Bombay Chamber of Commerce & Industry

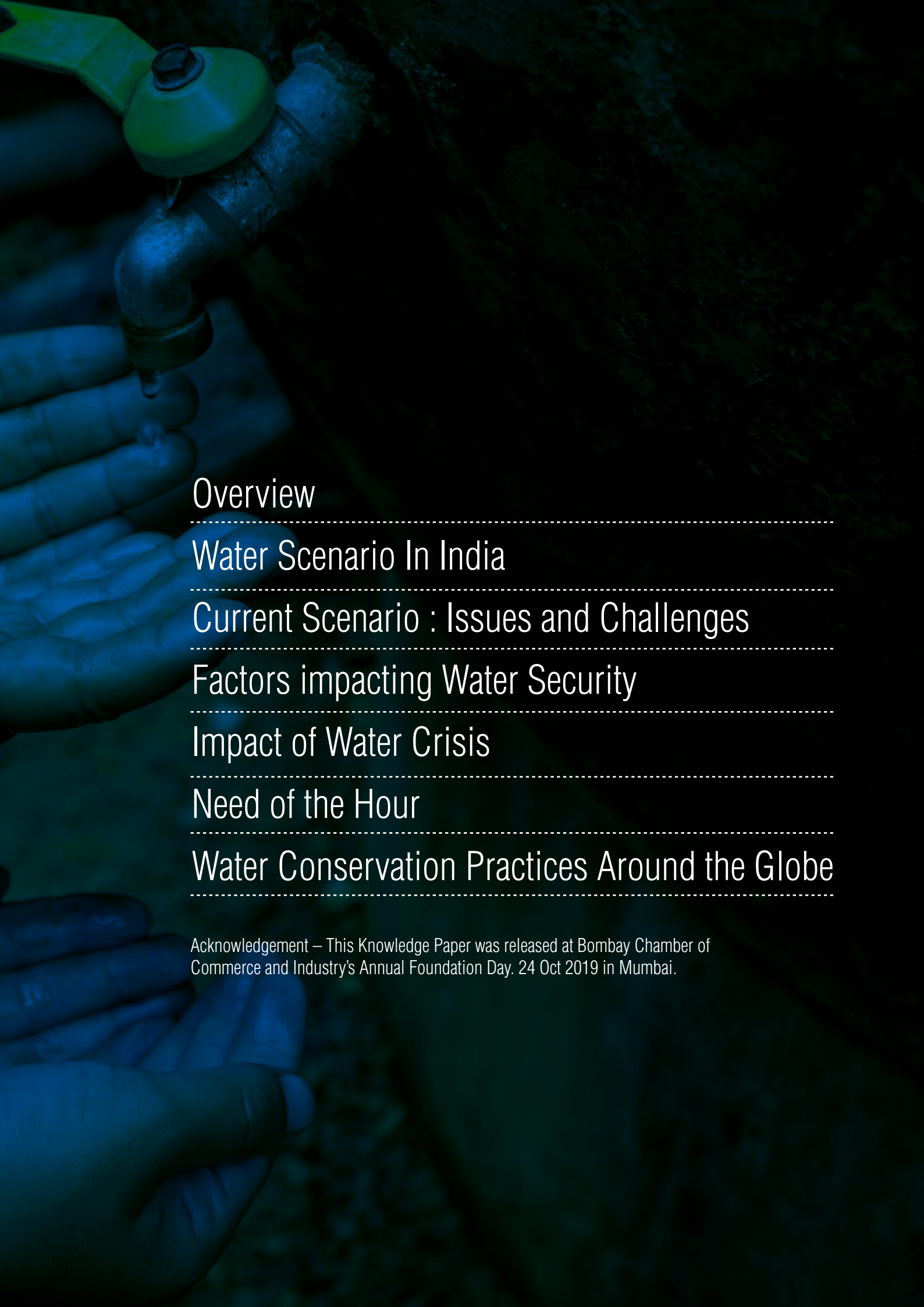
WATER: THE BIGGEST BUSINESS RISK FOR INDIA, INC.

AN OVERVIEW

ERM Knowledge Partner

> If present trends continue, **1.8 billion people** will be living in countries or regions with water scarcity by 2025, and two thirds of the world population could be subject to water stress

This statement was made almost a decade back by Asha-Rose Migiro, United Nations Deputy Secretary General while addressing a High Level Symposium on "Water Security at the United Nations" on 5 February 2009.



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6 CLEAN WATER AND SANITATION

Sustainable Development Goal 6 is one of 17 Sustainable Development Goals established by the United Nations General Assembly in 2015. It calls for clean water and sanitation for all people. The official wording is: "Ensure availability and sustainable management of water and sanitation for all."

6.1 By 2030, achieve universal and equitable access to safe and affordable drinking water for all

6.2 By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations

6.3 By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally

6.4 By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity

6.5 By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate

6.6 By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes

6.A By 2030, expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies

6.B Support and strengthen the participation of local communities in improving water and sanitation management

OVERVIEW

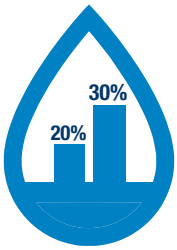
PURPOSE OF THE DOCUMENT

To think life without water is not only unimaginable but also frightening! Basic necessities of human existence food, fabric and shelter are not possible without water. **No water – No Life!** Scriptures of all religions, without exception, have emphasized the importance of water to life. All great thinkers of the world have preached the conservation of water. Mahatma Gandhi said, "Don't Use Money like Water but Use Water like Money" It is high time to apply our minds to think about ways and means to save such an importance resource like "WATER"

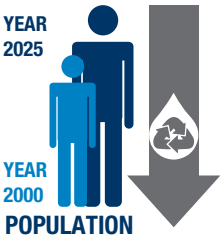
This document highlights the current water scenario around the globe and in India, the factors affecting the water scarcity / stress, impacts and actions to be taken to ensure availability and sustainable management of water and sanitation for all as per the SDG6. There are enough evidence to show that the awareness about water on the part of the common man has increased considerably but still remains to be done. "Knowledge Comes but Wisdom Lingers". It is good to think globally but very necessary to act locally. People appear to be aware but do not appreciate the fact that every action; however trifle, to save water contributes to global campaign. The present document gives innovative suggestions and actions taken about such small but important issues.

GLOBAL WATER SCENARIO

Water use has been increasing worldwide by about 1% per year since the 1980s. This steady rise has principally been led by surging demand in developing countries and emerging economies (although per capita water use in the majority of these countries remains far below water use in developed countries — they are merely catching up). This growth is driven by a combination of population growth, socio-economic development and evolving consumption patterns. Agriculture (including irrigation, livestock and aquaculture) is by far the largest water consumer, accounting for 69% of annual water withdrawals globally. Industry (including power generation) accounts for 19% and households for 12%.



Global water demand is expected to continue increasing at a similar rate until 2050, accounting for an increase of 20 to 30% above the current level of water use.



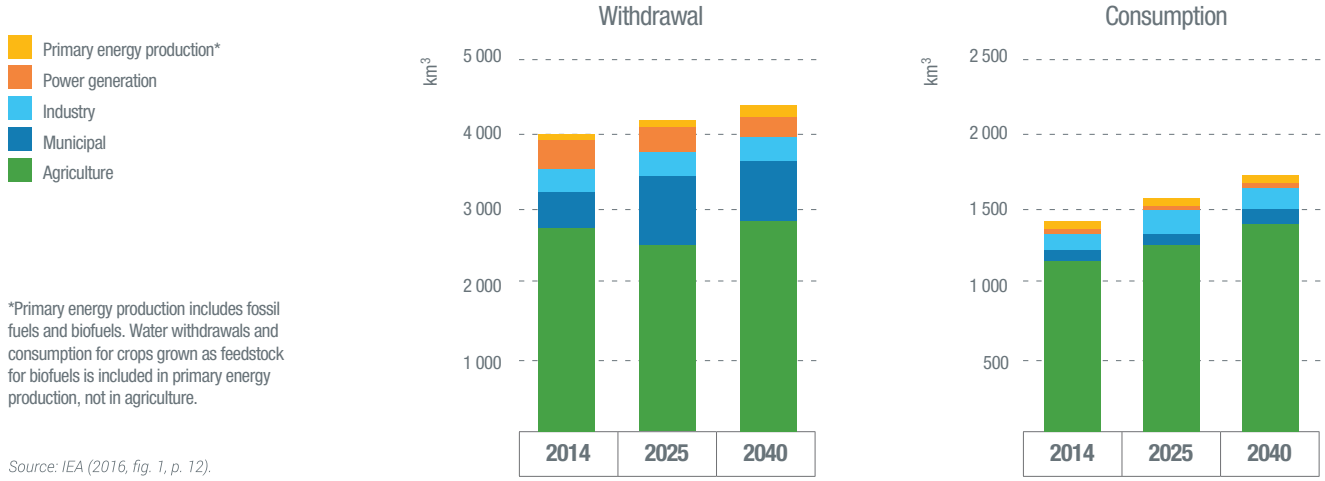
Because of population growth, between 2000 and 2025 the global average annual per capita availability of renewable water resources is projected to fall from 6,600 cubic metres to 4,800 cubic metres.

