KEMENTERIAN
ALAM SEKITAR DAN AIR
Ministry of Environment and Water

JABATAN ALAM SEKITAR MALAYSIA

Laporan Kualiti Alam Sekeliling

2019

Environmental Quality Report

KEMENTERIAN
ALAM SEKITAR DAN AIR
Ministry of Environment and Water

JABATAN ALAM SEKITAR MALAYSIA

Laporan Kualiti Alam Sekeliling 2019

Environmental Quality Report

Department of Environment, Malaysia

Edited by:
Publication Section
Strategic Communication Division
Department of Environment
Malaysia

ISSN 2636-9834

Design and Printed by:
D'FA Print Sdn. Bhd.
No.16 Jalan P/21
Selaman Light Industrial Park,
Bandar Baru Bangi, Selangor,

Tel : 03-8926 3808
Faks : 03-8926 2830

Kandungan
Content

BAB 1 | CHAPTER 1
KUALITI UDARA | AIR QUALITY

BAB 2 | CHAPTER 2
KUALITI AIR SUNGAI | RIVER WATER QUALITY

BAB 3 | CHAPTER 3
KUALITI AIR TANAH | GROUNDWATER QUALITY

BAB 4 | CHAPTER 4
KUALITI AIR MARIN DAN PULAU-PULAU | MARINE AND ISLAND MARINE WATER QUALITY

BAB 5 | CHAPTER 5
INVENTORI PUNCA PENCEMARAN | POLLUTION SOURCES INVENTORY

ANNEX

PRAKATA
FOREWORD

Saya amat berbesar hati untuk membentangkan Laporan Kualiti Alam Sekeliling 2019 seperti yang dikehendaki di bawah Seksyen 3(1)(i) Akta Kualiti Alam Sekeliling 1974.

It is my pleasure to present the Environmental Quality Report 2019 as required under Section 3(1)(i) of the Environmental Quality Act 1974.

Berdasarkan Indeks Pencemar Udara (IPU), kualiti udara keseluruhan bagi Malaysia pada tahun 2019 adalah berstatus sederhana pada kebanyakan masa. Peningkatan IPU yang disebabkan oleh jerebu di dalam dan di luar negara menyebabkan bilangan hari yang tidak sihat meningkat pada tahun 2019 dibandingkan dengan tahun 2018.

Based on the Air Pollutant Index (API), the overall air quality for Malaysia in 2019 was at moderate levels most of the time. Significant increase in API reading was mainly due to local and transboundary haze which had ascended the number of unhealthy days recorded in 2019 as compared to 2018.

Kualiti air sungai yang ditentukan dari segi Indeks Kualiti Air (IKA) telah menunjukkan peningkatan pada tahun 2019. Peratus bilangan sungai yang dikategorikan sebagai bersih pada tahun 2019 adalah sebanyak 61% daripada 672 sungai yang diawasi. Peratus bilangan sungai yang dikategorikan sebagai sederhana tercemar adalah sebanyak 30%, manakala peratus bilangan sungai yang dikategorikan sebagai tecemar adalah sebanyak 9%.

The river quality in terms of Water Quality Index (WQI) had shown an increase in 2019. Out of the 672 rivers monitored, 61% showed clean water quality in 2019. The percentage of slightly polluted rivers and polluted rivers were 30% and 9% respectively.

Pada tahun 2019, kualiti air tanah menunjukkan pematuhan terhadap Standard Kualiti Air Tanah Bagi Rawatan Air Mentah Secara Konvensional (Air Minuman) bagi semua parameter yang diawasi kecuali parameter arsenic (As), mangan (Mn), jumlah koliform, besi (Fe) dan sebatian fenol yang mempunyai peratusan julat nilai pematuhan yang rendah.

The groundwater quality in 2019 has shown compliance with the Groundwater Quality Standards for Conventional Raw Water Treatment (Drinking Water) excepts for arsenic (As), iron (Fe), manganese (Mn), total coliform and phenolics which showed low percentage of compliance.

Dalam tahun 2019, daripada 368 stesen pengawasan kualiti air marin bagi pantai, muara sungai dan pulau di negara ini, sebanyak 74 stesen adalah terbaik, 113 stesen baik, 166 stesen sederhana manakala 15 stesen yang lain dikategorikan sebagai tercemar. 11 daripada stesen tercemar berada di kawasan muara sungai, 3 di kawasan pantai dan 1 di kawasan pulau.

In 2019, out of the 368 marine water quality monitoring stations at coastal, estuary and islands in the country, 74 stations were excellent, 113 were good, 166 were moderate while the remaining 15 stations were categorised as poor. 11 of the poor stations were located at the estuary, 3 were located at coastal while the remaining 1 was located at the island.

Pada tahun 2019 sebanyak 4,013,189.03 tan metrik buangan terjadual telah dihasilkan. Ini mewakili peningkatan keseluruhan sebanyak 41.32% berbanding 2,355,085.21 tan metrik yang dilaporkan

In 2019, a total of 4,013,189.03 metric tonnes of scheduled wastes were generated. This represents an overall increase of 41.32% as compared to 2,355,085.21 metric tonnes reported in 2018. DOE will

pada 2018. JAS akan terus mengukuhkan dan melaksanakan strategi, program dan aktivitinya dengan berkesan dalam menguruskan alam sekitar secara lestari.

continue to strengthen and implement its strategies, programs and activities effectively in managing the environment sustainably.

“ Alam Sekitar, Tanggungjawab Bersama
Environment, Our Shared Responsibility. ”

NORLIN BINTI JAAFAR
Ketua Pengarah Kualiti Alam Sekeliling Malaysia
Director-General of Environmental Quality Malaysia

BAB 1
CHAPTER 1

KUALITI UDARA
AIR QUALITY

PENGAWASAN KUALITI UDARA
AIR QUALITY MONITORING

Jabatan Alam Sekitar telah menyediakan rangkaian pengawasan kualiti udara di seluruh negara dengan 65 stesen pengawasan kualiti udara automatik di bawah Program Pengawasan Kualiti Alam Sekitar (EQMP). Stesen-stesen pengawasan kualiti udara tersebut ditempatkan di lokasi yang strategik iaitu di kawasan bandar, pinggir bandar dan perindustrian bertujuan untuk mengesan sebarang perubahan ketara ke atas kualiti udara yang mungkin memberi kesan kepada kesihatan awam dan alam sekitar.

The Department of Environment (DOE) has provided an air quality monitoring network with 65 continuous monitoring stations under the Environmental Quality Monitoring Programme (EQMP). These monitoring stations are strategically located in urban, suburban and industrial areas to detect any significant changes in the air quality which may affect human health and the environment.

Status kualiti udara di Malaysia adalah ditunjukkan menerusi bacaan Indeks Pencemar Udara (IPU) dan bacaan IPU seluruh negara sentiasa dipaparkan di laman web APIMS. IPU adalah dikira berdasarkan kepekatan enam bahan pencemar utama iaitu ozon di permukaan bumi (O_3), karbon monoksida (CO), nitrogen dioksida (NO_2), sulfur dioksida (SO_2), habuk halus bersaiz kurang dari 10 mikron (PM_{10}) dan habuk halus bersaiz kurang dari 2.5 mikron ($PM_{2.5}$). IPU ini dikategorikan sebagai baik, sederhana, tidak sihat, sangat tidak sihat dan berbahaya seperti yang dinyatakan dalam **Jadual 1.1.** Bermula tahun 2018, pengiraan IPU Malaysia telah mengambil kira kepekatan habuk halus yang bersaiz diameter 2.5 mikron dan ke bawah ($PM_{2.5}$) dan mula dipaparkan oleh JAS melalui Air Pollutant Index Management System (APIMS) untuk diakses oleh orang awam.

The air quality status is reported in terms of Air Pollutant Index (API) and it is always showed in the APIMS website. API is calculated based on concentration of six major pollutants, which are ground level ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulphur dioxide (SO_2), and particulate matter of size less than 10 microns (PM_{10}) or less than 2.5 microns ($PM_{2.5}$). The API is categorised as good, moderate, unhealthy, very unhealthy and hazardous, as presented in **Table 1.1.** Beginning 2018, DOE has showed the API based on particulate matter of size less than 2.5 microns ($PM_{2.5}$) through the APIMS for public access.

Jadual 1.1: Indeks Pencemar Udara (IPU)
Table 1.1: Air Pollutant Index (API)

IPU/API	STATUS KUALITI UDARA/ AIR QUALITY STATUS	
0-50	●	Baik / Good
51-100	⬢	Sederhana / Moderate
101-200	⬟	Tidak Sihat / Unhealthy
201-300	■	Sangat Tidak Sihat / Very Unhealthy
>300	▲	Berbahaya / Hazardous

STATUS
KUALITI UDARA
AIR QUALITY STATUS

Berdasarkan IPU, kualiti udara keseluruhan bagi Malaysia pada tahun 2019 adalah berstatus sederhana pada kebanyakan masa. Ini adalah disebabkan oleh bacaan IPU dikira berdasarkan kepada parameter habuk halus $PM_{2.5}$. Parameter $PM_{2.5}$ adalah sangat halus dan stabil dalam udara. Peningkatan IPU yang disebabkan oleh jerebu di dalam dan di luar negara menyebabkan bilangan hari yang tidak sihat meningkat pada tahun 2019 dibandingkan dengan tahun 2018.

In 2019, the overall air quality for Malaysia based on API was mostly moderate. This was because the API readings were calculated based on $PM_{2.5}$ particulate matter, which are very fine particles and stable in the air. The increase in API caused by local and transboundary haze had ascended a number of unhealthy days recorded in 2019 as compared to 2018.

Pada bulan September tahun 2019, Malaysia mengalami keadaan berjerebu yang agak teruk akibat daripada jerebu setempat dan jerebu merentas sempadan dari negara jiran sehingga menyebabkan beberapa tempat di Sarawak dan Semenanjung Malaysia mencatatkan bacaan IPU yang sangat tidak sihat dan sangat berbahaya di dalam satu tempoh tertentu. Ini adalah kerana terdapat beberapa kejadian kebakaran belukar setempat yang menyebabkan kualiti udara di dalam negara merosot dan jerebu yang merentas sempadan akibat kebakaran tanah dan hutan di negara jiran. Malaysia mengalami keadaan berjerebu daripada jerebu merentas sempadan selama 20 hari iaitu dari 5 September 2019 hingga 25 September 2019. Pada masa yang sama, Malaysia juga mengalami kebakaran belukar di Lembah Klang, Rompin (Pahang) dan juga di Sri Aman (Sarawak).

In September 2019, Malaysia experienced a severe haze episode due to the local and transboundary haze from neighbouring countries and caused several areas in Sarawak and Peninsular Malaysia to record their API readings in certain periods at very unhealthy and very hazardous days. Several local bush fires had caused deterioration in the local air quality and transboundary haze as a result of land and forest fires in neighbouring country. Malaysia experienced the transboundary haze within 20 days from 5 September to 25 September 2019. Simultaneously, Malaysia also spotted some local bush fires in Klang Valley, Rompin (Pahang) and Sri Aman (Sarawak).

Tren kepekatan harian $PM_{2.5}$ di kawasan Klang pada tahun 2019 adalah lebih tinggi berbanding tahun 2018 terutama pada musim panas di antara bulan Julai hingga Oktober 2019. Ini seperti yang ditunjukkan di dalam **Rajah 1.1(a)**.

In 2019, the daily $PM_{2.5}$ concentration trend in Klang Valley area was slightly higher as compared to in 2018, especially during hot weather condition between July and October 2019. This is shown in **Figure 1.1(a).**

Rajah 1.1(b) menunjukkan kepekatan harian $PM_{2.5}$ bagi ketiga-tiga jenis kategori stesen terpilih di kawasan bandar (Klang), pinggir bandar (Kuantan) dan luar bandar (Kapit). Tren menunjukkan paras yang menghampiri dan lebih daripada standard kualiti udara ambien terutama bagi stesen di kawasan bandar iaitu Klang dan juga di kawasan pinggir bandar iaitu Kuantan di mana banyak berlakunya pembakaran terbuka di kawasan tersebut pada

Figure 1.1(b) shows the daily $PM_{2.5}$ concentration for three categories of selected stations in urban (Klang), suburban (Kuantan) and rural (Kapit) areas in the country. The trend approached higher $PM_{2.5}$ levels than the ambient air quality standards, especially for urban (Klang) and suburban (Kuantan) areas, whereby there were many open burning activities during hot weather condition. Rural area like Kapit also showed higher $PM_{2.5}$ levels than the ambient

musim panas. Kawasan luar bandar seperti Kapit juga menunjukkan paras yang lebih daripada standard kualiti udara ambien disebabkan oleh kesan jerebu merentas sempadan. Standard kualiti udara ambien bagi tahun 2019 adalah menggunakan Standard Kualiti Udara Ambien Malaysia IT-2 seperti yang ditunjukkan dalam **Jadual 1.2**.

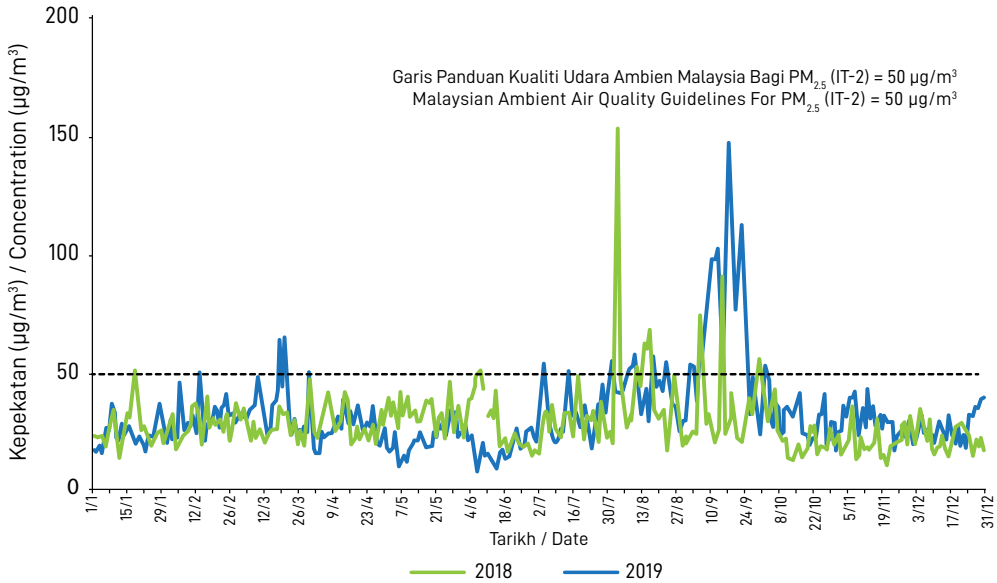
Selain pencemar $PM_{2.5}$, ozon di permukaan bumi (O_3) merupakan pencemar udara yang menjadi perhatian. Ia terhasil akibat tindak balas sebatian-sebatian organik meruap (Volatile Organic Compounds, VOCs) dan oksid-oksid nitrogen (NO_x) dengan kehadiran cahaya matahari. Cuaca panas terik menggalakkan lagi pembentukan pencemar O_3. Punca utama VOCs dan NO_x adalah dari pelepasan industri dan ekzos kenderaan bermotor terutama di bandar-bandar besar. Ini menyebabkan berlakunya beberapa hari yang tidak sihat di beberapa lokasi di Lembah Klang, Perak, Kedah dan Negeri Sembilan.

Kadangkala terdapat kepekatan maksimum harian bagi parameter O_3 dalam tempoh 1 jam adalah melebihi Standard Kualiti Udara Ambien Malaysia terutamanya di beberapa kawasan di Lembah Klang, Perak, Kedah dan Negeri Sembilan seperti yang ditunjukkan dalam **Rajah 1.1(c), Rajah 1.1 (d) dan Rajah 1.1 (e).** Keadaan ini menyebabkan beberapa hari yang tidak sihat dicatatkan terutama di kawasan-kawasan pusat perniagaan dan jumlah trafik yang tinggi.

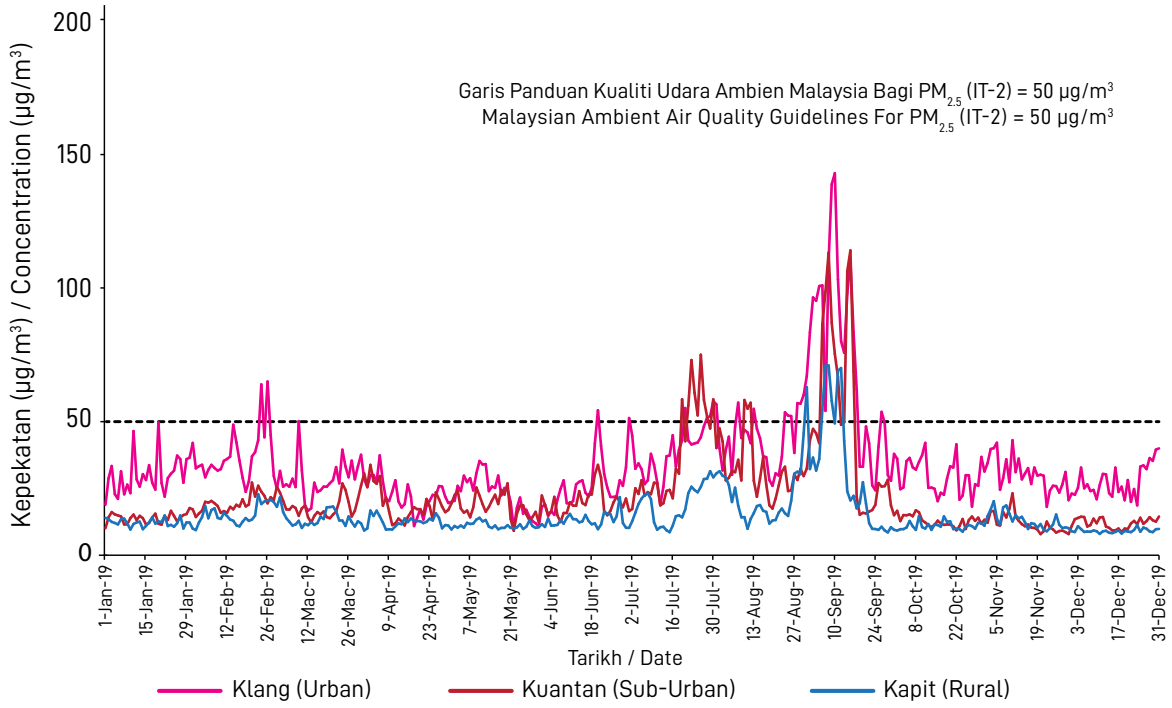
air quality standards, which were affected by the transboundary haze. The ambient air quality standard for 2019 is referred as the Malaysia Ambient Air Quality Standard IT-2, as shown in **Table 1.2.**

Besides $PM_{2.5}$, ground level ozone (O_3) remained as the pollutant of concern. O_3 pollutant is formed as a result of chemical reaction between volatile organic compounds (VOCs) and nitrogen oxides (NO_x) in the presence of sunlight. Formation of O_3 is enhanced during hot and sunny day. The major sources of VOCs and NO_x emission were from industries and motor vehicles, particularly in urban areas. These resulted in several unhealthy days recorded at various locations in Klang Valley and states of Perak, Kedah and Negeri Sembilan.

Occasionally, the daily maximum one-hour concentration of O_3 exceeded the Malaysian Ambient Air Quality Standard at several stations in Klang Valley, Perak, Kedah and Negeri Sembilan, as shown in **Figure 1.1(c), Figure 1.1(d)** and **Figure 1.1(e).** These conditions caused a number of unhealthy days recorded in some areas, especially those of central business with heavy traffic volumes.

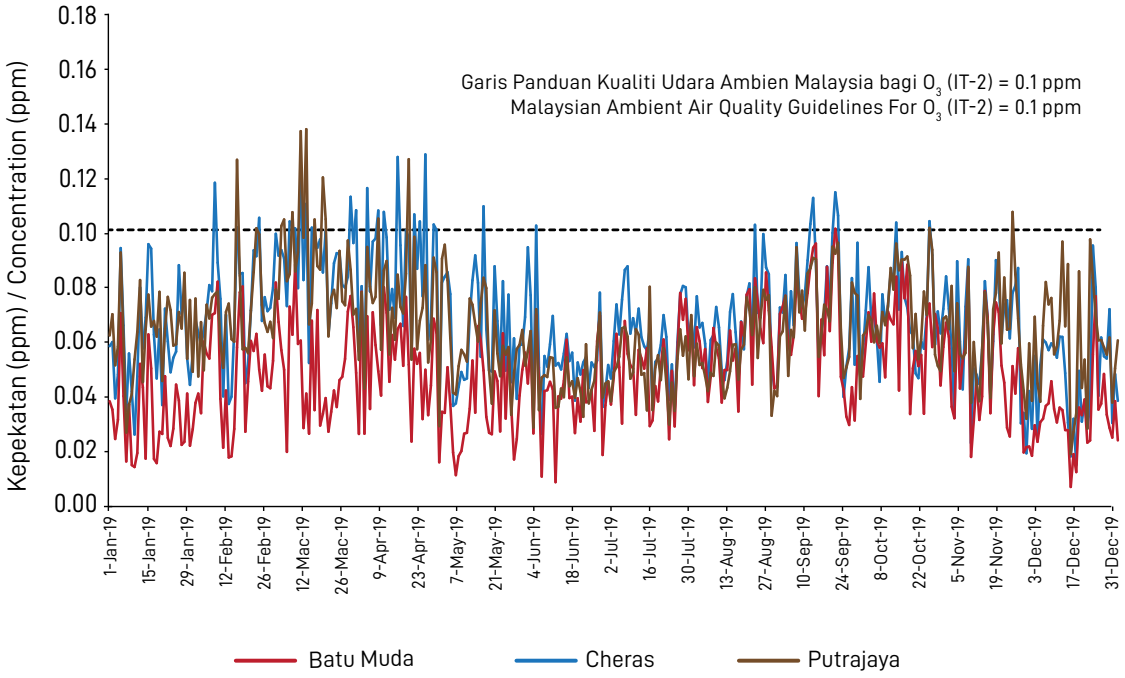


Rajah 1.1(a) : Tren Kepekatan 24 jam bagi Habuk Halus Bersaiz 2.5 Mikron ($PM_{2.5}$), Klang, 2018 dan 2019
Figure 1.1(a) : Trend of 24-hour Concentration of Particulate Matter ($PM_{2.5}$), Klang, 2018 and 2019



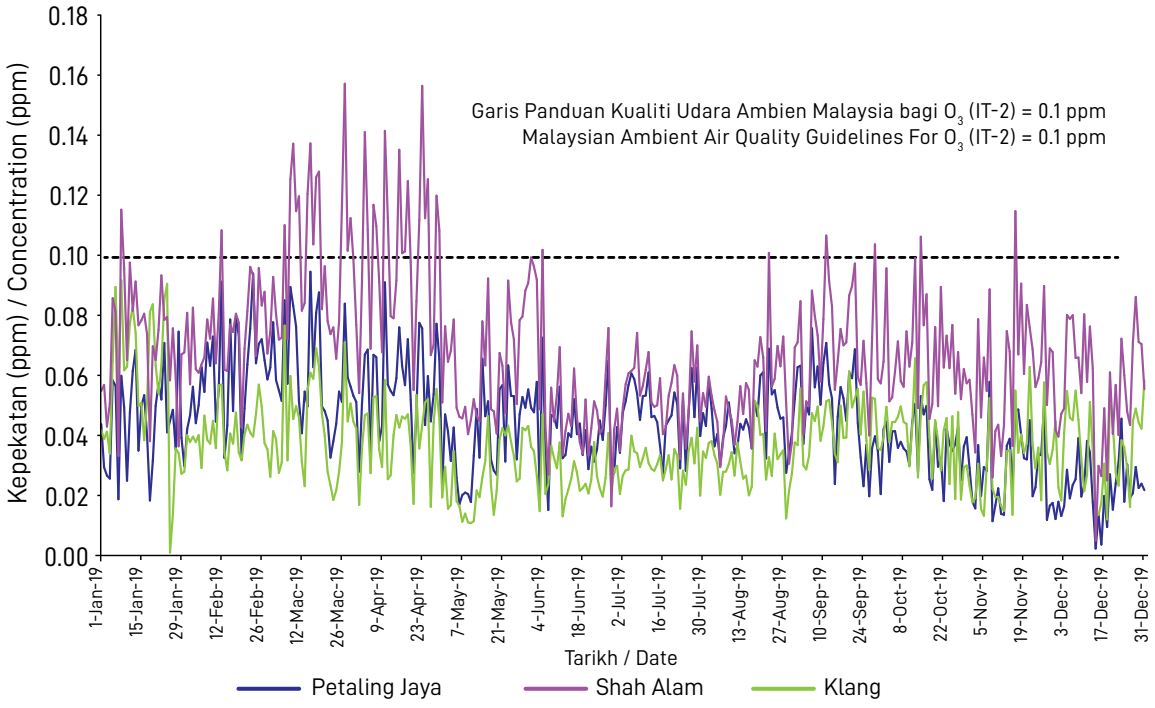
Rajah 1.1 (b) : Tren Kepekatan 24 jam bagi Habuk Halus Bersaiz 2.5 Mikron ($PM_{2.5}$), Malaysia, 2019

Figure 1.1 (b) Malaysia : Trend of 24 Hours Concentration of Particulate Matter ($PM_{2.5}$), Malaysia, 2019



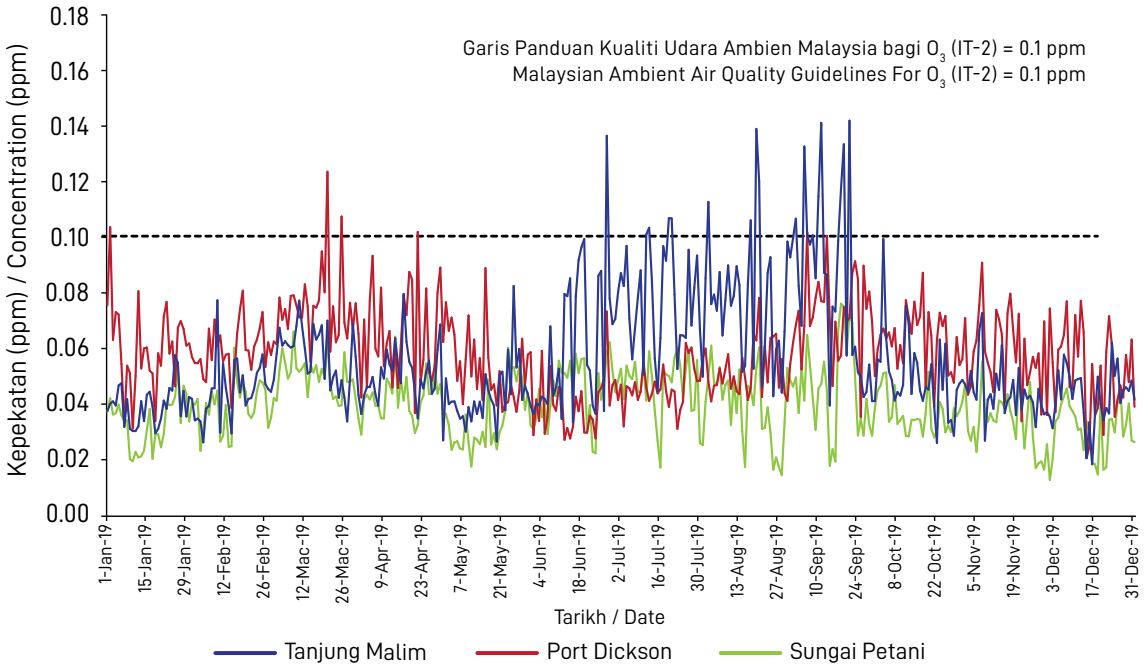
Rajah 1.1(c) : Tren Kepekatan Maksimum Harian Ozon (O_3) 1 Jam, Lembah Klang, 2019

Figure 1.1(c) : Trend of Daily Maximum 1-Hour Concentration of Ozone (O_3), Klang Valley, 2019



Rajah 1.1 (d): Tren Kepekatan Maksimum Harian Ozon (O_3) 1 Jam, Lembah Klang, 2019

Figure 1.1 (d) : Trend of Daily Maximum 1-hour Concentration of Ozone (O_3), Klang Valley, 2019



Rajah 1.1(e) : Tren Kepekatan Maksimum Harian Ozon (O_3) 1 Jam, Malaysia, 2019

Figure 1.1(a) : Trend of Daily Maximum 1-hour Concentration of Ozone (O_3), Malaysia, 2019

STATUS
KUALITI UDARA DI PANTAI BARAT
AIR QUALITY STATUS IN THE WEST COAST

Lembah Klang

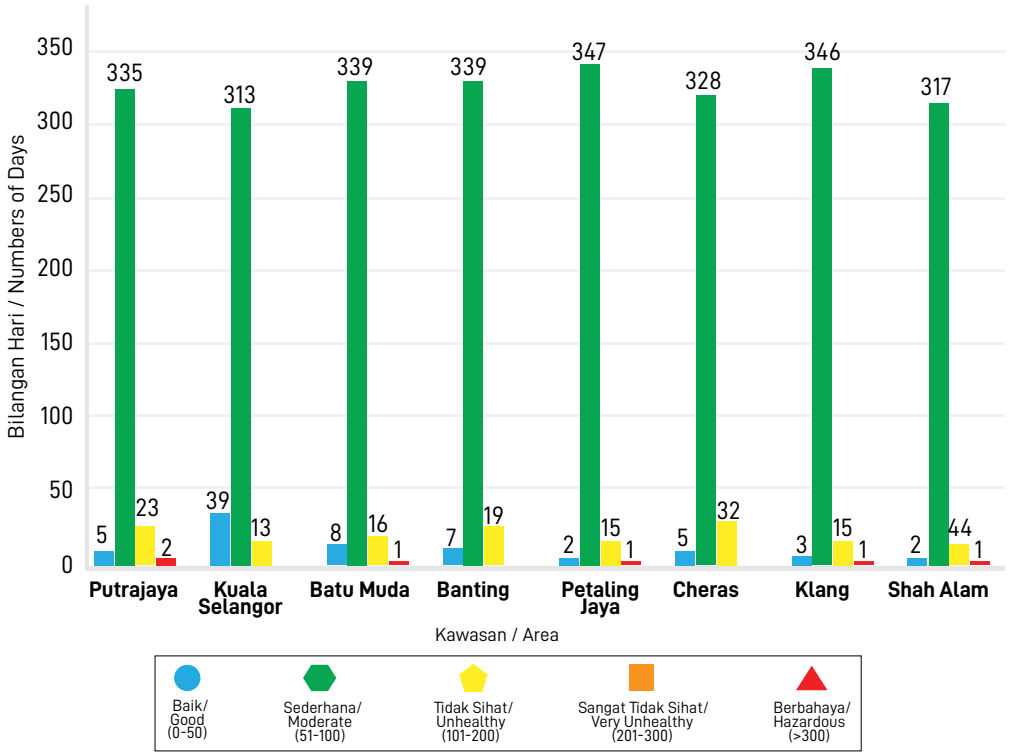
Pada tahun 2019, berdasarkan pengiraan IPU menggunakan $PM_{2.5}$, status kualiti udara di Lembah Klang menunjukkan semua stesen mencatatkan bacaan hari sederhana sepanjang masa. Status kualiti udara di Lembah Klang secara keseluruhannya ditunjukkan seperti di **Rajah 1.2.** Walau bagaimanapun, semua stesen mencatatkan bacaan IPU yang tidak sihat dan beberapa stesen di Lembah Klang ada menunjukkan bacaan IPU yang sangat tidak sihat dengan yang tertinggi adalah di Putrajaya (2 hari) dan masing-masing 1 hari di Batu Muda, Petaling Jaya, Klang dan Shah Alam. Ini adalah disebabkan oleh kebakaran belukar setempat dan jerebu merentas sempadan yang berpunca dari kebakaran hutan dan belukar dari negara jiran.

Keadaan ini juga telah menyebabkan semua stesen di Lembah Klang mencatatkan bilangan hari yang tidak sihat yang lebih tinggi pada tahun 2019 jika dibandingkan dengan tahun 2018 seperti yang ditunjukkan di dalam **Rajah 1.2(a)**.

Klang Valley

In 2019, based on the API calculation by using $PM_{2.5}$, the air quality in the Klang Valley showed that all stations were at moderate level all times. The overall air quality status in Klang Valley is shown in **Figure 1.2**. However, all stations recorded their API readings on unhealthy days and several Klang Valley stations showed very unhealthy API readings with the highest recorded in Putrajaya (2 days). Each station in Batu Muda, Petaling Jaya, Klang and Shah Alam recorded one very unhealthy day, which was caused by the local bush fires and transboundary haze from forest and bush fires in neighbouring country.

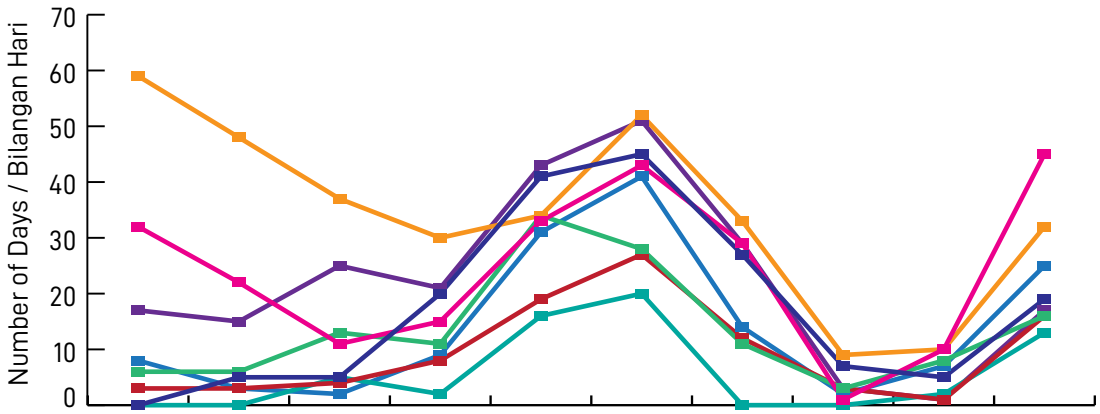
This situation also resulted at all stations in Klang Valley, which recorded a number of unhealthy days higher in 2019 as compared to in 2018 **Figure 1.2(a)**.



Rajah 1.2: Status Kualiti Udara, Lembah Klang 2019

Figure 1.2: Air Quality Status, Klang Valley, 2019

Nota : Bacaan adalah berdasarkan IPU Maksimum Harian
Note : Reading based on Daily Maximum API



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Banting	0	5	5	20	41	45	27	7	5	19
Shah Alam	32	22	11	15	33	43	29	1	10	45
Cheras	59	48	37	30	34	52	33	9	10	32
Klang	6	6	13	11	34	28	11	3	8	16
Petaling Jaya	3	3	4	8	19	27	12	3	1	16
Kuala Selangor	0	0	5	2	16	20	0	0	2	13
Putrajaya	8	3	2	9	31	41	14	2	7	25
Batu Muda	17	15	25	21	43	51	29	3	1	17

Rajah 1.2 (a) : Bilangan Hari Tidak Sihat, Lembah Klang, 2010-2019

Figure 1.2 (a) : Number of Unhealthy Days, Klang Valley, 2010 - 2019

Nota : Bacaan adalah berdasarkan IPU Maksimum Harian
Note : Reading based on Daily Maximum API

Wilayah Utara

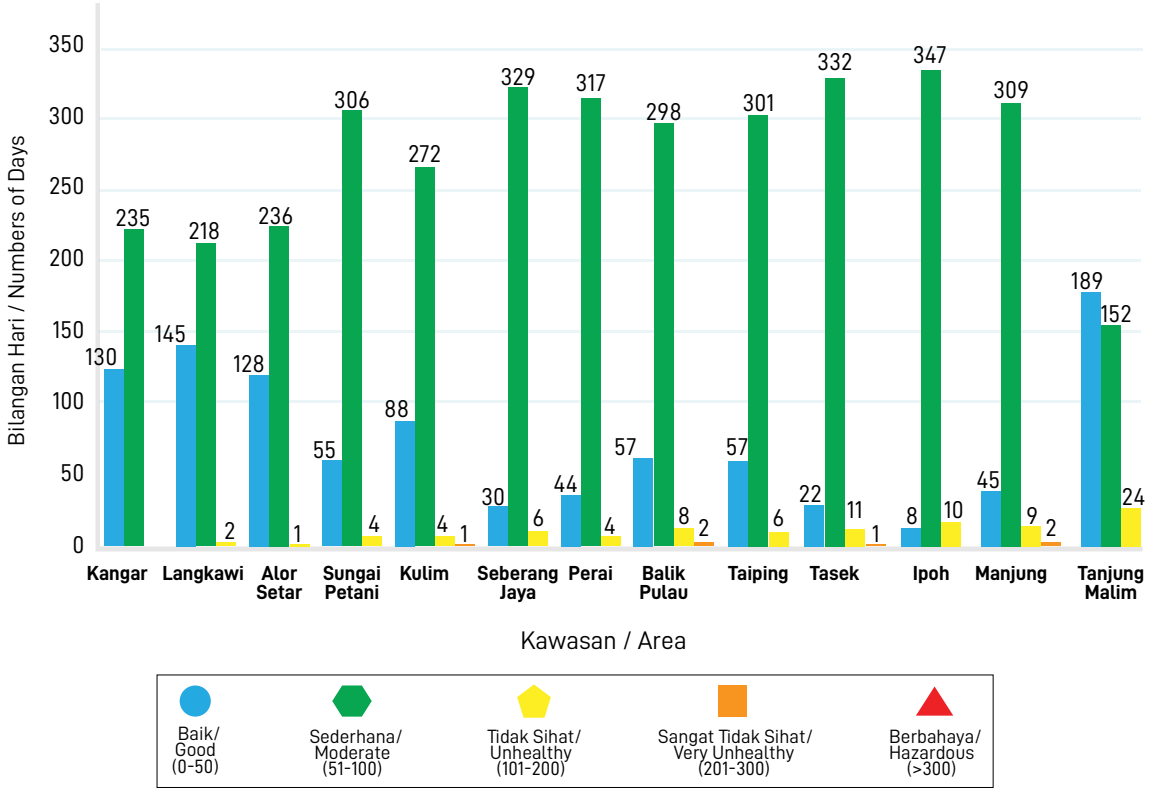
Secara keseluruhan, status kualiti udara di utara Pantai Barat Semenanjung Malaysia yang meliputi Negeri Perlis, Negeri Kedah, Negeri Pulau Pinang dan Negeri Perak adalah sederhana sepanjang masa. Tanjung Malim mencatatkan bacaan IPU baik yang lebih tinggi (189) berbanding stesen-stesen yang lain. Akibat jerebu merentas sempadan, semua stesen di wilayah utara telah merekodkan status kualiti udara tidak sihat kecuali Kangar dan ada beberapa stesen yang mencatatkan bacaan IPU sangat tidak sihat. Stesen tertinggi yang mencatatkan bacaan hari sangat tidak sihat adalah Balik Pulau dan Manjung (2) manakala Taiping dan Kulim masing-masing mencatatkan bacaan satu (1) hari IPU sangat tidak sihat.

Rajah 1.3 menunjukkan status kualiti udara keseluruhan bagi wilayah utara di Pantai Barat Semenanjung Malaysia.

Northern Region

The overall air quality status at the northern region in West Coast of Peninsular Malaysia, covering Perlis, Kedah, Pulau Pinang and Perak, was mostly moderate. However, Tanjung Malim recorded a good API reading but was higher (189) as compared to the other stations. All stations in the northern region recorded an unhealthy air quality status due to the transboundary haze, except for Kangar. Meanwhile, several stations noted very unhealthy air quality. Stations which recorded the highest reading for very unhealthy day were those in Balik Pulau and Manjung (2), while each station in Taiping and Kulim recorded one "very unhealthy" day.

Figure 1.3 Overall air quality status for the northern region in West Coast of Peninsular Malaysia.



Rajah 1.3 : Status Kualiti Udara, Wilayah Utara Pantai Barat Semenanjung Malaysia, 2019
Figure 1.3 : Air Quality Status, Northern Region of The West Coast Peninsular Malaysia, 2019

Nota : Bacaan adalah berdasarkan IPU Maksimum Harian
Note : Reading based on Daily Maximum API

Wilayah Selatan

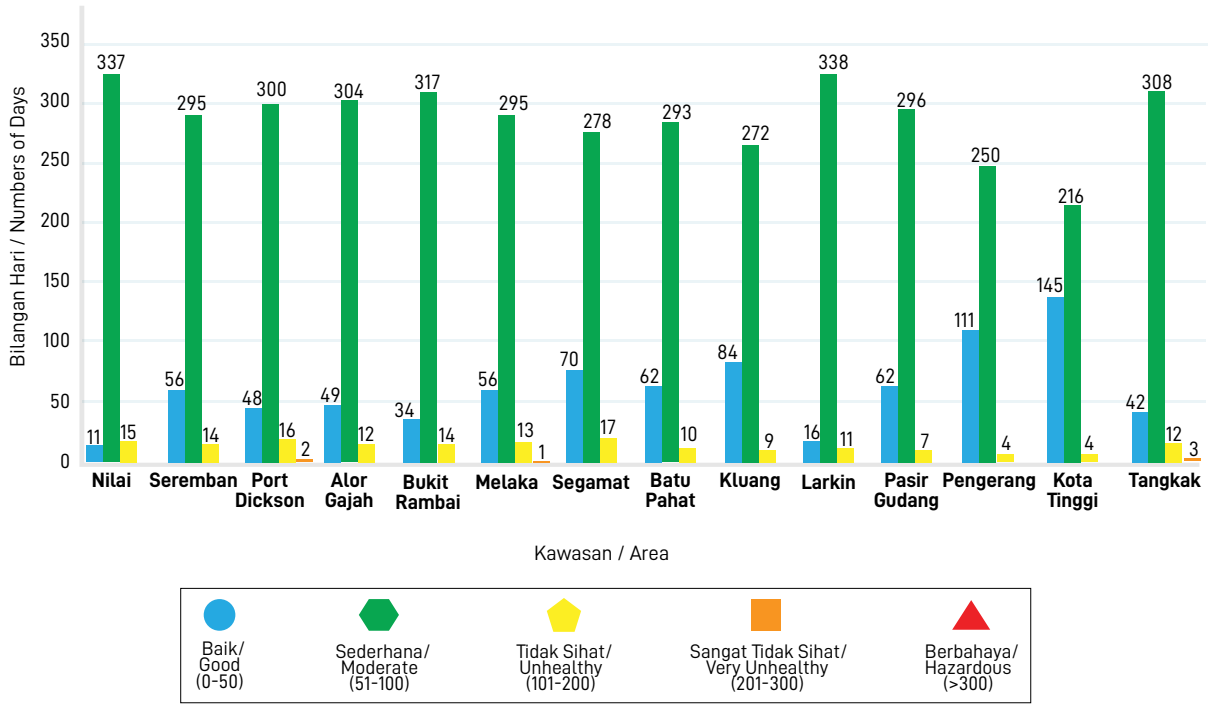
Kualiti udara di Wilayah Selatan Pantai Barat Semenanjung Malaysia (Negeri Sembilan, Negeri Melaka dan Negeri Johor) adalah sederhana pada kebanyakan masa. Keadaan sama seperti di wilayah utara, semua stesen di wilayah selatan menunjukkan bacaan IPU tidak sihat dan ada 4 stesen yang mencatatkan bacaan IPU yang sangat tidak sihat iaitu Tangkak (3), Nilai (2), Port Dickson (1) dan Melaka (1). Keadaan ini adalah disebabkan oleh jerebu setempat akibat pembakaran ladang dan belukar tempatan dan juga disebabkan oleh jerebu merentas sempadan.

Rajah 1.4 menunjukkan status kualiti udara secara keseluruhan bagi wilayah selatan di Pantai Barat Semenanjung Malaysia.

Southern Region

In the southern region of West Coast of Peninsular Malaysia (Negeri Sembilan, Melaka and Johor) the air quality was mostly moderate. The situation was similar to that in northern region, but all stations in the southern region recorded unhealthy days, while four stations recorded very unhealthy days, which were in Tangkak (3), Nilai (2), Port Dickson (1) and Melaka (1). This was due to the local haze caused by bush and farm fires and transboundary haze.

Figure 1.4 Overall air quality status for the southern region in West Coast of Peninsular Malaysia.



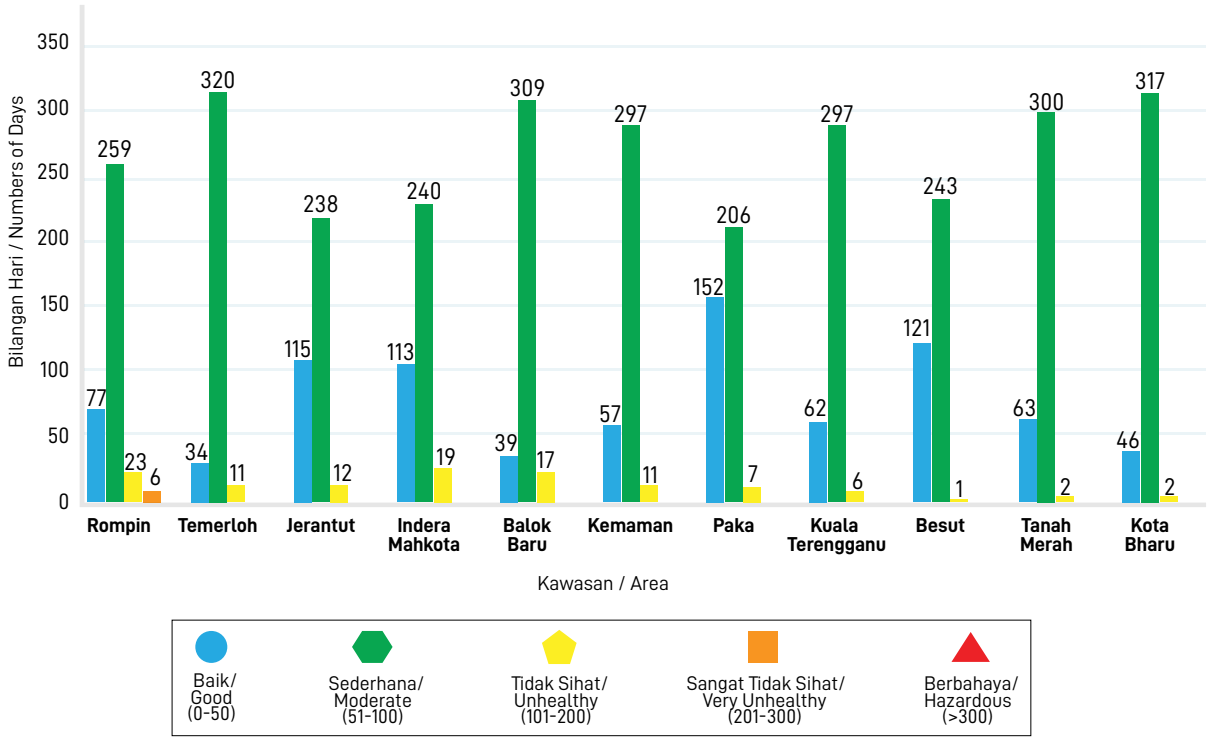
Rajah 1.4 : Status Kualiti Udara, Wilayah Selatan Pantai Barat Semenanjung Malaysia, 2019
Figure 1.4 : Air Quality Status, Southern Region of The West Coast Peninsular Malaysia, 2019

Nota : Bacaan adalah berdasarkan IPU Maksimum Harian
Note : Reading based on Daily Maximum API

STATUS
KUALITI UDARA DI PANTAI TIMUR
AIR QUALITY STATUS IN THE EAST COAST

Kualiti udara di Pantai Timur Semenanjung Malaysia (Negeri Pahang, Negeri Terengganu, Negeri Kelantan dan timur Negeri Johor) bagi tahun 2019 berstatus sederhana pada kebanyakan masa, dan semua stesen mencatatkan status kualiti udara tidak sihat sepanjang tahun dengan yang tertinggi adalah di Rompin (23) dan diikuti dengan Balok Baru (17) disebabkan kebakaran hutan dan belukar di Rompin dan Pekan, Pahang pada musim cuaca panas dan kering. Keadaan ini juga telah menyebabkan stesen Rompin mencatatkan bacaan sangat tidak sihat selama 6 hari. Status kualiti udara di Pantai Timur Semenanjung Malaysia secara keseluruhan adalah seperti di **Rajah 1.5**.

In the East Coast of Peninsular Malaysia (Pahang, Terengganu, Kelantan and East Johor) the air quality mostly remained moderate, while all stations recorded unhealthy days reading in 2019. The highest was in Rompin (23), followed by Balok Baru (17), Jerantut and Indera Mahkota (12), which was mostly caused by forest and bush fires from Rompin, Pekan and Pahang due to the hot and dry weather. This incident also caused the station in Rompin to record six (6) very unhealthy days. The overall air quality status in the East Coast of Peninsular Malaysia is shown in **Figure 1.5.**



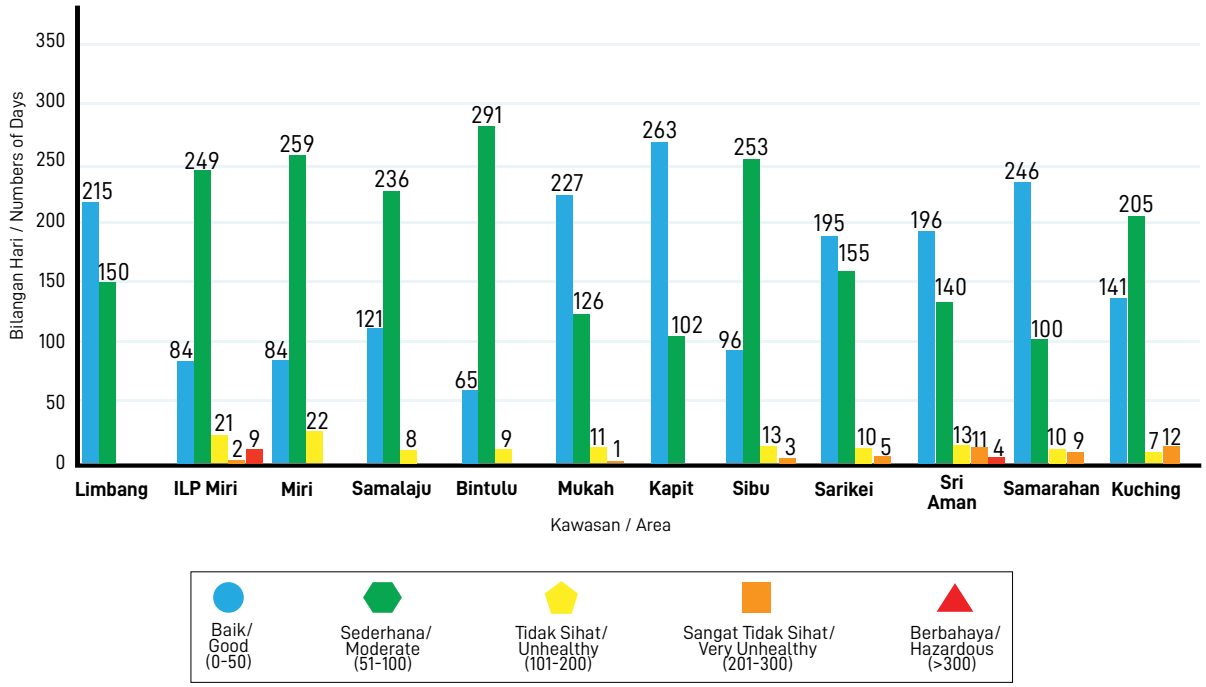
Rajah 1.5 : Status Kualiti Udara, Pantai Timur Semenanjung Malaysia, 2019
Figure 1.5 : Air Quality Status, East Coast Peninsular Malaysia, 2019

Nota : Bacaan adalah berdasarkan IPU Maksimum Harian
Note : Reading based on Daily Maximum API

STATUS
KUALITI UDARA DI SABAH, LABUAN DAN SARAWAK
AIR QUALITY STATUS IN SABAH, LABUAN AND SARAWAK

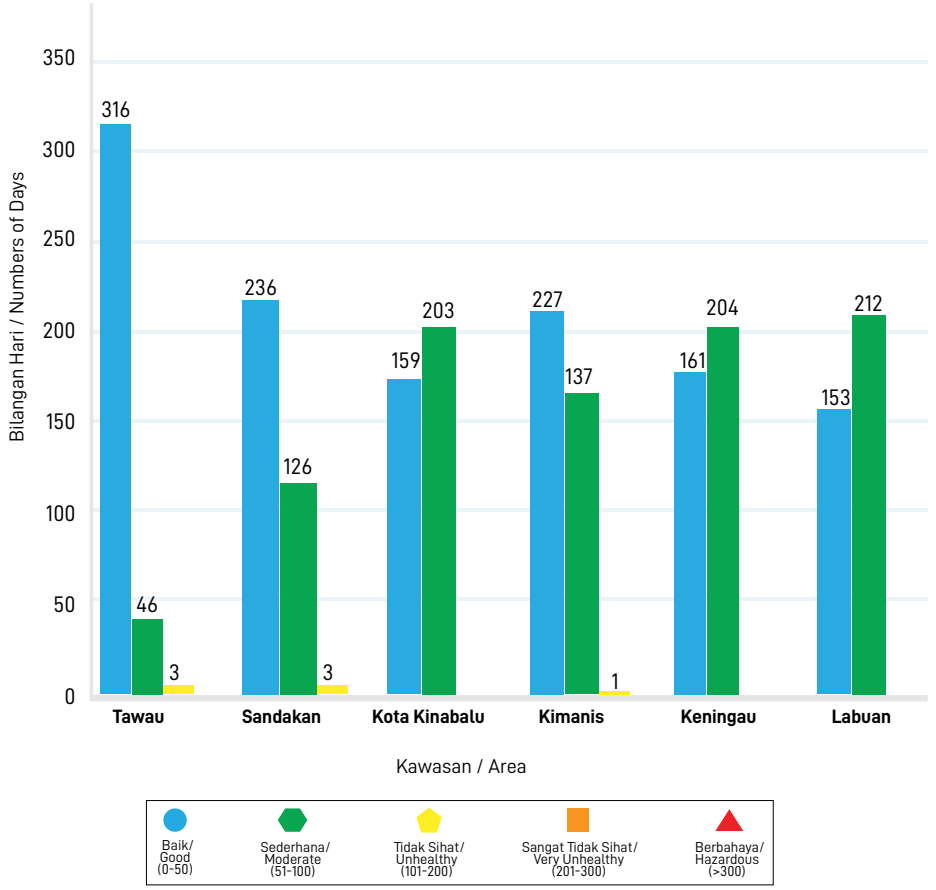
Kualiti udara di Sabah, Labuan dan Sarawak adalah pada tahap baik dan sederhana pada kebanyakan masa. Walau bagaimanapun bagi tahun 2019, semua stesen di Sarawak mencatatkan bacaan tidak sihat kecuali di Kapit. ILP Miri mencatatkan bacaan sembilan (9) hari yang berbahaya yang disebabkan oleh kebakaran belukar berdekatan dengan stesen ILP Miri dan empat (4) hari bacaan IPU yang berbahaya di Sri Aman disebabkan oleh berlakunya jerebu merentas sempadan dari negara jiran dan pada masa yang sama berlaku kebakaran di kawasan belukar dan hutan setempat. Di Sabah, 3 kawasan mencatatkan bacaan IPU yang tidak sihat iaitu di Tawau (3), Sandakan (3) dan Kimanis (1) yang terkesan daripada jerebu merentas sempadan manakala Kota Kinabalu mencatatkan bacaan IPU yang sangat tidak sihat iaitu dua (2) hari yang disebabkan oleh jerebu setempat. Status kualiti udara di Sarawak secara keseluruhan ditunjukkan dalam **Rajah 1.6** dan di Sabah dan Labuan ditunjukkan dalam **Rajah 1.7.**

The air quality status in Sabah, Labuan and Sarawak remained between good and moderate levels for most of the time. However, in 2019 all stations in Sarawak recorded unhealthy days, except for Kapit. ILP Miri recorded nine (9) days of caused by bush fires near the station, while hazardous readings were recorded on four (4) days in Sri Aman due to the transboundary haze from neighbouring country and local forest fires incident that occurred simultaneously. In Sabah, three stations recorded the API reading as "unhealthy days", which were in Tawau (3), Sandakan (3) and Kimanis (1) because they were affected by the transboundary haze. Meanwhile the local haze caused Kota Kinabalu to record its API reading as "very unhealthy day (2) . The overall air quality status in Sarawak is shown in **Figure 1.6** and **Figure 1.7**, revealing the overall air quality in Sabah and Labuan.



Rajah 1.6: Status Kualiti Udara, Sarawak, 2019
Figure 1.6: Air Quality Status, Sarawak, 2019

Nota : Bacaan adalah berdasarkan IPU Maksimum Harian
Note : Reading based on Daily Maximum API



Rajah 1.7 : Status Kualiti Udara Sabah dan Labuan, 2019
Figure 1.7 : Air Quality Status, Sabah dan Labuan, 2019

Nota : Bacaan adalah berdasarkan IPU Maksimum Harian
Note : Reading based on Daily Maximum API

TREN KUALITI UDARA
AIR QUALITY TREND

Enam (6) pencemar udara iaitu habuk halus bersaiz 10 mikron (PM_{10}), habuk halus bersaiz 2.5 mikron ($PM_{2.5}$), ozon permukaan bumi (O_3), sulfur dioksida (SO_2), nitrogen dioksida (NO_2) dan karbon monoksida (CO) dipantau secara berterusan di 65 buah lokasi. Parameter $PM_{2.5}$ mula dipantau sepenuhnya pada tahun 2018. Tren kualiti udara dari tahun 2010 hingga 2019 ditentukan dengan mengambilkira purata data kualiti udara tahunan daripada stesen-stesen pengawasan dan merujuk kepada Standard Kualiti Udara Ambien Malaysia seperti yang ditunjukkan dalam **Jadual 1.2**. Standard Kualiti Udara Ambien Malaysia IT-2 telah digunakan bagi tahun 2019.

Six (6) air pollutants, namely particulate matter (PM_{10}), particulate matter ($PM_{2.5}$), ground level ozone (O_3), sulphur dioxide (SO_2), nitrogen dioxide (NO_2) and carbon monoxide (CO) were continuously monitored at 65 locations. At the beginning of 2018, $PM_{2.5}$ parameters were fully monitored. The air quality trend from 2010 to 2019 period was computed by averaging the annual air quality data received from monitoring sites and with reference to Malaysia Ambient Air Quality Standard as shown in **Table 1.2**. The Malaysia Ambient Air Quality Standard IT-2 was used for 2019.

Jadual 1.2: Standard Kualiti Udara Ambien Malaysia
Table 1.2: Malaysian Ambient Air Quality Standard

PARAMETER/ PARAMETER	MASA PURATA/ AVERAGING TIME	UNIT/ UNIT	GARIS PANDUAN SEDIA ADA/ EXISTING GUIDELINES	STANDARD KUALITI UDARA AMBIEN MALAYSIA/ MALAYSIAN AMBIENT AIR QUALITY		
				IT-1 (2015)	IT-2 (2018)	STANDARD (2020)
PM_{10}	1 Tahun	µg/m³	50	50	45	40
	24 Jam	µg/m³	150	150	120	100
$PM_{2.5}$	1 Tahun	µg/m³	-	35	25	15
	24 Jam	µg/m³	-	75	50	35
SO_2	1 Jam	µg/m³	350	350	300	250
		ppm	0.135	0.135	0.115	0.095
	24 Jam	µg/m³	105	105	90	80
		ppm	0.040	0.040	0.035	0.030
*CO	1 Jam	mg/m³	35	35	35	30
		ppm	30.6	30.6	30.6	26.2
	8 Jam	mg/m³	10	10	10	10
		ppm	8.75	8.75	8.75	8.75
NO_2	1 Jam	µg/m³	320	320	300	280
		ppm	0.170	0.170	0.160	0.150
	24 Jam	µg/m³	75	75	75	70
		ppm	0.040	0.040	0.040	0.037
O_3	1 Jam	µg/m³	200	200	200	180
		ppm	0.100	0.100	0.100	0.090
	8 Jam	µg/m³	120	120	120	100
		ppm	0.060	0.060	0.060	0.050

Nota: *mg/m³ IT-Interim Tier (tahun)

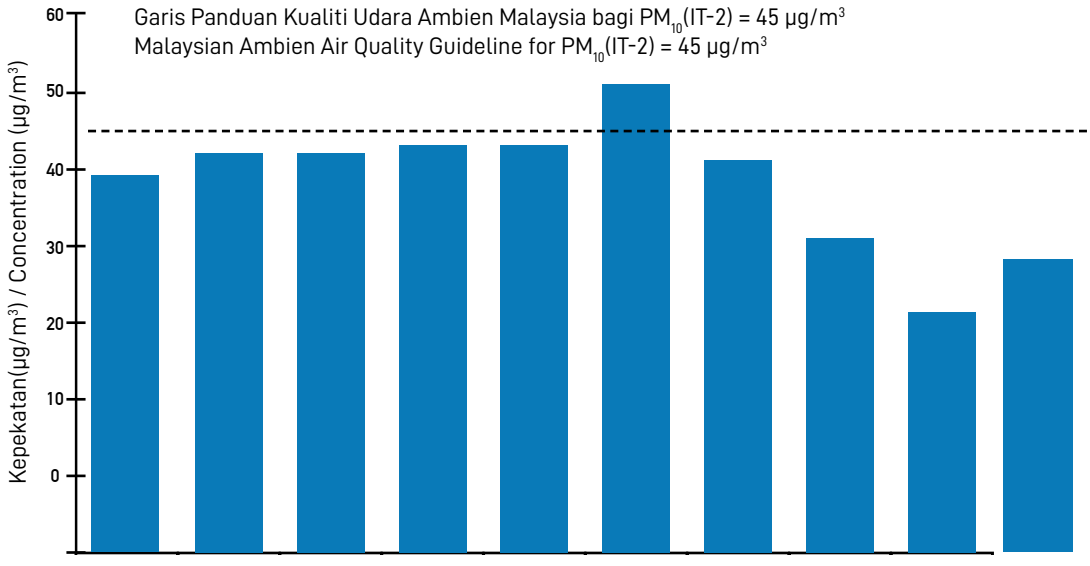
HABUK
HALUS BERSAIZ 10 MIKRON (PM_{10})
PARTICULATE MATTER (PM_{10})

Pada tahun 2019, nilai purata tahunan PM_{10} dalam udara ambien adalah 28 µg/m^3 iaitu masih belum melebihi had yang ditetapkan dalam Standard Kualiti Udara Ambien Malaysia bagi IT-2 iaitu sebanyak 45 µg/m^3. Bacaan PM_{10} bagi tahun 2019 adalah lebih tinggi sedikit berbanding dengan tahun 2018. Keadaan ini dipengaruhi oleh kejadian jerebu merentas sempadan daripada negara jiran di dalam satu tempoh yang tertentu.

Tren purata tahunan kepekatan PM_{10} dalam udara ambien bagi tahun 2010 hingga tahun 2019 adalah seperti yang ditunjukkan dalam **Rajah 1.8**. Berdasarkan kategori guna tanah, nilai kepekatan PM_{10} pada tahun 2019 adalah mematuhi Standard Kualiti Udara Ambien Malaysia IT-2 seperti yang ditunjukkan dalam **Rajah 1.8 (a).**

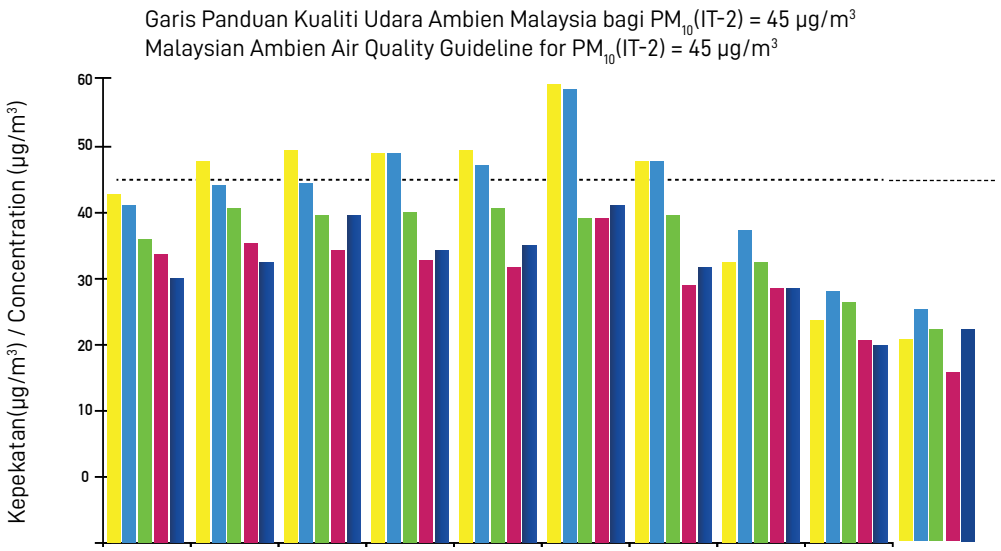
In 2019, the annual average PM_{10} value in ambient air was 28 µg/m^3, which was lower than the Malaysian Ambient Air Quality Standard IT-2 value (45 µg/m^3). The PM_{10} concentration in 2019 was slightly higher as compared to 2018, which was the effect of transboundary haze from neighbouring country within a certain period.

The trend of the annual average PM_{10} concentration levels in ambient air from 2010 to 2019 are as shown in **Figure 1.8**. Based on land use categories, PM_{10} concentration in 2019 was in compliance with the Malaysia Ambient Air Quality Standard IT-2 value, as shown in **Figure 1.8(a).**



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Kepekatan / Concentration	39	43	43	44	44	53	42	33	24	28
Nombor Lokasi / Number of sites	52	52	52	52	52	52	52	65	65	65

Rajah 1.8 : Purata Kepekatan Tahunan Habuk Halus Bersaiz 10 Mikron (PM_{10}), 2010 - 2019
Figure 1.8 : Annual Average Concentration of Particulate Matter (PM_{10}), 2010 - 2019



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Industri/Industrial	44	48	49	48	49	58	44	33	23	26
Bandar/Urban	42	45	46	48	46	57	44	35	28	32
Pinggir Bandar/ Suburban	36	41	39	40	41	49	39	31	26	29
Latarbelakang/Background	34	36	34	34	33	49	29	25	21	22
Pendalaman/Rural	30	34	39	35	36	43	32	25	22	28

Rajah 1.8(a) : Purata Kepekatan Tahunan Habuk Halus Bersaiz 10 Mikron (PM_{10}) Mengikut Guna Tanah, 2010 - 2019
Figure 1.8(a) : Annual Average Concentration of Particulate Matter (PM_{10}) by Land Use, 2010 - 2019

HABUK HALUS BERSAIZ 2.5 MIKRON ($PM_{2.5}$)

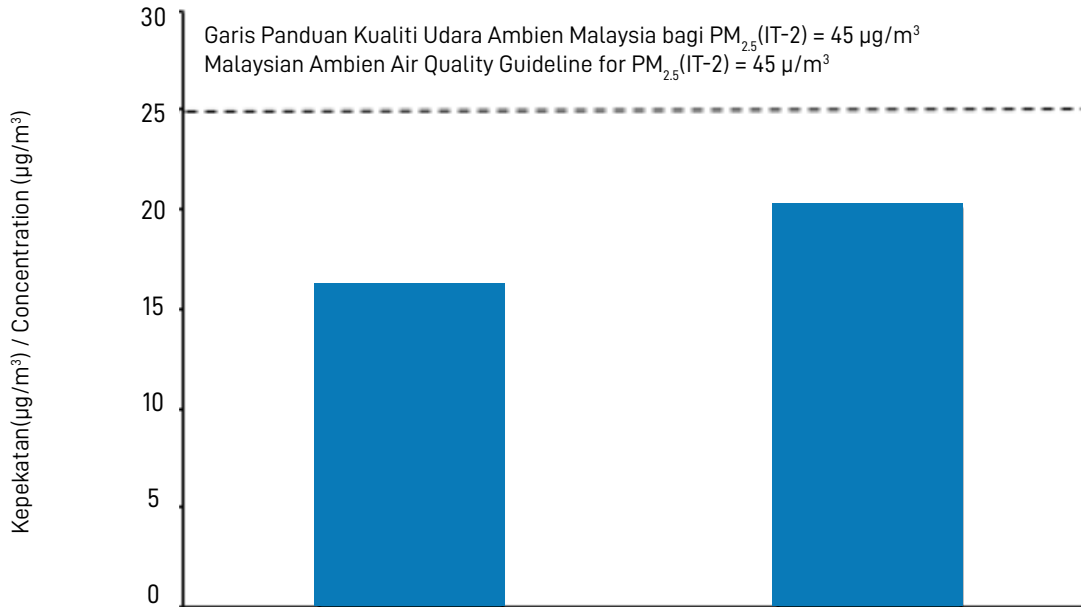
PARTICULATE MATTER ($PM_{2.5}$)

$PM_{2.5}$ mula diukur dan dianalisis bermula pada pertengahan tahun 2017. Walau bagaimanapun, analisis bagi $PM_{2.5}$ dilaporkan di dalam Laporan Kualiti Alam Sekitar bermula pada tahun 2018. Nilai purata tahunan $PM_{2.5}$ dalam udara ambien bagi tahun 2019 adalah 20 µg/m³ iaitu masih belum melebihi had yang ditetapkan dalam Standard Kualiti Udara Ambien Malaysia bagi IT-2 iaitu sebanyak 25 µg/m³. Bacaan $PM_{2.5}$ bagi tahun 2019 adalah lebih tinggi sedikit berbanding dengan tahun 2018 disebabkan oleh kejadian jerebu merentas sempadan daripada negara jiran di dalam satu tempoh yang tertentu **(Rajah 1.8(b)).**

Berdasarkan kategori guna tanah, nilai kepekatan $PM_{2.5}$ pada tahun 2019 adalah mematuhi Standard Kualiti Udara Ambien Malaysia IT-2 seperti yang ditunjukkan dalam **Rajah 1.8 (c).** Daripada rajah tersebut, kepekatan $PM_{2.5}$ tertinggi mengikut guna tanah adalah di kawasan bandar dan diikuti dengan kawasan pinggir bandar**.**

$PM_{2.5}$ was first measured and analysed in mid-year of 2017. However, analysis of $PM_{2.5}$ was first reported in the Environmental Quality Report started in 2018. In 2019, the annual average $PM_{2.5}$ value in ambient air was 20 µg/m³, which was lower than the Malaysian Ambient Air Quality Standard IT-2 value (25 µg/m³). The $PM_{2.5}$ concentration in 2019 was slightly higher as compared to in 2018, which was affected by the transboundary haze from neighbouring country within a certain period **(Figure 1.8(b))**.

