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Water Resource Management

Laws to Protect River and Sea Pollution

Rivers provide the main source of drinking water and will remain so for a long time to come. Coastal areas and seas provide valuable resources for the economic development of a nation. It is generally accepted that goods and services delivered by the coastal and marine ecosystems are worth trillions of dollars (UNEP/GPA 2006). Pollution of our rivers is attributed to point and non-point sources and marine pollution originates mainly from land-based sources. Major land-based pollution activities identified are urban settlements, agricultural run-offs, illegal coastal settlements, industrial discharges and sewerage/animal husbandry.

In 2004, based on Biochemical Oxygen Demand (BOD), 18 river basins were categorised as polluted, 37 river basins slightly polluted and 65 river basins clean. High BOD is due mainly to untreated or partially treated sewage as well as discharges from agro-based and manufacturing industries. During the same period, based on Ammoniacal Nitrogen, 30 river basins were polluted, 47 river basins slightly polluted and 43 river basins clean. Ammoniacal Nitrogen is attributed to sewage and livestock discharges. Suspended solids from earthworks and land clearing were responsible for 31 river basins being polluted and 11 river basins slightly polluted. The remaining 78 river basins were clean.

The principal legal instrument to control water pollution in Malaysia is the Environmental Quality Act (EQA) 1974 and its subsidiary legislations. However, the EQA is applicable to industrial discharges and sewage. Other related laws such as the National Land Code 1965, Forestry Act 1985, Land Conservation Act 1960, Local Government Act 1976 and Town and Country Planning Act 1976 among others have provisions to deal with pollution from other land-based activities. For pollution from non-point sources, the Local Authorities through the Local Government Act and by-laws could take legal action.

Environmental Quality Act (EQA)1974

The EQA 1974 which received the Royal Assent was enacted and came into force on 1 April 1974 for the abatement and control of pollution and enhancement of the environment and purposes connected therewith. Since then, 34 subsidiary environmental regulations have been introduced to deal with specific issues sources ranging from agro-based and manufacturing industries, air emissions from stationary and mobile sources, noise from motor vehicles, management of scheduled wastes and environmental impact assessment. After a comprehensive review, the EQA was again amended in 1996, inter-alia to address any lacuna in the law, to meet our commitment under the various multilateral environmental agreements and also to impose heavier penalties.

Sections 25, 27 and 29 of the EQA deal directly with the control of discharges into inland waters and Malaysian territorial waters. Section 25 states that "No person shall, unless licensed, emit, discharge or deposit any environmentally hazardous substances, pollutants or wastes into any inland waters in contravention of the acceptable conditions as specified under section 21". Section 27 prohibits the discharge of oil, whilst section 29 prohibits the discharge of wastes into Malaysian waters in contravention of acceptable conditions specified under section 21. Acceptable conditions are formulated in the

Continued on page 3

Contents

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From the desk of the Director General

Integrated Water Resource Management

Water is not merely a vital resource. In truth, it is more than that. Water is life itself! Water is cell biology and cell chemistry; it is farming and food; it is people and populations; it is society and success; government and governance; civilisation and culture; and the glory and grandeur of life on Earth. From the cellular to the molecular, from the individual to the societal level, from our earthly existence to our understanding and pursuit of our knowledge of our universe, the two atoms of hydrogen fused magically with a sole atom of oxygen is a priceless gift beyond all value we human beings can place on it. At the chemical level, water is the universal solvent without equal. It is peerless as the bulk and base of all that we behold, touch and feel. And air devoid of moisture and land parched without flowing water are recurrent nightmares of human existence. And yet everywhere where water is plentiful, it is very often taken for granted, abused and altered beyond repair without a thought of care. Even worse, we have largely forgotten our custodial responsibilities to ensure that future generations may live and prosper. Indeed when it comes to managing our water resources, we are at the crossroads. Which way do we go?

Natural water is a finite resource. In developing countries such as ours, managing water resources has not been given adequate due. To date, we have managed it in a most piecemeal manner belying the fact that what is needed is an integrative and holistic approach to its management. This is strikingly obvious as evidenced by the little or non participation by the general public and other stakeholders, apart from the government, in decisions affecting water resource management. This has left us with a legacy of water management systems that are poorly designed and under financed.

We must strike a balance between technological development and a good quality of life that is sustainable across generations. There must be a paradigm shift in our thinking. Water shortage, flooding, water pollution, sedimentation and illegal settlements, strange as they may seem, are all also factors to be considered in the complex relationship between water quality and quantity on one hand and human health and well being on the other. Water resources globally are facing a threat from human activities such as urbanisation, industrialisation and intensive agricultural practices, all of which give rise to pollutants.

Water pollutants are often categorised into 'point source' or 'non-point source'. The former enter water courses through pipes or channels and the latter arise from storm runoff from urban and rural land use. Point sources are further categorised into four main sectors: agro-based, manufacturing, livestock farming and sewage treatment. To this heady mix, add sullage. Sullage is defined as waste water without any inputs from toilets. It originates from kitchen sinks, washing machines, bathrooms, restaurants, wet markets, car washing centres and the like. And if this not enough, add to it garbage juice, hopper juice and leachates. There are about 86,000 chemicals in industrial and commercial use. All of these pollutants eventually find their way to the rivers that are the main source of that precious and vital resource - natural water. Chemicals can also be transferred to our water sources through movement of ground water through contaminated land.

There is indeed only one way in which we can manage all of this - Integrated Water Resource Management. It is defined as a process which promotes the coordinated development and management of water, land and related resources in order to maximise the resultant economic and social outputs in an equitable manner without compromising the sustainability of vital ecosystems. The key consideration in this approach is that water be managed in a basin-wide context under the principles of good governance and public participation. There are also ethical principles underpinning this new equity in water resource management. They are, in brief, human dignity, participation, solidarity, human equality, common good, and stewardship.

In 2004, based on Biochemical Oxygen Demand (BOD) parameter, 18 river basins in Malaysia were categorised as polluted, 37 as slightly polluted and 65 as clean. This must be juxtaposed with the fact that the main legal instrument to control water pollution is the Environmental Quality Act enacted in 1974, together with its subsidiary legislations. Other related laws such as the National Land Code 1965, Forestry Act 1985, Land Conservation Act 1960, Local Government Act 1976 and the Town and Country Planning Act 1976 have also provisions to control pollution.

Clearly the issue here is not merely one of enforcement but one of integration. The creation of the National Water Resources Council (NWRC) in 1998 was a step in the right direction. The Council is tasked with effective water management, including the implementation of interstate transfer of water. The Federal Government is moving towards greater involvement in the management of water resources and the implementation of integrated water resource management. Much work needs to be done. Our scientists and the public must contribute more.

This new awareness and paradigm shift in thinking was signaled by the Government's tough stance on Open Dump Sites and Rudimentary Landfills. On 28 April 2006, at the first meeting of the Cabinet Committee on Solid Waste Management and Environment, chaired by the Deputy Prime Minister, YAB Datuk Seri Najib Tun Razak, the decision was made to close down with immediate effect 16 open dump sites located near water intake points across the country. The Cabinet also decided that immediate action be taken against another 33 open dump sites which had been previously closed while making available sufficient financial allocations to overcome associated problems of relocation and repair.

Resolving the problems of the past and seeking a new an integrated way forward in water resource management requires greater cooperation amongst the various stakeholders - Government, Statutory bodies, NGOs, the private sector and not forgetting the Mr, Mrs, Miss, Master and Ms of Malaysia. Ultimately the moral will and ethical basis of our society in this vital matter must triumph. The alternative is too frightening to behold.

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Continued from page 1

form of Regulations. These Regulations under the EQA that control pollution affecting the rivers and seas are:

(a) Environmental Quality (Sewage and Industrial Effluents) Regulations 1979;
(b) Environmental Quality (Prescribed Premises) (Crude Palm Oil) Regulations 1977 and Amendments 1982; and
(c) Environmental Quality (Prescribed Premises) (Raw Natural Rubber) Regulations 1978 and Amendments 1981.

Environmental Quality (Sewage and Industrial Effluents) Regulations 1979

The Environmental Quality (Sewage and Industrial Effluents) Regulations 1979 came into force on 1 January 1979. These Regulations specify the requirements for new sources of discharges requiring written permission of the Director General of Environment. It regulates the acceptable conditions of discharge into inland waters by specifying parameter limits of effluent. Two standards are specified namely, Standard A and Standard B. Standard A is for discharges into any inland waters within catchment areas and Standard B for discharges into any other inland waters. Part V of the Regulations contains provision for the granting of licence for contravention of acceptable conditions. However, the Director General may refuse to grant the application for a licence if he is satisfied that the granting of such licence is likely to worsen the condition of the inland waters or cause pollution in any other segment or element of the environment. The Director General may grant the licence if he is satisfied that:

(a) there is no known practicable means of control to enable compliance with the acceptable conditions; or
(b) the estimated cost to be incurred for compliance will be prohibitive having regard to the nature and size of the industry, trade, or process being carried out in the premises discharging the effluent; or
(c) the design and construction of any treatment plant or other control equipment and their commissioning require a longer period than the period for compliance with the Regulations; or
(d) the imposition of the acceptable conditions as prescribed may result in circumstances which, in his opinion and having regard to all factors, are not reasonably practicable or are contrary to the intent and spirit of the Act; or
(e) a sewerage system is to be provided and the effluent is permitted to be admitted into the sewerage system.