Over 2 billion people live in countries experiencing high water stress. Although the global average water stress is only 11%, 31 countries experience water stress between 25% (which is defined as the minimum threshold of water stress) and 70%, and 22 countries are above 70% and are therefore under serious water stress. Growing water stress indicates substantial use of water resources, with greater impacts on resource sustainability, and a rising potential for conflicts among users.

Three out of ten people (2.1 billion people, or 29% of the global population) did not use a safely managed drinking water service in 2015, whereas 844 million people still lacked even a basic drinking water service. Of all the people using safely managed drinking water services, only one out of three (1.9 billion) lived in rural areas.

Globally, an estimated 2,000 children under the age of five die every day from water borne diseases; 780 million people lack access to safe drinking water. Close to 25% of the earth's population is forced to rely on contaminated water sources for basic needs and people are getting sick from their water. Up until now, the response to the water crisis has been focused solely on water availability, not on the critical issues of quality or sustainability.

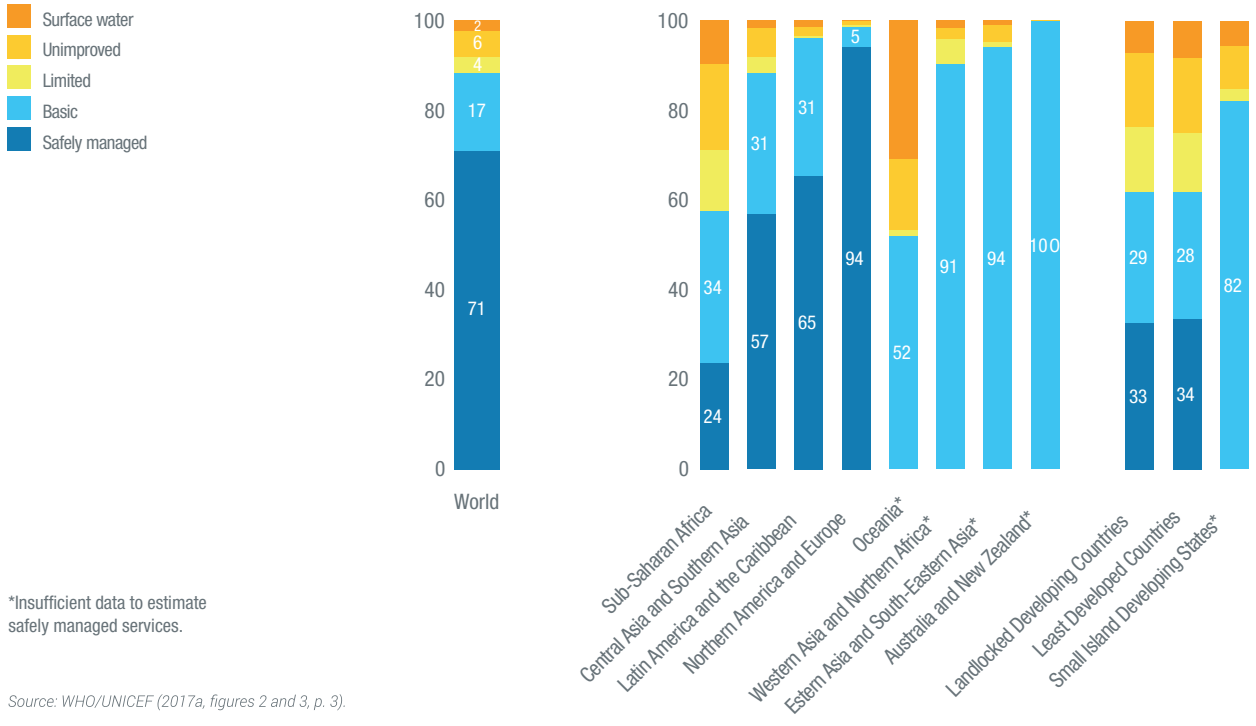
GLOBAL WATER DEMAND BY SECTOR TO 2040



*Primary energy production includes fossil fuels and biofuels. Water withdrawals and consumption for crops grown as feedstock for biofuels is included in primary energy production, not in agriculture.

Source: IEA (2016, fig. 1, p. 12).

GLOBAL AND REGIONAL DRINKING WATER COVERAGE, 2015 (%)



*Insufficient data to estimate safely managed services.

Source: WHO/UNICEF (2017a, figures 2 and 3, p. 3).

Source: Global Water Report 2019

WATER SCENARIO IN INDIA

India is rich in surface water resources. Average annual precipitation is 4000 billion cubic meters (BCM) and the average flow in the river system is estimated to be 1869 cubic km. Because of concentration of rains in the three-monsoon month, the utilizable quantum of surface water is about 690 BCM.

Groundwater is water that is found underground in the cracks and spaces in soil, sand and rock. Groundwater is stored in and moves slowly through layers of soil, sand and rocks called aquifers. Groundwater comes from rain, snow, sleet and hail that soaks into the ground. The net ground water availability considering natural discharge, recharge from rainfall, recharge from other sources as calculated by Central Ground Water Board is 433 BCM.

Hence, total available water considering surface and ground water is 1,063 BCM.

Scientists at IIT Delhi and Jamia Millia Islamia, New Delhi, pored over official calculations for estimating the country's water resources. They say the government has overestimated its usable water resources by at least 66%. According to him, the total available water is 668 BCM.

However, conditions varies from region to region, whereas some regions are drought affected, others are frequently flooded. In India also, with the rapid increase in the population, the demand for irrigation, human and industrial consumption of water has increased considerably, thereby causing depletion of water resources. The estimated water demand from various water sectors is given below:

Table-1: Estimated Water Demand for Various Sectors

Water Sectors	Projected Water Demand, BCM		
	2010	2025	2050
Irrigation	688	910	1072
Drinking Water	56	73	102
Industry	12	23	63
Energy	5	15	130
Others	52	72	80
Total	813	1093	1447

