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ENSEARCH
For a Better Environment
ENVIRONMENTAL MANAGEMENT & RESEARCH ASSOCIATION OF MALAYSIA

BERITA ENSEARCH

"The impact of CLIMATE CHANGE from today's path on WATER SCARCITY could reduce GDP of Central Africa, Mid Asia and East Asia by up to 6 %"

World Bank Group

Capacity Building NGO in the Environmental Field as an Enabler to Malaysian Professionals Growth

Brief History of ENSEARCH

ENSEARCH was registered on 26th November 1984 by a pioneer group of local professionals and academics from multidisciplinary background. The founder President (1984-2000) was Ir. K. Kumarasivam and the first Hon. Secretary General was Dato' Prof Dr. Abu Bakar Jaafar. Today, ENSEARCH has more than 300 Members consisting of Corporate, Individual and Life Members.

It is acknowledged that enhanced awareness and competency of organisations and individuals through education and training is essential to achieve the objectives of Malaysian Environmental Quality Act 1974. Therefore ENSEARCH began formulating and implementing Training programmes to enhance the capacity for environmental management in Malaysia.

In addition, ENSEARCH organises Tea Talks and Public Lectures to enhance awareness on pertinent and comprehensive issues on the environment. ENSEARCH has also been actively involved in dialogue sessions with relevant authorities in development of legislative and regulatory frameworks that strengthens the environmental management practices in Malaysia. In recognition of ENSEARCH's objectives, it has been given tax-exempt status whereby the donations to ENSEARCH are exempted from tax.

in this issue

NOTE TO MEMBERS

Members are encouraged to write to us at admin@ensearch.org in the event of changing contact details. Corporate members are recommended to provide more than one contact (email address) to facilitate better dissemination of ENSEARCH information.

Editor's Note

Dear Members,

It is the festive season of the year and hope all is well while the haze goes away.

Nevertheless, it is unfortunate that during this monsoon season, thousands of citizens are impacted where massive floods hit Kelantan, Terengganu and Johor, as the world celebrate International Day for Disaster Reduction in October.

Whether it is suspected to be climate change or loss of water catchment area upstream due to deforestation, it is high time for the government and people to act in response to such disaster, as it seems that flood mitigation efforts are not sufficient or ineffective, despite earlier experience in recent years.

With so many hype created by Greta the teen sensation, so many sweet promises from countries at the UN Climate Action Summit 2019, so much evidence from IPCC's Global Warming of 1.5 °C Special Report, yet consensus on more ambitious climate actions towards 1.5°C under Paris Agreement is not achieved at the UNFCCC Conference of Parties (COP25) held in Madrid, as if climate change impacts and repercussions are insignificant to impact our lives.

In this Berita ENSEARCH, we bring to you articles on Waste Water and Water Quality Assessment, which are closely related to the potential impact of climate change: Water Scarcity. In fact, the mid-term review of 11th Malaysia Plan highlighted "Improving Water Services" as one of the strategy in strengthening economic growth and development of National Water Balance Management System involving 18 river basins under the "Augmenting Climate Change Adaptation" strategy.

Further from the Sustainable Consumption & Production (SCP) articles featured in the previous Berita ENSEARCH, the presentation by Mr David Newman on Waste Management and Circular Economy at the recent International Conference and Exhibition of Waste Management (ICEWM2019) organised by ENSEARCH is featured as we continue the conversation on SDG 12: Responsible Consumption and Production. Mr David highlighted the Cradle to Cradle model where the lifecycle of a product involved Technosphere and Biosphere where manufacturing and production processes interacts with use of virgin material and decomposition during end of life. This echo the message on SCP from the previous Berita ENSEARCH: "*It is time to review and redesign the life cycle of products and services that is more environmentally as well as ecologically friendly.*"

It is also timely that the ICEWM2019 was held to initiate actions on waste management as the UN Habitat endorsed World Habitat Day was celebrated in October with call for action on "Frontier Technologies as an innovative tool to transform waste to wealth".

As highlighted in the featured articles and ICEWM2019, it is imperative to mainstream "Nature based Solutions" to many of the existing issues in environmental degradation and climate disasters.

Follow us as we track sustainability, climate change and environmental progress.

Merry Christmas and wishing a Happy New Year of 2020 to all.

Thank you.

Kelvin Diong

Editor

Featured Member

ENSEARCH Council Member

Ms Tania Golingi (ENSEARCH Sabah)

Ms Tania Golingi is ENSEARCH's 2019/2020 Co-Opted council Members from Sabah Branch. She heads the Ecology & Environment Department at DHI Water & Environment (Malaysia) Sdn Bhd and is responsible for marketing and development within environmental and technical management fields and of numerous projects in South East Asia. She completed BSc (Environmental) with 1st Class Hons. in Botany from University of Western Australia in 1997.

Ms Tania started her career as Environmental Scientist at Danish Hydraulic Institute, Malaysia and have participated in various positions and projects in Malaysia and Singapore. She rose the rank and eventually being promoted as Project Manager in Environmental Services, responsible for technical management of numerous projects in South East Asia.

With more than 20 years in the field, Ms Tania Golingi developed vast experience in Environmental Impact Assessment (EIA) study and consultation. She was involved in the Integrated Shoreline Management Plan for Perlis, Malaysia. She carried out environmental baseline assessment and provided input to the Shoreline Management Plan, particularly the identification of sensitive coastal and marine habitats as well as conservation requirements to be incorporated into the spatial plan.

Ms Tania is a mother of 3 boys. As an avid nature lover, she loves the outdoor activities such as hiking, swimming, diving etc. Even though these days her work at DHI doesn't take her outside the office as much as she like, she would jump on the nature visiting opportunity i.e. surveying mangroves, seagrass etc. whenever possible.

Featured Article

Wastewater and surface water issues in rural area of Bario, Sarawak: Is there any solution to it?

Contributed by: Dr. Nuruol Syuhadaa Mohd

Bario is a remote area of Sarawak located on the Kelabit Highlands, at an altitude of 3500 feet above sea level, covering an area of 3,850 km2 (***Figure 1).*** It is located in the middle of thick forest, close to the Sarawak-Kalimantan border, with the only access is either by 55-minutes flight with 16-seater twin otter plane or 14-hour journey with four wheel drive (4WD) using logging trail (***Figure 2***). Bario community consists of 6,000 people of 13 to 16 villages with a small number of roads linking between them. With annual rainfall of 2000 mm, Bario is drained by four small streams, Remapoh, Arur Laab, Arur Dalan and Merarui rivers, with one to four metres in width, which converge into Dapor river. Bario rivers also forms the headwaters of Limbang, Kuba-an, Libun, and Dapor rivers, with Libun and Dapor rivers being the important tributaries for the Tutoh and Ulu Baram rivers.

