# Striving for Positive Water Impact

*Lessons from a Partnership Approach in Five Watersheds*

Phoenix, Arizona, United States

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Boxford, Suffolk, United Kingdom

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Zhanjiang, Guangdong Province, China

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Sangareddy, Andhra Pradesh, India

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Mexico City, Federal District, Mexico

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PEPSICO

The Nature Conservancy

**“The Nature Conservancy is drawn to this partnership with PepsiCo because we want to work with companies that can help us bend the trajectory of our common water future toward a more positive outcome by promoting widespread adoption of sustainable water practices.”**

# Executive Summary

Availability of water is an inherently local phenomenon, defined by the supply, demand and quality of water within a watershed. Ecological and social impacts associated with unsustainable water use are similarly local by nature. PepsiCo is proactively working to protect the watersheds in which it operates, to help ensure that the company will continue to have the water it needs to support its operations and supply chain. PepsiCo was one of the first companies of its size to formally and publicly acknowledge water as a human right, thereby accepting the responsibility to help ensure that all watershed stakeholders have enough clean water to meet their basic human needs.

### Addressing Water-Related Risk

As the issue of water-related risk continues to grow in significance, companies and stakeholders need a more detailed understanding about how this risk manifests itself and can be addressed in different watersheds. Pilot studies, like those described in this report, help to inform the development of a strategy around corporate water risk management and illustrate what "sustainable water use" might look like.

### PepsiCo and The Nature Conservancy Partner to Better Understand Water Risk

PepsiCo and The Nature Conservancy have partnered to launch five Positive Water Impact pilot projects focused on understanding the watershed conditions and restoration opportunities for a group of diverse manufacturing plants in different parts of the world. The foundation of this understanding came through identifying the areas that PepsiCo influences through its use of water and the impacts and risks of that use. Our research helped identify optimal sub-watersheds for restoration, potential activities for improving water conditions, and the estimated benefits and costs associated with these activities. Engagement by local business units has been critical to this initiative.

By carefully examining the water balance in each watershed, and by thinking and acting proactively to avoid or minimize water risks in those watersheds, we believe that PepsiCo can make a substantial contribution toward sustainable water use in the places the company works. We hope that our experiences can inform other corporations facing similar challenges.

In collaboration both organizations achieved more than either partner could independently. PepsiCo's global presence and broad spectrum of sites provide a wide and diverse platform for testing and implementing The Nature Conservancy's approach to watershed protection and freshwater conservation. Achieving Positive Water Impact in a given watershed means that PepsiCo will make more and better water available to the environment and the communities within that watershed.

### What We Learn Will Be Broadly Applicable

Throughout the pilot process, we found that collecting information and making decisions was a highly iterative process. The importance of knowing a site's water source was illustrated early on; the question of stress depends more on the location of its water supply than the location of a facility.

The information and experience gained through these pilots will provide a framework for developing a tool for identifying, designing and evaluating watershed remediation strategies that are relevant to the specific challenges that individual sites face. The first component of this method is a watershed "diagnostic" that relies on a number of focused questions to help a site determine whether it is at risk of water stress, evaluate the level of risk, and identify the need for watershed restoration actions. The next component allows sites to use their local situation as a guide to potential action. This typically takes the form of a decision tree that results in identification of potential actions for each situation.

Given the importance of watershed management to PepsiCo, all of the company's business sectors are contributing to this global initiative with The Nature Conservancy. The pilot phase of the project included direct funding, and both PepsiCo corporate and business unit staff have provided additional in-kind support.

At the time of publication, specific initiatives and funding levels for Phase Two of Positive Water Impact were being explored and assessed.

# What Does "Sustainable Water Use" Look Like?

**From The Nature Conservancy**

From the global level, the water future is looking rather bleak. Virtually all reports and forecasts suggest that the global water crisis will only get worse. Global water use doubled between 1951 and 2002.[1] Today, nearly 3 billion people are living in river basins with "severe" water scarcity during at least part of the year.[2] For a substantial portion of the global population, the availability of water for drinking, bathing, growing food and generating electricity seems to become less certain every year.

The vast majority of the water we consume—more than 90 percent—goes to agriculture.[2] This agricultural production is essential to feeding our global population and supporting our economies. However, today the lack of food security and access to safe drinking water affects more than 800 million people in the world. This situation could worsen considerably as agricultural demands increase in the next 50 years. Without further improvements in water productivity or major shifts in production patterns, the amount of water consumed by agriculture could increase by 70–90 percent by 2050.[3]

Our water challenges are not restricted to agricultural water use. More than 80 percent of the sewage from cities and factories in developing countries is discharged into rivers and lakes without any treatment.[4]

The human species is not alone in feeling the impacts of water shortages or pollution. Populations of freshwater species have declined by 50 percent since 1970,[5] including many fish species that feed people.

When we look closely at local watersheds and communities, many opportunities for better water management become apparent.

At the same time, a sufficient supply of safe water is essential for businesses to operate, and they have considerable power and opportunity to influence the water situation, now and in the future. About 20 percent of global water consumption goes into generating products—primarily agricultural—for international trade.[2] Much of the remaining 80 percent of water consumption also appears to be connected to commercial markets. For instance, nearly two-thirds of all water use in the U.S. is for "indirect" purposes, meaning that it is used to produce ingredients for commercial products.[6] The food and beverage industry accounts for 30 percent of that indirect water use in the United States.

These water facts help to explain why The Nature Conservancy is partnering with PepsiCo to develop new approaches that address global water challenges. As one of the world's largest food and beverage companies, PepsiCo has considerable influence over water use in many countries. But numbers tell only part of our story.

The Nature Conservancy is drawn to this partnership with PepsiCo because we want to work with companies that can help us bend the trajectory of our common water future toward a more positive outcome by promoting widespread adoption of sustainable water practices. As discussed in this report, PepsiCo is committed to ensuring a Positive Water Impact, meaning that the company will "make more and better water available to the environment and the communities where we and our suppliers operate." We've started looking closely at five pilot locations, where we believe that we can make the water future better.

In contrast to the bleak appearance of the global water situation, we're finding that when we look closely at local watersheds

and communities, many opportunities for better water management become apparent. Together, we hope to create some rays of hope that can inspire and mobilize others.

1 Petra Döll, Kristine Fiedler, and Jing Zhang, "Global-scale analysis of river flow alterations due to water withdrawals and reservoirs," *Earth System Science*, no. 13 (2009): 2413–32.

2 Mesfin Mekonnen and Arjen Y. Hoekstra, *National Water Footprint Accounts: The Green, Blue and Grey Water Footprint of Production and Consumption*, report, vol. 1, series 50 (Delft, the Netherlands: UNESCO-IHE Institute for Water Education, 2011).

3 David Molden, ed., *Water for Food, Water for Life: Comprehensive Assessment of Water Management in Agriculture* (London: Earthscan and Colombo: International Water Management Institute, 2007), p. 645.

4 UN World Water Assessment Programme, *Water in a Changing World: the United Nations World Water Development Report 3*, vol. 2 (London: Earthscan, 2009), p. 318.

5 Millennium Ecosystem Assessment, *Ecosystems and Human Well-Being: Synthesis Report* (Washington, DC: Island Press, 2005), p. 160.

