

# **Integrating Drainage, Ecology and Recreation in a Campus River: A Case Study of International Islamic University**

## **ABSTRACT**

This paper describes the planning, design and construction of multiuse drainage facilities of Sungai Anak Pusu which runs across the central campus of the International Islamic University of Malaysia in Gombak. The Master Drainage Plan provides for the best management practices (BMPs) that provide retention ponds, detention facilities for surface runoff, open space, recreational greenway corridors and riparian habitat. This campus is one of the first local institutions of higher learning to implement a comprehensive plan for quality enhancement of the drainage system for a campus river. Under the plan, all surface water is routed through specially designed extended detention basins prior discharge into the receiving river. Selected stabilization measures are used along the river to preserve their natural character, ecological aspects and to provide recreational facilities.

**KEYWORDS:** drainage, ecology, greenway corridor, riparian vegetation

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INTRODUCTION

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One of the encouraging developments within the university campuses in Malaysia is the effort of the campus planning committee of the International Islamic University of Malaysia (IIUM) to integrate the tributary of the Gombak River into one of the important features for the benefit of the campus population. The campus at Gombak occupies a total of 283 hectares (710 acres) in a watershed area. It was completed in 1996 and is the smallest among the five campuses (the others are in Kuantan, Petaling Jaya, Janda Baik and Lembah Pantai). This campus offers five disciplines of study i.e. Law, Economics, Engineering, Medicine and Architecture and Environmental Design. The campus consists of academic buildings along the riverbank and residential colleges for single students at the fringe of the hills. The Dean of Architecture and Environmental Design was appointed the campus Development Director and he was responsible in overseeing the construction of the campus buildings and the proper channeling of the campus river.

## ISLAMIC PRINCIPLES

In designing the river drainage the Development Director places two important Islamic principles the basis for campus planning: caring for the environment and consideration for the neighbours. These principles were incorporated in the campus master plan with the following objectives:

- Eliminate potential hazards to life and property from flooding
- Improve the water quality of surface runoff
- Preserve the floodplain as natural drainageways
- Utilize the river for recreational and open space purposes
- Enhance the scenic views along the campus river
- Enhance the river banks with riparian plantings to improve the ecological planning aspect
- Provide the campus population with a nature and river walk for their benefit

To achieve the objectives of the master plan, the river was designed into two parts: the detention basin and the drainageways. These two parts were located at several selected locations along the river.

## DETENTION BASINS

The primary objective of the detention basin is to mitigate the increased runoff from the built-up areas in the campus and safely convey this runoff downstream to Sungai Gombak in a manner similar to the historic basin conditions. Several detention basins were located close to the residential colleges (Mahallat) and main faculty buildings (Kulliyah). These basins collect and store water before being released to the river channel. Within the detention basins, suspended solids are retained as a sequence of slow water velocities and long residence times. These suspended solids removed periodically along with silt and sand by local contractors needing these materials for use elsewhere. The construction of these basins will help to reduce the 10-yr and 100-yr flood. The local villages located downstream will not be affected by sudden flooding during the heavy downpour. Other functions of the basins include the following.

1. Act as ground seepage and for slow release of water.
2. Clean the water by separating mud and silt and depositing at the bottom
3. Act as a reserve for mud and silt to be excavated periodically at a nominal fee
4. Act as a natural hydrant in case of fire
5. Act as a reflecting pool for aesthetic purposes
6. Recreation facilities for boating and swimming excess water for students need during dry period

## WATER QUALITY

An important goal of the Sg. Anak Pusu drainage master plan is to improve the water quality of storm-water runoff from the built-up areas of the campus and other areas on the outskirts of the campus. Sg. Anak Pusu is recognized as an important natural resource to the community it they must be protected. The master plan requires that all developed condition runoff, to the maximum extent possible, be conveyed to a detention pond facility before being released to Sg. Gombak. The detention ponds serve a dual purpose of quantity and quality control of excess runoff. Two types of storage facilities have been constructed: (1) wet ponds with permanent pools that are typically 1.8m (6ft) deep; and (2) wetland ponds with shallow pools and wetland plantings at the bottom. The quality of the runoff water released from the quality/storage facilities is improved through a sedimentation process. A “water quality capture volume” is determined based on the volume of runoff from the 80<sup>th</sup> percentile storm event,

depending on the impervious area of the upstream basin. Because of the distribution of rainfall events, treating the 80<sup>th</sup> percentile runoff event is estimated to remove between 80% and 90% of the annual total suspended solids. The water quality volume is typically detained in the initial 0.45m (1.5ft) of depth above the permanent pool or wetland bloom and slowly released over an extended period of time through small orifices in the water quality outlet structure. The orifices are spaced apart to avoid concentrated flow and to maintain very low velocities across the pond so that small particles of sediment will settle out. The water quality volume is released over a period of 24h for a facility with a wetland bloom. In addition to aiding the sedimentation process, wetland plantings along the river will contribute to the treatment process through removal organisms. Wetlands established along the drainageways provide similar treatment benefits and wildlife habitat within the campus open-space corridors.