Due to its remoteness, the limited infrastructure facilities that are provided are often inadequate, hence resulting in a poor and often deteriorating environment. Electricity generated through solar panels was just implemented in less than 5 years while drinking water treatment facilities are still under construction, expected to be in operation in 2020. As for sanitation system, no plan seems to be in place as it is now. Currently, the sewage was discharged into the steel drum barrel with 200 L capacity that after years of usage, became corroded, and leaked out into the ditch (*Figure 3*). While the sullage (i.e. wastewater coming from kitchen) was directly discharged into the ditch, making the ditch functioning as an open sewer system, before being released untreated into Merarui River (***Figure 4 & Figure 5***). Additionally, they were at least two sites along the ditch and Dapor River that were known for the place where the buffalos wallowed (***Figure 6***). At one time, as many as 10 domesticated buffalos were found wallowing at a site along the ditch and as many as 100 wild buffalos were found wallowing at a site along the Dapor River. These buffalos were the primary inception of the animal feces that goes into the ditch and Dapor River.

Figure 1. Bario, Sarawak is a rural and remote area with main economic activities rely heavily on rice cultivation.

Figure 2. Bario (in a black circle) is very close to the Sarawak-Kalimantan border.

Figure 3. **The steel drum barrel that served as a septic tank**

Featured Article

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In Bario, there were two main indigenous tribes inhabited the area. The main tribe Kelabit inhabited the town and small villages scattered around the town, while the Penan tribe inhabited the jungle along the perimeter of Bario. The Penans are nomadic indigenous people that tend to build their settlement deep in the jungle. But nowadays, they tend to build their houses at the edge of the jungle close to the village, so that they could send their kids to the school while the parents work at the paddy field owned by Bario residents. The Penans are also inclined to build their houses close to the river because the river serve as their primary water resources. However, at the same time, they will also build outhouse toilet along the the same river, in this case, Arur Dalan River, hence, contaminating the river with human excretion. Arur Dalan River currently holds the main makeshift water reservoir for drinking water in Bario.

The main economic activities in Bario rely heavily on rice cultivation with paddy field concentrated in the middle of Bario town (***Figure 1***). All four streams (Remapoh, Arur Laab, Arur Dalan and Merarui rivers) as well as the ditch flowed through the paddy field, hence, making them prone to the non-point source of fertilizers used during the paddy planting. Therefore, as all three small streams (Remapoh, Arur Laab, Arur Dalan) and the ditch merge into Merario Rivers, before converged into Dapor River, it becomes imperative to investigate the quality of the surface water used as a main source of the water supply for Bario.

Surface water samples were collected at 8 sampling sites in Bario and analyzed for pH, Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total Suspended Solids (TSS), Ammonia (NH3-N) and E.Coli. In accordance to Malaysia's Department of Environment (DOE) Water Quality Index (WQI), all parameters were within class I, II and III except for BOD, COD and NH3-N in the samples from the ditch (***Table 1***).

Figure 4. The ditch that flows through the long house area of Kelabit tribe.

Figure 5. Dapor River - Three small streams (Remapoh, Arur Laab, Arur Dalan) and the ditch will merge into Merario Rivers, before converged into Dapor River.

Figure 6. Buffalos can be found wallowing in the ditch and in the Dapor River.

Featured Article

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High COD content, with concentrations ranged from 79.8 to 243.3 mg/L, indicated that the water was highly polluted with both oxidizable organic and inorganic pollutants. Additionally, it can also be seen that the highest COD were observed in water samples from the ditch, indicating the dominant impact of chemical sources. This assumption was held true as the ditch flows through the town of Bario; the main source of chemical constituents in the water [Peters et al., 2019].

As for BOD, high concentration of 6.50 to 8.02 mg/L implied that organic matter that needs oxygen while decaying or breaking down were coming from biological sources such as sewage, plant and animal matter (***Table 1***). High NH3-N concentrations, ranged from 0.90 – 0.96 mg/L, were also observed in water samples from the ditch. As the ditch flow through the town, it was believed that BOD and NH3-N were originated from human excretion due to the leaking septic tank [Wang et al., 2019]. As the ditch also flows through the paddy field, fertilizer runoff might also become a possible source for NH3-N [Peters et al., 2019]. However, considering the high E.Coli content of all samples, it was affirmed that human and animals excretion were the dominant sources that contaminate the water and not the fertilizer runoff [Silva Lanna et al., 2019].

In overall, the WQI of all water samples exhibited water quality within class III (moderate), with order of its quality from best to worse: Arur Dalan River > Merarui River > Dapor River > Ditch. Arur Dalan River flows mostly through the jungle and only small stretch flows through the town of Bario, hence, explaining its better quality. Unlike Arur Dalan River, the ditch, Merarui River and Dapor River all flow through the Bario town. Among these, the ditch posed the lowest water quality as it was the point where all the untreated and leaking sewage started to get into the surface water. Sg. Dapor held a slightly better quality than its tributary of Sg Merarui, primarily because it is relatively bigger and deeper than Sg. Merarui, hence having greater diluting capacity. In general, the water may still be used for water supply but extensive treatment is crucially required.

Table 1: Water quality of surface water and open ditch in Bario according to WQI proposed by Department of Environment (DOE), Malaysia.

	pH	TSS mg/L	DO mg/L	BOD mg/L	COD mg/L	NH_3-N mg/L	E.Coli CFU/ 100 mL	WQI Class
BR1 – Ditch (at Kg. Bario Asal)	5.84	62.06	4.67	6.50[4]	203.8[5]	0.90[4]	500	III
BR2 – Ditch (at local shop)	5.72	60.02	4.93	6.94[4]	243.3[5]	0.96[4]	700	III
BR3 – Ditch (at rsidents housing)	5.80	64.77	4.92	6.62[4]	223.3[5]	0.93[4]	800	III
BR4 - Arur Dalan River (upstream)	7.08	1.71	6.94	7.91[4]	79.8[4]	0.28	430	III
BR5 - Arur Dalan River (downstream)	6.51	3.52	6.47	7.93[4]	80.3[4]	0.56	620	III
BR6 - Merarui River (upstream)	6.76	4.37	5.54	8.02[4]	126.7[5]	0.37	540	III
BR 7 - Merarui River (downstream)	6.32	17.29	5.03	7.83[4]	174.6[5]	0.56	750	III
Br 8 - Dapor River	6.47	47.67	5.60	7.49[4]	176.8[5]	0.65	805	III

Note: WQI is calculated based on 6 parameters (pH, TSS, DO, BOD, COD and NH3-N).

