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Commentary on the Convergence of Water Rights, Structural Change, Technology, and Hydrology: A Case Study of New Mexico's Lower Rio Grande

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Commentary on "The Convergence of Water Rights, Structural Change, Technology, and Hydrology: A Case Study of New Mexico's Lower Rio Grande"

The article, "The Convergence of Water Rights, Structural Change, Technology, and Hydrology: A Case Study of New Mexico's Lower Rio Grande," by Rhonda Skaggs, et al.,[1] is valuable for bringing attention to the technological advances in measuring on-farm evapotranspiration (ET), but overreaches in describing the implications for the adjudication process and for water policy or management. Professor Skaggs' article concludes, "a hydrologic catastrophe is possible if unrealistically high water rights are awarded . . . users increase on-farm consumptive use, or if adjudicated CIR (consumptive irrigation requirement) in excess of actual consumptive use is transferred to other consumptive use."[2] The presumed link between awarded water rights and actual consumptive use prompted these comments. Below I outline several factors that soften the consequences of a mismatch between actual consumptive use and any court-decreed right to use water, including: the convergence between water rights and hydrology; the role of priority in basin administration; CIR is not the total "amount" of a water right; and the role of decreed rights in managing satisfactory conditions in a water-short basin. Because of these factors it is likely that public administrative actions and private water management operations will avoid the hydrologic risks foreseen by the authors, whether the decreed rights reflect actual water uses or not.

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1. Rhonda Skaggs et al., *The Convergence of Water Rights, Structural Change, Technology, and Hydrology: A Case Study of New Mexico's Lower Rio Grande*, 51 NAT. RESOURCES J. 95 (2011).

2. *Id.* at 116.

I. HOW A DECREE OF WATER RIGHTS CONVERGES WITH HYDROLOGY

Professor Skaggs' article raises the central issue of "over-allocation through adjudication of nonexistent wet water."[3] However, allocating water by the ladder of priority functions so that wet water becomes inherently compatible with such a decree of rights. The fundamental idea of prior appropriation is that existing variable wet water serves the senior bottom rungs of the ladder, while junior rights remain empty until wet water becomes available at times of high flow.[4] Orderly allocation of available wet water is the core function of a decree of priority.[5]

A decree "converges" with hydrology via the ladder of priority, not by ensuring a full supply for the listed rights. The relative position of right-holders, who may or may not receive water service under certain levels of flow if larger or smaller amounts are decreed for senior right holders, is a real issue for the parties to an adjudication. Those relationships of relative priority are the subject of the *inter-se* phase of New Mexico adjudications;[6] however, Professor Skaggs' article does not concentrate on the potential problems of distribution among the parties.

"Over-allocation" in a decree would not impact the hydrologic balance because decreed rights are not intended to balance average water supply. One commentator on the role of adjudication notes that "legal doctrine . . . does not match demand and supply."[7] Basin water

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3. *Id.* at 114.

4. William P. Balleau, *Water Appropriation and Transfer in a General Hydrogeologic System*, 28 NAT. RESOURCES J. 269 (1988). "The appropriation system presumes a priority of rights to use a scarce resource. In principle, junior appropriators are served less frequently than senior appropriators. The ladder of surface water priority includes increasing fractions of empty rights among the late water claimants . . . ." *Id.* at 282. "The yield of a surface system is not viewed as a simple average annual supply, reliably available, and apportioned to a fixed number of claimants. The priority system would have no purpose if the yield of the system was constant each year and reliable at all times. The priority systems deals with the variable duration of surface water flow." *Id.* at 274. "The system of prior appropriation is fully compatible with the hydrogeologic view of regional groundwater and surface water systems." *Id.* at 291.

5. Dan Tarlock, *The Illusion of Finality in General Water Rights Adjudications*, 28 IDAHO L. REV. 271, 281 (1989). "The original conception of adjudication as a simple method to secure the orderly distribution of water for irrigation purposes . . . ." *Id.* "Stream adjudications are special proceedings to determine the right to use the waters of a stream system." Rule 1-071(D) NMRA.

