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Expected Economic Benefits of the El Morillo Drain

The Texas Water Resource Institute
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Ronald D. Lacewell[1]
M. Edward Rister[1]
Allen W. Sturdivant[2]
Megan DuBois[1]
Callie Rogers[1]
Emily Seawright[1]

[1] *Texas A&M University, Department of Agricultural Economics, College Station, TX.*

[2] *Texas A&M University, Agricultural Research and Extension Center, Weslaco, TX.*

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Abstract

The study of the benefits (damages averted) attributable to the El Morillo Drain encompasses U.S. municipalities, industry, and agriculture. It is conservatively estimated that the annual direct benefits to residents of South Texas ranges between $16.3 and $30.3 million. This does not include effects on landscapes, industry that is dependant on low saline water, and water treatment plants. Accounting for the costs to agriculture from crop losses of about $26.7 million, the total annual impact of the El Morillo Drain for South Texas is between $43 and $57 million. Such economic impact assessments are indicative that maintenance of the Drain is a highly-beneficial activity, leaving little doubt that it is essential that the drain be updated, maintained, and operated. Certainly as South Texas population increases and demand for high quality water increases, the value of the El Morillo Drain will increase.

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Introduction

For several years, salinity content of the waters of the Lower Rio Grande were of great concern. As much as 700 parts per million of salt and boron is considered dangerous, but in the early 1960s, more than 2,500 ppm were flowing through the Rio Grande, causing a great deal of damage to irrigated crops and the drinking water supply. Anyone whose water supply was located downstream of the Anzalduas Dam was potentially affected by these saline waters (Rio Grande Valley Partnership).

The El Morillo Drain was constructed in 1969 to mitigate the potential impacts of such saline water. Today, there is a serious lack of awareness of the El Morillo Drain and its value to the region. In addition, there are questions related to the costs of maintaining the Drain and the associated benefits of the Drain. This study provides a preliminary analysis of the apparent benefits of the Drain accruing in South Texas, providing a basis for decisionmakers to evaluate the merits of continued financial support of the Drain's maintenance and operation.

History

Due to the extreme 1960s salinity conditions and following several appeals from local water users, a solution was developed by both the United States and Mexico governments through the International Boundary and Water Commission (IBWC). A project consisting of a canal (the Drain) was devised to move the heavily-saline waters originating in Mexico to the Gulf of Mexico before they made it to the Rio Grande. On September 19, 1966, Public Law 89-584 was authorized, concluding an agreement between the U.S. and Mexico for construction of the El Morrilo Drain (International Boundary and Water Commission). The $1.3 million cost of this project was split equally between the United States and Mexico governments. In late October of 1966, the Lower Rio Grande Water Committee signed a contract with the U.S. Federal Government in which the Federal Government agreed to contribute fifty percent of the United States construction and continuing maintenance costs. Of the remaining fifty percent of the U.S. share of the cost to be paid by the Lower Rio Grande Water Committee, both Cameron and Hidalgo Counties contribute 45% and Willacy County contributes 10% .

The Lower Rio Grande Water Committee paid in full its share of the $1.3 million project (i.e., $345,000) within one month after the project was launched. The committee continues its fund-raising activities today to cover its share of the maintenance costs of the Drain (A History of the International El Morrilo Drain Diversion Canal).

Description

Located in Mexico, along the south bank of the Rio Grande, in the State of Tamaulipas, the El Morillo Drain started diverting its waters on July 15, 1969. The El Morillo Drain consists of four electrically-operated pumps that lift 106 cubic feet per second of salty water. The total length of the conveyance channel is seventy-five miles, which includes a 0.7-mile underground conveyance through Reynosa (International Boundary and Water Commission).

