STRATEGIC SUSTAINABILITY CONSULTING

Every Last Drop – Water and Sustainable Business

How water issues can affect your profits, reputation, and supply chain

This paper will provide a broad overview of the current water situation by highlighting the major issues and trends surrounding water scarcity and quality in the context of business risk. It will also help you understand water conservation measures that you can take and walk you through developing a water strategy for your particular business. Lastly, it will provide you with all the resources you need to understand and manage the changing water situation. All of this will position your business for a prosperous future to stay ahead of your competition.

After reading this paper, you should have a solid answer to the following questions:

1. Why do you need to address water risk in your business?
2. What might the future look like for your industry and how will that shape key strategic business decisions?
3. How will you go about implementing a water conservation and risk strategy (including all of your stakeholders/supply chain)?
4. What behavioral and technological changes will you have to make and how fast will you see a return on investment?
5. How can you market your efforts to gain competitive advantage and adapt to the increasingly competitive and unstable world we live in?

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Every Last Drop – Water and Sustainable Business

How water issues can affect your profits, reputation, and supply chain

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Part One: Executive Summary

In order to sustain our rapidly growing population and to ensure our future prosperity, we need water. It is a key component of all of our business operations, whether directly involved in our key business processes or less obvious to us upstream in the supply chain. And while we can substitute different materials for oil-based products, we simply cannot substitute water. It's non-negotiable – we NEED water to survive. Yet, despite its extreme importance to our well-being, very few companies are strategically thinking about and addressing water risk.

And, climate change will only exacerbate water scarcity problems.

J.P. Morgan stated in a 2008 report that:

A scarcity of clean, fresh water presents increasing risks to companies in many countries and in many economic sectors. These risks are difficult for investors to assess, due both to poor information about underlying supply conditions and to fragmentary or inadequate reporting by individual companies.[1]

Companies are already starting to see evidence of future water troubles: companies' water allotments are starting to decrease, more stringent regulations are being put in place, the price of water is on the rise, and there is growing community opposition and increased public scrutiny of corporate water practices (e.g. Coca-Cola operations in rural India).

No company – no matter how small – can afford to ignore the effects that our water challenges will bring.

Common Water Uses

Supply Chain: Water use in Computer manufacturing, paper manufacturing, etc.

Operations: Flushing toilets, uniform and linen cleaning, kitchen/bathrooms, etc.

Product Use: Washing Machines, Cleaners, Irrigation Equipment, etc.

Globally, our current use of water is simply unsustainable. We must change our ways now to avoid water shortages, ecological collapse, and economic disaster in the future. The benefits of water conservation go beyond the ecological. Your organization will save money, mitigate long-term risks, and gain competitive advantages by assessing and modifying your use of water.

Simply put, businesses that do not address these challenges will be at higher risk, and those that do will be at lower risk and much better positioned for a prosperous future.

This paper will set the stage by highlighting the major issues and trends surrounding water scarcity and quality in the context of business risk. While ominous at times, using these facts to help create a water strategy for your business can help you to proactively address upcoming challenges and innovate your way to a prosperous – and profitable – future (see **Part Five: Specific Strategies for Businesses** for advice on your particular industry).

Are you a small business?

Feel free to skip to **Part Four: Creating & Implementing a Water Strategy** and **Part Five: Specific Strategies for Businesses** for quick advice.

Part Two: Water Troubles

How to we love all of the children of all species for all the time?
William McDonough

Water is one of the natural resources truly integral to our survival. With only a finite amount of fresh water on the planet available to us – less than 1% of all water on earth is useable fresh water above ground – and a world population that is growing rapidly (50 million people per year), water truly is the next big global issue.

Everyone is focused on energy and GHG emissions, but without water we wouldn't survive for more than a few days and with too much at the wrong time and place – say in the form of mass flooding – the consequences are equally destructive. So let's put aside our carbon debate for a minute and delve into the big picture surrounding water.

Global Water Scarcity & Population Growth: The Big Picture

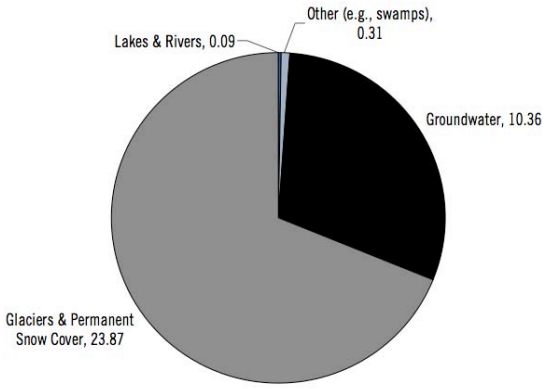
So, how much water is there on this planet? Well, according to UNESCO, the world contains approximately 1,386 million cubic kilometers (km) of water. Of this:

- 97.5% is salt water, 2.5% is fresh water

As you can see from **Figure 1**, more than two-thirds of fresh water is "trapped" in the form of ice and snow in mountains, glaciers and polar ice caps. About one-third of global freshwater is underground, and some of this is accessible – the United Nations estimates[1] that groundwater represents about 20% of global water withdrawals.

It is also important, and fascinating, to note that only about 0.26% (of the 2.5%) of total fresh water available, or about 90,000 cubic km, is actually above the ground in the form of lakes and rivers. So from a sustainability point of view, this tiny fraction of the world's water is actually what we should be using (and even only a portion of this amount), so that we do not deplete the limited ground water supplies – many of which are being extracted much more quickly than they can be replenished.

Figure 1: Total Global Freshwater by Location (Millions of Cubic Kilometers



Source: United Nations Educational Scientific and Cultural Organization

The Supply-Demand Balance

According to the World Resources Institute, 41% of the world's population, or 2.3 billion people, live in watersheds under "water stress", meaning that per capita water supply is less than 1700 m3/year.

One of the main issues surrounding water scarcity is this: **water is not always abundant where it is needed and conversely plentiful where there are low concentrations of people.** Unfortunately, water is not very easy to move around and doing so is costly, so certain highly populated areas are in extreme water shortages (many in the developing world), while other countries are less threatened by scarcity.

In many of the regions where the supply of water is an issue, there is also a *growing demand* for water. This compounds the problem. There are **three main factors that are driving overall demand for water:**

1. **Population Growth**
2. **Emerging markets (like China and India) have a burgeoning middle-class consumer sector.** As living standards increase so does water withdrawal – diet, quality of life, etc.).
3. **Urbanization and Industrialization: developed economies have very water-intensive industrial processes.**

Specific countries are feeling the effects of these water imbalances:

- Here in the U.S. the two fastest growing states (in term of population growth) are Arizona and Nevada, which also rank as the driest in terms of precipitation.[3]

- China has about 20% of the world's population, but only about 7% of the world's water resources (mostly located in the south of the country) – this continues to be a huge problem for China and one of the main concerns for them.

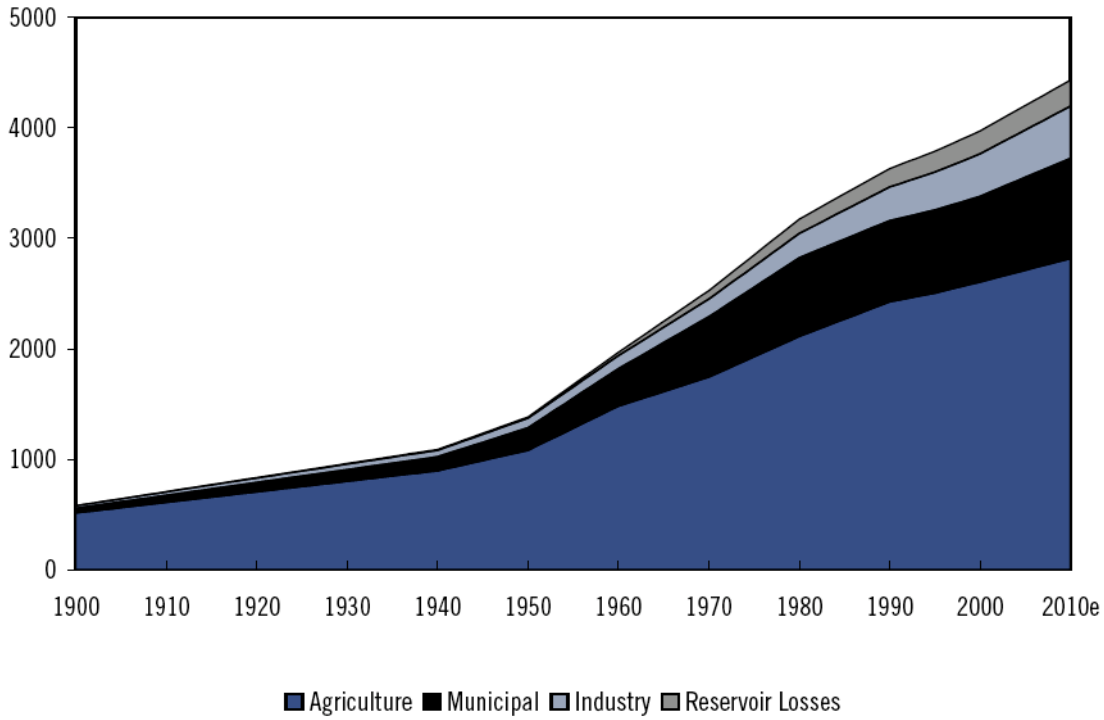
Water Demand: Long-Term Trends

Freshwater consumption worldwide has more than doubled since World War II and is expected to rise another 25 percent by 2030.[4] At a global level, water demand can be segmented into three main uses of water (see **Figure 3** below):

- **Agricultural** – water primarily used for irrigation.
- **Municipal** – water used by the populations of cities and towns.
- **Industrial** – water used for many purposes in industry (including cooling, food processing, electricity generation – particularly large customer, etc.)

At the global level, we can see that agriculture is the largest consumer of water.

Figure 2: Water Withdrawal by Sector (in Cubic Kilometers)



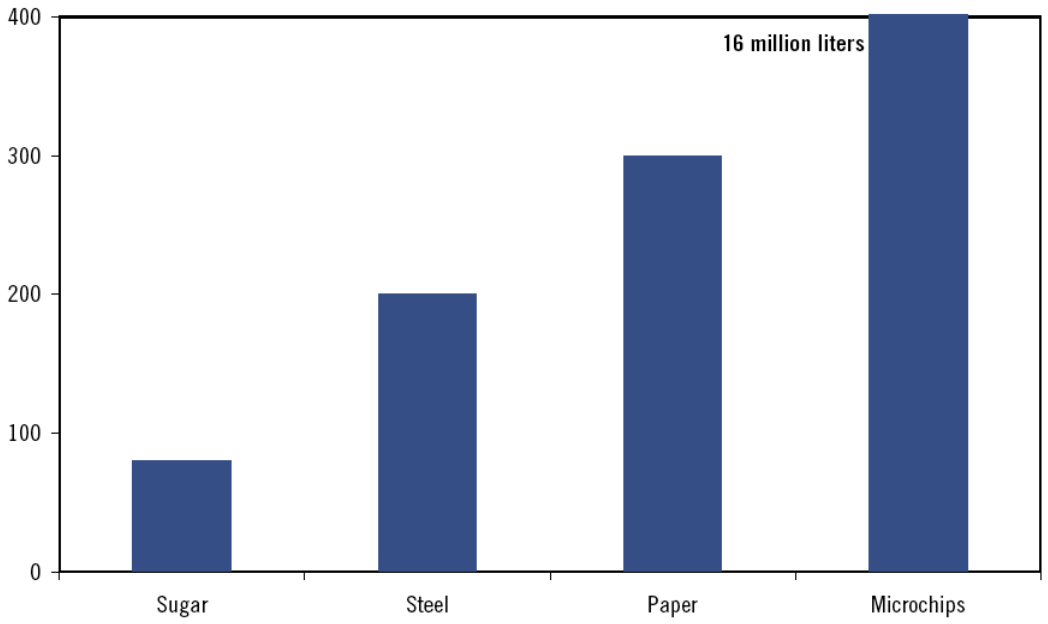
Source: United Nations Educational Scientific and Cultural Organization

However at the regional level, water demand varies greatly by sector. For example, in the U.S. and Europe, the industrial sector is actually the largest consumer of water. The key reason for this is that **many industrial processes are highly water intensive**. As **Figure 3** illustrates, it takes about 80,000 liters of water to produce one ton of sugar and two hundred times as much (16 million liters) to produce one ton of semiconductors!

Although the agricultural sector is currently the largest consumer of water in Asia, the municipal and industrial sectors are forecast to grow very rapidly over the next 15 years.

As you can see from **Figure 2** above, total global water withdrawal in 2010 is estimated to be about 4,430 cubic km. Although it seems like this is not a large figure (amounting to only about 10% of renewable water resources), one of the main issues, as we mentioned above, is the uneven distribution of water resources. Unpopulated areas like Siberia, which have huge natural water reserves, have a low water withdrawal rate relative to the available resources, while densely populated areas – like Africa, Asia, Southern Europe, and the U.S. – all have high water withdrawal rates relative to the available resources (about 30% water withdrawal as a percentage of resources).

Figure 3: Water Required in Ton Produced (Thousands of Liters)



Source: Citi Investment Research estimates

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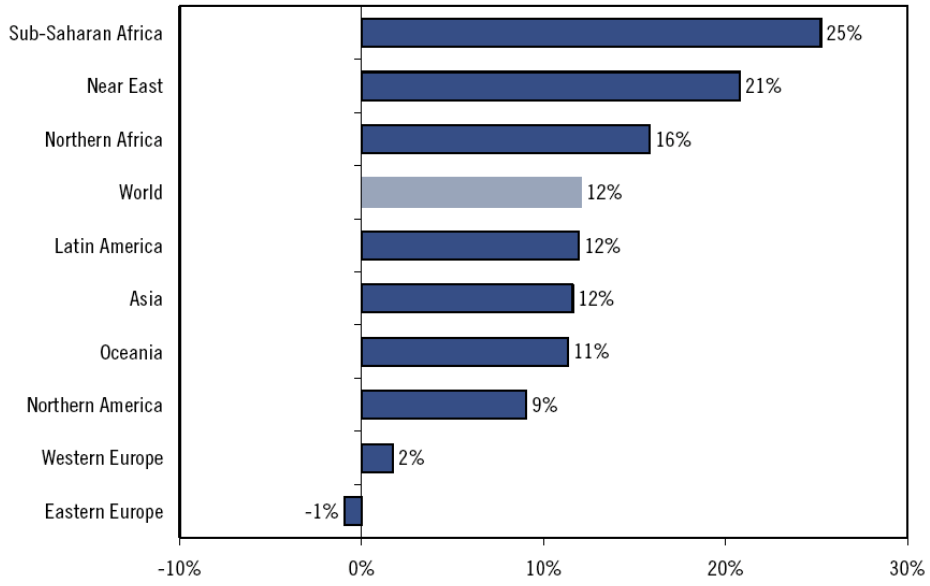
Population Growth and Urbanization

The world population is expected to be more than 9 billion by 2050; half of the world's population is expected to suffer from severe water shortages by then.

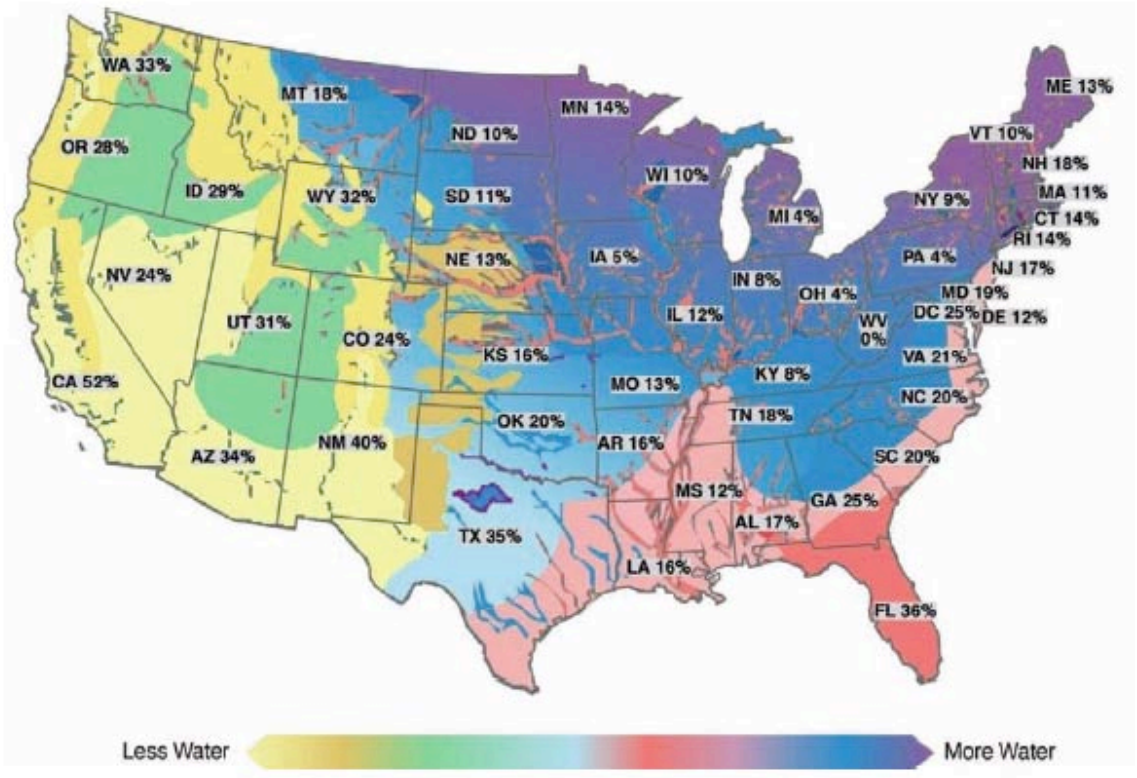
As the world's population grows, the demands for water – for both food and drinking – increase. The world's population is set to grow by about 12% over then next decade (about 50 million a year and faster in the developing world) – see **Figure 4 & 5.**

Figure 4: Forecast Population Growth, 2005 - 2015



Source: U.S. Census Bureau, International Data Base

Figure 5: Relative Water Availability and Projected Change in Population (2000-2020)



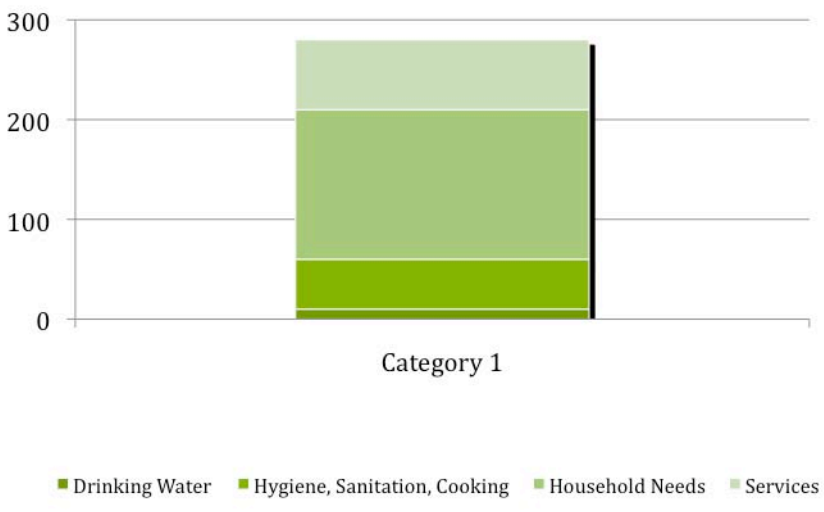
Changing Lifestyles

Now, it is obvious that more people will require more water, but changing lifestyle aspirations and food choices (particularly in developing nations) can compound the problem.

You may be familiar with the term "embedded carbon" (the amount of carbon that is released as a result of a product or process), but **did you know** there is a parallel term for water? **"Embedded water"** is the amount of water that it takes to produce and manufacture a particular product. As you can see in **Table 1,** a pound of beef takes 3,000 gallons of water to produce (over the life of the cow, etc.)!!! So, compared to a vegetarian diet, a diet containing 20% meat doubles water consumption.

The World Health Organization estimates that a minimum of 30-50 liters (8-15 gallons) per day is necessary for keeping up basic personal hygiene, cooking, and for cleaning – this is termed the "basic water requirement" (see **Figure 6**). Daily drinking requirements for the average adult are between 3 and 9 liters per day.

Figure 6: Daily Water Requirements in Liters Per Person



Source: Alexander Zehnder et al., *Water issues: the need for action at different levels,* Aquatic Sciences, 2003

Table 1: Embedded Water for Common Products

PRODUCT	WATER (IN GALLONS)
Apple	16
Orange	22
Egg	85
Loaf of bread	150
Pound of steel	270
Sunday paper	280
Pound of aluminum	1,000
Pound of cotton	1,300
Pound of beef	3,000

Freshwater Society Laura McDonald

What is Urbanization and how does it affect water supply?

Urbanization is the progressive movement of people into cities. It can increase the daily water requirement by five times the "basic water requirement" due to the changing aspirations and opportunities that increased income brings. The United Nations estimates that, by 2010, there will be about 21 urban megalopolises with populations of more than 10 million (this is up from 10 such cities in 1990). So as urbanization increases, so does water demand (see **Figure 7**).

Source*: Citi Investment Research*

Climate Change and Water

You may all be familiar with Al Gore's film, *An Inconvenient Truth*. In it he details the indisputable evidence that climate change is warming our planet and as a result weather patterns are getting more erratic and intense, our glaciers and polar ice caps are melting, and hundreds of species of plants and animals are affected. A scary scenario suggested by the film was of mass flooding in the populated coastal regions as global sea levels rise, which would displace millions of refugees and make Hurricane Katrina in New Orleans look tame in comparison. Other consequences suggest that heat waves, droughts, and wildfires, will all be more frequent and intense and more than a million species worldwide could be driven to extinction by 2050. While it is tough to predict how climate change will eventually pan out, and with a huge global effort to combat it now underway, the indicators are undeniable that global warming is occurring, and fast.

Table 2: Observed Changes in North American Water Resources During the Past Century

(▲=increase ▼=decrease)

	Water Resource Change	Affected Region
	1–4 week earlier peak streamflow due to earlier warming-driven snowmelt	U.S. West and New England regions, Canada
▼	Proportion of precipitation falling as snow	Western Canada and prairies, U.S. West
▼	Duration and extent of snowcover	Most of North America
▲	Annual precipitation	Most of North America
▼	Mountain snow water equivalent	Western North America
▼	Annual precipitation	Central Rockies, southwestern U.S., Canadian prairies, eastern Arctic
▲	Frequency of heavy precipitation events	Most of U.S.
▼	Runoff and streamflow	Colorado and Columbia River basins
	Widespread thawing of permafrost	Most of northern Canada and Alaska
▲	Water temperature of lakes (0.1-1.5°C)	Most of North America
▲	Streamflow	Most of the eastern U.S.
	Glacial shrinkage	U.S. western mountains, Alaska and Canada
▼	Ice cover	Great Lakes, Gulf of St. Lawrence
	Salinization of coastal surface waters	Florida, Louisiana
▲	Periods of drought	Western U.S., southern Canada

Source: B.C. Bates, Z.W. Kundzewicz, S. Wu and J.P. Palutikof, Eds., "Climate Change and Water," IPCC Technical Paper VI of the Intergovernmental Panel on Climate Change, IPCC Secretariat, Geneva, June 2008

So, how is climate change affecting the world's water supplies (see **Table 2**)? Well, many things are going on that affecting our access to a reliable and clean water source and increasing water scarcity. Among the **four major water-related areas aggravated by climate change are**:

- **Precipitation** – changes are occurring in the amount, intensity, and frequency, and type of precipitation, which will ultimately increase water scarcity.

- **Droughts** – becoming more intense, severe, and widespread as precipitation decreases.

    - In the Southeast U.S., 32% of the region is currently in "exceptional drought", the Department of Agriculture's most severe designation, and California water officials have warned that the state – heavily reliant on water for it's two massive industries, agriculture and computers – is facing "the worst drought in modern history."

- **Glaciers & Snow Cover** – decreasing, leading to less water runoff and storage.

- **Pollution** – according to the International Panel on Climate Change (IPCC), higher water temperatures, increased precipitation intensity, and longer periods of low flows all exacerbate water pollution.[5]

All of these factors will increase the vulnerability of ecosystems, which further diminishes the ability of the natural environment to filter water and prevent flooding events (as well as affecting native species).

Decaying Water Infrastructure and Water Pollution

Our centralized water infrastructure – water pipes, storage facilities, dams, and reservoirs – has served us well, however it is now outdated in many parts of the U.S. and much of it is more than 100 years old. Drinking water pipes typically last between 50 and 100 years, which means that 1-2% of the network must be replaced every year. However, much of this important work has been neglected. This is an important fact for any business because this outdated infrastructure could affect water delivery in the future.

Leaks and sewage spills are two of the biggest problems of this outdated system. A large percentage of water is wasted each year from leaks in water pipes and related infrastructure (leakage rates are as high as 20-40% in some places). Also, sewage pipes fail on a daily basis, hurting businesses and creating substantial health hazards.

One of the biggest problems with the water infrastructure is the lack of accurate monitoring of water use. In the future, we will see this need being met, with more precise monitoring and improved metering technologies being implemented.

Facts and Figures

- The drinking water piping network in the U.S. extends more than 700,000 miles (more than four times the length of the National Highway System).
- According to a report from Booz Allen, between now and 2030 an estimated $22.6 trillion will be needed to upgrade or replace water-related infrastructure worldwide. About 84 percent of the $23 trillion will be spent outside the U.S.
- The American Water Works Association (AWWA) estimates that U.S. water utilities will need to invest $250 billion to replace aging pipes over the next 30 years.
- The U.S. EPA estimates that there are as many as 73,000 sewer spills in America every year, which can send large amounts of untreated sewage into rivers and beaches.

With the increased intensity and frequency of violent storms, climate change also threatens water infrastructure and exacerbates the problem. The worrying truth is this: there might be water shocks in the future where we will be without water for periods of time (it is important to perform a risk assessment and plan for potential shortages).

Another big problem is the pollution from the runoff from over irrigation of agricultural and urban lands. This presents a huge liability for businesses and has a damaging effect on our freshwater resources.

