MODULE 7

WATER CONSERVATION

The topics covered in this module are:

- What is water conservation
- Water conservation in ancient India
- Water conservation methods - Information requirements
- Water conservation - Do's & Don'ts

OBJECTIVE (S) OF THE MODULE

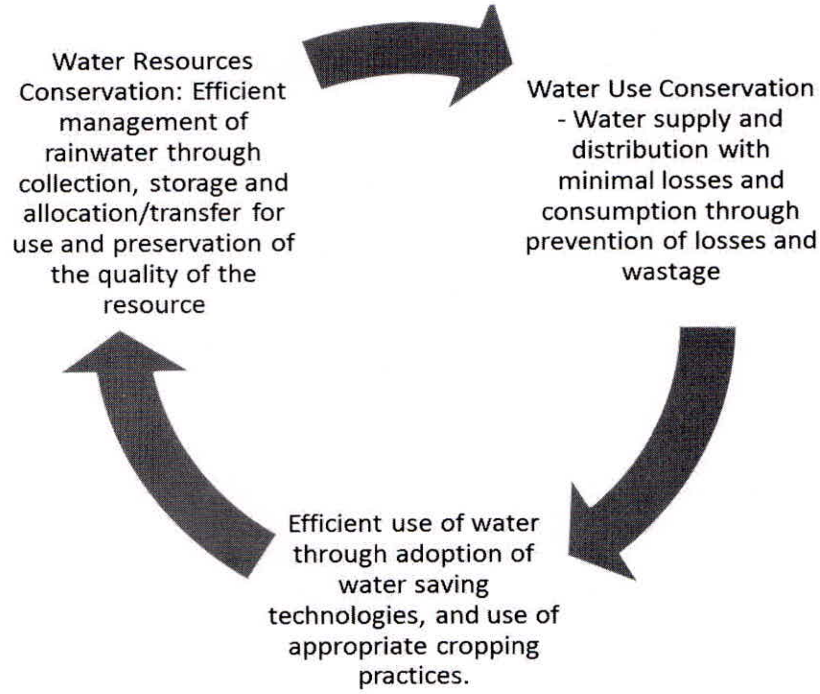
The trainer informs the following module objectives to participants:

- Explain water conservation and management in detail.
- Share the knowledge on ancient methods of water harvesting practiced across the country.
- Point out the important factors and information required for consideration while formulating a water conservation plan.
- Learn tips for conserving water at individual level.

WHAT IS WATER CONSERVATION

Water Conservation (WC) is defined as 'The minimization of loss or waste, care and protection of water resources and the efficient and effective use of water'.

Water is the source of life for every living thing. Water conservation means using less water or recycling used water so that it can be used again. Water Demand Management is the strategy by which water conservation objectives are met and may be considered as its component. Water Conservation has three dimensions.



Did You KNOW

March 22 is celebrated as World Water Day.

According to UN estimates, by 2025, almost two-third of the world will face shortage of potable (fit for drinking) water. We have to be cautious about using water and devise methods of conserving it. But first let us understand as to what made water scarce.

FACTORS FOR INCREASED WATER DEMAND

Following factors are responsible for increasing water demand are as follows:

a. Expansion of irrigation

b. Increasing demand by industry

c. Rising demand due to growing population

d. Increasing water use due to changing life style

Expansion of Irrigation

India is an agricultural country, hence, plenty of water is needed for irrigation. There has been a rapid increase in the irrigated area in India since independence. Thus, the demand for irrigation in India has been increasing continuously. The reasons for the increasing demand of irrigation are:

- regional and seasonal variation in the distribution of rainfall.
- uncertainty of rainy season.
- growing demand of water for commercial crops.
- changing cropping pattern.

More efficient and environmentally sound irrigation technologies can greatly reduce water demands and waste on fields by delivering water more precisely to crops. For example, low pressure sprinklers (allows 80% of water to reach crops)and micro irrigation (delivers small amounts of water precisely to crops). Israel now treats and reuses 30% of its municipal sewage water for crop production and plans to increase their percentage to 80% by 2025.

However, many of the world's poor farmers cannot afford most of the modern technological methods for increasing irrigation and irrigation efficiency. Instead, they use low cost traditional technologies which use up huge amount of water.

Industrial Use of Water

Most industries require water at various stages of production of goods and products. Water is used in industries in both consumptive and non-consumptive ways. Be it agro-based industries (cotton, textile, jute, sugar and paper) or mineral based industries (iron, steel, chemical and cement). Water is needed in large amounts during the production process or as heat exchanger for cooling various machine parts which get heated up during the production process.

In power plants water is used as a power source as well as a cooling agent. The ore and oil refining industries use water in various chemical processes.

Rising Demand for Growing Population

Population of India has been increasing continuously and it has increased three times since independence. Due to this increase in population, the demand for water has increased. We need water for drinking, for flushing or draining sewage or human waste, domestic use, irrigation, industries.

- Rising demand for water due to growing population is a single most important factor leading to water scarcity in our country and elsewhere.
- It is becoming impossible for the state to supply clean drinking water to its people.
- Most other human activities like washing, cleaning, cooking, flushing of waste etc. require water.
- More the number of people more is the demand for water to carry out day to day work.