Approximately 300,000 tons of salt is diverted from the Rio Grande by the El Morillo Drain. This diversion is reflected in about a 30% reduction in salinity concentration in the Rio Grande, which is a dramatic lowering in potential salinity of urban, industry, and irrigation water used in the United States and Mexico. The cumulative effects of such reductions are nearly twelve million tons since the operation of the El Morillo Drain began in 1969. Keeping the salt out of the river by use of the Drain has an estimated savings of 30,000 to 60,000 acre-feet of water each year because of reduced leaching requirements of salt from the soil (A History of the International El Morrilo Drain Diversion Canal). The salt concentration of water has declined to less than 800 ppm, which has improved agriculture development (both for the United States and Mexico) as well as benefitted cities and industry in both countries (International Boundary and Water Commission).

Significant changes between the United States and Mexico have occurred since 1969. Recent issues with the Drain have been addressed by the Lower Rio Grande Water Committee: (1) Trash in the Drain canal is blocking the water flow through Reynosa; and (2) Some levees and their flood-control systems are either too weak or too low to be effective. Other issues such as the maquiladoras and NAFTA have considerably changed the economic aspect of the border. Combine these economic shifts along with the respective responsibilities of the IWBC, the Border Environmental Cooperation Commission (BECC), the North American Development Bank (NADBank), the Corps of Engineers, and the Environmental Protection Agency (EPA) relating to environmental, infrastructure, and resource issues and a different situation exists from when the Drain was constructed (Lower Rio Grande Water Committee).

Today's concerns with excessive salinity levels are related more to people than farming. In the 1970s, population of Cameron, Hidalgo, and Willacy counties was 338,000, at time when agriculture affected just about everyone and everything in South Texas. Now, with a South Texas population of over one million, concerns of the Drain include not only irrigated agriculture but human use, such as drinking water and health of the public. Due to this and lack of insight on the function and use of the El Morillo Drain, this report is designed to provide information to the general public regarding some characteristics of the Drain and how it is benefitting everyone that lives, works, and/or recreates in South Texas. Such information has implications as to the allocation of the on-going cost to upgrade, maintain, and operate the El Morillo Drain (Rio Grande Valley Partnership).

Over the years, the Drain has worked well; in fact, it has worked so well that many residents and entities do not know that it exists. However, if the Drain were to incur significant failure and be inoperative much of the time, all of the Lower Rio Grande Valley would feel the impact. The River salinity would rise significantly to well over 1,000 ppm. It is expected that the standards of the Clean Drinking Water Act would not be met by cities with traditional water treatment plants; landscapes would suffer due to the excessive salts; and irrigated agriculture would be impacted due to reduced yields, loss in product quality, and even adjustments in cropping patterns from high-value saline-vulnerable crops to low-value high-tolerance-to-salts crops (The Monitor).

A review of salts introduction to the Rio Grande, where salinity concentration was typically over 1,000 and as high as 2,000 parts per million, identified the El Morillo Drain as the source (International Boundary and Water Commission). This finding originally justified the construction of the El Morillo Drain across Mexico to the Gulf of Mexico. The results of the Drain is a reduction of 300,000 tons of salts per year from the Rio Grande. This means less water is needed for leaching of soils which is associated with a water savings of 30,000 to 60,000 acre feet per year. Further, the construction of the Drain and divergence of salts to the Gulf of Mexico reduced salinity in the Rio Grande by 30% (International Boundary and Water Commission). The salinity of water from the Rio Grande changes due to rainfall and distance from the reservoirs. However, the 30% reduction in salinity is expected to be fairly constant. Therefore, these estimates are based on implications of less salinity due to the El Morillo Drain.

The El Morillo Drain has provided a major service to both the United States and Mexico by diverting salts to the Gulf of Mexico. Without the Drain, these salts would enter the Rio Grande, significantly increase overall salinity and impact all water users. Although it is clearly a benefit to the residents, there is little known about the level of the benefits of the Drain. The purpose of this study is to develop estimates of the benefits of the El Morillo Drain for both municipalities and for irrigated agriculture.

