

Rainwater harvesting for domestic use

By Indra Dissanayake

Beside all other things that the economic development is globally concerned paramount importance objective. Similarly this scenario has been considered as highly valuable for countries to achieve individually. In this context more emphasis are to be given by countries for sustainable development. Sustainable development means optimum utilization of natural and other resources while giving more emphasis to the benefit of future generations. The prime objective of Sri Lanka is also to achieve sustainable economic development through the optimum utilization of it's natural resources. At present Sri Lanka is confronted with series of problems in the areas of specially loss of forest cover, contamination of waters, degradation of rural lands, and highest rate of pollution in air, water and discharging of liquid and solid waste. It is also required to be concerned about increasing population and as a result unprecedented demand for food, urbanization which include supply of clean water or pipe born water, sanitation and better housing etc. Without proper management and such action related strategies, the overall stress towards natural resources would be aggravated creating negative impacts leading to a disastrous situation.

The social benefit of the Sri Lankan could be enhanced through better practice of well balanced utilization of natural resources such as water, land, air and also other biological resources. It can increase the wealth of Sri Lanka by avoiding costly environmental abuses. There can be significant improvement of the livelihood through implementation of well planning, which based with sound policies, result oriented strategies and decision making as well as applying of best practices of technologies. This would enhance the status of natural resources resulting the well being of the people. Similarly it is also require understanding of complex interaction among ecological and social systems. Rainwater Harvesting (RWH) in Sri Lanka has a historical consideration in many ways. Specially the location of Sri Lanka and specific phenomena of two monsoonal and intermonsoonal patterns of rain are favorable to receive fair amount of rainwater for almost all part of the island.

Rainwater harvesting was evolved for more than many centuries of years. Our ancestral kings were very keen to collect rainwater using different methodologies such as construction of giant tanks and reservoirs connected to cascade system which are used for retaining of water for domestic uses, agriculture and recharge of ground water aquifers.

Even at present in urban areas there are a large number of water retention low lands kept undisturbed (called wetlands or marshes) in order to retain storm water and to prevent flooding and allowed natural process of ground water recharge system. Therefore these marshy wetland areas are called 'the green lungs of the environment'. It support to maintaining of ground water table and natural services of entire ecosystem as well as safe guard the food security. In the 5th century, the construction of Sigiriya rock fortress by the king Kasyapa was the unique and magnificent showpiece with storage tanks and swimming pools etc. to present as rain water collection model. This system worked much vital manner when we consider the following valuable quotation expressed by one of our ancient kings the great Parakramabahu (1153-1186 A.D.) during Polonnaruwa kingdom. Not a single

drop of water received from rain should be allowed to escape in to the sea without being utilized for the benefit of human kind. (*Chulawamsa*)

