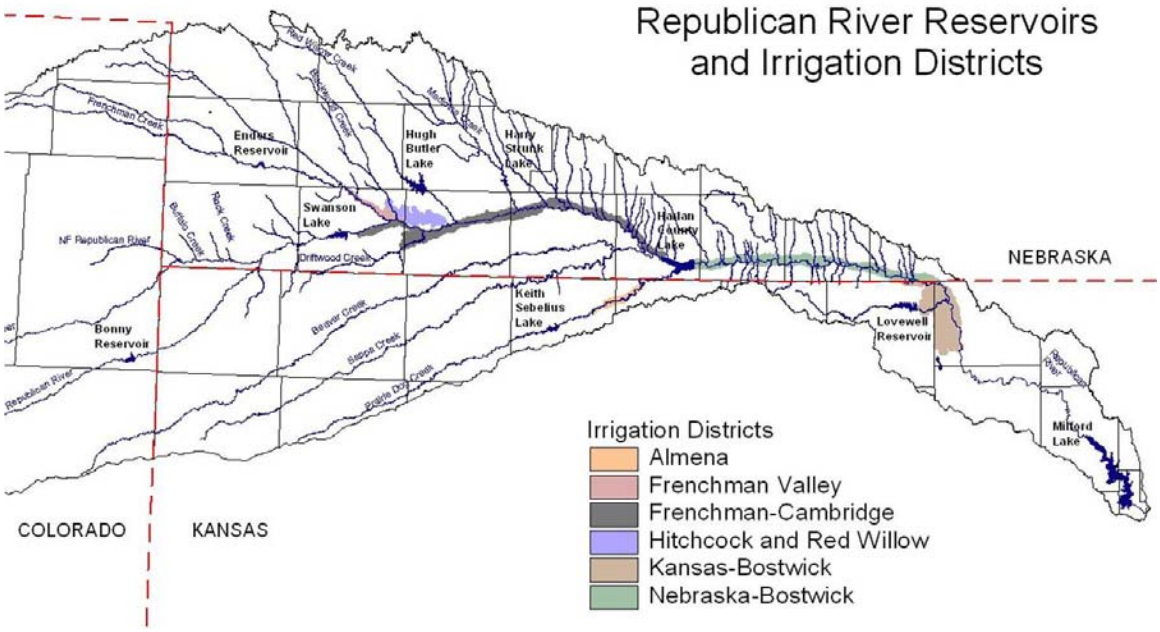
particular year. By this provision, the Compact's allocations are accurately translated into percentages of the annual determined water supply of each sub-basin and of the main stem. Attachment 1 to this report, which is Table 2 from the Republican River Compact Administration's Accounting Procedures, tabulates the original allocations as well as these percentages. (See Attachment 1, "RRCA Accounting Procedures, Table 2").

The allocations for the South Fork Republican River ("South Fork") are pertinent to the issues addressed later in this report. In 1943, the water supply of the South Fork sub-basin was determined to be 57,000 acre-feet per year. Of that sub-basin total, 25,400 acre-feet was allocated to Colorado, 23,000 acre-feet was allocated to Kansas, 800 acre-feet was allocated to Nebraska, and 8,000 acre-feet was "unallocated"—that is, reserved for use in the main stem of the Republican River downstream by Kansas and Nebraska. (Because the main stem does not flow through Colorado, Colorado has no share in the main stem's water supply.) Through the provision set forth in Article III of the Compact, these numbers were translated into percentages. As a result, in any given year, Colorado is allocated 44.4% of the water supply of the South Fork sub-basin, while Kansas is allocated 40.2%, Nebraska 1.4%, and the remaining 14.0% is "unallocated."

III. Post-Compact development.

After the ratification of the Compact by the States and Federal government, much of the planned federal system of reservoirs and irrigation districts was developed (see Figure 2 below). The need to protect the federal government's investments in water-supply infrastructure was a principal reason behind the Compact. *See* Statement of Mr. Robert D. Kutz, Project Manager for the Bureau of Reclamation ("Bureau"), 29th Annual Report of the RRCA, p. 14 (1989), *available at* http://dnrdata.dnr.ne.gov/download/RRCA/Annual_Reports/RRCA_1988.pdf (last accessed June 20, 2010). The Compact explicitly provides that federal surface water development in each State be charged to that state's respective allocation. Compact, Art. XI (a).

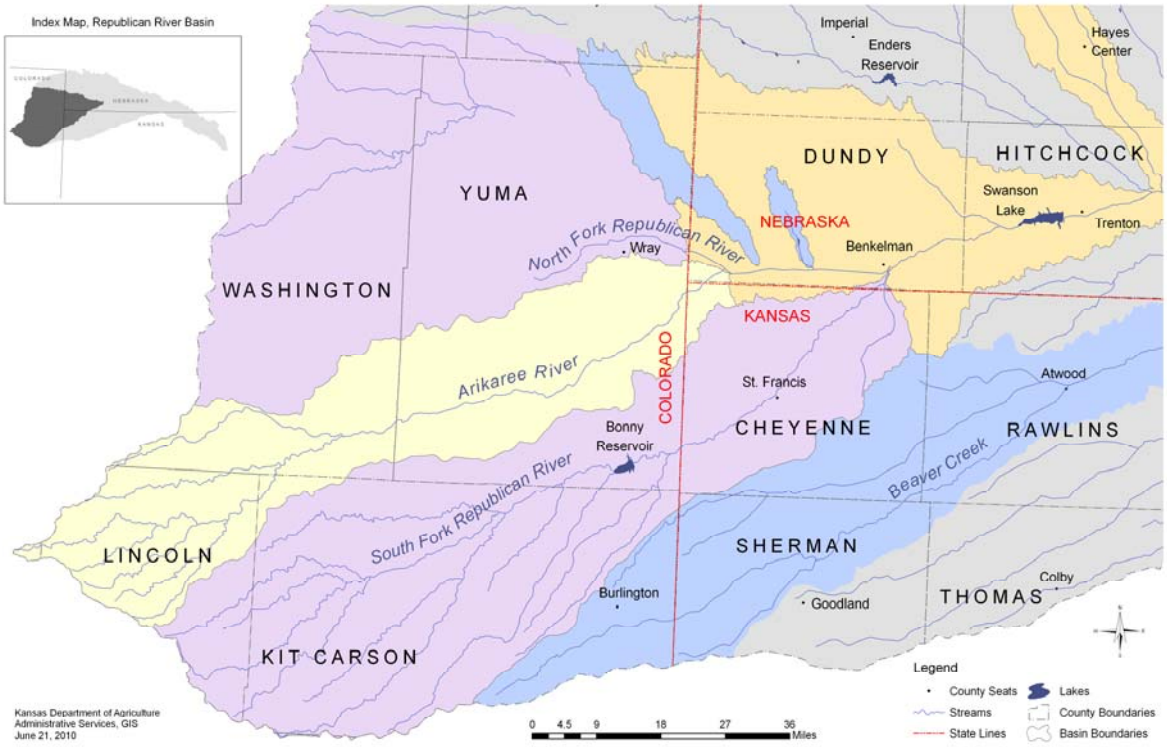
Figure 2 - Republican River Reservoirs and Irrigation Districts



While the limited groundwater use at the time of Compact negotiations was included in the determination of the original virgin water supply, and its use was a part of the allocations, the extent of groundwater development was not fully anticipated. Shortly after the signing of the Compact, center-pivot groundwater irrigation was invented in the Basin: Frank Zyback, a native of Columbus, Nebraska, installed his first systems near Strasburg, Colorado, during the late 1940's. The Court has made it clear that groundwater is part of the "Virgin Water Supply" of the Basin, insofar as it contributes to streamflows. *Kansas v. Nebraska and Colorado,* No. 126 Orig., First Report of the Special Master (Subject: Nebraska Motion to Dismiss); 530 U.S. 1272 (2000); FSS Section I.9. The Compact clearly placed the burden on each State to limit its consumptive use to its Compact allocation, regardless of whether the consumptive use derived from surface waters or groundwater which contributed to surface water flows. The depletion of stream flows caused by groundwater pumping is a physical process that has been well understood for many decades, and has been quantified and applied to the Basin using the methods agreed upon by the States, as is further described below.

As is shown in Figure 3 below, Kansas shares the South Fork sub-basin with Colorado, and that sub-basin extends very slightly into Nebraska, just before its confluence with the main stem Republican River.

Figure 3 - Republican River Basin above Swanson



The South Fork sub-basin has been extensively developed. Colorado's development includes extensive groundwater pumping in the Ogallala Aquifer (which discharges into the South Fork primarily above Bonny Reservoir), Bonny Reservoir, and limited pumping from the alluvial aquifer.

Like the other states, Colorado allowed very significant groundwater development within the Basin. According to Colorado's records, approximately 550,000 acres in Colorado's portion of the Basin are irrigated from groundwater. (Expert Report of James E. Slattery, May 24, 2010, p. 10). Due to extensive development above Bonny Reservoir, inflows into Bonny Reservoir and into Kansas have declined significantly. Figure 4 shows the inflows into Bonny Reservoir according to records of the U.S. Bureau of Reclamation ("Bureau"). Figure 5 shows the reservoir storage content, also according to the records of the Bureau. As a result of these extensive depletions, Bonny has become increasingly less viable for its authorized purposes, to the point where it has elicited the concern of the Bureau. (See Attachment 2, Letter from the Bureau of Reclamation to Mr. Wolfe, November 29, 2007).