Source: MOWR Ministry of Water Resources

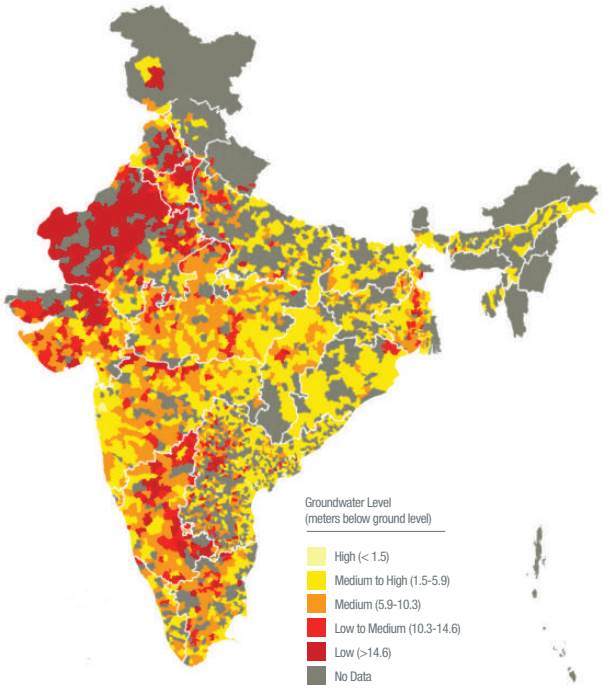
CURRENT SCENARIO – ISSUES & CHALLENGES

CURRENT WATER ISSUES

- According to the Composite Water Management Index (CWMI) report released by the Niti Aayog in 2018, 21 major cities (Delhi, Bengaluru, Chennai, Hyderabad and others) are racing to reach zero groundwater levels by 2020, affecting access for 100 million people.
- 12% of India's population is already living the 'Day Zero' scenario, thanks to excessive groundwater pumping, an inefficient and wasteful water management system and years of deficient rains. The CWMI report also states that by 2030, the country's water demand is projected to be twice the available supply, implying severe water scarcity for hundreds of millions of people and an eventual 6% loss in the country's GDP.
- Severe water scarcity in Chennai this year created serious issues for residents and business leaders. Chennai that is facing acute water shortage had nearly two dozen water bodies and wetlands but most of them are out of use today. A recent assessment found that only nine of them could be reclaimed as water bodies.
- With nearly 70 percent of water contaminated, India ranks 120th of 122 countries in a global water quality index.
- India uses the largest amount of groundwater – 24% of the global total, more than that of China and the US combined - and is the third largest exporter of groundwater -- 12 % of the global total.
- According to the Composite Water Management Index of the Niti Aayog, 75% of households do not have drinking water on premise and about 84% rural households do not have piped water access.
- It is estimated that around 40% of piped water in India is lost to leakage.
- India has been also poor in treatment and re-use of household wastewater. About 80% of the water-reaching households in India are drained out as waste flow through sewage to pollute other water bodies including rivers and land.
- More than 90% of the sewage generated by rural municipalities and more than 50% of sewage discharged by urban municipal go untreated and discharged to the fresh water ecosystem
- Industry produces pollutants that are extremely harmful to people, wildlife and the environment. Furthermore several of industrial facilities in India use freshwater to carry away waste from the plant and into rivers, lakes and oceans. Especially, industries produce nearly 31,000 million cubic meters of effluent which is discharged into our fresh water bodies
- Fluoride toxicity due to non-availability of safe drinking water and farming has become a major public health problem in India. In some parts of India fluoride levels exceeding from 1.0 mg/l to a maximum of 48 mg/l. There are thousands of villages in the endemic states in India experience excess fluoride problems. In states such as Andhra Pradesh, Gujarat and Rajasthan, 70-100% districts contain high fluoride levels in food and water.

54%

Of India's Groundwater Wells are Decreasing



70%
of India's water is contaminated

75%
of households do not have drinking water on the premises

84%
of rural households do not have access to piped water

600 million

Indians face high to extreme stress over water

Source: WBSCD India Water Network

FACTORS IMPACTING WATER SECURITY

Population Growth

Population growth is a significant driver of increasing water demand, both directly (e.g. for drinking water, sanitation, hygiene and household uses) and indirectly (e.g. through growing demands for water-intensive goods and services, including food and energy).

The global population reached 7.6 billion people as of June 2017. It is expected to reach about 8.6 billion by 2030 and further increase to 9.8 billion by 2050.

The population in India reached 1.37 billion as on 2010. It is expected to reach about 1.46 billion in 2025 and 1.70 billion in 2050.

Urbanization & Informal Settlements

Nearly all-net population growth is taking place in cities and the world is becoming increasingly urbanized, creating new and difficult challenges for urban water management. Over half (54%) of the global population currently lives in cities.

Water Quality

Pollution is a major cause of water shortage. The various factors responsible for water quality are industrial wastewater, domestic wastewater, storm water runoff, agricultural pollutants (pesticides & herbicides), atmospheric pollutants reaches water bodies along with rain, social & domestic activities on river banks as washing of cloths, animals, throwing of garbage, oil spillages as and salt-water intrusion.

Agriculture

Agriculture uses majority of available freshwater. India is among the top growers of agricultural produce in the world and therefore the consumption of water for irrigation is amongst the highest. Traditional techniques of irrigation causes maximum water loss due to evaporation, drainage, percolation, water conveyance, and excess use of groundwater. As more areas come under traditional irrigation techniques, the stress for water available for other purposes will continue.

Overexploitation

Nearly 50% of the world population depends on groundwater for its drinking needs. In developing countries like India, groundwater fulfils nearly 80% of irrigation requirement. This has resulted in fast depletion of groundwater sources. Free power and inefficient use of water by farmers had added to the problem of groundwater depletion. Groundwater increasingly is pumped from lower and lower levels, and much faster that rainfall is able to replenish it.

Deforestation

Deforestation is the permanent destruction of forests in order to make land available for other uses. An estimated 18 million acres (7.3 million hectares) of forest, which is roughly the size of the country of Panama, are lost each year, according to the United Nations' Food and Agriculture Organization (FAO).

Forests transport large quantities of water into the atmosphere via plant transpiration. This replenishes the clouds and instigates rain thus maintaining the forests. When deforestation occurs, precious rain is lost from this area, flowing away as river water and causing permanent drying.

After heavy rainfall on cleared forest lands, the run-off carries soil into local creeks and rivers. The rivers carry the eroded soils downstream, causing significant problems. Hydroelectric projects and irrigation infrastructure lose productivity from siltation, while industrial installations suspend operations due to lack of water. Siltation also raises river beds, increasing the severity of floods, and creates shoals and sandbars that make river navigation far more troublesome. The increased sediment load in rivers, repress fish eggs, causing lower hatch rates. As the suspended particles reach the ocean, the water becomes cloudy, causing regional declines in coral reefs and affecting coastal fisheries.

The forests cause rainfall and their absence would turn the interior of these continental areas into deserts.

Reduced usage of Rainwater

Rain water harvesting is patchy in India so much of the huge amount of water dumped on the country during the monsoon every year just dries up or flows into the ocean. Buildings, roads, and pavement redirect rainwater away from the soil and into drainage systems, preventing it from reaching aquifers or nourishing plants. These processes not only accelerate fresh rainwater along a path to the ocean, reducing our level of readily-available fresh water, but runoff water is often contaminated along the way with urban trash and litter, spills and leaks from cars that leave oil or chemicals on roads and driveways, and chemical runoff from fertilizers and pesticides used in urban lawns, parks, and golf courses.

Conflict

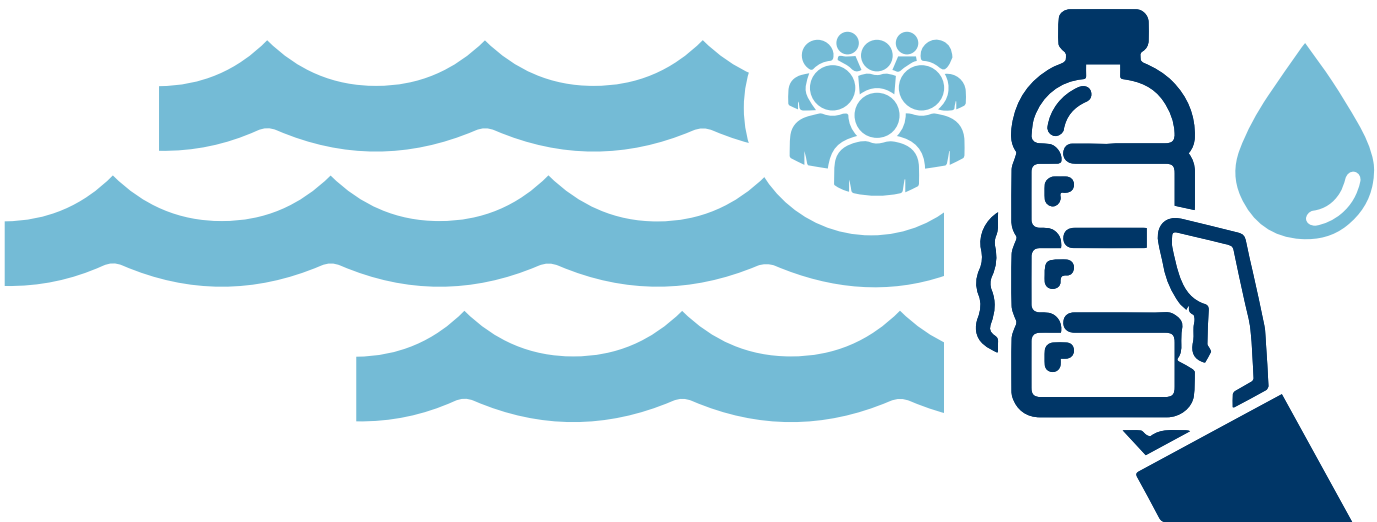
Conflict contributes to water shortages in areas. When people are fighting over control of water sources like rivers, some will not have access to it.

