Extreme Drought in Puerto Rico: Lesson Learned

Introduction

Normally Puerto Rico receives an average of 72 inches of rainfall per year. For two consecutive years, rainfall was significantly less than the average. In 2013the overage rainfall recorded was 20% less than the average. In 2014 the drought was worst. In fact, the Government of Puerto Rico had already announced the implantation of water rationing. However, in late August, 2014 tropical waves brought enough rainfall to restore minimum operational levels of key reservoirs. In 2015, Puerto Rico suffered an exceptional drought with the aggravating factor that reservoirs had not recovered due to the droughts of the two previous years.

Exacerbating Factors

There are several situations that prevail in Puerto Rico which negatively impact water availability. These factors are discussed in this section.

Sedimentation of Reservoirs

The storage capacity of several of Puerto Rico's key reservoirs has been significantly limited by sedimentation. For example, the Carraizo Reservoir which supplies 35% of the demand of the San Juan Metropolitan Area, has lost 50% of its storage capacity due to sedimentation. Another example is the Dos Bocas reservoir, located 45 miles west from San Juan. This Reservoir also supplies 35% of the demand of the San Juan Metropolitan Area, Due to sedimentation, Dos Bocas reservoir has lost 63% of its storage capacity.

Water Hyacinth

Most of Puerto Rico's reservoir are infested with water hyacinth. Water hyacinth evaporate between 7 to 10 times more water compared to areas of the reservoir not covered by this plant.

Significant unaccounted water

According to the Puerto Rico Water and Sewer Authority (PRASA), 55% of drinking water production is unaccounted.

Salt Water Intrusion

Due to over pumping, the south coast aquifers are in critical state. Therefore, additional groundwater can't be pumped to compensate for the dwindling surface water supplies.

Water for Environmental Needs

According to local and federal laws a minimum flow must be maintained to satisfy ecological needs.

Measures Implemented to cope with the drought

Water Rationing

In May, 2015, PRASA implemented water rationing, in the eastern portion of the San Juan Metropolitan Area (SJMA). This area has around 500,000 inhabitants. The water rationing consisted of cutting services for 24 hours on alternate days. By mid-June, water rationing in the eastern portion of the SJMA was increased to 48 hours without services, followed by 24 hours of water supply services.

In mid-June, PRASA also implemented 24-hour water supply service interruptions on alternate day on the western portion of SJMA. Approximately, 400,000 inhabitants were affected. By mid-July water rationing in this area was increased to 48hours, followed by 24 hours of service.

At the beginning of August, as water supplies dwindled, PRASA increased water rationing in the eastern portion of the SJMA to 72 hours, followed by 24 hours of service.

Meanwhile, rationing spread all over the towns in the eastern and southern portions of Puerto Rico. The only portion of the island not affected by water rationing was the western area.

The situation got so bad that PRASA was getting ready to cut off service for six consecutive days in the western end of the SJMA. Luckily, in mid-September rain events occurred which eliminated the need to impose more severe rationing.

Rationing was completely eliminated for the SJMA in October, 2015. However, daily 12-hour water rationing continued in various municipalities of the south coast until December, 2015.

<u>Establishment of Water Distribution Stations</u>

PRASA established 44 water distribution stations in the eastern area of the SJMA and 39 water distribution stations in the western area of the SJMA. Tank trucks with drinking water obtained from wells were available to supply the needs of the inhabitants. Mayors supplemented the water supply stations by providing water to the elderly and handicapped though tank trucks. The Department of Consumer Affairs issued and ordered freezing the price of bottled water, cisterns, appurtenances for the installation of cisterns, plastic eating, utensils, antibacterial soap, among others.

• Curtailed use of water

PRASA issued an order that prohibited the use of water provided by the utility for construction, sandblasting, cleaning of roots, watering of plants, cleaning carports and sidewalks, washing cars, filling swimming pools, irrigating parks, among others. To improve enforcement of the order, PRASA approved in June, 2015. Regulation which establishes fines for violations. Private citizens could be fined up to \$250 per violation. Corporations and government could be fined up to \$750 per violation.

• Expedited Fixing of Broken Pipes

PRASA established addition to expedite the fixing of broken pipes, PRASA also regulated the help of the citizens in notifying PRASA of any broken pipe observed. 1-800 number and a twitter account were established for this objective.

Seeding of clouds

PRASA signed a contract with a company with experiences in seeding clouds in mainland United States. The contract was for 90 days. The results of this effort are still debated.

Intensive Education Campaign to Conserve water

PRASA unleashed an intensive education campaign urging the citizens of Puerto Rico to conserve water. The effort included specific measures to be taken by individual citizens.

• Reactivation of Abandoned wells

PRASA reactivated around 20 wells in the north coast that were used to supply tank trucks.

Additional Measures to Adapt the New Climate Reality in the Caribbean

EPA'S WaterSense Program

This water conservation program has been proven to reduce at least 40% of water demand at homes, office buildings and hotels. If this program had been implemented in the south coast, water rationing in that part of the island could have been averted all together.

Wastewater Reuse

Wastewater is currently being reused in the industrial sector and in a couple of resorts. Wastewater reuse must be increased to cover the demand of all golf courses, irrigation of parks, green areas and aquifer recharge.

Unaccounted Water

Unaccounted water 55% is not acceptable. This must be brought down by phases to at least than industry standard of 17%

Water Harvesting

Very little water harvesting is currently done in Puerto Rico, although it was done in the past. The Government of Puerto Rico need to enact laws requiring mandatory water harvesting.

Dredging of Reservoirs

Although very expressive, key reservoirs must be dredged to restore the optimal water storage capacity.

• Implementing Erosion Controls

To minimize expensive dredging of reservoirs, strict erosion controls must be implemented. The Government of Puerto Rico since the year 2000 has planted over 1 million trees. The Government of Puerto Rico has established tax incentives for owners of private property that maintain a vegetation buffer zone along rivers and streams. Both the Puerto Rico Environmental Quality Board and the United States Environmental Protection Agency has stepped enforcement efforts to ensure compliance with erosion control measures during construction activities.

<u>Continuous Water Conservation Education Program</u>

To effectively create a water conservation culture, the government must develop and implement a continuous education campaign. Education campaigns during droughts only have short term effects.

Conclusion

Due to Climate Change, less rainfall is expected in the Caribbean Antilles. In addition, droughts are expected to be more frequent and intense. Therefore, we must implement measures to reduce the impact of the new climate reality. Among these measures are safe reuse of treated wastewater, intensified water harvesting, reducing water loss in the distribution system and implementing water conservation practices at homes, commercial establishments and the industrial sector.

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