6 Michael Blackhurst, Chris Hendrickson, and Jordi Sels i Vidal, "Direct and Indirect Water Withdrawal for U.S. Industrial Sectors," *Environmental Science Technology* 44, no. 6 (February 8, 2010), 2126–30.

**From PepsiCo**

At PepsiCo, water is fundamental to our ability to operate efficiently and vital to the communities we serve. Water stewardship is a central part of "Performance with Purpose"—our mission to deliver sustainable growth by investing in a healthier future for people and our planet.

As part of this commitment, we unveiled a set of global goals in early 2010 organized around a straightforward premise: We will respect the human right to water through world-class efficiency in our operations, preserving water resources and enabling access to safe water. Specifically, we have committed to:

- Improving our water use efficiency by 20 percent per unit of production by 2015;
- Striving for "positive water balance" in our operations in water-distressed areas; and
- Providing access to safe water to 3 million people in developing countries by the end of 2015.

In doing this, we made a strategic decision to implement protective policies and procedures, rather than apply mitigating measures reactively.[7] We now face the challenge of integrating these principles into our business at every level. An important step toward this integration is building awareness among diverse stakeholders.

PepsiCo has made great strides on our water stewardship journey over the past decade. We have developed water treatment, chemistry and eco-efficiency expertise within our facilities around the world, serving consumers in more countries than the United Nations has members.


**Doubled**

**Global water use doubled between 1951 and 2002.**

**3 billion**

**Nearly 3 billion people live with severe water scarcity.**

**50%**

**Freshwater species declined by 50 percent since 1970, including many fish species that feed people.**

**800 million**

**Today the lack of food security and access to safe drinking water affects more than 800 million people in the world.**

**Achieving Positive Water Impact at PepsiCo means that we will make more and better water available to the environment and the communities where we and our suppliers operate.**

We are working hard to reach our goals by minimizing the impact our business has on the environment and collaborating with industry peers, governments, academia, nongovernmental organizations (NGOs) and communities. As our journey evolved to become more holistic and comprehensive, we sought out partners of global renown who could share the value of the collaboration—one such partner is The Nature Conservancy.

Our business units are very active in addressing water challenges. For example, in 2009 PepsiCo India achieved a "positive water balance"—giving back more water to the community than our facilities consumed, which was verified externally by Deloitte LLP. In 2010, the balance became more positive as the volume of water saved and returned exceeded the volume consumed by a greater margin.

Positive Water Impact, as this report describes, is a natural evolution of positive water balance. Its focus is local, at the watershed level. It recognizes that beyond simply having enough water, people need to have water that's clean and safe to use. This connection between quantity and quality echoes the sufficiency and safety pillars of the human right to water, and is directly linked to water sources and their protection—topics in which The Nature Conservancy's leadership is globally recognized. By working together, we are able to leverage our complementary strengths. The Nature Conservancy's expertise in freshwater conservation and its scientific rigor enhance and strengthen PepsiCo's water stewardship initiatives. The variety of sites within PepsiCo provides a natural platform for testing and implementing The Nature Conservancy's approach. Together, we exemplify collaboration directed at solving important problems.

[7] PepsiCo, *Water Stewardship: Good for Business, Good for Society*, report (Purchase, NY: PepsiCo., 2010), http://www.pepsico.com/Download/PepsiCo_Water_Report_FNL.pdf.

# What Are the Major Water Challenges of the 21st Century?

The availability of water varies greatly from place to place as it gathers in local watersheds.

**As we enter the second decade of the 21st century, the global dialogue around water is showing signs of both maturation and anxiety for the future. Ten years ago, there were ominous pronouncements forecasting that this century's wars would be fought over water, yet this decade's discourse has turned toward the economic consequences of water scarcity, or more precisely, business risk.**

Business risk around water can manifest itself in a variety of forms, but it generally falls into two primary categories: physical risk and reputational risk. Physical risk is centered on the question of whether or not a company can expect to have sufficient supplies of clean water in the future to support its business. This area of risk can be influenced by increasing competition for water resources, mounting water scarcity, drought, climate change, water-source contamination, infrastructure failure, poorly managed water entitlement systems and other factors. Each of these stresses can lead to increasing financial costs for a company, such as higher energy costs required to deliver or treat water supplies, and higher insurance and credit costs. In more extreme cases, water supplies can be disrupted, or a company may be forced to close facilities or relocate. Reputational risk can occur if a company's water use comes into conflict with other water users and the diverse values that stakeholders hold with respect to water. Reputational risk can also result when surrounding stakeholders take a negative view of a company's operations. This type of risk can lead to value judgments being made against the company, and it may also trigger regulatory responses from governments that make it more difficult or costly to operate.

At least one in five of the global companies using the largest amounts of water is already experiencing damage to its business from drought and other shortages, flooding and rising prices.[8] Just this year, the World Economic Forum ranked water security among the top 10 global risks to businesses.[9] Analysts are also estimating that more than 20 percent of GDP is already at risk due to water stress.[10]

This atmosphere of heightened sensitivity to water-related business risk has given rise to numerous consultants, analysts and advisors claiming unique qualifications and capabilities for ascertaining water risks. New tools are becoming available for quantifying and prioritizing a company's water risks across its operations and supply chains. Numerous conferences and sector-specific roundtables have also assembled to provide forums for companies with similar business interests and risks to share water concerns and ideas.

However, there is still a great need for real-world experience in effectively managing water-related business risk. Pilot studies conducted in the factory and field are urgently needed to inform the evolution of thinking and strategy around corporate water risk management and to illustrate what sustainable water use looks like.

The water partnership formed between PepsiCo and The Nature Conservancy is designed as a first step to fill this need. We intend to learn by doing. We are taking our initial bearings from some basic realities of water, beginning with a focus on watersheds. Unlike the uniformity of carbon dioxide in the global atmosphere, the availability of water varies

greatly from place to place as it gathers in local watersheds. Use of that water must respect the limits of availability in each watershed to protect this important resource. The differences in water availability by watershed explain why ecological and social impacts associated with unsustainable water use are of a highly localized nature—it is very difficult to predict where such impacts may arise without understanding the water balance of local watersheds.

**PepsiCo embraces its responsibility to help ensure that all watershed stakeholders have enough clean water to meet their basic human needs, with the understanding that everyone holds a right to water.**

For that reason, we are focusing on the local watersheds and aquifers that supply PepsiCo facilities and farms as our geographic units of risk analysis. A watershed frames the water "bank account." By carefully auditing the withdrawals and deposits being made from the watershed account, we can better understand where imbalances may exist that could put strain on watershed stakeholders. Within that watershed account, we know that water withdrawals and pollution must be managed in ways that optimally yield benefits for all stakeholders, with attention to long-term economic, social and environmental sustainability. All watershed stakeholders are accountable to one another; we all share risk when water is not managed equitably and sustainably.