The Environmental Quality (Sewage and Industrial Effluents) Regulations 1979 applies to all industrial effluents and sewage. However, some industries face difficulties in complying with some of the parameter limits as prescribed in the Third Schedule of the Regulations. These include the pulp and paper industry, distillery, textile and existing sewage treatment plants. In such cases, contravention licences have been granted. Furthermore some parameter limits that are deemed to be important for the protection of the rivers and seas such as ammonia, nitrates, phosphorus and colour are not specified.

Review of the Regulations

Taking into account the shortcomings in the present Regulations, a comprehensive review was initiated by the Department of Environment. It is proposed that parameter limits be specified for specific type of industry rather than general standards across the board as at present. Consultations were held with all relevant stakeholders. Separate standards will be proposed for industrial effluents and sewage. Some parameters such as Chemical Oxygen Demand might be revised upwards for some industries based on the current internationally acceptable standard and new parameters introduced.

Other elements that are proposed include mandatory effluent quality reporting, requirements for competent operators and provision for the compounding of offences and the issuance of a prohibition order.

Different categories of discharge standards for sewage are being proposed for new plants and plants built before and those that were built after the publication of Guidelines for Developers: Sewage Treatment Vol. IV by the Department of Sewerage Services on 1 January 1999. The standards would also take into account the type of systems that were used as most of the old systems were not able to meet the standards stipulated in the Third Schedule of the Environmental Quality (Sewage and Industrial Effluents) Regulations 1979.

Environmental Quality (Prescribed Premises) (Crude Palm Oil) Regulations 1977

In the early years of enforcing the EQA, palm oil mill and raw natural rubber effluents were the most polluting sources of our rivers. Through the cooperative efforts of the various agencies, the Environmental Quality (Prescribed Premises) (Crude Palm Oil) Regulations 1977 were enforced on 4 November 1977. These Regulations provide a generation of standards to be complied within a specific time frame. To date most of the palm oil mills are in compliance with the BOD standards of 100 mg/l and even 20 mg/l for some mills. However, with the increasing number of mills being built, the assimilative capacity of some rivers might have been exceeded. In 2004, there were 383 mills licensed by the Department of Environment. It is estimated that these mills generate 20 million tonnes of palm oil mill effluent and 10 million tonnes of empty fruit bunches. More complaints are also being received of palm oil mills polluting rivers and affecting the livelihood of people depending on the rivers.

Technologies for zero or near zero discharge have been proposed. These include composting of palm oil mill effluents and empty fruit bunches. The industry should seriously look into these new technologies as some State Governments are requiring oil palm mills to comply with more stringent discharge standards and even no discharge especially in sensitive river basins.

Marine Water Quality Criteria and Standards

The Department of Environment initiated the marine water quality monitoring in 1978. In 2004, the contaminants of the marine water were total suspended solids, *Escherichia coli* and oil and grease. Based on the interim marine water quality standards, 77 percent of the samples exceeded the standards for total suspended solids, 50 percent for *Escherichia coli* and 49 percent for oil and grease. The interim marine water quality standards are adopted from those of other countries. Under the Ninth Malaysia Plan, the Department of Environment is to conduct a study to establish the Malaysian Marine Water Quality Criteria and Standards, taking into account the local conditions and nature of pollutants in our marine environment.

Conclusion

Rivers and oceans are valuable resources that need to be protected. Surveillance and enforcement would continue to be given priority. However, enforcement can never be enough. Industries need to continuously improve on their performance in terms of meeting discharge standards. Industries must realise that greater environmental awareness among consumers would result in the market demanding environment friendly goods and services. There must be a shift from the traditional end-of-pipe control to cleaner technology. More stringent environmental controls would be introduced in the future and with the cost of pollution control continuing to escalate, it makes good economic sense for industries to minimise the amount of waste they generate that subsequently needs to be treated and disposed.

Note: Views expressed are not necessarily those of the Department of Environment.

References

Department of Environment. Environmental Quality Report 2004.

Shamsuddin Ab. Latif. 2004. Proposed new provisions in the Environmental Quality (Sewage and Industrial Effluents) Regulations 1979 (unpublished).

UNEP/GPA. 2006. Protecting the coastal and marine environment from impacts of land-based activities.

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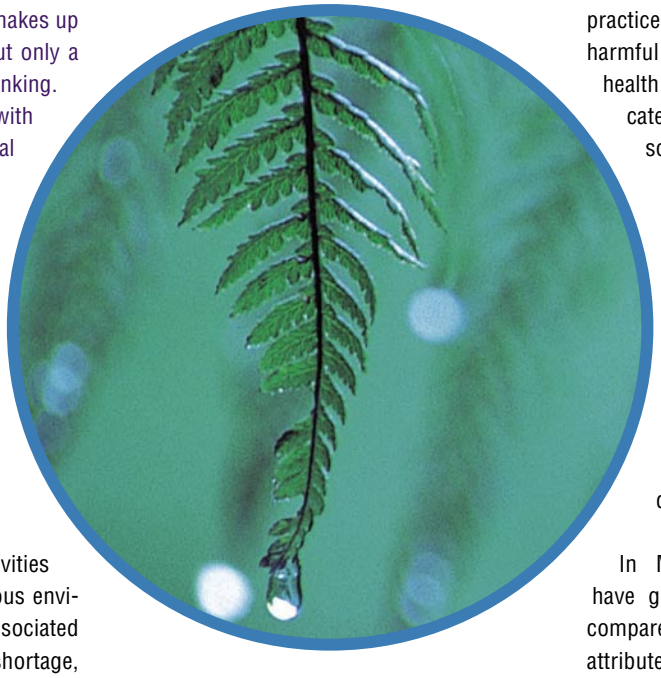
Water Resources at a Glance

Water a basic necessity of mankind makes up 74 percent of the earth's surface but only a small percentage is suitable for drinking. As the demand for water grows with increasing population and individual needs, this scarce resource is likely to shrink further. This is compounded by various activities of man which often render our water resources unusable. Mankind's strive to raise his standard of living and comfort has led to the exploitation of nature's free gift to the extent that its natural capacity for self-regeneration has been drastically reduced.



Disregard of the impact of man's activities on Mother Nature has led to numerous environmental problems. Problems associated with water resources are water shortage, flooding, water pollution and sedimentation. Tackling environmental issues should not be delayed as they have a cumulative impact and the delayed action will be more costly and the damage irreversible.

It is important for us to understand the relationship between water quality and quantity and their effect on human health. The consequences of unhealthy water quality deterioration are frequently seen as waterborne diseases, while fatalities due to floods are the result of too much water. Air, water and land are global properties of common usage but overuse of these common properties accelerates degradation of the environment. To achieve a balance between technological development and a good quality of life, there is a need for environmental planning and management coupled with thorough knowledge and understanding of our relationship and interactions which may have a profound effect on our environment.

Globally, water resources are threatened by human activities such as urbanisation, industrialisation, and intensive agriculture practices. Pollutant from such activities are harmful to aquatic organisms and public health. Water pollution sources are often categorised as point sources or non point sources, the former as dry weather pollutants that enter the water course through pipes or channels, and storm drainage as non point source pollution. Examples of various types of pollutants are oxygen demanding substances, industrial and municipal wastewater, agricultural wastes, sediments from land erosion, petroleum hydrocarbons, and acid mine drainage.

In Malaysia, water resource issues have grown in magnitude and complexity compared to 20 years ago. This can be attributed to the shift of the Malaysian economy from agriculture in the 1970s to industry-based in the 1990s.

In a move to identify sources of river water pollution, a total of 120 river basins were monitored with 926 monitoring stations established in 2004 (Figure 1). Based on these monitoring data, four main sectors were identified as the main contributors to river water pollution in Malaysia. From Figure 1, it can be seen that in 2004, sewage treatment plants recorded the highest

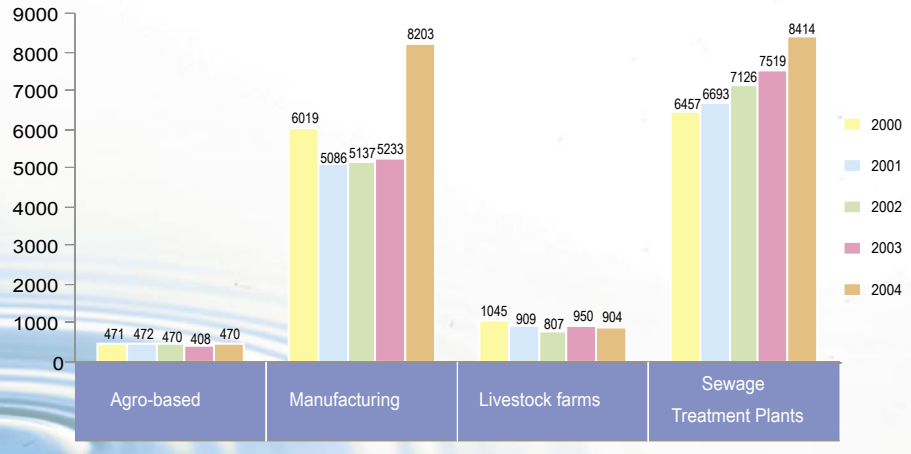


Figure 1: Number of Pollution SOurces in Malaysia 2000-2004

number followed by the manufacturing sector, livestock farming and the agro-based industries as the major sources of water pollution in Malaysia. The water pollution parameters are BOD from the agro-based sector, ammoniacal nitrogen from sewage and livestock farming and suspended solids from land clearing activities.

