Issue 5
Summer 2011
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MEXICO WATER REPORT

LGA Consulting

This edition of the Mexico Water Report has two new features: coverage of the Mexican potable water segment and our first non-Mexico Latin America water article. Up to now, the Mexico Water Report had a mixture of articles focused on private and public sector wastewater issues. LGA Consulting will continue to include potable water and clean water industrial articles in future editions. In light of Latin America`s booming, sustainable growth, the Mexico Water Report will begin to include in each edition an article on water segment issues and opportunities in other Latin American countries.

In this edition we will address:

- The Dynamic Brazilian Water Segment
  The first country profiled beyond Mexico that will be profiled in the Mexico Water Report is Brazil. The article included is a collaborative effort with the TVZ International, a Brazilian based consulting firm that works with LGA on Latin America-wide projects. These two trade offices, in the two dominant markets in the region, have been expanding their reach and capabilities for water-related products as well as other industrial/B2B and retail products to create region-wide coverage. If you are looking to start-up or expand in other growing Latin American markets beyond Mexico and Brazil, these two offices and their collaborators can help your company reach these markets and create more comprehensive, region-wide coverage.

- Compranet 5.0 – Is It Better than the Old System?
  The Mexican government's system of announcing public tenders, opening and closing timeframes, and identifying winning bidders has had historical problems. A new and improved system was intended to correct those issues, but problems remain.

- Channel Market Strategies in the Mexican Water Segment (Part II)
  This article is a continuation of the analysis of channel realities for selling to the water sector in Mexico begun in the last issue. In this edition, we will look at selling water segment products through integrators, strategic alliance partners and the pros and cons of establishing a Mexican subsidiary.

- Uses and Sources of Water in Mexico
  Mexico is bipolar when it comes to water resources with all the water it needs and more in the southern part of the country and extremely dry conditions and water shortages in the northern and central regions. This is an overview of water use and source issues in Mexico, including detailed information about surface and subterranean volumes and needs as well as dam and aqueduct infrastructure and flow information.

- Potable Water Treatment and Plants in Mexico
  Every foreigner has heard the advice: "When you go to Mexico, don't drink the water." Most Mexicans don't hesitate in uttering this same generalization. There are obvious needs for more potable water filtration and purification in Mexico. This article describes current potable water plant infrastructure, treatment details and funding, technology, and societal challenges.

Participation in the Top US and Mexican Water Exhibits in October

WEFTEC - Los Angeles, CA - On Tuesday, October 18th, the LGA Consulting General Manager will give a presentation on the state of the Mexican water segment at WEFTEC, one of the largest water-related trade shows and conferences in the world which attracts 18,000 attendees from more than 70 countries.

ANEAS Mexico Water Exhibition San Luis Potosi, Mexico - The LGA Consulting General Manager will be at the ANEAS water exhibit October 24-28, Mexico`s most important water show.

If your company is exhibiting or visiting the show and would like to meet with the General Manager, please contact us (see below).

Also, if you would like copies of past Mexico Water Reports, regional water presentations given by the LGA Consulting General Manager, or copies of the translations of Mexico's two wastewater treatment regulations (NOM 001 and 002), please go to the LGA Consulting website or contact the office General Manager by email at vlencioni@lgaconsulting.com or by toll free U.S. Number: (1) (888) 750-0988.

If you would like copies of past Mexico Water Reports, presentations given by the director of the Wisconsin Trade Office in Mexico on the Mexican water segment, or copies of the translations of Mexico's two wastewater treatment regulations (NOM 001 and 002), please go to the LGA Consulting website or contact the office director by email at vlencioni@lgaconsulting.com or by toll-free U.S. Number: (1) (888) 750-0988.

The Dynamic Brazilian Water Segment

Water & Wastewater Treatment

Constitutionally, the supply of basic sanitation services (water and sewage) in Brazil is the responsibility of the municipal government or a concession granted by the municipality to private enterprise. Up until now, most cities have fulfilled their constitutional obligation by giving their concession to a state-run basic sanitation company. Other cities operate their own services via a city sanitation department or a municipally owned company.

Almost 81% of all homes have running water in Brazil while in urban areas this figure rises to 94.2%. However, in terms of sewage collection, approximately 50% of households are not connected to the sewerage system. This figure varies depending on the region. The southeast (where Rio de Janeiro and São Paolo are located) has much more extensive coverage (70%), while the center-west part of the country (where the capital, Brasilia, is located) has 40% coverage, and coverage in the north is only 6.2%. Only one third of all sewage is collected and treated, most of which (11 billion liters a day) is then dumped in rivers, streams, lakes, or the ocean.

Providing universal basic sanitation infrastructure and services has gained new emphasize since the approval of the Sanitation Act in December 2007. The law reduced the uncertainties at federal, state and municipal levels allowing for public private partnerships (PPP) to take off, contributing to an important increase in investments in this area. In general and as a result of the new regulatory framework, Brazil has announced plans to invest $ 25 billion for sanitation projects between 2012 and 2014.

The 12 FIFA World Cup host cities of Belo Horizonte, Brasília, Cuiaba, Curitiba, Fortaleza, Manaus, Natal, Porto Alegre, Recife, Rio de Janeiro, Salvador and São Paulo are currently receiving important investments for water supply and sewage collection to comply with FIFA requirements and national policy goals for this sector.

According to the International Federation of Private Water Operators, private companies were servicing only 10% of the urban population in Brazil in 2007. Since then, there have been over 20 concession contracts or PPP's for water services and this continues as a growing trend. This difference in systems demonstrates how the Brazilian environmental sanitation sector is undergoing a revolution in terms of operations modernization, technology, and interest from foreign investment and away from classic minimalization attitudes when said systems were exclusively operated by municipal entities.

Foreign companies are stepping up and investing in PPPs and concessions like never before. Likewise, major Brazilian contractors are investing at historic levels in the sanitation sector and have set up new companies such as Foz do Brasil (part of the Odebrecht Group) and Cab Ambiental (part of the Queiroz Galvao Group) just to operate water services.

