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## Mining of Internationally Shared Aquifers: The El Paso-Juarez Case

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# Mining of Internationally Shared Aquifers: The El Paso-Juárez Case

## ABSTRACT

*The Paso del Norte on the U.S.-Mexico Border is a region where economic, social, and cultural lives are intertwined. However, management of natural resources faces sometimes insufficient communication among government agencies responsible for their well being. The international dimension of the region aggravates the lack of coordination among government agencies of both countries. As the region's main aquifer, the Hueco Bolson's ability to support the region's water needs is coming to an end. Additionally, there is no legal framework that could facilitate the process of bringing all the parties together on common grounds to address the situation. As population growth is expected to continue, so is the demand for water. The white map syndrome, when nothing is considered to exist on the other side of a border line, is a fact of life in the region. The cities of El Paso and Ciudad Juárez are one large metroplex with two distinct water systems. Unless all the actors in the region really work together to jointly develop alternatives for future water supply, the region is on a collision path. Water is a precious resource anywhere, especially in the desert. The problem is that people and institutions in these cities seem to have forgotten, because water comes from the tap, that they are in the desert.*

## INTRODUCTION

The border region shared by the communities of El Paso, Texas, southern Dona Ana County, New Mexico, and Juárez, Chihuahua, Mexico, faces significant challenges to assure water supplies for its residents in the near future. The region, also known as Paso del Norte, is home to close to two million people.<sup>1</sup> It is located in an arid region with annual rainfall of less than seven inches.<sup>2</sup>

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1. See CITY OF EL PASO, DEP'T OF PLANNING, RESEARCH & DEV., POPULATION AND HOUSING TRENDS \_\_ (1994). See also INSTITUTO NACIONAL DE ESTADISTICA, GEOGRAFIA E INFORMACION, CONTEO \_\_ (1995).

2. Interviews with Jose Manuel Canizales, Water Production Supervisor, Junta Municipal de Agua y Saneamiento de Ciudad Juarez, in Ciudad Juárez (July-Dec., 1998).

The Paso del Norte region has experienced a very high growth rate, especially on the Mexican side. From 1980 to 1994, Ciudad Juárez grew 63 percent, while El Paso had a 34 percent growth rate (table 1).<sup>3</sup> In the same period, water use grew 96 percent for Juárez and 32 percent for El Paso.<sup>4</sup> As the population growth is expected to continue, so is the demand for water.

TABLE 1. PASO DEL NORTE POPULATION GROWTH

	El Paso	Juárez
1900	15,906	8,212
1910	39,279	10,621
1920	77,560	19,457
1930	102,421	39,669
1940	96,810	48,881
1950	130,485	122,566
1960	276,687	262,119
1970	322,261	407,370
1980	425,259	649,275
1990	515,342	798,499
1995	600,000*	999,770

\*Estimated

For centuries the river and shallow wells had been the source of water in the region. With the turn of the century, the growing urban centers along the Rio Grande, where the river becomes the international boundary, started increasingly to depend on groundwater. The primary source of the region's groundwater is the aquifer called Hueco Bolson,<sup>5</sup> which is being depleted at a dramatic rate. Both communities are mining the same source; however, Ciudad Juárez faces the biggest challenges since it currently depends on the Hueco Bolson for 100 percent of its water supplies.<sup>6</sup> On the other hand, El Paso has had alternative sources for several decades.<sup>7</sup>

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3. See CITY OF EL PASO, *supra* note 1, at \_\_\_. See also Interviews with Roger Sperka, Geologist, El Paso Water Utility, in El Paso, Texas, in the offices of the El Paso Water Utility (Aug.-Sept., 1998).

4. Interviews with Jose Manuel Canizales, *supra* note 2; Interviews with Roger Sperka, *supra* note 3.

5. Interviews with Jose Manuel Canizales, *supra* note 2; Interviews with Roger Sperka, *supra* note 3.

6. Interviews with Jose Manuel Canizales, *supra* note 2.

7. Interviews with Roger Sperka, *supra* note 3.

## Water Sources

The region's three main sources of water are the Rio Grande and two aquifers, the Hueco Bolson and the Mesilla Bolson.<sup>8</sup> The Hueco Bolson extends south from the New Mexico/Texas state line to the Sierra Juárez to the west, and to the Sierra El Presidio and Sierra Guadalupe to the south.<sup>9</sup> From the Sierra Juárez, the Hueco Bolson turns southeast to Indian Hot Springs.<sup>10</sup> The Hueco Bolson has a connection with the Tularosa Bolson on the north.<sup>11</sup> This aquifer is truly shared by the two countries, and it is the key source of water for the city of El Paso, Ciudad Juárez, and military installations and smaller cities in New Mexico, Texas, and Mexico.<sup>12</sup> The Mesilla Bolson is a renewable aquifer west of El Paso that is also shared with the state of New Mexico.<sup>13</sup> Historically, the urban areas have exploited high quality groundwater while the region's farmers have relied on the surface waters of the Rio Grande, managed downstream of Elephant Butte Dam by a complex system of international treaties and interstate compacts.<sup>14</sup>

Starting in 1943, El Paso began to use surface water to complement the water mined from the Hueco and the Mesilla bolsons.<sup>15</sup> In the 1980s, El Paso increased its dependence on surface water rather than groundwater.<sup>16</sup> However, the city still depends mostly on groundwater to meet its water demand (figure 1).<sup>17</sup> On the other hand, Ciudad Juárez is totally dependent on the Hueco Bolson for its drinking and industrial water supply.<sup>18</sup>

The groundwater mining data from privately owned wells serving U.S. farmers and others is not available.<sup>19</sup> On the Mexican side, the National Water Commission (CNA) has records of the estimated extraction.<sup>20</sup> The agency reported that in 1997-1998 there were 351 operating wells in the

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8. See El Paso Water Utility, *Water Resources* (visited Sept.-Dec., 1999) <<http://www.epwu.org/souces.html>>.

9. See INT'L BOUNDARY & WATER COMM'N, *TRANSBOUNDARY AQUIFERS AND BINATIONAL GROUND-WATER DATA BASE, EL PASO TX/CIUDAD JUÁREZ 3* (1998).

10. See *id.*

11. See *id.*

12. See *id.*

13. See El Paso Water Utility, *supra* note 8.

14. See Univ. of Tex. at El Paso, *Paseo del Norte Sustainable Water Use Strategy: An Economic Development Strategy for the Sustainable Use of Water in the Paso del Norte Region* (last modified June 29, 1998) <<http://www.utep.edu/rio>>.

15. Interviews with Roger Sperk, *supra* note 3.

16. See *id.*

17. See El Paso Water Utility, *supra* note 8.

18. Interviews with Jose Manuel Canizales, *supra* note 2.

19. See INT'L BOUNDARY & WATER COMM'N, *supra* note 9, at 16.

20. See *id.*

Juárez Valley east of the city, 90 of them are owned by the CNA and 261 are privately owned.<sup>21</sup> Figure 2<sup>22</sup> shows a comparison of the groundwater users mining water on the Mexican side in recent years.

Under a 1906 Convention between the United States and Mexico, Mexico has the right to 74 million cubic meters per year from the Rio Grande.<sup>23</sup> The water is used for irrigation of farmland in the Juárez Valley. The surface water is supplemented by groundwater and currently by untreated Ciudad Juárez sewage output. The city is expected to have its two wastewater treatment plants operating sometime in the year 2000.<sup>24</sup> The high dependency of the region's residents upon groundwater, particularly from the Hueco Bolson, has depleted this source. Since 1940 the level has fallen as much as 45 meters, with most of the larger declines near municipal well fields.<sup>25</sup> Some of the biggest drops are beneath Ciudad Juárez.<sup>26</sup> As an example, the water level in one of the wells operated by Ciudad Juárez' water utility (JMAS), the JMAS-15 well, has dropped over 30 meters in 25 years.<sup>27</sup> In general, all Ciudad Juárez' wells evidence sharp rates of water level declines.<sup>28</sup>

The arid conditions in the Paso del Norte region result in a deficit of water worsened by higher extraction than recharge rate in the Hueco Bolson.<sup>29</sup> Even though over time wells have been abandoned because they have dried up or because of poor water quality (primarily high salinity), *the region does not have a regionwide plan to deal with water scarcity*, compromising the future water supply.<sup>30</sup> It is estimated that the current groundwater supply source will be depleted within 20 to 30 years unless something is done.<sup>31</sup>

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21. Interviews with Jose Manuel Canizales, *supra* note 2.

