

**NARBO TRAINING WORKSHOP ON RIVER BASIN MANAGEMENT & ORGANIZATIONS –
SRI LANKA, 24TH – 29TH APRIL 2005**



RIVER BASIN BASED WATER HERITAGE OF SRI LANKA

An Historical Perspective

M. U. A. Tennakoon, PhD, DSc

Director General, Mahaweli Authority of Sri Lanka

***Sudharma Elakanda, Network Coordinator, SASNET-RBO
, Mahaweli Authority of Sri Lanka***

1. VITAL STATISTICS

Land Extent : 65,000 sq. km.

River Basins : 103

Rainfall Received Annually : 12 m. ha. meters of water

Evaporation Loss : 50% of
Rainfall

Seepage Loss : 20% of Rainfall

Available as stream flow : 30% of
Rainfall



2. WATER USE OF THAT 30% + 20%



- **For Agriculture and to meet all Human, Animal and Plant needs**
- **For Drinking**
- **For Bathing and Washing**
- **Energy**
- **Other**



3. CLEAN WATER IS THE -

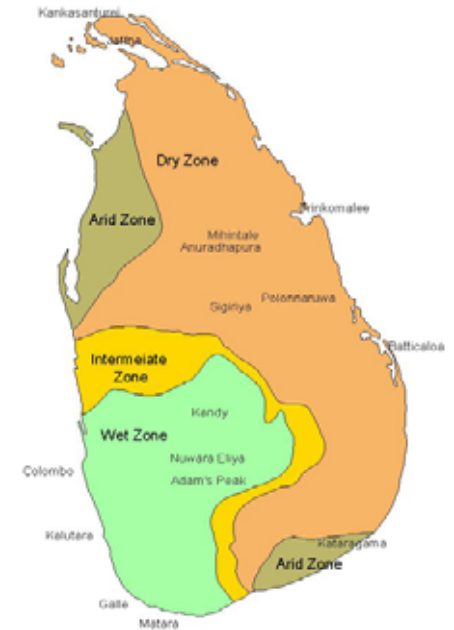
- Life giver
- Symbol of good health
- Symbol of fertility and prosperity
- Symbol of transfer
- Destroyer of evil

4. WE ARE A NATION

.....

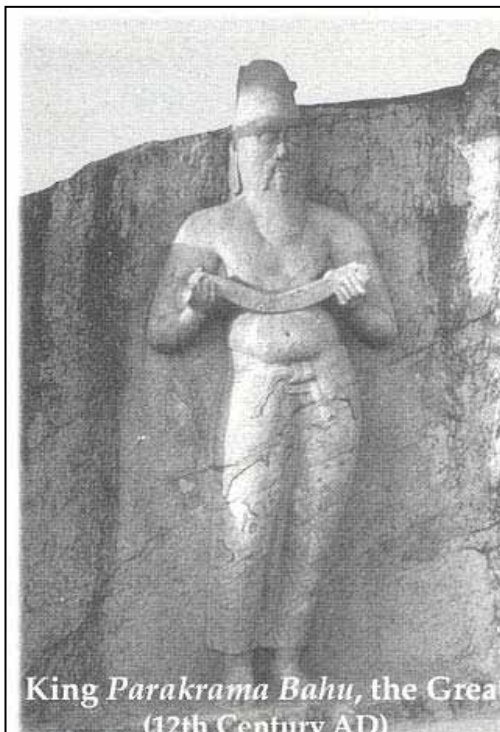
- Longing for adequate water
- **“May the rains shower on time & May the grains be abound thereby”** is our wish (7th century prayer)

RAINFALL AND MAJOR CLIMATIC ZONES



5. WE WISH THAT

- Even supernatural power cause rain for us.
- Rulers manage water well . Many did so.
- King Parakramabahu the Great (1153 – 1186 AD) said -



King Parakrama Bahu, the Great
(12th Century AD)

**“NOT A SINGLE DROP OF
WATER RECIVED FROM RAIN
SHOULD BE ALLOWED TO
ESCAPE INTO THE SEA
WITHOUT BEING UTILIZED
FOR HUMAN BENEFIT”**