PAC Plan

The Acceleration Growth Program (known as the "PAC Plan") was launched in 2007 by the Brazilian government to drive investments in the areas of energy, transportation, housing, and sanitation. Its objective is to provide general access to water and electricity country-wide with a strong urban water focus. PAC combines management initiatives and public works.

In its first phase, the program called for investments of US$ 349 billion of which 63.3% has been spent so far. In March 2010, the Brazilian government launched phase two (PAC2), a massive infrastructure investment program valued at roughly $880 billion. PAC 2 focuses on logistics, energy, and social development organized under six major initiatives, including the Water and Light for All (sanitation and access to electricity). Estimated investment for that segment of the plan is U.S. $16.6 billion to be spent between 2011 and 2014.

Imports & Opportunities

Brazilian imports of water-related equipment grew by 40% in 2010. The Brazilian federal government goal is to provide sanitation coverage to the entire population by 2020 which will require an investment of approximately $82 billion, 30% of which will be designated for equipment and replacement parts.

Imports from the United States grew 29% in 2010. While exporting to Brazil still has its challenges, Brazilian imports are vibrant. The United States ranks as the top foreign supplier of products, especially membranes, special pumps and valves, and measuring instruments among others. There is a strong, potential market for new water technology and products such as analytical and measuring equipment, monitoring equipment for water/sewage treatment stations, sludge treatment, leakage detection control, odor removal processes, flow meters (micro/macro measurements), pipe cleaning, pipe joints and flow control products, sensors and environmental monitoring and industrial effluent.

Demand for membranes in Brazil is estimated to grow by 9.3% percent per year, and reach $260 million by 2012, a rate that is well above the global average. Advances will be driven by a variety of factors including the greater use of non-chemical water treatment techniques. The government's policies in favor of industrial water re-use will also boost sales of membranes, as will use in key Brazilian industries such as the processing of sugar and sweeteners, the refining of ethanol, and petroleum and petrochemicals.

The Brazilian environmental sector is expected to receive investments of over U$10 billion per year between 2010 and 2020 to meet infrastructure demand. Brazil has 25% of the world's flowing fresh water. It also has the largest underground reservoir, the Guarani Aquifer. Below are some additional general and water statistics that demonstrate the importance of the Brazilian water market.

The most important segment is water with over 25% of the total followed by solid waste (22%), and energy efficiency (19.5%)	**2010**	**2011**
GDP	$ 2.2 Trillion US (7th in World)	$2.3 Trillion US
Economic Growth	+7.5%	+4.5%
Industrial Production	+10,1%	+5.0%
Foreign direct investment	$ 30 billion US	$ 38 billion US

Exports Growth Imports Growth	11.5% 36.2%	9.5% 13.1%
Other Major Investments	**2011 to 2014**	**Post 2014**
Growth Acceleration Program *(PAC)* - Phase 2 - massive infrastructure investment	$526 billion US	$364.4 billion US
Investments in the Water and Waste Water Sector (PAC 2)	$16.6 billion US	TBA
Investments in the Water and Waste Water Sector (Infrastructure Projects to Improve country's capacity for the 2014 World Cup and 2016 Olympic Games)	Guanabara Bay (RJ) Clean-Up Projects - $886 million US Cedae (water utility for State of Rio de Janeiro, serving 9 million people) IPO - $1.2 billion US Copasa Water Treatment - $600 million US Tiete Clean up (Phase 3) - $1.5 Billion US	
Investment in the Environmental Industry Sector	$10 billion US	$10 billion (per year thru 2020)

Compranet 5.0– Better than or eliminate the problems of the old system?

Within the last few months, the Mexican federal government has created a new federal registry for the publication of government procurement projects and other purchase activity. The new system is referred to as Compranet 5.0. It is intended to improve on the old system in several ways: (a) make it is easier to use and navigate, (b) include more detailed information on tenders, (c) allow more specific search filters (although you can no longer search by date or range of dates), (d) allow interaction directly with the purchasing entity, (e) provide greater clarity about the purchasing entity and the area in charge of the bid, and (f) allow you to export data directly to an Excel sheet for easier manipulation.

While we are pleased that the Mexican government has recognized the need to modify the old system and improved it, it is important to mention that the biggest problem with the old system will remain the biggest problem with the new system, i.e. that the information provided by federal, state, and local government officials to Compranet for publication tends to be late and terribly incomplete.

LGA Consulting monitored water segment tenders, bids, and awards in Compranet from July 2009 through June 2010. From our analysis, we have found three key problems with Compranet information for the Mexican water sector.

1. Time Frames on Compranet

From our analysis of local, state, and federal water bids, we have been able to determine that the average time between publication of a tender in Compranet and the close of bidding was only 7 calendar days, with 2/3 of the 1158 tenders closing in less than 10 days. Mexican authorities claim that Compranet works in such a way that Mexican or foreign companies can monitor the bids that come out and be able to respond to them with adequate time frames. We think that few bidders could assemble a serious proposal in that amount of time. Conagua, the Mexican water authority, should insist that all tenders should be open for at least one month, if not two, in order to allow foreign companies to be able to adequately access, process, and act on this information.

2. Information about Bid Winners

LGA Consulting regularly reviews the water project awards and the contact information on public sector water award winners. In this way, we are able to link U.S. companies with Mexican bid winners. When we tried to access the contact information for these award winners in Compranet, we found that the information listed was incorrect more times than not and that when we tried looking for the winning company by name, we could not always locate them. From our analysis of the 124 water award winners during the months of December 2009 and March 2010, we obtained the following results:

1. Compranet had correct telephone and email information for only 41% of the winners.
2. Only 52% could be located and reached by phone or valid email.
3. Less than 25% of the emails, valid or otherwise, were from company-branded domains as opposed to free, on-line providers (.e.g. gmail, yahoo, prodigy, etc.), suggesting the potential that the bidders were not affiliated with established businesses.