Climate Change & Variability

It is anticipated that climate change will affect the availability of water resources through changes in rainfall distribution, soil moisture, glacier and ice/snow melt, and river and groundwater flows.

Widespread changes in the distribution of precipitation, including inter-annual precipitation variability and seasonal shifts in streamflow, so that some regions are flooded and others face decreased summer precipitation, leading to lowered aquifers and a reduction of stored water in reservoirs fed with seasonal rivers, and drought.

Lengthening of the growing season and increased irrigation water usage; increased use of water to replace evaporative losses and to satisfy human needs in warmer weather. Higher temperatures and changes in flow can damage the quality of all freshwater sources.



IMPACT OF WATER CRISIS

Lack of Access to Drinking Water:

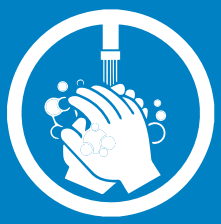
The biggest problem that happens when is that people are not able to get fresh, clean drinking water. The human body can only go so long without water, and a lack of drinking water can result in a number of other problems.

Hunger:

If there is no water that can be used in order to help water the crops, then it will lead to hunder. Animals will also die, which will result in a lack of meat as well. Water scarcity, in short, causes starvation to occur in masses for both people and animals that are located in the area.

Sanitation Issues:

Without access to clean water, there is no way to clean food, dishes, or people. When people are not given access to proper sanitation, disease (which we talked about above) ends up becoming much more of an issue than it would have been otherwise. It also causes mental health issues, including depression and anxiety.

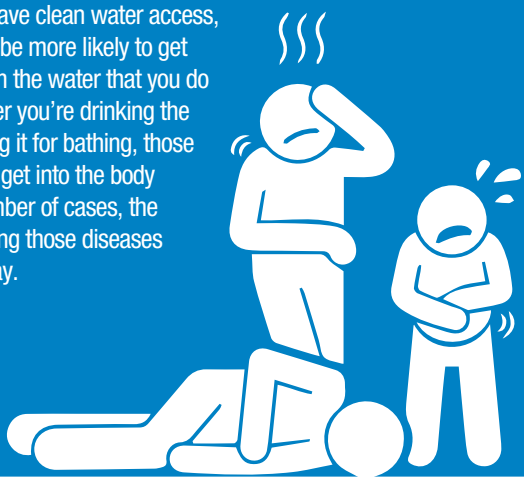


Lack of Education:

Water scarcity makes it difficult for people to get the education that they need or that they deserve. Why? Mainly, because those children are either too sick to go to school, or they are working to help get water to the home and the family.

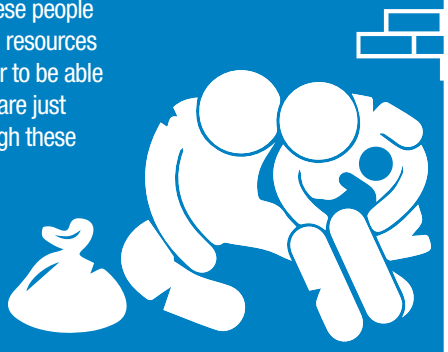
Diseases:

If you don't have clean water access, then you will be more likely to get diseases from the water that you do have. Whether you're drinking the water or using it for bathing, those diseases will get into the body and, in a number of cases, the people carrying those diseases will pass away.



Poverty:

Overall, people who are dealing with water scarcity are often stuck in poverty as well. These people are not able to get the resources that they need in order to be able to thrive, and instead are just barely surviving through these difficult times.



NEED OF THE HOUR

WHAT'S NEEDED?

HOW CAN WE DO IT?

Rainwater harvesting

India receives enough water through the southwest monsoon. However, most regions of the country are still water deficient due to inefficient water management practices. Rainwater harvesting should be encouraged on a large scale particularly in cities where surface run off rainwater is very high. Rainwater harvesting at micro-level, prima facia looks trifle but it has considerable impact on over all water management. It needs active people participation an indirectly makes the community water conscious an aspect very important for the success of any programme. Some of the rainwater harvesting methods are:

Artificial Recharging - can be done by various methods absorption pit method, absorption well method, well cum bore method, recharge trench cum injection well, borewell recharging and ground water recharging.

Harvesting - Water falling on a flat rooftop should be made to run through a pipe connected to the roof and prevented from running off to drainage on the roadside. This water should be filtered and stored in tanks constructed for the purpose of storing rainwater. A good quality filter is needed for purifying the water.

Groundwater Dams - Groundwater dams are structured that intercept or obstruct the natural flow of groundwater and provide storage for water underground. The main principal of groundwater dam is that instead of storing the water in surface reservoirs, water is stored underground. The main advantages of water storage in groundwater dams are that evaporation losses are much less for water stored underground. Further, risk of contamination of the stored water from the surface is reduced because as parasites cannot breed in underground water.

Reduce water wastage during consumption

Indian cities will need to learn lessons from Cape Town in south Africa which when faced with the prospect of running out of water in 2018 announced "Day Zero" when water taps in the city were turned off and people had to use communal water taps to conserve water. Limits on water use per person were set. State governments in India will need to take bold decisions and create awareness for the minimal use of water since water is a state subject in India.

Treatment & Reuse of Water

About 80 per cent of the water that reaches households, leaves as waste and pollutes our waterbodies and environment. There is a huge potential in reusing and recycling this treated wastewater at least for non-potable purposes, which is cost effective. Dual plumbing system at residential and commercial levels for grey and black water. Treated grey water to be used for flushing and greenbelt. The water can be reused for agriculture, landscape, golf course irrigation cooling water, toilet flushing, dust control, construction activities, concrete mixing.

Water Conservation / Water Efficiency

Develop and Implement a **Water Conservation** and **Smart Water Use Approach** with a key focus on water conservation, source sustainability, storage, and wastewater reuse and recycle.

Household Levels

- Low-flow shower heads sometimes called energy-efficient shower heads as they also use less energy
- Low-flush toilets, composting toilets and incinerating toilets. Composting toilets have a dramatic impact in the developed world, as conventional Western flush toilets use large volumes of water
- Dual flush toilets created by Caroma includes two buttons or handles to flush different levels of water. Dual flush toilets use up to 67% less water than conventional toilets
- Faucet aerators, which break water flow into fine droplets to maintain "wetting effectiveness" while using less water. An additional benefit is that they reduce splashing while washing hands and dishes
- Raw water flushing where toilets use sea water or non-purified water (i.e. greywater)
- Wastewater reuse or recycling systems, allowing:
  - Reuse of graywater for flushing toilets or watering gardens
  - Recycling of wastewater through purification at a water treatment plant. See also Wastewater - Reuse
- Rainwater harvesting
- High-efficiency clothes washers
- Weather-based irrigation controllers
- Garden hose nozzles that shut off the water when it is not being used, instead of letting a hose run.
- Low flow taps in wash basins
- Swimming pool covers that reduce evaporation and can warm pool water to reduce water, energy and chemical costs.
- Automatic faucet is a water conservation faucet that eliminates water waste at the faucet. It automates the use of faucets without the use of hands.

Commercial Levels

Many water-saving devices (such as low-flush toilets) that are useful in homes can also be useful for business water saving. Other water-saving technology for businesses includes:

- Waterless urinals
- Waterless car washes

- Infrared or foot-operated taps, which can save water by using short bursts of water for rinsing in a kitchen or bathroom
- Pressurized waterbrooms, which can be used instead of a hose to clean sidewalks
- X-ray film processor re-circulation systems
- Cooling tower conductivity controllers
- Water-saving steam sterilizers, for use in hospitals and health care facilities
- Rain water harvesting
- Water-to-Water heat exchangers.

Protection of Water from Pollution

Large cities located on banks of rivers are directly disposing off different wastes without treatment in rivers. Similarly, tourism has spread pollution at war speed on famous lakes and seacoasts. Man is greatly dependent on groundwater for his water related necessities, but some special industrial units have also polluted this amount of water stored in the security cover of the ground. Few steps, which can be taken to prevent this:

- Public awareness and public participation
- Zero liquid discharge system
- More stringent norms for discharge
- Skip the use of plastics
- Interception and diversion works to capture the raw sewage flowing in the waterbody
- Low cost sanitation works to prevent open defacation on waterbodies
- River front development works such a improvement in bathing ghats

Awareness

Reducing the wastage of water can be best achieved by launching awareness campaigns to involve all sections of the society for the conservation of water. Such awareness is possible through different media such as newspapers, radio and TV.