Benefits

Salinity in excessive amounts impacts all water users. For the residents and their use of water for drinking and cooking, the excessive salinity represents a health issue, including high blood pressure among other possible consequences. For companies such as bottling plants or manufacturing, it can cause excessive deterioration of equipment and even impact product quality. Some landscape plants are not tolerate to salinity. The result of excessive salinity is loss of quality and even plants dying.

A major impact of excessive salinity is experienced by irrigators of agricultural crops. Typically, higher-value crops (e.g., vegetables) are less tolerant to salinity than low- value crops (e.g., pasture). The salinity causes yield losses and even a change in quality. An estimate of benefits of the El Morillo Drain is losses that would be incurred without the Drain being in operation.

Municipal Impacts

There are many effects of increased salinity on cities and industry. This analysis draws from two studies, including one where residents were assumed to shift to bottled water for drinking and cooking (Chowdhury). Following the approach of Chowdhury , this estimation of costs for a situation in which there was not an effective drain uses a “damages avoided” process. Consumers’ expenditures on bottled water can be used as a proxy for their willingness-to- pay to avoid excess salts.

A second approach used is to apply estimates from a detailed study in Arizona of the impacts of salinity on water pipes, heaters, faucets, garbage disposals, clothes washers, and dish washers as well as several other impacts (Bureau of Reclamation). The Arizona study is massive, involving many disciplines and review of studies across the globe.

Bottled Water Substitution Costs. This is a straight-forward approach whereby the population of affected cities and towns is assumed to shift to bottled water. The population is converted to households using 2.7 people per household (Bureau of Reclamation). Average household consumption of bottled water per week is about 15 gallons in the summer and 10 gallons in the winter (Scholz). For South Texas, summer is designated as eight months (March - October) and winter as four months (November - February) . The population of cities and towns is presented in Table 1.

Table 1. Population of Texas Towns in Cameron, Hidalgo, and Willacy Counties, 2006.

County	Population
Cameron	332,909
Hidalgo	530,548
Willacy	16,979
TOTAL	880,436

Source: Texas Almanac.

Using the population of 880,436 and converting to households (assuming 2.7 people per household) suggests the number of households in these three counties would be 326,087. Based on the previously-mentioned levels of average personal water consumption by a household in the summer (i.e., 15 gals) and in the winter (10 gals), total water consumption is approximately 690 gallon per household per year. Using a price of 35 cents per gallon of bottled water (Scholz) gives a household cost per year of $241.50. For 326 thousand households, the total cost for South Texas personal water consumption would be $78.8 million per year (Exhibit 1). This value is based on the assumption that no households currently use bottled water and also assuming all households would switch to bottled water for personal water consumption to avoid the taste and health effects.

Alternatively, assuming that 50% of the households currently use bottled water and pay only $0.10 per gallon (based on bulk purchase price), the cost to South Texas for increased salinity without the El Morillo Drain is $69.00 per household, totaling about $11 million per year. This is a conservative approach and assumes bulk purchase of bottled water (i.e., $0.10 per gal rather than $0.35 (Scholz)) and that one half of the residents already buy bottled water. This does not consider the health, hospitalization, and other ramifications for the residents should they elect to not switch to bottled water.

Exhibit 1. Calculation of Costs for Bottled Water Requirements for Personal Water Consumption in South Texas, 2006 – Chowdhury Approach.

(a) Population	880,436	440,218
(b) Divided by Number of People per Household	2.7	
(c) Equals Number of Households	326,087	163,043
(d) Annual Water Consumption per Household	690 [510 during the summer and 180 during winter]	
(e) Multiplied by Price of Water (per gal)	$0.35	$0.10
(f) Equals Annual Household Cost	$241.50	$69.00
(g) Multiply (c) times (f) equals Total Annual Cost for South Texas Personal Water Consumption	$78.8 million	$11.2 million

Alternatively, the Central Arizona Salinity Study (Bureau of Reclamation) indicates that water consumption is about 0.5 gallons per day per person. Therefore, for a year, one person would consume about 180 gallons of water. For South Texas overall, this would be 158.5 million gallons of bottled water. Using the $0.35 per gallon of bottle water produces a total cost for all residents' personal water consumption of $55.5 million (Exhibit 2).