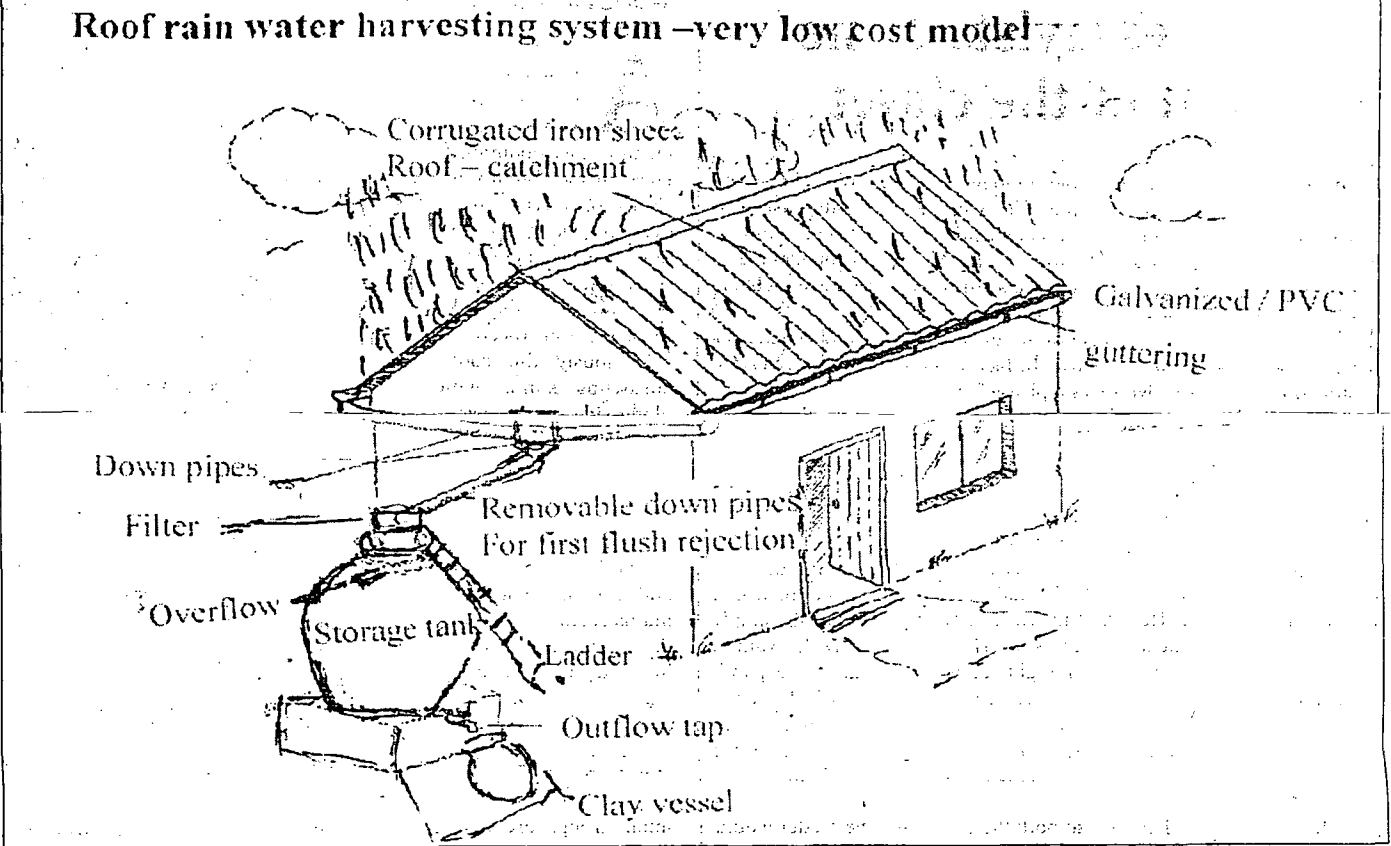
In view of the reasons out lined as follows it is possible to highlight how far that the Sri Lanka is confronted with water related stresses at present and even in the future. However, most of the people are unaware about exact picture and kept in the dark until the situation become worse and starts suffering in many ways. Therefore it is vital to disseminate more information on water and situation of the water resources at least for the general public to become vigilant on these issues.

Basic issue

At present the adequate level of water supply for the people of Sri Lanka has becoming an issue to the government. The growing trend of population is the basic issue for all other problems in relation to the water scarcity. Therefore, water consumption and demand for water was naturally lower and hardly manageable. The beginning of the twentieth century Sri Lanka had only few millions of people. In 1871 Sri Lanka population was only 2.4 million. From this level of population from 1871 to 1981 it was increased by 518.5 percent. For many decades average annual rate of growth was about 1.7 and crude birth rate (CBR) came down, higher life span, improvement of health and sanitation, eradication of many types of epidemics were taken place. The population of Sri Lanka was estimated to be more than 20m at the end of 2007 which implies an average density of around 320 persons per sq. km. This situation is some what higher rate compare to world average. The increase of population is directly affect to the demand for additional water usage for day to day life including sanitary requirements.

Along with the increase of population, additional housing for dwelling were also required to be constructed. There are different types of settlements can be seen in Sri Lanka. Traditional folk villages, estate settlements, rural service centre based hamlets/villages, commercial activity centered villages and urban centers based settlements. Based on these categories our administrative and political setup also established such as pradeshiya Saba, town councils and urban councils and Municipal councils.