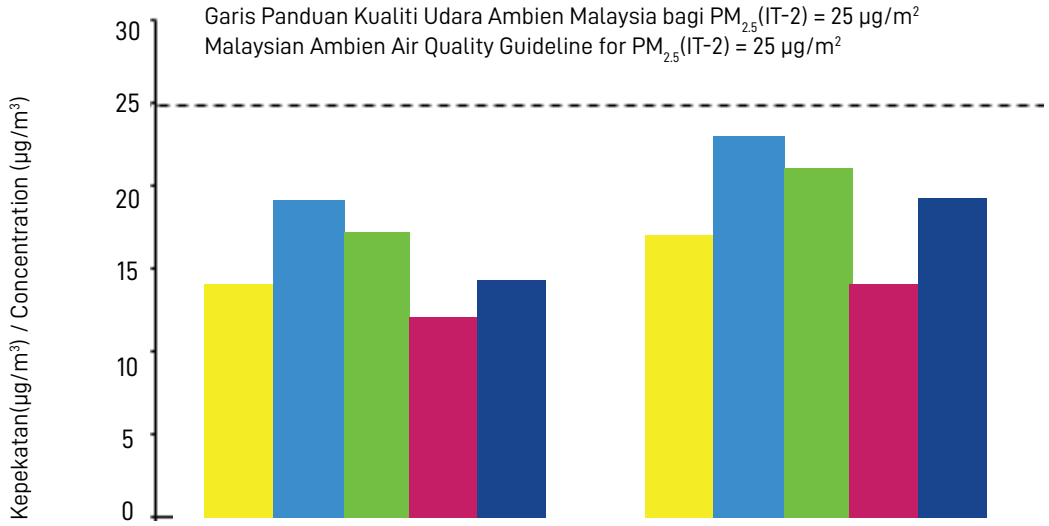
Based on land use categories, the $PM_{2.5}$ concentrations in 2019 was in compliance with Malaysia Ambient Air Quality Standard IT-2, as shown in **Figure 1.8(c)**, whereby the highest $PM_{2.5}$ concentration according to land use categories was in urban area and followed by suburban area.



	2018	2019
Kepekatan Concentration	16	20
Nombor Lokasi Number of sites	65	65

Rajah 1.8 (b): Purata Kepekatan Tahunan Habuk Halus Bersaiz 2.5 Mikron ($PM_{2.5}$), 2018- 2019

Figure 1.8 (b): Annual Average Concentration of Particulate Matter ($PM_{2.5}$), 2018 - 2019



		2018	2019
	Industri/Industrial	14	14
	Bandar/Urban	19	23
	Pinggir Bandar/ Suburban	17	21
	Latarbelakang/Background	12	14
	Pendalaman/Rural	14	19

Rajah 1.8 (c) : Purata Kepekatan Tahunan Habuk Halus Bersaiz 2.5 Mikron ($PM_{2.5}$) Mengikut Guna Tanah, 2018 - 2019

Figure 1.8(c) : Annual Average Concentration of Particulate Matter ($PM_{2.5}$) by Land Use, 2018 - 2019

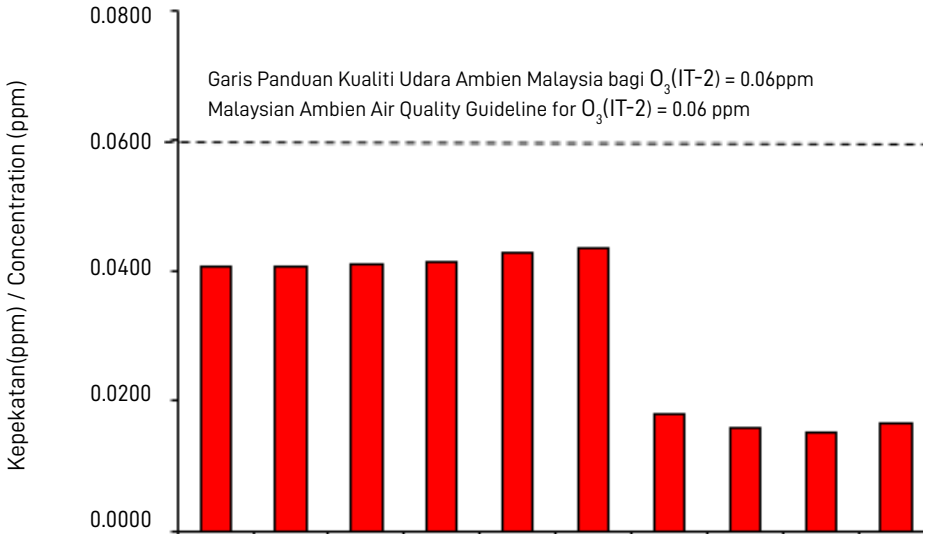
OZON
PERMUKAAN BUMI (O_3)
GROUND LEVEL OZONE (O_3)

Pada tahun 2019, purata tahunan kepekatan maksimum harian ozon didapati sedikit meningkat berbanding dengan tahun 2018. Secara keseluruhannya, tren purata tahunan kepekatan maksimum ozon tempoh 8 jam dalam udara ambien dari tahun 2010 hingga 2019 adalah mematuhi had sebanyak 0.6 ppm seperti yang ditetapkan dalam Standard Kualiti Udara Ambien Malaysia IT-2 dan tren tersebut adalah seperti yang ditunjukkan dalam **Rajah 1.9.**

Rajah 1.9(a) menunjukkan kepekatan ozon aras bumi untuk pelbagai kategori guna tanah dari tahun 2010 hingga 2019. Bermula tahun 2018, tiada pemantauan ozon dilakukan di kawasan industri kerana untuk memberi keutamaan pemantauan ozon di kawasan bandar. Kawasan bandar mencatatkan bacaan ozon lebih tinggi disebabkan oleh jumlah trafik yang lebih tinggi dan keadaan atmosfera yang kondusif menyebabkan pembentukan ozon. Pencemaran ozon aras bumi juga ketara di beberapa kawasan pinggir bandar dan pedalaman disebabkan oleh pergerakan angin yang membawa pencetus pencemar ozon aras bumi iaitu oksid-oksid nitrogen (NO_x) dan sebatian organik meruap (VOC) yang kebanyakannya dilepaskan daripada kenderaan bermotor dan industri.

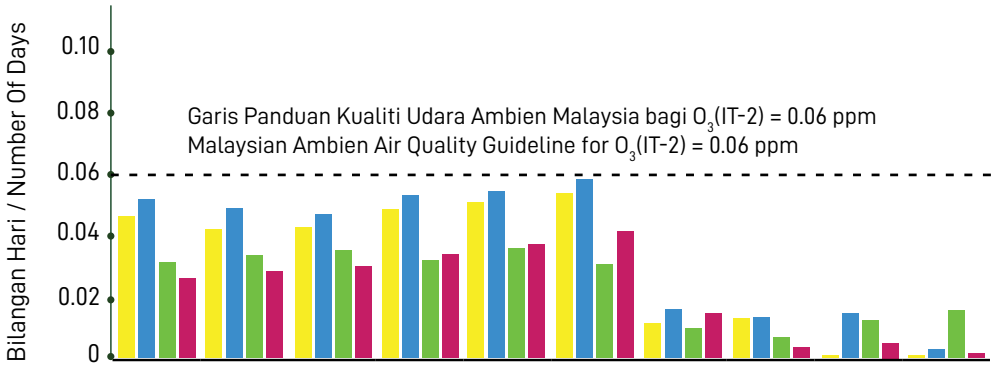
In 2019, the annual average daily maximum ozone concentration was slightly increased as compared to in 2018. The overall trend on the annual average daily maximum eight-hour ozone concentration in ambient air from 2010 to 2018 was well below the limit of 0.6 ppm, as stipulated in the Malaysia Ambient Quality Standard IT-2 and the trend is shown in **Figure 1.9.**

Figure 1.9(a) shows the ground level ozone concentrations for various land use categories between 2010 and 2019. Beginning 2018, there was no ozone monitoring in industrial areas because priority was given to urban area monitoring. Urban areas recorded higher levels of ground level ozone due to higher traffic volume and conducive atmospheric condition, resulting in ozone formation. Ground level ozone pollution was also dominant in some suburban and rural areas due to downwind effect transporting ground level ozone pollutant precursors namely nitrogen oxides (NO_x) and volatile organic compound (VOC) were emitted mainly from motor vehicles and industries.



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Kepekatan / Concentration	0.0406	0.0408	0.0409	0.0413	0.0429	0.0435	0.0180	0.0158	0.0153	0.165
Nombor Lokasi / Number of sites	41	41	41	41	41	41	41	45	45	45

Rajah 1.9: Purata Kepekatan Tahunan Ozon (O_3), 2010 - 2019
Figure 1.9: Annual Average Concentration of Ozone (O_3), 2010 - 2019



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Industri/Industrial	0.0412	0.0402	0.0407	0.0417	0.0431	0.0463	0.0170	0.0175	0.00	0.00
Bandar/Urban	0.0453	0.0447	0.0441	0.0457	0.0469	0.0489	0.0192	0.0176	0.0188	0.0200
Pinggir Bandar/ Suburban	0.0364	0.0383	0.0386	0.0370	0.0388	0.0354	0.0159	0.0155	0.0173	0.0185
Latarbelakang/Background	0.0287	0.0309	0.0327	0.0335	0.0378	0.0416	0.0190	0.0127	0.0099	0.0011

Rajah 1.9(a) : Purata Kepekatan Tahunan Ozon (O_3) Mengikut Guna Tanah, 2010 - 2019
Figure 1.9(a) : Annual Average Concentration of Ozone (O_3) by Land Use, 2010- 2019

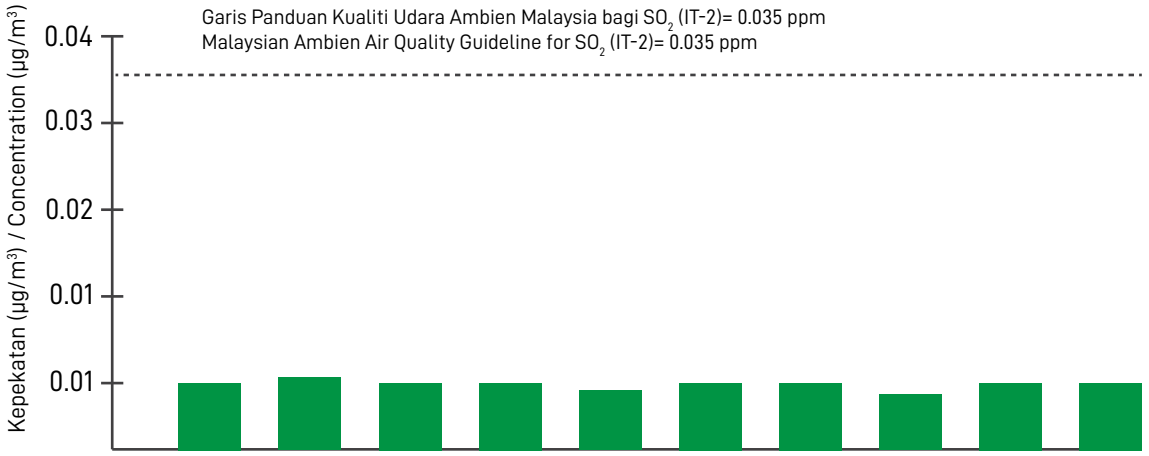
SULFUR
DIOKSIDA (SO_2)
SULPHUR DIOXIDE (SO_2)

Secara umumnya, purata kepekatan tahunan SO_2 menunjukkan tren penurunan dari tahun 2010 hingga 2019 (**Rajah 1.10**) dan ia adalah jauh di bawah had sebanyak 0.035 ppm seperti yang ditetapkan dalam Standard Kualiti Udara Ambien Malaysia IT-2. Ini adalah disebabkan oleh penggunaan bahan api berkualiti EURO2M yang lebih baik di negara ini bermula dari bulan September 2009 dan penguatkuasaan yang lebih ketat oleh JAS serta penggunaan gas asli secara meluas dalam proses industri dan kegunaan kenderaan. Mulai 1 September 2015, EURO4M RON97 telah dilaksanakan dan pada November 2015 EURO5 Diesel yang mengandungi kandungan sulfur kurang dari 10 mg/l pula telah diperkenalkan di pasaran. Walaupun jumlah kenderaan yang menggunakan bahan api tersebut adalah kurang dari penggunaan EURO2M, sedikit sebanyak ia mempengaruhi tren pelepasan SO_2 di kawasan industri dan bandar yang menunjukkan semakin berkurangan pelepasan SO_2. **Rajah 1.10 (a)** menunjukkan kepekatan purata tahunan bagi SO_2 mengikut kategori guna tanah. Berdasarkan kepada rajah tersebut, keadaan menunjukkan bahawa kepekatan SO_2 di kawasan-kawasan mengikut kategori tanah adalah lebih rendah

Generally, the annual average SO_2 concentration shows a declining trend between 2010 and 2018 (**Figure 1.10**) and it is well below the limit of 0.035 ppm, as stipulated in the Malaysian Ambient Air Quality Standard IT-2. This was attributed by the use of better fuel quality EURO2M in this country starting from September 2009 and also stricter enforcement by DOE, as well as the widely use of natural gas for industrial combustion processes and vehicles. On 1 September 2015, petrol EURO4M Ron 97 was implemented and EURO5 Diesel with the sulfur content less than 10 mg/l was marketed in November 2015. Although less vehicles used both types of fuels as compared to EURO2M vehicles, it showed that the SO_2 trend had decreased in urban and industrial areas. **Figure 1.10(a)** shows the annual average SO_2 concentrations from different land use categories . The figure shows that SO_2 concentration in all areas is slightly decreased as compared to other years, including urban

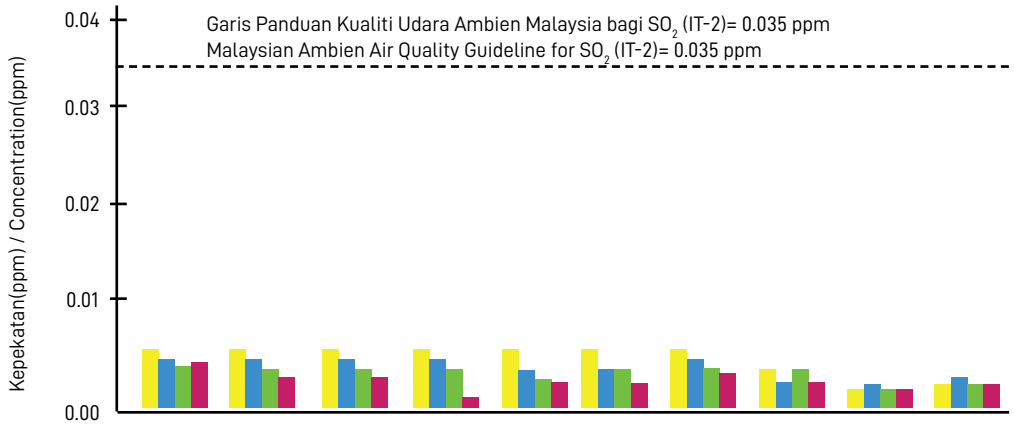
berbanding dengan tahun-tahun sebelumnya termasuk di kawasan bandar. Ini menunjukkan keberkesanan ke atas penggunaan bahan api yang lebih berkualiti yang digunakan oleh kenderaan-kenderaan di Malaysia.

areas. This could be due to the effectiveness of using better fuel quality by the vehicles in Malaysia.



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Kepekatan / Concentration	0.0406	0.0018	0.0018	0.0018	0.0020	0.002	0.002	0.0015	0.001	0.0011
Nombor Lokasi / Number of sites	41	44	44	44	44	44	42	52	52	52

Rajah 1.10: Purata Kepekatan Tahunan Sulfur Dioksida (SO_2), 2010 - 2019
Figure 1.10: Annual Average Concentration of Sulphur Dioxide (SO_2), 2010 - 2019



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Industri/Industrial	0.0022	48	49	48	49	58	44	33	23	26
Bandar/Urban	42	45	46	48	46	57	44	35	28	32
Pinggir Bandar/ Suburban	36	41	39	40	41	49	39	31	26	29
Latarbelakang/Background	34	36	34	34	33	49	29	25	21	22
Luar Bandar/Rural	30	34	39	35	36	43	32	25	22	28

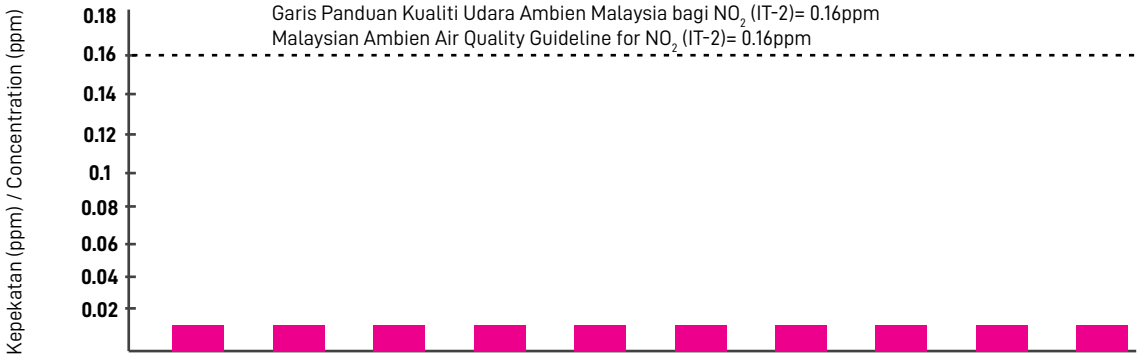
Rajah 1.10(a): Purata Kepekatan Tahunan Sulfur Dioksida (SO_2) Mengikut Guna Tanah, 2010 - 2019
Figure 1.10(a) : Annual Average Concentration of Sulfur Dioxide (SO_2) by Land Use, 2010- 2019

NITROGEN DIOKSIDA (NO_2)

NITROGEN DIOXIDE (NO_2)

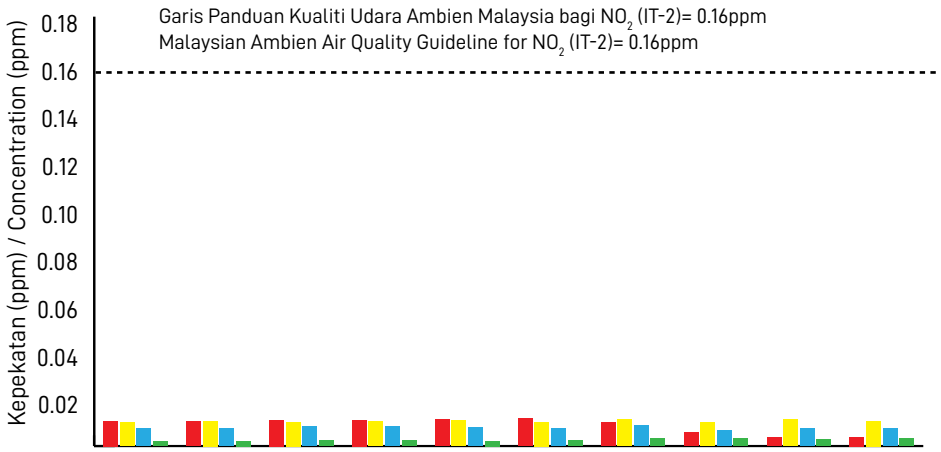
Pada tahun 2019, kepekatan NO_2 tidak berubah dan sama seperti tahun 2018. Kepekatan NO_2 kekal tinggi di kawasan bandar disebabkan oleh peningkatan yang ketara dalam bilangan kenderaan bermotor dan proses pembakaran. Anggaran beban pelepasan NO_2 menunjukkan sebanyak 66 peratus adalah daripada loji janakuasa, 25 peratus daripada pelepasan kenderaan bermotor, 7 peratus daripada industri dan 2 peratus daripada lain-lain sumber. Kepekatan purata tahunan NO_2 dalam udara ambien dari tahun 2010 hingga 2019 adalah stabil dan jauh berada di bawah had yang ditetapkan dalam Standard Kualiti Udara Ambien Malaysia IT-2. **(Rajah 1.11 dan Rajah 1.11 (a))**

In 2019, there was no change in NO_2, which was similar to the 2018 level. The NO_2 concentrations remained high in urban areas mainly because there was a significant increase in the number of motor vehicles and combustion processes. Estimation on NO_2 emission load indicated that 66% was from power plants, while 25% was from motor vehicles, 7 percent from industries and 2% from other sources. The annual average NO_2 concentration in ambient air from 2010 to 2019 had remained almost constant and well below the Malaysia Ambient Air Quality Standard IT-2. **(Figure 1.11 and Figure 1.11(a))**



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Kepekatan/ Concentration	0.0406	0.0018	0.0018	0.0018	0.0020	0.002	0.002	0.0015	0.001	0.0011
Nombor Lokasi / Number of sites	41	44	44	44	44	44	42	52	52	52

Rajah 1.11: Purata Kepekatan Tahunan Nitrogen Dioksida (NO_2), 2010 - 2019
Figure 1.11: Annual Average Concentration of Nitrogen Dioxide (NO_2), 2010 - 2019



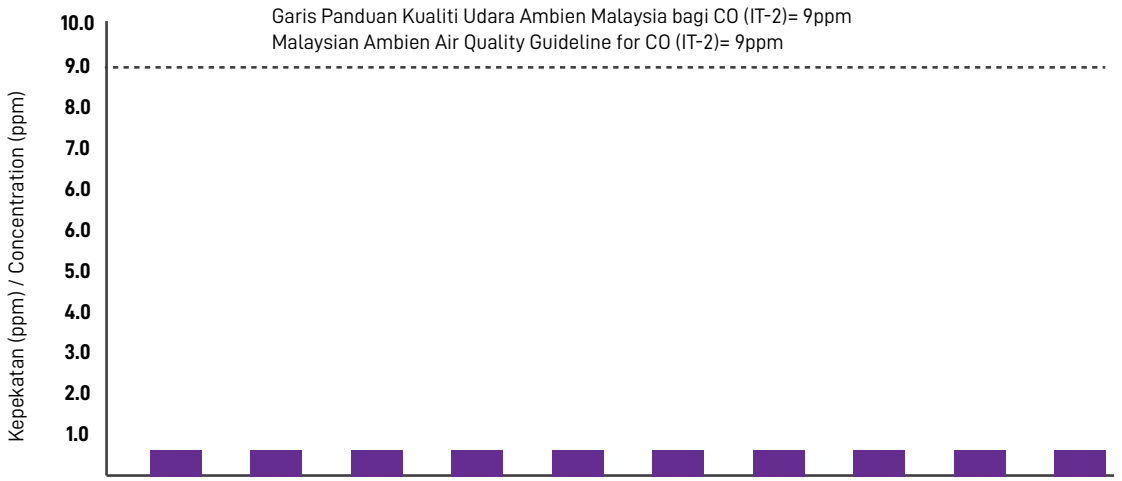
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Industri / Industry	0.0105	0.0104	0.0109	0.0109	0.011	0.0115	0.01	0.0058	0.0037	0.0038
Bandar / Urban	0.0098	0.0105	0.0101	0.0103	0.0107	0.0101	0.011	0.01	0.011	0.0105
Pinggir Bandar/ Suburban	0.0073	0.0081	0.0083	0.0077	0.0073	0.0088	0.0066	0.0075	0.0073	0.0069
Latarbelakang / Background	0.0019	0.0021	0.0022	0.0023	0.0021	0.0025	0.003	0.0031	0.0028	0.0032

Rajah 1.11(a): Purata Kepekatan Tahunan Nitrogen Dioksida (NO_2) Mengikut Guna Tanah, 2010- 2019
Figure 1.11(a): Annual Average Concentration of Nitrogen Dioxide (NO_2) by Land Use, 2010 - 2019

KARBON MONOKSIDA (CO)
CARBON MONOXIDE (CO)

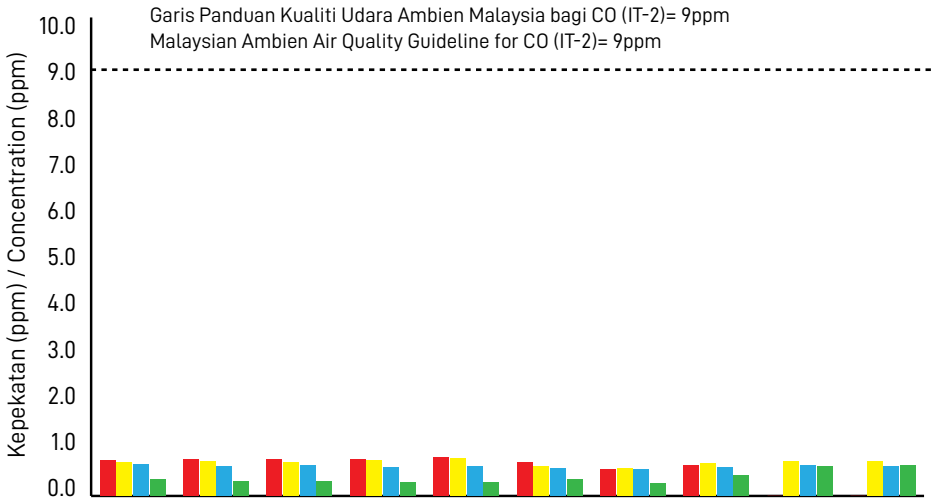
Kepekatan CO pada tahun 2019 menunjukkan sedikit peningkatan berbanding tahun 2018. Walau bagaimanapun, tren kepekatan CO dari tahun 2010 hingga 2019 adalah stabil. Tahap kepekatan yang dicatatkan juga mematuhi Standard Kualiti Udara Ambien Malaysia IT-2 (**Rajah 1.12**). Bermula pada tahun 2018, pemantauan CO di kawasan industri tidak lagi dilakukan. Di kawasan bandar, kepekatan CO adalah lebih tinggi yang berpunca daripada pelepasan kenderaan bermotor dengan menyumbang sebanyak 95 peratus daripada beban pelepasan CO pada tahun 2019. **Rajah 1.12 (a)** menunjukkan kepekatan CO untuk pelbagai kategori guna tanah.

In 2019, there was a slight increase in CO level as compared to 2018. However, the trend of CO concentration from 2010 to 2019 remained almost constant. The levels recorded were well in compliance with the Malaysian Ambient Air Quality Standard IT-2 **(Figure 1.12)**. Starting 2018, there was no CO monitoring done in the industrial area. In urban areas, the CO concentration was higher, whereby the main source of emission was from motor vehicles which contributed to 95 % of CO emission load in 2019. **Figure 1.12(a)** shows CO concentrations for various land use categories .



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Kepekatan / Concentration	0.6510	0.6809	0.6827	0.6855	0.7238	0.6184	0.5588	0.5819	0.6521	0.6617
Nombor Lokasi / Number of sites	41	41	41	41	41	41	41	45	45	45

Rajah 1.12: Purata Kepekatan Tahunan Karbon Monoksida (CO), 2010 - 2019
Figure 1.12: Annual Average Concentration of Carbon Monoxide (CO), 2010 - 2019



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Industri / Industry	0.0105	0.0104	0.0109	0.0109	0.011	0.0115	0.01	0.0058	0.0037	0.0038
Bandar / Urban	0.0098	0.0105	0.0101	0.0103	0.0107	0.0101	0.011	0.01	0.011	0.0105
Pinggir Bandar / Suburban	0.0073	0.0081	0.0083	0.0077	0.0073	0.0088	0.0066	0.0075	0.0073	0.0069
Latarbelakang / Background	0.0019	0.0021	0.0022	0.0023	0.0021	0.0025	0.003	0.0031	0.0028	0.0032

Rajah 1.12(a): Purata Kepekatan Tahunan Karbon Monoksida (CO) Mengikut Guna Tanah, 2010- 2019
Figure 1.12(a): Annual Average Concentration of Carbon Monoxide (CO) by Land Use, 2010 - 2019

BAB 2
CHAPTER 2

KUALITI AIR SUNGAI
RIVER WATER QUALITY

BAB 2
KUALITI AIR SUNGAI
RIVER WATER QUALITY

PROGRAM
PENGAWASAN KUALITI ALAM SEKITAR
THE ENVIRONMENTAL QUALITY MONITORING PROGRAMME (EQMP)

Program Pengawasan Kualiti Alam Sekitar atau (EQMP) merupakan satu program inisiatif kerajaan untuk memantapkan pemantauan kualiti alam sekitar. Program ini melibatkan pengumpulan data bagi kualiti air sungai di seluruh Malaysia bagi tujuan untuk melaporkan tahap sebenar kualiti alam sekitar Negara dalam usaha untuk memantau, mencegah dan mengawal pencemaran.

EQMP ini adalah penambahbaikan daripada sistem pengawasan kualiti alam sekitar yang telah digunapakai oleh Jabatan Alam Sekitar (JAS) sejak tahun 1995 sehingga 2015 bagi pengawasan kualiti air sungai.

The Environmental Quality Monitoring Programme or (EQMP) is a Government initiative to strengthen the monitoring of environmental quality. The programme involves data collection for river water quality throughout Malaysia for the purpose of reporting the actual level of environmental quality in the country in order to monitor, prevent and control pollution.

The EQMP is an improvement of the existing environmental quality monitoring system that has been adopted by the Department of Environment (DOE) from 1995 to 2015 for river water quality monitoring.

PENGAWASAN
KUALITI AIR SUNGAI
RIVER WATER QUALITY MONITORING

Jabatan Alam Sekitar (JAS) meneruskan program pengawasan kualiti air sungai pada tahun 2019 bagi menentukan kualiti air sungai dan mengesan perubahan ke atas kualiti air sungai. Sampel-sampel air sungai diambil daripada stesen-stesen yang telah ditetapkan dan diukur kualitinya secara in-situ serta dihantar ke makmal untuk dianalisis bertujuan menentukan kriteria dari segi fizik-kimia dan biologi. Indeks Kualiti Air (IKA) digunakan untuk mengukur tahap pencemaran dan kesesuaian jenis guna air seperti yang digariskan oleh Standard Kualiti Air Negara (**ANNEX**). IKA telah mengambilkira parameter Oksigen Terlarut (DO), Keperluan Oksigen Biokimia (BOD), Keperluan Oksigen Kimia (COD), Ammoniakal Nitrogen (NH_3-N), Pepejal Terampai (SS) dan pH. Pada tahun 2019, kualiti air sungai telah dinilai berdasarkan sejumlah 8,118 sampel air sungai yang telah diambil daripada sejumlah 1,353 stesen pengawasan manual yang merangkumi 672 sungai.

The Department of Environment (DOE) continues the river water quality monitoring programme in 2019 to determine the status of river water quality and to detect changes in river water quality. Water samples were collected from designated stations for in-situ and laboratory analysis to determine its physic-chemical and biological characteristics. The Water Quality Index (WQI) is used to indicate the level of pollution and the corresponding suitability in terms of water uses according to the National Water Quality Standards for Malaysia (NWQS) (**ANNEX**). The WQI takes into consideration parameters including Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Ammoniacal Nitrogen (NH_3-N), Suspended Solids (SS) and pH. In 2019, river water quality was assessed based on a total of 8,118 samples taken from a total of 1,353 manual monitoring stations covering 672 rivers in Malaysia.

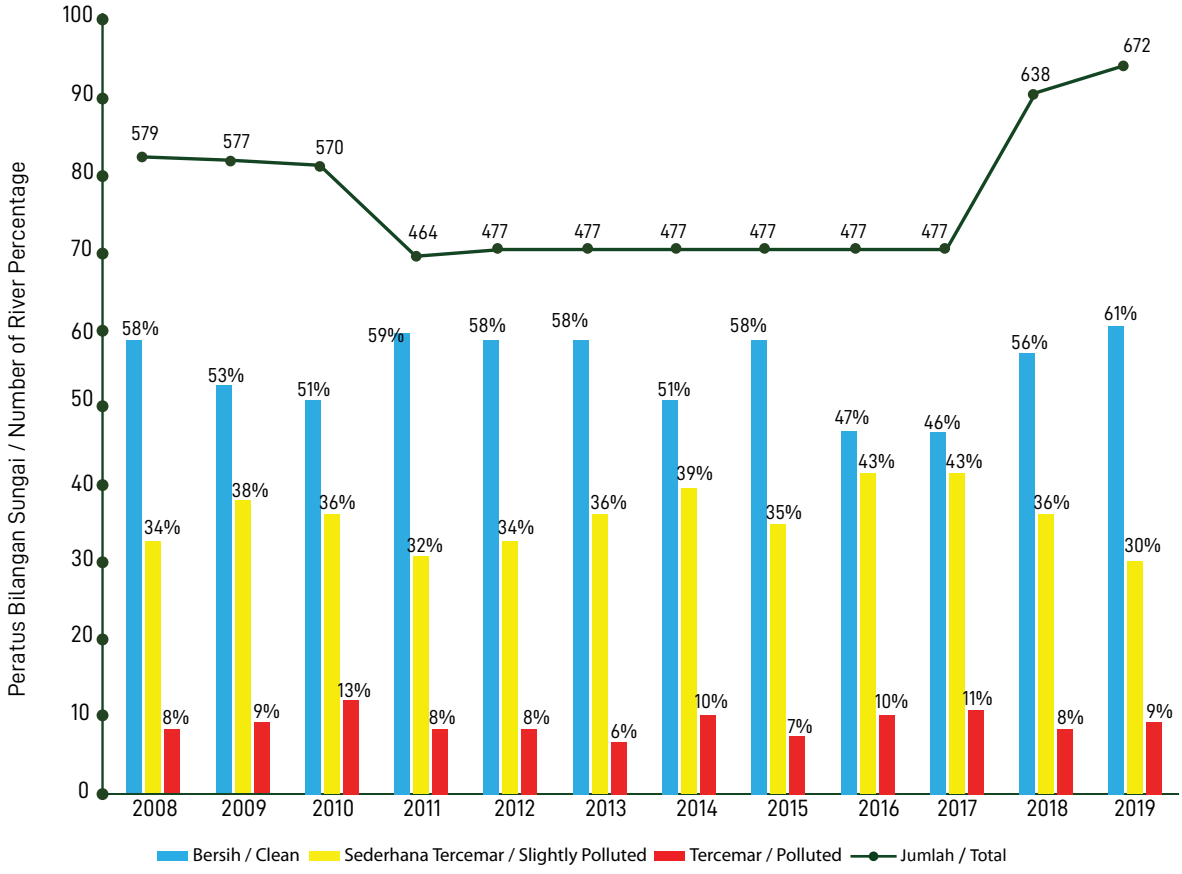
STATUS
KUALITI AIR SUNGAI
RIVER WATER QUALITY STATUS

Sejumlah 408 (61%) sungai daripada 672 sungai yang diawasi telah menunjukkan indeks kualiti air bersih, 205 (30%) adalah sederhana tercemar dan 59 (9%) adalah tercemar (**Rajah 2.1**). Status kualiti air bagi sungai-sungai yang diawasi adalah seperti dalam **Jadual 2.1, Jadual 2.2** dan **Jadual 2.3**.

Keperluan Oksigen Biokimia (BOD), Ammonikal Nitrogen (NH_3-N) dan Pepejal Terampai (SS) masih menjadi punca kepada pencemaran sungai. BOD yang tinggi kerap kali dikaitkan dengan pengolahan sisa kumbahan yang tidak berkesan, atau akibat pelepasan efluen daripada industri-industri pengilangan dan berasaskan pertanian. Punca utama NH_3-N pula boleh dikaitkan dengan aktiviti penternakan dan kumbahan domestik manakala punca utama SS adalah kerja-kerja tanah dan aktiviti pembukaan tanah yang tidak teratur.

Out of the 672 rivers monitored, 408 (61%) showed clean water quality, 205 (30%) were slightly polluted while 59 (9%) were polluted (**Figure 2.1**). The monitored rivers and their overall quality status are as in **Tables 2.1, Table 2.2** and **Table 2.3.**

As in previous years, the Biochemical Oxygen Demand (BOD), Ammoniacal Nitrogen (NH_3-N) and Suspended Solids (SS) remained to be significant in terms of river pollution. High BOD can be attributed to inefficient treatment of sewage or effluent from agro-based and manufacturing industries. The main sources of NH_3-N maybe attributed from animal farming and domestic sewage, while the sources for SS were mainly due to improper earthworks and land clearing activities.



Rajah 2.1 : Tren Kualiti Air Sungai, 2008-2019
Figure 2.1 : River Water Quality Trend, 2008-2019

Jadual 2.1 : Status Kualiti Air bagi Sungai Bersih, 2019
Table 2.1 : Water Quality Status of Clean Rivers, 2019

NEGERI/ STATE	LEMBANGAN SUNGAI/ RIVER BASIN	SUNGAI/ RIVER	BILANGAN STESEN/ NUMBER OF STATIONS	2018			2019		
				IKA/ WQI	KATEGORI/ CATEGORY	KELAS/ CLASS	IKA/ WQI	KATEGORI/ CATEGORY	KELAS/ CLASS
Perlis	Sg. Perlis	Sg. Wang Kelian	1	93	B/C	I	94	B/C	I
		Sg. Arau	2	82	B/C	II	82	B/C	II
		Sg. Terusan Mada	2	83	B/C	II	84	B/C	II
		Sg. Empangan Timah Tasoh	1	88	B/C	II	87	B/C	II
		Sg. Ngulang	1	85	B/C	II	82	B/C	II
		Sg. Jarum	1	84	B/C	II	83	B/C	II
		Sg. Kok Mak	1	84	B/C	II	86	B/C	II
		Sg. Pelarit	1	91	B/C	II	91	B/C	II
		Sg. Jernih	1	86	B/C	II	86	B/C	II
Kedah (Langkawi)	Sg. Kisap	Sg. Kisap	1	91	B/C	II	90	B/C	II
	Sg. Ulu Melaka	Sg. Melaka	3	85	B/C	II	82	B/C	II
		Sg. Tuba	1	90	B/C	II	88	B/C	II
		Sg. Petang	1	93	B/C	I	93	B/C	I
Kedah	Sg. Kedah	Sg. Janing	1	90	B/C	II	91	B/C	II
		Sg. Pedu	1	87	B/C	II	90	B/C	II
		Sg. Sintok	1	82	B/C	II	81	B/C	II
		Sg. Terusan Lengkuas	1	87	B/C	II	89	B/C	II
		Sg. Terusan Mada Selatan	1	85	B/C	II	88	B/C	II
		Sg. Terusan Tengah	1	87	B/C	II	89	B/C	II
		Sg. Ahning	1	86	B/C	II	88	B/C	II
		Sg Padang Terap	5	80	ST/SP	II	87	B/C	II
	Sg. Merbok	Sg. Tupah	1	92	B/C	II	93	B/C	I
		Sg. Bukit Nanas	1	91	B/C	II	93	B/C	I
		Sg. Tok Pawang	2	88	B/C	II	88	B/C	II
Kedah/ P.Pinang	Sg. Muda	Sg. Chepir	1	87	B/C	II	87	B/C	II
		Sg. Karangan	1	81	B/C	II	81	B/C	II
		Sg. Muda	12	85	B/C	II	86	B/C	II
		Sg. Gunung Inas	1	90	B/C	II	92	B/C	II
		Sg. Tawar	2	85	B/C	II	90	B/C	II
		Sg. Ketil	1	84	B/C	II	85	B/C	II
		Sg. Sedim	2	82	B/C	II	87	B/C	II
		Sg. Pegang	1	90	B/C	II	93	B/C	I
P.Pinang	Sg. Pinang	Sg. Air Terjun	1	93	B/C	I	93	B/C	I
		Sg. Batu Feringghi	2	84	B/C	II	87	B/C	II

Jadual 2.1 : Status Kualiti Air bagi Sungai Bersih, 2019
Table 2.1 : Water Quality Status of Clean Rivers, 2019

NEGERI/ STATE	LEMBANGAN SUNGAI/ RIVER BASIN	SUNGAI/ RIVER	BILANGAN STESEN/ NUMBER OF STATIONS	2018			2019		
				IKA/ WQI	KATEGORI/ CATEGORY	KELAS/ CLASS	IKA/ WQI	KATEGORI/ CATEGORY	KELAS/ CLASS
P.Pinang/ Kedah	Sg. Kluang	Sg. Satu	1	91	B/C	II	93	B/C	I
		Sg. Ara	2	82	B/C	II	85	B/C	II
	Sg. Perai	Sg. Kulim	5	85	B/C	II	91	B/C	II
P.Pinang/ Kedah/Perak	Sg. Kerian	Sg. Kechil	2	82	B/C	II	85	B/C	II
		Sg. Selama	3	86	B/C	II	87	B/C	II
		Sg. Kerian	6	82	B/C	II	83	B/C	II
		Sg. Terusan Bagan Serai	1	91	B/C	II	91	B/C	II
Perak	Sg. Bruas	Sg. Rotan	2	91	B/C	II	89	B/C	II
		Sg. Licin	1	93	B/C	I	95	B/C	I
		Sg. Bruas	3	85	B/C	II	90	B/C	II
		Sg. Dandang	1	89	B/C	II	86	B/C	II
	Sg. Kurau	Sg. Ara	2	91	B/C	II	92	B/C	II
		Sg. Kurau	4	80	ST/SP	II	86	B/C	II
	Sg. Perak	Sg. Chepor	1	94	B/C	I	94	B/C	I
		Sg. Chenderiang	2	87	B/C	II	91	B/C	II
		Sg. Behrang	1	92	B/C	II	94	B/C	I
		Sg. Berok	1	92	B/C	II	92	B/C	II
		Sg. Cuar	1	83	B/C	II	83	B/C	II
		Sg. Ibol	1	93	B/C	I	93	B/C	I
		Sg. Kerbau	2	92	B/C	II	92	B/C	II
		Sg. Klian Gunung	1	93	B/C	I	93	B/C	I
		Sg. Pelus	2	86	B/C	II	85	B/C	II
		Sg. Pulau	1	91	B/C	II	94	B/C	I
		Sg. Rui	2	87	B/C	II	91	B/C	II
		Sg. Tapah	1	94	B/C	I	95	B/C	I
		Sg. Klah	2	88	B/C	II	89	B/C	II
		Sg. Kinjang	1	93	B/C	I	94	B/C	I
		Sg. Kampar	2	87	B/C	II	87	B/C	II
		Sg. Batang Padang	3	82	B/C	II	82	B/C	II
		Sg. Kangsar	3	87	B/C	II	88	B/C	II
		Sg. Sungkai	2	85	B/C	II	88	B/C	II
		Sg. Raia	2	85	B/C	II	82	B/C	II
		Sg. Perak	18	87	B/C	II	88	B/C	II
		Sg. Bidor	3	78	ST/SP	II	84	B/C	II
		Sg. Manong	1	92	B/C	II	95	B/C	I
		Sg. Tesong	1	94	B/C	I	94	B/C	I
		Sg. Who	1	92	B/C	II	94	B/C	I

Jadual 2.1 : Status Kualiti Air bagi Sungai Bersih, 2019
Table 2.1 : Water Quality Status of Clean Rivers, 2019

NEGERI/ STATE	LEMBANGAN SUNGAI/ RIVER BASIN	SUNGAI/ RIVER	BILANGAN STESEN/ NUMBER OF STATIONS	2018			2019		
				IKA/ WQI	KATEGORI/ CATEGORY	KELAS/ CLASS	IKA/ WQI	KATEGORI/ CATEGORY	KELAS/ CLASS
Perak	Sg. Raja Hitam	Sg. Nyior	1	92	B/C	II	95	B/C	I
		Sg. Manjong	2	81	B/C	II	85	B/C	II
	Sg. Sepetang	Sg. Nyior	2	88	B/C	II	88	B/C	II
		Sg. Temerloh	2	84	B/C	II	86	B/C	II
		Sg. Jana	2	81	B/C	II	86	B/C	II
		Sg. Limau	1	90	B/C	II	90	B/C	II
		Sg. Trong	2	90	B/C	II	93	B/C	I
		Sg. Batu Tegoh	5	81	B/C	II	82	B/C	II
Selangor/ Perak	Sg. Bernam	Sg. Inki	1	91	B/C	II	93	B/C	I
		Sg. Dusun	1	87	B/C	II	85	B/C	II
		Sg. Slim	3	85	B/C	II	84	B/C	II
		Sg. Trolak	3	87	B/C	II	91	B/C	II
		Sg. Bernam	8	77	ST/SP	II	81	B/C	II
		Sg. Gelinting	1	88	B/C	II	87	B/C	II
Selangor	Sg. Selangor	Sg. Kerling	1	90	B/C	II	93	B/C	I
		Sg. Rangkap	1	91	B/C	II	92	B/C	II
		Sg. Selangor	10	82	B/C	II	81	B/C	II
		Sg. Kanching	1	84	B/C	II	84	B/C	II
		Sg. Serendah	1	85	B/C	II	87	B/C	II
		Sg. Batang Kali	1	87	B/C	II	87	B/C	II
		Sg. Air Hitam	1	76	ST/SP	III	92	B/C	II
	Sg. Tengi	Sg. Tengi	4	83	B/C	II	84	B/C	II
Selangor/ WPKL	Sg. Klang	Sg. Rumput	1	90	B/C	II	91	B/C	II
Selangor/ Putrajaya/ N.Sembilan	Sg. Langat	Sg. Anak Chuau	1	74	ST/SP	III	83	B/C	II
		Sg. Rinching	2	82	B/C	II	85	B/C	II
		Sg. Chuau	2	86	B/C	II	87	B/C	II
Melaka/ N.Sembilan	Sg. Melaka	Sg. Tampin	3	83	B/C	II	86	B/C	II
		Sg. Dusun	1	87	B/C	II	86	B/C	II
		Sg. Kemunting	1	82	B/C	II	87	B/C	II
N.Sembilan/ Melaka	Sg. Linggi	Sg. Batang Penar	6	82	B/C	II	82	B/C	II
		Sg. Jelai	1	83	B/C	II	84	B/C	II
		Sg. Kepayong	2	81	B/C	II	83	B/C	II
		Sg. Batu Hampar	1	85	B/C	II	88	B/C	II
		Sg. Muar	1	86	B/C	II	90	B/C	II
		Sg. Siput	1	84	B/C	II	85	B/C	II

Jadual 2.1 : Status Kualiti Air bagi Sungai Bersih, 2019
Table 2.1 : Water Quality Status of Clean Rivers, 2019

NEGERI/ STATE	LEMBANGAN SUNGAI/ RIVER BASIN	SUNGAI/ RIVER	BILANGAN STESEN/ NUMBER OF STATIONS	2018			2019		
				IKA/ WQI	KATEGORI/ CATEGORY	KELAS/ CLASS	IKA/ WQI	KATEGORI/ CATEGORY	KELAS/ CLASS
N.Sembilan/ Melaka	Sg. Linggi	Sg. Kundur Besar	1	88	B/C	II	86	B/C	II
		Sg. Pedas	1	83	B/C	II	83	B/C	II
		Sg. Rembau	2	85	B/C	II	82	B/C	II
		Sg. Chembong	1	83	B/C	II	83	B/C	II
Melaka	Sg. Kesang	Sg. Chohong	2	85	B/C	II	82	B/C	II
	Sg. Seri Melaka	Sg. Udang	1	86	B/C	II	81	B/C	II
	Sg. Duyong	Sg. Gapam	1	85	B/C	II	87	B/C	II
Johor	Sg. Batu Pahat	Sg. Kahang	1	82	B/C	II	86	B/C	II
		Sg. Merek	1	82	B/C	II	81	B/C	II
		Sg. Merpo	1	81	B/C	II	81	B/C	II
		Sg. Bantang	1	93	B/C	I	91	B/C	II
		Sg. Chaah	1	78	ST/SP	II	83	B/C	II
		Sg. Lenik	1	79	ST/SP	II	82	B/C	II
		Sg. Semberong Dam	1	85	B/C	II	85	B/C	II
	Sg. Benut	Sg. Machap Dam	1	84	B/C	II	91	B/C	II
	Sg. Johor	Sg. Pelepah	4	86	B/C	II	91	B/C	II
		Sg. Telor	1	85	B/C	II	84	B/C	II
		Sg. Lebam	1	84	B/C	II	85	B/C	II
		Sg. Papan	1	81	B/C	II	83	B/C	II
		Sg. Penggeli	2	83	B/C	II	87	B/C	II
		Sg. Sening	1	86	B/C	II	83	B/C	II
		Sg. Linggiu	1	84	B/C	II	88	B/C	II
		Sg. Layang	1	87	B/C	II	89	B/C	II
		Sg. Remis	1	83	B/C	II	86	B/C	II
		Sg. Semangar	1	81	B/C	II	82	B/C	II
		Sg. Sayong	4	81	B/C	II	85	B/C	II
		Sg. Santi	1	85	B/C	II	85	B/C	II
		Sg. Layau Kiri	1	89	B/C	II	84	B/C	II
		Sg. Belitong	1	83	B/C	II	86	B/C	II
		Sg. Johor	6	80	ST/SP	II	83	B/C	II
	Sg. Mersing	Sg. Empangan Congok	1	77	ST/SP	II	84	B/C	II
		Sg. Mersing	3	86	B/C	II	87	B/C	II
	Sg. Pulai	Sg. Pulai Dam	1	91	B/C	II	93	B/C	I
	Sg. Sedili Besar	Sg. Dohol	1	84	B/C	II	88	B/C	II
		Sg. Ambat	1	86	B/C	II	88	B/C	II
		Sg. Pasir Panjang	1	85	B/C	II	87	B/C	II

Jadual 2.1 : Status Kualiti Air bagi Sungai Bersih, 2019
Table 2.1 : Water Quality Status of Clean Rivers, 2019

NEGERI/ STATE	LEMBANGAN SUNGAI/ RIVER BASIN	SUNGAI/ RIVER	BILANGAN STESEN/ NUMBER OF STATIONS	2018			2019		
				IKA/ WQI	KATEGORI/ CATEGORY	KELAS/ CLASS	IKA/ WQI	KATEGORI/ CATEGORY	KELAS/ CLASS
Johor	Sg. Sedili Besar	Sg. Sedili Besar	6	81	B/C	II	82	B/C	II
		Sg. Temubor Kanan	1	89	B/C	II	90	B/C	II
	Sg. Sedili Kecil	Sg. Sedili Kecil	2	80	ST/SP	II	81	B/C	II
	Sg. Jemaluang	Sg. Jemaluang	2	81	B/C	II	86	B/C	II
Johor/ N.Sembilan/ Pahang	Sg. Muar	Sg. Air Panas	1	90	B/C	II	92	B/C	II
		Sg. Belemang	1	87	B/C	II	90	B/C	II
		Sg. Meda	1	86	B/C	II	82	B/C	II
		Sg. Pendol	1	84	B/C	II	89	B/C	II
		Sg. Segamat	3	86	B/C	II	87	B/C	II
		Sg. Juasseh	3	89	B/C	II	88	B/C	II
		Sg. Gemencheh	2	80	ST/SP	II	83	B/C	II
		Sg. Jelai	1	84	B/C	II	83	B/C	II
		Sg. Jementah	1	88	B/C	II	91	B/C	II
		Sg. Muar	25	79	ST/SP	II	82	B/C	II
		Sg. Palong	2	79	ST/SP	II	82	B/C	II
Pahang/Johor	Sg. Endau	Sg. Jasin	1	94	B/C	I	94	B/C	I
		Sg. Empangan Labong	1	91	B/C	II	92	B/C	II
		Sg. Lenggor	2	83	B/C	II	86	B/C	II
		Sg. Mamai	1	84	B/C	II	86	B/C	II
		Sg. Tamok	1	86	B/C	II	91	B/C	II
		Sg. Selai	1	89	B/C	II	92	B/C	II
		Sg. Endau	3	87	B/C	II	89	B/C	II
		Sg. Kahang	3	87	B/C	II	86	B/C	II
		Sg. Anak Sg Semberong	1	76	ST/SP	III	84	B/C	II
		Sg. Paloh	1	77	ST/SP	II	81	B/C	II
		Sg. Semberong	5	78	ST/SP	II	83	B/C	II
		Sg. Anak Endau	2	83	B/C	II	92	B/C	II
Pahang/ N.Sembilan	Sg. Pahang	Sg. Teranum	1	89	B/C	II	87	B/C	II
		Sg.Anak Sg. Lepar	1	84	B/C	II	84	B/C	II
		Sg. Belayar	1	91	B/C	II	89	B/C	II
		Sg. Berkelah	1	92	B/C	II	92	B/C	II
		Sg. Bilut	2	84	B/C	II	84	B/C	II
		Sg. Jengka	2	85	B/C	II	87	B/C	II
		Sg. Krau	1	87	B/C	II	90	B/C	II
		Sg. Maran	1	85	B/C	II	90	B/C	II

Jadual 2.1 : Status Kualiti Air bagi Sungai Bersih, 2019
Table 2.1 : Water Quality Status of Clean Rivers, 2019

NEGERI/ STATE	LEMBANGAN SUNGAI/ RIVER BASIN	SUNGAI/ RIVER	BILANGAN STESEN/ NUMBER OF STATIONS	2018			2019		
				IKA/ WQI	KATEGORI/ CATEGORY	KELAS/ CLASS	IKA/ WQI	KATEGORI/ CATEGORY	KELAS/ CLASS
Pahang/ N.Sembilan	Sg. Pahang	Sg. Mentiga	3	81	B/C	II	85	B/C	II
		Sg. Penjuring	1	91	B/C	II	87	B/C	II
		Sg. Pertang	2	83	B/C	II	83	B/C	II
		Sg. Raub	1	88	B/C	II	89	B/C	II
		Sg. Retang	1	85	B/C	II	87	B/C	II
		Sg. Salak	1	85	B/C	II	89	B/C	II
		Sg. Tasik Bera	1	84	B/C	II	86	B/C	II
		Sg. Telemong	3	88	B/C	II	88	B/C	II
		Sg. Teras	2	89	B/C	II	88	B/C	II
		Sg. Jempol	5	84	B/C	II	88	B/C	II
		Sg. Telang	1	87	B/C	II	90	B/C	II
		Sg. Teris	3	87	B/C	II	87	B/C	II
		Sg. Benus	3	86	B/C	II	83	B/C	II
		Sg. Kelau	4	83	B/C	II	83	B/C	II
		Sg. Lipis	3	85	B/C	II	86	B/C	II
		Sg. Tembeling	1	84	B/C	II	88	B/C	II
		Sg. Perting	1	89	B/C	II	91	B/C	II
		Sg. Tahan	1	84	B/C	II	88	B/C	II
		Sg. Teh	1	84	B/C	II	90	B/C	II
		Sg. Pahang	27	83	B/C	II	85	B/C	II
		Sg. Tanglir	5	83	B/C	II	86	B/C	II
		Sg. Koyan	1	86	B/C	II	88	B/C	II
		Sg. Lepar	1	86	B/C	II	91	B/C	II
		Sg. Luit	1	84	B/C	II	89	B/C	II
		Sg. Bentong	6	84	B/C	II	83	B/C	II
		Sg. Tasik Chini	10	88	B/C	II	90	B/C	II
		Sg. Semantan	4	84	B/C	II	85	B/C	II
		Sg. Tekal	1	83	B/C	II	81	B/C	II
		Sg. Kertam	1	83	B/C	II	90	B/C	II
		Sg. T. Paya Bungor	1	84	B/C	II	85	B/C	II
		Sg. Triang	3	84	B/C	II	86	B/C	II
		Sg. Jelai	3	84	B/C	II	87	B/C	II
		Sg. Habu	1	89	B/C	II	88	B/C	II
		Sg. Lenggok	1	89	B/C	II	91	B/C	II
		Sg. Bertam	4	83	B/C	II	89	B/C	II
		Sg. Burung	1	90	B/C	II	92	B/C	II
		Sg. Ringlet	1	82	B/C	II	82	B/C	II
		Sg. Tringkap	1	82	B/C	II	82	B/C	II
		Sg. Terla	2	91	B/C	II	91	B/C	II
		Sg. Telom	2	83	B/C	II	85	B/C	II

Jadual 2.1 : Status Kualiti Air bagi Sungai Bersih, 2019
Table 2.1 : Water Quality Status of Clean Rivers, 2019

NEGERI/ STATE	LEMBANGAN SUNGAI/ RIVER BASIN	SUNGAI/ RIVER	BILANGAN STESEN/ NUMBER OF STATIONS	2018			2019		
				IKA/ WQI	KATEGORI/ CATEGORY	KELAS/ CLASS	IKA/ WQI	KATEGORI/ CATEGORY	KELAS/ CLASS
Pahang/ N.Sembilan	Sg. Pahang	Sg. Bera	5	80	ST/SP	II	84	B/C	II
		Sg. Chini	1	80	ST/SP	II	86	B/C	II
		Sg. Gapoi	1	92	B/C	II	94	B/C	I
		Sg. Kundang	1	64	ST/SP	III	86	B/C	II
		Sg. Ulong	1	92	B/C	II	94	B/C	I
Pahang	Sg. Balok	Sg. Panjang	1	77	ST/SP	II	86	B/C	II
	Sg. Bebar	Sg. Bebar	2	79	ST/SP	II	83	B/C	II
		Sg. Merba	1	76	ST/SP	III	86	B/C	II
		Sg. Serai	2	79	ST/SP	II	81	B/C	II
	Sg. Kuantan	Sg. Kenau	1	88	B/C	II	90	B/C	II
		Sg. Charu	1	85	B/C	II	92	B/C	II
		Sg. Kuantan	8	84	B/C	II	87	B/C	II
		Sg. Pinang	1	85	B/C	II	89	B/C	II
		Sg. Reman	1	81	B/C	II	86	B/C	II
		Sg. Riau	1	83	B/C	II	84	B/C	II
		Sg. Pandan	1	84	B/C	II	83	B/C	II
	Sg. Merchong	Sg. Merchong	2	78	ST/SP	II	86	B/C	II
	Sg. Rompin	Sg. Pukin	3	81	B/C	II	83	B/C	II
		Sg. Jekatih	2	83	B/C	II	85	B/C	II
		Sg. Jeram	1	85	B/C	II	88	B/C	II
		Sg. Keratong	4	83	B/C	II	85	B/C	II
		Sg. Sepayang	1	81	B/C	II	84	B/C	II
		Sg. Pontian	5	84	B/C	II	87	B/C	II
		Sg. Aur	1	84	B/C	II	86	B/C	II
		Sg. Kepasing	1	80	ST/SP	II	81	B/C	II
		Sg. Rompin	5	80	ST/SP	II	87	B/C	II
Terengganu	Sg. Besut	Sg. Besut	5	87	B/C	II	90	B/C	II
		Sg. Jertih	1	84	B/C	II	84	B/C	II
	Sg. Dungun	Sg. Dungun	5	89	B/C	II	88	B/C	II
		Sg. Telemboh	1	83	B/C	II	86	B/C	II
	Sg. Kemaman	Sg. Cherul	3	85	B/C	II	85	B/C	II
		Sg. Perasing	1	83	B/C	II	82	B/C	II
		Sg. Kemaman	3	84	B/C	II	84	B/C	II
	Sg. Chukai	Sg. Ibok	2	82	B/C	II	84	B/C	II
		Sg. Bungkus	1	80	ST/SP	II	82	B/C	II
	Sg. Kertih	Sg. Kertih	2	83	B/C	II	83	B/C	II
	Sg. Kluang	Sg. Kluang	1	82	B/C	II	83	B/C	II
	Sg. Marang	Sg. Kerak	1	70	ST/SP	III	81	B/C	II
		Sg. Marang	1	85	B/C	II	83	B/C	II
		Sg. Temala	1	85	B/C	II	87	B/C	II

Jadual 2.1 : Status Kualiti Air bagi Sungai Bersih, 2019
Table 2.1 : Water Quality Status of Clean Rivers, 2019

NEGERI/ STATE	LEMBANGAN SUNGAI/ RIVER BASIN	SUNGAI/ RIVER	BILANGAN STESEN/ NUMBER OF STATIONS	2018			2019		
				IKA/ WQI	KATEGORI/ CATEGORY	KELAS/ CLASS	IKA/ WQI	KATEGORI/ CATEGORY	KELAS/ CLASS
Terengganu	Sg. Setiu	Sg. Bari	1	89	B/C	II	91	B/C	II
		Sg. Chalok	3	85	B/C	II	87	B/C	II
		Sg. Tarom	1	88	B/C	II	88	B/C	II
		Sg. Setiu	2	87	B/C	II	86	B/C	II
	Sg. Paka	Sg. Besul	1	85	B/C	II	86	B/C	II
		Sg. Paka	3	85	B/C	II	85	B/C	II
		Sg. Rengat	1	87	B/C	II	85	B/C	II
	Sg. Terengganu	Sg. Berang	2	89	B/C	II	91	B/C	II
		Sg. Nerus	6	84	B/C	II	88	B/C	II
		Sg. Telemong	1	83	B/C	II	89	B/C	II
		Sg. Terengganu	4	86	B/C	II	88	B/C	II
Kelantan	Sg. Golok	Sg. Golok	5	83	B/C	II	85	B/C	II
		Sg. Jedok	1	84	B/C	II	88	B/C	II
		Sg. Lanas	1	85	B/C	II	86	B/C	II
	Sg. Kelantan	Sg. Chiku	2	85	B/C	II	85	B/C	II
		Sg. Kenkren	1	85	B/C	II	88	B/C	II
		Sg. Ketil	2	86	B/C	II	86	B/C	II
		Sg. Muring	1	88	B/C	II	84	B/C	II
		Sg. Pelaur	1	89	B/C	II	88	B/C	II
		Sg. Penangau	1	81	B/C	II	82	B/C	II
		Sg. Tuang	1	88	B/C	II	87	B/C	II
		Sg. Pergau	8	90	B/C	II	92	B/C	II
		Sg. Lebir	5	82	B/C	II	85	B/C	II
		Sg. Galas	5	84	B/C	II	84	B/C	II
		Sg. Betis	1	83	B/C	II	84	B/C	II
		Sg. Kerilla	2	89	B/C	II	88	B/C	II
		Sg. Nal	3	82	B/C	II	86	B/C	II
		Sg. Relai	2	85	B/C	II	84	B/C	II
		Sg. Sokor	1	85	B/C	II	83	B/C	II
		Sg. Belatop	3	80	ST/SP	II	83	B/C	II
		Sg. Ber	1	78	ST/SP	II	84	B/C	II
		Sg. Berok	3	77	ST/SP	II	81	B/C	II
		Sg. Kelantan	7	80	ST/SP	II	82	B/C	II
		Sg. Kelesa	1	80	ST/SP	II	84	B/C	II
		Sg. Nenggiri	3	78	ST/SP	II	81	B/C	II
		Sg. Pehi	2	83	B/C	II	87	B/C	II
		Sg. Rasau	1	78	ST/SP	II	81	B/C	II
	Sg. Kemasin	Sg. Kemasin	2	78	ST/SP	II	81	B/C	II
		Sg. Semerak	3	84	B/C	II	84	B/C	II

Jadual 2.1 : Status Kualiti Air bagi Sungai Bersih, 2019
Table 2.1 : Water Quality Status of Clean Rivers, 2019

NEGERI/ STATE	LEMBANGAN SUNGAI/ RIVER BASIN	SUNGAI/ RIVER	BILANGAN STESEN/ NUMBER OF STATIONS	2018			2019		
				IKA/ WQI	KATEGORI/ CATEGORY	KELAS/ CLASS	IKA/ WQI	KATEGORI/ CATEGORY	KELAS/ CLASS
Sabah	Sg. Apas	Sg. Apas	1	88	B/C	II	91	B/C	II
	Sg. Balung	Sg. Balung	1	89	B/C	II	93	B/C	I
	Sg. Bongawan	Sg. Bongawan	1	89	B/C	II	88	B/C	II
	Sg. Bengkoka	Sg. Bengkoka	2	87	B/C	II	85	B/C	II
	Sg. Bingkongan	Sg. Menggaris	2	92	B/C	II	91	B/C	II
		Sg. Bandau	1	91	B/C	II	90	B/C	II
		Sg. Bingkongan	2	92	B/C	II	92	B/C	II
		Sg. Tandek	1	91	B/C	II	90	B/C	II
	Sg. Kalabakan	Sg. Kalabakan	3	84	B/C	II	86	B/C	II
	Sg. Brantian	Sg. Brantian	1	85	B/C	II	91	B/C	II
	Sg. Kalumpang	Sg. Kalumpang	3	84	B/C	II	89	B/C	II
		Sg. Pang Burong 1	1	84	B/C	II	89	B/C	II
	Sg. Kedamaian	Sg. Kedamaian	1	91	B/C	II	93	B/C	I
		Sg. Wariu	1	91	B/C	II	91	B/C	II
		Sg. Tempasuk	2	91	B/C	II	92	B/C	II
	Sg. Kimanis	Sg. Kimanis	1	91	B/C	II	89	B/C	II
	Sg. Kinabatangan	Sg. Koyah	1	86	B/C	II	88	B/C	II
		Sg. Menanggul	1	84	B/C	II	87	B/C	II
		Sg. Pin	1	84	B/C	II	85	B/C	II
		Sg. Takala	1	83	B/C	II	88	B/C	II
		Sg. Leepang	1	84	B/C	II	88	B/C	II
		Sg. Kinabatangan	4	83	B/C	II	87	B/C	II
		Sg. Karamuak	1	89	B/C	II	92	B/C	II
	Sg. Labok	Sg. Kinipir	2	90	B/C	II	91	B/C	II
		Sg. Liwagu	2	90	B/C	II	91	B/C	II
		Sg. Maliau	1	91	B/C	II	93	B/C	I
		Sg. Labok	1	89	B/C	II	89	B/C	II
		Sg. Tungud	1	88	B/C	II	90	B/C	II
	Sg. Lakutan	Sg. Lakutan	1	90	B/C	II	90	B/C	II
	Sg. Likas	Sg. Menggatal	2	89	B/C	II	90	B/C	II
		Sg. Inanam	3	86	B/C	II	84	B/C	II
	Sg. Lingkungan	Sg. Lingkungan	1	91	B/C	II	89	B/C	II
		Sg. Bukau	1	90	B/C	II	90	B/C	II
	Sg. Membakut	Sg. Membakut	1	89	B/C	II	87	B/C	II
	Sg. Menggalong	Sg. Menggalong	2	89	B/C	II	91	B/C	II
	Sg. Merotai	Sg. Merotai	3	89	B/C	II	87	B/C	II

Jadual 2.1 : Status Kualiti Air bagi Sungai Bersih, 2019
Table 2.1 : Water Quality Status of Clean Rivers, 2019

NEGERI/ STATE	LEMBANGAN SUNGAI/ RIVER BASIN	SUNGAI/ RIVER	BILANGAN STESEN/ NUMBER OF STATIONS	2018			2019		
				IKA/ WQI	KATEGORI/ CATEGORY	KELAS/ CLASS	IKA/ WQI	KATEGORI/ CATEGORY	KELAS/ CLASS
Sabah	Sg. Mounad	Sg. Mounad	2	87	B/C	II	87	B/C	II
	Sg. Moyog	Sg. Moyog	4	91	B/C	II	92	B/C	II
	Sg. Padas	Sg. Bunsit	1	90	B/C	II	92	B/C	II
		Sg. Liawan	1	90	B/C	II	91	B/C	II
		Sg. Padas	4	88	B/C	II	87	B/C	II
		Sg. Pegalan	3	88	B/C	II	89	B/C	II
		Sg. Tandulu	1	93	B/C	I	90	B/C	II
		Sg. Pangatan	1	88	B/C	II	86	B/C	II
	Sg. Paitan	Sg. Paitan	1	88	B/C	II	88	B/C	II
	Sg. Papar	Sg. Papar	5	91	B/C	II	92	B/C	II
	Sg. Sapi	Sg. Sapi	3	85	B/C	II	87	B/C	II
		Sg. Sualong	1	88	B/C	II	91	B/C	II
	Sg. Segama	Sg. Segama	3	84	B/C	II	91	B/C	II
	Sg. Segaliud	Sg. Segaliud	2	81	B/C	II	87	B/C	II
	Sg. Silabukan	Sg. Silabukan	2	88	B/C	II	90	B/C	II
	Sg. Sugut	Sg. Merali	1	88	B/C	II	92	B/C	II
		Sg. Bongkud	1	92	B/C	II	92	B/C	II
		Sg. Lohan	1	91	B/C	II	92	B/C	II
		Sg. Sugut	3	89	B/C	II	91	B/C	II
	Sg. Tawau	Sg. Tawau	4	84	B/C	II	88	B/C	II
	Sg. Tenghilan	Sg. Tenghilan	1	91	B/C	II	91	B/C	II
	Sg. Tingkayu	Sg. Tingkayu	2	84	B/C	II	89	B/C	II
	Sg. Tuaran	Sg. Tuaran	2	91	B/C	II	92	B/C	II
		Sg. Song Sai	1	89	B/C	II	91	B/C	II
		Sg. Damit	2	88	B/C	II	88	B/C	II
	Sg. Tungku	Sg. Tungku	2	88	B/C	II	88	B/C	II
	Sg. Umas-Umas	Sg. Umas-Umas	1	83	B/C	II	90	B/C	II
Sarawak	Sg. Baram	Sg. Tutuh	1	86	B/C	II	92	B/C	II
		Sg. Baram	4	84	B/C	II	88	B/C	II
	Sg. Balingian	Sg. Balingian	2	82	B/C	II	86	B/C	II
	Sg. Lawas	Sg. Lawas	3	86	B/C	II	91	B/C	II
	Sg. Kemena	Sg. Kemena	4	85	B/C	II	85	B/C	II
		Sg. Sibiu	1	86	B/C	II	83	B/C	II
	Sg. Kerian	Sg. Kerian	2	83	B/C	II	82	B/C	II
		Sg. Seblak	1	80	ST/SP	II	82	B/C	II
		Sg. Selalang	1	91	B/C	II	91	B/C	II
	Sg. Kayan	Sg. Kayan	3	79	ST/SP	II	81	B/C	II
	Sg. Limbang	Sg. Limbang	5	86	B/C	II	91	B/C	II
	Sg. Lupar	Sg. Lupar	3	83	B/C	II	88	B/C	II
		Sg. Sekerang	1	89	B/C	II	91	B/C	II

Jadual 2.1 : Status Kualiti Air bagi Sungai Bersih, 2019
Table 2.1 : Water Quality Status of Clean Rivers, 2019