As humans have destroyed ecosystems, particularly wetland destruction and over withdrawal of surface water, the ability of the natural environment to filter pollutants and naturally repair itself has been hindered.

Climate change will only exacerbate these problems.

The Water-Energy Confluence

The Pacific Institute states that:

A critical driver of the success in the 21st century economy will be how companies and investors balance the competing demands for water and energy. Companies should be prepared to provide details on the risks they face from water challenges and to be transparent about the energy trade-offs they make to address them.[6]

One of the most underappreciated facts about water is that it requires a huge amount of energy to move it around and process it. Water and energy are inextricably linked. Water is required for life, while energy is required to support our daily use of cars, computers, etc. For example, 20% of California's energy use goes towards transportation and processing of water, according to the Pacific Institute.

There is an increasing conflict between water availability and energy use, one oftentimes undermines the other; one process improvement may help alleviate GHG emissions, while increasing water use. For example, oil sands in Canada and corn-based ethanol production in the U.S. have both received billions of dollars in order to incrementally increase our fuel supply, however these processes are enormously water intensive (and have high GHG emissions as well), which may limit their long-term viability. It is necessary to look at both water and energy simultaneously to make sure that you are not sacrificing one for the other.

Saving water simultaneously saves the energy that is required to pump, process, and refine our water and waste. Once we start thinking of water and energy as highly related, we can start to minimize our impacts holistically (carbon footprint analyses should be looked at in conjunction with water footprint analyses).

Key Trends: Pricing and Privatization

Water Pricing

A recent report published by the Earth Policy Institute in 2007 predicted that municipal water rates would increase over a five-year period in the United States by an average of 27 percent.

"One simply cannot find another product whose real value so far exceeds its price – or for that matter, one whose price is often so unrelated to its true cost of delivery," wrote Steve Maxwell of TechKNOWLEDGy Strategic Group in the *State of the Water Industry 2008* report.[7] "Eventually, we will all bear the costs of correcting the water pollution problems that we have created, and rebuilding the infrastructure that we have allowed to fall into decay – huge costs that current water prices do not properly reflect," Maxwell added. Many municipalities are considering or already implementing tiered-pricing plans to incentivize conservation (higher intensity users pay more).

A typical American family currently pays about $25 a month for water, which is only about a quarter of a penny per gallon for clean drinking water. This is extremely cheap, considering the massive water infrastructure that enables this seemingly simple process. There has been a paradox in water pricing in that much of the cost of water infrastructure has been subsidized by the U.S. government and not passed on to the consumer at the municipal level.

One thing to be sure of is that water prices are going to continuously rise over the longer-term future. Until water prices reflect the "true cost" of delivering water, many infrastructure improvements will be hard to make. Only when "the well runs dry", will we realize the true value that water holds for us.

Privatization

With an enormous amount of capital expenditure required to fix the water infrastructure, financing has become a key issue because many municipalities have charged only nominal amounts for water. This has led to many private sector companies getting involved and forming **public-private partnerships** (a private company signs a contract with a government agency to supply services, and a regulator sets the standards for price and quality). One of the advantages of this type of arrangement is that the private company has the resources to maintain the water infrastructure as well as the technical expertise to manage the network efficiently. However, many environmentalists have been highly critical of private sector involvement, citing several examples where private companies, particularly in the poorer countries of the developing world, have not delivered on their promises to upgrade infrastructure, resulting in inadequate water delivery to the local people.

Table 3: Key Trends and Drivers of the Water Market

Key Drivers Behind the Market
▪ Water quality and water scarcity problems are reaching crisis proportions worldwide ▪ Awareness of water problems is gradually increasing – but public education and more attention is critical ▪ Regulation and enforcement levels are increasing, and new policies and approaches are emerging ▪ Huge economic (and human) capital investments are required – much more focus is needed
Resultant Trends and Developments
▪ Out-sourcing or "privatization" continues – but remains controversial, particularly in the U.S. ▪ "Musical chairs" in the industry – ownership rearrangement and widespread consolidation continues ▪ A strong surge of public and private equity investment interest in the industry ▪ Greater efficiency – more focus on "reducing demand to increase supply" ▪ Increased focus on water recycling and re-use – technologies and attitudes ▪ Incremental but continuing technological advance will help address some of the problems ▪ Consumers and residential users increasingly vote with their pocketbooks
Inescapable Conclusions
▪ Water prices often bear no relationship to cost of delivery – and certainly not to true value ▪ Interest in water may be high – but we still lack policy mechanisms to connect dollars with needs ▪ Delivered water prices must – and eventually will – rise to higher and higher levels ▪ The great challenge will be to manage water as an economic commodity, while providing it for all

Part Three: Introduction to Water Conservation

As the evidence piles up to suggest that man-made climate change is indeed real, it is simultaneously becoming clear that this trend will affect the hydrologic cycle, rainfall patterns and general water resource availability in numerous and complex ways that we don't yet understand – but which will certainly complicate and exacerbate an already dire water situation.

TechKNOWLEDGEy Strategic Group

A study published by the Pacific Institute estimated that one-third of California's current urban water use – more than 2.3 million acre-feet – could be saved with existing technology and 85% of this could be saved at costs below what it would cost to tap into new sources of supply.[8]

Contrary to popular belief, it is actually often more cost effective for businesses to invest in technologies and processes that save water, rather than to source more. Much like energy efficiency, ***a first step should always be water efficiency before seeking new sources of water.***

Let's begin by discovering what water conservation means and what technologies are at your disposal.

Defining Water Conservation

Before we begin to create a water strategy, let's start out by defining water conservation and some related terms:

Conservation (also know as demand management, improving water productivity, best management practices, water-use efficiency, etc.): any action or technology that increases the productivity of water use. The term **"water conservation"** is defined as **reducing water use by improving the efficiency of various uses of water** ***without decreasing services***.

Improving water-use efficiency: reducing the amount of water needed for any goal while still accomplishing that goal.

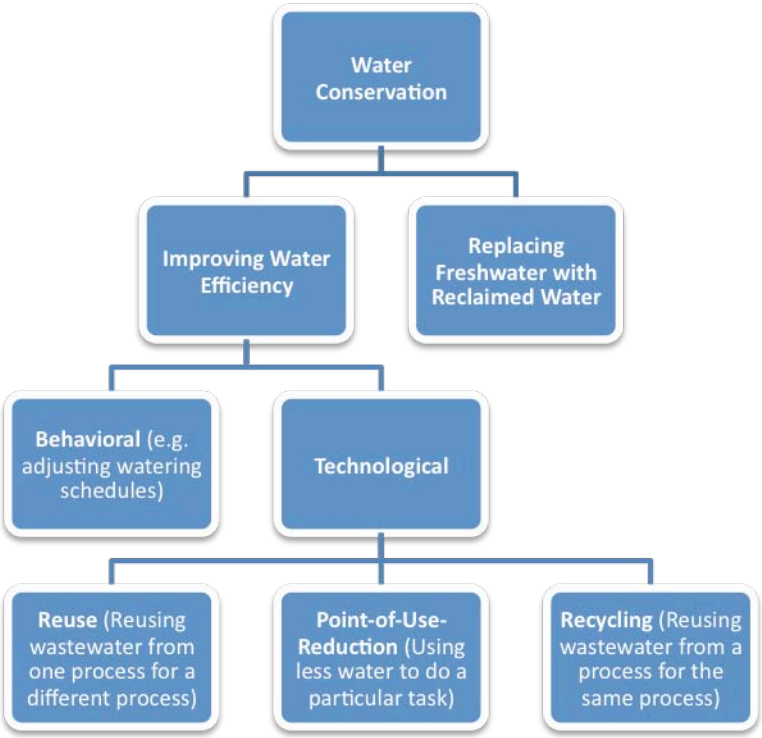
Categories of Water Efficiency

- **Reducing losses** (e.g. fixing leaking hose nozzles)
- **Reducing overall water use** (e.g. shutting off process water when not in use)
- **Employing water reuse practices** (e.g. reusing washwater)

Improving water efficiency can either be **behavioral** or **technological**.

- **Behavioral** changes involve anything that you do on a behavioral level to adjust water use.
- **Technological** efficiency involves replacing water-using equipment with equipment that serves the same purpose with less water.

Figure 7: Defining Water Conservation



Source: Pacific Institute

Water recycling is the reusing of treated wastewater from a process for the same process for beneficial purposes (e.g. agricultural and landscape irrigation, industrial processes, toilet flushing, and replenishing a ground water basin - referred to as ground water recharge).

Water reuse is the reusing of treated wastewater from one process for a different process for beneficial purposes, such as agricultural irrigation and industrial cooling.

To Increase Supply or Reduce Demand?

It is helpful to think about the water problem in one of two ways: by either **reducing demand** or **increasing supply**.

Step 1: Reduce our demand for water (i.e. behavioral changes, low-flow products, water efficiency, etc.).

Step 2: Once *Step 1* is complete, we can look at increasing our supply of water, if needed (i.e. water recycling, desalinization, rainwater harvesting, etc.).

Our assumption is that you want to use less water while improving your processes, without sacrificing your needs or cutting back in production. However, before you begin it is important to ask yourself some key questions so that you are not trying to make a process or product more efficient, which may not be worth doing in the first place. Don't just focus on improving efficiency of a product or process – first think through whether you really need that product/process to begin with. Ask yourselves the following questions at the start, and periodically throughout the process, as you progress (Table 4).

Table 4: The "Dummy" Check

Questions	Answer
Who requires the water?	Employees, customers, suppliers, other stakeholders, etc.
For what purpose or goal is the water used?	Produce goods and services, grow food, generate energy, recreation, cleaning, etc.
What kind of water is needed?	Drinking, waste/grey, etc.
How much water is needed?	Actually required to produce something, lifecycle analysis
Was it worth doing?	This is the most important question of all – common sense!

Water Use Behavior

Water use behavior is one of the most important parts of the equation, though hardest to manage. Your company should lower your water needs first and foremost before you make any technological improvements. This will require encouraging employees and maintenance staff to use less water, by educating them on the best ways to do so.

Water Behavior Tips

- **Make it Company Policy.** Consider instating an office-wide policy to limit the use of water and consider incentive programs that reward employees for using less water (among other sustainable behavior).

  - ☑ Educate employees about the importance and benefits of water conservation. Set up training sessions and keep employees up-to date about the company's policies and efforts.
  - ☑ Create water conservation suggestion boxes, and place them in prominent areas.
  - ☑ Install signs in restrooms and cafeterias that encourage water conservation. Check out the following site for water conservation posters: http://www.awarenessideas.com/Water-Conservation-Posters-s/36.htm.
  - ☑ Assign an employee to evaluate water conservation opportunities and effectiveness (a water efficiency coordinator).
  - ☑ Develop a water management plan for your facility.

- **Form a Green Team.** The key to implementing long-term change is to embed it in the organization's culture. By creating a **Green Team** that is responsible for researching green options and is empowered to implement new initiatives, your organization can integrate environmental responsibility into the core routines of day-to-day operations.

Technological Water Efficiency

A recent report by the United Nations stated that the industrial sector could cut its water demand by 40-90 percent, even with existing techniques and practices![9]

There is a huge opportunity for businesses to improve their water (and energy) efficiency. And as prices for water go up, it will surely make more financial sense to become more water efficient.

Some examples of water efficiency measures include: low-flow toilets & showers, efficient drip irrigation, and water recycling and reuse systems. Many utilities provide rebates and incentives for water efficiency products – it is worth checking whether any exist in your area before you make your final decision on what technologies to implement.

In the following section, we will discuss the different technologies at your disposal so that you understand what products you should consider for your business.

Getting Started: A Three-Step Process

To help facility managers evaluate where to look for water-saving measures whether in an office or commercial/industrial setting, consider the three-step process below.

Foremost, employees must understand how their job affects water use in their work environment. Solicit ideas from those most involved with the daily operations and activities of the organization. Make conserving water part of their job by having them identify where water is used, whether in bathrooms or manufacturing operations. Once the areas of water consumption have been determined, engage the employees to help implement conservation measures.

1. **Educate and involve employees on water conservation.**
2. **Locate all water using sources (bathrooms, wash sinks, hoses, dish machines, HVAC, cooling water, etc.) in facility.**
3. **Identify and implement water conservation options.**

Water Conservation: Basic Technologies

The following technologies and tips should be considered by all businesses large or small. Some are easier to implement and result in quick payback - **the typical payback period is three to seven years.** Others are more costly or may not make sense in your particular situation.

How far do you go?

A low-flow toilet is water efficient, but a composting toilet is *most* efficient. Some technologies might not fit into your budget or tastes. See **Table 11** for a summary of technologies to decide which ones might work best for you business.

Kitchens & Toilets

High-Efficiency Toilets & Urinals: Toilets are by far the biggest on-site user of water after landscape irrigation. High-efficiency toilets (using only 1.28 gallons per flush) – look for the WaterSense label (www.epa.gov/watersense) - and waterless urinals (e.g. www.falconwaterfree.com) are a great first step towards water conservation measures. They are fairly cheap and will reap substantial long-term savings. Additionally, many water utilities offer rebates and vouchers for these products.

Low-Flow Showerheads and Faucets: Low flow aerators and low flow showerheads help reduce water waste, but don't lower water pressure. Showerheads also come in versions that have valve that stops the water completely for soaping, shampooing, etc. Easy to install, inexpensive, and with quick savings, this is the cheapest way to quickly save a bit of water. This one's a no-brainer!

Think POU (point-of-use) for hot water. Recirculating hot water heating systems are great devices that can save substantial water and gas; you simply press a button and have hot water on demand where you need it instead of waiting minutes for the hot water to come while you waste it. Perhaps the best pump system is one that has a temperature controlled by-pass valve under the farthest fixture sink and a timer on a pump that can be conveniently located adjacent to the water heater. The timer can be set to go on and off at 15-minute intervals depending upon when you feel you need hot water at the fixtures. The pump is equipped with a handy extension cord that can be plugged into a convenience outlet near the pump. There is no water waste with this pump and it also minimizes energy waste since it only sends hot water into the water supply lines during the programmed times.

Think POU for filtered water. Likewise, filtered water at the POU can save water and energy as a replacement for other filtered water solutions like water delivery, which are energy intensive (i.e. large carbon footprint from driving).

Clothes Washers: ENERGY STAR clothes washers (preferably front loading) are dramatically more water and energy-efficient – they can cut related energy costs by more than a third and water costs by more than half. For residential-style models, an efficient clothes washer can save you an average of $50 a year on your utility bills and 18 gallons of water per load (equivalent to one shower).[10] If you need a commercial-style clothes washer for laundry facilities, you can save more than $1,000 per washer from your utility bills over ten years.[11]

Remember to…

- ***Set the hot water heater at 120 degrees.*** *According to the Department of Energy, for each 10ºF reduction in water temperature, you can save between 3%–5% in energy costs.*
- ***Use cold water when washing hands or clothes to save more energy and reduce bills for water heating.***

Dish Washers: Commercial dishwashers that have earned the ENERGY STAR are on average 25 percent more energy-efficient and 25 percent more water-efficient than standard models.[12] Whether you are a restaurant that relies on one, or just an office, it makes sense to invest in an efficient dishwasher - they will save on water and energy utility bills and can pay themselves back in 1-2 years.

Landscape Irrigation

Weather- or Sensor-Based Irrigation Control Technologies: State-of-the-art satellite-enabled irrigation controllers, self-closing nozzles on hoses, and soil moisture sensors are essential for any heavily landscaped area, especially if you are located in a drier region. This great technology allows some of the fastest ROI of any water technology available. Using satellites to get accurate real-time weather such as humidity, wind, and rainfall, and other information specific to the plant and soil type, landscapes are never over watered. ROI for these systems is usually about 1-2 years. To calculate your savings, visit www.weathertrak.com/savingscalc/index.php

Professional Help Needed? Review the list of landscape irrigation professionals partnering with WaterSense! All too often, landscape irrigation wastes water—up to 1.5 billion gallons every day across the country. These professionals are certified through WaterSense labeled programs for their expertise in water-efficient irrigation technology and techniques. Performing regular maintenance could reduce water used for irrigation by 15 percent, or about 9,000 gallons annually—that's the amount of water that would flow from a garden hose if it were left running for almost a whole day![13] WaterSense irrigation partners also can help you design and install a new irrigation system or audit an existing one to minimize the amount of water you use, greening your yard in more ways than one. This can help you reduce your water consumption, save money, and maintain a healthy and beautiful landscape. Visit http://www.epa.gov/watersense for more information.

Water Recycling & Reuse

Gray water: Gray water is any water that has been used in a building, excluding toilet water. Dish, shower, sink, and laundry water comprise 50-80% of residential "waste" water. This water can be recycled for landscape irrigation or for toilets. A dual plumbing system will need to be installed to redirect second use water into your toilet or for irrigation. Also, check out recycling systems direct from sink to toilets. Although gray water may not work for your situation, payback can be quick. For more information on gray water, check out: www.greywater.com.

Note: at the moment, building codes for gray water can be excessively complicated and as a result many systems are not installed to code. Although this is changing (slowly), check the local building codes in your area so that you understand your system and if it will cost more to build it to code.

Are rain barrels worthwhile?

This is a question that is asked frequently.

Some utilities even give them out to businesses and residential customers.

However, if you think how small they are – usually 50 gallons or less – our view is that they are more a product to *build awareness around sustainable water use than a true water saver.*

Rainwater harvesting: Rainwater harvesting is simply catching the rain from your roof and redirecting the water either into a cistern or directly into your landscape for irrigation. These systems will usually pay off within 1-2 years, depending on the size. If you install a big system with a cistern it could cost you substantially more. You also need to make sure that your roof is the right material. To calculate how much rainwater you could harvest every year:

CATCHMENT AREA (ft^2) X AVG RAINFALL (ft) = TOTAL RAINWATER (ft^3)

For more information on rainwater harvesting, check out: www.harvesth2o.com.

Table 5: Technologies to Consider

Category	BAT (Best Available Technology)	BPT (Best Practical Technology)	Application	Cost	Savings
Toilets & Urinals	Composting Toilet & waterless urinals	High-efficiency toilets & waterless (or high-efficiency) urinals	ALL	Cost varies, starting at about $200 - $300	EPA estimates that replacing an older toilet with a WaterSense labeled model will, on average, save more than $90 per year in reduced water utility bills, and $2,000 over the lifetime of the toilets as well as save 4,000 gallons per year. Waterless urinals are totally water free, so you save 100% water use from day one.
Faucets	Sensor-activated high-efficiency faucets	Aerators (at a minimum)	ALL	Low-flow faucet aerators usually cost $5 -$10. Sensor-activated systems are more costly.	Inexpensive and simple to install, low-flow shower heads and faucet aerators can reduce your home water consumption as much as 50%, and reduce your energy cost of heating the water also by as much as 50%.
Showerheads	Low-flow showerhead w/ stop valve	Low-flow showerhead w/ stop valve	ALL	Low-flow showerheads range from $8 - $50 depending on features and design	Inexpensive and simple to install, low-flow shower heads and faucet aerators can reduce your home water consumption as much as 50%, and reduce your energy cost of heating the water also by as much as 50%.
Hot Water	Recirculating Hot Water Systems w/ temperature controlled by-pass valve and a timer	Recirculating Hot Water Systems w/ temperature controlled by-pass valve and a timer	ALL	Cost varies, starting at about $300 w/o installation - you will also incur plumbing and electrical costs to install	These systems are easily installed and cost less than $400, paying off quickly in energy and water saved.
Clothes Washers	ENERGY STAR clothes washer	ENERGY STAR clothes washer	ALL, esp. laundry facilities	Cost varies, starting at about $800 w/o installation	For residential-style models, can save you an average of $50 a year on your utility bills and 18 gallons of water per load (equivalent to one shower).[14] For commercial-style clothes washers, you can save more than $1,000 per washer from your utility bills over ten years.[15]
Dishwashers	ENERGY STAR dishwasher	ENERGY STAR dishwasher	ALL, esp. food service	Cost varies, starting at about $400 w/o installation	ENERGY STAR qualified commercial dishwasher can save businesses energy about 90 MBtus, and an average of $850/year on their energy bills. In addition, businesses can expect to save more than $200/year and 52,000 gallons/year due to reduced water usage.[16] ROI is 1-2 years.
Gray water	Gray Water system for irrigation AND toilets (sink to toilet)	Gray Water system for irrigation	ALL	Might be more costly in urban areas.	Depending on the size, these systems will usually pay off within 1-2 years.

Table 5: Technologies to Consider (continued)

Category	BAT (Best Available Technology)	BPT (Best Practical Technology)	Application	Cost	Savings
Rain Water Harvesting	Rain Water Harvesting system for irrigation AND toilets	Rain Water Harvesting system for irrigation	Only certain kinds of roofs	A system with a large cistern (>5000 gallons) can cost upwards of $2500 with installation; might be more difficult (costly) in urban areas	Depending on the size, these systems will usually pay off within 1-2 years.
Irrigation	Satellite-enabled (drip) irrigation controllers w/ self-closing nozzles	Satellite-enabled (drip) irrigation controllers w/ self-closing nozzles	Any landscaped property	Smart irrigation controllers start at $500 w/o installation; there is a monthly fee subscription for this service that starts at about $50 annually.	ROI for these systems is usually about 1-2 years

Case Study:
Wal-Mart's Water Conservation Commitment

Wal-Mart is serious about its sustainability efforts, with company-wide environmental goals of being powered 100 percent by renewable energy and to create zero waste.

To move the company toward these ambitious goals, they have created the Sustainable Buildings network, which allows them to design and build more energy- and water-efficient stores and Clubs that reduce greenhouse gas emissions while maintaining the shopping experience for their customers. This involves a process of experimenting, piloting, then implementing new building technologies, to improve the new store prototype and retrofit existing stores.

- The restroom sinks in newly constructed Wal-Mart stores and Sam's Clubs use sensor-activated 1/2 gallon per minute high-efficiency faucets. These faucets regulate water flow and **reduce water usage by 78 percent compared to mandated 1992 EPA Standards**. Electronic sensors regulate a maximum 10 second run time per cycle. It is estimated this technology allows users to adequately wash their hands using less than one pint of water. In addition, water turbines are built into the faucet. During use, water flow through this turbine generates the electricity needed to operate the sensors.

- In newly constructed stores and Sam's Clubs, Wal-Mart installs high-efficiency urinals that use only 1/8 of a gallon (one pint) of water per flush. **This fixture yields 87 percent water savings per flush versus conventional one gallon per flush urinals**. Less maintenance is required on the 1/8 gallon per flush urinals compared to waterless urinals, making the 1/8 gallon per flush urinals a better option for Wal-Mart.

- The restroom toilets in newly constructed Wal-Mart stores and Sam's Clubs are high-efficiency toilets that use 1.28 gallons of water per flush. **The fixture yields a 20 percent reduction in water usage over current mandated 1992 EPA Standards**, of 1.6 gallon per flush fixtures. Automatic flush valves on the toilets have water turbines similar to the low-flow faucets, which generate the power required to activate the flush mechanism. These turbines save energy and save material by eliminating the need for electrical conduits and wiring otherwise required to power automatic flush valve sensors.

- It is estimated that these water conservation measures **will reduce the overall water consumption in each newly-constructed store by 17 percent compared to the 2005 baseline stores.**

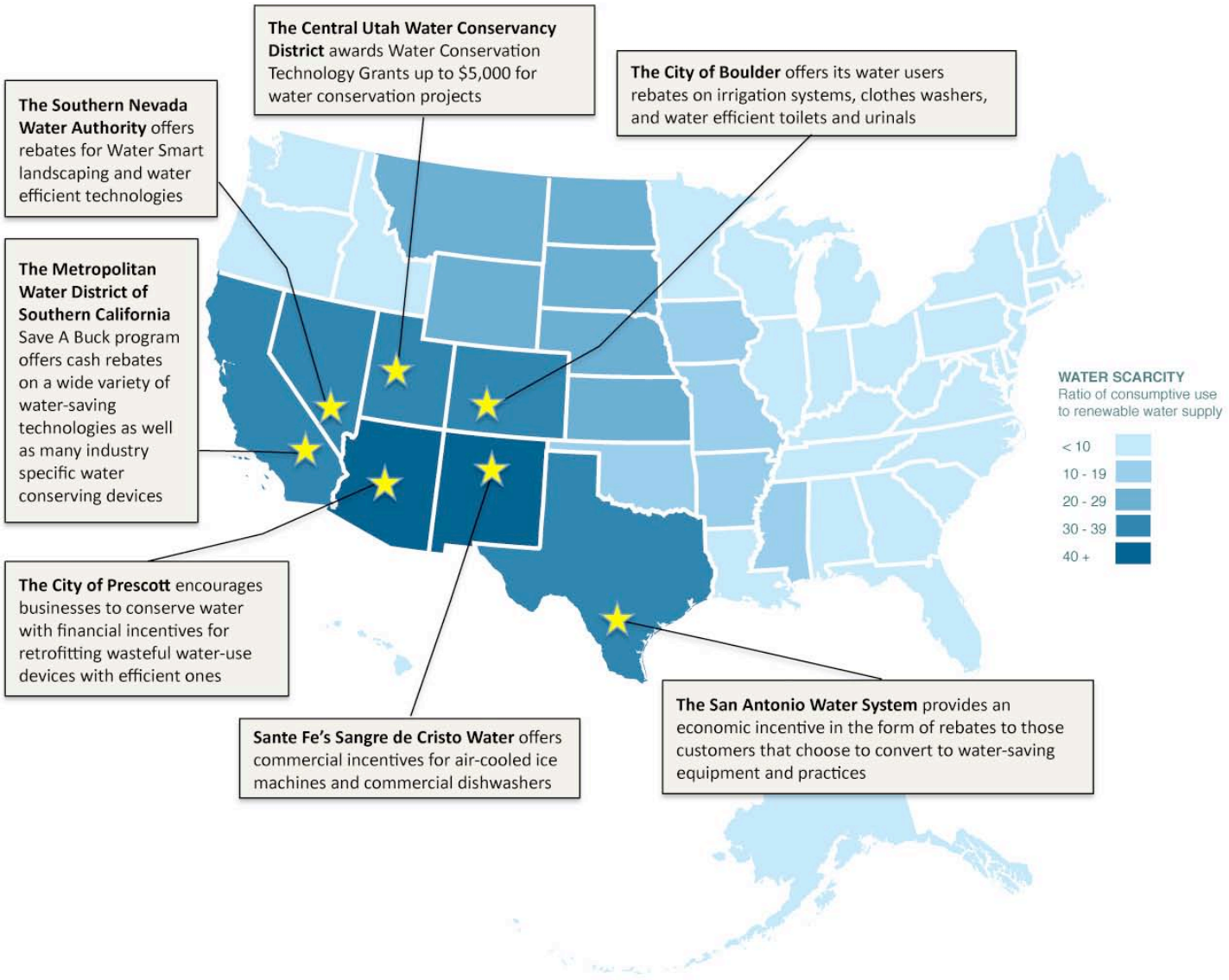
Source: walmartstores.com/download/3338.pdf

Water Conservation Incentive Programs & Rebates

Many water utilities offer rebates, incentives, free water audits and even installation for your water conservation efforts. It is worth contacting your local utility to see what is offered in your particular area and industry.

