

Issue 4  
Spring 2011  
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## MEXICO WATER REPORT



### **Water Projects and Infrastructure in Mexico City**

Mexico City, known officially as the Mexican Federal District (DF), is one of the largest cities on the planet with more than 10 million inhabitants although less than half of the size of the Valley of Mexico which includes another 10 million people. Due to these numbers, the major problem which it faces is rooted in the lack of public services and the water sector is no exception.

Continuous urban growth and a lack of local water sources and other factors have negatively affected the water supply, and deliver and drainage systems for the entity. The Federal District Water System faces considerable challenges in its attempt to repair leaks and treat waste water. In addition, if one bears in mind that 70% of the water supply comes from the aquifer subsystem located underground the city, one begins to understand the problem of the regular if not constant floods provoked by the land sinkage product of the overexploitation of the aquifer subsystem. This continuously uncontrolled water flows lead to infrastructure damages especially to the potable water and sewer/drainage networks. This together with the inadequate management of municipal and industrial waste paints a worrisome picture for the DF water system.

This article will present the current status of the DF water system in relation to existing infrastructure and the future needs for future potable water, potable water and sewer/drainage systems, and potable water and waste water treatment plants.

#### **Potable Water Situation in Mexico City**

The Federal District Water System is responsible for the supply of potable water and the storage and management of waste water in the DF whereas Conagua, its federal counterpart, is entrusted to provide the water in block to the DF to operate and maintain the great majority of deep wells and to organize large and interstate and interbasin hydraulic projects.

Despite the existence of 11,000 kms of distribution lines and more than 300 storage tanks with a capacity of more than 1.5 million cubic meters (m<sup>3</sup>), many DF inhabitants depend on non-water system sources like tanker trucks or local wells and springs to obtain potable water. Likewise, approximately 40% of the southern part of the DF does not have access to sewer or potable water systems. Also, there exists the problem that the DF loses 50 % to 60 % of its potable water between its source and the end-user in the distribution system, As a result, there is a latent need for the construction of new distribution infrastructure and the repair of the existing system.

Before continuing our analysis of DF infrastructure, projects, and budget issues, it is important to mention the vital role that the Lerma– Cutzamala System plays for the DF. This system was constructed to help avoid the overexploitation of the aquifer of the Valley of Mexico, transporting waters from the Cutzamala River to the Federal District via the Peripheral Aqueduct. The water imported is disinfected with chlorine and then incorporated into the Lerma-Cutzamala aqueduct before joining the DF potable water distribution system. The Lerma-Cutzamala System possesses 7 dams, 6 macro pumping plants, almost 73 kms of open channels, 44 kms of tunnels, 218 kms of aqueducts and the Los Berros water treatment plant that, being the largest potable treatment plant in Mexico, it provides 1.5 billion liters of water to Mexico City, equivalent to 26% of the total DF water supply. Despite the incredible size and dynamic of Lerma-Cutzamala, this infrastructure has turned out to be insufficient to continue to meet the basic, total needs of the DF. As a result, the DF and Conagua authorities continue working on new water source supplies to resolve this problem.

The DF potable water supply is shaped by external and internal sources located in Mexico City/DF, the State of Mexico which surrounds the DF and the State of Michoacán which neighbors the State of Mexico. The external sources are superficial waters and represent 35% of the total DF system. Internal sources consist of the local aquifer which represents the other 63%, composed of the Lerma-Cutzamala and the Mexico City aquifer.

The biggest problem that the DF distribution system faces is the loss of potable water which can reach upwards of 60% of the total water in the distribution system. This permits many DF zones to be without water service or with intermittent service. The important DF delegations or city subdivisions/boroughs of Álvaro Obregón, Coyoacán and Cuajimalpa are the major but not only delegations that feel the affect of these problems.

In a city where the population grows almost unabated and where the geography is very irregular and thus impedes the delivery of water to its inhabitants, the need to have a more efficient potable water system and a reliable distribution system is clear. In addition, the excessive DF aquifer extraction has forced DF and Conagua officials to bring water into the DF from basins outside of the Valley of Mexico. In light of the uniquely high and difficult DF terrain, bringing in water from outside of the Valley of Mexico has provoked the need for the construction of 227 pumping plants to get water to the 1.5 mile high city and then to provide water to its even higher areas.

The DF potable water distribution system is made up of a principal and secondary network. The principal network has 690 kms of pipelines of between .5 and 1.7 meters in diameter. The secondary network has more than 10,000 kms of pipelines of .5 meters in diameter along with 243 storage tanks with a 1.5 million cm<sup>2</sup> capacity. The DF Water System's 27 treatment plants and 377 chlorination stations supply close to 35,000 liters of potable water per second but this only meets 90% of the potable water requirements of its inhabitants. The DF potable water supply has always been problematic but this has been accentuated in recent years but some extreme drought conditions. As a result, the DF invested only a modest sum, 1 billion pesos (\$ 83.3 million USD) in 2009, to begin the rehabilitation of potable water lines.