6. State *ex rel.* Reynolds v. Pecos Valley Artesian Conservancy Dist., 99 NM 699, 663 P.2d 358 (1983). "[T]here can be no administration of junior rights as against senior rights until the parties have had an opportunity to contest priorities *inter se*."

7. William C. Schaab, *Prior Appropriation, Impairment, Replacements, Models and Markets*, 23 NAT. RESOURCES J. 25, 25 (1983).

rights do not add up to the basin long-term average water supply.[8] Decreed rights correctly exceed average supply so that in wet years water can be used by late-coming projects such as dams and wellfields, while in dry years water can be devoted to the senior rights using direct flow.[9] In some New Mexico basins, water rights or permits total several multiples of average yield.[10] For example, in the Mimbres Basin some decreed rights are for flood flows only.[11] Decreeing priority alongside the amount of each water right takes care of the rights in excess of wet water.

Groundwater storage rights are another reason that water-right claims exceed basin surface-water supply. Aquifer storage is a source for use in addition to direct stream flow. Nevada considers such "transitional storage" to be a major component of its State Water Plan,[12] and many New Mexico aquifers are likewise administered for storage depletion.[13] In the Lower Rio Grande (LRG), administrative guidelines allow one foot per year of progressive groundwater decline rate, equivalent to a half million acre-feet per year (AFY) from a 5000 square mile area.[14] Thus, the aquifer administrative-area guidelines afford considerable flexibility in bridging basin supplies across drought years. Senior users commonly take the readily divertible surface flows for agriculture. Eventually, the accumulated total of basin water rights properly exceeds typical divertible surface-water yield. Late-coming water rights claimants such as dams, cities and industry commonly recover and use the high runoff and flood flows, the yield from aquifer storage, or captured yield from unmanaged, nonbeneficial riparian or wetland losses. These later claims must, however, respect the reserve of water for ecological purposes and downstream obligations.

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8. *See* N.M. STATE PLANNING OFFICE, WATER RESOURCES OF NEW MEXICO: OCCURRENCE, DEVELOPMENT AND USE (1967) ("[W]ater is the limiting factor in New Mexico's economic development."); N.M. OFFICE OF THE STATE ENG'R & INTERSTATE STREAM COMM'N, NEW MEXICO STATE WATER PLAN 8 (Dec. 2003).

9. U.S. GEOLOGICAL SURVEY, BULLETIN 87: MINERAL AND WATER RESOURCES OF NEW MEXICO 425 (1965), *available at* http://geoinfo.nmt.edu/publications/bulletins/downloads/87/Bulletin87.pdf; Balleau, *supra* note 4, at 271.

10. *See* ERIC KEYES & JACK FROST, N.M. OFFICE OF THE STATE ENGINEER, THE ESTANCIA BASIN GROUND WATER FLOW MODEL, OSE MODEL DESIGN AND FUTURE SCENARIOS (2001).

11. Mimbres Valley Irrigation Co. v. Salopek et al., Luna County District Court Case No 6326, Decree entered January 14, 1993 (1993).

12. NEV. STATE ENGINEER'S OFFICE, WATER FOR NEVADA: GUIDELINES FOR NEVADA WATER PLANNING: VOLUME 3 13 (1971).

13. N.M. OFFICE OF THE STATE ENG'R, TULAROSA UNDERGROUND WATER BASIN ADMINISTRATIVE CRITERIA FOR THE ALAMOGORDO – TULAROSA AREA 4 (1997) ("The Tularosa Basin is recognized as a mined basin and is administered to allow use of groundwater to a specified amount of de-watering during a forty-year planning period").

14. N.M. OFFICE OF THE STATE ENG'R, MESILLA VALLEY ADMINISTRATIVE AREA GUIDELINES FOR REVIEW OF WATER RIGHT APPLICATIONS 7 (1999).

The idea of "over allocation through adjudication" misconceives a decree of water rights as an assured allocation of wet water, when a decree is a means to remove controversy and add certainty to the distribution of variable supply.[15] The purpose of a decreed property right is "social recognition, enforcement, and protection. . ."[16] none of which necessarily propagates into a hydrological problem of actual versus theoretical CIR. Those juniors, who are not served in low-flow periods while their neighboring seniors have water, can refer to the decree for comfort, and then, using one of the great benefits of a decree, they can know where to go to acquire more reliable (recognized, enforced, and protected) water.