## PRESERVATION AND STABILIZATION OF DRAINAGEWAYS

Preservation and stabilization of the drainageways is essential to protect property from potential damage caused by channel erosion, and to prevent downstream water quality problems created by stream degradation. The plan for Sg. Anak Pusu is to preserve and maintain the natural drainageways as much as possible, and install low-flow check structures and selective bank protection where needed to maintain the integrity of the drainageways. The check structures are constructed of concrete embankment in certain parts of the river. These embankments are designed to appear as natural features along the channels. The check structures control the longitudinal gradient of the low-flow zone of the drainageways, while allowing the less frequent, larger storm events to flow in the riverbank areas of the main channel on the steeper gradient. Since most of the stream erosion occurs in the low-flow zone and is caused by the more frequent smaller storm events, the approach is to control erosion caused by these smaller flood events, realizing that some damage may be sustained during the larger flood. A secondary benefit of the check structures is the preservation of existing wetland areas. Because of their relatively small size, check structures can be installed within existing channels with minimal disturbance to adjacent wetland areas. The checks are designed to create shallow pond areas upstream of the crest, which promotes development of new wetland areas in a short time. Where the existing stream is too steep or where it is already experiencing severe head cutting, grass-lined channels

will be constructed. These channels will be designed to carry the 100-yr flood discharges and will have trickle channels to carry low flows.

#### MULTIPLE USES OF DRAINAGEWAYS

The concept of multiple uses of drainageways has become the approach for modern drainage design. The rationale for multiple uses of drainageways includes decreased costs and increased campus community acceptance. By preserving the natural drainageways and developing walkways and parks in conjunction with storm-water detention ponds, development costs can be reduced for open-space recreation. At the Gombak campus development the natural streams and detention ponds not only serve their drainage and flood-control function, but also provide water quality treatment (as discussed earlier), enhanced wetland growth, recreation and open-space amenities and wildlife habitat. In times of drought or water shortage, this river provides a continuous supply of water for the students living in the residential colleges.

#### ENHANCEMENT OF SCENIC VIEWS

The Sg. Anak Pasu landscape provides a unique natural and scenic view. There are swathes of flood plains, still water and gliding water flow that carve an ecological and scenic view of the river. This is complimented by some of the administrative buildings having its frontage facing the river. Also some of the buildings have double frontage where the frontage facing the river has large glass windows for viewing purposes.

#### RECREATION AND OPEN SPACE

The drainageways within the campus is being developed into greenway corridors with paved trails that meander throughout the development. The greenway trails provide pedestrian and connection between the residential colleges and the academic buildings. Detention ponds are the focal points in many of the trails, providing passive water features that complement the park setting. Certain parts of the detention ponds are made available for the university's kayaking club as part of the extra-curricular activities of the campus. The separation of the campus building by this river space has also acts as natural firebreaks.

#### WILDLIFE HABITAT

Sg. Anak Pusu has become a major form of low-cost recreation for bird watchers, nature lovers, walkers, picnickers and students between lectures. By preserving and stabilizing the natural drainageways and increasing wetlands and other native plantings, wildlife habitat is enhanced along the greenways and parks. Grasses and wildflowers of varied growth heights provide cover and home for bees, butterflies, dragonflies and birds. Shrub plantings also serve as additional cover and food source for ground-dwelling wildlife and birds. Tree plantings provide cover and offer nest sites for birds and squirrels. The streams and ponds support ducks, frogs and fish. All of this adds up to an exciting and varied “watch-able wildlife” environment within the campus community.

## SUMMARY

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Over the years the authorities and publics are increasingly seeing rivers as assets rather than just storm water drains and collection ponds. IIUM is the first university in Malaysia to harness a natural flowing river to be incorporated in a campus design for the benefit of the students and staff. The benefits are in the form of fire breaks, adequate water supply for fire fighting, campus walk and a comprehensive plan for quality enhancement of urban storm-water runoff. Selected stabilization measures are used along the channels to preserve their natural character and maintain stability.

The five example by IIUM is developing the Campus River is part of the assets being fully utilized for the benefit of man nature. The Sg. Anak Pusu of IIUM drainageways development has been established to provide an attractive and significant impact in the campus community. The significance of this river will help to conserve a well-balanced reserve of “green lungs” as sources of water pollution filters and buffers for the sustenance of the overall development of the campus environment. The multiple-use concept enables the stabilized waterways and detention ponds to provide water quality treatment, recreation benefits and enhanced wildlife habitat. Also the application of Islamic principles to the aspect of drainageways form part of the basis for campus planning: caring for the environment and consideration for the neighbours. This will provide an added environmental quality for the benefit of the student population. Concerted efforts are needed to maintain this development for the benefit of the future campus community.

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