MANAGING SINGAPORE'S EROSION PROBLEM FOR SUSTAINABILITY

ER YAP KHENG GUAN
Director, Public Utilities Board
Singapore

Singapore has to manage the environmental impact and hence the environmental sustainability of our projects due to rapid urbanisation, for the sake of the future generations to whom we need to bequeath a cleaner and greener world.. Although Singapore is an island, we have some valuable waterways like the Singapore River and Kallang River, which have been beautified over the years. Many of our canals have also been softlined. People can enjoy cycling and strolling along our park connectors or enjoy the mangrove swamps at Pasir Risk Park. Property values have risen along our waterways as increasingly housing projects are designed to take advantage of the water. We have a collective responsibility to preserve these valuable national assets. Controlling erosion on urban sites, particularly during and after construction, is one huge challenge for us. Runoff from construction sites is the major source of sediment in an urban area. As the responsible government agency, Public Utilities Board (PUB) cannot be effective in solving the problem just by regulation alone. What is needed is for the industry to take ownership of the erosion and sediment problem. We are actively working with our 3P (people, private, public) partners to make it a vibrant waterbody which can be shared and enjoyed by all.

1. INTRODUCTION

The Public Utilities Board (PUB) will be constructing a Barrage across the Marina Channel. The Marina Barrage project is a uniquely Singapore 3-in-1 initiative. It is not just a simple dam, but will achieve three objectives: to create a new reservoir to augment our water supply, to act as a tidal barrier for flood control and the new body of freshwater at constant level will be a major lifestyle attraction of our city centre.

1.1 Water Supply

When the Barrage is completed in 2007, it will keep seawater out of the Marina Basin. Over time, the water within the Basin will turn into a body of freshwater. This body of freshwater will augment the local sources, which is one of the four national taps contributing to Singapore's water supply. Our water catchment areas will then increase from half to two-thirds of Singapore.

Water from this reservoir will be treated using advanced membrane technology. This ensures that the water is safe for drinking and also allows us to be more liberal in allowing land and water-based activities within the catchment. Recognising that the basin is an important body of water in the heart of the city, existing activities such as canoeing, skiing, water taxis and duck tours will continue with proper pollution control and navigational safety.

1.2 Flood Control

There are pockets of low-lying areas in the city. These areas are below or slightly above high tides and are therefore prone to flooding whenever heavy rain coincides with high tides. The proposed barrage will act as a tidal barrier to keep out high tides, with floodgates and pumps to release excess stormwater during heavy rains.

The barrage, which comprises inflatable dams and steel gates, will be built across the 350m wide Marina Channel to keep out sea water. The inflatable dams and steel gates are non-obtrusive and are easy to operate. During heavy rain, the steel gates and inflatable dams would be lowered to discharge excess stormwater to the sea. However, when it is not possible to do so during high tides, the excess stormwater will need to be pumped out into the sea.

1.3 New Lifestyle Attraction for the City

The Downtown at Marina Bay is envisioned to be a lively, vibrant and exciting waterfront destination. Marina Bay and the adjacent promenade areas have already been successfully used for activities such as the F1 Power Boat Grand Prix, outdoor concerts and dance parties, and arts and cultural events.

With the expected completion of the Marina Barrage at the mouth of Marina Channel in 2007, the Bay will be suitable for staging water-based events and performances, and international water-sport competitions. The consistent water level in the Marina Basin will enhance its value as a recreational resource for Singaporeans and tourists. Recreational activities such as power boating, pleasure boating, canoeing, kayaking, sailing, water skiing and wind surfing, can also take place, in addition to the water taxis and pleasure cruises that ply the area today.

2. Our Challenge – Soil Erosion!

To realise this vision, one of our challenges is to control erosion from construction sites.

Runoff from construction sites is the major source of sediment. It is very difficult to control soil erosion in tropical areas because the climatic and geologic conditions are of extraordinary complexity. Precipitation is generally very superior in magnitude and intensity to that of temperate areas and the climatic fluctuations as “El niño” are very well marked.

3. Best Management Practices

Controlling erosion on urban or suburban sites, particularly during and after construction, is a common problem. Non-point source pollution can be addressed by the use of Best Management Practices, which include securing silt fences or temporary diversions around the perimeter of the land-disturbing activity, leaving a few feet of vegetation along the outside edge of the site for a "filter strip". However, it is important that the erosion and sediment control structures are installed and maintained in accordance with local jurisdictions, manufacturers' specifications or engineering drawings to be effective.
Limiting the loss of soil during construction can be achieved through a combination of erosion control (stopping soil erosion at the source) and sediment control (trapping soil that has eroded before it leaves the site) practices. Therefore, an effective Erosion & Sediment Control must comprise 2 aspects:

3.1 Erosion Control

It is much easier and more cost-effective to prevent erosion than to trap sediments after erosion has taken place. The following are some good erosion control management :

a) to sequence and schedule the earthworks / demolition works in stages and progressively with the subsequent construction activities and building works
b) to minimise site disturbance by keeping site clearance works to a minimum by retaining as much of the existing vegetation as possible
c) to pave up the bare surfaces and all construction access by concrete or milled waste or other suitable materials

d) to turf up the bare surfaces immediately in an earthwork / demolition work if there is no subsequent construction activities
e) to protect the bare slopes/surfaces by close-turfing, cementitious spray / grouting, canvas sheet or erosion control blanket

Temporary covers /seedings during construction or while individual lots wait for new stages is an excellent way to control soil erosion.

f) to protect the earth stockpiles by canvas sheet or erosion control blanket

3.2 Sediment Control

After achieving minimum bare earth surfaces, sediment control facilities must be put in place to capture the sediments washed down from the construction sites. Some of these sediment control measures and facilities which must be in place before the works start shall include the following:

a) to provide concrete cut-off drains along the perimeter of the construction sites.
b) to provide silt fence properly installed and embedded onto the ground along the perimeter cut-off drains

A silt fence is used to slow down water so it can filter out the sediments carried in the water. They are not intended for a large drainage however and can become overwhelmed. Proper installation and maintenance is essential if it is to be effective.

c) to provide sedimentation basins/tanks of adequate size and sufficient numbers along the perimeter cut-off drains and before the discharge points into public drain

Sediment basins are an excellent way to trap large volumes of sediment. Unlike silt fence, basins can be designed to handle a large drainage.

4 Our Approach towards Quality Water

For many decades, the Government has put in many programmes to clean up and beautify our rivers. Today, Singaporeans enjoy clean and aesthetic waterways, such as Singapore River, Kallang basin. While our rivers are clean most of the time, we still see them turning brown after rain.

As the responsible government agency, PUB cannot be effective in solving the problem just by regulation alone. Enforcement action taken against silty runoff from construction sites is not practical or cost effective in the long run. What is needed is for the industry to take ownership of the erosion and sediment problem.

Our sustained publicity programmes include :-

a) Create awareness

- Pre-consultation
- Public education

- Website
- Advanced technologies

b) Promote ownership in the construction industry

- Contract clauses & BQ Items
- Industry's training eg. seminars & workshops
- Erosion Professional Courses
- Certification of Engineers

We are actively working with our 3P (people, private, public) partners to make it a vibrant waterbody which can be shared and enjoyed by all. The success of this 3-in-1 project requires everyone to do their part in keeping the basin clean and beautiful.