II. ROLE OF PRIORITY

Rather than seeking to apportion an average annual supply of water to a fixed number of claimants who receive a certain reliable supply, priority works to fit users' expectation for water service to the hydrologic variability. Priority distributes water to those entitled to it when availability is less than demand; which is most of the time in the arid West. There is no expectation that all decreed water rights will receive water all the time. Because a decree limits water use to the available supply, any increased consumptive use by those receiving water after a decree could not cause a catastrophe in the water balance. If the Court (based on its view of the evidence) awards unrealistic water rights, then some senior parties' water use and consumption may increase, but complementary junior use and consumption will be curtailed. However, the opposite pattern is equally possible. The overall balance is a necessary consequence where water availability is the limit on all use under shortage conditions.

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15. Anthony Scott & Georgina Coustalin, *The Evolution of Water Rights*, 35 NAT. RESOURCES J. 821, 825 (1995). Appropriative "*[W]ater rights have the following main features*: rights are specific as to quantity and type of use; the first user has the strongest rights . . . ; rights-holders (users) can enforce their rights only against those lower in seniority (later in time); the usufructary rights are fully transferable to any persons."*; See Id.* at 830, "[T]he legal sense does not guarantee certainty to a user because levels and flows are also changed by seasonal and other natural changes in supply beyond the user's control." *; See also Id.* at 920, "The seniority principle is an ingenious way of giving high exclusivity to some rights holders even when water availability fluctuates widely."*; See also Id.* at 965, "The holder of a junior right must carry the burden of insecurity but . . . . [trading] can give him as much water security as he wishes to buy."

16. *Id.* at 822.

In the LRG, allocated water is that amount identified by the Bureau of Reclamation as available for release from storage.[17] There is no opportunity for use to markedly exceed that amount. Due to feedback to the aquifer from the adjacent river, drains and canals, the released amount, as a multi-year average, limits even the groundwater source.[18] In the LRG, a buildup of the aquifer in subsequent full release years follows every period of aquifer drawdown from a sequence of low release years.[19] The LRG aquifer operates as an extension of Elephant Butte storage to smooth out natural surface water variations, but does not to add to the cumulative supply.[20] Thus, use remains limited to available supply over time. A decree of rights does not alter the prevailing hydrologic limitations on the level of water use.

The hydrological function of the decree does not hinge on high accuracy in quantifying CIR. Describing the accuracy required by the doctrine of beneficial use, one authority says, "we cannot advise the Committee that there is a legal standard which fixes the degree of accuracy required for water right decrees. We have not been able to find any reported cases which purport to prescribe such a 'sufficiently accurate' standard."[21] Certainly, New Mexico does not demand such accuracy in the informational contents of a decree, only that "[s]uch decree shall . . . declare . . . the priority, amount, purpose, periods and place of use, and as to water used for irrigation . . . the specific tracts of land to which it shall be appurtenant, together with such other conditions as may be necessary to define the right and its priority."[22] New Mexico does not prescribe CIR as an element of a water right. Professor Skaggs' article discusses the quantification of "amount" in terms of CIR and the related on-farm duty of water.

The body of Professor Skaggs' article does not mention priority or redistribution, but states in the conclusion that inequitable adjudications possibly violate prior appropriation principles by transferring wealth to

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17. U.S. BUREAU OF RECLAMATION, RIO GRANDE PROJECT WATER SUPPLY ALLOCATION PROCEDURES: RIO GRANDE COMPACT-COLORADO VISIT 3 (1996).

18. *See* PETER F. FRENZEL, U.S. GEOLOGICAL SURVEY, SIMULATION OF GROUND-WATER FLOW IN THE MESILLA BASIN, DOÑA ANA COUNTY, NEW MEXICO, AND EL PASO COUNTY, TEXAS Fig. 17G (1992), which shows that aquifer storage is replenished on a schedule of a few years.

