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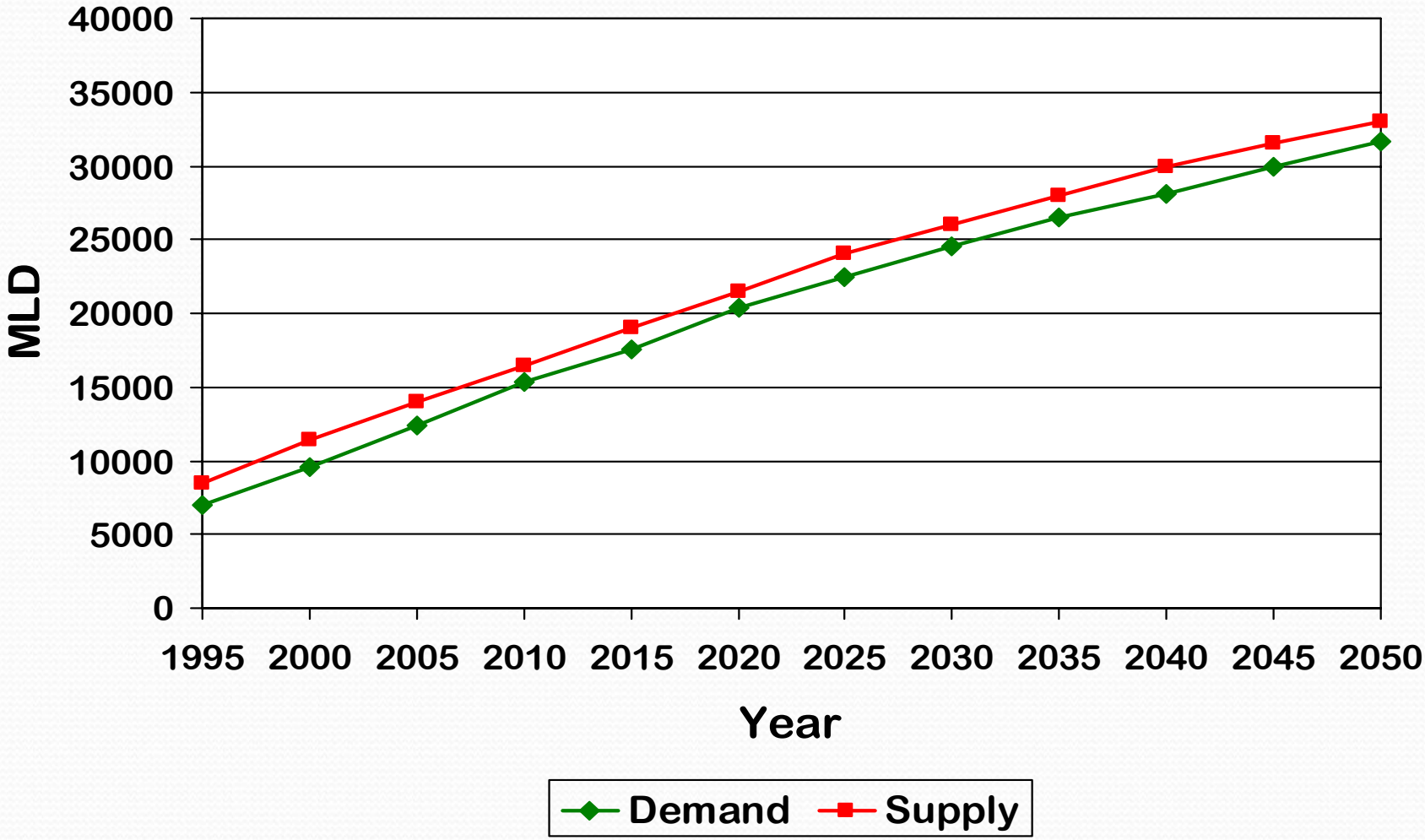
WATER SUPPLY KEY SATISTICS (2007)

- T/Plant Installed Capacity 15,859 Mld.
- Water Demand 12,584 Mld.
- Serves 97 % Urban
  86 % Rural
- Population : 27 Million (2007)
- Future Population: 47 Million (2050)

457 treatment plants
Length of water mains in service is 108,629 km
with 4455 no. of water towers and storage tanks
Number of connections is 5.930 million