Changing Life Style

Industrial development led to economic development. Purchasing capacity of individuals has increased. Thus, the life style of people changed and the standard of living has gone up. Large number of attractive appliances, gadgets and fittings for kitchen and bathroom are available in the market and people are generally tempted to use them, for example taps and showers are designed in such a way that large amounts of water come out when they are turned on. Washing machines and dishwashers use large amounts of water but are convenient and suit the present day life style.

Lot of water is used for recreational purposes like 'water parks' are becoming extremely favorite place for people to enjoy holidays. Most of the sports or games here require huge quantity of water. Although much of the water used in various water games are actually recycled and reused.

Water in the reservoirs is used for recreational purposes -boating, swimming and angling etc. Golf is becoming a very favourite sport and many golf courses are coming up at various places. Golf courses use excessive amount of water for its maintenance. Private and public gardens too require water for their maintenance.

Did You KNOW

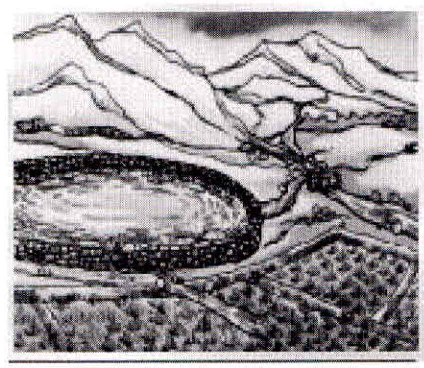
About 74% of home water usage is in the bathroom, about 21% is for laundry and cleaning, and about 5% is in the kitchen.

WATER CONSERVATION IN ANCIENT INDIA

Now, let us quickly discuss and learn the traditional structures of water harvesting practices in India one by one.

ZING

Zings are water harvesting structures found in Ladakh. They are small tanks, in which collects melted glacier water.



Essential to the system is the network of guiding channels that brings the water from the glacier to the tank. As glaciers melt during the day, the channels fill up with a trickle that in the afternoon turns into flowing water. The water collects towards the evening, and is used the next day.

KUL

Kuls are water channels found in precipitous mountain areas. These channels carry water from glaciers to villages in the Spiti valley of Himachal Pradesh. Where the terrain is muddy, the kul is lined with rocks to keep it from becoming clogged. In the Jammu region too, similar irrigation systems called kuhls are found.

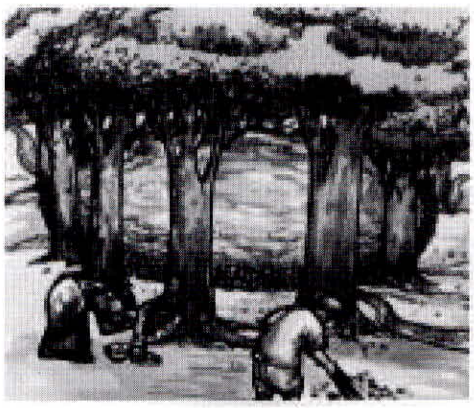
The kuls often span long distances, running down precipitous mountain slopes and across crags and crevices. Some kuls are 10 km long, and have existed for centuries. The crucial portion of a kul is its head at the glacier, which is to be tapped. The head must be kept free of debris, and so the kul is lined with stones to prevent clogging and seepage.

KUHL

Kuhls are a traditional irrigation system in Himachal Pradesh where surface channels diverting water from natural flowing streams (khuds). A typical community kuhl services six to 30 farmers, irrigating an area of about 20 ha. The system consists of a temporary headwall (constructed usually with river boulders) across a khud (ravine) for storage and diversion of the flow through a canal to the fields. By modern standards, building kuhls was simple, with boulders and labour forming the major input. The kuhl was provided with moghas (kuchcha outlets) to draw out water and irrigate nearby terraced fields. The water would flow from field to field and surplus water, if and, would drain back to the khud.

NAULA

Naula is a surface-water harvesting method typical to the hill areas of present Uttarakhand. These are small wells or ponds in which water is collected by making a stone wall across a stream. Naulas are surrounded by huge shady trees to prevent evaporation. Separate naulas are constructed for cattle. It was a custom of local people to worship Naulas and trees. It taught villagers to keep Naulas clean and to conserve water, besides protecting vegetal cover in recharge zone of the same. Naulas are common water harvesting structure in Kumaon, but less developed in Garhwal which is blessed with perennial rivers.



KHATRI

Khatris are structures, about 10x12 feet in size and six feet deep carved out in the hard rock mountain. The specially trained masons construct them at a cost of Rs 10,000-20,000 each. These traditional water harvesting structures are found in Hamirpur, Kangra and Mandi districts of Himachal Pradesh.

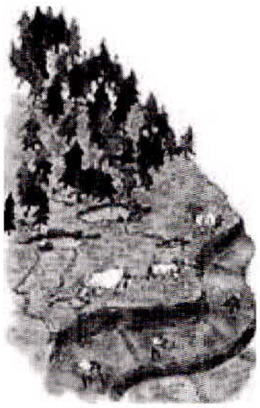
There are two types of khatris: one for animals and washing purposes in which rain water is collected from the roof through pipes, and other used for human consumption in which rainwater is collected by seepage through rocks. Interestingly, the khatris are owned by individual as well as by a community. There are government khatris as well, which are maintained by the panchayat.

