MICROBE-LIFT® Technology Restores River in the Heart of Kuching City

Location: Sungai Bintangor River, Kuching, Sarawak, Malaysia

Background:

Sg. Bintangor is situated in the heart of Kuching City. The river is about 0.65km long and 12-15m wide, forming as a tributary of the Sarawak River. It passes under a protocol road in Kuching and flows through Kpg. Masjid in Satok before joining the Sarawak River.

During high tide, the Sarawak Barrage at Sg Sarawak is closed to prevent the ingress of seawater; the water in Sg. Bintangor is relatively stagnant. During heavy rains, the barrage is opened to prevent flooding.

On dry days, the water may eve n back flow from Sg. Sarawak when the barrage is closed as the water level in Sg. Sarawak rises faster than Sg. Bintangor due to rainfalls around the catchment area. During heavy downpour and low tide, the flow in Bintangor can be quite fast and the water is discharged within a few hours. The average depth of the water ranges from 0.5 to 1.5m.

The river emits foul odors, which are clearly noticeable at the protocol road located above the river. The pollutants include solid wastes, animal and fish entrails, household garbage, oily and greasy scum and food remnants from surrounding eateries, workshops, and paint. It is a repulsive sight that adversely affects tourism. In addition, the dirty waters represent hygiene and health hazards. Of obvious hygiene concern, the dirty water also supports the breeding of harmful insects, such as mosquitoes.

A clean river is of paramount importance to blend in with the newly developed Sungai Bintangor riverbanks. At a recent survey of the catchment area of Sg. Bintangor, we found that the main pollutants came from four locations. These include food and sewage waste from the food courts, restaurants, hotels, lodging houses, housing estates, and the many makeshift food stalls along Jalan Nanas, Jalan Rubber, Jalan Satok, and Jalan Kulas.

One of the worst polluters is the Wet Market at Jalan Satok where a lot of animal and fish blood and entrails, left-overs, and vegetable and fruit wastes are simply flushed down drains without any type of filtration or grease traps.

Although most of the larger solid wastes are collected in rubbish bins provided by City Hall, most of the smaller and wet, untreated and unfiltered wastes, oils and greases, are washed down the culverts and storm drains, eventually ending up at the weir areas of Sungai Bintangor. Most of the time the weir area is covered in an ugly layer of smelly, dirty, and unsightly layer of grease scum.

Fig 1 & 2: *Pictures of Sg. Bintangor during low-level time prior to treatment in November 2007.*

This is a very difficult remediation due to the very high level of contamination and the lack of retention time for biological treatment.

Objective:

Any successful remediation of this site has to be two-phased. The city is challenged to change practices of those discharging into the river while a program of bioremediation with MICROBE-LIFT® Technology was designed to help remove scum and soluble organics in the river stream. Due to the very low retention time in a flowing stream, AEM designed a system of biomedia cages which were installed at the weir area and at strategically located points along the full length of the river to retain as much microbial biomass as possible during heavy rain and in the presence of high and ebbing tides.

A permanent weir had been constructed at the upstream section of Sg. Bintangovr near the road bridge to trap solid debris. The weir maintains the water level upstream at about 1.5m depth consistently and prevents the inflow of water from Sg. Sarawak. The water upstream the weir serves as an ideal location for the incubation of bacteria

Sometimes during thigh tide, the incoming water back-flows over the weir and at ebb tide, some floating debris and greasy scum trapped on the weir and not removed by the contractor, is carried over the weir and into Sarawak River. At certain times there is ingress of wastewaters from Sg. Sarawak into the Sg. Bintangor during high tide. This brackish water at the mouth of the river emits foul odor due to the untreated wastewaters from other tributaries discharging into the Sg. Sarawak. To prevent this malodor, all wastewaters discharging into Sg. Sarawak must be treated also.

In addition to inoculation with MICROBE-LIFT® technology, the treatment included use of BioAktiv, an oxygenation chemical to assure adequate aeration. Inoculation commenced on 1st December 2006 according to the dosage schedule listed below.

