

**Comments on “Economic Analysis of Critical
Habitat Designation for the Spikedace and Loach
Minnow,” prepared by Industrial Economics, Inc.
(IEC)**

Prepared on behalf of Phelps Dodge

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I. Introduction and Background

The US Fish and Wildlife Service (FWS) has proposed to designate 633 miles of rivers and streams and their flood plains in Arizona and New Mexico as critical habitat for the spinedace and loach minnow. In connection with the designation, FWS has issued a Final Draft report prepared by Industrial Economics, Inc. (IEC) titled “Economic Analysis of Critical Habitat Designation for the Spinedace and Loach Minnow,” (IEC Analysis).¹ The IEC Analysis identifies and analyzes the potential economic impacts associated with the proposed designation for the two species, including past and expected future economic effects to mining and grazing in areas proposed as critical habitat.

Phelps Dodge Corporation (PDC) has identified several mine districts and other properties at which designation of critical habitat for spinedace and loach minnow may impose costs. Although PDC mines and other properties are not located within areas defined as critical habitat, the designation could affect PDC water diversions or conveyance infrastructure, or require the purchase of new water rights (assuming availability), resulting in significant economic costs. PDC mines may suffer significant economic losses if habitat designation disrupts or otherwise makes unavailable water supplies, imposes significant mitigation costs, and/or creates project delays.

In addition, PDC and subsidiaries are large property owners in Arizona and New Mexico and own a significant amount of land along Eagle Creek in eastern Arizona and the Gila River in western New Mexico. Restrictions resulting from critical habitat designation on water withdrawals for all or part of the year would serve to lower profits from existing leases and direct use of farmland because farmers would have to substitute more costly groundwater (assuming availability) or shift to less profitable, less water-intensive crops. In the case of mining and grazing, limiting or prohibiting water withdrawals could result in a loss of PDC’s valuable water rights because beneficial use of water is a requirement for maintaining rights.

PDC mining activities contribute significantly to local, regional and even national economies. Because water is such an important input to the company’s operations, restrictions, curtailments, and in the worst case, complete and irreplaceable loss of a water supply, could have wide-ranging and consequential economic effects.

The IEC Analysis does not fully consider all of these effects or quantify their impacts. Economic effects to PDC and the broader economy associated with critical habitat designation are potentially significant and should be examined carefully before designating habitat. The following comments review the IEC Analysis, focusing on Chapters 5, “Potential Economic Impacts to Mining Operations.” Our comments present additional information and suggest changes that may be made to IEC’s assessment of economic impacts to PDC operations to improve their accuracy and usefulness.

¹ Issued 24 May 2006.

II. Comments

A. The IEC Analysis does not identify all the PDC mines that may be affected by critical habitat designation

The IEC Analysis states that “PDC has identified two operating mines, Morenci and Tyrone, and one non-operating mine, the Christmas mine district, for which spikedace and loach minnow impacts may be a concern.”² These three mines were indicated as being areas of concern in the PDC comments submitted in connection with proposed critical habitat designation for the Southwestern Willow Flycatcher. Because they are large, operating mines, potential impacts to Morenci and Tyrone are of greatest concern to PDC. However, in addition to these two mines and Christmas, the United Verde Mine may be affected by the designation and should be considered in the analysis.

1. Morenci Mine

Located in Morenci in southeastern Arizona, the Morenci complex is the largest copper-producing operation in North America. Morenci includes an open-pit mine, a concentrator, four solution extraction facilities and three electrowinning tankhouses. Morenci’s copper production accounts for the largest volume of copper produced by PDC by a single mine and approximately 56-59 percent of all PDC’s United States copper production. If this mine were to cease functioning or even curtail output, it would result in significant economic impacts.

Water for the Morenci Mine is supplied by various sources, including decreed surface water rights in the San Francisco River, Chase Creek, and Eagle Creek drainages, groundwater from the Upper Eagle Creek wellfield, and Central Arizona Project (CAP) water leased from the San Carlos Apache Tribe and delivered to Morenci via exchange through the Black River Pump Station. Much of the leased CAP water is diverted through lower Eagle Creek (which is proposed as critical habitat).

The Morenci Mine is a substantial asset for Greenlee County. Dr. George Leaming, a retired professor at the University of Arizona in Tucson, provided the data below describing some of the contributions made by mining operations.

Morenci Mine Data for year-ended 31 December 2005	
Property taxes paid in Arizona	\$7,864,428
Arizona tax on metal value (severance tax) paid or accrued	\$6,625,086
Sales and use taxes paid or accrued on purchases in Arizona	\$8,378,972
Arizona vehicle taxes paid	\$401,113
Fringe benefits for Arizona residents	\$81,395
Net cost of operating hospitals and recreation facilities for the benefit of employees of the company and other residents	\$2,696,475

² IEC Analysis, p. 5-5.

Purchases within Arizona (includes sales taxes paid)	\$376,738,922
Unemployment compensation tax (from site)	\$217,585
Workmen's compensation tax (from site)	\$1,618,750
Cumulative amounts expended for environmental control facilities (include amounts expended in prior years) (from site)	\$337,157,213
Kilowatt hours purchased (from site)	1,595,881,042
Kilowatt hours generated (from site)	66,000
Charitable Contributions	\$645,994

PDC is very concerned with costs associated with consultations which may be required in connection with water diversions, as well as costs that could be associated with replacement of some or all of the water supply as a result of critical habitat restrictions or other related activities.

2. Tyrone Mine

Located in Tyrone, New Mexico, the Tyrone Mine is an open-pit copper mine and processing facility. Tyrone is located 20 miles from the proposed critical habitat designation in the upper Gila River. However, PDC diverts a significant amount of water to support the mine from the Gila River, which is included in the Upper Gila Management Unit of the proposed critical habitat designation.

The mine relies heavily upon surface and groundwater supplies for its mining operations.³ The volumes used are so significant that accessing substitute water sources may be impossible.⁴ As with Morenci, PDC is concerned about consultation costs which may be required in connection with water diversions, as well as costs that may be associated with replacement of some or all of the water supply as a result of restrictions imposed to protect critical habitat.

The Tyrone Mine is a substantial financial asset for Grant County. In 2004, Tyrone's sales of 43.1 thousand short tons of copper generated \$28.7 million in net operating income, excluding special items and provisions.⁵ PDC is the main employer in the county and PDC's mining operations make significant contributions to local and state governments. As an example, a reduction in tax revenues from the operation of PDC's Tyrone and Chino mines in 1999 forced Grant County to eliminate 50 full-time positions, 36 of which had been previously filled. Employees remaining with the county incurred salary reductions of 20 percent and went to a 32-hour workweek.⁶ The table below presents data provide by Dr. George Leaming regarding Tyrone Mine.

³ "Proposed Critical Habitat Designation for the Southwestern Willow Flycatcher: Potential Economic Impacts on Phelps Dodge Corporation Operations," prepared by Triangle Economic Research (TER), 13 July 2005.

⁴ *Ibid.*

⁵ Phelps Dodge Form 10-K, 2004 Phoenix, Arizona, p. 58.

⁶ Interhemispheric Resource Center (IRC). *Copper, Phelps Dodge, and the Future of Grant County's Mining District*. Silver City, New Mexico: IRC, (October 2001), pp. 10-11.