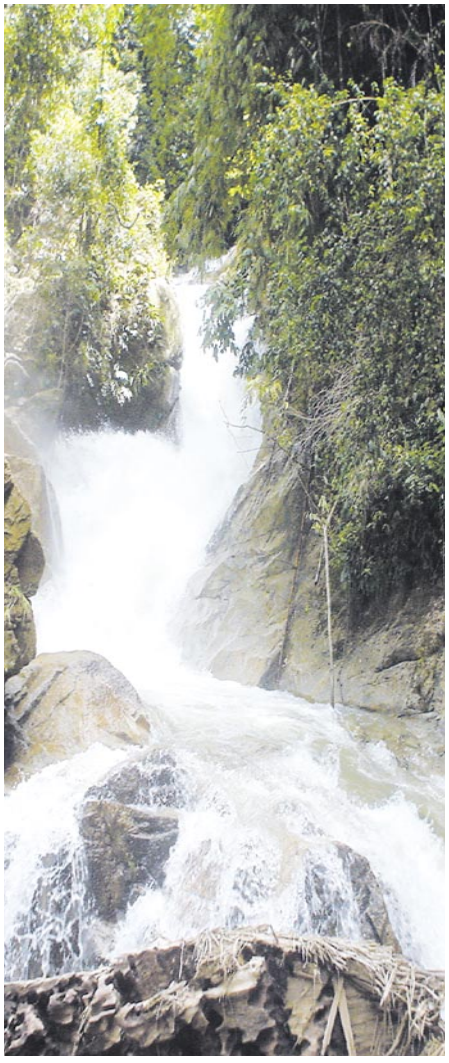
The management of rivers basins in Malaysia is fragmented and piecemeal in nature. Political and administrative boundaries override the natural river basin boundaries.

Rivers can run through more than one State. Therefore for effective management, an institutional framework must be established to resolve issues pertaining to river basin management which are shared between two or more States. The strategies must emphasise that the river must benefit both upstream and downstream users. Maintaining water quality for its valuable uses is critical and efforts should focus on achieving the goal set by all of its stakeholders.

Policies and a legislative framework are essential ingredients in managing resources. Preventive and control measures are effected through laws and legislations. Presently existing legislations on water sources reside within the jurisdictions of various agencies resulting in poor coordination of efforts and consequently enforcement becomes ineffective.

Monitoring and enforcement can be challenging. Strengthening the enforcement capacity of relevant agencies is essential as it will complement existing efforts to curb pollution. Existing legislations which are outdated and irrelevant should be rescinded or reviewed to bring about coordinated and effective river basin management.

Industries need a mindset change to adopt an effective solution instead of resorting to the cheapest means to solve an environmental problem. Investment costs for waste treatment should be internalised and be borne by the industry and not as an 'after thought' cost. Industry should go beyond mere compliance. Investment in pollution control systems should not be seen as an additional cost but rather as a corporate social responsibility towards the people which is its marketplace in the first place.



The ultimate solution to this problem rests in the moral and ethics of our population - our beliefs, commitment and practices towards preserving and caring for Mother Nature. In conclusion, to ensure the sustainability of fresh water supplies, efforts must be intensified to conserve and care for this vital resource that nature has provided to mankind.

Note: Views expressed are not necessarily those of the Department of Environment.

References

Bindu N. Lohani .1984. Environmental Quality Management. New Delhi: South Asian Publishers PVT.LTD

Department of Environment , 2000. Malaysia Environmental Quality Report 2001

Department of Environment, 2001. Malaysia Environmental Quality Report 2002

Department of Environment, 2002. Malaysia Environmental Quality Report 2003

Department of Environment, 2003. Malaysia Environmental Quality Report 2004

Department of Environment. 1999, The Environment – A Gift of God.

Pierce J. Jeffrey, F. Ruth Weiner & P. AArne Vesilind. 1997. Environmental Pollution and Control. United States of America: Library of Congress Cataloging-in- Publishing Data

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Untreated Sullage:

A Challenge to the Rehabilitation of Rivers in Malaysia

According to media reports , the nation is likely to face a water supply shortage in the years to come. Besides the problem of an impending water shortage, we also have to grapple with increasing pollution of our waters. The quality of our rivers is being degraded by increasing pollution from point sources (residential, industrial and commercial premises) and non point sources (storm runoff from urban and rural land use). Data from (Eriksson *et al.,* 2002) show that of the rivers monitored in the country, only 45 percent are clean. The rest need to be rehabilitated to regain a clean status.

It is generally believed that sewage is the main source of river pollution in the country. However, some studies reveal that untreated sullage(DOE, 2004) and urban runoff (DOE,

2003) are also responsible for the poor quality of water in our rivers. There are guidelines to treat sewage, industrial effluents and runoff (DID, 2000) but none have been established for the treatment of sullage. Consequentially, sullage remains one of the main pollution sources. It is time that proper attention is given to this source of pollution.

What is Sullage

Sullage is defined as wastewater without any input from toilets (excreta). It is termed as grey-water that mainly originates from kitchen sinks, washing machines, bathrooms (Figure 1), restaurants, wet markets, car washing centres, etc. Although the quantity and quality of sullage vary from source to source, the pollutant concentration could be high and should not be allowed to enter into the river system without any treatment (Eriksson *et al.*, 2002). Sullage quantity and quality also vary with time and day (Figure 2).

Many studies in the US and other developed countries reveal that sullage has a great potential to cause serious damage to the river ecology because it contains untreated organic material, household chemicals and pathogens similar to sewage water.

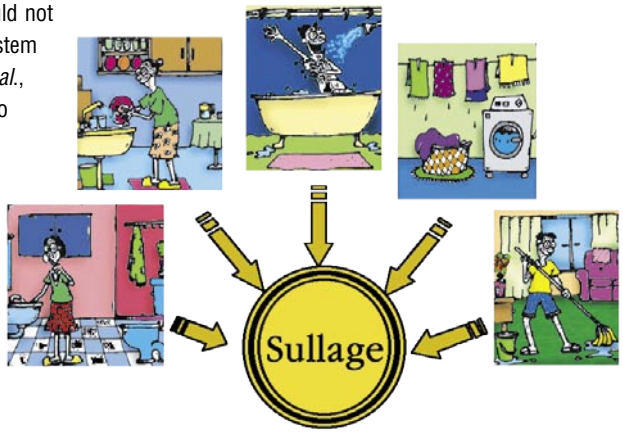
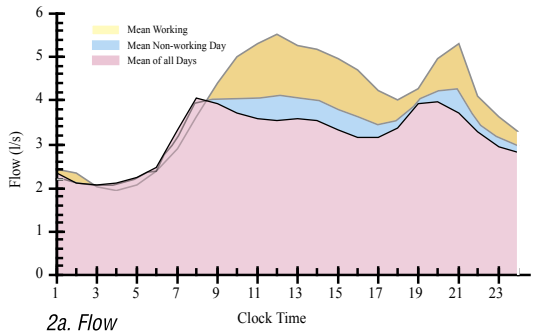


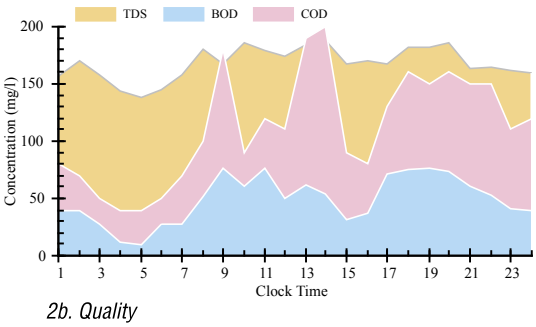
Figure 1: Sullage from household activities

How Much Sullage Do We Generate?

A significant portion of the water in urban streams is discharged from the residential and commercial activities as sullage. A few studies (DOE, 2004; 2003) reveal that sullage is very polluting in nature and must be treated properly before being allowed to enter the water body.



2a. Flow



2b. Quality

Figure 2: Variation of sullage flow and quality with time and day

An important point for us to note is to the extent sullage poses a threat to our rivers. The answer lies in getting the flowdata - how much sullage is discharged per household per day. A research conducted at UPM (Azni Idris *et al.*, 2004) revealed that generally there are three peaks in sullage flow during the working days (Figure 2a). The sullage flow from the 6.14 ha study area was between 2 to 6 l/s. The population within the study area was 1448 people from a total of 283 houses. However, in many new residential areas, all sullage conveying plumbing is connected to the sewer, which goes for treatment at sewage treatment plants.

As the sullage flow varies, the pollution load also fluctuates for different times and days (Figure 2b). It generally follows the trends of sullage flow patterns, that is, pollutant concentration is high during peak sullage flows. The maximum and minimum organic content, measured as Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) values on working days, can be 77 & 9 mg/l and 200 & 40 mg/l, respectively. Based on the NWQS, the quality of the sullage from residential areas is equivalent to Class V (Table 1). Sullage from

restaurants and wet markets would contain more pollutants, which suggest it is not suitable for any use. For water supply, a Class III river is set as a minimum, but extensive treatment is needed to make it suitable for drinking water. Class IV is considered polluted and Class V is seriously polluted.

A high concentration of nutrients in sullage is another critical issue which causes algal problems in the waterbodies. Although the concentrations of AN, Total Kjeldal Nitrogen (TKN) and ortho phosphate in the sullage is less than that in the typical sewage, they are excessively high, and can degrade the aquatic status of the urban stream where the assimilative capacity of the streams is low. It is known that excessive levels of AN in rivers would be toxic to most of the aquatic fauna; the threshold level should be less than 5 mg/l for AN.