Irrigation Innovation

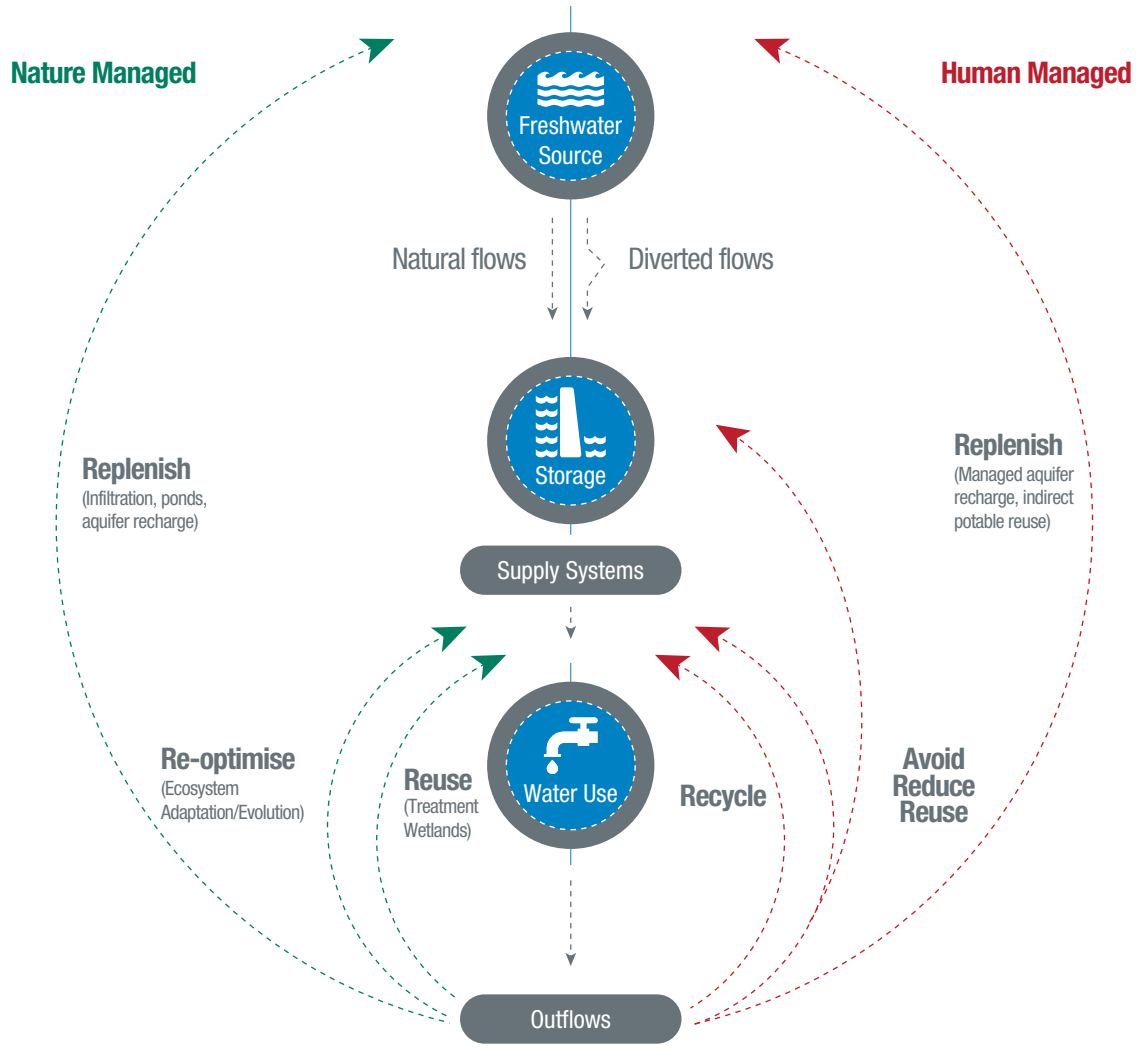
About 1500mm amount of water is required for irrigated rice in the Asian region. Rice crop needed 34–43% of the total world's irrigation water or about 24–30% of the entire world's developed freshwater resources. The following procedure can be adapted to use less water in rice farming:

- Some field channels can be constructed in the farmland to improve control over water by individual farmers. Such channels can be constructed in any type of irrigation system.
- According to the studies, performing shallow tillage operations before land soaking can be a great help for water conservation. It will fill the cracks and can greatly reduce the amount of water used in land preparation.
- Farmers level their fields from time to time so that it can save more water. This is nearly an extra 10% of the total water requirement to grow the crop.
- Farmlands must be covered with the construction of bunds around it. The average height of bunds should be high enough (at least 20 cm) to avoid overflowing during heavy rainfall.

Industrial Water Management

Optimisation of water use by industries is important because it can lower water withdrawals from local water sources thus increasing water availability and improving community relations, increasing productivity per water input, lowering wastewater discharges and their pollutant load, reducing thermal energy consumption and, potentially, processing cost. The integrated water management approach need to be adopted, which includes

- Water Use Mapping : from source till the end point (discharge point)
- Water Quantity & Quality Assessment: Documentation of oval water consumption and water quality from inflow to outflow.
- Lower the specific water intake through water conservation and reduction in losses.
- Zero liquid discharge facility.
- Enhancement of water use planning by adopting the latest economically feasible Information and communications technology.
- Water Audits to identify the leaks, water flows and then taken necessary measures to reduce losses.
- Water conservation measures as rainwater harvesting, installation of water efficient devices.
- Wastewater recycling.
- Reduction in leakages / losses and process optimization.
- Employee education and motivation.
- Minimise water use for cleaning.



TOOLS TO ACCESS WATER SUPPLY RISK AND VULNERABILITY

India water tool 3.0:

The World Business Council for Sustainable Development (WBCSD) launched the third version of the India Water Tool (IWT). IWT3.0 is a comprehensive and user-friendly application that makes water data from government and other organizations available on a publicly accessible platform. The goal is to assist key stakeholders identify water risks and plan for better water management in India.

Water can only be sustainably managed if data with an appropriate level of granularity is made available publicly in a format usable to all stakeholders. IWT 3.0 does all of this, while encouraging stakeholders to take action, whether at national, watershed or facility level. It will be a critical element of strengthening water management in India both now and in the future.

It includes:

- Over 20 datasets from key Indian government authorities and other organizations
- A dataset on real-time satellite capture of surface water availability from NASA and U.S. Geological Survey (USGS)
- Water stress models developed by the World Resources Institute (WRI) and Columbia Water Centre (CWC).
- It also brings results from two local watershed-level water-balance studies to give a complete picture of the watershed health and determine potential for water recharge and demand-side management. All water users and stakeholders can openly access this data and use it to plan management interventions in that watershed.

WRI Aqueduct:

Aqueduct's global water risk mapping tool helps companies, investors, governments, and other users understand where and how water risks and opportunities are emerging worldwide. The Atlas uses a robust, peer reviewed methodology and the best-available data to create high-resolution, customizable global maps of water risk.

WRI developed the Aqueduct Water Risk Atlas, including 12 global indicators and maps of water-related risk. Companies can use this information to prioritize actions, investors to leverage financial interest to improve water management, and governments to engage with the private sector to seek solutions for more equitable and sustainable water governance.

Aqueduct Global Maps 2.0 includes indicators of water quantity, water variability, water quality, and public awareness of water issues, access to water, and ecosystem vulnerability. The data used for the study were developed in consultation with experts and are publicly

INNOVATIVE TECHNOLOGIES FOR WATER MANAGEMENT & WATER SCARCITY

SCADA – Supervisory Control And Data Acquisition:

At present, most of the data around water management is obtained manually. There exists very few automated systems and communication media through which the site data could be transferred to the centralized location for online controlling and decision-making. Manual recording is prone to errors and the frequency of measuring various parameters is very limited.

There are huge benefits in the application of SCADA systems in water facilities as well as in water distribution plants. SCADA systems allow the plant to function uninterruptedly and help reduce labor and energy costs while drastically improving system efficiency.

