

Role of sustainable drainage systems in managing floods

The floods that occurred in the Western Province in May this year caused havoc in the lives of many of us living in the Western Province. Urban flooding is becoming more and more frequent, and the impacts such as disruption of transportation, inundation of houses and property, loss of human lives, loss of plants and animals like our cultivation, livestock and wild life, erosion, pollution, threats to public health due to contamination of water supplies and food and so on are affecting our personal lives as well as the national economy.

According to a recent World Bank publication titled "Cities and Flooding: A Guide to Integrated Urban Flood Risk Management for the 21st Century", in 2010 alone, 178 million people were affected by floods, and it states "Urban flooding poses a serious challenge to development and the lives of people, particularly the residents of the rapidly expanding towns and cities in developing countries."

The occurrence of floods is known to be the most frequent among all natural disasters.

Throughout the world economic losses due to flooding keep increasing over the years. This can be attributed to the fact that flooding is occurring more and more in the urban areas, where the concentration of population and assets is much higher than in the rural areas, making damage more intense, and more costly.

Thus there is no doubt that Flood Prevention, Protection and Mitigation need to be given high priority in the national development agenda of most countries.

We all know that as the rainwater flows over land to the streams, the flow in the streams increase, and the increasing stream flow causes the water level to rise. In the downstream areas of the stream, the effect of rainfall in the upper catchment can be seen as an increasing water level, until it reaches a peak level, and then after the rain ceases, the stream water level also subsides. Flooding takes place if the increased water level overtops the stream banks. Another way in which flooding takes place is if the rainwater does not get soaked into the ground or flow away fast enough, so that the ground gets ponded up.

Managing floods

Obviously, we cannot regulate the rainfall as we would like, so we need to look for ways and means of preventing floods, protecting the vulnerable elements and mitigating the impacts caused by floods.

The conventional way is to improve the drainage paths downstream, by dredging and widening the streams, canals, culverts and other structures, so that they can accommodate the peak flow without inundating the ground.

If canals are not feasible, we

design the drainage system to take the rainwater through underground pipe systems, for example by micro-tunneling, as fast as possible, to the sea, to prevent the flooding of urban areas.

In all these interventions, the main objective is to get rid of the water, and discharge it to the sea as soon as possible.

Are we doing the right thing?

I believe this is not how we should be managing the situation. People in many countries are exposed to water stress, and the situation is getting worse as the years go by. Sri Lanka is not an exception. Climate change impacts are likely to aggravate the issues. Fresh water is such a precious resource, can we afford to 'get rid' of it in order to protect ourselves and our properties from flooding?

This brings to mind a statement made by King Parakramabahu the Great, one of the greatest kings who ruled Sri Lanka in the 12th century A.D. "Not one drop of rain water shall reach the sea without putting it to good use".

Isn't this statement more relevant now than it was nine centuries ago?

It seems that we are not doing the right thing now. When flooding takes place, our solution is to dispose of the water as fast as possible, unconcerned about the fact that it is the very same rainwater that maintains life, provides food and amenity value for us, and nurtures the biodiversity that enriches the environment.

So isn't it the sensible thing to make use of the water as much as possible before discharging it into the sea? The ancient Kings would not have called it by that name, but for all intents and purposes, what is advocated in the above statement is, in fact, 'Sustainable Drainage'.

What is Sustainable Drainage, then?

In brief, 'Sustainable Drainage' is the management of surface water for maximum benefit.

The main design philosophy for Sustainable Drainage Systems (SuDS) is "Use surface water runoff as a resource".

- SuDS design concepts include
- Manage rainwater close to where it falls
 - Allow rainwater to soak into the ground
 - Promote evapotranspiration
 - Slowing and storing runoff to mimic natural runoff characteristics
 - Reduce contamination of runoff through pollution prevention and controlling the runoff at source
 - Treat runoff to reduce risk of urban contaminants causing environmental pollution

Many types of interventions are being used as Sustainable Drainage Systems.

Some examples are:

- Rainwater harvesting
 - Green Roofs
 - Pervious pavements
 - Bio-retention systems including rain gardens, to collect the runoff, allowing it to pond temporarily before filtering through the vegetation and underlying soil
 - Planting trees, which reduces the runoff due to evapotranspiration, at the same time providing shade and habitats to protect biodiversity
 - Swales, which are low tracts of land planted with marshy vegetation often designed to manage water runoff, filter pollutants and increase infiltration
 - Detention basins, ponds and wetlands designed to slow the flow of water, store and treat runoff while draining it through the site and encouraging biodiversity
 - Soakaways and infiltration basins that promote infiltration as an effective means of controlling the runoff and supporting groundwater recharge.
- There are systems that will work on any type of terrain, soil type or plot size.

While implementation of SuDS at household level is much less complicated, implementation at catchment or sub catchment level requires studying the rainfall-runoff characteristics of the catchment, similar to the conventional calculations.

Models such as SWMM's LID

(Low Impact Development) Control Editor incorporate provisions to assess the potential of SuDS interventions in storm drainage design.

This type of modelling techniques help us to select the most appropriate Sustainable Drainage System and the extent of the intervention needed to retrofit SuDS into existing systems, or, to design the storm sewers to discharge only the amount of rainwater that cannot be managed by SuDS

Interventions.

Design and Implementation Manuals are readily available for SuDS interventions, which of course need to be modified or adapted for local conditions. New pervious pavement materials are being developed, and the indigenous knowledge is also available for implementing these interventions.

It is high time that we take SuDS very seriously, and integrate them into our drainage system designs, before we find ourselves in a situation where we throw the rainwater into the sea to prevent flooding, and then use expensive desalination processes to get back the fresh water from the sea.

(This is a continuing series on articles of national importance provided by the Institution of Engineers Sri Lanka - IESL. The writer is also a Vice - President of the IESL and any comments on this article should be sent to es@iesl.lk)



File picture of garbage at Meetotamulla. Garbage clog drainage systems.

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