The results highlighted a crucial issue: the ditch and rivers posed high organic content (e.g. COD and BOD) and highly contaminated with ammonia (e.g. NH3-N) and pathogen (e.g. E.Coli). The primary source of these contaminants were believed to be originating from human excretion due to the leaking septic tank. High content of ammonia, other than causing eutrophication to the surrounding surface water, will pose huge technical implications to the water treatment plant operation. High ammonia content will make the chlorine disinfection process becomes ineffective. Firstly, the disinfection system will need more chlorine as the chlorine will first need to react with all the available ammonia before it can start disinfecting the pathogen [Zhang et al., 2019]. Secondly, the reaction of ammonia and chlorine will form disinfectant by-products that are more dangerous than the original form of ammonia and chlorine itself [Zhang et al., 2019].

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Therefore, the identification of a suitable wastewater treatment system to treat these contaminants, especially ammonia, has become a crucial issue.

With regard to that, we proposed solutions that will be targeting all three levels of wastewater management system of Bario:

A. Replace the 200L drum barrels that are being used as septic tanks with proper septic tanks.

B. Sparsely plant vegetation (i.e. water lily) that can absorb the nutrient from the wastewater at the ditch to enable it to be self-treating and increase its aesthetic.

C. Develop constructed wetland as a treatment for the wastewater before being released into the river.

Apparently, ecological engineering solutions like vegetated ditch and wetland are the most suitable treatment system for rural areas because of various reasons. Firstly, these two engineering solutions are excellent in removing nutrients especially NH3-N, as the vegetation will absorb the nutrient from the wastewater. They are also fairly good in removing pathogen like E.Coli as the root system of the vegetation will serve as a filter and a harbor for the pathogen to attach themselves to. Secondly, residents of Bario are all paddy planters. They are experts in planting paddy, managing an irrigated paddy field and handling piping and channeling. Hence, they have all the skills needed to maintain a wetland by themselves. Thirdly, these two engineering solutions require low and easy maintenance routine. Once the vegetation has growing steadily, the only maintenance needed is pruning the vegetation every couple of months. It is very critical not to allow the vegetation decay in the ditch and wetland as the decaying vegetation will release the nutrients from the plant back into the water [Wang et al., 2019]. In addition to the high

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aesthetic value, these approaches would also enrich the biodiversity of the surrounding area. Overall, these engineering solutions are the perfect example of a self reliance solution for wastewater management in rural areas like Bario.

In conclusion, as the sewage will be treated in septic tanks, and the sullage and surface water in the ditch will be treated using vegetated ditch and wetland, Bario has huge potential to facilitate more sustainable, economical and effective wastewater management system.

Acknowledgement: The authors would like to thank University of Malaya for the funding provided under University Malaya Transformation Research – Bario Programme Grant RG557-18HTM. The authors would also like to thank 'Penghulu' Bario, Mr. Robertson Bala and all residents of Bario for being very cooperative and helpful throughout the period of the study in Bario.

Figure 7: The team member of University Malaya Transformation Research – Bario Programme with Ketua Kampung Caleena Sakai.

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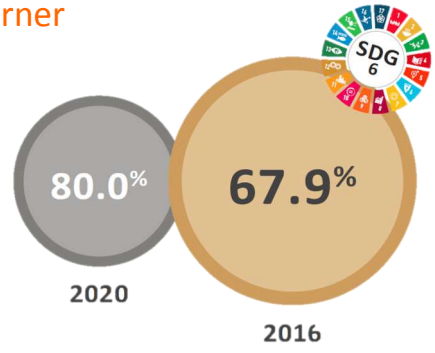
SDG Corner



Did you know?

The **11th Malaysia Plan** envision to have **80%** of sewerage connected services coverage by 2020, especially in main cities.

Featured Article

Water Quality Improvement and Preservation through Pollution Load Control

Contributed By: Zaki Zainudin, Samantha Loke Yin Ying and Chua Li Ying

Introduction

River water quality in Malaysia continues to degrade with time [1]. River pollution has been especially bad for rivers that flow through urban areas. The high pollutant loads have rendered these urban waterways unsuitable for body contact and recreational activities.

Issues relating to water quality impairment, particularly involving water supply disruption and fish kill continue to hit the national headlines. In 2017 alone, several incidences of ammonia (NH_3-N) contamination in Johor, affecting intake points along Sg. Johor and Sg. Sembrong were widely reported in the media [2], [3], [4].

Besides contamination in Johor, the Klang Valley region is also no stranger to supply disruption due to pollution. Through 2013 to 2016 several cases of contamination involving the Semenyih, Bukit Tampoi and Cheras Batu 11 supply schemes were reported [5], [6].

These shutdowns affect millions of consumers and many industries. Besides the inconveniences they cause, businesses also incur productivity losses.

While regulatory frameworks for pollution control have been in place since the late 70s, they still fail to tackle the issue holistically and effectively as more and more development takes place.

Regulatory Limitations and Discrepancies

The Environmental Quality Act, 1974 (EQA, 1974) is the primary act which regulates pollution sources including discharge to rivers and other surface water bodies. The National Water Quality Standards (NWQS) on the other hand, are the water quality benchmarking standards used to ascertain whether a river water quality is fit for a specific beneficial use. As shown in ***Table 1*** and ***Table 2,*** the NWQS are categorized into six classes.

Table 1: NWQS Water Classes and Beneficial Uses

Class	Uses
Class I	Conservation of natural environment Water Supply I—Practically no treatment necessary. Fishery I—Very sensitive aquatic species
Class IIA	Water Supply II—Conventional treatment required Fishery II - Sensitive aquatic species
Class IIB	Recreational use with body contact
Class III	Water Supply III—Extensive treatment required. Fishery III—Common of economic value and tolerant species: livestock drinking.
Class IV	Irrigation
Class V	None of the above

Original Article from https://www.linkedin.com/pulse/water-quality-improvement-preservation-through-pollution-loke

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Table 2: National Water Quality Standards for Malaysia [1]