APATANI

This is a wet rice cultivation cum fish farming system practiced in elevated regions of about 1600 m and gentle sloping valleys, having an average annual rainfall about 1700 mm and also rich water resources like springs and streams. This system harvests both ground and surface water for irrigation. It is practiced by Apatani tribes of ziro in the lower Subansiri district of Arunachal Pradesh.

In Apatani system, valleys are terraced into plots separated by 0.6 meters high earthen dams supported by bamboo frames. All plots have inlet and outlet on opposite sides. The inlet of lowlying plot functions as an outlet of the high lying plot. Deeper channels connect the inlet point to outlet point. The terraced plot can be flooded or drained off with water by opening and blocking the inlets and outlets as and when required. The stream water is tapped by constructing a wall of 2-4 m high and 1 m thick near forested hill slopes. This is conveyed to agricultural fields through a channel network.

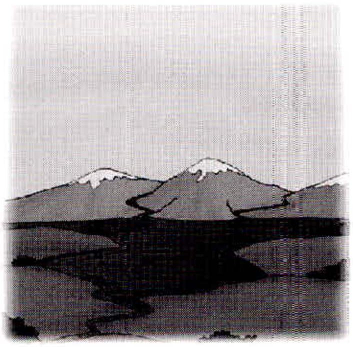
ZABO



The zabo (the word means 'impounding run-off') system is practiced in Nagaland in north-eastern India. Also known as the ruza system, it combines water conservation with forestry, agriculture and animal care.

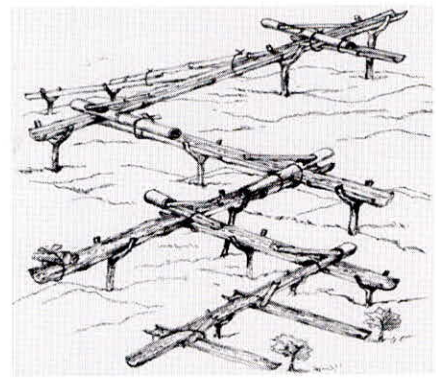
Villages such as Kikruma, where zabos are found even today, are located on a high ridge. Though drinking water is a major problem, the area receives high rainfall. The rain falls on a patch of protected forest on the hilltop; as the water runs off along the slope, it passes through various terraces. The water is collected in pond-like structures in the middle terraces; below are cattle yards, and towards the foot of the hill are paddy fields, where the run-off ultimately meanders into.

CHEO - OZIHI



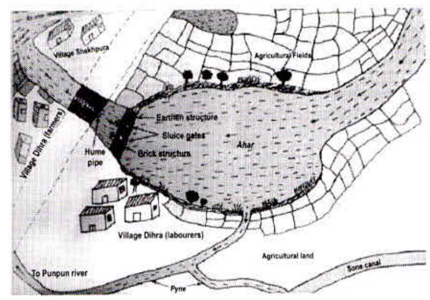
The river Mezii flows along the Angami village of Kwigema in Nagaland. The riverwater is brought down by a long channel. From this channel, many branch channels are taken off, and water is often diverted to the terraces through bamboo pipes. One of the channels is named Cheo-ozihi - Oziihi means water and Cheo was the person responsible for the laying of this 8-10 km-long channel with its numerous branches. This channel irrigates a large number of terraces in Kwigwema, and some terraces in the neighbouring village. There are three khels and the village water budget is divided among them.

BAMBOO DRIP IRRIGATION



Meghalaya has an ingenious system of tapping of stream and spring water by using bamboo pipes to irrigate plantations. About 18-20 litres of water entering the bamboo pipe system per minute gets transported over several hundred metres and finally gets reduced to 20-80 drops per minute at the site of the plant. This 200-year-old system is used by the tribal farmers of Khasi and Jaintia hills to drip-irrigate their black pepper cultivation.

AHAR PYNES



This traditional floodwater harvesting system is indigenous to south Bihar.

In south Bihar, the terrain has a marked slope -- 1 m per km -- from south to north. The soil here is sandy and does not retain water. Groundwater levels are low. Rivers in this region swell only during the monsoon, but the water is swiftly carried away or percolates down into the sand. All these factors make floodwater harvesting the best option here, to which this system is admirably suited.

DONGS

Dongs are ponds constructed by the Bodo tribes of Assam to harvest water for irrigation. These ponds are individually owned with no community involvement. Dongs are man-made structures akin to canals, to route water from available water sources, which are usually perennial, to the paddy cultivating fields. The water sources are small rivers, perennial swamps, beel, streams etc. Dong can have a breadth of 7-15 feet on average or even more. The breadth gradually increases over the course of its flow from the source till the end point. Usually dong dry out at the end of its course naturally or meet other large water bodies like river or beel. The longest dong is reported to be 10 km; however, the length of most dongs are between 2 and 5 km.