Tyrone Mine Data for year-ended 31 December 2005 (in thousands, excl. acreage and manpower)	
Property taxes paid in New Mexico (from site)	\$549,708
New Mexico tax on metal value (severance tax) paid or accrued (from site)	\$691,941
Sales and use taxes paid or accrued on purchases in New Mexico (from site)	\$25,036
Unemployment compensation tax (from site)	\$168,518
Workmen's compensation tax (from site)	\$9,159,773
Cumulative amounts expended for environmental control facilities (include amounts expended in prior years) (from site)	\$84,613,609
Kilowatt hours purchased (from site)	231,952,200
Kilowatt hours generated (from site)	3,057,000
Charitable Contributions	\$270,981

Also important to the operation of Tyrone Mine is Bill Evans Lake, which depends upon the continued diversion of water from the Gila River in Grant County. If Gila River water diversions were curtailed or prohibited, they could affect the lake, which could in turn impose costs on Tyrone Mine operations.

3. Christmas Mine District

Christmas Mine is an inactive mine located near Winkelman in Gila County, Arizona near the confluence of the San Pedro and Gila Rivers. The mine ceased production in 1983 and is now in a care-and-maintenance phase. However, PDC estimates that the Christmas Mine contains roughly 1.8 billion pounds of recoverable copper.⁷ Furthermore, it is believed that there are substantial copper deposits in the general area, for which several companies are currently exploring.⁸

PDC will need access to surface water or groundwater to re-open the Christmas Mine or to mine associated deposits in the area. However, critical habitat-related restrictions on surface water withdrawals from the Gila River or surface or groundwater withdrawals near the Gila River, could substantially delay, restrict or even eliminate future mining operations, which would have adverse impacts on PDC revenues and the economy in Gila County. For example, if PDC were to re-open the Christmas Mine in 2015 and extract 1.8 billion pounds of recoverable copper over a 25-year period, the present value of the revenues from that operation would be approximately \$384 million based on long-term average copper prices and a 7 percent real discount rate (\$840 million using a 3 percent real discount rate). Those revenues, and the jobs, spending, and taxes associated with the 25-year operation of the mine, would be lost if critical habitat designation for the spinedace and loach minnow precluded the re-opening of the mine.⁹

⁷ TER, Willow Flycatcher Comments, p. 33.

⁸ TER, Willow Flycatcher Comments, p. 33.

⁹ TER, Willow Flycatcher Comments, pp. 33-34.

Alternatively, if a Section 7 consultation associated with critical habitat designation for the Flycatcher only resulted in a two-year delay in mining, PDC's present-value revenue loss would be \$49 million using a 7 percent real discount rate (\$48 million using a 3 percent real discount rate). In summary, these alternatives could have a substantial adverse impact on PDC revenues if it were to re-open the Christmas Mine or extract ore from another deposit in the area.¹⁰

4. United Verde Mine

The United Verde Mine is an inactive copper mine that operated from the late 1800s until 1953. The site is located near the Verde River, adjacent to the town of Jerome in Yavapai County in central Arizona. The mine closed in 1953 and is currently in a long-term care-and-maintenance mode. However, some mineralized material still exists at the United Verde Mine. While PDC does not have reserve estimates for the mine, 25 million short tons of geologic material containing 6 percent zinc, 0.9% copper, and some silver and gold may be present at the mine.¹¹

If PDC resumed operations at the United Verde Mine, it would need permits for diversions, pumps, and pipelines that may cross federal lands or involve work in the waters of the United States, which may trigger a Section 7 consultation. Restrictions on water withdrawals because of critical habitat designation could result in potentially significant reductions in PDC revenues if the company were to resume mining operations at this site. This revenue reduction could adversely impact mine employment, spending by mine employees, and taxes paid by PDC and mine employees.

The Verde Valley is a rich agricultural and ranching region. PDC owns property in the Verde Valley that it leases to farmers and ranchers who irrigate the leased land. To continue irrigating the leased land, the lessees must be able to maintain and repair diversions and dikes in the Verde River. These activities could require permits triggering a Section 7 consultation. The proposed designation would delay or possibly eliminate the maintenance or repair of the water-diversion structures, which would result in adverse economic impacts on lessees directly, and PDC indirectly, through potentially large reductions in the lease value. Also, PDC could potentially lose its valuable water rights in the Verde Valley if water use is restricted or eliminated by critical habitat designation because water must be beneficially used to maintain water rights.

The overall population of Verde Valley is expected to grow 27 percent between 2000 and 2015, with some communities within the Verde Valley growing at a much faster rate.¹² There is increasing interest in residential or commercial development of PDC's farmland in the valley.¹³ However, such development would require water. Potential critical habitat designation-related restrictions on surface water use or groundwater use near the Verde River could adversely impact the value of PDC's non-mineralized property for future residential/commercial development.

¹⁰ TER, Willow Flycatcher Comments, pp. 33-34.

¹¹ TER, Willow Flycatcher Comments, p. 35.

¹² "Sedona Community Plan 2002," City of Sedona, New Mexico, 10 December 2002, p. 8-3.

¹³ TER, Willow Flycatcher Comments, p. 36.

B. PDC leases its land for grazing and agricultural use and these activities could be affected by critical habitat designation

The IEC Analysis does not consider potential effects to PDC grazing and agricultural activities related to critical habitat designation. PDC owns large tracts of land, together with water rights associated with that land, in the vicinity of their mining operations. PDC leases some of its non-mining land for grazing and agricultural purposes. For example, in eastern Arizona, PDC leases land along Eagle Creek north of the diversion by which it accesses water from Eagle Creek. The lower segment of private land from the diversion dam to the United States Forest Service (USFS) boundary includes 2,468 acres. The upper segment within the upper Eagle Creek basin includes 580 acres. Lands in the vicinity of the United Verde and Tyrone mines are also leased and used for agricultural purposes.

If habitat designation resulted in restrictions on the timing or quantity of surface water withdrawals for irrigating crops or other grazing or agricultural use, the value of the leased land could decrease because water supply is critical to agricultural and grazing activities. Similarly, if habitat designation were to delay or limit the ability of a lessee to maintain or repair surface water diversion structures, then the value of the land supported by those structures would correspondingly decrease. Limiting or prohibiting water withdrawals could result in a loss of PDC's valuable water rights because beneficial use of water is a requirement for maintaining rights.

C. Water replacement costs should be included in any assessment of potential economic effects of critical habitat designation

Mining is a water-intensive activity and access to water is vital for PDC copper production. Grazing and agricultural activities also require water for irrigation and other purposes. In both Arizona and New Mexico, water supplies are drawn from rivers and lakes, groundwater and effluent. Groundwater and surface water rights are actively traded in Arizona and New Mexico, where the arid climate and comparatively limited supplies make water a scarce and valuable commodity.