NEGERI/ STATE	LEMBANGAN SUNGAI/ RIVER BASIN	SUNGAI/ RIVER	BILANGAN STESEN/ NUMBER OF STATIONS	2018			2019		
				IKA/ WQI	KATEGORI/ CATEGORY	KELAS/ CLASS	IKA/ WQI	KATEGORI/ CATEGORY	KELAS/ CLASS
Sarawak	Sg. Lupar	Sg. Seterap	1	87	B/C	II	86	B/C	II
		Sg. Undup	1	91	B/C	II	88	B/C	II
		Sg. Ai	2	91	B/C	II	92	B/C	II
	Sg. Mukah	Sg. Mukah	5	79	ST/SP	II	83	B/C	II
	Sg. Miri	Sg. Lutong	2	71	ST/SP	III	86	B/C	II
		Sg. Padang Liku	1	80	ST/SP	II	90	B/C	II
	Sg. Niah	Sg. Niah	2	88	B/C	II	90	B/C	II
		Sg. Sekaloh	2	78	ST/SP	II	81	B/C	II
	Sg. Rajang	Sg. Binatang	1	89	B/C	II	89	B/C	II
		Sg. Baloi	1	84	B/C	II	89	B/C	II
		Sg. Meradong	1	83	B/C	II	86	B/C	II
		Sg. Rajang	11	83	B/C	II	85	B/C	II
		Sg. Sarikei	2	86	B/C	II	87	B/C	II
		Sg. Julau	1	90	B/C	II	90	B/C	II
		Sg. Kanowit	1	86	B/C	II	88	B/C	II
		Sg. Pakan	1	89	B/C	II	89	B/C	II
		Sg. Pila Parit	1	71	ST/SP	III	81	B/C	II
	Sg. Sarawak	Sg. Semadang	1	93	B/C	I	90	B/C	II
		Sg. Kelantan	1	84	B/C	II	84	B/C	II
		Sg. Kuap	2	86	B/C	II	85	B/C	II
		Sg. Sarawak Kiri	1	92	B/C	II	87	B/C	II
		Sg. Tapah	1	90	B/C	II	89	B/C	II
		Sg. Sarawak	6	88	B/C	II	85	B/C	II
		Sg. Sarawak Kanan	1	86	B/C	II	85	B/C	II
	Sg. Sibuti	Sg. Kejapil	1	85	B/C	II	90	B/C	II
		Sg. Sibuti	2	82	B/C	II	86	B/C	II
		Sg. Satap	1	78	ST/SP	II	86	B/C	II
	Sg. Oya	Sg. Oya	3	79	ST/SP	II	84	B/C	II
	Sg. Similajau	Sg. Similajau	2	89	B/C	II	89	B/C	II
	Sg. Trusan	Sg. Trusan	1	88	B/C	II	92	B/C	II
	Sg. Saribas	Sg. Layar	2	77	ST/SP	II	87	B/C	II
	Sg. Suai	Sg. Suai	1	84	B/C	II	89	B/C	II
	Sg. Tatau	Sg. Tatau	1	87	B/C	II	87	B/C	II
	Sg. Semunsam	Sg. Semunsam	1	87	B/C	II	85	B/C	II
	Sg. Sadong	Sg. Sadong	4	80	ST/SP	II	84	B/C	II
		Sg. Tarat	1	92	B/C	II	90	B/C	II

Nota/Note:
B/C : Bersih/ Clean
ST/SP: Sederhana tercemar/ Slightly polluted
T/P : Tercemar Polluted

Jadual 2.2 : Status Kualiti Air bagi Sungai Sederhana Tercemar, 2019
Table 2.2 : Water Quality Status of Slightly Polluted Rivers, 2019

NEGERI/ STATE	LEMBANGAN SUNGAI/ RIVER BASIN	SUNGAI/ RIVER	BILANGAN STESEN/ NUMBER OF STATIONS	2018			2019		
				IKA/ WQI	KATEGORI/ CATEGORY	KELAS/ CLASS	IKA/ WQI	KATEGORI/ CATEGORY	KELAS/ CLASS
Perlis	Sg. Perlis	Sg. Korok	1	73	ST/SP	III	71	ST/SP	III
		Sg. Perlis	1	72	ST/SP	III	72	ST/SP	III
		Sg. Serai	1	81	B/C	II	76	ST/SP	III
Kedah	Sg. Kedah	Sg. Changlun	1	79	ST/SP	II	77	ST/SP	II
	Sg. Merbok	Sg. Kedah	1	66	ST/SP	III	64	ST/SP	III
		Sg. Napoh	1	78	ST/SP	II	80	ST/SP	II
		Sg. Pendang	1	77	ST/SP	II	77	ST/SP	II
		Sg. Tekai	1	83	B/C	II	80	ST/SP	II
		Sg. Temin	1	78	ST/SP	II	77	ST/SP	II
		Sg. Merbok	1	74	ST/SP	III	77	ST/SP	II
		Sg. Korok	1	70	ST/SP	III	69	ST/SP	III
		Sg. Bongkok	1	71	ST/SP	III	63	ST/SP	III
		Sg. Batu	1	75	ST/SP	III	66	ST/SP	III
		Sg. Bukit Merah	1	81	B/C	II	80	ST/SP	II
Kedah (Langkawi)	Sg. Ulu Melak	Sg. Chenang	1	54	T/P	III	69	ST/SP	III
		Sg. Saga	1	84	B/C	II	76	ST/SP	III
	Sg. Kuah	Sg. Kuah	1	65	ST/SP	III	74	ST/SP	III
Kedah/ P.Pinang	Sg. Muda	Sg. Jerong	2	68	ST/SP	III	67	ST/SP	III
P.Pinang	Sg. Bayan Lepas	Sg. Tiram	2	74	ST/SP	III	71	ST/SP	III
		Sg. Bayan Lepas	1	70	ST/SP	III	76	ST/SP	III
	Sg. Jawi	Sg. Machang Bubok	1	72	ST/SP	III	70	ST/SP	III
		Sg. Junjong	3	67	ST/SP	III	62	ST/SP	III
		Sg. Tengah	1	49	T/P	IV	61	ST/SP	III
	Sg. Juru	Sg. Ara	1	70	ST/SP	III	66	ST/SP	III
		Sg. Permatang Rawa	2	74	ST/SP	III	64	ST/SP	III
		Sg. Kilang Ubi	5	68	ST/SP	III	68	ST/SP	III
		Sg. Pasir	1	59	T/P	III	61	ST/SP	III
	Sg. Kluang	Sg. Relau	1	79	ST/SP	II	66	ST/SP	III
		Sg. Kluang	1	70	ST/SP	III	63	ST/SP	III
P.Pinang/ Kedah	Sg. Pinang	Sg. Dondang	6	71	ST/SP	III	74	ST/SP	III
		Sg. Pinang	3	70	ST/SP	III	68	ST/SP	III
		Sg. Jelutong	1	67	ST/SP	III	64	ST/SP	III
		Sg. Titi Kerawang	1	65	ST/SP	III	63	ST/SP	III
		Sg. Air Itam	3	76	ST/SP	III	76	ST/SP	III
	Sg. Perai	Sg. Jarak	6	70	ST/SP	III	72	ST/SP	III

Jadual 2.2 : Status Kualiti Air bagi Sungai Sederhana Tercemar, 2019
Table 2.2 : Water Quality Status of Slightly Polluted Rivers, 2019

NEGERI/ STATE	LEMBANGAN SUNGAI/ RIVER BASIN	SUNGAI/ RIVER	BILANGAN STESEN/ NUMBER OF STATIONS	2018			2019		
				IKA/ WQI	KATEGORI/ CATEGORY	KELAS/ CLASS	IKA/ WQI	KATEGORI/ CATEGORY	KELAS/ CLASS
P.Pinang/ Kedah	Sg. Perai	Sg. Kubang Semang	1	61	ST/SP	III	64	ST/SP	III
		Sg. Seluang	1	62	ST/SP	III	64	ST/SP	III
		Sg. Keladi	1	76	ST/SP	III	74	ST/SP	III
		Sg. Perai	2	59	T/P	III	63	ST/SP	III
		Sg. Seluang Bawah	2	59	T/P	III	65	ST/SP	III
P.Pinang/ Kedah/ Perak	Sg. Kerian	Sg. Semang	1	80	ST/SP	II	76	ST/SP	III
		Sg. Serdang	1	75	ST/SP	III	73	ST/SP	III
Perak	Sg. Kurau	Sg. Air Hitam	1	76	ST/SP	III	76	ST/SP	III
	Sg. Perak	Sg. Kerdah	2	75	ST/SP	III	72	ST/SP	III
		Sg. Kinta	9	76	ST/SP	III	76	ST/SP	III
		Sg. Kepayang	2	75	ST/SP	III	70	ST/SP	III
		Sg. Pinji	2	65	ST/SP	III	67	ST/SP	III
		Sg. Pari	2	71	ST/SP	III	72	ST/SP	III
		Sg. Serokai	2	61	ST/SP	III	69	ST/SP	III
		Sg. Sintang	1	65	ST/SP	III	65	ST/SP	III
		Sg. Sungkai Mati	2	72	ST/SP	III	76	ST/SP	III
		Sg. Nyamok	1	76	ST/SP	III	68	ST/SP	III
		Sg. Teja	1	76	ST/SP	III	78	ST/SP	II
		Sg. Tumboh	1	70	ST/SP	III	71	ST/SP	III
		Sg. Kuang	1	84	B/C	II	80	ST/SP	II
		Sg. Klian Baru	2	74	ST/SP	III	76	ST/SP	III
	Sg. Raja Hitam	Sg. Derhaka	2	77	ST/SP	II	68	ST/SP	III
		Sg. Raja Hitam	3	69	ST/SP	III	68	ST/SP	III
	Sg. Sepetang	Sg. Lidin	1	78	ST/SP	II	75	ST/SP	III
		Sg. Malai	2	68	ST/SP	III	76	ST/SP	III
		Sg. Sepetang	2	76	ST/SP	III	78	ST/SP	II
	Sg. Wangi	Sg. Wangi	2	76	ST/SP	III	79	ST/SP	II
		Sg. Deralik	2	71	ST/SP	III	73	ST/SP	III
Selangor	Sg. Selangor	Sg. Sembah	2	74	ST/SP	III	74	ST/SP	III
		Sg. Guntong	1	74	ST/SP	III	73	ST/SP	III
		Sg. Kundang	1	64	ST/SP	III	66	ST/SP	III
		Sg. Rawang	1	70	ST/SP	III	70	ST/SP	III
	Sg. Sepang	Sg. Sepang	3	78	ST/SP	II	75	ST/SP	III

Jadual 2.2 : Status Kualiti Air bagi Sungai Sederhana Tercemar, 2019
Table 2.2 : Water Quality Status of Slightly Polluted Rivers, 2019

NEGERI/ STATE	LEMBANGAN SUNGAI/ RIVER BASIN	SUNGAI/ RIVER	BILANGAN STESEN/ NUMBER OF STATIONS	2018			2019		
				IKA/ WQI	KATEGORI/ CATEGORY	KELAS/ CLASS	IKA/ WQI	KATEGORI/ CATEGORY	KELAS/ CLASS
Selangor/ Putrajaya/ N.Sembilan	Sg. Langat	Sg. Semenyih	3	78	ST/SP	II	77	ST/SP	II
		Sg. Batang Benar	1	73	ST/SP	III	67	ST/SP	III
		Sg. Batang Labu	8	72	ST/SP	III	72	ST/SP	III
		Sg. Beranang	1	79	ST/SP	II	76	ST/SP	III
		Sg. Buan	1	73	ST/SP	III	76	ST/SP	III
		Sg. Limau Manis	1	80	ST/SP	II	74	ST/SP	III
		Sg. Sering	1	63	ST/SP	III	60	ST/SP	III
		Sg. Jijan	1	80	ST/SP	II	78	ST/SP	II
		Sg. Pajam	2	64	ST/SP	III	63	ST/SP	III
		Sg. Batang Nilai	2	69	ST/SP	III	72	ST/SP	III
		Sg. Langat	9	70	ST/SP	III	72	ST/SP	III
Selangor/ WPKL	Sg. Klang	Sg. Batu	5	75	ST/SP	III	70	ST/SP	III
		Sg. Anak Air Batu	1	73	ST/SP	III	72	ST/SP	III
		Sg. Bunos	3	61	ST/SP	III	67	ST/SP	III
		Sg. Penchala	3	64	ST/SP	III	64	ST/SP	III
		Sg. Pusu	1	68	ST/SP	III	67	ST/SP	III
		Sg. Keroh	3	67	ST/SP	III	60	ST/SP	III
		Sg. Gombak	5	66	ST/SP	III	63	ST/SP	III
		Sg. Damansara	5	64	ST/SP	III	62	ST/SP	III
		Sg. Jinjang	4	67	ST/SP	III	66	ST/SP	III
		Sg. Rasau	1	73	ST/SP	III	74	ST/SP	III
		Sg. Ampang	2	58	T/P	III	60	ST/SP	III
		Sg. Belongkong	1	57	T/P	III	67	ST/SP	III
		Sg. Semelah	1	82	B/C	II	80	ST/SP	II
Melaka	Sg. Duyong	Sg. Duyong	3	66	ST/SP	III	71	ST/SP	III
	Sg. Kesang	Sg. Kesang	3	74	ST/SP	III	72	ST/SP	III
		Sg. Chin Chin	3	74	ST/SP	III	73	ST/SP	III
		Sg. Tangkak	1	62	ST/SP	III	64	ST/SP	III
	Sg. Seri Melaka	Sg. Air Salak	1	70	ST/SP	III	65	ST/SP	III
		Sg. Seri Melaka	1	61	ST/SP	III	65	ST/SP	III

Jadual 2.2 : Status Kualiti Air bagi Sungai Sederhana Tercemar, 2019
Table 2.2 : Water Quality Status of Slightly Polluted Rivers, 2019

NEGERI/ STATE	LEMBANGAN SUNGAI/ RIVER BASIN	SUNGAI/ RIVER	BILANGAN STESEN/ NUMBER OF STATIONS	2018			2019		
				IKA/ WQI	KATEGORI/ CATEGORY	KELAS/ CLASS	IKA/ WQI	KATEGORI/ CATEGORY	KELAS/ CLASS
Melaka/ N.Sembilan	Sg. Melaka	Sg. Batang Melaka	3	79	ST/SP	II	80	ST/SP	II
		Sg. Rembia	2	70	ST/SP	III	66	ST/SP	III
		Sg. Durian Tunggal	1	76	ST/SP	III	73	ST/SP	III
		Sg. Melaka	14	72	ST/SP	III	71	ST/SP	III
	Sg. Linggi	Sg. Empangan Terip	1	72	ST/SP	III	72	ST/SP	III
		Sg. Kayu Ara	1	69	ST/SP	III	62	ST/SP	III
		Sg. Kenaboi	1	78	ST/SP	II	80	ST/SP	II
		Sg. Ngoi-Ngoi	1	72	ST/SP	III	73	ST/SP	III
		Sg. Paroi	1	75	ST/SP	III	76	ST/SP	III
		Sg. Senawang	1	74	ST/SP	III	74	ST/SP	III
		Sg. Temiang	2	66	ST/SP	III	68	ST/SP	III
		Sg. Simin	1	75	ST/SP	III	77	ST/SP	II
		Sg. Linggi	6	76	ST/SP	III	77	ST/SP	II
		Sg. Simpang Ampat	1	81	B/C	II	79	ST/SP	II
N.Sembilan	Sg. Lukut	Sg. Lukut	1	71	ST/SP	III	69	ST/SP	III
	Sg. Baru	Sg. Baru	1	70	ST/SP	III	68	ST/SP	III
Johor	Sg. Batu Pahat	Sg. Amran	1	69	ST/SP	III	74	ST/SP	III
		Sg. Bekok	6	77	ST/SP	II	71	ST/SP	III
		Sg. Simpang Kiri	3	65	ST/SP	III	61	ST/SP	III
	Sg. Batu Pahat	Sg. Berlian	1	76	ST/SP	III	79	ST/SP	II
	Sg. Benut	Sg. Ulu Benut	1	77	ST/SP	II	79	ST/SP	II
		Sg. Parit Hj. Yassin	1	80	ST/SP	II	77	ST/SP	II
		Sg. Pinggan	1	60	ST/SP	III	61	ST/SP	III
		Sg. Benut	4	71	ST/SP	III	65	ST/SP	III
	Sg. Endau	Sg. Dengar	1	81	B/C	II	80	ST/SP	II
		Sg. Jebong	1	71	ST/SP	III	61	ST/SP	III
		Sg. Lenga	1	74	ST/SP	III	60	ST/SP	III
		Sg. Melatai	1	68	ST/SP	III	63	ST/SP	III
		Sg. Mengkibol	3	73	ST/SP	III	74	ST/SP	III
		Sg. Pamol	1	68	ST/SP	III	65	ST/SP	III
	Sg. Johor	Sg. Anak Sg. Sayong	2	75	ST/SP	III	77	ST/SP	II
		Sg. Seluyut	1	76	ST/SP	III	77	ST/SP	II

Jadual 2.2 : Status Kualiti Air bagi Sungai Sederhana Tercemar, 2019
Table 2.2 : Water Quality Status of Slightly Polluted Rivers, 2019

NEGERI/ STATE	LEMBANGAN SUNGAI/ RIVER BASIN	SUNGAI/ RIVER	BILANGAN STESEN/ NUMBER OF STATIONS	2018			2019		
				IKA/ WQI	KATEGORI/ CATEGORY	KELAS/ CLASS	IKA/ WQI	KATEGORI/ CATEGORY	KELAS/ CLASS
Johor	Sg. Johor	Sg. Tiram	4	77	ST/SP	II	79	ST/SP	II
		Sg. Panti	1	79	ST/SP	II	72	ST/SP	III
		Sg. Berangan	1	63	ST/SP	III	67	ST/SP	III
		Sg. Chemangar	1	70	ST/SP	III	72	ST/SP	III
		Sg. Bukit Besar	2	83	B/C	II	76	ST/SP	III
		Sg. Temoh	1	58	T/P	III	64	ST/SP	III
		Sg. Sebol	1	75	ST/SP	III	69	ST/SP	III
	Sg. Kim Kim	Sg. Kim Kim	2	58	T/P	III	67	ST/SP	III
	Sg. Paloi	Sg. Paloi	1	85	B/C	II	80	ST/SP	II
	Sg. Skudai	Sg. Melana	2	71	ST/SP	III	68	ST/SP	III
	Sg. Pontian Besar	Sg. Air Hitam	2	72	ST/SP	III	80	ST/SP	II
		Sg. Pontian Besar	5	69	ST/SP	III	67	ST/SP	III
	Sg. Pontian Kecil	Sg. Pontian Kecil	2	78	ST/SP	II	79	ST/SP	II
	Sg. Pulai	Sg. Pulai	2	72	ST/SP	III	72	ST/SP	III
		Sg. Ulu Choh	1	64	ST/SP	III	67	ST/SP	III
	Sg. Rambah	Sg. Rambah	2	70	ST/SP	III	62	ST/SP	III
	Sg. Sanglang	Sg. Sanglang	1	63	ST/SP	III	60	ST/SP	III
	Sg. Sedili Kecil	Sg. Bahan	2	60	ST/SP	III	76	ST/SP	III
Johor/ N.Sembilan/ Pahang	Sg. Muar	Sg. Gemas	2	66	ST/SP	III	67	ST/SP	III
		Sg. Kelamah	1	74	ST/SP	III	79	ST/SP	II
		Sg. Merbudu	1	68	ST/SP	III	65	ST/SP	III
		Sg. P. Mengkuang	1	80	ST/SP	II	67	ST/SP	III
		Sg. Pagoh	1	69	ST/SP	III	67	ST/SP	III
		Sg Labis	3	83	B/C	II	79	ST/SP	II
		Sg. Sarang Buaya	1	63	ST/SP	III	70	ST/SP	III
		Sg. Senarut	1	71	ST/SP	III	66	ST/SP	III
		Sg. Simpang Loi	1	76	ST/SP	III	78	ST/SP	II
		Sg. Tenang	1	66	ST/SP	III	68	ST/SP	III
Pahang	Sg. Balok	Sg. Balok	2	70	ST/SP	III	68	ST/SP	III
		Sg. Yior	1	64	ST/SP	III	64	ST/SP	III
	Sg. Cherating	Sg. Cherating	1	82	B/C	II	79	ST/SP	II
	Sg. Kuantan	Sg. Talam	1	77	ST/SP	II	69	ST/SP	III
		Sg. Galing Besar	2	63	ST/SP	III	61	ST/SP	III
		Sg. Belat	1	82	B/C	II	79	ST/SP	II
Pahang/ Johor	Sg. Rompin	Sg. Bakar	1	79	ST/SP	II	71	ST/SP	III
	Sg. Tonggok	Sg. Tonggok	2	71	ST/SP	III	70	ST/SP	III

Jadual 2.2 : Status Kualiti Air bagi Sungai Sederhana Tercemar, 2019
Table 2.2 : Water Quality Status of Slightly Polluted Rivers, 2019

NEGERI/ STATE	LEMBANGAN SUNGAI/ RIVER BASIN	SUNGAI/ RIVER	BILANGAN STESEN/ NUMBER OF STATIONS	2018			2019		
				IKA/ WQI	KATEGORI/ CATEGORY	KELAS/ CLASS	IKA/ WQI	KATEGORI/ CATEGORY	KELAS/ CLASS
Pahang/ N.Sembilan	Sg. Pahang	Sg. Batu	1	82	B/C	II	79	ST/SP	II
		Sg. Kecau	3	81	B/C	II	80	ST/SP	II
		Sg. Serting	5	77	ST/SP	II	76	ST/SP	III
Terengganu	Sg. Chukai	Sg. Chukai	1	80	ST/SP	II	80	ST/SP	II
		Sg. Ruang	2	74	ST/SP	III	73	ST/SP	III
	Sg. Merang	Sg. Merang	1	77	ST/SP	II	77	ST/SP	II
	Sg. Merchang	Sg. Merchang	1	71	ST/SP	III	72	ST/SP	III
		Sg. Landas	1	70	ST/SP	III	65	ST/SP	III
	Sg. Terengganu	Sg. Pueh	2	71	ST/SP	III	69	ST/SP	III
	Sg. Ibai	Sg. Ibai	3	77	ST/SP	II	78	ST/SP	II
	Sg. Kemaman	Sg. Ransan	2	75	ST/SP	III	73	ST/SP	III
	Sg. Paka	Sg. Rasau	2	78	ST/SP	II	79	ST/SP	II
	Sg Golok	Sg. Tasik Garu	1	78	ST/SP	II	76	ST/SP	III
Kelantan	Sg. Kelantan	Sg. Aring	1	76	ST/SP	III	76	ST/SP	III
		Sg. Isos	1	69	ST/SP	III	73	ST/SP	III
	Sg. Kemasin	Sg. Gali	1	74	ST/SP	III	76	ST/SP	III
	Sg. Pengkalan Chepa	Sg. Raja Gali	1	73	ST/SP	III	73	ST/SP	III
		Sg. Alor Lintah	1	63	ST/SP	III	61	ST/SP	III
		Sg. Keladi	1	80	ST/SP	II	78	ST/SP	II
	Sg. Pengkalan Datu	Sg. Pengkalan Datu	3	78	ST/SP	II	76	ST/SP	III
		Sg. Pasir Hor	1	75	ST/SP	III	67	ST/SP	III
Sabah	Sg. Sembulan	Sg. Sembulan	2	73	ST/SP	III	77	ST/SP	II
	Sg. Kalumpang	Sg. Pang Burong 2	1	70	ST/SP	III	76	ST/SP	III
	Sg. Likas	Sg. Darau	1	84	B/C	II	76	ST/SP	III
		Sg. Likas	2	76	ST/SP	III	78	ST/SP	II
	Sg. Telipok	Sg. Telipok	2	80	ST/SP	II	77	ST/SP	II
Sarawak	Sg. Miri	Sg. Adong	1	59	T/P	III	70	ST/SP	III
		Sg. Miri	2	61	ST/SP	III	75	ST/SP	III
		Sg. Dalam	1	72	ST/SP	III	74	ST/SP	III
	Sg. Rajang	Sg. Salim	1	77	ST/SP	II	80	ST/SP	II
		Sg. Daro	1	64	ST/SP	III	76	ST/SP	III
		Sg. Jemoreng	1	63	ST/SP	III	78	ST/SP	II
	Sg. Sarawak	Sg. Semenggoh	1	66	ST/SP	III	77	ST/SP	II
		Sg. Tabuan	1	78	ST/SP	II	73	ST/SP	III

Jadual 2.2 : Status Kualiti Air bagi Sungai Sederhana Tercemar, 2019
Table 2.2 : Water Quality Status of Slightly Polluted Rivers, 2019

NEGERI/ STATE	LEMBANGAN SUNGAI/ RIVER BASIN	SUNGAI/ RIVER	BILANGAN STESEN/ NUMBER OF STATIONS	2018			2019		
				IKA/ WQI	KATEGORI/ CATEGORY	KELAS/ CLASS	IKA/ WQI	KATEGORI/ CATEGORY	KELAS/ CLASS
Sarawak	Sg. Sarawak	Sg. Samarahan	2	73	ST/SP	III	70	ST/SP	III
		Sg. Maong Kiri	1	69	ST/SP	III	76	ST/SP	III
	Sg. Saribas	Sg. Saribas	1	77	ST/SP	II	80	ST/SP	II
	Sg. Sibuti	Sg. Kabuloh	2	72	ST/SP	III	68	ST/SP	III
		Sg. Karangan	2	75	ST/SP	III	78	ST/SP	II

Nota/Note:
B/C : Bersih/ Clean
ST/SP: Sederhana tercemar/ Slightly polluted
T/P : Tercemar / Polluted

Jadual 2.3 : Status Kualiti Air bagi Sungai Tercemar, 2019
Table 2.3 : Water Quality Status of Polluted Rivers, 2019

NEGERI/ STATE	LEMBANGAN SUNGAI/ RIVER BASIN	SUNGAI/ RIVER	BILANGAN STESEN/ NUMBER OF STATIONS	2018			2019		
				IKA/ WQI	KATEGORI/ CATEGORY	KELAS/ CLASS	IKA/ WQI	KATEGORI/ CATEGORY	KELAS/ CLASS
P.Pinang	Sg. Jawi	Sg. Jawi	1	47	T/P	IV	49	T/P	IV
		Sg. Chempedak	1	39	T/P	IV	54	T/P	III
	Sg. Juru	Sg. Juru	2	58	T/P	III	56	T/P	III
		Sg. Rambai	2	54	T/P	III	51	T/P	IV
	Sg. Kluang	Sg. Dua Besar	1	65	ST/SP	III	57	T/P	III
P.Pinang/ Kedah	Sg. Perai	Sg. Air Melintas	1	51	T/P	IV	54	T/P	III
		Sg. Kereh	3	56	T/P	III	57	T/P	III
		Sg. Pertama	1	54	T/P	III	59	T/P	III
Kedah	Sg. Merbok	Sg. Bakar Arang	1	55	T/P	III	59	T/P	III
		Sg. Petani	1	56	T/P	III	54	T/P	III
Perak	Sg Perak	Sg. Seluang	1	64	ST/SP	III	58	T/P	III
Selangor/ WPKL	Sg. Klang	Sg. Air Busuk	1	58	T/P	III	59	T/P	III
		Sg. Untut	1	55	T/P	III	54	T/P	III
		Sg. Kuyoh	2	50	T/P	IV	51	T/P	IV
		Sg. Kerayong	4	54	T/P	III	54	T/P	III
		Sg. Klang	13	61	ST/SP	III	58	T/P	III
		Sg. Toba	1	64	ST/SP	III	59	T/P	III
Selangor	Sg. Buloh	Sg. Buloh	6	53	T/P	III	52	T/P	III
	Sg. Sepang	Sg. Rambai	1	31	T/P	IV	21	T/P	V
Selangor/ Putrajaya/ N.Sembilan	Sg. Langat	Sg. Balak	1	61	ST/SP	III	56	T/P	III
N. Sembilan/ Melaka	Sg Tuang	Sg. Tuang	1	88	B/C	II	58	T/P	III
	Sg Linggi	Sg. Tuang	1	70	ST/SP	III	57	T/P	III
Melaka	Sg. Merlimau	Sg. Merlimau	5	52	T/P	III	49	T/P	IV
	Sg. Duyong	Sg. Punggur	2	48	T/P	IV	51	T/P	IV
Melaka/ N.Sembilan	Sg. Melaka	Sg. Malim	2	54	T/P	III	58	T/P	III
		Sg. Putat	2	61	ST/SP	III	58	T/P	III
Johor	Sg. Air Baloi	Sg. Air Baloi	3	53	T/P	III	49	T/P	IV
	Sg. Batu Pahat	Sg. Simpang Kanan	2	59	T/P	III	56	T/P	III
		Sg. Temehel	1	44	T/P	IV	48	T/P	IV
		Sg. Batu Pahat	1	59	T/P	III	56	T/P	III
		Sg. Panchor	1	61	ST/SP	III	58	T/P	III
		Sg. Semberong	2	67	ST/SP	III	55	T/P	III
	Sg. Johor	Sg. Semenchu	1	61	ST/SP	III	35	T/P	IV
		Sg. Serai	1	61	ST/SP	III	57	T/P	III

Jadual 2.3 : Status Kualiti Air bagi Sungai Tercemar, 2019
Table 2.3 : Water Quality Status of Polluted Rivers, 2019

NEGERI/ STATE	LEMBANGAN SUNGAI/ RIVER BASIN	SUNGAI/ RIVER	BILANGAN STESEN/ NUMBER OF STATIONS	2018			2019		
				IKA/ WQI	KATEGORI/ CATEGORY	KELAS/ CLASS	IKA/ WQI	KATEGORI/ CATEGORY	KELAS/ CLASS
Johor	Sg. Endau	Sg. Singol	1	80	ST/SP	II	55	T/P	III
	Sg. Danga	Sg. Danga	2	47	T/P	IV	46	T/P	IV
	Sg. Kawasan Pasir Gudang	Sg. Perembi	1	42	T/P	IV	42	T/P	IV
		Sg. Masai	1	56	T/P	III	50	T/P	IV
		Sg. Buluh	1	26	T/P	V	41	T/P	IV
		Sg. Tukang Batu	1	22	T/P	V	37	T/P	IV
		Sg. Latoh	1	64	ST/SP	III	58	T/P	III
	Sg. Kempas	Sg. Kempas	2	46	T/P	IV	40	T/P	IV
	Sg. Sedili Besar	Sg. Mupur	1	48	T/P	IV	47	T/P	IV
	Sg. Sedili Kecil	Sg. Anak Sedili Kecil	2	76	ST/SP	III	56	T/P	III
	Sg. Pontian Besar	Sg. Ayer Merah	1	51	T/P	IV	46	T/P	IV
	Sg. Skudai	Sg. Skudai	9	63	ST/SP	III	57	T/P	III
	Sg. Segget	Sg. Segget	5	59	T/P	III	52	T/P	III
	Sg. Tebrau	Sg. Bala	1	45	T/P	IV	42	T/P	IV
		Sg. Sebulung	1	44	T/P	IV	38	T/P	IV
		Sg. Plentong	1	54	T/P	III	52	T/P	III
		Sg. Tebrau	5	51	T/P	IV	56	T/P	III
		Sg. Pandan	1	42	T/P	IV	43	T/P	IV
		Sg. Tampoi	1	45	T/P	IV	44	T/P	IV
		Sg. Sengkuang	1	30	T/P	V	35	T/P	IV
Johor/ N. Sembilan	Sg. Muar	Sg. Merlimau	1	55	T/P	III	59	T/P	III
		Sg. Serom	1	54	T/P	III	55	T/P	III
Terengganu	Sg. Kemaman	Sg. Neram	1	74	ST/SP	III	31	T/P	IV
Kelantan	Sg. Pengkalan Chepa	Sg. Alor B	1	57	T/P	III	48	T/P	IV
		Sg. Pengkalan Chepa	2	65	ST/SP	III	59	T/P	III

Nota/Note:
B/C : Bersih/ Clean
ST/SP: Sederhana tercemar/ Slightly polluted
T/P : Tercemar / Polluted

Jadual 2.4 menunjukkan sebanyak 35 daripada 59 sungai tercemar masih tergolong dalam Kelas III, 23 sungai adalah dalam Kelas IV, manakala 1 sungai adalah Kelas V. Berdasarkan BOD, 6 sungai diklasifikasikan sebagai Kelas III, 32 sungai dalam Kelas IV, manakala 21 adalah Kelas V. Dari segi NH_3-N pula, satu sungai tergolong dalam Kelas II, 14 sungai dalam Kelas IV, dan 44 sungai adalah Kelas V. Dari segi SS, sebanyak 11 sungai telah diklasifikasikan sebagai Kelas I, 29 sungai Kelas II, dan 17 adalah Kelas III manakala 2 adalah Kelas IV.

Table 2.4 shows that out of the 59 polluted rivers, 35 rivers were classified as Class III, while 23 rivers as Class IV, and 1 river as Class V. In terms of BOD, 6 rivers were classified as Class III, 32 rivers as Class IV, and 21 rivers as Class V. In terms of NH_3-N, one river was classified as Class II, 14 rivers as Class IV and 44 rivers as Class V. In terms of SS, 11 rivers were classified as Class I, 29 rivers as Class II, 17 rivers as Class III while 2 rivers as Class IV.

Jadual 2.4 : Sungai Tercemar dan Kelas Kualiti Air Berdasarkan BOD, AN dan SS, 2019
Table 2.4 : The Polluted Rivers and Classes Based on BOD, AN and SS, 2019

BIL. NO.	NEGERI/STATE	LEMBANGAN SUNGAI/ RIVER BASIN	SUNGAI/ RIVER	STATUS 2019		KELAS BERDASARKAN/ CLASS BASED ON		
				IKA/ WQI	KELAS/ CLASS	BOD	AN	SS
1	Johor	Air Baloi	Sg. Air Baloi	49	IV	IV	II	IV
		Batu Pahat	Sg. Batu Pahat	56	III	III	IV	II
			Sg. Panchor	58	III	III	IV	II
			Sg. Semberong	55	III	III	IV	I
			Sg. Simpang Kanan	56	III	III	IV	I
			Sg. Temehel	48	IV	IV	V	I
		Danga	Sg. Danga	46	IV	IV	V	III
		Endau	Sg. Singol	55	III	IV	V	III
		Johor	Sg. Semenchu	35	IV	V	IV	III
			Sg. Serai	57	III	III	V	II
		Kaw. Pasir Gudang	Sg. Buluh	41	IV	V	IV	III
			Sg. Latoh	58	III	V	IV	III
			Sg. Masai	50	IV	V	V	II
			Sg. Perembi	42	IV	V	V	II
			Sg. Tukang Batu	37	IV	V	V	II
		Kempas	Sg. Kempas	40	IV	V	V	III
		Pontian Besar	Sg. Ayer Merah	46	IV	V	V	II
		Sedili Kecil	Sg. Anak Sedili Kecil	56	III	V	V	III
		Sedili Besar	Sg. Mupur	47	IV	V	V	III
		Segget	Sg. Segget	52	III	IV	V	I
		Skudai	Sg. Skudai	57	III	IV	V	II
		Tebrau	Sg. Bala	42	IV	V	V	II
			Sg. Pandan	43	IV	V	V	II
			Sg. Plentong	52	III	IV	V	II
			Sg. Sebulung	38	IV	V	V	II
			Sg. Sengkuang	35	IV	V	V	II
			Sg. Tampoi	44	IV	V	V	II
			Sg. Tebrau	56	III	IV	V	II

Jadual 2.4 : Sungai Tercemar dan Kelas Kualiti Air Berdasarkan BOD, AN dan SS, 2019
Table 2.4 : The Polluted Rivers and Classes Based on BOD, AN and SS, 2019

BIL. NO.	NEGERI/STATE	LEMBANGAN SUNGAI/ RIVER BASIN	SUNGAI/ RIVER	STATUS 2019		KELAS BERDASARKAN/ CLASS BASED ON		
				IKA/ WQI	KELAS/ CLASS	BOD	AN	SS
2	Johor/ N.sembilan/ Pahang	Muar	Sg. Merlimau	59	III	IV	IV	II
			Sg. Serom	55	III	III	IV	I
3	Kedah	Merbok	Sg. Bakar Arang	59	III	IV	IV	II
			Sg. Petani	54	III	IV	V	II
4	Kelantan	Pengkalan Chepa	Sg. Alor B	48	IV	V	V	I
			Sg. Pengkalan Chepa	59	III	IV	IV	III
5	Melaka	Duyong	Sg. Punggur	51	IV	IV	V	II
		Merlimau	Sg. Merlimau	49	IV	IV	V	I
6	Melaka/ N. Sembilan	Melaka	Sg. Malim	58	III	IV	V	III
			Sg. Putat	58	III	IV	V	II
7	N.sembilan/ Melaka	Tuang	Sg. Tuang	58	III	IV	V	III
		Linggi	Sg. Tuang	57	III	IV	V	III
8	P.pinang	Jawi	Sg. Chempedak	54	III	IV	V	III
			Sg. Jawi	49	IV	IV	V	III
		Juru	Sg. Juru	56	III	IV	V	II
			Sg. Rambai	51	IV	IV	V	II
		Kluang	Sg. Dua Besar	57	III	IV	V	I
9	P.pinang/ Kedah	Perai	Sg. Air Melintas	54	III	IV	V	II
			Sg. Kereh	57	III	IV	V	III
			Sg. Pertama	59	III	IV	IV	III
10	Perak	Perak	Sg. Seluang	58	III	IV	V	II
11	Selangor	Buloh	Sg. Buloh	52	III	IV	IV	II
		Sepang	Sg. Rambai	21	V	V	V	IV
12	Selangor/ Putrajaya/ N.sembilan	Langat	Sg. Balak	56	III	IV	V	I
13	Selangor/ Wpkl	Klang	Sg. Air Busuk	59	III	V	V	II
			Sg. Kerayong	54	III	V	V	I
			Sg. Klang	58	III	IV	V	II
			Sg. Kuyoh	51	IV	IV	V	II
			Sg. Toba	59	III	IV	V	II
			Sg. Untut	54	III	V	V	I
14	Terengganu	Kemaman	Sg. Neram	31	IV	V	IV	III

STATUS
PENGAWASAN KUALITI AIR SUNGAI AUTOMATIK
CONTINUOUS RIVER WATER QUALITY MONITORING STATUS

Rajah 2.2 menunjukkan lokasi 30 stesen pengawasan sungai automatik serta takat pengambilan air yang disenaraikan seperti dalam **Jadual 2.5.**

Oksigen terlarut adalah salah satu penunjuk kepada kehadiran BOD yang disebabkan oleh bahan pencemar organik. Julat DO yang rendah didapati bagi stesen CR06A, manakala julat BOD juga adalah setara bagi stesen CR02K, CR06A, CR22C, CR25T, CR26D dan CR29Q.

Ammonium adalah satu bentuk ammonia yang telah terion. Pengukuran ammonium memberi petunjuk kepada potensi kehadiran pencemar ammonia atau ammonia nitrogen dalam air sungai apabila pH dan suhu air berubah. Julat bagi ammoniakal-N pada umumnya adalah rendah kecuali bacaan yang didapati di stesen CR08B, CR10B, CR11B, CR12W, CR20J dan CR24T.

pH adalah ukuran bagi keasidan dan kealkalian mengikut skala pH. Julat bagi pH yang tinggi diperhatikan di CR05A dan CR11B.

Kekeruhan digunakan sebagai penunjuk kehadiran pepejal terampai di dalam sungai. Bagi julat TSS yang direkodkan secara amnya adalah tinggi kecuali stesen CR01K, CR02K, CR03K, CR05A, CR19J and CR24T.

Figure 2.2 shows the location of the 30 continuous river monitoring stations and subsequent water intakes as listed in **Table 2.5**.

Dissolved oxygen is one of the indicators of BOD presence exerted by organic pollutants. Low range of DO were observed at CR06A, while relatively narrow BOD ranges were observed at CR02K, CR06A, CR22C, CR25T, CR26D and CR29Q.

Ammonium is an ionized form of ammonia. The measurement of ammonium indicates the potential presence of ammonia or ammoniacal nitrogen pollutants in rivers which is also improved pH and temperature changes. Ammoniacal-N range was generally narrow except for reading observed at CR08B, CR10B, CR11B, CR12W, CR20J and CR24T.

pH is a measurement of acidity and alkalinity based on pH scale. Relatively wide pH ranges were observed at CR05A and CR11B.

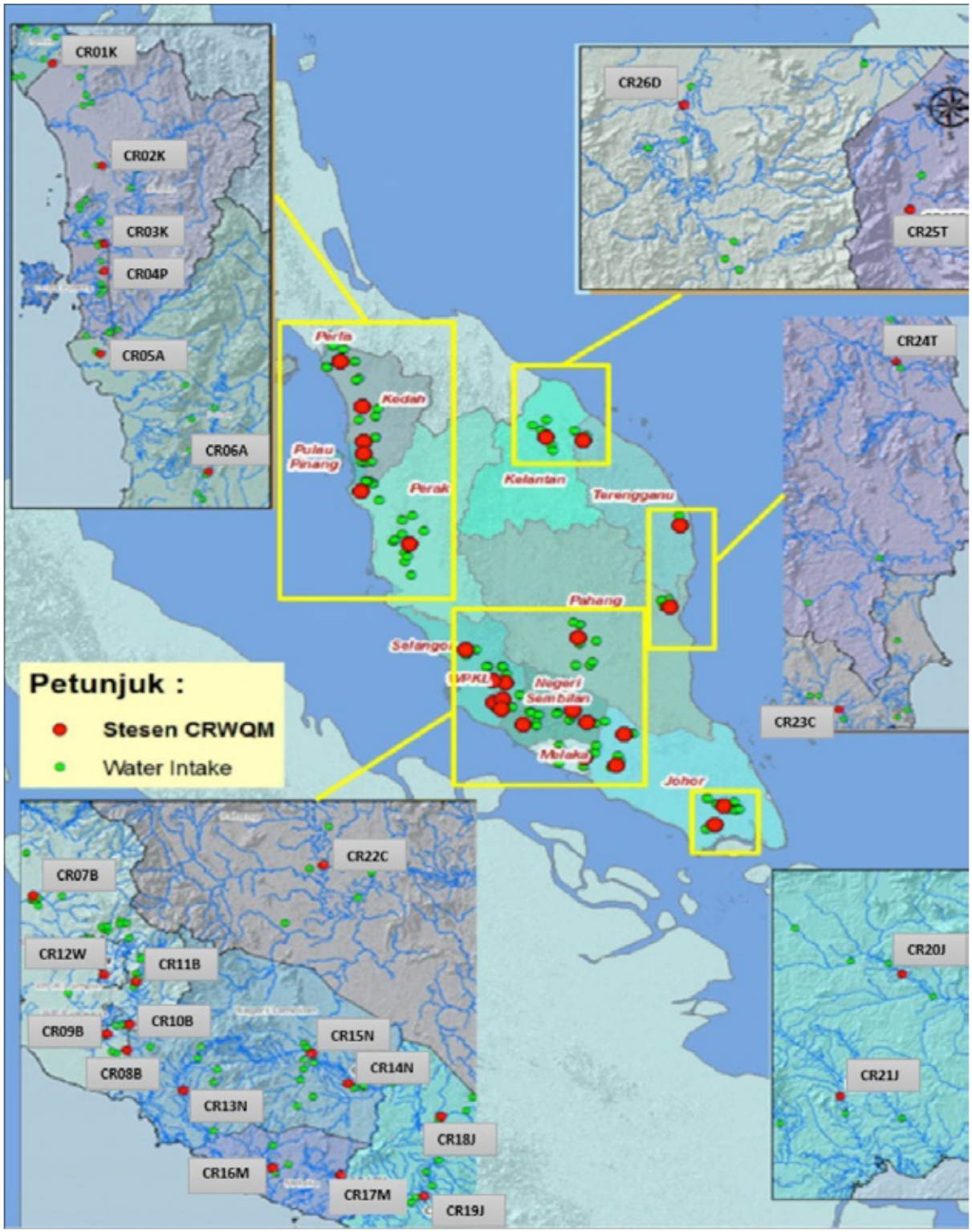
Turbidity is used as an indicator of suspended solids presence in a river. The range of TSS recorded were generally wide except for stations CR01K, CR02K, CR03K, CR05A, CR19J and CR24T stations.

Jadual 2.5: CRWQMS Lokasi: ID Stesen, Sungai bagi Stesen dan Takat Pengambilan Air
Table 2.5: CRWQMS Location: Station ID, River of the Station and Water Intake

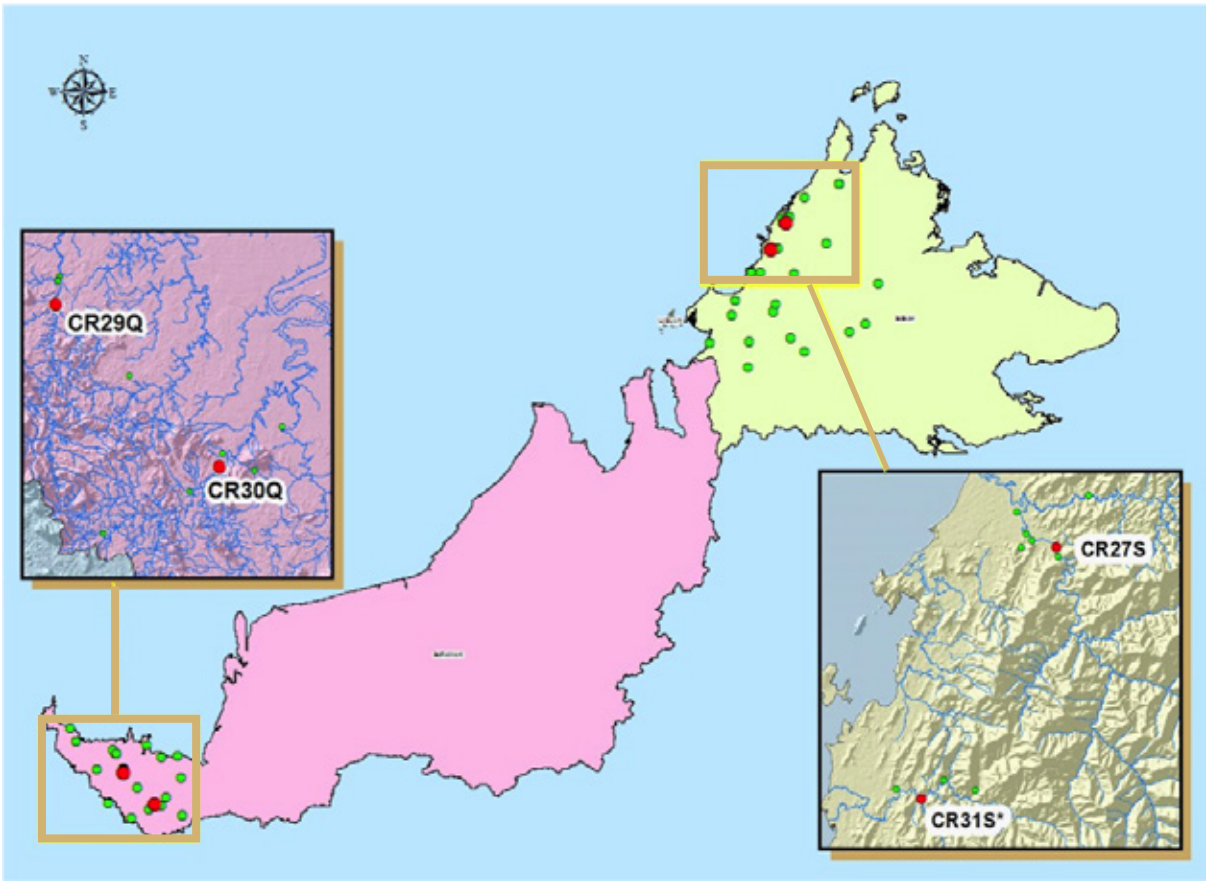
NEGERI/ STATE	ID STESEN/ ID STATION (CR)	SUNGAI/ RIVER	TAKAT PENGAMBILAN AIR/ WATER INTAKE
Perlis	01K	Terusan MADA	Arau Fasa IV
Kedah	02K 03K	Terusan MADA Sungai Muda	Bukit Jenun Kulim Hi-Tech
Penang	04P	Sungai Kulim	Toh Along
Perak	05A 06A	Sungai Bogak Sungai Perak	Parit Buntar Sultan Idris
Selangor	07B 08B 09B 10B 11B	Sungai Selangor Sungai Langat Sungai Semenyih Sungai Labu Sungai Langat	Sg. Selangor Fasa 1,2,3 Bukit Tampoi Jenderam Labu Lanjut Cheras Batu 11
Wilayah Kuala Lumpur	12W	Sungai Klang	NA
Negeri Sembilan	13N 14N 15N	Sungai Linggi Sungai Muar Sungai Muar	Linggi Pasir Besar Jelai Jempol
Melaka	16M 17M	Sungai Melaka Sungai Kesang	Durian Tunggal Chin Chin
Johor	18J 19J 20J 21J	Sungai Segamat Sungai Muar Sungai Johor Sungai Sekudai	Segamat Panchor Semanggar Skudai
Pahang	22C 23C	Sungai Pahang Sungai Kuantan	Lubuk Kawah Semambu
Terengganu	24T 25T	Sungai Paka Sungai Besut	Bulit Bauk Nukit Bunga
Kelantan	26D	Sungai Kelantan	Sokor
Sabah	27S 28S* 31S*	Sungai Tuaran Sungai Padas Sungai Moyog	Telibong Beufort Kasigui
Sarawak	29Q 30Q	Sungai Sarawak Sungai Batang Sadong	Sarawak Kiri Tebekang

*CR28S telah dipindahkan ke CR31S

*CR28S was relocated to CR31S



Rajah 2.2: Stesen Pengawasan Kualiti Air Sungai Automatik Dan Takat Pengambilan Air
Figure 2.2 : Continuous Water Quality Stations and Water Intakes



Rajah 2.2: Stesen Pengawasan Kualiti Air Sungai Automatik Dan Takat Pengambilan Air
Figure 2.2: Continuous Water Quality Stations and Water Intakes

TREN
PENCEMARAN AIR SUNGAI
TREND IN RIVER WATER POLLUTION

Kualiti air sungai yang ditentukan dari segi IKA telah menunjukkan peningkatan pada tahun 2019. Peratus bilangan sungai bersih telah sedikit meningkat kepada 61% pada tahun 2019 berbanding 56% pada tahun sebelumnya. Peratus bilangan sungai tercemar telah sedikit meningkat daripada 8% pada tahun 2018 kepada 9% pada tahun 2019. Trend ini ditunjukkan oleh **Rajah 2.1**.

The river water quality in terms of WQI had shown an increase in 2019. The percentage of clean rivers has slightly increased to 61% in 2019 compared to 56% in the previous year. The percentage of polluted river has slightly increased from 8% in 2018 to 9% in 2019. These trends are shown in **Figure 2.1**.

Berdasarkan sub-indeks BOD, 120 sungai adalah bersih pada tahun 2019 **(Rajah 2.3)**. Bilangan sungai yang tercemar dari segi sub-indeks BOD telah meningkat daripada 257 pada tahun 2018 kepada 288 sungai pada tahun 2019. Kemerosotan kualiti air sungai dari segi BOD ini adalah disebabkan oleh pelepasan bahan buangan yang bersifat organik daripada pelbagai punca seperti air sisa industri, serta

In terms of BOD sub-index, 120 of the monitored rivers has been categorised as clean in 2019 (**Figure 2.3**). The number of polluted rivers in terms of BOD sub-index has increased from 257 in 2017 to 288 rivers in 2019. The degradation of river water quality in terms of BOD may have been continuously attributed to various sources of organic pollutants including wastewater from

aktiviti komersil dan domestik.

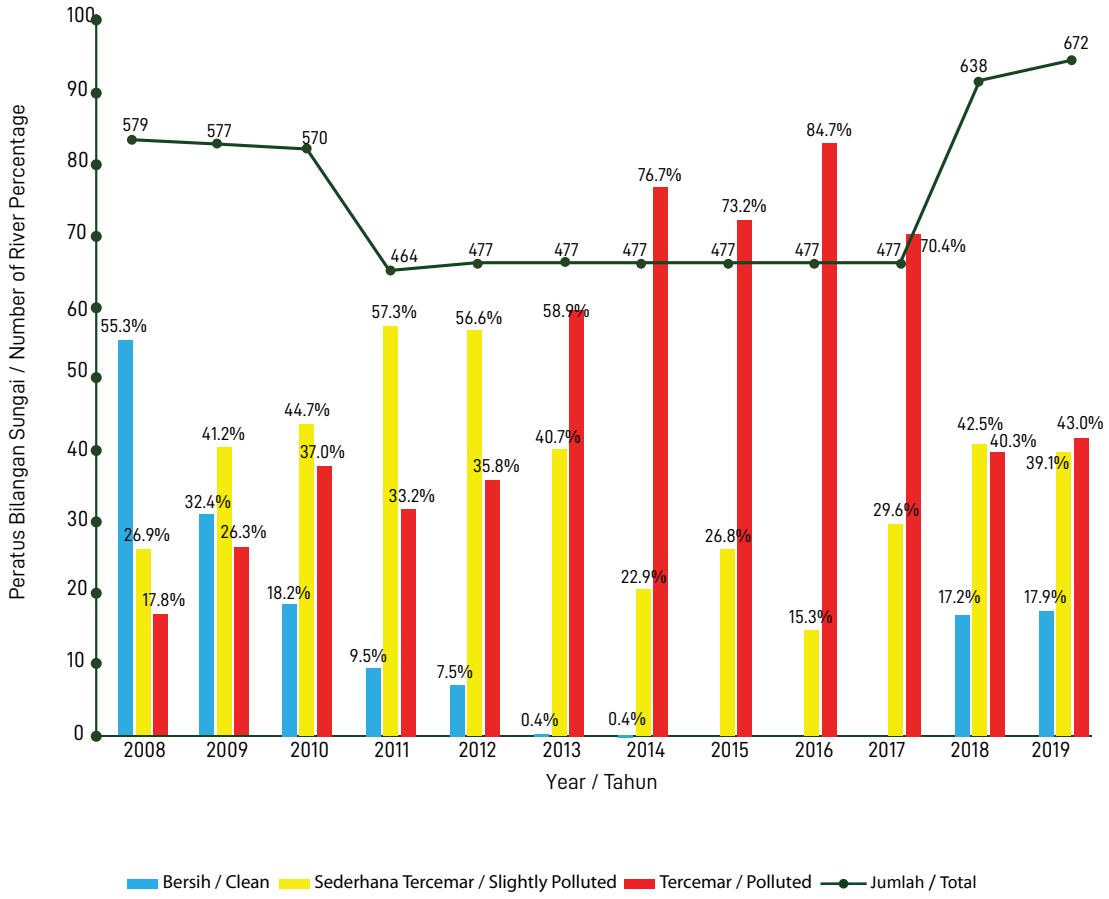
Dari segi sub-indeks NH_3-N pula, bilangan sungai bersih telah meningkat daripada 109 pada tahun 2018 kepada 208 pada tahun 2019 (**Rajah 2.4**). Bilangan sungai yang tercemar dari segi sub-indeks NH_3-N telah meningkat daripada 238 pada tahun 2018 kepada 283 sungai pada tahun 2019. Kemerosotan kualiti air sungai yang disebabkan oleh NH_3-N boleh dikaitkan dengan pelepasan air sisa kumbahan manusia dan haiwan yang tidak diolah dan terolah ke dalam air sungai secara berterusan.

Dari segi sub-indeks SS pula, bilangan sungai bersih telah meningkat daripada 320 pada tahun 2018 kepada 456 pada tahun 2019 (**Rajah 2.5**). Bilangan sungai tercemar dari segi sub-indeks SS pula telah menurun kepada 133 berbanding 209 sungai pada tahun lepas. Kemerosotan kualiti air sungai dari segi pepejal terampai tersebut boleh disebabkan oleh ketidakcekapan kawalan ke atas aktiviti kerja tanah dan pembukaan tanah di kawasan-kawasan tertentu.

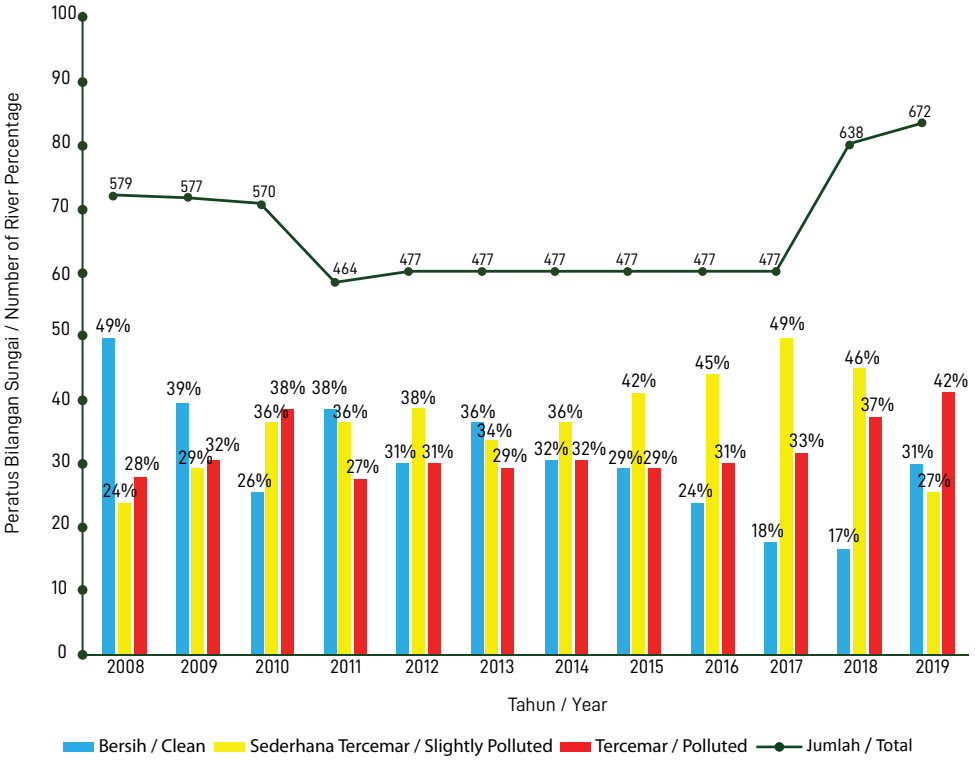
industrial, domestic and commercials activities.

In term of NH_3-N sub-index, the number of clean rivers has increased from 109 in 2018 to 208 rivers in 2019 **(Figure 2.4)**. The number of polluted rivers in terms of NH_3-N has increased from 238 in 2018 to 283 rivers in 2019. The degradation of river water quality caused by NH_3-N can be associated with the continuous discharge of treated and untreated sewage into the rivers.

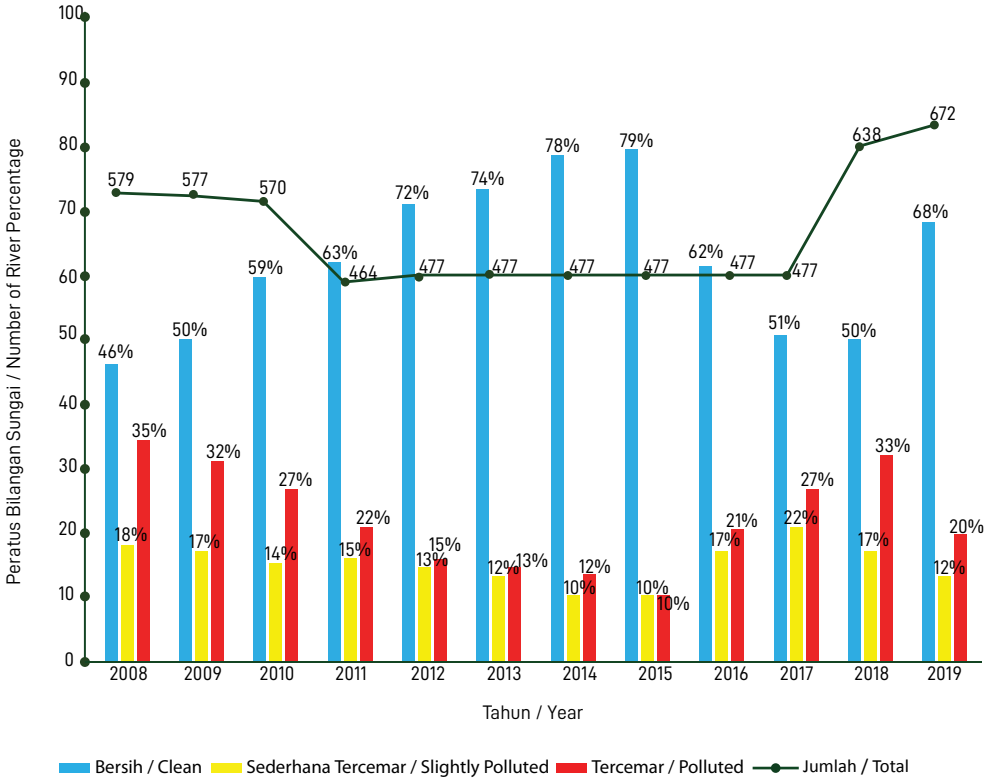
In term of SS sub-index, the number of clean rivers has increased from 320 in 2018 to 456 in 2019 **(Figure 2.5)**. The number of polluted rivers in terms of SS sub-index has decreased to 133 compared to 209 rivers in the previous year. The deteriorations in river water quality due to the suspended solids pollution can be attributed by inefficient control against improper earthworks and land clearing activities in certain areas.



Rajah 2.3 : Tren Kualiti Air Sungai Berdasarkan Sub-Indeks BOD (2008- 2019)
Figure 2.3 : River Water Quality Trend Based on BOD Sub-Index (2008-2019)



Rajah 2.4 : Tren Kualiti Air Sungai Berdasarkan Sub-Indeks AN (2008- 2019)
Figure 2.4 : River Water Quality Trend Based on AN Sub-Index (2008-2019)



Rajah 2.5 : Tren Kualiti Air Sungai Berdasarkan Sub-Indeks SS (2008- 2019)
Figure 2.5 : River Water Quality Trend Based on SS Sub-Index (2008-2019)

LOGAM
BERAT DALAM SUNGAI
HEAVY METALS IN RIVERS

Analisis kandungan beberapa jenis logam berat dalam air sungai telah dilakukan ke atas Raksa (Hg), Arsenik (As), Kadmium (Cd), Kromium (Cr), Plumbum (Pb), and Zink (Zn). Pada tahun 2019 kesemua sampel air sungai telah menunjukkan kandungan logam CN, Hg dan Cd pada tahap Kelas II. Sebanyak 76.8% daripada sampel air sungai yang diuji telah menunjukkan kandungan Fe dalam Kelas II, dikuti dengan Zn (99.9%), Pb (98.7%), As (98.9%) dan Cr (99.8%).

Heavy metals analysed in river where were Mercury (Hg), Arsenic (As), Cadmium (Cd), Chromium (Cr), Plumbum (Pb), and Zinc (Zn). In 2019, all of the water samples had shown that the concentration of CN, Hg and Cd was within Class II limit. About 76.8% of water samples have shown that the concentrations of Fe were within Class II limit followed by Zn (99.9%), Pb (98.7%), As (98.9%) and Cr (99.8%).

KUALITI
AIR SUNGAI DI HULU MUKA SAUK
RIVER WATER QUALITY UPSTREAM WATER INTAKES

Pada tahun 2019, 52 (94.5%) daripada 55 stesen pengawasan kualiti air di hulu muka sauk telah menunjukkan indeks kualiti air bersih sementara 3 (5.5%) stesen adalah sederhana tercemar. Berdasarkan IKA juga, 10 (18.2%) stesen adalah Kelas I dan 42 (76.4%) adalah Kelas II, manakala 3 (5.4%) Kelas III. **Jadual 2.6** menunjukkan status kualiti air di stesen hulu muka sauk terpilih berdasarkan IKA.

Dari segi BOD, 21 (38%) stesen telah menunjukkan kualiti air pada Kelas II and 30 (55%) stesen Kelas III dan 4 stesen (7%) Kelas IV. Berdasarkan NH_3-N pula, sebanyak 38 (69%) stesen menunjukkan kualiti air Kelas I, 12 (22%) Kelas II, 4 (7%) stesen Kelas III, dan 1 stesen (2%) adalah Kelas IV. Dari segi SS, 29 (53%) stesen adalah Kelas I, 13 (24%) stesen Kelas II, 10 (18%) stesen Kelas III, 2 (4%) stesen Kelas IV manakala 1 (2%) stesen Kelas V.

Rajah 2.6 menunjukkan peratusan stesen hulu muka sauk berdasarkan kelas kualiti air dan parameter utama. **Jadual 2.7, Jadual 2.8** dan **Jadual 2.9** menunjukkan kualiti air sungai di stesen di hulu muka sauk masing-masing berdasarkan sub-indeks BOD, AN dan SS.

In 2019, 52 (94.5%) from 55 monitoring stations located upstream of water intakes had shown clean water quality while 3 (5.5%) stations were categorised as slightly polluted. Based on overall WQI, 10 (18.2%) stations were categorised as Class I, 42 (76.4%) were Class II, while 3 (5.4%) were Class III. **Table 2.6** shows the water quality of the selected water intake stations based on WQI.

In terms of BOD, 21 (38%) station have shown Class II water quality and 30 (55%) stations as Class III and 4 (7%) stations as Class IV. In terms of NH_3-N, 38 (69%) stations showed water quality of Class I, 12 (22%) as Class II, 4 (7%) as Class III, and 1 (2%) station as Class IV. Meanwhile in terms of SS, 29 (53%) stations were categorised as Class I, 13 (24%) as Class II, 10 (18%) as Class III, 2 (4%) as Class IV, and 1 (2%) stations as Class V.

Figure 2.6 shows the percentage of water quality upstream of water intake stations in term of classes based on main parameters. **Table 2.7, Table 2.8** and **Table 2.9** shows the water quality at upstream stations of water intake points based on BOD, AN and SS sub-indexes respectively.