6. OUR HYDRAULIC CIVILIZATION IS 2,500 + YEARS OLD

- Many small reservoirs were more than 3,000 yrs. old
- Even some large reservoirs were more than 2,500 yrs. old (according to rock/cave/pillar inscriptions)

Eg:

- **King *Abhaya* constructed – Abhayawewa in 4th B.C.**
- **King *Mahasena* – Padaviya in 3rd A.D.**
- **King *Parakramabahu* – renovated Padaviya in 12th A.D.**
- Names of Kings *Vasabha & Mahasen* (Minneriya Deviyo) in the 1st and 3rd Centruies are noted in history for constructing a large number of small and large reservoirs, underground canals, open canals (Elahara) and ponds.

7. TAMING WATER COUSES IN -

- All rivers streams and tributaries dammed where possible for 15 centuries upto the end of 12th century A.D.

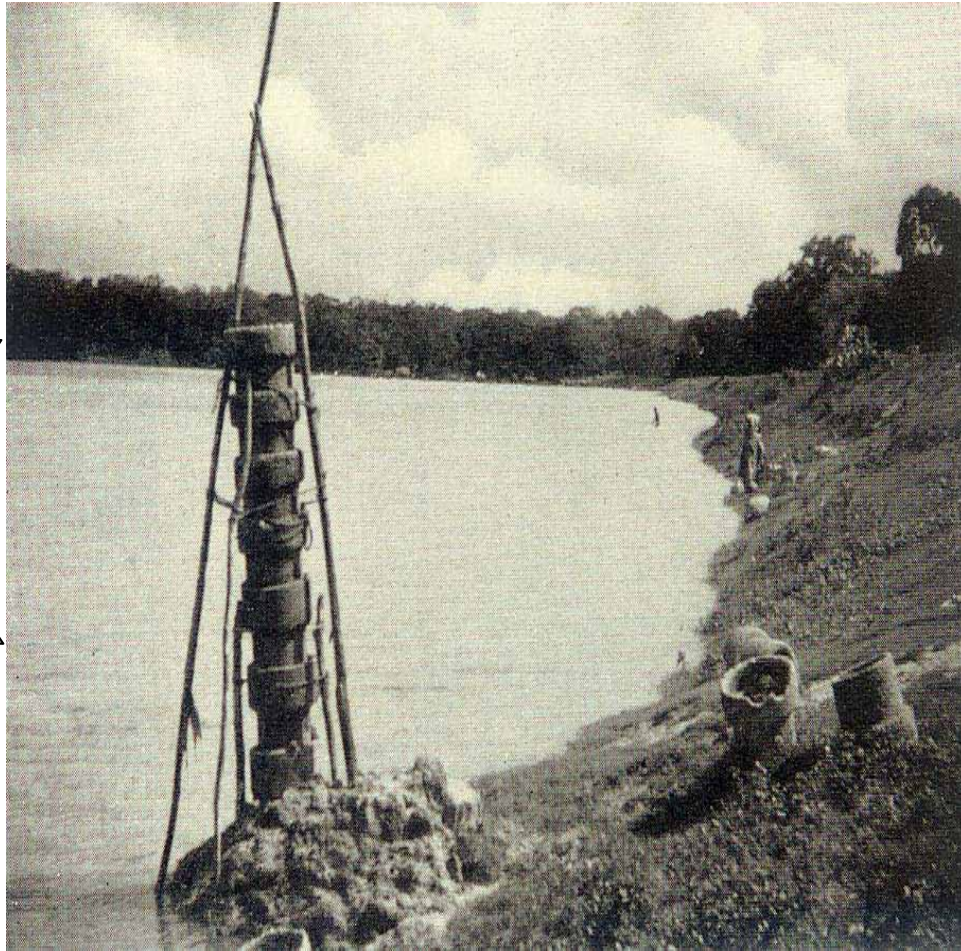
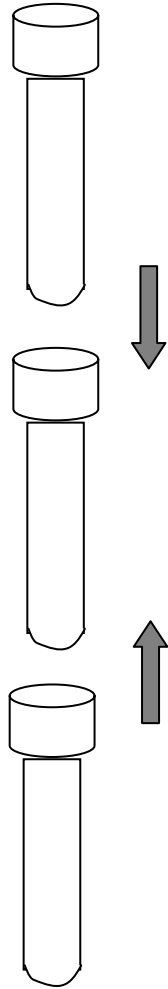
Thus the Padaviya Pillai inscription says -