Water rights are critical to PDC's mining operations, as well as grazing, agricultural and other activities in both Arizona and New Mexico. In fact, threats to water rights are at the top of the list of operational risks cited by PDC in company financial documents.¹⁴ Any threat to PDC's water supplies creates a major risk to its business activities, operating results and cash flows. The proposed critical habitat designation for the spinedace and loach minnow includes water sources proximate to PDC mining activities. Any restriction or curtailment of PDC's already highly regulated access to water could impose significant costs on PDC. In certain cases, restrictions could impose such large costs that PDC might choose to cease operating a mine

¹⁴ "Mines by their nature are subject to many operational risks and factors that are generally outside of our control and could impact our business, operating results and cash flows. These operational risks and factors include, but are not limited to (i) unanticipated ground and water conditions and adverse claims to water rights...(vii) delays in the receipt of or failure to receive necessary government permits..." Phelps Dodge Annual Report 2005, p. 36.

entirely. This would be the case if, for instance, a mine's closest alternative water source was so far away that only massive infrastructure expenditures would enable conveyance to the affected mine.

If PDC were to lose a portion of or all of its water supply, that supply would need to be replaced as soon as possible. In arid southwestern markets such as Arizona and New Mexico, new acquisitions can be costly and difficult to complete. In many cases, replacement sources may not be available in sufficient quantities. Water replacement costs may include several components, which we discuss below.

1. Search costs associated with finding new water supplies

Replacement supplies or rights are not always easily available or accessible. Identifying viable supplies involves researching and analyzing information on the availability of water and water rights in areas within piping distance of an affected area. This may involve considerable investigation and negotiation by specialist staff to secure and undertake the transaction.

2. Acquisition costs associated with obtaining the new water supplies and rights

In most cases, new water supplies may only be obtained by PDC at increasing costs, which may be dramatic, depending upon circumstances. For example, the more critical habitat designation restricts water usage at a given mine, and the more water that PDC must obtain from new sources to support that mine, the greater the average cost of the new supplies.

To provide some examples of the potential magnitude of water replacement costs of existing water rights, we have examined a broad set of water transactions undertaken in Arizona and New Mexico, the two states where PDC owns properties that could be affected by critical habitat designation. Since the value of water rights is heavily dependent on the specific attributes of the rights being acquired—*e.g.* whether the transaction involves groundwater or surface water, location of the property, the availability of existing conveyance infrastructure, and so forth—we have used a broad set of comparables to minimize variation along any single dimension.

We analyzed water transactions in Arizona and New Mexico that occurred between January 2000 and May 2006.¹⁵ Unfortunately, few transactions were perfectly comparable to the type PDC would likely undertake to make up for the gap between available and needed water resources in the event of critical habitat related restrictions. However, to provide an indication of the potential magnitude of costs, the data points are useful.

For any water contract in which a water entitlement was actually transferred (as opposed to a storage, conveyance or annual lease contract) we recorded the value of the unit-price of the transaction. To be conservative, we took the minimum cost if a transaction involved a range of

¹⁵ See Tables 1 and 2. As reported in the *Water Strategist* (editor Rodney T. Smith, published by Stratecon Inc., www.waterstrategist.com). We did not have the report for November 2001, though the impact on the results is almost sure to be minimal.

prices.¹⁶ We then calculated the 1st quartile price, the mean price, and the 3rd quartile price to obtain a range of potential prices per acre-foot.¹⁷ These numbers are used to create a range to estimate the cost of replacing a single acre-foot of water. For Arizona, the average minimum unit-price in a water transaction was \$1,898 per acre-foot. The first quartile price was \$1,175 and the third quartile price was \$2,000. In New Mexico, the average minimum unit-price in a water transaction was \$4,174. The first quartile price was \$3,775 and the third quartile price was \$4,643.

To illustrate the significance of these numbers, consider this example of replacement costs for water at the Morenci Mine in Arizona. Assume critical habitat designation-related restrictions prohibited PDC from using Eagle Creek and Black River water rights associated with the Morenci Mine. The combined Eagle Creek and Black River delivery system has produced in excess of 18,000 acre-feet per year of fresh water for mining operations and for potable uses at the Morenci Mine and Clifton town sites.¹⁸ If this water supply were unavailable, PDC would need to find alternative sources for approximately 18,000 acre-feet of water. Assuming that each of these missing acre-feet of water could be replaced at the average cost for water in Arizona of \$1,898 per acre-foot, PDC would need to pay \$34,168,500 to replace the 18,000 acre-feet. If PDC could obtain the water at the first quartile cost of \$1,175 per acre-foot, total cost would be \$21,150,000, and if it had to pay for the water at the third quartile price of \$2,000 per acre-foot, PDC would pay \$36,000,000.¹⁹ In other words, costs to replace this water could range from approximately \$21 million to \$36 million. These potential costs are obviously substantial and do not include the search, conveyance, and operational costs that could be associated with the acquisition and development of new supplies.

Using another example, consider a hypothetical situation in which critical habitat designation-related restrictions prohibited PDC from using approximately 7,000 acre-feet per annum of its Gila River water rights associated with Tyrone mine in New Mexico, a fraction of the total water consumed at the mine annually. In such a case, PDC would need to find alternative sources for approximately 7,000 acre-feet of water. Assuming that each of these missing acre-feet of water could be replaced at the average cost for water in New Mexico of \$4,174 per acre-foot, PDC would need to pay \$29,216,250 to replace the 7,000 acre-feet. If PDC could obtain the water at the first quartile cost of \$3,775 per acre-foot, total cost would be \$26,425,000, and if it had to pay for the water at the third quartile price of \$4,643 per acre-foot, PDC would pay \$32,497,500.²⁰ In other words, using average costs for the state, replacement costs could range from over \$29 million to over \$32 million to replace one water source at one mine.

¹⁶ See Tables 1 and 2, column labeled 'Minimum Cost.'

¹⁷ See Table 3.

¹⁸ Conversation with Jaron Bromm of Fennemore Craig (28 June 2006). Fresh water deliveries from the combined Morenci system can change significantly from year to year and depend upon numerous variables, including the need for water for mining operations and potable uses, economic conditions prevalent in the copper industry from time to time, precipitation in the Black River and Eagle Creek watersheds and at mining operations, and the continued availability of water from the Eagle Creek and Black River systems, among others.

¹⁹ See Table 4.

²⁰ See Table 5.

As substantial as these estimated costs are, however, estimates based on state average costs likely understate the true cost, as the location of the PDC properties are frequently in remote locations on river systems where average water costs are higher. In fact, water rights to the Gila River are considerably higher than the state average. We have analyzed five transactions involving the Gila River from 2001.²¹ Using the average price of these five transactions, \$6,383 per acre-foot, we multiply this average price by the 7,000 acre-feet that will need to be replaced to obtain a replacement cost of \$44,679,130 (\$2001),²² which is higher than the values obtained using state averages. According to appraiser Kevin Schrimsher, prices have increased considerably since 2001, with some water rights on the Gila River selling for as much as \$32,000 per acre-foot. Based upon a review of recent sales, Mr. Schrimsher estimates the cost of Gila River water rights currently average in the range of \$16,000 per acre-foot, resulting in a total replacement cost for 7,000 acre-feet on the Gila River for use at the Tyrone Mine potentially as high as \$112,000,000.²³

To summarize, water replacement prices are variable depending upon location, availability of substitutes and other factors. To provide an example of potential replacement costs, we used state average water rights prices in Arizona and New Mexico to develop a range of replacement costs for a portion of the water used at Morenci Mine in Arizona and Tyrone Mine in New Mexico. Data for the Gila River specifically indicates the potential for state averages to underestimate values substantially. Again we emphasize that these estimates are for water replacement only. They do not include search costs, operational costs associated with reduced water supplies while conveyance infrastructure is being developed, or infrastructure costs, as discussed below.

