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An Institutional Framework for a Water Market in the Elephant Butte Irrigation District

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ABSTRACT

Water scarcity in New Mexico has become increasingly severe over the past decade, threatening to disrupt interstate compact deliveries to Texas and Mexico. In response, the Office of the State Engineer (OSE) has launched Active Water Resource Management (AWRM), of which one component is water marketing. In this paper, we propose an institutional framework for a water market in the Elephant Butte Irrigation District (EBID)—the largest surface water supplier in New Mexico. This framework is based on a review of current water resource management, institutional and regulatory constraints, and requirements for an efficient market. The paper concludes with policy recommendations to transition the EBID to a fully operational water market.

I. INTRODUCTION

Water issues became increasingly important in New Mexico over the past decade.[1] Urban water supplies have been stressed as a result of rapid population growth, and explosive economic development has created new demands on already scarce supplies. In turn, a prolonged drought that began in 2003 produced a shortage of available water[2] and intensified tensions with downstream users in Texas. Despite the long-term problems that New Mexico has experienced with managing its water supply, it has lagged behind other states, such as California, Idaho, and Colorado in embracing innovative solutions to the problem such as market-based management of water resources. In this article, we aim to

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1. NEW MEXICO OFFICE OF THE GOVERNOR, STATE OF THE STATE ADDRESS (2007) (by 2007 Governor Bill Richardson was compelled to acknowledge this awareness by pronouncing it "The Year of Water"), *available at* http://www.governor.state.nm.us/MEDIA/PDF/StateoftheState2007.pdf.

2. *See generally* OFFICE OF THE GOVERNOR, GOVERNOR RICHARDSON'S POLICY INITIATIVES: WATER, *available at* http://www.governor.state.nm.us/priorities-water.php?mm=4.

address this crisis with a focus on the Elephant Butte Irrigation District, the largest water supplier in the state.

The importance of the Elephant Butte Irrigation District (EBID) and the agricultural sector to economic growth in New Mexico cannot be understated. EBID provides water to the Mesilla and Rincon Valleys of Doña Ana and Sierra Counties, respectively.[3] It provides all surface water irrigation for agriculture in Doña Ana County and is also an important potential source of water for the City of Las Cruces, which is the second largest metropolitan area in New Mexico.[4] Furthermore, the agricultural sector of Doña Ana County is crucial to the New Mexico economy. The market value of all agricultural production in Doña Ana County was approximately $389 million in 2007, a figure that ranked the county first among all New Mexico counties.[5] Additionally, Doña Ana County is the top pecan-producing county in the United States, which is important due to the high value of pecan crop production.[6]

One of the main drivers of increasing water scarcity in Doña Ana County and New Mexico is population growth. New Mexico's population has grown by approximately 4 percent annually throughout the 1990s, the second-highest growth rate along the U.S.–Mexico border behind Texas.[7] The population adjacent to the border is projected to reach anywhere from 328,000 to 425,000 by the year 2020 and is expected to reach half a million by 2040.[8] The population of Las Cruces alone is projected to reach 200,000 by 2035, exceeding the city's projected water supplies.[9]

In addition to population growth, urbanization is placing increasing pressure on scarce water supplies. Rapid urbanization negatively im-

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3. Elephant Butte Irrigation District, About EBID, http://www.ebid-nm.org/general/About_EBID/index.shtml (last visited June 23, 2009) [hereinafter About EBID].

4. *See* U.S. CENSUS BUREAU, 2000 CENSUS: NEW MEXICO—POPULATION, HOUSING UNITS, AREA AND DENSITY; *see also* ELEPHANT BUTTE IRRIGATION DISTRICT, ELEPHANT BUTTE IRRIGATION DISTRICT: GENERAL DATA AND INFORMATION 41 (1998).

5. UNITED STATES DEPARTMENT OF AGRICULTURE, 2002 CENSUS OF AGRICULTURE (2002), *available at* http://www.agcensus.usda.gov/Publications/2007/Full_Report/Volume_1,_Chapter_2_County_Level/New_Mexico/st35_2_002_002.pdf.

6. Justin Bannister, *New Mexico Is Nuts About Pecans, Now Number One Producer in the Country*, New Mexico State University Communications, May 8, 2007; Cary Blake, *New Mexico Tops in Pecans*, SOUTHWEST FARM PRESS, May 3, 2007.

7. James Peach & James Williams, *Population and Economic Dynamics on the U.S.-Mexican Border: Past, Present, and Future*, *in* THE U.S.-MEXICAN BORDER ENVIRONMENT: A ROAD MAP TO A SUSTAINABLE 2020, 37, 61 (Paul Ganster ed., 2000).

8. *See id.* at 37, 50–55; TERRACON, THE NEW MEXICO LOWER RIO GRANDE REGIONAL WATER PLAN, 6-91, 6-92 (2003), *available at* http://wrri.nmsu.edu/lrgwuo/rwp/LowerRioGrandeRegionalWaterPlan.pdf.

9. Diana Alba, *Water, Agriculture Are Issues as We Expand*, LAS CRUCES SUN-NEWS, May 14, 2007, at A1.

pacts agriculture because more water is needed for municipal uses and less land is devoted to agricultural activities. Increasing population growth and urbanization is further complicated by recurrent droughts. EBID most recently confronted a water crisis in 2003 when a severe drought resulted in short supplies and decreased reservoir storage levels.[10]

Both the Office of the State Engineer (OSE) and Governor Richardson have taken the lead in confronting these issues of increasing and competing demands for water. One of the efforts of the OSE is the current adjudication of water rights. The adjudication arose as an attempt to resolve conflicts over water by requiring the OSE to identify and quantify the rights to New Mexico's water supply. Additionally, the OSE has formulated an Active Water Resource Management (AWRM) plan to protect senior water rights holders and maximize the beneficial use of New Mexico's water.[11] The Governor's office has pursued several policy initiatives, including investments in the state's Strategic Water Reserve and acequias, a $4 million project to detect and repair leaks statewide, and appointment of a Drought Task Force.[12]

An additional policy instrument that can complement these initiatives in New Mexico is a water market. Markets are part of the AWRM plan being forwarded by the OSE and the New Mexico Interstate Stream Commission (NMISC). Recognizing that New Mexico's surface water resources are fully appropriated and many areas of the state "rely on non-sustainable groundwater aquifers," the OSE and the NMISC have suggested that the state should "promote water markets."[13] This promotion could happen through a number of market forms and should be aimed at

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10. ERENEY HADJIGEORGALIS & DUSTIN VENDRELY, MARKET-BASED MANAGEMENT OF WATER SCARCITY IN THE ELEPHANT BUTTE IRRIGATION DISTRICT 3, 7 (Water Task Force Report No. 7, 2007), *available at* http://aces.nmsu.edu/pubs/taskforce/water/WTF-7.pdf.

11. *See* Office of the State Engineer, Active Water Resource Management (2007), http://www.ose.state.nm.us/water_info_awrm.html (last visited June 22, 2009) [hereinafter OSE AWRM].

12. OFFICE OF THE GOVERNOR, *supra* note 2, at 1. The Strategic Water Reserve consists of water rights held by the New Mexico Interstate Stream Commission (NMISC) to assist the State in meeting interstate stream compact obligations and to supplement low flows for endangered species. *See* Office of the State Engineer, Strategic Water Reserve, http://www.ose.state.nm.us/hot_StrategicWaterReserve.html (last visited June 22, 2009). The Drought Task Force is responsible for developing strategies to reduce the State's vulnerability to drought. The Task Force, which is chaired by the State Engineer, includes experts in water conservation and quality, water rights, water project construction, and financing. *See* Office of the State Engineer, Governor's Drought Task Force, http://www.ose.state.nm.us/DroughtTaskForce/index.html (last visited June 22, 2009).

13. *See* OFFICE OF THE STATE ENGINEER AND NEW MEXICO INTERSTATE STREAM COMMISSION, NEW MEXICO STATE WATER PLAN 13, 16–17 (2003).

efficient management and application of water in accordance with existing regulations and policies.[14]

In this article,[15] we review the current water resource management structure of EBID and provide a set of policy recommendations aimed at fostering the generation of a water market for it. First, we examine water resource management practices in EBID, including current transfer mechanisms. Second, we review the institutional and regulatory constraints that must be taken into account when designing a water market for EBID. Third, we explore the requirements for an efficient water market in EBID, such as the institutional framework in which the market must operate, the market structure, intersectoral trade (trade between different types of uses), and environmental aspects. Finally, we provide a set of policy recommendations aimed at transitioning EBID to a fully operational water market.

II. WATER RESOURCE MANAGEMENT IN EBID[16]

The Rio Grande Project (Project) was authorized by an Act of Congress on February 25, 1905, pursuant to the Reclamation Act of 1902.[17] The Project included Elephant Butte Dam and Reservoir, Caballo Dam and Reservoir, a power generating plant, six diversion dams in New Mexico and Texas (Percha, Leasburg, Mesilla, American, International, and Riverside), and lands within the area. EBID and El Paso County Water Improvement District Number One (El Paso District One) both reside in the boundaries of the Rio Grande Project.