Based on the various reports of the respective authorities we can glance the trend and the present picture of housing and settlement development. The demand for new houses in Sri Lanka is rising around 100,000 unit per year (CB Report 2005). In addition there is need for upgrading of 1,325,880 substandard units requiring improvement. On top of that there are about 100,000 housing units either completely or partially damaged due to December, 26th 2004 tsunami disaster. Accordingly, the National Housing Development Authority (NHDA) has implemented a housing programme for building of 175,000 houses during the



period from 2005 to 2007. At the same time NHDA distributed roofing materials for 43,625 during 2005. Under the Real Estate exchange (Pvt) Ltd also planed to construct 3,000 houses during 2005 to 2007. In comparison with the financial facilities provided by various institutions that the private sector organizations are leading the way. They have issued 89,333 loan facilities to assist housing development. While state mortgage bank has issued 23,305 during the year 2005. In addition to all these efforts there are many NGO and a number of foreign donor agencies commenced construction of thousands of houses for homeless needy people. At the same time Urban Development Authority commenced it's programme for developing 62 Large, medium and small township encouraging private sector to construct series of luxury apartments. This would give an idea of how far we are to be ready for facilitate and ready to cope up with the requirement of water and sanitation facilities at least for the above development programmes and other proposed developments.

Demand

The demand for water has increased along with the new settlements. New housing complexes were erected to facilitate the demand for shelters. The traditional well water supply became unsuitable and polluted mainly due to increase of development schemes, factories, housing and condominiums, dumping of garbage, and so on. They were required to be supplied with pipe borne water mainly for drinking purposes and sanitation facilities.

In this manner the demand for potable water has also increased. In 2005 there were 291 water supply schemes operated for 907,662 water connections and 383 million cu. mtr. supplied under the national water supply and drainage board (NWSDB), (Central Bank 2005). However, this supply is only for 39% of the population had access to pipe borne water. The

United nation requires that all citizens in the country should access safe drinking water and adequate sanitation facilities by 2015. The NWSDB has estimated that the investment requirement of the water supply sector up to 2010 would be Rs. 140 billion.

In Sri Lanka large portion of pipe borne purified water is used for toilet flushing, washing of clothes and other cleaning activities such as vehicles, machineries and equipments etc. Specially, in major institutions and industries where large number of people visit for work and day to day personal matters have to be provided with mainly wash room facilities where thousands of liters of pipe borne water is wasted daily due to carelessness and negligence.

Let us consider what is happening to the water resources in Sri Lanka. In many ways water resources are depleting due to adverse impacts of the present activities taking place in the name of so called economic development

As mentioned above, along with the infrastructure development and expansion of settlement there are large extent of lands became under land clearing and or reclamation and development. These activities are much adverse to the ground water resources. The low lying areas natural functions were retarded due to destruction to flood detention and storm water collection and limitations to seepage that water in to ground and not allowing recharge of aquifer has created a situation of availability of less ground water quantities.

Labour force

As visualized in the table below there are a large number of industries established throughout the island and commence implementation of activities. In considering the labour force many thousands of liters of water used for washing and cleaning. Similarly, many factories which are using water for their production process finally discharge in to the environment. Of these factories many are dis-

charging waste water without any treatment and releases chemicals such as arsenic, cadmium, chromium, mercury, nickel, copper, lead and zinc and other toxic compounds. This would leads to pollute water ways as well as reducing available utilizable ground water. Best example is Ratmalana industrial zone which consist of large number of chemical and other types of production industries such as textile dying, paints and asbestos etc. Today ground water pollution level in Ratmalana is very much adverse. There are many studies carried out by various agencies indicated that in Ratmalana area ground water contamination is very much adverse and suggested to implement central purifying treatment plant in order to arrest further pollution. However, due to inefficient and backward beaurocratic system, funding allocation for treatment plant for Ratmalana was not seen the day light. Now the situation is worse due to escalation of costs and devaluation of rupee in the world market those costs cannot be bare up. One better known another example is faecal contamination and agrochemical leaching in to ground in Jaffna district there is a disease called Blue baby syndrome among the users of contaminated water.

Specially, shrimp farming in puttalam/Chilaw area is also another example. We have the experience of higher levels of unrestricted water uses. even ground water pumping and discharging of polluted water to the surrounding environment. Ultimately it was ended up with destruction to the industry as well as total destruction of environment affecting to the peoples livelihood.

As a result total collapse of prawn farms were taken place and recovery of previous environmental condition was also became impossible. Prawn farming was one time very much lucrative business and attractive investment. However, within few years later it became an uncodosive and unprofitable venture. Not only these shrimp farms were unsuitable for aquaculture farming, but also any other type of agriculture practices or any other types of plantation. At present these lands cannot be utilized for any other types of viable economic activities.