Smart Meters:

One of the crucial aspect to effective water demand management and an issue faced by major cities of India is Non-Revenue Water (NRW). NRW is the water lost in the system and not leading to any revenue. Reduction in NRW levels is vital for technical and financial sustainability of water utility and cities. Smart meters are an integral part of the array of offerings that come with intelligent water management systems. Installation of smart meters helps in optimising the water network to regulate and monitor different parameters such as hydraulic pressure and flow, water quality, head lossess, water and enery consumptiosn. Smart meters curbs extra water usage, tracking water consumpiton, flow patterns and allows equitable distribution of water.

Desalination:

Desalination treatment plants have been widely used all over the world, especially in places that are drought ridden or have limited access to water. Besides reverse and forward osmosis, there have been new advancements in the ways desalination works to make it cheaper and more efficient.

The use of Aquaporin, which are proteins that are embedded into membranes that filter out salt at the cellular level mimic biological processes. There are also some desalination plants that use solar UV technology to desalinate the water.

Irrigation Controllers:

There are two types of irrigation control - for home use and for commercial use. New technologies have made it easier to regulate the amount of water that is used in these practices. For home irrigation, like lawn sprinklers, there are new innovations that can download information (via Wi-Fi connection) to alert the system as per weather reports and landscape conditions to better assess the amount of water needed and customize the program accordingly. Secondly, for commercial irrigation, companies have developed new tubes that transport only water vapor through the system not solutes or actual water. This way, salt water can be used in irrigation practices to grow trees and crops. Commercial irrigation systems have also implemented the smart irrigation systems used in home sprinklers, just on a larger scale. These large scale smart systems preserve water, locate leaks or other potential problems and pinpoint exactly how much water is needed.

Mobile recycling facilities:

Currently, most wastewater recycling facilities are centrally located in towns and cities. This location makes wastewater recycling inaccessible to rural areas and expensive for cities to upkeep. Often, the wastewater loads in cities is so high that the facilities may not be able to filter out all the wastewater efficiently and some grey water may still end up in fresh water sources. To prevent this, some companies and municipalities have started using mobile wastewater facilities and modular sludge filters to provide filtration where it was inaccessible before. These mobile water treatment facilities are also used in developing countries where there may not be any wastewater filtration possible. They prevent pollution and contamination from running off and entering clean, fresh rivers, lakes and streams.

Wastewater Mining:

Wastewater mining is an alternate terminology used to describe wastewater recycling. The process of wastewater mining is aimed at extracting every drop of water possible that can be recycled for the purpose it was intended. Substantial advances have been made in the past couple of decades in the field of wastewater recycling. These

technologies include advanced activated sludge processes such as Membrane Bioreactor (MBR) and Membrane Aerated Biofilm Reactor (MABR), ultra and nano filtration such as disc filtration, cloth media filtration, etc.

Water Seer:

It looks like a well, but instead of withdrawing groundwater, the water seer uses the surrounding environment to extract water from the atmosphere. It is planted six feet below the surface, where its lower chamber is surrounded by cool earth. Above ground, wind spins a turbine which spins fan blades inside the device. These blades send the air into an internal condensation chamber where, as the warm air cools, the vapor condenses on the sides of the chamber. Water then flows down to the lower chamber and can be extracted with a simple pump and hose. In ideal conditions, it can collect 37 litres of water a day. Developed by VICI labs in the US.

Mesh Nets:

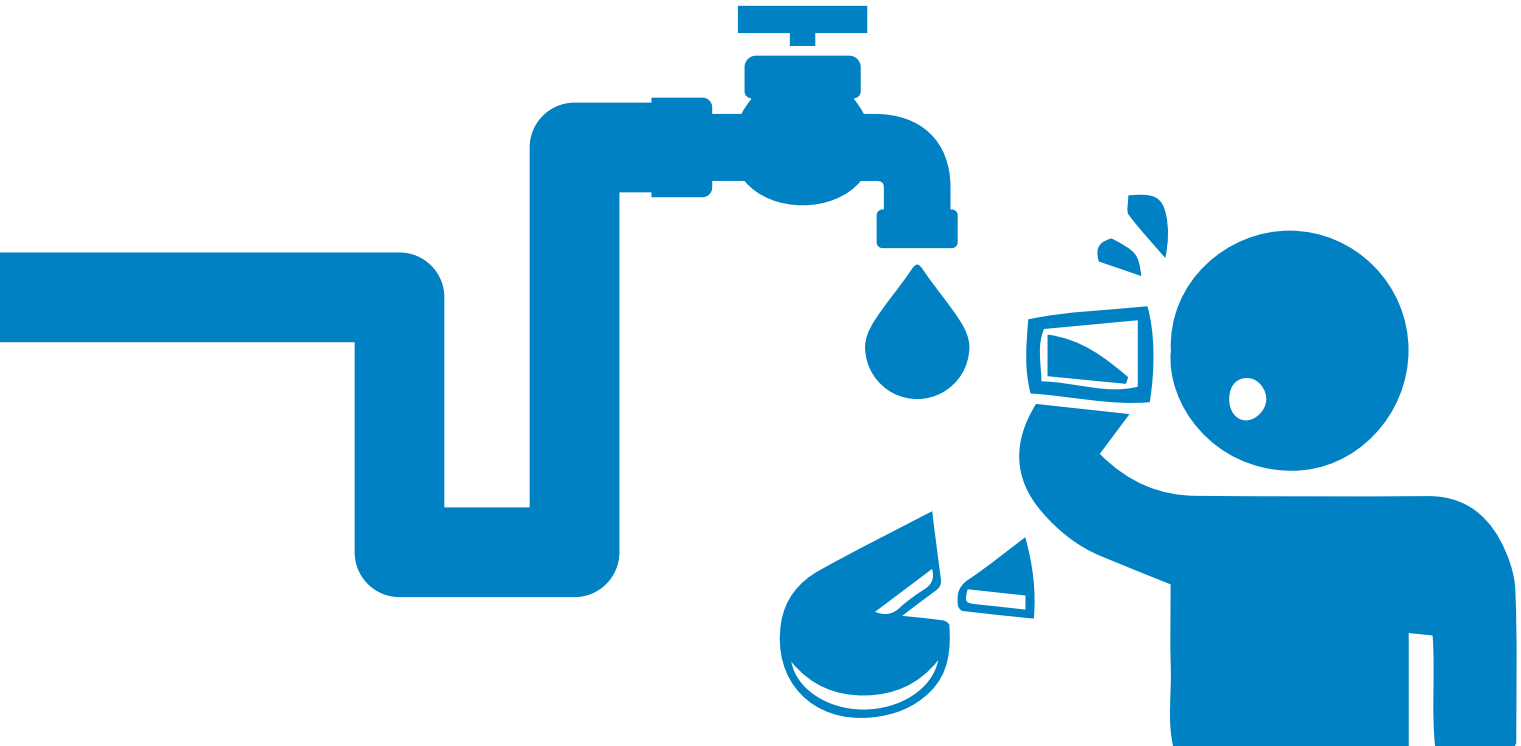
Vast mesh nets capture moisture from fog, which drips into collection trays after condensation. The largest of these projects is on the slopes of Mount Boutmezguida, a microclimate in Morocco where 6,300 litres of water can be harvested per day. The water is clean, free and instant, which is perhaps why Dar Si Hmad – the non-profit responsible for the project –was awarded the UN's 2016 Momentum for Change award. First developed in South America, fog-catching systems also exist in Chile, Peru, Ghana, Eritrea, South Africa and California.

More Clothes, less water:

It can take as much as 2,700 litres of water to make a cotton t-shirt, while jeans can guzzle almost 10,000 litres of water per pair. American denim brand Levi's, for example, has a finishing technique called 'Water Less' that uses 96 per cent less water than traditional methods. The company has made some 13 million 'Water Less' products since launching the initiative in 2011, and saved 172 million litres of water in the process.