KATAS / MUNDAS / BANDHAS

The katas, mundas and bandhas were the main irrigation sources in the ancient tribal kingdom of the Gonds (now in Orissa and Madhya Pradesh). A kata is constructed north to south, or east to west, of a village. A strong earthen embankment, curved at either end, is built across a drainage line to hold up an irregularly-shaped sheet of water. The undulations of the country usually determine its shape as that of a long isosceles triangle, of which the dam forms the base. It commands a valley, the bottom of which is the bahal land and the sides are the mal terrace. As a rule, there is a cut high up on the slope near one end of the embankment from where water is led either by a small channel or tal, or from field to field along terraces, going lower down to the fields. In years of normal rainfall, irrigation was not needed because of moisture from percolation and, in that case, the surplus flow was passed into a nullah. In years of scanty rainfall, the centre of the tank was sometimes cut so that the lowest land could be irrigated.

PAT SYSTEM

Bhitada village, Jhabua district of Madhya pradesh developed the unique pat system. This system was devised according to the peculiarities of the terrain to divert water from swift-flowing hill streams into irrigation channels called pats.

The diversion bunds across the stream are made by piling up stones and then lining them with teak leaves and mud to make them leakproof. The pat channel has to negotiate small nullahs that join the stream off and on, and also sheer cliffs before reaching the fields. These sections invariably get washed away during the monsoons. Stone aqueducts have to be built to span the intervening nullahs.

SAZA KUVA

An open well with multiple owners (saza = partner), saza kuva is the most important source of irrigation in the Aravalli hills in Mewar, eastern Rajasthan. The soil dug out to make the well pit is used to construct a huge circular foundation or an elevated platform sloping away from the well. The first is built to accomodate the rehat, a traditional water lifting device; the sloping platform is for the chada, in which buffaloes are used to lift water. Saza kuva construction is generally taken up by a group of farmers with adjacent landholdings; a harva, a man with special skills in groundwater detection, helps fix the site.

NAADA / BANDHA

Naada/bandha are found in the Mewar region of the Thar desert. It is a stone check dam, constructed across a stream or gully, to capture monsoon runoff on a stretch of land. Submerged in water, the land becomes fertile as silt deposits on it and the soil retains substantial amounts of water. These dams are constructed in phases over several years. The height is slowly increased up to the same height of the checkdam, which determines the size of the naada.

RAPAT

A rapat is a percolation tank, with a bund to impound rainwater flowing through a watershed and a waste weir to dispose of the surplus flow. If the height of the structure is small, the bund may be built of masonary, otherwise earth is used. Rajasthan rapats, being small, are all masonry structures. Rapats and percolation tanks do not directly irrigate land, but recharges well within a distance of 3-5 km downstream. Silting is a serious problem with small rapats and the estimated life of a rapat varies from 5 to 20 years.

CHANDELA TANK

These tanks were constructed by stopping the flow of water in rivulets flowing between hills by erecting massive earthen embankments, having width of 60m or more. These hills with long stretches of quartz reefs running underneath them, acted as natural ground water barrier helping to trap water between the ridges. The earthen embankments were supported on both sides with walls of coarse stones, forming a series of stone steps. These tanks are made up of lime and mortar and this is the reason why these tanks survived even after thousand years but the only problem, which these tanks are facing, is siltation of tank beds. Chandela tanks usually had a convex curvature somewhere in the middle of the embankment; many older and smaller tanks were constructed near the human settlement or near the slopes of a cluster of hills. These tanks served to satisfy the drinking water needs of villagers and cattle.

BUNDELA TANK

These tanks are bigger in size as compared to Chandela tanks. These tanks had solidly constructed steps leading to water in the tank; But these structures had chabootaras, pavillions and royal orchards designed to show off the glory of the king who built them. But these tanks are not as cost effective and simple as Chandela tanks. These tanks were constructed to meet the growing water demands in the area, maintenance of these tanks was done by the person employed by the king but in case of smaller tanks villagers collectively removed silt and repair embankment.

BUNDELA TANK

TALAB / BANDHIS

Talabs are reservoirs. They may be natural, such as the ponds (pokhariyan) at Tikamgarh in the Bundelkhand region. They can be human-made, such the lakes in Udaipur. A reservoir area of less than five bighas is called a talai; a medium sized lake is called a bandhi or talab; bigger lakes are called sagar or samand. The pokhariyan serve irrigation and drinking purposes. When the water in these reserviors dries up just a few days after the monsoon, the pond beds are cultivated with rice.

JOHAD

Johads are small earthen check dams that capture and conserve rainwater, improving percolation and groundwater recharge. Starting 1984, the last sixteen years have seen the revival of some 3000 johads spread across more than 650 villages in Alwar district, Rajasthan. This has resulted in a general rise of the groundwater level by almost 6 metres and a 33 percent increase in the forest cover in the area. Five rivers that used to go dry immediately following the monsoon have now become perennial, such as the River Arvari, has come alive.

PAAR SYSTEM

Paar is a common water harvesting practice in the western Rajasthan region. It is a common place where the rainwater flows from the agar (catchment) and in the process percolates into the sandy soil. In order to access the rajani pani (percolated water) kuis or beris are dug in the agor (storage area). Kuis or beris are normally 5 metres (m) to 12 m deep. The structure was constructed through traditional masonary technology. Normally six to ten of them are constructed in a paar. However depending on the size of the paar the numbers of kuis or beris are decided. Bhatti mentions that there are paars in Jaisalmer district where there are more than 20 kuis are in operation. This is the most predominant form of rainwater harvesting in the region. Rainwater harvested through PAAR technique is known as Patali paani.