Figure 4 - Historical Inflows into Bonny Reservoir from 1929 to 2009

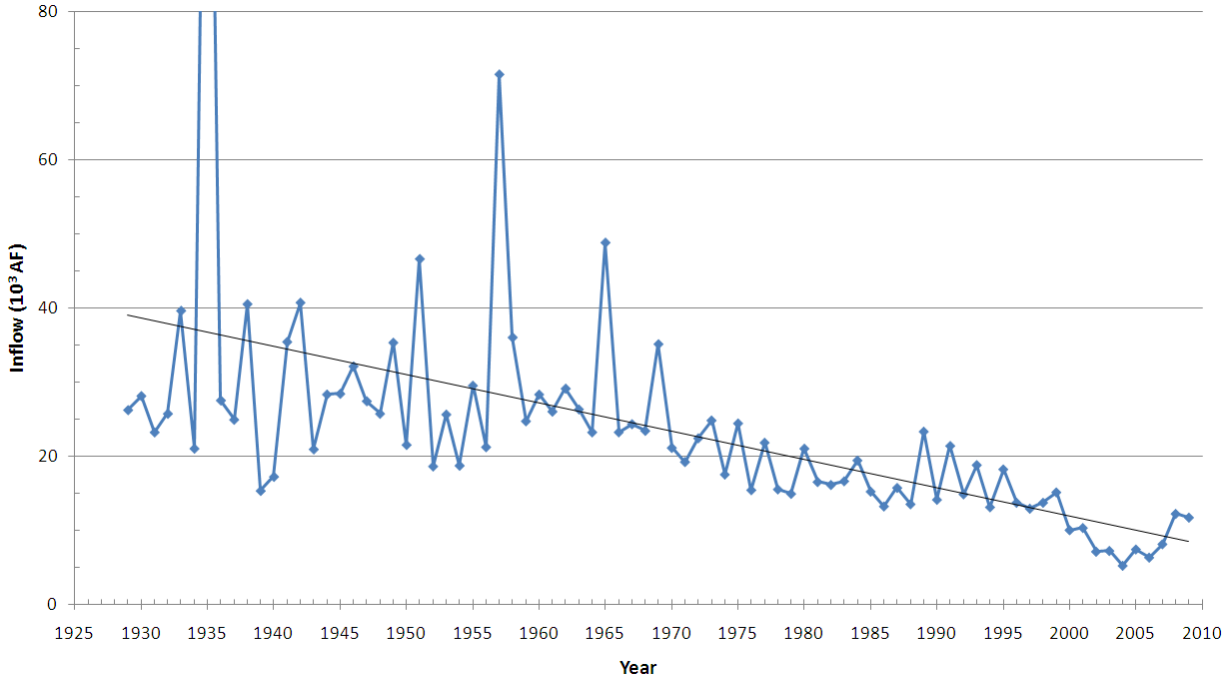
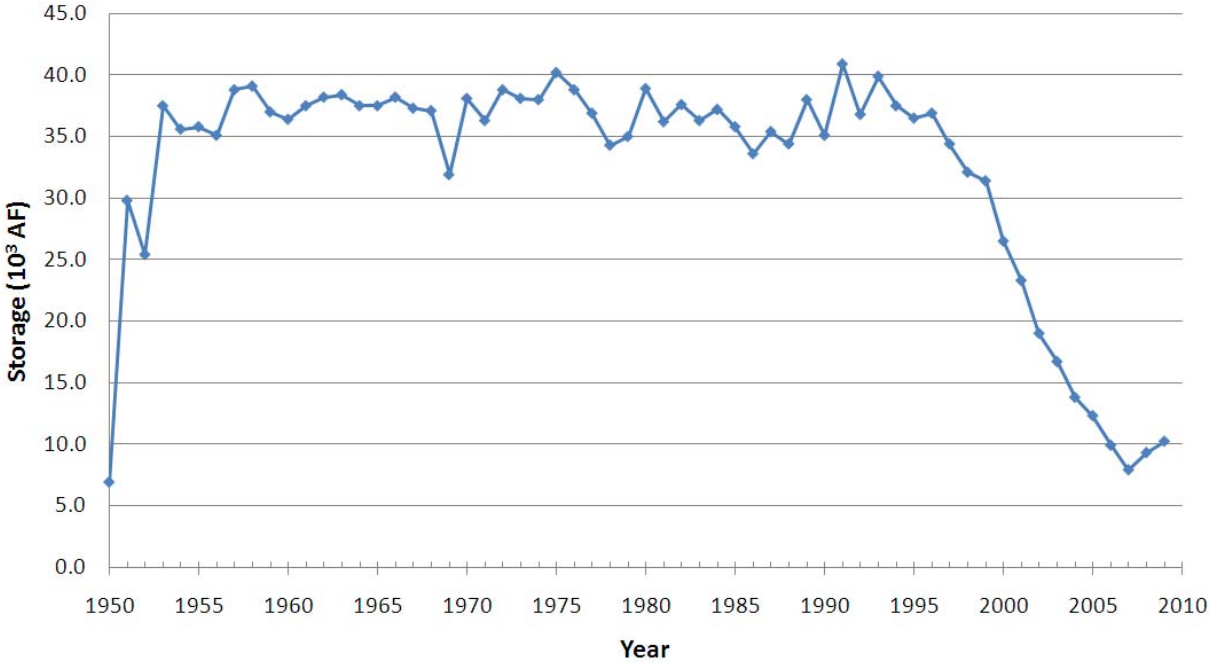


Figure 5 - Bonny Reservoir Year End Storage Content from 1950 to 2009



IV. The Final Settlement Stipulation (FSS).

During the course of the U.S. Supreme Court litigation begun by Kansas in 1998, Kansas accepted Nebraska's invitation to employ the combined technical expertise of all three States, and cooperate to produce a comprehensive settlement of their concerns. This settlement is the FSS. Through the FSS, the States agreed upon the details of how the Compact would be administered. Special Master McKusick hailed the FSS as a superior resolution of the controversies surrounding the Compact. By pooling their collective expertise to measure and to model the waters of the Basin, and by cooperatively establishing the procedures by which the Compact would be administered, the States, through the FSS, achieved a result that was vastly more comprehensive and more accurate than any resolution that litigation could have produced by itself. (*Kansas v. Nebraska & Colorado,* No. 126 Orig., Second Report of the Special Master, April 15, 2003, pp. 48, 74-77).

The FSS, its Accounting Procedures, and the Model comprise the jointly developed, detailed, and agreed-upon rules and methods for the administration of the Compact. Some of the most important rules address both the unique situations of particular states and their need for flexibility, as long as that flexibility was consistent with the Compact's terms. The FSS accomplishes such flexibility by rules that apply depending on the result of a particular test of compliance. The general statewide test for compliance is set forth in Section IV.A of the FSS and Table 3 of the Accounting Procedures. The rules governing sub-basin accounting and compliance are set forth in Section IV.B of the FSS and Table 4 of the Accounting Procedures. And the water-short year tests are set forth in Section V of the FSS and Table 5 of the Accounting Procedures.

The rules governing sub-basin accounting and compliance, which protect Kansas' South Fork sub-basin allocation, are a major reason why Kansas rejected the Colorado Proposal at the RRCA meeting in August, 2009. Under these rules, a State can use its specific sub-basin allocation. A state can also use the "unallocated water" for that sub-basin, provided that it under-uses its specific allocations elsewhere in the Basin to meet the statewide test. But that State cannot use a downstream State's specific sub-basin allocation. This test is done on a 5 year average basis. (FSS Section IV.B. and Appendix C, Tables 4A, 4B, 4C.)

Appendix A-1 of Mr. Book's expert report shows the detailed data underlying the sub-basin compliance test for Colorado. Kansas has similar tests for its sub-basins. The 5-year averages in the column labeled "Available Supply – CBCU" represent the sub-basin test. As is shown in the table, Colorado is failing this test of compliance in the South Fork sub-basin. Colorado's South Fork overuse has important implications for Colorado's Proposal, as discussed in Section V below. The last column in the table, labeled "Allocation – CBCU", has been added by Kansas. It compares Colorado's specific sub-basin allocation with its use of water in that sub-basin. As is shown, Colorado is currently overusing its specific allocations on both the South Fork and North Fork Republican River ("North Fork").

V. The Augmentation provisions of the FSS.

The FSS contains a limited number of particulars related to augmentation, and the RRCA Accounting Procedures are silent on the matter. Below is a complete recitation of the FSS's provisions on augmentation:

III. Existing Development ; B. Exceptions to Moratorium on New Wells

> III.B.1.k Wells acquired or constructed by a State for the sole purpose of offsetting stream depletions in order to comply with its Compact Allocations. Provided that, such Wells shall not cause any new net depletion to stream flow either annually or long-term. The determination of net depletions from these Wells will be computed by the RRCA Groundwater Model and included in the State's Computed Beneficial Consumptive Use. Augmentation plans and related accounting procedures submitted under this Subsection III.B.1.k. shall be approved by the RRCA prior to implementation.
>
> IV Compact Accounting ; A. RRCA Accounting Procedures
>
> IV. A. The States will determine Virgin Water Supply, Computed Water Supply, Allocations, Imported Water Supply Credit, augmentation credit and Computed Beneficial Consumptive Use based on a methodology set forth in the RRCA Accounting Procedures, attached hereto as Appendix C.
>
> IV Compact Accounting ; H. Augmentation Credit
>
> IV. H. Augmentation credit, as further described in Subsection III.B.1.k., shall be calculated in accordance with the RRCA Accounting Procedures and by using the RRCA Groundwater Model.