From the Project's inception in 1905, the ditches, laterals, and canals within the boundaries of EBID were managed by the Elephant Butte Water Users Association until this association entered into a contract with the Bureau of Reclamation (BOR) in 1918 to transfer all rights,

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14. *Id.*

15. For more detailed information, see generally Brandon S. Winchester, Designing a Water Market for the Elephant Butte Irrigation District of New Mexico (May 10, 2008) (unpublished M.S. thesis, New Mexico State University) (on file with Branson Library, New Mexico State University).

16. For a detailed explanation of the EBID's structure and operating procedures, see LEEANN DEMOUCHE, INTERPRETING THE ELEPHANT BUTTE IRRIGATION DISTRICT FOR WATER USERS (Cooperative Extension Service Circular No. 590, 2004), *available at* http://aces.nmsu/edu/pubs/_water/CR590.pdf. For an excellent history of Elephant Butte Irrigation District, see generally About EBID, *supra* note 3; PAUL LESTER, HISTORY OF THE ELEPHANT BUTTE IRRIGATION DISTRICT (1977); JOHN L. GREGG, A BRIEF HISTORY OF THE ELEPHANT BUTTE IRRIGATION DISTRICT (1996).

17. Pub. L. No. 57-161, 32 Stat. 388. The Rio Grande Project and the construction of Elephant Butte Dam were authorized under the Reclamation Act by Congress in 1902. *Id.*

privileges, and revenues to EBID. In 1996, EBID acquired from the BOR the title to the irrigation facilities that EBID had been operating.[18]

A. Groundwater Use

Both groundwater and surface water supplies are used in EBID. Groundwater use became widespread in EBID in the 1950s and 1970s to supplement short surface water supplies during droughts. Groundwater use has continued since that period, though to a lesser extent.[19] Though it has remained a primary alternative for drought mitigation, groundwater pumping has also served other purposes. Groundwater provides irrigation for cool-season crops,[20] high-value crops that are sensitive to irrigation timing, and water-intensive crops, such as pecans and alfalfa, that exceed EBID's consumptive use allotment.[21]

Groundwater is used to mitigate short surface water supplies, irrigate crops without EBID rights, and provide for municipal and industrial water uses. In a full supply year, approximately 125,000 acre-feet are extracted. From that total, approximately 44,000 acre-feet go to municipal and industrial uses, and the remainder is consumed by agricultural uses. During low surface water supply years, municipal and industrial wells pump approximately the same amount, and irrigators increase their pumping to between 200,000 and 300,000 acre-feet.[22] As of 2002, there were approximately 5,000 acres of crops irrigated solely by groundwater in the Lower Rio Grande.[23]

It is difficult to ascertain to what extent groundwater aquifers have been drawn down or replenished in EBID, because data on historical groundwater use have not been collected. But analyses of water levels by Shomaker and Associates, a firm that specializes in hydrology, have determined that a cone of depression is developing beneath Las Cruces. This indicates that the city is pumping water faster than it is being replenished.[24] Increased pumping during periods of short supply is of considerable interest and concern, as it relates to EBID's deliveries to El Paso District One and New Mexico's deliveries to Texas under the Rio Grande

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18. About EBID, *supra* note 3, at 19.

19. TERRACON, *supra* note 8, at 6-91, 6-92.

20. Crops that are irrigated outside the typical irrigation season.

21. J. PHILLIP KING & JULIE MAITLAND, WATER FOR RIVER RESTORATION: POTENTIAL FOR COLLABORATION BETWEEN AGRICULTURAL AND ENVIRONMENTAL WATER USERS IN THE RIO GRANDE PROJECT AREA 66 (World Wildlife Fund, 2003), *available at* http://cagesun.nmsu.edu/~jpking/wwf/agH2O0603.pdf.

22. OFFICE OF THE STATE ENGINEER, ACTIVE WATER RESOURCE MANAGEMENT: PROTECTING OUR WATER FUTURE (2006).

23. *Id.*

24. TERRACON, *supra* note 8, at 6-107.

Compact; increased pumping depletes the aquifer, causing the river to recharge the aquifer more, thus reducing downstream surface flows.[25] The OSE and EBID are concerned as Texas has shown a proclivity to sue and has been successful in such suits in the past.[26] Future litigation could "cost New Mexico control of its water destiny," meaning that an outcome similar to the one described above would prevent New Mexican irrigators from using groundwater as a drought mitigation tool.[27]

B. Water Transfer Background

The history of transferring water rights in EBID dates back to the early history of the Rio Grande Project. Some of the land that had received the right to use Project water could not be irrigated because it was seeped,[28] alkaline,[29] or had other conditions that prevented irrigation. The water user was, however, still obligated to pay a tax assessment to the BOR. These tax payments were large in this early period because the repayment period under the contract lasted only 10 years.[30]

To reduce the tax burden on these lands, the board of the Elephant Butte Water User Association set forth new regulations, allowing suspension of water rights on non-irrigable land and transfer to irrigable land. These transfers of water rights relieved users who could not irrigate their acreage and it ensured that the BOR was not assessing landowners for non-irrigable acreage.[31] This process has continued throughout the history of EBID and is recognized by New Mexico statutes.[32] Temporary water transfers—i.e., sending water from the field of one farm to the field of another farm—have been practiced since the implementation of the Project,[33] and have also been recognized in state law.[34]

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25. OFFICE OF THE STATE ENGINEER, KANSAS V. COLORADO: A SUMMARY OF PERTINENT REGULATORY AND LITIGATION HISTORY ON THE ARKANSAS RIVER, COLORADO 1–2 (2007) [hereinafter OSE: KANSAS V. COLORADO].

26. *See* Texas v. New Mexico, 482 U.S. 124 (1987).

27. OSE: KANSAS V. COLORADO, *supra* note 25, at 1–2.

28. Seeped land is land where groundwater has oozed from the ground to the surface and pools of water have formed.

29. Alkaline land is land containing a high percentage of salts.

30. ELEPHANT BUTTE IRRIGATION DISTRICT, ELEPHANT BUTTE IRRIGATION DISTRICT WATER POLICIES AND GUIDELINES 4 (2005) [hereinafter EBID WATER POLICIES AND GUIDELINES].

31. *Id.*

32. N.M. STAT. §§ 73-13-4, 73-13-5 (1978).

33. EBID WATER POLICIES AND GUIDELINES, *supra* note 30, at 5.

34. N.M. STAT. § 73-10-16 (1978).

C. Current Water Transfer Mechanism

Within EBID there are two types of water users: small-tract and farm-rate irrigators. Small-tract users are those that have parcels of land with less than two acres while farm-rate users include all parcels that are two acres or larger. Small-tract users, while large in number, use an insignificant amount of water: approximately 3 percent of EBID's total annual allotment.[35] These small-tract irrigators are currently not allowed to lease their water to other irrigators and may only buy water from other irrigators as part of a combination or ditch association.[36] EBID contends that allowing small-tract users to buy or sell water on a temporary basis would increase operating costs.[37] Farm-rate users, on the other hand, have significant flexibility in ordering and scheduling water deliveries and may order water on demand. They may also engage in water transfers. While small-tract users are not permitted to engage in temporary water transfers, they are free to sell their permanent water rights.[38]

Farm-rate users who wish to buy temporary water may obtain a list of willing sellers from EBID.[39] The number of sellers and the amount of water available for purchase in any given year depends on the water supply for that year. During the 2007 irrigation season, sellers listed a total of 34,000 acre-feet of water for sale.[40] According to EBID management, much of this supply is offered by part-time farmers who have other sources of income. These farmers may refrain from farming for a year but continue to pay assessments to retain their water rights.[41]

Temporary water is also available through the conservation pool. Water that is not ordered or delivered by July 1st is designated as conserved water and placed into the conservation pool. EBID then sells this

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35. *See* DEMOUCHE, *supra* note 16, at 10; HADJIGEORGALIS & VENDRELY, *supra* note 10, at 7.

36. DEMOUCHE, *supra* note 16, at 17. A combination is a group of small-tract irrigators, or a small-tract irrigator and a farm rate user, who use the same ditch and whose combined acreage is two or more acres. Combinations allow small-tract farmers to order and schedule water deliveries just as farm rate users do. The members of the combination are still not allowed to transfer or lease water outside of the combination. Small-tract irrigators using the same ditch can also form a ditch association that is comparable to an acequia. This is essentially a management apparatus where the association makes joint decisions to improve the situation of all in the association and to avoid conflict. *See id.*

37. *Id.* at 10.

38. *Id.* at 5, 8.