KUIS / BERIS

Found in western Rajasthan, these are 10-12 m deep pits dug near tanks to collect the seepage. Kuis can also be used to harvest rainwater in areas with meagre rainfall

The mouth of the pit is usually made very narrow. This prevents the collected water from evaporating. The pit gets wider as it burrows underunder the ground, so that water can seep in into a large surface area. The openings of these entirely kuchcha (earthen) structures are generally covered with planks of wood, or put under lock and key. The water is used sparingly, as a last resource in crisis situations. Magga Ram Suthar, of village Pithla in Jaisalmer district in Rajasthan, is an engineer skilled in making kuis/beris.

NADIS

Nadis are village ponds, found near Jodhpur in Rajasthan. They are used for storing waterfrom an adjoining natural catchment during the rainy season. The site was selected by the villagers based on an available natural catchments and its water yield potential. Water availability from nadi would range from two months to a year after the rains. They are dune areas range from 1.5 to 4.0 metres and those in sandy plains varied from 3 to 12 metres. The location of the nadi had a strong bearing on its storage capacity due to the related catchment and runoff characteristics.

KHADIN

A khadin, also called a dhora, is an ingenious construction designed to harvest surface runoff water for agriculture. Its main feature is a very long (100-300 m) earthen embankment built across the lower hill slopes lying below gravelly uplands. Sluices and spillways allow excess water to drain off. The khadin system is based on the principle of harvesting rainwater on farmland and subsequent use of this water-saturated land for crop production.

First designed by the Paliwal Brahmins of Jaisalmer, western Rajasthan in the 15th century, this system has great similarity with the irrigation methods of the people of Iraq around 4500 BC and later of the Nabateans in the Middle East. A similar system is also reported to have been practised 4,000 years ago in the Negev desert, and in southwestern Colorado 500 years ago.

TANKAS

Tankas (small tank) are underground tanks, found traditionally in most Bikaner houses. They are built in the main house or in the courtyard. They were circular holes made in the ground, lined with fine polished lime, in which raiwater was collected. Tankas were often beautifully decorated with tiles, which helped to keep the water cool. The water was used only for drinking. If in any year there was less than normal rainfall and the tankas did not get filled, water from nearby wells and tanks would be obtained to fill the household tankas. In this way, the people of Bikaner were able to meet their water requirements. The tanka system is also to be found in the pilgrim town of Dwarka where it has been in existence for centuries. It continues to be used in residential areas, temples, dharamshalas and hotels.

KUNDS / KUNDIS

A kund or kundi looks like an upturned cup nestling in a saucer. These structures harvest rainwater for drinking, and dot the sandier tracts of the Thar Desert in western Rajasthan and some areas in Gujarat.

Essentially a circular underground well, kunds have a saucer-shaped catchment area that gently slopes towards the centre where the well is situated. A wire mesh across water-inlets prevents debris from falling into the well-pit. The sides of the well-pit are covered with (disinfectant) lime and ash. Most pits have a dome-shaped cover, or at least a lid, to protect the water. If need be, water can be drawn out with a bucket. The depth and diameter of kunds depend on their use (drinking, or domestic water requirements). They can be owned by only those with money to invest and land to construct it. Thus for the poor, large public kunds have to be built.

BAORIS / BERS

Baoris or bers are community wells, found in Rajasthan, that are used mainly for drinking. Most of them are very old and were built by banjaras (mobile trading communities) for their drinking water needs. They can hold water for a long time because of almost negligible water evaporation. The baoris are not merely tanks, but also groundwater recharge facilities.

VAV / VAVDI / BAOLI / BAVAADI

Traditional stepwells are called vav or vavadi in Gujarat, or baolis or bavadis in Rajasthan and northern India. Built by the nobility usually for strategic and/or philanthropical reasons, they were secular structures from which everyone could draw water. Most of them are defunct today.

JHALARAS

Jhalaras were human-made tanks, found in Rajasthan and Gujarat, essentially meant for community use and for religious rites. Often rectangular in design, jhalaras have steps on three or four sides.

Jhalars areground water bodies which are built to ensure easy & regular supply of water to the surrounding areas. The jhalars are rectangular in shape with steps on three or even on all the four sides of the tank. The steps are built on a series of levels. The jhalaras collect subterranean seepage of a talab or a lake located upstream.

The water from these jhalaras was not used for drinking but for only community bathing and religious rites. Jhodhpur city has eight jhalaras two of which are inside the town & six are found outside the city. The oldest jhalara is the mahamandir jhalara which dates back to 1660 AD.

VIRDAS

Virdas are shallow wells dug in low depressions called jheels (tanks). They are found all over the Banni grasslands, a part of the Great Rann of Kutch in Gujarat. They are systems built by the nomadic Maldharis, who used to roam these grasslands. Now settled, they persist in using virdas.