22. See INT'L BOUNDARY & WATER COMM'N, *supra* note 9; Interviews with Jose Manuel Canizales, *supra* note 2.

23. Convention between the United States and Mexico for the Equitable Distribution of the Waters of the Rio Grande, May 21, 1906, U.S.-Mex., T.S. No. 455.

24. Interviews with Humberto Uranga, Public Relations Manager, Junta Municipal de Agua y Saneamiento de Ciudad Juárez, in Ciudad Juárez (July-Oct. 1998).

25. See INT'L BOUNDARY & WATER COMM'N, *supra* note 9, at 6 fig.21; Interviews with Jose Manuel Canizales, *supra* note 2.

26. See INT'L BOUNDARY & WATER COMM'N, *supra* note 9, at 6 fig.21; Interviews with Jose Manuel Canizales, *supra* note 2.

27. See INT'L BOUNDARY & WATER COMM'N, *supra* note 9, at 6 fig.21; Interviews with Jose Manuel Canizales, *supra* note 2.

28. See INT'L BOUNDARY & WATER COMM'N, *supra* note 9, at 6 fig.21; Interviews with Jose Manuel Canizales, *supra* note 2.

29. Interviews with Jose Manuel Canizales, *supra* note 2.

30. See *id.*

31. See INT'L BOUNDARY & WATER COMM'N, *supra* note 9 at 1.

## Legal Framework

The Paso del Norte region is shared by three states in two countries. This fragmentation itself represents a significant challenge. The only existing legal framework is for surface water rights; the issue of how to divide the groundwater in an orderly way has not been addressed. In this region where water is a scarce resource, shared by different legal jurisdictions, a common or agreed upon legal framework to deal with the issue is absent.

The overall complex legal framework does not seem to have facilitated the search for a long-term solution to the water supply problem of the region. Each state has its own definition of water rights. In Chihuahua, Mexico, the Mexican Constitution defines water as the property of the nation.<sup>32</sup> In Texas and New Mexico, corresponding state laws define rights. In particular, groundwater rights have three different frameworks, although in some cases, like the Hueco Bolson, it all comes from the same source. In Texas there is the "Right to Capture," under which the owner of the land has the rights to underground water; there are a few exceptions, Edwards Aquifer and Harris County Aquifer, but the Hueco Bolson is not among them. In New Mexico it is the state that regulates water rights. In Chihuahua, water rights are controlled by a federal agency, the National Water Commission (CNA).<sup>33</sup>

In addition to the complexity of different laws, there are a number of local and state agencies that in some instances have conflicting interests over the same resources. On the Mexican side there is the CNA, with overall control on all water issues.<sup>34</sup> At the state level there is the Central Water Utility (JCAS), which oversees the Ciudad Juárez water utility (JMAS). On the U.S. side, in the state of Texas there is the El Paso Water Utility (EPWU), which is responsible for providing water to the city of El Paso.<sup>35</sup> There are, additionally, other local entities that oversee water rights for agricultural and domestic uses in the region, for example, El Paso County Water Improvement District No. 1 (EPCWID) and the Lower Valley Water District. Additionally, there are interstate commissions that deal with the Rio Grande surface water that also have an impact on the aquifer: the Rio Grande Compact Commission, the New Mexico-Texas Water Commission, and the Elephant Butte Irrigation District (a New Mexico only institution). Finally, the International Boundary and Water

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32. See "Ley de Agua Nacionales," D.O., 1 de diciembre de 1992 (Mex.).

33. See *id.*

34. See *id.*

35. See El Paso Water Utility, *El Paso Water Utilities Public Service Board* (visited Sept.-Dec., 1999) <<http://www.epwu.org/main.html>>.

Commission, an international institution, looks at surface water, but has the potential to participate in issues regarding internationally shared aquifers.

This situation, two water utilities in the Paso del Norte region sharing the same body of groundwater, exemplifies how two entities that in all logic should be working closely together actually operate at some distance because of their own special legal and political environment.

### Water Mining

The groundwater mining of the Hueco Bolson is not exclusively done by the two major urban centers' water utilities. Farms and military installations situated over the aquifer also mine the resource to serve their needs;<sup>36</sup> however, the two urban water utilities mine over 80 percent of the water.<sup>37</sup> In the last four decades, groundwater pumped from the Hueco Bolson has increased by a factor of almost six.<sup>38</sup> Table 2 presents the number of Hueco Bolson wells available for each of the water utilities mining from the aquifer.

TABLE 2. HUECO BOLSON WELLS IN OPERATION

	El Paso	Juárez
1912	1	1
1924	6	2
1950	18	5
1960	42	12
1991	111	104
1995	84	130
1998	152	142

Currently, most of the available data is coming from the two major water utilities, El Paso Water Utility (EPWU) and the corresponding agency in Ciudad Juárez, the Junta Municipal de Agua y Saneamiento (JMAS). Figure 3<sup>39</sup> presents the total mining extracted by the two water utilities from the Hueco Bolson. In recent years, from 1990 to 1994, El Paso mining

36. See INT'L BOUNDARY & WATER COMM'N, *supra* note 9, at 7.

37. See *id.*; author estimates.

38. See INT'L BOUNDARY & WATER COMM'N, *supra* note 9, at 7.

39. Interviews with Roger Sperka, *supra* note 3; Interviews with Jose Manuel Canizales, *supra* note 2.

has decreased by 24 percent.<sup>40</sup> However, Ciudad Juárez' pumpage increased by 12.5 percent during the same period.<sup>41</sup>

Comparing the total water consumption (including industrial water), it is clear that El Paso residents use almost twice the water per capita as the Juárez residents (figure 4).<sup>42</sup> However, it is relevant to mention that in El Paso the industrial and commercial sectors consume between 22 to 25 percent of the water, while in Juárez these sectors consume only between 12 to 15 percent.<sup>43</sup> Additionally, in Juárez not all the residents have water service all year around and in 1998 about five percent were not even connected to the distribution network.<sup>44</sup>

During the past twenty-five years, the percentage of growth rates in the water supply delivered has been greater in Ciudad Juárez than in El Paso.<sup>45</sup> On the average, the growth has been 4.98 percent per year compared with 1.73 percent per year in El Paso.<sup>46</sup> Figure 5<sup>47</sup> shows yearly pumpage by the two communities from the Hueco Bolson.

### El Paso Consumption

By the end of 1998, the El Paso Water Utility (EPWU) operated 152 wells, 56 reservoirs, 41 booster pump stations, and two surface water treatment plants.<sup>48</sup> Historically, 60 percent of the annual usage has been from the Hueco Bolson (figure 6).<sup>49</sup> About 15 percent of the historical annual usage has been from the Mesilla Bolson and the rest has been supplied by treated surface water.<sup>50</sup>

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40. See INT'L BOUNDARY & WATER COMM'N, *supra* note 9, at 7.

41. See *id.*

42. Interviews with Roger Sperka, *supra* note 3; Interviews with Annai Padilla, Water Conservation Program, El Paso Water Utility, in El Paso, Texas, in the offices of the El Paso Water Utility (July-Dec., 1998); Interviews with Jose Manuel Canizales, *supra* note 2; Interviews with Humberto Uraga, *supra* note 24.