3. Construction and development costs of conveyance infrastructure to transport the new water supplies from their present locations to the affected area

In some cases, existing infrastructure may be insufficient or otherwise unable to transport new water supplies to the area where it is needed. If modified or new infrastructure is required, this can also serve to impose significant costs. Water is very heavy and expensive to move. Because of limited water supplies in both states, the need to construct new conveyance infrastructure is not a remote or unlikely possibility. PDC recently considered such costs related to building a new pipeline to bring water to Morenci Mine and the surrounding community from the upper Eagle Creek well fields.²⁴ PDC undertook various studies to determine the most expedient and cost-effective way to move water to the mine and surrounding community. PDC

²¹ See Table 6. These comparables were given to Jaron Bromm by Kevin Schrimsher, an appraiser in New Mexico. The data presented reports the price per acre of land with water. To determine the price of water rights alone, the appraiser has advised that we divide by a constant factor of 1.6 to convert to the total value to the water rights alone.

²² See Table 7.

²³ See Table 8.

²⁴ Information provided by Jaron Bromm of Fennemore Craig, 28 June 2006.

developed several feasible alternatives which ranged in price from \$22.5 million (\$1998) to \$157 million (\$1998).²⁵

4. Disruption to existing mine operations during the time period between the imposition of the water-use restrictions and the availability of the new water supplies at the affected mines

Depending upon the situation, loss of water rights may result in a disruption in mining operations if for example, there was a delay in negotiating new rights or conveyance infrastructure needed to be constructed.

The table below summarizes the replacement cost information presented in this section. As noted, while it is based on actual price information, these estimates are merely intended to provide the FWS with a rough range of potential costs at issues. These costs are likely to be very understated, as they are based upon averages and the actual amount of water which would need to be replaced is uncertain.

WATER REPLACEMENT COSTS (examples for illustrative purposes only)		
COST	MORENCI	TYRONE
Acquisition Costs		
State average cost		
18,000 AF	\$34,168,500	
7,000 AF		\$29,216,250
2001 appraisal comparables		\$44,679,130
2002-present appraisal comparables		\$112,000,000
Conveyance Infrastructure Costs	\$22,500,000-\$157,000,000 (\$1998)	

At the extreme, if PDC were required to replace all water supplies at a particular site, costs could potentially be so high as to result in mine closure, resulting in the imposition of significant costs on the local and broader economies. Such costs may include revenue losses for the mining company and job losses for employees. These losses adversely affect businesses that sell goods and services to the mining company and its employees. The losses could also adversely affect state and local governments, which rely upon taxes paid by the mining companies and their employees on their income, property and purchases.

Replacement costs for water can vary depending upon variables such as location, the amount of water being replaced and other factors. Water right purchases are not unusual or infrequent occurrences for PDC. In 2004, PDC showed \$147.9 million in land and water rights costs and \$126 million in 2005.²⁶ Even without critical habitat designation, water replacement costs are

²⁵ Information provided by Jaron Bromm of Fennemore Craig, 28 June 2006.

²⁶ Phelps Dodge 2005 Annual Report.

considerable. They could be significantly higher if, as a result of critical habitat designation, greater water volumes were required and each of the five mines was affected.

D. Benefits of providing water to the local communities provided by PDC are not considered.

In many of its mine districts, PDC not only provides water for its operations, it also provides the public drinking water supply for the local community. Such services provide considerable benefit to communities. As the previous section notes, in the event new water supplies were needed, costs would be involved with identifying potential sources, obtaining the rights, and developing the conveyance infrastructure. Costs associated with water replacement, which could potentially be significant, have been discussed in previous sections. In other words, there would be more than just producer surplus at stake; costs may be imposed upon individual households which could create a significant financial burden. As indicated in the table below, many of the counties where mines are located have median household incomes below national and state averages.

Mine	County	State	Median Household Income, 2003	Per Capita Money Income, 1999
Morenci	Greenlee County	AZ	\$40,931	\$15,814
Tyrone	Grant County	NM	\$28,246	\$14,597
Christmas	Gila County	AZ	\$31,745	\$16,315
United Verde	Yavapai County	AZ	\$35,260	\$19,727
		AZ (all)	\$41,963	\$20,275
		NM (all)	\$35,091	\$17,261
		USA	\$43,318	\$21,587

Source U.S. Census Bureau: State and County QuickFacts. Data derived from Population Estimates, 2000 Census of Population and Housing, 1990 Census of Population and Housing, Small Area Income and Poverty Estimates, County Business Patterns, 1997 Economic Census, Minority- and Women-Owned Business, Building Permits, Consolidated Federal Funds Report, 1997 Census of Governments. Last Revised: Thursday, 08-Jun-2006.

E. IEC Analysis does not consider the effects and costs of consultation on PDC water supply.

When a federal permit is required for a mining operation, the agency issuing the permit must determine whether the activity to be permitted may affect a listed species or critical habitat. Surface water withdrawals and groundwater pumping to support mining operations often require the installation of diversion structures, pipelines and pumping stations, which can involve dredging or filling waters of the United States or crossing federal lands. As explained in Section II.A., consultations may be required for PDC as a consequence of the habitat designation.

The consultation process can result in significant delays in the permit process and the imposition of requirements or restrictions with respect to the permitted activities that are deemed necessary to protect the listed species or critical habitat. Mine operators may also be required to take or avoid certain actions when necessary to avoid affecting a listed species. The designation of critical habitat upstream, adjacent to, or downstream of a federally permitted activity such as mining could result in consultations related to Section 7 of the Endangered Species Act (ESA) regarding the impacts of the permitted activity to the extent it affects the area designated as critical habitat.

Consultations can lead to the imposition of costs on mining operations related to such things as:

- Permitting delays
- Restrictions on the timing and/or amount of surface water withdrawals or groundwater pumping thus precluding beneficial use of the water as required by water rights
- Reduced output, resulting in revenue losses
- Increased operating costs
- Employment losses
- Property value reductions
- Regional economic effects
- Tax revenue losses
- Regulatory uncertainty costs
- Stigma impacts

Section 7 consultations and any resulting mitigation efforts required are not unusual occurrences which can serve to not only impose administrative costs, but more important, result in loss of water rights. As an example, PDC recently had to pay approximately \$460,000 in various section 7 consultation costs related to the Willow Flycatcher at the Dos Pobres/San Juan mine project in Arizona.²⁷ This consultation required significant mitigation efforts from PDC to offset impacts to Flycatcher habitat and impacts to stream flow. Even more significant than these out-of-pocket costs, however, is the fact that as a result of these consultations, PDC effectively provided 480 acre-feet of water rights for mitigating impacts to stream flow.²⁸ Using the Arizona state water price average of \$1,898 described in the previous section, the cost of this 480

²⁷ Information provided by Jaron Bromm of Fennemore Craig and John Korolsky of PDC (5 July 2006).

²⁸ Information provided by Jaron Bromm of Fennemore Craig (5 July 2006).

acre-feet is more than \$900,000, assuming availability and not including search or other potentially applicable costs. Replacing water rights can be costly at best, and impossible at worst in those situations where no replacement sources exist.