PepsiCo has begun to identify geographies where water risks appear to be moderate or high, and locations at which specific facilities and associated watersheds appear to have


**1 in 5**

**1 in 5 of the largest business water users is already experiencing significant water-related impacts.**

**10**

**The top 10 global risks to business include water security.**

**20%**

**More than 20 percent of GDP is already at risk due to water stress.**

the right enabling conditions for rapid learning. The company currently has five pilot watershed studies under way in which it is examining water budgets, assessing the sustainability of water use and designing watershed conservation activities that can improve water availability and/or quality. This report discusses some of our early findings from the following pilot sites:

- **Phoenix, Arizona, United States**
- **Boxford, Suffolk, United Kingdom**
- **Zhanjiang, Guangdong Province, China**
- **Sangareddy, Andhra Pradesh, India**
- **Mexico City, Federal District, Mexico**

In this report, we also outline the broader commitment that PepsiCo has made to have a Positive Water Impact in the local watersheds in which it operates. As a business accountable to its financial stakeholders, PepsiCo is looking for ways to ensure that it will continue to have access to sufficient quantities of clean water to sustain its business operations and supply chain while avoiding physical risk wherever possible. The company also embraces its responsibility to help ensure that all watershed stakeholders have enough clean water to meet their basic human needs, with the understanding that everyone holds a right to water. Importantly, the company is also committed to working with all water users to ensure enough clean water flowing through natural ecosystems to sustain their ecological health and the ecosystem services upon which we all depend.

By carefully examining the water balance in each watershed, and by thinking and acting proactively to avoid or minimize water risks in those watersheds, we believe that PepsiCo can make a substantial contribution toward ensuring sustainable water use in the places the company works. We hope that our experiences can inform other corporations facing similar challenges.

8 Environmental Resources Management Limited, *CDP Water Disclosure 2010 Global Report* (Carbon Disclosure Project, 2010), pp. 1–52.

9 Charles Emmerson, *Global Risks 2011: An initiative of the Risk Response Network*, report, ed. Nancy Tranchet, 6th ed. (Geneva: World Economic Forum, 2011), pp. 1–60.

10 Claudia Ringler, "Sustaining Growth via Water Productivity: 2030/2050 Scenarios" (lecture, International Food Policy Research Institute, Center for Development Research [ZEF], Bonn, April 19, 2011).

# Our Guiding Principles

**The Nature Conservancy and PepsiCo have agreed upon the following guiding principles for this study:**

**It's All Local**

Our first and most important focus is on water-stressed or water-scarce locations, but we aspire to integrate Positive Water Impact principles throughout PepsiCo's business. Doing this demands a robust method for identifying, evaluating and designing watershed remediation strategies that are relevant to the specific challenges faced by individual sites. This method, which will ultimately be used across the PepsiCo spectrum, must be applicable to small and large facilities, located in rural and urban settings, and operating in developed and developing economies. Consideration of local context ensures that a site's strategy will effectively address its specific water-related business risks or impacts. These could include scarcity, flooding, community access or declining quality, among others. The diversity of challenges guarantees that a generic solution would fit only a fraction of sites.

The vast majority of the water we consume—more than 90 percent—goes to agriculture.

**Cost Benefit**

It is important to devise a strategy or solution that makes local sense and is also affordable and timely. The Nature Conservancy's experience in watershed remediation provides insight into the time and resources required to "make a difference." In the "Promise of PepsiCo" commitments, PepsiCo has pledged to "strive for positive water balance in our operations in water-distressed areas."[11] In order to attach metrics to this pledge, we need to understand the costs and benefits associated with potential actions.

Consideration of local context ensures that a site's strategy will effectively address its specific water-related business risks or impacts.

**The Known Unknowns**

Water is complicated, and understanding a site's water situation requires insight into environmental, physical, political, economic, community and regulatory conditions. Often some of this information is unavailable or inconsistent. By initially focusing on a small number of sites, we have been able to identify the most efficient way to collect information and understand which information is essential.

[11] PepsiCo Inc., *2010 PepsiCo Annual Report* (PepsiCo, March 2011), http://www.pepsico.com/annual10/.

# What Have We Learned So Far?

**Active participation by local business units is absolutely necessary, and each of our pilot locations has provided feedback and suggestions throughout the process. This started with identifying pilot locations and has continued as the local teams have provided information on business conditions, community relationships and regulatory trends.**

### Nonlinear Process

The pilot process for each site was originally expected to progress stepwise from identifying area of influence, understanding impacts and risks, identifying optimal watersheds for restoration activities, identifying and designing effective interventions, and finally estimating benefits and costs associated with those activities. The process often progressed in a less straightforward manner. In some cases, information collected during one stage led to reevaluation of an earlier stage and then to a different path than expected.

### Water Source

The importance—and relative rarity—of knowing the source of a location's water became clear when we learned that one region indicated by multiple scarcity studies to be stressed[12,13] has historically obtained water via interbasin transfer from an area that does not appear to be threatened by water stress. This experience highlighted the need for a "diagnostic" that will help a site determine whether it is facing physical, economic, regulatory or other water stress.

### Local Business Focus

The importance of tailoring a project to local conditions—water availability, community needs and regulatory climate—was a driving force behind the Positive Water Impact initiative. Less obvious was the need to account for the focus of individual business units. In some areas, PepsiCo has been very active in local environmental and conservation projects, and leveraging these existing relationships and efforts can provide opportunities and partnerships unique to a specific location.

**PepsiCo supports the basic elements of the WHO/U.N. joint declaration on the human right to water and commits to the following:**

**Safety**
Ensure that our operations preserve the quality of the water resources in the communities in which we do business.

**Sufficiency**
Our operating objective is to ensure that our use of water will not diminish the availability of community water resources to the individuals or the communities in the areas in which we operate.

**Acceptability**
We will involve communities in plans to develop water resources, and assure transparency of any risks or challenges to the local governments and community members in an ongoing manner.

**Physical Accessibility**
We will ensure that our operations will not adversely impact physical accessibility of community members to community water resources and will address community concerns in a cooperative manner.

**Affordability**
We will appropriately advocate to applicable government bodies that safe water supplies should be available in a fair and equitable manner to members of the community. Such water should be safe and of consistent and adequate supply and affordable within local practices.

### Calculation Basis

With respect to the basis for calculating Positive Water Impact, a key question is whether the basis is 1) total PepsiCo water use, or 2) net consumption—total use minus quantity discharged.

No single answer applies in all cases, as there are:

- Some cases where it is clear that total water use must be offset to attain Positive Water Impact. For example, if a site's treated wastewater is discharged directly to salt water, then the discharged water is unavailable for further local use or support of the ecosystem. In this instance, the total water use must be our baseline for Positive Water Impact.
- Some cases where it is clear that net consumption must be offset to attain Positive Water Impact. For example, if a site's treated wastewater is discharged directly adjacent to the point of withdrawal and if the quality of the withdrawn water and discharge are similar, then the net consumption would be our baseline.
- Some cases where a more refined decision process is required. For example, if a site's treated wastewater is discharged to the same watershed from which water was withdrawn, but at a location significantly downstream from the withdrawal, then a site-specific evaluation is needed to determine an appropriate baseline.

Positive Water Impact calculations can be based on net consumption, provided that the wastewater discharged by PepsiCo is returned to a location near the point of withdrawal, with appropriate timing, and of sufficient quality to maintain the desired environmental conditions. If these conditions are not met, the calculations are based on total use.