Impact of Sullage on Urban Streams

Based on the UPM study, it was found that about 81 percent of the total water consumed in the study area was released as sullage while the remaining 19 percent water used in toilets went into the sewage treatment plant. This proportion may be different in other urban sub-catchments. However, the areas where all domestic wastewater is not connected to the sewage treatment plants may have a similar proportion between sewage and sullage. There is sufficient evidence to show that for an urbanised residential area, a significant amount of domestic wastewater is discharged into the municipal drain as badly polluted sullage or grey-water. Besides other pollution sources, sullage is also responsible for degrading water quality in urban streams. The situation is severe in the areas that were developed before 1990s and in small development lots which are not subject to the EQA, 1974 (DOE, 1974).

Generally, urban streams do not have enough assimilative capacity to absorb the pollution loads released from various point sources. For a river, the quantity and quality of sullage release pose a challenge for the rehabilitation and conservation of urban streams. Discharge of untreated sullage adds oxygen demanding substances, nutrients and toxic elements such as AN into the water, which in turn make the streams unsuitable for aquatic flora and fauna. As such, like any other pollution source, sullage should also be treated effectively before being discharged into the streams.

The Way Forward

Sullage is one of the main pollution sources, which has yet to receive the attention it deserves. It is being released from many urban (residential and commercial) areas without any treatment. High BOD, COD, AN, TKN, ortho phosphate and low DO are the main polluting characteristics of sullage from residential areas. Considering that about 81 percent of the water used in a typical urban area is released as sullage without any treatment, the impact on pollution load is significant. Management of sullage water can be done in two ways; first, prevention of discharge of sullage into municipal drains by having wastewater connection to the sewer. Second, provision of suitable on-site treatment systems (such as septic tank or mechanical sewage plant), which are able to degrade the BOD down to allowable discharge limits. As such, increased public awareness and upgrading of the laws are necessary to control discharge in order to protect the river systems from further degradation and exploitation.

Table 1: Quality of sullage compared to the Malaysian National River Water Quality Standards (NWQS)

Parameter	Value for Sullage [5]	Malaysian National River Water Quality Standards (NWQS)				
		Class I	Class II	Class III	Class IV	Class V
		Excellent for water supply	Conventional treatment needed for water supply	Extensive treatment needed for water supply	Suitable for irrigation	Not suitable for any use
AN(mg/l)	4.9	< 0.1	0.1 – 0.3	0.3 – 0.9	0.9 – 2.7	> 2.7
BOD(mg/l)	49.6	< 1	1 – 3	3 – 6	6 – 12	> 12
COD(mg/l)	115.6	< 10	10 – 25	25 – 50	50 – 100	> 100
DO(mg/l)	1.6	> 7	5 – 7	3 – 5	1 - 3	< 1
pH	6.7	> 7.0	6.0 – 7.0	5.0 – 6.0	< 5.0	< 5.0
TSS(mg/l)	43.2	< 2.5	25 – 50	50 – 150	50 – 300	> 300
WQI	28.8	> 92.7	76.5 – 92.7	51.9 – 76.5	31.0 – 51.9	< 31.0

AN - Ammoniacal Nitrogen, BOD - Biochemical Oxygen Demand, COD - Chemical Oxygen Demand, DO - Dissolved Oxygen, pH - Phosphorus, TSS - Total Suspended Solids, WQI - Water Quality Indicators

References

Azni Idris, Wan Noor Wan Azmin, Mohd. Amin Mohd. Som & Abdullah-Al-Mamun. 2004. The Importance of Sullage (Grey-Water) Treatment for the Restoration and Conservation of Urban Streams, *1st International Conference on Managing Rivers in the 21st Century: Issues & Challenges - Rivers 2004*, 21-23 Sept 2004.

Department of Environment Malaysia (DOE). 1979. Environmental Quality Act. Ministry of Science, Technology and Environment.

Department of Irrigation and Drainage (DID). 2000. Urban Stormwater Management Manual for Malaysia. Ministry of Agriculture, Malaysia. 1

Department of Environment (DOE). 2003. The Study of Pollution Prevention and Water Quality Improvement of Sungai Langat. Department of Environment Malaysia, Ministry of Science, Technology and the Environment.

Department of Environment Malaysia (DOE). 2004. The Study on Pollution Prevention and Water Quality Improvement of Sg. Melaka. Department of Environment Malaysia, Ministry of Natural Resources and Environment Malaysia.

Eriksson, E., K. Aufferth, M. Henze & A. Ledin. 2002. Characteristics of Grey Wastewater. *Urban Water* 4: 85-104.

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The Invisible Hazardous Impacts of Leachate

What is Leachate?

Leachate is a poisonous dark liquid waste effluent produced from the decomposition of organic matter by the action of precipitation, percolating through a landfill. Leachate is the term used for water that contains contaminants from waste, either in suspension or in solution. When leachate leaches out from waste, the content in the leachate (mainly organic metals and suspended solids) has the potential to cause severe contamination. Typical contaminants are metals, organic acids and ammonia; they pollute groundwater beneath the landfill by percolation, and surface water by seepage and runoff.

The flow of untreated leachate into water bodies not only affects human health but also damages agricultural production and the natural environment. Fish and other aquatic life can be severely affected by leachate pollution in rivers and lakes.

Beside municipal waste, leachate can also be generated from land that has been contaminated by chemicals or toxic materials used in industrial activities at factories, mines or storage sites. Open composting sites in high rainfall countries like Malaysia may also produce leachate.

If the contaminated water or leachate is adjacent to water catchment, spring or groundwater sources, it may have a very strong impact on the environment and ecology of the area. It is advisable to seek expert advice on the suitability of any leachate discharge, in view of the chemical complexity and variability of landfill leachates.

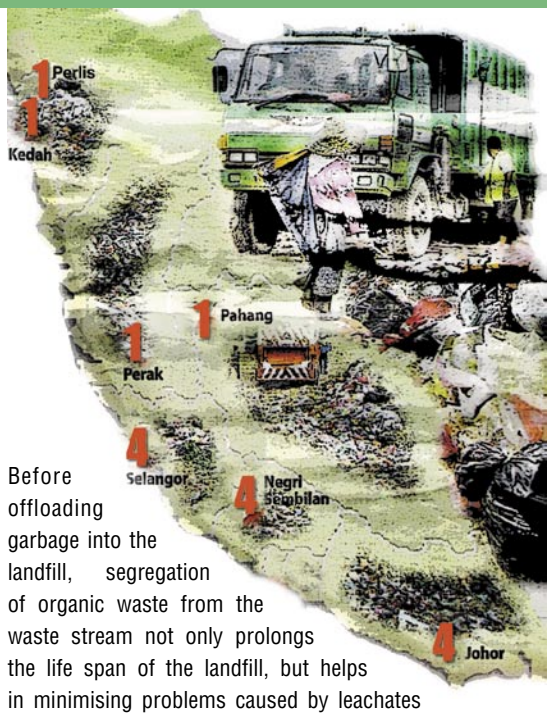
Harmful Materials Found in the Leachate

Typically, landfill leachate is anoxic, acidic, rich in organic acid groups, sulfate ions and with high concentrations of common metal ions especially iron. Leachate from the landfill is more hazardous, noxious and toxic than garbage hopper juice, because it contains more harmful materials, such as the following:

- High organic contaminant concentrations and high ammoniacal nitrogen. Very high ammoniacal nitrogen concentration in leachate is very difficult to treat or remove;
- Pathogenic micro-organisms;
- Toxic substances and heavy metals such as cadmium and toluene;
- Generally a very high biochemical and chemical oxygen demand [Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) which are measures of water pollution potential];
- High concentrations of suspended solids;
- High concentrations of ammonia which in theory can pose a health hazard to treatment plant workers, particularly acidic leachate;
- Methane may be generated when there are large amounts of organic material in the landfill, and methane which dissolves in the leachate, without treatment or discharge, can harm the environment and impact human health;
- Total Organic Compounds (TOC), sulphide and sulphate;
- Other landfill gases and Volatile Organic Compounds (VOCs); and
- High nitrogen content of the leachate may cause eutrophication of water bodies resulting in uninhabitable water for fish and other aquatic life, and unusable water for irrigation or drinking purposes.

Leachate Management

Successful selection of a leachate management system is a complex process. Waste collection, waste treatment facilities, and disposal are all linked as space for landfills in urban and suburban areas continues to decrease. Inevitably, leachate management needs to be seen as an integrated system, bearing in mind during process selection the changes in its quantity and quality.



Before offloading garbage into the landfill, segregation of organic waste from the waste stream not only prolongs the life span of the landfill, but helps in minimising problems caused by leachates (inclusive of dissolved methane) as only inert waste (stable and harmless) is diverted to the landfill.

The hazardous impacts of leachate are greatly mitigated by properly designed and engineered landfill sites. Waste containing heavy metal and toxic materials such as cadmium, toluene and others cannot be disposed off to municipal landfills.

Closure of Open Dump Sites and Rudimentary Landfills

On 28 April 2006, the first meeting of the Cabinet Committee on Solid Waste Management and Environment chaired by Deputy Prime Minister YAB Datuk Seri Najib Tun Abdul Razak made an important decision - to close down with immediate effect 16 open dumpsites located near water intake points that posed a threat to the safety and health of the people. These were 1 from Perlis, 1 from Kedah, 1 from Pahang, 1 from Perak, 4 from Selangor, 4 from Negeri Sembilan and 4 from Johor. The Cabinet also decided that immediate action be taken against another 33 open dump sites which had been closed, but still posed a health threat. The government would set aside financial allocations needed to overcome the problem.

The immediate landfill closure is a clear indication that leachate from open pits or rudimentary landfills is a key environmental pollutant and a public health hazard.