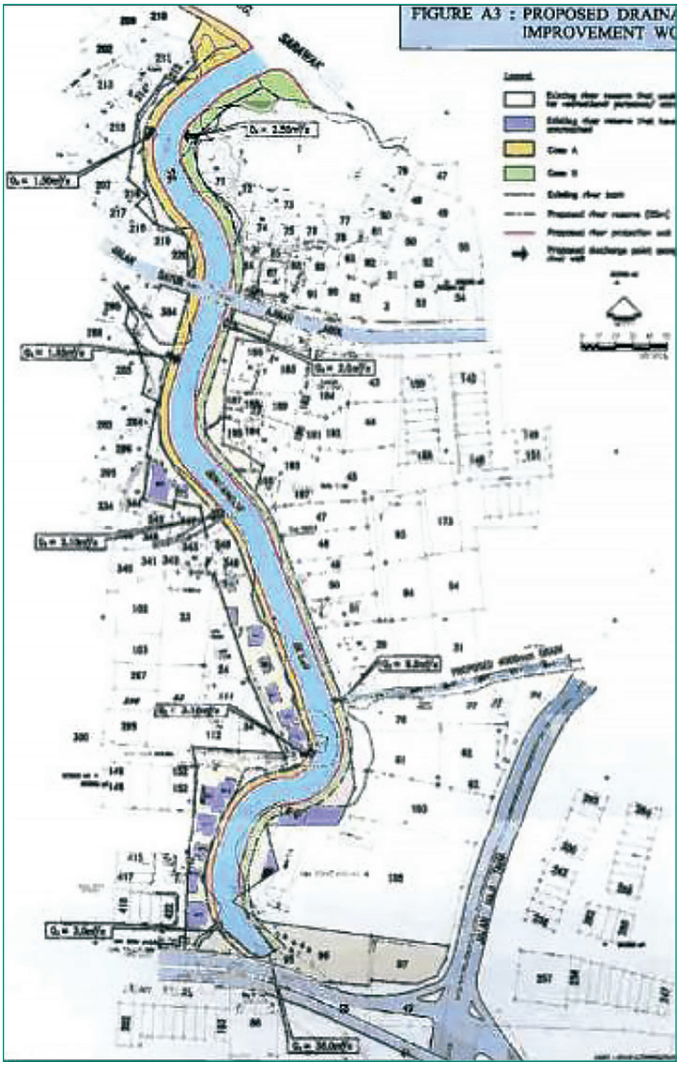

Fig.4: *Shows the installation of the biomedia cages in the river.*

Treatment

Date	Microbe-Lift® (gal)	BioAktiv (kg)	Remarks
12/01/2006	30	10	Inoculation dosing along the complete river.
12/02/2006	10	10	
12/03/2006	10		
12/04/2006	10	10	
12/05/2006	10		
12/06/2006	10		
12/07/2006	10	10	
12/08/2006	7		On the 8th day, 90% of the whole weir area was covered in a grayish and wrinkled layer of bubbling scum indicating active microbial in action. On the 9th day, bad odor was reduced by about 60% and surface scum at weir reduced by 50%.
12/09/2006	7		
12/10/2006	7		
12/11/2006	7		
12/12/2006	7		
12/13/2006	7		
12/14/2006	7	10	By the 14th day, bad odor has completely disappeared. Water after the weir turned greenish and cleaner, greasy scum reduced drastically. Lots of small bubbles were seen all over the weir area. Small fishes and marine creatures were found swimming along the river, especially at the weir area.
12/15/2006	7		
12/16/2006	7		
12/17/2006	7		
12/18/2006	7		
12/19/2006	7		However, as commercial solid debris continued to be dumped into the river and accumulate at the weir area, part of the dosing exercise was diverted to waste-water source further upstream.
12/20/2006	7		
12/21/2006	7	10	
12/22/2006	4		
12/23/2006	4		Water at weir area remained greenish and cleaner with noticeable marine life and the total absence of bad odor.
12/24/2006	4		
12/25/2006	4		
12/26/2006	4		
12/27/2006	4		
12/28/2006	4	10	
12/29/2006	4		

Fig. 5: *The dosage schedule specifies a total of 220 gallons* MICROBE-LIFT® formulation *and 70 gallons of BioAktiv to be introduced.*

Results Achieved

Water parameters were monitored. Samples were taken prior to treatment on 16th November, 2006, a relatively dry day. Almost two months into treatment, comparative samples show significant improvement.

	Location	BOD mg/l	COD mg/l	TSS MG/L	TN mg/l	Comments
11/16/2006	Mid stream	249	721	1350	111	pH 6.6. Very strong odor
12/20/2006	Influent	20	88	57	9	At the weir
12/20/2006	Effluent	4	18	30	11	At the river mouth, odor significantly reduced.

Fig. 6: *Pretreatment results demonstrate the extreme contamination of this site. The difference between influent and effluent parameters indicates efficiency of treatment.*

The early elimination of bad odor and the drastic reduction of surface scum are the first indication of the progress of remediation. Over the next two months, the MICROBE-LIFT® formulation will have established its optimum population in the biomedia cages at the weir and along the river maximizing the benefits. This treatment will be able to help reduce odors and scum and significantly reduce the organic loading. The introduction of hydroponic plants along the river will further improve organic reduction and help beautify the river, however, this site will not be fully remediated until the practice of dumping garbage into the river is changed.

For more information on MICROBE-LIFT® Technology contact
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