A second question relates to how existing restoration activities are considered when calculating the Positive Water Impact target. The target could be based on "consumption minus existing restoration activities," with Positive Water Impact calculations considering only new restoration activities. Conversely, the target could be based solely on consumption, including all existing restoration activities, when calculating the Positive Water Impact target. The former approach is used here, such that existing restoration activities are subtracted from consumption prior to performing Positive Water Impact calculations.

[12] "Global Water Tool 2010," World Business Council for Sustainable Development (WBCSD), Global Water Tool, accessed July 2011, http://www.wbcsd.org/templates/TemplateWBCSD5/layout.asp?type=p.

[13] Stephan Pfister, Annette Koehler, and Stefanie Hellweg, "Assessing the Environmental Impacts of Freshwater Consumption in LCA," *Environmental Science and Technology* 43, no. 11 (June 1, 2009): 4098–4104.

# Water Mitigation Efforts Under Review

## Positive Water Impact Process

The pilot process often progressed in a nonlinear manner, but these were the steps we covered for each location:

- Select Pilot Sites
- Identify "Area of Influence"
- Understand Impacts and Risks
- Identify Optimal Watersheds for Restoration
- Identify Restoration Activities
- Calculate Benefit Associated with Each Restoration Activity
- Estimate Costs Associated with Each Restoration Activity

### Phoenix, United States

Irrigation system improvement and upgrades

Municipal groundwater mitigation

### Mexico City, Mexico

Rainfall retention in mountains

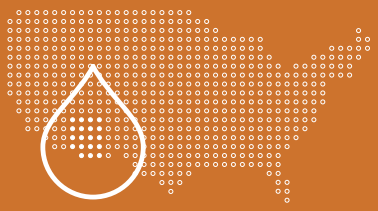
Restoration of Tláhuac-Xico Lake

Wastewater re-use


Boxford, England
Wastewater re-use
Sangareddy, India
Rainwater harvesting at facility
Rehabilitation of defunct water infrastructure in local villages
Improved irrigation practices
Zhanjiang, China
Wastewater re-use
Rainwater harvesting at facility
Rainwater harvesting from surrounding rural areas

# Phoenix, Arizona, U.S. Pilot

There are three PepsiCo facilities located in the Phoenix, Arizona area, including two bottling plants in Tolleson and Phoenix and a Frito-Lay plant in Casa Grande.



**Mitigation Efforts Under Review**

- Irrigation system improvement and upgrades
- Municipal groundwater mitigation

### Water Use in PepsiCo Facilities

The PepsiCo facilities in the Phoenix area receive water from a mix of groundwater and surface water sources, with Casa Grande relying primarily on groundwater and Phoenix and Tolleson bottling plants relying on surface water. The average annual water use at each facility varies, from 506,110 cubic meters at the Casa Grande plant to 589,390 cubic meters at the Phoenix bottling plant, to 1,516,440 cubic meters at the Tolleson facility, based on the last four years of water use data. PepsiCo decided to focus restoration actions on surface water for this pilot site. Therefore, the Positive Water Impact goal for this round of assessments is limited to the Phoenix and Tolleson bottling plants, which together use an average of 2,105,830 cubic meters of water annually.

### Watershed History and Trends

Water is provided to the Tolleson and Phoenix facilities by the Salt River Project, with 80 to 90 percent sourced from surface water in the Verde, Salt and Gila River basins and the remaining 10 to 20 percent from local groundwater. The Verde River was selected as the focus of PepsiCo's Positive Water Impact work in this pilot site area for several reasons. Thirty to forty percent of Salt River Project water originates from the Verde system and a high level of competition for Verde water exists among upstream water users. There is great potential for restoration and water efficiency projects in the Verde basin and the river is recognized and valued by the local community as an important economic, environmental, cultural and recreational asset worth protecting.

The majority of land in the upper Verde watershed is publicly owned, but the majority of the lands overlying the aquifer in the upper Verde Valley are privately owned or designated as Arizona State Trust Lands. This leaves the aquifer open to threats of dewatering from urban and suburban development. The cities of Camp Verde, Cottonwood and Clarkdale in the lower Verde Valley utilize regional and alluvial groundwater as public water supplies and ditch companies use surface water for irrigation.

Key sources of stress to the river include surface water diversions, groundwater pumping, invasion of non-native species and climate change. Seven large diversions take surface water from the Verde River for irrigation of crop lands and lawns and to supply recreational water features. Existing diversion structures are primitive and do not allow for control of the amount of water that is diverted. Most of the ditches drain excess water all the way to the terminus of the ditch before spilling it back into the river. This represents many miles of unnecessarily diverted water and causes evaporative losses that should be avoided to the extent possible. Crop irrigation and other surface water uses deplete the natural flow through the Verde Valley by more than 1.7 cubic meters per second.

### Restoration Activities Evaluated

Three potential restoration activities were identified for restoring water flow in the Verde: 1) the purchase of water rights for conservation purposes, 2) municipal groundwater mitigation, and 3) irrigation system improvements. With respect to irrigation system upgrades, staff from The Nature Conservancy have been working collaboratively with irrigation ditch companies to develop a strategy for improving diversion

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structures and the efficiency of water delivery systems. These improvements will enable a more effective, efficient and flexible water management system in the Verde Valley and contribute to improved river flows. This interaction has shown that each ditch in the Verde Valley requires unique consideration, because each ditch operates differently and

is influenced by variables that are specific to the existing water delivery system. For this reason, calculation of irrigation benefits that could be widely extrapolated as a pilot was not considered feasible for the Verde. As a result, our more detailed assessment of restoration alternatives focused on purchasing of water rights and municipal groundwater mitigation.

### Purchase of Senior Water Rights for Conservation Purposes

Restoration activities in the Verde are constrained by the presence of state and federal laws that dictate how water use is allocated. Water users are granted "water rights" that dictate the amount of water they can use and how the water can be used. Water law in the western United States is based upon a system where preferential, or senior, water rights are given to the first entity to remove water from a stream for beneficial use (e.g., agriculture). The entity with the oldest claim has the right to continue using that same quantity of water indefinitely, as long as that much water is naturally available and the water is applied to the same beneficial use. Water users can use the water for their own beneficial purposes, provided that water is still available to support the uses of those with senior water rights. Water rights are commonly overallocated, such that those who possess more recent water rights may not have access to water in a given year if the total quantity of water available is less than what is claimed by more senior rights. This legal system can greatly confound restoration of river flows, as any water that is returned to the stream via restoration activities is subject to use by those with water rights that would not have been otherwise satisfied.

However, a legal mechanism does exist that can provide protection of any "saved" or unused water, thereby allowing it to remain in the river. The specific activity under consideration in the Verde is the purchase of water rights presently being used for irrigation, and transfer of these rights to an instream beneficial use of supporting aquatic life. The water rights to be purchased must be senior enough to ensure that purchased water remains in the stream, and cannot be claimed by other users. The Nature Conservancy has recently completed two purchases of senior water rights, restoring 3,947 and 260,264 cubic meters of water per year to the Verde. The Nature Conservancy has subsequently identified several priority properties associated with senior water rights for acquisition that present additional opportunities for PepsiCo to protect and restore river flows.

