Integrated water resources management

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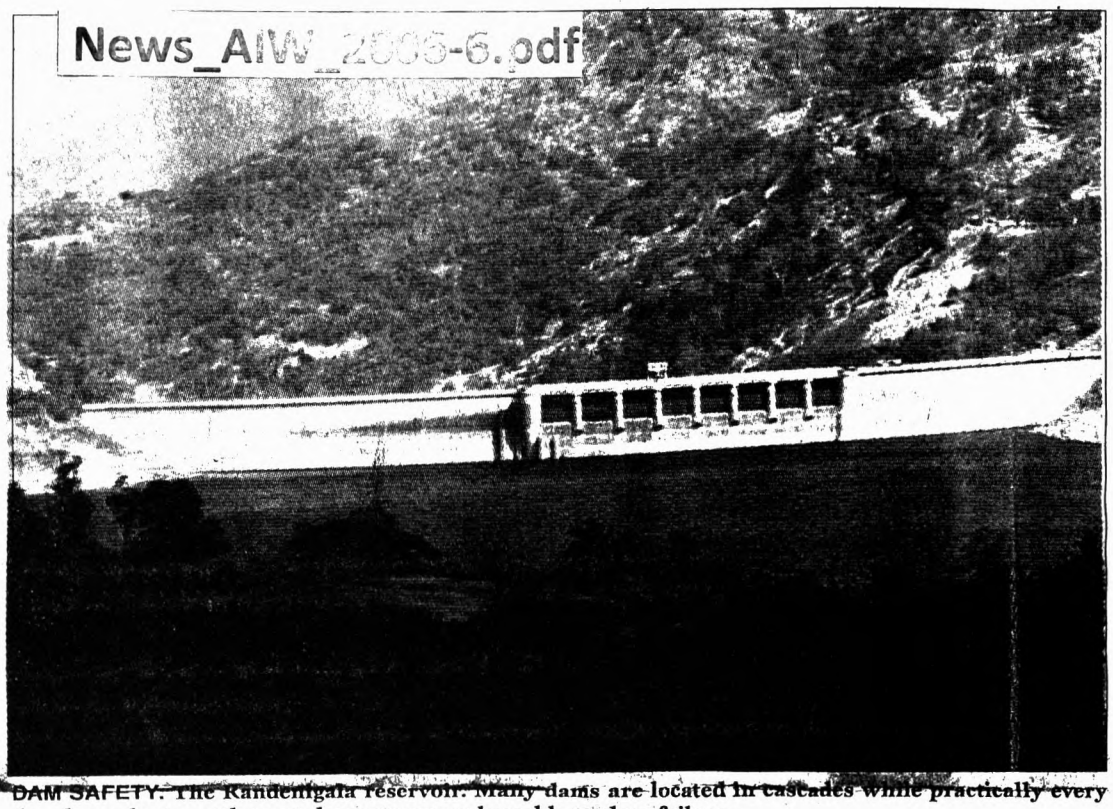

DAM SAFETY: The Randenigala reservoir. Many dams are located in cascades while practically every dam has a large settlement downstream vulnerable to dam failure.

Since the ancient hydraulic civilization in Sri Lanka, water resources development has focused on achieving self sufficiency in the staple food, rice. Even after the colonization of the country by the British, the attempt had been to increase food production by rehabilitating the vast network of the ancient irrigation infra-structure which went to disuse after the 12th century. After the arrival of British a separate department for irrigation was formed in 1900 to intensify this objective of tank rehabilitation. Successive governments since independence in 1948 also followed the same policy to achieve self sufficiency in rice. During the past few decades, while developing water resources of Kelani Ganga and development of lands under Mahaweli for agriculture, emphasis was also laid on hydro power development.

Today 35% of the water available in rivers and streams is being utilised mostly for irrigation with 6% of water for drinking and industrial use. However according to Irrigation Department still 65% of the available surface water in the 103 river basins goes to the sea without any beneficial use. Meanwhile a shortage of water exists in the dry zone during the South-West monsoon (Yala) while the frequent floods in major rivers in the Western part of the country creating havoc. From the available land extent for paddy, only 50% of the land is cultivated during Yala. Due to this reason there is a demand by the people requesting to provide additional infrastructure for greater regulation of water for supplementary irrigation and flood control by taming the wet zone rivers to detain flood water and to provide trans-basin diversion to the dry zone.

Dam safety

In Sri Lanka, the responsibility of dams is vested on a number of state institutions. The Irrigation Department (ID) is responsible for the largest number of major dams (350 earth dams; nearly 20% of them are classified as Large Dams) while the Mahaweli Authority (MASL) is responsible for the rock fill, concrete and earthen dams recently constructed with modern technology and several ancient dams, receiving Mahaweli waters. The original construction of the ID dams dates back from the pre-Christian era to a few centuries ago. The Ceylon Electricity Board (CEB) and the National Water Supply & Drainage Board (NWS&DB) are responsible for the other major and medium sized dams. The Provincial Councils are also responsible for around 12,000 minor earth dams. Another important characteristic is that many important dams are located in cascades while practically every dam has a large settlement downstream vulnerable to dam failure. Many important urban areas, too, are found within the downstream risk areas of Mahaweli, ID and CEB dams. The failure of any of these dams is likely to have consequent adverse effects on property, economy, agriculture and human lives, either within the river basin or even the trans-basin due to the nature of their development.