Based on my involvement in the development of the FSS and use of the FSS in administering the Compact for the State of Kansas, these subsections concerning augmentation plans make three things clear. First, the express purpose of augmentation plans is "for the sole purpose of offsetting stream depletions in order to comply with its Compact Allocations." Specifically, a State that proposes an augmentation plan may be allowed to use groundwater to obtain an offset, or credit, which compensates for its overuse of its allocation under the Compact and FSS. Therefore, such augmentation credits must be limited to the State's overuse of its allocations.

Second, augmentation plans are extraordinary means by which a state could achieve compliance. Without an augmentation plan, additional flows reaching a gage would simply increase the water supply of that subbasin, and the states would share in the increase of allocations accordingly. By contrast, water that is delivered under an approved augmentation plan is treated much differently: the augmenting state receives a credit against its excess depletions.

Finally, the States are free to approve or disapprove, at their discretion, a particular augmentation plan according to its merits.

It needs to be stressed that neither the RRCA Accounting Procedures nor the Model currently contain methods for calculating augmentation credits. Because the RRCA administers the Compact, the FSS requires that the States agree upon how these credits would work within the Accounting Procedures and the Model, prior to the implementation of any particular augmentation plan. At minimum, the FSS requires credits for augmentation to be determined using the Model, because these credits relate exclusively to groundwater: they derive solely from the pumping of groundwater, and they are used to offset a state's overuse of its allocations as expressed in terms of depletions to streamflow.

VI. The Specific Inadequacies of the Colorado Compliance Pipeline Proposal.

A. *Colorado has not addressed Kansas' longstanding concerns.*

Since it was first provided with some of the specifics of the Colorado's augmentation plan in March 2008, Kansas has worked with Colorado and Nebraska to resolve the plan's inadequacies. For example, on April 29, 2008, I sent an e-mail to both Colorado and Nebraska articulating Kansas' initial opinions of how Colorado's augmentation plan should be incorporated into the RRCA's methods for modeling and accounting. This e-mail included detailed attachments that contained substantial modeling work. (See Attachment 3, E-mail of David Barfield to Dick Wolfe, April 29, 2008.) During subsequent negotiations among the states, Kansas articulated its major concerns, as detailed below. As late as November, 2009— three months after Colorado had initiated arbitration in this matter—Kansas provided Colorado with an explanation of its objections and concerns. (See Attachment 4, letter of David Barfield to Dick Wolfe, November 30, 2009).

In June, 2008, the States entered into a confidentiality agreement regarding their discussions of the Colorado Proposal. (See Attachment 5, "Agreement Re: Discussions [of the Colorado Proposal]," June, 2008). While that agreement prevents me from revealing the specific contents covered by that agreement, significant discussions regarding the Colorado Proposal took place where Kansas made its concerns known, and provided Colorado with numerous analyses and counter-proposals. Mr. Wolfe's report states that Colorado has worked hard to respond to these concerns. Unfortunately, Colorado has failed to substantively address them.

B. *The Colorado Proposal contains three long-standing and principal flaws.*

i. The Colorado Proposal does not follow the Model and the Accounting Procedures of the FSS.

The FSS requires that the Model be used to determine the "Augmentation Credit." As detailed in Mr. Larson's report, Colorado's Proposal must be rejected because at best, it only partially considers the reality of how augmentation flows operate according to the Model. While the Colorado RRCA Proposal does include groundwater pumping from its proposed augmentation wells in the Model, it fails to include the augmentation outflows in the Model. This pumped groundwater is added to the surface system of the Basin to offset or replace excessive stream depletions by Colorado. This addition operates similarly to groundwater baseflows in the system; consequently, the Model is the appropriate mechanism by which to assess the impacts of these augmentation outflows, as the outflows move downstream from the Colorado-Nebraska stateline and interact with the underlying groundwater. As a result, Colorado's Proposal is incomplete and does not conform to the FSS' requirements and the Model.

Colorado's failure to incorporate its proposed augmentation outflows within the Model has the practical effect of allowing Colorado's "negative pumping impacts" in the reach of the North Fork just below the Colorado-Nebraska state line to continue to grow in the future. These negative pumping impacts act as a credit against Colorado's consumptive use. While Kansas and Nebraska agreed to a certain level of these credits, their continued future growth would not occur if these outflows were included in the Model, or if Colorado achieved compliance the conventional way-- by reducing its excessive groundwater pumping. Further, these increases in negative pumping impacts reduce the main stem Republican River computed water supply estimates, and thus reduce Kansas' allocation of the main stem supply.

Unfortunately, neither the Colorado RRCA Proposal nor the Colorado Arbitration Proposal has addressed the problem. See Mr. Larson's report for more detail on why the augmentation flows should be included in the Model.

ii. North Fork accounting credits must be limited to protect Kansas' sub-basin allocations on the South Fork.

As a result of its significant development, Colorado is overusing its South Fork sub-basin allocation by nearly 6,000 acre-feet per year. Its overuse includes nearly 2,500 acre-feet per year of Kansas' specific allocation (See Report of Mr. Book, Appendix A-1). Kansas cannot accept an augmentation plan that allows Colorado to replace its South Fork overuse on the North Fork, particularly Kansas' specifically allocated share. The Colorado proposal does not address Colorado's failure to meet its sub-basin obligations to Kansas on the South Fork.

Mr. Wolfe's report twice mischaracterizes or mistakes the intent of Kansas' position. First, Mr. Wolfe states, "Kansas has expressed concern that the AWS will be delivered to the North Fork of the Republican River but will be 'credited' against stream depletions in the South Fork of the Republican River sub-basin for the purpose of the sub-basin non-impairment requirement." (Wolfe Report, p. 8). Mr. Wolfe's statement does not address Kansas' concern. Kansas has never expressed the concern that Colorado would include North Fork water on the South Fork accounting (in Table 5 of the Accounting Procedures), as Mr. Wolfe incorrectly presumes. Rather, Kansas objects to the lack of limits on what Colorado can deliver for credit on the North Fork, particularly with respect to Colorado's overuse of its South Fork sub-basin allocation.

Both Mr. Wolfe and Mr. Slattery stated at deposition that Colorado will not deliver Kansas' specific allocations on the South Fork for credit on the North Fork. (Rough Draft of Deposition of Dick Wolfe, June 17, 2010, at 67; Rough Draft of Deposition of James Slattery, June 17, 2010, at 167.) However this assurance is not part of Colorado's RRCA Proposal. There must be an express condition to this effect in Colorado's Proposal.

Second, the Wolfe Report contains a section entitled "Colorado cannot and should not be required to replace depletions in exact time, location and amount." (Wolfe Report, pp. 11-12). This section significantly overstates the Kansas position on such replacement requirements. Kansas believes that augmentation credits, as Colorado proposes here, should be directly tied to the location and amounts of a State's overuse, and that replacements should occur only a timely basis. A further review of the Kansas position on replacements shows that position to be reasonable, and not the caricature that Mr. Wolfe describes.

Kansas has not argued for replacement of depletions in "exact time, location, and amount" as Mr. Wolfe's report alleges. Regarding timing, Kansas does not seek the instantaneous replacement of Colorado overuse; instead, Kansas envisions annual limits on credits, working with the 5-year compliance requirements. Kansas recognizes that some degree of flexibility is required in this area. However, since 4 of the 5 accounting years are known going into any year, and since the effects of Colorado's groundwater pumping and groundwater depletions are relatively predictable, this annual replacement requirement is not as challenging a task as it might first appear. In any event, Colorado cannot be allowed to significantly over-replace its overuse during wet periods and under-replace its overuse in the critical dry periods. (See also Section VI.B.iii below.) Regarding the amount of replacements, Kansas believes that

augmentation credits should be directly related to the status of Colorado's overuse under the Compact. Regarding location, Kansas remains willing to allow Colorado a degree of flexibility in selecting a location for replacements, as long as such a location is consistent with the FSS and Kansas' current and future needs in the South Fork sub-basin.

Thus, the central issue here is whether and to what degree Colorado should be able to replace its South Fork depletions in its North Fork pipeline. The more flexibility that is provided to Colorado, the more the South Fork flows will be impacted in the future. Given the extensive impacts that have already occurred in that sub-basin, Kansas cannot support a plan that allows Colorado to continue to dry up the South Fork, to the detriment of the citizens of Kansas.

Rather than place reasonable limits in its plan to address Kansas' concerns, the Colorado Proposal would allow Colorado to achieve statewide compliance by over-replacing water on the North Fork, and would require Kansas to prove its injury on the South Fork. The need to limit augmentation credits is especially important given Colorado's apparent plans to add additional water supply. Compared to earlier versions of its augmentation proposal, the Colorado Proposal seeks to obtain approval to deliver up to 25,000 acre-feet for credit at the North Fork stateline—significantly more than is currently required for compliance. Given such an amount, the vague limitations contained in the Colorado proposal are inadequate.

Mr. Wolfe's report and Mr. Slattery's reports, as clarified by their depositions, state that Colorado is committed to reducing its consumptive use to comply with the Compact. (See, for example, Rough Draft of Deposition of Dick Wolfe, June 17, 2010, at p. 59.) Unfortunately, such reductions have not yet occurred, and the Colorado Proposal does not contain any such commitment. Kansas has suggested that Colorado consider extending its North Fork pipeline into the Kansas portion of the South Fork sub-basin as one way to address this concern, but Colorado has not responded to this suggestion.

Regardless how Colorado achieves compliance on the South Fork, reasonable and clear limits on the amount of water that Colorado can deliver for credit on the North Fork must address this issue. At a minimum, Kansas' interest in the waters of the South Fork sub-basin extends to its specifically allocated waters and to its share (51.1%) of the "unallocated waters" of the South Fork.

iii. The operational limitations of Colorado's Proposal are ineffective.

