Water Marketing in the '90s

Entering the Electronic Age

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The first electronic water marketing system has been established in Westlands Water District, near Fresno, California. The system, called WaterLink, went on-line in Westlands in March 1996, and it may soon be expanded to additional water districts. WaterLink was designed by members of the Collaborative Field Demonstrations Project, a joint effort among the University of California Berkeley and Davis, the Natural Heritage Institute (a nonprofit natural resource conservation organization), farmers, and water district administrators. The project is funded by a grant from the Bureau of Reclamation.

WaterLink enables water users to buy and sell water using their home computers. They can post and read bids and asks, access information on average prices and trading volumes, and negotiate transactions. They can also use WaterLink to schedule water deliveries, and soon they will be able to use it to obtain water account balances much like one obtains a bank account balance at an ATM. This feature will enable water users to manage their water supplies more effectively and will streamline water district operations. In addition, water districts can use WaterLink to post information, such as rainfall summaries and water storage levels, in a cost-effective manner.

To use WaterLink, a water user needs only a computer (either a Macintosh or a PC with Windows), a modem, and the WaterLink software. WaterLink is a self-contained "client-server" network, which connects a water district (the server) and water users (the clients). While WaterLink currently is being used exclusively in Westlands Water District, it can easily be customized to serve other intradistrict or interdistrict water markets, and it can also be expanded to link to the Internet.

Why water markets?

Given the high cost of new water supply projects and continued increases in water demand, existing water supplies must be used efficiently. Well-functioning water markets are a key to more efficient use. They can provide water users with more short-run flexibility to adjust to volatile weather conditions and more long-run flexibility to adjust to shifts in production technology and consumer preferences than traditional nonmarket water allocation systems. Market-based systems confront users with the real opportunity cost of water and thereby create incentives for water to be used at its optimum level. Under traditional nonmarket systems, a water user with abundant supplies has little incentive to invest in water-conservation technology or engage in best-management practices. However, if a water user is able to sell water in a market, he or she will have an incentive to conserve. Given the potential gains-from-trade for both buyers and sellers, market-based systems of water allocation are gaining broader acceptance among a wide array of groups—urban, agricultural, and environmental.

Local water markets have been active for years in many agricultural water districts throughout the West. These are secondary markets in the sense that trades are deviations from an initial allocation of water. They are similar to tradable emissions permit markets, in which firms receive an initial quota of permits which they can then trade with other firms. A farm's initial allocation is based on long-term contracts between the farm, its water district, and the Bureau of Reclamation or a state water agency. In a wet year, a farm may receive its full contracted allocation, but in a drought year it may receive less than one hundred percent. Assuming a farm makes long-term plant-

ing and management decisions based on its expected annual allocation, any trades it makes may only result in small deviations from its initial supply. It will buy water if it falls a little short and sell if it has a little extra. However, a farm may also factor in its ability to buy or sell water in the local market when it makes its long-term planning decisions. For example, it may plant an orchard even if its annual water allocation will not be sufficient to support it if it believes it will be able to buy more water in the market. In this case, the farm's purchases may involve significant deviations from its initial supply.

The actual commodity traded in a local water market is the right to use a given amount of water during a given water year, not the long-term entitlement to an annual allocation of water. Buying water is similar to buying an option with an expiration date at the end of the water year. For example, a farm may buy the right to a given number of acre-feet (an acre-foot equals 326,000 gallons of water) from another farm in March and not take delivery of the water from the water district until August. The farm can take delivery of the water at any time during the year; however, the right expires on the last day of February, and at this point the farm must pay the district for the water whether or not it has been delivered. If a farm wants to buy water, it must consider two prices: first the price it is willing to pay to the seller (the transfer price), and second, the price it must pay to the water district to take delivery of the water (the district rate). The effective market price is the sum of the transfer price and the district rate. Given that transfer prices are private information, the market price at any given time is known only approximately.

While a number of local water markets are active, broader intersector water markets, in which long-term water rights are actually bought and sold, have been slower to develop. Despite the potential gains from trade, there are real obstacles which need to be addressed before greater market adoption will be feasible. First, the physical infrastructure may not exist to transport water from potential sellers to buyers. Second, in most cases, institutional and political barriers prevent intersector transfers. Third, property rights in water are difficult to define given the interdependence between water users. For example, third parties may be hurt indirectly if a transaction affects return flow quantities, groundwater levels, and/or water quality. Fourth, large-scale water sales from one region to another may damage the local economy in the basin of origin. Fifth, market participants may face high transaction costs associated with gathering market information, finding potential trading partners, negotiating deals, and legally affecting transfers.