39. EBID WATER POLICIES AND GUIDELINES, *supra* note 30, at 7. To transfer temporary water, farm-rate users must submit a water transfer application to the Water Records Department, which authorizes the movement of water from one parcel to another. *See id.*

40. Interview with Gary Esslinger, Treasurer-Manager for Elephant Butte Irrigation District (July 16, 2007).

41. *Id.*

water to its users on a first come, first served basis. EBID retains the revenue from conservation pool sales, which is used to augment its operating budget.[42] Placing water in the conservation pool is meant to maximize use of Project water in EBID, and ensure that all Project water allocated to EBID is put to beneficial use.[43]

Permanent transfers of water rights are also important in EBID. In New Mexico, water rights are appurtenant to irrigated land and are usually conveyed when land is sold. Water rights, however, can also be suspended and transferred from one tract to another. In EBID, rights can be transferred to any parcel within its boundaries as long as it meets EBID's criteria as irrigable land.[44]

EBID has promulgated a stacking policy in response to the recent hydrographic survey[45] by the OSE to maintain its 90,640 water-righted acres.[46] Stacking of water rights means adding more water rights to a parcel without increasing the acreage[47] and is provided for under New Mexico water law.[48] Under this policy, irrigators can now purchase additional water rights and apply them to their land. Only farm-rate irrigators may participate, and stacked water rights cannot exceed twice the number of original water rights. For example, a parcel with 10 EBID water-righted acres can be doubled so that 10 acres of land will hold

42. Interview with Valerie Beversdorf, Computer Resources and Geographical Information Systems Services Director for Elephant Butte Irrigation District (Oct. 13, 2006).

43. EBID WATER POLICIES AND GUIDELINES, *supra* note 30, at 8.

44. *See* ELEPHANT BUTTE IRRIGATION DISTRICT, FACT SHEET: WATER RIGHTS TRANSFERS 1–2 (2006), *available at* http://www.ebid-nm.org/Static/PDF/Fact%20Sheet/Fact-Water%20Right%20Transfers.pdf; EBID WATER POLICIES AND GUIDELINES, *supra* note 30, at 8. Those wishing to transfer water rights must submit an application for this transfer process to the Engineering Department, including reclassification if the transfer to land is currently non-irrigable. Once the proper documentation is obtained, including property deeds, a public hearing is scheduled and public notice is given by publishing an announcement of the hearing in the newspaper. At this hearing, the EBID Board of Directors can take the following actions: approve, deny, table, stipulate conditions, or request additional information. Those wishing to protest the Board's decision must appeal to the state district court within 10 days. *See id.*

45. This survey states that the land currently being irrigated is less than EBID's accounting of irrigated land that is based on historical irrigation. ELEPHANT BUTTE IRRIGATION DISTRICT, ELEPHANT BUTTE IRRIGATION DISTRICT STACKING POLICY 1 (2005).

46. EBID was originally allotted 90,640 water-righted acres under the Rio Grande Compact—though there have been times when less acreage was irrigated. To rectify this, EBID now allows these rights, which may have gone unused, to be stacked on land in order to keep this base amount of acreage. *Id.*

47. *Id.* at 2.

48. N.M. STAT. § 72-5-28 (1978).

water rights equivalent to 20 water-righted acres, under the stacking policy.[49]

D. Special Water User Associations

EBID has implemented policies that allow water deliveries to include residential, commercial, industrial, and agricultural uses. For non-agricultural users to take delivery of Project water, a Special Water User Association (SWUA) needs to be formed. An SWUA can be a municipality, county, university, or public utility within the EBID boundaries that will supply water for municipal or industrial uses. These SWUAs may lease annual allotments from water right holders in EBID for periods of five to 40 years.[50]

SWUAs must pay the tax assessments for the water rights that they lease. Irrigators who have leased their annual allotments to SWUAs cannot continue to irrigate their land from any source, including groundwater, during the term of the lease. Irrigators who continues to irrigate their land after leasing their water to the SWUA are not penalized. The SWUA, however, is assessed a penalty equal to the assessments on the land and a deduction from its water account.[51]

Any water leased by SWUAs from EBID needs to be treated before it is fit for municipal or industrial uses. SWUAs, therefore, need to construct water treatment plants to take advantage of this leased water. Currently, no SWUAs, including the City of Las Cruces, have constructed water treatment plants. All water rights held by SWUAs are currently stored in the conservation pool where the rights are leased by EBID irrigators.[52] Once SWUAs construct their water treatment plants, however, they will begin to draw out water from the conservation pool for municipal use.

III. INSTITUTIONAL AND REGULATORY FRAMEWORK AND CONSTRAINTS

There are several institutional aspects of water management in New Mexico that must be taken into consideration when designing a water market for EBID. These include New Mexico water law, the adjudication process, the AWRM plan pursued by the OSE, the Interstate

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49. EBID WATER POLICIES AND GUIDELINES, *supra* note 30, at 2.

50. ELEPHANT BUTTE IRRIGATION DISTRICT, POLICY 2003-GA8: SPECIAL WATER USER ASSOCIATIONS 33–35 (2003) [hereinafter EBID: SPECIAL WATER USER ASSOCIATIONS].

51. *Id.* at 35.

52. Interview with Valerie Beversdorf, *supra* note 42. If a SWUA pumps groundwater, EBID will determine the depletion of project water and reduce the SWUA's surface water delivery. EBID: SPECIAL WATER USER ASSOCIATIONS, *supra* note 50, at 36.

Compact Agreement with Texas, the Operating Agreement with El Paso District One, increased municipal demand for water, and the surface water treatment plant proposed by Las Cruces.

A. New Mexico Water Law

As in most western states, New Mexico regards a water right as a right to use water beneficially, instead of more traditional notions of property rights. All water remains the property of the State.[53] Water rights can be held by any entity and can be transferred to different tracts of land, as long as the transfer will not impair other water rights, is not detrimental to the welfare of the people of New Mexico, and is approved by the OSE.[54]

New Mexico is a prior appropriation state that adheres to the "first in time, first in right" doctrine. This means that the right that first put a claim to water and put it to beneficial use receives its water before all later water users.[55] The doctrine of prior appropriation establishes an entitlement to a specific amount of water, based on the amount of land one owns and the amount put to beneficial use, with a definite priority date.[56]

The doctrine of prior appropriation is important to water resource management in New Mexico because, in the absence of a water marketing institution, junior rights holders may be involuntarily subjected to curtailment during droughts.[57] The establishment of water markets in EBID will provide the opportunity for junior rights holders to purchase water from senior rights holders during water shortages. Water markets are particularly important for holders of groundwater rights, which are junior to all Rio Grande Project surface water rights in EBID.[58]

The scope or hierarchy of beneficial use, while referenced in statute, is not delineated in the water law of New Mexico and is left to the discretion of the OSE. The OSE has traditionally recognized agricultural, commercial, domestic, industrial, and recreational uses as beneficial. Instream flows have not been formally recognized by the OSE as a benefi-

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53. N.M. STAT. § 72-1-1 (1978).

54. BUREAU OF LAND MANAGEMENT, DEPARTMENT OF THE INTERIOR, NEW MEXICO WATER RIGHTS FACT SHEET 3 (2001).

55. *Id.* at 1.

56. S.J. NEWSOM, WATER EDUCATION FOUNDATION, LAYPERSON'S GUIDE TO WATER RIGHTS LAW 4 (2005).

57. *See* Charles DuMars, *New Mexico Water Law: An Overview and Discussion of Current Issues*, 22 NAT. RESOURCES J. 1045, 1046 (1982).

58. OFFICE OF THE STATE ENGINEER, *supra* note 22.

cial use, though the Attorney General issued a legal opinion in 1998[59] suggesting that such an application of surface water is permissible under state law.[60] The failure to codify beneficial use in New Mexico water law may, however, limit the incorporation of non-traditional uses of water—such as instream flows and recreational uses—into the water market.

In New Mexico, water rights can be lost by forfeiture. This is the so-called "use it or lose it" provision.[61] There are two exceptions to this forfeiture clause. Municipalities obtaining water rights to meet their 40-year growth plan are still subject to beneficial use restrictions, but they are given "more substantial 'reasonable time.'"[62] Additionally, as a result of recently passed legislation, irrigators can use more efficient irrigation methods without losing the right to use the water conserved, and they can now transfer or sell that conserved water.[63] However, long-term leases that do not include conserved water have no specific exemptions. This omission from the New Mexico water law typically works against the concept of water marketing because irrigators may risk forfeiture of their water rights for extended periods of leasing.

B. Adjudication

The impetus for the adjudication of water rights in New Mexico was the increasing conflict generated by disputes over the date of priority and the amount allowed to be diverted. For EBID, the most important conflict has been the ongoing dispute with El Paso District One regarding return flows. In 2001, the Attorney General of Texas received $6.2 million from the Texas legislature to pursue legal actions against New Mexico for issues related to the Rio Grande. El Paso District One recently sued EBID to receive a larger portion of return flows, but this lawsuit

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59. *See* Does New Mexico Law (Constitutional, Statutory, or Case Law) Permit the State Engineer to Afford Legal Protection to Instream Flows for Recreational, Fish or Wildlife, or Ecological Purposes?, Att'y Gen. Op. No. 98-01 (Mar. 27, 1998) [hereinafter Does N.M. Protect Instream Flows?].