Mr. Wolfe states that Colorado will "try to make deliveries as close as possible to the needed amount." (Wolfe Report, pp. 9-10). Yet the limitations set forth in the Colorado RRCA Proposal are insufficient to require such deliveries on a reliable basis, and instead leave those deliveries to Colorado's discretion. As detailed in Mr. Book's report, the Colorado RRCA Proposal allows the over-delivery of water in some years and the bare minimum of delivery in others. The Colorado RRCA Proposal's "projected deliveries" are not based on any projection of the status of Colorado's compliance; rather, those "projected deliveries" are only a cap on deliveries.

Kansas had suggested means to allow Colorado to project and to deliver water, based on actual values of un-replaced overuse for the first 4 of 5 years, and a forecast of water necessary for compliance in year 5. The Colorado RRCA Proposal does not adopt this suggestion, choosing instead to continue with its flawed approach, except that it includes 4,000 acre-feet per year minimum delivery. In Mr. Slattery's deposition, he described a methodology

by which Colorado could develop a "projected delivery" similar to Kansas' suggestions. (Rough Draft of Deposition of James Slattery, June 17, 2010, pp. 163-167.) However, this "projected delivery" approach differs fundamentally from what is contained in the Colorado RRCA Proposal. If Colorado is committed to resolving the problem of over-deliveries on the North Fork and addressing Kansas' other South Fork concerns, then it needs to amend its proposal accordingly. More detail on this issue is found in Mr. Book's expert report.

C. *The Colorado Expert Reports reveal four additional problems with the Colorado Proposal.*

i. The Colorado Proposal lacks any temporal limits.

The Colorado Proposal lacks any temporal limits. It contains no provision for future review of the augmentation plan, and it contains no time limits on the term of the augmentation plan's operation. The Ogallala aquifer of eastern Colorado is the source of the Colorado Proposal's augmentation water supply, but that source is finite and exhaustible. Given the extremely low rate of recharge in Colorado's portion of the Ogallala, the Colorado Proposal essentially plans to continue the aggressive mining of groundwater from an already regionally declining aquifer. Attachment 6, one of an ongoing series of publications by the U.S. Geological Survey on changes to Ogallala Aquifer water levels, clearly illustrates that this source of augmentation water is in regional decline. (See Attachment 6, "Fact Sheet 2009-3005," U.S. Geological Survey.) Water levels in this portion of the aquifer have historically declined, and the diversions identified in the Colorado Proposal will accelerate that decline. Ultimately, these continued declines will physically restrict Colorado's ability to supply augmentation water. While this portion of the aquifer has a significant "life-span" of water remaining in it, that supply is not sustainable. (See the Report of Mr. Larson.)

Given the RRCA's lack of experience with any augmentation plan, and given the potential for conditions in the Basin to change, Colorado's Proposal must require a periodic review. As Colorado has made clear, its leases of surface water and the loans that will enable Colorado's Proposal to proceed are based on twenty year terms. (Rough Draft of Deposition of Dick Wolfe, June 17, 2010, pp. 26-32). Thus, it seems reasonable to require periodic review of the augmentation plan by the RRCA twenty years after the plan's implementation.

It concerns me, in view of the ongoing depletion of the Ogallala Aquifer and the depletion of streamflows due to Colorado's irrigation of 550,000 acres from groundwater, that Colorado has not addressed the issue of its over-pumping in its plans to achieve compliance. Instead, Colorado's Proposal proposes to facilitate the ongoing, aggressive depletion of this finite and non-replenishable supply of groundwater. A periodic review will allow the States to investigate whether the Colorado proposal truly augments the water supply of the Basin sufficiently to offset depletions over the long term, as required by the FSS.

ii. Colorado's proposed changes to the Accounting Procedures require full review by the States.

The States have not conducted a detailed review of Colorado's proposed changes to the Accounting Procedures. In my view, there is significant additional work to do in this regard, to ensure that the Colorado Proposal fully conforms to the language and methods of the Accounting Procedures, including those changes to Colorado's Proposal that Colorado's

experts have offered in their expert reports and their depositions. Every augmentation plan is unique. That is why each and every augmentation plan must be approved separately by the RRCA. That is also why Kansas has insisted that the accounting terms and other elements of Colorado's Proposal be specific and limited to the augmentation plan set forth by that proposal alone, and not reach beyond it. For example, rather than proposing a generic accounting term for augmentation water supply, or "AWS," the term denoting augmentation water supply under Colorado's Proposal must be limited to that proposal, such as "Colorado North Fork augmentation water supply," or a term to that particular and specific meaning and effect. Moreover, an additional table in the Accounting Procedures may be helpful to ensure and to clarify where and how this augmentation water will be applied to the various tests of compliance under the FSS. The Accounting Procedures must fully specify the Model runs to be completed and details on how limits on deliveries for augmentation credit will be determined and documented.

iii. Colorado's "catch-up" provisions are inadequate.

Mr. Wolfe's report defends the lax operational limitations of the Colorado Proposal on the grounds that Colorado needs flexibility to "catch up" with its past overuse of its allocations. (Report of Mr. Wolfe, p. 9). A "catch up" provision has not been the subject of any sustained discussion among the States prior to this arbitration. Colorado has not included any detail in its Colorado RRCA Proposal. Such a provision must be distinct from the normal compliance requirements, and it must be clearly articulated in the augmentation plan and its associated documents.

iv. Colorado must explain the reasons for its increase in augmentation water to 25,000 acre-feet per year.

Colorado added language to its RRCA Resolution that would allow its augmentation to increase to the level of 25,000 acre-feet per year. This increase is vastly in excess of Colorado's current state of noncompliance. Any plans to expand the water supply must be separately approved by the RRCA.

VII. The Colorado Proposal has important ramifications for Kansas.

Other than the South Fork issue, the Wolfe Report does not recognize the consequences of Colorado's Proposal for Kansas. For example, Mr. Wolfe writes that because the North Fork flows from Colorado to Nebraska, Kansas is not directly affected by water deliveries into Nebraska. (Wolfe Report, p. 12). As I have elaborated in this report, Kansas will be affected by such an augmentation plan, both directly and indirectly, and so Kansas has numerous reasons to be concerned with the Colorado Proposal in its present form.

It bears repeating that the Colorado Proposal does nothing to address Colorado's noncompliance on the South Fork. Moreover, Colorado is seeking to obtain accounting credits that would offset its South Fork overuse under the statewide test of compliance.

The Compact allocates to Kansas 51.1% of water supply of the main stem Republican River. This water is derived from both the main stem's supply as well as the sum of all of the "unallocated water" of the Basin. Thus, any water delivered by Colorado to Nebraska under Colorado's Proposal will be part of that main stem supply. As a result, Kansas has a real and

vital interest in this water, especially in light of the almost certain fact that Nebraska will be fully using its allocation in critical, dry periods of limited water supply.

VIII. Conclusion.

In this Report, I have sought to explain Kansas' seven objections to Colorado's Proposal.

Kansas has three longstanding and principal objections to Colorado's Proposal. First, as a proposal that envisions moving pumped groundwater out of Colorado to offset depletions of groundwater in Colorado, the Colorado Proposal must be placed fully within the Model. To propose otherwise is inconsistent with existing treatment of the flows the augmentation plan seeks to replace. Second, by failing to include substantive limits to the credits it can accumulate on the North Fork, Colorado's Proposal effectively allow a permanent state of overuse, by replacing its South Fork overuse on the North Fork, thus depriving Kansas of its right to develop its full entitlement. Third, Colorado's RRCA Proposal lacks effective operational limits.

Colorado's expert reports and the depositions of its experts have revealed four additional problems with Colorado's Proposal. Fourth, the proposal lacks any temporal limits, despite the finite and diminishing supplies of the source of water upon which it is based. Fifth, Colorado's proposed changes to the Accounting Procedures require full review by the States. Sixth, Colorado's "catch-up" provisions are inadequate. And seventh, Colorado must obtain approval from the RRCA to increase its augmentation water to 25,000 acre-feet per year.

In the end, Colorado's Proposal remains incomplete—even as modified by the Colorado experts during the course of this proceeding. The necessary modifications must address Kansas' objections and concerns, and they must be fully integrated into a new proposal. Indeed, the fact that Colorado continues to modify its plan in response to input from the States demonstrates why it is imperative for the RRCA to work through the technical issues that Colorado's Proposal presents. As Kansas has earlier asserted, the bigger issue in the arbitration remains the effect of Subsection III.B.1.k of the FSS, which states that the RRCA shall approve augmentation plans and related accounting procedures prior to their implementation. If a state can ignore the FSS' requirement that the RRCA approve augmentation plans prior to their implementation, and use the FSS' dispute resolution procedures to impose the terms of augmentation plans, then Kansas will have lost its ability to protect its waters under the FSS and the Compact itself. That is a matter of the highest concern.

Kansas remains willing to work with the other states to accomplish an augmentation plan that is consistent with the Compact, the FSS, the Accounting Procedures, and the RRCA Groundwater Model. But Kansas cannot accept the Colorado Proposal in its current form. Kansas urges Colorado to resolve these issues.

List of attachments:

1. Attachment 1, "RRCA Accounting Procedures, Table 2."
2. Attachment 2, Letter from the Bureau of Reclamation to Mr. Wolfe, November 29, 2007.
3. Attachment 3, E-mail of David Barfield to Dick Wolfe, April 29, 2008.
4. Attachment 4, David Barfield letter to Dick Wolfe, November 30, 2009.
5. Attachment 5, "Agreement Re: Discussions [of the Colorado Proposal]," June, 2008.