Jadual 2.6 : Status Kualiti Air di Hulu Muka Sauk, 2019
Table 2.6 : Water Quality Status of Upstream Water Intakes, 2019

NEGERI/ STATE	LEMBANGAN SUNGAI/ RIVER BASIN	SUNGAI/ RIVER	STESEN ID/ ID STATIONS	MUKA SAUK/ WATER INTAKE	KUALITI AIR, 2018/ WATER QUALITY 2018			KUALITI AIR, 2019/ WATER QUALITY 2019		
					IKA/ WQI	KATEGORI/ CATEGORY	KELAS/ CLASS	IKA/ WQI	KATEGORI/ CATEGORY	KELAS/ CLASS
Perlis	Perlis	Sg. Terusan Mada	2PS13	Loji Rawatan Air Arau Fasa IV	83	B/C	II	84	B/C	II
			2PS14	Loji Rawatan Air TTPC, Sg. Baru	86	B/C	II	87	B/C	II
Kedah (Langkawi)	Melaka	Sg. Melaka	2LG05	Ulu Melaka	83	B/C	II	81	B/C	II
		Sg. Saga	2LG06	Padang Saga	84	B/C	II	76	ST/SP	III
Kedah	Kedah	Sg. Ahning	2KD11	Padang Sanai	86	B/C	II	88	B/C	II
		Sg. Padang Terap	2KD12	Kuala Nerang	88	B/C	II	91	B/C	II
		Sg. Temin	2KD10	Changloon	78	ST/SP	II	77	ST/SP	II
	Muda	Sg. Muda	2MD16	Jeneri	86	B/C	II	89	B/C	II
			2MD17	Jeniang	85	B/C	II	87	B/C	II
			2MD18	Bukit Selambau	85	B/C	II	86	B/C	II
			2MD20	Pinang Tunggal	84	B/C	II	86	B/C	II
		Sg. Nami	2MD21	Nami	87	B/C	II	88	B/C	II
		Sg. Sedim	2MD19	Bikan	86	B/C	II	87	B/C	II
P.Pinang	Pinang	Sg. Satu	2PG12	Batu Feringgi	91	B/C	II	93	B/C	I
Perak	Bernam	Sg. Gelinting	1BM15	Loji Rawatan Air Ulu Slim	88	B/C	II	87	B/C	II
		Sg. Trolak	1BM14	Loji Rawatan Air Trolak Timur	88	B/C	II	91	B/C	II
	Kurau	Sg. Air Hitam	2KU07	Loji Rawatan Air Jelai	92	B/C	II	92	B/C	II
	Perak	Sg. Manong	2PK62	Loji Rawatan Air Manong	92	B/C	II	95	B/C	I
		Sg. Sauk	2PK61	Loji Rawatan Air Sauk	89	B/C	II	92	B/C	II
		Sg. Tesong	2PK64	Loji Rawatan Air Sg. Klah	94	B/C	I	94	B/C	I
		Sg. Woh	2PK63	Loji Rawatan Air Kuala Woh	92	B/C	II	94	B/C	I
	Sepetang	Sg. Batu Tegoh	2SP18	Loji Rawatan Air Bukit Larut	94	B/C	I	95	B/C	I
Selangor	Klang	Sg. Gombak	1K53	Loji Rawatan Air Gombak	91	B/C	II	90	B/C	II
	Langat	Sg. Batang Labu	1L26	Loji Rawatan Air Salak Tinggi	73	ST/SP	III	72	ST/SP	III
		Sg. Semenyih	1L09	Loji Rawatan Air Semenyih	77	ST/SP	II	77	ST/SP	II

Jadual 2.6 : Status Kualiti Air di Hulu Muka Sauk, 2019

Table 2.6 : Water Quality Status of Upstream Water Intakes, 2019

NEGERI/ STATE	LEMBANGAN SUNGAI/ RIVER BASIN	SUNGAI/ RIVER	STESEN ID/ ID STATIONS	MUKA SAUK/ WATER INTAKE	KUALITI AIR, 2018/ WATER QUALITY 2018			KUALITI AIR, 2019/ WATER QUALITY 2019		
					IKA/ WQI	KATEGORI/ CATEGORY	KELAS/ CLASS	IKA/ WQI	KATEGORI/ CATEGORY	KELAS/ CLASS
Johor	Batu Pahat	Sg. Semberong Dam	3BP27	Semberong Dam	85	B/C	II	85	B/C	II
	Benut	Sg. Machap Dam	3BN10	Machap Dam	84	B/C	II	91	B/C	II
	Endau	Sg. Kahang	3ED38	Jalan Felda Kahang Timur, Kluang	87	B/C	II	86	B/C	II
	Muar	Sg. Jelai	1MN23	Loji Rawatan Air Dangi	84	B/C	II	83	B/C	II
		Sg. Jementah	3MR39	Loji Rawatan Air Jementah	88	B/C	II	91	B/C	II
		Sg. Muar	3MR38	Loji Rawatan Air Gombang	78	ST/SP	II	81	B/C	II
	Pulai	Sg. Pulai Dam	3PU04	Pulai Dam	91	B/C	II	93	B/C	I
Melaka	Kesang	Sg. Chin-Chin	1KA08	Muka sauk Loji Rawatan Air Chin-chin	83	B/C	II	80	ST/SP	II
Pahang	Bertam	Sg. Bertam	2CH15	Loji Rawatan Air Habu	92	B/C	II	94	B/C	I
		Sg. Terla	2CH14	Loji Rawatan Air Kuala Terla	92	B/C	II	88	B/C	II
		Sg. Ulong	2CH16	Brinchang Dam	92	B/C	II	94	B/C	I
	Pahang	Sg. Gapoi	4PH95	Muka sauk Loji Rawatan Air Gapoi	89	B/C	II	94	B/C	I
		Sg. Jempol	4PH96	Loji Air Sg Jerik	86	B/C	II	89	B/C	II
			4PH97	Loji Air Jengka 3	83	B/C	II	89	B/C	II
		Sg. Mentiga	4PH98	Loji Air Chini	86	B/C	II	82	B/C	II
		Sg. Triang	4PH93	Loji Rawatan Air Sg. Triang	82	B/C	II	86	B/C	II
Terengganu	Terengganu	Sg. Terengganu	4TE14	Loji Air Serada	87	B/C	II	89	B/C	II
Kelantan	Golok	Sg. Jeduk	4GL10	Syarikat Air Kelantan	88	B/C	II	90	B/C	II
	Kelantan	Sg. Chiku	4KE66	Felda Ciku 2	86	B/C	II	87	B/C	II
		Sg. Kelantan	4KE68	Loji Air Kelar, Pasir Mas	79	ST/SP	II	78	ST/SP	II
		Sg. Pehi	4KE67	Loji Air Pahi	83	B/C	II	88	B/C	II

Jadual 2.6 : Status Kualiti Air di Hulu Muka Sauk, 2019
Table 2.6 : Water Quality Status of Upstream Water Intakes, 2019

NEGERI/ STATE	LEMBANGAN SUNGAI/ RIVER BASIN	SUNGAI/ RIVER	STESEN ID/ ID STATIONS	MUKA SAUK/ WATER INTAKE	KUALITI AIR, 2018/ WATER QUALITY 2018			KUALITI AIR, 2019/ WATER QUALITY 2019		
					IKA/ WQI	KATEGORI/ CATEGORY	KELAS/ CLASS	IKA/ WQI	KATEGORI/ CATEGORY	KELAS/ CLASS
Sabah	Padas	Sg. Padas	72PD04	Water Intake Jabatan Air Beaufort	88	B/C	II	86	B/C	II
	Papar	Sg. Papar	75PP04	Sekolah Kebangsaan Mandalipau	92	B/C	II	92	B/C	II
			75PP05	Water Intake Kogopon	92	B/C	II	93	B/C	I
Sarawak	Kerian	Sg. Selalang	55SG01	Selalang Water Intake	91	B/C	II	91	B/C	II
	Mukah	Sg. Mukah	58MH05	Mukah Water Intake	85	B/C	II	83	B/C	II
	Rajang	Sg. Daro	56DR01	Daro Water Intake	64	ST/SP	III	76	ST/SP	III
		Sg. Jemoreng	56JG01	Jemoreng Water Intake	63	ST/SP	III	78	ST/SP	II
		Sg. Pakan	56PN01	Pakan Water Intake	89	B/C	II	89	B/C	II
		Sg. Pila Parit	56PL01	Igan Water Intake	71	ST/SP	III	81	B/C	II

Jadual 2.7 : Status Kualiti Air di Hulu Muka Sauk Berdasarkan Sub-Indeks BOD, 2019
Table 2.7 : Water Quality Status of Upstream Water Intakes Based on BOD Sub-Index, 2019

NEGERI/ STATE	LEMBANGAN SUNGAI/ RIVER BASIN	SUNGAI/ RIVER	STESEN ID/ ID STATIONS	MUKA SAUK/ WATER INTAKE	KUALITI AIR, 2018/ WATER QUALITY 2018			KUALITI AIR, 2019/ WATER QUALITY 2019		
					SUB-INDEKS BOD/ BOD SUB-INDEX	KATEGORI/ CATEGORY	KELAS/ CLASS	SUB-INDEKS BOD/ BOD SUB-INDEX	KATEGORI/ CATEGORY	KELAS/ CLASS
Perlis	Perlis	Sg. Terusan Mada	2PS13	Loji Rawatan Air Arau Fasa IV	83	ST/SP	III	81	ST/SP	III
			2PS14	Loji Rawatan Air TTPC, Sg. Baru	82	ST/SP	III	83	ST/SP	III
Kedah (Langkawi)	Melaka	Sg. Melaka	2LG05	Ulu Melaka	77	T/P	III	76	T/P	IV
		Sg. Saga	2LG06	Padang Saga	78	T/P	III	75	T/P	IV
Kedah	Kedah	Sg. Ahning	2KD11	Padang Sanai	82	ST/SP	III	83	ST/SP	III
		Sg. Padang Terap	2KD12	Kuala Nerang	81	ST/SP	III	81	ST/SP	III
		Sg. Temin	2KD10	Changloon	80	ST/SP	III	79	T/P	III
	Muda	Sg. Muda	2MD16	Jeneri	84	ST/SP	III	86	ST/SP	III
			2MD17	Jeniang	82	ST/SP	III	83	ST/SP	III
			2MD18	Bukit Selambau	83	ST/SP	III	83	ST/SP	III
			2MD20	Pinang Tunggal	80	ST/SP	III	83	ST/SP	III
		Sg. Nami	2MD21	Nami	80	ST/SP	III	78	T/P	III
		Sg. Sedim	2MD19	Bikan	84	ST/SP	III	86	ST/SP	III
P.Pinang	Pinang	Sg. Satu	2PG12	Batu Feringgi	86	ST/SP	III	88	ST/SP	II
Perak	Bernam	Sg. Gelinting	1BM15	Loji Rawatan Air Ulu Slim	83	ST/SP	III	83	ST/SP	III
		Sg. Trolak	1BM14	Loji Rawatan Air Trolak Timur	84	ST/SP	III	83	ST/SP	III
	Kurau	Sg. Air Hitam	2KU07	Loji Rawatan Air Jelai	87	ST/SP	III	81	ST/SP	III
	Perak	Sg. Manong	2PK62	Loji Rawatan Air Manong	83	ST/SP	III	90	ST/SP	II
		Sg. Sauk	2PK61	Loji Rawatan Air Sauk	82	ST/SP	III	83	ST/SP	III
		Sg. Tesong	2PK64	Loji Rawatan Air Sg. Klah	87	ST/SP	III	90	ST/SP	II
		Sg. Woh	2PK63	Loji Rawatan Air Kuala Woh	83	ST/SP	III	88	ST/SP	II
	Sepetang	Sg. Batu Tegoh	2SP18	Loji Rawatan Air Bukit Larut	87	ST/SP	III	90	ST/SP	II

Jadual 2.7 : Status Kualiti Air di Hulu Muka Sauk Berdasarkan Sub-Indeks BOD, 2019
Table 2.7 : Water Quality Status of Upstream Water Intakes Based on BOD Sub-Index, 2019

NEGERI/ STATE	LEMBANGAN SUNGAI/ RIVER BASIN	SUNGAI/ RIVER	STESEN ID/ ID STATIONS	MUKA SAUK/ WATER INTAKE	KUALITI AIR, 2018/ WATER QUALITY 2018			KUALITI AIR, 2019/ WATER QUALITY 2019		
					SUB-INDEKS BOD/ BOD SUB-INDEX	KATEGORI/ CATEGORY	KELAS/ CLASS	SUB-INDEKS BOD/ BOD SUB-INDEX	KATEGORI/ CATEGORY	KELAS/ CLASS
Selangor	Klang	Sg. Gombak	1K53	Loji Rawatan Air Gombak	86	ST/SP	III	83	ST/SP	III
	Langat	Sg. Batang Labu	1L26	Loji Rawatan Air Salak Tinggi	80	ST/SP	III	79	T/P	III
		Sg. Semenyih	1L09	Loji Rawatan Air Semenyih	80	ST/SP	III	79	T/P	III
Johor	Batu Pahat	Sg. Semberong Dam	3BP27	Semberong Dam	82	ST/SP	III	81	ST/SP	III
	Benut	Sg. Machap Dam	3BN10	Machap Dam	88	ST/SP	II	83	ST/SP	III
	Endau	Sg. Kahang	3ED38	Jalan Felda Kahang Timur, Kluang	86	ST/SP	III	78	T/P	III
	Muar	Sg. Jelai	1MN23	Loji Rawatan Air Dangi	83	ST/SP	III	79	T/P	III
		Sg. Jementah	3MR39	Loji Rawatan Air Jementah	78	T/P	III	88	ST/SP	II
		Sg. Muar	3MR38	Loji Rawatan Air Gombang	78	T/P	III	88	ST/SP	II
	Pulai	Sg. Pulai Dam	3PU04	Pulai Dam	83	ST/SP	III	81	ST/SP	III
Melaka	Kesang	Sg. Chin-Chin	1KA08	Muka sauk Loji Rawatan Air Chin-chin	81	ST/SP	III	75	T/P	IV
Pahang	Bertam	Sg. Bertam	2CH15	Loji Rawatan Air Habu	88	ST/SP	II	88	ST/SP	II
		Sg. Terla	2CH14	Loji Rawatan Air Kuala Terla	86	ST/SP	III	86	ST/SP	III
		Sg. Ulong	2CH16	Brinchang Dam	86	ST/SP	III	88	ST/SP	II
	Pahang	Sg. Gapoi	4PH95	Muka sauk Loji Rawatan Air Gapoi	82	ST/SP	III	88	ST/SP	II
		Sg. Jempol	4PH96	Loji Air Sg Jerik	81	ST/SP	III	81	ST/SP	III
			4PH97	Loji Air Jengka 3	82	ST/SP	III	88	ST/SP	II
		Sg. Mentiga	4PH98	Loji Air Chini	81	ST/SP	III	86	ST/SP	III
		Sg. Triang	4PH93	Loji Rawatan Air Sg. Triang	82	ST/SP	III	86	ST/SP	III
Terengganu	Terengganu	Sg. Terengganu	4TE14	Loji Air Serada	82	ST/SP	III	88	ST/SP	II

Jadual 2.7 : Status Kualiti Air di Hulu Muka Sauk Berdasarkan Sub-Indeks BOD, 2019
Table 2.7 : Water Quality Status of Upstream Water Intakes Based on BOD Sub-Index, 2019

NEGERI/ STATE	LEMBANGAN SUNGAI/ RIVER BASIN	SUNGAI/ RIVER	STESEN ID/ ID STATIONS	MUKA SAUK/ WATER INTAKE	KUALITI AIR, 2018/ WATER QUALITY 2018			KUALITI AIR, 2019/ WATER QUALITY 2019		
					SUB-INDEKS BOD/ BOD SUB-INDEX	KATEGORI/ CATEGORY	KELAS/ CLASS	SUB-INDEKS BOD/ BOD SUB-INDEX	KATEGORI/ CATEGORY	KELAS/ CLASS
Kelantan	Golok	Sg. Jeduk	4GL10	Syarikat Air Kelantan	81	ST/SP	III	79	T/P	III
	Kelantan	Sg. Chiku	4KE66	Felda Ciku 2	79	T/P	III	76	T/P	IV
		Sg. Kelantan	4KE68	Loji Air Kelar, Pasir Mas	79	T/P	III	81	ST/SP	III
		Sg. Pehi	4KE67	Loji Air Pahi	79	T/P	III	83	ST/SP	III
Sabah	Padas	Sg. Padas	72PD04	Water Intake Jabatan Air Beaufort	96	B/C	II	96	B/C	II
	Papar	Sg. Papar	75PP04	Sekolah Kebangsaan Mandalipau	95	B/C	II	96	B/C	II
			75PP05	Water Intake Kogopon	95	B/C	II	96	B/C	II
Sarawak	Kerian	Sg. Selalang	55SG01	Selalang Water Intake	95	B/C	II	96	B/C	II
	Mukah	Sg. Mukah	58MH05	Mukah Water Intake	96	B/C	II	96	B/C	II
	Rajang	Sg. Daro	56DR01	Daro Water Intake	95	B/C	II	94	B/C	II
		Sg. Jemoreng	56JG01	Jemoreng Water Intake	95	B/C	II	94	B/C	II
		Sg. Pakan	56PN01	Pakan Water Intake	95	B/C	II	96	B/C	II
		Sg. Pila Parit	56PL01	Igan Water Intake	95	B/C	II	92	B/C	II

Jadual 2.8 : Status Kualiti Air di Hulu Muka Sauk Berdasarkan Sub-Indeks AN, 2019
Table 2.8 : Water Quality Status of Upstream Water Intakes Based on AN Sub-Index, 2019

NEGERI/ STATE	LEMBANGAN SUNGAI/ RIVER BASIN	SUNGAI/ RIVER	STESEN ID/ ID STATIONS	MUKA SAUK/ WATER INTAKE	KUALITI AIR, 2018/ WATER QUALITY 2018			KUALITI AIR, 2019/ WATER QUALITY 2019		
					SUB-INDEKS AN/ AN SUB-INDEX	KATEGORI/ CATEGORY	KELAS/ CLASS	SUB-INDEKS AN/ AN SUB-INDEX	KATEGORI/ CATEGORY	KELAS/ CLASS
Perlis	Perlis	Sg. Terusan Mada	2PS13	Loji Rawatan Air Arau Fasa IV	92	B/C	I	95	B/C	I
			2PS14	Loji Rawatan Air TTPC, Sg. Baru	90	ST/SP	II	91	ST/SP	I
Kedah (Langkawi)	Melaka	Sg. Melaka	2LG05	Ulu Melaka	92	B/C	I	93	B/C	I
		Sg. Saga	2LG06	Padang Saga	79	ST/SP	II	82	ST/SP	II
Kedah	Kedah	Sg. Ahning	2KD11	Padang Sanai	96	B/C	I	99	B/C	I
		Sg. Padang Terap	2KD12	Kuala Nerang	84	ST/SP	II	96	B/C	I
		Sg. Temin	2KD10	Changloon	70	T/P	II	80	ST/SP	II
	Muda	Sg. Muda	2MD16	Jeneri	89	ST/SP	II	94	B/C	I
			2MD17	Jeniang	95	B/C	I	93	B/C	I
			2MD18	Bukit Selambau	92	B/C	I	92	B/C	I
			2MD20	Pinang Tunggal	83	ST/SP	II	87	ST/SP	II
		Sg. Nami	2MD21	Nami	96	B/C	I	96	B/C	I
		Sg. Sedim	2MD19	Bikan	92	B/C	I	95	B/C	I
P.Pinang	Pinang	Sg. Satu	2PG12	Batu Feringgi	96	B/C	I	99	B/C	I
Perak	Bernam	Sg. Gelinting	1BM15	Loji Rawatan Air Ulu Slim	97	B/C	I	96	B/C	I
		Sg. Trolak	1BM14	Loji Rawatan Air Trolak Timur	92	B/C	I	99	B/C	I
	Kurau	Sg. Air Hitam	2KU07	Loji Rawatan Air Jelai	93	B/C	I	99	B/C	I
	Perak	Sg. Manong	2PK62	Loji Rawatan Air Manong	98	B/C	I	97	B/C	I
		Sg. Sauk	2PK61	Loji Rawatan Air Sauk	79	ST/SP	II	98	B/C	I
		Sg. Tesong	2PK64	Loji Rawatan Air Sg. Klah	98	B/C	I	98	B/C	I
		Sg. Woh	2PK63	Loji Rawatan Air Kuala Woh	97	B/C	I	99	B/C	I
	Sepetang	Sg. Batu Tegoh	2SP18	Loji Rawatan Air Bukit Larut	97	B/C	I	98	B/C	I
Selangor	Klang	Sg. Gombak	1K53	Loji Rawatan Air Gombak	97	B/C	I	97	B/C	I

Jadual 2.8 : Status Kualiti Air di Hulu Muka Sauk Berdasarkan Sub-Indeks AN, 2019
Table 2.8 : Water Quality Status of Upstream Water Intakes Based on AN Sub-Index, 2019

NEGERI/ STATE	LEMBANGAN SUNGAI/ RIVER BASIN	SUNGAI/ RIVER	STESEN ID/ ID STATIONS	MUKA SAUK/ WATER INTAKE	KUALITI AIR, 2018/ WATER QUALITY 2018			KUALITI AIR, 2019/ WATER QUALITY 2019		
					SUB-INDEKS AN/ AN SUB-INDEX	KATEGORI/ CATEGORY	KELAS/ CLASS	SUB-INDEKS AN/ AN SUB-INDEX	KATEGORI/ CATEGORY	KELAS/ CLASS
Selangor	Langat	Sg. Batang Labu	1L26	Loji Rawatan Air Salak Tinggi	41	T/P	IV	38	T/P	IV
		Sg. Semenyih	1L09	Loji Rawatan Air Semenyih	66	T/P	III	60	T/P	III
Johor	Batu Pahat	Sg. Semberong Dam	3BP27	Semberong Dam	92	B/C	I	96	B/C	I
	Benut	Sg. Machap Dam	3BN10	Machap Dam	61	T/P	III	72	ST/SP	II
	Endau	Sg. Kahang	3ED38	Jalan Felda Kahang Timur, Kluang	74	ST/SP	II	87	ST/SP	II
	Muar	Sg. Jelai	1MN23	Loji Rawatan Air Dangi	92	B/C	I	97	B/C	I
		Sg. Jementah	3MR39	Loji Rawatan Air Jementah	97	B/C	I	93	B/C	I
		Sg. Muar	3MR38	Loji Rawatan Air Gombang	90	ST/SP	II	91	ST/SP	I
	Pulai	Sg. Pulai Dam	3PU04	Pulai Dam	93	B/C	I	79	ST/SP	II
Melaka	Kesang	Sg. Chin-Chin	1KA08	Muka sauk Loji Rawatan Air Chin-chin	87	ST/SP	II	97	B/C	I
Pahang	Bertam	Sg. Bertam	2CH15	Loji Rawatan Air Habu	94	B/C	I	99	B/C	I
		Sg. Terla	2CH14	Loji Rawatan Air Kuala Terla	98	B/C	I	94	B/C	I
		Sg. Ulong	2CH16	Brinchang Dam	93	B/C	I	99	B/C	I
	Pahang	Sg. Gapoi	4PH95	Muka sauk Loji Rawatan Air Gapoi	86	ST/SP	II	98	B/C	I
		Sg. Jempol	4PH96	Loji Air Sg Jerik	92	B/C	I	93	B/C	I
			4PH97	Loji Air Jengka 3	84	ST/SP	II	92	B/C	I
		Sg. Mentiga	4PH98	Loji Air Chini	92	B/C	I	91	ST/SP	I
		Sg. Triang	4PH93	Loji Rawatan Air Sg. Triang	88	ST/SP	II	96	B/C	I
Terengganu	Terengganu	Sg. Terengganu	4TE14	Loji Air Serada	87	ST/SP	II	89	ST/SP	II
Kelantan	Golok	Sg. Jeduk	4GL10	Syarikat Air Kelantan	87	ST/SP	II	93	B/C	I
	Kelantan	Sg. Chiku	4KE66	Felda Ciku 2	92	B/C	I	93	B/C	I

Jadual 2.8 : Status Kualiti Air di Hulu Muka Sauk Berdasarkan Sub-Indeks AN, 2019
Table 2.8 : Water Quality Status of Upstream Water Intakes Based on AN Sub-Index, 2019

NEGERI/ STATE	LEMBANGAN SUNGAI/ RIVER BASIN	SUNGAI/ RIVER	STESEN ID/ ID STATIONS	MUKA SAUK/ WATER INTAKE	KUALITI AIR, 2018/ WATER QUALITY 2018			KUALITI AIR, 2019/ WATER QUALITY 2019		
					SUB-INDEKS AN/ AN SUB-INDEX	KATEGORI/ CATEGORY	KELAS/ CLASS	SUB-INDEKS AN/ AN SUB-INDEX	KATEGORI/ CATEGORY	KELAS/ CLASS
Kelantan	Kelantan	Sg. Kelantan	4KE68	Loji Air Kelar, Pasir Mas	93	B/C	I	91	ST/SP	I
		Sg. Pehi	4KE67	Loji Air Pahi	94	B/C	I	97	B/C	I
Sabah	Padas	Sg. Padas	72PD04	Water Intake Jabatan Air Beaufort	90	ST/SP	II	86	ST/SP	II
	Papar	Sg. Papar	75PP04	Sekolah Kebangsaan Mandalipau	90	ST/SP	II	88	ST/SP	II
			75PP05	Water Intake Kogopon	91	ST/SP	I	92	B/C	I
Sarawak	Kerian	Sg. Selalang	55SG01	Selalang Water Intake	83	ST/SP	II	67	T/P	III
	Mukah	Sg. Mukah	58MH05	Mukah Water Intake	83	ST/SP	II	74	ST/SP	II
	Rajang	Sg. Daro	56DR01	Daro Water Intake	58	T/P	III	66	T/P	III
		Sg. Jemoreng	56JG01	Jemoreng Water Intake	61	T/P	III	69	T/P	III
		Sg. Pakan	56PN01	Pakan Water Intake	73	ST/SP	II	74	ST/SP	II
		Sg. Pila Parit	56PL01	Igan Water Intake	64	T/P	III	77	ST/SP	II

Jadual 2.9 : Status Kualiti Air di Hulu Muka Sauk Berdasarkan Sub-Indeks SS, 2019
Table 2.9 : Water Quality Status of Upstream Water Intakes Based on SS Sub-Index, 2019

NEGERI/ STATE	LEMBANGAN SUNGAI/ RIVER BASIN	SUNGAI/ RIVER	STESEN ID/ ID STATIONS	MUKA SAUK/ WATER INTAKE	KUALITI AIR, 2018/ WATER QUALITY 2018			KUALITI AIR, 2019/ WATER QUALITY 2019		
					SUB-INDEKS SS/ SS SUB-INDEX	KATEGORI / CATEGORY	KELAS / CLASS	SUB-INDEKS SS/SS SUB-INDEX	KATEGORI / CATEGORY	KELAS/ CLASS
Perlis	Perlis	Sg. Terusan Mada	2PS13	Loji Rawatan Air Arau Fasa IV	65	T/P	III	70	T/P	III
			2PS14	Loji Rawatan Air TTPC, Sg. Baru	73	ST/SP	II	78	ST/SP	II
Kedah (Langkawi)	Melaka	Sg. Melaka	2LG05	Ulu Melaka	76	B/C	II	71	B/C	III
		Sg. Saga	2LG06	Padang Saga	82	B/C	II	79	B/C	II
Kedah	Kedah	Sg. Ahning	2KD11	Padang Sanai	60	T/P	III	75	T/P	II
		Sg. Padang Terap	2KD12	Kuala Nerang	86	B/C	I	93	B/C	I
		Sg. Temin	2KD10	Changloon	56	T/P	III	68	T/P	III
	Muda	Sg. Muda	2MD16	Jeneri	63	T/P	III	72	T/P	II
			2MD17	Jeniang	59	T/P	III	68	T/P	III
			2MD18	Bukit Selambau	61	T/P	III	63	T/P	III
			2MD20	Pinang Tunggal	70	ST/SP	III	78	ST/SP	II
		Sg. Nami	2MD21	Nami	71	ST/SP	III	75	ST/SP	II
		Sg. Sedim	2MD19	Bikan	64	T/P	III	60	T/P	III
P.Pinang	Pinang	Sg. Satu	2PG12	Batu Feringgi	87	B/C	I	94	B/C	I
Perak	Bernam	Sg. Gelinting	1BM15	Loji Rawatan Air Ulu Slim	74	ST/SP	II	77	ST/SP	II
		Sg. Trolak	1BM14	Loji Rawatan Air Trolak Timur	77	B/C	II	89	B/C	I
	Kurau	Sg. Air Hitam	2KU07	Loji Rawatan Air Jelai	93	B/C	I	90	B/C	I
	Perak	Sg. Manong	2PK62	Loji Rawatan Air Manong	93	B/C	I	95	B/C	I
		Sg. Sauk	2PK61	Loji Rawatan Air Sauk	94	B/C	I	93	B/C	I
		Sg. Tesong	2PK64	Loji Rawatan Air Sg. Klah	93	B/C	I	94	B/C	I
		Sg. Woh	2PK63	Loji Rawatan Air Kuala Woh	91	B/C	I	95	B/C	I
	Sepetang	Sg. Batu Tegoh	2SP18	Loji Rawatan Air Bukit Larut	96	B/C	I	95	B/C	I

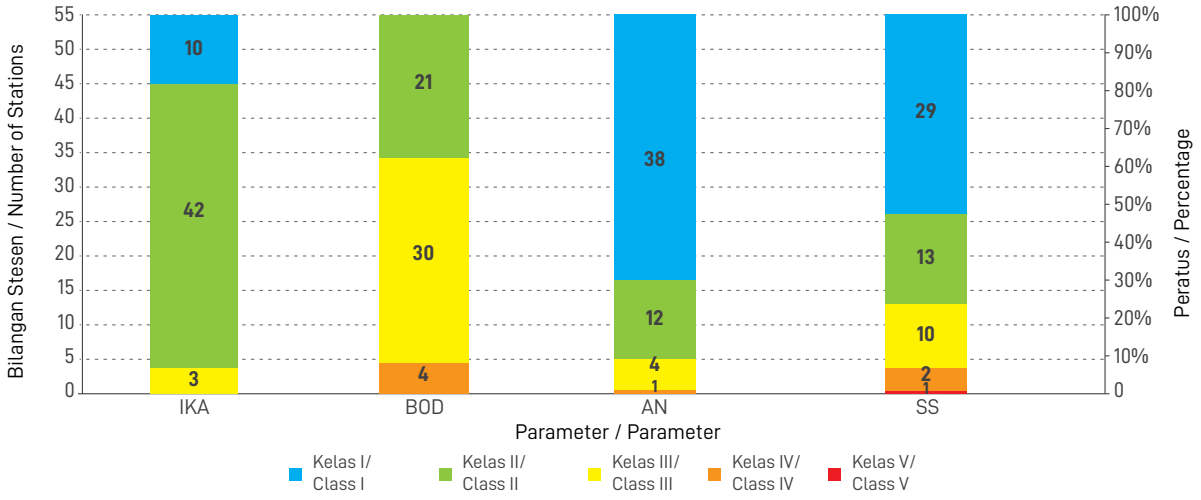
Jadual 2.9 : Status Kualiti Air di Hulu Muka Sauk Berdasarkan Sub-Indeks SS, 2019

Table 2.9 : Water Quality Status of Upstream Water Intakes Based on SS Sub-Index, 2019

NEGERI/ STATE	LEMBANGAN SUNGAI/ RIVER BASIN	SUNGAI/ RIVER	STESEN ID/ ID STATIONS	MUKA SAUK/ WATER INTAKE	KUALITI AIR, 2018/ WATER QUALITY 2018			KUALITI AIR, 2019/ WATER QUALITY 2019		
					SUB-INDEKS SS/ SS SUB-INDEX	KATEGORI / CATEGORY	KELAS / CLASS	SUB-INDEKS SS/SS SUB-INDEX	KATEGORI / CATEGORY	KELAS/ CLASS
Selangor	Klang	Sg. Gombak	1K53	Loji Rawatan Air Gombak	91	B/C	I	93	B/C	I
	Langat	Sg. Batang Labu	1L26	Loji Rawatan Air Salak Tinggi	62	T/P	III	64	T/P	III
		Sg. Semenyih	1L09	Loji Rawatan Air Semenyih	50	T/P	IV	53	T/P	IV
Johor	Batu Pahat	Sg. Semberong Dam	3BP27	Semberong Dam	88	B/C	I	84	B/C	II
	Benut	Sg. Machap Dam	3BN10	Machap Dam	66	T/P	III	90	T/P	I
	Endau	Sg. Kahang	3ED38	Jalan Felda Kahang Timur, Kluang	90	B/C	I	91	B/C	I
	Muar	Sg. Jelai	1MN23	Loji Rawatan Air Dangi	51	T/P	IV	80	T/P	II
		Sg. Jementah	3MR39	Loji Rawatan Air Jementah	81	B/C	II	93	B/C	I
		Sg. Muar	3MR38	Loji Rawatan Air Gombang	83	B/C	II	79	B/C	II
	Pulai	Sg. Pulai Dam	3PU04	Pulai Dam	93	B/C	I	93	B/C	I
Melaka	Kesang	Sg. Chin-Chin	1KA08	Muka sauk Loji Rawatan Air Chin-chin	67	T/P	III	57	T/P	III
Pahang	Bertam	Sg. Bertam	2CH15	Loji Rawatan Air Habu	90	B/C	I	95	B/C	I
		Sg. Terla	2CH14	Loji Rawatan Air Kuala Terla	87	B/C	I	94	B/C	I
		Sg. Ulong	2CH16	Brinchang Dam	93	B/C	I	95	B/C	I
	Pahang	Sg. Gapoi	4PH95	Muka sauk Loji Rawatan Air Gapoi	92	B/C	I	93	B/C	I
		Sg. Jempol	4PH96	Loji Air Sg Jerik	75	ST/SP	II	87	ST/SP	I
			4PH97	Loji Air Jengka 3	71	ST/SP	III	80	ST/SP	II
		Sg. Mentiga	4PH98	Loji Air Chini	77	B/C	II	84	B/C	II
		Sg. Triang	4PH93	Loji Rawatan Air Sg. Triang	52	T/P	IV	57	T/P	III

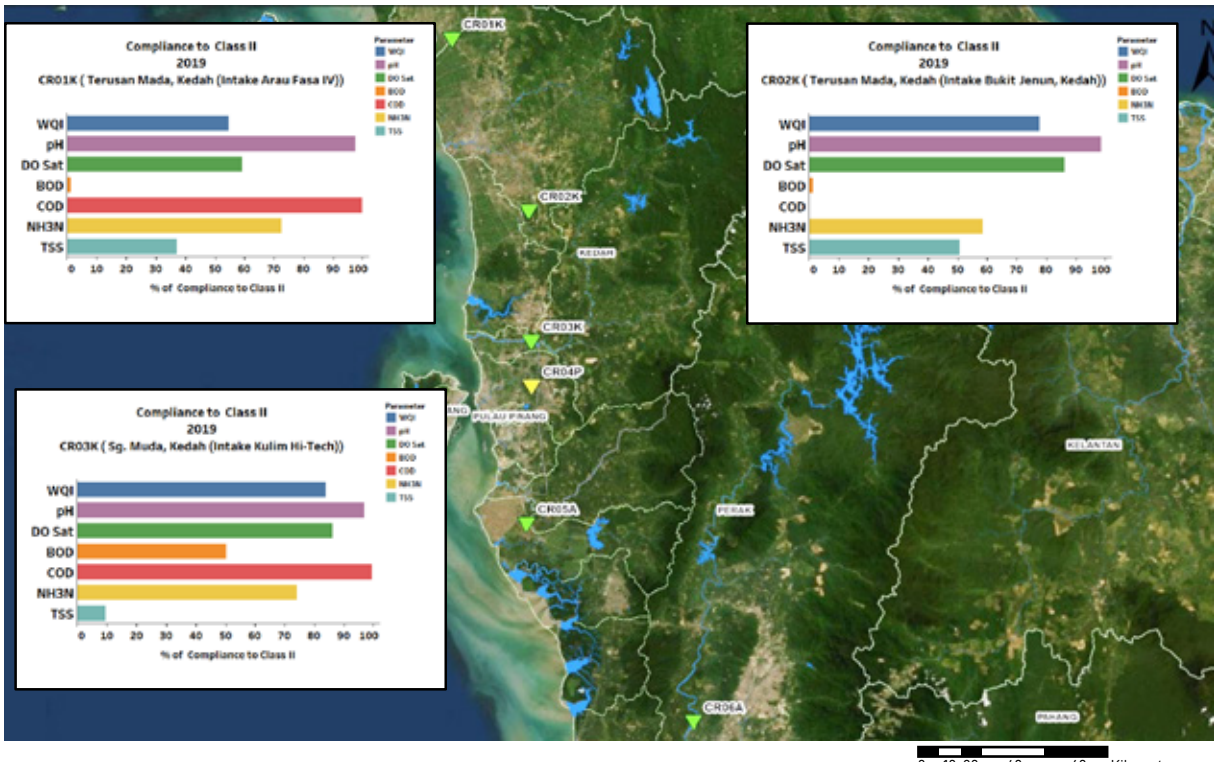
Jadual 2.9 : Status Kualiti Air di Hulu Muka Sauk Berdasarkan Sub-Indeks SS, 2019
Table 2.9 : Water Quality Status of Upstream Water Intakes Based on SS Sub-Index, 2019

NEGERI/ STATE	LEMBANGAN SUNGAI/ RIVER BASIN	SUNGAI/ RIVER	STESEN ID/ ID STATIONS	MUKA SAUK/ WATER INTAKE	KUALITI AIR, 2018/ WATER QUALITY 2018			KUALITI AIR, 2019/ WATER QUALITY 2019		
					SUB-INDEKS SS/ SS SUB-INDEX	KATEGORI / CATEGORY	KELAS / CLASS	SUB-INDEKS SS/SS SUB-INDEX	KATEGORI / CATEGORY	KELAS/ CLASS
Terengganu	Terengganu	Sg. Terengganu	4TE14	Loji Air Serada	92	B/C	I	87	B/C	I
Kelantan	Golok	Sg. Jeduk	4GL10	Syarikat Air Kelantan	82	B/C	II	96	B/C	I
	Kelantan	Sg. Chiku	4KE66	Felda Ciku 2	78	B/C	II	90	B/C	I
		Sg. Kelantan	4KE68	Loji Air Kelar, Pasir Mas	27	T/P	V	38	T/P	V
		Sg. Pehi	4KE67	Loji Air Pahi	49	T/P	IV	71	T/P	III
Sabah	Padas	Sg. Padas	72PD04	Water Intake Jabatan Air Beaufort	63	T/P	III	52	T/P	IV
	Papar	Sg. Papar	75PP04	Sekolah Kebangsaan Mandalipau	90	B/C	I	91	B/C	I
			75PP05	Water Intake Kogopon	85	B/C	I	91	B/C	I
Sarawak	Kerian	Sg. Selalang	55SG01	Selalang Water Intake	89	B/C	I	94	B/C	I
	Mukah	Sg. Mukah	58MH05	Mukah Water Intake	69	T/P	III	78	T/P	II
	Rajang	Sg. Daro	56DR01	Daro Water Intake	87	B/C	I	92	B/C	I
		Sg. Jemoreng	56JG01	Jemoreng Water Intake	93	B/C	I	91	B/C	I
		Sg. Pakan	56PN01	Pakan Water Intake	84	B/C	II	85	B/C	I
		Sg. Pila Parit	56PL01	Igan Water Intake	88	B/C	I	91	B/C	I



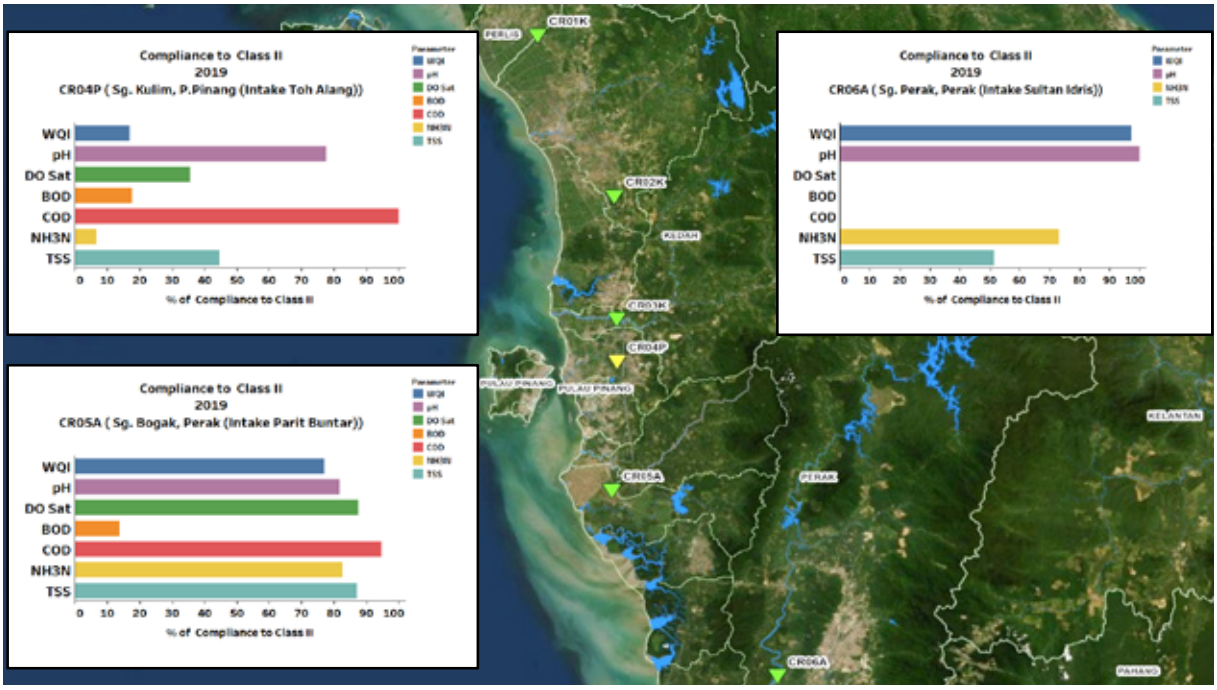
Rajah 2.6 : Kualiti Air Sungai di Stesen di Hulu Muka Sauk, 2019
Figure 2.6 : River Water Quality at Upstream Stations of Water Intakes, 2019

CRWQM - WILAYAH UTARA
CRWQM - NORTHERN REGION



Basemap
Water Body
State Boundary
Basin

River WQI
Class I
Class II
Class III
Class IV
Class V
WQI Not Avilable

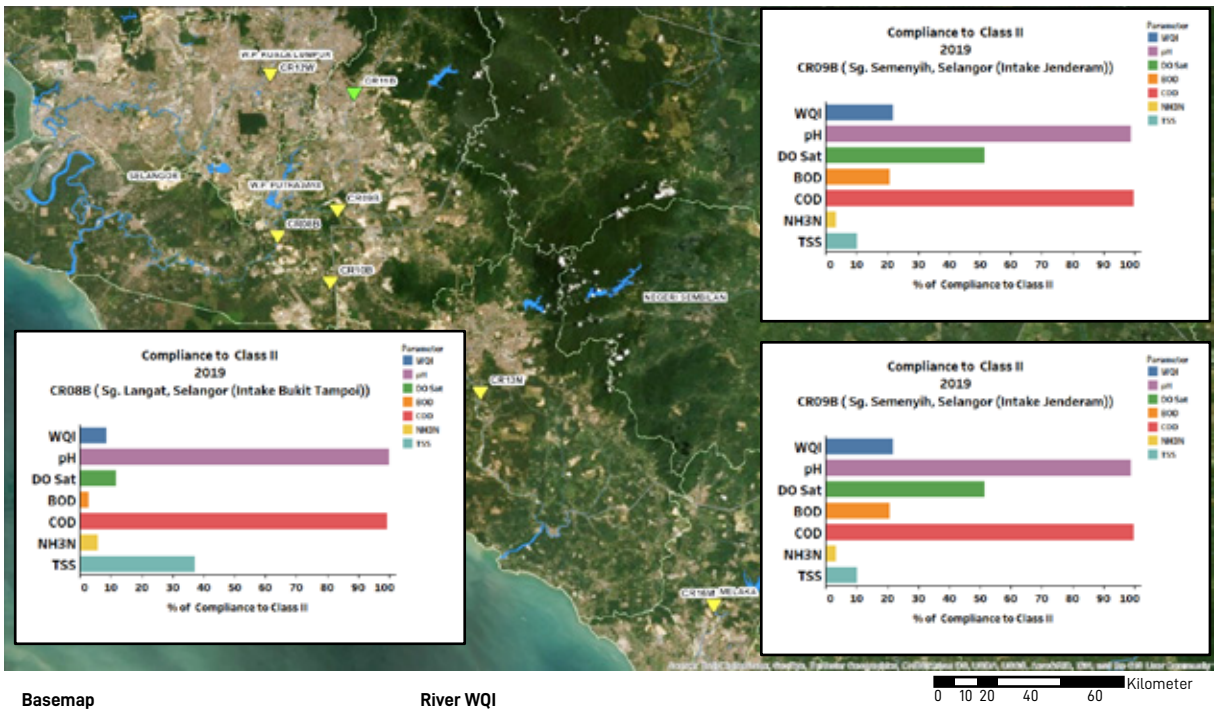


Basemap
Water Body
State Boundary
Basin

River WQI
Class I
Class II
Class III
Class IV
Class V
WQI Not Avilable

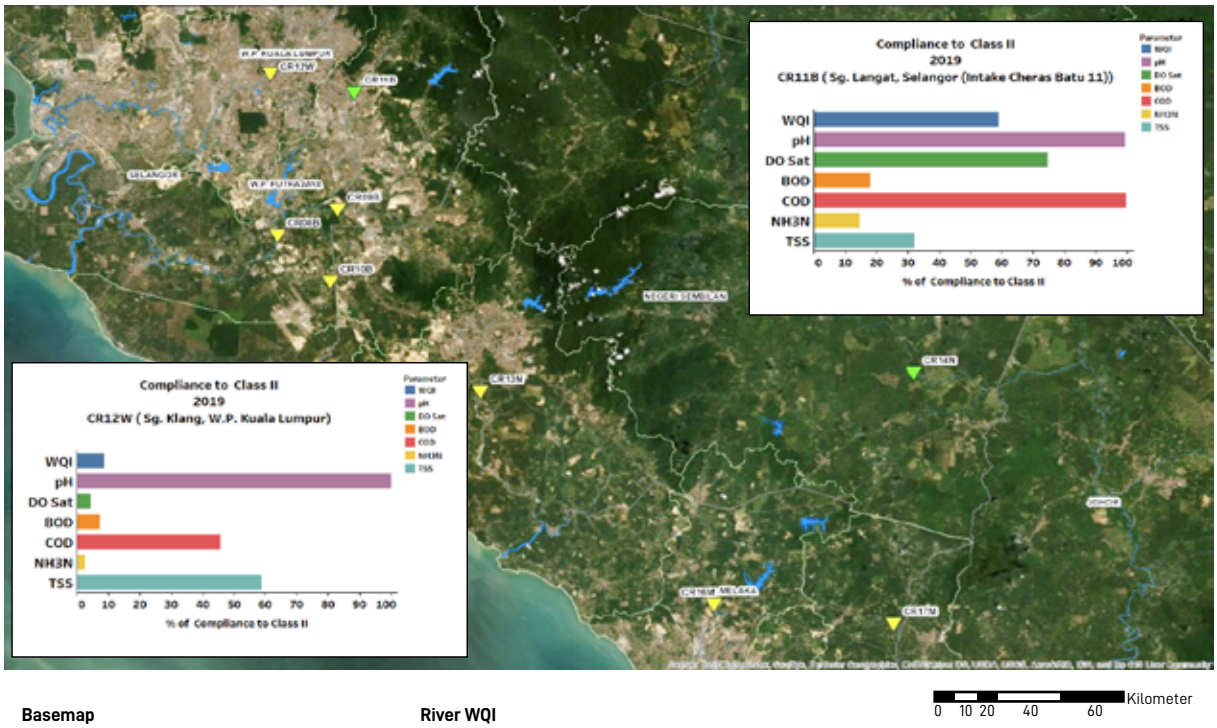
Peratus Pematuhan Kelas II (Utara)
Percentage of Compliance to Class II (Northern)

CRWQM - WILAYAH TENGAH
CRWQM - CENTRAL REGION



Basemap
Water Body
State Boundary
Basin

River WQI
Class I
Class II
Class III
Class IV
Class V
WQI Not Avilable

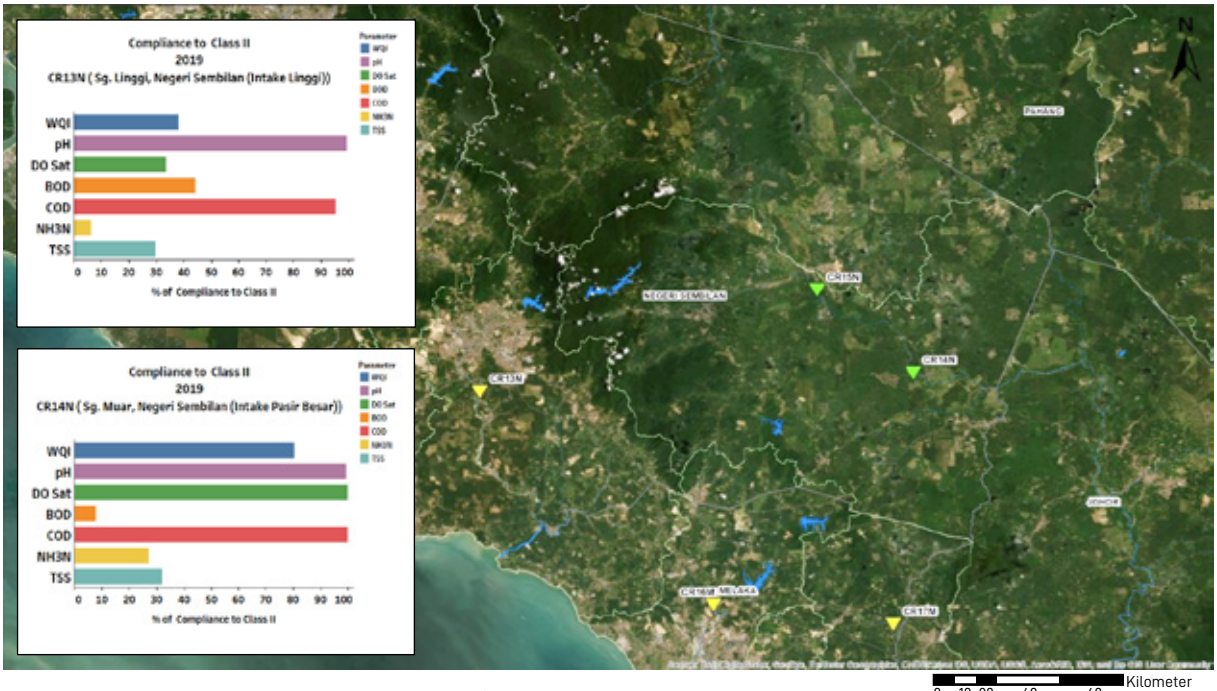


Basemap
Water Body
State Boundary
Basin

River WQI
Class I
Class II
Class III
Class IV
Class V
WQI Not Avilable

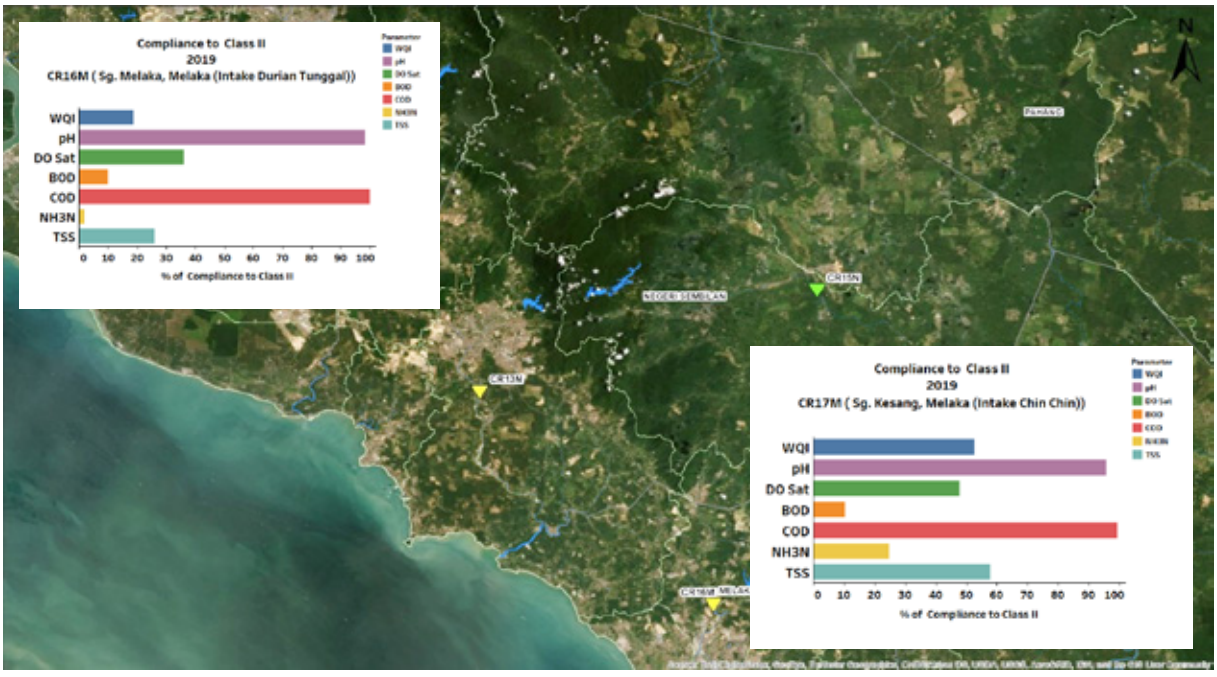
Peratus Pematuhan Kelas II (Tengah)
Percentage of Compliance to Class II (Central)

CRWQM - WILAYAH TENGAH
CRWQM - CENTRAL REGION



Basemap
Water Body
State Boundary
Basin

River WQI
Class I
Class II
Class III
Class IV
Class V
WQI Not Avilable

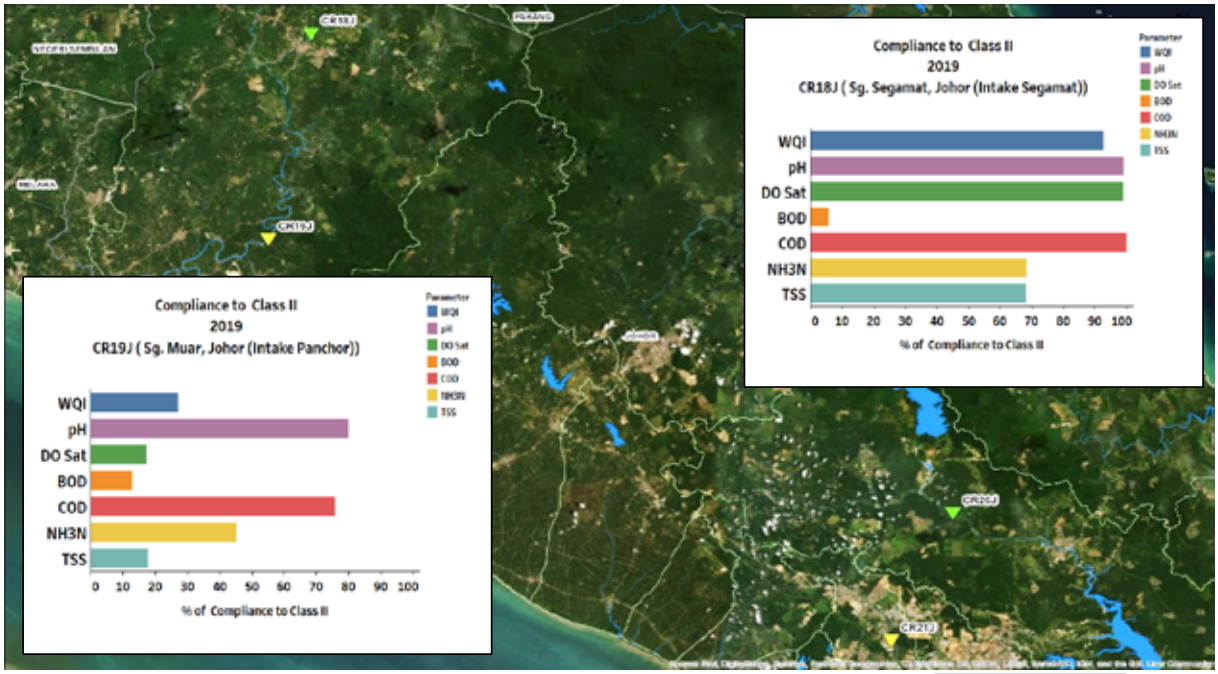


Basemap
Water Body
State Boundary
Basin

River WQI
Class I
Class II
Class III
Class IV
Class V
WQI Not Avilable

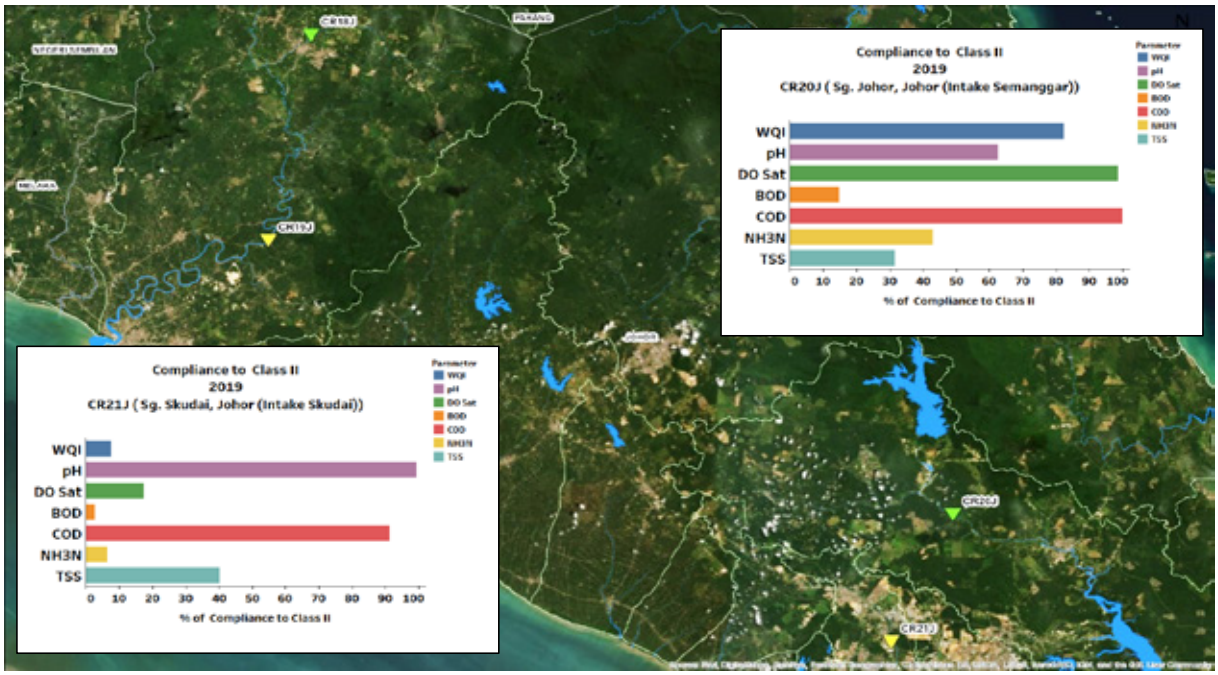
Peratus Pematuhan Kelas II (Tengah)
Percentage of Compliance to Class II (Central)

CRWQM - WILAYAH SELATAN
CRWQM - SOUTHERN REGION



Basemap
Water Body
State Boundary
Basin

River WQI
Class I
Class II
Class III
Class IV
Class V
WQI Not Avilable

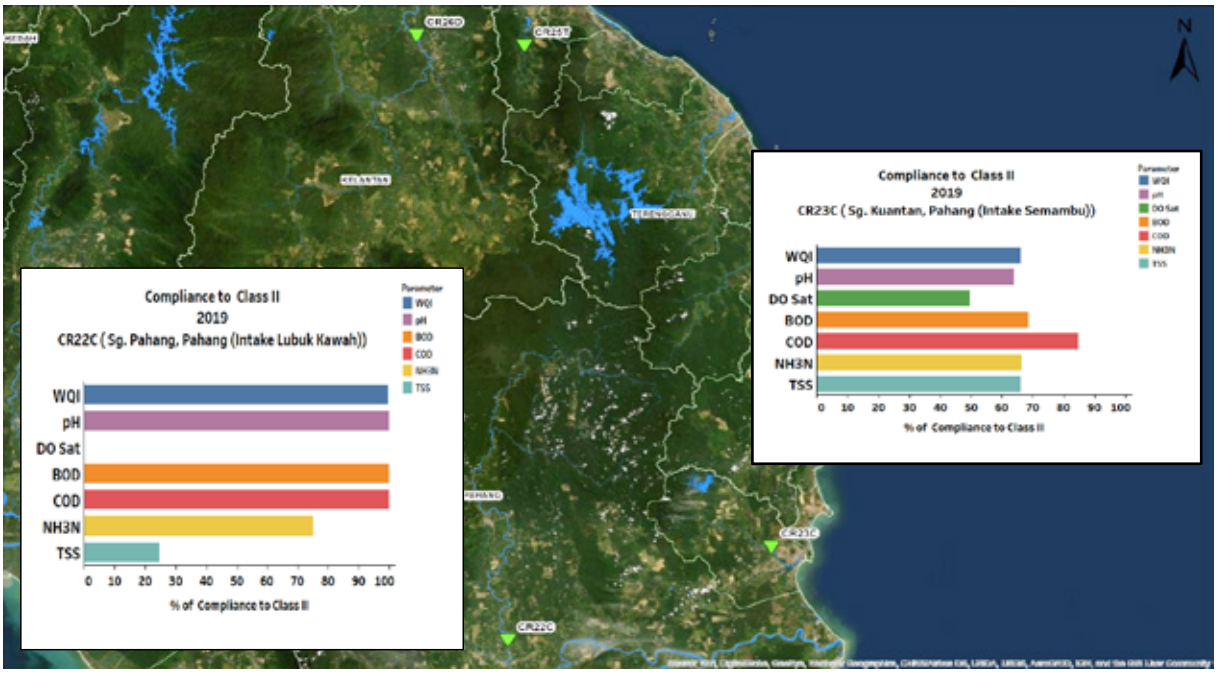


Basemap
Water Body
State Boundary
Basin

River WQI
Class I
Class II
Class III
Class IV
Class V
WQI Not Avilable

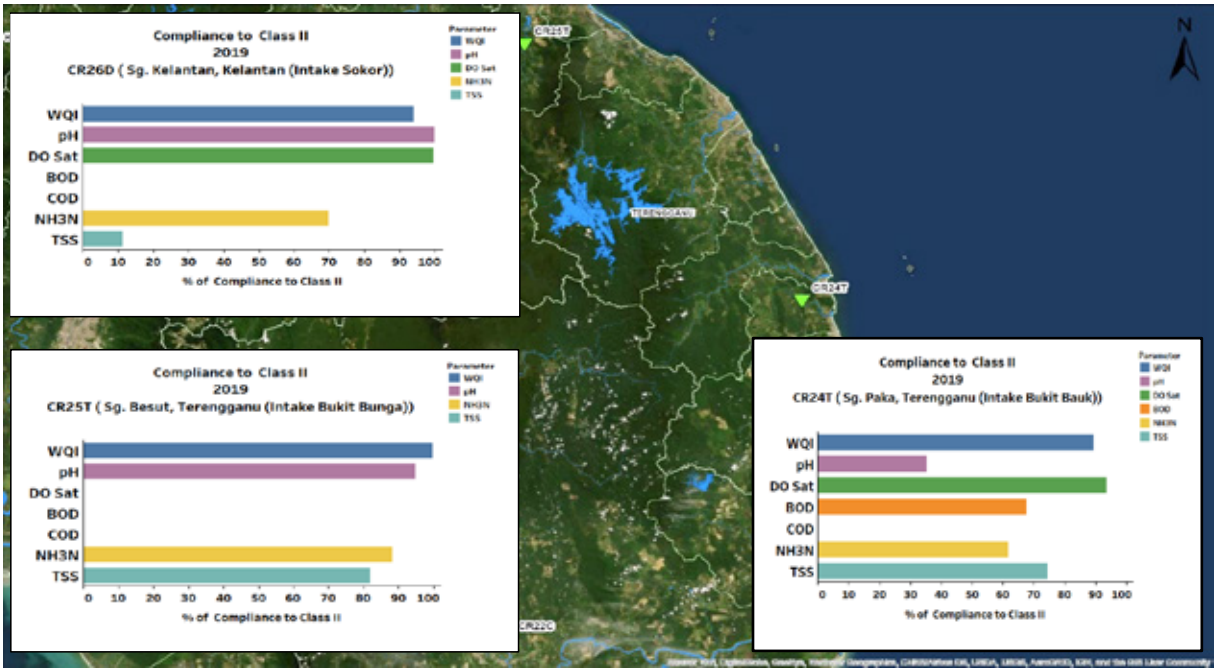
Peratus Pematuhan Kelas II (Selatan)
Percentage of Compliance to Class II (Southern)

CRWQM - WILAYAH TIMUR
CRWQM - EASTERN REGION



Basemap
Water Body
State Boundary
Basin

River WQI
Class I
Class II
Class III
Class IV
Class V
WQI Not Avilable

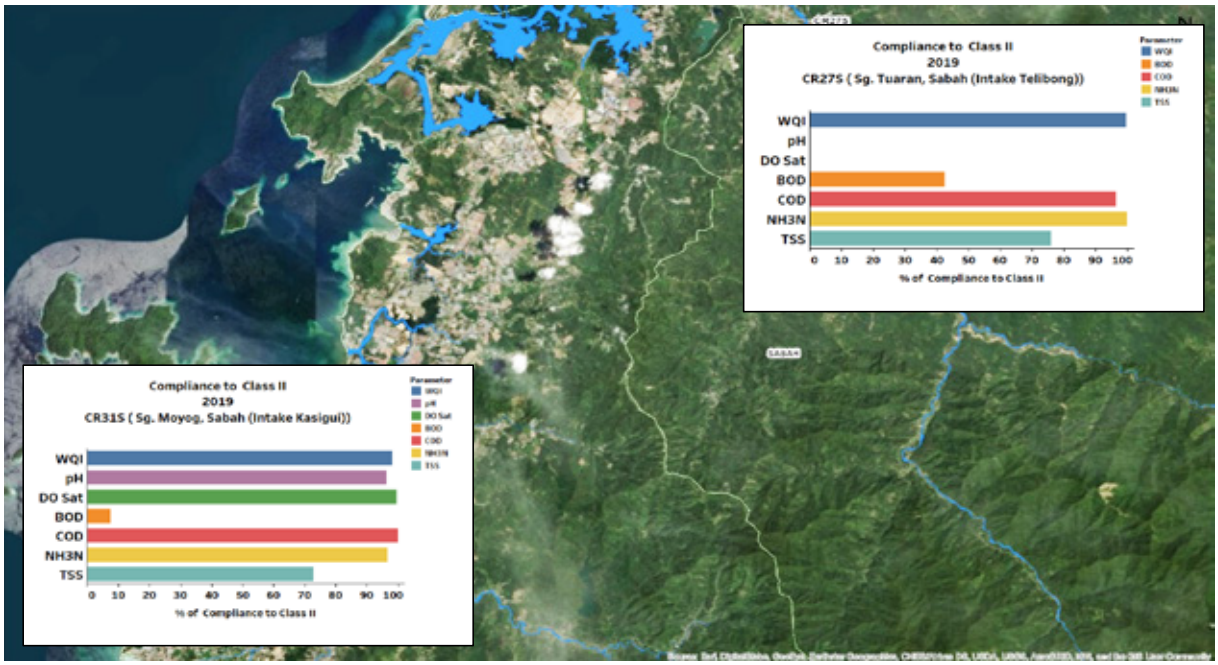


Basemap
Water Body
State Boundary
Basin

River WQI
Class I
Class II
Class III
Class IV
Class V
WQI Not Avilable

Peratus Pematuhan Kelas II (Timur)
Percentage of Compliance to Class II (Eastern)

CRWQM - WILAYAH SABAH
CRWQM - SABAH REGION

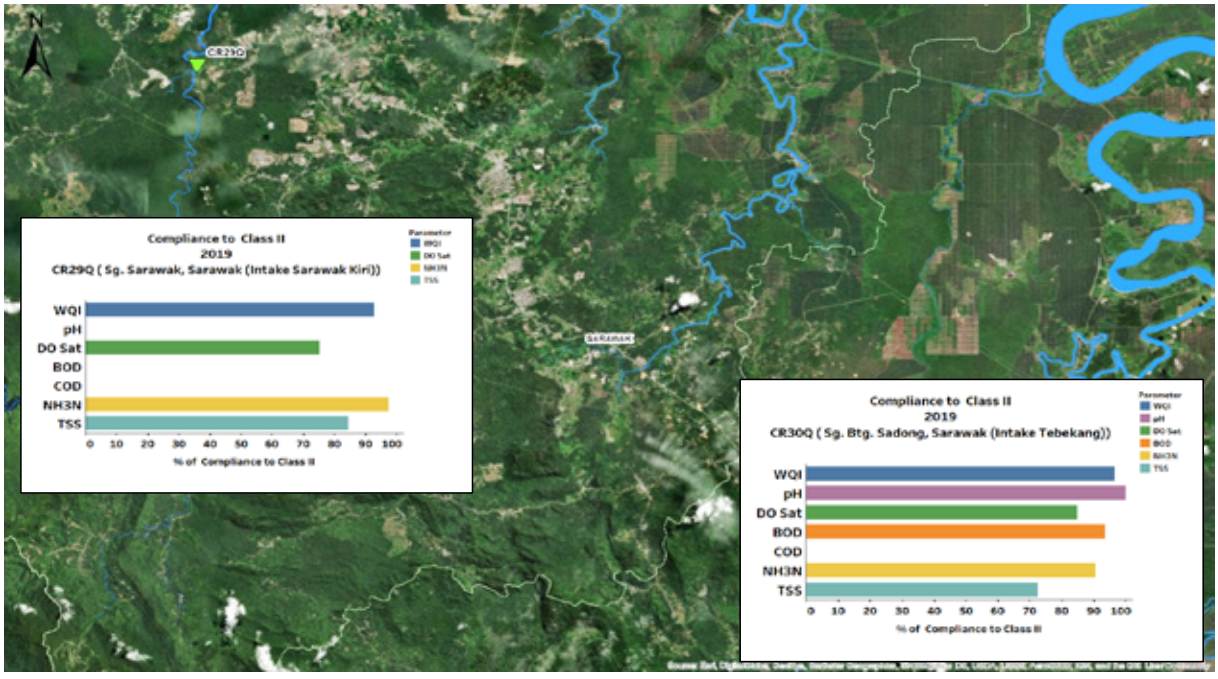


Basemap
Water Body
State Boundary
Basin

River WQI
Class I
Class II
Class III
Class IV
Class V
WQI Not Avilable

Peratus Pematuhan Kelas II (Sabah)
Percentage of Compliance to Class II (Sabah)

CRWQM - WILAYAH SARAWAK
CRWQM -SARAWAK REGION



Basemap
Water Body
State Boundary
Basin

River WQI
Class I
Class II
Class III
Class IV
Class V
WQI Not Avilable

Peratus Pematuhan Kelas II (Sarawak)
Percentage of Compliance to Class II (Sarawak)

BAB 3
CHAPTER 3

KUALITI AIR TANAH
GROUND WATER QUALITY

PENGAWASAN KUALITI AIR TANAH
GROUNDWATER QUALITY MONITORING

Program Pengawasan Kualiti Air Tanah Kebangsaan telah dimulakan semenjak tahun 1997. Tapak stesen pengawasan yang telah dipilih adalah mewakili jenis guna tanah spesifik. Program pengawasan telah dijalankan terhadap 120 buah stesen pengawasan kualiti air tanah (telaga) di seluruh negara. Walau bagaimanapun hanya 115 stesen telah dijalankan persampelan air tanah. Ini memandangkan terdapat stesen pengawasan kualiti air tanah yang tiada luahan air akibat faktor pembangunan dan rekahan batuan di dalam stesen tersebut (telaga air tanah). **Jadual 3.1** menunjukkan taburan stesen pengawasan kualiti air tanah seluruh Malaysia mengikut jenis kategori guna tanah.

Groundwater water quality monitoring was established in 1997. The sites were selected based on specific land use. Groundwater monitoring program have been carried out on 120 groundwater quality monitoring stations (wells) throughout the country. However, only 115 stations were conducted for groundwater sampling. This is for the reasons of no discharge of groundwater due to development factors and rocks cracking in the groundwater quality monitoring stations. **Table 3.1** shows the distribution of groundwater quality monitoring stations (wells) throughout the state in Malaysia by land use category.

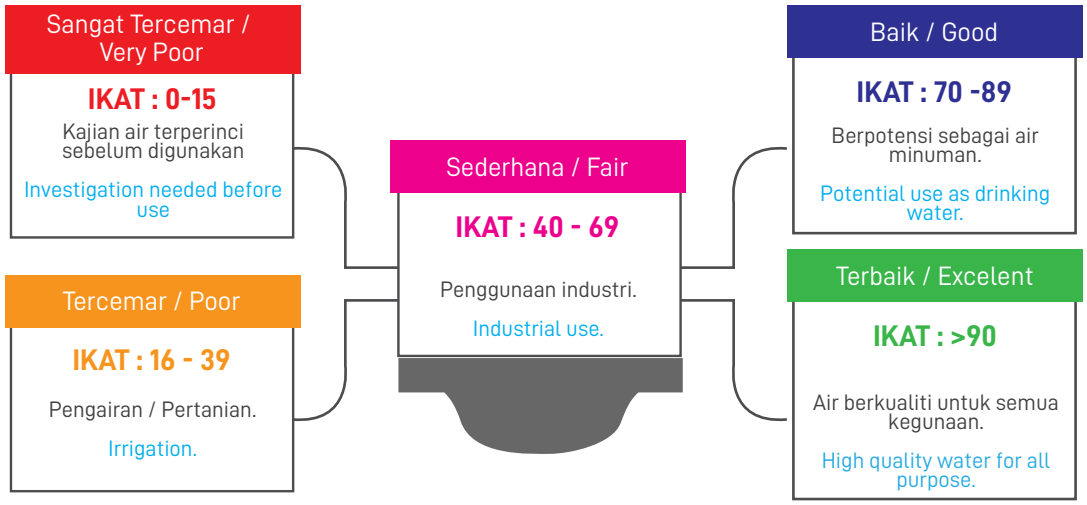
Pada tahun 2019, sebanyak 459 sampel telah dianalisa untuk bahan kimia organik meruap (VOCs), racun perosak, logam berat, anion, bakteria (koliform), sebatian berfenol, jumlah keliatan, jumlah pepejal terlarut, pH, suhu, konduktiviti dan oksigen terlarut (DO).