WATER SUPPLY AND DEMAND (PEN. MALAYSIA) 2000-2050

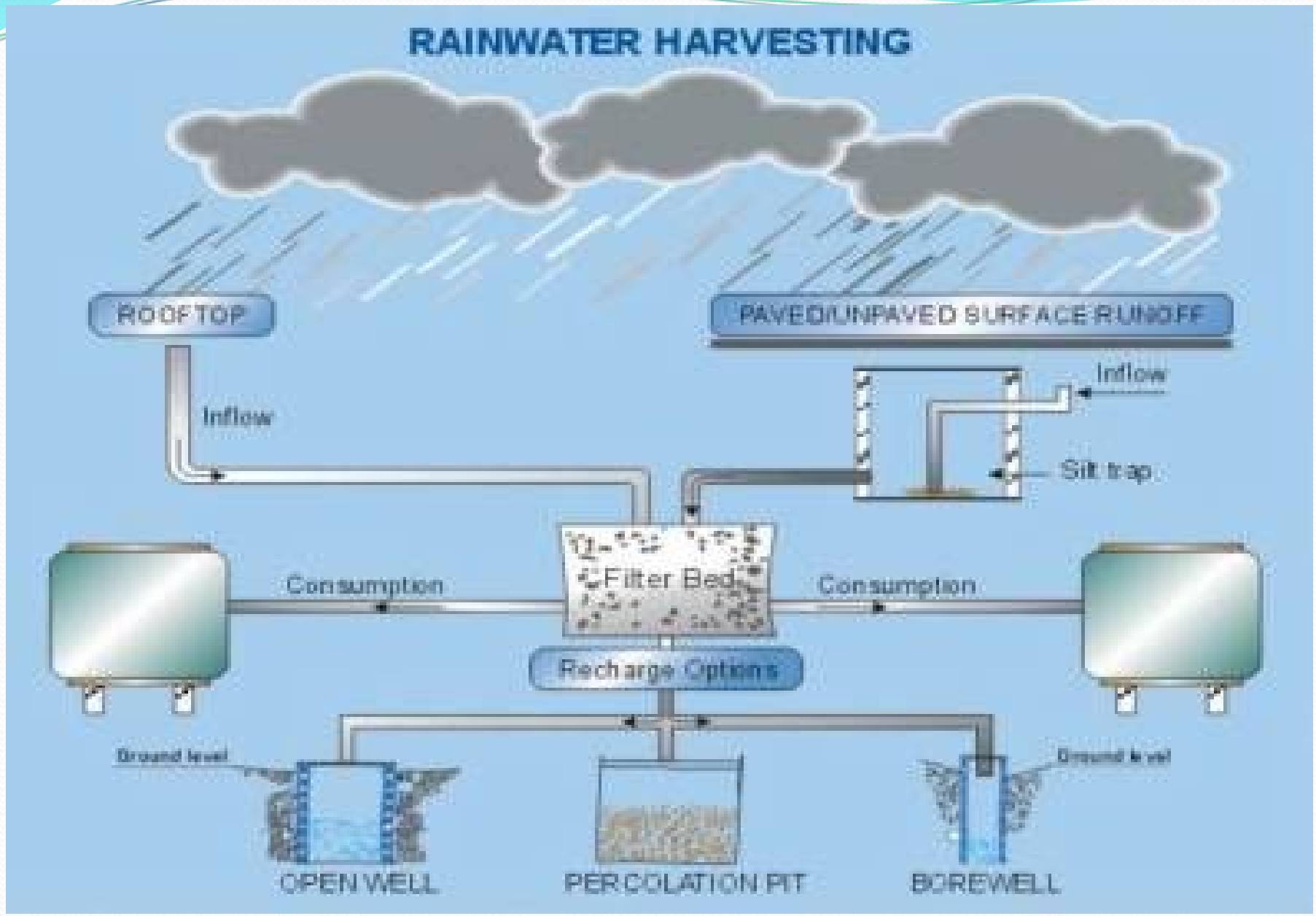


Traditional Approach to Water Demand

- Water supply development which focused on developing new supplies and structures
- Hallmarks of this strategy include large dams, river intakes, diversions, large water supply treatment works, reservoirs, pipes and others.
- Enhance environmental degradation and may create social-political issues

What is Rainwater Harvesting ?