The Water Market in Westlands

The most active local water market is located in Westlands Water District, the home of WaterLink. Westlands, the largest water district in the Central Valley Project (CVP), includes 600 farms covering nearly 600,000 acres. In a given year, thousands of trades are made and hundreds of thousands of acre-feet change hands. During the 1994–95 season, 2,563 trades were made and 284,480 acre-feet were transferred. Many different types of water are traded, including CVP contract water and water imported by Westlands from neighboring water districts. For a limited time, farms also were allowed to trade

groundwater; however, due to concerns over water quality impacts, they no longer can pump groundwater into the distribution system.

Most trading opportunities in Westlands, and in other California water districts, are confined to internal district markets. Trades between west-side districts, which are part of the CVP, and east-side districts, which are not part of the CVP, are limited because there are few east-west canals across the Central Valley. Within the CVP, an extensive network of canals connects districts and farms, but institutional barriers constrain trades between districts. Interdistrict trades require approval from the Bureau of Reclamation, and except in special cases, farmer-to-farmer trades between districts are not allowed. When interdistrict trades do occur, district representatives negotiate deals on behalf of their farmers. In contrast, internal district trades only require water district approval, and permission is routinely granted.

Given that market size is limited by the size of a water district, there is more "market potential" in Westlands than in other water districts. In addition to its size, other factors contribute to the market activity in Westlands. First, Westlands has relatively junior water rights, which means it receives fewer acre-feet per acre and faces greater supply rationing during drought years than other districts in the CVP. Second, within Westlands, water rights and land productivity vary across farms, and often the more productive land is not associated with the senior water rights. Due to the relative scarcity of water and the variation in supply and demand across years and between farms, there are potential gains from trade. Third, Westlands has the most sophisticated water distribution and metering system of any district in the CVP. All farms in the district are connected to a pressurized system of pipes which permits metered delivery on demand. As a result of this physical infrastructure, the costs of transporting water and enforcing trades are relatively low.

While in many respects the institutional and physical barriers to trade are low in Westlands, market participants may still face high transaction costs. Unlike most markets, the water market in Westlands has no centralized trading location and no publicly posted market price. Due to the lack of public and private institutions supporting the market, potential traders must spend considerable resources gathering market information, finding potential trading partners, and negotiating deals. The trading patterns observed in Westlands during 1994–95 provide evidence of high transaction costs. First, although trading volumes were heavy, the majority of the transfers involved movements of water between affiliated farms, which were under common management despite being legally distinct. By trading only with affiliated farms, farms can reduce or eliminate the costs associated with searching for a trading partner and bargaining over price. Second, while nearly half the farms in the district made at least one trade with an unaffiliated farm, a few very active traders accounted for the majority of the trading activity. This pattern may reflect the economies of scale associated with investing in market information and developing a network of trading partners. Intuitively, a "novice" trader should face greater up-front market participation costs than an "experienced" trader who already has knowledge about market supply and demand conditions. Third, farms which traded in the market tended to trade repeatedly with the same trading partners. By developing long-term trading relationships, farms may be able to reduce the transaction costs associated with future trades.

Figures 1 and 2 illustrate the share of trading activity which occurred between affiliated farms in 1994–95. All of these trades took place without WaterLink, which was not available until 1996. Figure 1 shows the number of trades per month and figure 2 shows the associated volume of water. The trades are labeled "internal," if they were between affiliated farms, or "market" if they were between unaffiliated farms. Internal trades are comparable to transfers of inputs between factories in the same firm; unlike market trades they do not involve an exchange of money. Both internal and market trades peaked during the summer growing season and then again at the end of the water year. The end-of-the-year increase in trading activity in Westlands is motivated less by a real water demand increase than by institutional constraints: a farm must use its annual water supply by the last day of February or pay for unused water. Thus farms use their remaining supplies to pre-irrigate their fields for the next year.