Low Award Amounts

The value of the 498 municipal, state, and federal water project awards listed in Compranet from July 2009 through June 2010 was 3.411 billion pesos (about U.S.$275 million). The award amounts in the second half of 2009 (2.244 billion pesos) were twice the amounts in the first half of 2010 (1.166 billion). We believe that this imbalance is a consequence of (a) the fact that water budgets in Mexico tend to be back loaded into the last half of the year for funding reasons, and (b) that indeed there has been less spending in 2010 even though the 2010 Conagua budget actually increased more than the inflation in 2010.

The value of these projects represent only 18.9% of the U.S.$1.45 billion Conagua budget for water and waste water projects in Mexico in fiscal 2010. Larger/richer municipalities and states generally rely on Conagua for no more than half of their water budgets. As a result, the Conagua budget generally represents no more, and probably less, than 2/3 of the funds spent on all Mexican government water projects each year. One could conclude that the water awards reported in Compranet, which should comprehensively include all municipal, state, and federal water projects, actually represent no more than 12.5% (and probably closer to 10%) of the total national water project budget in 2010.One has to ask where this budgeted money is going? Is it being spent on water projects but not being reported in Compranet?

Conclusion

Without a doubt, Compranet 5.0 is an upgrade over the old system. However, as mentioned above, too often the problem is not the system but the info in the system. One has to also wonder why Conagua is not monitoring and trying to eliminate these additional local and state government spending discrepancies and to insist on the publication of complete award winner information.

Channel Market Strategies in the Mexican Water Segment (PART II)

In the past edition of the Mexico Water Report, we discussed selling direct, through a local distributor, or via a local representative. Here we will analyze the pros and cons of selling through integrators, strategic alliances, and subsidiary offices.

Integrators

The use of local integrators for the sale of water products to the Mexican public sector is important and is becoming even more important for two reasons. First, a foreign manufacturer trying to sell into a Mexican public project must use a locally-based company,

either a manufacturer, distributor, or integrator, in order to participate. Second, with the new national content regulation for government purchases, foreign products without significant (60%) local content cannot meet national requirements for direct sales. However, if these foreign products are incorporated into an integrated project, where local content in materials, services, and labor are viable/plentiful and where national content requirements drop from 60% to 40%, they can meet the regulations.

NAFTA supposedly protects U.S. and Canadian companies from this type of discrimination but many Mexican federal entities use this new regulation to create a de facto "Buy Mexico" policy for government procurement sales. It is also important to mention that if any federal funds are used for municipal and state purchases (probably 90% or more of all water segment purchases), national content requirements apply. The Mexican federal government is aggressively enforcing these new content provisions at the national level.

However, many Mexican distributors have had success convincing municipal water authorities to avoid formal bid processes when sourcing replacement parts and instead buying under the simplified process called "adjudicación directa". Likewise, LGA Consulting is seeing that some municipalities are not enforcing the new national content regulations and thus allowing 100% foreign made products to satisfy their procurement needs of replacement parts. Nonetheless, while replacement parts might appear to be a better fit for distributors than integrators, integrators have begun to diversify their product and service mix so that they are capturing more and more of the service and replacement part business that used to be the domain of Mexican distributors.

With no national content requirements and no restrictions requiring Mexican-based company sales, sales of water-related products to private sector customers are wide open. In these cases, integrators have some advantages in larger projects. However, private sector companies often are less interested in an integrated solution and more interested in price and functionality. Likewise, larger private sector companies are generally more capable of dealing with technology challenges in implementation and with multiple vendors for more cost effective solutions. While integrators can and are used for larger projects, medium and small projects or product purchases are more likely to be handled by local distributors, local representatives, or even direct sales from foreign-based companies.

The key to successfully working with an integrator is to not rely exclusively on the integrator to market and promote your products in the market. Integrators too often reach for the least expensive, functional product to put into the mix of their integrated system or project in order to provide the client with the most cost effective solution. Unless your product happens to be the lowest cost, functionally viable product in the market, either your direct sales force in the United States or local independent reps is going to have to help drive sales and marketing efforts in country. This is the only way to ensure that the end-user is fully aware of your product's cost-benefit and that your product is duly pulled through by the integrator. With this support, it is really just a matter of time before your integrator is talking with your lower cost competitors.

Strategic Alliance Partner

Working with a local Mexican partner can be beneficial for two important reasons. First, these types of companies can sell your product and related aftermarket parts and service to the private sector without discrimination as your de facto distributor. These types of relationships are more likely to generate true business development and not just order taking as so often is the case with distributors. For larger projects, where an integrated approach is needed or prudent, the alliance partner can also provide this type of support in-house, or work with other local partners to provide the needed synergies and support.

Sales and market development assistance is often not the driving force behind a strategic alliance. Market viability is often determined by the ability of the foreign company to include local content, either for regulatory reasons (as mentioned above) or to remain price competitive with other local manufacturers. The ability to combine foreign products with local fabrication and assembly capabilities to create a cost effective product offering that your fellow, foreign competitors probably cannot match offers a company a pronounced market advantage. In a market like Mexico where price is unfortunately king, these types of synergies can be the difference between success and failure.

Subsidiary Office

If clients will not buy product sold direct from the United States, if reps are hard to find, if distributor margins threaten your viability and their order taking mentality are not getting your product into market niches, if strategic alliance partners and integrators become tiresome and distracting and too demanding, AND if the market potential is clear, it might be time to open up a sales office in Mexico.

Independent local intermediaries offer certain benefits that are especially evident in new, smaller, or less dynamic markets. However, relying on them for promotion, marketing, business development and even sales outreach in primary international markets generally leads to frustration. Also, too often trying to perform this function in these types of markets from abroad can be distracting and therefore even more frustrating.

Some U.S. companies with less international experience wrongly believe that a joint venture or strategic alliance is the most viable way for them to enter the market with local presence without the headaches of opening and operating a full fledged subsidiary. However, it has been our experience that if a company is unable to handle the responsibilities and support needed for a Mexican subsidiary office, it is probably even less prepared to deal with a joint venture with local ownership interests.