60. BUREAU OF LAND MANAGEMENT, *supra* note 54, at 3–4.

61. *See* N.M. STAT. § 72-5-28 (1978). It is commonly understood that the period of non-use required to forfeit one's water right is five years. A period of four consecutive years of not putting appropriated water to beneficial use results in a notice of non-use by the OSE. After another year of non-use, the water right is forfeited and may be appropriated. *See id.*

62. N.M. STAT. § 72-1-9 (1978); *see also* State ex rel Martinez v. City of Las Vegas, 134 N.M. 375, 89 P.3d 47 (2004).

63. N.M. STAT. § 72-5-18 (1978).

was dismissed with the signing of the operating agreement[64] between the two districts.[65]

The OSE is charged with identifying and quantifying the rights to use the waters of New Mexico's waterways.[66] The adjudication will establish the point of diversion, purpose of use, and the priority date of the water right; the quantity of each right, or duty of water,[67] will be set through negotiations between EBID and the OSE after the adjudication is completed. The adjudication process in the lower Rio Grande has been ongoing since 1986.[68]

C. Active Water Resource Management—OSE

Active Water Resource Management (AWRM) is a set of policy tools that the OSE has implemented as a proposed solution to the increasing demand for water. The lower Rio Grande Basin of New Mexico, which includes EBID, is considered a high priority area for AWRM. The objectives of AWRM are to actively manage the state's water resources to: (1) ensure that senior water right owners are protected during a shortage; (2) enable junior water right owners to plan for times of shortage; (3) facilitate accommodation of new or growing water uses; (4) reduce the negative impact of water shortages; and (5) identify and stop illegal diversions or over-diversions.[69]

To accomplish the AWRM objectives, the plan calls for well-metering, appointment of water masters, curtailment of junior users' water (priority call), and alternatives to priority calls to avoid curtailing junior users.[70] Well-metering is intended to prevent illegal, wasteful pumping and to improve conservation, while providing data to develop means of addressing water shortages.[71] In December 2004, the OSE issued an order mandating that all water rights owners with groundwater wells buy, in-

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64. *See* Elephant Butte Irrigation District, Compromise and Settlement Agreement (Dec. 9, 2009), http://ebid-nm.org/Static/PDF/OpAg/OpAg.pdf. This agreement is referred to as the Operating Agreement and is signed by Elephant Butte Irrigation District, El Paso County Water Improvement District No. 1, and the U.S. Bureau of Reclamation. *See id.*

65. Interview with Gary Esslinger, Treasurer-Manager for Elephant Butte Irrigation District (Feb. 19, 2008).

66. *See* N.M. STAT. §§ 72-4-13, 72-4-15, 72-4-16, 72-4-17, 72-4-19 (1978).

67. The duty of water is the total volume of irrigation water required for a crop to mature taking into consideration consumptive use, evaporation, and seepage.

68. Interview with Hon. Jerald Valentine, District Judge Civil Division IV, Third Judicial District Court of New Mexico (July 20, 2007).

69. OFFICE OF THE STATE ENGINEER, *supra* note 22.

70. OFFICE OF THE STATE ENGINEER, PROPOSED RULES AND REGULATIONS PROVIDING FOR ACTIVE WATER RESOURCES ADMINISTRATION OF THE WATERS OF THE LOWER RIO GRANDE WATER MASTER DISTRICT 1–16 (2006) [hereinafter OSE PROPOSED RULES AND REGULATIONS].

71. *See* OFFICE OF THE STATE ENGINEER, WELL METERING REQUIREMENTS (2005).

stall, and maintain a flow meter for each well by March of 2006. Water rights owners are required to report the volume of water pumped quarterly and make up any over-diversions that do not include purchased water.[72]

As of a March 2006 inspection there was only 25 percent compliance with the well-metering order. Despite this non-compliance, wells were not shut down during the 2006 irrigation season.[73] During the 2007 irrigation season, the OSE was in the process of identifying those irrigators who were not in compliance. Letters of non-compliance were to be mailed to irrigators along with the requirements of the order.[74] Initially there was no penalty for non-compliance, but legislation passed in 2007 clarifies procedures surrounding the service of compliance orders and allows for monetary penalties. In addition, the law provides for the suspension of water diversion until meters are installed.[75]

The OSE, to conjunctively manage ground and surface water, has set forth a Farm Delivery Requirement (FDR). The FDR, or duty of water,[76] has been set at four acre-feet per year, including groundwater pumping, for all land holding EBID surface water rights. If farmers receive two acre-feet of surface water per irrigation season, the FDR would permit them to pump an additional two acre-feet of groundwater. This level of four acre-feet is an interim value that may be altered through negotiations between EBID and the OSE after the adjudication is completed by the Stream Court.[77] Farmers who have water-intensive crops may lease additional water and/or stack[78] water rights.[79]

In early 2005, the OSE hired water masters to monitor water use in the Lower Rio Grande of New Mexico and provide an enforcement mechanism for the tenets of AWRM.[80] Water masters account for ground and surface water diversions, issue orders from the OSE (such as the

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72. *Id.*

73. OFFICE OF THE STATE ENGINEER, *supra* note 22.

74. Interview with Rasul Ahadi, Office of the State Engineer (July 11, 2007).

75. N.M. STAT. § 72-2-18 (1978).

76. *See supra* note 67.

77. The Stream Court is the judicial body, usually a district court, that has exclusive jurisdiction over adjudication and determines who has the right to use the surface and ground waters of a stream system. *See* OSE PROPOSED RULES AND REGULATIONS, *supra* note 70, at 4. In the Lower Rio Grande Basin, the Stream Court is embodied by the Honorable Jerald A. Valentine, District Judge in the Third Judicial District Court of New Mexico.

78. Stacking water rights is the practice by which irrigators can add water rights to a parcel without increasing acreage.

79. OSE PROPOSED RULES AND REGULATIONS, *supra* note 70, at 50.

80. A bill was passed in 2007 that allows water rights owners in an irrigation district to petition the OSE to appoint or remove a water master. *See* N.M. STAT. § 72-3-2 (1978).

well-metering order), and stop illegal diversions.[81] They also provide annual reports on their basin to the OSE, which include summaries of the amount of land irrigated and the amount of water used for purposes other than irrigation.[82]

In the case of a short supply, AWRM provides for three forms of priority administration that would curtail water rights to differing degrees. The most severe form of priority administration is the priority call where all water rights junior to Rio Grande Project rights are cut off until senior users get their full delivery of water. A priority call would also prohibit all groundwater pumping by junior users without a replacement plan,[83] because the water is conjunctively managed in EBID's irrigation area. This includes Las Cruces, which uses groundwater to supply its water users. A priority call is issued as a last resort to ensure compliance with interstate compact agreements regarding downstream commitments when all other alternatives have been exhausted.[84] Only EBID or the BOR can make a priority call, and the OSE must agree that it is valid and senior rights are not receiving their full water allocations. EBID would have to submit extensive evidence that its delivery[85] of surface water is being negatively affected by groundwater pumping, while the BOR would have to provide evidence that groundwater pumping is interfering with deliveries to Mexico to make a priority call.[86]

Less severe forms of priority administration include supply administration and depletion limit administration. Both supply and depletion administration involve reduced delivery of water to junior users, but they differ in the severity and reach of the curtailment. Under supply administration, the reduced delivery to junior users would only affect the most junior users and it would only be temporary, as the supply

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81. *See generally* OSE PROPOSED RULES AND REGULATIONS, *supra* note 70, at 37–43 (describing the duties and jurisdiction of a water master).

82. *See generally* MARTIN MCMILLAN, 2006 FIELD CHECKS OF IRRIGATED ACREAGE AND WATER DIVERSION FOR OTHER THAN IRRIGATION PURPOSES IN THE GILA-SAN FRANCISCO, SAN SIMON CREEK, AND VIRDEN VALLEY WATER BASINS (2007).

83. *See* OSE PROPOSED RULES AND REGULATIONS, *supra* note 70, at 23–26. A replacement plan is a plan filed by the owner of an out-of-priority water right to the State Engineer for the purpose of off-setting depletions under priority administration. They are meant to prevent crop or serious economic loss during times of shortage. This would take the form of a junior water right leasing rights—for less than two years—from a right senior to the administration date promulgated by the OSE. Here, the junior water right is essentially retaining their right to divert their water and replacing any diversions they make with the water leased from the senior water right holder. See *id.* at 54–67 for discussion of replacement plans.

84. *See id.* at 23–26.