Parameter	Unit	CLASS					
		I	IIA	IIB	III	IV	V
Ammoniacal Nitrogen	mg/L	0.1	0.3	0.3	0.9	2.7	>2.7
Biochemical Oxygen Demand	mg/L	1	3	3	6	12	>12
Chemical Oxygen Demand	mg/L	10	25	25	50	100	>100
Dissolved Oxygen	mg/L	7	5-7	5-7	3-5	<3	<1
pH	-	6.5-8.5	6-9	6-9	5-9	5-9	-
Colour	TCU	15	150	150	-	-	-
Electrical Conductivity*	µ S/cm	1000	1000	-	-	6000	-
Floatables	-	N	N	N	-	-	-
Odour	-	N	N	N	-	-	-
Salinity	%	0.5	1	-	-	2	-
Taste	-	N	N	N	-	-	-
Total Dissolved Solid	mg/L	500	1000	-	-	4000	-
Total Suspended Solid	mg/L	25	50	50	150	300	300
Temperature	°C	-	Normal +2	-	Normal +2	-	-
Turbidity	NTU	5	50	50	-	-	-
Faecal Coliform**	count/100 ml	10	100	400	5000 (20000)a	5000 (20000)a	-
Total Coliform	count/100 ml	100	5000	5000	50000	50000	>50000

Note:

N: No visible floatable materials or debris, no objectional odour or no objectional taste

****: Related parameters, only one recommended for use***

*****: Geometric mean***

a: Maximum not to be exceeded

Effectively, Class I water quality is "excellent water quality", perhaps comparable to natural level where there is little to no pollution, whereas Class IV/V on the other hand, is grossly polluted, comparable to the infamous water quality of Sg. Klang, Sg. Juru or Sg. Segget.

The existing regulatory mechanism for water pollution control focuses on the limit of the concentrations of pollutants in effluent discharges, but does not consider the capacity of the receiving water to assimilate the load. It also does not take into account of the need to protect the beneficial uses of the water. In other words, compliance with limits as per the law, does not guarantee good water quality at the receiving river/water body.

For example, the Standard A limit (the most stringent standard of the EQA, 1974, as shown in ***Table 3***), prescribes an upper NH_3-N threshold of 10 mg/L. When compared to the NWQS, this falls within the Class V, "very polluted" category. The same applies for other water quality parameters.

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Table 3: Acceptable Conditions of Sewage Discharge [Second Schedule of Environmental Quality (Sewage) Regulations 2009, EQA, 1974]

Parameter	Unit	STANDARD	
		A	B
Ammoniacal Nitrogen (enclosed water body)	mg/L	5.0	5.0
Ammoniacal Nitrogen	mg/L	10.0	20.0
Nitrate—Nitrogen (enclosed water body)	mg/L	10.0	10.0
Nitrate—Nitrogen	mg/L	20.0	50.0
Phosphorus (enclosed water body)	mg/L	5.0	10.0
BOD_5 at 20°C	mg/L	20	50
COD	mg/L	120	200
pH	-	6..0-9.0	5.5-9.0
Suspended Solid	mg/L	50	100
Temperature	°C	40	40
Oil & Grease	mg/L	5.0	10.0

The EQA 1974 was perhaps drafted, with the anticipation that the river's dilution capacity would offset some part of the load, bringing it down to acceptable levels. Unfortunately this is not always the case because:

1. The effluent discharge volume can be "big"; relative to the "small" receiving water body.
2. The cumulative/total effect of other discharges which adds considerable load to the receiving water body.
3. Influence of point sources not regulated under the EQA 1974, such as commercial establishments, restaurants, wet markets, car washes, etc., which can add considerable load (usually high concentration waste).
4. Illegal discharge/dumping.
5. Seasonal variations which influence the dilution volume. In essence during dry-spells the river would become more sensitive to pollution.
6. Effects of non-point sources of pollution (pollution driven by runoff).

EQA 1974 only governs discharge limits related to industrial, sewage, leachate from landfills and transfer stations, palm oil mill and rubber industry effluent [7]. Other point source discharges such as from restaurants, wet markets, poultry farms, car wash premises, etc. are currently "grey areas" and remained unregulated in existing environmental regulations.

This bears various operational implications in terms of accountability, the type of best-available treatment technology to be used, monitoring and enforcement. Appropriate strategies/legislation review will have to also be drafted to deal with these issues.

Change however, is underway as the authorities begin to adopt load control strategies (e.g. Total Maximum Daily Load, TMDL). TMDL is a pollution budgetary tool that involves calculations of the maximum amount of pollutants allowed to enter into a water body daily to meet the water quality standard [8]. The next step would be then to allocate the necessary reductions to one or more of the pollution sources if it does not meet the targets/goals.

Pollution load control is not a new concept, it has been practiced in various countries to restore their impaired waters, such as the United States (TMDL), Japan (Total Pollutant Load Control System, TPLCS) [9] and Korea (Total Pollutant Load Management System, TPLMS) [10], [11].

Setting Water Quality Targets

Malaysia is missing one of the most important components in surface water quality preservation: pragmatic water quality goals or targets. A water quality target is usually set based on the desired beneficial uses within the designated area/ river stretch on a per parameter basis.

In the past, many parties adopted a "basin-wide" approach, when it comes to water quality target, such as adopting the "Class IIB" threshold of the National Water Quality Standards (NWQS). While this effort is commendable, it remains superfluous. Such approach also bears significant management, technological and cost implications.

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Moving forward and in tandem with the TMDL/load control strategy, it is more advantageous to set targets which are pragmatic and meaningful to implement. The beneficial uses of water as prescribed by the NWQS can be a good basis to set the targets. This is also in tandem with international norms.

For example, elevated levels of ammonia (NH_3-N) can be harmful to sensitive fish species. The Malayan mahseer a.k.a. *kelah/empurau* (genus *Tor*) and *udang galah* (*macrobrachium rosenbergii*) cannot tolerate elevated levels of NH_3-N [12], [13]. For this reason, river stretches which host very sensitive aquatic species may require "Class I" comparable water quality, where the NWQS prescribes NH_3-N should not exceed 0.1 mg/L.

On the other hand, downstream urban river stretches, would have higher NH_3-N concentrations due to the myriad of sources present. More "hardy" species such as Tilapia would be able to withstand higher NH_3-N concentrations, some say, even up to Class IV (0.9 – 2.7 mg/L) [14]. Hence it is sufficient for such stretches to adopt a NWQS Class III target, which is for "Fishery III – common, of economic value and tolerant species; livestock drinking".

It is a romantic notion wanting to see *Kelah* swimming in Sg. Gombak in Kuala Lumpur; however, to achieve such good water quality in the middle of the city, requires astronomical effort and cost, to achieve as well as maintain. At least in the initial stages, it is sufficient to achieve a more humble, Class III designation in major city centres. This by itself would be a monumental achievement in view of the current Class IV/V denotations plaguing many urban rivers in Malaysia such as Sg. Klang, Sg. Segget, Sg. Tebrau, Sg. Juru and others.

Areas near intakes should achieve a Class IIA denotation. This is consistent with the prescribed beneficial use of the NWQS. Thus, it is clear that targets should be pragmatic, meaningful and in accordance to specific beneficial uses coherent to a river stretch. There is one exception to this rule: If the current, baseline water quality is better than the prescribed NWQS class, then surely, the baseline should be maintained and adopted as the target.