These structures harvest rainwater. A structure is built to reach down (about 1 m) to this upper layer of accumulated rainwater. Between these two layers of sweet and saline water, there exists a zone of brackish water. As freshwater is removed, the brackish water moves upwards, and accumulates towards the bottom of the virda.

JACKWELLS

Jackwells are pits used to collect rainwater drop by drop. The difference in the physiography, topography, rock types and rainfall meant that the tribes in the different islands followed different methods of harvesting rain and groundwater.

PHAD

Phad irrigation is one of the traditional forms of irrigation practiced in the Khandesh region of Maharashtra. The system starts with a bandhara (check dam or diversion-weir) built across a rivers. From the bandharas branch out kalvas (canals) to carry water into the fields. The length of these canals varies from 2-12 km. Each canal has a uniform discharge capacity of about 450 litres/second. Charis (distributaries) are built for feeding water from the kalva to different areas of the phad. Sarangs (field channels) carry water to individual fields. Sandams (escapes), along with kalvas and charis, drain away excess water. In this way water reaches the kayam baghayat (agricultural command area), usually divided into four phads (blocks).

The size of a phad can vary from 10-200 ha, the average being 100-125 ha.

BANADHARAS

These are check dams or diversion weirs built across rivers. A traditional system found in Maharashtra, their presence raises the water level of the rivers so that it begins to flow into channels. They are also used to impound water and form a large reservoir.

Where a bandhara was built across a small stream, the water supply would usually last for a few months after the rains.

They are built either by villagers or by private persons who received rent-free land in return for their public act. Most Bandharas are defunct today. A very few are still in use.

KOLHI

The Kohlis, a small group of cultivators, built some 43,381 water tanks in the district of Bhandara, Maharashtra, some 250-300 years ago. These tanks constituted the backbone of irrigation in the area until the government took them over in the 1950s. It is still crucial for sugar and rice irrigation. The tanks were of all sizes, often with provisions to bring water literally to the doorstep of villagers

CHERUVU

Cheruvu are found in Chitoor and Cuddapah districts in Andhra Pradesh. They are reservoirs to store runoff. Cheruvu embankments are fitted with thoomu (sluices), alugu or marva or kalju (flood weir) and kalava (canal).

KERE

Tanks, called kere in Kannada, were the predominant traditional method of irrigation in the Central Karnataka Plateau, and were fed either by channels branching off from anicuts (chech dams) built across streams, or by streams in valleys. The outflow of one tank supplied the next all the way down the course of the stream; the tanks were built in a series, usually situated a few kilometres apart. This ensured a) no wastage through overflow, and b) the seepage of a tank higher up in the series would be collected in the next lower one.

ERI

Approximately one-third of the irrigated area of Tamil Nadu is watered by eris (tanks). Eris have played several important roles in maintaining ecological harmony as flood-control systems, preventing soil erosion and wastage of runoff during periods of heavy rainfall, and recharging the groundwater in the surrounding areas.

OORANIS

The tanks, in south Travancore, though numerous, were in most cases oornis containing just enough water to cultivate the few acres of land dependent on them. The irregular topography of the region and the absence of large open spaces facilitated the construction of only small tanks unlike large ones seen in the flat districts of the then Madras Presidency, now Tamil Nadu.

KORAMBUS

Korambu is a temporary dam stretching across the mouth of channels, made of brushwood, mud and grass. It is constructed by horizontally fixing a strong wooden beam touching either banks of the canal. A series of vertical wooden beams of appropriate height is erected with their lower ends resting firmly on the ground and the other ends tied to the horizontal beam. Closely knitted or matted coconut thatch is tied to this frame. A coat of mud is applied to the matted frame. A layer of grass is also applied carefully which prevents dissolution of the applied mud. Korambu is constructed to raise the water level in the canal and to divert the water into field channels. It is so built that excess water flows over it and only the required amount of water flows into the diversion channels. The height of the Korambu is so adjusted that the fields lying on the upstream are not submerged. Water is allowed to flow from one field to another until all the field are irrigated. They are built twice a year especially before the onset of the monsoon season in order to supply water during winter and summer season. In Kasargod and Thrissur districts of Kerala, Korambu is known as chira.

WATER CONSERVATION METHODS - INFORMATION REQUIREMENT

Every community has special circumstances affecting its water supply and demands. The appropriate plan for one community might differ from that of its neighbor. Careful consideration should be given to methods benefiting a particular system.

This module describes methods and provides examples for devising a beneficial local water conservation plan that considers various demand sectors, dimensions and coverages and recognizes the interaction of related conservation programs.

Did You KNOW

Each year since 1997, February 2nd is celebrated as the World Wetlands Day around the globe

WATER AUDIT

A water system having well-maintained meters and meter records, is in a position to undertake and periodically update a system water audit. The information gained from the audit can help -

- determine how much unaccounted - water leakage
- what portion is due to meter under registration
- other needed areas of improvement.

The audit is also a preliminary element of a detailed water demand summary.

The steps of a water audit include:

- identifying and quantifying all water sources and all metered uses,
- identifying and estimating authorized unmetered uses,
- identifying and estimating water losses, and
- analyzing audit results.

Quantify the Supply

The utility should have a current list of all water sources supplying the distribution system, including interconnections with other systems and intermittent or emergency supplies.