Figure 8 and **Table 6** below show some examples of state incentive programs.

Figure 8: Water Scarcity and Incentive Programs



Source: http://www.greenbiz.com/blog/2009/03/16/water-basics-managing-measuring

Table 6: Example of Water Conservation Programs

State	Description
Arizona	The City of Prescott encourages businesses to conserve water with financial incentives for retrofitting wasteful water-use devices with efficient ones http://www.cityofprescott.net/services/water/conservation.php
New Mexico	Sante Fe's Sangre de Cristo Water offers commercial incentives for air-cooled ice machines and commercial dishwashers http://www.santafenm.gov/index.asp?NID=1110
Texas	The San Antonio Water System provides an economic incentive in the form of rebates to those customers that choose to convert to water-saving equipment and practices http://www.saws.org/conservation/commercial/
California	The Metropolitan Water District of Southern California Save A Buck program offers cash rebates on a wide variety of water-saving technologies as well as many industry specific water conserving devices http://www.mwdsaveabuck.com/commercial_01.php
Nevada	The Southern Nevada Water Authority offers rebates for Water Smart landscaping and water efficient technologies http://www.snwa.com/html/cons_biz.html
Utah	The Central Utah Water Conservancy District awards Water Conservation Technology Grants up to $5,000 for water conservation projects http://www.cuwcd.com/publicinformation/conservation.htm
Colorado	The City of Boulder offers its water users rebates on irrigation systems, clothes washers, and water efficient toilets and urinals www.bouldersaveswater.net

Source: http://www.greenbiz.com/blog/2009/03/16/water-basics-managing-measuring

Basic Water Conservation Checklist

Have your water company conduct a free waste use survey of your facility or have one of our consultants help you by conducting a **Green Audit** of your business. Review it annually to identify additional ways to reduce your water use. **Complete the following water conservation measures applicable to your business:**

* Rebates and installation may be available from your local water utility

☑ **Your water bill.** Understand your water bill and review it monthly for indications of leaks, spikes or other problems. Call you local water utility for a free water walk-through if you notice any unusual increases in use or if you are looking for suggestions on how to improve the efficiency of your water use. Shut off the water supply to equipment and areas that are unused and discontinue water circulation pumping in areas not in use.

☑ **Your water meter.** Learn how to read your water meter. (It is recommended that the meter is read twice a day for early detection of water consumption spikes that may indicate leaks or other high use problems). Read water meters at least monthly. Compare the results to the same month of the previous year. This will help to identify leaks as they occur, as well as monitor your conservation efforts.

☑ **Check & repair leaks!** Regularly check for and repair all leaks in your facility (toilet leaks can be detected in tank toilets with leak detecting test tablets available from your local water utility and leaks around faucets and toilets may be indicated by water stains). Train your staff to monitor and respond immediately to leaking equipment. Check the pressure. Where system pressure is higher than 60 psi, install pressure-reducing valves.

☑ **Go low flow.** Install low flow aerators with flow rates not to exceed 2.2 gpm for sink faucets and lavatory sinks and 2.5 gpm for kitchen sinks, and 2.5 gpm (or lower) low flow showerheads. *

☑ **Try sweep.** Use "dry sweeping", water efficient "spray brooms", or low flow (<3 gpm) spray nozzles with automatic shut-off rather than a garden hose to wash down concrete or asphalt surfaces. *

☑ **Irrigation.** Test irrigation sprinklers 4 times per year for leaks, water runoff, over watering and dry spots and make necessary adjustments to ensure proper operation and coverage. Repair all broken or defective sprinkler heads/nozzles, lines & valves. Adjust sprinklers for proper coverage – optimizing spacing and avoiding runoff onto paved surfaces. Adjust sprinkler times and/or durations according to seasons, water during non-daylight hours to limit evaporation (generally before 7 am or after 9 pm).

- ☑ **Install signs & train employees.** Install signs in restrooms, restaurants and guest rooms encouraging water conservation, without compromising proper hand washing procedures for food handlers and employees.

- ☑ **Recycle and Reuse.** Recycle and reduce water use wherever possible, consistent with state/local regulations. Install gray water or rainwater harvesting system to deliver reusable water for cooling, washing and watering landscapes (call Public Health Dept. to see if permitted).

BEHAVIORAL CHANGES

Make it Company Policy

- ☑ Educate employees about the importance and benefits of water conservation.

- ☑ Create water conservation suggestion boxes, and place them in prominent areas.

- ☑ Install signs in restrooms and cafeterias that encourage water conservation.

- ☑ Assign an employee to evaluate water conservation opportunities and effectiveness (a water efficiency coordinator).

- ☑ Develop a water management plan for your facility.

Employee Practices

- ☑ Encourage employees to use cold water whe washing hands or clothes to save more energ and reduce bills for water heating. Don't le water run while washing hands.

- ☑ Don't use toilets as a garbage disposal.

- ☑ Do report leaks and water losses immediately.

- ☑ Wash full loads in laundry machines.

- ☑ Change window-cleaning schedule from "periodic" to "as required".

- ☑ Shut off water-cooled air conditioning units when not needed.

- ☑ Use a broom, water broom or low-volume pressure washer rather than a hose to clean sidewalks, driveways, loading docks and parking lots. *

- ☑ Instruct cleaning crews to use water efficiently for mopping.

- ☑ Switch from "wet" carpet cleaning methods, such as steam, to "dry," powder methods.

- ☑ Wash vehicles only when needed.

- ☑ Don't wash building exteriors or other outside structures.

- ☑ Encourage water conservation at home.

EQUIPMENT/FACILTIES

Bathrooms/Restrooms

- ☑ **Toilets & Urinals.** Replace all pre-1992 toilets with 1.6 gpf toilets. Provide additional urinals in men's restrooms & reduce number of toilets. Replace non-efficient toilets (>3.5 gpf) with ultra high efficiency toilets (< 1.2 gpf).* If you are not replacing toilets, for older models install toilet tank water displacement devices, such as toilet dams, bags or weighted bottles. Retrofit flushometer (tankless) toilets with water-savings diaphragms, which save one gallon (20 percent) per flush.

- ☑ **Urinals.** Replace all urinals with models that flush at no more than 1.0 gpf. Replace non-efficient urinals with new ultra low-flow (<0.5 gpm) or install waterless urinals. Set urinals with programmable automatic flush valves to a water-saving mode that flushes the urinal after more than one use.

- ☑ **Faucets & Showerheads.** Install low flow (aerators), self-closing faucets, either infrared or spring-loaded and low-flow showerheads (<2 gpm)

- ☑ Institute an optional towel and linen reuse policy for guests. Provide guests with information in the room about this option.

Heating & Cooling

- ☑ Retrofit once-through water-cooled refrigeration units, air conditioners, and ice-machines by using temperature controls and a recirculating chilled water loop system.

- ☑ Replace water-cooled air conditioning units with air-cooled models.

- ☑ Reduce water pressure to no higher than 70psi by installing pressure-reducing valves with pressure gauges.

- ☑ Install conductivity controller on cooling tower, if it does not exist. *

- ☑ Adjust boiler and cooling tower blow-down rate to maintain TDS (total dissolved solids) at levels recommended by manufacturer's specifications.

- ☑ Return steam condensate to the boiler for reuse.

- ☑ Consider using ozone as a cooling tower treatment to reduce water used for makeup.

- ☑ Check steam traps periodically; repair when necessary.

- ☑ Ensure water pipes are properly insulated avoid wasting water waiting for it to heat up.

Kitchen & Cafeteria

- ☑ Adjust ice machines to dispense less ice if ice is being wasted. Upgrade equipment with water-efficient models.

☑ Provide table signs urging water conservation.

Dishwasher Hints. Operate dishwashers only when fully loaded. Check with the manufacturer to see if dishwasher spray heads can be replaced with more efficient heads, or if flow regulators can be installed. In conveyor type washer, ensure that water flow stops when there are no dishes in the washer. Install a sensing arm, or ware gate that will detect the presence of dishes. Control flow of water to garbage disposal or consider eliminating the use of the disposal. Reuse the rinse water from the dishwasher as flush water in garbage disposal units. Install spray rinsers (foot pedal-operated) for pot washing and reduce flow of spray rinsers for prewash. Turn dishwashers off when dishes are not being processed.

Monitor continuous flow fixtures:

☑ Soak dirty pots and pans versus cleaning with running water and scrape dishes before loading into dishwasher

☑ Do not use constantly running water to melt ice in bar sink strainers or to thaw food

☑ Turn off food preparation faucets not in use.

☑ Educate the staff about the benefits of water use efficiency.

☑ Evaluate wash formula and machine cycles for efficiency. It may be appropriate to reprogram machines to eliminate a cycle.

☑ Turn off the continuous flow used to wash the drain trays of the coffee/milk/soda beverage island. Clean thoroughly as needed.

☑ Replace existing spray valves with efficient, high-velocity models. *

Laundry

☑ Install water efficient clothes washers. *

☑ Evaluate wash program considering daily wash loads. Consult manufacturer for specifications regarding minimizing water necessary for various load soil conditions.

☑ Check with chemical vendor and evaluate wash formula.

☑ Investigate a rinsewater reclamation system to reuse rinsewater for wash cycle.

☑ Consider installing a washwater and rinsewater treatment and reclamation system.

LANDSCAPE

☑ Landscape with drought resistant, low-maintenance plants. Practice xeriscaping. Discontinue irrigation of lawns and ornamental plants.

☑ Use low volume irrigation such as a drip system or soaker tubes. Use soaker hoses

(made from recycled rubber) to deliver water directly to plant roots.

- ☑ Water early in the morning or in the evening when wind and evaporation are lowest.
- ☑ Install an automatic rain shutoff device on sprinkler systems.
- ☑ Adjust the irrigation schedule for seasonal changes. Sprinklers generally do not have to be run as often in cooler weather or during the rainy season.
- ☑ Use mulch around landscape plants to reduce evaporation and weed growth.
- ☑ Use reclaimed water for irrigation and other approved uses.
- ☑ Install foot triggers on any faucet
- ☑ Apply water, fertilizer and pesticides to your landscape only when needed rather than on an automatic schedule. Look for signs of wilt before watering established plants. Ensure that your landscaper implements this practice.
- ☑ Hire a landscaper who has been certified by a Green Business Program. Any contractors and/or employees need to be informed of the water saving practices the facility wants followed.
- ☑ Avoid runoff by making sure sprinklers are directing water to landscaped areas and not to parking lots, sidewalks or other paved areas.
- ☑ Lower pool level to avoid splash-out. Use pool cover to reduce evaporation and heat loss when pool is not being used.
- ☑ Reduce water used to back-flush pool filters, remaining on site to watch the back-flush process.
- ☑ Raise the lawn mower cutting height - longer grass blades help shade each other, cut down on evaporation, and inhibit weed growth.
- ☑ Minimize or eliminate fertilizing, which requires additional watering.

Part Four: Creating and Implementing a Water Strategy

We can no longer be wasteful and careless in our attitude towards our water resources. Not only in the West, where the crucial value of water has long been recognized, but in every part of the country, we must manage and conserve water if we are to make the best use of it for future development.

– President's Water Resources Policy Commission (1950's)

This section was adapted from a new report by the Pacific Institute and Ceres, ***Water Scarcity and Climate Change: Growing Risks for Businesses & Investors.***

Companies have an economic imperative to mitigate their water impact. The risks associated with not doing so could lead to financial disaster. Less water does not mean less prosperity. On the contrary, water withdrawals in the U.S. peaked in the 1970's and have since leveled off (and even declined) due to water efficiency, while U.S. GNP has risen dramatically.[17]

This section will cover the different questions that you need to answer and the actions that you need to take in order to minimize the risks to your company. The following steps will help you assess your water inputs and outputs so that you can manage them to ultimately save water and maximize business opportunities.

Increased corporate water risk disclosure and reporting is vital for all companies that use lots of water. It is important to know the water supplies and future trends in supply and demand for the regions that you do business in – this includes your stakeholders (supply chain, employees, etc.) as well!

Firms that use water more efficiently now will have a competitive advantage over companies that choose to wait. A successful program must prioritize needs, set well informed goals, establish current performance minimums and carefully plan a course for action. Consider these principles when establishing water efficiency initiatives. **Remember to see this as a business opportunity – saving water, saves money!**

After reading this section, you will have insight in how to:

- **Calculate your businesses water footprint**
- **Identify the physical, regulatory, and reputational risks associated with your water footprint**
- **Engage key stakeholders and integrate water issues into strategic business planning and governance.**
- **Disclose and communicate water performance and risks.**
- **Create an action plan to reduce your water use throughout your value chain and incorporate water issues into your climate change strategy.**

What's Your Value Chain?

Or supply chain, a value chain is a chain of activities. Products pass through all activities of the chain in order and at each activity the product gains some value. The chain of activities gives the products more added value than the sum of added values of all activities.

When a company does a **lifecycle analysis**, oftentimes the supply chain can hold the biggest impacts. Water intensity is frequently hidden in companies' raw material inputs or suppliers. According to the Pacific Institute, it can take more than 1,000 times as much water to produce some inputs than is used in all onsite activities.

It is essential to know your impacts throughout your business, from end-to-end.

Value chain components include: Suppliers, Partners, Wholesalers, Retailers, End users

Examples:

- The farmers that grow the cotton for your clothing store
- The manufacturing plant that produces one of your components
- A customer using your product after you sell it

Six Steps to Creating Your Businesses Water Strategy

A recent report by the Pacific Institute and Ceres outlined five steps to assess your water risk and mitigate your impacts (we added the last step so that you can put all of this into an action plan).[18]

1. **Measure your company's water footprint (i.e. water use and wastewater discharge) throughout its value chain.**

2. **Assess the physical, regulatory and reputational risks associated with your water footprint, and seek to align findings with the company's energy and climate risk assessments.**

3. **Engage key stakeholders (e.g. local communities, non-governmental organizations, government bodies, suppliers, and employees) as a part of water risk assessment, long-term planning and implementation activities.**

4. **Integrate water issues into strategic business planning and governance.**

5. **Disclose and communicate water performance and associated risks.**

6. **Create an action plan to reduce your water use throughout your value chain.**

Step 1: Measuring Your Water Footprint

Corporate water footprinting[19] – continually developed by the Water Footprint Network (WFN) – has emerged as an accounting method to figure out how much water you are using (and polluting),

throughout your supply chain and operations.

Measuring your water footprint will not only help you determine how much water your business uses, it can also provide a useful standard for comparing and benchmarking your water use against your industry peers.

But, what is a water footprint?

A simple definition of a **water footprint** is the *total volume of freshwater that is used to produce the goods and services produced by the business.*

Typically, water footprinting is geographically focused on your individual watershed, indicating the location of water withdrawal or discharge, and includes both **direct water use** (e.g. water withdrawals) and **indirect water use** (e.g. water used to produce inputs).

The Water Footprint Network methodology differs from many other tools and approaches in that it measures water use in both your direct and indirect (suppliers, etc.) operations, whereas most other approaches simply measure water use in direct operations only.

The water footprint method further differs in that it looks at water consumption (as opposed to *just withdrawal*) by going beyond looking at blue water use only (i.e. use of ground and surface water), also including a green and a grey water footprint component.

Three primary components are measured in a water footprint (see **Table 6** below):

- **Blue Water Footprint** – freshwater from surface water and groundwater sources.
- **Green Water Footprint** – rainwater stored in soil as soil moisture.
- **Gray Water Footprint** – polluted water.

Table 7: Relative Water Footprint of Various Industry Sectors

	Raw Material Production	Suppliers	Direct Operations	Product Use/End of Life
Apparel				
High-Tech/Electronics				
Beverage				
Food				
Biotech/Pharma				
Forest Products				
Metals/Mining				
Electric Power/Energy				

Source: Pacific Institute/Ceres

Table 7 illustrates the relative differences in water footprints of different industries using generic value chain segments. It is important to understand that individual company water risk is not directly proportional to water use and discharge rates – the water footprint intensity – but are influenced by many factors, among them:

- Location of water withdrawal/discharge and natural socio-economic factors in the region
- Quality of water required, timing or reliability of water supply necessary for certain processes/sectors
- Climate change impacts and energy implications of water use/discharge

A large water footprint is still a good starting point as an indicator of increased business risk. Answer the questions later in this section to get started measuring your own water footprint.

Think on a Watershed Basis

Since water is so dependant on the area in which it is located, it is essential that you start to think about your own watershed. Mark McElroy from *The Center for Sustainable Innovation* advises:

> *Turn to the science of, essentially, hydrology, without trying to become a hydrologist. Even a layman can do a top-level of research and investigation as to what the general status or condition of water resources are in an area. I would try to get a general appreciation for:* ***is this an area that is generally considered water rich, water poor, have there been water shortages in this part of the world?*** *And, try to get a handle for where all that is heading…*

This local water resources knowledge will give you an understanding on the potential risks to your business either now or in the future (see **Water Tools** section for more).

Some General Water Footprint Conclusions and Trends

The Pacific Institute and Ceres in their *Water Scarcity & Climate Change* report identify **three major trends and conclusions**:

- **Value chain impact is larger than operations.** The most significant water risks often lie in a company's value chain – especially in the production of raw materials (food crops, fibers, and metals) – and not necessarily in their own direct day-to-day operations. It is important to see the big picture around your product or services to see how water risk may affect you upstream in your supply chain – these indirect risks can still pose great risks to your bottom line and/or reputation. For example, Dell and HP, representing 55 percent of the U.S. PC market[20], are not acknowledging or reporting the huge water footprint associated with the manufacture of semiconductors, which are a crucial component in their supply chain.

- **Rising competition with local populations for water access.** Many industries require vast amounts of high quality water for their operations (i.e. beverage, food, high-tech/electronics, and biotech/pharmaceutical). When companies operate in locations where water is scarce, they can face huge reputational and physical damages if they do not address their impact and take that into consideration when making decisions in sensitive areas. Local populations need to be prioritized over profit, so that all individuals have access to safe and affordable water. When faced with severe scarcity, shortage, or contamination of water sources, manufacturing facilities risk being shutdown or relocated. In addition, increased water scarcity is also leading to lower quality water, which increases pre-treatment costs.

- **Wastewater discharge poses growing risk.** Certain sectors (food, biotech/pharmaceutical, forest products, metals/mining, and electric power/energy) face many risks associated with their gray water footprint – those with large quantities of wastewater discharge. The reputational and regulatory risks associated with these sectors is very high, due to the high volume and concentration of chemicals in wastewater created by their manufacturing processes, which is a constant threat to freshwater resources and local ecosystems – only a small amount of contaminate can have enormous consequences. New or more stringent wastewater regulations may increase costs for wastewater treatment and discharge, disproportionately affecting these sectors.

Getting Started: Assessing your Baseline

One of the biggest hindrances to effective action is a lack of information (and/or failure to disseminate it). It is crucial that you do a comprehensive analysis of where your organization is starting from – **a baseline analysis** – in order to create a roadmap for where you are going.

1. A Simpler Approach

A simple way to do this first step is by gathering your water utility invoices for key operations and surveys with key suppliers. Obtain documentation from the previous fiscal year of your water purchased (e.g. monthly utility bills) and calculate total water usage and spending for your company. This will give you a baseline to measure your progress.

It should be noted that this simple approach will only address your direct water use and not the supply chain or the end-of-product use, which for most office-based companies will be the most important aspects of their water footprint (the water used to make computers, paper, etc.). This raises the question as to **how far you should go** with your footprint analysis? If you want to involve both your direct water use and your indirect water use, you should try the more involved approach presented by the **Water Footprint Network** below.

2. More Involved Approach

You can use the methodology presented by the **Water Footprint Network**, or you might also consider a professional **water audit** (visit http://www.sustainabilityconsulting.com to inquire about our **SSC Green Audit**). Audits can be free or relatively inexpensive, while yielding significant financial and water savings. Contact your local water utility to arrange an audit. Oftentimes, they are offered for free. (Note: you may need to work with other tenants in the building for an accurate measurement.)

Use the results of your water audit to forecast the expected annual savings and costs for each potential efficiency investment. Tax incentives and utility rebates should also be included in the calculation. It serves you if you prioritize you investments so that you implement the smaller, easier investments (some may be free) before the more costly ones.

Benchmarks
(Annual Basis)

Hotels/Motels	0.079 - 0.165 thousand gals. (Kgal)/sq. ft. 30.2 - 39.5 Kgal/room
Nursing/ Assisted Living	0.062 - 0.101 Kgal/sq. ft. 32.8 - 40.7 Kgal/bed 25.4 - 39.6 Kgal/apartment
Restaurants	0.17 - 0.21 Kgal/sq. ft. 10.6 - 14.3 Kgal/seat
Schools	0.012 - 0.019 Kgal/sq. ft. 1.7 - 2.7 Kgal/student

Source: *Benchmarking Task Force Collaboration for Industrial, Commercial & Institutional Water Conservation*, Colorado Waterwise Council, June 2007.

3. Benchmarking

Benchmarking is an important step to improve water efficiency -- it is the process of comparing one's own operational performance to other organization's so that you can become the leader in your field and make continual improvements! Essential to the process is looking at other industry sectors that have discovered ways of improving water efficiency. Benchmarking can be performance-based, process-based or strategic-based and can compare financial or operational performance measures, methods or practices or strategic choices.

Five Steps of a Benchmarking Process

1. ***Planning***
   Managers must select a process to be benchmarked. A benchmarking team should be formed. The process of benchmarking must be thoroughly understood and documented. The performance measure for the process should be established (i.e. cost, time and quality).

2. ***Observation***
   The observation step is a study of the benchmarking partner's performance level, processes and practices that have achieved those levels and other enabling factors.

3. ***Analysis***
   In this phase, comparisons in performance levels among the facilities are determined. The root causes for the performance gaps are studied. To make accurate and appropriate comparisons, the comparison data must be sorted, controlled for quality and normalized.

4. ***Adaptation***
   This phase is putting what is learned throughout the benchmarking process into action. The findings of the benchmarking study must be communicated to gain acceptance, functional goals must be established and a plan must be developed. Progress should be monitored and corrections in the process made accordingly. The benchmarking process should be interactive. It should also recalibrate performance measures and improve the process itself.

5. ***Search***
   Information on the "best-in class" performer must be determined. The information can be derived from the company's existing network, industry experts, industry and trade associations, publications, public information and other award-winning companies. This information can be used to identify the best benchmarking partners with which to begin cooperative participation.

Source: http://www.p2pays.org/ref/01/00692.pdf

Water Tools

We have checked out and researched the following water footprint tools. Let our knowledge and use of these tools guide you. There are three main tools that you should know about. See **Table 9** below for a quick comparison.

Table 9: Comparison of Water Tools

	Direct or Indirect Operations	Risk Analysis	GRI Compliant	Cost	Sample Users
Water Footprint Network (WFN)	Both direct and indirect operations	Yes	Yes	Not yet available as a product or tool. Methodology is free on website: www.waterfootprint.org	Coca-Cola, Nestlé
Corporate Water Gauge	Direct operations only	No	Yes	Offered through training or initial consulting engagements, with a minimum fee of $5000. After initial training, the tool is royalty-free under a perpetual non-exclusive license thereafter	Manufacturing & Industrial clients
Global Water Tool	Direct operations only	Yes	Yes	Free for download on website: http://www.wbcsd.org/web/watertool.htm	Mining, Manufacturing, and other water-intensive businesses with many sites in different geographic areas

1. Water Footprint Network (WFN)

The Water Footprint Network (www.waterfootprint.org) presents one of the more comprehensive methodologies out there, analyzing both the direct (operations) and indirect (supply-chain) water used to run and support a business; it differs from the ***Corporate Water Gauge*** and the ***Global Water Tool***, which only measure water withdrawals and water use in direct operations ONLY.

The water footprint method further differs in that it looks at **"water consumption"** (as opposed to just water withdrawal), where consumption refers to the part of the water withdrawal that really gets lost through evaporation, i.e. the part of the water withdrawal that does not return to the system from which it was withdrawn. Besides, the water footprint goes beyond looking at blue water use only (i.e. use of ground and surface water). It also includes a green water footprint component (use of rainwater) and a grey water footprint component

(polluted water). The WFN is in the process of creating many tools that will be available soon.

It should be noted that this is not really a tool yet and currently exists as a complex accounting methodology. In the near future, this will be broken down into useable tools. For now, check out the water footprint calculator: http://www.waterfootprint.org/?page=files/WaterFootprintCalculator.

Also, see **Step 1: Measuring Your Water Footprint** above for more information about the Water Footprint Network.

2. Corporate Water Gauge from The Center for Sustainable Innovation

The Corporate Water Gauge from the Center for Sustainable Innovation (www.sustainableinnovation.org) is a newer tool that brings a watershed basis approach to water reporting which is more compliant with GRI because it includes a 'sustainability context' that can help fulfill the promise of *true sustainability reporting* by actually allocating water resources to individual facilities by measuring water use against availability of local water resources.

This tool uses GIS datasets, local precipitation data and more, which it uses to allocate water resources to individual facilities as a basis for measuring sustainability performance. This is not so much a risk tool as a sustainability tool, so it is recommended that you use the Global Water Tool if you are trying to measure just risk.

See our **Interview with Mark McElroy from Sustainable Innovation** below where he goes into more detail on the Corporate Water Gauge.