These targets are not only advantageous for river rehabilitation, but also for preservation. Water quality continues to deteriorate every year due to rapid development. Setting targets to maintain the baseline water quality and/or beneficial use, would prevent the situation from getting worse. Preservation is just as important as rehabilitation in water quality management.

So, who should set these targets?

Presumably, because water resources is a "state" matter (as allotted in the federal constitution), it should be the respective state authorities. However, operationally, both state and federal agencies are involved in water resource preservation. Hence while the "driver" may be the respective state governments, everyone should be involved.

Finally, to further add weight to the targets, they should be tied back to the respective Key Performance Indicators (KPIs) of the government agencies. By doing so, the targets will be taken more seriously and more affirmative measures and cross-agency collaboration will happen. This is especially beneficial for load control measures/allocations that fall under different jurisdictional purviews. A far-fetched but nonetheless, very meaningful notion would be to gazette the water quality targets.

Pollution Load Control

Load management entails the control of concentration as well as volume (discharge volume) of effluent generating premises. The US EPA, as part of their TMDL initiative, expresses pollution load in kg/day.

The load released into the water column, must be that it does not exceed the water quality targets as previously discussed. This means the discharge must be within the river's 'carrying capacity', also known as the 'Waste Assimilative Capacity' or WAC.

In TMDL terms, the maximum load that an individual premise can release, is dubbed the "Waste Load Allocation" or WLA. The TMDL formula is:

Featured Article

Water Quality Improvement and Preservation through Pollution Load Control

Contributed By: Zaki Zainudin, Samantha Loke Yin Ying and Chua Li Ying

Equation 1:

TMDL = SWLA + SLA + MOS [8]

Where:

TMDL = Total Maximum Daily Load (TMDL)

WLA = Waste-load allocation for point-sources of pollution

LA = Load-allocation for non-point sources of pollution

MOS = Margin of safety (additional allocation to account for uncertainty of the response of water body)

The WLA or "permissible load" is derived using simple mass-balance or more complex modelling tools. To ensure the water quality target is consistently met, there are two approaches:

1. The steady flow approach:

The WLA is derived during low flow (low river dilution); a condition assumed to be when the river is very sensitive to pollution. The US EPA generally prescribes 7Q10 (7-day low flow with a return period of 10 years) when generating WLAs/ TMDLs.

2. The dynamic flow approach:

The WLA is derived seasonally, with varying flow regimes, as long as the water quality target is not breached each "season". In essence, it is a "variable WLA" that change with time (monthly, quarterly etc.).

Approach (1) is perhaps more "enforcement friendly" since the WLA remains static. The downside is, effluent discharging premises have to consistently achieve very low WLA at all times. This usually translates to higher treatment and management costs.

Approach (2) on the other hand, implies an effluent discharging premise will have more leeway during wet periods; when the flow of the river will be more, which incurs more dilution. This translates to better treatment cost savings. On the part of the authorities however, enforcement becomes trickier; because of the varying WLA.

Example below demonstrates the simple mass balance approach in deriving WLA.

Calculation to Derive WLA (Simple Mixing)

Problem: Derive WLA and effluent concentration permitted in order to preserve ambient water quality of NH_3-N = 0.3 mg/L maximum, post effluent discharge.

Baseline NH_3-N in the river @ 7Q10, C_i : 0.15 mg/L Initial river flow/discharge @ 7Q10, Q_i: 0.20 m^3/s Target NH_3-N, C_t : 0.30 mg/L Effluent discharge, Q_e : 0.01 m^3/s Effluent concentration, C_e : ?

Step 1: calculate the baseline in-stream NH_3-N load, using the following equation:

$L_i = C_i \times Q_i \times 86.4$

Where:

L_i = *Initial pollutant load (kg/day)*
86.4 = *Conversion factor to express the mass flow in kg/day*

$L_i = 0.15 \times 0.20 \times 86.4 = 2.592$ *kg/day*

Step 2: calculate the target load, post mixing, after the effluent discharge

$L_t = C_t \times (Q_i + Q_e) \times 86.4$

$L_t = 0.30 \times (0.20 + 0.01) \times 86.4 = 5.443$ *kg/day*

Step 3: calculate the WLA or available quantum of pollution load to not exceed 0.3 mg/L

WLA = 5.443 – 2.592 = 2.851 kg/day

Step 4: calculate the WLA with a MOS

As previously discussed, load control strategies should be accompanied with a margin of safety (MOS). Hence, arbitrarily adopting a 20% MOS, yields:

WLA_{MOS} = 2.281 kg/day.

Step 5: calculate the effluent concentration, C_e allowed

If the premise were to release effluent at 0.01 m^3/s, the maximum effluent NH_3-N concentration, C_e to still meet the ambient 0.3 mg/L post-discharge target should be:

C_e = (2.281 kg/day) / (0.01 x 86.4) = **2.64 mg/L**

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The example above assumes uniform, steady flow, steady state conditions, with no decay, settling or ammonia uptake. In essence, the WLA is derived solely based on dilution.

In reality though, ammonia uptake and other processes also influence constituents such as dissolved oxygen (DO) and algae. The same is also true for DO-BOD-SOD interactions, algae respiration, etc.

These more complex bio-chemical interactions can also be mathematically characterized and used in water quality modelling software packages. These software packages are often deployed to derived WLAs.

Control of non-point sources (NPS) of pollution is usually a management issue. Active runoff treatment is not feasible because of the enormous volume. NPS pollution control in the conventional sense means preventing pollution deposition on surfaces (particularly impervious surface). Increase of pervious/porous surface areas, also means better runoff infiltration into the soil. Erosion and sediment control measures also abate NPS pollution.

There have been recent proposals to capture and store runoff for delayed treatment, perhaps even for potable and non-potable water supply. This is an emerging concept which should be further explored.