“ This tank constructed by *King Mahasen* [3rd Century A.D] restored by *King Parakramabahu* [12th A.D.] who dammed the streams rivers and lakes retaining all their water for use in rice fields in Lanka”.

8. IRRIGATION TECHNOLOGY

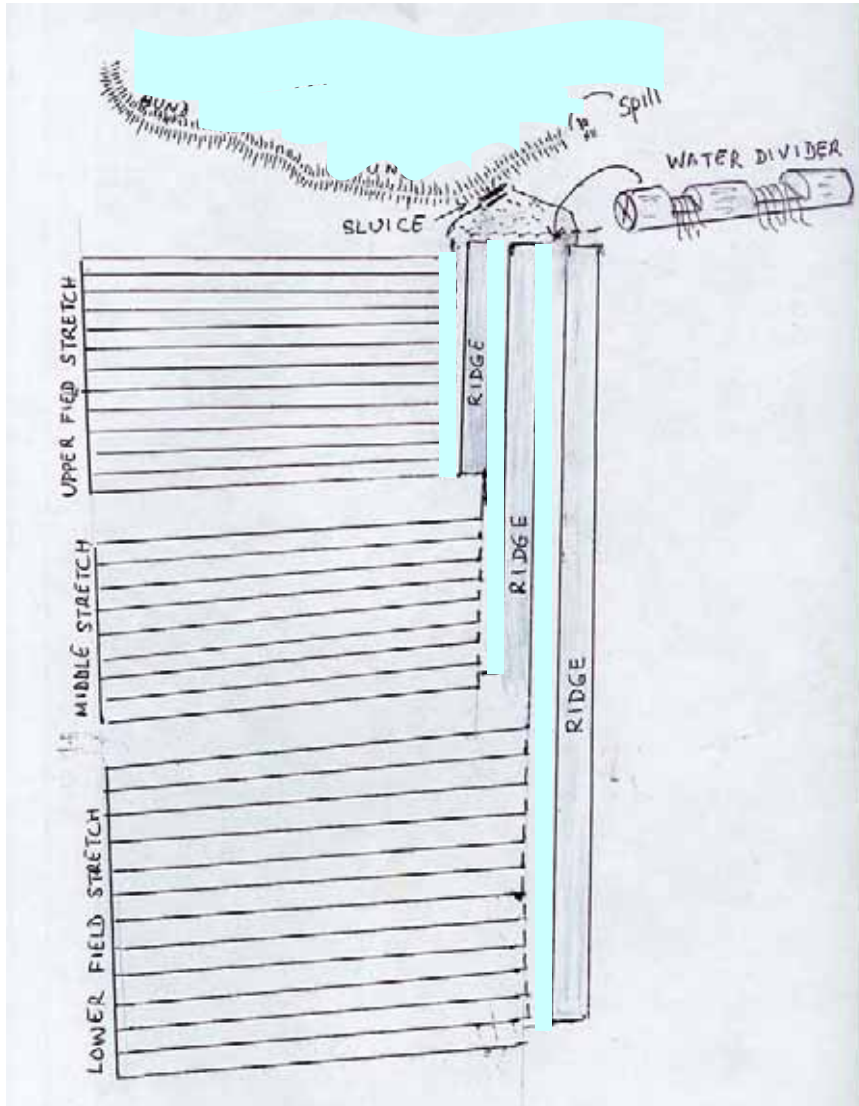
- Varied from SIMPLE to SOPHISTICATE ONES
- Technology in **minor irrigation tanks** (reservoirs) was ;
 - Environment friendly
 - Simple
 - Community managed
 - Mostly TK based
 - Rational and fair