19. *Id.* at 40, Figure 17G. "The simulated depletion of aquifer storage is eventually replenished . . . ." *Id.* at 57.

20. Letter from Steve Reynolds to Water Law Study Committee (1983) (on file with author). "Water will only be available from (aquifer) storage for an interim period before effects of the groundwater withdrawal are fully transmitted to the river."

21. Tarlock, *supra* note 5, at 284.

22. N.M. STAT. § 72-4-19 (1978).

late coming heavy users from old time lower users.[23] If that becomes an issue, then post-decree priority administration would address it. In the particular case of the LRG, a recent agreement among the State and other parties calls for priority administration or a system of alternative administration.[24] The State describes alternative administration as a "less painful alternative to priority administration, and one that is more responsive to local water users needs."[25] While the administrator's preference for less pain might translate into less enforcement of priorities, the value of a decree would remain as "social recognition" and identification of the valid rights available for transfer to new projects. The implications of alternative administration for the sustainability of the basin water balance are unforeseeable. But the strict decree of water rights in terms of CIR does not, on its own, threaten the sustainability of the basin.

III. CIR DOES NOT DESCRIBE THE FULL AMOUNT OF A WATER RIGHT

Professor Skaggs' article contrasts modern measurement of actual CIR with theoretical water requirements for full-supply, healthy, well-managed crops. Such theoretical values have been used successfully in other basins to quantify decreed rights.[26] New Mexico makes no distinction between actual or theoretical CIR in terms of the "amount" of water use.[27] CIR is not a descriptor of a water right, but is a sub-component of the "amount" of the right. CIR has a more significant role in the administration of change in place and purpose of rights than in the decree itself. Conceptually, the actual beneficial use (without waste) as tied to purpose, periods and places of use is the amount of a water right.[28] Either type of CIR, actual or theoretical, is a minor component of the "use" of water in its broader aspects.

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23. Skaggs, *supra* note 1, at 116.

24. Agreement on Settlement in Principle on Stream System Issue 97-101, June 8, 2011, *available at* http://www.ose.state.nm.us/PDF/HotTopics/EBID-Agreement/FinalAgreement-2011-06-08.pdf.

25. N.M. Office of the State Eng'r, *The LRG AWRM Process*, *available at* http://www.ose.state.nm.us/PDF/ActiveWater/LowerRioGrande/LRG-AWRM-Process.pdf

26. JOHN W. LONGWORTH & MOLLY L MAGNUSON, LOWER RIO GRANDE BASINWIDE CONSUMPTIVE USE IRRIGATION REQUIREMENT ANALYSIS 20 (2011) (listing 12 basins where theoretical CIR values have been used in hydrographic survey or in decrees).

27. N.M. STAT. § 72-14-19 (1978) calls for the "amount" to be decreed without specifying units or methods.

28. *Id.*

Professor Skaggs' article describes the "duty" as a function of CIR divided by irrigation efficiency.[29] Because the efficiency of water application to the root zone of the farm crop varies from farm to farm[30] and farm operations are planned in practice from handbooks and rules of thumb,[31] the need for highly refined accuracy in CIR is undercut. According to the U.S. Department of Agriculture on-farm application efficiency can vary from 35 to 80 percent, or a factor of two in duty of water for a fixed CIR.[32] In the LRG, an efficiency of 67.3 percent "is assumed" by the New Mexico Office of the State Engineer (NMOSE).[33] Applying averages loses information on the particulars in the original database; thus, handbook values for farm design are not site specific as may be preferred for evidence of rights. Absent a corresponding accurate methodology for farm-by-farm determination of water efficiency in application to the purpose, periods and places of use, the improved methods for measuring farm-by-farm consumptive use cannot be converted precisely into the basis for water rights. The varying efficiency of conveying water from the river through storage facilities via canals to the farm adds even more uncertainty to the site-specific amount of water "used" for the farming purpose.