3. Global Water Tool from the World Business Council for Sustainable Development

The Global Water Tool is a free and easy-to-use tool for companies and organizations to map their water use and assess risks relative to their global operations and supply chains. This is mainly a risk tool and is not nearly as comprehensive as the Water Footprint Network methodology. The tool, which was developed by CH2M HILL and an advisory board of 22 WBCSD member companies, aims to help corporations better manage their water use. It is great for a high level risk Analysis for mining, manufacturing, and other water-intensive businesses with many sites in different geographic areas made to answer such questions as:

- How many of your sites are in extremely water-scarce areas? Which sites are at greatest risk? How will that look in the future?
- How many of your employees live in countries that lack access to improved water and sanitation?
- How many of your suppliers are in water scarce areas now? How many will be in 2025?

It does not provide specific guidance on local situations, which require more in-depth systematic analysis. It was recently updated in March 2009 with more recent water datasets. It is downloadable from http://www.wbcsd.org/web/watertool.htm.

Key Questions: Does the company measure and understand its water footprint?

1. **Does the company know its direct water use?**
    a. Does the company measure how much water is required and used in its direct operations?
    b. Does the company measure the quantity and quality of its wastewater discharges?
    c. Does the company understand the connections between its energy and water use?

2. **Does the company know its indirect water use?**
    a. Does the company know which parts of its supply chain are most water-intensive?
    b. Is the company aware of how much water is used or discharged in association with its products and services?

Source: Pacific Institute/Ceres

Interview with Mark McElroy from Sustainable Innovation

We interviewed Mark McElroy, the founder of The Center for Sustainable Innovation (www.sustainableinnovation.org). Mark shared some interesting ideas – some quite different from our own – about sustainability, his **Corporate Water Gauge** tool, GRI and more.

Background: *With over 25 years of experience in management consulting, having worked at PriceWaterHouse Coopers and as a partner at KPMG, Mark McElroy is a veteran of the consulting industry. He was also a board member of the Sustainability Institute. His primary focus is on developing tools and methods for use by corporate sustainability managers, and focusing on the corporate sustainability management function itself and how to position it within organizations. In 2004, he founded The Center for Sustainable Innovation, which has focused on R&D to develop tools and methods such as the Corporate Water Gauge as well as consulting with companies trying to integrate sustainability management into their operations.*

Strategic Sustainability Consulting: Does your tool address a companies supply chain?

Mark McElroy: No it doesn't and that is quite intentional. We don't do that b/c we don't think it is appropriate to do that when we are trying to

address the sustainability performance of an organization. There's a big difference between doing what's referred to as lifecycle analyses, or lifecycle assessments, and organizational sustainability assessments. Here again, these are two different tools designed to address two different issues. And if your issue or intent is to understand the sustainability performance of an organization, your suppliers, in a sense, have nothing to do with it. They, for their part, can and should be, in our view, doing their own sustainability analyses regarding their own operations. It's not your job as a sustainability manager for one company, to in effect to take responsibility for what your suppliers are doing, your customers, etc.

SSC: How do you see your tool differing from the Global Water Tool offered by the WBCSD?

MM: It has a different focus and it has an important role to play and I think that a case could be made that both tools could be used side-by-side, depending on what an organization is trying to accomplish. I mean, our does not **doesn't really address the issue of risk** and, nor does the WBCSD's tool, so far as we're concerned, address the issue of sustainability. So, if you are interested in assessing risk and sustainability, you should use both tools. The WBCSD tool doesn't really do as thorough a job, in our view, at assessing the availability of renewable water resources at a very local watershed level of analysis and so far as we can tell, it doesn't address AT ALL **the need to allocate water resources to individual facilities as a basis for measuring sustainability performance**.

SSC: You mention that your tool is more compliant with GRI because it includes a 'sustainability context', while most sustainability reporting does not. Can you talk a bit about this? Why should businesses care about this?

MM: Without regard to any specific area or metric, what GRI essentially says is that sustainability measurements – take water, for example - that simply measures the level of water use or the efficiency of water use or which plots trends in water use, is grossly inadequate when it comes to making sustainability judgments, **b/c it fails to take the actual state of water resources into account**. So, even an organization that is reporting year over year declines or improvements in efficiency in water use, could still be performing in a wildly unsustainable fashion, b/c for all we know, the water resources that they are relying on are dropping at three times the rate. So the metrics really have to, in some way, take actual - in this case water resource conditions - into account as opposed to simply measuring water use; water use needs to be measured against water availability and I have never seen a GRI report that attempts to include consideration of the status of water availability, for any of the companies that are preparing GRI reports. And, even GRI itself, in preparing it's own GRI reports, fails to include that kind of context. So, that's what 'sustainability context' means and it was the widespread failure to include context in sustainability reports that inspired us to develop a general specification for metrics that would ALWAYS INCLUDE CONTEXT. [*I asked Mark whether he had been in*

contact with GRI about this issue and he said that they keep trying but have not had any luck yet].

SSC: What do you see as the biggest water risks facing companies today?

MM: [*laughs*] Running out of water, I guess! Running out of water or using water resources in a way that really fails to take other peoples interests into account and therefore raising the specter of litigation, regulatory interventions, and so forth. All of these issues can be addressed in a very deliberate way trying to take account of how much water is there out there in the places where we do business and are we using more or less than our fair share. We can all argue and disagree over what we think that fair share might be, but that's the right conversation to be having, as far as we are concerned, instead of not having the conversation at all.

SSC: If a business were just starting to think about their water use, where would you tell them to put their emphasis? How would you advise them to get started on this?

MM: I guess the way I would advise them would be the way that we did; turn to the science of, essentially, hydrology, without trying to become a hydrologist. Even a layman can do a top-level of research and investigation as to what the general status or condition of water resources are in an area. I would try to get a general appreciation for: is this an area that is generally considered water rich, water poor, have there been water shortages in this part of the world? And, try to get a handle for where all that is heading…

SSC: So once you have completed the corporate water tool, and you might have an idea of how much water should be allocated in your watershed, what do you do from then? How does a company go from that to creating an action plan?

MM: That of course is what this is all about. These tools are designed to inform management, not only on what the current profile of their water use is, but if there are any gaps between volume of water used versus volume of water allocated and if you are overusing, for example, the tool will tell you by how much. It will help to put an order of magnitude to the issue of excessive use or unsustainable use (if that's the case), and by the same token, it will help to put an order of magnitude on sustainable use and how far below an allocation an organizations actual use of water resources is; that might be used in the latter case, to help project a period of time, if any organization is experiencing growth but their water use is sustainable; one question is well, how long before we get to a point when our use of water resources exceeds our allocation and what should we be doing to control or manage that? That's precisely the kind of information that process managers, facilities managers, and engineers require to evaluate engineering alternatives or water use alternatives as part of their planning process.

Step 2: Assess Risks

According to a new report by the Pacific Institute and Ceres, very few companies are strategically thinking about water as a business risk in their operations. This is in part because they are largely unaware of water-related risks and how climate change will exacerbate our water problems. Businesses that start to think about these challenges now (incorporating their findings into their climate change strategies) will be far better positioned and put themselves at less risk in the future.

Water is very different to GHG emissions, which are essentially the same no matter where they might be generated. **It DOES matter whether you are using water in an arid or wet region, a city or the countryside.** Not all watersheds are created equal, nor are all communities and countries. "Because of water's regional and timing-specific character, companies need to convert water footprint data into actual water impacts and risks"[21], reveals the Pac Institute.

There are **three major water-related risks that businesses face:**

1. **Physical Risk:** local hydrological conditions (potential shortage risks, water quality risks, flooding risks, and possible impacts of climate change on future water supply and demand);
2. **Regulatory risks:** socio-economic conditions as they relate to water (trends in regional demand, local water governance capacity, and regional water pricing) and potential regulatory costs;

Table 10: Potential Business Impacts from Water Scarcity

Challenge:	Business Impacts may Include:
Increasing water demand	Increased competition for water resources resulting in: - Higher costs for water. - Regulatory caps for water use. - Conflicts with local communities and other large-scale users. - Growing demand for water efficient products and technologies.
Water scarcity and climate change	- Decreased amount of water available for business activities. - Increased costs for water. - Operational disruptions and associated financial loss. - Impacts on future growth and license to operate.
Declining water quality	- Increased costs for pre-treatment to obtain desired water quality. - Increased costs for wastewater treatment to meet more stringent regulations. - Regulatory restrictions for specific industrial activities and investments. - Increased health costs for employees in the countries that are impacted. - Increased responsibility (and costs) to implement community water infrastructure and watershed restoration projects to mitigate reputational risks.

3. Reputational risks: potential impacts of a company's water withdrawal or wastewater discharge on local communities and ecosystems, and disparities or inequities in local and regional water access.

Your business should determine the risks associated with all of your operations **(including your supply-chain!)** and have detailed understanding of local water conditions, as well as hydrological, socio-economic, and political factors.

Answer the questions below for guidance on how to approach this.

Key Questions: Has the company assessed the business risks associated with its water footprint?

1. Has the company evaluated water risks associated with its direct operations?

a. How are the company's direct operations dependent on quantity, quality, timing and cost of water supply?
b. What is the nature of the company's water rights and legal obligations with regard to quantity, quality, price, reliability and duration of water supply?
c. What percentage of the company's direct operations is located in water-stressed or ecologically sensitive regions? Is water demand growing in those regions?
d. What percentage of the company's direct operations relies on energy sources that require large amounts of water to produce?
e. What percentage of the company's direct operations is located in the areas where local population lacks access to clean and affordable drinking water and sanitation?
f. What is the water infrastructure situation and water management capacity in regions with key operations?
g. How does the amount and source of the company's water withdrawals impact local communities and ecosystems?
h. How does the quantity and quality of wastewater discharges impact local communities and ecosystems?
i. What is the quantity/quality of the company's wastewater discharges in relation to permitted levels and/or industry averages?

2. **Has the company considered water risks related to its extended supply chain?**

a. How might the company's supply chain be affected by changes in water supply, quality, reliability, and price?
b. What percentage of the company's supply chain is located in water-stressed or ecologically sensitive regions?

Key Questions: Has the company assessed the business risks associated with its water footprint? (Continued)

c. Has the company considered water-related regulatory risks of key suppliers?
d. What percentage of the company's key suppliers relies on energy sources that require large amounts of water to produce?

3. **Has the company considered water risks related to its products and services?**

a. How are the company's products and services dependent on quantity, quality, reliability and the price of water supply? How do they perform in relation to competitors?
b. What percentage of the company's product users and customers is located in water-stressed or ecologically sensitive regions? Are those customers and users located in regions with growing water demand?
c. Do the company's services and products have potential impacts on water resources when disposed of or recycled?
d. How will water supply, quality, and reliability in the company's key markets be potentially affected by climate change?
e. What percentage of the company's direct operations and supply chain are located in areas where the local population lacks access to clean and affordable drinking water and sanitation?
f. Has the company considered water-related regulatory risks of its products and services?

4. **Does the company have contingency plans to respond to water risks, such as supply disruptions, price increases, more stringent regulations, etc.?**

a. Does the company conduct contingency planning for regions with key operations?
b. Does the company have contingency plans to respond to supply chain disruptions or raw material price increases due to water issues?

5. **Has the company assessed how climate change will affect water availability, reliability, price and quality?**

a. How might the company's direct operations be affected by changes in water supply quantity, quality, and reliability due to climate change?
b. Does the company assess how its raw material supply and supply chain may be affected by change in water supply quantity, quality and reliability due to climate change?
c. Does the company assess how users of its products and services may be affected by change in water supply quantity, quality and reliability due to climate change?
d. How might water price, permits and water quality regulation be affected by climate change in key places the company operates?

Source: Pacific Institute/Ceres

Step 3: Engage key stakeholders

It is important to engage your key stakeholders early on in your decision-making process. Talk with the local community, your suppliers, local government officials, employees, and any other relevant parties. Involve them in the process, get feedback and share best practices.

It is particularly important to establish good communication with your own employees so that you get buy in into the importance of water management. Equally crucial is to understand the needs of the local communities in which you do business.

This process should create an open dialogue that should enable you to minimize surprises and reduce risk of future water-related disputes and/or disruptions. Also, these discussions can lead to crucial action steps and help you prioritize your most important initiatives.

Answer the questions below for guidance on how to approach this.

Key Questions: Does the company engage with key stakeholders (e.g., local communities, non-governmental organizations, government bodies, suppliers, employees) as a part of its water risk assessment, management, and long-term planning?

1. **Does the company consult with local communities and non-governmental organizations regarding water impacts as it considers where and how to site or expand its operations?**

2. **Does the company work with local governments, businesses and communities to develop and implement integrated watershed management in locations with key operations?**

3. **Does the company collaborate with governments and communities to address issues related to access to drinking water and sanitation?**

Source: Pacific Institute/Ceres

Step 4: Integrate Water Issues Into Strategic Business Planning and Governance

Businesses need to start integrating water risk into business planning and strategic decision-making. This involves a few key areas to focus on, from developing a comprehensive corporate water policy to contingency plans.

The following section was directly taken from the recent study entitled *Pacific Institute and Ceres,* ***Water Scarcity and Climate Change: Growing Risks for Businesses & Investors:***

> ***Corporate water policy:*** *A corporate water policy is an essential vehicle for guiding decisions throughout a business, and for communicating practices and expectations to suppliers, partners, and other stakeholders. A corporate water policy should include the following:*
>
> - *A statement on why water is important for the business*
> - *How, and to what degree, company activities impact water resources*
> - *Challenges the business faces in water management.*
>
> ***Water management and governance:*** *To help drive performance, companies should develop water management plans, set goals and targets, and establish high-level executive and board accountability for water risk. Specifically, companies should:*
>
> - *Affirm top management commitment by clearly articulating the linkages between water-related issues and financial performance.*
> - *Make water management the responsibility of a top executive who reports directly to the CEO and ensure that a board committee has water management issues as a clear part of its mandate.*
> - *Develop a water management program with specific priorities, tasks, measures and quantified performance goals based on the company's water, energy, and carbon footprints and impact assessments.*
> - *Consult water suppliers, industry associations, and regulatory agencies for guidance, best management practices, technical assistance or financial incentives, and information about applicable regulations.*
> - *Form a water-energy team staffed by representatives of every business function that uses significant amounts of energy or water, or that has the potential to pollute water systems.*
> - *Publicize water management objectives to employees and external stakeholders and solicit feedback.*
> - *Provide clear position statements on public policies that impact water issues at the local, state and federal levels.*
>
> ***Integrate water with energy and climate strategic planning:*** *Companies will need to consider and integrate the potential impacts of climate change on water supplies and water quality. Climate-related impacts on water should also be considered when making a range of strategic business decisions from factory design and siting to new product development. Companies should also evaluate the energy implications of water management plans and strategy*

and seek combined and integrated solutions to water and energy.

Contingency plans: *For key areas of operation and sourcing in high-risk regions, contingency plans should be developed to respond to risks such as decreasing water availability and quality, higher water prices, extreme hydrologic events, and local economic development. Potential climate-related impacts should be explicitly considered in contingency plans. Contingency plans should also include demand-side and supply-side strategies.*

Risk management in companies' value chain: *A company's strategic water plan should focus on managing water quality and increasing water efficiency in the processing and sourcing of raw materials and other inputs, as well as water impacts during and after product use. Water risk management should also foster engagement with suppliers, including training and support along the supply chain.*

Be sure to also answer the **key questions** below.

Key Questions: Does the company engage with key stakeholders (e.g., local communities, non-governmental organizations, government bodies, suppliers, employees) as a part of its water risk assessment, management, and long-term planning?

1. **Does the company consult with local communities and non-governmental organizations regarding water impacts as it considers where and how to site or expand its operations?**
2. **Does the company work with local governments, businesses and communities to develop and implement integrated watershed management in locations with key operations?**
3. **Does the company collaborate with governments and communities to address issues related to access to drinking water and sanitation?**

Source: Pacific Institute/Ceres

Key Questions: Has the company integrated water risk into its overall business planning and governance structure?

1. **Does the company have a water management policy and plan?**

    a. Has the company's top management (i.e. CEO and board) publicly expressed its commitment to sustainable water management?
    b. Has the company made water management the responsibility of a direct report to the CEO and ensured that a board-level committee has water management as part of its mandate?
    c. Has the company formed an integrated water-energy team staffed by a representative of every business function that uses significant amounts of water or energy, or has the potential to pollute water?
    d. Has the company developed water management programs with specific priorities, tasks, measures and quantified performance goals based on the company's water, energy, and carbon footprints and impact assessments?
    e. Does the company have a system that promotes continuous improvement in water management and performance?

2. **Does the company meet or exceed regulatory requirements for water use and quality?**

    a. Does the company meet or exceed regulatory requirements in its direct operations?
    b. Does the company work with suppliers to make sure that they meet or exceed regulatory requirements for water use and quality?

3. **Does the company's water management planning integrate the impacts of climate change on water resources?**

    a. Does the company consider impacts of climate change on water for siting or investment decisions?
    b. Does the company consider the energy implications of water management plans and activities?

4. **Does the company develop or invest in business opportunities that address water issues?**

    a. Does the company develop and provide solutions to water scarcity and quality, such as water efficiency or treatment technologies, water-efficient products, etc.?
    b. Does the company apply best available technologies to improve water efficiency or wastewater quality?
    c. Does the company consider energy implications of measures and solutions to water issues?

Source: Pacific Institute/Ceres

Step 5: Disclose Water Performance and Risks

Once you have measured your company's water footprint, assessed your biggest water risks, engaged your key stakeholders, and integrated your findings into your business strategy, it is now time to disclose all of this publicly.

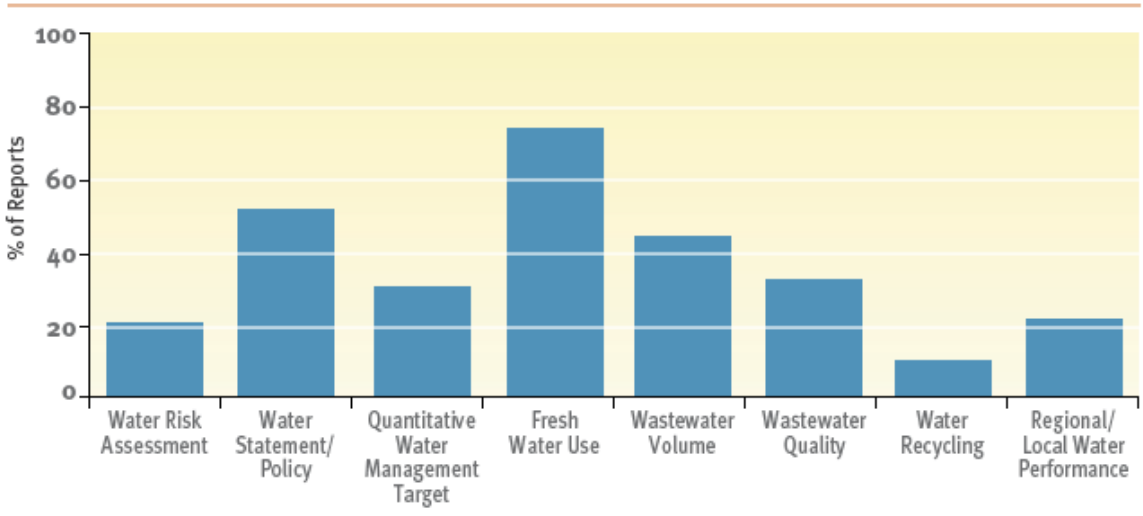
> *The Pacific Institute report showed that only 20 percent of 121 of the largest companies in 11 water-intensive industry sectors report water-related risks or describe programs to assess water risks, and only 10 percent describe supply chain considerations in relation to water management. Not a single company reported on the actual water use or wastewater data of their suppliers. Another problem with present corporate water disclosure is the inconsistency of reporting methods and metrics, which makes comparison and benchmarking difficult for external audiences. The study also found that site-specific information or local facility-level data is often not provided. However, considering the location-specific character of water scarcity, such information is crucial to fully understanding water risks.*[22]

Transparency and authenticity are the keys to being a socially responsible business. Not only does this help stakeholders assess how you are addressing your water risks, it also helps your own employees get on board and realize the importance of water

All businesses, small or large, should publicly report their management activities and the key metrics of their water use and impacts and track how they are performing over time. This can be as simple or complex as your own business, however it is important to let the world know what you are doing to address your water risks.

Answer the questions below for guidance on how to approach this.

Figure 11: Water Reporting – Types of Information Published in Non-Financial Reports



Source: "Corporate Reporting on Water. A Review of Eleven Global Industries." Pacific Institute

Key Questions: Does the company disclose and communicate its water performance and associated risks?

1. **Does the company report and communicate its water policies and management plans?**

2. **Does the company report its water performance, using broadly accepted metrics or indicators, such as those provided by the Global Reporting Initiative?**
   a. Does the company report its water use/discharges for direct operations?
   b. Does the company report water use/discharges at the regional or facility levels?
   c. Does the company report water use/discharges for key suppliers?

3. **Does the company disclose water-related risks in its 10-K or other financial filings?**

Source: Pacific Institute/Ceres

Step 6: Create an Action Plan

If you've been following along with this process, by now you have strategically identified several overarching water issues to focus on over the coming year. You've also identified which specific actions make the most sense to pursue, given their relative environmental impact, their potential for success, and other business considerations (like flexibility and return on investment).

Now it's time to allocate resources. For each of the high priority action items, complete the following questions

1. **Who will have responsibility for accomplishing this task?**
   For every action item, you need to select a single person who will be accountable for the project. There may be many people involved in the task, but at the end of the day there needs to be a single point of reference for everyone involved.

2. **What resources are needed?**
   Identify all of the things that you'll need to accomplish the task at hand. How many hours will need to be devoted to each action item? What technical issues (new IT hardware/software, for example) do we need to address? How much money do you need to invest? Be generous here –there is sometimes a tendency to underestimate the resources you'll need in order to make it "look feasible". In reality, if you don't have the personnel, technology, and budget to see a project all the way through, you need to go back to the action item and see if there is a way to break it down

into smaller, m ore manageable pieces. If you can't break it down further, and still don't have the necessary resources, it's better to put the project on hold completely.

3. **What is the timeline?**

   Figure out how long it will take to finish each task. This is different than the total number of hours people will spend actually doing the task, but rather the number of days or weeks that will elapse from beginning to end of each action item. So while it might only take 5 hours to install power management settings on all of your organization's computers, it might take a whole week to complete the task (doing a few computers each day).

4. **How will we measure progress?**

   There is a saying: what gets measured gets managed—and it's especially true with green initiatives. In order to create a solid water strategy, you absolutely MUST be able to compare "before" and "after". Too many organizations try to retroactively measure their progress, but it's much more effective to choose a measure ahead of time to ensure that you gather the right data along the way.

Make sure you have input from a variety of people during this process, since it's important to have an accurate and reasonable action plan before you begin to try out specific actions. Additionally, be sure to put it all into a single document—an action plan needs to be something everyone can see and touch and edit. Having the plan in your head, or in a scattered set of notes and emails, invites confusion and conflicting expectations—especially about the time and effort being allocated to different initiatives.

Once you have a water management strategy on paper, the next step is to begin actually making the improvements! As you get started, you'll go through a process of trial and error. Don't be afraid to go back and modify your document—in fact, plan to regularly evaluate your plan to tweak and adjust accordingly. Remember that your plan is a living document!

Part Five: Specific Strategies for Businesses

"The path to a sustainable water future lies not with more hard infrastructure of dams and pipelines but with the soft infrastructure of local water management, smart small-scale technology, active community participation in decision-making, and efforts of innovative businesses."

Pacific Institute's *Waste Not, Want Not* report, 2003

Since water use varies greatly among individual users in both quantity and purpose, it makes sense to examine each industry independently. Different types of businesses have different needs and processes, which requires specific knowledge of the best practices within your particular industry.

Organizations often choose less-efficient technologies (or don't do anything) because they are operating with incomplete information. Our intention is to fill the gaps in your knowledge so that you have a good idea of the most cost-effective solutions for your particular business (be sure to look at the case studies to get real-world examples of how others in your industry are approaching water management).

Residential

The average American family washes almost 400 loads of laundry each year. Families can cut their related energy costs by more than a third — and the water costs by more than half — just by purchasing a clothes washer with the ENERGY STAR labels.[23]

It is important to encourage employees to bring sustainable water conservation practices back home. After all, that is where your employees spend a great deal of their time.

Much of this will be in the behavioral component – i.e. how they use water (see **Water Use Behavior** section). For example, do they water their lawn too much in the (middle) heat of the day or in the cool of the early morning?

The second component is the technological – what water technology products are at their disposal that will help them beyond the behavioral (see **Water Conservation: Basic Technologies** section). Remember, many water utilities offer substantial rebates or incentives for these products, so check with your local utility before purchasing. Toilets and landscaping are good quick wins, representing the lion's share of residential water use.

Quick wins:

- Check and repair leaks
- High-efficiency toilets
- Aerators for all faucets & low-flow showerheads with stop valves
- ENERGY STAR clothes washers & dishwashers

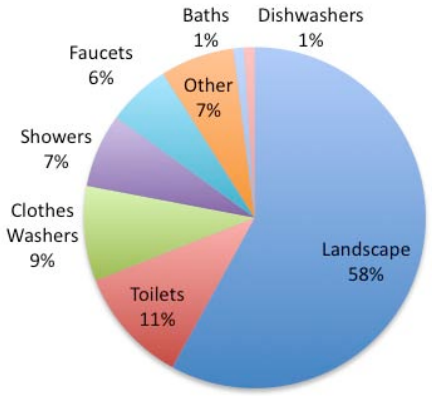
For landscape irrigation:

- First, minimize your watering needs by switching to native species and less water-intensive (drought-tolerant) plants.

- Satellite-enabled (drip) irrigation controllers w/ self-closing nozzles
- Gray Water system and/or Rain Water Harvesting system

For a great resource check out: www.h2oconserve.org. Be sure to look for the ENERGY STAR (www.energystar.gov) and WaterSense (www.epa.gov/watersense) product labels.