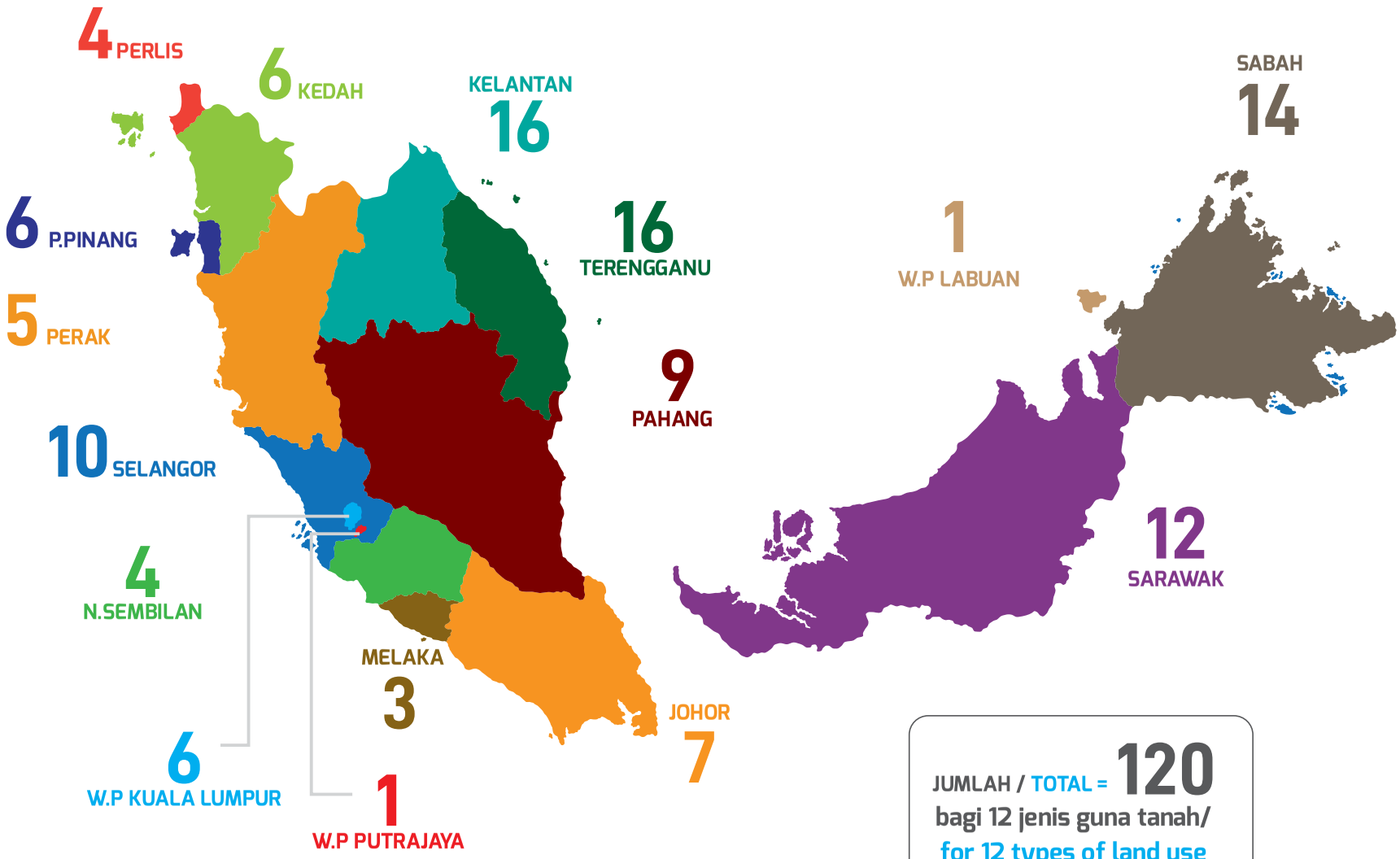
In 2019, 459 samples were analyzed for volatile organic compounds (VOCs), pesticides, heavy metals, anions, bacteria (coliform), phenolic compounds, total hardness, total dissolved solids (TDS), pH, temperature, conductivity and dissolved oxygen (DO).

Indeks Kualiti Air Tanah (IKAT) digunakan sebagai satu kaedah menentukan kategori dan status kualiti air tanah. IKAT dibangunkan berdasarkan 7 parameter utama iaitu pH, besi, jumlah pepejal terlarut, nitrat, e.coli, fenol dan sulfate . IKAT yang berskala 0 hingga 100 akan menentukan kategori kualiti air tanah dari terbaik hingga sangat tercemar **(Jadual 3.2)**.

The Malaysia Groundwater Quality Index (MGQI) is used as a method to determine the groundwater quality status and its category. MGQI was developed based on the main parameters which are pH, iron, total dissolved solids, nitrate, E-Coli, phenol and sulphate. MGQI with a scale quality ranging from 0 to 100 that will identify quality of the groundwater from excellent to very poor. **(Table 3.2).**

Jadual 3.2: Klasifikasi Indek Kualiti Air Tanah
Table 3.2: Groundwater Quality Index Classification





Peta Malaysia: Jumlah Telaga Pengawasan Bagi Setiap Negeri Seluruh Malaysia, 2019.
Malaysia Map: Monitoring Well For Each States Of Malaysia, 2019.

Jadual 3.1: Taburan Stesen Pengawasan Kualiti Air Tanah di Seluruh Negeri di Malaysia Mengikut Jenis Kategori Guna Tanah, 2019

Table 3.1: Distribution of Groundwater Quality Monitoring Stations (Wells) Throughout State in Malaysia by Land Use Category, 2019

KATEGORI/ CATEGORY	BILANGAN TELAGA/ NUMBER OF WELLS	NEGERI/ STATE	BILANGAN TELAGA/ NUMBER OF WELLS
Kawasan Pertanian/ Agriculture	14	Sabah	2
		Terengganu	5
		Pahang	1
		Kedah	2
		Perlis	1
		Kelantan	2
		Selangor	1
Bandar & Pinggir Bandar/ Urban & Suburban	14	Sabah	1
		Terengganu	2
		Pahang	2
		Kedah	1
		Perlis	2
		Kelantan	2
		Selangor	3
		Kuala Lumpur	1
Tapak Perindustrian/ Industrial Sites	22	Sabah	1
		Terengganu	5
		Johor	2
		Kedah	1
		Kelantan	2
		Melaka	1
		Selangor	3
		Pulau Pinang	3
		Negeri Sembilan	1
		Perak	1
		Pahang	1
		Perlis	1
Bekas Tapak Pelupusan Sampah/ Ex-Solid Waste Landfills	26	Sabah	7
		Sarawak	2
		Terengganu	2
		Johor	2
		Kelantan	3
		Perak	1
		Kuala Lumpur	5
		Negeri Sembilan	3
		Melaka	1
Padang Golf/ Golf Courses	7	Sabah	2
		Kelantan	4
		Kuala Lumpur	1

Jadual 3.1: Taburan Stesen Pengawasan Kualiti Air Tanah di Seluruh Negeri di Malaysia Mengikut Jenis Kategori Guna Tanah, 2019
Table 3.1: Distribution of Groundwater Quality Monitoring Stations (Wells) Throughout State in Malaysia by Land Use Category, 2019

KATEGORI/ CATEGORY	BILANGAN TELAGA/ NUMBER OF WELLS	NEGERI/ STATE	BILANGAN TELAGA/ NUMBER OF WELLS
Luar Bandar/ Rural	5	Terengganu	1
		Kelantan	3
		Melaka	1
Bekas Lombong Emas/ Ex-Mining Areas (Gold Mines)	3	Sarawak	3
Bekalan Air/ Water Supply	5	Sabah	1
		Sarawak	4
Bekas Tapak Pelupusan Bangkai Haiwan/ Ex-Animal Burial Sites	14	Sarawak	2
		Johor	3
		Perak	3
		Selangor	3
		Pulau Pinang	3
Akuakultur/ Aquaculture	7	Pahang	6
		Terengganu	1
Tapak Pelupusan Radioaktif/ Radioactive Landfills	1	Perak	1
Peranginan/ Resorts	2	Sabah	1
		Kedah	1

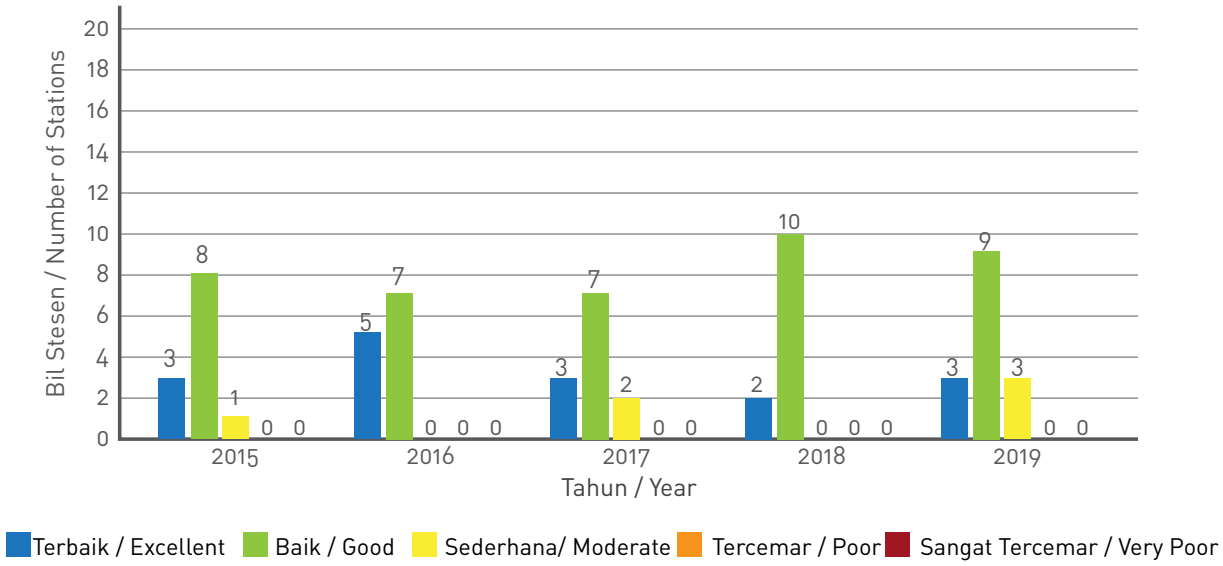
STATUS
KUALITI AIR TANAH BAGI KAWASAN PERTANIAN
STATUS OF GROUNDWATER QUALITY INDEX FOR AGRICULTURE

Tren Indeks Kualiti Air Tanah mulai tahun 2015 hingga 2019 bagi kawasan pertanian adalah seperti yang ditunjukkan dalam **Rajah 3.1.** Berdasarkan **Rajah 3.1,** didapati bilangan stesen terbaik telah meningkat dibandingkan tahun sebelumnya. Bilangan stesen baik pula telah menurun, bilangan stesen sederhana telah meningkat dibandingkan tahun sebelumnya dan tiada stesen tercemar dan sangat tercemar, pada tahun 2019.

Pada tahun 2019, sebanyak 15 stesen kawasan pertanian telah dipantau berbanding 12 pada tahun 2018. Hasil program pengawasan yang telah dijalankan menunjukan 3 stesen (20.0%) adalah terbaik, 9 stesen (60.0%) baik dan 3 stesen (20.0%) sederhana **(Jadual 3.3).**

Groundwater Quality Index for agriculture from year 2015 until 2019 is shown in **Figure 3.1.** Based on **Figure 3.1**, the number of excellent stations has increased compared to the year before. The number of good stations has decreased, and the number of moderate stations has increased. No station was categorised as poor and very poor in the year 2019.

In 2019, a total of 15 stations for agriculture were monitored compared to the previous year of 12 monitoring wells. The monitoring results indicated that 3 stations were excellent (20.0%), 9 stations were good (60.0%) and 3 stations were moderate (20.0%) **(Table 3.3).**



Rajah 3.1: Tren Indeks Kualiti Air Tanah Kawasan Pertanian
Figure 3.1: Trends of Groundwater Quality Index for Agriculture

Jadual 3.3: Status Indeks Kualiti Air Tanah bagi Kawasan Pertanian
Table 3.3: Status of Ground Water Quality Index for Agriculture

NEGERI/ STATE	KLASSIFIKASI STESEN/ STATION CLASSIFICATION	KAWASAN / AREA	NOMBOR STESEN/ STATION NUMBER	NILAI IKAT /GWQI VALUE					KATEGORI (2019) / CATEGORY (2019)
				2015	2016	2017	2018	2019	
Perlis	Pertanian / Agriculture	Rimba Mas, Padang Besar	MW(7)-R3-115.72	92	97	90	83	92	Terbaik/ Excellent
Kedah	Pertanian / Agriculture	Padang Mat Sirat, Langkawi	MW(7)-KV-1-5.80	94	82	82	81	89	Baik/Good
		Padang Mat Sirat, Langkawi	MW(7)-KV-1-12.09	88	80	80	79	79	Baik/Good
		*SK. Kepala Batas	MW(7)-R610014-2-9.34	-	-	-	-	81	Baik/Good
Selangor	Pertanian / Agriculture	*Masjid Jameul Huda, Parit 7, Sekinchan	MW(7)-S310105-1-13.70	-	-	-	-	60	Sederhana/ Moderate
Pahang	Pertanian / Agriculture	Sek. Keb. Lepar	MW(7)-C7-1-6.64	86	98	81	95	88	Baik/Good
Kelantan	Pertanian / Agriculture	Kampong Jembal Kota Bharu.	MW(7)-D6-1-7.58	84	89	96	80	97	Terbaik/ Excellent
		Sek. Keb. Beris Lalang Bachok	MW(7)-D15-1-4.05	86	97	76	75	80	Baik/Good
Terengganu	Pertanian / Agriculture	Kg.Merang, Setiu	MW(7)-T8-1-8.56	88	81	81	82	79	Baik/Good
		Sek. Keb. Alor PeroiKg, Gajah Mati	T21-1-45.82	68	81	66	82	60	Sederhana/ Moderate
		Sek. Keb. Alor PeroiKg, Gajah Mati	T21-1-22.13	74	81	66	83	63	Sederhana/ Moderate
		Sek. Keb. Alor PeroiKg, Gajah Mati	T21-1-6.16	79	81	80	82	80	Baik/Good
		*Sk. Telaga Hulu Terengganu	MW(7)-T510216-1-9.06	-	-	-	-	78	Baik/Good
Sabah	Pertanian / Agriculture	Limbawang Agriculture Stesen, Beaufort	MW(7)-H511511-1-7.50	88	91	86	81	82	Baik/Good
		Yongs Farm, Tawau	MW(7)-H411712-1-16.2	96	93	93	93	97	Terbaik/ Excellent

Nota / Note :
* Stesen Baru / New Station
- Tiada Data / No Data

STATUS

KUALITI AIR TANAH BAGI BANDAR DAN PINGGIR BANDAR

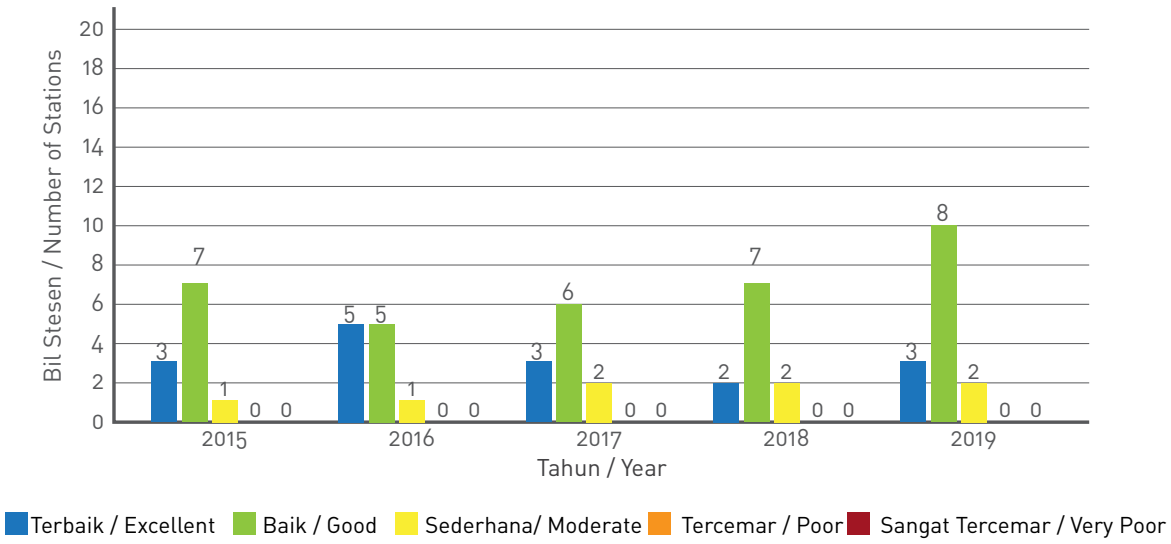
STATUS OF GROUNDWATER QUALITY INDEX FOR URBAN AND SUBURBAN

Tren Indeks Kualiti Air Tanah mulai tahun 2015 hingga 2019 bagi bandar dan pinggir bandar adalah seperti yang ditunjukkan dalam **Rajah 3.2.** Berdasarkan **Rajah 3.2** didapati bilangan stesen terbaik telah meningkat dibandingkan tahun sebelumnya. Bilangan stesen baik juga telah meningkat. Bilangan stesen sederhana masih sama. Tiada stesen tercemar dan sangat tercemar pada tahun 2019.

Pada tahun 2019, sebanyak 13 stesen bandar dan pinggir bandar telah dipantau berbanding 11 pada tahun 2018. Hasil program pengawasan yang telah dijalankan menunjukan 3 stesen (23.0%) adalah terbaik, 8 stesen (61.5%) baik dan 2 stesen (15.4%) sederhana **(Jadual 3.4).**

Groundwater Quality Index trend for urban and suburban from year 2015 until 2019 is shown in **Figure 3.2**. Based on **Figure 3.2,** the number of excellent stations has increased compared to the year before. The number of good stations has increased as well. The number of moderate stations remained unchanged since 2018. No station was categorised as poor and very poor in the year 2019.

In 2019, a total of 13 stations for urban and suburban were monitored compared to the previous year of 11 monitoring wells. The monitoring results indicated that 3 stations (23.0%) were excellent, 8 stations (61.5%) were good and 2 stations (15.4%) were moderate **(Table 3.4)**.



Rajah 3.2: Tren Indeks Kualiti Air Tanah bagi Bandar dan Pinggir Bandar (2015-2019)
Figure 3.2: Trends of Groundwater Quality Index for Urban and Suburban (2015-2019)

Jadual 3.4: Status Indeks Kualiti Air Tanah bagi Bandar dan Pinggir Bandar
Table 3.4: Status of Groundwater Quality Index for Urban and Suburban

NEGERI/ STATE	KLASSIFIKASI STESEN/ STATION CLASSIFICATION	KAWASAN / AREA	NOMBOR STESEN / STATION NUMBER	NILAI IKAT /GWQI VALUE					KATEGORI (2019) / CATEGORY (2019)
				2015	2016	2017	2018	2019	
Perlis	Bandar & Luar Bandar/ Urban & Suburban	Arau , Perlis	MW(7)-R4-1-5.41	80	80	80	77	76	Baik/Good
		Arau , Perlis	MW(7)-R4-1-19.80	97	96	95	93	87	Baik/Good
Kedah	Bandar & Luar Bandar/ Urban & Suburban	SK Darul Uloom Kepala Batas	MW(7)-K2-1-6.22	65	59	59	55	75	Baik/Good
Selangor	Bandar & Luar Bandar/ Urban & Suburban	Saujana Golf Resort, Subang	MW(7)-S13-1-5.45	96	93	82	69	79	Baik/Good
		Saujana Golf Resort, Subang	MW(7)-S13-1-12.67	96	96	88	78	97	Terbaik/ Excellent
W.P. Putrajaya	Bandar & Luar Bandar/ Urban & Suburban	*Taman Wetland	MW(7)-W210103-1-10.0	-	-	-	-	72	Baik/Good
Pahang	Bandar & Luar Bandar/ Urban & Suburban	Nenasi	MW(7)-C13-1-45.97	82	88	85	90	88	Baik/Good
Kelantan	Bandar & Luar Bandar/ Urban & Suburban	Sek.Men.Keb. Rantau Panjang	MW(7)-D7-1-5.50	88	95	91	82	96	Terbaik/ Excellent
		Sek.Men.Keb. Rantau Panjang	MW(7)-D7-1-20.23	88	90	92	81	86	Baik/Good
		*Sek.Men.Keb. Cherang Ruku, Pasir Puteh	MW(7)-D510202-1-7.96	-	-	-	-	67	Sederhana/ Moderate
Terengganu	Urban & Suburban	Kg. Raja, Besut	MW(7)-T1-1-7.25	80	82	83	84	79	Baik/Good
		Kg. Raja, Besut	MW(7)-T1-1-31.79	82	82	67	85	64	Sederhana/ Moderate
Sabah	Urban & Suburban	SK Inanam	MW(7)-H511601-9-7.50	85	74	78	80	93	Terbaik/ Excellent

Nota / Note :
* Stesen Baru / New Station
- Tiada Data / No Data

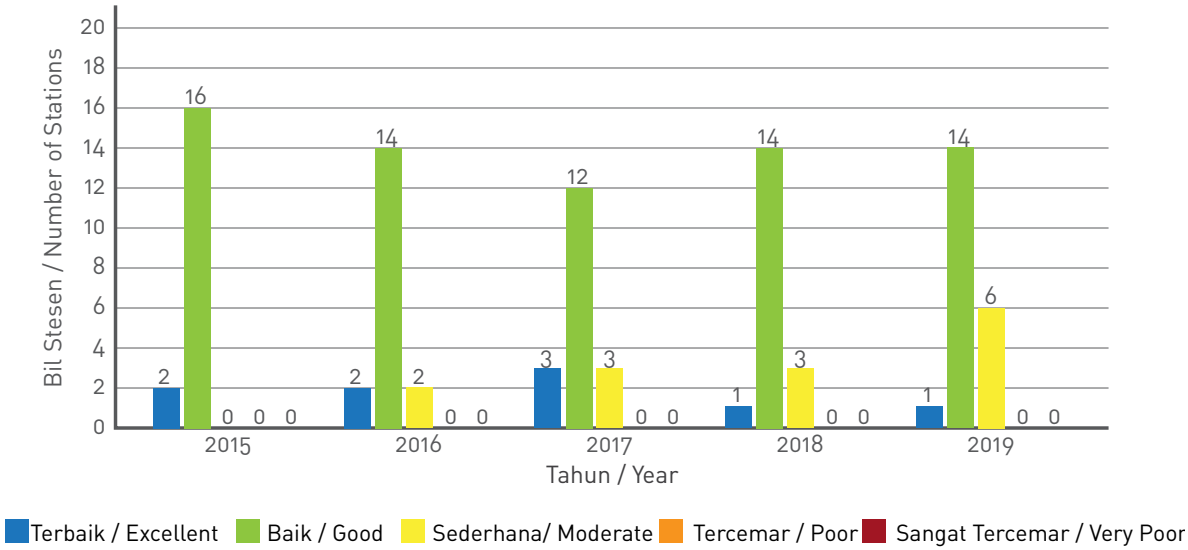
STATUS
KUALITI AIR TANAH BAGI TAPAK PERINDUSTRIAN
STATUS OF GROUNDWATER QUALITY INDEX FOR INDUSTRIAL SITES

Tren Indeks Kualiti Air Tanah mulai tahun 2015 hingga 2019 bagi tapak perindustrian adalah seperti yang ditunjukkan dalam **Rajah 3.3**. Berdasarkan **Rajah 3.3** didapati bilangan stesen terbaik kekal seperti tahun sebelumnya. Bilangan stesen baik juga kekal manakala bilangan stesen sederhana telah meningkat. Tiada stesen tercemar dan sangat tercemar pada tahun 2019.

Pada tahun 2019, sebanyak 21 stesen tapak perindustrian telah dipantau berbanding 18 pada tahun 2018. Hasil program pengawasan yang telah dijalankan menunjukan 1 stesen (4.76%) adalah terbaik, 14 stesen (66.7%) baik dan 6 stesen (28.5%) sederhana **(Jadual 3.5).**

Groundwater Quality Index trend for industrial sites from year 2015 until 2019 is shown in **Figure 3.3**. Based on **Figure 3.3,** the number of excellent stations remain unchanged compared to the year before. The number of good stations remain unchanged as well while the number of moderate stations has increased compared to the year before. No station was categorised as poor and very poor in the year 2019.

In 2019, a total of 21 stations for industrial sites were monitored compared to the previous year of 18 monitoring wells. The monitoring results indicated that 1 station (4.76%) was excellent, 14 stations (66.7%) were good and 6 stations (28.6%) were moderate **(Table 3.5)**.



Rajah 3.3: Status Indeks Kualiti Air Tanah bagi Tapak Perindustrian (2015-2019)
Figure 3.3: Trends of Groundwater Quality Index for Industrial Sites (2015-2019)

Jadual 3.5: Status Indeks Kualiti Air Tanah bagi Tapak Perindustrian
Table 3.5: Status of Groundwater Quality Index for Industrial Sites

NEGERI / STATE	KLASSIFIKASI STESEN/ STATION CLASSIFICATION	KAWASAN / AREA	NOMBOR STESEN / STATION NUMBER	NILAI IKAT / GWQI VALUE					KATEGORI (2019) / CATEGORY (2019)
				2015	2016	2017	2018	2019	
Perlis	Tapak Perindustrian/ Industrial Sites	*Felda Chuping	MW(7)-R610006-2-6.55	-	-	-	-	71	Baik/Good
Kedah	Tapak Perindustrian/ Industrial Sites	Kulim Hi-Tech	MW(7)-K3-1-8.45	74	65	68	70	82	Baik/Good
Pulau Pinang	Tapak Perindustrian/ Industrial Sites	Mak Mandin (MAGRI)	MW(7)-P1-2-4.50	80	76	86	76	69	Sederhana/ Moderate
		Mak Mandin (KASTAM)	MW(7)-P1-1-6.50	82	76	91	77	74	Baik/Good
		Bayan Lepas	MW(7)-P2-1-4.34	93	91	89	87.00	78	Baik/Good
Selangor	Tapak Perindustrian/ Industrial Sites	SK Seksy. 20, Shah Alam	MW(7)-S9A-1-8.20	76	82	74	67	82	Baik/Good
		CIAST, Seksy. 19, Shah Alam	MW(7)-S9-1-20.21	81	81	77	67	81	Baik/Good
		CIAST, Seksy. 19, Shah Alam	MW(7)-S9-1-5.97	72	77	72	66	54	Sederhana/ Moderate
Negeri Sembilan	Tapak Perindustrian/ Industrial Sites	Senawang Edible Oil	MW(7)-N4-1-6.44	77	72	71	71	81	Baik/Good
Melaka	Tapak Perindustrian/ Industrial Sites	Petronas Oil Refinery, Melaka	MW(7)-M1-1-8.10	70	73	75	71	64	Sederhana/ Moderate
Johor	Tapak Perindustrian/ Industrial Sites	Tg. Puteri, Pasir Gudang	MW(7)-J5-1-7.34	87	88	92	99	73	Baik/Good
		Tg. Puteri, Pasir Gudang	MW(7)-J5-2-7.49	79	77	74	72	70	Baik/Good
Pahang	Tapak Perindustrian/ Industrial Sites	*LYNAS, Gebeng	MW(7)-C310302-1-6.50	-	-	-	-	66	Sederhana/ Moderate
Kelantan	Tapak Perindustrian/ Industrial Sites	Eastern Garment MFG. Pkln.Chepa	MW(7)-D6-2-51.38	74	82	81	70	87	Baik/Good
		Eastern Garment MFG. Pkln.Chepa	MW(7)-D6-2-4.24	85	87	90	80	79	Baik/Good
Terengganu	Tapak Perindustrian/ Industrial Sites	TCOT Kerteh, Kemaman	MW(7)-T15-1-5.68	92	99	81	82	88	Baik/Good
		TCOT Kerteh, Kemaman	MW(7)-T15-1-24.89	72	65	68	85	82	Baik/Good
		KSB Telok Kalong, Kemaman	MW(7)-T16-1-5.57	74	81	70	87	64	Sederhana/ Moderate
		KSB Telok Kalong, Kemaman	MW(7)-T16-1-18.76	81	81	66	83	61	Sederhana/ Moderate
		*Sk. Bari, Setiu	MW(7)-T510208-1-7.97	-	-	-	-	74	Baik/Good
Labuan	Tapak Perindustrian/ Industrial Sites	Asian Supply Base W. P. Labuan	MW(7)-H511509-1-6.80	86	83	83	81	91	Terbaik/ Excellent

Nota / Note :
* Stesen Baru / New Station
- Tiada Data / No Data

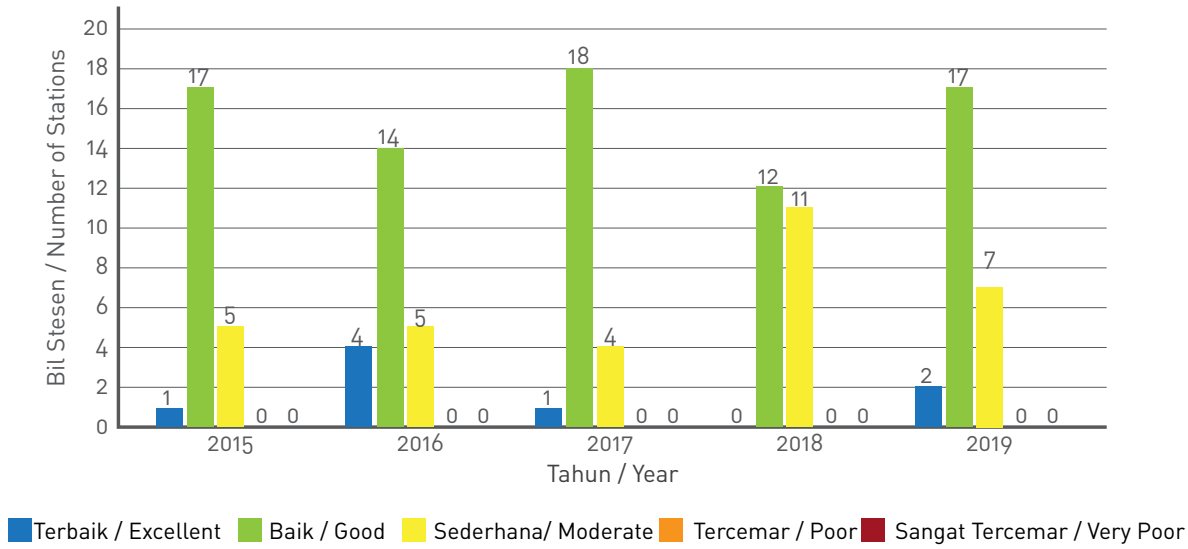
STATUS
KUALITI AIR TANAH BAGI BEKAS TAPAK PELUPUSAN SAMPAH
STATUS OF GROUNDWATER QUALITY INDEX FOR EX-SOLID WASTE LANDFILLS

Tren Indeks Kualiti Air Tanah mulai tahun 2015 hingga 2019 bagi bekas tapak pelupusan sampah adalah seperti yang ditunjukkan dalam **Rajah 3.4.** Berdasarkan **Rajah 3.4** didapati bilangan stesen terbaik telah meningkat berbanding tahun sebelumnya. Bilangan stesen baik juga telah meningkat manakala bilangan stesen sederhana telah menurun berbanding tahun sebelumnya. Manakala, tiada stesen tercemar dan sangat tercemar pada tahun 2019.

Pada tahun 2019, sebanyak 26 stesen bekas tapak pelupusan sampah telah dipantau berbanding 23 pada tahun 2018. Hasil program pengawasan yang telah dijalankan menunjukan 2 stesen (7.69%) adalah terbaik, 17 stesen (65.4%) baik dan 7 stesen (26.9%) sederhana **(Jadual 3.6).**

Groundwater Quality Index trend for ex-solid waste landfills from year 2015 until 2019 is shown in **Figure 3.4.** Based on **Figure 3.4.**, the number of excellent stations for 2019 has increased compared to the previous year. The number of good stations has increased as well, while moderate station has decreased compared to the previous year. No station was categorised as poor and very poor in the year 2019.

In 2019, a total of 26 stations for ex-solid waste landfills were monitored compared to the previous year of 23 monitoring wells. The monitoring results indicated that 2 stations (7.69%) were excellent, 17 stations (65.4%) were good and 7 stations (26.9%) were moderate **(Table 3.6).**



Rajah 3.4: Tren Indeks Kualiti Air Tanah bagi Bekas Tapak Pelupusan Sampah (2015-2019)
Figure 3.4: Trends of Groundwater Quality Index for Ex-Solid Waste Landfills (2015-2019)

Jadual 3.6: Status Indeks Kualiti Air Tanah bagi Bekas Tapak Pelupusan Sampah
Table 3.6: Status Of Groundwater Quality Index for Ex-Solid Waste Landfills

NEGERI / STATE	KLASSIFIKASI STESEN / STATION CLASSIFICATION	KAWASAN / AREA	NOMBOR STESEN / STATION NUMBER	NILAI IKAT /GWQI VALUE					KATEGORI (2019) / CATEGORY (2019)
				2015	2016	2017	2018	2019	
Perak	Bekas Tapak Pelupusan Sampah / Ex-Solid Waste Landfills	Pusing, Batu Gajah	MW(7)-A11-1-6.05	68	70	70	70	59	Sederhana/ Moderate
Kuala Lumpur	Bekas Tapak Pelupusan Sampah / Ex-Solid Waste Landfills	Jln Sg. Besi	MW(7)-S11-1-5.50	72	82	70	51	86	Baik/Good
		Jln Sg. Besi	MW(7)-S11-1-5.54	64	81	68	59	82	Baik/Good
		Jln Sg. Besi	MW(7)-S11-1-5.57	76	98	72	65	93	Terbaik/ Excellent
		Tmn Beringin, Kepong	MW(7)-S13-1-7.26	88	96	72	58	95	Terbaik/ Excellent
		Tmn Beringin, Kepong	MW(7)-S13-2-6.10	80	75	64	56	87	Baik/Good
Negeri Sembilan	Bekas Tapak Pelupusan Sampah / Ex-Solid Waste Landfills	Kualiti Alam	MW(7)-N5-1-8.00	95	95	82	64	84	Baik/Good
		Kualiti Alam	MW(7)-N5-1-7.55	83	79	70	64	64	Sederhana/ Moderate
		*TPS Tanah Merah (CYPARK), Port Dickson	MW(7)-N210108-2-10.03	-	-	-	-	69	Sederhana/ Moderate
Melaka	Bekas Tapak Pelupusan Sampah / Ex-Solid Waste Landfills	*Tapak Pelupusan Sampah, Sungai Udang	MW(7)-M210209-1-7.68	-	-	-	-	62	Sederhana/ Moderate
Johor	Bekas Tapak Pelupusan Sampah / Ex-Solid Waste Landfills	Kg. Batu 4, Kota Tinggi	MW(7)-J4-1-6.94	67	73	76	82	65	Sederhana/ Moderate
		*Tapak Pelupusan Sisa Pepejal, Ladang CEP, Simpang Renggam	MW(7)-J110302-1-7.02	-	-	-	-	64	Sederhana/ Moderate
Kelantan	Bekas Tapak Pelupusan Sampah / Ex-Solid Waste Landfills	Panji Landfill, Panji Kota Bharu	MW(7)-D6-3-13.43	89	90	88	83	89	Baik/Good
		Panji Landfill, Panji Kota Bharu	MW(7)-D6-3-5.34	86	89	88	80	89	Baik/Good
		P.Mas Landfill, Kg.Pusu 40, P.Mas	MW(7)-D8-1-5.22	76	87	90	76	89	Baik/Good
Terengganu	Bekas Tapak Pelupusan Sampah / Ex-Solid Waste Landfills	Kg. Kubang Badak, K.Terengganu	MW(7)-T10-1-5.45	84	80	80	67	78	Baik/Good
		Kg. Kubang Badak, K.Terengganu	MW(7)-T10-1-22.89	86	76	81	81	78	Baik/Good

Jadual 3.6: Status Indeks Kualiti Air Tanah bagi Bekas Tapak Pelupusan Sampah
Table 3.6: Status Of Groundwater Quality Index for Ex-Solid Waste Landfills

NEGERI / STATE	KLASSIFIKASI STESEN / STATION CLASSIFICATION	KAWASAN / AREA	NOMBOR STESEN / STATION NUMBER	NILAI IKAT /GWQI VALUE					KATEGORI (2019) / CATEGORY (2019)
				2015	2016	2017	2018	2019	
Sabah	Bekas Tapak Pelupusan Sampah / Ex-Solid Waste Landfills	ITAC, Kg. Duvanson, Penampang	MW(7)-H511601-1-8.80	72	68	70	70	82	Baik/Good
		ITAC, Kg. Duvanson, Penampang	MW(7)-H511601-2-14.0	80	68	74	82	82	Baik/Good
		ITAC, Kg. Duvanson, Penampang	MW(7)-H511601-3-8.00	68	69	78	85	86	Baik/Good
		ITAC, Kg. Duvanson, Penampang	MW(7)-H511601-4-17.3	79	71	78	84	85	Baik/Good
		ITAC, Kg. Duvanson, Penampang	MW(7)-H511601-5-19.0	74	70	74	76	73	Baik/Good
		ITAC, Kg. Duvanson, Penampang	MW(7)-H511601-6-10.2	82	81	72	69	80	Baik/Good
		ITAC, Kg. Duvanson, Penampang	MW(7)-H511601-7-10.3	76	82	80	73	82	Baik/Good
Sarawak	Bekas Tapak Pelupusan Sampah / Ex-Solid Waste Landfills	Kemuyang, No.1	MW(7)-QS-K1-11.10	56	48	56	58	53	Sederhana/ Moderate
		Kemuyang, No.2	MW(7)-QS-K2-10.78	72	68	62	51	72	Baik/Good

Nota / Note :
* Stesen Baru / New Station
- Tiada Data / No Data

STATUS
KUALITI AIR TANAH BAGI PADANG GOLF
STATUS OF GROUNDWATER QUALITY INDEX FOR GOLF COURSES

Tren Indeks Kualiti Air Tanah mulai tahun 2015 hingga 2019 bagi padang golf adalah seperti yang ditunjukkan dalam **Rajah 3.5.** Berdasarkan **Rajah 3.5**, didapati bilangan stesen terbaik kekal seperti tahun sebelumnya. Bilangan stesen dalam kategori baik meningkat berbanding tahun sebelumnya. Tiada stesen sederhana, tercemar dan sangat tercemar pada tahun 2019.

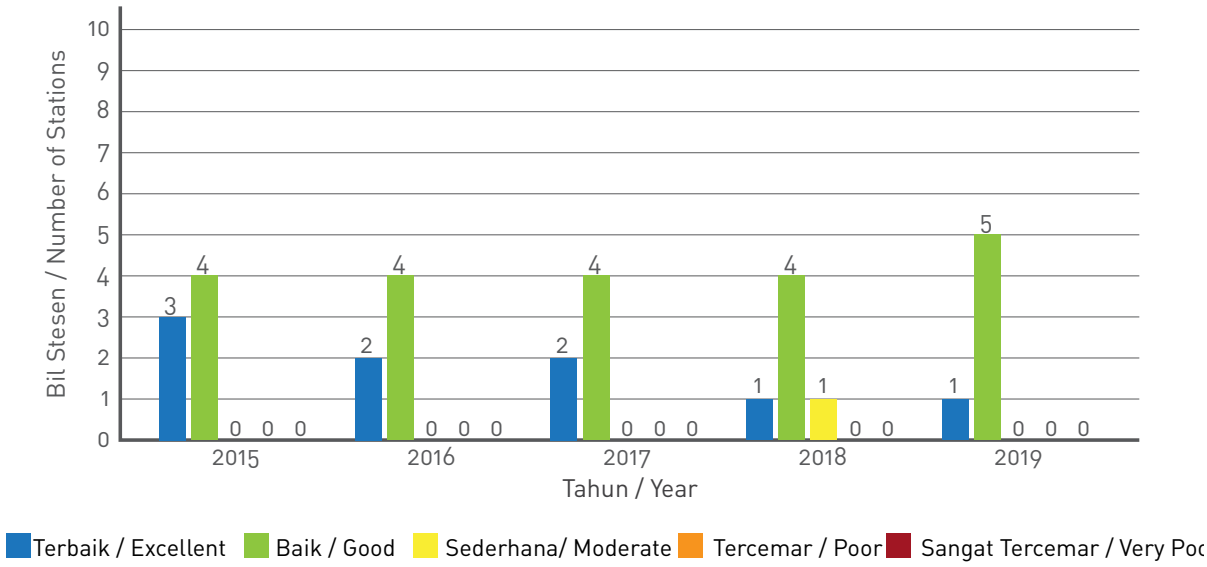
Pada tahun 2015 sebanyak 7 stesen yang dipantau. Walau bagaimanapun bermula pada tahun 2016, hanya 6 stesen yang dipantau memandangkan 1 stesen di Kuala Lumpur telah kering **(Jadual 3.7).**

Groundwater Quality Index trend for golf courses from year 2015 until 2019 is shown in **Figure 3.4.** Based on **Figure 3.4**, the number of excellent stations remain unchanged compared to year before. The number of good stations has increased compared to year before. No station was categorised as moderate, poor and very poor in the year 2019.

In year 2015 seven (7) stations were monitored. However starting from 2016, only six (6) stations were monitored as one (1) station in Kuala Lumpur has run dry **(Table 3.7).**

Hasil program pengawasan yang telah dijalankan menunjukan 1 stesen (16.7%) adalah terbaik dan 5 stesen (83.3%) baik **(Jadual 3.7).**

The monitoring results indicated that 1 station (16.7%) was excellent and 5 stations (83.3%) were good **(Table 3.7)**.



Rajah 3.5: Tren Indeks Kualiti Air Tanah bagi Padang Golf (2015-2019)
Figure 3.5: Trends of Groundwater Quality Index for Golf Courses (2015-2019)

Jadual 3.7: Status Indeks Kualiti Air Tanah bagi Padang Golf
Table 3.7: Status of Groundwater Quality Index for Golf Courses

NEGERI / STATE	KLASSIFIKASI STESEN / STATION CLASSIFICATION	KAWASAN / AREA	NOMBOR STESEN / STATION NUMBER	NILAI IKAT /GWQI VALUE					KATEGORI (2019) / CATEGORY (2019)
				2015	2016	2017	2018	2019	
Kuala Lumpur	Padang Golf / Golf Courses	Royal Selangor Golf Club	MW(7)-S12-1-5.37	90	-	-	-	-	Tiada Data / No Data
Kelantan	Padang Golf / Golf Courses	Kelab Golf & Desa Pkln. Chepa	MW(7)-D3-1-6.90	77	83	84	82	89	Baik/Good
		Kelab Golf & Desa Pkln. Chepa	MW(7)-D3-1-6.37	79	88	90	71	84	Baik/Good
		Kelab Golf D'Raja Kubang Kerian	MW(7)-D6-4-31.29	73	82	82	65	82	Baik/Good
		Kelab Golf D'Raja Kubang Kerian	MW(7)-D6-4-9.05	75	78	89	75	85	Baik/Good
Sabah	Padang Golf / Golf Courses	Sandakan Golf Club, Sandakan	MW(7)-H511801-1-8.82	95	93	86	79	81	Baik/Good
		Sandakan Golf Club, Sandakan	MW(7)-H511801-2-8.60	96	93	96	96	96	Baik/Good

Nota / Note :
* Stesen Baru / New Station
- Tiada Data / No Data

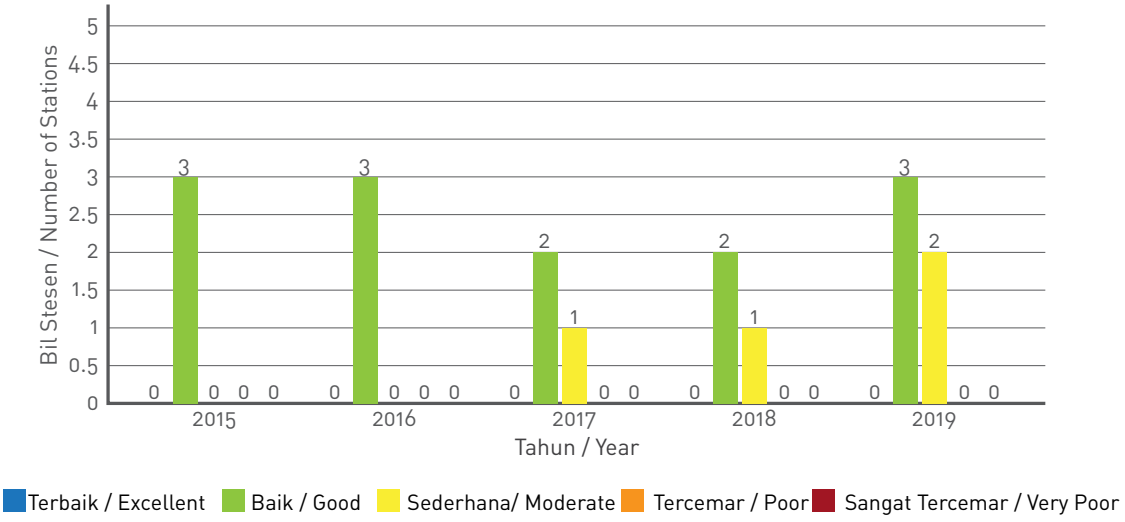
STATUS
KUALITI AIR TANAH BAGI LUAR BANDAR
STATUS OF GROUNDWATER QUALITY INDEX FOR RURAL

Tren Indeks Kualiti Air Tanah mulai tahun 2015 hingga 2019 bagi luar bandar adalah seperti yang ditunjukkan dalam **Rajah 3.6**. Berdasarkan **Rajah 3.6** didapati tiada stesen terbaik sejak tahun 2015 manakala bilangan stesen baik dan sederhana telah menunjukkan peningkatan berbanding tahun sebelumnya. Tiada stesen tercemar dan sangat tercemar pada tahun 2019.

Pada tahun 2019, sebanyak 5 stesen luar bandar telah dipantau berbanding 3 pada tahun 2018. Hasil program pengawasan yang telah dijalankan menunjukan 3 stesen (60.0%) adalah terbaik dan 2 stesen (40.0%) sederhana **(Jadual 3.8).**

Groundwater Quality Index trend for rural from year 2015 until 2019 is shown in **Figure 3.6**. Based on **Figure 3.6,** no station was excellent since year 2015 while the number of good and moderate stations has increased compared to the previous year. No station was categorised as poor and very poor in the year 2019.

In 2019, a total of 5 stations for rural were monitored compared to the previous year of 3 monitoring wells. The monitoring results indicated that 3 stations (60.0%) were excellent and 2 stations (40.0%) were moderate **(Table 3.8)**.



Rajah 3.6: Tren Indeks Kualiti Air Tanah bagi Luar Bandar (2015-2019)
Figure 3.6: Trends of Groundwater Quality Index for Rural (2015-2019)

Jadual 3.8: Status Indeks Kualiti Air Tanah bagi Luar Bandar
Table3.8: Status of Groundwater Quality Index for Rural

NEGERI / STATE	KLASSIFIKASI STESEN /STATION CLASSIFICATION	KAWASAN / AREA	NOMBOR STESEN / STATION NUMBER	NILAI IKAT /GWQI VALUE					KATEGORI (2019) / CATEGORY (2019)
				2015	2016	2017	2018	2019	
Kelantan	Luar Bandar / Rural	Sek. Keb. Jelawat Bachok	MW(7)-D11-1-6.10	85	88	81	81	80	Baik/Good
		Sek. Men. Keb. Jelawat Bachok	MW(7)-D11-2-5.09	74	82	74	65	65	Sederhana/ Moderate
Selangor	Luar Bandar / Rural	*Institut Alam Sekitar, EIMAS, UKM Bangi	MW(7)-S210104-1-20.30	-	-	-	-	72	Baik/Good
Melaka	Luar Bandar / Rural	*Pusat Kecemerlangan Buangan Terjadual, JAS Tabuh Naning	MW(7)-M210209-2-21.10	-	-	-	-	49	Sederhana/ Moderate
Terengganu	Luar Bandar / Rural	Kg.Padang Pak Wan, Bkt. Payung, Marang	MW(7)-T14-1-6.99	82	81	80	81	80	Baik/Good

Nota / Note :
* Stesen Baru / New Station
- Tiada Data / No Data

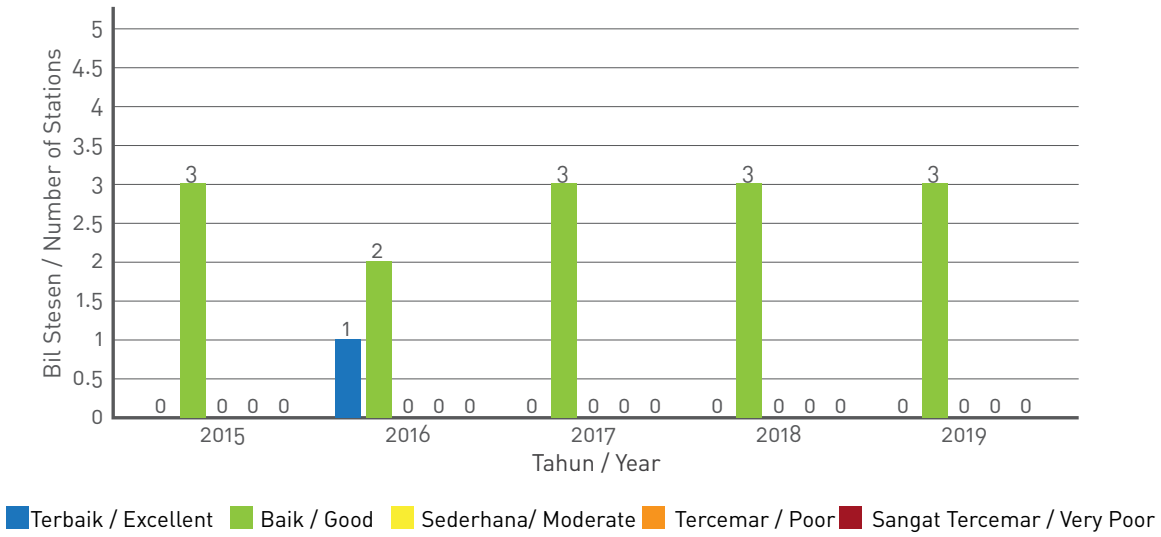
STATUS
KUALITI AIR TANAH BAGI BEKAS LOMBONG EMAS
STATUS OF GROUNDWATER QUALITY INDEX FOR EX-MINING (GOLD MINE)

Tren Indeks Kualiti Air Tanah mulai tahun 2015 hingga 2019 bagi bekas lombong emas adalah seperti yang ditunjukkan dalam **Rajah 3.7**. Berdasarkan **Rajah 3.7** didapati kesemua stesen berada dalam kategori baik. Tiada stesen terbaik, sederhana, tercemar dan sangat tercemar pada tahun 2019.

Pada tahun 2019, sebanyak 3 stesen bekas lombong emas telah dipantau. Hasil program pengawasan yang telah dijalankan menunjukan kesemua stesen (100%) adalah baik **(Jadual 3.9)**.

Groundwater Quality Index trend for ex-mining (Gold Mine) from year 2015 until 2019 is shown in **Figure 3.7**. Based on **Figure 3.7**, all stations were good and no station was categorised as excellent, moderate, poor and very poor in the year 2019.

In 2019, a total of 3 stations for ex-mining (Gold Mine) were monitored. The monitoring results indicated that all stations (100%) were good **(Table 3.9)**.



Rajah 3.7: Tren Indeks Kualiti Air Tanah bagi Bekas Lombong Emas (2015-2019)
Figure 3.7: Trends of Groundwater Quality Index for Ex-Mining (Gold Mine) (2015-2019)

Jadual 3.9: Status Indeks Kualiti Air Tanah bagi Bekas Lombong Emas
Table 3.9: Trends of Groundwater Quality Index for Ex-Mining (Gold Mine)

NEGERI / STATE	KLASSIFIKASI STESEN / STATION CLASSIFICATION	KAWASAN / AREA	NOMBOR STESEN / STATION NUMBER	NILAI IKAT /GWQI VALUE					KATEGORI (2019) / CATEGORY (2019)
				2015	2016	2017	2018	2019	
Sarawak	Bekas Lombong Emas / Ex-Mining (Gold Mine)	Bau, No. 1	MW(7)-QK-B1-27.27	85	85	82	82	85	Baik/Good
		Bau, No. 2	MW(7)-QK-B2-29.50	85	85	85	82	84	Baik/Good
		Bau	MW(7)-QK-B3-29.00	88	97	82	73	82	Baik/Good

Nota / Note :
* Stesen Baru / New Station
- Tiada Data / No Data

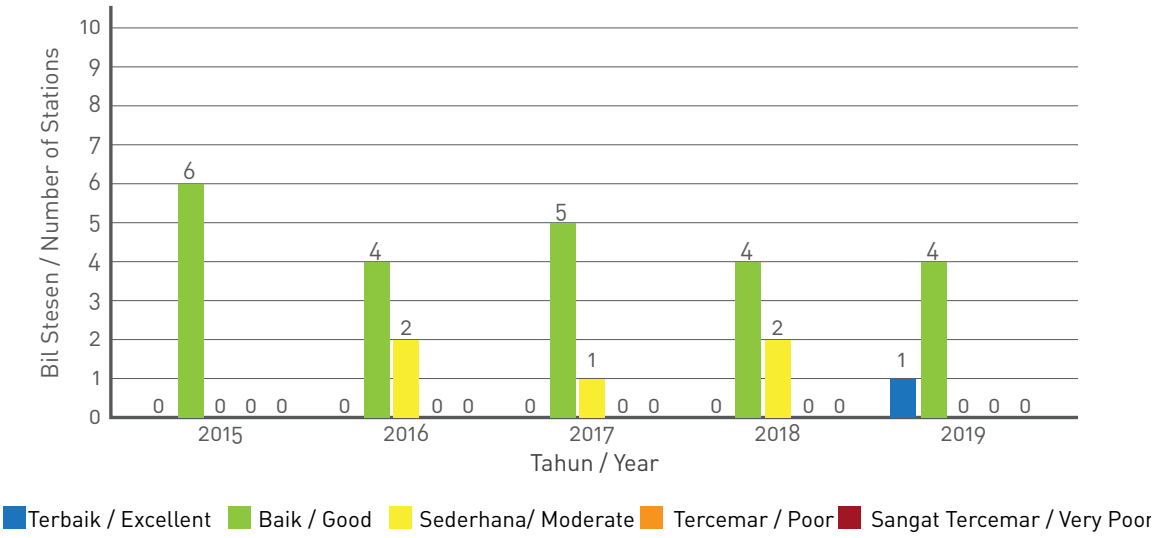
STATUS
KUALITI AIR TANAH BAGI BEKALAN AIR
STATUS OF GROUNDWATER QUALITY INDEX FOR WATER SUPPLY

Tren Indeks Kualiti Air Tanah mulai tahun 2015 hingga 2019 bagi bekalan air adalah seperti yang ditunjukkan dalam **Rajah 3.8**. Berdasarkan **Rajah 3.8** didapati stesen terbaik meningkat berbanding tahun sebelumnya manakala stesen baik kekal sejak tahun 2018. Tiada stesen sederhana, tercemar dan sangat tercemar pada tahun 2019.

Groundwater Quality Index for water supply trend from year 2015 until 2019 is shown in **Figure 3.8**. Based on **Figure 3.8**, the number of excellent stations has increased compared to the previous year. The number of good stations remain unchanged since 2018. No station was categorised as moderate, poor and very poor in the year 2019.

Pada tahun 2019, sebanyak 5 stesen bekalan air telah dipantau berbanding 6 pada tahun 2018. Hasil program pengawasan yang telah dijalankan menunjukan 1 stesen (20.0%) adalah terbaik dan 4 stesen (80.0%) baik **(Jadual 3.10)**.

In 2019, a total of 5 stations for water supply were monitored compared to the previous year of 6 monitoring wells. The monitoring results indicated that 1 station (20.0%) was excellent and 4 stations (80.0%) were good **(Table 3.10)**.



Rajah 3.8: Tren Indeks Kualiti Air Tanah bagi Bekalan Air (2015-2019)
Figure 3.8: Trends of Groundwater Quality Index for Water Supply (2015-2019)

Jadual 3.10: Status Indeks Kualiti Air Tanah bagi Bekalan Air
Table 3.10: Status of Groundwater Quality Index for Water Supply

NEGERI / STATE	KLASSIFIKASI STESEN / STATION CLASSIFICATION	KAWASAN / AREA	NOMBOR STESEN / STATION NUMBER	NILAI IKAT /GWQI VALUE					KATEGORI (2019) / CATEGORY (2019)
				2015	2016	2017	2018	2019	
Sabah	Bekalan Air / Water Supply	Kg. Tajau Laut, Kudat	MW(7)-H511604-1-4.5	88	84	80	75	87	Baik/Good
Sarawak	Bekalan Air / Water Supply	Kabong, No. 1	MW(7)-QB-K1-6.70	80	81	81	79	84	Baik/Good
		Pusat Rawatan Air. JKR, No. 1, Miri	MW(7)-QL-L1-7.53	81	81	72	56	92	Terbaik/ Excellent
		Pusat Rawatan Air. JKR, No. 2, Miri	MW(7)-QL-L2-7.90	73	70	72	70	-	Tiada Data / No Data
		LAKU (Lambir), No. 1, Miri	MW(7)-QM-L1-30.50	75	68	62	59	75	Baik/Good
		Kg. Lusut Kiri, No. 3, Miri	MW(7)-QM-L3-28.30	70	62	72	82	77	Baik/Good

Nota / Note :
* Stesen Baru / New Station
- Tiada Data / No Data

STATUS

KUALITI AIR TANAH BAGI BEKAS TAPAK PELUPUSAN BANGKAI HAIWAN

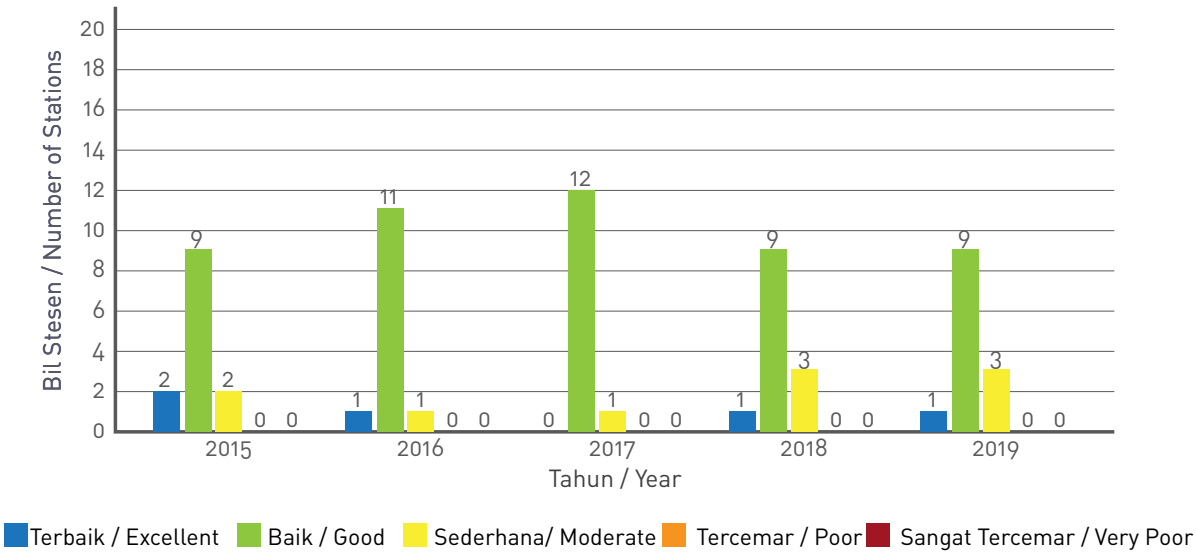
STATUS OF GROUNDWATER QUALITY INDEX FOR EX-ANIMAL BURIAL SITES

Tren Indeks Kualiti Air Tanah mulai tahun 2015 hingga 2019 bagi bekas tapak pelupusan bangkai haiwan adalah seperti yang ditunjukkan dalam **Rajah 3.9.** Berdasarkan **Rajah 3.9** didapati jumlah stesen terbaik kekal seperti tahun sebelumnya. Bilangan stesen baik dan sederhana juga masih kekal seperti tahun 2018. Tiada stesen tercemar dan sangat tercemar pada tahun 2019.

Pada tahun 2019 sebanyak 13 stesen yang dipantau, **(Jadual 3.11)**. Hasil program pengawasan yang telah dijalankan menunjukan 1 stesen (7.7%) adalah terbaik, 9 stesen (69.2%) baik dan 3 stesen (23.1%) sederhana **(Jadual 3.11)**.

Groundwater Quality Index trend for ex-animal burial sites from year 2015 until 2019 is shown in **Figure 3.9**. Based on **Figure 3.9**, the number of excellent stations remain unchanged from the previous year. The number of good and moderate stations remain unchanged as well compared to the year 2018. No station was was categorised as poor and very poor in the year 2019.

In the year 2019, 13 stations were monitored, **(Table 3.11)**. The monitoring results indicated that 1 station (7.7%) was excellent, 9 stations (69.2 %)were good and 3 station (23.1%) were moderate **(Table 3.11)**



Rajah 3.9: Tren Indeks Kualiti Air Tanah bagi Bekas Tapak Pelupusan Bangkai Haiwan (2015-2019)
Figure 3.9: Trends of Groundwater Quality Index for Ex-Animal Burial Sites (2015-2019)

Jadual 3.11: Status Indeks Kualiti Air Tanah bagi Bekas Tapak Pelupusan Bangkai Haiwan
Table 3.1: Status of Groundwater Quality Index for Ex-Animal Burial Sites

NEGERI / STATE	KLASSIFIKASI STESEN / STATION CLASSIFICATION	KAWASAN / AREA	NOMBOR STESEN / STATION NUMBER	NILAI IKAT /GWQI VALUE					KATEGORI (2019) / CATEGORY (2019)
				2015	2016	2017	2018	2019	
Perak	Bekas Tapak Pelupusan Bangkai Haiwan / Ex-Animal Burial Sites	Tapak Bazar Seramik Tambun	MW(7)-A(IP)-1-5.92	75	73	70	69	69	Sederhana/ Moderate
		Tapak Bekas Wabak JE Jalong	MW(7)-A(SS)-2-3.14	-	-	-	-	-	Tiada Data / No Data
		Tapak Bekas Wabak JE Jalong	MW(7)-A(SS)-1-7.65	80	84	85	85	83	Baik/Good
Pulau Pinang	Bekas Tapak Pelupusan Bangkai Haiwan / Ex-Animal Burial Sites	Perkampungan Ldg Valdor (Kelapa)	MW(7)-P(LV)-1-7.45	88	78	73	89	96	Terbaik/ Excellent
		Perkampungan Ldg Valdor (Tengah)	MW(7)-P(LV)-2-6.78	91	85	73	88	74	Baik/Good
		Perkampungan Ldg Valdor (Jalan)	MW(7)-P(LV)-3-7.30	86	76	80	91	72	Baik/Good
Johor	Bekas Tapak Pelupusan Bangkai Haiwan / Ex-Animal Burial Sites	Ulu Choh (Pintu)	MW(7)-JPN-1-6.90	69	73	74	82	62	Sederhana/ Moderate
		Ulu Choh (kolam)	MW(7)-JPN-2-6.10	72	70	74	81	70	Baik/Good
		Ulu Choh (sungai)	MW(7)-JPN-3-6.71	76	77	78	82	78	Baik/Good
Selangor	Bekas Tapak Pelupusan Bangkai Haiwan / Ex-Animal Burial Sites	stesen kg. sg. keroh, sepang	MW(7)-S(SE)-1-5.67	72	82	72	63	59	Sederhana/ Moderate
		TNB Sepang	MW(7)-S(SE)-2-6.95	90	94	87	71	79	Baik/Good
		Ladang Sepang	MW(7)-S(SE)-3-5.60	72	84	82	78	78	Baik/Good
Sarawak	Bekas Tapak Pelupusan Bangkai Haiwan / Ex-Animal Burial Sites	Oya Road, No. 1, Sibu	MW(7)-QS-Y1-10.00	70	69	64	55	79	Baik/Good
		Oya Road, No. 2, Sibu	MW(7)-QS-Y2-9.17	68	74	72	71	78	Baik/Good

Nota / Note :
* Stesen Baru / New Station
- Tiada Data / No Data

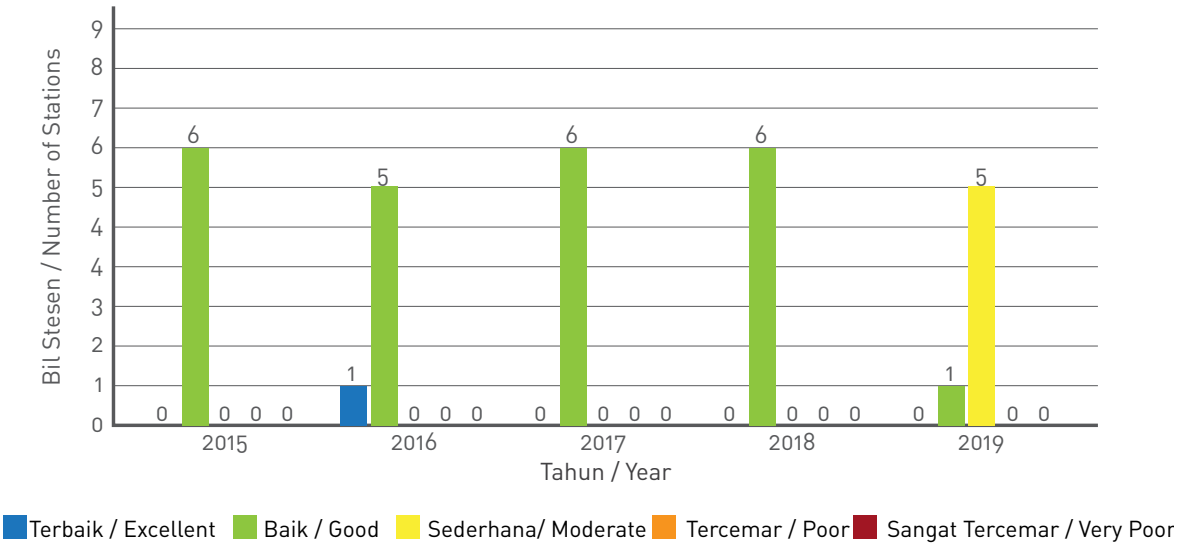
STATUS
KUALITI AIR TANAH BAGI AKUAKULTUR
STATUS OF GROUNDWATER QUALITY INDEX FOR AQUACULTURE

Tren Indeks Kualiti Air Tanah mulai tahun 2015 hingga 2019 bagi akuakultur adalah seperti yang ditunjukkan dalam **Rajah 3.10**. Berdasarkan **Rajah 3.10** didapati tiada stesen terbaik pada tahun 2019. Bilangan stesen baik menurun berbanding tahun sebelumnya manakala bilangan stesen sederhana meningkat berbanding tahun 2018. Tiada stesen tercemar dan sangat tercemar pada tahun 2019.

Pada tahun 2019, sebanyak 6 stesen bagi akuakultur telah dipantau. Hasil program pengawasan yang telah dijalankan, 1 stesen (16.7%) adalah baik dan 5 stesen (83.3%) sederhana **(Jadual 3.12)**.

Groundwater Quality Index trend for aquaculture from year 2015 until 2019 is shown in **Figure 3.10**. Based on **Figure 3.10,** no station was excellent in the year 2019. The number of good stations has decreased compared to the previous year while the number of moderate stations has increased. No station was categorised as poor and very poor in the year 2019.

In 2019, a total of 6 stations for aquaculture were monitored. The monitoring results indicated that 1 station (16.7%) was good good while 5 stations (83.3%) were moderate **(Table 3.12)**.



Rajah 3.10: Tren Indeks Kualiti Air Tanah bagi Akuakultur (2015-2019)
Figure 3.10: Trends of Groundwater Quality Index for Aquaculture (2015-2019)

Jadual 3.12: Status Indeks Kualiti Air Tanah bagi Akuakultur
Table 3.12: Status of Groundwater Quality Index for Aquaculture

NEGERI / STATE	KLASSIFIKASI STESEN / STATION CLASSIFICATION	KAWASAN / AREA	NOMBOR STESEN / STATION NUMBER	NILAI IKAT /GWQI VALUE					KATEGORI (2019)/ CATEGORY (2019)
				2015	2016	2017	2018	2019	
Pahang	Akuakultur / Aquaculture	Nenasi (Agrobest)	MW(7)-C16-2-10.5	73	81	80	81	62	Sederhana/ Moderate
		Nenasi (Agrobest)	MW(7)-C16-3-43	72	79	79	80	68	Sederhana/ Moderate
		Nenasi (Agrobest)	MW(7)-C16-4-38	73	83	82	83	72	Baik/Good
		Nenasi (Agrobest)	MW(7)-C16-5-10	79	92	84	79	60	Sederhana/ Moderate
		Nenasi (Agrobest)	MW(7)-C16-6-10	77	82	73	82	64	Sederhana/ Moderate
		Nenasi (Agrobest)	MW(7)-C16-7-29	82	87	87	88	69	Sederhana/ Moderate

Nota / Note :
* Stesen Baru / New Station
- Tiada Data / No Data

STATUS
KUALITI AIR TANAH BAGI PERANGINAN
STATUS OF GROUNDWATER QUALITY INDEX FOR RESORT

Tren Indeks Kualiti Air Tanah mulai tahun 2015 hingga 2019 bagi peranginan adalah seperti yang ditunjukkan dalam **Rajah 3.11**. Berdasarkan **Rajah 3.11,** didapati stesen terbaik dan sederhana telah meningkat pada tahun 2019. Tiada stesen baik, tercemar dan sangat tercemar sejak tahun 2015.

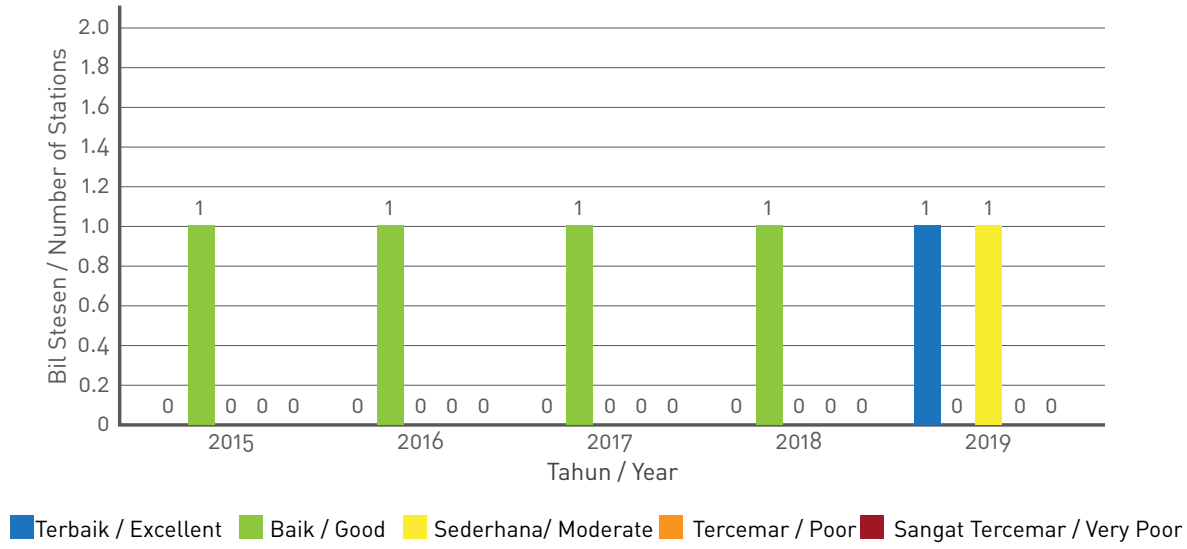
Pada tahun 2019, sebanyak 2 stesen peranginan telah dipantau berbanding 1 pada tahun 2018. Hasil program pengawasan yang telah dijalankan, 1 stesen (50.0%) adalah terbaik manakala 1 lagi stesen (50.0%) sederhana **(Jadual 3.13)**.

Jadual 3.14 menunjukkan Standard Kualiti Air Tanah bagi Rawatan Air Mentah Secara Konvensional (Air Minuman) merujuk kepada parameter utama dalam penilaian Status Kualiti Air Tanah**.**

Groundwater Quality Index trend for resort from year 2015 until 2019 is shown in **Figure 3.11.** Based on **Figure 3.11,** the number of excellent and moderate stations has increased in 2019. No station was categorised as good, poor and very poor since the year 2015.

