Canals and rivers: Melaka River remediation, Melaka, Malaysia

Melaka is a coastal city located on the Southwestern side of the Malaysian Peninsula on the strategic shipping lanes of the Melaka Strait. All through its history Melaka has been a major trading centre, and at various times has come under the influence of Malay, Arab, Indian, Chinese, Portuguese, Dutch and British traders. This has given Melaka and its environs a rich cultural heritage and in 2008 it was listed as a UNESCO World Heritage Site. Because of this rich heritage Melaka is a destination for many tourists.

The City of Melaka is located along the Melaka River which flows North to South through the middle of the city. The river has been the centre of activity throughout the long history of Melaka. However, industrialization and economic development over the last 20 years has led to the indiscriminate dumping of trash and the run-off of nutrients and raw sewage directly into the river. This, coupled with a buildup in sediment in the river bed, has resulted in it becoming non-flushing, foul smelling and murky and blackish in nature, along with algal plumes in certain locations.

To restore the Melaka River to its original clean condition the Government has undertaken a major remediation program. The first stage of this was to construct sewage treatment plants along the river to ensure all domestic and industrial wastewater entering the river was treated. The next stage involved the remediation of the river itself.

The decision was made to dredge the Melaka River along a 13.5 km length through the built-up area of the city in order to remove the contaminated sediments and to reshape the geometry of the river so that it would become naturally self-flushing. This entailed the removal of some 570,000 m^3 of sediments. The dredged contaminated sediments would be dewatered at two locations along the river using Geotube® dewatering containers. The dewatered solids would be transported to an offsite landfill for disposal.

To evaluate the feasibility of returning the Geotube® filtered effluent water directly to the Melaka River without the need for further treatment a test program was carried out. Samples of the raw contaminated sediments were obtained from a number of locations along the river and were tested for contaminant levels. The results obtained, shown in the table below, demonstrate the high amounts of nutrients and raw sewage deposited in the sediments of the river. Small scale Geotube® filtration tests were carried out on the raw contaminated sediment samples with the filtered effluent water tested for contaminant

Melaka River by night

Contaminant	Raw contaminated sediments	Geotube® filtered effluent water
Phosphorus	5 - 220 ppm	0.05 – 0.9 ppm
Nitrogen	2.5 - 65 ppm	0.3 - 0.6 ppm
TSS	43,000 - 160,000 ppm	2 - 50 ppm
BOD	140 - 360 ppm	2 - 5 ppm
COD	350 - 1,200 ppm	5 - 15 ppm

ppm – parts per million (by weight)
TSS – Total Suspended Solids
BOD – Biological Oxygen Demand
COD – Chemical Oxygen Demand

levels. The results, also shown in the table below, demonstrate that with the use of the correct chemical dewatering accelerant the filtered effluent water contained relatively small contaminant levels, and met the Government water quality requirements for direct return to the river.

At two locations along the river Geotube® dewatering platforms were constructed to process the dredged contaminated sediments. The platforms consisted of a geomembrane liner covered with a geotextile protection layer. On top of this a granular drainage blanket was constructed before placement of the Geotube® dewatering containers. The plan was that these two dewatering sites would be returned to their natural condition following completion of the dredging and dewatering program.

Due to the high levels of trash encountered in the river sediments dredging had to be carried out in a careful manner. To prevent blockage of the pipeline to the Geotube® dewatering facilities a trash separation unit was installed to filter out out the trash from the contaminated sediment slurry following dredging.

The dredged contaminated sediment slurry was dosed with the optimum chemical dewatering accelerant prior to entry into the Geotube® dewatering containers. To efficiently fill the Geotube® containers approximately 10 filling and dewatering cycles were carried out. During dewatering, the effluent water was tested for quality and then returned directly to the Melaka River. The complete dewatering process occurred over a 2 to 3 month period.

Once the dewatering process had been completed the Geotube® containers were cut open. The dewatered contaminated sediments now resembled a solid material that could be easily excavated and loaded onto transport for removal to a local landfill facility.

Following removal of the dewatered contaminated sediments from the dewatering facility additional Geotube® containers were laid out on the dewatering platform and the whole dewatering process was repeated.

When the environmental dredging project had been completed each dewatering facility was returned to its natural condition.

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Contractor: Sinnaiyah and Sons Sdn Bhd, Johore Bahru, Malaysia.

Dredging of contaminated sediments from Melaka River

Separation of trash from contaminated sediment slurry

Geotube® dewatering of contaminated sediments showing slurry delivery pipes

State of contaminated sediments following Geotube® dewatering

Excavation of dewatered contaminated sediments for transport to offsite landfill