Figure 9: Residential Use of Water



Source: AWWA End Uses of Water

Golf Courses

Golf accounts for 0.5 percent of annual water usage in the United States (some golf courses use as much as 132,000,000 gallons of water per year![24]), according to a study released this year by the Golf Course Superintendents Association of America. Golf courses are all but weaned from municipal fresh-water systems, with 86 percent now using some other source, liked recycled effluent water, surface water or water treated by reverse osmosis. Significantly, 70 percent of superintendents surveyed said they were keeping their turf drier.[25]

Walter Norley, the founder and chief executive of Advanced Sensor, says:

> *The reality is that that the water situation itself is very significant. There is usage legislation in a number of states, and when it comes to mandates, the golf world will be the lowest-hanging fruit of all the irrigation applications. If decisions are to be based on who gets water, crops for food or someone's green, green, green fairways, it's pretty obvious who will get the water.*

Golf courses are a huge water user and therefore water availability presents not only a huge business risk, but an essential component of future business operation.

Run-off from over-irrigation is also a huge problem, causing pollution of local freshwater resources and also damaging property.

If you own or operate a golf course, you probably know how important it is to develop a water strategy that takes into account your particular watershed and community needs. Your community may be trying to ban further development of golf courses, especially in areas of water shortage.

Water Conservation for Golf Courses

According to the United States Golfing Association, the golf industry has recognized its responsibility to reduce water use and become less reliant on potable irrigation sources, taking many steps to achieve that goal, including[26]:

1. **New grass varieties that use less water or can tolerate poor quality water.** Water savings of between 30% to 50% can be realized by the use of certain varietals, including:

   a. **Buffalograss (Buchloe dactyloides)**, a native of the American Great Plains, can replace high water use grasses on fairways and roughs in a large geographic area of the Mid-West, resulting in water savings of 50% or more.

   b. Improved cold-tolerant, seeded-type **bermudagrass (Cynodon dactylon)** cultivars allow this stress-tolerant, low water use grass to be established in the transition zone as a replacement for high water use cool season grasses. Water savings of 30% to 50% or more can be realized.

   c. **Seashore paspalum (Paspalum vaginatum)** is an extremely salt-tolerant grass that can be irrigated with high-salt or brackish waters with little effect on turf quality. Cultivars are available for greens, tees, fairways and roughs, and some can be irrigated with water directly from the ocean!

   Ongoing breeding work on **zoysiagrass** (Texas A&M), **saltgrass** (Colorado State and Arizona State), **annual bluegrass** (Minnesota and Penn State Universities), **alkaligrass** (Loft's), **fairway crested wheatgrass** (Utah State), **colonial bentgrass** (Univ. of Rhode Island) and a number of grass species at Rutgers University and at other commercial seed companies, will provide new grass varieties for golf that reduce water and pesticide use for decades to come.

4. **New technologies that improve the efficiency of irrigation systems.** Considerable savings of water and energy resources can be achieved with these technologies with an ***ROI of about 1-2 years***. For example, the SCGA Members Club in Murrieta, CA recently installed a completely new, state-of-the-art irrigation system and has reduced water use by about 35%. And because they are able to complete their irrigation schedule in a narrow window during nighttime hours, their considerable energy costs have been reduced by about 50%.

   a. **Weather- or Sensor-Based Irrigation Control Technologies.** Using satellites to get accurate real-time weather such as humidity, wind, and rainfall, and other information specific to the plant and soil type, landscapes are never over-irrigated. There also is a considerable effort being made to adapt various types of sensors to evaluate turf soil moisture replacement needs, including tensiometers, porous blocks, heat dissipation blocks, neutron probes, and infrared thermometry.

   b. **Improving irrigation uniformity through careful evaluation of sprinkler head design, nozzle selection, head spacing, pipe size and pressure selection.** The Center for Irrigation Technology (CIT)(Cal State University at Fresno, 5370 N.

c. Chestnut, Fresno, CA 93740; phone 209-278-2066; http://cati.csufresno.edu/cit) is a leader in combining sprinkler uniformity and relative turfgrass quality needs to achieve the greatest water savings possible on golf courses and other turf areas. Many golf course irrigation design companies and individual golf courses routinely use CIT services to reduce golf course water and energy consumption.

d. **Using state-of-the-art computerized control systems, portable hand-held controllers, and variable frequency drive pumping systems to apply water in the most efficient means to reduce water and energy consumption.**

5. **"Best management practices" in golf course maintenance that result in less water use.** Best Management Practices for water conservation could be described as the combination of proper plant selection and cultural maintenance practices that provide adequate turf quality for the game of golf while minimizing water use. These could include:

a. Selecting low-water-use turf grasses, groundcovers, shrubs and trees for use on the course.

b. Providing adequate levels of nutrients to the turf, including a balance of potassium and nitrogen, while avoiding excessive levels of nitrogen.

c. Using mulches in shrub and flowerbeds to reduce water evaporation losses.

d. Adjusting mowing heights to the ideal levels, depending on species and seasonal water use characteristics.

e. Using soil cultivation techniques such as spiking, slicing and core aerification to improve water infiltration and minimize runoff during irrigation or rainfall events.

f. Improving drainage where needed, to produce a healthier turf with better root systems that can draw moisture from a larger volume of soil.

g. Limiting cart traffic to paths to minimize turf wear and limit soil compaction.

h. Cycling irrigation sessions to ensure good infiltration and minimize runoff.

i. Root pruning trees near critical turf areas to prevent tree root competition with the turf for moisture and nutrients.

6. **Alternative water sources that reduce or eliminate the use of potable water.** Communities are concerned about golf course water needs - either from municipal sources or from on-site wells - especially in areas of drought and water use restrictions. Many golf courses have developed alternative irrigation water supplies that don't depend on potable sources. These include:

a. **Storage ponds to collect storm runoff water that might otherwise be lost and wasted.**

b. **Use of tertiary treated effluent from municipal sewage treatment facilities.** This recycled water provides moisture and nutrients to the golf course while helping the municipality avoid discharging the effluent water into nearby rivers. The turf does an excellent job of filtering the water of nutrients and breaking down various chemicals and biological contaminants in the water. Use of recycled water on golf courses is mandatory in some locales in the Southwest, and it is estimated that more than 1000 courses nationwide currently use this source of water.

c. **Use of brackish waters or even ocean water to supplement other water sources.** Bermudagrass is quite tolerant and seashore paspalum is very tolerant of high salt content water, allowing golf courses to irrigate with brackish waters that otherwise have little other use. For example, the Old Collier Golf Club in Naples, FL is planting its greens, tees, fairways and roughs to two of the new seashore paspalum varieties emanating from the Univ. of Georgia breeding program, and will be using ocean water from a nearby estuary bay to irrigate the turf. A state-of-the-art irrigation system will allow precise application of this water so as not to affect native plant materials, and the entire course will be irrigated during six off-peak hours to minimize energy costs.

d. **Construction of reverse-osmosis (RO) desalinization plants on-site to produce irrigation water from ocean water or brackish water where other supplies are not available or are very expensive to purchase.** The Everglades Club on the Barrier Island of Palm Beach, FL; the Jupiter Island Club in Hobe Sound, FL; the Sombrero Country Club in Marathon, FL; and the Mahogany Run Golf Course in St. Thomas, U.S. Virgin Islands, all have built RO plants in recent years and have established good-quality, dependable, and less costly supplies of irrigation water, while allowing others in their communities to use the limited supply of potable water.

7. **Golf course design concepts that minimize the area maintained with grasses that require considerable use of water.** When designing a golf course, here are some ways to design for water savings:

- Careful earth shaping and good drainage design is used to collect runoff and sub-surface drainage water in on-site storage lakes.
- Turfed areas and water-demanding landscape areas are held to a minimum, resulting in water savings of 50% or more.
- Golf course sites with poor or inconsistent soils are capped with a 6-inch layer of sand to allow uniform water infiltration and a significant reduction in water use by reducing runoff and avoiding over-application of irrigation water

Water Quality for Golf Courses

For golf courses, water quality is often linked to the use of pesticides and fertilizers on the course and the potential for these chemicals to enter groundwater or surface water systems.

USGA-sponsored research has focused on the factors influencing water quality; between 1991 and 1994, ten research studies investigating pesticide and fertilizer effects were sponsored at 11 universities. This research provided useful preliminary information on pesticide and fertilizer fate, as well as testing and developing a variety of measurement devices and research methodology for turfgrass.[27]

Among the numerous practices to help maintain water quality:

- Adapted grasses with pest resistance
- Correct mowing heights
- Proper fertilization and irrigation
- Adequate drainage
- Integrated pest management
- Biological controls

Groundwater and surface water quality is affected by two mechanisms: **leaching** and **runoff**.

Leaching is the downward movement of a pesticide or fertilizer through the soil and potentially into the groundwater. Many fertilizers and pesticides must penetrate the turfgrass to reach the soil and roots to achieve effectiveness. Yet when products penetrate too quickly, the result can be negative in several ways. First, the product may not perform as well as desired or expected. Second, the product may move below the root zone so the plant is unable to utilize the product. The applied product may continue moving through the soil and eventually enter the groundwater. Thus, it is in the interest of everyone to determine when leaching is likely to occur and how it can be prevented. The degree to which a product leaches is affected by several factors:

- Soil type (products leach less in clay than sand) & turf maturity (a well-established, mature turf with some thatch will slow leaching).

- The degree to which fertilizers or chemicals bind to the soil (soil scientists use a term called Koc to predict binding potential - a Koc value of less than 300 to 500 is considered low, and may indicate the potential for leaching in some situations).

- Persistence of chemicals or fertilizers in the soil (how long it takes to break down).

- Solubility of the pesticide in water.

- Proper application of pesticides and fertilizers.

Runoff describes the movement of water across the turf and soil surface, such as what happens after a thunderstorm or heavy irrigation. If this water removes pesticides or fertilizers from the turf, then it can move these chemicals into streams, lakes, and rivers.

Surface water features such as ponds, lakes, and streams are an integral part of many golf courses and landscapes. They not only provide a valuable source of irrigation and habitat for fish and wildlife, but also add challenging obstacles for golfers.

Protecting surface water requires good planning by turf managers to prevent accidental pesticide and fertilizer contamination. **The most common reason for surface water contamination by fertilizers or pesticides is heavy rainfall soon after application, before the material has moved into the soil or thatch.** Heavy rainfall can move the pesticide or fertilizer because it has remained on the surface and not yet had a chance to be adsorbed by the soil, used by the plant, or broken down in the soil. Sloping terrain, thin turf, and poorly drained or compacted soils can also contribute to the potential movement of fertilizers and pesticides into surface waters.

Several encouraging developments have reduced the potential for pesticide and fertilizer movement into surface waters. New pesticides are used at lower rates and degrade faster in the environment. This reduces the chances for surface water contamination. Golf course superintendents are highly trained to do a better job of applying pesticides and fertilizers. Newer, more technologically advanced equipment improves the placement of these materials. By raising the awareness of turf managers to be more careful with pesticides and fertilizers applied near water, the chances for surface water contamination are significantly reduced.

Resources

For more information, visit the United States Golf Association (http://www.usga.org), where you will find research, specific products, techniques, and technologies to consider and more.

Case Study:
Soil Sensors Help Save Water for Golf Clubs

Soil sensors monitor moisture, temperature, and salinity in the soil and feed data to a software network accessed remotely on any computer. This allows huge water savings. As Shawn Emerson says, superintendent at Desert Mountain Golf Club: "with these sensors, we only water when the soil tells us it needs to be watered."[1]

Early adopters of soil sensor technology say they will cut an average of 10 percent of their typical water use, amounting to millions of gallons of water each year. At that rate, these systems pay themselves off within the first year, depending on the volume of water a course uses.

Currently, fewer than 100 of the estimated 15,700 golf courses in the United States have sensors installed. With more than 20 states affected by some form of drought or water restriction, this technology is sure to spread. And the technology can be used in many applications besides the golf course, including athletic fields, agriculture, commercial and residential landscaping, and in parks.

Some Success Stories:

- In 2005, Merion Golf Club in Ardmore, Pa. installed a product called RZ wireless before a golf championship, saving about 10% of their typical water use, amounting to millions of gallons per year.

- Desert Mountain Golf Club, a complex of six courses with 500 acres of turf in the Southwest, save more than 100 million gallons of effluent water, or an average of 18 million and 20 million gallons per course for the year. Approximate savings at current prices: $130,000.

- The Card Sound Golf Club in the Florida Keys recently installed wireless sensors in April and uses recycled water from reverse osmosis for irrigation needs. Since this water has high salt content, the club must regularly flush the greens with fresh water using approximately 150,000 gallons; water savings have been significant from implementing wireless sensors - they have halved the amount of water needed to do this.

- There are a few companies competing in the market for wireless sensors, the leader currently a system called UgMo (http://ugmo.com/), a network of wireless sensors that mine subsurface data and link to a software package developed by Advanced Sensor Technology of King of Prussia, Pa.. Other competitors include, Toro (www.toro.com) and Environmental Sensors (www.esica.com).

Source: New York Times
(http://www.nytimes.com/2009/05/21/sports/golf/21watering.html?_r=1&partner=rss&emc=rss&pa

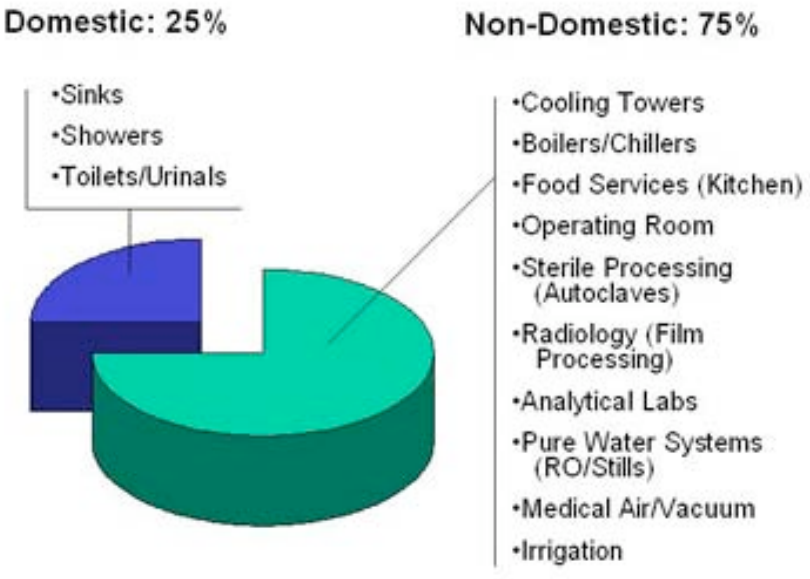
Hospitals & Medical Facilities

Hospitals use an average of about 139,000 gallons of water per day.[28] Healthcare facility water use varies widely depending on type, size, geographical location, and water use equipment/practices. A water use study published in 2002 showed a range of water use from 68,750 to 298,013 gallons per year per bed for hospitals in the size range of 133 to 510 beds.[29] This is a huge liability for any business, especially one that relies on water to save lives.

Most of all water use in a medical facility is used for cooling (54%), followed by domestic water use (24% - bathrooms, operations, etc.), and then cleaning (10%).[30] These are the three main areas that you should look for your facility. Look at the checklist below to see the areas where your medical facility can save.

As different as many hospitals and medical facilities can be, they have similar water uses in equipment, operations and procedures. Water conservation makes good sense for healthcare facilities. Reducing water use can lead to major savings in terms of lower water and sewer bills. In addition, many water conservation techniques can be directly linked to reduced energy consumption, resulting in even greater cost savings.

Figure 10: Hospital Water Use



Source: Practice Greenhealth Green Guide for Health Care Series - Water Conservation

Medical Facility Water-Saving Tips

In addition to the general water-saving tips in the **Basic Water Conservation Checklist**, here are some specific to medical facilities[31]:

- **Conduct a water use survey to update current water use needs.** Medical methods, processes and equipment are constantly upgrading, thus changing the need for water in some areas.

- **Staff.** Evaluate daily routines of staff (i.e. patient showering, cleanup, scrubbing and hand washing) and encourage efficient practices and procedures regarding water use.
  - Set up a system for all facility staff to look for and report leaks and constantly running water sources. Some large facilities have had hidden leaks, or failed valves, that ran for years before discovery.

- **Operations and Equipment.** *Domestic water use accounts for an average of 24 percent of the water use in health care facilities.* This includes bathrooms, equipment, faucets, etc.
  - **X-ray.** Whether you are using traditional x-ray film or the newer digital x-ray technology (which we highly recommend), there are many ways to reduce the water intensity and waste from your x-ray.
    - **First off, consider going "digital"**. Digital x-ray technology enables digital image review, thereby eliminating the film and chemicals used by an analog processor. For example, eliminating 50,000 analog films saves 1,900 gallons (7,200 L) of fixer and developer per year. Digital x-rays save energy and space, and avoid water and chemical use for film processing, while maintaining the same imaging volume. Additionally, this avoids the need to purchase, handle and dispose of processing developer and fixer chemicals. For example, a GE Healthcare digital radiography x-ray system has the potential to reduce energy consumption by 4,300 kWh or 78%, and save approximately $100,000 USD per year in productivity and material costs based on US national averages.[32]
    - **X-Ray Film Processor Re-Circulation System.** If you can't go digital, this is a second best option. The amount of water required to operate a non-digital x-ray film processor can be reduced by 98%! In one year, a typical film processing system needlessly sends hundreds of thousands of gallons of water down the drain. The average processor uses 788,400 gallons of water per year. With this re-circulation system, you can reduce wash-water effluent to 13,530 gallons per year, which lowers water and sewage costs. Municipal water supplies can be shut down by disasters such as earthquakes, storms and droughts; with 15 gallons of bottled water and a power source, the processor can process films during a loss of water in an emergency. This technology is eligible for up to a $2,000 Rebate from the California Urban Water Council.[33]

Also,

- Install automatic valves on film processing or X-ray equipment to stop water flow when equipment is not in use.
- Use temperature control valves. X-ray film processors in hospitals use an average of 3.2 acre-feet (1.04 million gallons) of water per year. Package systems are now available for those units that reduce water use to only .1 of an acrefoot (32,585 gallons) per year.[34]

- **Recycle brine from reverse osmosis or filter backwash for cooling.**
- **Lab Aspirators.** Replace lab aspirators with a central vacuum system.
- **Eliminate use of city water for cooling sterilizer condensate** before dumping to drain when possible, considering drain material and diversity of drains or available floor space for holding tanks.
- **Surgical Vacuum Pumps.** Reduce flow to surgical vacuum pumps to acceptable minimum level and maintain proper operation.
- **Cooling Systems.** Look for and inventory all single-pass or once-through cooling systems. The types of equipment that typically use single-pass cooling water are: ice machines, X-ray machines, CAT scanners, degreasers, hydraulic equipment, condensers, air compressors, welding machines, vacuum pumps and air conditioners. Various options for saving this water range from shutting off water when not in use, to closed loop systems, to recycling the water elsewhere.

- **Heating/Cooling**. *Cooling can account for up to 53 percent of the water use in a hospital.*
  - **Reduce excessive blowdown!** Many cooling towers operate below the suggested levels of total dissolved solids (TDS) unnecessarily. Adjust boiler and cooling tower blowdown rate to maintain TDS at levels recommended by manufacturers' specifications. Inspect all floats and valve switches on older towers on a more frequent basis.
  - **Return steam condensate to the boiler for reuse.**
  - **Consider using ozone as a cooling tower treatment to reduce water used for makeup.**
  - **Shut off water-cooled air conditioning units when not needed, or replace water-cooled equipment with air-cooled systems.**
  - **Check steam traps periodically**; repair when necessary.

- **Cleaning.** *Water used for general cleaning averages 10 percent of all of the water used in a hospital.*
  - **Overhaul faulty steam traps on sterilizers.**
  - **Instruct cleaning crews to use water efficiently for mopping.**
  - **Use full loads in sanitizers, dishwashers, sterilizers and laundry washing machines, consistent with infection control requirements.**

- **Switch from "wet" carpet cleaning methods, such as steam, to "dry," powder methods.**
- **Change window-cleaning schedule from "periodic" to "as required."**

Resources

- **Healthcare Environment Resource Center (HERC):** http://www.hercenter.org/facilitiesandgrounds/waterconserve.cfm
- **Practice Greenhealth:** http://www.practicegreenhealth.org/ OR http://cms.h2e-online.org/ee/facilities/waterconserve/
- **EPA's WaterSense Program:** http://epa.gov/watersense/

Case Study:
Some Hospital Success Stories

- **Using a recalculating closed-cooling loop.** Carney Hospital in Dorchester has several refrigeration and air conditioning units that are cooled with once-through water. By incorporating these units into a recalculating closed-cooling loop, the facility can reduce water consumption by three million gallons per year to save more than $20,000 in annual water and sewer costs. Initial cost of this project is estimated at $29,000, and payback would occur in less than 18 months.

- **Flow restrictors for developing x-rays.** New England Memorial Hospital had an opportunity to save water in its x-ray developing process. By retrofitting the flow restrictors to the developing machines, water consumption can be reduced by 176,00 gallons annually. The estimated cost of modifying the machines is $150 and the water and sewer savings is approximately $1,400, resulting in a payback of less than two months.

- **Fixing leaks!** In one New England-area hospital, a solenoid valve on a bacteriology lab incubator failed, resulting in an unnecessary constant flow of 5 gpm, or 2.6 million gallons annually. At present water and sewer rates that is $18,00 wasted per year. The cost to rectify the situation is estimated at $200, giving an immediate payback.

- **Flow control fixtures.** Carney Hospital in Dorchester is installing flow control fixtures on all patient and exam room faucets at its facility. The existing flow rate of the faucets was measured at 5 gallons per minute (gpm). After retrofitting the faucets, the flow was reduced by 3.5 gpm to 1.5 gpm. The average usage of sinks at the facility is estimated at 25 minutes per day. This results in a water savings of 88 gallons per day, or 32,000 gallons of heated water per year for a combined water and energy savings of approximately $280 annually per sink. The cost to retrofit one sink is estimated at $12, resulting in a payback of less than one month.

- **Ultra low-flow toilets.** New England Memorial Hospital in Stoneham has more than 300 flushometer toilets in its facility, which use approximately 4.5 gallons per flush. Replacing all the existing toilets with ULF toilets would save more than 5 million gallons of water annually based on estimates of average daily population in the hospital and information on toilet use. The cost of this measure is estimated at $65,000 and the water and sewer savings of approximately $42,000 result in a payback of 18 months.

- **Elimination of Seal and Cooling Water on Medical Air Compressors and Vacuum Pumps** - Recirculating seal and cooling water for four vacuum pumps and one medical compressor as well as removing a vacuum pump that was not needed resulted in a net annual savings of 8.5 million gallons. Project cost: $19,500 - Annual Savings: $55,686; Payback: 0.35 years.

- **Refrigeration System Retrofit** - Facility staff discovered the refrigeration system serving the morgue was cooled with once-through cooling water. In 1994 the system was replaced with an air-cooled unit, thereby eliminating 2.1 million gallons per year. Project cost: $5,500 - Annual Savings: $13,750; Payback: 0.40 years.

- **Increase the Cooling Tower Concentration Ratio from Four Cycles to 12** - Reducing the amount of water that is bled from the cooling tower would result in a savings of roughly 600,000 gallons per year. The chemical treatment vendor should be contacted to confirm that this would have no adverse effect on tower operation. Since this measure requires only the adjustment of the set point on the bleed-off controller there is no initial cost -- payback is immediate. Project cost: $0 - Annual Savings: $3,900

Source: "Water Efficiency & Management for Hospitals" Massachusetts Water Resources Authority (MWRA) Charlestown Navy Yard, 100 First Ave., Boston, MA 02129 (http://www.mwra.state.ma.us/water/html/bullet2.htm); "Hospital Cost Reduction Case Study: Norwood Hospital" Massachusetts Water Resources Authority (MWRA) Charlestown Navy Yard, 100 First Ave., Boston MA 02129 (http://www.mwra.state.ma.us/water/html/bullet1.htm)

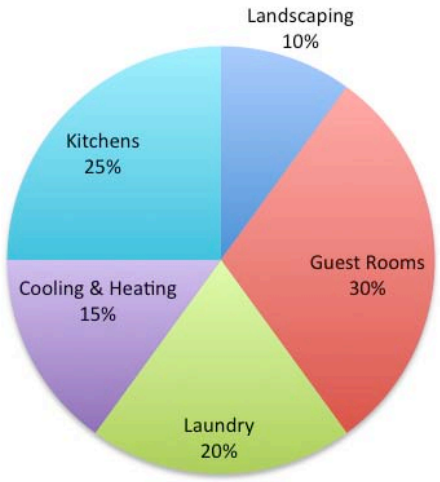
Hotels, Motels, & Lodging

The hotel sector is such an attractive target for water conservation because the lodging sector is significant consumer of water relative to many other commercial businesses. In addition, hotels are very recognizable to the public and sensitive to public perception, so they are great places to raise awareness around water issues. Consider it your duty as a hotel to let your visitors know that you are a community leader in sustainable water use and you will not only save money, but you will gain competitive advantage over other hotels that are not going down the right path.

Did you know?

Tourism can impose huge extra demands on public water supplies - they typically use between two and five times more water than locals.

Figure 11: Water Usage at Hotels and Motels



Source: http://www.p2pays.org/ref/01/00692.pdf Strategies.