The Fort Huachuca, Arizona military reservation, which is subject to Section 7 requirements of the ESA, is located in southwestern Arizona, in the same region as PDC mines. A recent Report to Congress²⁹ in compliance with the ESA details water management activities to mitigate aquifer overdraft describes recharge costs, which provide more examples of how expensive water replacement can be. The Report describes recharge costs in connection with aquifer overdraft mitigation as high as \$14 million for 610 acre-feet, or approximately \$23,000 an acre-foot at Bisbee, and nearly \$6 million for 180-acre feet, or approximately \$32,000 an acre-foot at Huachuca City.³⁰ Again, we stress that given the limited supply of water rights in the southwest, the potential for any water or water rights losses and any associated economic effects, including mitigation costs, must be considered very carefully when evaluating the economic impacts of proposed habitat designation.

Also, it is important to note that owners of water rights are required to comply with beneficial use requirements to maintain their water rights, which as has been established, are valuable assets. The owners of water rights may lose those valuable rights if Section 7 consultations result in restrictions on water use. Water rights have substantial economic value and efforts must be undertaken to assess the value of such loss and to quantify replacement costs.

F. Secondary economic impacts associated with potential water diversion or conveyance issues are not fully addressed.

The IEC Analysis acknowledges mining's contribution to the Arizona economy.³¹ As described in Section II.A., PDC employs large numbers of people in its mining operations in the southwest United States. PDC also purchases many products and services from businesses in the region as part of its mining operations. The sectors that benefit from these transactions include public utilities, construction contractors, transportation firms, wholesalers, service businesses, and smaller mining firms.³² PDC employees also purchase goods and services from local businesses, such as grocery stores, restaurants, clothing stores, barbershops, car dealerships, and many other businesses. PDC pays numerous state and local taxes (including production *ad valorem* taxes, excise and severance taxes, and property taxes) on its mining operations, as do PDC's employees on their personal income and purchases.

²⁹ "Water Management of the Regional Aquifer in the Sierra Vista Subwatershed, Arizona-2004," US Department of the Interior (30 March 2005), <http://www.uspartnership.com/documents/Section321.2004.pdf> (accessed 6 July 2006).

³⁰ *Ibid.*, Table 6, p. 14.

³¹ "...the mining industry's contribution to Arizona's economy is important, particularly to some rural communities who rely on mining activities to provide employment and tax revenue." IEC Analysis, p. 5-2.

³² Interhemispheric Resource Center (IRC). *Copper, Phelps Dodge, and the Future of Grant County's Mining District*. Silver City, New Mexico: IRC, (October 2001), p. 9.

A loss in net income at any of PDC's properties associated with critical habitat designation could result in a loss of jobs, reduced spending and lower tax collections in the affected county, and possibly have more extended effects regionally or nationally. Although the IEC Analysis considers potential economic impacts to PDC mines, it does not consider such secondary economic effects which may arise in connection with these impacts

To the extent they may be considered in the future, we note that any potential economic losses associated with critical habitat designation are properly measured as welfare losses (i.e., lost producer and consumer surplus). Revenue losses and cost increases both contribute to a reduction in mining profits (i.e., a producer surplus loss). However, lost profits understate total impacts, because lost profits can lead to reductions in mining employment. In the case of job losses, mine workers may not be able to find alternate employment immediately, which leads to additional welfare losses during the employment period. Other dislocation or adjustment losses may also arise following a reduction in mining profits. Using lost mining revenues, as opposed to lost mining profits, as an impact measure may better capture such losses.³³

III. Summary

We recommend that the IEC Analysis comprehensively catalogue and quantify the potential costs and economic effects which may be imposed upon PDC operations and related communities as a result of critical habitat designation for the spikedace and loach minnow. IEC's Analysis should be expanded to include all of PDC's properties and activities (including grazing and agricultural use, in addition to mining) where water supplies or rights may be at risk as a result of designation. Further, consultation costs and mitigation efforts in connection with habitat designation could serve to increase costs and threaten water rights and should be more carefully considered.

Any restriction or curtailment of PDC's already highly regulated access to water could impose significant and consequential costs on PDC. In the worst case, if PDC were required to replace all water supplies at any particular site, costs could potentially be so high as to result in mine closure. Mine closure would result in significant costs for the local and broader economies. Revenue losses to PDC and job losses for employees would adversely affect other businesses that sell goods and services to the mining company and its employees. The losses would likely impact state and local governments, which rely upon taxes paid by the mining companies and their employees on their income, property and purchases. The potential for all such economic effects and their ramifications should be fully examined before designating habitat.

³³ See, for example, David Sunding, "Economic Impacts of Critical Habitat Designation for the Buena Vista Lake Shrew," Boston, MA: Charles River Associates (December 14, 2004).

Table 1
Arizona Water Transactions¹
From Water Strategist, January 2000-May 2006²