- An old method of meeting water demand
- Rainwater harvesting is simply capture, diversion and storage of rainwater for plant, irrigation or other uses.
- Can take place on many levels including large scale landscapes. i.e. commercial sites and individual households.


RAINWATER HARVESTING
ROOF TOP
PAVED/UNPAVED SURFACE RUNOFF
Inflow
Inflow
Silt trap
Filter Bed
Consumption
Consumption
Recharge Options
Ground level
Ground level
OPEN WELL
PERCOLATION PIT
BOREWELL

Why harvest rainwater?

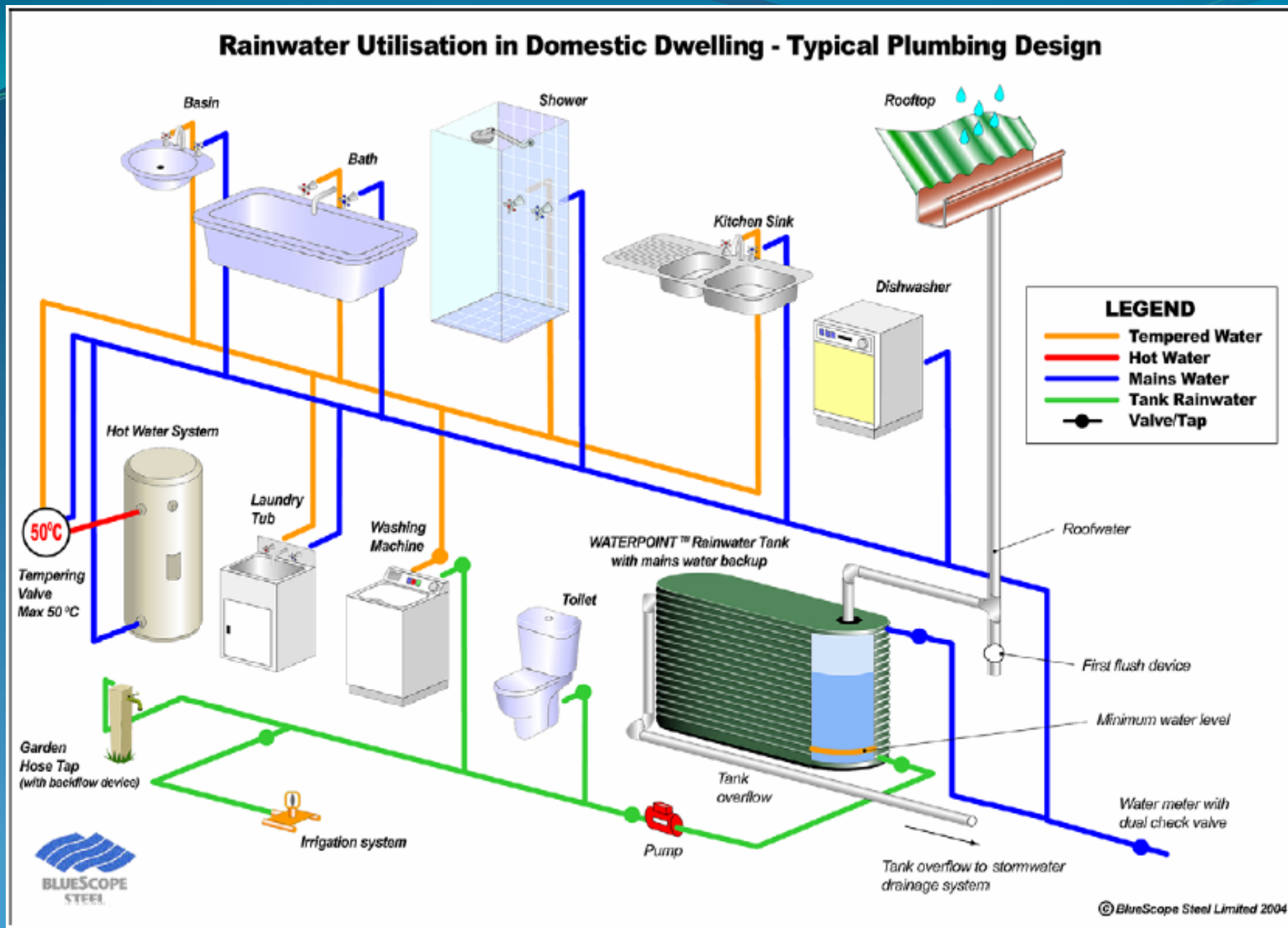
- Will not replace mains water consumption but helps to reduce
- By supplementing usage for toilet flushing, washing machines and general cleaning.
- Reduce requirements for new source works
- Reduce water supply infrastructure costs
- Improve security of water supply in water stress area