In 2019, a total of 2 station for resort were monitored compared to the previous year of 1 monitoring well. The monitoring results indicated 1 station (50.0%) was excellent while 1 station (50.0%) was moderate **(Table 3.13).**

Table 3.14 shows the Groundwater Quality Standards for Conventional Treatment of Raw Water (Drinking Water) refer to significant parameter in identify of Groundwater Quality Status



Rajah 3.11: Tren Indeks Kualiti Air Tanah bagi Peranginan (2015-2019)
Figure 3.11: Trens of Groundwater Quality Index for Resorts (2015-2019)

Jadual 3.13: Status Indeks Kualiti Air Tanah bagi Peranginan
Table 3.13: Status of Groundwater Quality Index for Resorts

NEGERI / STATE	KLASSIFIKASI STESEN / STATION CLASSIFICATION	KAWASAN / AREA	NOMBOR STESEN / STATION NUMBER	NILAI IKAT /GWQI VALUE					KATEGORI (2019) / CATEGORY (2019)
				2015	2016	2017	2018	2019	
Sabah	Peranginan / Resort	Pulau Manukan	MW(7)-H511601-8-6.50	79	82	83	85	93	Terbaik/ Excellent
Kedah	Peranginan / Resort	*Kuarters Imigresen Tanjung Rhu, Langkawi	MW(7)-KV 69912-1-10.10	-	-	-	-	68	Sederhana/ Moderate

Nota / Note :
* Stesen Baru / New Station
- Tiada Data / No Data

Jadual 3.14: Standard Kualiti Air Tanah Bagi Rawatan Air Mentah Secara Konvensional (Air Minuman) Merujuk Kepada Parameter Utama Dalam Penilaian Status Kualiti Air Tanah
Table 3.14: Status of Groundwater Quality Standards for Conventional Treatment of Raw Water (Drinking Water) Refer to Significant Parameter in Identify of Groundwater Quality Status

PARAMETER/ PARAMETER	SIMBOL/ SYMBOL	STANDARD/ STANDARD	UNIT/ UNIT
Koliform / Total coliform	-	5000	MPN/100 ml
Pepejal Terlarut / TDS	-	1500	mg/l
Klorida / Chloride	Cl^-	250	mg/l
Besi / Iron	Fe^{2+}	1.0	mg/l
Keliatan / Hardness	$CaCO_3$	500	mg/l
Mangan / Manganese	Mn^{2+}	0.2	mg/l
Nitrit / Nitrite	NO_2^-	0.4	mg/l
Raksa / Mercury	Hg^{2+}	0.001	mg/l
Kadmium / Cadmium	Cd^{2+}	0.003	mg/l
Arsenik / Arsenic	As^{+3}	0.01	mg/l
Plumbum / Lead	Pb^{2+}	0.05	mg/l
Kromium / Chromium	Cr^{3+}	0.05	mg/l
Kuprum / Copper	Cu^{2+}	1.0	mg/l
Zink / Zinc	Zn^{2+}	3.0	mg/l
Sulfat / Sulphate	SO_4^{2-}	250	mg/l
Selenium / Selenium	Se-	0.01	mg/l
Sebatian Fenol / Phenolics	-	0.002	mg/l

Nota / Note :
* Stesen Baru / New Station
- Tiada Data / No Data

STATUS
KUALITI AIR TANAH
GROUNDWATER QUALITY STATUS

Penilaian terhadap kualiti air tanah adalah berdasarkan kepada nilai peratusan yang melebihi had penerimaan dalam Standard Kebangsaan Bagi Standard Kualiti Air Tanah Bagi Rawatan Air Mentah Secara Konvensional (Air Minuman).

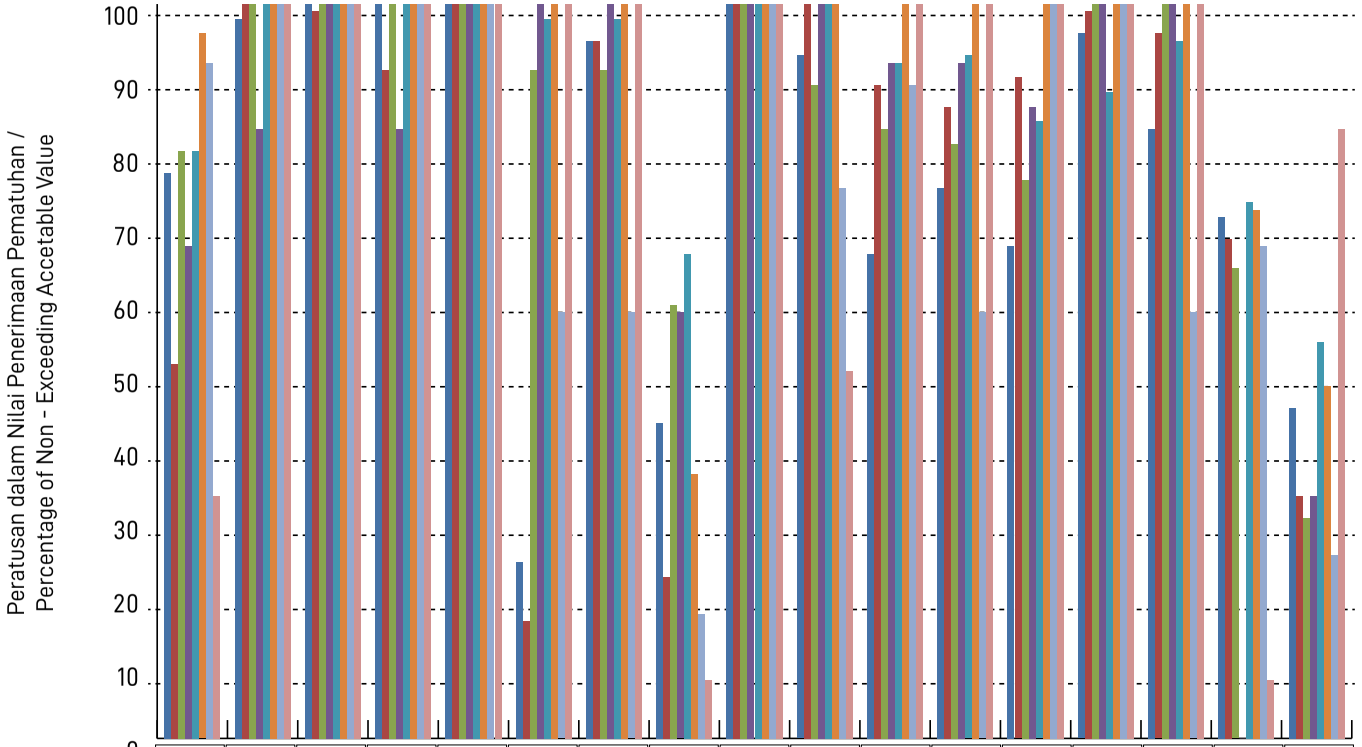
The assessment of groundwater quality was based on percentage value exceeding the standard of the Standard Kualiti Air Tanah Bagi Rawatan Air Mentah Secara Konvensional (Air Minuman)

Nilai peratusan tersebut adalah sebagaimana di dalam **Jadual 3.15**

The percentage value is as shown in **Table 3.15** below

Jadual 3.15: Peratusan Julat Nilai Pematuhan, 2019
Table 3.15: Percentage of Compliance, 2019

PERATUSAN JULAT NILAI PEMATUHAN (%) / PERCENTAGE OF COMPLIANCE (%)	KATEGORI / CATEGORY
0% - 49%	Rendah / Low
50% - 79%	Sederhana / Moderate
80% - 100%	Tinggi / High



	As	Hg	Cd	Cr	Cu	Fe	Pb	Mn	Zn	Se	CaCO3	TDS	Cl	NO3	SO4	T - Coliform	Phenol
Industri/Industry	77	98	100	100	100	24	95	43	100	93	66	75	67	96	83	71	45
Tapak Pelupusan Sampah / Landfill	51	100	99	91	100	16	95	22	100	100	89	86	90	99	96	68	33
Pertanian /Agriculture	80	100	100	100	100	91	91	59	100	89	83	81	76	100	100	64	30
Bekalan Air / Water Supply	67	83	100	83	100	100	100	58	100	100	92	92	86	100	100	0	33
Bandar / Pinggir Bandar / Urban/ Suburban	80	100	100	100	100	98	98	66	100	100	92	93	84	88	95	73	54
Padang Golf / Golf Course	96	100	100	100	100	100	100	36	100	100	100	100	100	100	100	72	48
Luar Bandar / Rural	92	100	100	100	100	58	58	17	100	75	89	58	92	100	58	67	25
Bekas Lombong/ Ex - mining	33	100	100	100	100	100	100	8	100	50	100	100	100	100	100	8	83

Rajah 3.12: Peratusan Pematuhan oleh Pencemar Terpilih Mengikut Guna Tanah, 2019
Figure 3.12: Percentage of Compliance of Selected Contaminants by Land Use, 2019

Pada tahun 2019, keputusan yang diperolehi daripada pengawasan kualiti air tanah yang dijalankan menunjukkan bahawa semua stesen berada dalam pematuhan Standard Kualiti Air Tanah Bagi Rawatan Air Mentah Secara Konvensional (Air Minuman) kecuali bagi arsenic (As), mangan (Mn), jumlah koliform, besi (Fe) dan sebatian fenol yang mempunyai peratusan pematuhan yang rendah bagi gunatanah tertentu seperti **Rajah 3.12** dan Jadual **3.16.**

In 2019, the results derived from monitoring showed that all stations were within the Groundwater Quality Standards for Conventional Raw Water Treatment (Drinking Water) except for arsenic (As), iron (Fe), manganese (Mn), total coliform and phenolics which showed low percentage of compliance for certain land use as shown in **Figure 3.12** and **Table 3.16.**

Jadual 3.17 menunjukkan nilai peratusan yang melebihi Standard Kualiti Air Tanah mengikut negeri.

Table 3.17 shows the percentage of Groundwater Quality Standards exceedance by state.

Jadual 3.16: Peratusan Pematuhan oleh Pencemar Mengikut Guna Tanah dalam Peratusan Julat 0-49%, Tahun 2019

Table 3.16: Percentage of Compliance of Selected Contaminants by Land Use Within Percentage 0-49%, Year 2019

KATEGORI GUNATANAH / CATEGORY OF LANDUSE	PARAMETER/ PARAMETER	PERATUSAN PEMATUHAN KEPADA STANDARD/ PERCENTAGE OF STANDARD COMPLIANCE
Bekalan Air Tempatan/ Municipal Water Supply	Total Coliform Mn	0%-10%
Bekas Lombong Ex-Mining		
Tapak Perindustrian/ Industrial Sites	Fe Mn	11%-30%
Tapak Pelupusan Sampah/ Landfill		
Pertanian/ Agriculture		
Luar Bandar/ Rural Areas		
Tapak Perindustrian/ Industrial Sites	Phenol Mn As	31%- 49%
Tapak Pelupusan Sampah/ Landfill		
Bekalan Air Tempatan/ Municipal Water Supply		
Padang Golf/ Golf Cources		
Bekas Lombong/ Ex Mining		

Jadual 3.17: Nilai Peratusan yang Melebihi Standard Kualiti Air Tanah Mengikut Negeri
Table 3.17: The Percentage of Groundwater Quality Standards Exceedance by State

NEGERI/ STATE	BILANGAN STESEN/ NO. OF STATION	MAKLUMAT STESEN/ STATION DESCRIPTION	NILAI PERATUSAN YANG MELEBIHI STANDARDS KUALITI AIR TANAH (%) / THE PERCENTAGE OF GROUNDWATER QUALITY STANDARDS EXCEEDANCE (%)				
			As	Fe	Mn	T-COLIFORM	PHENOL
Sabah	14	1) ITAC, Penampang 1	100	50	50	0	100
		2) ITAC, Penampang 2	25	50	100	100	100
		3) ITAC, Penampang 3	0	0	50	50	100
		4) ITAC, Penampang 4	0	0	50	50	50
		5) ITAC, Penampang 5	50	50	50	50	50
		6) ITAC, Penampang 6	0	0	50	100	100
		7) ITAC, Penampang 7	0	25	50	100	100
		8) Limbawang	25	75	100	100	100
		9) Tawau	25	25	50	100	100
		10) Kg. Tajau Laut	0	100	100	100	100
		11) Sandakan Golf Club No.1	0	0	0	50	75
		12) Sandakan Golf Club No.2	0	25	25	100	75
		13) Inanam	0	75	75	75	75
		14) Pulau Manukan	50	100	100	100	100
W.P Labuan	1	1)Asian Supply Base	0	25	50	100	100
Sarawak	12	1) Kemuyang no.1	0	100	100	100	75
		2) Kemuyang no.2	0	75	75	100	75
		3) Kabong	75	100	100	100	100
		4) Kuala Lawas no.1	100	0	0	75	75
		5) Kuala Lawas no.2	-	-	-	-	-
		6) Laku	0	75	0	75	75
		7) Kg. Lusut Kiri	50	100	100	100	100
		8) Bau no.1	100	100	100	100	100
		9) Bau no.2	100	100	100	100	100
		10) Bau	25	75	25	75	75
		11) Oya no.1	100	100	100	75	100
		12) Oya no.2	100	100	75	75	100
Terengganu	16	1) Kerteh no.1	0	25	25	75	75
		2) Kerteh no.2	0	50	0	100	100
		3) Telok Kalong no.1	0	100	0	75	75
		4) Telok Kalong no.2	25	50	100	75	75
		5) Kg. Kubang Badak no.1, K.Treg	0	0	0	75	75
		6) Kg. Kubang Badak no.2, K.Treg	0	100	0	75	100
		7) Kg. Merang,Setiu	0	0	0	75	75
		8) Kg. Raja no.1 , Besut	0	0	0	0	75
		9) Kg. Raja no.2, Besut	0	100	100	75	75
		10) Bukit Payung, Marang	0	0	50	100	75
		11) Kg. Alor Peroi no.1	50	50	100	100	100
		12) Kg. Alor Peroi no.2	25	100	100	100	100

Jadual 3.17: Nilai Peratusan yang Melebihi Standard Kualiti Air Tanah Mengikut Negeri
Table 3.17: The Percentage of Groundwater Quality Standards Exceedance by State

NEGERI/ STATE	BILANGAN STESEN/ NO. OF STATION	MAKLUMAT STESEN/ STATION DESCRIPTION	NILAI PERATUSAN YANG MELEBIHI STANDARDS KUALITI AIR TANAH (%) / THE PERCENTAGE OF GROUNDWATER QUALITY STANDARDS EXCEEDANCE (%)				
			As	Fe	Mn	T-COLIFORM	PHENOL
Terengganu		13) Kg. Alor Peroi no.3	25	100	100	100	100
		14)SK Bari, Setiu	0	0	0	75	75
		15)Blue Archipelago	75	50	75	100	100
		16)SK Telaga, Hulu Terengganu	0	0	0	75	100
Pahang	9	1) Nenasi	0	75	75	75	75
		2) Lepar	0	75	0	75	100
		3) Agrobest no.2, Nenasi	25	0	0	100	100
		4) Agrobest no.3, Nenasi	25	100	100	100	100
		5) Agrobest no.4, Nenasi	0	75	75	100	100
		6) Agrobest no.5, Nenasi	25	0	25	75	75
		7) Agrobest no.6, Nenasi	25	100	100	100	100
		8) Agrobest no.7, Nenasi	0	0	75	100	100
		9) Lynas	25	25	100	100	100
Johor	7	1) Tg. Puteri, Pasir Gudang (MUCC)	0	50	0	75	75
		2) Tg. Puteri, Pasir Gudang	100	100	100	100	100
		3) Kota Tinggi	25	75	100	100	100
		4) Ulu Choh (Pintu)	75	75	75	100	75
		5) Ulu Choh (Kolam)	75	75	100	100	100
		6) Ulu Choh (Sungai)	100	100	100	100	100
		7) Tapak Pelupusan Sisa Pepe-jal,Ladang CEP,Lot 2075,Mukim Renggam	75	75	75	100	100
Kedah	6	1) Kulim Hi-tech	0	0	0	75	100
		2) Pulau Langkawi no.1	0	50	0	25	100
		3) Pulau Langkawi no.2	100	0	0	25	100
		4) SK Darul Uloom Kepala Batas	75	100	100	100	100
		5) SK Kepala Batas	0	0	0	75	100
		6) Kuarters Imigresen, Tg.rhu,Langkawi	0	0	0	100	100
Perlis	4	1) Arau no.1	0	100	0	50	50
		2) Arau no.2	0	0	50	50	50
		3) Rimba Mas	0	0	0	0	100
		4) Felda Chuping	0	0	0	75	50

Jadual 3.17: Nilai Peratusan yang Melebihi Standard Kualiti Air Tanah Mengikut Negeri
Table 3.17: The Percentage of Groundwater Quality Standards Exceedance by State

NEGERI/ STATE	BILANGAN STESEN/ NO. OF STATION	MAKLUMAT STESEN/ STATION DESCRIPTION	NILAI PERATUSAN YANG MELEBIHI STANDARDS KUALITI AIR TANAH (%) / THE PERCENTAGE OF GROUNDWATER QUALITY STANDARDS EXCEEDANCE (%)				
			As	Fe	Mn	T-COLIFORM	PHENOL
Kelantan	16	1) Eastern Garment MFG no.1	0	75	75	75	75
		2) Eastern Garment MFG no.2	75	0	0	75	75
		3) Panji no.1	0	50	0	75	75
		4) Panji no.2	0	75	75	100	100
		5) Pasir Mas	0	100	100	100	100
		6) Kampong Jembal	0	100	100	75	100
		7) Beris Lalang	0	25	25	100	100
		8) Rantau Panjang no.1	0	75	0	50	50
		9) Rantau Panjang no.2	0	0	0	75	50
		12) Kelab Golf & Desa no.1	0	100	25	75	75
		13) Kelab Golf & Desa no.2	0	50	25	75	75
		10) Kelab Golf DiRaja Kubang Kerian no.1	50	100	100	100	100
		11) Kelab Golf DiRaja Kubang Kerian no.2	33	100	0	100	100
		14) Bachok no.1	25	25	50	75	75
		15) Bachok no.2	25	50	75	75	100
		16) SMK CHERANG RUKU, PASIR PUTEH	0	0	0	100	100
Melaka	3	1) Petronas Sungai Udang	75	100	100	100	100
		2) Pusat Kecemerlangan Buangan Terjadual, Jabatan Alam Sekitar	0	75	0	100	100
		3) Tapak Pelupusan Sampah, Sungai Udang	75	75	100	100	100
Perak	5	1) Tambun	100	100	100	75	100
		2) Jalong no.2	75	100	100	100	100
		3) Batu Gajah	100	100	100	75	75
		4)Pusat Kecermelangan Kenderaan Bermotor, JAS Gopeng, Perak	-	-	-	-	-
		5) Jalong no.1	0	75	75	75	75
Kuala Lumpur	6	1) Jln. Sungai Besi no.1	100	67	100	100	100
		2) Jln. Sungai Besi no.2	0	0	0	75	75
		3) Jln. Sungai Besi no.3	0	0	0	75	75
		4) Taman Beringin no.1	75	50	50	50	50
		5) Taman Beringin no.2	75	75	75	100	100
		6) Royal Selangor Golf Club	-	-	-	-	-
Putrajaya	1	1) Taman Wetland, W.P. Putrajaya	50	75	0	50	50

Jadual 3.17: Nilai Peratusan yang Melebihi Standard Kualiti Air Tanah Mengikut Negeri
Table 3.17: The Percentage of Groundwater Quality Standards Exceedance by State

NEGERI/ STATE	BILANGAN STESEN/ NO. OF STATION	MAKLUMAT STESEN/ STATION DESCRIPTION	NILAI PERATUSAN YANG MELEBIHI STANDARDS KUALITI AIR TANAH (%) / THE PERCENTAGE OF GROUNDWATER QUALITY STANDARDS EXCEEDANCE (%)				
			As	Fe	Mn	T-COLIFORM	PHENOL
Selangor	10	1) Sek Keb Seksyen 20,Shah Alam	0	25	0	75	75
		2) CIAST no.1, Shah Alam	0	75	75	75	75
		3) CIAST no.2, Shah Alam	0	75	75	75	75
		4) Saujana Golf Resort no.1, Subang	50	75	75	75	75
		5) Saujana Golf Resort no.2, Subang	75	75	50	75	75
		6) Stesen Kampung Sungai Keroh, Sepang	75	50	75	100	100
		7) TNB Sepang	25	100	100	75	75
		8) Ladang Sepang	0	75	75	100	100
		9) Masjid Jameul Huda,Parit 7,Sekinchan	75	0	0	50	50
		10) Institut Alam Sekitar (EIMAS)	0	0	0	50	50
Pulau Pinang	6	1) Mak Mandin no.1	75	0	75	75	75
		2) Mak Mandin no.2	100	50	75	75	75
		3) Bayan Lepas	0	0	0	75	75
		4) Valdor (Kelapa)	0	75	75	75	75
		5) Valdor (Tengah)	0	0	0	50	50
		6) Valdor (Jalan)	0	0	75	75	75
Negeri Sembilan	4	1) Senawang	75	67	0	75	75
		2) Kualiti Alam Sdn. Bhd no.1	67	75	100	100	100
		3) Kualiti Alam Sdn. Bhd no.2	75	75	75	75	100
		4) TPS Tanah Merah (Cypark) Port Dickson	100	100	100	100	100

BAB 4
CHAPTER 4

KUALITI AIR MARIN DAN PULAU-PULAU
MARINE AND ISLAND MARINE WATER QUALITY

PENGAWASAN KUALITI AIR MARIN
MARINE WATER QUALITY MONITORING

Jabatan Alam Sekitar (JAS) telah menjalankan pengawasan kualiti air marin semenjak tahun 1978 di Semenanjung Malaysia dan 1985 di Sabah dan Sarawak. Objektif utama program pengawasan kualiti air marin ini adalah untuk menilai status kualiti air marin dan seterusnya untuk menentukan tahap pencemaran daripada punca-punca di daratan dan juga laut. Punca-punca pencemaran ini boleh menimbulkan ancaman pada kelestarian ekosistem dari segi kesihatan dan biodiversiti persekitaran marin.

The marine water quality is being monitored by the Department of Environment (DOE) since 1978 in Peninsular Malaysia, and 1985 in Sabah and Sarawak. The primary objective of the monitoring programme was to assess the marine water quality status, and subsequently determine the degree of pollution from both the land-based and sea-based sources. Pollution sources are threatening the sustainability of ecosystem health and marine environment biodiversity.

Stesen-stesen pengawasan yang dibangunkan di bawah Program Pengawasan Kualiti Air Marin diklasifikasikan kepada tiga (3) kategori seperti berikut:-

Monitoring stations established under the Marine Water Quality Monitoring Programme were classified into three (3) categories as follows:

Stesen pantai terletak di sepanjang pantai kira-kira 100 meter dari gigi air laut dan ia mestilah sekurang-kurangnya 500 meter dari muara sungai.

Coastal stations are located along the coastline; approximately 100 meters from the water edge and it must be at least 500 meters away from estuary.

Stesen muara sungai terletak di persekitaran muara sungai di mana terdapat interaksi antara air tawar dan air laut. Stesen muara sungai banyak menerima kesan daripada ekosistem sungai.

Estuary stations are located within an estuarine environment, where freshwater and seawater interact. They receive impacts from the riverine ecosystem.

Stesen pulau pula dibahagikan kepada empat (4) kategori termasuk Pulau (Kawasan Dilindungi), Pulau (Taman Laut), Pulau (Pembangunan) dan Pulau (Resort). Stesen Pulau (Kawasan Dilindungi) adalah stesen yang dibangunkan di dalam Kawasan Perlindungan Perikanan di bawah Peraturan-Peraturan Perikanan (Kawasan Larangan) 1994. Stesen Pulau (Taman Laut) adalah stesen pengawasan yang dibangunkan di kawasan Taman Laut yang ditetapkan di bawah Perintah Taman Laut

Island Stations are further divided into four (4) categories, namely protected area island, marine park island, development island and (resort island). Protected area island stations are stations established within the fisheries protected area under the Fisheries (Prohibited Area) Regulation, 1994. (Marine Park) Island Stations are monitoring stations established within the designated marine park area under the Marine Park Malaysia Order, 1994. Meanwhile, development island stations are monitoring

Malaysia 1994. Stesen Pulau (Pembangunan) adalah stesen pengawasan yang dibangunkan di sekitar pulau yang sekurang-kurangnya 90 km^2 dengan jumlah penduduk lebih daripada 20,000 orang; atau/ dan pulau-pulau yang ada kepentingan ekonomi. Stesen Pulau (Resort) adalah stesen pengawasan di sekitar pulau yang dibangunkan untuk pelancongan, yang mempunyai resort dan chalet sebagai pemacu ekonomi setempat bagi pulau tersebut.

Pada tahun 2018, Standad Kualiti Air Marin Malaysia (SKAMM) dan Indeks Kualiti Air Marin Malaysia (IKAMM) telah disemak semula untuk memantapkan rangka kerja dalam pengurusan alam sekitar yang lestari. Standad Kualiti Air Marin Malaysia merupakan standad ambien, memberi fokus pada perlindungan dan kelestarian ekosistem akuatik serta perkhidmatan ekosistem tersebut kepada masyarakat dan mengambilkira faktor ekonomi, praktikal dan sosial.

SKAMM berdasarkan pra penentuan klasifikasi berdasarkan objektif kualiti air marin. SKAMM terdiri daripada lima kelas kualiti air seperti berikut:-

1. Kelas 1 merangkumi air di perairan yang diwartakan atau ada perlindungan berkanun dan perairan yang tidak diwartakan tetapi ada ekosistem marin yang sensitif seperti terumbu karang, rumpai laut, tapak pendaratan penyu dan perairan yang terdapat habitat tertentu seperti habitat sensitif kawasan sumber makanan organisma marin.

2. Kelas 2 merangkumi air yang ada aktiviti perikanan dan marikultur yang berdasarkan pada zon penangkapan ikan yang diterbitkan oleh Jabatan Perikanan sebagai panduan. Perairan dalam Kelas 2 terdiri daripada sebahagian zon pemuliharaan (termasuk `Kawasan larangan perikanan') sehingga ke Zon Ekonomi Eksklusif (EEZ). Aktiviti marikultur yang ditakrifkan sebagai Kelas 2 adalah aktiviti dalam badan air marin tersebut (seperti penternakan sangkar dan penternakan kerang) dan tidak termasuk aktiviti akuakultur perikanan darat.

stations established around islands which are at least 90 km^2 with a total population of more than 20,000 people or/ and islands of economical importance. Resort island stations are stations established in surrounding islands which are developed for tourism. Normally, there are resorts and chalets developed on the islands as the key economic driver for the islands.

In 2018, the Malaysian Marine Water Quality Standards (MMWQS) and Malaysian Marine Water Quality Index (MMWQI) were revised to meliorate the referencing framework for sustainable environmental management. The MMWQS are ambient standards, which focuses on protection and sustainability of the aquatic ecosystems and services they provide to the society, as well as to accomplish it in an economical, practical and socially relevant manner.

The MMWQS is established by pre-determined classification based on its marine water quality objective. MMWQS comprises five water quality classes:

1. Class 1 water comprises the gazetted and statutory protected waters; and un-gazetted area but with the presence of sensitive ecosystems, including coral reefs, seagrass, turtle landing site and water specific to habitats and feeding ground of sensitive marine organisms.

2. Class 2 water encompasses fisheries and mariculture activities, identified based on fishing zone established by the Department of Fisheries as a guide. Its water comprises the conservation zone (notwithstanding 'Fisheries Prohibited Area' until the economic exclusive zone (EEZ). Mariculture activities defined are those within the marine water, such as marine cage and cockle culture, but excluding the on land aquaculture activities.

3. Kelas 3 ialah standad untuk kualiti air marin yang terdedah kepada pelepasan efluen secara langsung daripada aktiviti antropogenik. Oleh itu, ekosistem di perairan ini akan mengalami banyak pencemaran. Tahap perlindungan adalah bertujuan untuk mengekalkan kesihatan ekosistem yang masih ada dan memulihara kualiti air marin di kawasan yang terjejas.

3. Class 3 is for marine water that is exposed to direct effluent discharge from anthropogenic activities. Therefore, ecosystems in these areas are subjected to some degree of degradation. The corresponding level of protection is therefore aimed at sustaining the health of remaining ecosystems and to improve water quality of affected areas.

4. Kelas E (Interim) adalah standad yang banyak dipengaruhi oleh musim dan variasi diurnal. Selain itu, ciri-ciri geologi dan corak pergerakan air turut menyumbang pada sifat dinamik di perairan ini. Berdasarkan pada kepelbagaian semulajadi ini, Standad Kelas E terhasil adalah daripada ciri-ciri kualiti air muara sungai yang boleh mewakili persekitaran yang belum terganggu. Kawasan muara sungai sebegini akan dijadikan Tapak Rujukan untuk mewakili tiga jenis muara utama di Malaysia. Kelas E1 dipilih untuk mewakili muara jenis dataran pantai, Kelas E2 mewakili muara jenis lagun manakala Kelas E3 akan mewakili muara sungai yang besar dan ada rangkaian kompleks.

4. Class E (Interim) is for estuaries water which is subjected to seasonal and diurnal variations. In addition, the geological characteristics and water circulation patterns also contribute to the dynamic nature of these waters. Based on these natural variations, standards derived from the water quality characteristic of estuarine waters are deemed to represent relatively undisturbed environment. These sites, which are referred to as reference sites, are selected to represent the three major estuary types in Malaysia. Therefore, Class E1 is taken to be a representative of the coastal plain, Class E2 represents the lagoon type estuary while Class E3 is to be referred to when assessing estuaries with a large and complex distributary network.

5. Kelas R adalah standad untuk kegunaan air marin bagi tujuan rekreasi. Ia merujuk pada Standad Kebangsaan Kualiti Air Rekreasi Semulajadi dan Garispanduan bagi Pemantauan Air Rekreasi Semulajadi (Air Marin & Air Tawar) yang diterbitkan oleh Kementerian Kesihatan Malaysia.

5. Class R is for recreational use of marine waters. It is based on the National Standards Water Quality for Natural Recreational and Guidelines for Water Monitoring for Natural Recreational (Marine and Freshwater) by the Ministry of Health, Malaysia.

IKAMM adalah pengagregatan parameter kualiti air marin yang paling relevan bertujuan untuk menyediakan maklumat yang berkaitan dengan status kualiti air marin bagi badan air. Indeks ini berdasarkan pada parameter kualiti air yang dipilih iaitu oksiden terlarut, faecal coliform, ammonia, nitrat, fosfat dan jumlah pepejal terampai.

MMWQI is an aggregation of the most relevant marine water quality parameters which aims to provide information pertinent to the marine water quality status of a water body. The index is derived based on dissolved oxygen, faecal coliform, unionised ammonia, nitrate, phosphate and total suspended solid.

Penggunaan IKAMM versi baru telah mengeluarkan parameter minyak dan gris daripada formula indeks kerana tahap minyak dan gris didapati sentiasa di bawah had pengesanan dalam Rangkaian Pengawasan Kualiti Air Marin selama lima tahun. Dengan mengeluarkan parameter tersebut

The revised MMWQI has removed oil and grease parameter from the index formulation because the level of oil and grease was always below the marine water quality monitoring network detection limits for the past five years. Removal of the parameter has marked a new index formulation, which is more sensitive and

menghasilkan formula indeks yang baru, yang lebih sensitif dan lebih ketat dalam mengesan kemerosotan kualiti air marin.

Walaupun adanya semakan rumusan indeks versi baru, penggabungan IKAMM masih dalam julat daripada 0 hingga 100, dengan 0 menunjukkan kualiti air sebagai tercemar manakala 100 menunjukkan kualiti air sebagai terbaik **(Jadual 4.1).**

Jadual 4.2 menunjukkan Standard Kualiti Air Marin Malaysia

Sebanyak 188 stesen pantai, 85 stesen muara sungai dan 96 stesen pulau telah dipantau pada tahun 2019. Terdapat enam (6) frekuensi persampelan bagi setiap stesen dengan jumlah sampel sebanyak 1128 sampel untuk stesen pantai, 510 sampel untuk stesen muara sungai dan 570 sampel untuk stesen pulau. Sampel-sampel tersebut dianalisa dan hasil analisa dirumuskan berdasarkan IKAMM bagi enam frekuensi.

stringent towards the deterioration of marine water quality.

Despite the revision in index formulation, MMWQI aggregation is still scaled from 0 to 100, whereby 0 indicates poor water quality while 100 indicates excellent water quality **(Table 4.1).**

Table 4.2 shows Malaysian Marine Water Quality Standards

In 2019, a total of 188 coastal stations, 85 estuary stations and 95 island stations were monitored. There were six (6) sampling frequencies in total for each monitoring station, amounting to 1128 samples for coastal stations, 510 samples for estuary stations and 570 samples for island stations. These samples were analysed and results were summarised based on MMWQI of the six frequencies.

Jadual 4.1: Klasifikasi Indeks Kualiti Air Marin Malaysia
Table 4.1: Malaysian Marine Water Quality Index Classification

KATEGORI / CATEGORY	NILAI INDEKS/INDEX VALUE
Terbaik/ Excellent	90 -100
Baik/ Good	80 - <90
Sederhana/ Moderate	50 - <80
Tercemar/ Poor	0 - <50

Jadual 4.2: Standard Kualiti Air Marin Malaysia
Table 4.2: Malaysian Marine Water Quality Standards

PARAMETER (µG/L) MELAINKAN DINYATAKAN SEBALIKNYA/ PARAMETER (µG/L) UNLESS OTHERWISE STATED	KLASIFIKASI / CLASSIFICATION					
	KELAS 1/ CLASS 1	KELAS 2/ CLASS 2	KELAS 3 / CLASS 3	INTERIM KELAS E1/ INTERIM CLASS E1	INTERIM KELAS E2/ INTERIM CLASS E2	INTERIM KELAS E3/ INTERIM CLASS E3
	HABITAT MARIN SENSITIF / SENSITIVE MARINE HABITATS	PERIKANAN (TERMASUK MARIKULTUR)/ FISHERIES (INCLUDING MARICULTURE)	INDUSTRI, AKTIVITI KOMERSIAL & KAWASAN KEDIAMAN PESISIR PANTAI / INDUSTRY, COMMERCIAL ACTIVITIES & COASTAL SETTLEMENTS	MUARA SUNGAI / ESTUARIES		
				DATARAN PANTAI/ COASTAL PLAIN	LAGUN/ LAGOON	RANGKAIAN KOMPLEKS/ COMPLEX DISTRIBUTARY NETWORK
Oksigen Terlarut / Dissolved Oxygen (mg/l)	>6.0	>5.0	>3.0	>5.0	>5.0	>5.0
Jumlah Pepejal Terampai/ Total Suspended Solids (mg/l)	25.0	50.0	100.0	30.0	30.0	30.0
Fosfat / Phosphate	5.0	75.0	670.0	100.0	180.0	180.0
Nitrat / Nitrate	10.0	60.0	700.0	200.0	570.0	430.0
Ammonia	35.0	50.0	320.0	5.0	10.0	10.0
Merkuri / Mercury	0.04	0.04	0.04	0.04	0.04	0.04
Kadmium / Cadmium	0.50	2.00	3.00	1.00	1.00	1.00
Kromium (VI) / Chromium (VI)	0.14	10.00	20.00	10.00	10.00	10.00
Kuprum / Copper	1.30	2.90	8.00	1.00	1.00	1.00
Sianida / Cyniade	2.00	7.00	14.00	5.00	5.00	5.00
Plumbum / Lead	2.20	8.50	12.00	1.30	2.00	2.00
Zink / Zinc	7.00	50.00	100.00	16.00	5.00	5.00
Arsenik (III) / Arsenic (III)	1.00	3.00	3.00	3.00	1.00	1.00
Aluminium	27.0	27.0	55.0	27.0	27.0	27.0
TBT	0.001	0.010	0.050	0.002	0.002	0.002
PAH	100.0	200.0	1000.0	5.0	5.0	5.0
Jumlah Fenol Total Phenol	1.0	10.0	100.0	10.0	10.0	10.0
Minyak & Gris/ Oil & Grease (mg/l)	0.01	0.14	5.00	1.00	1.00	1.00
Faecal Coliform (cfu/100ml)	70	70	70	70	70	70
Suhu/ Temperature (°C)	≤ 2 °C bertambah melebihi ambien maksimum/ ≤ 2 °C increase over maximum ambient					
pH	6.5 - 9.0					
Marine Litter	Bebas dari *marine litter*/ Free from marine litter					

STATUS
STESEN-STESEN KUALITI AIR MARIN
STATUS OF MARINE WATER QUALITY STATIONS

Dalam tahun 2019, daripada 368 stesen pengawasan kualiti air marin bagi pantai, muara sungai dan pulau di negara ini, sebanyak 74 stesen adalah status kualiti air terbaik, 113 stesen baik, sementara 166 stesen sederhana manakala 15 stesen yang lain tercemar. 11 daripada stesen yang tercemar berada di kawasan muara sungai, 3 di kawasan pantai dan 1 di kawasan pulau.

Johor dan Selangor masing-masing merekodkan 5 stesen sebagai tercemar, manakala 2 stesen tercemar di Pulau Pinang dan 1 stesen tercemar masing-masing di Perak, Melaka dan Kelantan. Faecal coliform, oksigen terlarut, nitrat dan fosfat merupakan parameter-parameter utama yang menjejaskan kualiti air marin. IKAMM versi baru untuk pengiraan indeks kualiti air marin pada tahun 2019 telah menunjukkan penanda aras baru untuk pengawasan yang lebih sensitif dan ketat terhadap perubahan kualiti air marin.

Jadual 4.3 dan **Jadual 4.4** menunjukkan senarai stesen pantai dan muara sungai yang mencapai kategori terbaik bagi tahun 2019.

In 2019, out of the 368 local marine water quality monitoring stations at coastal, estuary and islands, 74 stations were categorised as excellent, 113 stations as good, while 166 stations were moderate. The remaining 15 stations were categorised as poor. A total of 11 poor water quality stations were located at the estuary, three (3) were at coastal area while the remaining one (1) was located on the island.

Johor and Selangor recorded five (5) poor stations, respectively, while Pulau Pinang recorded two (2) poor stations and one (1) poor station located in Perak, Malacca and Kelantan. Faecal coliform, dissolved oxygen, nitrate and phosphate were the key parameters that deteriorated the marine water quality. The new version of MMWQI for marine water quality index calculation in 2019 has demarcated a new benchmarking to monitor which is more sensitive and stringent towards changes in marine water quality.

Table 4.3 and **Table 4.4** show the list of coastal and estuary stations which achieved the excellent category in 2019.

Jadual 4.3: Senarai Stesen Pantai dengan Status Kategori Terbaik, 2019
Table 4.3: Coastal Stations under the Category of Excellent Status, 2019

BIL./ NO.	NEGERI/ STATE	LOKASI/ LOCATION
1	Terengganu	Pantai Tok Jembal
2	Terengganu	Pantai Kelulut
3	Kelantan	Pantai Bisikan Bayu
4	Sabah	Pantai Sabandar
5	Pahang	Pantai Cherating (Legend B)
6	Terengganu	KIPC Selatan
7	Terengganu	Pantai Teluk Kalong
8	Sabah	Pantai Teluk Brunei 2
9	Sabah	Pantai Teluk Brunei 6
10	Johor	Tanjung Resang

Jadual 4.4: Senarai Stesen Muara Sungai dengan Status Kategori Terbaik, 2019
Table 4.4: Estuaries Stations under the Category of Excellent Status, 2019

BIL./ NO.	NEGERI/ STATE	LOKASI/ LOCATION
1	Terengganu	Tioxide Utara (Kg. Bukit Kuang, Kijal)
2	Terengganu	Tioxide Tengah (Pupuk Semangat, Kijal)
3	Sarawak	Kuala Sungai Semantan

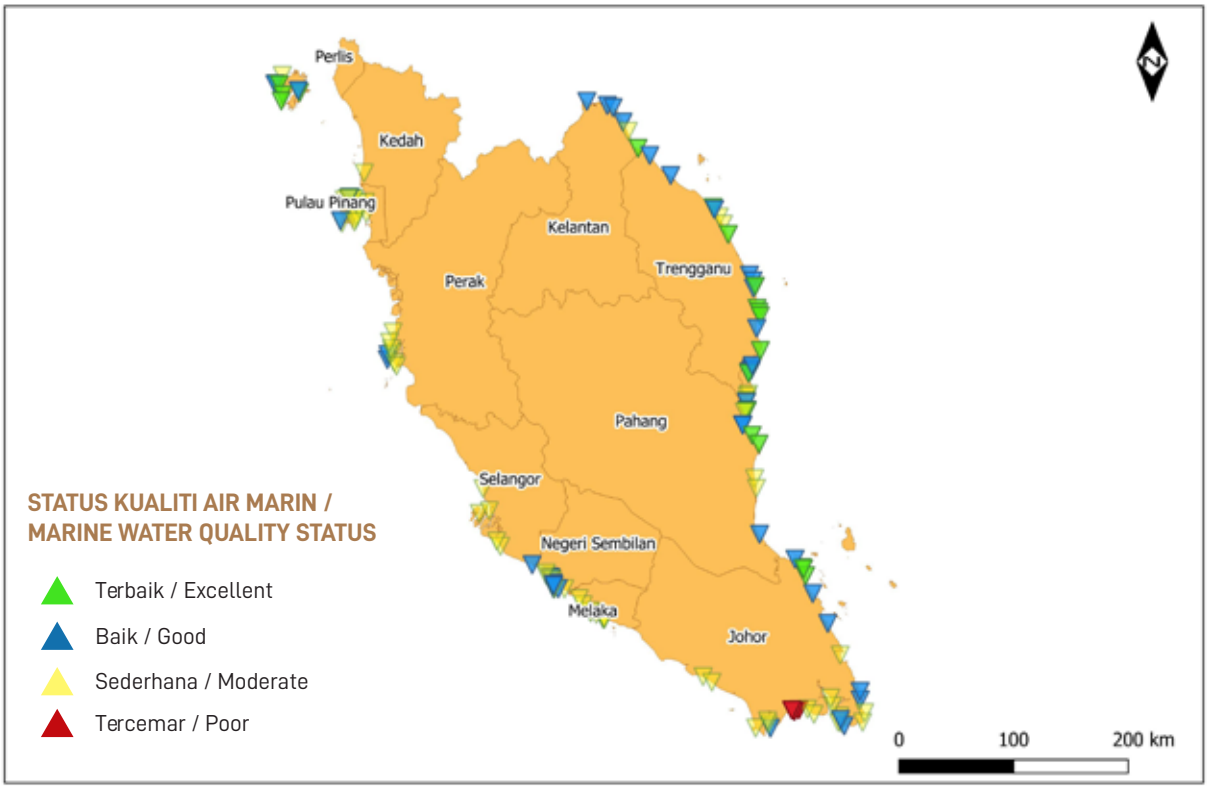
Stesen pulau yang mencapai kategori terbaik bagi tahun 2019 adalah seperti di **Jadual 4.5.**

The island stations that achieved the excellent category for the 2019 are listed in **Table 4.5.**

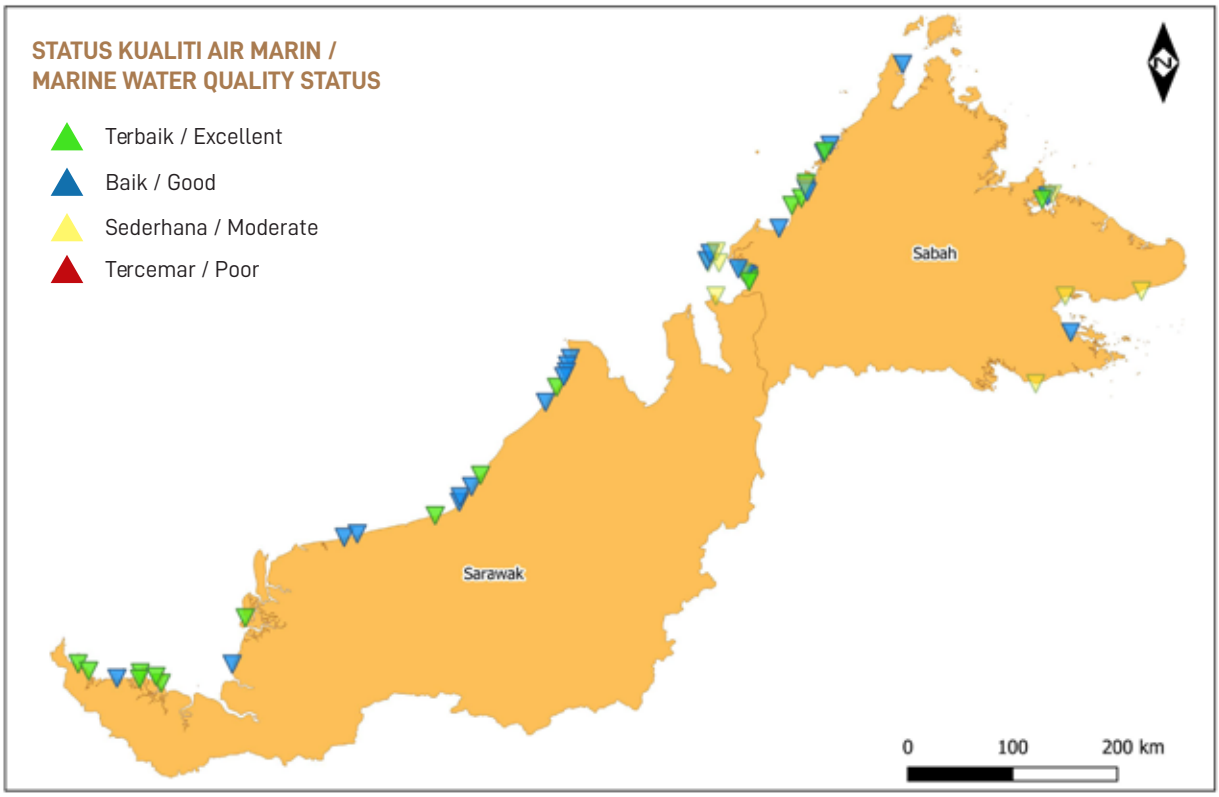
Jadual 4.5: Senarai Stesen Pulau dengan Status Kategori Terbaik, 2019
Table 4.5: Island Stations under the Category of Excellent Status, 2019

BIL./ NO.	NEGERI/ STATE	LOKASI/ LOCATION
1	Terengganu	Lima
2	Pahang	Sembilang
3	Terengganu	Gemia
4	Kedah	Teluk Ewa
5	Kedah	Dangli
6	Pahang	Cebeh
7	Pahang	Sepui
8	Sabah	Mantanani Besar
9	Kedah	Pasir
10	Kedah	Gasing

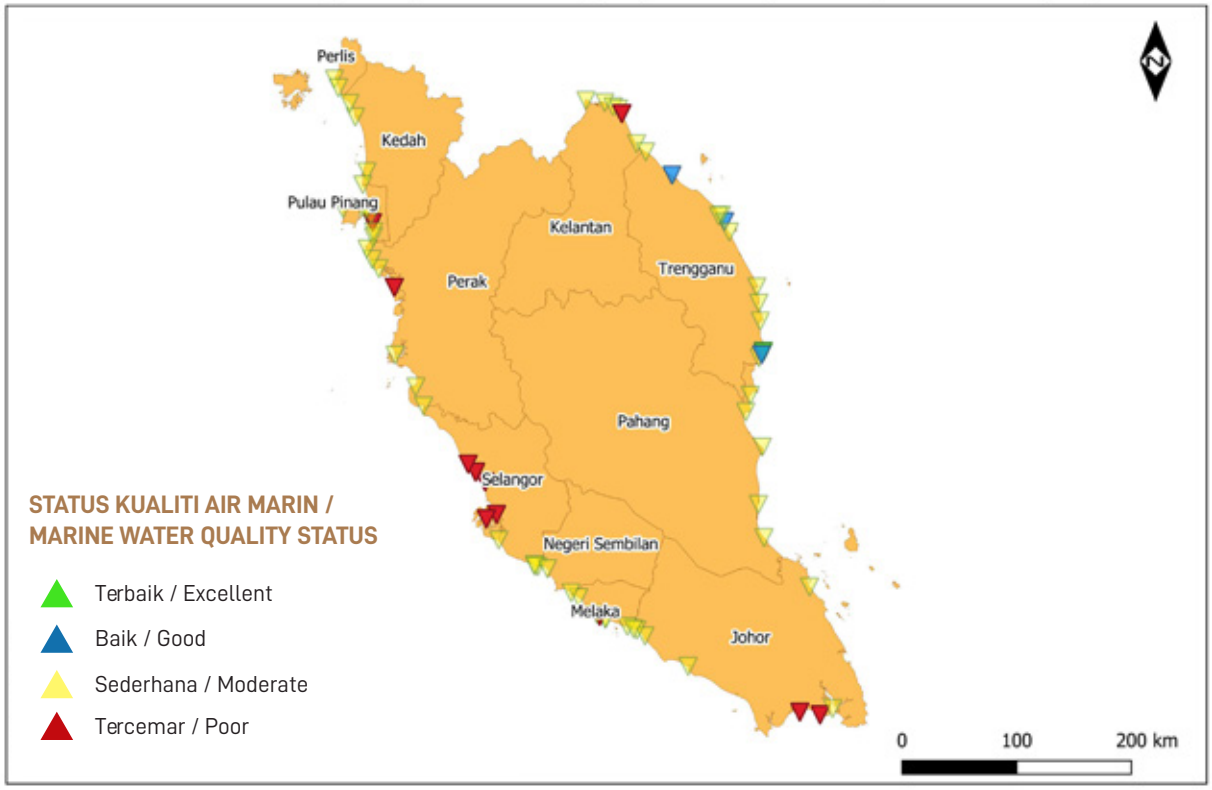
Peta Semenanjung Malaysia: Lokasi Stesen Pantai dan Indeks
Map of Peninsular Malaysia: The Location of Coastal Stations and it's Index



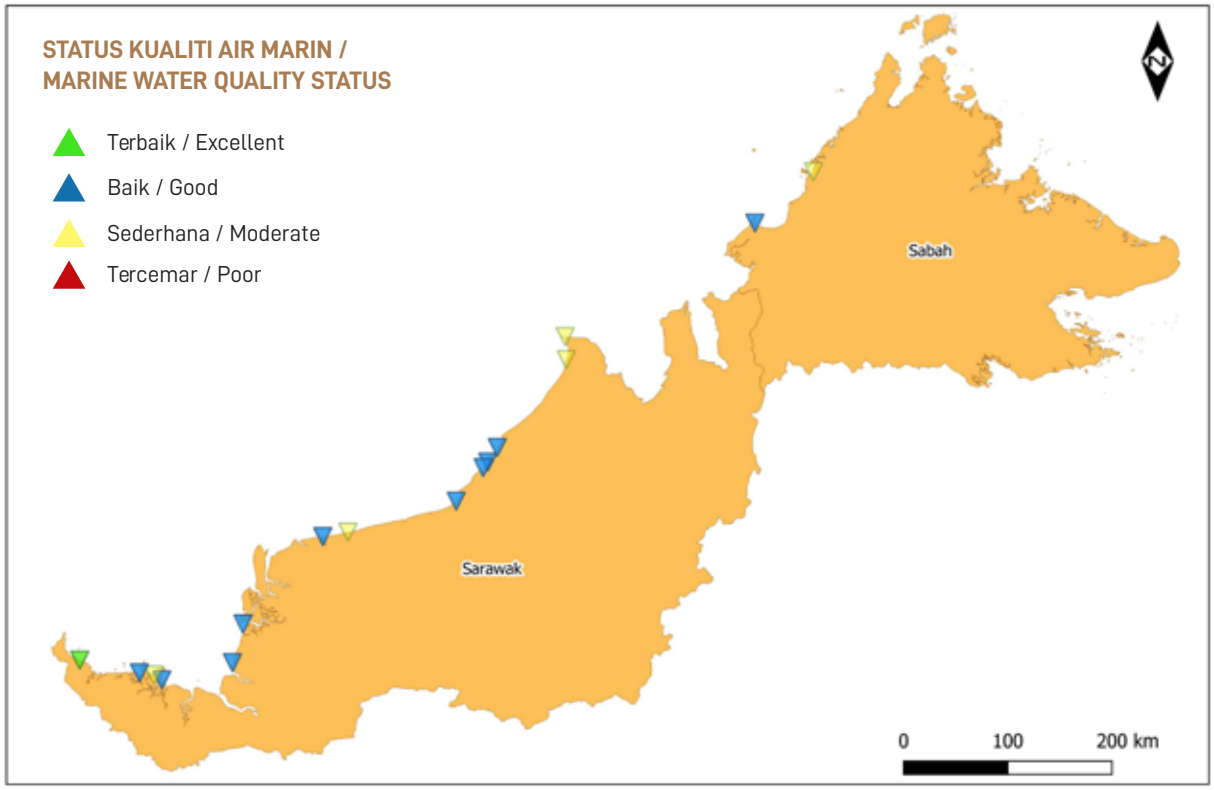
Peta Sabah dan Sarawak: Lokasi Stesen Pantai dan Indeks
Map of Sabah and Sarawak: The Location of Coastal Stations and it's Index



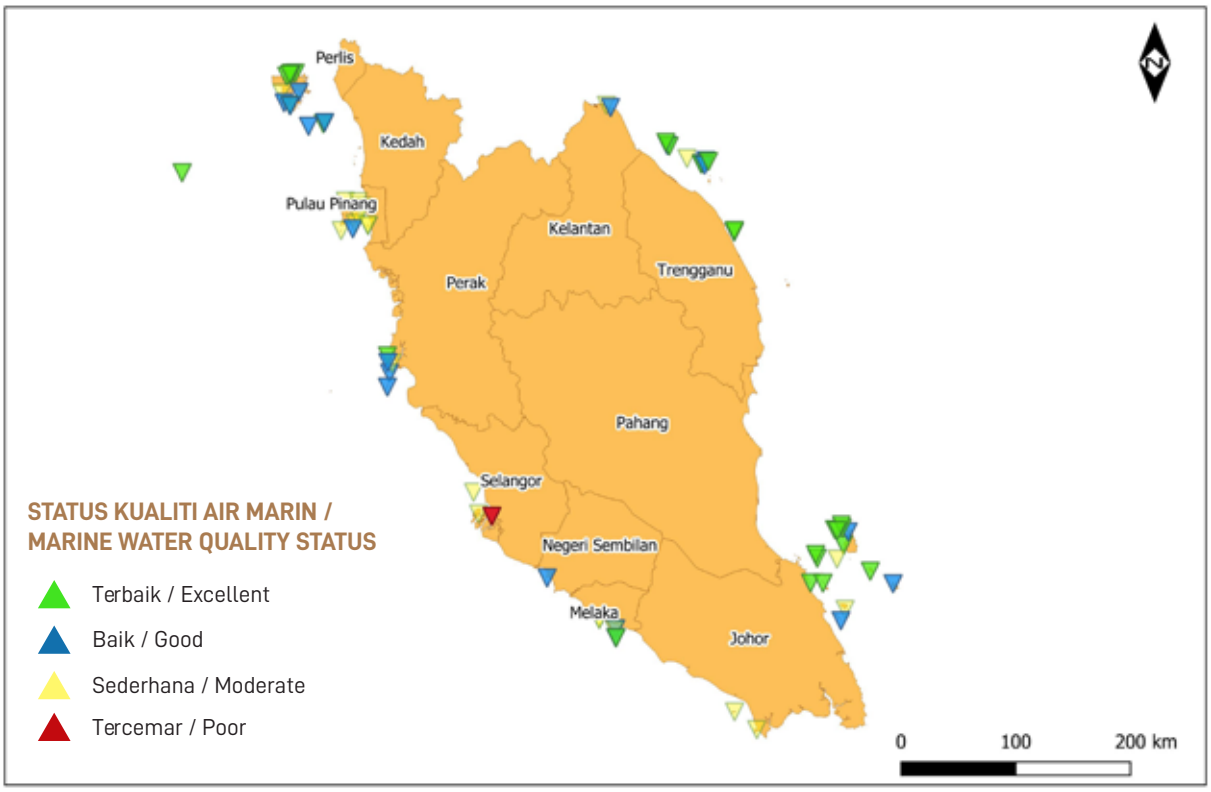
Peta Semenanjung Malaysia: Lokasi Stesen Muara Sungai dan Indeks
Map of Peninsular Malaysia: The Location of Estuary Stations and it's Index



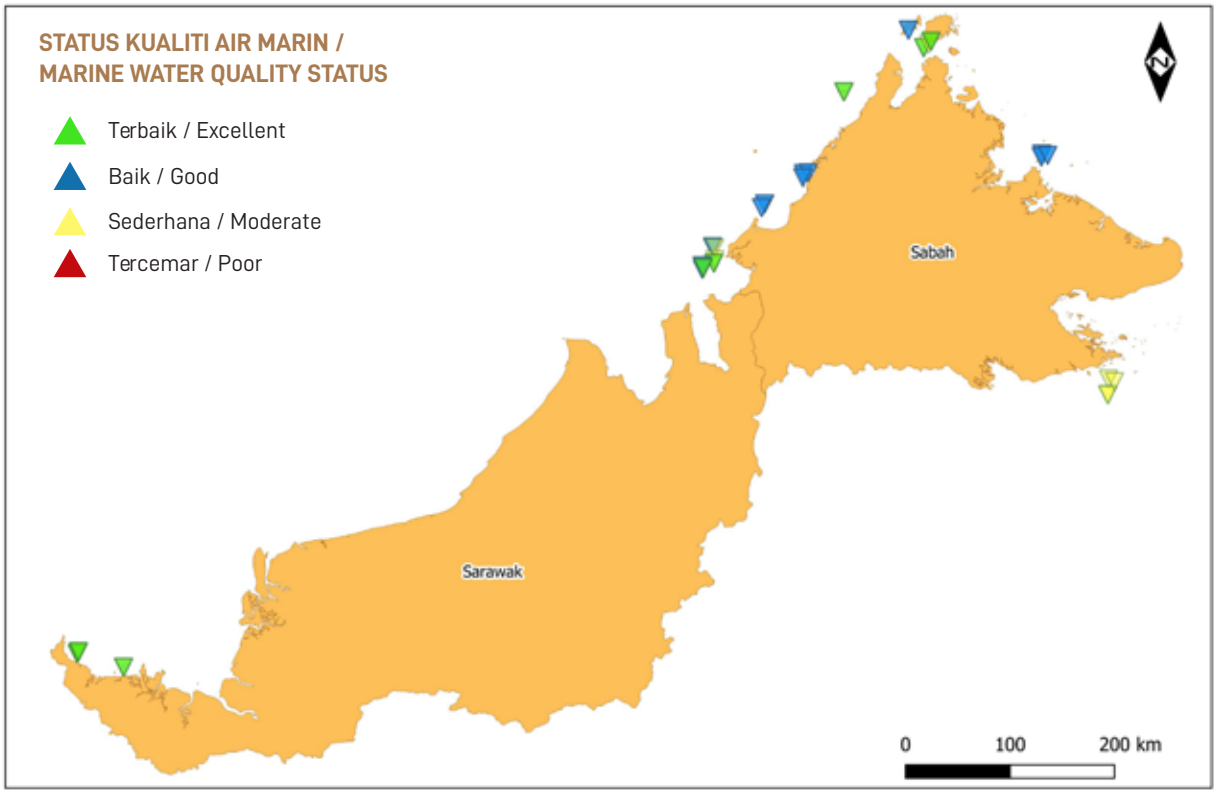
Peta Sabah dan Sarawak: Lokasi Stesen Muara Sungai dan Indeks
Map of Sabah and Sarawak: The Location of Estuary Stations and it's Index



Peta Semenanjung Malaysia: Lokasi Stesen Pulau dan Indeks
Map of Peninsular Malaysia: The Location of Island Stations and it's Index



Peta Sabah dan Sarawak: Lokasi Stesen Pulau dan Indeks
Map of Sabah and Sarawak: The Location of Island Stations and it's Index



STATUS
KUALITI AIR MARIN PANTAI
COASTAL WATER QUALITY STATUS

Sebanyak 188 stesen pantai dipantau pada tahun 2019. Daripada 188 stesen pantai, 37 stesen (19.68%) adalah terbaik, 69 stesen (36.70%) baik, 79 stesen (42.02%) sederhana manakala 3 stesen (1.6%) tercemar **(Jadual 4.6)**.

A total of 188 coastal stations were monitored in 2019. Out of the 188 coastal stations, 37 stations (19.68%) were excellent, 69 stations (36.70%) were good, 79 stations (42.02%) were moderate while 3 stations (1.60%) were categorised as poor **(Table 4.6)**.