For the improvement of the potable water supply, the DF has a total budget through 2012 of 4.47 billion pesos (\$373 million USD). From these funds, Wisconsin's Trade Office in Mexico expects more related works during 2011 and 2012. It is important to mention that these funds are strictly DF funds and additional Conagua funds for these projects will make total available money more than double the above mentioned amounts. While DF potable water projects will move forward in 2011, it is important to mention that an even greater ongoing priority is in the rehabilitation of the DF deep drainage system.

### **Deep Drainage System Situation in Mexico City**

The DF system for carrying waste water out of the Valley of Mexico consists of three areas: (a) the above-ground Great Canal, (b) complementary river systems (principally the Hondo River, the Churubusco River, and the De la Piedad River) and (c) the subterranean Deep Drainage System. The DF Deep Drainage System was constructed in 1967 and put in operation in 1975. It is made up of a 6.5 meter in diameter tunnel designed originally to remove waste water and rain.

Originally, it was designed to work exclusively during the rainy season and that during the low water season, it could be closed for inspection, cleaning and maintenance. However, due to some regional collapses in lands affected by these structures, it has not been possible to inspect these tunnels as had been hoped. And, last year, when the tunnel was temporarily closed for some partial inspections during the dry season, an unexpected heavy rain occurred and severe flooding occurred in the eastern part of the city.

In general and as a result of this very controversial flooding incident, the attention of the water sector has refocused extensively on the rehabilitation of the DF deep drainage tunnels. As a result, DF investment on potable water infrastructure decreased last year by more than 50% vs 2009 totals, with said funds being transferred to Deep Drainage System projects.

This system includes a Central Issuer Channel, 9 interceptors with a length of 154 kms. Below is a table that shows general information about this system.

DF Deep Drainage System	Length (Km.)	Diameter (m)	Capacity (m3/s)
Central Emission Tunnel	50.0	6.5	220
Central Interceptor	16.1	5.0	90
Interceptor Center-Center	3.7	5.0	90
Interceptor East	22.2	5.0	85
Interceptor Center - East	16.0	4.0	40
Interceptor - West	16.5	4.0	25
Interceptor Iztapalapa	5.5	3.1	20

The Central Issuer has a capacity of 220 m3/s and function as the principal exit tunnel for rainfall

and waste water out of the Valley of Mexico and serves as the most important tunnel for the prevention of flooding in the DF.

The Central Interceptor, with a capacity of 90m<sup>3</sup>/s, relieves the De La Piedad River to help prevent floods and receives the sewer and drainage collections from the four most important city delegations.

The Interceptor Center-Center, with a capacity of 90m<sup>3</sup>/s, relieves almost 70% of the Mexico City downtown area and is interconnected with Interceptor East and Central Interceptor to facilitate the exit of waters to the Central Emission Tunnel.

The Interceptor East, with a capacity of 85 m<sup>3</sup>/s, runs north and south and has as principal function relieve to relieve the Great Canal of which 30% of the DF central area and 50% of the DF north area rely.

The Interceptor Center - East, one of the smaller interceptors with a capacity of 40 m<sup>3</sup>/s, joins Interceptors East and Central Interceptor, assisting the central section of the DF.

The Interceptor West, another smaller interceptor with a capacity of 25 m<sup>3</sup>/s, initiates in the southwest of the city and comes out into Rio Hondo whose waters come from 16 DF collector sources. This interceptor also is linked to the Chapultepec Park drainage system that helps prevent floods in this part of the city.

The Interceptor Iztapalapa, the smallest of the interceptors with a capacity of 20 m<sup>3</sup>/s, receives 80% of the waste water from the Iztapalapa Delegation, one of the largest and least developed in the DF.

### **Present and future Sewer and Drainage System Projects in Mexico City**

Currently, the DF Water System has allocated 5 billion pesos (about \$416.6 million USD) as investment funds through 2012 for the rehabilitation of deep drainage system tunnels damaged by the routine dragging of foreign objects and the degradation of the concrete from the vapors emitted by the waste water. In 2009, during the first two stages, the most damaged tunnels were rehabilitated. In 2010, 350 million pesos (over \$29 million USD) were invested in the formal maintenance of the rest of the deep drainage tunnels and 600 million pesos (\$50 million USD) will be allocated each year hereafter for regular maintenance of the system.

In the last 2 years, there have been three important public works projects in the DF Deep Drainage System. The two most important, both in northern Mexico City, are the “Pensador Mexicano” project (almost \$5.5 million USD) and the “Colonia Moctezuma” project (about \$7.25 million USD) both of which changed drains, storage units and key macro valves (“vaso regulador”) to prevent flooding. The third project, the “El Arenal” project, on the east side of the city, carried out the rehabilitation of pumping stations, created an increase in sewage capacity and replaced the drainage/tunnel network. Over 60 million pesos (\$5 million USD) were allocated for this last project. Beside the projects already mentioned, there are still additional needs in these technical areas, so new projects in other parts of the DF with similar investment amounts are expected during the next five years.