Index	Document Date	State	Acquirers	Supplier	Amount of Water	AMA	Purpose	Terms	Minimum Cost	Status	Notes
3	Apr-06	AZ	Private entities	Private entities	Purchase of 57.7 AF of Type II non-irrigation groundwater rights in the Tucson AMA	Tucson	M&I, domestic	\$2,000/AF to \$3,000/AF	\$ 2,000	Complete	Can be used for municipal, industrial and domestic purposes. Additional \$2.12/AF fee and groundwater withdrawal fee (\$3/AF) to the AZ Dept. of Water Resources.
7	Jan-06	AZ	Private entities	Private entities	Purchase of 100.2 AF of Type II non-irrigation groundwater rights in the Phoenix AMA	Phoenix	M&I, domestic	\$1,200/AF-\$1,500/AF	1,200	Complete	Additional fees to the AZ Dept. of Water Resources, statewide fee of \$2.12/AF for water quality assurance and a groundwater withdrawal fee of \$2.75/AF, which includes \$2.50/AF for the Arizona Water Banking Authority and \$0.25/AF for augmentation and conservation. The groundwater withdrawal fee varies by AMA (e.g. by region)
8	Jan-06	AZ	Private entities	Private entities	Purchase of 135.5 AF of Type II non-irrigation groundwater rights in the Prescott AMA	Prescott	M&I, domestic	\$12,000/AF-\$12,700/AF	12,000	Complete	Price recently increased substantially, there are 19 Type II rights with a total of 4,475.94 AF in the Prescott AMA. In addition to the purchase price, acquirers must pay fees to the AZ Dept. of Water Resources: Quality assurance fee of \$2.12/AF and groundwater withdrawal fee of \$2/AF (\$1/AF for administration and enforcement and \$1/AF for augmentation and conservation). Groundwater withdrawal fees vary by AMA
9	Jan-06	AZ	Private individual	Private individual	Purchase of 9AF of Type II non-irrigation groundwater rights in the Tucson AMA	Tucson	M&I, domestic	\$2,000/AF-\$3,000/AF	2,000	Complete	In addition to the purchase price, fees to the AZ Dept. of water resources include: \$2.12/AF for water quality assurance, \$3/AF for groundwater withdrawal fee (\$2.50/AF for the Water Banking Authority, \$0.50 for augmentation and conservation)
12	Jan-05	AZ	Private entities	Private entities	Purchase of 1,146.3 AF of Type II non-irrigation groundwater rights in the Phoenix AMA	Phoenix	M&I, domestic	\$1,100/AF-\$1,200/AF	1,100	Complete	Uses include golf course and turf watering, dairy operations, and general industrial use. Phoenix AMA prices range from \$1,100-\$1,200/AF, with, in addition, the \$2.12 quality assurance fee and a \$2.75/AF groundwater withdrawal fee (\$2.50 for water banking authority and \$0.25 for augmentation and conservation)
13	Jan-05	AZ	Private entities	Private entities	Purchase of 118.44 AF of Type II non-irrigation groundwater rights in the Prescott AMA	Prescott	M&I, domestic	Up to \$4,000/AF	4,000	Complete	Previously prices had been \$1,580-\$2,000/AF, though currently buyers are offering up to \$4,000/AF. (+\$2.12 QAF, \$1 for administration and enforcement, and \$1 for augmentation and conservation)
14	Jan-05	AZ	Private entities	Private entities	Purchase of 27 AF of Type II non-irrigation groundwater rights in the Tucson AMA	Tucson	M&I	\$3,000/AF	3,000	Complete	To be used for establishing potable water service for new development. (+\$2.12/AF QAF, \$2.50/AF for water banking, \$.50/AF for augmentation and conservation)
15	Feb-05	AZ	City of Prescott	A charitable trust	Purchase of a ranch with about 4,500 deeded acres and 13,000 AF of groundwater	Unknown	M&I	\$22.5 million, based upon \$75/acre and \$1,750/AF	1,750	Pending ADWR approval and construction of a pipeline to convey water to city	Ranch in Big Chino Valley. Seller pays 50% of environmental remediation up to \$100,000. Center for Biological Diversity opposes the sale on the grounds that it would harm the Verde River, which provides habitat for many endangered species
21	May-05	AZ	Private Entity	Private Entity	Purchase of 35 AF of type II non-irrigation groundwater rights in the Tucson AMA	Tucson	M&I, domestic	\$1,500/AF-\$3,000/AF	1,500	Complete	Going rate \$1,500/AF-\$2,000/AF. (+\$2.12/AF for QAF, \$2.50 for WBA, \$0.50 for A&C)
23	July/August 2005	AZ	Private entities	Private entities	Purchase of 3,485 AF of Type II non-irrigation groundwater rights in the Phoenix AMA	Phoenix	M&I, domestic	\$1,100/AF-\$1,200/AF	1,100	Complete	With 2.12 QAF, \$2.50 WBA, \$.50 A&C
24	July/August 2005	AZ	Private entity	Private entity	Purchase of 161.6 AF of Type II non-irrigation groundwater rights in the Tucson AMA	Tucson	M&I, domestic	\$1,500/AF-\$3,000?AF	1,500	Complete	With 2.12 QAF, \$2.50 WBA, \$.50 A&C
26	Oct-05	AZ	Private individuals	Private individuals	Purchase of 8 AF of Type II non-irrigation groundwater rights in the Tucson AMA	Tucson	M&I, domestic	\$2,000/AF-\$3,000/AF	2,000	Complete	With 2.12 QAF, \$2.50 WBA, \$.50 A&C
30	Jan-04	AZ	Developer	Dairy Operator	Purchase of 140 AF of Type II non-irrigation groundwater rights in the Phoenix AMA	Phoenix	M&I	\$1,100/AF	1,100	Complete	(\$2.12 QAF, \$2.50 WBA, \$.25 C&A)
31	Jan-04	AZ	Private entities	Private entities	Sales of 110 AF of Type II non-irrigation groundwater rights in the Phoenix AMA	Phoenix	M&I, domestic	\$1,100/AF	1,100	Complete	(\$2.12 QAF, \$2.50 WBA, \$.25 C&A)
32	Jan-04	AZ	Private entities	Private entities	Sales of 1 AF of Type II non-irrigation groundwater rights in the Tucson AMA	Tucson	M&I, domestic	\$1,500/AF-\$2,000/AF	1,500	Complete	(\$2.12 QAF, \$2.50 WBA, \$.50 C&A)
38	May-04	AZ	Private entities	Private entities	Sales of 72 AF of Type II non-irrigation groundwater rights in the Tucson AMA	Tucson	M&I, domestic	\$1,500/AF-\$2,000/AF	1,500	Complete	(\$2.12 QAF, \$2.50 WBA, \$.50 C&A)
40	Jun-04	AZ	Private Individual	Arizona State Land Dept	Purchase of 4.12 acres of land with 1.4 AF of Type II non-irrigation groundwater rights in the Tucson AMA	Tucson	M&I, domestic	\$2,800/AF	2,800	Complete	(\$2.12 QAF, \$2.50 WBA, \$.50 C&A)
41	Jun-04	AZ	Agricultural producer	Agricultural producer	Purchase of 105 AF of Type II non-irrigation groundwater rights in the Phoenix AMA	Phoenix	Livestock Use	\$1,200/AF	1,200	Complete	(\$2.12 QAF, \$2.50 WBA, \$.25 C&A)
43	July/August 2004	AZ	Private entities	City of Avondale and private entities	Purchase of 1,335 AF of Type II non-irrigation groundwater rights in the Phoenix AMA	Phoenix	M&I, domestic	\$1,100/AF-\$1,200/AF	1,100	Complete	(\$2.12 QAF, \$2.50 WBA, \$.25 C&A)

Table 1
Arizona Water Transactions¹
From Water Strategist, January 2000-May 2006²