In the Central Arizona Salinity Study, it was estimated that the cost of bottled water per household would be $135.93. Using this value for South Texas suggests an annual cost of increased salinity due to the El Morillo Drain of $44.3 million. If one-half of the households already use bottled water then the annual additional cost would be $22.1 million (Exhibit 3).

Exhibit 2. Calculation of Costs for Bottled Water Requirements for Personal Water Consumption in South Texas, 2006 – Central Arizona Salinity Study Approach A.

(a) Population	880,436
(b) Multiplied by Number of Days per Year	365
(c) Multiplied by Daily Per Capita Potable Water Consumption (gals)	0.5
(d) Equals Annual Household Cost	$241.50
(e) Multiplied by Price of Water (per gal)	$0.35
(f) Multiply (d) times (e) equals Total Annual Cost for South Texas Personal Water Consumption	$55.5 million

Exhibit 3. Calculation of Cost s for Bottled Water Requirements for Personal Water Consumption in South Texas, 2006 – Central Arizona Salinity Study Approach B.

(a) Population	880,436
(b) Divided by Number of People per Household	2.7
(c) Equals Number of Households	326,087
(d) Multiplied by Central Arizona Salinity Study Annual Household Cost Estimate	$135.93
(e) Multiply (c) times (d) equals Total Annual Cost for South Texas Personal Water Consumption Assuming All Require Bottled Water	$44.3 million
(f) Dividing (e) by 2 equals Total Annual Cost for South Texas Personal Water Consumption Assuming One-Half of the Households Already Consume Bottled Water	$22.1 million

Exhibit 4. Summary of Calculated Costs of Bottled Water Requirements for Personal Water Consumption in South Texas, 2006.

Alternative 1 – Chowdhury Approach	$78.8 million
Alternative 2– Conservative Version of Chowdhury Approach, with 50% Adoption of Bottled Water and $0.10/gal Bulk Water Purchase Price	$11.2 million
Alternative 3 – Central Arizona Salinity Study Approach A	$55.5 million
Alternative 4 – Central Arizona Salinity Study Approach B	$22.1 million

Household Costs. The Central Arizona Salinity Study (Bureau of Reclamation) undertook a massive study to estimate the costs of salinity in the typical household, excluding the issue of personal water consumption addressed in the previous section. Such additional household costs included impacts on water pipes, water heaters, faucets, garbage disposals, clothes washers, and dish washers. The costs developed by this study were based on reduced life of water-using appliances. Given the Arizona estimates for water pipes were based on galvanized steel and most plumbing is now PVC pipe, this cost is not included for South Texas.

To estimate the benefits (or the reduction in costs to appliances and plumbing) for households, the Central Arizona Salinity Study (Bureau of Reclamation) was applied to South Texas. Values in the Arizona study are reproduced here to demonstrate how damages are calculated.

Table 2. Potential Impact of Increased Salinity on Appliances and Plumbing for A Representative Household in South Texas, 2006.

Item	New Cost	Added Cost/Yr	Percent of Households with Appliance	Annual Weighted Household Cost
Water Heaters	$302.45	$4.71	100	$4.71
Faucets	408.59	6.33	100	6.33
Garbage Disposals	109.61	1.47	43	.63
Cloths Washers	629.20	5.54	95	5.26
Dish Washers	431.98	3.80	60	2.28
TOTAL Additional Annual Household Cost without El Morillo Drain				$19.21

Source: Bureau of Reclamation.