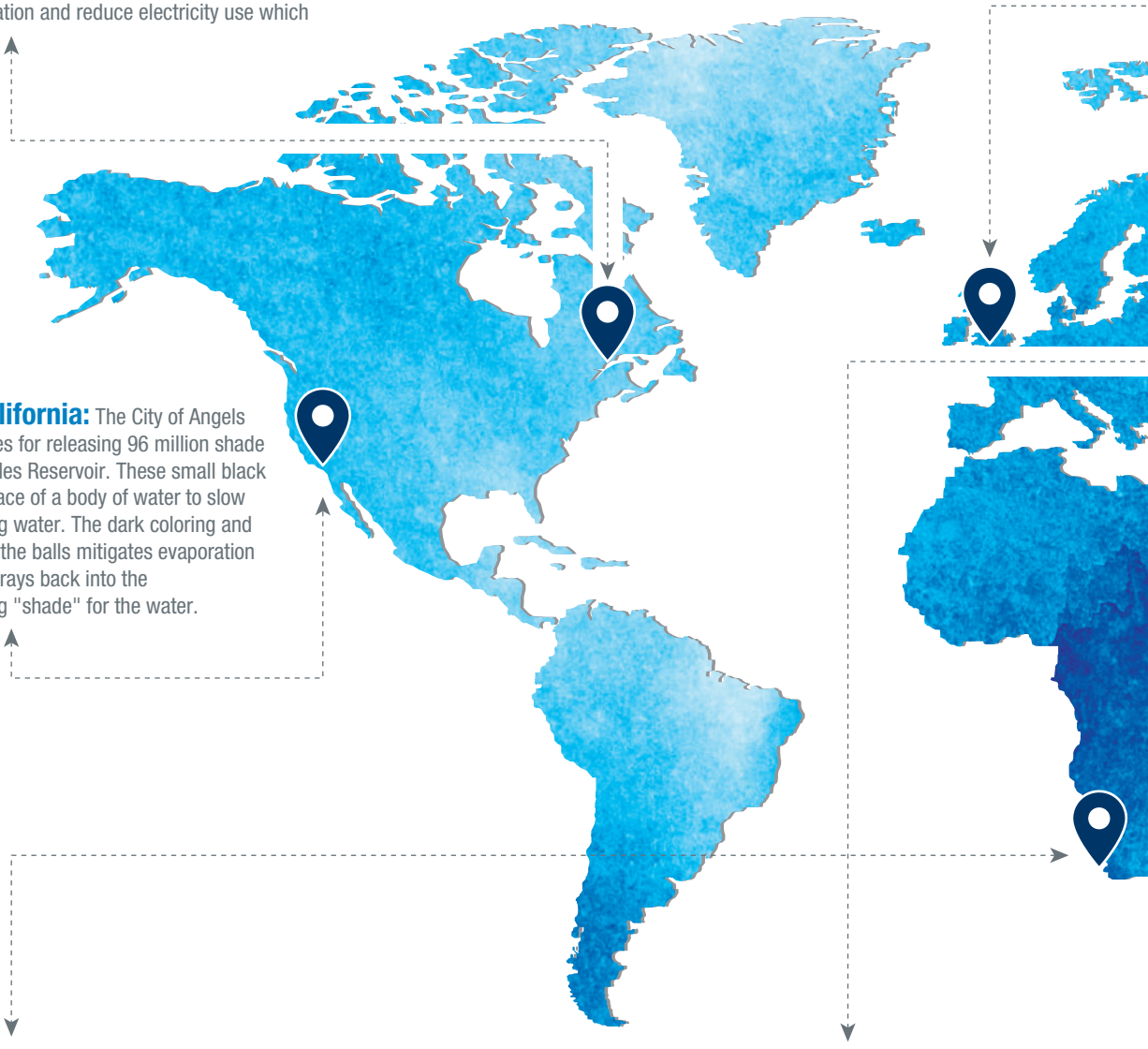
Sportswear manufacturers like Adidas and Nike, for example, have embraced "waterless dyeing" technology for their colorful polyester gear, which reduces water use to almost zero

Different versions of this technology exist, including American company ColorZen, which treats cotton fibers to make it possible to dye them using less energy and water, as well as Dutch outfit DyeCoo, which uses liquidized carbon dioxide to dye clothes.



WATER CONSERVATION PRACTICES AROUND THE GLOBE

Boston: Scoring at the top of the American Council for an Energy-Efficient Economy (ACEEE) City Energy Efficiency Scorecard for 2014 and 2015, Boston is leading the way U.S. cities focus on water conservation and energy efficiency. This city requires all large buildings to report their water use and comply with an assessment every five years to ensure that the water is being utilized properly. They also require buildings to adhere to an Energy Star certification and reduce electricity use which requires water.



Los Angeles, California: The City of Angels recently made headlines for releasing 96 million shade balls into the Los Angeles Reservoir. These small black spheres cover the surface of a body of water to slow evaporation, conserving water. The dark coloring and expansive coverage of the balls mitigates evaporation by reflecting the sun's rays back into the atmosphere—providing "shade" for the water.

Cape Town, South Africa: Even though the city's population has increased over the last 15 years, they have managed to reduce their overall water consumption. This city implements two strategies to achieve this, employing technologies to utilize their water resource most efficiently and convincing their citizens to consume less water. Some technologies in place include, leak detection piping, adjusted water pressure, replacement of faulty water meters and improve parks irrigation practices. The city also implements a water training program in their schools, educating their young citizens on the importance of future water conservation.

Israel: This country has always been a leader in water conservation because of its location and desert climate but recently they have taken their efforts above and beyond. Israel recycles 85% of its wastewater and within the next three years, 50 percent of its farming needs will be using recycled water. They have 300+ desalination plants which provide water for the country and export over $2 billion worth of filtered salt water to other countries in need.

United Kingdom: The UK is a world leader in water metering technology, which enhances the way that their residents can adjust their water usage using online databases. These smart meters give citizens an inside look on what their water is being used for and how much is utilized. This allows households to understand where their water consumption is used the most and alerts if there are any substantial increases, which could signal a leak or other problem. The UK also provides incentives for home owners to install water saving technologies and smart water appliances to promote overall water conservation.

Northern China: Due to the large-scale agriculture that goes on in northern China, the country took initiatives to conserve water and increase water efficiency. In 2008, the country financed the $74 million North China Plain Water Conservation Project, which would improve the agricultural practices that take place on the 250,000+ farms on the North China Plain. The main improvements of the project include more efficient drainage and irrigation sprinklers and wells, farming practices like soil and environmental monitoring, ground leveling support and institutionalized water and soil conservation practices. Since the initiative started productivity has increased 60-80% and groundwater depletion has been reduced or in some places eliminated.

South Korea: The South Korean government started a project in 2004 called Songdo, which is built on an artificial island and constructed to provide "green space" like rooftop vegetation. They also have installed rainwater collection systems, which will capture water to be recycled and used for household appliances, irrigation on parks and for industrial buildings, reducing the demand for freshwater. These systems not only capture the rainwater but store it in containers to reduce the commercial use of precious freshwater.

Saudi Arabia: Due to its desert location, Saudi Arabia has been a true innovator for desalination techniques. Today, they make the highest production of desalinated water (water that has been filtered to remove salt) worldwide. To make their conservation even better, they have started to convert all of their desalination plants to be powered with solar energy and plan to have all plants solar powered by 2019.

Bengaluru, India: This city is surrounded by nearly 450 freshwater lakes and home to 10 million people. In 2010, their lakes were at risk of being bought by private owners which would make them unavailable for conservation and cut off from the aquifers that provides water for the city. Officials in their Environment Support Group took charge and presented the case to the city's court, who made it illegal for the lakes to be privatized. In addition, a government agency was established to protect and save Bengaluru's lakes, making them sustainable and available to the urban communities and farms surrounding the city. In 2012, the UN awarded Bengaluru with the Best Water Practices certification to acknowledge their water conservation achievement.