Index	Document Date	State	Acquirers	Supplier	Amount of Water	AMA	Purpose	Terms	Minimum Cost	Status	Notes
44	July/August 2004	AZ	Private individual	Private individual	Purchase of 53 AF of Type II non-irrigation groundwater rights in the Pinal AMA	Pinal	M&I, domestic	\$1,000/AF-\$2,000/AF	1,000	Complete	(\$2.12 QAF, \$2.50 WBA, \$.50 C&A)
45	July/August 2004	AZ	Town of Chino Valley and the Town of Prescott Valley	Private entities and the Humboldt Unified School District	Purchase of 96.6 AF of Type II non-irrigation groundwater rights in the Prescott AMA	Prescott	M&I	\$1,580/AF-\$2,000/AF	1,580	Complete	(\$2.12 QAF, \$1 A&E, \$1 C&A)
46	July/August 2004	AZ	Private company	Private company	Purchase of 59.3 AF of Type II non-irrigation groundwater rights in the Tucson AMA	Tucson	M&I, domestic	\$1,500/AF-\$2,000/AF	1,500	Complete	(\$2.12 QAF, \$2.50 WBA, \$.50 C&A)
48	Oct-04	AZ	Various water users	Various water users	Purchase of 62 AF of Type II non-irrigation groundwater rights in the Tucson AMA	Tucson	M&I, domestic	\$1,500/AF-\$2,000/AF	1,500	Complete	(\$2.12 QAF, \$2.50 WBA, \$.50 C&A)
50	Jan-03	AZ	Private individuals	Private individuals	6.8 AF of Type II groundwater rights in the Tucson AMA	Tucson	M&I, domestic	\$1,500/AF-\$2,000/AF	1,500	Complete	(\$2.12 QAF, \$3 pumping fee)
53	Mar-03	AZ	Water users in the Phoenix AMA	Water users in the Phoenix AMA	Sales of 1,156 AF of Type II groundwater rights	Phoenix	M&I, domestic	\$1,000/AF	1,000	Complete	(\$2.12 QAF, \$2.50 WBA, \$0.25 C&A)
54	May-03	AZ	Private entity	Private entity	Sale of 136 AF of Type II non-irrigation groundwater rights in the Pinal AMA	Pinal	M&I, domestic	\$2,900/AF	2,900	Complete	(\$2.12 QAF, \$2.50 WBA, \$0.50 C&A)
55	May-03	AZ	Private entity	Private entity	Sale of 530 AF of Type II non-irrigation groundwater rights in the Tucson AMA	Tucson	M&I, domestic	\$2,000/AF	2,000	Complete	(\$2.12 QAF, \$2.50 WBA, \$0.50 C&A)
58	July/August 2003	AZ	Private entities	Private entities	Sale of 27 AF of Type II non-irrigation groundwater rights in the Tucson AMA	Tucson	M&I, domestic	\$2,000/AF	2,000	Complete	(\$2.12 QAF, \$2.50 WBA, \$0.50 C&A)
59	Sep-03	AZ	Private entities	Private entities	Sales of 3,020 AF of Type II non-irrigation groundwater rights in the Phoenix AMA	Phoenix	M&I, domestic	\$1,000/AF	1,000	Complete	(\$2.12 QAF, \$2.50 WBA, \$0.25 C&A, \$1 stored water recovery fee)
61	Oct-03	AZ	Private individuals	Private individuals	Sales of 8.2 AF of Type II non-irrigation groundwater rights in the Tucson AMA	Tucson	M&I, domestic	\$2,000/AF	2,000	Complete	(\$2.12 QAF, \$2.50 WBA, \$0.25 C&A, \$1 stored water recovery fee). Prices in the Tucson AMA around \$2,000/AF
64	Dec-03	AZ	Developer	An ice company	Purchase of 276 AF of Type II non-irrigation groundwater rights in the Phoenix AMA	Phoenix	M&I	\$1,100/AF	1,100	Complete	The ice company discontinued operations, the developer will use the water for a project in the Queen Creek area. (\$2.12 QAF, \$2.50 WBA, \$0.25 C&A)
70	May-02	AZ	Private individuals and companies	Private individuals and companies	42 AF of Type II groundwater rights in the Tucson AMA	Tucson	M&I, domestic	\$1,500/AF-\$2,000/AF	1,500	Complete	(\$2.12 QAF, pumping fee of \$3/AF to the AMA)
74	July/August 2002	AZ	Private individuals and companies	Private individuals and companies	19 AF of Type II groundwater rights in the Tucson AMA	Tucson	M&I, domestic	\$1,500/AF-\$2,000/AF	1,500	Complete	(\$2.12 QAF, pumping fee of \$3/AF to the AMA)
76	Oct-02	AZ	Private individuals and companies	Private individuals and companies	63 AF of Type II groundwater rights in the Tucson AMA	Tucson	M&I, domestic	\$1,500/AF-\$2,000/AF	1,500	Complete	(\$2.12 QAF, pumping fee of \$3/AF to the AMA)
77	Oct-02	AZ	Private individuals and companies	Private individuals and companies	1,576 AF of Type II groundwater rights in the Pinal AMA	Pinal	M&I, domestic	\$1,000/AF	1,000	Complete	(\$2.12 QAF, pumping fee of \$3/AF)
81	Mar-01	AZ	Town of Marana	Individual	10 AF of Type II groundwater in the Tucson AMA	Tucson	M&I	\$2,000/AF	2,000	Complete	Town will pay \$5.12 in annual fees to the Tucson AMA.
83	May-01	AZ	Allegheny Energy, Inc.	Vidler Water Company	6,478.5 AF of Harquahala valley groundwater rights	Unknown	Cooling at an electricity generating facility	\$1,400/AF	1,400	Complete	The current pumping charge for Type I rights is \$4.87/AF. \$2.75/AF withdrawal fee and \$2.12/AF environmental charge.
95	Feb-00	AZ	Various water users	Various	170.1 AF of Type II non-irrigation groundwater rights in Tucson AMA	Tucson	M&I	\$1,500/AF	1,500	Complete	Owners must pay a pumping fee to the AMA of \$3.00/AF, up from \$2.75 in 1999, plus \$2.12/AF if the water is used for non-irrigation purposes to be deposited in a water quality assurance fund.
101	Sep-00	AZ	Various	Various	17.3 AF Type II groundwater rights in the Tucson AMA	Tucson	M&I	\$1,500/AF-\$2,000/AF	1,500	Complete	(2.12 QAF, \$3.00 pumping fee)
103	Oct-00	AZ	Town of Marana	Four Individuals	147 AF of Type II groundwater rights in the Tucson AMA	Tucson	M&I	\$1,500/AF-\$2,000/AF	1,500	Complete	(2.12 QAF, \$3.00 pumping fee). Acquisition funded from town capital acquisition fund

Notes:

¹ As reported in the Water Strategist (editor Rodney T. Smith, published by Stratecon Inc., www.waterstrategist.com)

² November 2001 report was not included in the construction of this spreadsheet

Table 2
New Mexico Water Transactions¹
From Water Strategist, January 2000-May 2006²

Index	Document Date	State	Acquirers	Supplier	Amount of Water	Purpose	Terms	Minimum Cost	Status	Notes
2	Mar-06	NM	Santa Fe County	Developers	Dedications of 143 AF in the Middle Rio Grande Basin and 3.15 AF in the Santa Fe Basin	M&I	\$5,000/AF to \$7,000/AF	\$ 5,000	Complete	For residential and commercial development
4	Feb-06	NM	City of Albuquerque	Irrigator	Purchase of 76.31 AF of Middle Rio Grande water rights	M&I	\$6,000/AF	6,000	Complete	For future municipal water needs
5	May-06	NM	Santa Fe County	Macho Grande Del Rio Grande Ltd	Purchase of 3,166.649-acre farm and 1,188 AF of appurtenant groundwater rights	M&I	\$3,115/AF (\$1.3 million for the land, \$3.7 million for the water)	3,115	County needs to apply for and receive approval from the State Engineer to transfer the water and secure a tribal agreement for conveyance	The approvals are needed to move the point of diversion and purpose of use. A previous application to transfer 588 AF of water that were purchased from the same farm in 1997 is still pending. It had been protested by several environmental groups who argued it would adversely affect the Rio Grande silvery minnow. Another protest argued that the use of Rio Grande water beneath the Otowi Gauge would create a new use for Rio Grande water and violate a policy of the Rio Grande compact commission (See WIM 1998 for background on the protests)
17	Feb-05	NM	City of Albuquerque	Irrigators	Purchases of 214.61 AF of Middle Rio Grande River consumptive water rights	M&I	\$4,500/AF-\$5,000/AF	4,500	Complete	
25	July/August 2005	NM	City of Albuquerque	Irrigator	Purchase of 24.15 AF of Middle Rio Grande water rights	M&I	\$4,770/AF	4,770	Complete	No longer offering leasebacks on its water acquisitions. City currently extracting water through wells but is developing a surface diversion project.
33	Jan-04	NM	City of Albuquerque	Irrigator	Purchase of 46.22 AF of Middle Rio Grande River consumptive water rights	M&I	\$4,600/AF	4,600	Complete	In 2002, Albuquerque paid \$4,577/AF over the year for water
51	Jan-03	NM	City of Albuquerque	Irrigators	Purchase of 257.37 AF of Middle Rio Grande surface water rights	M&I	Ranged \$4,100/AF-\$4,912/AF, with an average of \$4,446/AF	4,100	Complete	Purchased in a series of eight transactions. Dependent for delivery on completion of surface diversion project expected to be completed in 2005
65	Feb-02	NM	City of Albuquerque	Irrigator	Purchase of 7.45 AF of Middle Rio Grande water rights	M&I	\$3,800/AF	3,800	Complete	Until it is needed the water may be leased back to the irrigator free for the initial term of five years.
73	Jun-02	NM	City of Albuquerque	Irrigators	Purchase of 227.83 of Middle Rio Grande surface water rights	M&I	Ranged \$3,700/AF-\$4,600/AF with an average of \$4,347/AF	3,700	Complete	Purchased in a total of five transactions.
80	Feb-01	NM	City of Albuquerque	Various Irrigators	466.14 AF of Middle Rio Grande surface water rights	M&I	Ranged \$4,000/AF-\$4,250/AF with an average of \$4,132.56/AF	4,000	Complete	
89	Sep-01	NM	City of Albuquerque	Various Irrigators	157.60 AF of Middle Rio Grande surface water rights	M&I	Ranged \$2,500/AF - \$4,250/AF with an average of \$4,132.56/AF	2,500	Complete	Acquired in seven separate transactions
96	Mar-00	NM	City of Albuquerque	Various Irrigators	Four purchases totaling 72.01 AF Rio Grande surface water	M&I	\$4,000/AF-\$4,200/AF	4,000	Complete	Purchased from four irrigators. Yield from the rights will be leased back to the irrigators until it is needed to meet anticipated future demand by the city.