Professor Skaggs' article describes the LRG as a case study to examine hydrologic risks associated with theoretical and actual consumptive use. The Rio Grande Project (the Project), a Bureau of Reclamation irrigation facility below Elephant Butte, serves 155,000 acres in the LRG of New Mexico and Texas. In the LRG, the amount of use decreed might be the Project release from storage in reservoirs, which could then also include the evaporation from these reservoirs. If included in the amount of use, the LRG evaporation would be a significant component of that amount. For example, according to the Bureau of Reclamation, allotments for the Project are:[34]

In this example, the Project "use" of water is the release from storage plus reservoir evaporation; a range of 582,000 acre-feet (AF) to over

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29. Skaggs, *supra* note 1, at Fig. 1 illustrates that CIR is divided by on-farm irrigation efficiency to derive the water applied from the farm gate, which is the conventional "duty" aspect of the amount of use.

30. *See* U.S. DEP'T OF AGRIC., NAT'L ENG'G HANDBOOK, PT. 652 IRRIGATION GUIDE 6-4, Table 6-1(1997).

31. *See* BRIAN C. WILSON ET. AL., WATER USE BY CATEGORIES IN NEW MEXICO COUNTIES AND RIVER BASIS, AND IRRIGATED ACREAGE IN 2000, TECHNICAL REPORT 51, Table 5.3 (2003) (listing the per capita water requirements used to quantify livestock withdrawals in New Mexico).

32. U.S. Dep't of Agric., *supra* note 30.

33. LONGWORTH & MAGNUSON, *supra* note 26.

34. U.S. BUREAU OF RECLAMATION, *supra* note 17, at 5.

	Average AF	*Full Supply (AF)*
Reservoir Evaporation	90,000	Greater than 90,000
Release from Storage	492,000	763,800
Deliver to Farms	304,000	528,700

883,000 AF. Professor Skaggs' article calculated ET for several hundred fields in 2002 (a full allocation year with an evapotranspiration mode of 36 to 48 inches depending on crop).[35] The decreed rights for farms in the Project, including downstream obligations to Mexico and Texas farms, would reasonably accumulate to the full supply amount (over 800,000 acre-feet per year (AFY)) despite average use being significantly less. The total average farm delivery at 304,000 AF is a third of the full Project use, and average CIR is appreciably less than farm delivery. Accordingly, the link between a highly accurate CIR, totaling a few hundred thousand AF, and the amount of water to be "used," in the range of 800 to 900 thousand AF, is weak. It is hard to visualize that a serious problem would arise due to inaccuracy in the right to CIR; a small component of overall water use in the LRG.

In recent decrees the NMOSE has asked the court to add limitations to a decree under the clause which states, "other conditions as may be necessary to define the right and its priority."[36] The project delivery requirement (PDR), farm delivery requirement (FDR) and CIR have been decreed on tributaries of the Rio Grande and are formal stream system issues ordered for trial by the court in the LRG.[37] Older decrees indicate a duty (equivalent to FDR), or a divertible amount (equivalent to PDR), or in some cases (e.g., Costilla Creek), an instantaneous diversion rate.[38] Flumes measure diversion in cfs, FDR, and volume applied to farms in real time for use in practical farm operations or in administered water distribution by a water master. CIR is a new issue for adjudication. CIR is of interest more for subsequent transfer than for determining historical use.

35. Skaggs, *supra* note 1, at 110, Figs. 5 and 6.

36. Plaintiff New Mexico's Motion for Order Adjudicating Irrigation Water Rights at 2, U.S. v. Abousleman, No. CIV 83-1041 SC (D.N.M. Nov. 18, 1996).

37. State of New Mexico, *ex rel.*, Office of the State Engineer v. Elephant Butte Irrigation District et al., Amended Order Commencing Stream System Issue/Expedited *Inter Se* Proceeding No. 101 Consumptive Irrigation and Farm Delivery Requirements for All Crops in the Lower Rio Grande Basin CV-96-888 (2009).

38. N.M. STAT. § 72-15-13 (1978). "[T]he term 'duty of water' is defined as the rate in cubic feet per second of time at which water may be diverted at the head gate to irrigate a specified acreage of land during the period of maximum requirement. . .."

