

27th November - 4th December 2013 Sri Lanka

Overview of Mahaweli Programme to Enhance the water Security

Eng. N.C.M Navaratne, Deputy Director General (Technical services) Mahaweli Authority of Sri Lanka



CONTENT

Historical Background of Water Resources Development in Mahaweli Basin for Water Setawey Development PROJECT

Mahaweli Development programme.

- Accelerated Mahaweli Programme.
- Achievements of MASL to enhance water Security
 - Physical Constructions
 - Upper watershed management
 - Proper O&M of Reservoirs and Conveyances
 - Integrated approach to reduce water usage and increase productivity.
 - Rehabilitation of Dams/Reservoirs for sustainability of water security

Future Programmes and projects to enhance water security.

- Moragahakanda and Kaluganga Reservoirs
- Raising Maduruoya Reservoir Spillway
- Raising Kotmale Dam
- Raising of Minipe Anicut
- Diversion of Water from Randenigala Reservoir.
- Pumping Options from Mahaweli River.
- Diversion of water to other basins Meeoya, NCP Canal.



Water Security?

Water security has been defined as "the reliable availability of an acceptable quantity and quality of water for health, livelihoods and production, coupled with an acceptable level of water-related risks."

Level of Water Security of a country is a Key Indicator of its Development Potential.

History of Water Security in Sri Lanka.

- Sri Lanka has a written Irrigation Heritage over 2500 years
- Settlements based on river basins
- Thousands of small tank located all over the country
- Irrigation and Agriculture based development
- Country was self sufficient in food.
- Three elements of irrigation system
 - Kala Oya- Malwathu Oya area
 - Abanganga- Mahaweli Ganga area
 - Walawe- Kiridi Oya area
- No Settlements in the hill Country
- No Reservoirs constructed across Major Rivers.





History

In Colonial Era



History

Colonial Era (After 1815)

- Wet Forests cleared
- Economic and social changes
- Land Use changes
- Settlements moved to hill Country
- Urbanization Process
- Rapid Population in Wet Zone
- Land Fragmentation

Change of climate

Flash floods,

- Dried out rivers
- Longer drought periods threatening to water security
- Food scarcity

NEED OF WATER RESOURCES PLANNING FOR FOOD & WATER SECURITY

Resulted in



Mahaweli Authority of Sri Lanka



MAHAWELI DEVELOPMENT



letwork of Asian River Basin Organization

Mahaweli Development Programme



- Mahaweli is Sri Lanka's longest river with 208 m (335 km) in length & catchment area of 10,448 Sq.km
- Mahaweli Basin generates over 12,000MCM annually and discharges to the sea around 8000 MCM.
- Mahaweli Development
 Programme is the largest
 multi-purpose (Physical and
 Human Resources)
 Development programme ever
 implemented in Sri Lanka



Mahaweli Master Plan Study in 1968

Purpose of the study.

- To provide basic information on the land and water resources of the Mahaweli Ganga Basin and the Dry Zone areas
- To Provide and overall water management plan with a view to the effective use of water for irrigation and power generation.
- To provide technical plans, Preliminary design of work, cost estimates, priorities, phasing and financing needed for implementation of the plan.



Envisages storing some six million acre feet of water in 15 reservoirs located on the Mahaweli Ganga river, its tributaries and the Maduru Oya.

> 11 of power stations with installed capacity of the stations were 508 megawatts.

The total output of firm power 2,037 million k W h. per year

The main reservoirs are Randenigala and Victoria for the irrigation supply of the Mahaweli Basin and Moragahakanda, Polgolla and Kotmale for the north central part.

The irrigation areas included in the Master Plan are grouped into 14 irrigation systems.

 Eight of these (A, B, C, D-1, D-2, E, F, G) are located in the Basin of the Mahaweli Ganga and Maduru Oya. (Irrigated area of 470,000 acres)

Remaining six systems (H, I, M, K, J) are in the north-Central part.

Background of The Accelerated Mahaweli Programme

Accelerated Mahaweli Programme

Started - 1977 Oct. 12 Duration - 5 years Investment cost - Rs. 20 Billion

To find employment for nearly 1.2 million

To make the country self - sufficient in rice

To meet the growing demand for power (industries, households and rural electrification)



letwork of Asian River Basin Organizations

Master Plan

Accelerated Programme







Achievemnts of Mahaweli Program to enhance water Security Physical Constructions

Trincomalee

SRI LANKA

Asian River Basin Organization

Polonnaruwa

RE	SERVOIR NAME	CAPACITY (M	CM)
POLGOLLA		4.1	Anuradhapurat Anuradhapurat
BC	WATHENNA	52	Nachchadana
КО	THMALE	172	
VICTORIA		721	Habaran
RANDENIGALA		861	Signeral Signeral
RANTAMBE		22	Dambal On Carolina C
ULHITIYA/RATKINDA		145	
MADURUOYA		597	Natural Con
To	al	2574.1	
	CANAL TYPE	LENGTH KM	Metalee ((' /
	TRANS BASIN CANAL	>36 KM	Kegalle Vicios
	MAIN CANAL	>367 KM	
	BRANCH CANAL	>450 KM	10 00 10 20 30 40 km
	DISTRIBUTARY CANAL	>2600 KM	
	FIELD CANAL	>7000 KM	Network

Polgolla Reservoir

- Dam Height (Meters)
- Dam Length (Meters) 144
- Capacity (MCM)

- **ir**14.6
 144
 4.1
- Rs. 225 M

Completed Year

Cost

Type of Funding

- Local

- 1976



<u>Bowathenna</u> Reservoir

Dam Height (Meters)	- 29'8
Dam Length (Meters)	- 226
Capacity (MCM)	- 52

Power Generation (MW)

Cost - Rs.