Jadual 4.6: Status Kualiti Air Marin bagi Pantai
Table 4.6: Marine Water Quality Status for Coastal

NEGERI / STATE	KLASSIFIKASI STESEN/ STATION CLASSIFICATION	KAWASAN/ AREA	NOMBOR STESEN LAMA / OLD STATION NUMBER	NOMBOR STESEN BARU / NEW STATION NUMBER	NILAI IKAMM/ MMWQI VALUE					KATEGORI (2019)/ CATEGORY (2019)
					2015	2016	2017	2018	2019	
Kedah	Pantai/ Coastal	Pantai Merdeka	5603905	MMKC001	68	76	79	91	79	Sederhana/ Moderate
		Langkawi Island Resort	6399914	MMKC002	71	66	90	94	90	Terbaik/ Excellent
		Pantai Kok	6397922	MMKC003	72	66	83	94	92	Terbaik/ Excellent
		Pantai Kuah	6398925	MMKC004	71	71	91	94	84	Baik/ Good
		Pantai Pasir Tengkorak	6499701	MMKC005	85	68	93	94	68	Sederhana/ Moderate
		Pantai Teluk Burau	6396923	MMKC006	70	64	85	94	83	Baik/ Good
		Pantai Teluk Nibong	6497915	MMKC007	74	63	91	84	91	Terbaik/ Excellent
		Pantai Tengah	6297903	MMKC008	68	60	87	94	92	Terbaik/ Excellent
		Pantai Beras Basah*	NA	MMKC009	-	-	93	94	92	Terbaik/ Excellent
Pulau Pinang	Pantai/ Coastal	Gertak Sanggul	5201919	MMPC001	53	53	71	81	58	Sederhana/ Moderate
		Kawasan Perindustrian Bayan Lepas 2**	5303933	NA	-	-	-	-	-	Stesen tutup/ Close station
		Kawasan Perindustrian Bayan Lepas 3**	5302939	NA	53	50	-	-	-	Stesen tutup/ Close station
		Pantai Bersih	5403906	MMPC003	52	76	50	66	58	Sederhana/ Moderate
		Pantai Miami	5502901	MMPC004	69	61	68	93	69	Sederhana/ Moderate
		Pantai Pasir Panjang	5201938	MMPC005	70	63	86	93	81	Baik/ Good

Jadual 4.6: Status Kualiti Air Marin bagi Pantai
Table 4.6: Marine Water Quality Status for Coastal

NEGERI / STATE	KLASSIFIKASI STESEN/ STATION CLASSIFICATION	KAWASAN/ AREA	NOMBOR STESEN LAMA / OLD STATION NUMBER	NOMBOR STESEN BARU / NEW STATION NUMBER	NILAI IKAMM/ MMWQI VALUE					KATEGORI (2019)/ CATEGORY (2019)
					2015	2016	2017	2018	2019	
Pulau Pinang	Pantai / Coastal	Batu Feringgi (Casuarina)	5402904	MMPC006	66	79	67	67	60	Sederhana/ Moderate
		Luar Pantai Teluk Bahang	5402930	MMPC007	65	88	85	93	57	Sederhana/ Moderate
		Persiaran Gurney	5403902	MMPC008	48	83	62	66	58	Sederhana/ Moderate
		Rumah Pam Baru Perai	5304927	MMPC009	52	66	59	64	56	Sederhana/ Moderate
		Rumah Pam Lama Perai	5303926	MMPC010	55	61	64	65	57	Sederhana/ Moderate
		Selat PP Selatan (Jelutong)	5303911	MMPC011	49	60	49	59	57	Sederhana/ Moderate
		Tanjung Bungah	5402937	MMPC012	61	83	84	67	57	Sederhana/ Moderate
		Teluk Tempoyak	5202923	MMPC013	52	51	61	75	57	Sederhana/ Moderate
		Batu Maung	5202901	MMPC014	52	46	59	62	57	Sederhana/ Moderate
		Pantai Sungai Batu Ferringhi 3*	NA	MMPC015	-	-	62	93	83	Baik/Good
		Pantai Sungai Batu Ferringhi 2*	NA	MMPC016	-	-	61	93	70	Sederhana/ Moderate
		Pantai Sungai Batu Ferringhi 1*	NA	MMPC017	-	-	51	85	71	Sederhana/ Moderate
Perak	Pantai/ Coastal	Pantai Pasir Bogak	4205908	MMAC001	55	58	91	92	80	Baik/ Good
		Pantai Teluk Dalam	4205928	MMAC002	54	75	91	93	88	Baik/ Good
		Pantai Teluk Batik	4205932	MMAC003	73	51	89	92	62	Sederhana/ Moderate
		Pantai Tanjung Batu	4406927	MMAC004	69	53	92	94	61	Sederhana/ Moderate
		Pantai Teluk Rubiah*	NA	MMAC005	-	-	93	92	62	Sederhana/ Moderate
		Pantai Damai Laut*	NA	MMAC006	-	-	91	92	70	Sederhana/ Moderate
		Pantai Teluk Senangin*	NA	MMAC007	-	-	92	93	67	Sederhana/ Moderate
		Pantai Pasir Panjang	4205924	MMAC008	51	52	93	93	70	Sederhana/ Moderate
Selangor	Pantai/ Coastal	Pantai Bagan Lalang	2616927	MMBC001	89	90	92	88	81	Baik/ Good
		Pantai Morib	2712902	MMBC002	70	62	89	87	61	Sederhana/ Moderate

Jadual 4.6: Status Kualiti Air Marin bagi Pantai
Table 4.6: Marine Water Quality Status for Coastal

NEGERI / STATE	KLASSIFIKASI STESEN/ STATION CLASSIFICATION	KAWASAN/ AREA	NOMBOR STESEN LAMA / OLD STATION NUMBER	NOMBOR STESEN BARU / NEW STATION NUMBER	NILAI IKAMM/ MMWQI VALUE					KATEGORI (2019)/ CATEGORY (2019)
					2015	2016	2017	2018	2019	
Selangor	Pantai / Coastal	Selat Pulau Babi	3012929	MMBC003	87	75	72	90	73	Sederhana/ Moderate
		Selat Klang Utara	3013908	MMBC004	68	78	64	62	56	Sederhana/ Moderate
		Pantai Remis*	NA	MMBC005	-	-	67	90	58	Sederhana/ Moderate
		Pantai Klanang*	NA	MMBC006	-	-	91	82	58	Sederhana/ Moderate
Negeri Sembilan	Pantai/ Coastal	Bagan Pinang	2518915	MMNC001	87	97	68	91	82	Baik/ Good
		Telok Sinting	2419908	MMNC002	90	97	87	88	71	Sederhana/ Moderate
		Port Dickson Bandar	2517907	MMNC003	84	97	68	68	60	Sederhana/ Moderate
		Port Dickson Batu 4	2518937	MMNC004	91	97	67	90	81	Baik/ Good
		Port Dickson Batu 5	2418906	MMNC005	88	97	79	68	63	Sederhana/ Moderate
		Port Dickson Batu 6	2418916	MMNC006	88	97	68	92	77	Sederhana/ Moderate
		Port Dickson Batu 7	2418905	MMNC007	86	97	67	88	86	Baik/Good
		Port Dickson Batu 8	2418912	MMNC008	77	97	75	87	86	Baik/Good
		Port Dickson Batu 10	2418914	MMNC009	93	97	68	89	84	Baik/
		Port Dickson Janakuasa TNB	2517909	MMNC010	79	97	68	68	59	Sederhana/ Moderate
		Telok Pelanduk	2419917	MMNC011	93	97	81	90	87	Baik/ Good
		Pantai Cermin	2416918	MMNC012	89	97	68	92	70	Sederhana/ Moderate
		Pantai Teluk Kemang*	NA	MMNC013	-	-	68	67	83	Baik/ Good
		Pantai Seri Purnama*	NA	MMNC014	-	-	85	93	80	Baik/ Good
Melaka	Pantai/ Coastal	Pantai Rombang	2221916	MMMC001	58	68	85	85	68	Sederhana/
		Pantai Kundur	2221908	MMMC002	55	57	84	82	77	Sederhana/ Moderate
		Pantai Tanjung Bidara	2320909	MMMC003	53	57	82	93	78	Sederhana/ Moderate
		Teluk Gong	2320902	MMMC004	55	57	88	93	76	Sederhana/ Moderate
		Pulau Melaka Point A1	2121915	MMMC005	78	72	64	67	60	Sederhana/ Moderate

Jadual 4.6: Status Kualiti Air Marin bagi Pantai
Table 4.6: Marine Water Quality Status for Coastal

NEGERI / STATE	KLASSIFIKASI STESEN/ STATION CLASSIFICATION	KAWASAN/ AREA	NOMBOR STESEN LAMA / OLD STATION NUMBER	NOMBOR STESEN BARU / NEW STATION NUMBER	NILAI IKAMM/ MMWQI VALUE					KATEGORI (2019)/ CATEGORY (2019)
					2015	2016	2017	2018	2019	
Melaka	Pantai/ Coastal	Pulau Melaka Point A2	2121915	MMMC006	-	-	72	81	60	Sederhana/ Moderate
		Pulau Melaka Point B1	2121916	MMMC007	84	63	63	62	57	Sederhana/ Moderate
		Pulau Melaka Point B2	2121916	MMMC008	-	-	66	58	57	Sederhana/ Moderate
		Pantai Klebang*	NA	MMMC009	-	-	67	81	58	Sederhana/ Moderate
Johor	Pantai / Coastal	Tanjung Bin	1336975	MMJC001	90	84	92	92	81	Baik/ Good
		Pelabuhan Tanjung Pelepas	1438943	MMJC002	89	85	90	92	67	Sederhana/ Moderate
		Hadapan Jabatan Laut	1438918	MMJC003	62	84	80	88	77	Sederhana/ Moderate
		Pantai Stulang Laut	1437951	MMJC004	58	76	61	63	49	Tercemar/ Poor
		Jeti Teluk Jawa	1438918	MMJC005	64	53	62	62	52	Sederhana/ Moderate
		Pelabuhan Pasir Gudang	1428939	MMJC006	75	75	64	65	54	Sederhana/ Moderate
		Hadapan HSAJB	1437920	MMJC007	64	44	59	59	36	Tercemar/ Poor
		Pantai Lido	1437921	MMJC008	59	66	55	52	37	Tercemar/ Poor
		Pantai Teluk Mahkota	1841911	MMJC009	85	89	92	94	72	Sederhana/ Moderate
		Pantai Tanjung Leman	2140694	MMJC010	88	88	94	93	87	Baik/ Good
		Pantai Sri Pantai	2339960	MMJC011	87	88	94	94	87	Baik/ Good
		Tanjung Merak	1441968	MMJC012	73	89	93	73	60	Sederhana/ Moderate
		Tanjung Pengelih	1441967	MMJC013	88	88	93	93	77	Sederhana/ Moderate
		Pantai Tanjong Stapa	1341961	MMJC014	88	89	93	93	86	Baik/ Good
		Pantai Teluk Gorek	2538958	MMJC015	89	88	93	94	92	Terbaik/ Excellent
		Pantai Air Papan	2538959	MMJC016	89	89	93	94	92	Terbaik/ Excellent
		Jeti Kukup	1334925	MMJC017	62	87	88	89	58	Sederhana/ Moderate
		Pasir Gogok	1441966	MMJC018	89	90	94	93	74	Sederhana/ Moderate
		Tanjung Buai	1340973	MMJC019	88	80	92	92	63	Sederhana/ Moderate
		Pantai Desaru	1542914	MMJC020	65	89	94	94	81	Baik/ Good

Jadual 4.6: Status Kualiti Air Marin bagi Pantai
Table 4.6: Marine Water Quality Status for Coastal

NEGERI / STATE	KLASSIFIKASI STESEN/ STATION CLASSIFICATION	KAWASAN/ AREA	NOMBOR STESEN LAMA / OLD STATION NUMBER	NOMBOR STESEN BARU / NEW STATION NUMBER	NILAI IKAMM/ MMWQI VALUE					KATEGORI (2019)/ CATEGORY (2019)
					2015	2016	2017	2018	2019	
Johor	Pantai / Coastal	Tanjung Sepang	1443969	MMJC021	64	87	94	93	87	Baik/ Good
		Tanjung Penyusup	1444920	MMJC022	62	86	92	93	62	Sederhana/ Moderate
		Pantai Sungai Lurus	1730962	MMJC023	64	89	90	91	59	Sederhana/ Moderate
		Punggur	1531974	MMJC024	87	88	84	87	59	Sederhana/ Moderate
		Pantai Penyabung*	NA	MMJC025	-	-	93	93	80	Baik/ Good
		Tanjung Resang*	NA	MMJC026	-	-	94	94	93	Terbaik/ Excellent
		Tanjung Balau*	NA	MMJC027	-	-	93	93	84	Baik/ Good
		Batu Layar*	NA	MMJC028	-	-	93	94	62	Sederhana/ Moderate
		Tanjung Sengat*	NA	MMJC029	-	-	92	91	60	Sederhana/ Moderate
Pahang	Pantai/ Coastal	Pantai Cherating (Club Med A)	4133903 (A)	MMCC001	85	60	92	94	88	Baik/ Good
		Pantai Cherating (Club Med B)	4133903 (B)	MMCC002	85	61	93	94	85	Baik/ Good
		Pantai Cherating (Legend A)	4133942 (A)	MMCC003	87	81	92	94	88	Baik/ Good
		Pantai Cherating (Legend B)	4133942 (B)	MMCC004	87	61	89	94	94	Terbaik/ Excellent
		Pantai Muhibbah Balok A	3933901 (A)	MMCC005	77	58	68	89	59	Sederhana/ Moderate
		Pantai Muhibbah Balok B	3933901 (B)	MMCC006	75	59	65	83	59	Sederhana/ Moderate
		Pantai Batu Hitam A	3833915 (A)	MMCC007	85	62	68	87	75	Sederhana/ Moderate
		Pantai Batu Hitam B	3833915 (B)	MMCC008	87	56	81	91	62	Sederhana/ Moderate
		Pantai Berserah A	3933941 (A)	MMCC009	90	65	80	90	74	Sederhana/ Moderate
		Pantai Berserah B	3933941 (B)	MMCC010	78	63	67	90	80	Baik/ Good
		Pantai Teluk Cempedak A	3833910 (A)	MMCC011	78	59	67	88	83	Baik/ Good
		Pantai Teluk Cempedak B	3833910 (B)	MMCC012	67	59	88	91	90	Terbaik/ Excellent
		Pantai Teluk Gelora A	3833909 (A)	MMCC013	62	64	67	77	75	Sederhana/ Moderate
		Pantai Teluk Gelora B	3833909 (B)	MMCC014	64	59	66	76	62	Sederhana/ Moderate
		Pantai Sepat A	3737915	MMCC015	62	88	91	93	81	Baik/ Good

Jadual 4.6: Status Kualiti Air Marin bagi Pantai
Table 4.6: Marine Water Quality Status for Coastal

NEGERI / STATE	KLASSIFIKASI STESEN/ STATION CLASSIFICATION	KAWASAN/ AREA	NOMBOR STESEN LAMA / OLD STATION NUMBER	NOMBOR STESEN BARU / NEW STATION NUMBER	NILAI IKAMM/ MMWQI VALUE					KATEGORI (2019)/ CATEGORY (2019)
					2015	2016	2017	2018	2019	
Pahang	Pantai / Coastal	Pantai Sepat B	3633916	MMCC016	85	80	91	93	88	Baik/ Good
		Pantai Legenda A	3534943 (A)	MMCC017	82	85	93	94	93	Terbaik/ Excellent
		Pantai Legenda B	3534943 (B)	MMCC018	64	79	93	94	92	Terbaik/ Excellent
		Pantai Kuala Api-Api	3235917	MMCC019	66	79	90	93	58	Sederhana/ Moderate
		Pantai Tanjung Batu	3334915	MMCC020	83	79	90	94	72	Sederhana/ Moderate
		Pantai Chendor*	NA	MMCC021	-	-	86	94	84	Baik/ Good
		Pantai Lanjut*	NA	MMCC022	-	-	93	92	86	Baik/ Good
Terengganu	Pantai/ Coastal	Pantai Batu Buruk	5331935	MMTC001	58	78	94	93	59	Sederhana/ Moderate
		Pantai Bukit Keluang	5825903	MMTC002	52	64	94	94	86	Baik/ Good
		Pantai Chendering	5231934	MMTC003	53	61	89	94	69	Sederhana/ Moderate
		Pantai Rantau Abang	4833917	MMTC004	60	61	90	94	85	Baik/ Good
		KIPC Utara	4634954	MMTC005	62	74	91	94	92	Terbaik/ Excellent
		KIPC Tengah	4534955	MMTC006	73	77	89	94	90	Terbaik/ Excellent
		KIPC Selatan	4534956	MMTC007	75	74	89	94	94	Terbaik/ Excellent
		Pantai Rhu 10*	NA	MMTC008	-	-	94	94	89	Baik/ Good
		Pantai Tok Jembal*	NA	MMTC009	-	-	94	94	95	Terbaik/ Excellent
		Pantai Kelulut*	NA	MMTC010	-	-	94	94	95	Terbaik/ Excellent
		Pantai Teluk Ketapang*	NA	MMTC011	-	-	94	94	80	Baik/ Good
		Pantai Kuala Abang*	NA	MMTC012	-	-	94	94	88	Baik/ Good
		Pantai Teluk Kalong*	NA	MMTC013	-	-	94	94	94	Terbaik/ Excellent
		Pantai Sura*	NA	MMTC014	-	-	94	94	89	Baik/ Good
		Pantai Tanjung Bidara*	NA	MMTC015	-	-	94	94	93	Terbaik/ Excellent
		Pantai Kemasik*	NA	MMTC016	-	-	93	88	86	Baik/ Good
Kelantan	Pantai/ Coastal	Pantai Seri Tujuh	6221910	MMDC001	63	66	88	93	88	Baik/ Good

Jadual 4.6: Status Kualiti Air Marin bagi Pantai
Table 4.6: Marine Water Quality Status for Coastal

NEGERI / STATE	KLASSIFIKASI STESEN/ STATION CLASSIFICATION	KAWASAN/ AREA	NOMBOR STESEN LAMA / OLD STATION NUMBER	NOMBOR STESEN BARU / NEW STATION NUMBER	NILAI IKAMM/ MMWQI VALUE					KATEGORI (2019)/ CATEGORY (2019)
					2015	2016	2017	2018	2019	
Kelantan	Pantai / Coastal	Pantai Cahaya Bulan	6122903	MMDC002	61	78	87	93	87	Baik/ Good
		Pantai Sabak	6123909	MMDC003	61	66	81	93	88	Baik/ Good
		Pantai Irama Bachok	6024908	MMDC004	62	66	86	93	89	Baik/ Good
		Pantai Bisikan Bayu	5825905	MMDC005	64	66	89	94	95	Terbaik/ Excellent
		Pantai Melawi*	NA	MMDC006	-	-	93	94	85	Baik/ Good
Sarawak	Pantai/ Coastal	Pantai Sematan	1898902	MMQC001	76	74	88	90	91	Terbaik/ Excellent
		Pantai Pandan	1824918	MMQC002	87	75	87	91	91	Terbaik/ Excellent
		Pantai Pasir Putih	1604910	MMQC003	67	88	80	87	91	Terbaik/ Excellent
		Pantai Bako	1704906	MMQC004	88	74	88	89	91	Terbaik/ Excellent
		Pantai Damai	1702904	MMQC005	76	89	86	91	91	Terbaik/ Excellent
		Pantai Tanjung Kembang	1810923	MMQC006	87	85	69	85	88	Baik/ Good
		Pantai Harmoni Mukah	2920921	MMQC007	54	85	72	86	89	Baik/ Good
		Pantai Tanjung Batu	3132602	MMQC008	67	82	84	89	88	Baik/ Good
		Pantai Likau	3230915	MMQC009	89	78	85	89	87	Baik/ Good
		Pantai Emas	3331903	MMQC010	88	90	87	90	90	Terbaik/ Excellent
		Pantai Piasau	4539918	MMQC011	82	68	86	89	87	Baik/ Good
		Pantai Brighton	4449917	MMQC012	93	68	81	88	80	Baik/ Good
		Pantai Esplaned	4339920	MMQC013	97	68	86	82	88	Good
		Pantai Beraya	4238921	MMQC014	97	68	87	88	90	Terbaik/ Excellent
		Pantai Bungai	4137922	MMQC015	82	94	88	87	88	Baik/ Good
		Pantai Belawai	2212913	MMQC016	83	73	84	88	90	Terbaik/ Excellent
		Pantai Mukah*	NA	MMQC017	-	-	84	88	87	Baik/ Good
		Tanjung Kidurong*	NA	MMQC018	-	-	85	90	87	Baik/ Good

Jadual 4.6: Status Kualiti Air Marin bagi Pantai
Table 4.6: Marine Water Quality Status for Coastal

NEGERI / STATE	KLASSIFIKASI STESEN/ STATION CLASSIFICATION	KAWASAN/ AREA	NOMBOR STESEN LAMA / OLD STATION NUMBER	NOMBOR STESEN BARU / NEW STATION NUMBER	NILAI IKAMM/ MMWQI VALUE					KATEGORI (2019)/ CATEGORY (2019)
					2015	2016	2017	2018	2019	
Sarawak	Pantai/ Coastal	Pasir Pandak*	NA	MMQC019	-	-	86	90	90	Terbaik/ Excellent
		Rambungan*	NA	MMQC020	-	-	89	90	89	Baik/ Good
		Sri Tanjung Lawas*	NA	MMQC021	-	-	92	86	78	Sederhana/ Moderate
		Pantai Luak*	NA	MMQC022	-	-	88	78	88	Baik/ Good
		Pasir Panjang*	NA	MMQC023	-	-	87	88	91	Terbaik/ Excellent
Sabah	Pantai/ Coastal	Pantai Teluk Brunei 1	5053901	MMSC001	82	66	70	92	85	Baik/ Good
		Pantai Teluk Brunei 2	5053902	MMSC002	83	59	65	93	94	Terbaik/ Excellent
		Pantai Teluk Brunei 3	5053903	MMSC003	85	67	65	92	81	Baik/ Good
		Pantai Teluk Brunei 4	5053904	MMSC004	86	66	69	93	78	Sederhana/ Moderate
		Pantai Teluk Brunei 5	5053905	MMSC005	85	65	69	93	88	Baik/ Good
		Pantai Teluk Brunei 6	5053906	MMSC006	83	67	70	93	94	Terbaik/ Excellent
		Borneo Golf Seawater	5355901	MMSC007	79	68	68	92	88	Baik/ Good
		Pantai Manis Papar	5555901	MMSC008	83	66	69	91	92	Terbaik/ Excellent
		Pantai Melinsung	5565902	MMSC009	83	67	73	93	90	Terbaik/ Excellent
		Pantai Tanjung Aru (Roll Skating)	5656902	MMSC010	67	63	86	93	92	Terbaik/ Excellent
		Pantai Tanjung Aru (No. 3)	5656903	MMSC011	66	67	82	93	88	Baik/ Good
		Pantai Lok Kawi	5656904	MMSC012	69	62	85	93	87	Baik/ Good
		Pantai Dalit Tuaran	6161901	MMSC013	70	64	74	93	88	Baik/ Good
		Mangrove Paradise	6161902	MMSC014	67	68	86	93	87	Baik/ Good
		Pantai Sabandar	6161903	MMSC015	68	67	71	93	95	Terbaik/ Excellent
		Pantai Bak-Bak Kudat	6665901	MMSC016	65	63	70	93	85	Baik/ Good
		Pasir Putih Sandakan	5580901	MMSC017	84	67	66	92	84	Baik/ Good
		Pantai TLDM	5580902	MMSC018	87	69	69	92	67	Sederhana/ Moderate

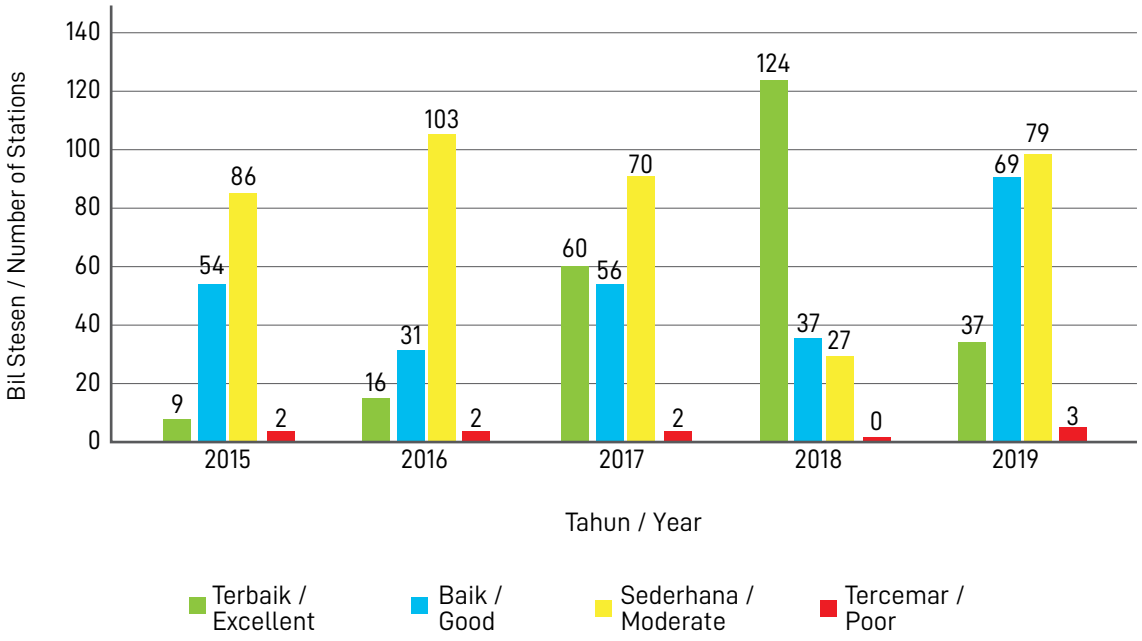
Jadual 4.6: Status Kualiti Air Marin bagi Pantai
Table 4.6: Marine Water Quality Status for Coastal

NEGERI / STATE	KLASSIFIKASI STESEN/ STATION CLASSIFICATION	KAWASAN/ AREA	NOMBOR STESEN LAMA / OLD STATION NUMBER	NOMBOR STESEN BARU / NEW STATION NUMBER	NILAI IKAMM/ MMWQI VALUE					KATEGORI (2019)/ CATEGORY (2019)
					2015	2016	2017	2018	2019	
Sabah	Pantai / Coastal	Pantai Batu Sapi	5580903	MMSC019	84	67	51	93	93	Terbaik/ Excellent
		Pantai Ulu Tungku	5085901	MMSC020	84	68	69	92	70	Sederhana/ Moderate
		Pantai Sarina Kunak	4481901	MMSC021	82	69	68	93	84	Baik/ Good
		Pantai Kg. Lamak	4581902	MMSC022	82	67	49	91	79	Sederhana/ Moderate
		Pantai Tinagat	4473901	MMSC023	82	69	70	93	78	Sederhana/ Moderate
		Pantai Tanjung Aru (Rest Lido)	5656901	MMSC024	68	68	86	93	79	Sederhana/ Moderate
Labuan	Pantai/ Coastal	Pulau Papan	5151905	MMLC001	76	75	73	92	68	Sederhana/ Moderate
		Kiamsam	5151906	MMLC002	77	76	73	93	64	Sederhana/ Moderate
		Sungai Pagar	5151907	MMLC003	77	78	71	92	83	Baik/ Good
		Layang-Layangan	5251902	MMLC004	76	77	73	92	82	Baik/ Good
		Tanjung Aru	5251903	MMLC005	78	72	73	91	59	Sederhana/ Moderate

Nota/ Note:
* : Stesen baru/ New station
** : Stesen tutup/ Close station
\- : Tiada data/ No data
NA : Tidak berkenaan/ Not available

Rajah 4.1 menunjukkan bilangan stesen pengawasan pantai yang dikelaskan berdasarkan klasifikasi IKAMM. Bilangan stesen terbaik menurun daripada 124 stesen pada tahun 2018 kepada 37 stesen pada tahun 2019; walau bagaimanapun stesen kualiti air baik meningkat daripada 37 stesen pada tahun 2018 kepada 69 stesen pada tahun 2019.

Figure 4.1 shows the number of coastal monitoring stations which were grouped based on MMWQI classification. The number of excellent station has decreased from 124 stations in 2018 to 37 stations in 2019. Nevertheless, the number of good stations has increased from 37 stations in 2018 to 69 stations in 2019.



Rajah 4.1: Tren Status Kualiti Air Marin bagi Kawasan Pantai, 2015 - 2019
Figure 4.1: The Trend of Marine Water Quality Status for Coastal Area, 2015 - 2019

STATUS
KUALITI AIR MUARA SUNGAI
ESTUARY WATER QUALITY STATUS

Sebanyak 85 stesen muara sungai dipantau pada tahun 2019. Daripada 85 stesen pengawasan bagi muara sungai, 3 stesen (3.53%) adalah terbaik, 13 stesen (15.29%) baik, 58 stesesn (68.24%) sederhana manakala 11 stesen (12.94%) tercemar **(Jadual 4.7).**

In 2019, a total of 85 estuary stations were monitored. Out of the total, 3 stations (3.53%) were were excellent, 13 stations (15.29%) were good, 58 stations (68.24%) were moderate, while the remaining 11 stations (12.94%) were categorised as poor **(Table 4.7).**

Jadual 4.7: Status Kualiti Air Marin bagi Muara Sungai
Table 4.7: Marine Water Quality Status for Estuary

NEGERI / STATE	KLASSIFIKASI STESEN/ STATION CLASSIFICATION	KAWASAN/ AREA	NOMBOR STESEN LAMA / OLD STATION NUMBER	NOMBOR STESEN BARU / NEW STATION NUMBER	NILAI IKAMM/ MMWQI VALUE					KATEGORI (2019)/ CATEGORY (2019)
					2015	2016	2017	2018	2019	
Perlis	Muara Sungai/ Estuary	Kuala Sungai Baru	6201902	MMRE001	56	60	64	70	50	Sederhana/ Moderate
		Kuala Sungai Perlis	6401901	MMRE002	53	61	64	66	58	Sederhana/ Moderate
Kedah	Muara Sungai/ Estuary	Kuala Kedah	6102908	MMKE001	50	77	62	61	53	Sederhana/ Moderate
		Kuala Jerlun	6302925	MMKE002	59	75	62	82	50	Sederhana/ Moderate
		Kuala Segantang Garam*	NA	MMKE003	-	-	83	88	57	Sederhana/ Moderate
		Kuala Sungai Muda*	NA	MMKE004	-	-	64	62	62	Sederhana/ Moderate
Pulau Pinang	Muara Sungai/ Estuary	Kuala Sungai Jawi	5204901	MMPE001	49	45	49	54	46	Tercemar/ Poor
		Kuala Sungai Juru	5303904	MMPE002	59	70	49	47	51	Sederhana/ Moderate
		Kuala Sungai Kerian	5104901	MMPE003	60	34	56	60	52	Sederhana/ Moderate
		Kuala Sungai Pinang	5403934	MMPE004	47	58	52	61	52	Sederhana/ Moderate
		Kuala Sungai Perai	5303908	MMPE005	56	64	52	59	53	Sederhana/ Moderate
		Kuala Sungai Tengah	5204935	MMPE006	67	65	58	37	52	Sederhana/ Moderate
		Kuala Sungai Pinang (Balik Pulau)	5202929	MMPE007	46	60	55	64	50	Sederhana/ Moderate
Perak	Muara Sungai/ Estuary	Kuala Sungai Manjung	4205930	MMAE001	67	78	88	91	71	Sederhana/ Moderate
		Kuala Sungai Gula	4906926	MMAE002	60	67	82	84	55	Sederhana/ Moderate
		Kuala Sungai Kurau	4994919	MMAE003	73	59	61	64	54	Sederhana/ Moderate
		Kuala Sungai Tanjung Piandang	5003921	MMAE004	73	57	59	61	51	Sederhana/ Moderate
		Kuala Sungai Sepetang	4806925	MMAE005	66	56	60	58	46	Tercemar/ Poor
		Kuala Sungai Perak	4007901	MMAE006	70	64	61	81	53	Sederhana/ Moderate
Selangor	Muara Sungai/ Estuary	Kuala Sungai Sepang	2517922	MMBE001	78	85	92	89	60	Sederhana/ Moderate
		Kuala Sungai Sepang (Kecil)	2612928	MMBE002	92	86	93	89	61	Sederhana/ Moderate
		Kuala Sungai Sepang (Kawalan)	2616926	MMBE003	86	92	93	92	70	Sederhana/ Moderate
		Kuala Sungai Langat (Jugra)	2814925	MMBE004	55	72	82	62	50	Sederhana/ Moderate
		Kuala Sungai Klang	3013909	MMBE005	67	77	60	37	38	Tercemar/ Poor

Jadual 4.7: Status Kualiti Air Marin bagi Muara Sungai
Table 4.7: Marine Water Quality Status for Estuary

NEGERI / STATE	KLASSIFIKASI STESEN/ STATION CLASSIFICATION	KAWASAN/ AREA	NOMBOR STESEN LAMA / OLD STATION NUMBER	NOMBOR STESEN BARU / NEW STATION NUMBER	NILAI IKAMM/ MMWQI VALUE					KATEGORI (2019)/ CATEGORY (2019)
					2015	2016	2017	2018	2019	
Selangor	Muara Sungai/ Estuary	Kuala Sungai Langat (Lumut)	2913903	MMBE006	67	81	60	39	49	Tercemar/Poor
		Kuala Sungai Buloh	3212930	MMBE007	66	67	64	62	44	Tercemar/ Poor
		Kuala Sungai Selangor	3312915	MMBE008	90	74	85	69	45	Tercemar/ Poor
		Kuala Sungai Tengi	3311931	MMBE009	67	72	74	64	49	Tercemar/ Poor
		Kuala Sungai Bernam	3808924	MMBE010	55	72	56	86	52	Sederhana/ Moderate
Negeri Sembilan	Muara Sungai/ Estuary	Kuala Sungai Linggi	2319901	MMNE001	81	97	75	65	52	Sederhana/ Moderate
		Kuala Sungai Lukut	2517910	MMNE002	68	97	66	66	52	Sederhana/ Moderate
Melaka	Muara Sungai/ Estuary	Kuala Sungai Melaka	2123903	MMME001	55	56	63	65	55	Sederhana/ Moderate
		Kuala Sungai Sri Melaka	2121914	MMME002	52	53	57	59	45	Tercemar/ Poor
		Kuala Sungai Merlimau	2124912	MMME003	86	71	81	75	52	Sederhana/ Moderate
		Kuala Sungai Kesang	2186905	MMME004	77	70	83	82	54	Sederhana/ Moderate
		Kuala Sungai Sebatu	2186904	MMME005	58	69	86	87	56	Sederhana/ Moderate
		Kuala Sungai Melaka 2*	NA	MMME006	-	-	64	64	52	Sederhana/ Moderate
		Kuala Sungai Baru*	NA	MMME007	-	-	84	83	55	Sederhana/ Moderate
		Kuala Sungai Lereh	2221922	MMME008	-	69	63	64	55	Sederhana/ Moderate
Johor	Muara Sungai/ Estuary	Kuala Sungai Melayu	1437946	-	66	58	63	-	-	Stesen tutup/ Close station
		Kuala Sungai Skudai	1437922	-	57	65	40	-	-	Stesen tutup/ Close station
		Kuala Sungai Tebrau	1438943	-	59	56	62	-	-	Stesen tutup/ Close station
		Kuala Sungai Segget	1437919	MMJE001	62	47	53	32	33	Tercemar/ Poor
		Kuala Sungai Laloh	1439965	MMJE002	87	82	61	61	39	Tercemar/ Poor
		Kuala Sungai Johor	1440916	MMJE003	88	85	92	92	72	Sederhana/ Moderate
		Kuala Sungai Batu Pahat	1729930	MMJE004	84	87	90	80	57	Sederhana/ Moderate
		Kuala Sungai Muar	2024932	MMJE005	81	88	92	66	55	Sederhana/ Moderate
		Kuala Sungai Mersing	2438905	MMJE006	89	85	67	67	59	Sederhana/ Moderate

Jadual 4.7: Status Kualiti Air Marin bagi Muara Sungai
Table 4.7: Marine Water Quality Status for Estuary

NEGERI / STATE	KLASSIFIKASI STESEN/ STATION CLASSIFICATION	KAWASAN/ AREA	NOMBOR STESEN LAMA / OLD STATION NUMBER	NOMBOR STESEN BARU / NEW STATION NUMBER	NILAI IKAMM/ MMWQI VALUE					KATEGORI (2019)/ CATEGORY (2019)
					2015	2016	2017	2018	2019	
Pahang	Muara Sungai/ Estuary	Kuala Kuantan*	NA	MMCE001	-	-	66	67	56	Sederhana/ Moderate
		Kuala Rompin Kecil*	NA	MMCE002	-	-	89	93	69	Sederhana/ Moderate
		Kuala Pahang*	NA	MMCE003	-	-	92	73	59	Sederhana/ Moderate
		Kuala Nenasi*	NA	MMCE004	-	-	93	94	63	Sederhana/ Moderate
		Kuala Sungai Balok*	NA	MMCE005	-	-	65	66	57	Sederhana/ Moderate
Terengganu	Muara Sungai/ Estuary	Kuala Sungai Besut	5825902	MMTE001	64	63	73	67	58	Sederhana/ Moderate
		Kuala Sungai Dungun	4734918	MMTE002	55	53	65	86	59	Sederhana/ Moderate
		Kuala Sungai Ibai	5231949	MMTE003	63	61	90	93	85	Baik/ Good
		Kuala Sungai Kerteh	4534922	MMTE004	54	56	91	92	59	Sederhana/ Moderate
		Kuala Sungai Marang	5232911	MMTE005	63	72	90	91	67	Sederhana/ Moderate
		Kuala Sungai Paka	4634920	MMTE006	69	72	80	94	58	Sederhana/ Moderate
		Kuala Sungai Setiu	5627953	MMTE007	62	75	92	93	86	Baik/ Good
		Kuala Sungai Terengganu	5331907	MMTE008	72	55	66	67	59	Sederhana/ Moderate
		Kuala Sungai Kemaman/Chukai	4234929	MMTE009	54	56	90	94	59	Sederhana/ Moderate
		Tioxide Utara (Kg. Bukit Kuang, Kijal)	4234950	MMTE010	63	63	89	94	95	Terbaik/ Excellent
		Tioxide Tengah (Pupuk Semangat, Kijal)	4234951	MMTE011	62	61	90	94	94	Terbaik/ Excellent
		Tioxide Selatan (KSB, T. Kalong)	4234952	MMTE012	53	-	94	94	85	Baik/ Good
		Pulau Duyung	5231908	MMTE013	48	57	66	66	58	Sederhana/ Moderate
Kelantan	Muara Sungai/ Estuary	Kuala Sungai Golok	6220911	MMDE001	57	76	75	67	58	Sederhana/ Moderate
		Kuala Sungai Kelantan	6222901	MMDE002	52	74	79	65	55	Sederhana/ Moderate
		Kuala Sungai Pengkalan Chepa	6223912	MMDE003	63	72	89	67	53	Sederhana/ Moderate
		Kuala Sungai Pengkalan Datu	6123913	MMDE004	63	61	86	81	68	Sederhana/ Moderate
		Kuala Sungai Kemasin	5824914	MMDE005	58	57	63	67	39	Tercemar/ Poor
		Kuala Sungai Semerak*	NA	MMDE006	-	-	87	67	69	Sederhana/ Moderate

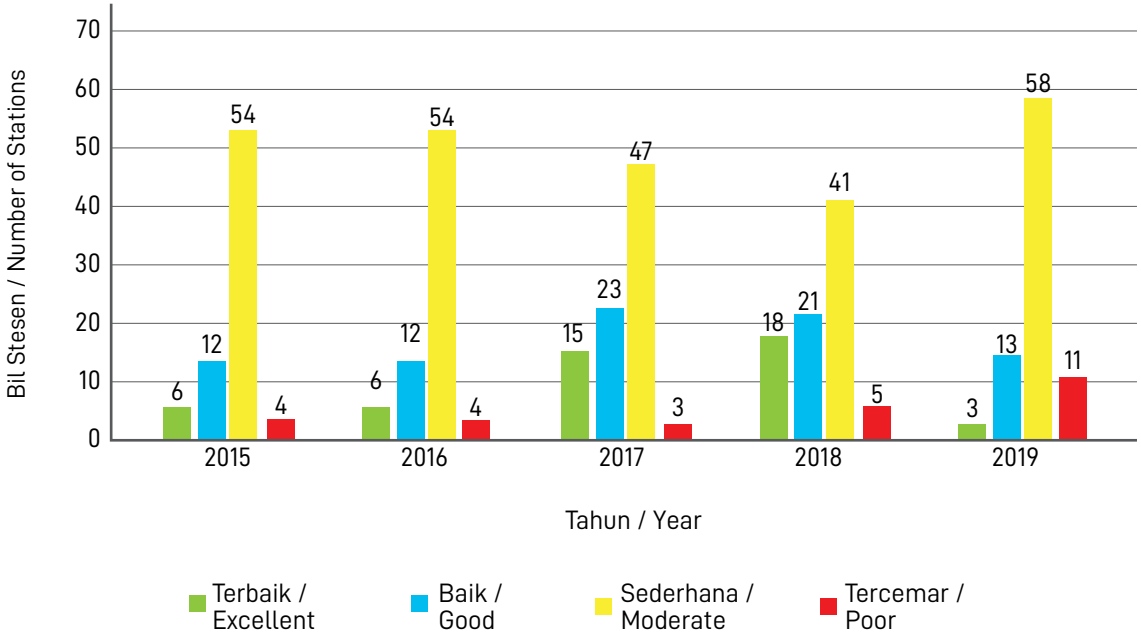
Jadual 4.7: Status Kualiti Air Marin bagi Muara Sungai
Table 4.7: Marine Water Quality Status for Estuary

NEGERI / STATE	KLASSIFIKASI STESEN/ STATION CLASSIFICATION	KAWASAN/ AREA	NOMBOR STESEN LAMA / OLD STATION NUMBER	NOMBOR STESEN BARU / NEW STATION NUMBER	NILAI IKAMM/ MMWQI VALUE					KATEGORI (2019)/ CATEGORY (2019)
					2015	2016	2017	2018	2019	
Sarawak	Muara Sungai/ Estuary	Kuala Sungai Semantan	1898901	MMQE001	80	90	86	90	91	Terbaik/ Excellent
		Kuala Sungai Sarawak	1604907	MMQE002	62	70	85	86	86	Baik/ Good
		Kuala Sungai Bako	1704905	MMQE003	69	66	55	90	63	Sederhana/ Moderate
		Kuala Sungai Santubong	1702903	MMQE004	87	89	87	88	87	Baik/ Good
		Kuala Batang Krian (Kabong)	1710922	MMQE005	64	73	64	76	80	Baik/ Good
		Kuala Batang Rejang	2111909	MMQE006	82	87	83	85	89	Baik/ Good
		Kuala Mukah	2920920	MMQE007	70	89	72	83	76	Sederhana/ Moderate
		Kuala Batang Kemena	3130911	MMQE008	77	69	68	87	83	Baik/ Good
		Kuala Tanjung Similajau	3431903	MMQE009	90	92	84	89	84	Baik/ Good
		Kuala Sungai Panipah	3332904	MMQE010	91	92	86	89	87	Baik/ Good
		Kuala Pantai Nyalau	3431903	MMQE011	93	86	84	79	83	Baik/ Good
		Kuala Sungai Baram	4539919	MMQE012	97	66	72	76	74	Sederhana/ Moderate
		Kuala Sungai Miri	4349915	MMQE013	72	68	61	78	74	Sederhana/ Moderate
		Kuala Sungai Trusan*	NA	MMQE014	-	-	70	87	80	Baik/ Good
Sabah	Muara Sungai/ Estuary	Kuala Penyu	5453901	MMSE001	65	66	71	92	83	Baik/ Good
		Muara Sungai Inanam	5050905	MMSE002	88	45	86	91	75	Sederhana/ Moderate

Nota/ Note:
* : Stesen baru/ New station
** : Stesen tutup/ Close station
\- : Tiada data/ No data
NA : Tidak berkenaan/ Not available

Rajah 4.2 menunjukkan bilangan stesen pengawasan muara sungai yang dikelaskan mengikut klasifikasi IKAMM. Bilangan stesen terbaik berkurang daripada 18 stesen pada tahun 2018 kepada 3 stesen pada tahun 2019 manakala bilangan stesen baik berkurang daripada 21 stesen pada tahun 2018 kepada 13 stesen pada tahun 2019.

Figure 4.2 shows the number of estuary monitoring stations which were grouped based on MMWQI classification. The number of excellent station has reduced from 18 stations in 2018 to 3 stations in 2019, while the number of good stations has reduced from 21 stations in 2018 to 13 stations in 2019.



Rajah 4.2: Tren Status Kualiti Air Marin bagi Kawasan Muara Sungai, 2015 - 2019
Figure 4.2: The Trend of Marine Water Quality Status for Estuary Area, 2015 - 2019

STATUS
KUALITI AIR MARIN PULAU
ISLAND MARINE WATER QUALITY

Sebanyak 95 stesen pengawasan pulau dibangunkan yang meliputi 79 pulau yang telah dipantau pada tahun 2019. **Jadual 4.8** menunjukkan senarai stesen pengawasan pulau. Daripada 95 stesen pengawasan, 34 stesen (35.79%) adalah terbaik, 33 stesen (34.74%) baik, manakala 27 stesen (28.42%) sederhana. 1 stesen (1.05%) tercemar pada tahun 2019 **(Jadual 4.9).**

A total of 95 island monitoring stations were established surrounding 79 islands and were monitored in 2019. **Table 4.8** shows the list of island monitoring stations. Out of the 95 island monitoring stations, 34 stations (35.79%) were excellent, 33 stations (34.74%) were good, while the remaining 27 stations (28.42%) were moderate. 1 station (1.05%) was categorised as poor in 2019 **(Table 4.9)**.

Jadual 4.8: Stesen-Stesen Pengawasan Bagi Pulau, 2019
Table 4.8: Island Monitoring Stations, 2019

NEGERI/ STATE	BIL. PULAU/ NO. OF ISLAND	BIL. STESEN/ NO. OF STATION	PULAU/ ISLAND	ID STESEN LAMA/ OLD STATION ID	ID STESEN BARU/ NEW STATION ID	KATEGORI/ CATEGORY
Kedah	10	1	Singa Besar	7KR01	MMKR001	Peranginan/ Resort
		2	Dayang Bunting	7KR02	MMKR002	Peranginan/ Resort
			Dayang Bunting 2*	NA	MMKR003	Peranginan/ Resort
		1	Pulau Perak	7KP01	MMRP001	Dilindungi/ Protected
		1	Payar	7KM03	MMKM001	Taman Laut/ Marine Park
		1	Kaca	7KM04	MMKM002	Taman Laut/ Marine Park
		1	Segantang	7KM06	MMKM003	Taman Laut/ Marine Park
		4	Pantai Kuah	7KD07	MMKD001	Pembangunan/ Development
			Pantai Chenang	7KD09	MMKD002	Pembangunan/ Development
			Tanjung Rhu	7KD010	MMKD003	Pembangunan/ Development
			Teluk Ewa	7KD08	MMKD004	Pembangunan/ Development
		1	Pasir*	NA	MMKP001	Dilindungi/ Protected
		1	Gasing*	NA	MMKP002	Dilindungi/ Protected
		1	Dangli*	NA	MMKP003	Dilindungi/ Protected
Pulau Pinang	7	1	Tanjung Tokong*	NA	MMPP001	Dilindungi/ Protected
		3	Batu Maung	7PD01	MMPD001	Pembangunan/ Development
			Padang Kota	7PD04	MMPD002	Pembangunan/ Development
			Teluk Bahang	7PD03	MMPD003	Pembangunan/ Development
		1	Aman	7PR05	MMPR001	Peranginan/ Resort
		1	Jerejak	7PR06	MMPR002	Peranginan/ Resort
		1	Kendi	7PR07	MMPR003	Peranginan/ Resort
		1	Rimau	7PR08	MMPR004	Peranginan/ Resort
		1	Gedong	7PR09	MMPR005	Peranginan/ Resort
Perak	4	2	Pantai Teluk Gedong	7AR01	MMAR001	Peranginan/ Resort
			Pantai Puteri Dewi	7AR02	MMAR002	Peranginan/ Resort
		1	Pangkor Laut	7AR03	MMAR003	Peranginan/ Resort
		1	Sembilan	7AR04	MMAR004	Peranginan/ Resort
		1	Tukun Perak	7AP05	MMAP001	Dilindungi/ Protected
Selangor	3	1	Ketam	7BR01	MMBR001	Peranginan/ Resort
		1	Angsa	7BR02	MMBR002	Peranginan/ Resort

Jadual 4.8: Stesen-Stesen Pengawasan Bagi Pulau, 2019
Table 4.8: Island Monitoring Stations, 2019

NEGERI/ STATE	BIL. PULAU/ NO. OF ISLAND	BIL. STESEN/ NO. OF STATION	PULAU/ ISLAND	ID STESEN LAMA/ OLD STATION ID	ID STESEN BARU/ NEW STATION ID	KATEGORI/ CATEGORY
Selangor		1	Lumut	7BR03	MMBR003	Peranginan/ Resort
N. Sembilan	1	1	Arang	7NP01	MMNP001	Dilindungi/ Protected
Melaka	3	2	Upeh (Point A)	7MR02	MMMR001	Peranginan/ Resort
			Upeh (Point B)	7MR02	MMMR002	Peranginan/ Resort
		2	Besar (Point A)	7MR01	MMMR003	Peranginan/ Resort
			Besar (Point B)	7MR01	MMMR004	Peranginan/ Resort
		2	Undan (Point A)	7MR03	MMMR005	Peranginan/ Resort
			Undan (Point B)	7MR03	MMMR006	Peranginan/ Resort
Johor	8	1	Setindan	7JR01	MMJR001	Peranginan/ Resort
		1	Babi Tengah	7JR02	MMJR002	Peranginan/ Resort
		1	Dayang	7JM03	MMJM001	Taman Laut/ Marine Park
		1	Nanga Besar	7JM08	MMJM002	Taman Laut/ Marine Park
		1	Sibu Tengah	7JM11	MMJM003	Taman Laut/ Marine Park
		1	Pemanggil	7JM15	MMJM004	Taman Laut/ Marine Park
		1	Kukup	7JP17	MMJP001	Dilindungi/ Protected
		1	Pisang	7JP18	MMJP002	Dilindungi/ Protected
Pahang	9	1	Tioman (Teluk Salang)	7CM02	MMCM001	Taman Laut/ Marine Park
		1	Tioman (Kg. Nipah)	7CM01	MMCM002	Taman Laut/ Marine Park
		1	Tulai	7CM05	MMCM003	Taman Laut/ Marine Park
		1	Labas	7CM07	MMCM004	Taman Laut/ Marine Park
		1	Cebeh	7CM04	MMCM005	Taman Laut/ Marine Park
		1	Sepui	7CM06	MMCM006	Taman Laut/ Marine Park
		1	Sembilang	7CM08	MMCM007	Taman Laut/ Marine Park
		1	Seri Buat	7CM03	MMCM008	Taman Laut/ Marine Park
		1	Tokong Bahara	7CM09	MMCM009	Taman Laut/ Marine Park
Terengganu	9	1	Gemia	7TR01	MMTR001	Peranginan/Resort
		1	Perhentian Besar (South)	7TM04	MMTM001	Taman Laut/ Marine Park
		2	Perhentian Besar (West)	7TM05	MMTM002	Taman Laut/ Marine Park
			Perhentian Kecil	7TM06	MMTM003	Taman Laut/ Marine Park
		2	Redang (North)	7TM07	MMTM004	Taman Laut/ Marine Park

Jadual 4.8: Stesen-Stesen Pengawasan Bagi Pulau, 2019
Table 4.8: Island Monitoring Stations, 2019

NEGERI/ STATE	BIL. PULAU/ NO. OF ISLAND	BIL. STESEN/ NO. OF STATION	PULAU/ ISLAND	ID STESEN LAMA/ OLD STATION ID	ID STESEN BARU/ NEW STATION ID	KATEGORI/ CATEGORY
Terengganu		2	Redang (South)	7TM08	MMTM005	Taman Laut/ Marine Park
		1	Lang Tengah	7TM11	MMTM006	Taman Laut/ Marine Park
		1	Pinang	7TM12	MMTM007	Taman Laut/ Marine Park
		1	Ekor Tebu	7TM13	MMTM008	Taman Laut/ Marine Park
		1	Lima	7TM14	MMTM009	Taman Laut/ Marine Park
		1	Kapas	7TM09	MMTM010	Taman Laut/ Marine Park
Sarawak	3	1	Satang	7QP01	MMQP001	Dilindungi/Protected
		1	Talang-Talang Kecil	7QP02	MMQP002	Dilindungi/Protected
		1	Talang-Talang Besar	7QP03	MMQP003	Dilindungi/Protected
Sabah	16	1	Gaya	7SR01	MMSR001	Peranginan/Resort
		1	Mabul	7SR03	MMSR002	Peranginan/Resort
		2	Sipadan (N)	7SR04	MMSR003	Peranginan/Resort
			Sipadan (W)	7SR05	MMSR004	Peranginan/Resort
		1	Manukan	7SM09	MMSR005	Peranginan/Resort
		1	Tiga	7SR10	MMSR006	Peranginan/Resort
		1	Kapalai	7SR12	MMSR007	Peranginan/Resort
		1	Molleangan Besar	7SR14	MMSR008	Peranginan/Resort
		1	Banggi (South)	7SR15	MMSR009	Peranginan/Resort
		1	Banggi (East)	7SR20	MMSR010	Peranginan/Resort
		1	Balambangan	7SR16	MMSR011	Peranginan/Resort
		1	Mantanani Besar	7SR21	MMSR012	Peranginan/Resort
		1	Sapi	7SM08	MMSM001	Taman Laut/ Marine Park
		1	Kalampunian Besar	7SM11	MMSM002	Taman Laut/ Marine Park
		1	Selingan	7SP17	MMSP001	Taman Laut/ Marine Park
		1	Gulisan	7SP18	MMSP002	Taman Laut/ Marine Park
		1	Bakungan Kecil	7SP19	MMSP003	Taman Laut/ Marine Park
Labuan	4	1	Kuraman	7LM05	MMLM001	Taman Laut/ Marine Park
		1	Rusukan Besar	7LM07	MMLM002	Taman Laut/ Marine Park
		1	Rusukan Kecil	7LM06	MMLM003	Taman Laut/ Marine Park

Jadual 4.8: Stesen-Stesen Pengawasan Bagi Pulau, 2019
Table 4.8: Island Monitoring Stations, 2019

NEGERI/ STATE	BIL. PULAU/ NO. OF ISLAND	BIL. STESEN/ NO. OF STATION	PULAU/ ISLAND	ID STESEN LAMA/ OLD STATION ID	ID STESEN BARU/ NEW STATION ID	KATEGORI/ CATEGORY
Labuan		4	Pohon Batu	7LD01	MMLD001	Pembangunan/Developement
			Water Front	7LD02	MMLD002	Pembangunan/Developement
			LubukTemiang	7LD03	MMLD003	Pembangunan/Developement
			Ranca-Ranca	7LD04	MMLD004	Pembangunan/Developement

Nota/ Note:
* : Stesen baru/ New station
** : Stesen tutup/ Close station
\- : Tiada data/ No data
NA : Tidak berkenaan/ Not available

Jadual 4.9: Status Kualiti Air Marin bagi Pulau
Table 4.9: Marine Water Quality Status for Island

NEGERI / STATE	KLASSIFIKASI STESEN/ STATION CLASSIFICATION	KAWASAN/ AREA	NOMBOR STESEN LAMA / OLD STATION NUMBER	NOMBOR STESEN BARU / NEW STATION NUMBER	NILAI IKAMM/ MMWQI VALUE					KATEGORI (2019)/ CATEGORY (2019)
					2015	2016	2017	2018	2019	
Kedah	Pulau/ Island	Singa Besar	7KR01	MMKR001	73	61	90	93	84	Baik/Good
		Dayang Bunting	7KR02	MMKR002	71	60	91	93	90	Terbaik/Excellent
		Dayang Bunting 2*	NA	MMKR003	-	-	93	93	84	Baik/Good
		Pulau Perak	7KP01	MMRP001	72	56	94	94	93	Terbaik/Excellent
		Payar	7KM03	MMKM001	73	75	91	94	92	Terbaik/Excellent
		Kaca	7KM04	MMKM002	75	74	93	94	86	Baik/Good
		Segantang	7KM06	MMKM003	75	70	91	94	83	Baik/Good
		Pantai Kuah	7KD07	MMKD001	69	51	92	94	85	Baik/Good
		Pantai Chenang	7KD09	MMKD002	73	63	74	82	73	Sederhana/Moderate
		Tanjung Rhu	7KD010	MMKD003	88	67	92	94	91	Terbaik/Excellent
		Teluk Ewa	7KD08	MMKD004	74	74	92	94	95	Terbaik/Excellent
		Lembu**	7KM05	NA	75	71	-	-	-	Stesen Tutup/Closed Station
		Pasir*	NA	MMKP001	-	-	93	94	94	Terbaik/Excellent
		Gasing*	NA	MMKP002	-	-	94	94	94	Terbaik/Excellent
		Dangli*	NA	MMKP003	-	-	92	94	95	Terbaik/Excellent
Pulau Pinang	Pulau/ Island	Tanjung Tokong*	NA	MMPP001	-	-	63	66	57	Sederhana/Moderate
		Batu Maung	7PD01	MMPD001	52	46	64	62	55	Sederhana/Moderate
		Padang Kota	7PD04	MMPD002	47	82	52	65	58	Sederhana/Moderate
		Teluk Bahang*	7PD03	MMPD003	-	-	61	82	59	Sederhana/Moderate
		Aman	7PR05	MMPR001	69	72	72	88	60	Sederhana/Moderate
		Jerejak	7PR06	MMPR002	68	46	57	65	57	Sederhana/Moderate
		Kendi	7PR07	MMPR003	72	76	83	93	77	Sederhana/Moderate
		Rimau	7PR08	MMPR004	72	51	85	93	85	Baik/Good
		Gedong	7PR09	MMPR005	66	71	63	86	56	Sederhana/Moderate
Perak	Pulau/ Island	Pantai Teluk Gedong	7AR01	MMAR001	68	56	85	92	69	Sederhana/Moderate
		Pantai Puteri Dewi	7AR02	MMAR002	68	79	92	94	90	Terbaik/Excellent
		Pangkor Laut	7AR03	MMAR003	63	52	89	92	86	Baik/Good
		Sembilan	7AR04	MMAR004	63	58	93	94	82	Baik/Good
		Tukun Perak	7AP05	MMAP001	62	69	93	93	88	Baik/Good
Selangor	Pulau/ Island	Ketam	7BR01	MMBR001	54	93	88	89	57	Sederhana/Moderate

Jadual 4.9: Status Kualiti Air Marin bagi Pulau
Table 4.9: Marine Water Quality Status for Island

NEGERI / STATE	KLASSIFIKASI STESEN/ STATION CLASSIFICATION	KAWASAN/ AREA	NOMBOR STESEN LAMA / OLD STATION NUMBER	NOMBOR STESEN BARU / NEW STATION NUMBER	NILAI IKAMM/ MMWQI VALUE					KATEGORI (2019)/ CATEGORY (2019)
					2015	2016	2017	2018	2019	
Selangor	Pulau/ Island	Angsa	7BR02	MMBR002	59	88	85	92	71	Sederhana/Moderate
		Lumut	7BR03	MMBR003	58	87	61	54	47	Tercemar/Poor
Negeri Sembilan	Pulau/ Island	Arang	7NP01	MMNP001	94	97	68	92	81	Baik/Good
Melaka	Pulau/ Island	Upeh (Point A)	7MR02	MMMR001	56	58	65	85	59	Sederhana/Moderate
		Upeh (Point B)	7MR02	MMMR002	54	67	82	84	70	Sederhana/Moderate
		Besar (Point A)	7MR01	MMMR003	62	70	89	94	84	Baik/Good
		Besar (Point B)	7MR01	MMMR004	56	70	90	93	71	Sederhana/Moderate
		Undan (Point A)	7MR03	MMMR005	54	77	90	94	83	Baik/Good
		Undan (Point B)	7MR03	MMMR006	56	61	90	94	91	Terbaik/Excellent
Johor	Pulau/ Island	Setindan	7JR01	MMJR001	89	89	94	94	91	Terbaik/Excellent
		Babi Tengah	7JR02	MMJR002	89	89	94	94	94	Terbaik/Excellent
		Dayang	7JM03	MMJM001	90	88	94	94	88	Baik/Good
		Nanga Besar	7JM08	MMJM002	89	90	94	94	70	Sederhana/Moderate
		Sibu Tengah	7JM11	MMJM003	89	88	94	94	86	Baik/Good
		Pemanggil	7JM15	MMJM004	89	90	94	94	91	Terbaik/Excellent
		Kukup	7JP17	MMJP001	87	83	91	87	58	Sederhana/Moderate
		Pisang	7JP18	MMJP002	89	86	93	93	58	Sederhana/Moderate
Pahang	Pulau/ Island	Tioman (Teluk Salang)	7CM02	MMCM001	76	78	92	94	94	Terbaik/Excellent
		Tioman (Kg. Nipah)	7CM01	MMCM002	83	85	93	94	83	Baik/Good
		Tulai	7CM05	MMCM003	88	85	93	94	94	Terbaik/Excellent
		Labas	7CM07	MMCM004	85	86	93	94	91	Terbaik/Excellent
		Cebeh	7CM04	MMCM005	85	85	94	94	95	Terbaik/Excellent
		Sepui	7CM06	MMCM006	79	83	93	94	95	Terbaik/Excellent
		Sembilang	7CM08	MMCM007	58	75	93	94	96	Terbaik/Excellent
		Seri Buat	7CM03	MMCM008	57	84	94	94	94	Terbaik/Excellent
		Tokong Bahara	7CM09	MMCM009	75	86	93	94	69	Sederhana/Moderate
Terengganu	Pulau/ Island	Gemia	7TR01	MMTR001	58	64	89	94	96	Terbaik/Excellent
		Perhentian Besar (South)	7TM04	MMTM001	59	63	89	94	86	Baik/Good
		Perhentian Besar (West)	7TM05	MMTM002	57	62	90	94	92	Terbaik/Excellent
		Perhentian Kecil	7TM06	MMTM003	59	61	90	94	91	Terbaik/Excellent

Jadual 4.9: Status Kualiti Air Marin bagi Pulau
Table 4.9: Marine Water Quality Status for Island

NEGERI / STATE	KLASSIFIKASI STESEN/ STATION CLASSIFICATION	KAWASAN/ AREA	NOMBOR STESEN LAMA / OLD STATION NUMBER	NOMBOR STESEN BARU / NEW STATION NUMBER	NILAI IKAMM/ MMWQI VALUE					KATEGORI (2019)/ CATEGORY (2019)
					2015	2016	2017	2018	2019	
Terengganu	Pulau/ Island	Redang (North)	7TM07	MMTM004	58	78	90	94	88	Baik/Good
		Redang (South)	7TM08	MMTM005	58	64	89	94	85	Baik/Good
		Lang Tengah	7TM11	MMTM006	71	64	90	94	75	Sederhana/Moderate
		Pinang	7TM12	MMTM007	59	63	90	94	94	Terbaik/Excellent
		Ekor Tebu	7TM13	MMTM008	60	63	90	94	87	Baik/Good
		Lima	7TM14	MMTM009	59	64	90	94	97	Terbaik/Excellent
		Kapas	7TP16	MMTM010	58	76	90	93	90	Terbaik/Excellent
Kelantan	Pulau/ Island	Panjang	7DP01	MMDP001	65	66	88	93	82	Baik/Good
		Kundur	7DP02	MMDP002	63	65	89	93	84	Baik/Good
Sarawak	Pulau/ Island	Satang	7QP01	MMQP001	75	90	87	90	91	Terbaik/Excellent
		Talang-Talang Kecil	7QP02	MMQP002	87	77	87	91	92	Terbaik/Excellent
		Talang-Talang Besar	7QP03	MMQP003	90	91	87	90	90	Terbaik/Excellent
Sabah	Pulau/ Island	Gaya	7SR01	MMSR001	85	85	73	93	86	Baik/Good
		Mabul	7SR03	MMSR002	71	82	87	93	60	Sederhana/Moderate
		Sipadan (N)	7SR04	MMSR003	70	84	88	93	63	Sederhana/Moderate
		Sipadan (W)	7SR05	MMSR004	70	80	85	93	77	Sederhana/Moderate
		Manukan	7SM09	MMSR005	84	82	70	93	85	Baik/Good
		Tiga	7SR10	MMSR006	82	84	85	92	87	Baik/Good
		Kapalai	7SR12	MMSR007	70	85	85	93	77	Sederhana/Moderate
		Molleangan Besar	7SR14	MMSR008	83	83	88	93	91	Terbaik/Excellent
		Banggi (South)	7SR15	MMSR009	82	84	87	93	79	Sederhana/Moderate
		Banggi (East)	7SR20	MMSR010	83	83	88	93	93	Terbaik/Excellent
		Balambangan	7SR16	MMSR011	84	83	88	93	88	Baik/Good
		Mantanani Besar	7SR21	MMSR012	82	83	85	93	95	Terbaik/Excellent
		Sapi	7SM08	MMSM001	84	84	72	93	85	Baik/Good
		Kalampunian Besar	7SM11	MMSM002	83	81	86	93	89	Baik/Good
		Selingan	7SP17	MMSP001	66	84	89	93	85	Baik/Good
		Gulisan	7SP18	MMSP002	87	85	89	93	80	Baik/Good
		Bakungan Kecil	7SP19	MMSP003	50	83	87	93	83	Baik/Good

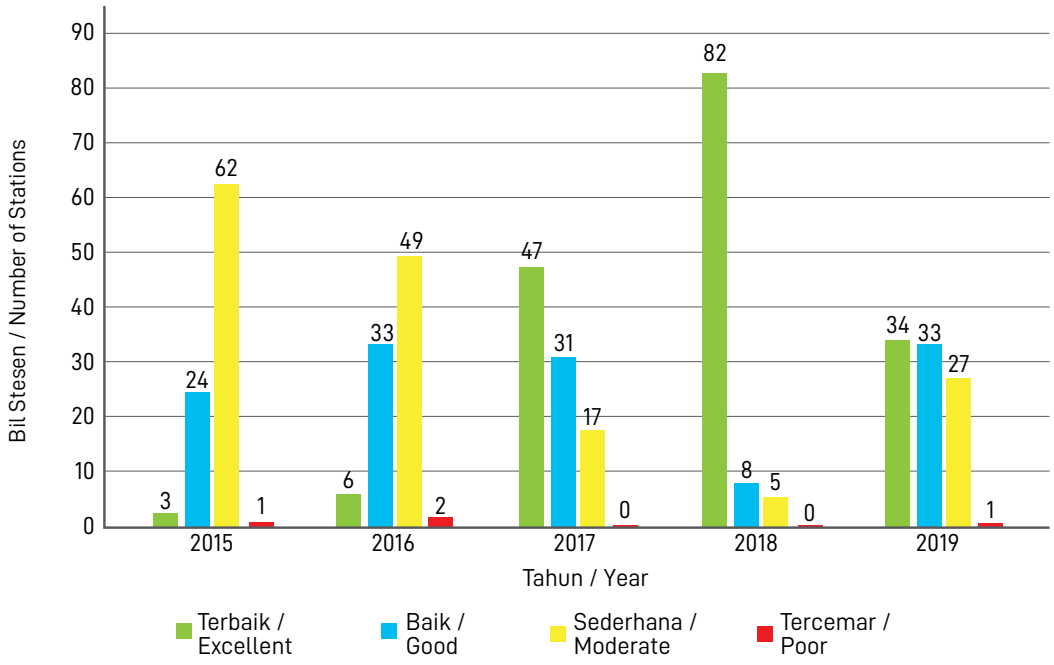
Jadual 4.9: Status Kualiti Air Marin bagi Pulau
Table 4.9: Marine Water Quality Status for Island

NEGERI / STATE	KLASSIFIKASI STESEN/ STATION CLASSIFICATION	KAWASAN/ AREA	NOMBOR STESEN LAMA / OLD STATION NUMBER	NOMBOR STESEN BARU / NEW STATION NUMBER	NILAI IKAMM/ MMWQI VALUE					KATEGORI (2019)/ CATEGORY (2019)
					2015	2016	2017	2018	2019	
Labuan	Pulau/ Island	Kuraman	7LM05	MMLM001	68	73	89	93	88	Baik/Good
		Rusukan Besar	7LM07	MMLM002	66	50	91	93	88	Baik/Good
		Rusukan Kecil	7LM06	MMLM003	66	50	90	92	90	Terbaik/Excellent
		Pohon Batu	7LD01	MMLD001	67	67	63	92	86	Baik/Good
		Water Front	7LD02	MMLD002	64	76	66	92	61	Sederhana/Moderate
		LubukTemiang	7LD03	MMLD003	65	74	72	92	67	Sederhana/Moderate
		Ranca-Ranca	7LD04	MMLD004	66	52	91	92	90	Terbaik/Excellent

Nota/ Note:
* : (Stesen baru/ New station)
** : (Stesen tutup/ Close station)
- : (Tiada data/ No data)
NA : (Tidak berkenaan/ Not available)

Rajah 4.3 menunjukkan bilangan stesen pengawasan pulau yang diklasifikasikan berdasarkan klasifikasi IKAMM. Bilangan stesen sebagai terbaik berkurang daripada 82 stesen pada tahun 2018 kepada 34 stesen pada tahun 2019 manakala stesen sebagai baik meningkat dari 8 stesen pada tahun 2018 kepada 33 stesen pada tahun 2019.

Figure 4.3 shows the number of island monitoring stations which were grouped based on MMWQI classification. The number of excellent station has reduced from 82 stations in 2018 to 34 stations in 2019, while the number of good stations has increased from 8 stations in 2018 to 33 stations in 2019.



Rajah 4.3: Tren Status Kualiti Air Marin bagi Kawasan Pulau, 2015 - 2019
Figure 4.3: The Trend of Marine Water Quality Status for Island Area, 2015 - 2019

Stesen Marin dalam Kategori Tercemar

Jadual 4.10 menunjukkan terdapat 15 stesen marin adalah tercemar iaitu 3 stesen pantai, 11 stesen muara sungai dan 1 stesen pulau. Unjuran peratusan sub-indeks adalah dengan menggunakan skala 0 hingga 100%. Sub-indeks yang memberikan nilai 49% dan ke bawah dijadikan sebagai tanda aras yang ditandakan warna merah bermaksud kemerosotan pada IKAMM.

Jadual juga menunjukkan semua stesen marin yang mengalami kemorosotan adalah disebabkan oleh parameter faecal coliform (FC). Selain itu, oksigen terlarut (DO), fosfat (PO_4) dan nitrat (NO_3) juga turut mempengaruhi nilai IKAMM.

Stesen muara Sungai Klang dan Kuala Sungai Segget adalah stesen yang menerima kesan terbanyak daripada tiga (3) parameter, manakala stesen yang lain kebanyakannya terkesan daripada satu (1) atau dua (2) parameter sahaja.

Kesimpulannya, penurunan nilai IKAMM banyak dipengaruhi oleh bakteria dan nutrien yang tinggi daripada daratan seperti aktiviti kumbahan dan pertanian. Corak pergerakan air pasang surut, sifat dinamik setiap stesen dan sedimen turut memberi kesan pada kualiti air marin.

Marine Stations in Poor Category

Table 4.10 shows that there were 15 marine stations categorised as poor, which consisted of three 3 coastal stations, 11 estuaries and 1 island station. Sub-index projection percentage uses a scale of 0% to 100%. The sub-index which gives a value of 49% and below is a benchmark and marked in red, that indicating a decline in MMWQI.

The table also shows that all marine stations experienced degradation due to faecal coliform (FC) parameters. In addition, dissolved oxygen (DO), phosphate (PO_4) and nitrate (NO_3) had a slight impact on the MMWQI value .

Kuala Sungai Klang and Kuala Sungai Segget stations are stations with the most impact by the three (3) parameters, while the other stations are mostly impacted by one (1) or two (2) parameters only.

In conclusion, the decline in MMWQI value is influenced by high bacteria and nutrients from landbase activities such as sewage and agriculture. However, the tidal water circulation patterns, dynamic of each station and sediment will also affect marine water quality .

Jadual 4.10: Senarai Stesen Marin dengan Status Kategori Tercemar dan Peratusan Sub-Indeks Mengikut Parameter, 2019

Table 4.10: Marine Stations under the Category of Poor Status and it's Sub-Index Percentages by Parameter, 2019

NEGERI/ STATE	KLASIFIKASI STESEN/ STATION CLASSIFICATION	LOKASI/ LOCATION	ID STESEN/ STATION ID	IKAMM/ MMWQI	KATEGORI IKAMM/ MMWQI CATEGORY	PERATUSAN SUB INDEKS (%) / SUB INDEX PERCENTAGES (%)					
						OKSIGEN TERLARUT / DISSOLVED OXYGEN	AMONIA TIDAK TERION / UNIONIZED AMMONIA	FAECAL COLIFORM	JUMLAH PEPEJAL TERAMPAI/ TOTAL SUSPENDED SOLID	NITRAT / NITRATE	FOSFAT / PHOSPHATE
Johor	Pantai/ Coastal	PANTAI STULANG LAUT	MMJC004	49	Tercemar / Poor	85	92	8	89	73	64
Johor	Pantai/ Coastal	HADAPAN HSAJB	MMJC007	36	Tercemar / Poor	10	92	8	94	88	55
Johor	Pantai/ Coastal	PANTAI LIDO	MMJC008	37	Tercemar / Poor	10	92	8	94	89	57
Selangor	Muara Sungai/ Estuary	KUALA SUNGAI LANGAT (LUMUT)	MMBE006	49	Tercemar / Poor	75	94	8	84	74	59
Selangor	Muara Sungai/ Estuary	KUALA SUNGAITENGI	MMBE009	49	Tercemar / Poor	90	96	8	74	79	87
Selangor	Muara Sungai/ Estuary	KUALA SUNGAI SELANGOR	MMBE008	45	Tercemar / Poor	96	98	8	66	46	88
Kelantan	Muara Sungai/ Estuary	KUALA SUNGAI KEMASIN	MMDE005	39	Tercemar / Poor	35	99	8	93	93	93
Melaka	Muara Sungai/ Estuary	KUALA SUNGAI SRI MELAKA	MMME002	45	Tercemar / Poor	52	82	8	89	89	82
Pulau Pinang	Muara Sungai/ Estuary	KUALA SUNGAI JAWI	MMAE001	46	Tercemar / Poor	96	89	8	84	89	49
Perak	Muara Sungai/ Estuary	KUALA SUNGAI SEPETANG	MMAE005	48	Tercemar / Poor	69	98	8	78	83	75
Selangor	Muara Sungai/ Estuary	KUALA SUNGAI BULOH	MMBE007	44	Tercemar / Poor	42	95	8	87	79	82
Selangor	Muara Sungai/ Estuary	KUALA SUNGAI KLANG	MMBE005	38	Tercemar / Poor	30	93	8	87	83	28
Johor	Muara Sungai/ Estuary	KUALA SUNGAI LALOH	MMJE002	39	Tercemar / Poor	10	86	8	89	89	69
Johor	Muara Sungai/ Estuary	KUALA SUNGAI SEGGET	MMJE001	33	Tercemar / Poor	10	87	8	92	74	50
Selangor	Pulau/ Island	LUMUT	MMBR003	48	Tercemar / Poor	83	90	8	85	76	58

PENGAWASAN KUALITI AIR MARIN AUTOMATIK
CONTINUOUS MARINE WATER QUALITY MONITORING

Rangkaian Pengawasan Kualiti Air Marin Automatik bertujuan untuk menyediakan data kualiti air marin hampir waktu sebenar bagi sepuluh (10) lokasi stesen yang ditetapkan.

The Continuous Marine Water Quality Monitoring, (CMWQM) network aims to provide near real-time marine water quality data in ten (10) designated locations.

Jadual 4.11 menyenaraikan lokasi bagi stesen-stesen pengawasan mengikut kelas kualiti air masing-masing.

Table 4.11 lists the monitoring station locations and the respective water quality classes.

Rajah 4.4 menunjukkan lokasi stesen CMWQM.

Meanwhile **Figure 4.4** shows the location of CMWQM stations.

Pada tahun 2019, tiada insiden pencemaran dikesan di semua stesen CMWQM. Kepekatan bagi kebanyakan parameter yang direkodkan adalah pada tahap keadaan semulajadi dengan mengambil kira potensi gangguan sediaada di sekitar stesen tersebut.

In 2019, pollution incidents were not detected at all CMWQM stations. Concentration for most parameters recorded at the stations were typical of its nature, considering the potential disturbances present in nearby stations.

Kualiti Air Marin yang dipantau oleh Rangkaian CMWQM turut dipengaruhi oleh kesan musim monsun. Kualiti air marin telah menunjukkan tahap turun naik yang tinggi disebabkan peningkatan jumlah hujan semasa Monsun Timur Laut. Secara relatif, kualiti air marin adalah stabil di kebanyakan stesen kecuali bagi CM11Q. CM11Q adalah terletak di muara Sungai Santubong, Sarawak, disebabkan adanya interaksi air tawar - air laut yang unik untuk pembentukan ciri hidrologi muara sungai. Oleh yang demikian, parameter kualiti air CM11Q menunjukkan tahap turun naik yang tinggi.

Marine water quality monitored by the CMWQM Network was affected by monsoon seasons. Marine water quality revealed a higher degree of fluctuation due to higher volume of precipitation during the North East Monsoon. Marine water quality was relatively stable in most stations, except for CM11Q. CM11Q is located in the estuary of Santubong River, Sarawak, due to the unique freshwater-seawater interaction which subsequently shaped the hydrological characteristic of the estuary, in which CM11Q showed a higher degree of fluctuation in the water quality parameters.

Jadual 4.12 menunjukkan purata dan persentil ke-90 parameter kualiti air yang dipantau di CMWQM. Secara purata, julat suhu air laut adalah daripada 29.10°C hingga 30.68°C, julat pH adalah daripada 7.74 hingga 8.16, julat kemasinan adalah daripada 29 ppt hingga 32.39 ppt dan julat oksigen terlarut dari 4.27 mg/L hingga 6.66 mg/L. Parameter kualiti air marin ini adalah stabil dan konsisten di semua stesen CMWQM kecuali bagi CM11Q disebabkan lokasinya terletak di muara sungai.

Table 4.12 reveals the mean and 90th percentile of the water quality parameters monitored in CMWQS. Averagely, the seawater temperature was ranged from 29.10°C to 30.68°C, pH ranged from 7.74 to 8.16, salinity ranged from 29 ppt to 32.39 ppt and dissolved oxygen ranged from 4.27 mg/L to 6.66 mg/L. The marine water quality parameters were relatively stable and consistent in all CMWQM stations, except for CM11Q due to its location in the river estuary.

Rajah 4.5 – **Rajah 4.7** menunjukkan peratus ketidakpatuhan yang direkod bagi jumlah pepejal terampai, oksigen terlarut dan polycylic aromatic hydrocarbons (PAHs) yang berkaitan dengan Standad Kualiti Air Marin Malaysia bagi semua stesen. Jumlah pepejal terampai, PAHs menunjukkan lebih daripada 90% kepatuhan terhadap Standad Kualiti Air Marin Malaysia pada tahun 2019. Peratus ketidakpatuhan yang tinggi direkodkan untuk oksigen terlarut bagi stesen-stesen yang terletak di muara sungai, teluk atau kawasan yang menerima kesan daripada input sungai.

Figure 4.5 – **Figure 4.7** show percentage of non-conformance records of total suspended solid, dissolved oxygen and polycyclic aromatic hydrocarbons (PAHs) in relation to the Malaysian Marine Water Quality Standards of all stations. Total suspended solid, PAHs showed more than 90% conformance with the Malaysian Marine Water Quality Standards in 2019. Higher percentage of dissolved oxygen non-conformance was recorded in stations located in estuary, bay or areas which were affected by riverine inputs.

Oksigen terlarut di CM11Q seringkali melebihi standad yang ditetapkan semasa air surut di muara Sungai Santubong. Oksigen terlarut rendah adalah disebabkan perubahan sifat hidrologi kitaran pasang surut. Status kualiti air marin yang dipantau di bawah Rangkaian Pengawasan Kualiti Air Marin Automatik pada tahun 2019 adalah baik.

Dissolved oxygen in CM11Q often exceeded the recommended standards during low tide in the Santubong River estuary. The low dissolved oxygen was due to changes in the hydrological characters caused by the tidal cycle. In 2019, the status of marine water quality monitored under the Continuous Marine Water Quality Monitoring Network was good.