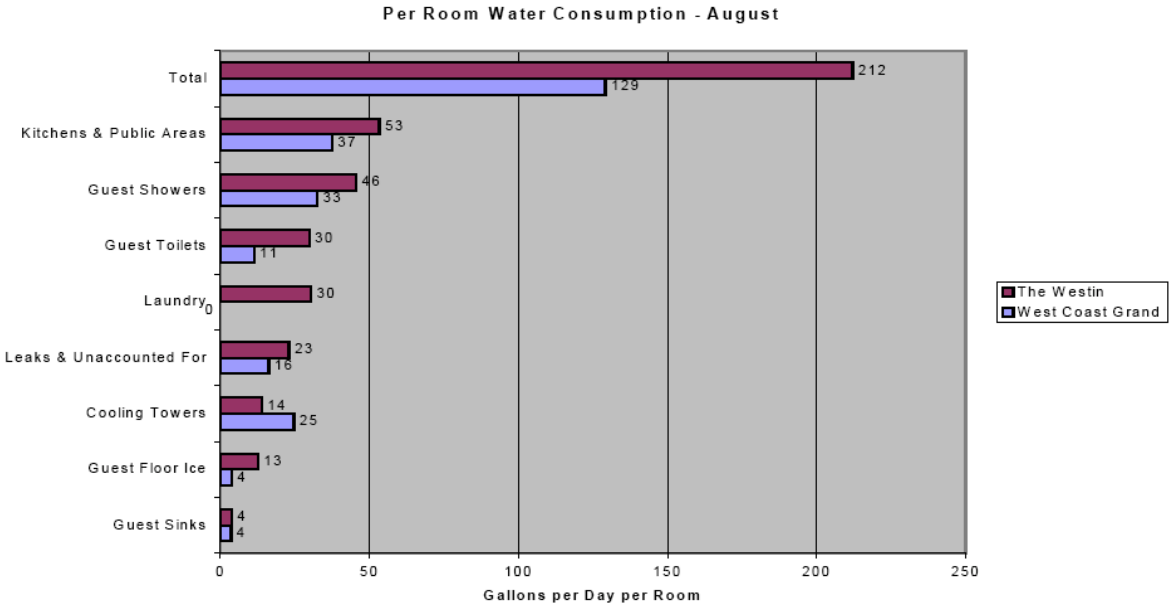
In a 2002 study conducted by the Seattle Public Utility[35] - in which they collected baseline data on hotel water use, identified factors associated with increased water use, and assessed potential savings - it was found that total water usage across a wide variety of hotels ranged from under 100 gallons per day per room (gpd/rm) to over 400 gpd/rm. Older, luxury hotels and hotels with full service restaurants and on-site laundry facilities typically exhibit the highest water usage per room. Identified savings potential varied from between 0% - 45% of total usage, with between 10%-20% taken as typical.[36]

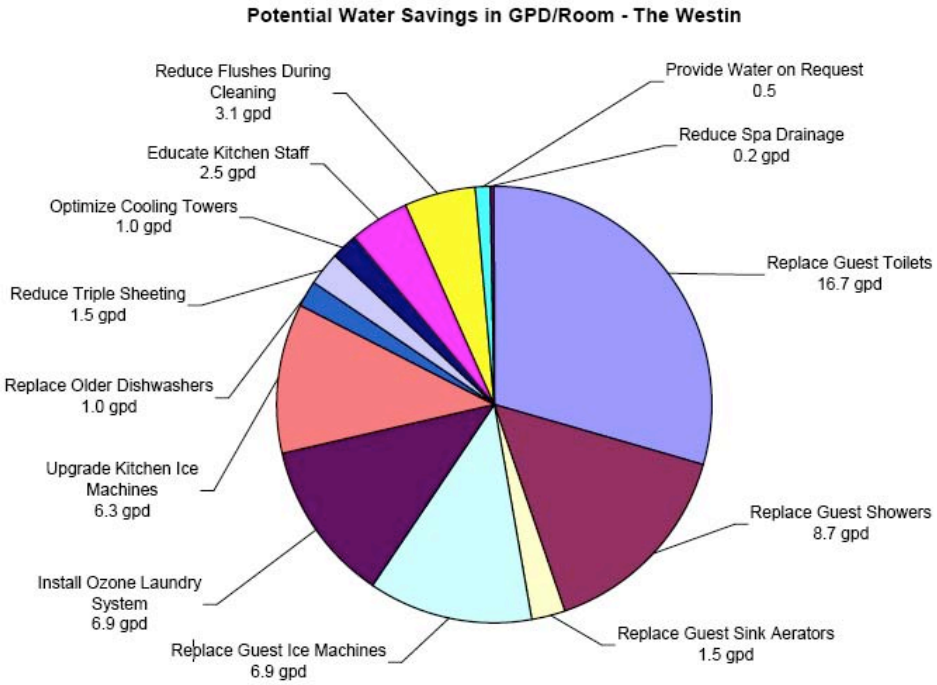
The study also revealed that **most** hotels surveyed had installed some kind of water conservation measures in the last five years (this is Seattle remember - expect this to be lower in other less "green" regions):

- 31% had adopted the well-known towel-linen exchange program,
- 90% had installed faucet aerators/restrictors and low-flow showerheads,
- 50% had installed low flow toilets,
- 60% used air-cooled ice machines,
- 5% (only) used efficient commercial dishwashers.

See **Figure 15** below for some a sample of the The Westin Hotels' water consumption and potential savings areas. You will notice that **kitchens & public areas** (The Westin has a full service restaurant), **toilets**, and **laundry** make up the majority of its water use. The Westin is an older hotel and close to 90% of the projected savings were from equipment measures primarily related to upgrades to restrooms, ice machines and laundry equipment.

Figure 12: Sample Hotel Water Consumption & Savings





Water conservation tips for hotels:

In addition to the general water-saving tips in the **Basic Water Conservation Checklist**, here are some specific to hotels:

EQUIPMENT MEASURES: Considerable water conservation opportunities are achieved through replacing or substantially upgrading older equipment. After utility incentives are factored in, *most of these upgrades could be made with a simple payback of two years or less*. The most significant equipment measures include:

- **Guest Room Toilets:** Replace older 3.5 gpf toilets with more modern 1.6 gpf models and waterless urinals for public restrooms. In addition to excessive flush volumes, individual floor metering revealed significant water loss attributed to leaking flappers.
- **Guest Showers:** Replace older 3.5 gpm showerheads with models using 2.5 gpm or less. The Westin Hotel tested 1.75 gpm models on one floor with excellent results.
- **Faucet Flow Restrictors:** Replace existing 2.5 gpm & 3.0 gpm faucet aerators with 1.5 gpm or lower aerators. These lower flow aerators also result in less splashing and associated cleanup, with no discernable difference to the guest. Install 2.5 gpm in-line flow restrictors in kitchen prep sinks commonly used for thawing and rice washing.
- **Single Pass Water-Cooled Ice Machines:** Replace existing water-cooled ice machines or connect to an existing cooling water recirculation system.
- **Laundry:** Install ozone systems and/or rinse water recycle system to reduce laundry water and associated water heating and chemical use.
- **Dishwashers:** Replace inefficient dishwashers with water conserving models. This measure may only be cost effective for dishwashers that are already nearing the end of their expected life.
- **Irrigation:** If you have outdoor landscaping, consider drip irrigation, soil sensors, and weather-based irrigation controls (see **Landscape Irrigation** section in **Part Three**)

BEHAVIORAL MEASURES: In addition to equipment replacement, behavioral changes are just as important so that your employees are educated and on-board. The most significant behavioral measures include:

- **Toilet Leaks:** Significant sources of leakage were discovered related to deteriorated toilet flappers. Implement a regular toilet flapper replacement schedule.
- **Steam Heat Exchangers:** Install sub-meters on cold water feed lines to all heat exchangers. Regularly log readings and make repairs to heat exchangers as necessary.
- **Other Sub-metering:** Install sub-meters for other significant water consuming operations including dishwashers, pools and spas, laundry, irrigation, and kitchens. Log usage and perform maintenance as necessary to reduce waste.
- **Cooling Towers:** Cooling towers were not being operated at optimum levels. Conductivity readings should be recorded at

least weekly. Cooling tower controls should be upgraded as necessary and set to maintain cycles of concentration near 10. Cooling tower maintenance contracts should be amended to ensure the water treatment service provider maintains the target cycles of concentration.

- **Food and Beverage:** Significant excess use was observed in kitchens where continuously running water, often for hours at a time, was used for thawing frozen food and washing rice. Educate kitchen staff regarding correct methods for thawing frozen food and rinsing rice. Frozen food may be thawed in a refrigeration unit and sushi rice should be agitated in a colander. Additionally, sub-metering of kitchen use and back charging costs to the kitchens could help raise awareness among kitchen managers of wasteful practices.
- **Housekeeping:** Publicize towel-linen programs. Educate custodial staff to reduce number of times toilet is flushed during room cleaning.

Resources

- **American Hotel & Lodging Association's Green Resource Center** (AH&LA's Green Task Force is developing a series of comprehensive, sustainable greening guidelines designed expressly to create an environmental-friendly and sustainable hotel. In developing the guidelines, the goal is to identify those that are the most reputable and provide the best pathways for the industry as a whole): http://www.ahla.com/green.aspx

- **A Hotel Water Conservation case study performed by the Seattle Public Utilities (SPU):** http://www.p2pays.org/ref/37/36217.pdf

Instituting a towel-linen exchange program for your hotel.

Multiple night guests are given the option of not having towels and linens laundered daily. Implementing a towel and sheet re-use program saves water and also energy, detergents, and labor. The combined financial savings alone makes it worthwhile, but the water savings is like putting money in the bank - **even with a conservative 25% participation rate in the program, your utility costs can drop 5%.**

*Towel-linen programs were one of the first attempts by the US hotel industry to reduce environmental impact and have been a relatively easy and successful way in which to reduce the 180 billion gallons of water used each year by US hotels.[1] The American Hotel & Lodging Association (AH&LA) has partnered with the U.S. Environmental Protection Agency's ENERGY STAR® to launch the **Good Earthkeeping program** that developed in-room guest cards and promotional content to facilitate water conservation through these programs. It is estimated that over 3,400 hotels in the US offer towel-linen programs.*

⇨ **Three components for a successful towel-linen program:**

- Provide cards for guests in the bathroom, providing tips that guests can follow for conserving water during their stay. Ideas include reporting leaks to management, shutting off the faucet while brushing their teeth or shaving, taking short showers, and moderating use of the thermostat. Be sure to provide in-room towel rack hangers that ask guests to consider reusing their towels to help conserve water.

- Provide cards for guests in the bedroom, asking guests to consider leaving the sheets on their bed for their entire stay.

- Lastly, train your staff properly explaining the program.

Source: www.p2pays.org/ref/37/36217.pdf

Case Study:
The Westin Hotel in Seattle

Summary of Potential "Equipment Measures"

Seven potentially cost-effective "Equipment Measures" were proposed with potential savings estimated at 54,000 gpd, or around 30% of annual average water usage for the hotel. Savings potential could be significantly higher, up to 40%, if reduction in toilet leakage is taken into account.

2. **Replace Guest Room Toilets with 1.6 gpf Models**
   Potential Savings: Savings are estimated at 9,475 average gpd (not including leakage reduction). This would translate into annual dollar savings of approximately $28,000. Savings may be substantially higher after reduced leakage is taken into account.
   Potential Cost: Cost will vary with type of toilet selected. For illustration a purchase cost of $90 per toilet is used, plus $30 for in-house installation, minus a $60 per toilet incentive from SPU, for a net installed cost of $60 per toilet, or $53,460 for 891 toilets.
   Payback Period: Approximately 1.9 years (not including savings related to leak reduction). Actual payback after accounting for savings attributable to leak reduction could be under one year.

3. **Replace Guest Room Showers with 2.5 gpm Showerheads**
   Potential Savings: Savings are estimated at 8,500 average gpd. Water savings for water and sewer would amount to approximately $28,000 annually. Significant energy savings would also be available. Energy savings resulting from less purchased steam to make hot water will be in the neighborhood of 1,000 mbtu.
   Potential Cost: At an estimated $40 installed cost per showerhead, total cost would amount to $35,500. Depending on choice of showerhead, actual cost may be lower.
   Payback Period: One year or less when energy savings are included.

4. **Replace Guest Room Sink and Lavatory Flow Restrictors with 1.5 gpm Aerators**
   Potential Savings: Savings are estimated at 2.0 gpd per occupied room, 1,425 average gpd, or $4,800 per year.
   Potential Cost: Aerators may be purchased for around $1 each. Total installed cost may be estimated at $2 each, for a cost of $3,564 for 1,782 aerators (2 per guest room). Additional energy savings should apply.
   Payback Period: Less than one year.

5. **Replace Guest Floor Ice Machines with Air Cooled Models**
   Potential Savings: 70 machines at 210 gpd per machine equal 14,700 gpd, or $49,000 per year.
   Potential Cost: Cost for a replacement 300 lb capacity air-cooled machine, complete with dispenser is estimated at $4,000, minus a $300 per machine incentive available from SPU. Net cost for 70 machines would be $259,000. As existing machines may be nearing the end of their useful life, it may be appropriate to begin a preventive replacement program, scheduled over a number of years. Installation of narrower machines may also allow side by side installation of vending machines, such as for drinks, providing for an increase in revenue. As an alternative, ice machines could be removed from every other floor and replaced with drink machines.
   Payback Period: 5.75 years (less if vending machine could be added)

6. **Install Ozone Laundry System and/or Rinse Water Recycle**
   Potential Savings: A 25% reduction in laundry water use would result in saving 6,750 gpd or $19,000 per year for water and sewer. A 20 degree F reduction in average water temperature (27,000 gpd) would result in savings of $18,000 per year for purchase of steam, based on $11 per thousand pounds of steam. Additional savings may be available from reductions in chemical and labor costs.
   Potential Cost: Estimated at $79,000.
   Payback Period: Approximately 2 years, not counting potential chemical or labor savings.

6. **Connect Kitchen Ice Machines to Glycol Loop or Replace with Air Cooled Models**
   Potential Savings: 5,200 gpd, or $15,000 per year.
   Potential Cost: Replacement of 10 machines at an estimated cost of $3500 per machine, minus an incentive of $600 per machine comes to a net total cost of $29,000.
   Payback Period: Under 2 years.
   Action Taken: Since the initial field work and development of draft recommendations, the Westin has replaced two 600 pound kitchen ice machines with air-cooled models.

7. **Replace Dishwasher in Roy's Kitchen with Water Conserving Model**
   Potential Savings: Projecting average savings of 2 gpm, 16 hours per day, this would result in water savings of 1,920 gpd, with water and sewer savings of around $5,500 per year. Energy savings are estimated at $4,000 per year. Additional chemical savings may also be available.
   Potential Cost: Estimated at $15,000.
   Payback Period: Under 2 years.

Summary of Potential "Behavior Measures"

Six "Behavior Measures" were proposed. It is difficult to predict exact savings for behavioral measures. However, potential savings from all of these measures combined were estimated at 10,000 gpd, or between 6% of average water usage for the hotel. Savings potential could be significantly higher. Up-front costs are minimal, so the payback for each of these measures is very attractive.

1. **Reduce or Discontinue "Triple Sheeting"**
   Potential Savings: Approximately 2 gallons of water per sheet, or 1,780 gallons per day for all 891 rooms. Additional savings would be available for labor (both laundry and housekeeping), energy (both for heating water and drying), and laundry chemicals.
   Potential Cost: No cost/cost reduction.
   Payback Period: Immediate.

2. **Increase Cooling Tower Cycles of Concentration to 10**
   Potential Savings: Water savings are estimated at 500 average gpd (1,000 gpd during peak season). Utility savings would amount to approximately $500 annually. Reduced chemical use may result in additional savings.
   Potential Cost: Minimal.
   Payback Period: Immediate.

3. **Educate Kitchen Staff Regarding Water Conservation**
   Educate of F&B staff regarding correct techniques for thawing of frozen food, rice rinsing, dishwasher loading and equipment cleaning.
   Potential Savings: Water savings estimated at 2,500 average gpd. Utility savings would amount to approximately $7,000 annually. Additional energy savings may be available.
   Potential Cost: Minimal.
   Payback Period: Immediate.

4. **Reduce Toilet Flushes During Room Cleaning**
   Potential Savings: Water savings attributable to flushing one time less per cleaning are estimated at 3,000 average gpd. Utility savings would amount to approximately $8,500 annually.
   Potential Cost: None
   Payback Period: Immediate

5. **Provide Ice Water Only On Request**
   Potential Savings: Water savings are estimated at 500 average gpd. Utility savings would amount to approximately $1,500 annually.
   Potential Cost: None
   Payback Period: Immediate.

6. **Reduce Frequency of Spa Drainage**
   Potential Savings: Water savings from reducing spa drainage to once weekly from twice weekly are estimated at 200 average gpd. Water and Sewer savings would amount to approximately $500 annually. Additional energy savings would be expected.
   Potential Cost: Minimal.
   Payback Period: Immediate.

Source: www.p2pays.org/ref/37/36217.pdf

Laundries

Water and wastewater costs represent more than 50% of the total operating costs in the typical commercial laundry.[37] Managers of laundry facilities have a vested interest in participating in any water conservation strategy that is deemed cost-effective.

Whether your laundry facilities are on-site (hotels, hospitals, nursing homes, prisons, universities, etc.) or centralized contract laundries, or "Industrial Laundries", that launder fabrics from other businesses (such as uniforms, restaurant table cloths, bed linens, etc.), your facility is sure to use vast amounts of water at varying degrees of efficiency. The potential for water conservation exists in most all facilities and should be part of every laundries' water conservation strategy.

However, quality of service is still paramount to the success of your business and all water conservation measures must maintain the effectiveness of cleaning the fabrics.

As stated by the Alliance for Water Efficiency[38]:

Water is the universal solvent in the world, and there are practical limits to the reduction of water quantity and the ability to clean fabrics. ***The greatest water conservation opportunities often exist in the various methods of reusing or recycling water from the machines.*** *The extent of a laundry's ability to recycle water usually lies in the facility's ability to filter, clarify and sanitize the effluent water from the washing machines.*

Calculating Water Savings Potential

The water savings potential of a commercial laundry can be easily calculated, as in the following example:

Site data: hotel, 500 rooms, 70% average occupancy

Daily average of bed linens = 350 sets X 3 lbs = 1,050 lbs

Daily average towels sets = 350 sets X 1.75 lbs = 612.5 lbs

Pre-existing efficiency: 3.1 gallons/pound

Proposed efficiency: 1.8 gallons/pound

Efficiency differential: 3.1 – 1.8 = 1.3 gallons/pound savings

Annual Savings: (1,050 + 612.5) X 364 days X 1.3 = 786,695 gallons

There are many variables affecting laundry use in hotels, such as: occupancy rates, bed sizes, towel sizes and quantities placed in rooms, laundry operational practices, business versus resort type business, etc. The above example is only a simplified version of the type of analysis needed to truly assess and project water savings potential.

In general, 2 gallons of water used per pound of clothes is considered to be a "good" water efficiency standard for commercial laundries; though this is not always achievable for heavily soiled fabrics. As a reference: one set of queen size bed sheets weigh about 3 pounds; requiring 6 gallons of water to wash and rinse. Water conservation measures should not impair the cleaning or sanitation goals of the laundry operation. Recycling rinse water for the wash cycle is always recommended, except in very rare situations where health codes prohibit such use in specialized situations.

Further water recycling requires special equipment to filter, sanitize, treat, and store the water; this equipment is expensive to install and maintain. The cost effectiveness of such measures is calculated on a case-by-case basis. Ozonation and membrane technologies offer exciting opportunities to advance clothes washing efficiencies far better than 2 gallons per pound. Both of these systems allow for greater reuse of the water, and can also reduce chemical and energy costs of the laundry. These technologies are already proven effective in some applications, and are advancing rapidly. Water utilities embarking on commercial laundry water conservation programs should investigate local resources for these technologies, and promote such systems as appropriate. In some laundries, water efficiency can be improved to less than 1.5 gallons per pound.

Ozone Gas Laundry Systems

The use of ozone gas, O3, is an excellent way in which to reduce water use in laundry operations and allows for faster washing and drying, all done with less chemicals and energy. Ozone systems use air to create ozone gas electrically. The gas then becomes the primary oxidant, or cleaner, for laundry, thereby replacing much of the detergent and bleach, as well as allowing a typical laundry cycle to be completed mostly in cold water. Additionally, fewer rinse cycles are needed to rinse out the remaining chemicals leading to the water savings. During laundering, ozone laundry systems also purify and disinfect wash water; decompose fats, oils and grease (FOG) and soften the wash water with a neutral pH level.[1]

The Westin hotel currently plans to install such an ozone system. Other hotels such as the Greenbelt Marriott, saved over $50,000/year in utility and processing costs after installing an ozone system.[2]

1 EPA Office of Water and the American Hotel & Motel Association
2 American Laundry News, Vol. 24, No 11, November 1998

Case Study: Charlotte's Marriott City Center Hotel

Charlotte's Marriott City Center Hotel achieved significant saving within five months after installing an ozone laundry system. The hotel, which has three washers and launders about 15 loads per day, reported saving of $7,600.

According to the facilities director, the ozone unit contributed to reductions in hot water usage, allowing the hotel to eliminate the need for an existing boiler. The ozone system has also led to reductions in gas consumption and chemical usage.

Source: www.p2pays.org/ref/23/22005.pdf

Water Conservation Tips for Laundries

In addition to the general water-saving tips in the Basic Water Conservation Checklist**, here are some specific to laundry facilities:**

- **Immediate and No or Low Cost Conservation Options:**
  - Monitor daily water usage in order to identify excess use.
  - Increase employee awareness of the need to conserve water
  - Wash only full loads
  - Turn off and isolate steam supply to equipment when it is not in use

- **Short Term Options:**
  - Determine if one washer or method of washing uses more water than others and schedule larger jobs on the most water efficient washers.
  - Instruct maintenance personnel to routinely inspect and repair any leaking water or steam lines as well as pumps and valves.
  - Implement soil-sorting procedures to ensure that heavily soiled materials are correctly sorted to minimize overwashing of lighter loads or to eliminate the need for rewashing.
  - Conserve wash water by programming for each load both the number of cycles and the water fill level per cycle depending on whether fabrics are light, medium or heavily soiled.
  - To facilitate usage of less rinse water, evaluate wash formulas to reduce the amount of water needed to clean each pound of laundry.

- **Long Term Options:**
  - Install continuous batch washers with countercurrent flow, which uses up to 70 percent less water and steam than conventional washer extractors of similar capacity.
  - Retrofit conventional washers with a holding tank to capture final rinse waters. This option provides an estimated water savings of 30 percent.
  - Reuse cooler rinse waters in the presoak cycle to remove soils in light-colored garments before using hot water in wash cycles which can further set the soil into the garment.
  - Minimize overall water usage by installing automated liquid injection wash systems or retrofit existing equipment where possible.
  - Install ozone systems for water, chemical and energy reductions. Ozone systems inject ozone gas into the wash waters, which act as an oxidant and biocide allowing the usage of water at cold temperatures.
  - Modify industrial piping to reuse non-contact cooling water and steam condensate

Resources

- **LaundryESP** (designed to build on the industry's existing strengths of recycling and reusability and its more efficient use of resources (water, energy and wash chemicals) when compared to home laundering**:** http://www.laundryesp.com/

- Also, refer to the following documents:

    - Sullivan, G et al (2008) SEMPRA Commercial Laundry Program Measurement and Evaluation

    - Riesenberger, J. and J. Koeller (2005) Commercial Laundry Facilities

    - WMI (2006) Assessment of Water Savings for Commercial Clothes Washers

Office Buildings & Retail Spaces

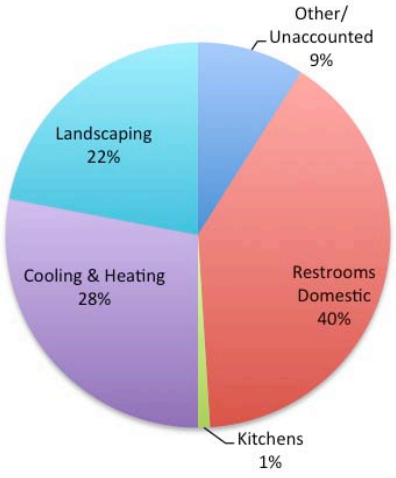
In an office, your main water culprits will be **restrooms** and **heating & cooling**. **Landscape irrigation** can also be a huge water user for offices. Although offices vary greatly in type and size, your best bet is to follow our general recommendations for basic water conservation (see **Basic Water Conservation Checklist** in **Part Three** and go through those recommendations).

Quick wins will include:

- **Installing low-flow toilets and waterless urinals.**
- **Eliminating "once-though" cooling of equipment by recycling water flow to cooling tower or replacing with air-cooled equipment.**

To reduce outdoor water use, maximize natural vegetative cover, and limit the amount of lawn area provided. Consider using drought-tolerant grasses and plants. Consider weather-enabled drip irrigation for landscapes.

Figure 13: Water Usages at Offices



Source: http://www.p2pays.org/ref/01/00692.pdf

Case study: A St. Petersburg building saves 35% of its water use!

Following a comprehensive water use evaluation, a building in St. Petersburg, Florida was given the following recommendations for water conservation:

Bathroom retrofits

- Replacing flushometer valves to reduce the flow
- Installing lavatory aerators which allow water flow at a rate of 2.0 gallons per minute

Potential savings of 0.2 million gallons of water and $744 each year!

Cooling adjustments

- Adjustment of conductivity up to a higher level that could still provide reliable service while using less water

Potential savings of 1.5 million gallons of water and $6,874 each year!

Source: http://www.swfwmd.state.fl.us/conservation/waterwork/casestudy-office.html

Resources

- **EPA's WaterSense Program:** http://epa.gov/watersense/
- **Division of Pollution Prevention and Environmental Assistance:** http://www.p2pays.org/ref/23/22004.pdf
- **U.S. Green Building Council's LEED Certification:** http://www.usgbc.org

Real Estate Developers & Property Management

According to the U.S. Green Building Council, buildings in America account for 14% of potable water consumption. Native landscaping can reduce water consumption by 30-60% and cut maintenance expenses by as much as 85% while providing wildlife habitat and eliminating pesticide run off.

With buildings having such high energy, water and resource demands, it makes both economic and environmental sense to reduce your impacts and minimize inefficiencies. Enhancing water efficiency in the construction phase will cut CO2 emissions and operating expenses over the lifespan of the building – resulting in substantial long-term savings. And, as property managers facing rising water utility bills, anything that you can do to reduce the operating costs of your building can dramatically add to your bottom line.

In fact, studies show that green buildings often sell for more and maintain their value better - often bringing 3% higher rents and about a 7.5% increase in a building's value, according to one report.

If you are a developer or a property manager, your building should be as water-efficient as possible. Follow our general recommendations for basic water conservation (see **Basic Water Conservation Checklist** in **Part Three** and go through those recommendations) and then implement as many technologies as you can afford.

Consider LEED

Consider the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) rating system, which offers up to five LEED water-efficiency credits:

- Two for reducing potable water use for irrigation
- One for reducing potable water use for sewage conveyance; and
- Two for reducing potable water use inside a building.

Many cities now encourage LEED certification, and some require it outright for city-funded projects.

http://www.usgbc.org

Resources

- **EPA's WaterSense Program:** http://epa.gov/watersense/
- **Division of Pollution Prevention and Environmental Assistance:** http://www.p2pays.org/ref/23/22004.pdf
- **U.S. Green Building Council's LEED Certification:** http://www.usgbc.org

Restaurants and Food Services

According to the Green Restaurant Association, an average restaurant can use 300,000 gallons of water per year.[39] With restaurants having such high energy, water and resource demands, it makes sense to reduce your impacts and minimize inefficiencies.