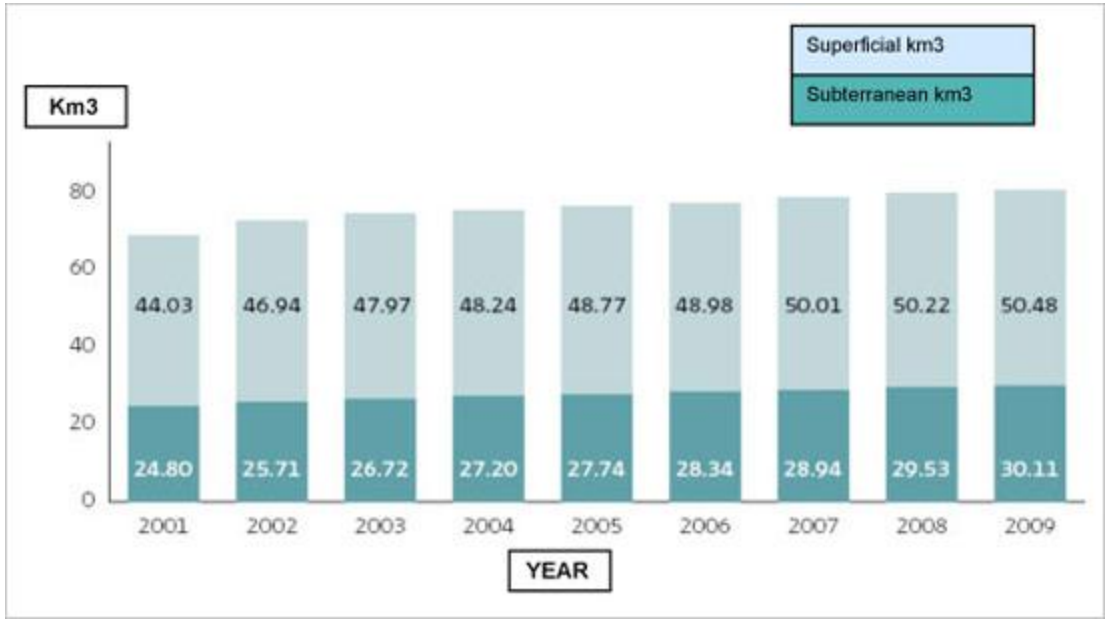
Subsidiary operations can be structured in a number of ways. Some companies want the visible in-country presence, employee base, and perhaps on-the-ground service that current and future clients require without running the business through the Mexican entity, effectively creating a Mexican cost center and a service agreement between the U.S. manufacturer and its Mexican subsidiary. Others want to run all or almost all of the business through the Mexican subsidiary, creating the capability of warehousing product and parts and/or giving Mexican clients the local invoices they want.

In the next edition of the Report, we will analyze the important exclusivity issue, the effectiveness of incentives, and suggestions about the best mixture of carrots and sticks to use in Mexico and specifically in the Mexican water segment.

Uses and Sources of Water in Mexico

Water does not always exist where it needs to be used and often needs to be moved from source to site of use. Every economic activity requires water and this water comes from surface or subterranean sources. The graph below shows the amount of water used for all economic purposes (agriculture, public, industry and electric power generation) for 2001-2009 in Mexico and their source.

Nearly two-thirds of the water used in the country comes from surface sources (rivers, streams and lakes) while the other third comes from subterranean sources (aquifers). Surface water use grew by 15% from 44.03 km3 in 2001 to 50.48 km3 in 2009. At the same time, subterranean water used increased 21% from 24.8 km3 in 2001 to 30.11 km3 in 2009. The total amount of water used from both surface and subterranean sources in 2001 was 68.83 km3 and for 2009 the total increased to 80.59 km3, a 17% jump.



Past editions of the Mexico Water Report mentioned that agriculture uses the most water, more than three quarters of the total volume annually. It is interesting to note that at the same time, the United States uses only about 40% of its national water supply for agriculture. In Mexico in 2009, 61.8 km3 were assigned for agriculture with two thirds or 41 km3 coming from surface sources. Only 12% of total resources, 11.4 km3, were used for public supply. Inverse to agriculture, almost two thirds (62.2%) of the water for public use came from ground water. While industry uses less than 9% of the total water supply in Mexico, the United States uses over 40% of its water supply for industrial applications. Surface and subterranean sources represent almost exactly 50% of water used by industry in Mexico.

Aqueducts

In Mexico there are more than 3,000 km of aqueducts with a total capacity of 112 m3/second that bring water to different cities, rural communities, and other economic activities. Length of an aqueduct has almost no relation to capacity amongst the major Mexican aqueducts. The Vizcaino aqueduct, at 206 kms, is the longest aqueduct in Mexico but it has one of the lowest capacities with only 62 l/s. On the other hand, the Uxpanapa aqueduct has the highest capacity in Mexico with 20,000 l/s but is only 40 km in length.

Largest Mexican Aqueducts by Capacity				
Aqueduct	**Length (km)**	**Capacity (l/s)**	**Location**	**Region**
1.Uxpanapa-La Cangrejera	40	20000	Veracruz	Southeast
2.Sistema Cutzamala	162	19000	Valley of Mexico	Central
3. Lerma	60	14000	Valley of Mexico	Central
4.Chapala-Guadalajara	42	7500	Guadalajara	Central
5.Linares - Monterrey	133	5000	Monterrey	North
6.El Cuchillo - Monterrey	91	5000	Monterrey	North
7.Rio Colorado- Tijuana	130	4000	Baja California	Northwest
8.Chicbul-Ciudad del Carmen	122	390	Campeche	Southeast
9.Vizcaino-Pacifico Norte	206	62	Baja California	Northwest

Three of the four highest capacity aqueducts are located in the Central region. This region contains the highest population, industrial, and agricultural concentrations in the country. The second and third largest aqueducts are focused almost exclusively on water supply for the greater Mexico City area and the fourth largest serves the Guadalajara area, the second most populous city in the country and its major agricultural focus.

The North region has the fifth and sixth most important aqueducts that supply the city of Monterrey, Mexico's third most populous city and the second most important industrial center. The seventh largest aqueduct is in the very arid and industrial north of Mexico.