8.1 EXAMPLE I – WATER REGULATION



Sluice blocks can be attached or detached to keep Water Level up or down (here the tanks is $\frac{1}{4}$ full)

8.2 EXAMPLE II – WATER MANAGEMENT



“ Water divider is a miniature weir consisting of a log of wood into which two or more flat bottomed grooves of equal depth have been cut”

Leach 1961, p.160

9. STATE PROVIDED WATER : NEVER SOLD IT

- But any abuse faced severe penalties**
- Land preparation was never to wait until tank is full**
- It was the duty of irrigation headmen at all times, to close sluice gates when it is about to rain**

10. ADVANCE & SOPHISTICATE TECHNOLOGIES IN USE IN THE PAST STILL REMAIN WITH US

A Few Example:

- Yoda Ela (giant canal). 1" to 1 mile gradient with self generated gravity at every bend of canal over a distance of 57 miles.



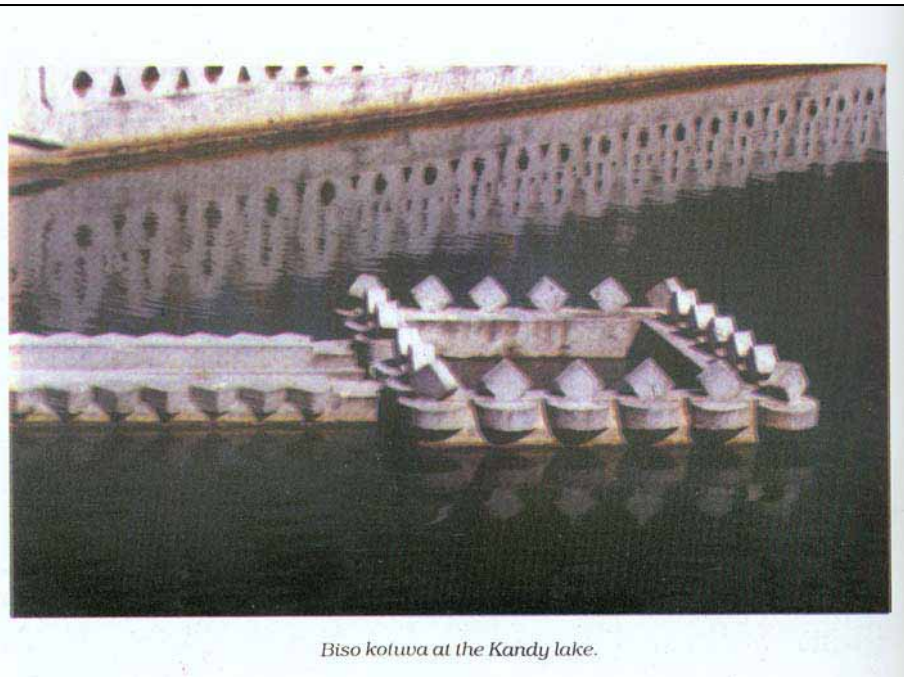
- **The Trans-Basin canal network in the Polonnaruwa District taking water from one large reservoir to another.**



- The Maduru Oya reservoir sluice more than 9 Centuries old, discovered in 1978, considered an engineering marvel.