Other Advantages

- Economically viable and environmentally sound
- Improve asset protection (eg lawns, gardens and motor vehicles)
- Improve stormwater quality
- Reduce flash flood by reducing stormwater volume and peak stormwater discharges

The increased interest has been facilitated by a number of external factors, including:

- the shift towards more community-based approaches and technologies which emphasise participation, ownership and sustainability;
- the increased use of small-scale water supply for productive and economic purposes (livelihoods approach);
- the decrease in the quality and quantity of ground- and surface water;
- the failure of piped water supply systems due to poor O&M;
- the flexibility and adaptability of rainwater harvesting technology;
- the replacement of traditional roofing (thatch) with impervious materials (e.g. tiles and corrugated iron);
- the increased availability of low-cost tanks (e.g. made of ferro-cement or plastics).


Rainwater Utilisation in Domestic Dwelling - Typical Plumbing Design
Basin
Bath
Shower
Rooftop
Kitchen Sink
Dishwasher
LEGEND
Tempered Water
Hot Water
Mains Water
Tank Rainwater
Valve/Tap
Hot Water System
50°C
Tempering Valve Max 50 °C
Laundry Tub
Washing Machine
Toilet
WATERPOINT™ Rainwater Tank with mains water backup
Roofwater
First flush device
Minimum water level
Tank overflow
Garden Hose Tap (with backflow device)
Irrigation system
Pump
Water meter with dual check valve
Tank overflow to stormwater drainage system
BLUESCOPE STEEL
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Examples of RWH for domestic water supplies

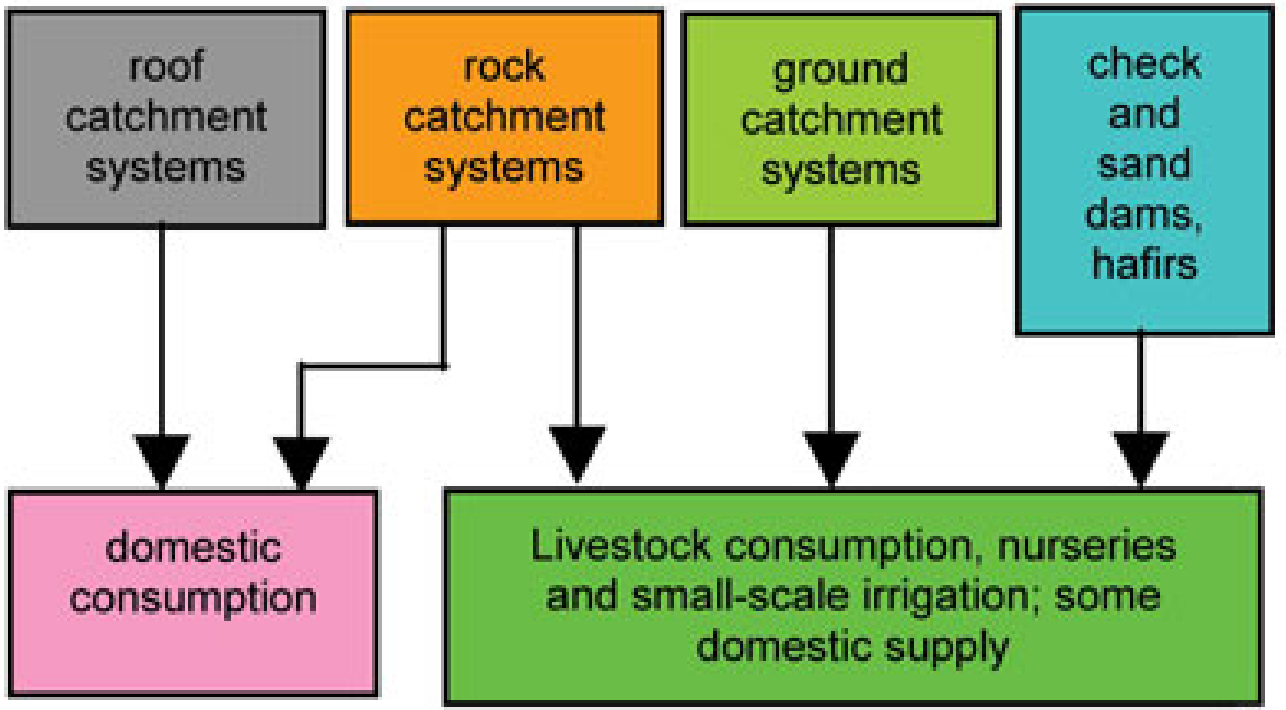
- **Japan:** Sumida City (part of Tokyo) and several other Japanese cities using rainwater sources inside the city boundary to restore the regional water cycle and secure water for emergencies.
- **Fiji:** As a small island, fresh groundwater is not commonly available and exploration induces salt water intrusion. Rainwater is collected from rooftops (e.g. schools and government buildings) and large hard surfaces (e.g. an airport runway).
- **Thailand:** In less than five years (in the 1980s), more than 10 million 2m3 concrete tanks for rainwater storage were constructed in the North East of Thailand.
- **USA:** more than 250,000 households make use of RWH. On certain islands in the Caribbean requests for new buildings need to include a rainwater collection system in their design.