Where researchers determine CIR in a post-audit fashion by energy-balance methods of remote sensing as described by Professor Skaggs, then the administrative and managerial purpose of decreeing a right to such a value for CIR is unclear. Those methods might serve to quantify the recent depletion in the decades since the 1980s when suitable imagery is available for review. However, rights commonly originate from actions to appropriate water many generations ago. The available satellite imagery is too late to document the original action of water use.

Recent history does become relevant in applications for transfer of place or purpose of use. In a transfer application the NMOSE considers the differences between the atmospheric losses on the tract before and after the transfer. Unmanaged riparian vegetation can lose as much water through ET as the farm purpose did earlier.[39] Many farms occupy the footprint of pre-development riparian vegetation that consumed equivalent water.[40] Remote sensing cannot tell the future difference from the recent past, or the distant past from the recent past, and therefore has a way to go to become applicable to water management decisions for farm operations, administrative practice or for quantifying rights.

The hydrologic conditions desired for a basin are policy and planning matters with many components beyond water rights. Professor Llamas, Chair of the European Academies of Sciences Advisory Council, lists eight components for consideration: ecological, economic, social, legal, institutional, intergeneration, political, ethical and hydrologic. The aspects other than the legal decree of rights are of overriding importance and involve sustainability, economic and ecological allocation and downstream obligations.[41] In the LRG the hydrologic conditions desired in these terms also are in a "state of flux" along with the perception of beneficial use. We can anticipate that the eventual LRG decree of water rights declaring limitations on water use in terms of priority, amount and other conditions will be one factor among many other considerations that establish the future desired hydrologic conditions in the basin. The LRG water balance has been sustained for 96 years of the Rio Grande Project without a court decree limiting water use in any way. Basin water use will not likely be thrown out of orbit solely because a theoretical rather than actual CIR is in the final decree.

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39. Richard G. Allen et. al., *Satellite-based Energy Balance for Mapping Evapotranspiration with Internalized Calibration (METRIC)—Applications*, 133 J. OF IRRIGATION AND DRAINAGE ENG'G 395, 400, (2007).

40. *Id.*

41. *See generally* M. Ramón Llamas et. al., *The Manifold Dimensions of Groundwater Sustainability: An Overview*, Jan. 2006, *available at* http://docs.china-europa-forum.net/doc_644.pdf (providing an overview of Environmental ethics' "significant role in identifying driving motivations for human beings in relation to groundwater resources").

The attention that Professor Skaggs places on accurate CIR, absent equally careful site-specific data on application efficiency and overall project efficiency, will not translate into an accurate amount of water use for a decree of water rights. Data on diversions, release from storage and delivery to farms forms a better basis for historic water use. In any case, accuracy in quantification of rights goes to the distributary aspects among the parties, not to the cumulative depletion in the LRG basin. Any discrepancy that arises between a decreed amount of right to use water in a basin and water availability in the basin is primarily due to those other factors, not to poor quantification of CIR.

IV. ROLE OF DECREED RIGHTS IN MANAGING BASIN CONDITIONS

Adjudication of water rights has a different purpose and effect from that of water management or administration. Water management may be viewed as the actions by water-right owners to operate their projects (farms, town supplies, research stations, etc.) to meet their separate objectives inside the constraints of the declared terms of the decree.[42] Administration is the public review by the administrative agency of applications by water-right owners to change the terms of the decree (place, purpose, etc.).[43] Administrative review ensures that others are not impaired and that public welfare and water conservation are respected.[44] In contrast, the main purpose of a decree of water rights is recognition of enforceable relations among seniors and juniors as discussed above. A related essential function of a decree of water rights is to state the initial ownership conditions from which approved changes in water use can be made to produce the intended equitable flow of values consequent to the changed flow of water.[45] A decree has remarkably little to do with project management beyond capping diversions, and is a single factor among

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42. *See* IRA G. CLARK, WATER IN NEW MEXICO: A HISTORY OF ITS MANAGEMENT AND USE xi-xii (1987), for role of administrative agencies in New Mexico water. Public Administration sectors have executive, legislative, or judicial authority over the institutions with a given area. These agencies also set policy, create laws, adjudicate civil legal cases, provide for public safety and for national defense. In general, government establishments in the Public Administration sector oversee governmental programs and activities that are not performed by private establishments. *See also North America Industry Classification System*, U.S. CENSUS BUREAU, http://www.census.gov/cgi-bin/sssd/naics/naicsrch?code=92&search=2007.