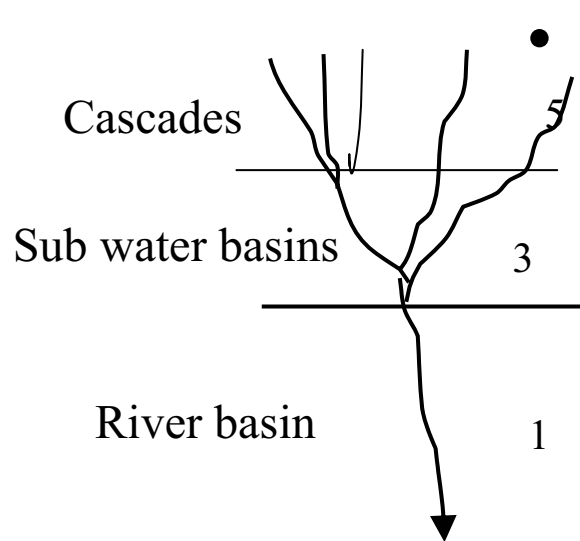


- **Bisokotuwa** (a device to reduce high velocity of water at the inner-toe of a tank, causing water to fall vertically into a bottom of a square well-like structure and then causing water to gradually move horizontally in a tunnel avoiding sluice outlet damage from flow of water at the outer-toe of the bund).



Biso kotuwa at the Kandy lake.

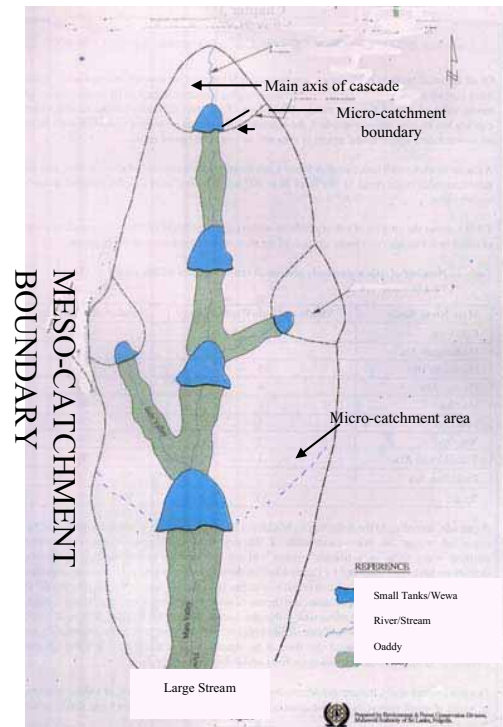
11. Morphology (Form, Content and Distribution) of Reservoirs



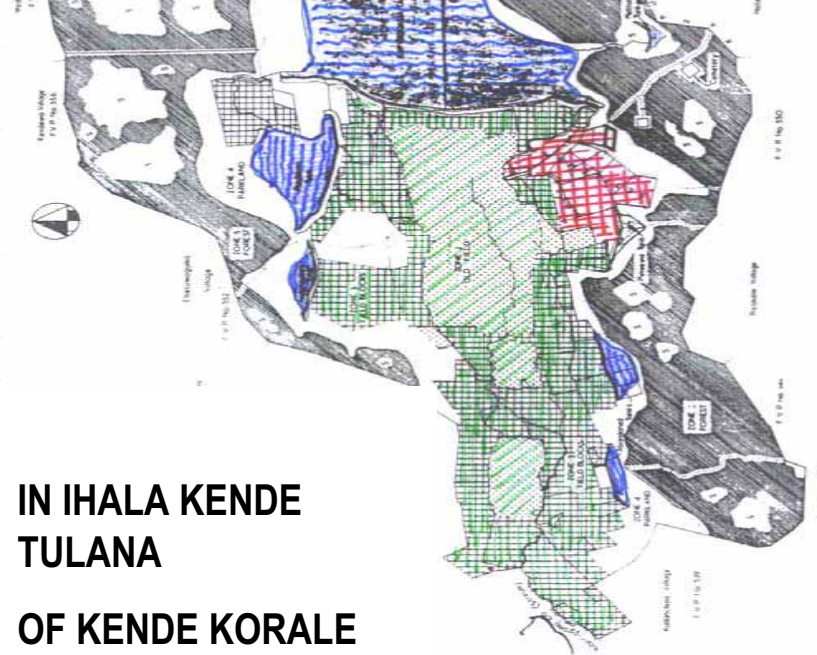
- All reservoirs are either in
 - Cascades (micro-basins)
 - Sub Water Basins (Stream Basins)
 - River Basins (eg. Mahaweli)