Notes:

¹ As reported in the Water Strategist (editor Rodney T. Smith, published by Stratecon Inc., www.waterstrategist.com).

² November 2001 report was not included in the construction of this spreadsheet

Table 3
Average Minimum Unit-Price Calculations for Water Transactions by State

<u>State</u>	<u>Observations</u>	<u>Minimum Min. Price</u>	<u>Maximum Min. Price</u>	<u>Average Min. Price</u>	<u>25% Min. Price</u>	<u>75% Min. Price</u>
AZ ¹	40	\$ 1,000	\$ 12,000	\$ 1,898	\$ 1,175	\$ 2,000
NM ²	12	2,500	6,000	4,174	3,775	4,643

Notes:

¹ Prices used are from Table 1, column labeled "Minimum Cost"

² Prices used are from Table 2, column labeled "Minimum Cost"

Table 4
Potential Cost of Replacing Eagle Creek and Black River Water at
Morenci Mine

Eagle Creek and Black River Water Used at		
Morenci Mine (AF/Year) ¹	(a)	18,000
Arizona Avg. Cost/AF ²	(b)	\$1,898
Arizona 1st Quartile Cost/AF ³	(c)	\$1,175
Arizona 3rd Quartile Cost/AF ⁴	(d)	\$2,000
Total Minimum Cost (Using Avg. Cost)	(e) = (a) * (b)	\$34,164,000
Total Minimum Cost (Using 1st Quartile Cost)	(f) = (a) * (c)	\$21,150,000
Total Minimum Cost (Using 3rd Quartile Cost)	(g) = (a) * (d)	\$36,000,000

Notes

- ¹ Fennemore-Craig (Jaron Bromm)
- ² See Table 3, Column labeled "Average Min. Price"
- ³ See Table 3, Column labeled "25% Min. Price"
- ⁴ See Table 3, Column labeled "75% Min. Price"

Table 5
Potential Cost of Replacing Gila River Water at Tyrone Mine

Gila Water Used at Tyrone Mine (AF/Year) ¹	(a)	7,000
New Mexico, Avg. Cost/AF ²	(b)	\$4,174
New Mexico, 1st Quartile Cost/AF ³	(c)	\$3,775
New Mexico, 3rd Quartile Cost/AF ⁴	(d)	\$4,643
Total Minimum Cost (Using Avg. Cost)	(e) = (a) * (b)	\$29,218,000
Total Minimum Cost (Using 1st Quartile Cost)	(f) = (a) * (c)	\$26,425,000
Total Minimum Cost (Using 3rd Quartile Cost)	(g) = (a) * (d)	\$32,501,000

Notes

- ¹ Fennemore-Craig (Jaron Bromm)
- ² See Table 3, Column labeled "Average Min. Price"
- ³ See Table 3, Column labeled "25% Min. Price"
- ⁴ See Table 3, Column labeled "75% Min. Price"

Table 6
Calculations of Average Water Rights Costs of Gila River Water for the Tyrone Mine Using 2001 Comparable Transactions

Transaction	Seller	Buyer	Per Water Right Acre Price	Price for Water Rights
1(2001)	Mary Hooker Agnew	The Nature Conservancy	\$11,381	\$7,069
2(2001)	Paulo Richarte	Jerold L. Collins	\$10,000	\$6,211
3(2001)	Sarah D. Mugler	Jerold L. Collins	\$10,000	\$6,211
4(2001)	Steve Villarreal	Jerold L. Collins	\$10,000	\$6,211
5(2001)	Barbara Stockton	Jerold L. Collins	\$10,000	\$6,211
Average			\$10,276	\$6,383

Notes

¹ All information found in appraisal data provided by Kevin Schrimsher to Fennemore-Craig (Jaron Bromm).

Table 7
Potential Cost of Replacing Gila River Water at the Tyrone Mine

Water potentially to be replaced at the Tyrone Mine (Acre-Feet) ¹	(a)	7,000
Gila River Water Rights Costs/AF ²	(b)	\$6,383
Potential Replacement	(c) = (a) * (b)	\$44,679,130

Notes

¹ Fennemore-Craig (Jaron Bromm)

² See Table 6, Column labeled "Price for Water Rights," Row labeled 'Average'

Table 8
Potential Cost of Replacing Gila River Water at the Tyrone Mine Using Post-2001 Comparable Transactions

Water potentially to be replaced at the Tyrone Mine (Acre-Feet) ¹	(a)	7,000
Gila River Water Rights Costs/AF ²	(b)	\$16,000
Potential Water Replacement Costs	(c) = (a) * (b)	#####

Notes

¹ Data provided by Jaron Bromm of Fennemore-Craig

² Water sales data provided by Kevin Schrimsher, Schrimsher Ranch Real Estate, Farm & Ranch Sales & Appraisals, 505-622-2343

SALE	WATER RIGHTS	LAND ACRES	DATE	PRICE OF WATER	\$/AC OF WATER	SELLER	BUYER
1	16.5	28	PENDING 7/06	165000	10000	CONFIDENTIAL	CONFIDENTIAL
2	0.125	0	PENDING 7/06	2500	20000	CONFIDENTIAL	CONFIDENTIAL
3	0.1	0	PENDING 7/06	2000	20000	CONFIDENTIAL	CONFIDENTIAL
4	0.063	0	2/21/2002	2000	32000	Holiman	Wheeler
5	1	0	3/4/2002	10000	10000	Dinwiddie	Bowen
6	1	0	8/22/2002	10000	10000	Wood	Riva
7	1	0	9/17/2002	10000	10000	Dinwiddie	Brewer
				Average	16000		