6. Attachment 6, “Fact Sheet 2009-3005, Changes in Water Levels and Storage in the High Plains Aquifer, Predevelopment to 2007,” U.S. Geological Survey.

Table 2: Original Compact Virgin Water Supply and Allocations

Designated Drainage Basin	Virgin Water Supply	Colorado Allocation	% of Total Drainage Basin Supply	Kansas Allocation	% of Total Drainage Basin Supply	Nebraska Allocation	% of Total Drainage Basin Supply	Unallo-cated	% of Total Drainage Basin Supply
North Fork - CO	44,700	10,000	22.4			11,000	24.6	23,700	53.0
Arikaree River	19,610	15,400	78.5	1,000	5.1	3,300	16.8	-90	-0.4
Buffalo Creek	7,890					2,600	33.0	5,290	67.0
Rock Creek	11,000					4,400	40.0	6,600	60.0
South Fork	57,200	25,400	44.4	23,000	40.2	800	1.4	8,000	14.0
Frenchman Creek	98,500					52,800	53.6	45,700	46.4
Driftwood Creek	7,300			500	6.9	1,200	16.4	5,600	76.7
Red Willow Creek	21,900					4,200	19.2	17,700	80.8
Medicine Creek	50,800					4,600	9.1	46,200	90.9
Beaver Creek	16,500	3,300	20.0	6,400	38.8	6,700	40.6	100	0.6
Sappa Creek	21,400			8,800	41.1	8,800	41.1	3,800	17.8
Prairie Dog Creek	27,600			12,600	45.7	2,100	7.6	12,900	46.7
Sub-total Tributaries	384,400							175,500	
Main Stem + Blackwood Creek	94,500								
Main Stem + Unallocated	270,000			138,000	51.1	132,000	48.9		
Total	478,900	54,100		190,300		234,500			

7-1596B (9-89)
Bureau of Reclamation

ATTACHMENT 2

United States Department of the Interior

BUREAU OF RECLAMATION
Great Plains Region
Nebraska-Kansas Area Office
P.O. Box 1607
Grand Island, Nebraska 68802-1607

TAKE PRIDE IN AMERICA

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NOV 29 2007

Dick Wolfe, State Engineer
State of Colorado
1313 Sherman Street, Room 818
Denver, CO 80203-2277

Subject: Written Comments, Rules and Regulations – Republican River Basin in Colorado – Armel Unit, Upper Republican Division, Pick-Sloan Missouri River Basin Program, Colorado

Dear Mr. Wolfe:

Enclosed are our general and specific review comments which are being provided for your consideration in response to the draft "Rules and Regulations Governing the Diversion, Use, and Control of Water Resources in the Republican River Basin in Colorado for Compliance with the Republican River Compact" dated September 24, 2007.

Reclamation is aware of the fact that Colorado, like Nebraska, has not been in compliance with the Republican River Compact Settlement provisions since groundwater use was first included in 2003. Non-compliance by Colorado not only hurts Nebraska and Kansas, but also Reclamation projects interests. The primary cause for non-compliance with the Compact settlement and damage to Reclamation project interests is the same in Colorado and Nebraska – overuse of groundwater resources within the Republican River basin.

Reclamation is encouraged by Colorado's efforts to attempt to achieve Compact compliance. Reclamation will continue to work with Colorado and others to find effective, equitable solutions that will lead to Compact compliance. However, Reclamation is very concerned to see the approach outlined in the proposed rules and regulations. We believe the proposed rules and regulations are inappropriate because: (a) the rules do not sufficiently address the primary cause of the problem and, therefore, do not yield a sustainable solution; and (b) the rules do not treat water right holders in an equitable manner consistent with the long standing approach of "first in time, first in right."

Reclamation respectfully suggests that Colorado achieve sustainable use of its allocation of Republican River basin water resources by developing rules and regulations applicable to all Colorado users of basin groundwater and surface water. The foundation of the

rules and regulations needs to rest upon seniority of use. Reclamation's experiences lead us to believe a comprehensive and equitable approach will yield a sustainable remedy capable of responding to the realities of regional economics.

After you have had an opportunity to review the enclosed comments, we would like to meet with you and the Department of Natural Resources to discuss both our comments and the development of a comprehensive alternative approach. Thank you for the opportunity to provide comments to the proposed draft rules and regulations. If you have any questions, please contact me at the above address or telephone 308-389-5300.

Sincerely,

AARON M. THOMPSON

Aaron M. Thompson
Area Manager

Enclosure

cc: Alexandra Davis
Assistant Director
Department of Natural Resources
1313 Sherman Street, Room 718
Denver, CO 80203

Grady McNeill
Colorado Division of Wildlife
6060 Broadway
Denver, CO 80216
w/enclosure to both

BUREAU OF RECLAMATION COMMENTS ON
Rules and Regulations Governing the Diversion, Use and Control of Water Resources in the Republican River Basin in Colorado for Compliance with the Republican River Compact
November 29, 2007

GENERAL

Groundwater Use: We believe the primary reason Colorado is out of compliance with the Republican River Compact is due to the large number of groundwater wells constructed in the basin during the last 40 plus years. These wells are causing a continual decline in the groundwater level. As of 1990, nearly 17 million acre-feet had been mined from the Ogallala aquifer in eastern Colorado (VanSlyke and Joliet, 1990) and by 2002, the average rate of decline in the water table exceeded one foot per year (Colorado Department of Natural Resources, 2002). Since groundwater is hydrologically connected to the surface water supply the declining groundwater levels are seriously depleting surface water flows. Unless the groundwater use in the basin is limited sufficiently to allow groundwater levels to recover, the continued pumping of groundwater will only exasperate Colorado's problem. The rules and regulation proposed do not provide sufficient restrictions to groundwater use. Curtailing wells within 3 miles of the river is a start, but we do not believe this will provide long term Compact compliance. While curtailment of wells within 3 miles of the river may temporarily restore some surface flows, the continual pumping of water by wells outside the 3 mile zone will eventually outpace the curtailed wells and the groundwater level next to the river will again drop lowering river flow and cause further Compact compliance problems. It is our understanding that the wells within the curtailment zone only represent about 5 percent of the total wells in the basin. A sufficient restriction on groundwater pumping is essential to a proper balance between supply and demand that can be sustained on a long term basis. We also recognize that it may take years for groundwater levels and surface water flows to recover.

Bonny Reservoir/Armel Unit – South Fork Republican River

Between 1948 and 1951 the Bureau of Reclamation (Reclamation) constructed Bonny Dam and Reservoir as part of the Armel Unit (previously the St. Francis Unit). This project was planned as a multipurpose project to provide for irrigation, flood control, recreation and fish, wildlife conservation and enhancement. While the irrigation portion of the project did not develop, all of the other uses are currently served by the project. During the early planning stage of the project, Reclamation was concerned that this unit, as well as other units of the Pick-Sloan Missouri River Basin program constructed in the Republican River basin, be planned and constructed to fit within each state's fair share of the Republican River water supply. Prior to construction of Bonny Dam, Reclamation worked closely with Colorado, Nebraska and Kansas on the project plans. Reclamation also encouraged the states to negotiate a three state compact that would allocate the Republican River water supply between the states. Reclamation believed that this was a necessary prerequisite to project development in the basin. The states agreed and a

Compact was negotiated. The Republican River Compact became effective on May 26, 1943. Based on the 1943 Compact, Reclamation finalized the plans for the Armel Unit. These plans showed that the Armel Unit would use about 20 percent of Colorado's total Compact allocation and about 45 percent of Colorado's South Fork Republican River allocation. Reclamation applied for and received a water right for Bonny Dam and Reservoir with a priority date of December 3, 1948. In 1982, the full conservation pool in Bonny Reservoir was contracted to the Colorado Division of Wildlife to be managed for recreation, and fish and wildlife purposes with incidental uses encompassing irrigation needs.

The Definite Plan Report (DPR) prepared for the Armel Unit in the 1940s used the historic runoff of the Republican River at the Bonny Dam site to estimate anticipated inflow to Bonny Reservoir. These records indicated that the average future inflow to Bonny Reservoir would be about 30,800 acre-feet per year. During the first ten years of operation (1950-1959) computed inflow to Bonny Reservoir was 31,400 acre-feet. As well development occurred at a significant rate in the 1960s and 1970s along with other smaller development, reservoir computed inflow took a noticeable sharp decline. By the 1970s annual computed inflow had dropped to an average of only 19,700 acre-feet and in the 1990s the average computed annual inflow to Bonny Reservoir was only 15,200 acre-feet. This steep rate of decline in reservoir inflow corresponds directly with the large number of irrigation wells developed in the basin. The drop in reservoir inflow has seriously impacted reservoir storage and all the benefits associated with the project, including but not limited to recreation, and fish and wildlife.

The vast majority of wells within the South Fork of the Republican River basin were developed after Bonny Dam was constructed and have water rights junior to the 1950 storage right for Bonny Reservoir. The last time Bonny Reservoir filled to its normal full pool of 41,300 acre-feet was in 1995. Since that time reservoir storage has gradually declined to its present level of only about 8,000 acre-feet. Unless adequate restrictions are developed and enforced on groundwater use, Bonny Reservoir will continue to decline until it is essentially empty.

North Fork Republican River

Groundwater development in this sub-basin has also significantly reduced streamflows to the North Fork Republican River, thereby reducing inflows to Reclamation's Swanson Lake in Nebraska. Lack of supply in upstream projects impacts all downstream projects since return flows do not become available as supplies. This is also true in other sub-basins where Colorado groundwater depletions are occurring.