11.1 CASCADE:

- Separated from one another by low ridges or mounds.
- Has 3-15 small reservoirs in each cascade
- A Cascade ends either at a large stream or a reservoir
- Tanks in a cascade has definite forms, contents and catchment areas of tanks of their own or overlapping catchments upstream.
- A careful water balance is generally maintained.
- The tanks are mutually supportive, one way or the other

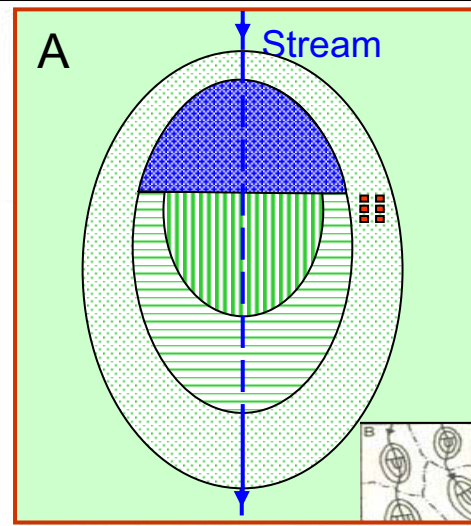


MAP OF KAPIRIGGAMA VILLAGE



IN IHALA KENDE
TULANA
OF KENDE KORALE

NUWARAGAM PALATA
ANURADHAPURA
DISTRICT



(A) Tank bund
Settlement
Zone 1 = Tank
Zone 2 = "Old Fields"
Zone 3 = "Field Blocks"
Zone 4 = Parklands
Zone 5 = Forest
(Modified and adopted from Tennakoon 1974)

(B) --- Village boundaries
Inset (B) shows general pattern of village boundaries and land use zones

Schematic Diagram of a Typical Dry Zone Village

- Those tanks have definite environment friendly forms and contents and in the use of land around them, particularly those downstream of tanks.

- Those forms and contents have been evolved with centuries of experience acquired through TK in keeping with the topography.
- **Those forms and contents when ignored create environmental, social and economic degradation.**
- We need to re-consider, re-assess and follow them to a possible degree in the modern context of river basin development as a whole.
- **Cascade-Based 30,000 tanks in this small island cannot be ignored in the present efforts of river basin based development. Cascades are integral parts of river basins. Our first experiment in this regard in Kala Oya (stream) basin development.**

III

12. MODERN RIVER BASIN

DEVELOPMENT AND MANAGEMENT

- River Basin Development Approach in Sri Lanka is nearly 50 years old.
 - Gal Oya (Eastern Sri Lanka) on TVA model
 - Mahaweli Ganga – since 1968
 - Master Plan (1968)
 - Accelerated Mahaweli Project (1978)
 - Restructuring MASL (1998)

12 A. PHYSICAL OUTPUTS OF MAHAWELI PROJECT

- Five Major Dams
- Transbasin Canals/Anicuts – 02 Nos.
- Irrigation Canals (All Types) – 8350 km.
- New Irrigable Lands – 120,000 Ha.
- New Roads (All Grades A, B, C & D)–1350 Km.
- New Schools – 310 Nos.
- Other Service Building - 592 Nos.

13. MAHAWELI DEVELOPMENT PROJECT

– its Goals & Achievements

- Mainly for irrigation purposes in the Dry Zone .
- It is a multi-purpose river basin development project
- It has cost us SR 92 billion (as at 2004)
- Increased Power Generation Capacity by 137% (Six Power Stations produce – 2032 GWh/Annually)
- Paddy Cultivation Area of Mahaweli – 16% of Total Paddy Cultivation Area of the Country
- Mahaweli Paddy Contribution – 25% of National Production
- Mahaweli Power Contribution – 55% of National Power Generation (1994-95)
- Mahaweli has already recovered the cost

