

Time & Tide

A quick history of water and people



Water is the fundamental element of life. Historically, civilisations have flourished along riverbanks and coasts. Even in the most inhospitable conditions, across barren deserts and treeless mountains, people have adapted to water resources or the lack of them. We drink water, bathe with it, travel across it, farm with it, produce electricity from it and fight over who gets how much — in queues around communal wells and over which side of the dam you're on. From exploiting water for sustenance to exploiting water sustainably, we as a race are evolving.

Scarcity of water tops the World Economic Forum's suggested list of risks to our planet. At Wipro, we have been working towards sustainable water management for more than a decade and this year, it is at the centre of our sustainable development initiatives. As we look forward to the future of water, we find it necessary to explore its past. From the elaborate fountains crisscrossing the ancient city of Machu Pichu to contemporary China's controversial mega dam projects, 'Time and Tide' tries to capture a small part of this long history, as the human race tries to keep the global water crisis at bay.



Time and Tide

A select history of water around the world

North America

01 Ancient Mayan water technology
► ca. 500 AD, Yucatán peninsula

Water had always been a pressing concern for the Mayans as the Yucatán peninsula had little surface water. They devised several water supply technologies to adapt to this environment. Cenotes or underground caves, were prized sources of water, so much so that the Mayans kept their existence a secret from colonial powers. Above the cenotes, on the surface, they had aguadas — reservoirs made in the craters they dug, using the mud to build their homes. In other places, elaborate cisterns called chultuns were engineered to re-direct run-off rainwater to various Yucatán towns. These simple, low cost sustainable methods are as relevant today when water shortage isn't limited to naturally arid regions.

02 The Great Lakes and America's first people
► 1500 AD, USA, Canada

The Great Lakes, a chain of five lakes — Superior, Michigan, Huron, Erie, and Ontario — together form the largest group of freshwater lakes on Earth. Stretching from New York to Minnesota, they are home to centuries-old Native American tribes. The first "foreigners" entered these lands in the 1500s, bringing with them new items of trade, strange diseases, and an alien culture. Over the years, the Native Americans became pawns in the war for the control of the North America, first bullied and then appeared by the colonizing Europeans. The years after the American Revolution saw relocation and assimilation policies by the US government both forced on and subsequently rejected by the natives. For the last 25 years, the Great Lakes Indian Tribes have been fighting for their political sovereignty with significant success.

03 Present day Mexico City rests on a dry lake, drained of its former glory
► 1521 AD, Mexico City

Thousands of years ago, a large lake called Texcoco occupied the region roughly around what is today's Mexico City. The area served as a cradle for successive Meso-american civilizations. The Aztecs arrived in the 13th century and made Tenochtitlan their capital. They built a network of

canals and dykes, fertile gardens and massive temples. In 1521, the invading Spaniards destroyed the city, building a new capital in its place. Mexico rested on drained canals and lakes of Tenochtitlan, and wasn't a patch on its predecessor. Water shortage was a direct consequence, something which the city is still grappling with.

04 The development of the Mississippi
► 1673 AD, USA

The banks of the Mississippi have been home to generations of natives, who lived, farmed and built their lives along it. The French were the first among many foreigners to foray into the Upper Mississippi region, turning the river into a pulsating trade and transport route. But, fortunes changed when rail roads and ships came into the picture, sidelining river transport which was already considered risky. It was then that the US government decided to build wing dams and closings dams control river flow, followed by levees to check flooding. Not everyone was happy with the growing intervention — conservationists voiced their concerns initiating the continuing battle for control over the Mississippi.

05 New York City, home to the world's largest water supply system
► 1842 AD, New York City, USA

A network of tunnels and aqueducts in the Big Apple meets the daily water needs of eight billion New Yorkers with ease. In 1842, the Old Croton Aqueduct was built, carrying almost 90 million gallons of water into the city per day. The following years saw newer reservoirs and the New Croton Aqueduct in 1890. The consolidated distribution system in New York City today provides uninterrupted supply of clean, potable water across the five boroughs of the city.