### Municipal Groundwater Mitigation/Water Banking

Many municipalities in Arizona use groundwater as their water supply, and discharge their wastewater to otherwise dry channels where the water provides no beneficial use. Some municipalities are now considering construction of groundwater recharge facilities that will facilitate the infiltration of their wastewater to recharge local groundwater. This approach to groundwater mitigation can be used to contribute to stream flow restoration in the Verde via the concept of water banking. State law in Arizona complicates the purchase of water rights for conservation purposes by specifically attaching the water right to the specific plot of land where the water is to be used, as well as to the nature of the use. Purchased water rights can be severed from the original plot of land and used for instream beneficial purposes, but must be transferred either to the State of Arizona or a political subdivision (such as a municipality). Municipalities can receive state water credits through groundwater mitigation; these credits allow municipalities to have instream beneficial uses via the purchase of water rights transferred to them. This water banking system is still under development, but shows promise as a means for restoring water in a system controlled by complicated laws.

In addition to the pilot, PepsiCo is conducting other activities to contribute to Positive Water Impact. For example, the Casa Grande Frito-Lay plant has improved its water use efficiency by 24 percent from 2006 to 2010 by investing in improvements at the plant.

## Boxford, Suffolk, UK Pilot

PepsiCo operates a juicing and bottling plant at Copella Hill Farm, located in Boxford, Suffolk, UK.

**Mitigation Efforts Under Review**

- Wastewater re-use

### Water Use in PepsiCo Facilities

The Boxford plant used approximately 80,000 cubic meters of freshwater per year in 2009 and 2010. The plant treats its own wastewater on-site and discharges the treated wastewater into a lagoon, where a portion of the water is used for agricultural irrigation purposes and the majority of the remainder is sprayed on the fields surrounding the site. A small amount of water is believed to be lost via evaporation from the pond, while another 6,760 cubic meters per year are evaporated through cooling water.

### Watershed History and Trends

This facility currently receives roughly 75 percent of its water from a municipal water supplier, with the remainder coming from an on-site, 72-meter-deep borehole. The source of the municipal water is split roughly evenly between surface water and groundwater. The surface water is primarily taken from among 18 storage reservoirs that are filled by pumping water from local rivers during periods of sufficiently high flow. The municipal water supplier receives its groundwater from wells located throughout the region. Overabstraction of groundwater

is a serious concern, and the region in which the facility is located is the driest in the country. Local rainfall is roughly one half of the national average, with rainfall narrowly exceeding evaporation. Historical changes in groundwater levels show wide variability across the aquifer, with some wells showing no historical decrease in water level and others showing a localized decrease of tens of meters. In addition to concern about existing overabstraction, government agencies forecast a significant future increase in water demand due to an up to 20 percent increase in the population served by the water supplier by 2035.

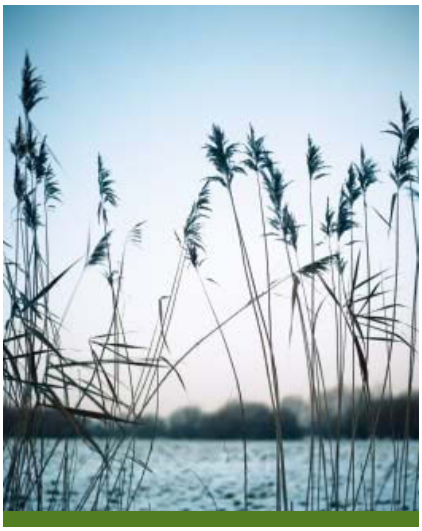
### Restoration Activities Evaluated

Because the facility receives water from a regional surface and groundwater supply as well as a local groundwater aquifer, potentially viable restoration alternatives to be considered are those that: 1) facilitate groundwater recharge to the aquifer local to the facility, 2) restore flows upstream in the municipal water supply watershed, or 3) reduce abstraction of water from either of these areas. As part of this project, The Nature Conservancy initially identified a wide range of potential restoration activities for the Boxford facility. Initial preference was given to restoration alternatives that had already been identified at the facility by PepsiCo and their water supplier. PepsiCo is currently considering numerous water re-use projects, as described below. Wastewater re-use will directly support Positive Water Impact to the extent that it will reduce existing water use. The Boxford plant previously evaluated capturing rainwater for direct use in the plant, which would also reduce existing water use, but determined that the small volume of water available limited the value of this approach. Other potential restoration alternatives were considered but determined to be poorly suited for the Boxford site.

### Wastewater Re-Use

The Boxford facility currently applies a portion of their wastewater to agricultural irrigation use. The salinity of the wastewater is currently too high to allow for wider agriculture irrigation use, as certain local agricultural products (e.g., soft fruits) require water with lower levels of dissolved sodium. Plans are being considered for increased re-use of the wastewater, which will require additional treatment of wastewater quality. The re-use alternatives under consideration are: 1) more widespread irrigation use to include soft fruits, 2) direct re-use of the effluent within the plant not as ingredient water but for primary washing of apples followed by utility use, and 3) discharge of the wastewater directly to the River Box, the local surface water body.

The alternatives of increased irrigation and direct use will both result in decreases in the amount of water that needs to be abstracted and will directly contribute to Positive Water Impact. Additional study will be needed to determine the extent to which direct discharge of the wastewater to the River Box will contribute to Positive Water Impact, because the river is not the original source of the water that is used by the plant. ●



**The region in which the facility is located is the driest in the country. Local rainfall is roughly one half of the national average, with rainfall narrowly exceeding evaporation.**

## Zhanjiang, Guangdong Province, China Pilot

PepsiCo operates a bottling plant in Zhanjiang, on the eastern coast of the Leizhou Peninsula. This facility is located on an inlet to the South China Sea.

**Mitigation Efforts Under Review**

- Wastewater re-use
- Rainwater harvesting at facility
- Rainwater harvesting from surrounding rural areas

### Water Use in PepsiCo Facilities

The annual water use for this PepsiCo facility in 2010 was 118,259 cubic meters, with 46,069 cubic meters per year leaving the facility as wastewater. The wastewater is sent to the municipal wastewater network and ultimately discharged into the South China Sea. Since the wastewater provides no freshwater benefit, the Positive Water Impact target for this facility corresponds to the total water use of 118,259 cubic meters per year minus the 2,435 cubic meters per year currently being applied for beneficial re-use, or 115,824 cubic meters per year.