In most projects, when tunnel materials are changed, they are changed from concrete to high-density polyethylene since it has better resistance to the problems associated with regular Mexico City land movement and sinking problems. It is noteworthy that many of the Deep Drainage System problems are the result of leaks which are thought to represent as much as 40% of the water in the system at times. To date 2,000 km of drainage network has been changed but the drainage system has 12,000 km of network so still more than 80% of this replacement work still pending. Eventually, the recovered water flow will increase by 3m<sup>3</sup>/s which will lead to further flood prevention.

It is important to mention that the vast majority of products currently used for these Mexico City projects are manufactured by or at least sold by US companies since these products cannot be found in the Mexican market. In fact, water officials have said that better local distribution and service of these types of products would go a long way towards more comprehensive use of these materials as well as some important cost reductions. When unique materials or technologies are required for solutions in the DF, as is often the case, US companies should continue to expect that these future projects will represent good market opportunities.

### **Waste Water Situation in Mexico City**

Another one of the serious problems that the DF Water System has to face is the lack of waste water treatment and treatment capacity. Currently, there are 25 waste water treatment plants in the DF with an installed capacity of 6,640 lps. However, the capacity of these plants, 2,500 lps, represents only 38% of the capacity that would be needed to treat total DF waste water volumes. With this limited capacity and with the vision of treating DF waste water in Atotonilco, outside of the Valley of Mexico, it is not all that surprising that only 7% of DF waste waters are currently treated.

There are 6 waste water treatment plants in northern Mexico City with a combined installed capacity of 700 lps. In the central area, there are 5 plants whose combined installed capacity is nearly 5 000 lps, with the “Cerro de la Estrella” plant being the largest of these plants with 80% of the total capacity in the central area. Finally, in the southern area, there are 5 plants with a combined installed capacity of 800 lps. It is important to mention that 5 billion pesos (\$416.6 million USD) is currently programmed for the installation of new technology and to increase the production of treated waste water from 2.5 m<sup>3</sup>/s to 7.2 m<sup>3</sup>/s by 2012. In the future, the DF hopes that this water treatment will result in important, additional water reuses which will alleviate some DF aquifer concerns and eventually recharge aquifers.

Another challenge has to do with the storage of waste water prior to its treatment or delivery outside of the Valley of Mexico. Most waste water storage areas are located in the northern part of the city where all DF waste water is directed on their way out of the Valley of Mexico. However, this leads to an uneven, less than ideal distribution of waste water storage. To address this the DF has launched projects to add other reserve basins especially in the Iztapalapa area in the southern part of the city.

With recent flooding problems, the DF budget priority has been somewhat away from treatment plants and towards the rehabilitation of deep drainage system tunnels. However, the DF has made the rehabilitation of its existing waste water treatment plants, such as the “Milpa Alta” in southern

part of the city, a priority as well. On the potable water side, an important project is the construction of a potable water treatment plant in “Cerro de la Estrella”, in the south area of the city, which seeks to build an infiltration pond and to return this treated water to the aquifer – the first effort of its kind in Mexico. In addition, the DF has sought to invest in wetlands construction and similar “swamps” for waste water maintenance, especially in the water abundant areas of Xochimilco and Tlahuac in the southern part of the city which they hope will also help in with water level issues in these wetland areas.

## **Conclusion**

With the above information on DF potable water, waste water, and water treatment issues, we can get a glimpse of the DF water system and infrastructure challenges. These problems must be attacked on all fronts as they are circular problems. The exploitation of the DF aquifer for drinking water makes Mexico City land continue to sink, in some areas as much as 30 cm per year. With the fall in ground water levels, it is necessary to pump deeper producing lower quality water creating further land degradation which increases operation, maintenance and water purification costs. In addition, the supply and drainage network are affected as land subsidence creates more pressure and leads to cracks and fissures that causes 50-60% potable water loss. When you combine these problems with the lack of wastewater treatment and a growing population, one can visualize the seriousness of the challenge that the DF Water System faces – and the level of assistance that they are likely to require from domestic and foreign companies to help solve these problems.

The DF and Conagua have increased their budgets for DF water projects during the last few years with Conagua funding of DF water projects as its top priority, doubling funding from just over 5 billion pesos in 2009 to over 10 million pesos (over \$800 million USD) in 2010. This increase made the DF Conagua budget three times that of the State of Mexico and larger than the budgeted funds for the next five most important Mexican states. Still, these funds are clearly not enough to solve these problems in general and because too many important DF projects have had to be put off to address other more urgent and politically sensitive water issues.

In response to these realities, there have been some initial proposals to increase private sector participation in new infrastructure projects and rehabilitation and maintenance programs. Although these measures are still in planning stages, many water officials believe that this is the only way to address the problems of water sector in the DF. These types of programs will create more business opportunities for domestic companies and for foreign companies to provide products and technologies for better funded and therefore more generally stable integrated projects and solutions.