SPECIFIC COMMENTS

Rule 3. A. 3: The Scope and Purpose of the Rules includes all waters of the Republican River Basin within Colorado allocated for beneficial consumptive use by the Republican River Compact. The Rules further state that this includes reservoir storage having a storage capacity of 15 acre-feet or greater. Since Bonny Reservoir has a normal full

capacity of 41,300 acre-feet well above 15 acre-feet there is no reason to single this reservoir out. We believe the words "including but not limited to Bonny Reservoir" should be deleted from the Rules.

Rule 4. A. 10: Under the definition of "Reservoir" its states: "means Bonny Reservoir and all other reservoirs that have a storage capacity of 15 acre-feet or greater at the principal spillway elevation." We believe it is improper and unnecessary to single out Bonny Reservoir in this definition. The definition should be revised as follows: "'Reservoir' means all reservoirs that have a storage capacity of 15 acre-feet or greater at the principal spillway elevation."

Rule 5. C.: This Rule deals with the need to curtail beneficial consumptive use in Colorado to achieve Compact compliance. The Rule states: "curtailment must focus upon diversion and other beneficial uses that will have an *immediate or relatively immediate* positive impact on reducing Colorado's Computed Beneficial Consumptive Use . . ." The Rules appear to only deal with short term compliance and do not address long term compliance. To be effective the Rules need to address both short term and long term Compact compliance. Long term compliance will only be achieved though restrictions on groundwater use both within and outside of the 3 mile curtailment zone. The Rules should be expanded to include adequate restrictions to well pumping outside of the 3 mile zone. The burden for over development by individuals and inaction by the State should not be borne in this disparate fashion.

Rule 5. F.: This Rule states that the Curtailment Zone is based upon the State Engineer's determination of the amount of curtailment necessary to bring Colorado into Compliance. There is no information in the record to support that well curtailment in the 3 mile zone will bring Colorado into long term compliance. While it appears that this may be effective in providing some short term compliance we do not believe this will provide needed long term compliance. Again we believe that Colorado must also implement restriction on the wells outside of the 3 mile Curtailment Zone.

Rule 6. B. 3.: The basis for determining the impact of curtailment of Reservoir Storage on compact compliance is confusing. Under 3.a. we believe part (b) should be reworded as follows: "(b) Reservoir seepage that does not return to the stream." Not all of the reservoir seepage provides groundwater recharge as most of the seepage through the dam returns directly to the river. A portion of the seepage from the floor of the reservoir does recharge groundwater but it may be lost to groundwater pumping or help maintain streamflow below the dam by the interaction of groundwater and surface water.

Under 3.a. ii is an explanation of how the Republican River Compact Administration accounting is determined. The problem with using this accounting method within the Rules is a chicken and egg issue. If the model run is made with all the wells on and all reservoir storage and recharge turned on and then with the reservoirs turned off it does not account for the priority date for the reservoirs vs. the wells. Had the wells not developed as they did after Bonny Reservoir was constructed, most of the reservoir seepage from Bonny would assist in keeping the river flow higher below the dam due to

the higher groundwater levels that existed prior to the significant development of wells in the basin. With the wells in place the groundwater level is low and most of the reservoir seepage that reaches the groundwater only assists in providing an additional supply to the wells. We believe separate RRCA Groundwater Model runs should be made first with Bonny Reservoir in place, the wells turned off and groundwater at its 1950 level; and then one with Bonny Reservoir turned off, the wells turned off and groundwater levels at its1950 level. These runs would give a fairer representation of the true impact of Bonny Reservoir seepage on streamflow considering its senior water right to the wells. While this information may not assist in determine actual Compact accounting numbers, it would help determine how water use restriction could be fairly implemented in bringing Colorado into Compact compliance.

Rule 7. B. 1&2: Rule 7 deals with curtailment of use to meet Compact Compliance. Under both B.1. and B. 2. the Rules state: "the State Engineer shall order the release of any water stored not in compliance with the Compact, in Reservoir Storage, at an appropriate time." It is not clear what is meant by the phase "water stored not in compliance with the Compact." The three States agreed in the 2003 Final Settlement Documents that water stored in reservoirs is not part of the Compact Water Supply available for allocation (Republican River Compact Administration (RRCA) Accounting Procedures and Reporting Requirements December 15, 2002, Section III Basic Formulas). This water is not counted as part of the supply to be allocated until such time as the stored water is beneficially consumed or it is released from storage and reaches a Compact gage. Since water stored in a reservoir is not counted as part of the Compact Water Supply, the storage of water can not be considered as "not in compliance with the Compact." The act of storing water in a reservoir does not impact Compact Compliance. The RRCA accounting procedures treats stored water as a separate water supply from the Compact Water Supply until such time that it is either beneficially consumed or released and reaches a Compact gage.

It is also unclear what is meant by "[released] at an appropriate time." There is no explanation or definition of "appropriate time?" We also question the State Engineer's authority to require the owner of a reservoir to retain water in storage until such time that the State Engineer determines it is an appropriate time to release the water. Some clarification or definition is also needed for "at an appropriate time."

Rule 9: This Rule deals with Compact Compliance Pipelines. While we recognize that pumping water from wells and piping the flow directly to the river will significantly improve Colorado's Compact compliance on a short term basis we are concerned with the long term impact of these wells on the groundwater level. As stated earlier we believe that the only way Colorado can come into Compact compliance on a long term basis is through adequate restrictions on groundwater use that will allow the groundwater level and surface water flow to begin to recover. Limiting groundwater curtailment to the 3 mile zone and then allowing pumping for Compact Compliance Pipelines will continue to allow mining of the groundwater resulting in a continual decline in groundwater levels and further Compact compliance problems to the determent of senior surface water users.

Barfield, David

From: Barfield, Dave
Sent: Tuesday, April 29, 2008 5:38 PM
To: Williams, Jim; Sullivan, Megan; Ken.Knox@state.co.us
Cc: Wolfe, Dick; 'bdunnigan@dnr.ne.gov'; Ross, Scott; 'Willem.Schreuder@prinmath.com'
Subject: RRCA EC - Colorado Augmentation modeling
Attachments: Groundwater model scenario of Colorado augmentation pumping for 2007.doc; PrelimRRCA Accounting For 2007_4_29_2008_KS.xls; Prelim2007WITHCOpipelineKS.xls; CompareCOImpactsOfAugPlanPrelim2007KS.xls

Below and attached is information related to Kansas' view of how the Colorado augmentation plan should be modeled and how the accounting should be done. Sam Perkins has updated the referenced model runs on Willem's site.

Also
We look forward to seeing many of you on Thursday to discuss this and other matters.

David Barfield
Chief Engineer
Division of Water Resources, Kansas Department of Agriculture
785-296-3710
dbarfield@kda.state.ks.us

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Modeling and accounting for Colorado's proposed augmentation plan.

The FSS has the following statements related to augmentation.

Subsection III.B.1.k, provides for an exception to Section III. B's list of moratorium requirements:

> "Wells acquired or constructed by a State for the sole purpose of offsetting stream depletions in order to comply with its Compact Allocations. Provided that, **such Wells shall not cause any new net depletion** to stream flow either annually or long-term. The determination of net depletions from these Wells will be computed by the RRCA Groundwater Model and included in the State's Computed Beneficial Consumptive Use. **Augmentation plans and related accounting procedures submitted under this Subsection III.B.1.k. shall be approved by the RRCA prior to implementation.**"

Section IV. A. states:

> "The States will determine Virgin Water Supply, Computed Water Supply, Allocations, Imported Water Supply Credit, augmentation credit and Computed Beneficial Consumptive Use based on a methodology set forth in the RRCA Accounting Procedures, attached hereto as Appendix C."

Section IV. H states the following:

> "**Augmentation credit**, as further described in Subsection III.B.1.k., **shall be calculated in accordance with the RRCA Accounting Procedures and by using the RRCA Groundwater Model.**"

Thus, the RRCA groundwater must be used to determined the augmentation credit. We do not view modeling and accounting for augmentation plans as parallel to an import credit. It is a replacement of a state's groundwater CBCU (baseflow reductions). Where and when it replaces depletions, the augmentation water must be input into the groundwater model. The model runs will offset the groundwater CBCU being replaced and determine the fate of these replaced baseflows in the groundwater system.

We propose the following procedures be used for the Colorado augmentation plan, which will deliver augmentation water to the CO-NE stateline gage.

Surface water accounting

The actual gaged streamflow at the CO-NE stateline, which will include the augmentation flows, will be input into RRCA accounting spreadsheet, without any reduction or modification. As outlined below in the description of the groundwater model runs, this will be offset by a reduction in the groundwater CBCU so there will be no increase in virgin water supply or allocations as a result.

RRCA groundwater model runs

The attached document describes the model runs Kansas proposes. The procedure will not require additional runs of the model but modifies the data inputs to accommodate the augmentation water. Results of running the 2007 preliminary model run, with and without augmentation of 15,000 AF at the CO-NE stateline line, is also summarized.

"Base run"

When doing the base run of the model, the actual measured augmentation flows will be specified as inflow to the North Fork Republican River at the CO-NE stateline. Thus the model will be properly informed of the replacement of baseflow depletions and account for its effect downstream.

The actual augmentation pumping will be included in this run, with no acres irrigated associated with this pumping.

RRCA groundwater model impact runs

In the "no Colorado pumping" run, all CO groundwater pumping will be turned off as well as the augmentation flows.

The other impact runs (no KS pumping, no NE pumping, No mound), will leave the augmentation flows in the model run.

Accounting

Attached are three documents related to the accounting.