### Watershed History and Trends

Water for this facility is provided from the Xiashan Lindong water plant of the Zhanjiang water company. The utility draws its water from two local wells at 200-meter depth. Groundwater abstraction in the metropolitan area began in the 1950s and excessive groundwater withdrawal has been identified as a problem in recent decades. Water levels at monitoring wells near the city dropped by as much as 30 meters

between 1966 and 2004, with a significantly higher rate of decrease since the 1980s.[14]

### Restoration Activities Evaluated

A tiered procedure was used to identify potential watershed restoration activities for consideration in this pilot project. The first tier of this procedure was to identify the subset of all restoration activities that were potentially applicable at Zhanjiang. Since the plant receives its water solely from groundwater, potentially viable restoration alternatives to be considered are those that either reduce groundwater abstraction or facilitate groundwater recharge. Proposals included water re-use, municipal water conservation, rainwater harvesting, and improved irrigation practices. The Zhanjiang plant is currently providing re-use of some of its treated wastewater on-site for irrigation purposes, and is considering expanding this re-use to other nearby areas. Beneficial re-use of wastewater therefore qualifies as a prime candidate for consideration. Municipal water conservation was not considered in detail because of the current public perception that water is inexpensive and plentiful, which would serve as a serious deterrent to its acceptance. Improved irrigation practices were not considered because drip irrigation has already been widely implemented in the area, so that further improvements would be expected to provide little additional benefit. In response to the above factors, PepsiCo selected beneficial re-use and rainwater harvesting as the restoration alternatives to be considered in this pilot.

### Beneficial Re-Use of Wastewater Effluent

The first restoration alternative to be quantified consists of beneficial re-use of wastewater effluent. The plant has already implemented this activity on-site, by using treated wastewater to irrigate lands surrounding the facility. A total of 2,435 cubic meters per year of wastewater is being used on-site at the plant facility. This re-use directly offsets irrigation water that would otherwise be taken from the municipal water supply. It provides a restoration benefit of 2,435 cubic meters per year. This amount of re-use fully satisfies all irrigation needs at the facility, such that on-site use of treated wastewater cannot be increased to provide a greater amount of restoration. As discussed below, other beneficial uses of this wastewater are now being investigated.

### Rainwater Harvesting

The second restoration activity under consideration was rainfall harvesting to support aquifer recharge. Two types of rainfall harvesting were considered: 1) harvesting of rainfall directly from the PepsiCo facility and 2) harvesting of rainfall from rural areas.

**The first restoration alternative to be quantified consists of beneficial re-use of wastewater effluent. The plant has already implemented this activity on-site, by using treated wastewater to irrigate lands surrounding the facility.**

Harvesting of rainfall directly from the PepsiCo facility will provide a relatively low-cost option for returning water to the local aquifer. Because the natural vegetation and infiltration capacity of these areas have been disturbed on the plant site, rainwater harvesting can help to restore some of the aquifer recharge function of the site. Harvesting of rainwater from the facility roof requires remodeling of the roof drainage network, including realignment of the collection gutters, reconnection of gutter spouts (outlets) to selected downpipes through a network of horizontal conduits, and installing collection chambers fitted with filters at the receiving end of the downpipes. The harvested water can be channelized to a sunken pond and a recharging pit. Historical precipitation data, combined with information on the size of the facility, were used in estimating that 2,550 cubic meters of water per year can be captured on-site.

Harvesting of rainfall from rural areas was considered as an additional restoration option because the total amount of water restored from wastewater re-use and rainfall harvesting from the facility will not be sufficient to meet the Positive Water Impact goal for this site. A rainfall-runoff model based upon the Runoff Curve Number method as implemented in the Soil & Water Assessment Tool[15] was applied to estimate the amount of runoff that could be captured via rainwater harvesting from rural lands. This model requires inputs describing climate, land cover, soil type and topography. Daily meteorological data was obtained for Zhanjiang for the period 2001 to 2010, and local PepsiCo staff provided soil characteristics. The model was applied to determine the amount of water that could be recharged to the aquifer, beyond what currently infiltrates under existing conditions. Model results indicate that 6,000 cubic meters of water per year can be restored per hectare of land devoted to rainfall harvesting. Approximately 20 hectares of rural land would need to be devoted to rainfall harvesting to restore a quantity of water equivalent to the 118,259 cubic meters per year of water currently used by the facility.

### Other PepsiCo Activities

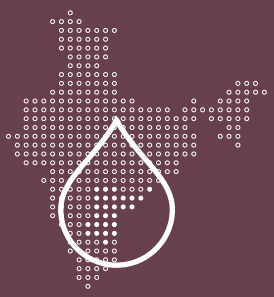
PepsiCo is working with the local government to develop a program that would allow their wastewater effluent to be used for irrigation elsewhere in the community, thereby reducing the current groundwater extraction. The benefits of expanded application of re-use have not been quantified as part of this project. ●

[14] Zhou Xun et al., "Evolution of the Groundwater Environment under a Long-term Exploitation in the Coastal Area near Zhanjiang, China," *Environmental Geology* 51, no. 5 (January 2007): 847–56.

[15] Susan L. Neitsch et al., *Soil and Water Assessment Tool Theoretical Documentation: Version 2005*, report (Temple: U.S. Department of Agriculture—Agricultural, 2005), pp. 1–476.

# Sangareddy, Andhra Pradesh, India Pilot

The bottling plant of Aradhana Foods & Juices Private Limited, a PepsiCo India unit, is located in the village of Pothireddypalli, near the township of Sangareddy in the Medak District of south central India.



**Mitigation Efforts Under Review**

- Rainwater harvesting at facility
- Rehabilitation of defunct water infrastructure in local villages
- Improved irrigation practices

### Water Use in PepsiCo Facilities

The current water intake for this plant is 420,000 cubic meters per year for all purposes. The plant discharges 160,000 cubic meters of treated wastewater per year, all of which is applied on plant grounds. This wastewater application is neither creating a beneficial use nor offsetting the use of another water source. The Positive Water Impact target for this facility corresponds to the total water use of 420,000 cubic meters per year. It is noted that expansion of the plant is being considered, which is likely to increase the Positive Water Impact target to an estimated 730,000 cubic meters per year in the future.

### Watershed History and Trends

This facility currently receives its water from the Manjeera River. The reservoir formed by the dam is the primary source of water supply in the surrounding villages. PepsiCo historically drew water from three bore wells within its premises; however, these wells are presently not used because the groundwater quality is insufficient to meet plant needs. Groundwater is still being used to support agriculture in the area, but water levels have been declining steeply over time. Urbanization and industrial growth have led to the progressive decline of groundwater levels. Nearly a decade ago, the groundwater level was 30–40 meters below the land surface, while today it is around 70–80 meters below the surface. Based on these observations, the groundwater level has been declining at a rate of 4 meters per year. Historical flow records for the Manjeera River are not available.

### Restoration Activities Evaluated

As part of this project, we initially identified a wide range of potential watershed restoration activities for the Sangareddy facility. Because the plant historically obtained its water from the depleted local aquifer, and now receives water from the Manjeera River, potential restoration alternatives to be considered are those that either: 1) facilitate groundwater recharge to the aquifer local to the facility, or 2) restore flows upstream in the Manjeera River watershed. Initial preference was given to restoration alternatives that had already been identified at the facility by PepsiCo India in support of its achievement of positive water balance. Alternatives included rainwater harvesting from the PepsiCo facility premises and rehabilitation of defunct water infrastructure in local villages. The total quantity of water potentially restored by these activities was found to be only a fraction of PepsiCo's water use, so additional restoration activities would be required to meet the site's Positive Water Impact target. The restoration alternative of improved irrigation practices was selected due to the capability to restore large quantities of water.