The information in Table 2 is taken from the Bureau of Reclamation Central Arizona Salinity 2003 study. In that study, the investigators developed equations that estimate the life of appliances and plumbing as a function of salinity. For the purposes of this current study, an average salinity for the Rio Grande in South Texas without the El Morillo Drain was set at 1,200 ppm and with the Drain a 30% improvement was assumed, resulting in 840 ppm. The Expected Life equations from the Bureau of Reclamation study are as follows:

Water Heaters: Life = 14.63 - 0.013*PPM + 0.00000689*PPM^2 – 0.0000000011*PPM3;

Faucets: Life = 11.55 – 0.00305*PPM;

Garbage Disposals: Life = 9.23 – 0.00387*PPM + 0.000001.13*PPM^2;

Clothes Wash: Life = 14.42 – 0.011*PPM +0.0000046*PPM^2; and

Dish Washer: Life = 14.42 – 0.011*PPM +0.0000046*PPM^2.

By calculating the life of each appliance or plumbing piece for the "With the Drain"scenario, the average annual cost was estimated by dividing this life into the new cost. Similarly, for the "No Drain" scenario, the shorter expected life was divided into the new cost. The difference in such average cost estimates represents the added annual cost due to the shortened life of water-related equipment. The next step was to take this added annual cost and weight it by the expected number of households that have the appliance. For example, every household is expected to have a water heater, but only 43% of the households have a garbage disposal. Lacking any other readily-available source of data, the weights derived in the Central Arizona Salinity Study are assumed here for South Texas. The weighted average annual cost of appliances per household is then multiplied by the number of households to arrive at the annual total cost of $6.3 million (Exhibit 5). These additional household costs are added to the cost of bottled water for personal consumption to realize a total $17.5 to $28.4 million residential cost (Exhibit 6).

Exhibit 5. Calculated Costs of Non-Personal Water Consumption Household Costs Occurring Without the El Morillo Drain in South Texas, 2006.

(a) Number of Households	326,087
(b) Additional Annual Household Cost	$19.21
(c) Multiply (a) times (b) equals Total Annual Household Cost for South Texas Non-Personal Water Consumption	$6.3 million

Exhibit 6. Total Residential Costs Occurring Without the El Morillo Drain in South Texas, 2006.

(a) Annual Personal Water Consumption Costs -- Exhibit 4	$11.2 - 22.1 million
(b) Annual Household Cost for Non-Personal Water Consumption – Exhibit 5	$6.3 million
(c) Add (a) and (b) equals Total Residential Cost for South Texas	$17.5 - 28.4 million

The Bureau of Reclamation study further estimates that water use in a community is about 76.2% for residential and 23.8% commercial. This suggests that the commercial (i.e., industry) benefits of the El Morillo Drain (damages averted due to its operation) are approximately $2.0 million; i.e., approximately one-third of the $6.3 million residential benefits. Not accounted for in such a commercial estimate of damages without the Drain are the accelerated salt-induced deterioration of plants that bottle soda pop, food processing, water treatment plants, and other such facilities. Also, this estimate does not include impacts on landscape plants, golf courses, parks, and other non-agricultural irrigation.

In summary, it is estimated that municipal and residential benefits (damages averted) due to the El Morillo Drain range between $19.3 million and $30.4 million (Exhibit 7). This estimate does not include many of the users and factors mentioned above. Another critical user of the waters of the Rio Grande are in the production of food and fiber (which is addressed in the next section).

Exhibit 7. Total Residential and Municipal Costs Occurring Without the El Morillo Drain in South Texas, 2006.