85. This delivery includes delivery to EBID irrigators and to El Paso District One.

86. OSE PROPOSED RULES AND REGULATIONS, *supra* note 70, at 23–26.

administration expires at the end of each year.[87] Depletion limit administration curtails more junior water rights than supply administration and for an indefinite period of time.[88] Only the OSE has the authority to authorize supply or depletion administration.[89]

To avoid the negative impacts of priority administration, the OSE is encouraging the adoption of alternative administration plans. An alternative administration plan is a voluntary agreement among water right holders in an affected region to share the water deficits. Alternative administrations may include shortage sharing agreements, rotation agreements, or water marketing arrangements.[90]

Shortage sharing agreements are voluntary agreements among water rights holders to proportionally reduce their water allocations during drought or to compensate other users for forgoing their water use.[91] These agreements could be between multiple users such as farmers, municipalities, and businesses. An example of a shortage sharing agreement occurred in the San Juan Basin of New Mexico in 2003 and 2004 between Indian nations, power and mining companies, irrigation districts, and municipalities. Those who took voluntary water shortages received payments from the industrial interests, and the BOR was able to maintain minimum flow levels.[92]

A rotation agreement is another voluntary agreement where water users take turns using water according to a schedule set by users who divert water from the same source. Such an agreement has worked successfully on the Jemez River, where American Indian and non-Indian farmers divert water for various uses. This agreement stemmed from a 1996 lawsuit brought by the Jemez and Zia Pueblos. These Pueblos held unquantified senior water rights and sought to enforce those senior rights in federal court.[93] The parties to the lawsuit, the Pueblos, and a number of ditch associations, drafted an agreement to rotate water diversions during drought. Weekly rotation schedules, determined by the

87. *Id.* at 27–29.

88. *Id.* at 27–30.

89. *Id.*

90. *Id.* at 5, 31–34; *see also* OSE AWRM, *supra* note 11.

91. *See* Office of the State Engineer, Active Water Resource Management: Other Options, http://www.ose.state.nm.us/water_info_awrm_options.html (last visited June 22, 2009) [hereinafter OSE AWRM Options].

92. *See generally* San Juan River Basin Recovery Implementation Program Biology Committee, Conference Call Summary—February 12, 2003; PNM, Regional Entities to Consider 2004 San Juan Basin Shortage Sharing Principles and Recommendations (2003), *available at* http://www.pnm.com/news/2003/1029_sharing.htm.

93. United States v. Abousleman, No. Civ. 83-1041-SC (D.N.M. 1994).

water supply, were set up under this agreement, and the agreement was given legal clout when it was adopted by the federal court as an order.[94]

The final suggested form of alternative administration is water banking, where farmers could temporarily "bank" their water so that another user may lease it. Water banking allows for a mutually beneficial transaction as the seller still receives some revenue, normally greater or equal to the foregone agricultural production income, and the buyer receives water to bring their crop to harvest.[95] In this article, we consider the feasibility of implementing not only a water bank but also other types of water transfer mechanisms in EBID as alternatives to priority administration.

D. Interstate Compact and Operating Agreement Considerations

EBID managers and policymakers are primarily concerned about deliveries of water to El Paso District One under the operating agreement. The OSE shares this concern, so it implemented AWRM to quell the prospect of under-delivering to El Paso District One and avoid possible subsequent litigation.[96] Several facets of AWRM are meant to directly diminish the likelihood of failing to meet either Rio Grande Compact or operating agreement obligations, including well-metering and the FDR.[97] These are meant to rein in the increased pumping of groundwater that occurs in a short water supply year.

The Rio Grande Compact covers deliveries from Colorado to New Mexico and from New Mexico to Texas. An interesting aspect of this arrangement is that the Texas portion of the Compact begins at Elephant Butte Dam; this means EBID is technically in Texas for purposes of the Compact. Water delivered to Elephant Butte Dam is then allocated between EBID and El Paso District One.[98]

The distribution of water allocations between EBID and El Paso District One has only recently been clarified through an operating agreement between the two districts in early 2008. Both EBID and El Paso District One took over administration of the Rio Grande Project from the BOR in 1979 and, since that time, both have clashed over the amount of water that EBID needs to deliver to El Paso District One. Both sides filed

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94. *See* PAUL BOSSERT ET AL., UTTON TRANSBOUNDARY RESOURCES CENTER, THE RIO JEMEZ BACKGROUND PAPERS ON THE ADJUDICATION PROCEEDING AND WATER RIGHTS ISSUES 37–41 (2004).

95. *See* OSE AWRM Options, *supra* note 91.

96. *See* OSE PROPOSED RULES AND REGULATIONS, *supra* note 70, at 1, 23–26; OSE: KANSAS V. COLORADO, *supra* note 25, at 1–2.

97. *See* OSE PROPOSED RULES AND REGULATIONS, *supra* note 70, at 18–30, 35–36.

98. Interview with Gary Esslinger, *supra* note 65.

numerous lawsuits until the operating agreement was established. This operating agreement acts as a miniature version of the Rio Grande Compact by setting forth the procedures by which each district's allocation will be calculated, along with a system of debits and carryover credits that each district can accrue.[99]

The conflict between EBID and El Paso District One is comparable to the conflict in the Arkansas River Basin in Colorado that resulted in the *Kansas v. Colorado* litigation before the U.S. Supreme Court.[100] In *Kansas v. Colorado*, Colorado irrigators pumped extra groundwater during years of short surface water supply. This increased pumping depleted the aquifer, reducing Colorado's deliveries to Kansas. Regulators in Colorado attempted to institute regulations that would curtail groundwater pumping that reduced Arkansas River flows, but these efforts were thwarted. Eventually, the State of Kansas filed suit against Colorado in the U.S. Supreme Court, citing violations of the Arkansas River Compact. Kansas prevailed, after years of costly litigation, when the Court ruled that Colorado irrigators' pumping was depleting flows and that Colorado could no longer pump extra groundwater in years of short supply to make up for surface water deficits. In response, Colorado limited pumping by requiring those who pump to replace the depletions in the river.[101]

EBID faces the same situation in the Lower Rio Grande with irrigators pumping more groundwater in short supply years, thereby depleting already low surface water flows which disrupt EBID's deliveries to El Paso District One and New Mexico's deliveries to Texas.[102] The OSE is addressing groundwater pumping during periods of short supply through AWRM.[103]

E. Increasing Municipal Demand

Population growth and urban sprawl[104] in Doña Ana County has been explosive over the last five decades. Urbanized land in Las Cruces increased by 784.9 percent between 1982 and 1997, while population

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99. *Id.*

100. Kansas v. Colorado, 514 U.S. 673 (1995).

101. OSE: KANSAS V. COLORADO, *supra* note 25, at 1.

102. *Id.* at 1–2.

103. *See* OSE PROPOSED RULES AND REGULATIONS, *supra* note 70, at 18–30, 35–36, 48.

104. Sprawling is defined as "land being consumed at a faster rate than population growth." This uses both urbanized land and metropolitan density to quantify the amount of sprawling. Urbanized land takes into account housing, commercial and industrial land, roads, highways, parks, etc. Metropolitan density is calculated as the population of an area divided by its urbanized land. *See* WILLIAM FULTON ET AL., WHO SPRAWLS MOST? HOW GROWTH PATTERNS DIFFER ACROSS THE U.S., at 3 (THE BROOKINGS INSTITUTION CENTER ON

growth increased by 57.5 percent over the same period.[105] The growth of urbanized land and population leads to significantly increased demand for municipal water and could lead to less land devoted to agricultural activities, assuming the urban growth displaces farmland. This has led to concerns that water supplies will be inadequate to support continued growth over the coming decades.

The City of Las Cruces' groundwater rights are expected to meet municipal water demands only until 2035. To meet increased future demand, the City is acquiring surface water rights through permanent water rights purchases and lease-to-own agreements.[106] The City currently holds several 40-year water leases that will transfer ownership of the water rights to the City upon their expiration. In addition, the City is beginning to buy water rights from irrigators instead of engaging in long-term leases.[107] Finally, the City is requiring that all new developments convey surface or groundwater rights to the City. If the developers are unable to convey such rights, they must pay the City for acquiring rights at a price higher than if acquired through private negotiation.[108]

F. Water Treatment Plant

The City of Las Cruces plans to build a surface water treatment plant by 2012 that would recycle wastewater for reuse on lawns and golf courses through a purple pipe[109] program.[110] The treatment plant will initially be able to process 500,000 gallons per day with an option to upgrade to 1,000,000 gallons per day. Using surface water in such a way is designed to offset outdoor use and maintain groundwater supplies for potable drinking water use.[111]

Construction of the water treatment plant will negatively impact water supplies available to EBID irrigators because the City of Las Cruces currently holds surface water rights in EBID's conservation pool.

URBAN & METROPOLITAN POLICY 2001), *available at* http://www.brookings.edu/es/urban/publications/fulton.pdf.

105. *Id.* at 4.

106. Alba, *supra* note 9, at A1.

107. Interview with Valerie Beversdorf, *supra* note 42.

108. DEMOUCHE, *supra* note 16, at 7–8.

109. A purple pipe program uses reclaimed water pumped through purple pipes to distinguish it from potable water. This is tertiary treated water that is close in quality to drinking water and has levels of nitrogen and minerals that are safe for construction, watering, and other such uses. Interview with Adrienne Widmer, Water Rights and Project Manager for the City of Las Cruces, New Mexico (July 18, 2007).