43. Interviews with Humberto Uraga, *supra* note 24; Interviews with Annai Padilla, *supra* note 42.

44. Interviews with Humberto Uraga, *supra* note 24.

45. Interviews with Jose Manuel Canizales, *supra* note 2; Interviews with Roger Sperka, *supra* note 3.

46. Interviews with Jose Manuel Canizales, *supra* note 2; Interviews with Roger Sperka, *supra* note 3.

47. Interviews with Jose Manuel Canizales, *supra* note 2; Interviews with Roger Sperka, *supra* note 3.

48. See El Paso Water Utility, *Water Systems* (visited Sept.-Dec. 1999) <<http://www.epwu.org/water.html>>.

49. See *id.*

50. See *id.*



Water demand in El Paso was at 768 liters per person per day (lpd) in 1989 prior to institution of an aggressive water conservation program,<sup>51</sup> but it has been declining rapidly since then. In 1998 the per capita level of consumption was 632 lpd.<sup>52</sup> The goal is to reduce usage to 605 lpd by the year 2000.<sup>53</sup>

By the end of 1998 the EPWU had 78 operational, 18 blendable, 27 reserve, and four unconnected wells in the Hueco basin, with a total capacity of 666,000 M<sup>3</sup>D (cubic meters per day).<sup>54</sup> The 96 wells, representing operational and blendable wells only, provide a maximum capacity of 545,000 M<sup>3</sup>D.<sup>55</sup>

In 1997 these wells pumped a total of 62.7 MM<sup>3</sup> (million cubic meters) of water from the Hueco basin, supplying 40 percent of El Paso's total water demand.<sup>56</sup> Most of the groundwater was pumped from the well fields in the mesa area, specifically the Mesa-Nevis, Airport, Cielo Vista, and Eastwood well fields.<sup>57</sup>

EPWU's production wells in the Mesilla Bolson are located within the Canutillo well field and are categorized as shallow, intermediate, and deep wells.<sup>58</sup> The Canutillo wells were drilled starting in 1952 in response to the drought of the early 1950s.<sup>59</sup> Groundwater can be pumped from 15 shallow, 10 intermediate, and seven deep wells in the Canutillo well field, having a total capacity of 146,000 M<sup>3</sup>D.<sup>60</sup> These wells provided 18 percent of El Paso's water supply in 1997, for a total of 28 MM<sup>3</sup>.<sup>61</sup>

El Paso has two surface water plants. The 151,000 M<sup>3</sup>D Robertson/Umbenhauer plant, originally built in 1943, is centrally located in the city.<sup>62</sup> The second surface water plant, the Jonathan Rogers Water Treatment Plant, with a capacity of 151,000 M<sup>3</sup>D, started production in early 1993 and is located further downstream to serve the city's eastside and expanding lower valley area.<sup>63</sup> Their production represents just less than 45 percent of total current annual demand.<sup>64</sup> Because of the second water plant, recent withdrawals from the Hueco Bolson have dropped to

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51. Interviews with Annai Padilla, *supra* note 42.

52. *See id.*

53. *See id.*

54. Interviews with Roger Sperka, *supra* note 3.

55. *See id.*

56. *See id.*

57. *See id.*

58. *See id.*

59. *See id.*

60. *See id.*

61. *See id.*

62. *See El Paso Water Utility, supra* note 48.

63. *See id.*

64. *See id.*

40 percent.<sup>65</sup> Both plants operate during the seven or eight month irrigation season when Rio Grande Project water is available.<sup>66</sup>

EPWU is actively seeking alternative schemes to obtain river water throughout the year. Among them is the possibility of bringing piped water all the way from the Elephant Butte Dam.<sup>67</sup>

The surface water for El Paso is diverted from the EPCWID irrigation canals at the Robertson/Umberhauer and Jonathan Rogers water treatment plants.<sup>68</sup> A total of 66.8 MM<sup>3</sup> were diverted in 1997, which makes surface water the major source of supply for the city.<sup>69</sup> From 1993 to 1997, when the new treatment plant started, surface water outstripped groundwater sources three out of four years.<sup>70</sup>

With the trend of reducing its dependency on the Hueco Bolson water, El Paso is accommodating the steady population growth it has been experiencing in the last several decades (figure 7).<sup>71</sup>

### Juárez Consumption

The first water distribution system was built in 1912 with a well and an elevated tank.<sup>72</sup> By 1924 the city had drilled two more wells.<sup>73</sup> Several years later it was possible to develop a more extensive distribution network that by 1935 supplied water to the majority of the population.<sup>74</sup> In the period between 1936 to 1950, the population grew from 40,000 to 122,566 and the Water Utility had five operating wells.<sup>75</sup> By 1960 Ciudad Juárez had 12 wells providing drinking water to its residents.<sup>76</sup>

In 1998, JMAS operated on average 136 out of 142 in-service wells during the high demand period in the summer.<sup>77</sup> It also had 23 reservoirs and 29 booster pump stations.<sup>78</sup> The distribution network for JMAS reached between 94 and 96 percent of the city residents.<sup>79</sup> However, the water

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65. See *id.*

66. See *id.*

67. Interviews with Roger Sperka, *supra* note 3.

68. See El Paso Water Utility, *supra* note 48.

69. See *id.*

70. See *id.*

71. See CITY OF EL PASO, *supra* note 1, at \_\_; Interviews with Roger Sperka, *supra* note 3.

72. Interviews with Jose Manuel Canizales, *supra* note 2.

73. See *id.*

74. See *id.*

75. See *id.*

76. See *id.*

77. See *id.*

78. See *id.*

79. See *id.*

supply is not enough to provide continuous service to all connected users 24 hours a day, especially during the summer.<sup>80</sup>

The Juárez distribution network has a significant number of leaks, many of them undetected. Estimates of water losses through leaks are between 15 and 30 percent of total supply.<sup>81</sup>

The inadequate infrastructure of the JMAS is due to a number of factors, including politically based management policies and limited resources to address the existing service deficits and prepare for the future demand. In order to reduce the deficiencies, the utility must, among other things, have better control over its sources of income. For instance, only a fraction of the users have meters, and even those with meters are charged a fixed amount based on the number of rooms in the house and the number of declared residents.<sup>82</sup> Also, the Utility is not able to collect a significant portion of the bills sent to users.<sup>83</sup>

Together with the deficient infrastructure, the JMAS was not able to keep up with the increased demand, particularly in 1996 and 1997 (figure 8).<sup>84</sup> In both years, the total water supply to the network was less than in the previous year.<sup>85</sup> An explanation given to the public was that the city residents were using less water per capita, which may be true. But the cause is not related to attitudes toward conservation. Instead, water is simply not being supplied. When a system has a significant deficit and the input is reduced, it seems reasonable to suppose that such reduction is not due to a reduction in demand. Instead, it is more likely the reason is because supply fell short. That is the case in Ciudad Juárez, where a significant number of neighborhoods do not receive water 24 hours a day, especially during the summer.<sup>86</sup>

### **Actions Being Taken**

The water issues in the Paso del Norte region have been studied for several decades.<sup>87</sup> The studies have been conducted by government agencies as well as by academic institutions and consultant firms from both

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80. *See id.*

81. *See id.*; Interviews with Humberto Uranga, *supra* note 24.

82. Interviews with Humberto Uranga, *supra* note 24. *See also* DIAGNOSTICO DE OPERACION DE LA JUNTA MUNICIPAL DE AGUA Y SANEAMIENTO DE CIUDAD JUÁREZ \_\_ (1995) (study conducted for the Border Environmental Cooperation Commission).

83. Interviews with Humberto Uranga, *supra* note 24.

84. Interviews with Jose Manuel Canizales, *supra* note 2.

85. *See id.*

86. *See id.*; Interviews with Humberto Uranga, *supra* note 24.

87. *See Univ. of Tex. At El Paso, supra* note 14.

sides of the border.<sup>88</sup> Several of these efforts require collaboration from institutions and individuals in the region. Nevertheless, day-to-day operations do not necessarily involve agencies and institutions from the other side of the border. Data sharing has been an informal practice that depends more on the good will of the individuals involved than on institutional mechanisms.<sup>89</sup>

The white map syndrome, when nothing exists on the other side of the border line, is a fact of life. None of the agencies in charge of providing water to the region's residents and/or controlling the overall usage of the resource seem to handle the whole aquifer as one entity (table 3).<sup>90</sup> They present their reality as if the Hueco Bolson ends at the border line.