This shows that due to prawn farming activities both surface water and ground water became contaminated in Chillaw, Mundalama areas.

Dumping of waste is also an adverse impact to the water resources. most of the occasion many factories discharge most of their solid wastes to the marshy or

reclaimable low lying areas. Specially due to leachet flowing or seepage as well as decomposing of waste to the sub soil, that ground water contamination take place. Most of our local authorities are indiscriminately discharge waste including hospital wastes without any sorting out and no proper records about those areas or records about dumping grounds. After certain years, which would lead erupt to an unknown reasons for diseases or some kinds of environmental disastrous situation. Then people may try to find facts as to what has happened but no body would be able to find the exact reason.

By that time there is no remedies or rectification measures for averting the adverse impacts. E.g. Japanese mercury poisoning and mina Mata diseases discovered after many years of suffering by thousands of people.

In addition to the above there are many other sources of pollutants such as agro based chemical such as carbafuran and other types of weedisides and fertilizer nutrients dissolve in to the water resources. Algae formation in number of reservoirs is a common example to show the pollution level. Specially, Kotmale reservoir has badly developed algae formation during dry seasons.

At the same time large number of hotels and restaurants are another sources of pollution, discharging waste to the environment specially affecting the water resources. At this point it is important to mention here that the reduction of reservoir capacity due to siltation is also alarmingly concerned by authorities as it is again affecting to reduce water retention capacity of the reservoirs.

Water bodies

Throughout Sri Lanka, there are a large number of water bodies already polluted due to discharge of domestic, industry, hotel and hospital effluent, agriculture chemicals, fertilizers and solid wastes. It is very commonly known factor that Beira lake, Kandy lake and Lake Gregory, Negombo lagoon and so many other water bodies seriously polluted and very difficult to rehabilitate to the natural state. As a result not only surface water bodies but also ground water resources too affected.

Similarly the development of modern irrigation system as well as concrete canals and drains are also adversely affect to the depletion of ground water resources due to non availability of seepage in to the ground soil.

Water Supply by National Water Supply and Drainage Board

	2004	2005	Growth Rate	2004	2005
Total number of water supply schemes	284	291	2.5		1.4
Total number of new connections given during the period	58,781	66,117	18.1		12.5
Total number of connections (as at end yr)	841,505	907,662	7.5		7.9
Total water production (Mn., Cu., Mtr.)	368	383	3.1		4.1
Unaccounted water %					
Greater Colombo	36.5	35.9	-1.2		-1.7
Regions	29.6	30.9	-4.7		4.3

Source: Central Bank 2005

Continued on page 38

Rainwater ... *Continued from page 35*

Therefore storm water straight away flowing in to the rivers and to sea. No body is able to utilize storm water like most of the developed countries use and recycle these water for many other uses. On the other hand there are certain factors to be considered in relation to storm water. Specially our road network consist of many thousands of Kilometers. The storm water flowing along those roads are polluted due to dissolving of various substances, such as tar and waste oil dropped on the road from the vehicles. This polluted water goes in to the water bodies canals and rivers.

As mentioned above, up to 2006 Central Environmental Authority (CEA) has issued Environmental Protection Licenses (EPL) which details are as follows:

Site clearance for industries from 1990 to 2006 = 5,701

EPL issued in 2006 including renewals of 1351 = 2,129

Application for EPL 2006 = 3,035

(These figures are inclusive of high, medium and low polluting industries scattered around the country).

According to economic performance indicators the annual mining sector development is also a major contributor to the economy. Mainly gem mining is encouraged to increase foreign income earning. Mining sector includes gem, sand and other minerals, clay and quarry etc mining. Specially gem

and mineral mining process are involve removal of ground water and as a result depletion of water resources affecting the bio diversity too. There are many instances of reduction in ground water level, during minor dry period even drying of lands and dieing of plants and such symptoms specially in Ratnapura district which is mainly a wet zone with high level of ground water resources. At the same time unattended pits are become as origin of mosquito breeding and spreading so many diseases. Also these pits are the causes of land slides and earth slips specially in hilly areas. In Gampaha District along Maha oya sand mining and clay mining has been destructively developed. Even in Kelani river and many other main rivers are badly damaged due to rapid level of sand mining. As a result it is clearly visible that river beds lowering and saline water intrusion in to the inland areas. Also there is another problem along coastal belt low land areas lanward salinity. This is mainly because of obstruction of land ward fresh water flow due to adhoc construction and filling of marshy lands without proper management measures. We can see most of the coastal areas specially Southern, Western and North western belt have been affected due to salinity intrusion. In view of this adverse impact there are changes in biodiversity and many other human activities.