Leachate Treatment

Leachate of municipal solid waste contains parameters that are harmful to receiving watercourses. Leachate also contains several substances which, depending upon the types of waste disposed off into the landfill, may be toxic to life, or may simply alter the ecology of the stream or watercourse or damage the environment. It is therefore imperative that leachate is treated properly and adequately before discharge. Special care must be taken not to discharge any hazardous or odour producing chemicals to the public drain or river.

A full treatment process consisting of biological and chemical treatment (inclusive of Ozonation, Activated Carbon, Reverse Osmosis and Flash Evaporation) should be able to treat leachate. Moreover, the process must be robust and simple to operate, as well as comply with the requirements of DOE. A good leachate management system will be able to treat leachate, degrade the municipal solid waste, and help stabilise the landfill. The selected process must fulfill the conditions highlighted in the box.

1. Remove suspended solids and color;
2. Remove very high rates of ammoniacal nitrogen or reduction in the concentration;
3. Adjust pH; and
4. Provide reduction in the concentration of a wide variety of contaminants including TOC, BOD and COD, nitrate, iron, and other heavy metals or contaminants.

Leachate Monitoring

Discharge of leachate, whether intentionally or unintentionally, poses a serious treat to the environment. Hence, both proper monitoring and treatment are important. The points that need to be noted are highlighted in the box.

1. Monitoring of leachate will be required during the operation of the landfill. This needs to be continued into the closure and post-operation phases for as long as the risks of leachate production exists.
2. Monitoring the volume and characteristics of leachate before and after treatment on a regular basis during operation.
3. Monitoring the chemical, biological and biodiversity status of nearby surface water.
4. Monitoring the important parameters which include
   - concentrations of BOD/COD, TOC, pH, ammonia, suspended solids and heavy metals discharged;
   - biodiversity indicators such as aquatic macro invertebrates and fish; and
   - physical/chemical water quality measurements
5. Monitoring the mitigation measures to reduce leachate impacts during operation and post operation.
6. Monitoring the volume of leachate by reducing or eliminating rain and groundwater access to waste.
7. Monitoring the head of leachate and maintain it as low as possible or below the level of nearby groundwater and prevent its escape.
8. Monitoring the collection of leachate from beneath the landfill by providing a basal drainage layer across the site with drainage sumps at the lowest points.
9. Monitoring the treatment of leachate before discharge, mainly to reduce ammonia and chemical oxygen demand by chemical or biological means.
10. Monitoring the 'removal' ('removal' normally comprises 'nitrification' or the oxidation of ammonium to nitrate, itself a nutrient, which may give rise to concerns in an effluent) of ammoniacal nitrogen, because these compounds are not effectively removed by physical aerobic processes (processes which take place in the presence of oxygen) under normal conditions, and therefore simple aeration without the presence of a sludge biomass, or spraying / irrigation is not effective for the removal process. An aerobic biological process is needed for ammoniacal nitrogen removal.
11. Monitoring the methane level in the leachate that can be discharged to the public drain or river. The maximum permissible safe concentration of dissolved methane in the leachate is 1.4 mg/l.
12. Monitoring the discharge of sulphides in the leachate.
13. Monitoring the discharge of sulphates. Sulphate discharge in high concentrations must be avoided in concrete treatment plants in view of potential concrete attack.
14. Monitoring discharge of any toxic and biologically inhibitory substances.
15. Monitoring incoming garbage juice. Less liquids entering a landfill means less leachate leaving the landfill; this in turn means having to deal with less problems.
16. Monitoring the condition of soil and underground water contamination.
17. Monitoring illegal toxic waste disposal to Municipal Solid Waste landfills.
18. Monitoring the daily indicators of proper functioning of a treatment plant

Conclusion

The public has a major role to play in preventing toxic materials from entering the waste stream. If toxic materials are kept out of garbage containers, then any hopper juice produced has less potential to be harmful. The public must internalise moral and ethical values to enhance the quality of life for all.

As generators of waste ourselves, it may be useful to note that wetness in the waste stream creates garbage and/or hopper juices. Therefore waste generators (the public) must keep their waste dry before collection. Less garbage juice and storm water entering the landfill means the generation of less leachate. Separation of organic waste and inorganic waste will be able to cut down the volume of garbage juice and prevent fermentation, and consequently the noxious and awful odour.

Closure of open dump sites or rudimentary landfills is no doubt a good decision, but post-treatment of landfills is important too. New landfills with material recycling facilities will enhance the management of both solid waste and leachate.

The National Solid Waste Management Law will be helpful in guiding both the public and the private sectors pertaining to waste recycling, segregation, spillage of hopper juice, landfill construction, leachate treatment, and other solid waste management issues.

Let us all follow the rules to ensure that we continue to enjoy : Fresh Air, Clean Water and Uncontaminated Soil.

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Integrated Water Resource Management:
Perspectives and Initiatives in Malaysia

Natural water is a finite resource that is vital to human development. It needs to be properly managed in a sustainable manner, particularly during the dry season when water reserves in many dams drop to a critical level. In many developing countries, maintaining adequate water resources is a problem because of lack of integration and an holistic approach to its management. Population increases lead to an increase in water demand or water supply requiring an efficient and effective water treatment system in place to achieve the standard set for drinking water. Usually there is little participation of the general public and other stakeholders apart from the government. In addition, not only systems are poorly designed and underfinanced, regulatory and management aspects remain weak. Collaborative Decision Making (CDM) mechanism has been promoted as a better management approach to managing water resources in a river basin, including the use of indicators in performance measurements (Mazlin *et al.* 2004a;b).

Water resource management often focuses on meeting demands by the population without taking into consideration the requirement to protect the natural water resource from pollution. Generally, the numerous consumer complaints revolve around poor water quality rather than health related aspects of water. Changes in government policy play an important role in increasing the complexity of managing natural water resources. In addition, the transformation of our economy from an agriculture-intensive to industry-intensive one has resulted in massive changes in land use activities. Changes in land use such as deforestation, agriculture, industrial and residential development do have a large impact on water quality in many river systems. Rapid development within cities or township areas, industrial estates, industries, and the increasing use of chemicals in agriculture have resulted in poor water quality of many of our rivers. River systems have been subjected to tremendous increases in pollution sources as a result of these activities. Maintaining good water quality has become a major concern in water resources management not only in Malaysia but around the world as well

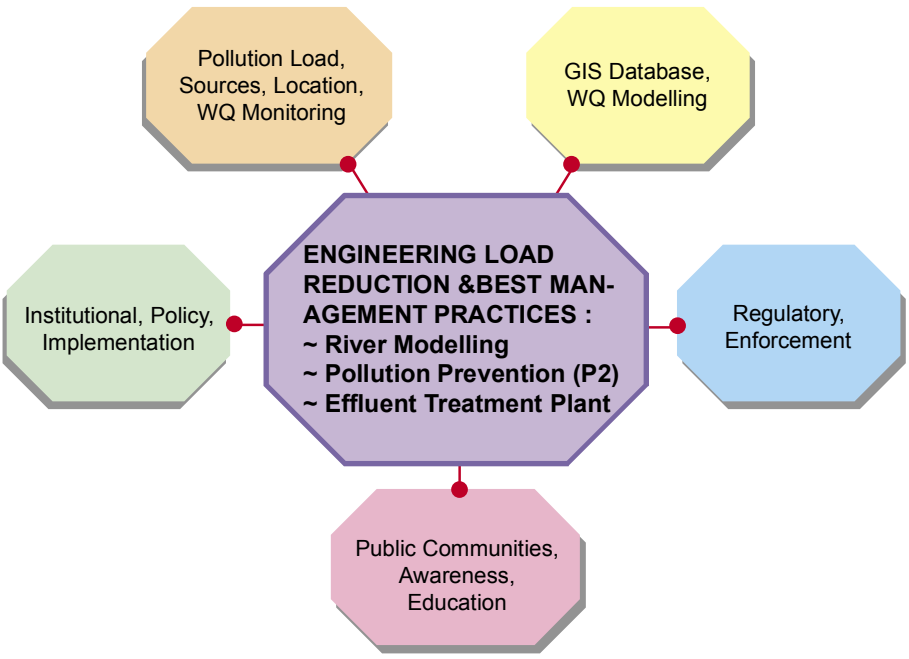


Figure 1: Schematic representation of a holistic approach to managing water quality of the Langat River

Concepts of IWRM and IRBM

The concepts of Integrated Water Resource Management (IWRM) and Integrated River Basin Management (IRBM) aim to provide the best approach on how to treat the natural water resources economically. IRBM which deals with issues of water allocation, pollution control and flood control is a subset of IWRM which addresses the broader issues of food self sufficiency, tariffs, cross subsidies, institutional roles, etc. Water governance should be the focal point of a participatory approach involving all levels of stakeholders. Meanwhile, integrated in this context refers to the integration within and between natural and human systems.

Integrated management of water quality appears to be a superior approach to gathering all data involving environmental systems. IWRM and IRBM when applied to water systems result in integration between freshwater and coastal zones; land and water; surface water and groundwater; quantity and quality; as well as upstream and downstream. The principles to be adopted are economic efficiency, equity and environmental sustainability. There is also a need to develop a structural framework comprising management instruments.

The role of the Global Water Partnership of which the Malaysian Water Partnership (MyWP) is a chapter, promotes and facilitates IWRM / IRBM. The global mission's message calls for the involvement of all stakeholders, moving towards full-cost pricing of water

services, increasing public funding for research and innovation while promoting cooperation in the management of international basins and increasing investments in water projects (Hiew, 2001). Water as an important resource in the coastal zone should also be managed sustainably within the context of Integrated Coastal Zone Management (ICZM) as discussed by Mazlin and Sarah (2003).