Dishwashing and **bathrooms** are two huge water users in a restaurant. If you look at the point system from the Green Restaurant Association below (**Become a Water Efficient Restaurant: Point System from the Green Restaurant Association**), you will get an idea about what technologies are worth the most points and therefore which ones are most beneficial to the environment (but may cost more).

Here are some quick wins:

Low-Flow Pre-Rinse Spray Valves are one of the easiest and most cost effective energy saving devices available to the foodservice operator. In addition to minimizing water consumption, water heating energy and sewer charges are also reduced. Replacing a typical spray valve that flows up to three gallons of water per minute (gpm) with a low-flow unit can yield the following results:

Table 12: Spray Value Savings

Hours of Spray Valve Usage	Water Savings gallons/day	Waste Water Savings gallons/day	Gas Savings therms/day	Annual Dollar Savings
1 hour/day	60 gallons	60 gallons	0.5 therms	$300 - $350
2 hours/day	120 gallons	120 gallons	1.0 therms	$600 - $700
3 hours/day	180 gallons	180 gallons	1.5 therms	$900 - $1050

Table shows results based on spray valve water savings of 1 gallon per minute, water cost of $2.00 per unit (748 gallons), sewer cost of 3.00 per unit (748 gallons), and gas cost of $1.00 per therm.

Source: Food Service Technology Center (http://www.fishnick.com/equipment/sprayvalves/

This table shows results based on spray valve water savings of 1 gallon per minute, water cost of $2.00 per unit (748 gallons), sewer cost of 3.00 per unit (748 gallons), and gas cost of $1.00 per therm. The FSTC recommends a pre-rinse spray valve with a flow rate of 1.6 gallons per minute or less, and with a cleanability performance of 26 seconds per plate or less, based on the ASTM Standard Test Method for Performance of Pre-Rinse Spray Valves.

To calculate cost savings, visit the FSTC pre-rinse spray valve calculator: http://www.fishnick.com/saveenergy/tools/watercost/

Note: The FSTC has supported the California Urban Water Conservation Council (CUWCC) to actively promote low-flow pre-rinse spray valves through its Rinse & Save program (www.cuwcc.org). If you are outside the area covered by the Rinse & Save program, try contacting your water utility, as they are always looking for ways to reduce water consumption, and may have local programs of their own. The Federal Government has also issued guidelines for its facilities when purchasing pre-rinse spray valves. These guidelines, published by the Federal Energy Management Program (FEMP) can be followed by any facility interested in energy efficiency and conservation: http://www.eere.energy.gov/femp/pdfs/prerinsenozzle.pdf

ENERGY STAR Appliances & ENERGY STAR Commercial Kitchen Packages can save up to as much as 50 percent over their conventional counterparts.[40] According to Pacific Gas and Electric's Food Service Technology Center, as much as 80 percent of the $10 billion annual energy bill for the commercial food service sector does no useful work.[41] This is due to inefficient appliances, heating ventilation and air conditioning systems, and lighting and refrigeration.

To help counter these costs, ENERGY STAR helps restaurant owners and operators improve the performance of their facilities and equipment while reducing energy costs. Restaurants that invest strategically can cut utility costs 10 to 30 percent without sacrificing service, quality, style or comfort — while making significant contributions to a cleaner environment.[42] Purchasing ENERGY STAR qualified commercial food service equipment as a package for new kitchen construction or as a replacement for aging equipment, can save significant amounts of money and energy on foodservice operators' electric, gas, water and sewer bills. Commercial food service products in these eight categories may earn the ENERGY STAR: fryers, hot food holding cabinets, commercial refrigerators and freezers, and commercial steam cookers, commercial dishwashers, commercial ice makers, commercial griddles and commercial ovens.

Potential Savings: Outfitting an entire kitchen with a suite of ENERGY STAR Qualified Commercial Food Service Equipment could save operators about 350 Mbtu/year annually, or the equivalent of approximately $3600.[43] Besides saving energy, ENERGY STAR qualified steam cookers and commercial dishwashers save water. Steam cookers that have earned the ENERGY STAR are 90% more water efficient than non-qualified steam cookers; an ENERGY STAR qualified commercial dishwasher is 25% more water efficient than standard models.[44]

Visit the ENERGY STAR website to learn more about an **ENERGY STAR Commercial Kitchen Package:** http://www.energystar.gov/index.cfm?c=commercial_food_service.commercial_food_service

Get Certified by the Green Restaurant Association: Whether you are trying to certify your restaurant as "green", get an endorsement for your food service products (i.e. takeaway boxes), or get your distributors and employees on board, the GRA can help.

With the world's largest database of environmental solutions for the restaurant industry, and almost twenty years of experience, the Green Restaurant Association is the expert in helping restaurants become more environmentally sustainable. The GRA was founded with the mission of creating an ecologically sustainable restaurant industry, with the goal to make the process as simple and affective as possible.

To find out more, visit www.dinegreen.com.

Your restaurant will save a lot of money by "going green" and your customers, employees, and suppliers will be more satisfied being a part of your business. More and more customers have started to expect their restaurants to think environmentally. In fact, one survey showed 62 percent of consumers said they would likely choose a restaurant based on its environmental friendliness. Your restaurant can capitalize on all of these green efforts, by marketing them and receiving rave reviews and good PR as a result. This can give you the competitive advantage that you need to catapult your establishment to the next level.

Case Study:
25 Year Old Restaurant Goes Green – The Draft House

The Draft House, a pub-style eatery that's been serving up comforting favorites like wings, burgers, chowder, and of course beer, for 25 years. In the restaurant industry, 25 years is a big accomplishment! To mark their quarter-century birthday, the restaurant decided to start changing some of their ways.

Challenge: In 2007, The Draft House began the certification process with the GRA and started with the basics – which for a 25-year-old community staple, seemed like a huge endeavor. The restaurant proved that old habits don't have to die hard, and they completed their first four steps in just four months. Getting rid of Styrofoam, implementing a recycling program, changing a few faucets, and adding recycled paper towels into the mix was easier than the establishment thought.

"At first I couldn't find a distributor in my area that carried any of the non-Styrofoam products I needed…and we used a lot of Styrofoam!" says owner Lee Irish. "My consultant at the GRA made the hunt a lot simpler because she basically did it for me."

Irish says the biggest lesson he wants to share with customers and colleagues is that even an older, more established restaurant is capable of implementing small changes that make a big impact. "Yes, we were set in our ways, but once we got the tools we needed and realized how possible it was to be environmentally responsible, it motivated me and my team to go full-steam ahead."

Results: After only one year since their certification, The Draft House reports reducing their water use by 54% and a 50% reduction in trash. Irish says that the reductions translate directly into money saved. The Draft House was invited by local recyclers to speak on behalf of their experience and share their success story with others in the state in an effort to encourage more restaurants to start with even the smallest steps.

Source: Green Restaurant Association (http://www.dinegreen.com/restaurants/cases.ap)

Schools

Schools use a tremendous amount of water everyday, and require water for their heating and cooling systems, restrooms, drinking water faucets, locker rooms, cafeteria, laboratories, and outdoor playing fields and lawns.

As you can see from **Figure 17** below, the majority of water use in schools is in **restrooms, landscaping** and **heating & cooling**. Follow our general recommendations for basic water conservation (see **Basic Water Conservation Checklist** in **Part Three** and go through those recommendations).

To reduce water use in the school, consider replacing old equipment such as dishwashers with energy-saving devices. Repair water leaks and leaky toilets. Install water aerators and automatic shut-off devices on faucets. Use low-flow showerheads and timer shut-off devices to reduce water use during showers. Install toilet dams on older models. To reduce outdoor water use, maximize natural vegetative cover, and limit the amount of lawn area provided. Maintain playing fields using drought-tolerant grasses. Facility managers could wind up saving thousands of dollars annually on reduced water and sewer charges simply by reviewing how their facilities use water and by upgrading inefficient fixtures and irrigation processes.

Quick wins will include:

- **Installing low-flow toilets and waterless urinals.**
- **Eliminating "once-though" cooling of equipment by recycling water flow to cooling tower or replacing with air-cooled equipment.**
- **To reduce outdoor water use, maximize natural vegetative cover, and limit the amount of lawn area provided. Maintain playing fields using drought-tolerant grasses. Consider weather-enabled drip irrigation for landscapes.**
- **Water-efficient kitchen appliances such as ENERGY STAR dishwashers and low-flow pre-rinse spray valves.**

Figure 14: Water Usage at Schools

Source: http://www.p2pays.org/ref/01/00692.pdf

Resources

- **EPA's WAVE Program:** The WAVE Program (Water Alliances for Voluntary Efficiency) is an EPA program designed to focus attention on the value of water and the need for efficient use of this important natural resource. The WAVE Program is a voluntary program which encourages educational institutions to implement and install water saving techniques and equipment. Participants receive free water management software and technical support, which help them to evaluate potential economic benefits from conserving water. Visit: http://cfpub.epa.gov/schools/index.cfm

- **Healthy School Environments Assessment Tool (HealthySEAT):** HealthySEAT is a new software tool from EPA designed to help school districts conduct voluntary, customized self-assessments of their school facilities for environmental, health, and safety hazards. http://www.epa.gov/schools

- **National Clearinghouse for Educational Facilities:** a list of links, books, and journal articles on water efficiency, water recycling, and plumbing issues in school buildings and grounds. http://www.edfacilities.org/rl/water.cfm

Case study: A Seffner, FL high school saves 22% of its water use!

Following a comprehensive water use evaluation, a Seffner, Florida high school was given the following recommendations for water conservation:

Bathroom retrofits

- Replacing toilets with new 1.6 gallon per flush models
- Potential savings of 790,000 gallons of water and $6,100 each year!

Cooling adjustments

- Adjustment of conductivity up to a higher level that could still provide reliable service while using less water
- Potential savings of 60,000 gallons of water and $150 each year!

Irrigation modifications

- Reduction of irrigation time
- Application of other appropriate measures
- Potential savings of 3,100,000 gallons of water and $7,600 each year!

Source: http://www.swfwmd.state.fl.us/conservation/waterwork/casestudy-school.html

Industrial

In this section, we try to introduce you to the biggest areas of risk, pulling on the research of a new study by the Pacific Institute. The industrial sector uses water for a variety of purposes, including cleaning, heating, and cooling. Industrial processes tend to be hugely water intensive and therefore present a substantial opportunity for mitigating water risks and saving money (as well as the precious environment!). These processes often produce a type of wastewater that requires specialized treatments, in contrast to the fairly straightforward treatment of wastewater for residential uses.

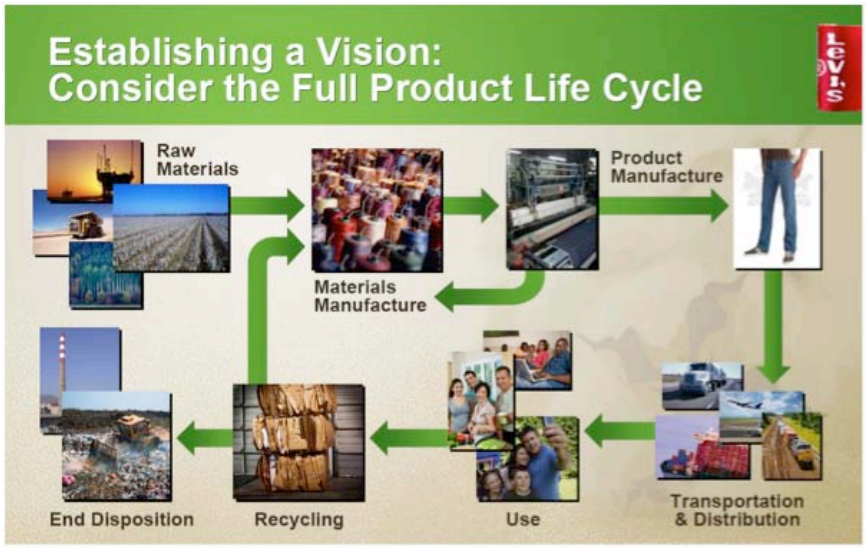
It should also be noted, that while you should make sure your facility and operations implement all the basic water conservation strategies and technologies mentioned in the sections above, many of your biggest water saving technologies will have to be custom-designed by engineering firms.

Apparel/Textiles

Cotton requires 25 cubic meters of water for each 250 grams of cotton produced – this is equivalent to the amount needed for the average t-shirt.[45] It should also be stressed that cotton is highly vulnerable to the potential water risks associated with climate change.

If you are a company that is either manufacturing or retailing apparel or textiles, you must be aware of your entire water footprint. As a retailer, you might not be using much water per se, but you must take these facts into consideration.

Figure 15: Life Cycle Analysis



Source: https://www.exl.carlson.com/imageRepository//COTTONINCORPORATED/Year2008/sustainabilitysummit2008/Kobori_v2.pdf

Consider:

- Anything that reduces water intensity in your supply chain (i.e. farming cotton, processing, washing including wastewater discharge, etc.)
- Education of downstream users in sustainable clothes/garment washing
- Direct operations improvements

Table 13: Water Footprint Intensity of Apparel Sector

APPAREL		Raw material production	Suppliers	Direct operations	Product use/ end of life
Value chain segment		Growing and harvesting cotton plants	Textile manufacturing; Garment manufacturing	Retail and marketing; Distribution	Consumer's garment use
Withdrawal	*Intensity*	High	Medium	Low	High
	Description	Freshwater withdrawal for cotton crop irrigation (22,000L/kg)	Freshwater for textile manufacturing, in particular for dyeing and bleaching (500L/kg)	Water use in retail and commercial facilities (bathroom, kitchen, landscaping)	Water use to wash garments (1,650L/kg)
Discharge	*Intensity*	Medium	High	Low	Medium
	Description	Agricultural runoff containing fertilizer, pesticides	Wastewater discharge containing dye, bleach, detergent and other processing chemicals	Wastewater discharge from retail and commercial facilities (bathroom, kitchen, landscaping)	Wastewater discharge containing detergent

Source: Pacific Institute/Ceres

Table 14: Water Risks for Apparel/Textiles Sector

Physical Risks	Reputational Risks	Regulatory Risks
▪ Cotton production stage has the largest water footprint, and is most susceptible to water shortage and climate change impacts. ▪ Change in water supply, quality and price impacts textile manufacturing. ▪ Majority of manufacturing happens in water-scarce regions.	▪ Large percent of textile/garment manufacturing operations are located where local communities lack access to reliable and affordable drinking water. ▪ Water withdrawal for cotton irrigation and agricultural runoff affects water resources shared with local community. ▪ Wastewater discharge from dyeing, bleaching or laundering processes have negative impacts on local water sources and ecosystems, and may damage company's brand image and reputation.	▪ Water scarcity, increased demand and competition for freshwater resources can affect license to operate, and change the pricing structure. ▪ New or more stringent wastewater regulations may increase cost for treating wastewater in textile manufacturing.

Source: Pacific Institute/Ceres

Resources

For a great website that is great inspiration for sustainable apparel and corporate transparency, visit Patagonia: http://www.patagonia.com/web/us/footprint/index.jsp

Case Study:
Levi Strauss's Lifecycle Analysis of 501 Jean

Levi's jeans are sold in over 110 countries (with more than 55,000 retail locations worldwide) and they contract about 800 factories in 45 countries employing approximately 315,000 workers. Committed to building sustainability into everything they do, Levi's wants to reduce the amount of water needed to produce and use denim jeans. "It's only natural to believe there will be limits on the amount of water we use, they'll be charges for it, and it will become a commodity," Michael Kobori said, Vice-President of Supply Chain Social and Environmental Sustainability at Levi's.

Levi's completed a full lifecycle analysis (raw materials, materials manufacture, product manufacture, transportation & distribution, use, recycling, and end disposition) for a pair of 501 jeans and determined it uses 3,480 liters (918 gallons) of water in its entire life cycle. They determined that 49% of the water is used in growing the cotton while 45% is used in home laundering, and 11% in the milling, manufacturing, and prewashing the jeans.

Lifecycle Impact of Levi's® 501® Jean

Data from LS&CO.'s Life Cycle Assessment on Levi's® 501® Jean for U.S. Market, 2006 production year

- 32.3 kg of CO2 equivalent to 78 miles driven by the average auto in the US.
- 3480.53 liters of water equivalent to 575 flushes of a 3.78 liter/flush low flow toilet.
- 400.1 MJ of Energy equivalent to powering a computer for 556 hours.

Challenge: To reduce water impacts of cotton and consumers, which are the two biggest impact areas in their product life cycle and essentially 'out of their control' (i.e. not in direct operations).

Solution:

- **Wash 'Only as Necessary' policy**: The company requires its contractors to install water treatment systems and recommends that consumers wash jeans in cold water "only as necessary."
- **Eco-friendly products:**
  - Levi's® Naturals jeans and jackets with Sally Fox (naturally colored) cotton
  - Silver Tab® Elements made from recycled polyester fleece, organic cotton, natural dyes.
  - Levi's® eco jeans made from 100% organic cotton, using more "sustainable" sundries, finishes, packaging, recycled cotton, sustainable factory certification.
- **The future: 'sustainable' cotton:** to formulate and implement a comprehensive cotton strategy to assure an affordable supply of 'sustainable' fiber and continue to complete life cycle based material and product evaluations.

Results & Actions:

Levi's is still in a research phase and trying to figure out how to formulate and implement a comprehensive cotton strategy, as well as assure an affordable supply of the most sustainable fiber products. They are also gathering data to figure out how effective their products and policy solutions have been. This is difficult data to obtain – for example, how do you measure how many customers wash jeans in cold water? The main takeaway is that Levi's has an idea of it's two biggest impact areas, both up and down the supply chain: cotton and consumers.

Levi's Vision for 2011

- LS&CO. supporting social and environmental sustainability programs throughout supply chain: from cotton farm to retail
- Mill and sundry suppliers implementing labor, water quality programs
- LS&CO. benchmarked, set targets, achieving progress on energy, water, materials, chemical usage, producing significant cost savings
- Full transparency of initiatives with consumers, customers, investors, stakeholders
- Levi's® Eco™ product and Levi's® Fair Trade product (TBD) widely available at retail. Consumers, customers, investors reward social and environmental sustainability.

Other Key Sustainability Goals:

- **Energy Efficiency and Climate Change:** Achieve carbon neutrality by implementation of energy reduction initiatives and the use of 100% renewable energy first in our operations and then throughout the supply chain
- **Water:** Reduce water usage and improve water quality throughout the product life cycle while growing our business
- **Resource Efficiency:** Evolve into a zero-waste company offering consumers more sustainable products
- **Chemicals:** Minimize the environmental impact from chemicals used in production of LS&CO. product in all stages of the product life cycle
- **Influence:** Provide leadership to encourage other companies, consumers, governments and civil society organizations to address environmental sustainability

Source:
https://www.exl.carlson.com/imageRepository//COTTONINCORPORATED/Year2008/sustainabilitysummit2008/Kobori_v2.pdf

Beverages

If you are a beverage company, water is most definitely integral to your whole operations. As water quantity and quality comes is less and less assured, it is crucial that you have a well thought out plan for the future. Beverage manufacturing requires high quality source water and for this reason will compete with the water needs of the local communities in which you operate. This is a huge risk area for your business.

All major beverage firms are facing stiff public opposition to new bottling plants – and to bottled drinking water altogether, especially from local communities. In 2008, Morgan Stanley released a study revealing that 16 percent of consumers are cutting back on bottled beverages and drinking more tap water for environmental reasons.[46]

Examples of troubles that some beverage companies are having:

- **Coca-cola and PepsiCo** bottlers lost their operating licenses in parts of India due to water shortages.
- **Nestlé Waters** has been fighting the local community of McCloud, California for the last five years to build the largest bottling plant in the United States.
- **Starbucks** has been hugely criticized for its water wasting practices and received lots of negative publicity for the company's "open tap" or "dipper well" policy --10,000 coffee shops worldwide have been "wasting" 23.4 million liters of water daily (enough to fill an Olympic swimming pool every 83 minutes).[47]

Since your biggest water use will be in your direct operations and upstream in raw materials, these are the two areas that your business should focus on. Is there any way that you can make processes more efficient? It may be difficult to use less water in your actual product, so it will be challenging to do this. Coca-Cola, the largest beverage company in the world, has ambitious goals to be "water neutral" which they are trying to achieve by water offsets – they invest in projects that support conservation programs to balance the water used in producing all of the company's beverages.

Consider:

- Efficiency improvements in bottling, distribution, and raw material production.
- Cleaning up your wastewater discharge.
- Investment in community water projects.

Table 15: Water Footprint of Beverages Sector

BEVERAGE		Raw material production	Suppliers	Direct operations	Product use/ end of life
Value chain segment		Food crop production, such as sugar cane, barley, fruits	Bottle, container and packaging manufacturing; Ingredient suppliers	Bottling; Distribution; Retail and marketing	Beverage consumption; Container recycling and disposal
Withdrawal	*Intensity*	High	Medium	High	Medium
	Description	Freshwater for crop irrigation; Freshwater for rinsing and cleaning crops	Freshwater to manufacture containers and packaging; Freshwater for washing and cooling	Water as a product ingredient; Water use in dispensing products; Water withdrawal for bottled water; Washing, cleaning, pasteurization (steam)	Water use to wash and recycle beverage containers
Discharge	*Intensity*	Medium	Low	Medium	Medium
	Description	Agricultural runoff; wastewater from food processing facilities containing fertilizer, pesticides, and herbicides.	Wastewater discharge containing toxic chemicals	Wastewater discharge from beverage manufacturing processes such as brewing, cooking, and fermentation; Wastewater discharge from retail and commercial facilities (bathroom, kitchen, landscaping)	Wastewater discharge; Impact of discarded bottles and packaging on aquatic ecosystems

Source: Pacific Institute/Ceres

Table 16: Water Risks for Beverage Sector

Physical Risks	Reputational Risks	Regulatory Risks
▪ Most significant water use is embedded in the raw material production phase. Severe drought or changes in patterns of precipitation can decrease crop yield and quality. ▪ Potable water is principal and non-substitutable ingredient for beverage products. Water scarcity or contamination of water sources may force bottling or manufacturing facilities to shut down or relocate.	▪ Beverage manufacturing requires potable water, putting water use in direct competition with local populations. ▪ Decline in economic, social and physical wellbeing of consumers due to the lack of access to clean water may affect market growth for beverage products in emerging economies.	▪ Water scarcity may raise the price of water, cap the amount of withdrawal, or result in the suspension of license to use water resources.

Source: Pacific Institute/Ceres

Case Study:
Coca Cola aims to become "water neutral"

Challenge: The Coca-Cola Company has committed to offset all water used for manufacturing to the environment, with the overarching goal of being "water neutral." The Coca-Cola water stewardship framework focuses on three components: reduce, recycle, and replenish.

Results & Actions: First, the company pledged to set specific goals in 2008 for its global operations to reduce use of water.

Second, it is striving by 2010 to have 100 percent of facilities returning water used in manufacturing processes back to the environment at a level that will continue to support aquatic life.

Lastly, Coca-Cola is working to replenish water through support of watersheds and community-level sustainability water programs. The objective within this third component is to support conservation programs that balance or "offset" the water used in producing all of the company's beverages.

Related Coca-Cola efforts include collaboration with the World Wildlife Fund to achieve large-scale results through a five-year effort to conserve freshwater resources. This initiative is supported by a $20 million grant from the company. Coca-Cola is already involved in 120 community-based water projects in 50 countries that focus on water supply, sanitation, hygiene, watershed management, productive water use, and education and awareness.

Sources: "The mark we make today shapes the future," The Coca-Cola Company 2006 Corporate Responsibility Review." See: http://www.thecocacolacompany.com/citizenship/pdf/corporate_responsibility_review2006.pdf

"Sustainability," The Coca-Cola Company. See: http://www.thecoca-colacompany.com/citizenship/index.html

Biotechnology/Pharmaceutical

Biotech and Pharmaceutical companies face increasing water risks, especially regulatory and reputational risks. There is a high concentration of chemicals and microbial organisms in the wastewater released from manufacturing these products. Spills can damage ecosystems, as well as company reputation and brand image.

In 2007 pharmaceutical giant Merck agreed to pay $20 million in assorted fines, environmental improvements and cleanup costs as a consequence of polluting Wissahickon Creek in Pennsylvania with a chemical discharge that resulted in fish kills and fouled drinking water supplies.[48]

Additionally, these businesses are at risk as concerns grow about the discharge from product disposal and/or human and animal waste, where these chemicals are found in water supplies and can pose health risks even at trace levels.

Consider:

- Efficiency improvements in direct operations.
- Cleaning up your wastewater discharge.
- Investment in community water projects and providing innovative solutions to the end user discharge problem into water streams.

Table 17: Water Footprint for Biotech/Pharmaceutical Sector

BIOTECH/ PHARMACEUTICAL		Raw material production	Suppliers	Direct operations	Product use/ end of life
Value chain segment		Production of basic chemicals; Food and animal products	Container and packaging manufacturing	Pharmaceutical product manufacturing; R&D; Distribution; Retail and marketing	Disposal of unused products
Withdrawal	*Intensity*	Low	Low	Medium	Low
	Description	Freshwater for agricultural raw material (plants, animal)	Freshwater to manufacture containers and packaging; Washing, cooling	Water as a product ingredient; Washing, cleaning, pasteurization (steam)	Drinking and sanitation water for consumers
Discharge	*Intensity*	Low	Low	**High**	Medium
	Description	Agricultural runoff, wastewater from food processing facilities containing fertilizer, pesticides, and herbicides; Feedlot runoff; Animal waste	Wastewater discharge containing toxic chemicals	Wastewater discharge that contain high concentration of chemicals and/or microbial organisms; Wastewater discharge from retail and commercial facilities (bathroom, kitchen, landscaping)	Disposal of unused products may release toxic chemicals and biological agents into the surrounding environment

Source: Pacific Institute/Ceres

Table 18: Water Risks for Biotech/Pharmaceutical Sector

Physical Risks	Reputational Risks	Regulatory Risks
▪ High quality water is an essential input used as a main ingredient as well as in processing and cleaning, making this sector especially susceptible to changes in water availability and quality. ▪ Production of pure/ionized water and clean steam generation is energy-intensive, making this sector susceptible to disruption or increased cost of energy supply due to water scarcity.	▪ Rising consumer concerns about pharmaceutical contamination in water sources. ▪ Use of high quality water puts industry in direct competition with local populations.	▪ New or more stringent wastewater regulations may increase cost for wastewater treatment and discharge.