43. CLARK, *supra* note 42.

44. N.M. STAT. § 72-5-23 (1978) "[A]ll or any part of the right to water "may be transferred for other purposes . . . without detriment to existing water within the state and not detrimental to the public welfare of the state . . . on approval . . . by the state engineer."

45. Schaab, *supra* note 7.

many others in the societal goal for managing the hydrologic conditions desired for the basin.

V. CONCLUSION

As reported by Professor Skaggs, the progress in quantifying atmospheric losses of water based on remotely sensed temperature and interpreted plant vigor is producing increasing valuable water-accounting data for water managers, planners, policy makers and administrators. But, how the improved hydrologic data as used in water rights adjudication could result in worsened hydrologic conditions is less clear. The actual net water loss from the land surface over time is new information and is critically valuable for water accounting. A water right, in contrast, is decreed based on evidence presented to the court from data on historic beneficial use of water in all its aspects of diversion, storage, conveyance, place, purpose, amount (volume and rate) and other conditions of use. A decree of water rights is not the means to control the basin water balance. In a decree, CIR is a tool to administer subsequent transfers, not a statement about actual depletion in the overall basin. Net water loss to the atmosphere is peripheral to, and is not a necessary element of, a water right. Quantification of CIR is a recent innovation in New Mexico court proceedings. The court evidence for a beneficial use amount is commonly (since the early 20th century) based on empirical canal ratios of diverted amounts delivered to farm head gates (the duty of water).[46] The purpose of the original CIR calculation was to aid canal sizing for new project design.[47] Courts commonly decree a relatively large water duty as a right because they recognize the right must be sufficient for farming in hot, dry years and for tall, leafy crops, as well as other times and other crops. Due to occasional shortage of water the long term average water use is invariably less than the water right. Few, if any, water-management operations set for themselves the primary objective of fully depleting their decreed CIR. Under New Mexico administrative practice, a nominal CIR has been used since the 1950s to permit transfer of water uses to new places and purposes.[48] The CIR role in administration is to avoid impairment that would otherwise arise by trans-

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46. *See* HARRY F. BLANEY & WAYNE D. CRIDDLE, DETERMINING WATER REQUIREMENTS IN IRRIGATED AREAS FROM CLIMATOLOGICAL AND IRRIGATION DATA 6 (1950); *See also* HARRY F. BLANEY & WAYNE D. CRIDDLE, DETERMINING CONSUMPTIVE USE AND IRRIGATION WATER REQUIREMENTS 47 (1962) for discussions of various methods of determining the amount of water consumed by crops.

47. BLANEY & CRIDDLE, *supra* note 46.

48. Celina A. Jones, *The Administration of the Middle Rio Grande Basin: 1956-2002*, 42 NAT. RESOURCES J. 939, 944 (2002).

ferring a full "duty" to a new purpose and place where a larger fraction of the duty might be depleted. Thus, administrative errors in CIR might affect the future distribution of available water, but not the basin balance of available water.

It is reasonable to reconsider whether a CIR limit belongs in the LRG court issues for determination and decree, but if CIR is decreed at a higher (or lower) level than the actual average, the hydrologic conditions of the LRG are unlikely to be perturbed. CIR is but one element that makes up the amount of a water right and factors other than the decreed amount of water rights control the hydrologic conditions and the water balance in the basin. Due to the tenuous link between the rights on the ladder of priority and the global use of available water, and due to the overriding importance of other factors, there is no real prospect of a hydrologic catastrophe caused by errors in awarding water rights, any consequent change in consumptive use, or by erroneous administration of transfer amounts. However, a court ordered CIR has the potential to hamper case-by-case administration of a realistic transferable quantity of net CIR. As water rights become more certain through court decree, as physical structures in the basin are better designed and managed, and as the water-accounting technology improves while the hydrology continues to vary unpredictably, we may expect more, not less, social satisfaction with hydrologic conditions.