As demonstrated in Westlands, transaction costs can have a significant impact on market participation rates and trading patterns. In the future, as more people are connected to WaterLink and insti-

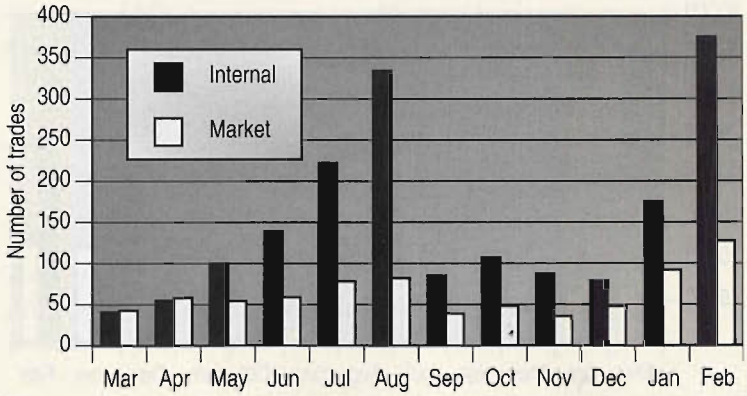

Figure 1. Number of trades 1994–95, Westlands

tutions evolve to facilitate trading, transaction costs may fall. The value of WaterLink lies in its ability to provide market information, reduce negotiation costs, and expedite communication between water users and water districts.

Using WaterLink

WaterLink users have access to weekly and seasonal market statistics on the number of transactions, the volume of transactions, and the average trading price. They can post offers to buy and sell water, and they can read offers which have been posted by other users. To post a water-wanted or water-for-sale ad, they simply fill out a form and e-mail it to the WaterLink administrator. The administrator reviews the form and then posts the ad to an electronic bulletin board which all WaterLink users can access. Buyers and sellers can then use WaterLink to negotiate deals and record trades with their water district. Water users can still negotiate deals and communicate with the water district by phone, fax, or in person; however, e-mail is in many ways more convenient once it becomes part of a daily routine. By using e-mail, water users can avoid the time delays associated with playing "phone tag," sending faxes, and making trips to the water district.

In addition to providing market information and expediting the water transfer process, WaterLink provides many other services. WaterLink users can place water delivery orders electronically, and in the near future they should be able to obtain their water account balances much like one obtains a bank account balance at an ATM. This feature will enable water users to manage their water supplies more effectively and will streamline water district operations. WaterLink can be used to provide a myriad of public information cost effectively. Traditionally, water districts have mailed or faxed news items to their water users each month, but as more water users obtain on-line information, water districts will be able to reduce and perhaps eventually eliminate their mailing and faxing costs. Table 1 summarizes WaterLink's main features.

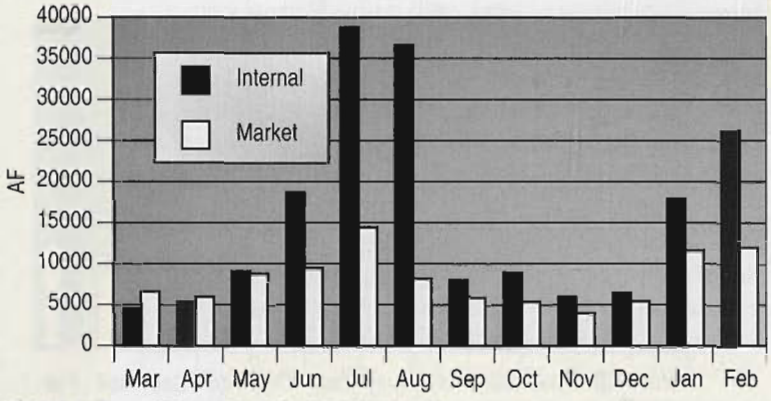

Figure 2. Total AF traded 1994–95, Westlands

WaterLink: Westlands and beyond

WaterLink went on-line in Westlands Water District in March 1996, after training sessions with district staff members and water users. About fifty people currently use the system, and Westlands has recently obtained licenses for additional users. Given that WaterLink is still in the early stages of adoption, many of the trades in Westlands still take place without the use of WaterLink. A few water users have reported bid and ask prices on WaterLink, but most have been reluctant to provide price information. No attempts have been made to induce price reporting for fear that would scare potential traders away from the market. If market activity increases and traders perceive that their property rights are secure, they may begin reporting prices on their own in order to compete with other traders. To date, farmers have been using WaterLink most often to place water orders, and district staff members anticipate that many more water users will adopt the system once the electronic water accounting feature is added. WaterLink adoption rates may also increase during the next period of water scarcity when the potential value of the system is greater.