06 Hoover, the world's tallest dam
► 1935 AD, Arizona-Nevada border, USA

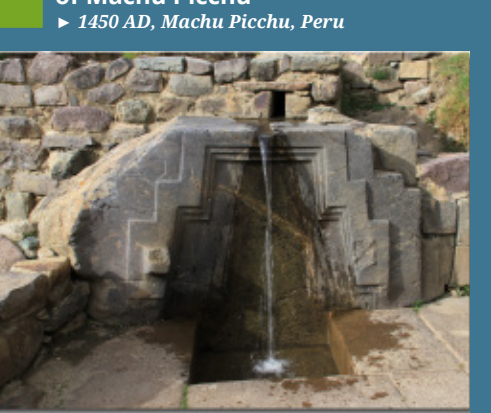
The Hoover Dam stands 725 feet tall with a base comparable to the length of two foot-ball fields. It took five years and 21,000 men to build the dam, which confines the rough waters of the Colorado River to Lake Mead, protecting southern California and Arizona from disastrous floods. Its



sheer size and appearance draws tourists from the world over, who come to see the great dam America built way back in 1935, while in the depths of the Great Depression.

South America

07 A network of fountains supplied clean water to the ancient city of Machu Picchu
► 1450 AD, Machu Picchu, Peru



08 After 11 billion years, the Amazon has begun to shrink
► 1541 AD, Amazon

If one goes by the geological clock, the desire to control the Amazon is relatively new. For the basin of the world's longest river has been inhabited for ten thousand years — by tribes, both big and small. Foreigners came in 1541 and yet it was only when the value of natural latex was realised that the world turned its eyes to the Amazon. The demand continues to be high, with Brazil controlling the world rubber monopoly. In an effort to secure this control, the government is building roads through the jungles of Amazon today, causing widespread deforestation in the process. As the tree cover thins, the waters of the Amazon keep dwindling.



09 The pristine waterfalls of Igazu have awed tourists for centuries
► 1541 AD, Brazil-Argentina border

10 Paraguay and Brazil equally reap the benefits of the Itaipu Dam, which they jointly built
► 1991 AD, Paraguay and Brazil

11 Hamza, an underground river, as long as the Amazon, but wider
► 2012 AD, Brazil

The Rio Hamza was probably one of Amazon's best kept secrets, until it was discovered in 2012. Flowing four kilometres under the Amazon, the "underground" River Hamza equals it in length but is at least a hundred times wider. Named after and discovered by Valiia Mannathal Hamza and his team at the National Observatory in Rio, the river flows west to east, from the Andean foothills to the Atlantic coast. The fact that it flows in the same direction as the Amazon, is enough to qualify them as twin rivers, but there are marked differences between the two especially when it comes to width and flow speed.

12 Many believe that submerged ancient cities lie beneath the waters of Lake Titicaca
► Present day, Bolivia-Peru border

Europe

13 2000 year old Roman aqueducts are still functional today
► ca. 300 BC, Rome, Italy

While the rich and the poor of ancient Rome led very different lives, they did have equal and uninterrupted access to one thing: water. The Romans were skilled engineers and conceptualized an elaborate system of winding aqueducts which carried water to all parts of this ancient city. Be it a private villa, or a public bath, water began to drip its gracing way to a vast desert. Earthquakes, climate change and tectonic shifts contributed to its decline. Although physically absent, the Saraswati is the third river of the Triveni Sangam, or the holy confluence of three rivers in north India, which is the site for the historic Maha Kumbh Mela.



bridges and arches, crisscrossed the city, feeding water into fountains and fields. Today, one can still find the residents of Rome, just like their ancestors, filling bottles from the Trevi Fountain, which gets its water from the Acqua Vergine, revived during the Renaissance.

14 In medieval Europe, technology replaced manual labour as waterwheels began to crop up in the countryside
► ca. 1100 AD, England, Germany, France

15 In 19th century England, the river Thames was filthy and homes lacked plumbing and running water
► ca. 1800 AD, England

16 The Rhine, lifeline of the Roman Empire
► Present day, Central and Eastern Europe

The Rhine, the second longest river in Europe, was once bridged and crossed by the great Julius Caesar. This easily navigable river was the lifeline of the Roman Empire. When the empire declined, many powers fought to control it. While centuries of political realignments continuously changed the borders of the countries along the Rhine, the castles along the river survived them all. Built by Roman emperors to protect their lands, they tell the history of the region nourished by the mighty river.

17 The Danube has seen the rise and fall of many empires
► Present day, Central and Eastern Europe

Once an invincible frontier for the mighty Roman Empire, the Danube today forms the boundaries of eight different European countries. It is the longest river of the European Union, rising in the Black Forest mountains of Germany and flowing for almost 3,000 km before it finally drains into the Black Sea. While the Rhine has always been given economic precedence over the Danube, the latter did support the growth of two major empires: the Austrian and Hungarian.