Components of Rainwater Harvesting System

- There are 3 components in Rainwater Harvesting System which;
  - Catchment Areas
  - Conveyance Systems
  - Water Storage

Rainwater sources and types of use

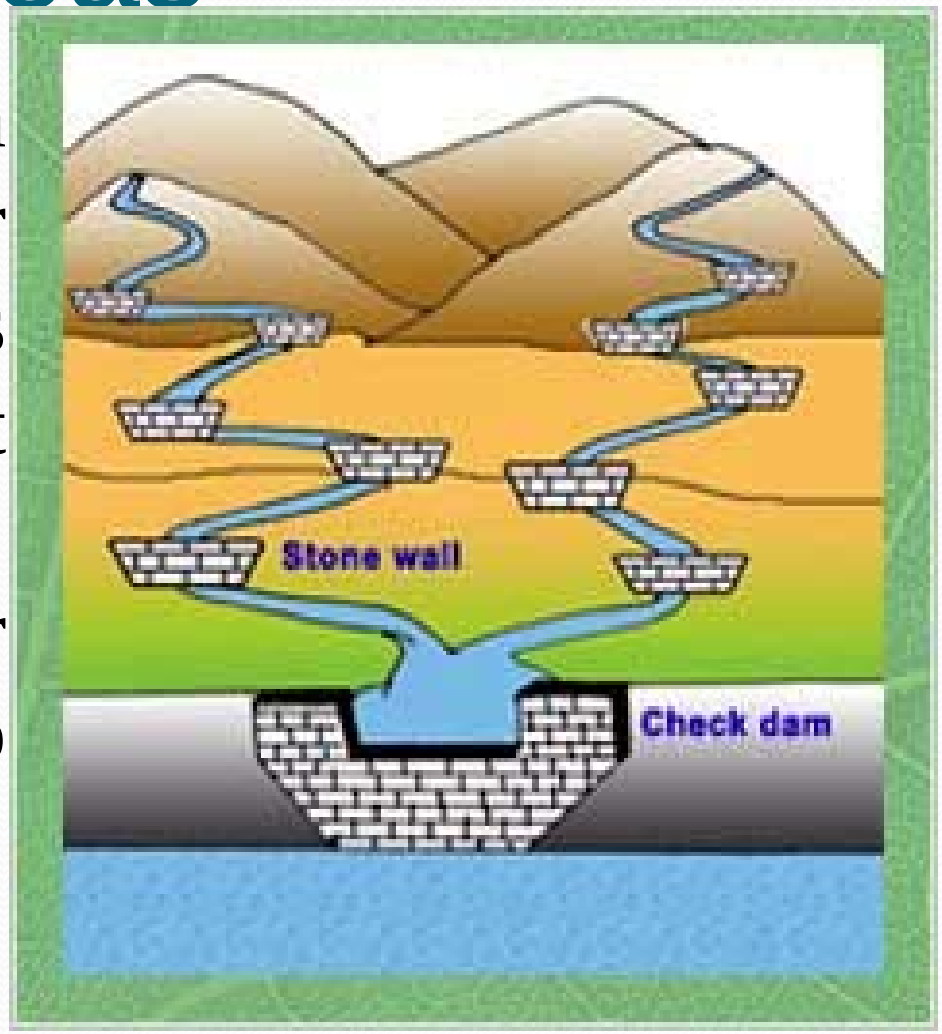
Rainwater harvesting can be categorised according to the type of catchment surface used, and by implication the scale of activity



Small-scale rainwater harvesting systems and uses
(adapted from Gould and Nissen-Petersen, 1999)

Catchment Areas

- The catchment area of any water harvesting system is an area that reasonably impermeable to water which can be used to produce run off.