Completed Year

Type of Funding

- Local

- 1976



- Rs. 202 M



<u>Kothmale</u> <u>Reservoir</u>

- Dam Height (Meters) 87
- Dam Length (Meters) 600
- Capacity (MCM) 172
- Power Generation (MW)
- Cost
- Sponsored by
- **Completed** Year

- 201 (67x3)
- Rs. 5403 M
- Sweden
- 1986





Victoria Reservoir

Dam Height (Meters) - 122

Dam Length (Meters) - 520

Capacity (MCM) - 721

Power Generation (MW)

- 210 (70x3)

- Rs. 4810 M

Cost

Sponsored by

Completed Year

- United Kingdom
- 1984





Randenigala Reservoir

- Dam Height (Meters) - 94
- Dam Length (Meters) - 485
- Capacity (MCM)
- Power Generation (MW)
- Cost
- Sponsored by
- **Completed Year**

- Rs. 4057 M

861

- Germany
- 1986





Rantambe Reservoir

Dam Height (Meters)	- 41'5	
Dam Length (Meters)	- 420	
Capacity (MCM)	- 22	L.
Power Generation (M	W) -	50 (25x2)
Cost	- F	Rs. 5190 M
Sponsored by	-	Germany
Completed Year	-	1990



etwork of Asian River Basin Or

<u>Ulhitiya/Rathkinda</u> Reservoir

- Dam Height (Meters) 25
- Dam Length (Meters) 4960
- Capacity (MCM)
- Cost
- **Completed Year**
- Type of Funding

- Rs. 262 M
- 1983

- 145

- Local



<u>Maduruoya</u> <u>Reservoir</u>

Dam Height (Meters)

Dam Length (Meters)

Capacity (MCM)

- 1090

- 597

- 41

Cost

Sponsored by

Completed Year

- Rs.1445 M

- Canada

- 1983





PRESENT STATUS OF MAHAWELI DEVELOPMENT

(1)AGRICULTURE DEVELOPMENT				
SYSTEMS	ESTIMATED DEVELOPED AREA AS PER UNDP MASTER PLAN (HA)	DEVELOPED AREA UPTO DATE (HA)	% COMPLETED	REMARKS
А	35,304	7,050	20%	FURTHER DEVELOPMENT RESTRICTED DUE TO ENVIRONMENTAL CONSIDERATION
В	44,373	18,000	41%	MADURUOYA RB IS TO BE DEVELOPED (13,500 HA)
С	31,134	22,801	73%	FULL DEVELOPMENT COMPLETED
D1 & D2	43,198	36,621	85%	KAUDULLA NEW AREA (1,440 HA) IS TO BE DEVELOPED UNDER MORAGAHAKANDA PROJECT.KANTALE SUGARCANE AREA (5,120 HA) IS TO BE DEVELOPED UNDER NCP CANAL PROJECT.
E	8,260	7,530	91%	FULL DEVELOPMENT COMPLETED
F	3,522		0%	TO BE DEVELOPED UNDER KALU GANGA PROJECT (3,000 HA)
G	4,453	5,750	129%	FULL DEVELOPMENT COMPLETED.
Н	39,514	50,547	128%	FULL DEVELOPMENT COMPLETED.(DEVELOPED AREA INCLUDES I/H & M/H)
NCP (I,J,K,L,M)	154,089		0%	TO BE DEVELOPED UNDER NCP CANAL PROJECT (75,000 HA)
Total	363,847	148,299	41%	



PRESENT STATUS OF MAHAWELI DEVELOPMENT

(2)POWER GENERATION POTENTIALS				
ITEM	HYDROPOWER STATION	INSTALLED CAPACITY PROPOSED IN MDP (MW)	INSTALLED CAPACITY DEVELOPED UNDER MDP (MW)	REMARKS
1	UKUWELA	34	38	
2	VICTORIA	80	210	
3	KOTMALE	102	201	
4	RANDENIGALA	100	122	
5	RANTAMBE		49	
6	BOWATENNA	11	40	PRESENTLY RUNNING AT 11 MW
7	MORAGAHAKAN	40		PROPOSED INSTALLED CAPACITY IS 27 MW
8	UPPER UMA OYA	25		TO BE DIVERTED TO SEDZ.PROPOSED INSTALLED CAPACITY IS 120 MW
9	LOWER UMA OYA	29		PROPOSED INSTALLED CAPACITY IS 25 MW FOR LOWER UMA OYA & THAT FOR THALPITIGALA IS 5 MW
10	TALDENA	13		
11	PALLEWELA	10		
12	HASALAKA OYA	11		PROPOSED INSTALLED CAPACITY IS 14 MW
13	HEEN GANGA	6		PROPOSED INSTALLED CAPACITY IS 3 MW
TOTAL 461		660		



Upper watershed management



UPPER MAHAWELI WATERSHED MANAGEMENT

 Catchment areas of Kothmale, Victoria, Randenigala., District of Kandy, Nuwaraeliya and Badulla.