(a) Total Residential Cost for South Texas – Exhibit 6	$17.5 - 28.4 million
(b) Annual Municipal Cost	$2 million
(c) Add (a) and (b) equals Total Residential and Municipal Cost for South Texas	$19.5 - 30.4 million

Irrigated Agriculture Impacts

Irrigated agriculture is an important part of the economy of the Rio Grande Valley. This analysis is limited to the U.S. part of the region, otherwise referred to as South Texas in this study. The estimated impact of not having the El Morillo Drain (benefits) is based on current cropping patterns and associated expected yield losses. A more detailed analysis would include an option for cropping pattern adjustments. Based on statistics of the U.S. Department of Agriculture (National Agriculture Statistics Service), irrigated acres for 2005-06 are approximately 300 thousand for Cameron, Hidalgo and Willacy Counties. Table 3 provides summary irrigated acres across the three counties by crop. In addition, the average irrigated yield is provided. The National Agriculture Statistics Service provides yields for all but oats, peanuts, vegetables, and citrus. Those average yields were taken from Lacewell et al. (2006). There are no published yield estimates for peanuts and oats for this region; therefore, these crops are not considered. In addition, these two crops are minor in the region and have little impact on the overall estimate.

Different crops have different reactions to salinity. Some crops such as cotton are reasonably salt tolerant while others are very sensitive. This estimate of yield loss due to salinity is based on work done at the U.S. Department of Agriculture Salinity Lab in California (Runkles et al.). The relationships used in this study are based on work done by Ayers and Wescot. The process for estimating yield impact involves taking the parts per million of salinity (ppm) and converting to the electrical conductivity of the irrigation water and then to the electrical conductivity of the soil at the root zone. Electrical conductivity of the water is estimated by multiplying ppm of salinity by 0.00155 (Grossmann and Keith Consulting Engineers; Runkles et al.). Estimating electrical conductivity of soil solutions at the root zone was done by applying a factor of 1.5 to the weighted-average electrical conductivity of the irrigation water assuming a leaching fraction of 20% (Grossmann and Keith Consulting Engineers; Runkles et al.).

Table 3. Irrigated Acres by Crop for Cameron, Hidalgo and Cameron Counties, 2005-06.

Crop	Irrigated Acres	Yield Per Acre
Cotton	61,000	812 lbs
Corn	35,400	95.7 bu
Sorghum	93,600	4,806 lbs
Oats (small grain)	1,000	
Peanuts	1,000	
Sunflower	23,000	1,737 lbs
Sugarcane	40,500	33.5 tons
Vegetables	34,526	368.9 bags
Citrus	8,089	23.2 tons

Source: National Agricultural Statistics Service; Lacewell et al. (2006).

Yield impacts of salinity were then estimated with the following equations (Lacewell et al. 1992):

Cotton: Reduction = -40.48 + 5.21ECe;

Sorghum: Reduction = -26.83 + 7.05ECe;

Corn: Reduction = -26.83 + 7.05ECe; and

Vegetables: Reduction = -20.46 +12.02ECe;

where one ECe is calculated for 1,200ppm and another ECe is calculated for 840ppm.

It was assumed that sunflowers were impacted the same as sorghum and citrus the same as cotton. The interpretation of the Cotton equation means that the soil ECe times 5.21 must equal 40.48 before any damages begin to occur. The higher the ECe before damages begin to occur indicates tolerance to salt. If the region goes from 840 ppm of salinity to 1,200 ppm, then the only crop that incurs a yield loss is vegetables. The loss for vegetables is 13%. Since there are numerous vegetable crops in South Texas, onions are used as a proxy to represent all vegetables. Because vegetables are the only really vulnerable crop, then a 13% loss in yield represents a 13% reduction in gross revenue. This means the 368.9 yield would be reduced by 48.2 sacks. The value per sack is \$16.00 so the per acre impact is a loss in revenue of \$768 per acre. With total acres of vegetables of 34,526 and a yield of 368.9 per acre, the total reduction in output would be 48.2 less bags per acre or 1,665,900 less bags across the region. At a value of \$16.00 per bag this represents a loss to the Lower Rio Grande Valley of \$26.5 million (Exhibit 8). Associated with this reduction in output is a reduction in jobs along with a reduction in economic activity.

Exhibit 8. Total Irrigated Agricultural Losses Occurring Without the El Morillo Drain in South Texas, 2006.