The San Luis-Delta Mendota Water Users Association is negotiating possible expansion of WaterLink to over twenty additional Central Valley Project water districts in the San Joaquin Valley. WaterLink can easily be adapted to meet the specific needs of each water district. Multiple intradistrict markets can be established, or one large interdistrict market network can be established. In order to set up a large interdistrict market, someone must develop the institutional structure to govern trade. Key issues concern the role of the water districts and whether water users are allowed to trade directly with one another across districts or whether all interdistrict trades must be intermediated by a third party.

If water users are allowed to trade directly, one large multidistrict WaterLink system would serve all water users. For example, if a water user posted an ad to sell water, it would go out to water users in every district. Likewise, if a water user wished to buy water, he or she could read ads posted by water users from any district. Potential trading partners could then negotiate transactions using WaterLink's e-mail feature or another medium. If an agreement were reached, the water users would need to obtain approval from their water districts for the trade and then record the amount traded; however, they might or might not be required to report the transaction price.

If water users are not allowed to trade directly in the interdistrict market, either water districts or an independent organization could intermediate trades.

Table 1. Waterlink features

Feature	Description	User Access
Market summary information	Provides number of transactions, volume in AF and average price on a weekly and seasonal basis.	Read only
Water wanted posting	Provides names of prospective buyers, number of AF wanted, bid price contact information.	Read and write
Water for sale posting	Provides names of prospective sellers, number of AF offered, offer price contact information.	Read and write
Electronic mail	Streamlines buyer-seller negotiations and communication between water users and districts.	Read and write
Water ordering	Allows scheduling of delivery locations and dates.	Write only
Water accounting*	Provides account balance information. Password required.	Read only
Rainfall information	Reports weekly and seasonal rainfall for current and previous years.	Read only
Storage information	Reports Lake Shasta and San Luis Reservoir water levels for current and previous years.	Read only
CIMIS	California Irrigation Management Information System. Lists past average daily water use and forecasted use by crop.	Read only
Want ads	An electronic classified ad service.	

**Feature not yet available*

Both the intermediator and the degree of intermediation must be determined. In one scenario, the intermediator's role would be to match individual buyers to individual sellers, in a manner similar to a dating service. For example, water users who wanted to buy water would post for-sale ads and water users who wanted to sell water would post water-wanted ads, and the intermediator would attempt to match buyers and sellers. Once the parties are matched, the intermediator would not be involved in the bilateral bargaining process. If an agreement were reached, the buyer and seller would report the trade but they might or might not be required to report the transaction price. In an alternative scenario, the intermediator would act as a broker, buying water from water users at a publicly posted bid price and selling water to other water users at a publicly posted ask price. In this later system, known as a buy-back program, centralized sales and purchases through the intermediator would take the place of bilateral bargaining.

Regardless of the institutional structure that evolves, WaterLink can reduce the transaction costs associated with water trading by reducing search and negotiation costs and by providing market information. As with other network technologies, such as phones, fax machines, and ATMs, the worth of WaterLink will increase as the number of users increases. Intuitively, a water user in search of water is more likely to find a seller using WaterLink if 1,000 water users use the system than if only ten use it. Likewise, the value of the e-mail feature of WaterLink will increase with e-mail users. In addition to the benefits to water users, the data generated by WaterLink will provide policy makers with valuable information about water markets which can be used to design institutions to facilitate trading. In the near term, most water trades will continue to be short-term local transactions; however, in the future, as water becomes more scarce, there will be greater incentives to invest in the physical structures and institutions which can make long-term intersector markets and options markets possible. ◘

■ For more information

Natural Heritage Institute. "Challenge Grant Program: Collaborative Field Demonstrations of the Efficacy and Practicality of Financial Incentives for Agricultural Water Conservation." Annual Report, San Francisco, 1993–94 and 1994–95.

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The authors would like to thank Greg Thomas, president of the Natural Heritage Institute, and James Murphy for his work on the development and implementation of WaterLink.

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