Implementation Strategies

Some strategies which can be deployed to control and minimize pollution load:

1. The authorities should adopt a "discharge last" policy. Effluent reuse and recovery should instead be promoted. The effluent generating premise should recover as much as possible, where the residual balance should only be allowed for discharge. This can be done through the adoption of an 'Effluent Optimization and Recovery Plan'.
2. Adoption of tertiary/advanced/polishing systems will produce very good effluent quality. Tertiary systems include membrane treatment technologies, phytoremediation, etc. The downside of these systems is they usually require substantial capital and operating expenditures. However, in many instances, because the effluent quality is very good, the treated effluent can be recovered and re-used, off-setting operational costs. This is part of effluent optimization and recovery. Some industries can even supply/sell to others.
3. The government should also look into giving tax incentives and rebates for industries/premises that install tertiary treatment systems. As previously mentioned, these systems are costly and such incentives would encourage adoption, at the same time preserve water resources.
4. Centralization of sources also brings many benefits, easing management and treatment. This applies to both domestic and industrial sources. The centralization of sewage sources to regional sewage treatment plants a part of 'River of Life' initiative is commendable. Such centralization efforts are yet to be seen in the industrial sector.
5. Constructed wetlands and phytoremediation strategies should also be further encouraged. The Putrajaya Wetlands and Lake is a good model to follow.
6. In the event all of the above is not feasible, a last resort would be to divert the effluent to a downstream river segment with larger carrying capacity. This can be done through by finding alternate routes for effluent flow or constructing a discharge/outfall drain.

Conclusion

River pollution in Malaysia definitely calls for a review on pollution management. Setting pragmatic and common water quality targets is very important, as it provides stakeholders with a clear picture of what to strive for. This applies to **both water quality preservation and rehabilitation**. Setting the targets according to beneficial uses and river stretches, is perhaps the most pragmatic method. Integrated River Basin Management (IRBM) plans is one of the avenues where these targets can be included. From this, appropriate pollution load control and management strategies can be implemented.

Featured Article

Water Quality Improvement and Preservation through Pollution Load Control

Contributed By: Zaki Zainudin, Samantha Loke Yin Ying and Chua Li Ying

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SDG Cor-

SDG 6.1: By 2030, achieve universal and equitable access to safe and affordable drinking water for all

SDG 6.3: By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally

Did you know?

SDG 6.A: By 2030, expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies

SDG 6.B: Support and strengthen the participation of local communities in improving water and sanitation management

Past Events & Activities

The International Conference and Exhibition on Wastes Management (ICEWM2019)

"Effective Solution for a Greener Future"

The International Conference and Exhibition on Wastes Management - ICEWM2019 driven by ENSEARCH Council 2018/2019 was successfully held on 24th to 26th September 2019 at the Shah Alam Convention Centre (SACC) with the World Biogas Association as Collaborator and Cenergi SEA Sdn Bhd as the Lead Sponsor. A dedicated workshop was also organised by the WBA global members on the 24th of September. The event is also supported by SWCorp & Malaysia Business Chamber Vietnam.

In line with the United Nations Sustainable Development Goals (SDG 12 & SDG 13), the ICEWM2019 aimed to generate conversation and inspire waste management solutions to address Municipal Solid Waste, Hazardous Wastes, Food Waste and other types of waste.

The event was regarded as an interactive information sharing avenue where Public and Private Sectors exchanged ideas and showcased their experiences as well as current best practices in Waste Management. The event also received endorsement from the Ministry of Housing and Local Government (KPKT) and Ministry of Energy, Science, Technology, Environment and Climate Change (MESTECC).

Opening remarks by ENSEARCH President, Mr Gobinathan Kumaran Nair; welcoming 300 local, regional and international delegates as well as 25 Exhibitors attending the Conference.

YB Ng Sze Han, Exco of Local Government, Public Transport and New Village Development is the Guest-of-Honour officiating the opening of ICEWM2019.

Past Events & Activities

The International Conference and Exhibition on Wastes Management (ICEWM2019)

"Effective Solution for a Greener Future"

ENSEARCH invited 5 leading companies providing environmental solutions to share their invaluable experience. Business leaders from Cenergi SEA, Texcycle Sdn Bhd, Cenviro, Worlwide Holdings Berhad and Renewcell Sdn Bhd. presented the rise of their companies along with the past and present issues they faced as well as the outlook of waste industry. The business leaders also open to forging alliance to work together in achieving a common goal for a better future in the region.

Dr Gary Theseira (Special Officer of MESTECC) moderated the informative "Foreign Mission Dialogue: Current and Future Waste Management in their respective countries" dialogue. 4 respective ambassadors (Sweden, Netherlands, Germany and Scotland) as well as Scottish Environmental Protection Agency Specialist, Ms Katie Olley from the European Delegation enlightened the conference participants as they shared the existing status and future planning of the waste industry in their respective countries. The panelists also talked about transboundary movement of recycled material and centralized material processing/recovery centers as part of circular economy.

The ICEWM2019 successfully brought together Business Leaders, Decision Makers, Businesses, Industry Players, Consultants, Regulators, Researchers, Governments, Policy Makers, Academia, NGOs and Analysts from Malaysia and Asian region onto the platform for sustainability and environmental management.

SDG Cor-

Did you know?

The 11th Malaysia Plan introduced Sustainable Consumption & Production (SCP) to achieve green growth and address environmental sustainability, focusing on several priority areas: the public sector, private households and industries such as building, housing, food, tourism and transport.

Past Events & Activities

The International Conference and Exhibition on Wastes Management (ICEWM2019)

GLOBAL WASTE TRENDS: COMPLEXITIES, OPPORTUNITIES, CHALLENGES

By : Mr David Newman (President of World Biogas Association)

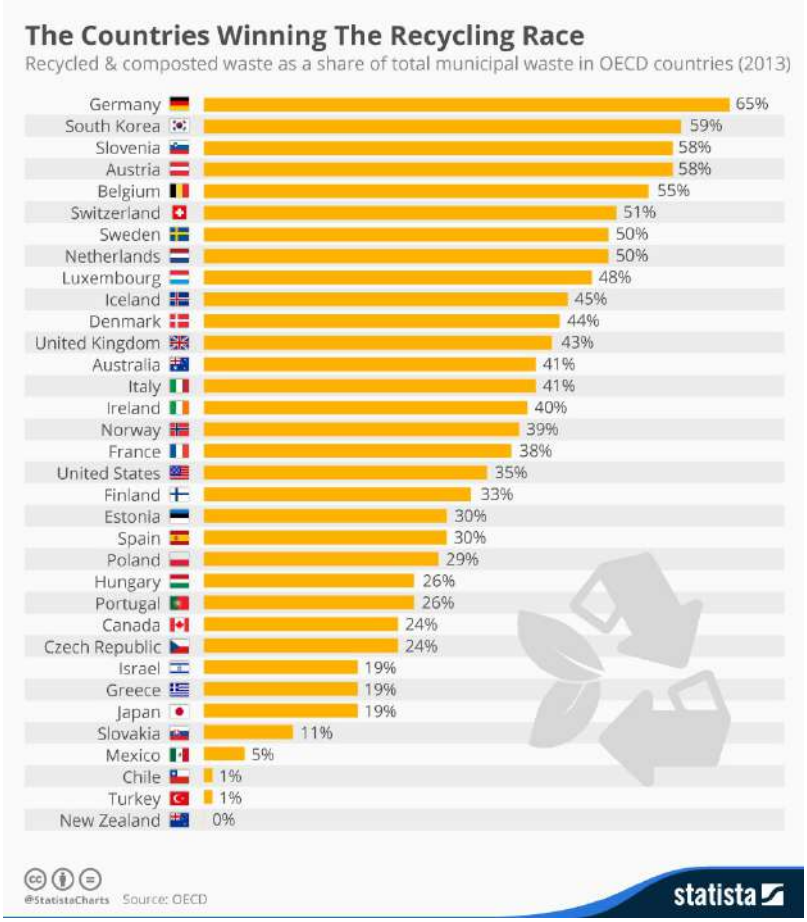
At the workshop, Mr David Newman shed light on the Sustainable waste management debate, drawing evidence and case studies from practicle models:

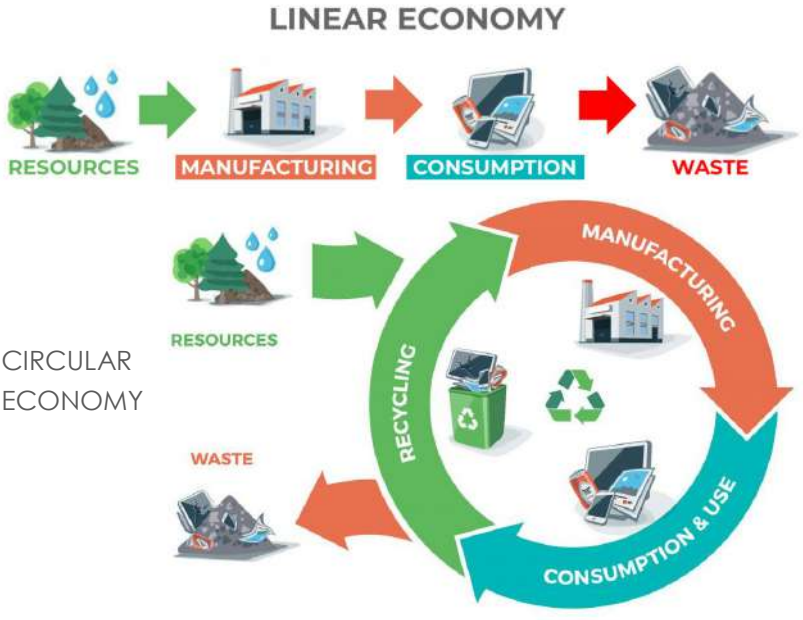
1. Circular Economy and Bioeconomy
2. Climate change and SLCPs
3. Public health and disease prevention
4. Resource management and security, prevention and product design
5. City decor and personal security
6. Soil fertility
7. Energy production and security
8. Creating secure employment and wealth: engaging informal sector
9. Protecting natural environments, such as rivers, lakes, seas, coastlines
10. Tourism and inward investment
11. Funding and taxation, producer responsibility and legislation
12. Public outreach and communications
13. Data management

He explained the win-win business ecosystem of Circular Economy by European Commision, including the €600 billion savings for EU businesses (equivalent to 8% of their annual turnover), approximately 580,000 occupation opprtunities and most importantly the reduction of EU carbon emissions by 450 million tons per year.

He also highlighted the critical condition of soil degradation:

- 80% of the world's agricultural land suffers moderate to severe erosion.
- 10 Million ha of agricultural land are lost through soil erosion every year (~0.7%)
- Over last 40 Years ~ 30% of world's cropland has become unproductive





Past Events & Activities

The International Conference and Exhibition on Wastes Management (ICEWM2019)

WORLD BIOGAS ASSOCIATION

"GLOBAL WASTE TRENDS: COMPLEXITIES, OPPORTUNITIES, CHALLENGES"

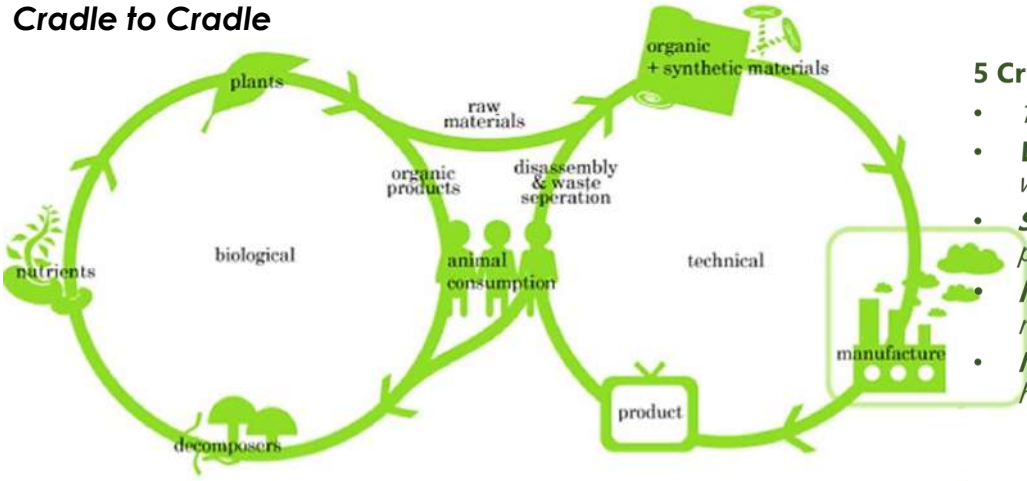
By : Mr David Newman (President of World Biogas Association)

Mr David explained EU's new targets that came into effect in 2018

1. Recourse to landfill must be no more than 10% of MSW by 2035
2. Only inert, pre treated waste can go to landfill by 2035
3. MSW recycling must be 65% by 2035
4. Food waste must be separately collected in all houses by end of 2023
5. Packaging waste recycling targets increase including 55% of plastic packaging waste to be recycled by 2030
6. New rules calculating the effective recycling rates, to mean last point of treatment
7. A ban on certain plastic items and on oxo degradable plastics
8. Investments to assist the transition to a more circular economy

These link to SDG12-target 12.5, a commitment to half food waste per capita by 2030.

Cradle to Cradle



5 Criteria

- *100%* ***Renewable Energy*** *Use*
- ***Water Stewardship****-clean water output*
- ***Social Responsibility****- positive impact on community*
- ***Material Reutilisation****- recyclability/compostability*
- ***Material Health****-impact on human & environment*

Food Waste: Our single largest MSW WASTE STREAM and the single largest METHANE EMITTER

Past Events & Activities

The International Conference and Exhibition on Wastes Management (ICEWM2019)

"GLOBAL WASTE TRENDS: COMPLEXITIES, OPPORTUNITIES, CHALLENGES"

By : Mr David Newman (President of World Biogas Association)

What are the challenges?