### Rainwater Harvesting

Rainwater harvesting is highly applicable for this site, as it is a practical strategy for replenishing the local aquifer that has become depleted through historical and continuing use. The short-term intense rainfall received in this area is a popular choice for harvesting due to efficiency and magnitude. Two types of rainwater harvesting were considered by PepsiCo to support aquifer recharge: 1) harvesting of rainwater falling directly on the roof of constructed area, and 2) harvesting of surface runoff in the open areas of the plant grounds.

Harvesting of rainwater from the facility roof requires remodeling of the roof drainage network. This would include realignment of the collection gutters, reconnection of gutter spouts (outlets) to selected downpipes through a network of horizontal conduits, installing collection chambers fitted with filters at the receiving end of the downpipes. The harvested water can be channelized to a sunken pond and a recharging pit. Historical precipitation data, combined with information on the size of the facility, were used to estimate that 15,290 cubic meters per year can be captured on-site.

Harvesting of rainfall can also be conducted on the open lands of the plant site, via capturing runoff in down-slope ponds and allowing it to infiltrate into the groundwater. Since the natural vegetation and infiltration capacity of these areas have been disturbed on the plant site, rainwater harvesting can help to restore some of the aquifer recharge function of the site. PepsiCo had previously estimated the area of open land potentially usable for surface runoff harvesting. This amount of land, coupled with local precipitation data and runoff coefficient, was used in estimating that 17,613 cubic meters per year could potentially be harvested from capturing surface runoff in open areas of the plant and returning it to the aquifer.

### Rehabilitation of Existing Water Infrastructure

PepsiCo had evaluated opportunities for the management of surface water resources in the surrounding villages that can be rehabilitated to increase their water harvesting potential, and provide recharge to the locally depressed aquifer. Five ponds have been identified in the local area, where heavy silting has reduced the water storage capacity and the associated groundwater recharge. The revamping of these five water bodies through deepening and de-silting can restore it to its original capacity and provide surface water in the local community. PepsiCo has estimated the water savings that could result from the revamping of existing water infrastructures. As per the estimates, the

**The short-term intense rainfall received in this area enhances the desirability of rainwater harvesting both in terms of efficiency and magnitude.**

revamping would enhance the water recharge potential of the existing water infrastructures by a total of 24,100 cubic meters per year.

**Irrigation Management**

Implementation of all of the restoration activities previously identified by PepsiCo and described above would restore 57,000 cubic meters per year, which is a fraction of the total water use of 420,000 cubic meters per year. Local villages are actively involved in agricultural practices and improvements in agricultural water use efficiency, such as irrigation management, which can produce considerable water savings.

The case study results of flood and drip irrigation methods in a nearby district show that water use efficiency of cotton cultivated under drip irrigation methods is significantly higher when compared with those under flood irrigation methods. In addition, environmental problems generally associated with flood irrigation methods, such as waterlogging and salinity, are also minimal under drip irrigation.[16,17] As a result of water savings, drip irrigation also helps to save a considerable amount of the electrical energy used for lifting water from wells. Water savings associated with a change to drip irrigation occur only when comparing irrigation methods for the same amount of irrigated area and crop production. Drip irrigation provides the capability to grow crops on land not otherwise suited for agriculture; if the switch to drip irrigation results in significant expansion of cultivated lands, the amount of water restored will diminish rapidly.

The water savings associated with switching to drip irrigation were estimated from the difference in water consumption reported between drip irrigation methods and flood irrigation methods, and calculated to be 554 millimeters of water per hectare per year. Using the appropriate conversion coefficients, this results in the water savings of 5,540 cubic meters of water per year for every hectare of cotton cultivation converted to drip irrigation from flood irrigation. Approximately 76 hectares of land currently using flood irrigation would need to be converted to drip irrigation to provide water savings equivalent to PepsiCo's current consumption of 420,000 cubic meters per year.

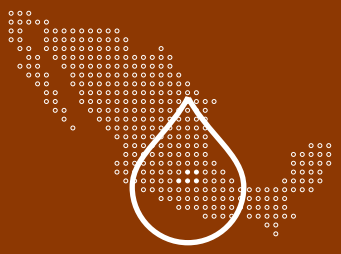
PepsiCo is contributing to Positive Water Impact in other ways beyond those discussed above. The Sangareddy facility is currently implementing advanced wastewater treatment, including reverse osmosis, to allow a portion of the wastewater it currently discharges to be used in plant utilities. This process will reduce the amount of municipal water that will need to be supplied to that facility and further contribute to our goals. ●

[16] Narayanamoorthy, A., *Efficiency of Irrigation: A Case of Drip Irrigation*, Occasional paper—45 (Mumbai: National Bank for Agriculture & Rural Development, Department of Economic Analysis & Research, 2005), pp. 1–128.

[17] Narayanamoorthy, A., "Economics of Drip Irrigation in Cotton: Synthesis of Four Case Studies" (paper, 7th IWMI-Tata Annual Partners' Meet, ICRISAT Campus, Hyderabad, April 2–4, 2008).

## Mexico City, Federal District, Mexico Pilot

PepsiCo has six food facilities located in the Federal District of Mexico City and a beverage facility nearby in Mexico State.



**Mitigation Efforts Under Review**

- Rainfall retention in mountains
- Restoration of Tláhuac-Xico Lake
- Wastewater re-use

PepsiCo and The Nature Conservancy evaluated several local watersheds that provide water to these facilities and selected the Xochimilco-Tláhuac watershed as the pilot site. The watershed selection criteria included the percent of water supply derived from the watershed, existing stakeholders working in the watershed, value of the watershed to local residents, security, current land protection status of the watershed, and value of and level of threat to biodiversity in the watershed. Due to the complexity of water stewardship in Mexico, The Nature Conservancy hosted a meeting with federal agencies, local agencies, universities and NGOs as part of the pilot site selection process and during development of restoration activities.

**Water Use in PepsiCo Facilities**

PepsiCo's water use in the basin currently averages 500,000 cubic meters per year (an average over 2009 and 2010). This compares to an overall allocated water use in the basin of 4,650 million cubic meters per year. The food facilities are served by the municipal water system, while the beverage

facility draws water from on-site groundwater wells. The Mexico City wastewater system is complicated, with several different wastewater treatment plants serving the municipal area, so it is not known where the wastewater that the PepsiCo facilities send to the utility for treatment is ultimately discharged. For this reason, all of the water that the facilities use is counted toward PepsiCo's Positive Water Impact goal for this pilot site.

### Watershed History and Trends

During the last 50 years, Mexico City and neighboring municipalities have seen a rapid population growth rate. More than 21 million people living in the urban area depend upon the hydrological region "Cuenca del Valle de México" for their water supply. Water needs have increased 30-fold from 1870 to 2007. The water for the city has historically been supplied by groundwater, supplemented in more recent decades with water from outside the basin that is piped to the city from the Lerma and Cutzumala basins. Despite the importation of water from surface water sources, aquifer depletion is still a major concern. As far back as 1952, hydrologists have estimated that the extraction rate exceeded the infiltration rate of the aquifer. CONAGUA, the federal agency responsible for water management, currently estimates that allocated water uses exceed the sustainable supply by more than 30 percent.