For each source, the following should be recorded:

- Name of source
- Type of source (well, reservoir, natural surface water body, purchased)
- Type of measuring device
- Date of installation
- Identification number of measuring device
- Frequency of reading
- Type of recording register (e.g., dial, builder type)
- Units register indicates
- Multiplier (if any)
- Size of conduit
- Frequency of testing date of latest calibration

Quantify Authorized Metered Water Use

All authorized uses of water, including unbilled public uses, should be metered and quantified by category in the same time period as the water source audit. The first step in quantifying metered watered use is to identify all metered accounts. Metered accounts should then be sorted by type of use, including industrial, institutional, commercial, residential, public purpose, wholesale sales to other jurisdictions, and other possible breakdowns, such as categories of residential use. Uses should also be broken down by meter size.

Quantify Authorized Unmetered Uses

Authorized unmetered water uses are often called authorized unaccounted - for water. Such uses include public buildings and parks, fire fighting, and street cleaning. While all public services should be metered, it is obviously impossible to precisely quantify water running through fire hydrants. Such uses can, however, be estimated as part of the system water audit. Authorized unmetered uses may include:

- Firefighting
- Landscaping in large public areas
- Firefighting training
- Decorative water facilities
- Flushing of mains
- Swimming pools
- Storm drain flushing
- Construction sites
- Sewer flushing
- Water quality and other testing
- Street cleaning
- Process water at treatment plants
- Schools

Did You KNOW

About 9000 litres of water is used for publishing newspapers per day.

Quantify Water Losses

All water that is not either metered use or authorized unmetered use is considered to be water lost from the distribution system. To determine total losses, subtract authorized unmetered water from total unmetered water.

The categories of losses are as follows:

- Source meter error
- Customer meter under-registration
- Accounting procedure errors

- Illegal connections
- Malfunctioning distribution system controls
- Storage tank overflow
- Theft
- Underground leaks

Analyze Audit Results

Conducting a water audit is one way to discover evidence of insufficient record-keeping, faulty metering, illegal taps, leaking storage tanks, or leaking mains.

Estimate Variable Utility Costs

Once key problem areas are identified, you can determine variable utility costs (costs per unit of water production; costs vary with changes in production) and variable wastewater system costs.

Wastewater costs include energy costs for operating pumps and chemical costs for the treatment of water, and are assumed to be directly related to the volume of water produced.

Another variable cost is for water purchased from another supplier. Once variable utility costs have been determined, it is possible to measure the cost-effectiveness of alternative ways to reduce unaccounted-for water and achieve water conservation. Cost effectiveness is primarily based on the value of recoverable water. For example, correcting problems may be more cost-effective than expanding facilities to eliminate a supply shortage

REDUCING WATER LOSS

From the surface of the reservoirs large quantities of water are lost through evaporation. Average annual evaporation from water bodies in India varies from 1 to 3.5 m. At an average annual loss of 2.25 m, evaporation from existing water bodies turns out to 27000 million cubic metres (mm^3). This is equivalent to the domestic needs for an urban population of nearly 140 crores.

It may not, however, be possible to take remedial measures of evaporation retardation on all storages/water bodies. Assuming even 20% of the above area falls in scarcity and drought areas, it may be necessary to tackle around 2400 sq.km of surface area. It is further seen that about 30% of evaporation retardation may be achieved by known retardation methods. Thus it may perhaps be possible to effect a saving to the extent of 1620 mm^3.

REDUCING WATER DEMAND

Reducing water consumption in the home is a simple and easy way to decrease water and energy bills and reduce your household's impact on the environment.

Conserving scarce water resources helps reduce the need to dam rivers, reduce wastewater produced and treated at sewage plants, lower energy requirements for treating and transporting water and wastewater, and reduce greenhouse gas emissions.

Low cost water reduction can take place in every household, often with costs recouped through water and energy savings within one year.

5 ways to reduce water demand at individual level are -

- Reduce indoor water use by choosing water efficient showers, toilets, taps and appliances.
- Minimise outdoor water use through reducing grassy areas and planting native species. Minimise paving of outdoor areas as this increases heat radiation and water run-off from the site.
- Wash cars and bikes on the lawn so that the grass is watered at the same time.
- Sweep your paths and drives instead of hosing them down.
- Re-use water where possible.
- Promote low water usage technologies for irrigation

Did You KNOW

The United Nations has declared 2013 the International Year of Water Cooperation.

WATER CONSERVATION TIPS - DO's & DON'Ts

Did You KNOW

Government of India declared the year 2013 as "Water Conservation Year" to create awareness among all the citizens in the country.

(Source: CGWB)

CONSERVING WATER INDOORS

Do's	Don'ts
• Verify your home is leak free. Repair dripping taps by replacing washers. • Turn off water while brushing teeth. • For shaving, use mug rather than using running water. • Close faucets while soaping and rinsing clothes.	• Do not flush the toilet unnecessarily. Use water efficient flushes, plumbing fixtures having sensors, low flow faucet aerators which require minimum water. • Don't use running water for releasing ice from tray. • Don't use extra detergent in

- Keep overflow valve in the overhead tanks so as not to waste water.
- Use waste water of cloth cleaning to clean the floor.
- Use waste water in flush.
- While going outdoor, turn off the main valve for water.
- Develop habit of monitoring water meters.

washing clothes.