Environmental modeling has become an important tool for environmental management. This can be observed in increasing interest among scientists and engineers to develop environmental models. Of late, studies on the application of models, either as predictive tools or as a numerical representation of the real environment, have been published in many journals and books.

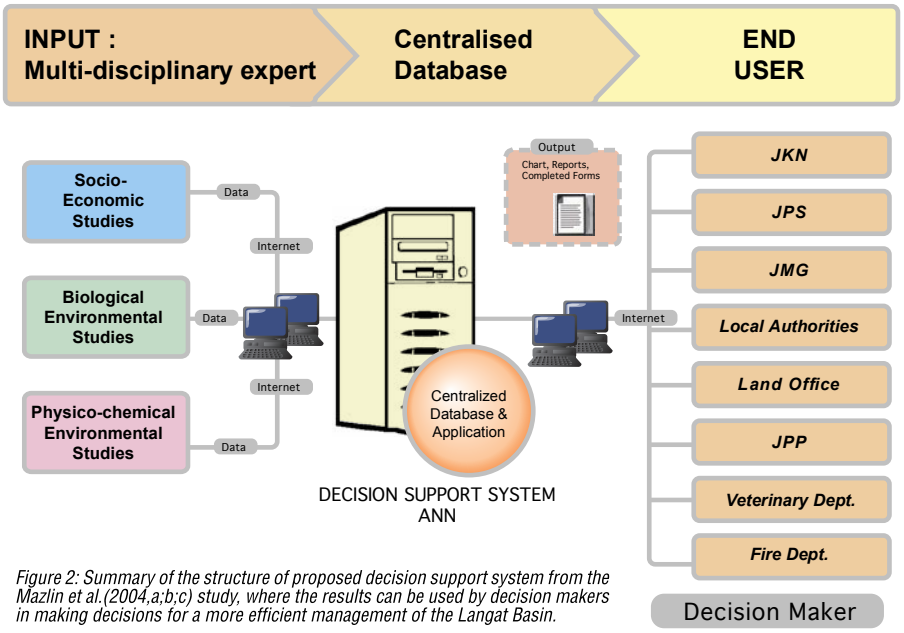
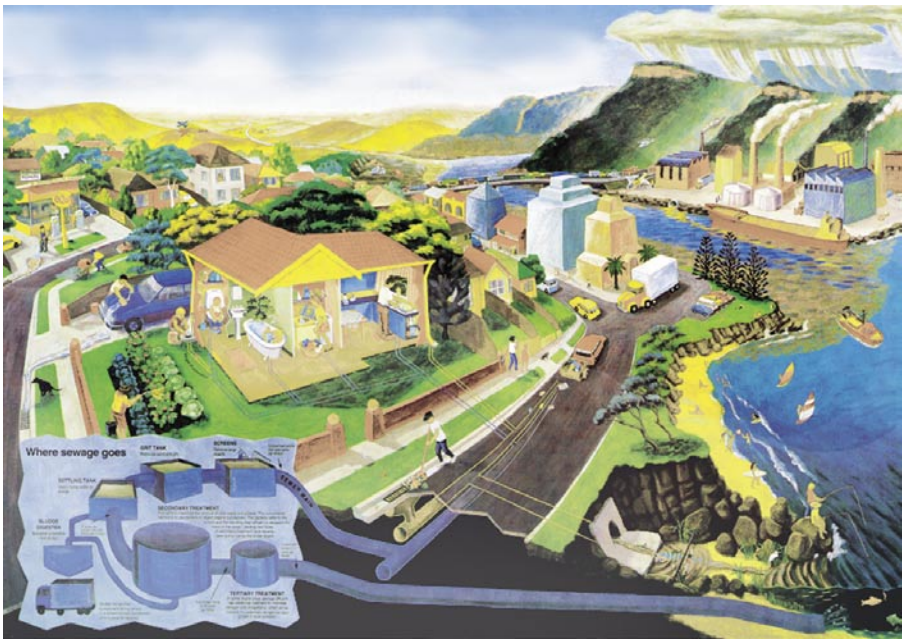


Figure 2: Summary of the structure of proposed decision support system from the Mazlin et al.(2004,a;b;c) study, where the results can be used by decision makers in making decisions for a more efficient management of the Langat Basin.



Integrated Water Resource Management in Malaysia (IRWM)

Malaysia has recently adopted IWRM as an innovative approach to managing its water resources. Clear pronouncements to this effect are found in the Third Outline Perspective Plan (OPP3) and the 8th Malaysia Plan (MP8) documents. The adoption provides the necessary impetus to break away from traditional practices characterised by multiple individualist sector-centred approaches. In line with the current international trend, the new approach promises to overcome deficiencies in cross-sector co-ordination, reduce conflicts and inefficiency, and engender equity.

However, countrywide adoption and implementation of IWRM principles and practices have been hampered due to the following factors:

1. General lack of awareness of IWRM, countrywide;
2. Lack of capacity in implementing agencies (public, private and NGOs); and
3. Absence of Best Management Practices (BMPs) in IWRM in the Malaysian context.

Under the Malaysian Constitution, water is a state matter. Nevertheless when it comes to water resource development, utilisation and management, both the federal and state governments are involved. This is because the responsibility for water resource administration is fragmented and is shared among a number of federal and state agencies, with each having its own specific involvement in water related issues. Their interest in water related matters could be viewed from any of the following aspects:

- Planning, development and management of water resource aspects;
- Protection and conservation of water aspects;
- Land use control and watershed management aspects.

IWRM includes actions necessary to develop an effective framework of policies, legislations, financing structures, capable institutions with clearly defined roles, and a set of management instruments (GWP-ToolBox, 2003). The purpose of such a framework is to effectively regulate the use, conservation and protection of the water resources, balancing requirements for broad economic development and the need to sustain ecosystems. The emphasis here is on the process of establishing priorities and actions for integrated management of water resources. Priorities include ecosystem protection and conservation in the basin. As only modest progress has been made in creating public awareness in IWRM, its realisation is still minimal.

WRM/IRBM of the Langat River

The Langat Basin is an area drained by the Langat River in the state of Selangor, Malaysia. The Basin is currently one of the fastest developing areas in the country. A number of large scale socio-economic projects are either currently taking shape or are already completed in the Basin. These include the new

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township of Putrajaya (new Federal Government Administrative Centre), Multimedia Super Corridor (MSC) for the information technology industry, the BioValley for biotechnology research/industry, the Kuala Lumpur International Airport and several institutions of higher learning.

Rapid urbanisation in the Basin has led to a large influx of people into the region. A sudden increase in population has exerted a number of stresses on the Langat River. One of the main problems is river pollution from sewage and suspended solids resulting from land clearing and discharge of untreated or incompletely treated sewage. The problem is of concern to many including government, non-governmental organisations and the public as the Langat River is the main potable water resource for the whole Langat Basin and the Klang Valley (Kuala Lumpur) nearby where almost a million people depend on this river for drinking water. Many attempts have been made to arrest the deterioration of the Langat River water quality but with limited success. The root of the problem is the absence of a truly integrated management system of water resources in the Basin.

Integrated management has been applied in several water quality improvement programmes funded by the government for the Langat River Basin. The Consultancy Unit of Universiti Malaya (UPUM, 2002) has conducted a Pollution Prevention and Sungai Langat Water Quality Improvement Programme funded by the then Ministry of Science, Technology and Environment. The objectives of the study were:

i. To improve, upgrade and maintain raw water quality of Sungai Langat from medium polluted to clean category (Class III to Class II), so that it is suitable for water treatment purposes using conventional methods
ii. To evaluate various control instruments such as engineering, scientific, legal, economic and institutional at meeting the objectives of reducing pollution load into the Sungai Langat and the maintenance of a suitable environment for repair and self restoration.
iii. To restore and maintain Sungai Langat at Class II after the implementation of the river improvement project.

In this study the holistic approach to watershed management was applied (Figure 1). A watershed management plan (WMP) is needed to address several issues: (i) pollution load estimation, sources and geographical information system (GIS), (ii) pollution load reduction strategies and best management practices (BMPs), and (iii) community, institutional and regulatory aspects.

The IRBM concept was taken into consideration as well in the study by Mazlin *et al.* (2004a; b; c). This study started at the end of year 2000 and was completed in December 2003 under the IRPA Grant mechanism. The objectives of the study were:

i. To understand inter and multi-disciplinary approaches to monitoring and assessing the health of the Langat Basin ecosystem and suggest a framework for integration.
ii. To identify strategies and tools that allow integration of conservation and development, maintenance of ecological integrity, protection of ecosystem resilience and satisfaction of basic human needs.
iii. To gather scientists and technical experts to monitor, analyse, evaluate and make recommendations on the sustainable management of ecosystem health at the national level based on the Langat Basin as a case study.
iv. To suggest a list of environmental health indicators which will assist planners, policy and decision makers in planning and environmental management.
v. To develop an information directory related to Langat Basin Ecosystems to facilitate finding of information and references.
vi. To develop a decision support system inclusive of databases, good management systems, modeling and friendly user interface.

This study advocated the concept of IWRM-IRBM and introduced a general framework for structuring IWRM-IRBM planning and implementation. It also involved the development of a simulation model using Artificial Neural Networks (ANN).