18 Thousands flock to Lourdes every year for a touch of its "miracle water"
► Present Day, France



Africa

19 The Masai of Kenya worship Engai, the rain god, who has both a destructive and benevolent side

20 Aquifers have been installed across Libya to access its precious underground fossil water
► 1983 AD, Libya

21 How Namibia secured her water supply
► 2002 AD, Windhoek, Namibia

In Namibia, droughts are commonplace and rainfall, scarce. Water shortage is a perpetual concern in its capital, Windhoek, which has battled the problem with a secret weapon: waste water reclamation. It was first put into practice in 1968 with the building of the Goresangh Water Reclamation plant. The city continues to innovate in the face of climate change. Built in 2002, the New Goresangh Reclamation Plant is a great example of internationally complaint advanced technology in water reclamation.

22 Political interests dominate the Nile
► Present day, Egypt/Ethiopia

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27 The mystery of the Saraswati
► 1500 BC, Rajasthan, India

The Saraswati used to flow through the Thar desert back when it was a fertile land inhabited by flourishing civilizations. Sometime around 3000 BC the river began to dry up, giving way to a vast desert. Earthquakes, climate change and tectonic shifts contributed to its decline. Although physically absent, the Saraswati is the third river of the Triveni Sangam, or the holy confluence of three rivers in north India, which is the site for the historic Maha Kumbh Mela.

23 Lake Chad shrinks to a twentieth of its original size
► Present day, West Africa

As the waters of the once large Lake Chad in West Africa begin to evaporate, communities and countries fight over the remains. Besides an imbalance in the demand-supply ratio, climate change is a major contributor to the plight of Lake Chad today. Loss of jobs and increasing poverty are direct outcomes, forcing many communities to migrate to cities.

While the Early Cholas ruled ancient India only for a century, they created something which has lasted many more. The Grand Anicut dam, built by them in the 2nd century AD, diverted waters of the Kaveri river, irrigating

Asia

24 In Chinese mythology, weather and rain are commanded by fire-breathing dragons

25 The world's first civilisation thrived on the banks of the Tigris-Euphrates
► 5000-3500 BC, Mesopotamia

Mesopotamia, which literally means, 'the land between the rivers', was home to possibly the world's first civilization, fed and watered by the Tigris and Euphrates rivers. In spring, the two rivers flooded heavily, spilling beyond their banks, leaving behind rich, cultivable soil once they receded. The rivers also carried goods and people, accelerating trade and transport. Today, both rivers have been dammed for electricity and other purposes. As a result, desert land has expanded and the rivers have become a source of political tension.

26 The Indus Valley's efficient drainage system
► ca. 3000 BC, Mohenjo-daro, Dholavira, Present day Pakistan and India

In the ancient city of Mohenjo-daro, the people of the Indus Valley Civilization lived in mud houses along right angled streets with indoor bathrooms that connected to a network of well-planned drains. Wooden screens kept solid waste out of the system, and covered drains were punctuated with removable slabs to allow easy cleaning. At Dholavira in present day Kutch, known for its arid climates and salt pans, potable water was accessed through an intricate system of stone canals and deep reservoirs.

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the surrounding areas of the Chola dynasty. Years later, engineers used it as a prototype to build other dams. What's incredible is that the massive structure, more than a 1000 feet high, is still fully functional today, irrigating 1,000,000 acres of land surrounding it.

29 An advanced hydraulic engineering system existed on an ancient rock in Sri Lanka
► 475 - 495 AD, Sri Lanka

Atop a 200 meter vertical column once lay Sigiriya, the ancient capital of Sri Lankan king, Kashyapa. Today only ruins survive of this 5th century architectural marvel, but thousands of years ago, Sigiriya had an advanced hydraulic system which efficiently met its water requirements. Reservoirs, cisterns and canals ensured that plenty of water reached the castle. Much of this inflow was used to landscape the Water and Boulder Gardens surrounding the castle.

30 Water never runs dry in Mecca's famous Zamzam well
► 771 AD, Saudi Arabia

Legend has it that the 'Zamzam' well in Mecca has never run dry, ever since it miraculously quenched the thirst of Prophet Ibrahim's infant son, Ishmael. Twenty meters away from the holy Kaabah, and excavated by hand, the 35 meter deep well has generations swearing by its purity and healing properties. The high quantity of magnesium, calcium salts and fluorides make it germ-free and potable, without ever having to treat it chemically. Surrounded by glass panels in a basement room, the well is under constant surveillance; the water, pH levels and electric conductivity are all measured by a digital monitor. Thousands of pilgrims come here every year, satisfying their thirst for both water and blessings.