Geological and geographical set up of Sri Lanka is also influenced to its water availability. Many of the hilly areas are not possible to access water easily due to non retention of water and deep in ground water table. This may be due to forest clearing, soil erosion and destruction of water sources. In some remote settlements of Kegalle, Kandy and Matale districts are having general feature of hilly condition and it is difficult to retain water in those hilly areas. People who are living in those areas are confronted with many hardships for fetching water for day to day water requirements. Some villages of Anuradhapura, Puttlam and Hambantota districts are confronted with seasonal dry spells. Also certain areas of coastal belt are confronted with water scarcity due to salinity intrusion.

Availability

Having considered the facts mentioned above, we can visualized the main features of water availability and the condition of water resources in Sri Lanka. It is an eye opener to our decision makers and policy makers at least to act promptly and quickly to develop a mechanism for best use of roof rain water which is a gift from the nature. Roof water collection means getting clean water just from out side their door step. It reduce arduous method and time spent for fetching water. It is eco-

nomical and ensure health and sanitation of the family, specially in the areas of lime mixed and water containing of high fluoride etc. substances.

There are very few studies to examine the economic issues involved in conservation of water resources mainly through Roof Rain Water Harvesting (RRWH) in Sri Lanka. Roof rainwater collection was a very primitive and isolated method until recent time.

This forgotten resource of RRWH has received considerable attention during the period of mid 1990s within the water shortage districts of Sri Lanka. During the past few years RRWH were evolved as a result of various studies as well as development of various technical inputs due to recent efforts of both government and non government organizations and several groups of innovative communities.

However, it was given a much less emphasis towards the impact of harvested RRW consumption. Many developed countries such as Germany, USA and Asian region countries such as India have given much attention and priorities for collection of rainwater for domestic uses.

Therefore, it is vital to consider Economic Valuation (EV) and benefit analysis to the rural and urban livelihood as well as to the society as a whole. If we consider these benefits and values of savings which is beneficial in many ways.

Through rainwater harvesting it is beneficial individually and as a family in many ways. Those benefits have to be calculated separately taking in to account that labour time savings, health, medicine and many other components in order to show costs and benefits individually and the society as a whole.

Like any other goods in the market there can be main three categories for rain water harvesting system such as demand, water collection and storing and distribution or reuse system. RRWH can be simple or complex system depending on the requirement and the severity of the water scarcity to be addressed. Rainwater harvesting cost calculation can be done in consideration of materials used for this purpose.

It's main costs include labour charges and materials such as gutters, down pipes, filters (not very complicated ones) and water retention tank (capacity/size according to the daily and monthly requirements). If any one is not happy to use rainwater for drinking purposes or required to use rainwater as separately then water pump together with separate overhead tank. These costs can be recovered within very short period as the water supply is exclusively free and no water bills or no hazard for fetching of daily water requirements. Also no hazard of salinity, chemical, toxic or harmful external particles and as a result it save medical or medicine cost for dis-

eases and labour time savings for people to engage in other activities. An average calculation shows that 30 to 50 percent water is used by consumers for toilets flushing and gardening including washing utensils and cars etc.

According to the 2005 water supply data, this waste water quantity is equivalent to approximately 100 m. cu mtrs. which is equivalent to Rs. billions in monetary terms. On the other hand rainwater is the best source of water for plants because it is free of salts and other minerals that can be harmful to root growth. Therefore use of free rainwater can reduce the use of drinking water unnecessarily and massive cost to the government to supply purified costly pipe water.

It is also support to reduce dependence on ground water and some what control of off site flooding as well as erosion.

This mechanism has been successfully implemented by the Japanese through their rainwater programmes. Rainwater harvesting can be incorporated to large scale water uses such as schools, temples, Government buildings, meeting halls and places where large gathering in the Parking sites, pavilions and other complexes etc.

supply system in order to utilize them mainly for toilet flushing and gardening. On this purpose it can be suggested to incorporate at the planning stage or in to new landscape during design phase.