WATER CONSERVATION INITIATIVES – BY GOVERNMENT OF INDIA

- Hon'ble Prime Minister has written a letter to all sarpanchs on 08.06.2019 regarding the importance of water conservation and harvesting and exhorted them to adopt all appropriate measures to make water conservation a mass movement.
- Creation of a new Ministry of **Jal Shakti** for dealing with all matters relating to water at one place in an integrated manner.
- The National Water Policy (2012) has been formulated by Department of Water Resources, RD & GR, inter-alia; advocates rain water harvesting and conservation of water and highlights the need for augmenting the availability of water through direct use of rainfall. It also, inter-alia, advocates conservation of river, river bodies and infrastructure should be undertaken in a scientifically planned manner through community participation. Further, encroachment and diversion of water bodies and drainage channels must not be allowed and wherever, it has taken place, it should be restored to the extent feasible and maintained properly. In compliance to the decision taken by the Committee of Secretaries, an 'Inter-Ministerial Committee' under the Chairmanship of Secretary (WR, RD & GR) has been constituted to take forward the subject of 'Push on Water Conservation Related Activities for Optimum Utilization of Monsoon Rainfall'.
- Central Ground Water Authority (CGWA) has issued directions under Section 5 of "The Environment Protection Act, 1986" for mandatory Rain Water harvesting / Roof Top Rain Water Harvesting for all target areas in the Country including UTs. While granting 'No Objection Certificate (NOC)' for drawing ground water, CGWA insists for mandatory rainwater harvesting as per the guidelines issued. Central Ground Water Board (CGWB) under DoWR, RD & GR has also prepared a conceptual document entitled "Master Plan for Artificial Recharge to Ground Water in India" during the year 2013, which envisages construction of 1.11 crore rain water harvesting and artificial recharge structures in the Country at an estimated cost of Rs. 79,178 crores to harness 85 BCM (Billion Cubic Metre) of water, in an area of 9,41,541 sq.km by harnessing surplus monsoon runoff to augment ground water resources. Besides, CGWB has taken up Aquifer Mapping and Management programme during XII Plan, under the scheme of Ground Water Management and Regulation. The Aquifer Mapping is aimed to delineate aquifer disposition and their characterization for preparation of aquifer/area specific ground water management plans with community participation. The management plans are shared with the respective State Governments for taking appropriate measures.
- Department of Water Resource, RD&GR has instituted National Water Awards to incentivise good practices in water conservation and ground water recharge.
- Mass awareness programmes (Trainings, Seminars, Workshops, Exhibitions, Trade Fares and Painting Competitions etc.) are conducted from time to time each year under the Information, Education & Communication (IEC) Scheme of DoWR, RD & GR in various parts of the Country to promote rain water harvesting and artificial recharge to ground water.
- The Ministry of Rural Development in consultation and agreement with the Department of Water Resources, RD & GR and the Ministry of Agriculture & Farmers' Welfare has developed an actionable framework for Natural Resources Management (NRM), titled "Mission Water Conservation" to ensure gainful utilization of funds. The Framework strives to ensure synergies in Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS), Pradhan Mantri Krishi Sinchayee Yojana (PMKSY), erstwhile Integrated Watershed Management Programme (IWMP) now PMKSY-Watershed Development Component and Command Area Development & Water Management (CAD&WM), given their common objectives. Types of common works undertaken under these programmes/schemes are water conservation and management, water harvesting, soil and moisture conservation, groundwater recharge, flood protection, land development, Command Area Development & Watershed Management.
- Department of Land Resources is currently implementing 8214 watershed development projects in 28 States covering an area of about 39.07 million ha. under the Watershed Development Component (WDC) of the Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) principally for development of rainfed portions of net cultivated area and culturable wastelands. The major

activities taken up under the WDC-PMKSY, inter-alia, include ridge area treatment, drainage line afforestation, soil and moisture conservation, rain water harvesting, horticulture, and pasture development etc.

- Ministry of Housing & Urban Affairs has released Model Building Bye-laws, 2016 which recommends Rainwater Harvesting for all types of Building with plot size 100 sq.m or more. Barring the States/UT of Manipur, Sikkim Mizoram and Lakshadweep, all the States have incorporated the provisions in their respective building bye laws. The plans submitted to the local bodies shall indicate the system of storm water drainage along with points of collection of rain water in surface reservoirs or in recharge wells. Further, all building having a minimum discharge of 10,000 litre and above per day shall incorporate waste water recycling system. The recycled water should be used for horticultural purposes.
- The government on Monday launched a countrywide water conservation scheme focusing on 256 districts with the lowest availability of groundwater. The states with the highest number of these districts are Rajasthan (29), Tamil Nadu (27) and Telangana (24). the government will mobilize farmers through Krishi Vigyan Kendras and urge them to shift to efficient irrigation practices. Each district would draft a water conservation plan, with focus on rainwater harvesting. Nodal officers would work with urban local bodies for reuse of waste-water for industrial and agricultural use, including segregation of grey water (kitchen) and black water (sewerage). Each of the urban areas will restore at least one traditional water body,"

ABBREVIATIONS

SDG – Sustainable Development Goals

BCM – Billion Cubic Meters

IIT – Indian Institute of Technology

CWMI – Composite Water Management Index

GDP – Gross Domestic Product

ZLD – Zero Liquid Discharge System

ACEEE – American Council for an Energy Efficient Economy

CGWA – Central Ground Water Authority

IEC – Information Education & Communication

MGNREGS – Mahatma Gandhi National Rural Employment Guarantee Scheme

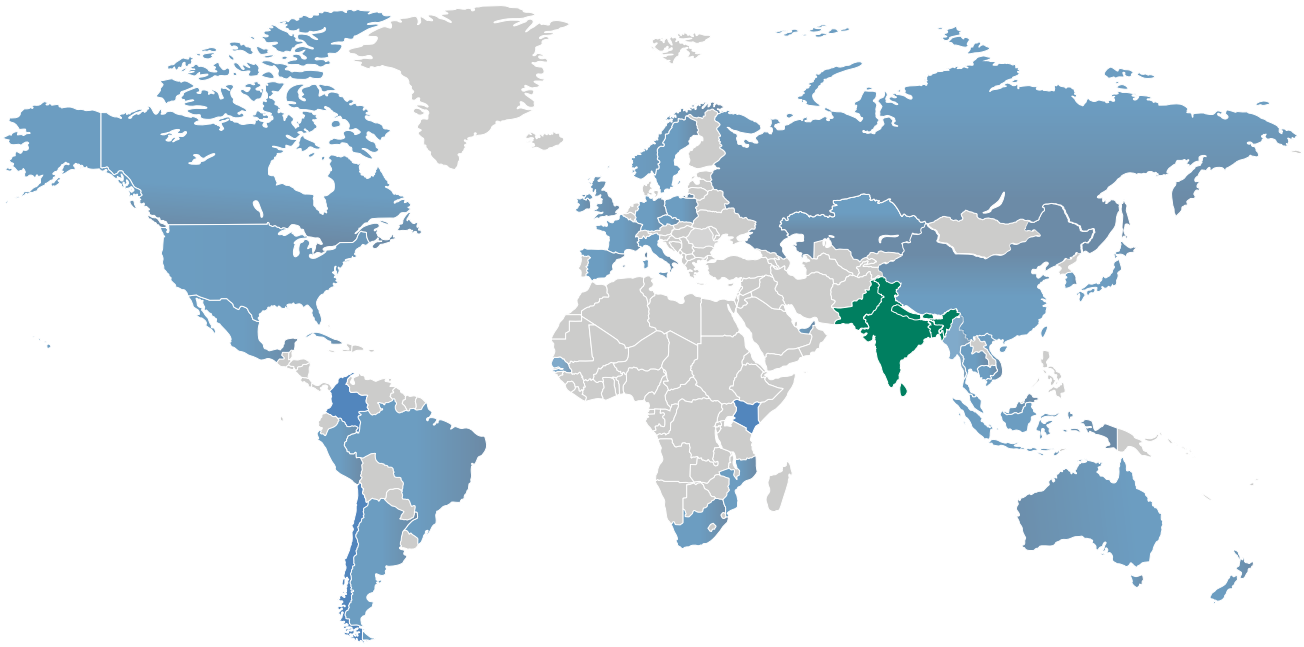
PMKSY – Pradhan Mantri Krishi Sinchayee Yojana

IWMP – Integrated Watershed Management Programme

CAD & WM – Command Area Development and Water Management

WDC – Watershed Development Component

ERM – Environment Resource Management



ERM Environmental Resources Management

Environmental Resources Management (ERM) is a leading global provider of environmental, health, safety, risk, social consulting services and sustainability related services. With 160 offices in over 40 countries and territories employing more than 5,000 people who work on projects around the world, ERM is committed to providing a service that is consistent, professional and of the highest quality to create value for our clients. For over 40 years, ERM has been working with clients around the world and in diverse industry sectors to enable them in addressing their environmental, health, safety, risk and social impacts.

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Bombay Chamber of Commerce & Industry

The Bombay Chamber Of Commerce and Industry is the oldest operating chamber of commerce in India serving Indian commercial organizations for the past 184 years. The Chamber has several thousand members from large, medium and small companies. Members of the Chamber contribute very significantly to the Gross Domestic Product (GDP) of the country. The Board of the Chamber includes top professionals from industry, banking, and finance. It has its headquarters in Mumbai, the commercial capital of India and home to many, if not most, multinationals, banks and financial institutions in the country, the majority of whom are its members.

www.bombaychamber.com