An urgent necessity for the formulation of a national plan for disaster preparedness arose in 1986, due to the failure of the Kantale dam, a major ID earth dam. The subsequent public hearing of the World Commission of Dams held in Sri Lanka in 1998 and the round of inspections conducted for 32 major dams on risk assessment by national & international consultants under the Mahaweli Restructuring Programme during the years 2003/2004 confirmed the necessity of establishing an effective institution to deal with dam safety. Therefore sustainability of the infrastructure already built is also a management function of the state.

Availability of water

The total land extent of Sri Lanka is 65,525 sq.kms and the annual rainfall varies from 900 mm to 6000 mm. There are 103 river basins in the country and the available water from precipitation is 42,869 mcm annually and the annual runoff to the sea is estimated as 27,900 mcm. Therefore 35% of water is utilized and 65% goes to the sea. Of the 103 river basins only 17 river basins have drainage areas of more than 1000 sq.kms. The irrigation sector is the largest water user and the annual irrigation water use has been estimated as 12,000 mcm. Drinking and industrial water use has been estimated as 6% of the total water use. Being an agricultural country with rice as the staple food the total extent under paddy is 735,000 ha under major and minor irrigation schemes including rain-fed paddy. The average productivity of rice farming is 3.5 ton/ha in major irrigation schemes where there is sufficient water for irrigation. Before the implementation of the Mahaweli Project, the Mahaweli Ganga was the largest river with 10,000 sq.kms of catchment discharging 10,000 mcm of water annually to the sea. This amount has been now reduced due to large scale water regulations in the basin with large reservoirs. In view of the above, today Kalu Ganga discharges the largest amount of water and it is of the order of 4000 mcm. The Kelani Ganga comes second and it carries 3400 mcm of water annually to the sea. The Mahaweli Ganga is third.

Integrated Water Resources Planning

Having achieved near self-sufficiency in rice by making large investments up to 1980, rapid urban development and the expansion of cities shifted the emphasis from sectoral development to multi-sectoral water resources management. Today almost all the major cities in Sri Lanka are confronted with drinking water scarcity even though most of the cities are surrounded by reservoirs. The authorities are unable to supply 24 hours of water for most of the cities. In particular in the city of Colombo, 64% of the population are un-served by piped water and 18% extract water from unsafe sources. As a result of this, potential conflicts among the major users have emerged. However the cry for further augmentation of irrigation reservoirs by trans-basin diversion of water from the wet zone rivers has not ended. The reason for this situation is inadequate water during the South West monsoon (Yala) in most of the medium and minor tanks as explained above. This is clearly shown in the present government policy and plans are being drawn to carry out feasibility studies for the development of water resources of major rivers like Kelani Ganga and Kalu Ganga.

The present population of greater Colombo is about 1.5 mn and the projected population in 2025 is 4.0 mn. The NWS&DB is now confronted with the problem of meeting this demand due to the shortage of water in the Kelani river during the dry weather flow. The problems of drinking water at Anuradhapura, Kandy, Kurunegala, Trincomalee, Matara and Hambantota are well known. Due to the reasons given above the necessity of a holistic approach to implement a rational water resources development plan has been now realized and the implications of some of the sectoral planning so far implemented are under review.

Hydrological Monitoring

Safety assurance for dams and rational water resources development plans are founded largely on a sound information system. The rainfall, river gauging and the hydrological data base are vital elements in an information system. Therefore a critical review of the hydrometric network is essential to examine the viability of the above objectives.

It is also evident that some of the major water resources projects implemented during the recent past performed below the design expectations due to the shortcomings in river gauging.

Flood forecasting is a mandatory function of the Irrigation Department and the department is expected to provide scientific forecasts during an emergency. Both rain gauges and river gauges are mostly concentrated in the wet zone, but the density in the dry zone is very poor. The examination of the number of measuring stations in 1964, 1974 and 2006 shows the gradual deterioration of the network density from 1974. Under the accelerated Mahaweli programme in 1980, selected stations were upgraded with better facilities. Present capacity and ability of the hydrometric network to meet national water resources development and management is inadequate and needs major rehabilitation and modernization. Due to the lapses in the information data base, water resources planning, development and management decisions are made on the basis of doubtful hydrological data, which need more attention. Therefore, while addressing the other issues the establishment of a sound data base and data management system for multi-sectoral integrated water resources planning is essential. The functions of the enhanced data base should ensure,

i. Water resources development and management planning
ii. Flood forecasting in natural rivers
iii. Safety of dams
iv. Water allocation and monitoring

Integrated water resources development and management also have been aggravated due to the large number of ministries where water related functions are disintegrated to a level where normal coordination between ministries is difficult. Despite the multiplicity of institutions and ministries, the present practice of water resources development, especially during the recent past has not been able to address issues of national interest. Therefore the balance water resources have to be developed very carefully in a holistic manner to solve problems of irrigation ,drinking, industrial, environmental and flood protection while harnessing the much needed hydropower potential.

Integrated water resources management is the core of the management strategy of national water resources, for which the concept of multi sectoral planning of river basins has to be introduced. In order to meet this objective one of the basic and most important requirements is a sound knowledge and information system of the resources and a decision support system with appropriate analytical tools. In addition, a great emphasis is needed to change the orientation of the professional staff of the key government institutions from sectoral planning to integrated water resources planning.

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