31 Stairwells were ideal pitstops for tired travellers in ancient India
► 1499 AD

32 Redirecting rivers in China
► 1952 AD, China

The Chinese government's South-North Water Transfer initiative diverts large volumes of water from the Yangtze River in the south to the Yellow River in the north through a \$62 billion project. This will ease the water crises in cities like Beijing and Tianjin in the north but at least 330,000 people will lose their homes and jobs down south. Pollution levels will rise and water will become unfit for consumption. Though the transfer has already started, the emphasis on sensible approaches like rainwater harvesting by some has inspired locals to adopt it in their daily lives.

33 21 billion Chinese get their drinking water from rainwater harvesting in Gansu
► 1980 AD, Gansu, China

Farmers of Gansu in China have been collecting rainwater for their daily use for thousands of years. But its full potential was realised only in 1980, when the Gansu Research Institute for Wa-ter Conservancy introduced new methods of rainwater harvesting which trumped traditional ones. Clays roofs and courtyards gave way to cemented ones, and cellars were dug up to collect run-off rainwater. The people of Gansu survived a historic drought in 1995, relying solely on har-vested rainwater. The water project of Gansu was such a success that it quickly spread to other parts of the country and the world. Today China, a country often criticised for its environmental excesses, is giving lessons in water management to Nigeria, Saudi Arabia and Algeria.

34 In the conflict-ravaged middle east, the Jordan River is an arbiter of cooperation
► 2010 AD, Jordan, Syria, Israel

In the centre of the Middle Eastern conflict, the Jordan River has been exploited by Israel and its neighbours. With multiple dams channelling water into the farms in Jordan, Syria and Israel, what is left of the lower Jordan is sludge, often toxic. Since 1950, 30 out of 32 military conflicts over water have been along the Jordan River. What's heartening is that even in the midst of war, Jordan and Israel agreed on a water sharing framework in the 1970s. While hostilities flare up regularly between Israel and Palestine today, their cooperation over water continues — even if Palestinians end up buying underground water from their own land back from Israel's Merokot.

35 In the deserts of Rajasthan, rain water runs deep
► Present day, Rajasthan, India

Across the Thar, besides *palar pani* (rain water) and *patal pani* (underground water), villages are nourished by *rejwani pani* (surface water that doesn't make it to the water table). The ancient rich lands have an impervious layer of gypsum, formed almost 30 lakh years ago. The layer hardens when it comes in contact with water, keeping it from trickling down to the water table while the sand prevents the trapped humidity from evaporating back into the atmosphere. The cavity of a specially constructed kuin, a small and narrow well, turns the humidity into drops of water. The kuin's circumference is kept to a minimum to prevent evaporation. In places like Jaisalmer, which witnessed its lowest annual average rainfall last year at 7mm, kuins serve as efficient water re-tainers. Like a kuin, Lake Jaseri has a *bittu ro ballyo*, or a layer of stone which prevents rainwater from escaping, thereby maintaining a fixed water level all year around.

36 The shrinking Aral Sea
► Present day, Russia

In 1991, the Soviet government collapsed, and took along with it, the rich waters of the Aral Sea. Located between Kazakhstan and Uzbekistan, this large water body gave life to the deserts of Central Asia, and was home to at least a hundred varieties of aquatic species. Today, it has lost 80% of its volume, and is almost one fifth its original size. It started when the Soviets diverted River Amu and River Syr — the two sources of water for the Aral — for irrigation. With its water supply cut off, the Aral Sea started evaporating and its animal species slowly disappeared. Today the waters of the Aral Sea have bifurcated, leaving a long, dry expanse of desert land in between.

37 Rainwater harvesting in a traditional sumo arena
► Present day, Tokyo, Japan

It was a sumo wrestling arena that led the way to conscious water management in Ja-pan. The Ryogoku Kokugikan arena in Tokyo has a 8,400 square meter rooftop, which acts as catchment surface for collecting rainwater. Other public facilities have intro-duced similar systems throughout the capital. Today many households across the capi-tal have installed the rojison, a unique water utilization facility which uses a hand pump to collect rainwater for gardening, fire-fighting and consumption.