Conclusions

The concepts of IWRM and IRBM promote a holistic approach to managing the natural water resources of Sungai Langat within the Langat Basin community area. They need to be adopted as a matter of urgency as they aim for pollutant-free water discharge into the Langat river or water courses. By applying this approach the current quality of water will not only be enhanced, but environmental protection is assurred as well which directly provides for healthy living. The realisation of benefits by applying this approach has been proven in many instances in recent years worldwide. In fact, this approach offers greater integration via participation amongst the government agencies, non-government sectors and stakeholders, on reducing or alleviating pollution levels and increasing environmental awareness amongst the general public. The resolution to treat available natural water resource within the context of environmental conservation and best water resources management practices is an imperative.

References

GWP-ToolBox. 2003. *Sharing Knowledge for Equitable, Efficient and Sustainable Water Resources Management.* Global Water Partnership ToolBox Integrated Water Resources Management.

Mazlin B. Mokhtar, Rahmah Elfithri & Abdul Hadi Harman Shah. 2004a. Collaborative Decision Making as a Best Practice in Integrated Water Resources Management: A Case Study on Langat Basin, Malaysia. In *Proceedings First Southeast Asia Water Forum*, pp. 333-354.

Mazlin Bin Mokhtar, Rahmah Elfithri & Abdul Hadi Harman Shah. 2004b. Collaborative Decision Making in the Langat River Basin: Potential Indicators for Management of Water Resources. In Aminuddin Ab. Ghani *et al., Proceedings of the 1st International Conference on Managing Rivers in the 21st Century: Issues & Challenges*, pp. 370 – 374.

Mazlin Bin Mokhtar, Shaharudin Idrus, & Sarah Aziz(ed). 2004c. Ecosystem Health of The Langat Basin. *Proceedings of the Langat Basin Research Symposium 2003*, Bangi, Selangor: UKM, 290p.

Mazlin B. Mokhtar & Sarah Aziz A. Ghani Aziz. 2003 Integrated coastal zone management using the ecosystems approach: some perspectives in Malaysia. *Ocean & Coastal Management* 46 (5): 407 – 419.

Unit Perundingan Universiti Malaya. 2002. Program Pencegahan Pencemaran dan Peningkatan Kualiti Air Sungai Langat; Draf Laporan Akhir.

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Ethics in Water Resource Management

Water is fungible. As aggregates of molecules, it does not stay in one place. It is the natural resource on which human life, food security and the health of ecosystems depend. Water resource is that portion of the hydrological cycle that provides the overall economic, social and life support functions to all possible needs of water, including economic, social and environmental needs.

Water geography is defined by its ecosystems - the sources and sinks of water molecules: wetlands, lakes, falls, rivers and oceans. Water is a renewable resource. It is not created nor destroyed. It is just put into a form which makes it available, contaminated, salinated, or removed from aquifers.

Water a Global Concern

Water is a global issue. It has been incorporated into the human rights agenda through the United Nations. The challenge is to ensure that rights are protected: rights to access to water resource. No one disputes the fundamental right of every person to have water to live and survive. Our world has a global water crisis right now. The crisis is not about having too little water to satisfy our needs. It is a crisis of poor water management resulting in billions of people and the environment consequently suffering.

The international observance of World Water Day (WWD) is an initiative that grew out of the 1992 United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro contained in Chapter 18 (Fresh Water Resources) of Agenda 21. The United Nations General Assembly designated 22 March of each year as the World Day for Water. The theme 'Water and Culture' of WWD 2006 draws attention to the fact that there are as many ways of viewing, using, and celebrating water as there are cultural traditions across the world. Sacred water is at the heart of many religions and is used in different rites and ceremonies. Water has been represented in art for centuries - in music, painting, writing, cinema - and it is an essential factor in many scientific endeavours as well. Eighty percent of our body is formed of water, and two-thirds of the planet's surface is covered by water. Water is our culture, our life.

In Malaysia, the National Water Resources Council (NWRC) was set up in 1998 for effective water management, including the implementation of inter-state transfer of water. To ensure sustainable water resource and efficient water supply services, the Federal Government is moving towards greater involvement in the management of water resource and water supply services, and the implementation of integrated water resource management.

Integrated Water Resource Management (IWRM)

To achieve sustainable development, we must manage our most vital natural resource in an integrated manner or precisely through IWRM. IWRM can be defined "as a process which promotes the coordinated development and management of water, land and related resources in order to maximise the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems." It emphasises that water should be managed in a basin-wide context under the principles of good governance and public participation.

An effective water resource management is needed to integrate a number of water sub-sectors such as hydropower, water supply and sanitation, irrigation and drainage, and environment. This form of integration will ensure that social, economic, environmental and technical dimensions are taken into account in the management and development of water resources. The art and practice of equitable distribution of and access to water resources for all people, as a fundamental human right and international obligation, is the essence of ethical questions of all trans-boundary natural resources of a finite nature.

The growth in population and expansion in urbanisation, industrialisation and irrigation in agriculture are imposing growing demands and pressure on water resources, besides contributing to rising water pollution. The unavailability of clean water supply is a growing problem and is bound to be an accelerated problem as the global population reaches 10 billion. The ethical dilemma is how should we manage the scarcity of water resources? Should the availability of water be considered as a human right? If so, then should the earth's water resources be managed in such a way that each person is allocated a basic entitlement of drinking water? But who ensures that the rights are protected? All peoples have the right to have access to water resources in quantities and of a quality equal to their basic needs.

Ethical Considerations

The more we consume material products, the more water is used. Conservation of water does not only mean using low flow showers; it means reducing material consumption. For example, the production of a car uses 50 times as much water as its weight. Therefore conservation ethics should be included into whatever water systems exist in the bioregion.

Humans create artificial lakes, dam rivers, redirect the flows of streams and rivers, and flood enormous land areas in order to manage their water resources. However, these concepts of protecting rivers, lakes and oceans only benefit human use. What ethical restrictions should be imposed on natural waterways? Are there water systems of such unique value that they should be protected beyond all human economic value?

There are about 86,000 chemicals in industrial and commercial use. These chemicals can enter and contaminate water resources. What ethical considerations are in place for what goes into water systems? Should we not ask: Is it good for the river that we use it as a septic system?

There are several ethical principles behind water resource use :

- **Principle of human dignity**
  No life without water; those to whom it is denied are denied life.
- **Principle of Participation**
  The poor must be involved in water planning and management.
- **Principle of Solidarity**
  Upstream-downstream inter-dependency calls for integrated water management.
- **Principle of Human Equality**
  Render to all persons their due.
- **Principle of the Common Good**
  Water is a common good.
- **Principle of Stewardship**
  Finding an ethical balance among using, changing, and preserving water resources and land.

Managing water resources is our responsibility and we are part of the solution. We have to focus on how we use water in an effective way.

Reference

Krimsky, S. 2005. Water Ethics Beyond Riparian Rights. WSSS Seminar.

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Contaminated Land Management in Malaysia

Contaminated land can be described as "land containing substances that when present in sufficient concentrations, may cause harm to humans, animals and the environment". Although a difference of opinion exists as to the exact nature of contaminated land, generally contaminants are classified as hazardous materials that do not naturally occur on a particular site. Contaminants present in soils are therefore the result of pollution from previous land usage. However, some areas may become affected from neighbouring properties by the movement of ground water.

We have not yet inherited a frightening legacy of contaminated land as in other developed countries. This can be attributed to the relatively recent industrialisation in Malaysia. Moreover, abandoned industrial sites are not many. However, contamination of land will become an increasingly serious concern unless positive efforts are directed at addressing this issue now. Moreover, we run the risk of being burdened with pockets of unsafe and unproductive contaminated land. Experience in other parts of the world has shown that acquiring, cleaning, and redeveloping contaminated industrial sites can be very expensive and time consuming.

Many contaminated sites remain obscure including abandoned municipal open dump sites. Industrial activities may also lead to disposal of waste by tipping it onto the land thus contaminating the land at the site. Land contamination may arise from unintentional leaks and spills too. Contaminants can range from solvents, oil, petrol, heavy metals to radioactive substances. Contaminants are not just restricted to industrial processes; other sources may include agricultural activities, inadequate waste disposal measures, deposition from the atmosphere and every day activities such as petrol distribution and dry cleaning.

Legislation

Specific legislations governing contaminated land are non-existent in most countries. In fact, many of the developed countries are beginning to promulgate legislations to govern contaminated land. Similarly there is no specific legislation addressing soil and groundwater contamination in Malaysia; neither are there any soil or groundwater quality standards. However section 24 of the Environmental Quality Act 1974, states that:

1. No person shall, unless licensed, pollute or cause or permit to be polluted any soil or surface of any land in contravention of the acceptable conditions specified under section 21.
2. Notwithstanding the generality of subsection (1), a person shall be deemed to pollute any soil or surface of any land if -
   (a) he places in or on any soil or in any place where it may gain access to any soil any matter whether liquid, solid, or gaseous; or
   (b) he establishes on any land a refuse dump, garbage pit, soil and rock disposal site, sludge deposit site, waste injection well or otherwise uses land for the disposal of or a repository for solid or liquid wastes so as to be obnoxious or offensive to human beings or interfere with underground water or detrimental to any beneficial use of the soil or the surface of the land.
3. Any person who contravenes subsection (1) shall be guilty of an offence and shall be liable to a fine not exceeding one hundred thousand ringgit or to imprisonment for a period not exceeding five years or both and to a further fine not exceeding one thousand ringgit a day for every day that the offence is continued after a notice by the Director General requiring him to cease the act specified therein has been served upon him.