Cutzamala System

In any discussion of Mexican aqueducts, one has to discuss the Cutzamala, the aqueduct that provides Mexico City with a major portion of its water supply. The Cutzamala aqueduct is 2nd nationally in both length and capacity. While rivers and streams provide Mexico City with only 3% of its total water supply, the Cutzamala System provides 18% for all four water uses in the Valley of Mexico basin. In fact, Cutzamala together with the Lerma Aqueduct System provide the greater Mexico City with 25% of its water supply. The rest of the water supply in the region, 73%, is extracted from ever dwindling and sensitive aquifers.

The Cutzamala system is formed by seven dams for storage, six pumping stations, and several water treatment plants. The Cutzamala System consumes almost 1% of the total electric power generation of the country. This system overcomes considerable challenges in moving over 485 million m3 annually to one of the largest and most congested urban areas in the world. The altitude of Mexico City and the drastic altitude changes from source to end user present further challenges. The system climbs over 1,100 meters from the lowest part of the system at Pumping Plant 1 at 1,600 meters above sea level to Oscillation Tower 5 at 2,700 meters above sea level. Once the water is pumped and treated through the different stages of the system, it then falls by gravity to Mexico City users located at almost 2,300 meters above sea level.

The California Aqueduct, considered one of the longest and highest capacity aqueducts in the United States, also faces similar altitude issues. However, while the California aqueduct climbs some 2000 feet, Cutzamala Aqueduct climbs almost 3,500 feet and has more staggered and irregular altitude changes. However, the California Aqueduct moves considerably more volume, with a capacity of 370m3/s.

Dams

Mexico has about 4,500 dams with 536 considered large according to the International Commission on Large Dams (ICOLD). Mexico ranks 13th in the world numbers of large dams, i.e. those that have at least 15 meters of depth and/or capacity of 3 million m3 or higher. It is interesting to note that Conagua says that Mexico actually has 677 such dams, which would place Mexico 9th overall in this category and between Brazil (635) and Canada (793). None the less, Mexico's large dams still represent only about 7.5% of U.S. totals and just under 15% of the dams in China or India.

Country	Number of Large Dams

United States	9 265
China	4 688
India	4 636
Spain	1 267
South Korea	1 205
Japan	1 121
South Africa	915
Canada	793
Brazil	635
Turkey	625
France	597
Italy	549
Mexico	536
United Kingdom	517

World’s Highest Dams

While one might say that Mexico has average capacity dams, it clearly has some of the highest dams in the world. Mexico has the 7th and 9th highest dams in the world.

10 Highest Dams	Height (meters)	Country
Rogun	335	Tajikistan
Nurek	300	Tajikistan
Xiaowan(Yunnan)	292	China
Grande Dixence	285	Switzerland
Inguri	272	Georgia
Vajont	262	Italy
Manuel M. Torres	261	Mexico
Tehri	261	India
Alvaro Obregon	260	Mexico
Mauvoisin	250	Switzerland

Mexico also has the second highest Rock Fill (Type ER) dam (Aguamilpa) in the world at 187 meters, the second highest gravity (Type PG) dam at 260 meters (Alvaro Obregon), the third highest Earth (Type TE) dam at 261 meters (Manuel M. Torres), and the fourth highest Arch (Type VA) dam at 207 meters (Zimapan).
Mexico’s Largest Dams

Of the 536 large dams in Mexico, available information only exists on the top 100 dams according to storage capacity. These 100 dams are also classified by their use: electric power generation, irrigation, public supply, flood control, or combination of two or more areas. Mexico does not rely on hydroelectric sources nearly as much as Brazil which generates 40% of its electricity from hydroelectric dams. Nonetheless, 27 of these top 100 dams and 22 of the top 30 dams are used at least partially for power generation and they tend to be the largest dams.

Basin	Total Dams	Regions	Total capacity per Region (hm3)
Golfo Norte	10	North	25,876
Cuencas Centrales del Norte	4		
Rio Bravo	1		
Pacifico Norte	15	Northwest	24,522
Peninsula de Baja California	1		
Noroeste	8		
Lerma-Santiago-Pacifico	23	Center	12,698
Valle de Mexico	2		
Frontera Sur	5	Southeast	37,208
Golfo Centro	3		
Balsas	14	Southwest	17,757

Pacifico Sur	2	
Total	**100**	**118,061**

The region with the most large dams is the Central region with a total of 25 followed closely by the Northwest Region with 24. While the difference in number of dams between these two regions is just one, the difference in capacity is considerable with the Northwest region dams having almost double the capacity of those of the Central region. On the other hand, the Southeast region, with only 8 dams, has three times the capacity of the 25 dams in the Central region and 50% more capacity than the dams in the North and Northwest regions, the 2nd and 3rd most important regions.

The first and the third largest dams by capacity are located in the Southeast region, specifically in the Frontera Sur basin. The North and Northwest regions, are areas with the most extreme climatic conditions, the most exploited aquifers, and some of the lowest surface water sources, making the storage of water imperative for agriculture, public and industrial supply.