110. Alba, *supra* note 9, at A1.

111. Interview with Adrienne Widmer, *supra* note 109.

Once the water treatment plant is built, the City will withdraw its water from the conservation pool and EBID will no longer be able to sell this water to agricultural users. In addition, the aquifer will recharge less, because the water extracted by the City will no longer flow through the ditches and laterals of EBID.[112]

IV. REQUIREMENTS FOR AN EFFICIENT WATER MARKET IN EBID

An efficient water market must possess three essential features: clearly defined property rights; regulation of groundwater supplies; and access to information on prices and supply and demand conditions.[113] The structure of the market should meet the needs of the majority of its users to be a useful mechanism for the reallocation of scarce water supplies.[114] Limiting barriers to trade and providing flexibility in moving both the location and purpose of a water right, either temporarily or permanently, is also important. Flexibility is particularly important where the water is traded for a different type of use, or what is called an intersectoral trade.[115] In addition, mechanisms should be in place to prevent negative externalities and third-party impacts as well as environmental degradation.[116] Finally, in the case of EBID it is important to resolve issues and concerns surrounding the future of the conservation pool.

A. Property Rights

The first necessity for an efficient water market is well-defined property rights.[117] Well-defined water rights would specify a priority

112. Interview with Valerie Beversdorf, *supra* note 42.

113. *See generally* K. William Easter et al., *Formal and Informal Markets for Water: Institutions, Performance, and Constraints*, 14 WORLD BANK RES. OBSERVER 99, 100–03 (1999); K. William Easter & Robert Hearne, *Water Markets and Decentralized Water Resources Management: International Problems and Opportunities*, 31 WATER RESOURCES BULLETIN 9, 13–15 (1995); ROBERT R. HEARNE & K. WILLIAM EASTER, WORLD BANK TECH. PAPER NO. 315: WATER ALLOCATION AND WATER MARKETS: AN ANALYSIS OF GAINS-FROM-TRADE IN CHILE (1995); BONNIE COLBY SALIBA & DAVID B. BUSH, WATER MARKETS IN THEORY AND PRACTICE: MARKET TRANSFERS, WATER VALUES, AND PUBLIC POLICY 48–52 (1987).

114. *See generally* J.G. Tisdell & J.R. Ward, *Attitudes Towards Water Markets: An Australian Case Study*, 16 SOC'Y & NAT. RESOURCES 61, 62–63 (2003).

115. Afamia C. Nakat & Charles D. Turner, *Water Use and Transfer Scenarios in El Paso County, Texas, USA*, 29 WATER INT'L 338, 347–50 (2004); Charles W. Howe et al., *Innovative Approaches to Water Allocation: The Potential for Water Markets*, 22 WATER RESOURCES RES. 439, 439–41 (1986).

116. Howe et al., *supra* note 115, at 441–42.

117. *See generally* K. William Easter et al., *supra* note 113, at 101; Robert Hearne & K. William Easter, *The Economic and Financial Gains from Water Markets in Chile*, 15 AGRIC. ECON. 187, 188 (1997); Victor Brajer, *The Strengths and Weaknesses of Water Markets as They*

date, allocation, point of diversion, and type of use.[118] These rights should be marketable, enforceable, and separable from land.[119]

When water rights are not clearly defined, negative externalities may arise. A negative externality is any negative impact on third parties that is generated by a market transaction but is not compensated for within the market. Examples of negative externalities that may arise from poorly defined water rights include reduced water flows to third parties resulting from over-diversion of surface water or over-extraction of groundwater and environmental damage. Additionally, conflicts typically arise between users when a right's priority, duty of water, and point and type of use are not clearly defined. This lack of clearly defined rights brought about the ongoing state-wide adjudication by the OSE.

B. Groundwater Regulation

Groundwater must be regulated to ensure a well-functioning water market where users tap both surface water and groundwater for irrigation.[120] The lack of groundwater regulation is akin to undefined groundwater property rights and presents problems such as aquifer depletion, increased pumping costs for other irrigators, reduced flows to downstream users, and environmental damage such as increased salinity and land subsidence.[121] If groundwater use is not regulated in a water market, irrigators could sell their surface water and then pump additional groundwater to irrigate their crops. In the case of EBID, groundwater over-extraction would reduce flows to El Paso District One and Mexico, hence violating the operating agreement and interstate compact.

C. Information on Prices and Supply and Demand Conditions

Buyers and sellers need information on prices and supply and demand conditions to make informed, rational decisions about their irriga-

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Affect Water Scarcity and Sovereignty Interests in the West, 29 NAT. RESOURCES J. 489, 495 (1989); J.W. Milliman, *Water Law and Private Decision-Making: A Critique*, 2 J. LAW & ECON. 41, 57–58 (1959).

118. David W. Yoskowitz, *Spot Market for Water Along the Texas Rio Grande: Opportunities for Water Management*, 39 NAT. RESOURCES J. 345, 349–50 (1999).

119. Easter et al., *supra* note 113, at 101.

120. *Id.*; Easter & Hearne, *supra* note 113, at 10; Alberta Charney & Gary Woodard, *Socioeconomic Impacts of Water Farming on Rural Areas of Origin in Arizona*, 72 AM. J. AGRIC. ECON. 1193, 1196–97 (1990).

121. Keith Knapp et al., *Water Transfers, Agriculture, and Groundwater Management: A Dynamic Economic Analysis*, 67 J. ENVTL. MGMT. 291, 293–95 (2003); L. Jeff Lefkoff & Steven M. Gorelick, *Benefits of an Irrigation Water Rental Market in a Saline Stream-Aquifer System*, 26 WATER RESOURCES RES. 1371, 1379–80 (1990).

tion practices.[122] Without this information, uncertainty about the quantity of water available at particular times and locations impedes the efficient use of the resource by increasing the costs of participating in market transfers.[123] These costs, deemed search costs, are especially important in developing markets where price information is inadequate and there is no central trading location.[124]

Search costs associated with a nascent water market are influenced by the amount of research and information needed, the cost of enacting a market through legislation, the physical infrastructure in place and its ability to foster market transfers, and the costs of monitoring and enforcing. A specific example of an establishment transaction cost in New Mexico is the cost of adjudicating water rights to make them marketable.

Several markets in the western United States and Australia provide information to their users by posting offers to buy and sell water and water rights, as well as other relevant information, often through websites known as online bulletin boards. The Northern Colorado Water Conservancy District (NCWCD) and the Westlands Water District in California have established online bulletin boards through their websites to facilitate temporary water transfers.[125] In the Rio Grande Basin in Texas, users can contact the water master for information on possible sales and purchases.[126] Most of the water exchanges in Australia also have established websites and water users can trade water online on the National Water Exchange in Australia.[127]

D. Market Structure and Pricing

An essential requirement for an active water market is to choose a market transfer mechanism that is easily accessible and meets the needs of users. Choosing an inappropriate mechanism will lead to inactive water markets that do not improve water resource management in a basin. For example, the Arkansas River Basin Bank, established as a pilot

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122. Easter et al., *supra* note 113, at 101; Yoskowitz, *supra* note 118, at 351.

123. Marie Leigh Livingston, *Institutional Requisites for Efficient Water Markets*, *in* MARKETS FOR WATER: POTENTIAL AND PERFORMANCE 19, 26–28 (1998).

124. Janis Carey et al., *Transaction Costs and Trading Behavior in an Immature Water Market*, 7 ENV'T & DEV. ECON. 733, 746–48 (2002).

125. N. Colo. Water Conservancy Dist., Rental Water List, http://www.ncwcd.org/hot_topic/rentalwater.asp (last visited June 22, 2009); Westlands Water District, http://www.westlandswater.org (last visited June 22, 2009).

126. Yoskowitz, *supra* note 118, at 352.

127. Nat'l Stock Exchange of Austl., Water Exchange Australia, https://www.waterexchange.com.au (last visited June 22, 2009); Henning Bjornlund, *Efficient Water Market Mechanisms to Cope with Water Scarcity*, 19 INT'L J. WATER RESOURCES DEV. 553, 557 (2003).

program in Colorado in 2003, and the water bank on the Pecos River in New Mexico, established in 2002, had not generated any water transactions as of 2006. The Edwards Aquifer Groundwater Trust established in 2001 also remains inactive, while the Texas Water Bank has conducted only one transaction since its establishment in 1993.[128] In sharp contrast, the bulletin board market in the NCWCD is very active, trading on average 30 percent of its water allocation annually; water trading is also common in the Rio Grande Basin of Texas and the Murray-Darling Basin of Australia.[129]

Evaluating user needs and preferences regarding different market mechanisms is crucial to identifying a suitable water market mechanism for a given area. How well the market will achieve expectations depends in part on farmers' perceptions and attitudes to water trading in general and their perceptions of the structure and conduct of the market.[130] Economic instruments such as markets, may only work—or work well—if water users embrace the new institutional mechanisms of the market.[131]

E. Intersectoral and Interstate Trade

Efficient water markets limit barriers to trade and provide flexibility in moving both the location and purpose of a water right, among competing needs, either temporarily or permanently.[132] While it is necessary to have mechanisms in place that protect against third party effects from water transfers, overly burdensome regulations may inhibit trades and limit the benefits attainable from water markets.