38 The world's deepest lake is home to unique species of flora and fauna
► Present day, Siberia

Discovered in the 16th century, the beautiful Lake Baikal is the deepest lake in the world at 1,637 meters deep. It is home to diverse flora and fauna, most of which isn't found anywhere else in the world. The Baikal is so loved that the Russians make it a point to go see it at least once in their life. The surface area of the Baikal Lake covers a large part of Eastern Siberia, but an even larger part of its citizens' hearts.

39 Millions visit the mighty Ganges, flowing through the heart of India, to attain salvation
► Present day, India

40 The rainbow serpent tickled a frog to produce streams and lakes, say Aboriginal Dreamtime myths
► Australia

41 New Zealand's first public water supply project couldn't cope with rising demand
► 1874 AD, Wellington, New Zealand

Started in 1871, Wellington's first public water supply reservoir was a boat-shaped dam in the suburb of Karori which diverted the waters of the Te Aro Stream via a series of cast iron pipes. Another dam, the Lower Karori, built on the Kaiwharawhara Stream was completed in 1878, spelling the end of Wellington's water woes — but not for long as it couldn't keep up with population growth and industrial demands.

42 Wellington's second attempt at adequate water supply fails with the Wainuiomata dam
► 1884 AD, Wainuiomata, New Zealand

Grappling with the water supply failure in Wellington, the government of New Zealand looked at Wainuiomata, about 27 kilometres away from the city. A small dam, with a pipeline carrying water to Wellington was built in 1884. Things didn't quite go according to plan as the dam was ravaged by floodwaters more than once. A huge financial loss, the Wainuiomata dam led to many controversies across water supply and distribution in the years to come.

43 Australia tackles water shortage with citizens' cooperation
► Present day, Australia

Australia, in her entire history, has never dealt with a water crisis. But water is far from easily available in the land down under. It is the driest continent on earth, and this poses a big challenge for water management. Instances of droughts and increasing aridity, limited resources and growing demands have nudged the folks of Australia to sit up and take notice. Citizens and companies, are consciously trying to restrict their residential and commercial water usage. Active steps in water preservation such as seawater desalination, recycling wastewater and rain water harvesting are being undertaken by the government.

44 The health of the Murray and Darling rivers suffers while their diverted waters bring prosperity to their banks
► Present day, Australia

While the term 'polar regions' and an atypical climate club the Antarctic and Arctic regions together, the two ends of the earth are quite different. The biggest difference is geography; the Arctic is surrounded by land while Antarctica, by an ocean. Thanks to this difference, there are several other contrasting features: Arctic ice is much thicker than the ice at the South Pole, and its biodiversity is less endemic. But perhaps the starkest contrast of them all is age: glaciation and winter ice cover developed in the Arctic only two million years ago, as opposed to Antarctica where it did almost 14 million years ago.

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46 The world's freshwater, frozen at its two ends
► Present day, Both the Arctic and the Antarctic

The glaciers and ice sheets found at the Poles is home to almost 78% of the earth's freshwater with another sizeable chunk in Greenland. Approximately 7,000,000 cubic metres of freshwater covers the globe today. Antarctica has little surface water but large saline lakes exist in its oasis areas, with some coastal ponds in the peripheral regions. 68% of polar freshwater lies frozen and locked beneath its ice sheets and glaciers.

47 Global warming and melting polar ice
► Present day, Both the Arctic and the Antarctic

As the earth's climate undergoes a slow but dramatic change, masses of glaciers and ice sheets have begun to melt and slowly disappear, particularly at the Polar Regions. Run off water, which many areas rely on, will soon reduce as the glaciers melt and disappear. An indirect impact is the increase in sea water levels the world over. With levels rising by about 3.1mm per year, there is widespread fear of inundation especially in the coastal regions — evacuation looms large in the future of some island nations of the world.

48 The world's longest river flows through eleven African countries, several of which have been involved in protracted disagreements over it. Egypt and Sudan signed an agreement in 1959, settling issues over water sharing rights for good. However, new projects are still a cause of conflict among most Nile basin countries, who are already struggling to meet their water needs. While Egypt functions unilaterally, diverting billions of cubic meters of Nile water to the Sinai desert, Ethiopia is busy signing water sharing agreements with other nations. Deaf to her neighbours' protests and worried about losing control, Egypt has been known to involve the military in this matter.

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