Largest Dams in Mexico by Water Capacity

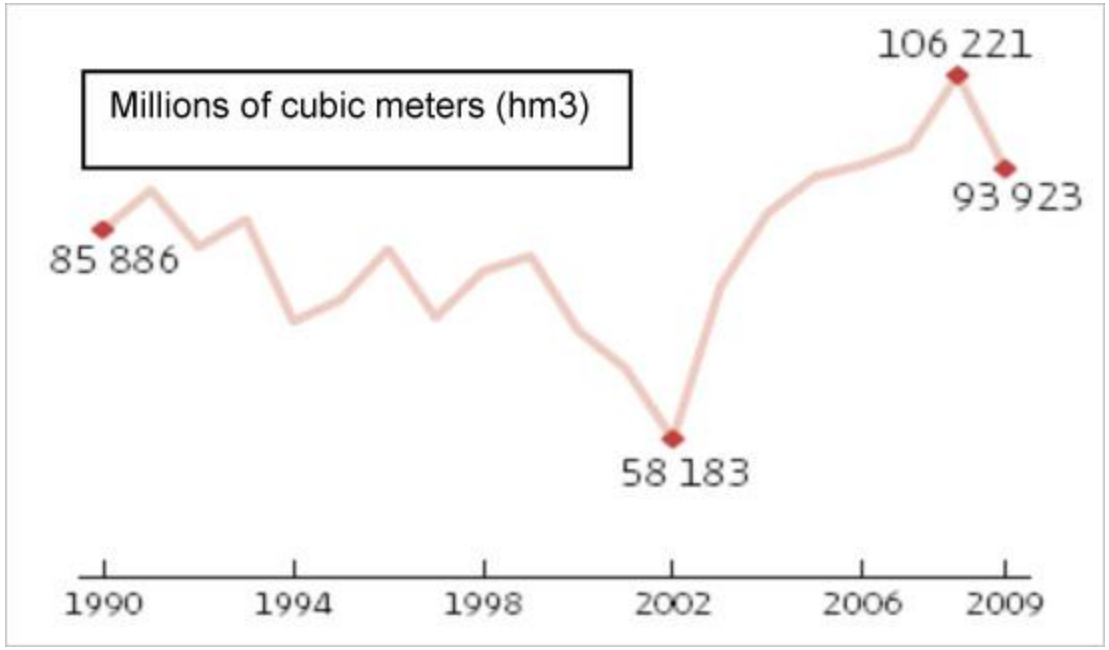
Official Name and common names	Capacity (hm3)	Basin / Region
La Angostura (Dr. Belisario Dominguez)	12,762	Frontera Sur / Southeast
Infiernillo	12,500	Balsas / Southwest
Malpaso (Netzahualcóyotl)	10,596	Frontera Sur / Southeast
Temascal (Presidente Miguel Alemán)	8,119	Golfo Centro / Southeast
Aguamilpa (Solidaridad)	5,540	Lerma-Santiago-Pacifico /

		Center
La Amistad	4,462	Rio Bravo / North
Falcón	3,912	Rio Bravo / North
Las Adjuntas (General Vicente Guerrero)	3,910	Golfo Norte / North
El Palmito (Lázaro Cardenas)	3,336	Cuencas Centrales del Norte / North
El Humaya (Adolfo López Mateos)	3,072	Pacifico Norte / Northwest

The largest dam in Mexico is La Angostura Dam (also known as the "Dr. Belisario Dominguez Dam") located in Chiapas in the Frontera Sur river basin and one of the few dams in the country used exclusively for electric power generation. The second largest dam, "Infiernillo", is a multipurpose dam with almost identical capacity. Both dams have similar capacities of around 12,500 hm3, each representing just over 10% of the total capacity of these 100 largest dams. In fact, the top four dams, all located in southern Mexico and unfortunately far from Mexico's important urban bases, make up 37% of the total capacity of these top 100 dams.

How do Mexico's two largest dams compare to other major dams in the world? The world's largest dam, the Three Georges Dam in China, has a capacity of 39,300 hm3. and the largest dam in the United States, Hoover Dam, has a capacity of 35,200 hm3. The two largest dams in Mexico have less than 1/3 of Three Georges Dam capacity and just about 1/3 of Hoover Dam. In fact, the three largest Mexico dams would fit inside of Hoover Dam. While Mexico has large dams, one would not characterize them as mega dams.

Volume of water in the 100 most important Mexican dams (2009)



The maximum storage capacity of all 100 dams is 118,061 hm3. (hm3 = 1 million m3). The lowest storage volume in the last 20 years was in 2002 with 58,183 hm3, just under 50% of total storage capacity. The highest volume of water stored in the same period was in 2008 with 106,221 hm3 that represented almost 90% of total 2009 storage capacity. In 2009, this amount dropped 11.6% to 80% of capacity. Mexico's very high rainfall totals, and the country's growing and increasingly urban population suggest that Mexico must continue to invest significantly in building new and maintaining or expanding current dams in order to meet its water storage needs.

Potable Water Treatment and Plants in Mexico

Every foreigner has heard the advice and general expression: "When you go to Mexico, don't drink the water." However, most Mexicans don't hesitate in uttering this same generalization. Potable water problems in the developing world are difficult, but Mexico faces these traditional problems along with other barriers that make the delivery of 100% potable water to the population that much more challenging.

Most people in Mexico do not drink from the tap because they do not trust the water quality. Even though water treatment plants produce potable water, it gets polluted in the delivery system and the chlorination methods used in 80% of the processes don't prevent this contamination.

The traditional developing world potable water challenge that Mexico faces is based on two issues. One is competition for public infrastructure funds. Even when water is a priority, wastewater solutions tend to be a greater priority than potable water issues, especially in major urban areas.

The second challenge is keep water truly potable, not only at the plant but also at the point of consumption. Over 50% of Mexican potable water is lost in the delivery system and never makes it into a home. However, the most important qualitative problem lies in the fact that this leaky delivery system also contaminates the purified water. Until this problem is addressed, it is hard for developing world water commissions to know how to apply appropriate technology and financial resources to solve this problem.

A third challenge, unique to Mexico, lies in the fact that the Mexican population, especially in urban areas, has come to rely on bottled water for its potable water supply. The second issue of the Mexico Water Report included a discussion of the importance of the Mexican bottled water market which is second in the world in per capita consumption and market revenue. As long as the Mexican population relies on bottled water, it will be hard for the Mexican government at federal or local levels to justify financial expenditures for the type of comprehensive projects needed to provide consistent potable water.

Current Mexico Potable Water Reality

Currently, 91% of Mexico has potable water service. According to the latest published information, potable water coverage in urban areas is 94%. It is interesting to note that in 2005, urban potable water coverage was actually better (95%) than four years later in 2009. This statistic is somewhat alarming but is at least partially explained by the fact that Mexico is finding it hard to keep up with the continuing and increasing urbanization challenges which make it possible for coverage to deteriorate a full percentage point.

On the other hand, while one might conclude that rural area potable water coverage is unacceptably low, it has made some considerable advances, going from 51.2% in 1990 to 70.7% in 2005 and 79% in 2009.