Several other sections of the Environmental Quality Act address soil contamination indirectly. Section 31 gives the Director General the power to require the owner or occupier of a premise to install pollution control equipment, conduct a study on environmental risk, and maintain a monitoring programme. Section 33A allows the Director General to request for an environmental audit for premises perceived to be polluting. Section 34B prohibits the placing of any waste on land or surface waters. The Environmental Quality (Scheduled Wastes) Regulations 2005 list contaminated soil as a scheduled waste requiring specific ways to adequately treat and dispose off the waste.

Identification of Contaminated Sites in Malaysia

Very little work has been carried out in identifying contaminated sites in Malaysia. In October 1997, the Department of Environment (DOE) commissioned Universiti Putra Malaysia to investigate and assess existing and closed municipal landfill sites in the Federal Territory of Kuala Lumpur and to propose appropriate remedial action by relevant authorities. The study was carried out on six closed and one existing municipal landfill sites. These included Paka 1, Sri Petaling, Jinjang Utara, Paka 2, Brickfields and Sungei Besi. The only active landfill site serving Kuala Lumpur City was the Taman Beringin Landfill. The investigations included characteristics of the landfill sites, surrounding land use, social aspects, topography, geological and hydro-geological component, groundwater flow pattern, hydrological component, water quality, gas measurement, vegetation, fauna diversity and toxicity tests.

The most polluted sites were identified based on three criteria, that is, water quality, landfill gas emissions and environmental pollutants in soils, leachate and groundwater. Taman Beringin was identified as the most polluted site followed by Jinjang Utara, Paka 1, Brickfields, Paka 2, Sri Petaling, and Sungei Besi. However, no remediation action was taken mainly because it was not in use then.

Other than the above study, contaminated sites that have been identified by the DOE are those sites contaminated by illegal dumping of toxic and hazardous waste where clean up was subsequently undertaken.

Future Plans

Under the Ninth Malaysia Plan, the DOE will undertake a study on the criteria and standards for managing and restoring contaminated land in Malaysia. The purpose of the study is to provide a framework for the proper assessment and management of contaminated sites. This would ensure a consistent standard for site assessment and subsequent clean-up and restoration. It would also provide guidance to those responsible for management as well provide

assurance to the community that public health and environmental concerns on contaminated sites are being addressed.

The proposed criteria and standards from the study will be used as an input to the DOE in formulating the appropriate regulations, if so required, for the control of land pollution. The outcome of the study should also provide useful information to the Government in formulating policy and guidelines for future development on contaminated sites.

Definition, Criteria and Standards

A definition of contaminated land will be part of the proposed study. Criteria for determining contaminated land including various types of contamination and use shall be developed. The severity of contamination and associated health and environmental risks shall be considered in developing the criteria. The study will include the development of standards for a wide variety of potential soil and groundwater contaminants and other substances and media that may be present.

Guidelines for Assessing and Reporting Contaminated Sites

Guidelines and protocols for assessing contaminated sites will be developed and guidelines for preparing reports of such assessment will also be included. The main objective of these guidelines is to ensure that reports prepared by consultants and others on the investigation, assessment, remediation and any subsequent monitoring of contaminated land contain sufficient and appropriate information to enable efficient review and appropriate action by regulators, site auditors, members of the public and other interested parties.

Technical guidelines on how to carry out investigations to enable contaminated sites to be assessed thoroughly and in the most economical manner shall also be developed. These guidelines will include some of this information:

1. Preliminary site investigation to determine the probability that a site is contaminated;
2. Detailed site investigation to provide additional information needed to confirm or refute potential for site contamination, primarily by sampling and chemical analysis of environmental media (air, surface water, groundwater, soil, flora, fauna);
3. Sampling strategy to obtain an accurate picture of distribution of contaminants on site, sampling preparations, sampling techniques, appropriate standard operating procedures and QA/QC protocols;
4. Health and environmental assessment to determine the potential human exposure and environmental impact of the contaminants on the current and proposed land use of the contaminated sites; and
5. Use of relevant models for exposure and risk assessment of contaminated lands and estimation of soil to groundwater contaminant release.

Guidelines for Remediation of Contaminated Sites

At the end of this study, technical guidelines for remediation of contaminated sites will also be developed. These guidelines essentially will consist of the following information:

1. Establishing remediation goals/targets;
2. Appropriate remediation methods to be used depending on the type and severity of contamination and site conditions;
3. Extent of remediation required, including areas off-site which have been affected;
4. Extent (if any) of public consultation and any local nuisance abatement required before and during remediation;
5. Plans to protect health and the environment during remediation, including safety considerations;
6. Outline of a site management plan if partial remediation is proposed; and
7. Sampling and analysis to be conducted to determine if remediation has reduced the level of contamination or risk to tolerable levels.

Guidelines for Planning and Management of Contaminated Land

There is a clear need for guidelines for better management and planning and to enable contaminated sites to be utilised for economic activities in the future. The study will therefore include the formulation of guidelines that will take into consideration the output of the study of the selected sites representing the various categories of contaminated land and identifying suitable land use for these contaminated sites. The guidelines shall also include the determination of the status of quality of the identified sites and the clean-up method required for such sites.

Pilot Study for Selected Sites

Pilot studies for selected sites representing the various categories of contaminated land will be conducted. Such studies will use the various guidelines that will be developed as stated above, namely the Guidelines for Assessing and Reporting Contaminated Sites and Guidelines for the Remediation of Contaminated Sites.

Inventory of Contaminated Sites

Identification of selected sites representing the various categories of contaminated land in the country shall be carried out. The identified sites along with relevant information and its profile shall be recorded. A database on an inventory of contaminated sites and its profiles will also be developed in a manner that enables easy retrieval of information, references and updating to be made.

Subsequent to the study, the DOE would continue its efforts to identify all contaminated sites throughout the country. The contaminated land information system envisaged to be one of the outcomes of the study would be continuously improved and upgraded where necessary.

Awareness and Capacity Building

The DOE would continue to play its role in promoting awareness to the public, decision makers and the professionals on the importance of protecting the environment including issues related to contaminated sites. It is expected that some basic training and awareness programmes on contaminated sites would be conducted during the study. A more specific training needs and capacity building programme amongst managers and professionals in relation to contaminated sites would be identified for implementation in the future.

Research Needs

Areas of research on contaminated sites ranked in terms of priority to be carried out as recommended in the study would be examined and the DOE would continue to support and collaborate with research institutes in enabling such research to be undertaken in the country. The DOE is also open to collaboration with international organisations for the management of contaminated land.

Conclusion

The environmental implications of contaminated land is a potential problem and the DOE is now taking the initiative to deal with it. An increasing population especially in urbanised areas has put heavy pressure on scarce land resources and the necessity to utilise or redevelop contaminated sites will be inevitable. The absence of legislation coupled with a low level of awareness has, in the past, diverted attention away from the contaminated site problem. There are no standards and protocols developed in Malaysia yet. In the absence of agreed standards or guidelines, an ad hoc approach was adopted resulting in variable standards being applied. There is a need for Malaysia to develop its own criteria and standards as a means for the protection and enhancement of contaminated land as well as developing technologies to meet local needs. General awareness amongst the public needs to be heightened and overall capacity amongst professionals needs to be raised.

In conclusion, the DOE looks forward to playing an important role, in partnership with others, in supporting, encouraging and promoting the importance of identifying contaminated land, managing and restoring these sites for beneficial use so as to eventually contribute to the overall betterment of our environment.

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Activity Highlights

Department of Environment, Malaysia

November 2006

4th ASEAN-Oil Spill Preparedness and Response (OSPAR) Management Meeting

Malaysia hosted the 4th ASEAN-Oil Spill Preparedness and Response (OSPAR) Management Meeting from 14-15 November 2006 at Langkawi Island. The two day meeting was chaired by the Deputy Director General of Environment (Operations) Ir Lee Heng Keng and attended by delegates from Brunei Darussalam, Indonesia, Malaysia, Philippines, Singapore, Thailand and observers from Japan, Cambodia, Myanmar and Vietnam.

The OSPAR Project was initiated in May 1993 in accordance with the Yokohama Declaration on Oil Spill Preparedness and Response in 1991. Six ASEAN countries (Brunei Darussalam, Indonesia, Malaysia, Philippines, Singapore, and Thailand) are participants of the ASEAN Oil Spill Response Action Plan (OSRAP).

December 2006

DOE Environmental Awareness Camp (KeKAS)

Organised by DOE in collaboration with Ministry of Education, it was held at Dusun Eco Resort, Bentong, Pahang from 8-11 December 2006. This second camp is a continuation of the first camp that was held in May at Institute of Biodiversity, Lanchang, Pahang. Forty trainee teachers and lecturers from 8 Teacher's Training Institutes in West Malaysia were trained as KeKAS facilitators during the camp.

Upcoming Events

Bandar Lestari Valuation Workshop – Environment Award 2005/2006

The Bandar Lestari Valuation Workshop - Environment Award 2005/2006 will be held on 5 December 2006 at Crystal Crown Hotel, Petaling Jaya. For further enquiries, please contact faizul@doe.gov.my.

Bandar Lestari-Environment Award 2005/2006: Public Opinion Survey Workshop

This workshop will be held on 12 December 2006 in Port Dickson in collaboration with the Institute of Environment and Development (LESTARI), UKM. For further enquiries, please contact faizul@doe.gov.my.

Forthcoming Issue

ISSUE 4 : How well does the public understand environmental issues and concerns? What has been done and what more needs to be done? Read all about **Environmental Education and Awareness** and more in this issue.

Article contributions and comments are welcomed. They are to be directed to:
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