### Restoration Activities Evaluated

As part of this project, The Nature Conservancy initially identified a wide range of potential watershed restoration activities for Mexico City, including agricultural land practice changes, stormwater management, land use alterations, hydraulic/hydrologic water body alterations, wastewater treatment, water re-use, rainwater harvesting and aquifer recharge. Selection of potential restoration activities gave high priority to restoration alternatives that are already being considered at a local level. The Amecameca River Basin Commission, with the participation of 25 stakeholder groups, developed a water plan containing objectives directly related to specific restoration activities. The stakeholders included municipalities, civic organizations, state environment and agriculture agencies, the national water authority, and the secretariat of environment and natural resources. Since funding is usually the roadblock for implementation of these activities, the River Basin Commission is hoping to receive more federal funding allocated to execution of this ambitious program. The team selected two of these restoration activities, rainfall retention and restoration of Tláhuac-Xico Lake, for consideration in this project, and a third potential restoration activity corresponding to re-use of PepsiCo wastewater as a source for industrial cooling water.

### Retain Rainfall at Higher Elevations

The first restoration alternative consists of retaining rainfall in the upper and middle sub-basins of the watershed, through the use of retention structures and reforestation/riparian restoration. Deforestation of the mountains has left the sub-basin vulnerable to impacts of extreme climate events, as rainfall is being increasingly converted to stormwater runoff instead of infiltrating into the soils. Urban zones in the lower basin suffer from increased flooding due to stormwater runoff, while the springs disappear and the area is plagued by fires and loss of moisture and soils. To avoid flooding, this stormwater is exported from the basin via pumping. By retaining water in the upper areas of the watershed, this restoration alternative can help prevent floods and sedimentation, restore forest ecosystems, and in some cases, restore springs. The Commission's water plan proposes 78 activities that will retain all of the runoff generated in normal and extreme storms. The initial focus will be on construction of stormwater retention structures capable of capturing rainfall peaks and promoting infiltration. Upon completion of these civil protection measures, work will then be focused on soil management and forest restoration, required in order to prevent sedimentation and to restore ecosystems. These activities are being coordinated by numerous governmental and private agencies.

These projects are designed to retain 40 million cubic meters of water per year in the watershed that would otherwise be lost to stormwater runoff. This restoration benefit is 80 times greater than PepsiCo's current water use in the basin, such that PepsiCo would need to provide cost sharing for only a small fraction of this project to achieve Positive Water Impact.

### Restoration of Tláhuac-Xico Lake

The second restoration activity under consideration consists of increasing the storage capacity of Tláhuac-Xico Lake, which was a freshwater lake until it was drained in the late 19th century. The goal of the deepening is twofold: 1) provide increased capacity to capture stormwater and reduce flooding, and 2) provide a sustainable supply of potable water and reduce the reliance on groundwater abstraction. Work required to accomplish these objectives includes dredging, development of infrastructure (levees, canals) and construction of a water treatment plant that can produce potable water from the lake.

These projects are designed to provide a future potable water supply of 37.8 million cubic meters per year. This restoration benefit is 75 times greater than PepsiCo's current water use in the basin, such that PepsiCo would need to provide cost sharing for only a small fraction of this project to achieve Positive Water Impact.

### Re-Use of Effluent as Industrial Cooling Water

The third restoration activity evaluated consists of providing PepsiCo's treated wastewater to other industrial facilities, in order to offset the use of potable water. Theoretically, all wastewater generated by PepsiCo facilities could be supplied as re-use, given appropriate conditions. The key conditions needed include sufficient effluent quality to meet cooling water requirements, and industries requiring cooling water supplies located sufficiently near a PepsiCo facility to make construction of pipelines economically feasible.

PepsiCo is conducting other activities to contribute to Positive Water Impact beyond the alternatives discussed above. The Sabritas Vallejo facility is currently implementing advanced wastewater treatment, including reverse osmosis, to allow the majority of the wastewater they currently discharge to be directly re-used in the plant. This process will greatly reduce the amount of municipal water needed to supply that facility, thereby allowing more water to remain in the aquifer and surface water bodies that supply these facilities. ●

# What Are We Doing Next?

As concern about water-related risk continues to grow for corporations around the world, the need for approaches that assess and address this risk becomes more critical. The methodology applied at the five PepsiCo pilot sites offers a practical path forward for corporations wishing to address this risk. It began with selecting the pilot sites based on areas of water scarcity as indicated through a broad global assessment. At each of these locations, the area of influence was delineated, indicating the spatial extent of possible water use impacts and the limits of the study area. Within this area of influence, optimal watersheds were selected for assessment, and water use risks and impacts determined. Finally, restoration activities to reduce the impacts and risks of water use were developed, and the costs and benefits of these activities estimated.

This phase of the project allowed us to test the application of this approach at pilot sites with unique water resources, challenges and opportunities. The lessons learned as we applied the methodology will be used to inform refinement for future application across the PepsiCo system. This approach will allow PepsiCo to identify areas at risk of water stress and to develop a portfolio of actions to address this stress. These actions are not just intended to reduce PepsiCo's water scarcity risks, but also to address the risks of all of the other water users in the watersheds where PepsiCo operates. An important emphasis during this phase of work is that the water-related problems and solutions are inherently unique to individual watersheds. Each watershed is impacted by a unique set of water users in a particular hydrologic setting, so that effort needs to be taken to truly understand the water situation in each catchment and to develop practical solutions to ensure the sustainability of water use in the watershed.

The ultimate value of this phase of work is twofold. For each individual site, the assessment of the sustainability of water use resulted in a suite of actions that PepsiCo and others in the watershed can apply to improve the availability of clean water to meet the needs of both the environment and all water users. At the same time, this work provides lessons that can be integrated into future applications of this methodology, both within the PepsiCo system and in other watersheds where large water users operate. PepsiCo is now able to select activities at these pilot sites that will help achieve Positive Water Impact, while at the same time developing a process for assessment of water stress in all of the watersheds in which the company operates.

In addition, we continue to explore how the Positive Water Impact initiative can be leveraged to provide true synergies with both existing partners and prospective programs.

At the time of this report's publication, specific initiatives and funding levels for Phase Two of Positive Water Impact were still being explored and assessed.

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## About PepsiCo

PepsiCo offers the world's largest portfolio of billion-dollar food and beverage brands, including 19 different product lines that generate more than $1 billion in annual retail sales each. Our main businesses—Quaker, Tropicana, Gatorade, Frito-Lay and Pepsi Cola—also make hundreds of other enjoyable foods and beverages that are respected household names throughout the world. With net revenues of approximately $60 billion, PepsiCo's people are united by our unique commitment to sustainable growth by investing in a healthier future for people and our planet, which we believe also means a more successful future for PepsiCo. We call this commitment Performance with Purpose: PepsiCo's promise to provide a wide range of foods and beverages for local tastes; to find innovative ways to minimize our impact on the environment, including by conserving energy and water usage, and reducing packaging volume; to provide a great workplace for our associates; and to respect, support and invest in the local communities where we operate. For more information, please *visit www.pepsico.com*.


## About The Nature Conservancy

The Nature Conservancy works to significantly improve the health of globally important natural systems in ways that enhance the lives of people by making conservation a central part of solving critical challenges facing our world.


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