Limiting barriers to trade is particularly important for intersectoral and interstate trading. Evidence from established water markets in California and Colorado have shown that some of the greatest benefits to irrigators in water markets come from sales to municipalities and hydropower, where the marginal value of water far exceeds its value in agricultural production.[133] In addition, several studies have shown that the larger the trading area in a water market, the greater the gains, particularly for interstate and inter-basin trading.

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128. PEGGY CLIFFORD ET AL., WASHINGTON DEPARTMENT OF ECOLOGY, ANALYSIS OF WATER BANKS IN THE WESTERN STATES 56–60, 92, 114, 119 (2004).

129. Howe et al., *supra* note 115, at 439-441; Ari Michelsen, *Administrative, Institutional, and Structural Characteristics of an Active Water Market*, 30 WATER RESOURCES BULLETIN 971, 976–977 (1994).

130. Tisdell & Ward, *supra* note 114, at 62.

131. Easter et al., *supra* note 113, at 100–01.

132. Nakat & Turner, *supra* note 115, at 347; Howe et al., *supra* note 115, at 439–41.

133. Richard E. Howitt, *Empirical Analysis of Water Market Institutions: The 1991 California Water Market*, 16 RESOURCE & ENERGY ECON. 357, 361–63 (1994); Michelsen, *supra* note 129, at 443–44.

F. Environment

A fully operational water market must include the environment as a key player for two reasons. First, water market trades may have substantial negative impacts on the environment if minimum instream flows and water quality are not maintained. Such was the outcome of the early years of water marketing in Australia where unregulated trade led to increased salinity and degradation of water resources.[134] Second, incorporating the environment into the market allows for the lease and/or purchase of water rights to provide for instream flows or environmental habitat.

Over the past 20 years, water trusts[135] have emerged in the western United States and have become key players in the acquisition of environmental flows through water markets. Oregon was the first state to establish a water trust in 1993. It was followed by Texas in 1997, Washington in 1998, and Montana and Colorado in 2001. The Columbia Basin Water Transactions Program, which spans several states, was established in 2002. Key to the success of these trusts has been the expansion of the doctrine of beneficial use in these states to include water leasing for environmental flows.

V. POLICY RECOMMENDATIONS

Two of the requirements for an efficient water market in EBID—clear property rights and groundwater regulation—are currently being incorporated into rules and regulations governing water resource management in the lower Rio Grande Basin. First, the OSE, EBID, and the State of New Mexico's judiciary are working to further clarify property rights over water through the adjudication process. Adjudication will set forth the point of diversion and the purpose of use for each right. The duty of water for each right will then be negotiated between the OSE and EBID once the adjudication is completed. Second, groundwater regulation is being administered through the OSE's AWRM plan. Additionally, the OSE has at its disposal priority administration to manage groundwater pumping in the event that downstream deliveries are threatened.

Other aspects of the institutional framework of the proposed water market for EBID must be resolved. These include providing appro-

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134. Henning Bjornlund, *Can Water Markets Assist Irrigators Managing Increased Supply Risk? Some Australian Experiences*, 31 WATER INT'L 221, 223 (2006).

135. Water trusts are typically non-profit organizations that transact with irrigators to procure water for the protection of fish habitat and wildlife. *See* A. DAN TARLOCK, JAMES N. CORBRIDGE, JR., DAVID H. GETCHES & REED D. BENSON, WATER RESOURCE MANAGEMENT: A CASEBOOK IN LAW AND PUBLIC POLICY 364–367 6th Ed. (2009).

priate information on prices and supply and demand conditions, creating an appropriate market structure, addressing the potential for trade between sectors and states, environmental concerns, and the future of EBID's conservation pool. The policy recommendations set forth below address these issues with the goal of creating an efficient water market that addresses EBID's institutional and regulatory constraints and operates within statutes and regulations.

A. Information on Prices and Conditions of Supply and Demand

POLICY RECOMMENDATION 1: *Implement an online bulletin board that would allow potential buyers and sellers to list desired quantities and prices, and explore the feasibility of allowing online trading of temporary allotments.*

To increase the flow of information on supply and demand conditions as well as prices for water, it is recommended that EBID should expand their current website to allow for a bulletin board approach. Currently, EBID's website allows irrigators to access information about their balance of water and allows them to transfer water between accounts they manage. This website could be expanded to include information on irrigator and municipality offers to buy and sell temporary water.

The development of the online bulletin board could be financed through a Challenge Grant from the BOR under their Water 2025 Initiative.[136] These grants provide a 50 percent cost share for projects that focus on conservation, efficiency, and water marketing.[137] The criteria for proposed projects include involvement of water marketing, the likelihood that the project will reduce conflict over water, a geographic area located in a "hot spot,"[138] and evidence of collaboration and stakeholder involvement.[139]

B. Market Structure and Pricing

POLICY RECOMMENDATION 2: *Establish a spot water market in EBID that allows prices to be determined by the interaction of supply and demand.*

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136. The Water 2025 Initiative has been revised as the Water for America Initiative. *See* U.S. Bureau of Reclamation, Challenge Grant Program, http://www.usbr.gov/wfa/grants.html (last visited June 22, 2009).

137. *Id.*

138. Portions of EBID are identified as Bureau of Reclamation "hot spots," including some portions identified with a "substantial conflict potential" and other areas with a "highly likely" conflict potential. *See* U.S. BUREAU OF RECLAMATION, WATER 2025: PREVENTING CRISES AND CONFLICT IN THE WEST 3 (2005).

139. U. S. BUREAU OF RECLAMATION, OVERVIEW OF WATER 2025 CHALLENGE GRANT SELECTION CRITERIA (2008), *available at* http://www.doi.gov/water2025/criteria.html.

To determine the market mechanism most appropriate to EBID, an extensive survey of irrigators was carried out during the summer of 2005.[140] In this survey, farmers were asked about their preferences regarding potential market mechanisms for the EBID (see Table 1, below). Market mechanisms considered in the survey included a spot water market, a water bank, an options market for short-term transfers, and permanent transfers of water rights with or without ties to land.

Table 1: Water Transfer Mechanisms—Descriptions from Farmer Survey

Water Bank
- Farmers buy and sell water from a central institution known as the "water bank."
- Prices are set by the bank (i.e., farmers cannot individually negotiate prices).
- The buying price is higher than the selling price to offset the costs of administering the bank.
- Water banks are used to sell water only on a short-term basis.
- There is no brokerage of water rights.

Spot Water Market
- Farmers individually negotiate transfers of water during an irrigation season among themselves.
- Water is transacted privately, outside of the brokerage of the irrigation district.
- Transfers must be approved by the irrigation district.
- Prices are negotiated individually. They are not fixed or set by a central authority.

Water Options Market
- A farmer pays another farmer for the "option" of purchasing a certain amount of water at some specified time in the irrigation season.
- The fee is non-refundable, but the farmer pays for the additional water only if he exercises this option by the expiration date.
- If the farmer does not purchase the water by the expiration date, the seller is free to sell his water to any other farmer. The option fee is not refundable.

Water Rights Market
- Farmers individually negotiate transfers of water rights.
- These transfers are permitted separate from land.
- All transfers must obtain prior approval from the irrigation district.

Land and Water Rights Market
- Farmers individually negotiate transfers of water rights.
- These transfers are permitted only with land.
- These transfers would not require prior approval from the irrigation district or other state entity.

It was discovered that irrigators in EBID prefer short-term leasing mechanisms over mechanisms that facilitate the trading of permanent water rights. Irrigators also indicated that they preferred a spot water market, which allows them to individually negotiate prices for water leases, over a water bank that sets fixed prices for water transfers and generally does not allow profit to accrue to sellers. There was very little

140. *See* HADJIGEORGALIS & VENDRELY, *supra* note 10 (containing a detailed report of this survey and its results).

support for an options market. Only 29 percent of farmers were inclined to participate in an options market if this mechanism were made available to them. In contrast, 62 percent and 53 percent of farmers would participate in a spot water market and water bank, respectively, if given the opportunity.[141]

Small irrigators[142] indicated a stronger preference for a spot water market mechanism to a water bank. Eighty-two percent of these farmers would participate in a spot water market, while only 66 percent responded that they would participate in a water bank mechanism.[143] Given that the majority of farmers in EBID fall into the category of small irrigators, we recommend implementation of a spot water market instead of a water bank. However, both mechanisms are expected to perform well in EBID.

POLICY RECOMMENDATION 3: *EBID should approve and execute transfers in the market.*

In the survey conducted in EBID in 2005, irrigators preferred that EBID handle the administration of the market.[144] Any transfers that occur would have to be approved by EBID, who would also have to take care of the physical delivery of the water. EBID should deliver the water because outsourcing delivery would only increase costs, which would be passed on to irrigators and create administrative barriers to efficiency. Additionally, experience in Australia (such as the exchange run by Murray Irrigation Limited) demonstrates that markets run by irrigation districts can succeed.[145]

C. Intersectoral and Interstate Trade

POLICY RECOMMENDATION 4: *EBID should remove the current minimum five-year duration for leases to SWUAs.*

EBID has developed a process for the transfer of water between agricultural users and SWUAs. Current EBID policy allows for SWUAs to enter into leases ranging from five to 40 years. By requiring minimum lease periods of five years, EBID may be precluding potential lease activity. SWUAs may wish to lease surface water rights from irrigators on an

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141. Ereney Hadjigeorgalis, *Managing Drought Through Water Markets: Farmer Preferences in the Rio Grande Basin*, 44 J. AM. WATER RESOURCES ASS'N 594, 599–601 (2008); HADJIGEORGALIS & VENDRELY, *supra* note 10, at 14–16.