When analyzing potable water coverage by state, it is clear that the more developed areas of the country are making more progress while the least developing areas seem to be languishing. Fifteen of Mexico's 32 states have potable water coverage above 95% and

only eight states are below the national average of 90.7%. However, of these states, seven are below 85% with four at or below 80%: Tabasco, Veracruz, Chiapas, and Guerrero.

Mexico's ambitious 2030 water program establishes 100% potable water coverage as a goal. Brazil has made an identical 2030 commitment. Parallel to this goal, the Mexican government established a more realistic 2012 goal of 92% nationwide potable water coverage. While this goal might end up being met, this loftier 2030 goal seems out of reach because of its very ambitious nature and because of the above-mentioned traditional and Mexico-unique potable water challenges.

Potable Water Plants, Capacity and Flows

The latest published figures by the Mexican Water Commission (CONAGUA) are somewhat confusing and perhaps not congruent. Conagua information claims that the 631 potable water treatment plants in Mexico had an installed capacity of 133 m3/s and that they processed 90 m3/s per year in 2009. However, they also say that of the total national potable water supply (328.2 m3/s), 62% or 203.5m3/s of is from subterranean water sources with the rest (38%) or 124.7m3/s coming from surface water sources. They also say that only 83.1m3/s of surface water sources or 1/3 is actually treated. As a result, we are uncertain how Conagua can call this 1/3 of surface water sources "potable" if it is never treated.

Operating potable water plants by region (2009)

Region	Hydro Administrative Region		Number of operational plants	Capacity	Potable Flow
Northwest	I	Peninsula de Baja California	41	12.22	6.66
	II	Noroeste	24	4.13	2.14
	III	Pacifico Norte	154	9.28	7.75
North	VI	Rio Bravo	60	26.3	15.9

	VII	Cuencas Centrales del Norte	67	0.56	0.4
	IX	Golfo Norte	43	6.66	5.89
Central	VIII	Lerma-Santiago-Pacifico	112	19.95	12.48
	XIII	Aguas del Valle de Mèxico	43	5.27	4.17
Southwest	IV	Balsas	20	22.76	17.28
	V	Pacifico Sur	8	3.18	2.59
Southeast	X	Golfo Centro	9	6.64	4.15
	XI	Frontera Sur	49	16.13	10.63
	XII	Peninsula de Yucatàn	1	0.01	0.01
Total			**631**	**133.09**	**90.04**

There are 631 water treatment plants divided into 5 regions. The Northwest has over 1/3 of the total number of treatment plants with 219. The Southwest has the fewest plants (only 28 plants representing less than 5% of the total). However, the number of water treatment plants does not necessarily correspond to higher installed capacity or treated flows. The installed capacity for these 631 treatment plants is 133.09 m3/s while the total treated flow is only 90.04 m3/s or only 2/3 of their capacity. With the exception of the

potable treatment plants in the Southwest region that are working at close to 80% capacity, all other regions were at or well below 2/3 capacity in 2009.

The states with the largest number of potable treatment plants are Sinaloa with 142 plants or 22.5% of all potable plants in the country, followed distantly by Tamaulipas and Zacatecas each with 54 plants. The states with fewest plants are the State of Mexico (11), Nuevo Leon (12), Baja California (26) and Mexico City (38). However, in general, these plants treat some of the highest capacities in the country.

Although the State of Mexico and the Federal District which make up the Greater Mexico City area have very comparable populations, the difference between the number of potable treatment plants and the treated flows in these jurisdictions is quite dramatic. The State of Mexico, with its 11 plants, has an installed capacity of 22,164 m3/s and processes 16,739 m3/s annually while the Federal District, with its 38 plants, has an installed capacity of only 3,788 m3/s while processing 2,935 m3/S. Thus, the Federal District has less than 15% of the capacity and only 17.5% of the treated flows of the State of Mexico which demonstrates the evidently small size of the plants in the Federal District.

The situation is similar in Sinaloa which has the largest number of plants in the country (142) with an installed capacity of only 9,267 m3/s, processing 7,743 m3/s, representing only about 40% of the capacity and less than half of the treated flow from the potable treatment plants in the State of Mexico.

New plants are probably required in states with little unused capacity like Sinaloa and Zacatecas (at virtual full capacity now) or Tamaulipas (above 80% capacity). However, in most Mexican states, especially important states like Baja California, Nuevo León, the Federal District, and the State of Mexico, there still seems to exist ample capacity for treating potable water.

Therefore, from this analysis of the existing information on potable water treatment plants, one can conclude that the extensive, regionally unused capacity (1/3) consistently suggests that the solution to the potable water problems is probably not investing in the construction of new potable treatment plants but the maintenance and renovation of the existing plants to take advantage of more of the existing installed capacity. That being said, this analysis does not take into consideration water quality or efficiency issues which could very well dictate the need for new plants or the modernization of existing plants.

Potable water standards and purification processes

To regulate potable water supply and distribution systems, the Secretary of Health has established three main standards: (a) NOM-230-SSA1-2002 which covers compliance with health requirements in the supply systems, (b) NOM-127-SSA1-1994 y which covers regulation of the permissible limits of quality and treatment that water, and (c) NOM-179-SSA1-1998 which covers monitoring and evaluation of the water quality control. These regulations together establish the basis for potable water purification and disinfection. Mexican potable water treatment plants use 10 purification processes.