Some examples are:-

Natural surface such as rock outcrops

- Developed surfaces such as paved highways, aircraft runways or rooftops
- Surfaces prepared with minimal costs and effort such as those cleared of vegetation of rocks and smoothed or both smoothed and compacted
- Surfaces treated chemically with sodium salt, silicones latex or oils
- Surfaces covered with asphalt, concrete, butyl rubber, plastic, tar paper, sheet metal

Conveyance System

- This system can be the catchment surface itself acting as a sheet run off.
- It needs to be designed appropriately to manage the severest intensity of rain as well as not to lose any water during the conveyance process. i.e. rooftops rainwater gutters and rainwater down pipes.

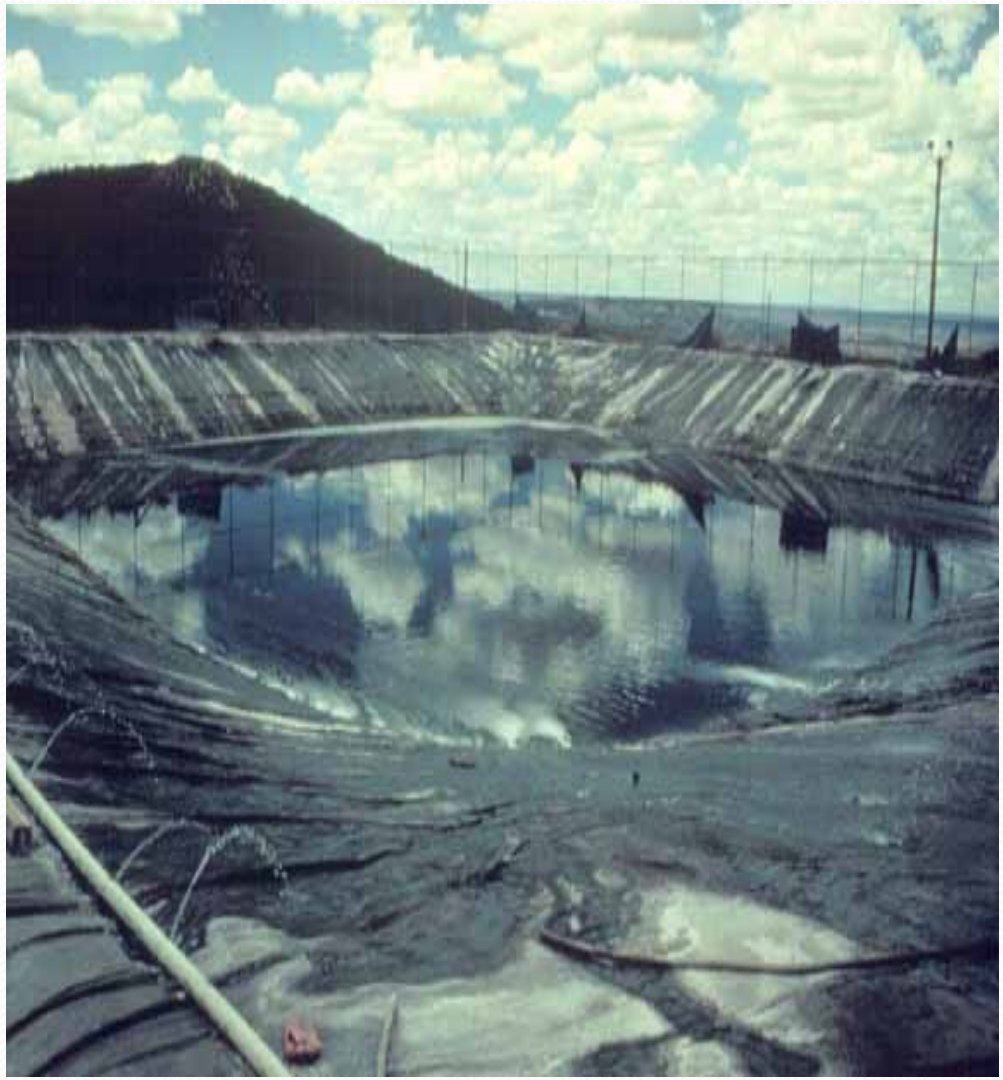
Conveyance System

Water Storage

- There are 3 types of storages:-
  - Soil profile
    - Water directed from hillsides on cultivated areas for storing water in the soil for plant use.