TABLE 3. WATER UTILITIES INFRASTRUCTURE

	El Paso	Juárez
Wells		
Hueco Bolson	152	142
Operational	96	148
Reservoirs	56	23
Booster Pump Stations	41	29
Groundwater Treatment Plants	2	0

The only recent effort that could be classified as a joint venture is the Transboundary Aquifer and Binational Groundwater database report led by the International Boundary and Water Commission.<sup>91</sup> This study, completed in January 1998, could become the first step toward a more institutionalized mechanism to share information, and perhaps from it, it may be possible to some day have a joint plan to manage the aquifer.<sup>92</sup>

During the field research for this work, individuals at both water utilities in El Paso and Juárez recognized the absence of a formal mechanism to share data and work together.<sup>93</sup> Since El Paso Water Utility has a more fully developed mechanism to make its information available to the public, it is easier for Ciudad Juárez' JMAS to be informed. That is

88. See *id.*

89. Interviews with Roger Sperka, *supra* note 3; Interviews with Jose Manuel Canizales, *supra* note 2.

90. Interviews with Jose Manuel Canizales, *supra* note 2.

91. See INT'L BOUNDARY & WATER COMM'N, *supra* note 9.

92. See *id.*

93. These comments have been collected by the author for years as he has interacted with officials from both utilities.

not the case for EPWU, since Juárez' information is not fully made available to the public, and in some instances information is withheld from the public even if asked for explicitly. JMAS does not seem to have fully developed policies for making information available.

From the results of multiple studies, it is clear that both water utilities conduct some level of cooperation by providing information; however, there is not a concrete effort to jointly develop a policy for water supply for the region. EPWU has developed a master plan that defines the water supply for El Paso until the year 2040.<sup>94</sup> In this plan, the utility is seeking to considerably reduce the dependency on the Hueco Bolson water and increase the dependency on surface water. In the plan, the EPWU includes the practice of injecting water into the Hueco Bolson so it can be used as water storage when there is a surface water surplus.<sup>95</sup>

The City of El Paso Master Plan resulted from a joint effort between the cities and the local irrigation district. They formally signed a Memorandum of Understanding in 1989 to work together on a long-range Water Resource Management Plan for the El Paso area.<sup>96</sup> After several studies, it was determined that the Hueco basin would be exhausted of all fresh waters that could be economically retrieved by approximately the year 2025, causing massive water supply shortages in the region.<sup>97</sup>

To avoid such a catastrophe, the Plan proposed a new strategy for meeting El Paso's water demand by the year 2040.<sup>98</sup> The Plan's water supply composition is shown in figure 9.<sup>99</sup> The Plan has a number of components:

- Water conservation. This involves an aggressive program with positive results in the reduction of water consumption per capita.
- Water reuse. El Paso is presently or is planning to utilize at least a portion of wastewater effluent from its wastewater treatment plants.
- Use of surface water coupled with aquifer storage and recovery in the Hueco Bolson. During wet years of high flow in the Rio Grande, additional water would be restored and recharged to the Hueco basin. The Hueco, thereby, would serve as an

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94. See El Paso Water Utility, *supra* note 8.

95. See *id.*

96. See *id.*

97. See *id.*

98. See *id.*

99. See *id.*

underground reservoir to be utilized for water supply during dry years of reduced flow in the Rio Grande.

- Desalination of brackish groundwater.
- Groundwater pumped from the Mesilla Bolson. Withdrawals from the Mesilla are expected to increase somewhat over the next decade and remain constant thereafter.<sup>100</sup>

It is not known whether JMAS or CNA has a similar plan for the Mexican side. It is very possible that they are not even working on such a defined plan. The lack of a long-term plan represents a major risk to Ciudad Juárez due to its total dependency on groundwater for its water needs.<sup>101</sup>

Juárez' water utility, JMAS, unable to provide full coverage to all the population, does not have many options for the future. In the last six years, the number of wells remained practically unchanged. Even though it is estimated that the population grew over 27 percent, water supply only increased about 12 percent.<sup>102</sup> This means the service deficit increased.<sup>103</sup>

The utility does not have a well-defined long-term plan to assure water supply for the fast growing urban center in the Paso del Norte region. Several options have been mentioned, nevertheless, JMAS has failed to present a well-developed plan.<sup>104</sup> Among the options that have been discussed are the reduction of water demand through reuse of treated water by industry, and the possibility of treating Rio Grande river water given to Mexico under the 1906 Convention between the United States and Mexico.<sup>105</sup> Both options are possible but not necessarily easily implemented, especially the latter, since the farmers with current water rights would need to agree. If this option were to be implemented, dependency on the Hueco Bolson could be reduced to close to 50 percent, a significant reduction under the current supply conditions. The option to reuse treated water could alleviate a small amount of the water deficit since industrial consumption only accounts for about ten percent of current usage. It is not very likely that all of the industrial demand could be covered with treated water since there are a few high water consumption industries.<sup>106</sup> Most of the industrial water demand is for personal needs.

In addition to the water utilities' formal or informal plans to support the region's future water demand, during 1996 and 1997 two

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100. See *id.*; Interviews with Humberto Uranga, *supra* note 24.

101. Interviews with Humberto Uranga, *supra* note 24.

102. Interviews with Jose Manuel Canizales, *supra* note 2.

103. See *id.*

104. See *id.*

105. See *id.*

106. See *id.*

efforts were conducted to seek alternatives to the water supply problem for the region. The first to provide results was the project "An Economic Development Strategy for the Sustainable Use of Water in the Paso del Norte Region."<sup>107</sup> This project was led by the University of Texas at El Paso (UTEP) and brought together a significant number of players from the region. This exercise involved several meetings and the development of special reports by academics and consultant firms in the region. Although it was more devoted to surface water issues, it did address the issue of urban water demand versus agricultural water demands and its economic and social implications, indirectly touching on the issues of groundwater.<sup>108</sup>

The other recent effort is the work mentioned above that was led by the U.S. and Mexican sections of the International Boundary and Water Commission. They summoned a Binational Technical Group to develop a report about the information available on the groundwater in the El Paso, Texas, and Ciudad Juárez, Chihuahua, area. This group started work toward the end of 1995 and finished its report in January 1998.<sup>109</sup>

There is some level of understanding of the problem among the residents. In a joint exercise of the city of El Paso and Ciudad Juárez, business groups gathered to discuss an Economic Strategy Plan for the region in 1996; water supply for the region was the second priority issue listed by the group,<sup>110</sup> the first was border crossing. The group agreed that they will address one issue at a time, so the water issue is supposedly next to be addressed.

Also, toward the end of 1997 and the first months of 1998, the Environmental Committee of Ciudad Juárez conducted a number of open meetings to define the environmental priorities of the city.<sup>111</sup> Out of twenty priorities, the first four dealt with water issues, particularly water supply and water quality. By the same token, the significant reduction of water consumption per capita in El Paso is a clear indication that its residents are making an effort toward water conservation.

## CONCLUSIONS

The Hueco Bolson's ability to support the water needs of the city of El Paso and Ciudad Juárez is reaching an end. Over exploitation is the main cause. Both cities have pumped from the same body of water without really talking to each other for many years, as if the other does not exist.

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107. Univ. of Tex. at El Paso, *supra* note 14.

108. *See id.*

109. *See* INT'L BOUNDARY & WATER COMM'N, *supra* note 9.

110. The author participated in the exercise.

111. The author was a member of the Committee at the time.

One might think they had been running a race to see which one gets more out of the Bolson without realizing or wanting to understand that they were destroying their own future. Additionally, the current legal framework that applies to the region does not facilitate the process of bringing together all the parties on common grounds.