- Don't use running water while hand-washing clothes.
- Don't operate automatic washing machine unless it is fully loaded.
- Don't use shower/big bath tubs in bathrooms.

CONSERVING WATER OUTDOORS

Do's

- Minimize grass lawns in your yard because less grass means less water demand.
- Water the lawns during early morning hours when temperature and wind speeds are the lowest. This reduces losses from evaporation.
- Try to use waste of dish washing/cloth cleaning for gardening and cleaning the floor.
- Check leaks in hose, pipes etc.
- Plant native and/or drought tolerant grasses, ground covers, shrubs and trees. Once established, they do not need to be watered as frequently and they usually will survive a dry period without any watering.
- Group plants together based on similar water needs.
- While watering plants, instead of running hose, use water cane.

Don'ts

- Don't over - water your lawns. A good rain eliminates the need for watering for more than a week.
- Don't use flood irrigation systems instead use sprinkler/drip irrigation systems.
- Don't allow water to flow into gutter.
- Don't wash floors with a hose. Use a broom.
- Don't use excessive fertilizer in your lawn. The application of excess fertilizer increases the need for water.

CONSERVING WATER AT PUBLIC PLACES

Do's	Don'ts
• Inform local bodies of leaks in water supply system. • Close public taps after use. • Close running taps opened by others. • Paste water saving instructions at public places. • Encourage users to install high efficiency plumbing fixtures and provide incentives if possible. • Check for leakages in water supply systems and attend to leakage complaints immediately. • Encourage residents to adopt water conservation and roof top rain water harvesting systems. • Adopt water efficient flushes at public conveniences. • Consider for providing dual water supply system for public conveniences.	• Don't use excessive water at public conveniences. • Don't let water run at public toilets. • Don't use water more than the requirement. • Don't use treated effluent water for horticulture purposes.

CONSERVING WATER IN AGRICULTURE FIELDS

Do's	Don'ts
• Learn to compute water requirements of crops and apply as much water as needed. • Schedule water application rates with growth of crop. • Choose irrigation system best suited to crops, soil and climate. • Provide a good maintenance to irrigation system. • Use sensors to indicate irrigation time. • Recycle tail end water for irrigation.	• Do not irrigate field randomly rather follow a proper schedule. • Don't leave the land unlevelled. • Don't let the weeds grow and eat away water. • Don't breach canals. • Don't consider water only as a priceless resource rather think if no water than what and how?

- Level the land properly.
- Check joints, couplings properly for leaks.
- It should be ensured that canals are free from seepages.
- Use clean water with drip and sprinklers.

CONSERVING WATER IN INDUSTRIES

- Perform water audit to benchmark unit wise water use.
- Modernize processes to reduce water requirements.
- Recycling water with a recirculating cooling system can greatly reduce water use by using the same water to perform several cooling operations.
- Use high pressure washing systems to reduce waste water generation.
- Three cooling water conservation approaches are - evaporative cooling, ozonation and air heat exchange. The ozonation cooling water approach can result in fivefold reduction in blow down when compared to traditional chemical treatment and should be considered as an option of increasing water savings in a cooling tower.
- The use of de-ionized water in rinsing can be reduced without affecting production quality, by eliminating some plenum flushes, converting from a continuous flow to an intermittent flow system and improving control on the use.
- The re-use of de-ionized water may also be considered for other uses because it may still be better than supplied municipal water.
- The waste water should be considered for gardening etc.
- Proper processing of effluents by industrial units to adhere to the norms for disposal to avoid pollution.
- Consider segregating waste water streams according to the level of contamination. Waste water segregation can reduce the use of treatment chemicals, facilitate material recovery and allow greater use of water.
- Tips recommended for indoor and outdoor water conservation may also be applied.

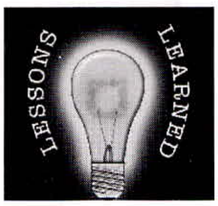
WATER CONSERVATION BY SOCIETY

- Be and encourage others to be part of water conscious community.
- Encourage your neighbours and friends to install and use high efficiency

plumbing fixtures and exhort them to adopt water saving habits.

- Encourage for adopting roof top rain water harvesting.
- Encourage for plantation / afforestation in the area.
- Encourage school system to help develop and promote a water conservation ethics among children.
- Support projects that will lead to conservation of fresh water and reuse of waste water for various purposes.
- Encourage social groups engaged in water conservation program.

LESSONS LEARNED



- Water Conservation (WC) is defined as "The minimization of loss or waste, care and protection of water resources and the efficient and effective use of water."
- According to UN estimates, by 2025, almost two-third of the world will face shortage of potable (fit for drinking) water.
- Factors responsible for increasing water demand are expansion of irrigation, increasing demand by industry, rising demand due to growing population and increasing water use due to changing life style.
- Water harvesting is not a new concept and it is being practiced in different parts of the country since ancient times.
- Every community has special circumstances affecting its water supply and demands.
- There are a number of ways to save water, and they all start with you!

NOTES

The trainer can note down important notes below and discuss them towards the end of the training programme.

NOTES