Financing	Commodity Markets & Secondary Raw Materials	Governance

Whilst circular economy shall be mainstreamed, Mr David explained the logic behind the reason virgin raw materials are still preferred compared to recycling.

"The raw materials are abundant, cheaper, cleaner and readily available."

It is predicted that prices of virgin plastic PET will fall from $1000/ton today to around $600/ton in 2030. As the recyclables' prices are often highly volatile, it is discouraging to invest in recycling.

To change the existing paradigm, the externality costs i.e. cost of extraction, CO_2 emissions, environmental pollution and remediation cost etc. shall be factored into the equation, which have always been ignored.

"We need to recycle to reduce resource consumption but to do so we need money, and lots of it."

Mr David pointed out mismanagement of waste in Malaysia, in irony that the country is signatory to UN SDGs, UNFCCC and Basel Convention. The country has a large a growing market that create waste but not utilised, while materials and waste products are imported for the recycling industry which is not fully regulated. Most of these illegal imports pollute the environment and the polluters are at large.

Recycling income in EU countries

- Serbia €30/person/annum
  5% recycling rate, no energy recovery
- Hungary €60/person/annum
  15% recycling rate + energy recovery
- Portugal €100/family/annum
  21% recycling rate + energy recovery
- UK €90/person/annum
  44% recycling rate + energy recovery
- Belgium €165/person/annum
  65% recycling rate + energy recovery
- Germany €350+/family/annum

"We can't expect poor people to pay enough to cover the clean-up of waste."

Perhaps, the waste system could be financed through other alternatives such as Extended Producer Responsibility on goods and waste through Landfill tax to incentivise recycling and Industries to bare its own industrial waste cost. Maybe citizens should pay as they throw and more recycling or repair centres shall be made available to public to encourage reusing or recycling products.

"It is time to make polluters pay!"

Past Events & Activities

"Fundamental of Quantitative Risk Assessment and its Application from an EIA Perspective"

Trainer: En Adnan Yusop Ali

The Quantitative Risk Assessment training was very responded with 20 participants eager to enhance their understanding and application of QRA. En Adnan, an experienced EIA Consultant conducted the session, provided some fundamental principles of QRA and insights on the application of QRA in Environmental Impact Assessment.

"Dynamic River Water Quality Modelling"

Trainer: Ir Dr Zaki Zainudin

The Dynamic River Water Quality Modelling Training was another full house with Ir Dr Zaki Zainudin in the house! The 22 participants learnt about the Water Quality Analysis Simulation Program (WASP8) package, an alternative modelling instead of QUAL2K.

BACK BY POPULAR DEMAND!

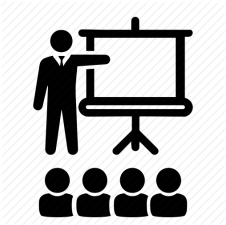
Forum on EIA in Malaysia in the New Decade– 18 Feb 2020

Technical Field Visit 2020 Cenergi Biogas Plant - 20 Feb 2020

HRDF Claimable & EiMAS CPD Points Applicable.

ENSEARCH Training & Activities Calendar 2019

COMING SOON—EiMAS CPD Approved



Forum on EIA in Malaysia in the New Decade
(18 February 2020)

Technical Field Visit 2020 (Cenergi Biogas Plant, Jerantut)
(20 February 2020)

Air Pollution Assessment Level 2 - Intermediate
(2 Days Training - Mac 2020)

Monitoring and Evaluation for Palm Oil Sector
(April 2020)

Scheduled Waste Management (Life Cycle and Control of Chemical Waste)
(July 2020)

Social Impact Assessment and EIA Training
(August 2020)

Water Quality Modeling (Wastewater Impact and Prevention)
(September 2020)

ENSEARCH Trainings are **HRDF Claimable & EiMAS CPD Points Applicable.** For more information:

Please register or state your interest at www.ensearch.org or drop us an email at spo@ensearch.org.

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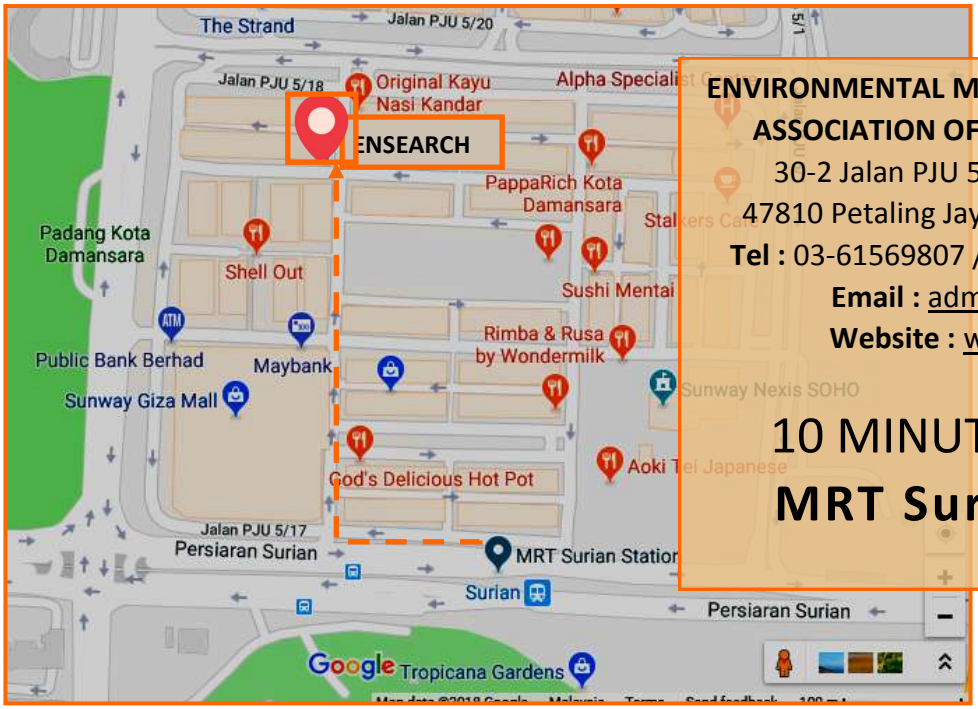

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Breaking News on Climate Change

"In November 2019, seven eminent Scientist reported their conclusion that more than half the 'tipping points' identified by the Intergovernmental Panel on Climate Change, decades ago have been activated, raising the spectre of abrupt and irreversible Climate Change"

Source: Nature Journal

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