(a) Acres of vegetables	34,526
(b) Undamaged vegetable yields (bags/ac)	368.9
(c) Salinity-induced yield damage (%)	13
(d) Value of yield ($/bag)	16
(e) Multiply (a) times (b) times (c) times (d) equals Irrigated Agricultural Damages Associates with Salinity in South Texas, 2006	$26.5 million

Implications

The U.S. residential, municipal, and agricultural implications of the El Morillo Drain are estimated at annual benefits accruing to South Texas between $42 and $56 million (Exhibit 9) per year, ignoring any secondary or multiplier effects. This is a cursory overview of benefits accruing in the U.S. as a result of the existence and operation of the El Morillo Drain. It is evident that the El Morillo Drain is a major asset for the United States in the lower Rio Grande Valley.

Exhibit 9. Total Residential, Municipal, and Agricultural Costs Occurring Without the El Morillo Drain in South Texas, 2006.

(a) Total Residential Cost for South Texas – Exhibit 6	$17.5 - 28.4 million
(b) Annual Municipal Cost	$2 million
(c) Annual Agricultural Cost for South Texas - Exhibit 9	$26.5 million
(d) Add (a) and (b) and (c) equals Total Residential and Municipal Cost for South Texas	$46.0 - 56.9 million

Limitations

With reduced salinity due to the El Morillo Drain, less water is needed for leaching crops and landscapes. Water savings are an estimated 30,000 to 60,000 acre feet per year. The value of this water was not estimated so these benefits are not included in the aforementioned results.

Also not included in this study is explicit accounting for the fact that salinity in excess of 1,000 ppm is a violation of the Clean Drinking Water Act. This has severe implications for water treatment plants across all the municipalities in the region. It is expected that without the El Morillo Drain, they would be required at some point to install additional facilities to reduce the salt in the water. An analysis of a plant designed to take the salt from water in South Texas suggests the costs are $1.65 per thousand gallons (Sturdivant et al.). This is applicable to only one plant with a groundwater source and essentially no cost for disposal of the brine. The cost of adding a reverse osmosis unit to the back of a current water treatment plant is unknown at this time. However, such costs are being investigated by the authors in an independent but related study.

Since 1,000 ppm of salinity in urban water exceed that allowed in the Clean Drinking Water Act, there are implications for municipal water treatment plants. To stay in compliance with regulations, it may be necessary for current operating plants to add on a desalination process before distributing to the public. The expected salinity levels are higher for the groundwater than would be associated with river water in the absence of the El Morillo Drain so the associated treatment costs are expected to be less for saline river water. Also, there is no known published literature related to adding a desalination unit at the end of a current water treatment plant. But, for the sake of providing an estimate, if per capita use of water is 150 gallons per day and with a population of over 880 thousand, at $1.65 per 1,000 gallons of potable water (based on Sturdivant et al.), the cost would be almost $80 million (Exhibit 10). Again, it is anticipated that the cost of adding a desalination plant to an existing water treatment plant would be less than the $1.65. However, the point is that without the El Morillo Drain, the urban community of South Texas would incur significant costs (in the millions of dollars).

Exhibit 10. Estimate of Costs for Treating All Potable Water With a Desalination Process Without the El Morillo Drain in South Texas, 2006.

(a) Population	880,436
(b) Multiplied by Number of Days per Year	365
(c) Multiplied by Per Capita Daily Potable Water Consumption (gals)	150
(d) Multiplied by Cost Estimate for Desalination Process ($/1,000 gals)	$1.65
(e) Results in Total Residential Cost for South Texas	$79.5 million

Conclusions

It appears clear that the El Morillo Drain is a highly beneficial facility that warrants the expenditures necessary for updating and annual operation and maintenance. The costs of not having this Drain are indeed expensive to the people, agriculture, and has implications for the overall human and economic health of the region.

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