- The first is a draft accounting for 2007 (PrelimRRCA Accounting For 2007_4_29_2008_KS.xls) using the preliminary data that is available. It is a first draft and has not been extensively reviewed yet.
- The second spreadsheet shows (Prelim2007WITHCOpipelineKS.xls) takes this preliminary accounting and adds 15,000 AF at the NF stateline and includes the results of the model runs described above. The allocations for KS and NE are lower as 15,000 AF of water inserted at the CO-NE stateline is not tracked through the Mainstem reach. In practice, it will either become CU, be stored, or show up at the Hardy gage and thus be added to the water supply and allocations.
- The final spreadsheet (CompareCOImpactsOfAugPlanPrelim2007KS.xls) compares the two results.

While CO credit on the North Fork is almost 100% of augmentation flows and there is no increase in allocations, there is a reduction in CO's "credit" in the mainstem reach.

KANSAS
DEPARTMENT OF AGRICULTURE

Mark Parkinson, Governor
Joshua Svaty, Acting Secretary

www.ksda.gov/dwr

November 30, 2009
By U.S. Mail and Email

Dick Wolfe, State Engineer
Colorado Commissioner
Republican River Compact Administration
Colorado State Engineer
1313 Sherman St., Room 818
Denver, CO 80203
Dick.wolfe@state.co.us

Dear Commissioner Wolfe:

At the Republican River Compact Administration ("RRCA") meeting in Lincoln on August 12, 2009, the states of Kansas and Nebraska voted against Colorado's resolution to approve Colorado's Compliance Pipeline ("CCP"). Shortly afterwards, the Republican River Water Conservation District of Colorado ("the district") wrote to the states of Kansas and Nebraska requesting an explanation of the reasons for their votes and the concerns behind them. This letter is Kansas' response to that request, which is provided in the hope that it will contribute to a successful resolution of the issue.

Kansas has been working closely with Colorado to seek agreement on the CCP. Kansas does not oppose the idea of the CCP as a matter of principle. However, Kansas cannot agree to a proposal that is inconsistent with the Compact and Final Settlement Stipulation (FSS), and is against our interest as a state. As I elaborate below, Kansas' concerns about the CCP are real and significant, and affect Nebraska as well as Kansas.

While the FSS does not specify detailed requirements for augmentation plans, it requires the plan and its accounting procedures to be agreed upon by the Compact states through the RRCA prior to implementation.

The three principal objections Kansas has to the CCP in its present form are as follows: First, it proposes to exchange North Fork groundwater deliveries for South Fork well depletions. Second, the CCP proposal does not appear to provide effective limits on the accumulation of delivery credits over time. Finally, Colorado's proposal for accounting and modeling does not accurately reflect the impact of the CCP.

1. ***South Fork Overuse***.

First, Kansas is concerned that the CCP does not conform to a fundamental prohibition of both the Compact and the FSS: namely, that the overuse of an upstream state cannot deprive a downstream state of its right to develop the specifically allocated waters of its sub-basins. Both the Compact and the

FSS allocate and measure the waters of the Republican River Basin by its discrete sub-basins, not by gross delivery at a state line. In the initial five years of accounting since the FSS became law, Colorado has overused its North Fork allocation by approximately 8,000 AF per year and its South Fork allocation by approximately 6,000 AF per year. Included within Colorado's South Fork overuse is the use of a significant portion of Kansas' specific allocation on the South Fork. Under the current CCP proposal, Colorado seeks to comply with the Compact by pumping groundwater from the North Fork sub-basin and placing it in the North Fork alone. This approach fails to address Colorado's overuse on the South Fork sub-basin; as a result, Kansas' South Fork water users would remain deprived of their Compact share. Kansas' insistence that its South Fork users receive their allocation is not an obstacle to compliance; rather, it is a central requirement of Compact compliance, and it is not transferable to a different sub-basin. The CCP must satisfy each sub-basin test under both the Compact and the FSS.

In light of this problem, Kansas has proposed a potential solution: constructing an extension to the pipeline that would deliver water to one of the tributaries of the South Fork in Kansas. Such an extension would increase construction costs, but it carries at least three benefits. First, it secures the reliable source of water to the South Fork that Kansas users must receive under the Compact. Second, it preserves Colorado's commitment to the sub-basin allocations of the Compact, and, in doing so, vastly reduces the likelihood of controversy and possible litigation on this issue. Finally, it avoids placing Nebraska in the awkward position of acting as a middleman for Colorado's compliance obligations to Kansas.

In discussing the South Fork issue with Colorado, it has been suggested that Colorado should be allowed to move forward with its North Fork pipeline without addressing the South Fork issue by adding a limitation on the amount of credit to insure it does not include Kansas South Fork water. Unfortunately, this suggestion has two problems: it fails to address the total of Colorado's non-compliance, and it would be very difficult to administer in combination with other limitations in the accounting, as noted below.

2. *The accumulation of credits over time.*

Kansas' second concern relates to how the CCP proposal will affect the RRCA accounting. In its current form, the CCP proposal continues to fail to set an effective limit on annual maximum deliveries. As a result, the proposal does nothing to prevent Colorado from amassing a very large accounting credit. This is again inconsistent with the principle of replacing depletions when and where they occur. Without an effective limit, Colorado could over-deliver water in wet periods and under-deliver in dry ones. Kansas has provided specific suggestions that would resolve this concern while providing Colorado with a reasonable degree of flexibility, but those suggestions have not been included in Colorado's resolution.

3. Accounting issues.

Kansas' third concern relates to problems that the CCP proposal poses to the surface water and groundwater accounting. The CCP proposal seeks to offset the over-depletion of baseflows on the North Fork. Since the augmentation water comes in the form of baseflow augmentation, Kansas has proposed that the appropriate way to account for the water is to provide Colorado with a 100% credit at the stateline, and then to include the augmented baseflows in the RRCA groundwater model. This is the most appropriate way to account for this water. In the alternative, Kansas has offered to provide Colorado with a 100% credit at the stateline, but cap the negative depletions predicted by the model in the mainstem

reach. Either of these alternatives would mirror the modeling/accounting results that would occur if Colorado actually reduced groundwater consumptive use.

In either case, Kansas cannot ignore the effects of including the augmentation of baseflows in the surface water accounting, while allowing the distortion of the groundwater model results on the mainstem reach of the Republican. Although Kansas has repeatedly stressed these problems, Colorado has yet to propose accounting changes that would address them.

In addition, if the states reach an agreement on how to properly account for the CCP, the appropriate operational limitations must be clearly added to the accounting procedures.

I hope that this summary clarifies Kansas' concerns over the CCP.

Very truly yours,

David W. Barfield

David W. Barfield
Kansas Commissioner, RRCA

cc: Brian Dunnigan, Nebraska Commissioner, RRCA (by U.S. Mail and email)
Pete Ampe, Asst. Attorney General, State of Colorado (by email only)
Dennis Coryell, RRWCD (by email only)
Stan Murphy, RRWCD (by email only)
David Robbins, Counsel, RRWCD (by email only)

AGREEMENT RE DISCUSSIONS

The parties to this Agreement are the States of Kansas, Nebraska and Colorado. They are jointly referred to hereinafter as the "Parties" and individually as a "Party."

The Parties, desiring to preserve their ability to exchange documents and discuss candidly and informally their differences regarding compliance with the Republican River Compact and the Final Settlement Stipulation in *Kansas v. Nebraska & Colorado*, No. 126, Orig., U.S. Sup. Ct.("Discussions"), without any prejudice resulting to the rights of any Party, hereby agree as follows:

1. The Parties make no admission of fact or law, responsibility, fault, or liability by pursuing, entering into, or participating in the Discussions. Nothing contained in this Agreement nor in the Discussions shall alter the rights or liabilities of any Party.

2. Nothing contained in this Agreement or in the Discussions shall be construed to limit the right of any Party to undertake or pursue any action that is currently, or that may become, available to it. No Party waives its right to pursue at any time dispute resolution under the Final Settlement Stipulation or to pursue any relief that would otherwise be available absent the Parties' engaging in the Discussions.

3. The Discussions shall be for settlement purposes only, and shall be treated as if they were subject to Rule 408 of the Federal Rules of Evidence. Further, no Party shall refer to or introduce in any judicial, arbitration or other proceeding: (a) any statement made during the Discussions; (b) which Party made any statement; or (c) any document provided to another Party for purposes of the Discussions. Information that is otherwise admissible or discoverable or known or available to the Parties shall not be rendered inadmissible or non-discoverable because of its use in the Discussions.

4. No Party shall be bound by anything said or done during the Discussions, unless and until a separate written agreement to that effect is executed by all Parties.

5. Each Party declares that it is bound by, and intends to comply with, its open records law(s). However, except as otherwise provided herein, the Parties shall not disclose to any person or entity not a Party to this Agreement, any information regarding the content of the Discussions, except as required under each Party's state open records law(s). In particular, the Parties shall not issue press releases or answer questions from the press or others concerning the content of the Discussions without the agreement or the participation of the other Parties. The parties may disclose that discussions are taking place as part of the dispute resolution process.

6 This Agreement shall not be construed to prohibit disclosure of data, information, communications, documents or other material lawfully in the public domain or created or existing independent of the Discussions. This prohibition on disclosure shall extend only to the content of the Discussions.

7. The Parties reserve the right to inform the decision makers of their respective States of the content of the Discussions.

8. This Agreement may be executed in counterparts.

9. This Agreement shall remain in full force and effect during the Discussions. Any Party wishing to terminate the Discussions and this Agreement shall do so in writing to the other two Parties, specifying the date of termination. After termination, this Agreement shall remain in full force and effect with regard to the Discussions prior to termination.

10. The Parties shall be deemed to include each named Party's officers, agents, employees, contractors, consultants and legal counsel who have knowledge of the contents of the Discussions.