142. In this report, small irrigators were defined as those who have less than 10 acres of land. *See* HADJIGEORGALIS & VENDRELY, *supra* note 10.

143. Hadjigeorgalis, *supra* note 141, at 602.

144. HADJIGEORGALIS & VENDRELY, *supra* note 10, at 14.

145. Bjornlund, *supra* note 134, at 230–31.

interim basis, one year for example. Restricting leases to longer periods of time also limits the benefits that irrigators could achieve, as cities would be willing to pay higher prices during short-term droughts.

POLICY RECOMMENDATION 5: *EBID should allow SWUAs to lease their annual allotments of water to irrigators within EBID.*

Yet another potential avenue for market development is in leases of water from urban to agricultural users. In the event that SWUAs try to hedge the risk they face in increased population growth, they may buy a surplus of water rights. Should this happen, until their supplies are needed, they should have the opportunity to lease that water to agricultural users who may need water to irrigate their water-intensive crops or those users who may not have access to groundwater wells.

POLICY RECOMMENDATION 6: *EBID should shift the burden of preventing illegal diversions in agriculture to urban transfers from SWUAs to irrigators.*

It is EBID's policy that lands owned by irrigators who lease their water to SWUAs cannot be irrigated from any source, including groundwater, while those lands and their water rights are participating in a lease. If the irrigator continues to irrigate his land, however, the SWUA is penalized by paying the assessment for that land and an equal deduction from their EBID water account.

There are two reasons why the onus of enforcing non-irrigation agreements should not fall on the SWUAs. First, the SWUAs cannot enforce compliance with this regulation by irrigators. Second, requiring SWUAs to bear the financial burden of illegal diversions made by irrigators increases both the transaction costs and transaction risk of engaging in intersectoral trades, inhibiting mutually beneficial transactions.

Current OSE and EBID regulations provide for the monitoring of illegal diversions through ditchriders (EBID) and water masters (OSE). EBID and the OSE should, therefore, combine their efforts to stop illegal diversions on land under lease by a SWUA, and the SWUA should not be penalized for any illegal diversions that occur outside its control.

POLICY RECOMMENDATION 7: *Amend the operating agreement with El Paso District One to allow for market transactions that would compensate downstream irrigators for the temporary suspension of their water rights.*

Consider a scenario where a drought occurs throughout the region. Irrigators in EBID face the prospect of receiving a partial allocation due to EBID's need to deliver water to El Paso District One. EBID has a large proportion of pecan farms—a crop that is very water intensive. Pecan farmers may be willing to pay irrigators in El Paso District One to suspend their irrigation for that season, reducing the amount of water that needs to be delivered. Evidence suggests that irrigators in El Paso

would be willing to enter into such transactions, as they routinely lease their water to El Paso Water Utilities for municipal use.[146]

An amendment of the operating agreement requires unanimous action by the parties (EBID, El Paso District One, and BOR) and is provided for by the agreement itself. The agreement calls for an annual review of the agreement and its operations; this would provide an appropriate avenue for such an amendment. While this represents a complex process, the outcome could provide a mutually beneficial means of conflict resolution and provide a model for management of transboundary water resources.

D. Environment

There are two main environmental objectives to include in the design of a water market for EBID: (1) to mitigate the environmental impact of the market itself, and (2) to provide an avenue to allow leasing and sales of water and water rights for environmental (i.e., instream) flows. EBID has already incorporated mechanisms to mitigate the environmental impact of the market through the regulation of groundwater. The following policy recommendation will help achieve the environmental objectives in the EBID water market.

POLICY RECOMMENDATION 8: *Amend Chapter 72 of the New Mexico Statutes to provide a concrete definition of beneficial use. Instream flows should be included in this definition to allow for mutually beneficial transfers of water to the environment*.

Any use of water in New Mexico must be deemed a beneficial use to avoid forfeiture of water rights. What constitutes a beneficial use, however, has never been codified by the State of New Mexico. The OSE has the sole discretion in determining beneficial use and has traditionally approved agricultural, commercial, domestic, industrial, and recreational uses.[147] Nothing bars the OSE from approving instream uses and the At-

146. Rodney T. Smith, *Transactions*, WATER STRATEGIST, Sept. 2006, at 2, 10–11.
147. BUREAU OF LAND MANAGEMENT, *supra* note 54, at 2.

torney General of New Mexico has written a legal opinion[148] suggesting that instream use would be recognized as a beneficial use.[149]

While the OSE has the power to determine beneficial use, a statutory codification of beneficial use would help the OSE in its administration of the state's water. This codification would include traditionally recognized beneficial uses and should include instream flows. Such an allowance would create opportunities for mutually beneficial transactions for those concerned with the environment and irrigators. Experiences in Montana, Washington, and Oregon have shown that irrigators, when provided with proper incentives, are willing to lease and sell their water and water rights for environmental purposes.

Potential exists for market transfers of water from EBID irrigators to environmental groups. EBID is negotiating a rehabilitation plan with the World Wildlife Fund (WWF) that would transfer water to an environmental use.[150] EBID is willing to work with the WWF in this regard with the stipulation that they become a constituent through the acquisition of EBID water rights. Under the proposed plan, EBID would treat the flooding of an area to provide habitat for wildlife as another agricultural use, like the irrigation of trees and other foliage.[151]

E. Conservation Pool

POLICY RECOMMENDATION 9: *To replace revenue lost through decreased operation of the conservation pool, EBID should increase irrigators' assessments for maintenance and operation costs.*

Revenue accruing from conservation pool sales is expected to decrease for two reasons. First, increased leasing between irrigators, resulting from the creation of a lease market in EBID, will displace previous conservation pool sales. Second, when surface water treatment plants are

148. The Attorney General's Opinion, built upon case law, states that prior decisions recognized instream flows as a beneficial use. *See* Does N.M. Protect Instream Flows?, *supra* note 59; State ex rel. State Game Commission v. Red River Valley Co., 182 P.2d 421 (N.M. 1945). This is coupled with the fact that a water right for agricultural use is not established unless there is a diversion of water. *See* State ex rel. Reynolds v. Miranda, 493 P.2d 409 (N.M. 1972). Combining these two facts lead the Attorney General to conclude that instream flows could be considered a beneficial use if they involve a diversion and there is legal precedence for the use of New Mexico's waters in an environmental arena. New Mexico's statutes allow for the OSE to issue regulations that implement statutes. *See* N.M. STAT. § 72-2-8 (1978).

149. BUREAU OF LAND MANAGEMENT, *supra* note 54, at 3–4.

150. Interview with Gary Esslinger, *supra* note 65.

151. *Id.*

constructed, the water supply currently held by SWUAs in the conservation pool will be withdrawn, leading to decreased revenues for EBID.[152]

As a means of replacing these revenues, two options were considered: (1) charging a commission for each water transfer, and (2) increasing operation and maintenance assessments of irrigators. A commission, or transfer fee, would serve as a tax on trades, increasing transaction costs and decreasing activity in the market.[153] An increased operation and maintenance assessment is preferred, as it would avoid this distortion and would spur trading by increasing the costs of holding unused rights.

VI. CONCLUSION

Continued growth, both in population and economic terms, requires an adequate water supply to meet new demands while continuing to provide for established uses. Population growth, coupled with recurrent drought, has been increasing in New Mexico for the last 50 years and has strained already scarce supplies, endangering delivery obligations to Texas. Faced with this situation, policymakers in New Mexico have implemented AWRM to regulate the use of surface and groundwater in New Mexico. Within AWRM there is scope for the establishment of a water market.

In this article, we reviewed the current resource management structure of EBID, the institutional and regulatory constraints faced in establishing a water market, and the requirements for an efficient water market. In doing so, we were able to provide a set of policy recommendations aimed at fostering the generation of a water market in EBID. These recommendations include: providing information on prices and supply and demand conditions through online bulletin boards, allowing prices to be determined through the interaction of supply and demand, guarding against aquifer overdraft by regulating groundwater use, opening the breadth of the market by allowing more intersectoral and interstate trades, and providing an avenue of representation for the environment.

Appropriate institutions are essential to the success of any water market. Successful water markets should have clearly defined, transferable water rights, regulated groundwater use, and access to information on prices and supply and demand conditions. Furthermore, a water market should be autonomous enough for users to benefit from it, while providing enough regulation to guard against negative aspects that can arise.

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152. Interview with Valerie Beversdorf, *supra* note 42.

153. *See* Easter et al., *supra* note 113, at 100–01.