Central Process	**Process Description**	**Capacity**		**Potable Flow**	
		No.	**%**	**m3/s**	**%**
Softening	Hardness Removal	21	3.3	0.63	0.7
Absorption	Trace Organic Removal	15	2.4	0.84	0.9
Conventional Clarification	Suspended Solids (TSS) Removal	195	30.9	62.29	69.2
Patent Clarification	TSS Removal	140	22.2	6.64	7.4
Reversible Electrodialysis	Dissolved Solids Removal	1	0.02	0.06	0.01
Direct Filtration	TSS Removal	62	9.8	14.19	15.8
Slow Filters	TSS Removal	7	1.1	0.38	0.4
Reverse Osmosis	Dissolved Solids Removal	174	27.6	1.29	1.4
Iron and Manganese	Iron & Manganese	16	2.5	3.73	4.1

Removal

Total	**631**	**100**	**90.04**	**100**

Conventional clarification is the most frequently used process used at 195 plants or 31% of the total. These plants are responsible for 70% of the total water treated. While reverse osmosis plants are second in frequency with 174 representing, almost 30% of all plants, they are responsible for an insignificant 1.4% of total treated flows. The third and fourth most frequently used processes, patent clarification (140 plants) and direct filtration (62 plants), are together responsible for almost 25% of the total water treated. The remaining 5 processes mentioned above have a modest number of plants (61 total or less than 10%) and are used to treat less than 6% of total flows. The primary function of almost two-thirds of potable treatment plants is the removal suspended solids.

Conventional clarification technology is used in the largest plants, and in 20 of the 32 states it is the most important treatment process. In 14 states, the treated amounts are significant, ranging from 1,500 l/s to over 15,000 l/s. It is interesting to note that half of all treatment by conventional clarification, representing over 1/3 of all potable water treated, is generated in the states of Mexico (only 6 plants processing 15,559 l/s), Tamaulipas (29 plants processing 10,039 l/s) and Jalisco (15 plants processing 8,620 l/s) alone. Also, if the state of Tabasco, the fourth most important state for conventional clarification (30 plants processing 6,010 l/s) is included in the mix, these four states represent 2/3 of all of the water treated by conventional clarification.

In the States of Mexico and Jalisco, conventional clarification processes are used to treat more than 90% of all water treated. In Tabasco and Tamaulipas, conventional clarification is responsible for about 80% of all water treated. While treatment amounts are less significant, it is worth noting that Sinaloa has 30 plants and Sonora 24 plants that together treat almost over 5,000 l/s.

Treatment processing plants with other, alternative methods appear to have distinct preferences by water authorities in certain parts of the country. Patent clarification processes are used extensively in the states of Sinaloa (106 plants, 45% of total treatment) and Tabasco (8 plants, 20% of total treatment), and the state of Sinaloa has 6 iron & manganese plants that produce close to 40% of all water using this process. While insignificant in terms of treated flows, the following states have double digit reverse osmosis plants which represent close to 1/3 of all treatment plants in Mexico: Colima (32), Durango, (31), the Federal District, Baja California Sur, and Guanajuato.

Of the 12 states that do not rely heavily on conventional clarification process, only four treat significant amounts of water with other processes. In Nuevo Leon, 85% of water treatment, or 6,165 l/s, are produced in just two large plants using direct filtration processes. The other 15% is from 7 plants using conventional clarification methods. Baja California is very similar, where 75% of water treatment, or 4,873 l/s, are produced in 16 smaller plants using direct filtration while the other 25% is from 9 plants using conventional clarification methods.

About half of the 32 Mexican states treat insignificant amounts of water (less than 500 l/s), with 13 states treating less than 250 l/s and 10 states (almost 1/3) without plants (5) or treating less than 25 l/s (5). In southern Mexico where subterranean and surface water sources are plentiful, only the state of Tabasco does any significant potable water treatment. The arid northern states that have access to surface water (Baja California, Nuevo Leon, Sinaloa, and Tamaulipas) treat significant amounts of potable water, equal to more than 1/3 of all potable water treated in Mexico. On the other hand, the rest of northern Mexican states treat virtually no water at all.

Disinfection and Disease Control Challenges

In order to understand potable water treatment issues, one must understand disinfection realities and their impact. This final step in the water purification process is now carried out in 97% of the potable water supply, increasing almost 20% points since 1991 and over 8% points from 1991 to 1992 alone, climbing from 84.5% to 92.7% coverage.

Year	Supplied water (l/s)	Disinfected water (l/s)	Coverage %
1991	240 075	202 900	84.5
1992	247 580	229 400	92.7
1993	249 692	237 149	95
1999	309 774	287 147	92.7
2000	312 007	294 400	94.4

2005	324 467	311 295	95.9
2009	**328 176**	**318 647**	**97.1**

In the early 1990s, the Latin American disinfection average was 84% while Mexico was beginning to reach 95%. The decrease from 1993 through 1999 is possibly the result of the severe 1994 economic crisis. However, since that time there has been a steady increase in the disinfection levels in Mexico, growing by 5% points during the last 10 years. In fact, only the states of Chiapas (83.1%) and Guerrero (88.2%) present serious areas of concern. Only two other Mexican states (Yucatan and San Luis Potosi) have disinfection coverage of less than 95%.

While the Mexican track record for disinfection appears to be good, it has not resulted in significant advances in the control and eradication of infectious diseases like typhoid and salmonella, two of the most dangerous digestive system diseases in Mexico.

Cases of Infectious Diseases in Mexico since 2002

Disease	**Number of cases per year**				
	2002	**2004**	**2006**	**2008**	**2009**
Infectious Diseases	6 831 630	5 951 869	5 765 081	5 500 546	5 493 987
Typhoid	7 889	25 952	37 012	44 199	46 724
Salmonella	80 494	109 444	115 014	120 986	137 270
Shigellosis	31 473	22 321	16 483	12 885	12 441

The overall number of infectious diseases is down 20% and Shigellosis down over 60% from 2002 levels. However, the Typhoid and Salmonella situations appear to be worsening considerably, with the number of cases of Typhoid up 600% and Salmonella up 70% annually since 2002.

While Mexico's population growth has stabilized relative to many other developing countries, the population shift from rural to major urban areas has been difficult to manage and made controlling these diseases that much more difficult. However, these kinds of increases cannot be attributed strictly to population relocation issues and must become higher priorities for funding and actions by Mexican federal and major municipal authorities.

As a result, moving forward, we expect to see greater emphasize on disinfection campaigns, greater funding for colloidal silver and calcium hypochlorite supplies, and a more strict, intensive and extensive enforcement of NOM-179-SSA1-1998 to guarantee greater precision in the disinfectant dosages and increased monitoring of disinfection equipment.