To preserve the Mahaweli catchment area of 3,200 sq.km by developing vegetation cover and the application of soil conservation measures to maintain the water storage capacity for down stream development

- Catchment Quality Improvement
- Soil conservation measures
- Conservation oriented Agriculture
 development
- Monitoring of watershed hydrology
- Minimization soil erosion

- Vegetation development in catchment areas.
- Minimization of encroachment in Mahaweli River, streams and reservoir banks.
- Improved domestic waste management
 - Reduce earth slips and flood damages.



Biological Soil Conservation Programs





Soil and water Conseravation Measures









Catchment Conservation Activities



Proper O&M of Reservoirs and Water Conveyances

Mahaweli Authority spends around Rs. 600 to 1000 million annually for up keeping and operation and maintenance of water infrastructure.







Integrated approach to reduce water usage and increase productivity



Integrated approach to reduce water usage and increase productivity

System	No of Organizations
System C	197
System H	222
System B	133
System G	41
System Hurulu wewa	82
System UW	279
System L	15
Rambakenoya	08
Total	977

INSTITUTIONAL ARRANGEMENT FARMER ORGANISATIONS AT MAHAWELI SYSTEMS



Proper O & M of Reservoirs and Conveyances



Practice of Bulk Water Allocation

Mahaweli System "H" Water Duty - After the Introduction of Water Quota System



Yala Season - (1999 - 2008)





Performance in Paddy Production

Average yield in Maha season(2011/2012) - 6289kg/ha



Average Yield of Paddy in Mahaweli Areas Compared to National Average (Yala Season) 7 6 5 Mt/Ha 4 3 2 1 0 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 Mahaweli 4.84 4.77 5.2 4.96 5.25 5.45 5.6 5.62 5.57 6.19National 3.74 3.71 4.23 3.98 4.26 4.46 4.25 4.19 4.44 4.42

Source : Mahaweli Hand Book 2011, Planning & Monitoring Unit



Average Yield of Paddy in Mahaweli Areas Compared to National Average (Maha Season)



Increase of Diversified Crop areas (OFC & Fruits)

Instead of monoculture farming MASL introduce the optimum crop diversification strategies within it's production area.





Rehabilitation of Dams/Reservoirs for sustainability of water security



Objective:

Establish long-term sustainable arrangements for operation and maintenance of large dams; and improve water Security Enhancement.

Rehabilitation of Dams and Reservoirs are being carried out under Component 1(Dam safety and Operational Efficiency.) of the Dam safety and Water Resources Planning Project Financed by World Bank and GOSL

REHABILITATATED DAMS UNDER MASL

- 1. POLGOLLA
- 2. BOWATHENNA
- 3. KOTHMALE
- 4. VICTORIA
- 5. RANDENIGALA
- 6. RANTAMBE
- 7. MADURUOYA
- 8. KALA WEWA
- 9. KANDALAMA WEWA
- 10. DAMBULU OYA
- 11. CHANDRIKA WEWA







FUTURE PROJECTS



MORAGAHAKANDA – KALUGANGA RESERVOIRS







RAISING MADURU OYA SPILLWAY by 2.0 m

Capacity will increased by another 134 MCM







Raising Kotmale Dam by another 30 m

Capacity will increase by 345 MCM





Raising of Minipe Anicut by 4.0 m.

Spillage over the anicut after daily power generation of Rantembe Reservoir power house can be retained at the pond created by raising anicut by 1.0 MCM







Diversion of Water from Randenigala Reservoir upto Moragahakanda Kalugaga eservoir complex.

Pumping Water from Mahaweli River to Minneriya Tank







Diversion of water to other basins – Meeoya, NCP Canal.





NCP Canal.









SUMMARY OF POTENTIAL PROJECTS UNDER MAHAWELI PROGRAMME TO ENHANCE WATER SECURITY

NAME OF PROJECT	ENHANCED CAPACITY (MCM)	EXTENT/ SERVICE AREA
Moragahakanda Reservoir	569.9	System H, G & D
Kaluganga Reservoir	265.6	System H, G , D & F
Raising Kothmale Dam	345.0	System H, G & D
Raising Maduruoya	134.0	System B – RB area
Raising Minipe Anicut	1.0	System B, C, E
Malwathu Oya Reservoir	200.0	System M, 13,000 Hectares
Yan Oya Reservoir	169.0	System I, 5000 Hectares
Kivul Oya Reservoir	55.0	System L , 1700 Hectares
Randenigala – Kaluganga Diversion	-	System H, G & D (200.0 MCM Diversion)
Upper Elahera & NCP Canal	_	North Central & Northern Province (1000.0 MCM Diversion including 100 MCM pumping)

THANK YOU ..