11. Notice pursuant to this Agreement shall be to the undersigned by certified mail.

_____Dated_____
John B. Draper
Kansas Counsel of Record
Special Assistant Attorney General
P.O. Box 2307
Santa Fe, New Mexico 87504-2307

_____Dated_____
Justin D. Lavene
Special Counsel to the Attorney General
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_____Dated 6/18/08
Peter J. Ampe
First Assistant Attorney General
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GROUND-WATER RESOURCES PROGRAM

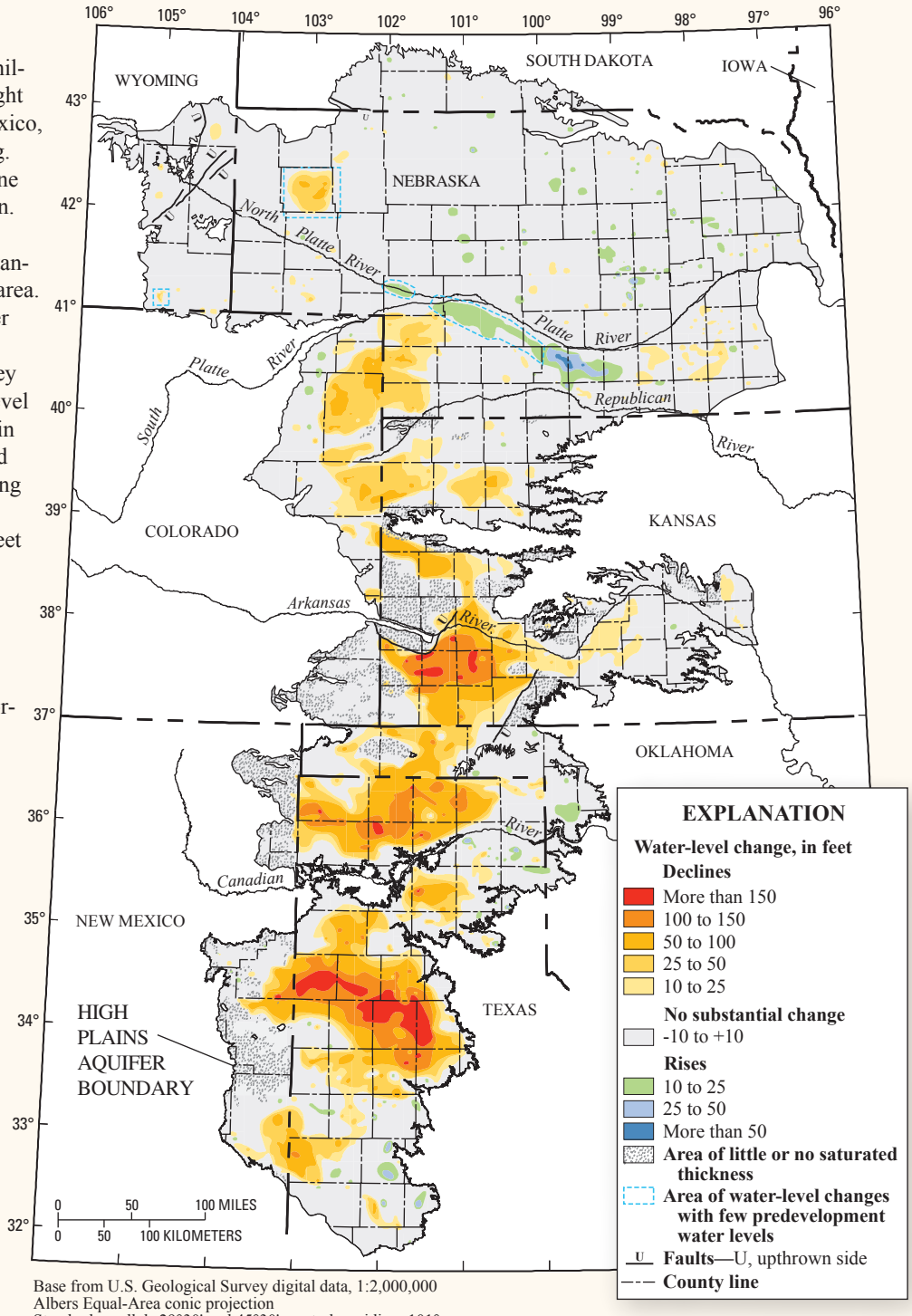
Changes in Water Levels and Storage in the High Plains Aquifer, Predevelopment to 2007

—By V.L. McGuire

The High Plains aquifer underlies 111.6 million acres (174,000 square miles) in parts of eight States—Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas, and Wyoming. The area overlying the High Plains aquifer is one of the primary agricultural regions in the Nation. Water-level declines began in parts of the High Plains aquifer soon after the beginning of substantial irrigation with ground water in the aquifer area. By 1980, water levels in the High Plains aquifer in parts of Texas, Oklahoma, and southwestern Kansas had declined more than 100 feet (Luckey and others, 1981). In response to these water-level declines, the U.S. Geological Survey (USGS), in collaboration with numerous Federal, State, and local water-resources agencies, began monitoring more than 7,000 wells in 1988 to assess annual water-level changes in the aquifer. This fact sheet summarizes changes in water levels and drainable water in storage in the High Plains aquifer from predevelopment (before about 1950) to 2007 and serves as a companion product to a USGS report that presents more detailed and technical information about water-level and storage changes in the High Plains aquifer during this period (McGuire, 2009).

The areas of water-level changes in the High Plains aquifer from the time before substantial ground-water irrigation development (predevelopment) to 2007 are shown in figure 1. Drainable water in storage is the fraction of water in the aquifer that will drain by gravity and can be withdrawn by wells. The remaining water in the aquifer is held in the aquifer material by capillary forces, and generally cannot be withdrawn by wells. Drainable water in storage is termed "water in storage" in this fact sheet (McGuire, 2009).

In parts of the area that overlie the High Plains aquifer, farmers and ranchers began using ground water for irrigation extensively in the 1930s and 1940s. Estimated irrigated acreage in the area overlying the High Plains aquifer increased from 1940 to 1980 and changed slightly from 1980 to 2005: 1949—2.1 million acres, 1980—13.7 million acres, 1997—13.9 million acres, 2002—12.7 million acres, 2005—15.5 million acres. In 2005, irrigated acres overlaid 14 percent of



Base from U.S. Geological Survey digital data, 1:2,000,000
Albers Equal-Area conic projection
Standard parallels 29°30' and 45°30', central meridian -101°

Figure 1. Water-level changes in the High Plains aquifer, predevelopment to 2007 (modified from Gutentag and others, 1984; Lowry and others, 1967; Luckey and others, 1981; and Burbach, 2007).

the aquifer area, not including the areas with little or no saturated thickness (McGuire, 2009).

About every 5 years, ground-water withdrawals for irrigation and other uses are compiled from water-use data and reported by the USGS and agencies in each State. Ground-water withdrawals from the High Plains aquifer for irrigation increased from 4 to 19 million acre-feet from 1949 to 1974. Ground-water withdrawals for irrigation in 1980, 1985, 1990, and 1995 were 4 to 18 percent less than withdrawals for irrigation in 1974. Ground-water withdrawals for irrigation were 21 million acre-feet in 2000 and 19 million acre-feet in 2005 (McGuire, 2009).

Water-level changes in the aquifer result from an imbalance between discharge and recharge. Discharge is primarily ground-water withdrawals for irrigation. Discharge also can include evapotranspiration where the water table is near the land surface, and seepage to streams, springs, and other surface-water bodies where the water table intersects the land surface. Recharge is primarily from precipitation. Other sources of recharge can be seepage from streams, canals, and reservoirs, and irrigation return flows.

Water-level declines may result in increased costs for ground-water withdrawals because of increased pumping lift and decreased well yields (Taylor and Alley, 2001). Water-level declines also can affect ground-water availability, surface-water flow, and near-stream (riparian) habitat areas (Alley and others, 1999).

Water-Level Changes, Predevelopment to 2007

The map of water-level changes in the High Plains aquifer from predevelopment to 2007 (fig. 1) was generated using methods described by McGuire (2009). The map is based on water levels from 3,643 wells, which were measured in both predevelopment and in 2007, and other previously published data in areas in Nebraska and Wyoming with few predevelopment water levels (Lowry and others, 1967; Luckey and others, 1981; Burbach, 2007; fig. 1).

The water-level changes from predevelopment to 2007 ranged from a rise of 84 feet in Nebraska to a decline of 234 feet in Texas. The area-weighted, average water-level change from predevelopment to 2007 was a decline of 14.0 feet. From predevelopment to 2007, water levels declined more than 10 feet in approximately 26 percent of the aquifer area, more than 25 feet in about 18 percent of the aquifer area, and more than 50 feet in about 11 percent of the aquifer area. In approximately 72 percent of the aquifer area, water-level changes ranged from a decline of 10 ft to a rise of 10 ft. In approximately 2 percent of the aquifer area, water levels rose more than 10 ft from predevelopment to 2007 (McGuire, 2009).

Change in Water in Storage, Predevelopment to 2007

Total water in storage in 2007 was about 2.9 billion acre-feet, which was a decline of about 270 million acre-feet since predevelopment. Water in storage for predevelopment was estimated from water in storage in 2000 and water-level changes from predevelopment to 2000. Changes in water in storage before predevelopment were not estimated (McGuire, 2009).

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Acknowledgments

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For More Information

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This fact sheet is available at *http://pubs.usgs.gov/fs/2009/3005/* or from U.S. Geological Survey, Information Services, Box 25286, Denver Federal Center, Denver, CO 80225.

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