Food & Agriculture

Agriculture accounts for more than two-thirds of global water use. About 70 percent of global water is dedicated to agriculture and as much as 90 percent of water in developing countries is going to agriculture, where populations are skyrocketing. JPMorgan estimates that the total annual direct use of five of the world's biggest food and beverage companies (Nestlé, Unilever, Kraft, Danone and Coca-Cola) represents about 600 billion liters – or 95 liters for every person on the planet in 2006.[49] It is expected that climate change will increase water demand for agriculture, primarily for irrigation. Some research estimates an over 40 percent increase in irrigated land by 2080.[50]

The biggest area of water risk lies in the raw material production that use irrigation and precipitation to grow food and maintain pasturelands. Many of the world's food growing areas are located in semi-arid regions that are expected to become much drier due to climate change. One example of a troubled region here in the U.S. is the Ogallala aquifer that supplies water to about 27 percent of the irrigated lands in the U.S. and 70 to 90 percent of the irrigation water for three of the country's top producing grain states – Texas, Kansas, and Nebraska. The CNA Corporation concluded in a 2007 study that this aquifer could be "greatly exacerbated by a decrease in rainfall in the region" and the water table has already seen a drop of more than 100 feet in some areas.[51]

Food commodity prices are also being impacted dramatically by reduced water availability, as

evidenced by sharp increases in global rice prices triggered by a drought in 2008 in Australia, which dramatically reduced rice production.

Also, livestock, demand for which is rising as global demand for meat increases, will raise water requirements as climate change increases temperatures. As the consumer becomes educated about how water-intensive and carbon intensive meat is, this may affect the demand for meat products.

Another huge area of concern for agriculture is the affect it has on water quality. The release of fertilizers such as nitrogen and phosphorus into water can lead to eutrophication – "dead zones" that deprive water of oxygen and characterized by algal blooms. According to the Pacific Institute, in the United States, the discharge of nutrients into the Mississippi River from Midwestern farms has resulted in an aquatic dead zone in the Gulf of Mexico the size of New Jersey![52]

As water problems become more severe, the impacts of agriculture will come more and more into the public spotlight. It is crucial that you try to minimize your impacts.

Consider:

- Satellite-enabled smart irrigation scheduling – using irrigation scheduling information to more precisely irrigate to meet crop water needs and boost production. [53]
- Modest crop shifting – shifting a small percentage of lower-value, water-intensive crops to higher-value, water-efficient crops. [54]
- Advanced irrigation management – advanced water management methods that save water, such as regulated decicit irrigation. [55]
- Efficient Irrigation Technology – shifting crops irrigated using flood irrigation to drip systems. [56]
- Efficiency improvements in farming, livestock, and raw material production.
- Cleaning up your wastewater discharge, decreasing the amount of runoff of fertilizer nutrients.
- Investment in community water projects.

Table 19: Water Footprint of Food and Agricultural Sector

FOOD		Raw material production	Suppliers	Direct operations	Product use/ end of life
Value chain segment		Food crop and livestock production	Container and packaging manufacturing; Ingredient suppliers	Meat and food processing; Distribution; Retail and marketing	Cooking and preparation of food products; Recycling and disposal of packaging and containers
Withdrawal	*Intensity*	High	Medium	High	Medium
	Description	Freshwater for crop irrigation; Freshwater for rinsing and cleaning crops; Freshwater requirements for livestock – drinking, sanitation, grazing	Freshwater to manufacture containers and packaging; Washing and cooling	Water as a product ingredient; Washing, cleaning, pasteurization (steam)	Water to wash and cook food products; Water to wash and recycle containers
Discharge	*Intensity*	High	Medium	High	Medium
	Description	Agricultural runoff, wastewater from food processing facilities containing fertilizer, pesticides, and herbicides; Feedlot runoff; Animal waste	Wastewater discharge containing toxic chemicals	Wastewater discharge from meat and food processing; Wastewater discharge from retail and commercial facilities (bathroom, kitchen, landscaping)	Wastewater discharge; Impact of discarded packaging on aquatic ecosystems

Table 20: Water Risks for Food and Agriculture

Physical Risks	Reputational Risks	Regulatory Risks
1. Most significant water use is embedded in crop or livestock production. 2. Changes in precipitation patterns, severe drought and flooding due to climate change may decrease crop yield and quality. ▪ Increased temperature and dry weather due to climate change may raise water requirements for crops and livestock.	▪ Agricultural runoff and wastewater from food/meat processing facilities may have negative impacts on local water sources and ecosystems, potentially damaging company's brand image and reputation. ▪ Meat has a very large water and carbon footprint, with a potential reputational risk and impact on demand for meat products. ▪ Higher water temperature due to climate change may increase water borne pathogens, and fruit and food supply may face more risk of contamination, and subsequent reputational and financial damage.	▪ Water scarcity and increased demand and competition for freshwater resources can change the pricing structure. ▪ More stringent requirements for wastewater quality may be imposed on food/meat processing facilities

Source: Pacific Institute/Ceres

Case Study:
Unilever reduces water use across much of its value chain

Challenge: Unilever has been comprehensively analyzing its direct and indirect water impacts, taking into account water used by suppliers in growing raw materials, as well as by consumers using Unilever products. They would like to substantially reduce their water footprint, specifically reducing total water consumption by 4.7 percent.

Results & Actions: Since introducing systematic measurement of its water use in 1995, the company has reduced its direct water consumption per ton of production by roughly 62 percent. In 2007, Unilever reduced total water consumption in its operations worldwide by 4.9 million cubic meters and the volume of water per ton of production by 7.5 percent, exceeding its target of 4.7 percent.

On the supply chain side, Unilever is providing financial and technical support to help tomato farmers in Brazil convert to drip irrigation, reducing water consumption by up to 30 percent while increasing crop yield. At tea plantations in Tanzania, drip irrigation trials completed in 2007 showed 10 percent water saving compared to current irrigation techniques, with no yield loss. This is equivalent to saving 70 liters of water for every kilo of black tea produced. When fully implemented on a 3,000 hectare farm, Unilever anticipates that 700 million liters of water will be saved.

On the consumer end, the company estimates that a reformulated version of laundry detergent requiring less rinsing will have considerable water use impacts in water-stressed areas of India where washing clothes accounts for large portion of domestic water consumption. Based on assumptions about laundry habits, Unilever estimates potential savings in the region of 14 billion liters of water a year.

Source: "Our biggest challenges," Unilever. See: http://www.unilever.com/ourvalues/environment-society/sustainable-development-report/environ-sus/water/default.asp

High Tech

If you are in the high tech sector – anything from raw materials production to product assembly to data centers – your future success depends on a clean and consistent supply of freshwater, either directly or indirectly.

Most of this sectors' water footprint is associated with semiconductor manufacturing, which require huge amounts of ultra clean water. For example, Intel and Texas Instruments alone used 11 billion gallons of water for cleaning and rinsing in the production of silicon chips in 200. [57]

Additionally, eleven of the world's 14 biggest semiconductor factories are in the Asia-Pacific region, where water scarcity risks are especially severe. A JPMorgan study estimates that a water-related shutdown at a fabrication facility could result in $100-200 million in missed revenue during a quarter ($0.02-0.04 per share).[58]

Lastly, electronic waste (or e-waste) is a growing concern as it contaminates groundwater supplies and local ecosystems. This can lead to serious health concerns, regulatory controls, and negative reputational hazards. According to the Silicon Valley Toxics Coalition (an NGO watchdog), e-waste is concentrated with heavy metals, like chromium, zinc, lead, copper, manganese, selenium, and arsenic that can leach into groundwater sources more than other waster sources.[59] This will only become a larger threat as landfills are filled with more and more e-waste.

If you are downstream in the high-tech sector, your water usage is clearly lower, however you are at high risk upstream and you must factor this into your business strategy and create a contingency plan (see **Part Four: Creating & Implementing a Water Strategy**).

Table 21: Water Footprint of Food and Agricultural Sector

ELECTRONICS/ HIGH-TECH		Raw material production	Suppliers	Direct operations	Product use/ end of life
Value chain segment		Silicon extraction and production; Metal and plastic production	Silicon wafer/semiconductor and electronic parts manufacturing	Product assembly and manufacturing; Retail and marketing; Distribution	Consumer's product use; Disposal
Withdrawal	*Intensity*	Medium	High	Medium/Low	Low
	Description	Freshwater for scrubbing and cooling; Freshwater for silicon extraction	Ultra-pure water for wafer manufacturing; Freshwater for scrubbing and cooling; A typical fab can use as much as 3 million gallons of water per day	Water use in assembly, retail and commercial facilities (bathroom, kitchen, landscaping)	Water use in electronics recycling process
Discharge	*Intensity*	High	High	Low	Medium
	Description	Wastewater containing heavy metal, acid and toxic chemicals	Wastewater containing heavy metal and toxic chemicals	Wastewater discharge from retail and commercial facilities (bathroom, kitchen, landscaping)	Electronic waste – leachate and runoff containing heavy metal and toxic chemicals from landfill

Source: Pacific Institute/Ceres

Table 22: Water Risks for High Tech Sector

Physical Risks	Reputational Risks	Regulatory Risks
▪ Silicon wafer production requires large amounts of ultra pure water (UPW) for cleaning and rinsing. Thus changes in water availability and quality significantly impact these operations. ▪ Offshore productions are increasingly moving to Asia and Pacific Rim where water resources are under stress. ▪ UPW production is very energy-intensive and susceptible to disruption or increased cost of energy supply due to water scarcity.	▪ UPW production requires potable water, putting water use in direct competition with local populations. ▪ Contamination of groundwater resources by electronic waste may damage manufacturers' brand image and reputation. ▪ Decline in economic, social and physical wellbeing of consumers due to the lack of access to clean water may affect market growth for electronic products in emerging economies.	▪ Water scarcity, increased demand and competition for freshwater resources can affect license to operate, and change the pricing structure. ▪ New or more stringent wastewater regulations may increase costs

Source: Pacific Institute/Ceres

Metals/Mining

The metal and mining sector relies on high volumes of water for its successful operation. Mining is location-dependent and cannot be relocated, meaning that you are tied to the watershed in which you operate (which may be water rich or poor). It is essential that you determine how water availability in your region is going to affect your mining sites.

The mining sector is also responsible for a significant amount of wastewater related to ore mining and refining which is a potential liability for contamination of local water resources. Already, companies have had to pay a huge amount in settlements for violation of environmental standards (see **In the News: Patriot Coal to Pay $6.5 Million to Settle Clean Water Act Violations** section below).

Mining operations are vulnerable to severe rain or flooding; these large natural events may disrupt operation and they are only going to get more severe with climate change.

Consider:

- Efficiency improvements in direct operations, including water recycling and reuse.
- Cleaning up your wastewater discharge.
- Investment in community water projects.

In the News: Patriot Coal to Pay $6.5 Million to Settle Clean Water Act Violations

February 5, 2009

Patriot Coal recently paid a $6.5 million settlement (the third largest penalty ever paid in a federal Clean Water Act case for discharge permit violations) for violations of the Clean Water Act, the Justice Department and U.S. Environmental Protection Agency (EPA)

The company was penalized for violating the Clean Water Act more than 1,400 times for discharging excess amounts of metals, sediment, and other pollutants into dozens of rivers and streams in West Virginia, which significantly harms water quality and aquatic life.

As part of the settlement, Patriot agreed to implement extensive measures to prevent future violations and to perform environmental projects, at a total estimated cost of $6 million. Specifically, Patriot will develop and implement a company-wide compliance-focused environmental management system including creating a database to track information relevant to compliance efforts; conduct regular internal and third-party environmental compliance audits; implement a system of tiered response actions for any possible future violations; and conduct annual training for all employees and contractors with environmental responsibilities. The company will also perform five stream restoration projects in local watersheds and perform assessments of mining impacts on aquatic life.

Source: WWW.USDOJ.GOV

Table 23: Water Footprint of the Metals and Mining Sector

METALS & MINING		Raw material production	Suppliers	Direct operations	Product use/ end of life
Value chain segment		Mining and drilling	Suppliers of mining or manufacturing equipment	Manufacturing of steel and other metals	Recycling and disposal of metal products
Withdrawal	*Intensity*	High	Low	High	Medium
	Description	Water used for dust control, drilling and as slurry in product transportation	Cooling water or steam generation in manufacturing facilities	Freshwater use for cooling, boiler and rinsing	Water use for cooling, boiler and rinsing
Discharge	*Intensity*	High	Low	High	Medium
	Description	Runoff and wastewater containing dust, sediments and metals and toxic chemicals; Drainage water from mines that require treatment to discharge	Wastewater containing heavy metals and other potentially toxic chemicals	Wastewater containing heavy metals and other potentially toxic chemicals	Wastewater containing heavy metals and other potentially toxic chemicals

Source: Pacific Institute/Ceres

Table 24: Water Risks for Metals and Mining Sector

Physical Risks	Reputational Risks	Regulatory Risks
▪ Siting of mining operations depends on location of raw material/mines. These operations cannot change their locations to adapt to water scarcity. ▪ Climate change is expected to increase the frequency and severity of extreme weather events. Mining operations may be disrupted by severe rain or flooding. ▪ Higher atmospheric and water temperature may impact process cooling and may increase the amount of water required for operation	▪ Because of high volume and toxicity of wastewater and mine drainage, impacts of leaks on water resources and surrounding ecosystems can be high, raising the risks for reputational damage.	▪ Stringent wastewater regulations may increase cost for wastewater treatment and discharge. ▪ Since a high volume of water is required for mining and metal manufacturing, the impact of price increases or water supply disruptions can be significant.

Source: Pacific Institute/Ceres

Resources

Global Water Tool from the World Business Council for Sustainable Development, www.wbcsd.org: recently updated in March 2009 with more recent water datasets, the Global Water Tool is a free and easy-to-use tool for companies and organizations to map their water use and assess risks relative to their global operations and supply chains (good for a site by site risk analysis). This is mainly a risk tool and is not nearly as comprehensive as the Water Footprint Network methodology. It is downloadable from www.wbcsd.org/web/watertool.htm.

Forest Products

In the United States, the forest products sector is the third-largest water user among industrial manufacturers.[60] These fact makes the forest products sector - especially pulp and paper manufacturing - particularly vulnerable to water scarcity shortages and rising costs of water.

Again, paper and pulp manufacturing is yet another industrial process that produces a large quantity of wastewater. There has been strong community opposition to pulp mills around the world, as they pollute local water resources if not managed properly. Since forests are such a key component of local ecosystems and watersheds that influence water supply and quality, it is crucial that planting, harvesting, and logging practices be managed so that conflicts with the ecosystem, water supply, and local community do not put the company and brand image in jeopardy.

Climate change will pose a significant risk to the forest sector, including an increase in forest fires (including more droughts and less water to fight them) and changes in precipitation patterns that will negatively affect forest growth. This will require more costly forest management practices and technologies.

Table 25: Water Footprint of the Forest Products Sector

FOREST PRODUCTS		Raw material production	Suppliers	Direct operations	Product use/ end of life
Value chain segment		Growing and maintenance of forests	Suppliers of logs, wood chips	Paper and pulp manufacturing; Wood product manufacturing; Distribution; Retail and marketing	Recycling and disposal of paper and wood products
Withdrawal	*Intensity*	Medium	Low	High	Medium
	Description	Precipitation and irrigation requirements to grow and maintain forests; Water use to combat forest fire	Freshwater use to manufacture containers and packaging; Washing, cooling	Freshwater use in pulp and paper-making process; Cooling water and steam generation	Water use to manufacture paper using recycled material
Discharge	*Intensity*	Low	Low	High	Medium
	Description	Agricultural runoff containing fertilizer, pesticides and herbicides; Increased sediments from logging operations	Wastewater discharge from cleaning and cooling process	Wastewater discharge from pulp and paper-making process has high concentration of cleaning and bleaching chemicals, inks, oils; Wastewater discharge from retail and commercial facilities (bathroom, kitchen, landscaping)	Wastewater discharge in recycled paper-making process has high concentration of cleaning and bleaching chemicals, inks, oils

Table 26: Water Risks for Forest Products Sector

Physical Risks	Reputational Risks	Regulatory Risks
▪ Paper product manufacturing is very water-intensive. Increasing water scarcity and climate change may disrupt or raise cost of water supply. ▪ Climate change may increase risk of forest fire, due to increased temperature, drought and water shortages for fire fighting. ▪ Changes in precipitation patterns due to climate change may negatively affect forest growth. ▪ Pulp and paper manufacturing, is extremely energy-intensive, making this sector susceptible to disruption or increased cost of energy supply due to water scarcity.	▪ Pulp and paper manufacturing has high volume and concentration of chemicals in wastewater, which can lead to significant financial and reputational risks in case of spills and leaks. ▪ Planting, harvesting and logging operations can have negative impacts on local water resources, which can damage companies' brand image and reputation.	▪ Stringent wastewater regulations may increase cost for wastewater treatment and discharge. ▪ Water scarcity, increased demand and competition may raise the price for water, cap amount of withdrawal, or suspend license to use water sources.

Source: Pacific Institute/Ceres

Electric Power/Energy

Electric power plants are very water intensive, accounting for 39 percent of freshwater withdrawals in the United States![61] Fossil fuel plants and nuclear power plants require about 140 liters and 200 liters of water per kilowatt-hour of electricity produced, respectively.[62]

Uncertainty about future supplies of water may have significant effects on operations -for example, in summer 2007, prolonged drought conditions forced the Tennessee Valley Authority to partially shut down its Brown Ferry nuclear plant in Alabama due to the high temperature of the cooling water drawn from the Tennessee River.

Furthermore, heated discharges from power plants have a harmful effect on water quality and local ecosystems, which is only exacerbated as water levels drop.

Hydropower plants are particularly susceptible to climate change and the decreases in water flow (less snowfall and less precipitation). In parts of the United States such as Alaska and the Rocky Mountains, natural water storage in snowpack and glaciers has been reduced. Climate change may also increase evaporation rates of reservoirs in arid parts of the U.S., such as Lake Mead and Lake Powell on the lower Colorado River.[63]

Lastly it should be noted that this sector has significant water-related risks embedded in raw material supply - such as extraction and processing of fossil fuels. Oil sands, for example, require massive amounts of water to extract and process the oil (every barrel of oil requires two to four barrels of water for processing)! A significant change in water supply may disrupt fuel supply and/or increase the cost of fuel for power generation. This could have a huge trickle-down effect.

Case Study: Droughts undermine U.S. and European nuclear plants

In 2003, Electricité de France had to shut down a quarter of its 58 nuclear plants due to water shortages caused by a record-setting heat wave. The closures triggered price spikes of 1,300 percent and about €300 million in losses for the French utility. Nuclear plants in the southeastern U.S. faced a similar threat in 2007 when one nuclear plant was partially closed and several others were threatened by drought-induced water shortages. "Water is the nuclear industry's Achilles heel," says Jim Warren, executive director of the North Carolina Waste Awareness and Reduction Network. Nuclear plant closures in the southeastern U.S. would have adverse impacts on businesses due to the higher cost of replacement power. "Currently, nuclear power costs between $5 to $7 to produce a megawatt hour," says Daniele Seitz, an energy analyst with New York-based Dahlman Rose & Co."It would cost 10 times that amount if you had to buy replacement power – especially during the summer."

Sources: Marc Levinson et al., "Watching water: A guide to evaluating corporate risks in a thirsty world," JPMorgan Global Equity Research, March 31, 2008.
Mitch Weiss, "Drought Could Force Nuke-Plant Shutdowns," Associated Press, January 24, 2008. See: http://www.commondreams.org/archive/2008/01/24/6580

Table 27: Water Footprint of the Eclectic Power/Energy Sector

ELECTRIC POWER / ENERGY		Raw material production	Suppliers	Direct operations	Product use/ end of life
Value chain segment		Extraction and refining of oil, natural gas and coal	Suppliers of power generation equipment	Power generation; Power distribution; Maintenance	Energy used for various purposes
Withdrawal	*Intensity*	High	Low	High	N/A
	Description	Water used for steam and water flooding of reservoirs, steam for oil extraction, cooling and steam generation for refining processes,	Cooling water or steam generation in manufacturing facilities	Water use for cooling, steam generation, flue gas treatment; Hydropower generation requires reliable water flow	Water is not needed to use electricity. However, there is often a strong energy-water connection – energy is required to heat or deliver water
Discharge	*Intensity*	High	Low	High	N/A
	Description	Wastewater containing metals and hydrocarbons	Wastewater containing heavy metals and other potentially toxic chemicals	Significant thermal discharge impacts on local ecosystems	No wastewater discharge associated with energy use

Table 28: Water Risks for Electric Power/Energy Sector

Physical Risks	Reputational Risks	Regulatory Risks
▪ Thermal power generation requires large amounts of cooling water. Hydropower plants are at risk of decreases in water flow. ▪ An increase in the severity of extreme weather events will damage power generation/ distribution facilities. ▪ Higher atmospheric and water temperatures increases the amount of water required for cooling. ▪ Oil and natural gas supply may be disrupted or become more expensive due to severe weather conditions.	▪ The temperature and salinity of return flows can damage ecosystems and habitats, which may damage company's brand image or reputation.	▪ New or more stringent wastewater regulations may increase cost for wastewater treatment and discharge. ▪ Since a high volume of water is required for power generation, the impact of price increase or water supply disruption can be significant.

Part Six: Resources

Associations

Alliance for Water Efficiency

The Alliance for Water Efficiency is a stakeholder-based 501(c)(3) non-profit organization dedicated to the efficient and sustainable use of water. Located in Chicago, the Alliance serves as a North American advocate for water efficient products and programs, and provides information and assistance on water conservation efforts.

Website: http://www.allianceforwaterefficiency.org/

California Urban Water Conservation Council (CUWCC)

CUWCC is a partnership of water suppliers, environmental groups, and others interested in conserving California's greatest natural resource - WATER.

Website: www.cuwcc.org/

Pacific Institute

The Pacific Institute is a nonpartisan research institute that works to advance environmental protection, economic development, and social equity. They put out great cutting-edge water research.

Website: http://www.pacints.org

H20 Conserve

H2O conserve is a web-based project that offers tools and knowledge that enable individuals to make water conservation part of their everyday lives.

Website: http://www.h2oconserve.org/

California Department of Water Resources: http://www.water.ca.gov/

The WateReuse Association

The WateReuse Association is a nonprofit organization whose mission is to advance the beneficial and efficient use of water resources through education, sound science, and technology using reclamation, recycling, reuse and desalination for the benefit of our members, the public, and the environment.

Website: http://www.watereuse.org/

American Water Works Association

Founded in 1881, AWWA is the authoritative resource on safe water, providing knowledge, information and advocacy to improve the quality and supply of water in North America and beyond. AWWA advances public health, safety and welfare by uniting the efforts of the full spectrum of the water community.

Website: http://www.awwa.org/

EPA's WaterSense Program

WaterSense is a partnership sponsored by the EPA to promote water-efficient products and practices.

Website: http://www.epa.gov/watersense/

EPA Water Information: http://www.epa.gov/ebtpages/water.html

North Carolina Division of Pollution Prevention and Environmental Assistance

The North Carolina Division of Pollution Prevention and Environmental Assistance provides free, non-regulatory onsite pollution prevention assessments, including water efficiency to businesses, industries and municipalities in North Carolina. DPPEA resources also include technical fact sheets and manuals on pollution prevention and a clearinghouse of more than 44,000 references. A matching grant program is also available for innovative pollution prevention and water efficient technologies.

Web site: http://www.p2pays.org; ALSO CHECK OUT http://www.p2pays.org/ref/01/00692.pdf

WaterPartners International

WaterPartners International is a U.S.-based nonprofit organization committed to providing safe drinking water and sanitation to people in developing countries. Working in partnership with donors and local communities, we have helped thousands of people develop accessible, sustainable, community-level water supplies. WaterPartners not only offers traditional, grant-funded programs, but is also harnessing the power of micro-finance to address the world water crisis.

Website: http://www.water.org/

Water Innovations Alliance

The Water Innovations Alliance is a new industry association focused on developing new funding, reducing regulatory barriers, increasing collaboration and raising awareness for cutting-edge water technologies and the problems they solve. The Alliance serves the entire spectrum of the water sector: corporations, investors, engineering firms, start-ups, NGOs, research centers, municipalities, and others in the field.

Website: http://www.waterinnovations.org/

World Water Council

The World Water Council was established in 1996 in response to increasing concern from the global community about world water issues. Its mission is to promote awareness, build political commitment and trigger action on critical water issues at all levels, including the highest decision-making level, to facilitate the efficient management and use of water in all its dimensions and on an environmentally sustainable basis.

Website: http://www.worldwatercouncil.org/

Water - Use it Wisely: http://wateruseitwisely.com/

Water Footprint & Water Risk

Water Footprint Network (WFN)

The mission of the Water Footprint Network is to promote the transition towards sustainable, fair and efficient use of fresh water resources worldwide by advancing the concept of the 'water footprint'.

Website: http://www.waterfootprint.org/

The Center for Sustainable Innovation

The Center for Sustainable Innovation (CSI) is a 501(c)(3) non-profit corporation created in 2004 by its founder and current Board Chair, Mark W. McElroy, Ph.D. Its purpose is to conduct research, development, training and consulting for, and with, companies around the world interested in improving the sustainability performance of their operations.

Website: http://www.sustainableinnovation.org/

World Business Council for Sustainable Development

The World Business Council for Sustainable Development (WBCSD) is a CEO-led, global association of some 200 companies dealing exclusively with business and sustainable development. The Council provides a platform for companies to explore sustainable development, share knowledge, experiences and best practices, and to advocate business positions on these issues in a variety of forums, working with governments, non-governmental and intergovernmental organizations.

Website: http://www.wbcsd.org/ or www.wbcsd.org/web/watertool.htm

Gray Water

http://www.greywater.com/
http://www.greywater.net/
http://www.greywaterguerrillas.com/

Rainwater Harvesting

http://www.harvesth2o.com/

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