A recent effort by the city of El Paso to reduce its dependency on the Hueco Bolson for its water needs is a good sign. However, more needs to be done. It is urgent that people and institutions on both sides of the border start working together toward a manageable mechanism to share the resource, including changes to the legal framework that may be required. The IBWC report offers a significant opportunity to follow up from the official national levels. At the same time, efforts like the University of Texas at El Paso's help to build momentum toward possible locally agreed upon solutions.

Ciudad Juárez faces a number of issues that could be used as opportunities for dedicating more effort to issues of future water supply. The city has a significant deficit in service coverage and quality of coverage. Furthermore, with a yearly growth between 30,000 to 50,000 people, the deficit condition will not improve and the need for water supply alternatives becomes more critical.

The cities of El Paso and Ciudad Juárez are one large metroplex with two distinct water systems. However, they depend on each other to survive because their social and economic lives are intertwined. Unless all the actors in the region really work together and jointly develop alternatives for future water supply, the region is on a collision path. Water is a precious resource anywhere, especially in the desert. The problem is that people and institutions in these cities seem to have forgotten, because water comes from the tap, that they are in the desert.



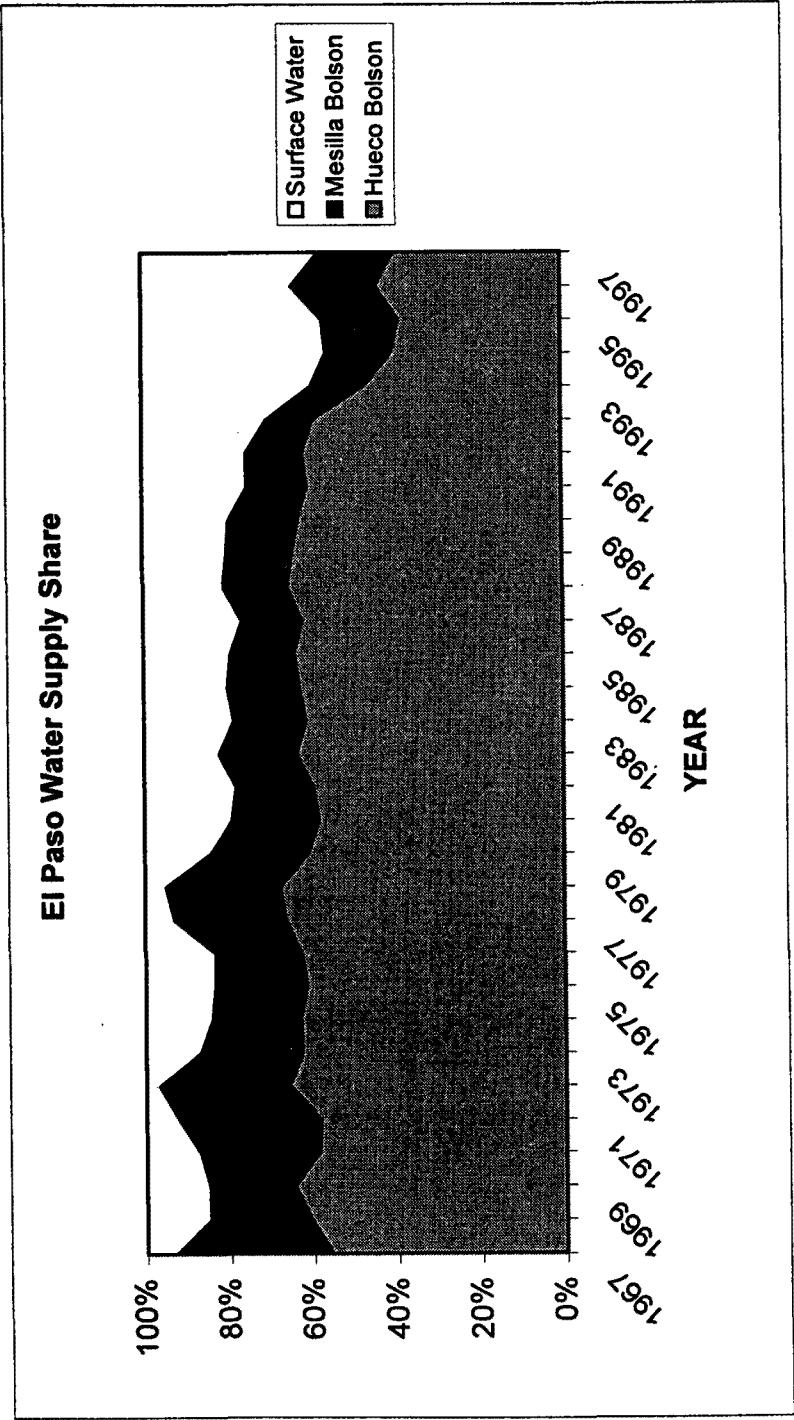


FIGURE 1. EL PASO WATER SUPPLY SHARE FROM 1967 TO 1997

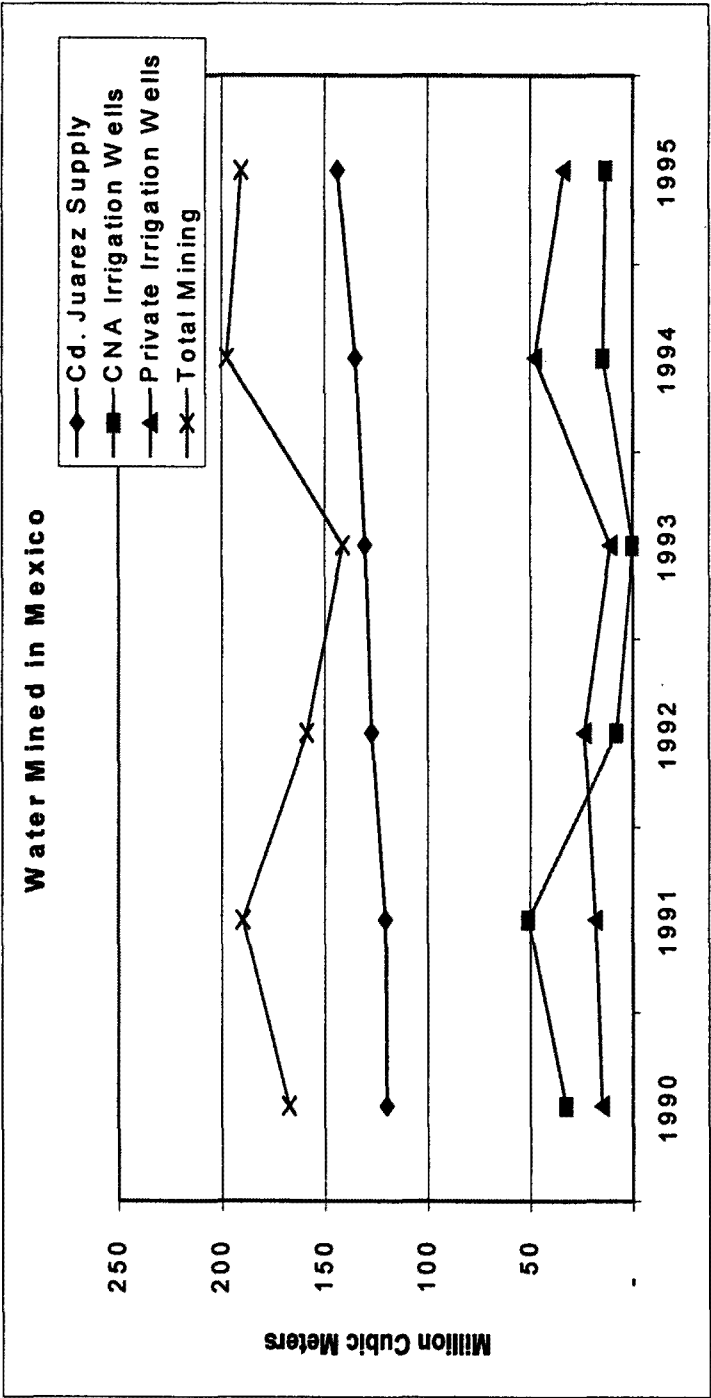


FIGURE 2. WATER MINED IN MEXICO

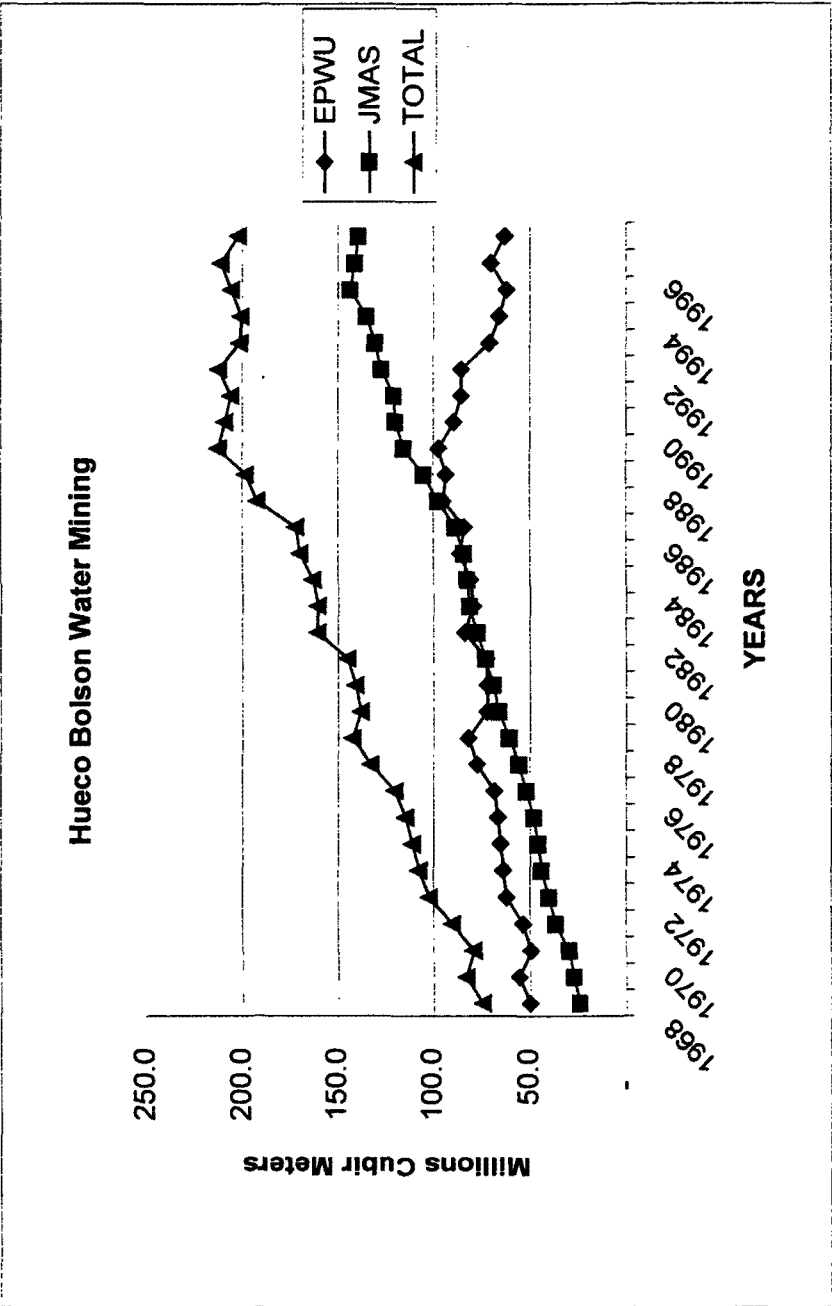


FIGURE 3. HUECO BOLSON WATER MINING