13 A. MASL IS MOVING TOWARDS RIVER BASIN MANAGEMENT TO ADDRESS:

- Inter-sectoral allocation of water resources among diverse users/uses.**
- Management of Multi-purpose Water Infrastructure.**
- Watershed / Water Quality/ Riverine Management.**
- Reliability of water availability to meet all demands.**
- Demand Management through conservation measures.**
- Impacts on Environmental and Health concerns.**

14. MAHAWELI: ITS PROBLEMS

- River basin environment being increasingly threatened
- Erosion, destruction of vegetation, waste dumping river bank encroachment etc.
- Increasing water pollution
- Problematic allocation of water for competing demands (agriculture and hydro-power competition.)
- Problematic alienation of land served with Mahaweli waters.
- Maintenance of a large network of canals, distributory canals, field channels the total length of which exceeds the direct distance from Colombo to London.

14.1 MAHAWELI: ITS PROBLEMS

- **Aging of our large structures built on different technologies – Russian, Scandinavian, British, America and German**
- **Training of our Engineers in maintenance of structures**
- **Possible threats from natural disasters – earth slips and earth quakes as well as possible threats of floods unforeseen**
- **Dam Safety is one of our services concerns**

14.2 MAHAWELI: ITS PROBLEMS

- Insufficiency and out-moded methods of our collection, processing, dissemination and use of **hydro-meteorological data**
- Insufficient knowledge of our **ground water status** and its effective use.
- Under-utilization of our reservoirs from non-agricultural but effective other economic pursuits such as inland fisheries and tourism.
- Economic use of water on the whole.

15. WHY NARBO IS IMPORTANT?

- **It is a vehicle for us to tell the world our irrigation traditions, opportunities, capabilities that we have had in the past.**

WHY NARBO.....

To bring into focus our strengths, weaknesses, opportunities, threats and our experience gained in river basin management

WHY NARBO.....

To seek the support of economically strong nations in the network as well as to learn from the neighbouring countries or the member countries of NARBO who have decades of experience in River Basin Management.

WHY NARBO

- **To constantly share experience through exchange programmes.**

WHY NARBO

To seek assistance particularly in areas of Dam Safety and improvement in hydro-meteorology database and its proper use.

WHY NARBO.....

To collectively find ways and means of effectively facing the already predicted water shortage in 2025 which should be a prime concern of of the member countries almost all of which are thickly populated

16. OUR PLEDGE

While paying equal attention to our minor irrigation works (small tanks) in cascades and sub-water basins as integral parts of total river basin development, we make every possible endeavor to work jointly with the NARBO Network with a high aptitude of sharing our knowledge and experience with all other members of the network.

Victoria Dam



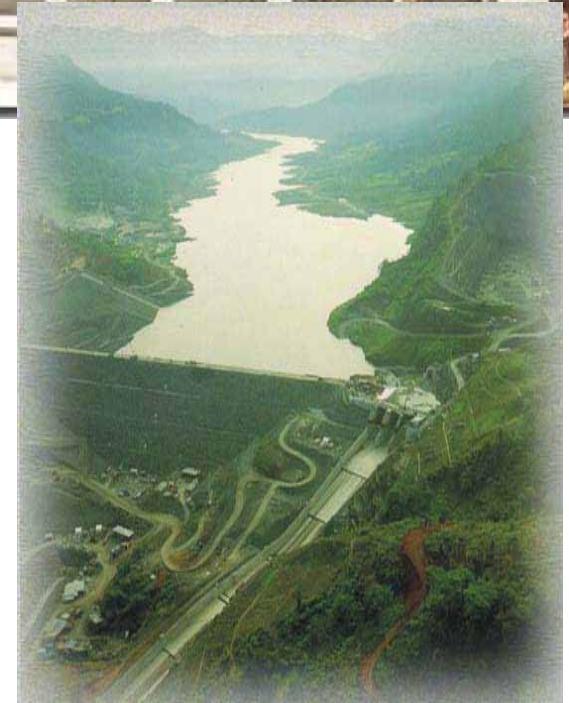
Rantambe Dam



Maduru Oya Dam



Randenigala Dam



THANK YOU

Kotmale Dam

FOR YOUR ATTENTION