Water Storage

- Excavated ponds
  - Economical means of storing the large quantities of water which are needed for run off farming.



Water Storage

Tank or cistern containers

- Can be used effectively for livestock watering and domestic supplies.

Water Storage

- External water storages are necessary and may be part of a run off farming system.
- The storage and water distribution facility is the most expensive single item and may represent up to 50% of the total cost.
- Storage can be underground or above-ground storage tanks depending on space limitation .
- The tank must be structurally sound to store enough water until the next time it rains.

Water Quantity and Quality

Water Quantity

Rainwater systems can be classified by their reliability:

- Occasional - water stored for few days. Suitable when there is a uniform rainfall pattern with very few days without rain and a reliable alternative water source nearby.
- Intermittent - in situations with one long rainy season when all water demands are met by rainwater; during dry season water collected from other sources.
- Partial - rainwater used throughout the year but not sufficient for all domestic demands. Requires water from other sources.
- Full - for the whole year, to meet all domestic, usually no alternative water source other than rainwater, water well managed, with enough storage to bridge the dry period.

Ensuring Enough Water Quantity For Domestic Consumption

- Other than Full System – conjunctively use with other alternative water source to ensure quantity.
- For Full System – Proper design of catchment and storage plus good water demand management and conservation practices
- For most installations, many combinations of catchment and storage sizes will provide the desired quantities of water.
- Water Conservation - for domestic supplies, 20 to 40 liters per capita/day adequate for cooking, drinking and washing.

Ensuring Water Quality

- Water collected form catchment can contain organism and water soluble impurities from windblown dust deposited on the surface or chemical pollutants directly from the treatment (e.g. salt, silicone, tars, oils, etc) or from weathering by-products created by deterioration of the treatment materials.
- Animal feces can be source of bacteria and virus contamination if area is not protected.
- Quality of water from most surface treatments is usually adequate for livestock,
- Filters are needed in most cases if the water is for human consumption.

Ensuring Water Quality

Regular maintenance of Rainwater Harvesting System need to be carryout such as :

- regular cleaning of the catchment surface (i.e., the rooftop) and storage tank to avoid physical and bacteriological contamination of the rain water;
- periodic inspection of the catchment surface for leaks,
- regular cleaning of the filters to maintain good water quality and acceptable rate of filtration.

Gaps in Knowledge

- The economics of water harvesting have never been fully documented, therefore, better understanding is needed for economic viability of different methods particularly in developing countries.
- The reliability of a system and the degree of risk associated with a system depends upon the reliability of rainfall, combination of catchment and storage, used conjunctively with other sources, water demand management and conservation.
- Rainfall records are essential to design and operation.
- Evaporation from storage is a serious problem plus there is no economical and effective method to overcome the evaporation except tanks and cisterns.

- Technical research must be conducted to reduce the costs of catchment treatment and to make the treatment practical for a wider variety of soils and situations.
- The technology of water harvesting will largely be advanced through empirical experimentation, so, more information and data are needed from a wider range of climatic, soil, economic and social conditions.

- Information on success and failure of rain harvesting projects need to be shared
- Efforts should be made toward establishing an accessible international outlet for such information
- After these information available, more work is needed on the modeling and synthesis of water harvesting system.
- Although there are a large number of techniques available and many variations within the techniques, new ideas are needed
- Quantitative information on the quality of water collected by water harvesting systems is still limited
- Water quality analysis must be an integral part of any water harvesting project.

Conclusion

- There are many methods of harvesting rainwater and it depends on the site condition, rainfall distribution and water requirement.
- It is possible to achieve sustainable water supply with a combination of demand management, recycling water and harvesting rainwater.
- The benefits of harvesting rainwater can be maximized by a structured, scientific approach and detailed study.

THANK YOU