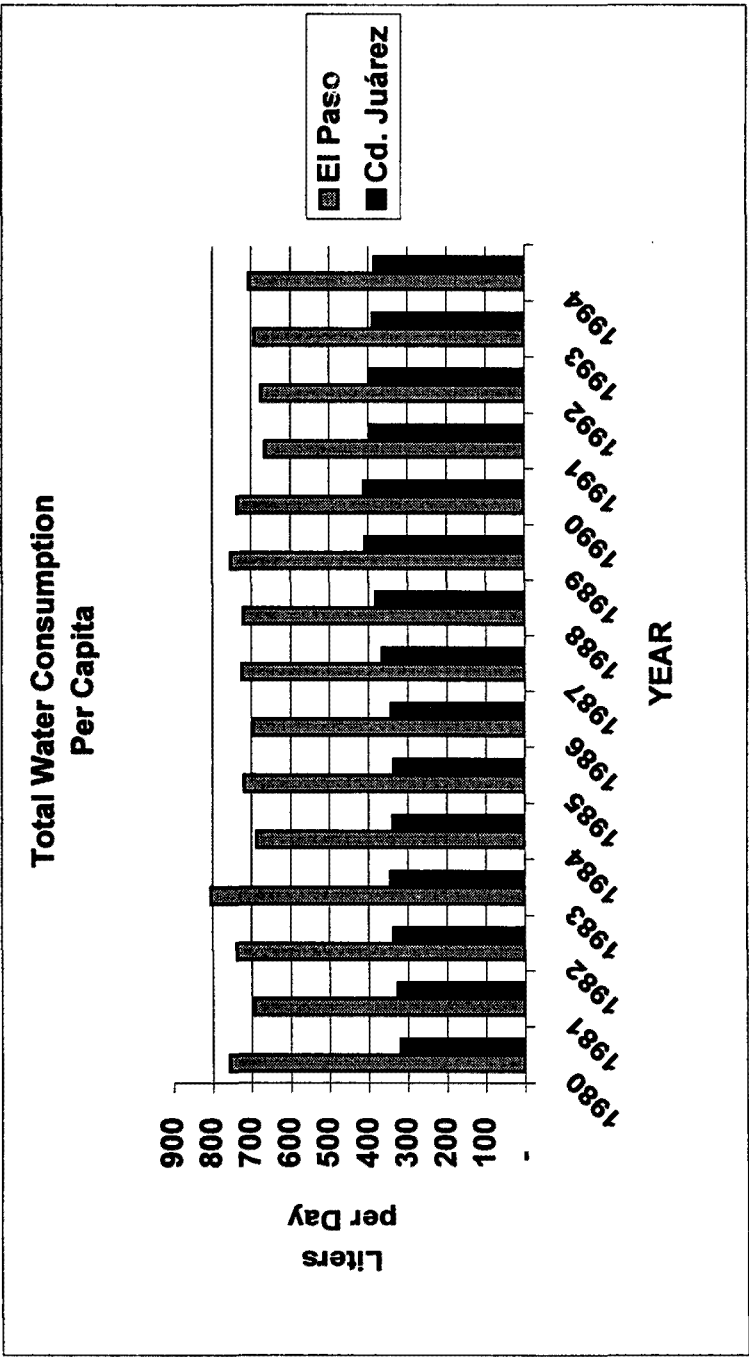


FIGURE 4. TOTAL WATER CONSUMPTION PER CAPITA

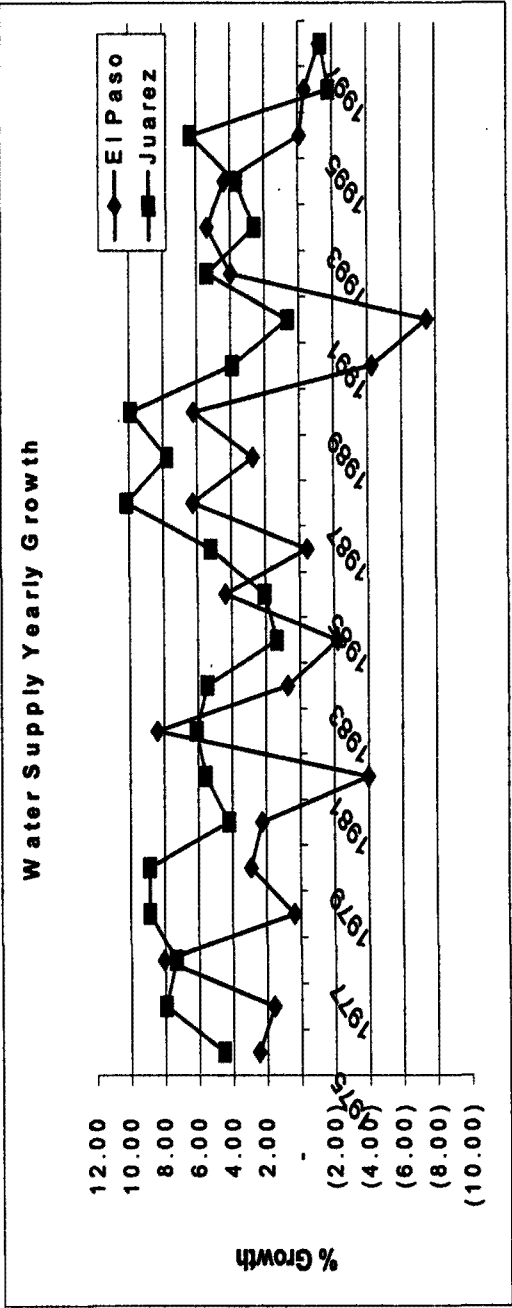


FIGURE 5. WATER SUPPLY YEARLY GROWTH EL PASO/JUÁREZ

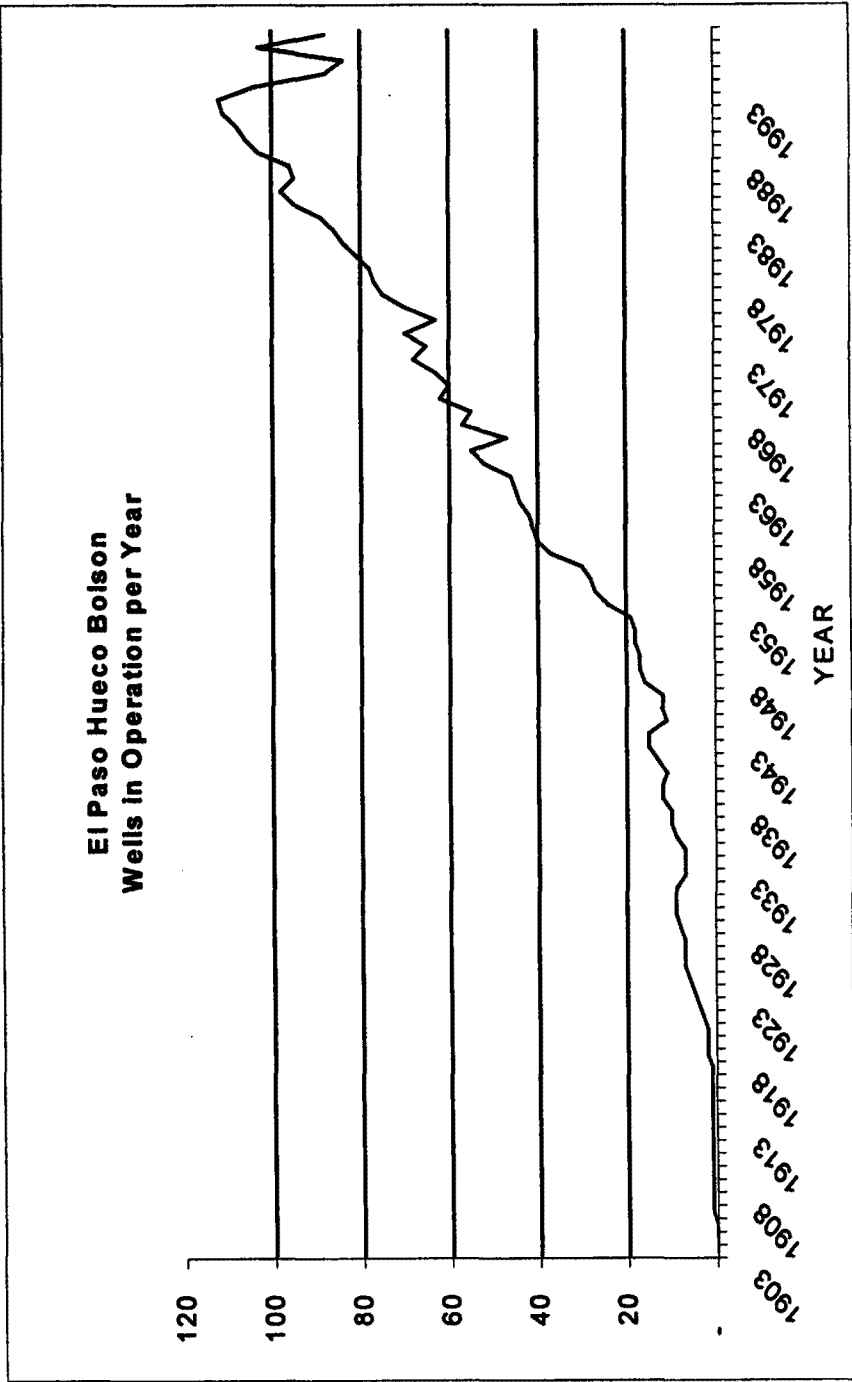


FIGURE 6. EPWU HUECO BOLSON'S WELLS IN OPERATION PER YEAR

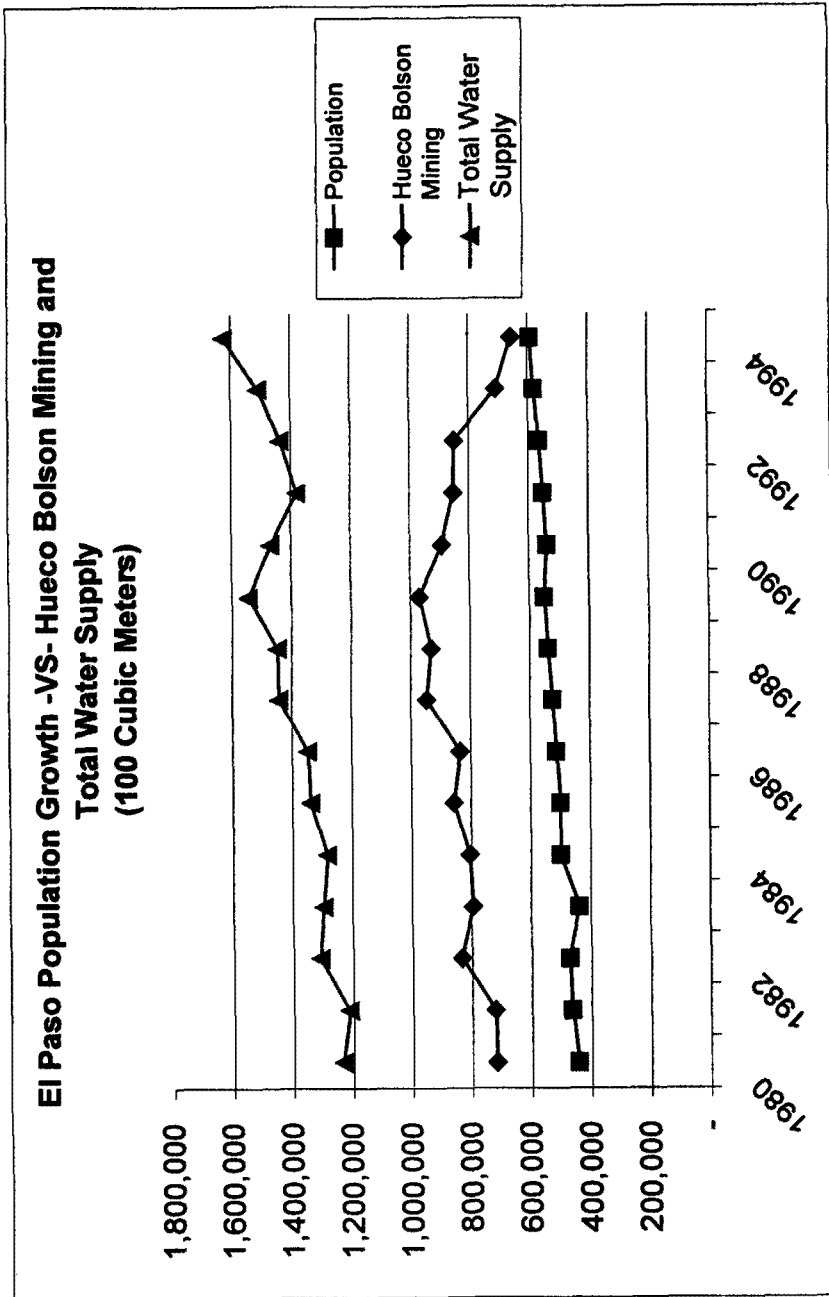


FIGURE 7. EL PASO MINING OF THE HUECO BOLSON AND ITS POPULATION GROWTH

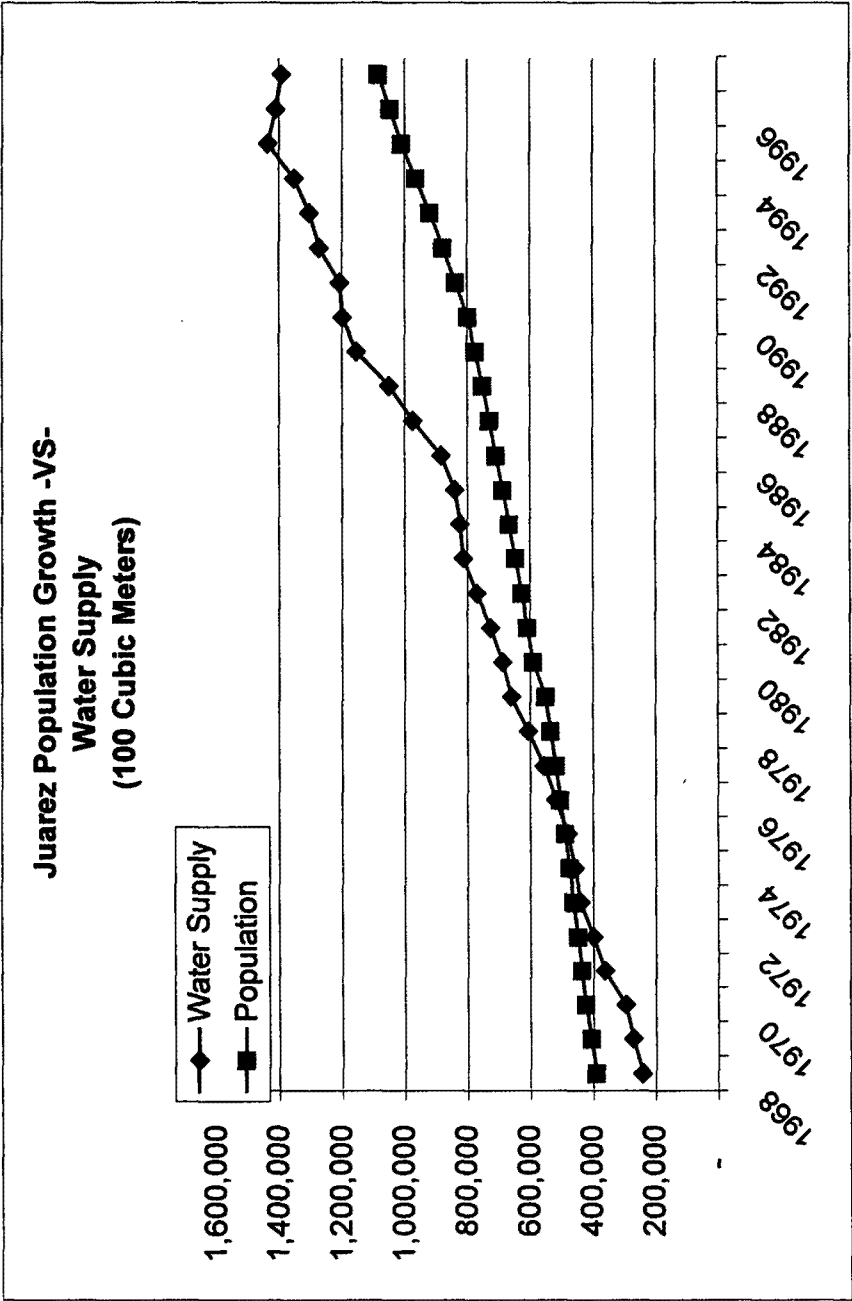


FIGURE 8. JUÁREZ' POPULATION GROWTH VERSUS WATER SUPPLY



EL PASO PROJECTED SOURCES OF SUPPLY

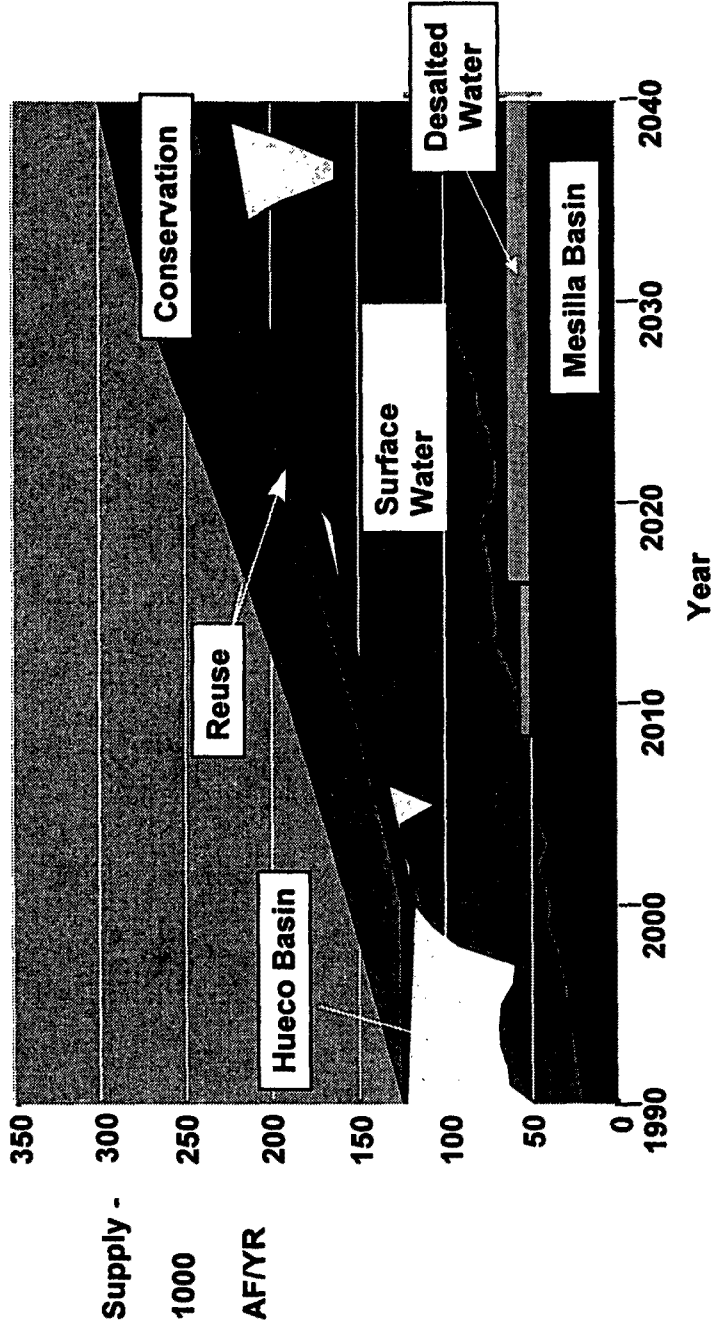


FIGURE 9. FUTURE WATER SOURCES FOR EL PASO