Jadual 4.11: Stesen Pengawasan Kualiti Air Marin Automatik
Table 4.11: Continuous Marine Water Quality Monitoring Stations

BIL./ NO.	LOKASI STESEN/ STATION LOCATION	ID STESEN/ STATION ID	STRUKTUR/ STRUCTURE	KATEGORI STESEN/ STATION CATEGORY
1	Pulau Langkawi, Kedah	CM01K	Jetty	Kelas 2 / Class 2
2	Pulau Undan, Melaka	CM02M	Jetty	Kelas 2 / Class 2
3	Port Dickson, Negeri Sembilan	CM03N	Beacon	Kelas 2 / Class 2
4	Tanjung Piai, Johor	CM04J	Beacon	Kelas E / Class E
5	Tanjung Pengelih, Johor	CM05J	Jetty	Kelas 3 / Class 3
6	W. P. Labuan	CM10S	Jetty	Kelas 3 / Class 3
7	Santubong, Sarawak	CM11Q	Jetty	Kelas E / Class E
8	Pulau Mentagor, Perak	CM12A*	Jetty	Kelas 2 / Class 2
9	Pulau Kapas, Terengganu	CM13T*	Jetty	Kelas 1 / Class 1
10	Teluk Sepanggar, Sabah	CM14S*	Jetty	Kelas 3 / Class 3

* Stesen mula beroperasi semenjak bulan Ogos 2019 / Station operated since August 2019

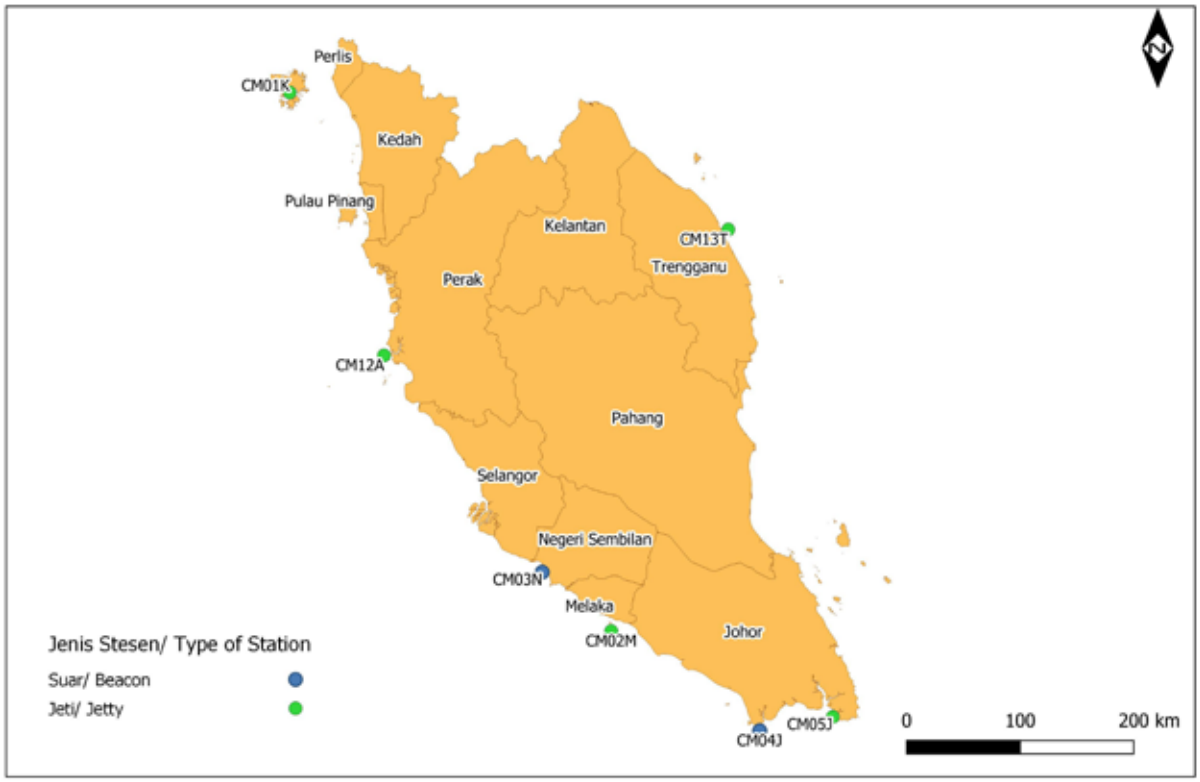
Jadual 4.12: Purata dan Persentil ke-90 Parameter Kualiti Air Yang Dipantau

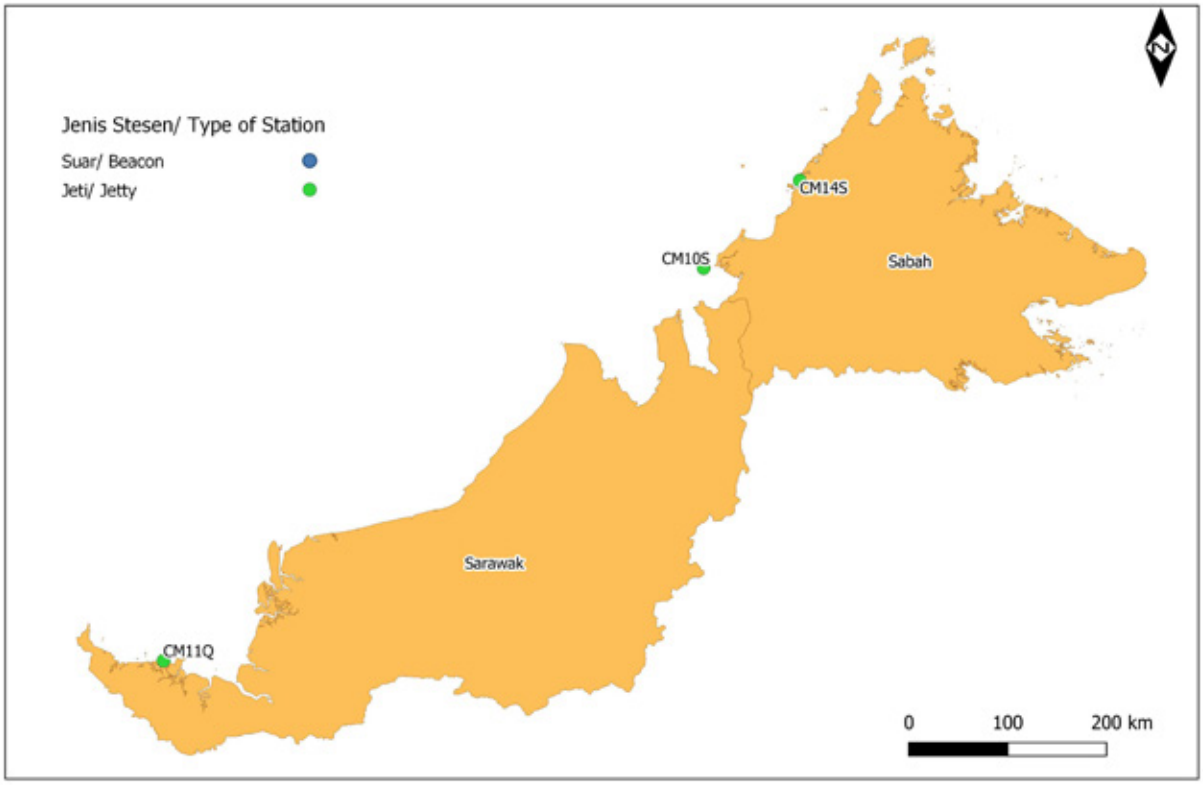
Table 4.12: Mean and 90Th Percentile of The Monitored Water Quality Parameters

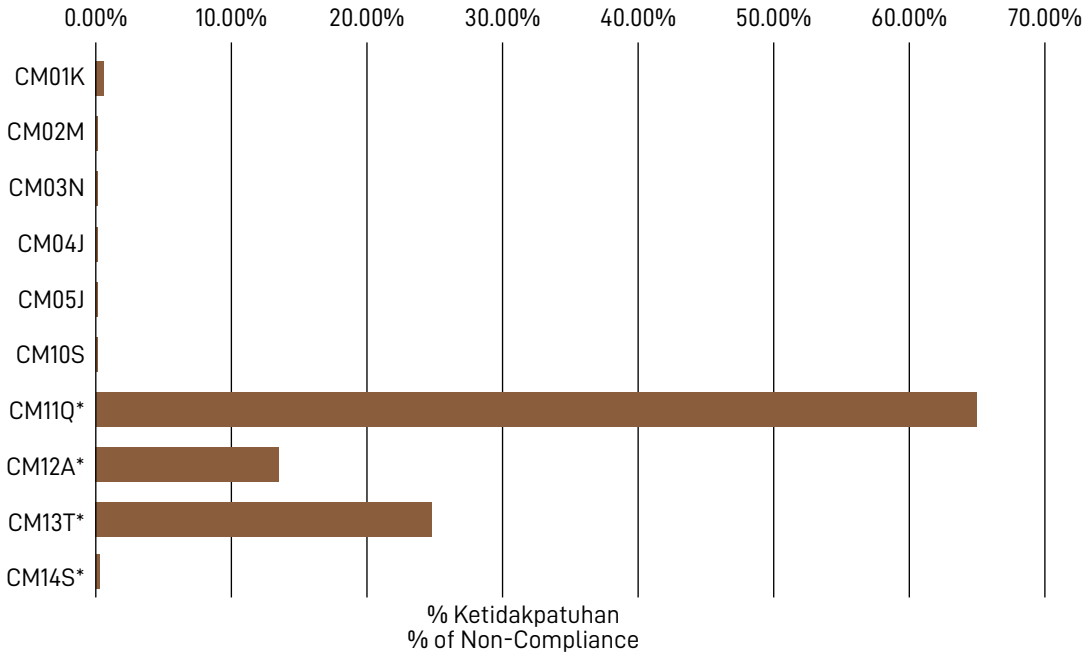
PARAMETER/ PARAMETER	PURATA DAN PERSENTIL KE-90 / MEAN AND 90TH PERCENTILE	STESEN ID/ ID STATION									
		CM01K	CM02M	CM03N	CM04J	CM05J	CM10S	CM11Q	CM12A	CM13T	CM14S
Suhu (°C)/ Temperature (°C)	Purata / Mean	30.46	29.99	30.20	29.88	29.72	30.07	30.38	29.99	29.10	30.68
	Persentil ke-90 / 90th Percentile	31.70	30.83	30.98	30.81	30.85	31.11	31.36	30.50	30.24	31.51
Kemasinan (ppt)/ Salinity (ppt)	Purata / Mean	31.87	31.61	31.68	31.70	31.47	31.89	29.00	31.78	30.70	32.39
	Persentil ke-90 / 90th Percentile	33.13	33.15	33.27	33.39	33.29	33.98	32.04	32.78	33.93	33.26
Konduktiviti (ms/cm)/ Conductivity (ms/cm)	Purata / Mean	54.15	53.32	53.61	53.31	52.83	53.75	49.71	53.55	50.85	55.13
	Persentil ke-90 / 90th Percentile	56.71	56.15	56.78	56.20	55.90	55.76	55.00	55.01	55.48	56.77
pH	Purata / Mean	8.16	8.14	8.11	8.05	8.04	8.10	7.74	8.11	8.12	8.14
	Persentil ke-90 / 90th Percentile	8.26	8.22	8.18	8.17	8.15	8.16	7.95	8.21	8.25	8.32
Oksigen Terlarut (mg/L)/ Dissolved Oxygen (mg/L)	Purata / Mean	6.36	6.41	6.66	6.22	5.98	5.83	4.27	5.68	6.30	6.44
	Persentil ke-90 / 90th Percentile	5.66	6.06	6.29	5.80	5.45	5.12	2.15	4.86	5.42	4.83
Kekeruhan (NTU)/ Turbidity (NTU)	Purata / Mean	13.42	5.57	5.93	21.97	15.77	1.89	11.61	15.24	35.12	92.99
	Persentil ke-90 / 90th Percentile	14.72	8.99	10.57	35.61	34.45	3.10	23.95	4.54	23.73	12.61
Jumlah Pepejal Terlarut (mg/L)/ Total Dissolved Solid (mg/L)	Purata / Mean	31868	31620	31691	31699	31486	31868	29273	31777	30693	32343
	Persentil ke-90 / 90th Percentile	32972	33012	33127	33206	33121	33679	32038	32666	33631	33097
Jumlah Pepejal Terampai (mg/L)/ Total Suspended Solid (mg/L)	Purata / Mean	6.56	2.79	2.96	10.96	7.88	0.94	5.80	7.50	16.77	44.67
	Persentil ke-90 / 90th Percentile	7.36	4.50	5.29	17.81	17.22	1.55	11.98	2.27	11.87	6.35
fDOM (µg/L)	Purata / Mean	4.84	5.05	3.49	4.52	3.91	3.31	16.01	2.78	2.37	3.69
	Persentil ke-90 / 90th Percentile	8.33	10.06	7.91	9.83	7.70	5.91	26.68	4.55	5.75	6.37
PAHs (µg/L)	Purata / Mean	12.64	12.05	6.00	20.40	NA	10.12	1.50	9.73	35.04	25.13
	Persentil ke-90 / 90th Percentile	13.38	17.68	9.72	31.63	NA	15.91	2.39	10.43	62.73	75.34
Chlorophyll-a (µg/L)	Purata / Mean	2.08	0.44	0.68	1.00	1.04	0.61	0.87	0.74	0.58	4.11
	Persentil ke-90 / 90th Percentile	3.22	0.85	1.35	1.90	1.97	1.44	1.91	1.52	1.33	5.59
BGA Phycoerythrin (µg/L)	Purata / Mean	4.27	1.29	1.28	2.48	1.91	1.57	1.79	1.63	1.56	10.45
	Persentil ke-90 / 90th Percentile	6.64	2.39	2.25	4.63	4.41	3.48	3.93	3.16	1.75	14.80

Nota/ Note:
NA (Tidak berkenaan/ Not available)

Rajah 4.4: Lokasi Stesen Pengawasan Kualiti Air Marin Automatik
Figure 4.4: Location of Continuous Marine Water Quality Monitoring Stations

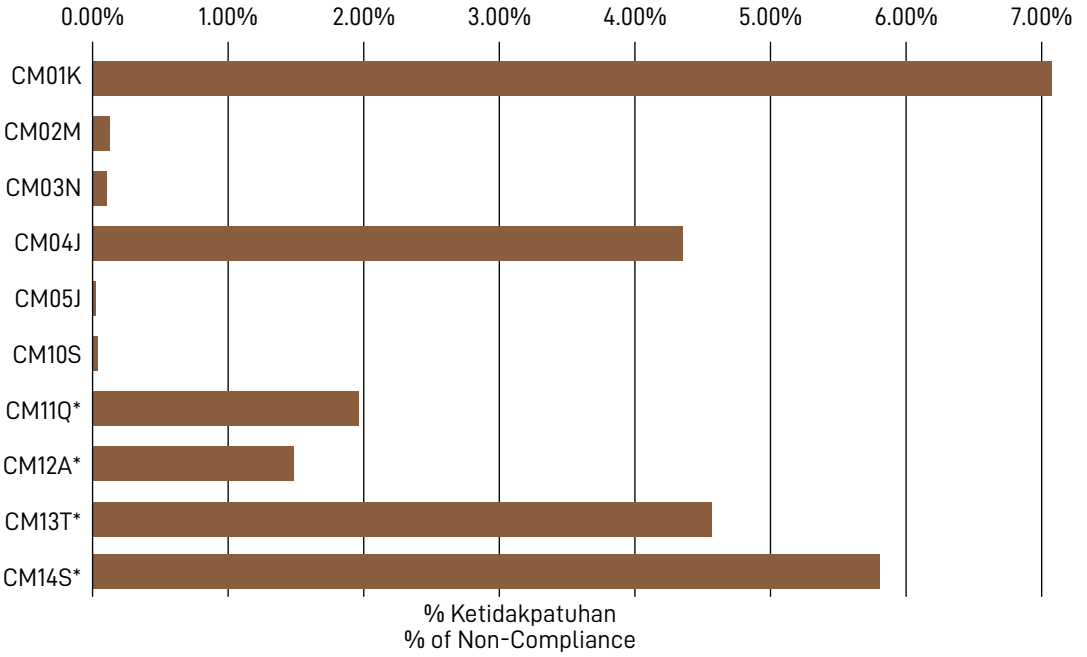






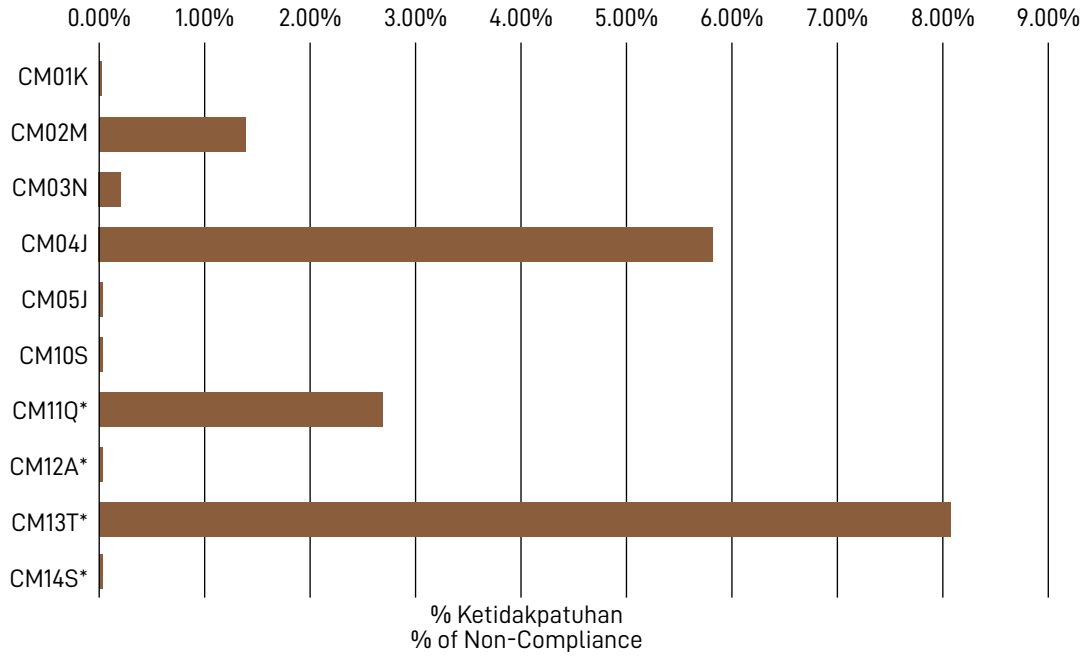
Rajah 4.5: Peratus Ketidakpatuhan Parameter Oksigen Terlarut Berdasarkan Standad Kualiti Air Marin Malaysia

Figure 4.5: Percentage of Non-Conformance Dissolved Oxygen Parameter Based on Malaysian Marine Water Quality Standards



Rajah 4.6: Peratus Ketidakpatuhan Parameter Jumlah Pepejal Terampai Berdasarkan Standad Kualiti Air Marin Malaysia

Figure 4.6: Percentage of Non-Conformance Total Suspended Solid Parameter Based on Malaysian Marine Water Quality Standards



Rajah 4.7: Peratus Ketidakpatuhan Parameter Polycyclic Aromatic Hydrocarbons Berdasarkan Standad Kualiti Air Marin Malaysia

Figure 4.7: Percentage of Non-Conformance Polycyclic Aromatic Hydrocarbons Parameter Based on Malaysian Marine Water Quality Standards

PERBANDINGAN INDEKS KUALITI AIR MARIN MALAYSIA (IKAMM) VERSI 2012 & 2019

THE DIFFERENCES OF MALAYSIAN MARINE WATER QUALITY INDEX (MMWQI) VERSION 2012 & 2019

Objektif IKAMM Versi 2019 adalah ke arah mencapai objektif Standad Kualiti Air Marin Malaysia (SKAMM) yang baharu iaitu untuk melindungi dan memastikan kelestarian ekosistem akuatik serta perkhidmatan ekosistem tersebut kepada masyarakat dengan mengambil kira faktor ekonomi, praktikal dan sosial . Ini adalah selaras dengan hasrat Kerajaan dan sasaran global melalui "Goal 14 – Life Below Water, Sustainable Development Goals 2030" untuk memulihara dan meningkatkan kualiti air marin di Negara ini.

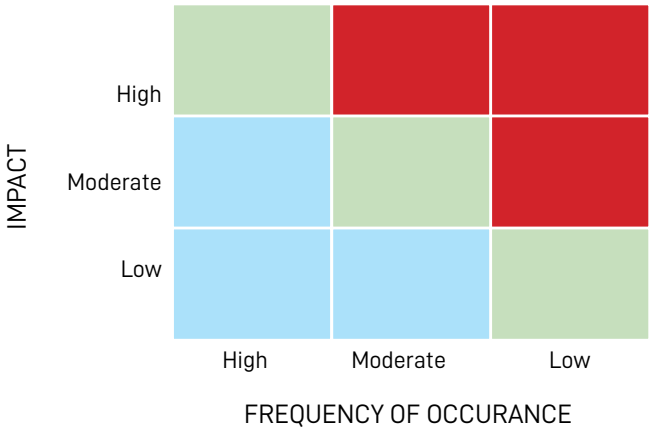
Perbezaan IKAMM Versi 2019 yang menggantikan Versi 2012 adalah dengan menggugurkan parameter minyak dan gris (O&G) dalam pengiraan IKAMM. Berdasarkan data kualiti air

The main objective of MMWQI Version 2019 is to achieve the objective of a new Malaysian Marine Water Quality Standard (MMWQS), of which is to protect and sustain aquatic ecosystems and the services they provide to the society and accomplish it in an economical, practical and socially relevant manner. This is in-line with the Malaysian Government in achieving the global goal, "Goal 14 – Life Below Water, Sustainable Development Goals" for preserving and improving the nation's marin water quality.

The difference between MMWQI Version 2019 and Version 2012 is the removal of the parameter oil and grease (O&G) from the MMWQI formulation. Based on the recorded five-year collected

marin yang direkodkan bagi tempoh masa 5 tahun yang dicerap melalui Rangkaian Program Pengawasan Kualiti Air Marin Kebangsaan mendapati parameter O&G ini jarang sekali melebihi had yang ditetapkan. Hasil analisis O&G di makmal sering menunjukkan bahawa kepekatan O&G adalah pada di bawah nilai had pelaporan (Limit of Reporting, LoR) iaitu <5mg/L. Justeru itu, pengguguran parameter O&G akan meningkatkan sensitiviti indeks terhadap sebarang perubahan kualiti air marin di stesen-stesen yang telah ditempatkan di seluruh Malaysia dan sekali gus lebih ketat berbanding IKAMM Versi tahun 2012. IKAMM Versi 2019 terdiri daripada enam (6) parameter iaitu oksigen terlarut, ammonia tak terion, nitrat, fosfat, faecal coliform dan jumlah pepejal terampai yang berbanding tujuh (7) parameter sepertimana telah ditetapkan dalam IKAMM Versi 2012. Pemberat dalam pengiraan formula IKAMM juga telah disemak dan dikaji semula berdasarkan Analisis Risiko Impak berbanding Kekerapan Pelanggaran Standad seperti yang ditunjukkan dalam **Rajah 4.8** di bawah. Seterusnya analisis statistik menggunakan Pearson's Second Coefficient (PSC) of Skewness telah digunakan untuk mengenalpasti nilai normalisasi pemberat bagi setiap parameter.

marine water quality data from the National Marin Water Quality Program Network, the O&G parameter seldom exceeded the stipulated limit. Result from the O&G analysis at the laboratory showed that the concentration was always below the reporting limit (LOR) < 5mg/L. Therefore, after the O&G removal the index will be more sensitive in detecting the changes in marine water quality at all stations in Malaysia. It will be more stringent than MMWQI Version 2012. The MMWQI Version 2019 has only six (6) parameters, which are dissolved oxygen, unionised ammonia, phosphate, nitrate, faecal coliform, total suspended solid as compared to MMWQI Version 2012 with seven (7) parameters. Weightage for the MMWQI calculation was also reviewed and revised based on impact against frequency of standard violation risk analysis, as shown in **Figure 4.8.** Then, followed by the statistical analysis by using Pearson's second coefficient (PSC) of skewness to identify the normalised value for each parameter.



Rajah 4.8: Analisis Risiko Impak Berbanding Kekerapan Pelanggaran Standad
Figure 4.8: The Impact Vs Frequency of Standard Violation Risk Analysis

Nota: Kotak merah menunjukkan risiko tinggi, kotak hijau menunjukkan risiko sederhana manakala kotak biru menunjukkan risiko rendah.
Notes: Red box is for high risk, green box is for medium risk and blue box is for low risk

Berdasarkan kaedah yang diterangkan di atas, pengguguran parameter O&G dan penetapan nilai pemberat yang baharu untuk pengiraan IKAMM Versi 2019 tidak akan menyebabkan perubahan yang drastik terhadap status kualiti air marin di stesen pengawasan yang dilaporkan sebelum ini. Ini adalah memastikan kesinambungan analisis data dan status kualiti air marin yang telah dilaporkan dalam Laporan Kualiti Alam Sekeliling bagi tahun-tahun sebelumnya. Peratus perubahan bagi setiap kategori stesen pengawasan kualiti air marin yang menunjukkan status tercemar perlulah tidak melebihi 10% sahaja. Ini untuk memastikan kesinambungan penggunaan IKAMM terdahulu dan dalam masa yang sama untuk memastikan stesen-stesen di kawasan titik panas yang sering dilaporkan sebagai stesen tercemar boleh dipantau dari semasa ke semasa berdasarkan status sebenar kualiti air marin. Perbandingan nilai pemberat bagi setiap parameter yang terlibat dalam pengiraan IKAMM Versi 2012 dan 2019 adalah seperti yang ditunjukkan dalam **Jadual 4.13.**

Based on the method discussed above, removal of O&G parameter and the new weightage value for the calculation of MMWQI Version 2019 will not cause a drastic impact that may change the previous reported category of marine water quality at the marine monitoring station. This is to ensure that continuity of the analysed data and status of marine water quality reported in previous Environmental Quality Report. The percentage changes of the marine water quality monitoring station at poor category must not exceed 10%. This is to ensure that the continuity performance of previous MMWQI and ensure the station located at the hot spot areas, which is always reported as poor station, will be continuously monitored from time to time based on the real status of marine water quality. The comparison of weightage value for each parameter for index calculation by using MMWQI Version 2012 and Version 2019 is showed in **Table 4.13.**

Jadual 4.13: Perbandingan Nilai Pemberat Bagi Setiap Parameter bagi Pengiraan IKAMM
Table 4.13: The Comparison of Weightage Value for Each Parameter in MMWQI

PARAMETER/ PARAMETER/	IKAMM VERSI 2012/ MMWQI VERSION 2012	IKAMM VERSI 2019 / MMWQI VERSION 2019
Oksigen Terlarut/ Dissolved Oxygen	0.20	0.18
Ammonia Tidak Terion/ Unionized Ammonia	0.16	0.15
Faecal coliform/ Faecal coliform	0.14	0.19
Jumlah Pepejal Terampai/ Total Suspended Solid	0.14	0.15
Minyak dan Gris/ Oil and Grease	0.13	NA
Nitrat/ Nitrate	0.12	0.16
Fosfat/ Phosphate	0.11	0.17

Nota :

N/A Tidak Berkenaan / Not Available

Jadual 4.14: Status Kualiti Air Marin di Stesen Pengawasan Marin bagi Tahun 2018 dengan menggunakan IKAMM Versi 2012 dan Versi 2019

Table 4.14: Marine Water Quality Status at The Marine Monitoring Station in year 2018 by using MMWQI Version 2012 and Version 2019

BIL./ NO.	KATEGORI STESEN/ STATION CATEGORY	TAHUN 2018 (IKAMM VERSI 2012)/ YEAR 2018 (MMWQI VERSION 2012)				TAHUN 2018 (IKAMM VERSI 2019)/ YEAR 2018 (MMWQI VERSION 2019)			
		TERBAIK / EXCELLENT	BAIK / GOOD	SEDERHANA/ MODERATE	TERCEMAR/ POOR	TERBAIK / EXCELLENT	BAIK / GOOD	SEDERHANA/ MODERATE	TERCEMAR/ POOR
1	Pantai/ Coastal	124	37	27	0	130	30	25	3
2	Pulau/Island	82	8	5	0	83	7	4	1
3	Muara Sungai/ Estuary	18	21	41	5	22	16	41	6
JUMLAH/TOTAL		224	66	73	5	235	53	70	10

Jadual 4.15: Perbandingan Pengiraan Indeks Kualiti Air Marin bagi Tahun 2018 dengan menggunakan IKAMM Versi 2012 dan Versi 2019

Table 4.15: The Difference on Marine Water Quality Index Calculation for Year 2018 by using MMWQI Version 2012 and Version 2019

BIL./ NO.	KATEGORI/ CATEGORY	PERATUS STATUS KUALITI AIR MARIN BERDASARKAN JUMLAH KESELURUHAN STESEN, 2018 (IKAMM VERSI 2012)/ PERCENTAGE OF MARINE WATER QUALITY STATUS BASED ON TOTAL STATION NUMBER, 2018 (MMWQI VERSION 2012)	PERATUS STATUS KUALITI AIR MARIN BERDASARKAN JUMLAH KESELURUHAN STESEN 2018, (IKAMM VERSI 2019) / PERCENTAGE OF MARINE WATER QUALITY STATUS BASED ON TOTAL STATION NUMBER, 2018 (MMWQI VERSION 2019)	PERATUS PERBANDINGAN PENINGKATAN (+)/ PENURUNAN (-) STATUS KUALITI AIR MARIN/ PERCENTAGE DIFFERENCE ON INCREASEMENT (+)/ DECLINING (-) OF MARINE WATER QUALITY STATUS
1.	Terbaik/ Excellent	60.9 %	63.9 %	(+)3.00 %
2.	Baik/ Good	17.9 %	14.4 %	(-)3.5 %
3.	Sederhana/ Moderate	19.8 %	19.0 %	(-)0.8 %
4.	Tercemar/ Poor	1.4 %	2.7 %	(+)1.4 %
JUMLAH / TOTAL		**100%**	**100%**	

Jadual 4.14 menunjukkan bilangan stesen mengikut kategori status kualiti air marin dalam rangkaian Stesen Pengawasan Kualiti Air Marin pada Tahun 2018 berdasarkan pengiraan indeks menggunakan IKAMM Versi 2012 dan 2019. Seterusnya dalam **Jadual 4.15** menunjukkan peratus perbandingan stesen dalam rangkaian stesen pengawasan kualiti air marin mengikut indeks yang dikira

Table 4.14 shows number of stations in the marine water quality monitoring network in accordance with the marine water quality status calculated by using the percentage difference of station category based index calculation by using MMWQI Version 2012 and Version 2019. Then, **Table 4.15** shows the percentage difference of stations in the marine water quality monitoring programme network in accordance to the index

menggunakan kedua-dua versi IKAMM. Peratus perbandingan stesen kategori terbaik dan tercemar menunjukkan peningkatan iaitu masing-masing mencatatkan peratusan 3% dan 1.4%, manakala bagi stesen kategori baik dan sederhana pula telah menunjukkan penurunan iaitu sebanyak 3.5% dan 0.8%.

Oleh itu, peratusan stesen tercemar bagi setiap kategori stesen seperti yang dinyatakan dalam jadual di atas menunjukkan peratus perubahan status kualiti air marin bagi kategori tercemar kurang daripada 10%. Ini bermakna IKAMM Versi 2019 didapati tidak menyebabkan perubahan drastik ke atas status indeks yang dikira menggunakan IKAMM Versi 2012 disamping masih relevan dan sensitif dalam mengesan sebarang perubahan kualiti air marin di kawasan perairan Negara.

calculated by using both MMWQI versions. The percentage difference of stations categorised as excellent and poor were increased, recording a percentage of 3% and 1.4%, respectively. Meanwhile, for the station categorised as good and medium were reduced to 3.5% and 0.8%, respectively.

Therefore, the percentage changes of station categorised as poor showed in the table was below 10%. This means that MMWQI Version 2019 does not cause a drastic change of the index status calculated by using MMWQI Version 2012. Besides, it is relevant and sensitive in detecting any changes that have occurred in the marine water quality in Malaysian water.

Jadual 4.16: Status Kualiti Air Marin di Stesen Pengawasan Marin Bagi Tahun 2018 dan 2019 dengan menggunakan IKAMM Versi 2019

Table 4.16: Marine Water Quality Status at The Marine Monitoring Station in Year 2018 and 2019 by using MMWQI Version 2019

BIL./ NO.	KATEGORI STESEN/ STATION CATEGORY	TAHUN 2018/ YEAR 2018 IKAMM VERSI 2019/ MMWQI VERSION 2019				TAHUN 2019/ YEAR 2019 IKAMM VERSI 2019/ MMWQI VERSION 2019			
		TERBAIK / EXCELLENT	BAIK / GOOD	SEDERHANA/ MODERATE	TERCEMAR / POOR	TERBAIK / EXCELLENT	BAIK / GOOD	SEDERHANA/ MODERATE	TERCEMAR / POOR
1	Pantai/ Coastal	130	30	25	3	37	69	79	3
2	Pulau/Island	83	7	4	1	34	33	27	1
3	Muara Sungai/ Estuary	22	16	41	6	3	13	58	11
JUMLAH/TOTAL		235	53	70	10	74	115	164	15

Jadual 4.16 menunjukkan perbandingan status kualiti air marin di antara tahun 2018 dan 2019 yang indeks dikira menggunakan IKAMM Versi 2019. Bilangan Stesen baik dan tercemar bagi tahun 2019 telah meningkat manakala bagi stesen terbaik dan sederhana pula mencatatkan penurunan pada tahun 2019.

Merujuk pada stesen tercemar terdapat peningkatan daripada 10 stesen pada tahun 2018 ke 15 stesen pada tahun 2019. Ini bermakna IKAMM Versi 2019 adalah lebih sensitif kerana ia dapat menggambarkan status sebenar kualiti air marin di stesen pengawasan marin.

Table 4.16 shows the comparison of marine water quality status between year 2012 and 2019 in accordance to the index calculated by using MMWQI Version 2019. The number of stations categorised as good and poor in 2019 were increased. Meanwhile, for stations categorised as excellent and medium were decreased in 2019.

Based on the poor station category, the increase was 10 stations in 2018 to 15 stations in 2019. This means that the MMWQI Version 2019 is more sensitive as it is able to represent the actual marine water quality status at the marine

BAB 4
KUALITI AIR MARIN DAN PULAU-PULAU
MARINE AND ISLAND MARINE WATER QUALITY

Daripada senarai stesen yang tercemar pada tahun 2019 (**Jadual 4.16**), 11 stesen tersenarai adalah dibawah Kelas Muara Sungai dan stesen ini sering dilaporkan tercemar sejak tahun 2018 disebabkan oleh paras parameter nutrien yang tinggi seperti fosfat dan paras oksigen terlarut yang rendah.

monitoring station. From the listed stations categorised as poor category in 2019 (**Table 4.16**), 11 listed stations were from the class under estuary station and these stations were always reported as poor since 2018 due to the high level of nutrient parameter like phosphate and low level of dissolved oxygen.

BAB 5
CHAPTER 5

INVENTORI PUNCA PENCEMARAN
POLLUTION SOURCES INVENTORY

PENGIRAAN BEBAN PENCEMARAN
POLLUTION LOAD CALCULATION

Sungai merupakan antara sistem semulajadi utama yang mempunyai keupayaan asimilasi untuk mengurangkan kesan daripada pencemaran melalui proses penguraian, penyebaran dan pelarutan. Namun begitu, keupayaan ini ada batas dan sekiranya ia melebihi, kemerosotan kualiti air sungai akan terjadi.

River is one of the natural systems that have the assimilative capacity to reduce the impacts from pollution through the processes of degradation, dispersion and dilution. However, this capacity is limited and once exceeded, it will cause the quality of the river to deteriorate.

Keupayaan asimilasi sungai ini amat berkait rapat dengan beban pencemaran yang ditakrifkan sebagai kepekatan bahan cemar yang dibawa oleh jasad air pada sesuatu masa yang diberikan. Beban pencemaran ini dipengaruhi oleh faktor kadar alir jasad air tersebut dan juga kepekatan bahan cemar yang dibawa.

This assimilative capacity is heavily dependent on water pollution load is defined as concentration of pollutants carried by the water body at a given time. Pollution load is influenced by the water body flowrate and the pollutants concentration carried by the water body.

Beban pencemaran air adalah kriteria penting bertujuan untuk mengatur strategi dan merancang tindakan pencegahan dan mengawal pencemaran. Pelaksanaan kawalan beban pencemaran air adalah usaha untuk meningkatkan kualiti air sungai demi mengekalkan pelbagai kegunaan berfaedah sungai seperti sumber bekalan air, rekreasi, ternakair (akuakultur), pertanian serta menampung keperluan sistem ekologi.

The water pollution load is one of the important criteria in planning and strategizing the mode of action for pollution prevention and control. The implementation of the pollution load control is one of the effort to enhance the river water quality in order to maintain the beneficial use of river as a source of water supply, recreation, aquaculture, agriculture as well as sustaining the ecological needs.

BEBAN PENCEMARAN AIR
WATER POLLUTION LOAD

Untuk tahun 2019, sebanyak lima (5) jenis punca pencemaran air ditumpukan dalam pelaporan status beban pencemaran air, iaitu industri pembuatan, industri berasaskan pertanian, loji rawatan kumbahan, ternakan babi dan pasar basah.

For the year of 2019, there are five (5) types of water pollution load sources that are emphasized in this report, which are manufacturing industries, agricultural-based industries, sewage treatment plant, piggery and wet market.

Sumber data industri pembuatan dan industri berasaskan pertanian diperolehi daripada JAS negeri manakala bagi loji rawatan kumbahan adalah daripada Indah Water Konsortium Sdn. Bhd. Data-data berkaitan aktiviti ternakan babi diperolehi daripada Jabatan Perkhidmatan Veterinar dan Pihak Berkuasa Tempatan

The source of data for manufacturing industries and agricultural-based industries were provided by states DOE while the sewage treatment plant data were obtained from Indah Water Consortium Sdn. Bhd. All data regarding piggery were provided by Department of Veterinary Services and data on wet market are acquired

membekalkan data bilangan pasar basah.

Pengiraan beban pencemaran ditumpukan kepada tiga (3) parameter utama yang memberikan kesan ketara kepada kualiti air sungai iaitu Keperluan Oksigen Biokimia (BOD), Pepejal Terampai (SS) dan Ammoniakal Nitrogen (NH_3-N).

Keperluan Oksigen Biokimia

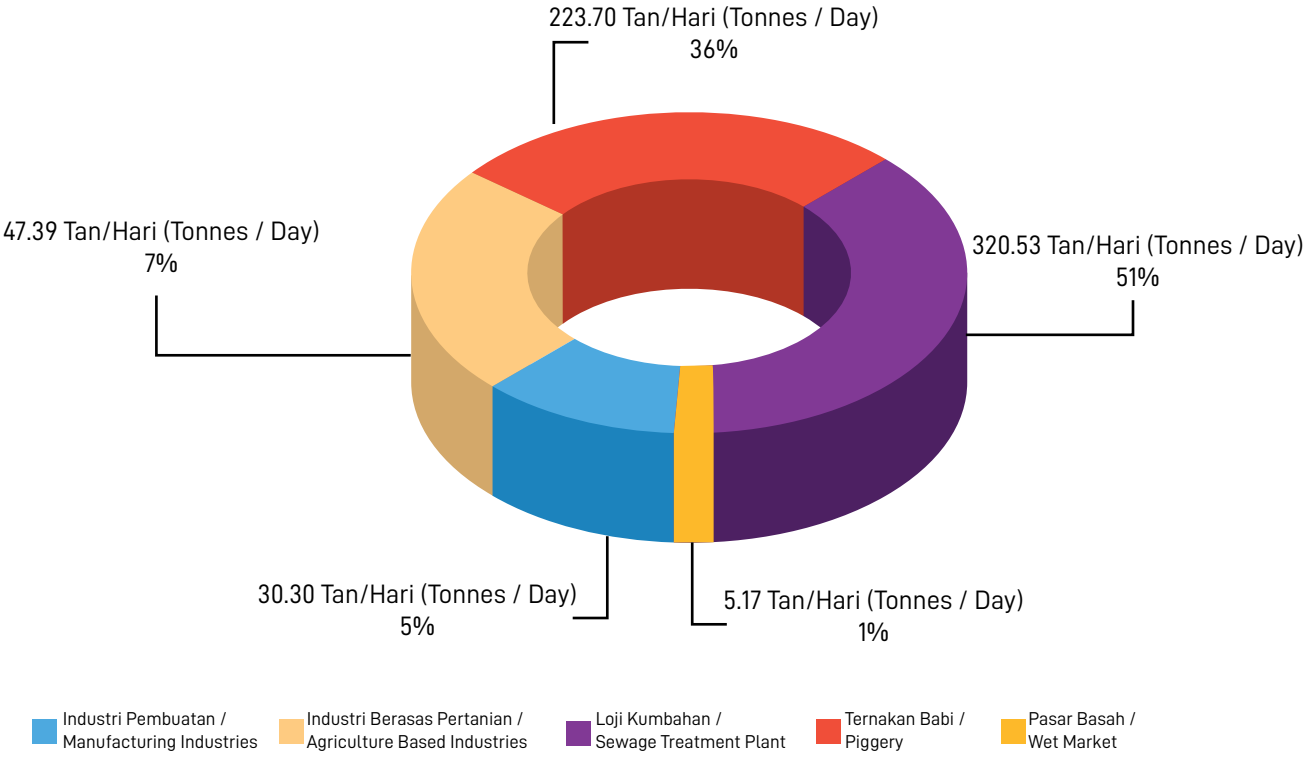
Pada tahun 2019, anggaran jumlah beban pencemaran BOD terhasil adalah sebanyak 627.09 tan/hari. Pelepasan daripada loji kumbahan adalah penyumbang beban pencemaran BOD tertinggi iaitu sebanyak 320.53 tan/hari (51%), diikuti dengan aktiviti ternakan babi 223.70 tan/hari (36%), industri berasaskan pertanian 47.39 tan/hari (7%), industri pembuatan 30.30 tan/hari (5%), dan pasar basah 5.17 tan/hari (1%) **(Rajah 5.1).**

from Local Authority.

Calculation on pollution load is mainly focused on three (3) main parameters that show obvious effect to the river water quality which are Biochemical Oxygen Demand (BOD), Suspended Solids (SS) and Ammoniacal Nitrogen (NH_3-N).

Biochemical Oxygen Demand

In the year 2019, a total estimation of 627.09-tonnes/day pollution loads for BOD was generated. Sewage treatment plants remain as the largest BOD load contributor with a total load of 320.53 tonnes/day (51%), followed by piggery activities which contributed 223.70 tonnes/day (36%), agriculture-based industries 47.39 tonnes/day (7%), manufacturing industries 30.30 tonnes/day (5%), and wet markets 5.17 tonnes/ day (1%) **(Figure 5.1).**



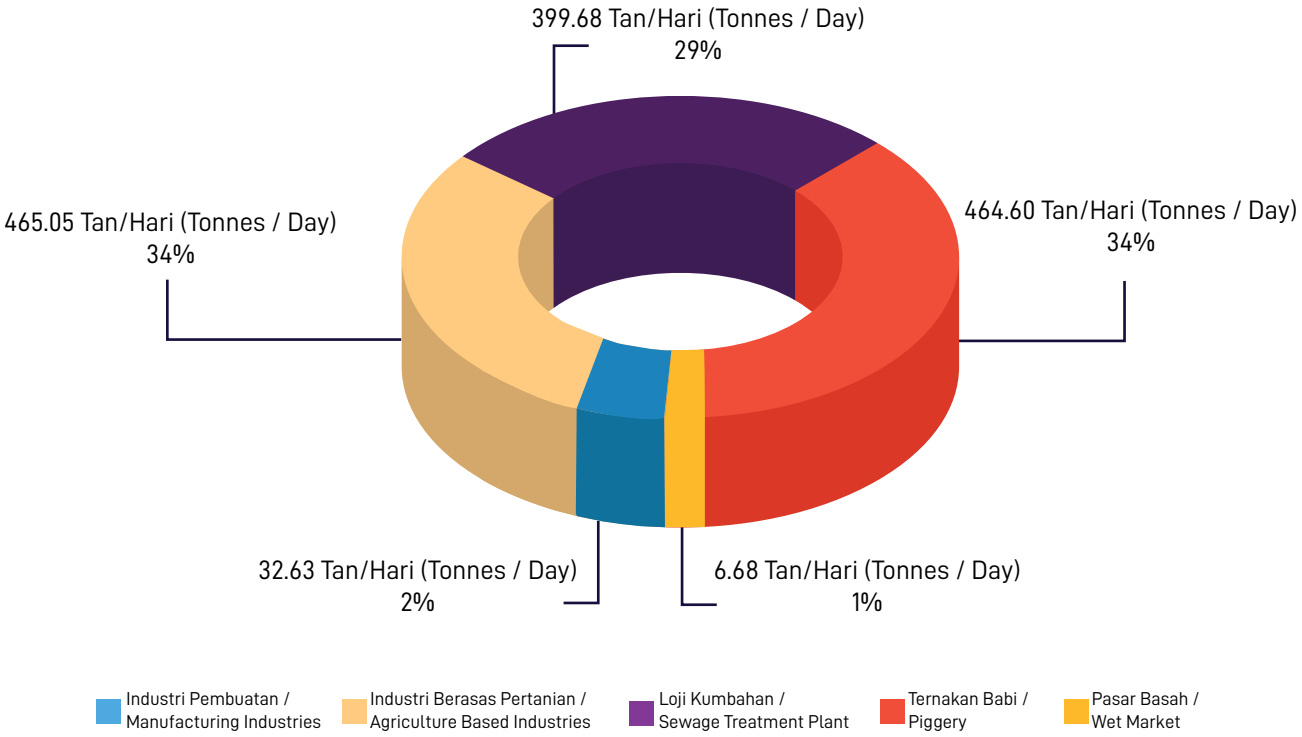
Rajah 5.1: Anggaran Beban BOD (Tan/Hari) Mengikut Punca Pencemaran Air, 2019
Figure 5.1: Estimation of BOD Load (Tonnes/Day) by Sources of Water Pollution, 2019

Beban Pepejal Terampai

Pada tahun 2019, anggaran jumlah beban pencemaran bagi SS adalah sebanyak 1368.64 tan/hari. Jumlah beban pencemaran daripada industri berasaskan pertanian dan ternakan babi berada di tangga teratas dengan 34% masing-masing mencatatkan nilai sebanyak 465.05 tan/hari dan 464.60 tan/hari. Diikuti dengan loji kumbahan sebanyak 399.68 tan/hari (29%), industri pembuatan 32.63 tan/hari (2%) dan pasar basah 6.68 tan/hari (1%) **(Rajah 5.2).**

Suspended Solids Load

In the year 2019, the overall estimation for the SS loads gave a total figure of 1368.64 tonnes/day. Total pollution load from agriculture-based industries and piggery activities topped the list with 34% each with 465.05 tonnes/day and 464.60 tonnes/day respectively. Followed by sewage treatment plant 399.68 tonnes/day (29%), manufacturing industries 32.63 tonnes/day (2%), and wet market 6.68 tonnes/day (1 %) **(Figure 5.2)**.



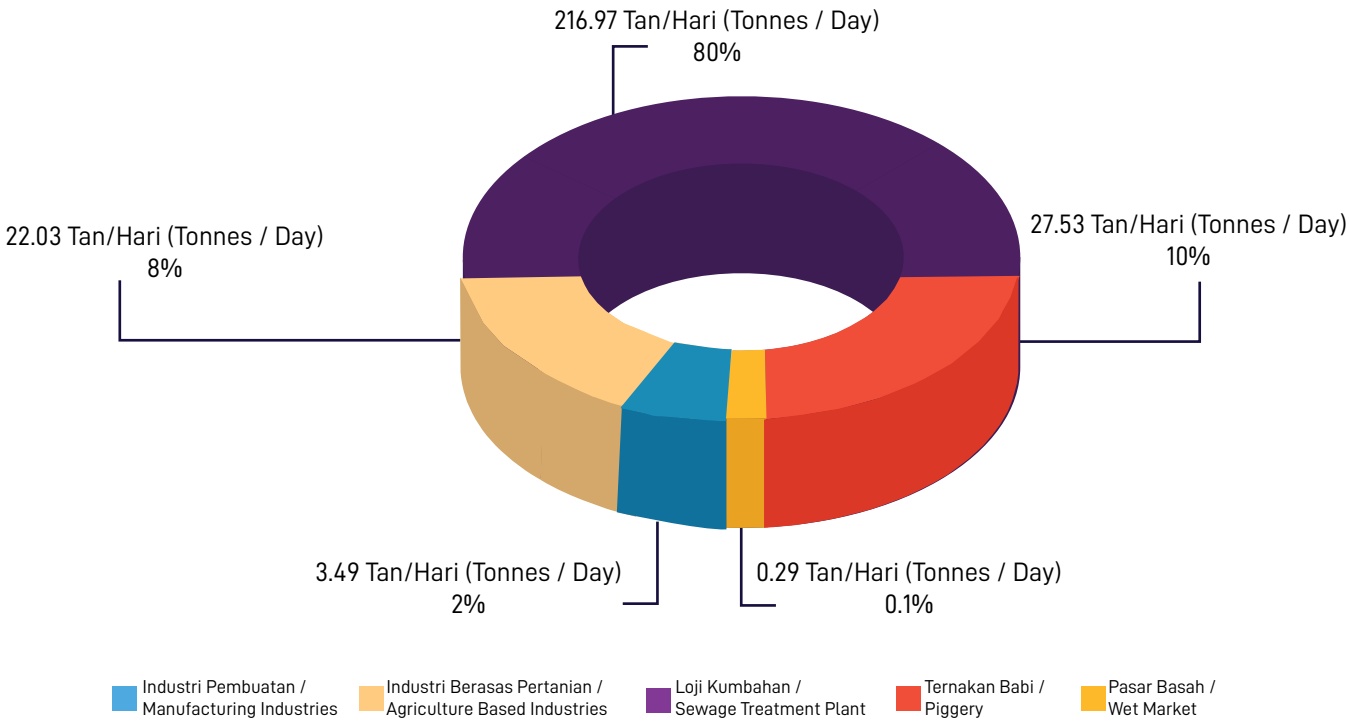
Rajah 5.2: Anggaran Beban SS (Tan/Hari) Mengikut Punca Pencemaran Air, 2019
Figure 5.2: Estimation of SS Load (Tonnes/Day) by Sources of Water Pollution, 2019

Beban Ammoniakal Nitrogen

Pada tahun 2019, anggaran beban pencemar NH_3-N adalah sebanyak 270.31 tan/hari di mana pelepasan loji kumbahan adalah penyumbang terbesar beban NH_3-N dengan jumlah sebanyak 216.97 tan/hari (80%), diikuti aktiviti ternakan babi iaitu 27.53 tan/hari (10%), industri berasaskan pertanian 22.03 tan/hari (8%), industri pembuatan 3.49 tan/hari (2%) dan pasar basah 0.29 tan/hari (0.1%) **(Rajah 5.3).**

Ammoniacal Nitrogen Load

In the year 2019, the NH_3-N load is estimated to be a total of 270.31 tonnes/day in which sewage treatment plant remained as the largest contributor of NH_3-N with a total load of 216.97 tonnes/day (80%), followed by piggery activity 27.53 tonnes/ day (10%), agriculture-based industries 22.03 tonnes/day (8%), manufacturing industries 3.49 tonnes/day (2%) and wet market 0.29 tonnes/day (0.1%) **(Figure 5.3)**.



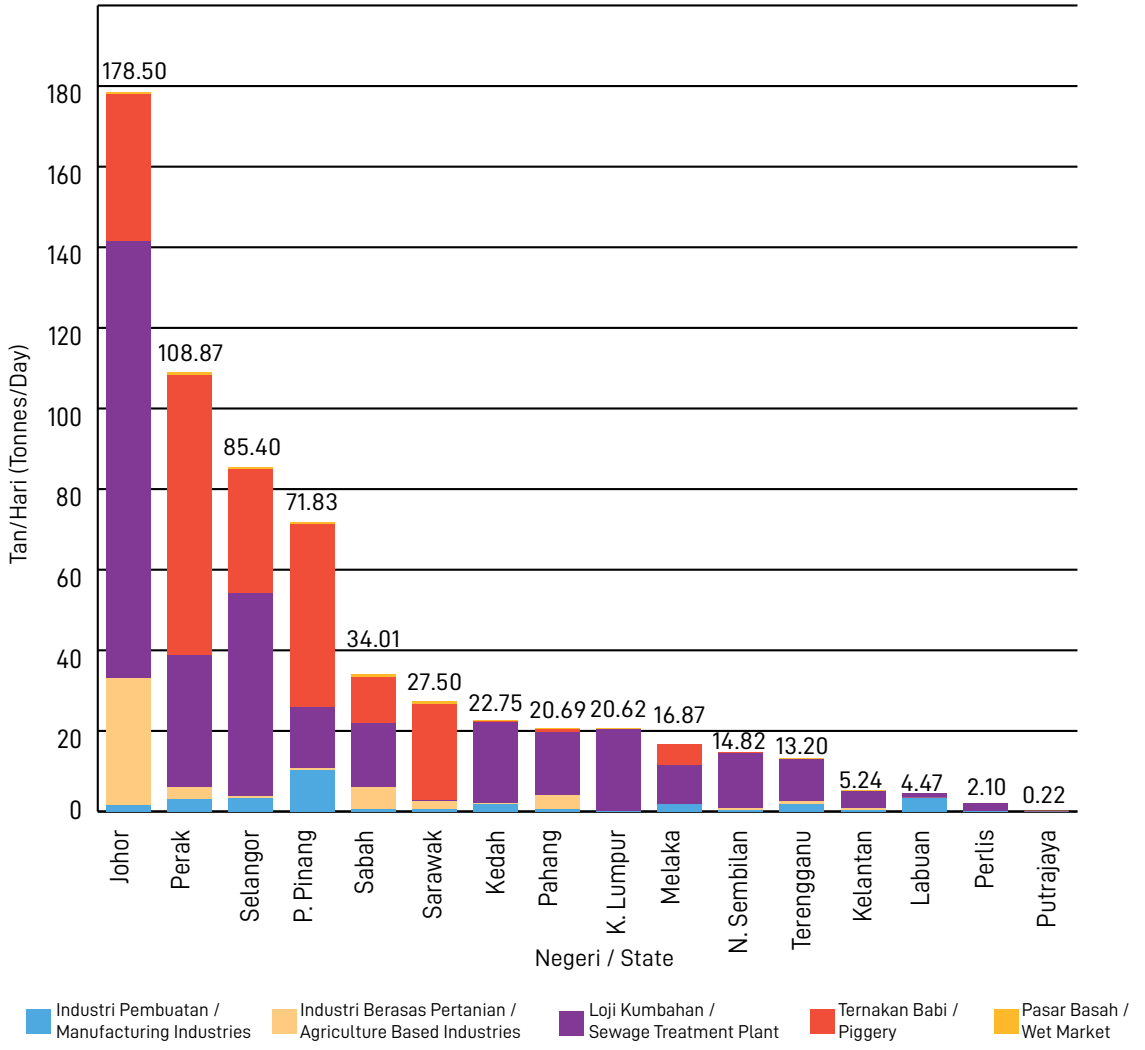
Rajah 5.3: Anggaran Beban NH_3-N (Tan/Hari) Mengikut Punca Pencemaran Air, 2019
Figure 5.3: Estimation of NH_3-N Load (Tonnes/Day) by Sources of Water Pollution, 2019

Beban Pencemaran Keperluan Oksigen Biokimia (BOD) Mengikut Negeri

Anggaran penghasilan beban BOD di Negeri Johor adalah tertinggi iaitu sebanyak 178.50 tan/hari, diikuti negeri Perak 108.87 tan/hari, Selangor 85.40 tan/hari, Pulau Pinang 71.83 tan/hari, Sabah 34.01 tan/hari dan Sarawak sebanyak 27.50 tan/hari. Beban BOD untuk lain-lain negeri termasuk Wilayah Persekutuan Labuan dan Putrajaya adalah kurang daripada 22.75 tan/hari. Beban pencemar BOD mengikut negeri ditunjukkan dalam **Rajah 5.4.**

Biochemical Oxygen Demand Load (BOD) By States

The estimation for BOD loads generated in the state of Johor was recorded as the highest with a value of 178.50 tonnes/day, followed by the state of Perak 108.87 tonnes/day, Selangor 85.40 tonnes/day, Penang 71.83 tonnes/day, Sabah 34.01 tonnes/day and Sarawak with 27.50 tonnes/day. BOD load for the rest of the states including Federal Territory of Labuan and Putrajaya are less than 22.75 tonnes/day. BOD pollution load based on States is shown in **Figure5.4**.



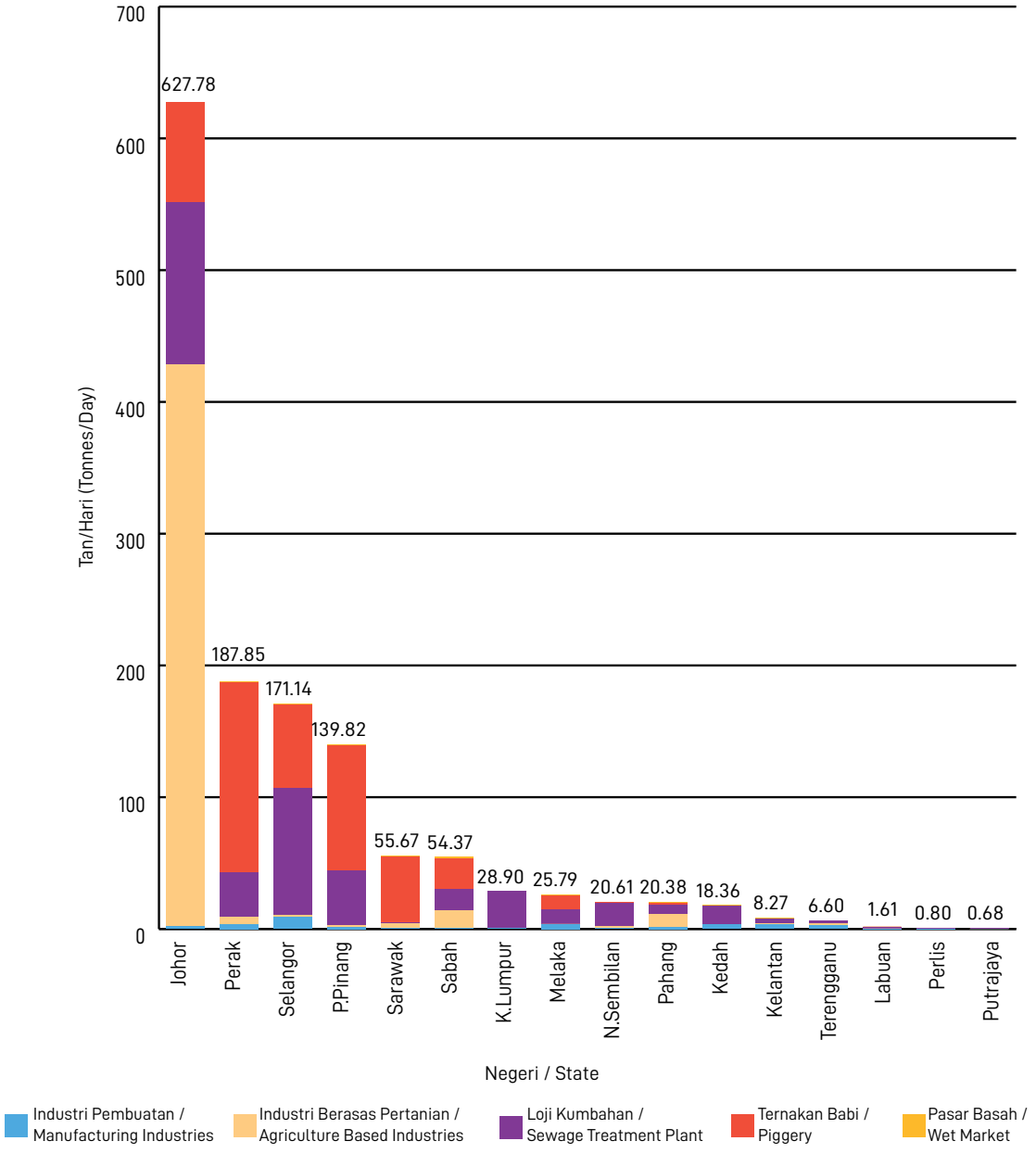
Rajah 5.4: Taburan Anggaran Beban BOD (Tan/Hari) dan Punca Pencemaran Air Mengikut Negeri, 2019
Figure 5.4: Dispersions of BOD (Tonnes/Day) Load Estimation and Sources of Water Pollution By States, 2019

Beban Pencemaran Pepejal Terampai Mengikut Negeri

Anggaran penghasilan beban SS di Negeri Johor adalah tertinggi iaitu sebanyak 627.78 tan/hari, diikuti negeri Perak 187.85 tan/hari, Selangor 171.14 tan/hari, Pulau Pinang 139.82 tan/hari, Sarawak 55.67 tan/hari dan Sabah sebanyak 54.37 tan/hari. Beban SS untuk lain-lain negeri termasuk Wilayah Persekutuan Labuan dan Putrajaya adalah kurang daripada 28.90 tan/hari. Beban pencemar SS mengikut negeri ditunjukkan dalam **Rajah 5.5.**

Suspended Solids Load By State

The estimation of SS loads generated in the state of Johor was recorded to be the highest with a value of 627.78 tonnes/day, followed by the state of Perak 187.85 tonnes/day, Selangor 171.14 tonnes/day, Penang 139.82 tonnes/day, Sarawak 55.67 tonnes/day and Sabah generated 54.37 tonnes/day. SS load for the rest of the states including Federal Territory of Labuan and Putrajaya generated less than 28.90 tonnes/day. SS pollution load based on States is shown in **Figure 5.5**.



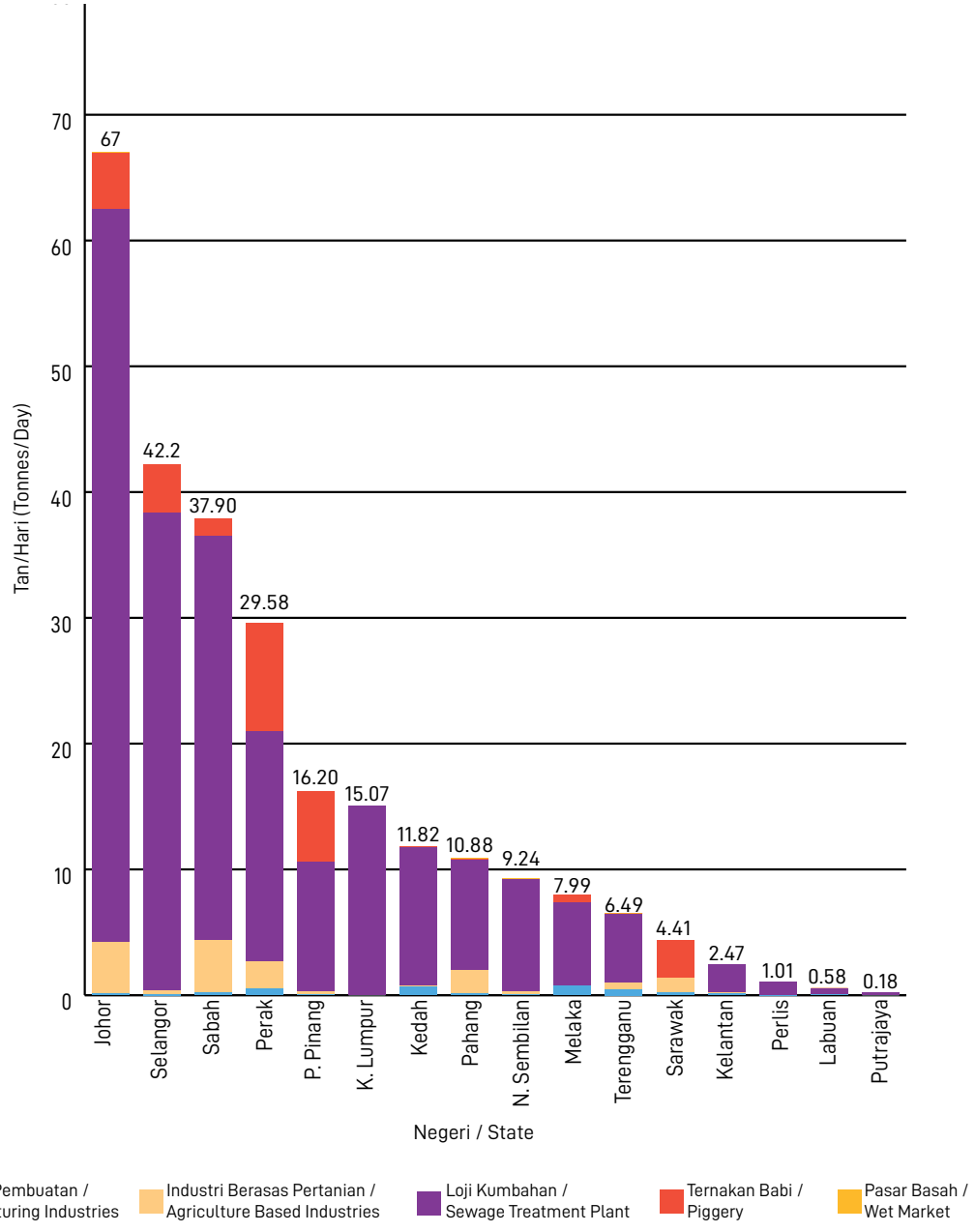
Rajah 5.5: Taburan Anggaran Beban SS (Tan/Hari) dan Punca Pencemaran Air Mengikut Negeri, 2019
Figure 5.5: Dispersions of SS Load (Tonnes/Day) Estimation and Sources of Water Pollution by States, 2019

Beban Pencemaran Ammoniakal Nitrogen Mengikut Negeri

Anggaran penghasilan beban NH_3-N di Negeri Johor adalah tertinggi iaitu sebanyak 67.00 tan/hari, diikuti negeri Selangor 42.20 tan/hari, Sabah 37.90 tan/hari dan Perak 29.58 tan/hari. Beban NH_3-N untuk lain-lain negeri termasuk Wilayah Persekutuan Labuan dan Putrajaya adalah kurang daripada 16.20 tan/hari. Beban pencemar NH_3-N mengikut negeri ditunjukkan dalam **Rajah 5.6**.

Ammoniacal Nitrogen Load By State

The estimation of NH_3-N loads generated in the state of Johor was recorded to be the highest with a value of 67.00 tonnes/day, followed by the state of Selangor 42.20 tonnes/day, Sabah 37.90 and Perak 29.58 tonnes/day. NH_3-N load for the rest of the states including Federal Territory of Labuan and Putrajaya generated less than 16.20 tonnes/day. NH_3-N pollution load based on States is shown in **Figure 5.6**.



Rajah 5.6: Taburan Anggaran Beban NH_3-N (Tan/Hari) dan Punca Pencemaran Air Mengikut Negeri, 2019
Figure 5.6: Dispersions of NH_3-N (Tonnes/Day) Load Estimation and Sources of Water Pollution by States, 2019

PUNCA-PUNCA
PENCEMARAN UDARA
SOURCES OF AIR POLLUTION

Peningkatan punca industri dan bilangan kenderaan bermotor boleh menyebabkan pencemaran udara yang teruk jika pelepasan pencemar termasuk pelepasan asap daripada kedua-dua aktiviti ini tidak dikawal dengan berkesan.

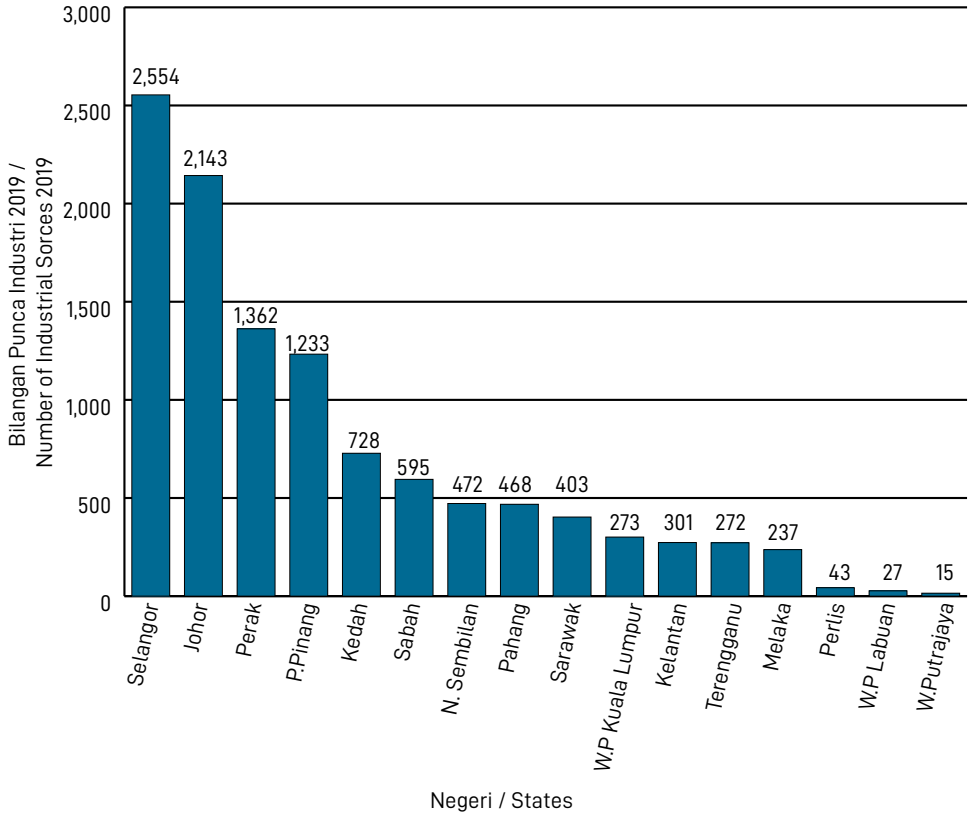
Sehingga bulan Disember 2019, jumlah punca industri yang melepaskan bahan pencemar ke udara adalah sebanyak 11,126. Bilangan punca pencemar yang tertinggi adalah di Selangor (2,554:23%) diikuti Johor (2,143:19%) dan Perak (1,362:12%) seperti ditunjukkan dalam **Rajah 5.7.**

Pada tahun 2019, terdapat peningkatan bagi jumlah keseluruhan kenderaan bermotor yang berdaftar. Bilangan teksi dan kenderaan sewa pandu sendiri yang berdaftar meningkat sebanyak 0.14%, diikuti dengan kenderaan penumpang meningkat sebanyak 3.59%, motosikal sebanyak 4.16%, kenderaan barangan sebanyak 2.63%, dan bas sebanyak 1.58% berbanding dengan tahun 2018. Bilangan kenderaan bermotor yang berdaftar yang direkodkan oleh Jabatan Pengangkutan Jalan pada tahun 2018 dan 2019 adalah seperti yang ditunjukkan dalam **Rajah 5.8**. Jumlah kenderaan berdaftar yang sedang digunakan (aktif) meningkat sebanyak 2.92% berbanding dengan tahun 2018. Bilangan kenderaan penumpang meningkat sebanyak 2.58%, teksi menurun sebanyak 4.50% dan motosikal meningkat sebanyak 4.19%, manakala kategori lain menurun berbanding dengan bilangan tahun 2018. Bilangan kenderaan berdaftar yang sedang digunakan (aktif) adalah seperti ditunjukkan dalam **Rajah 5.9**.

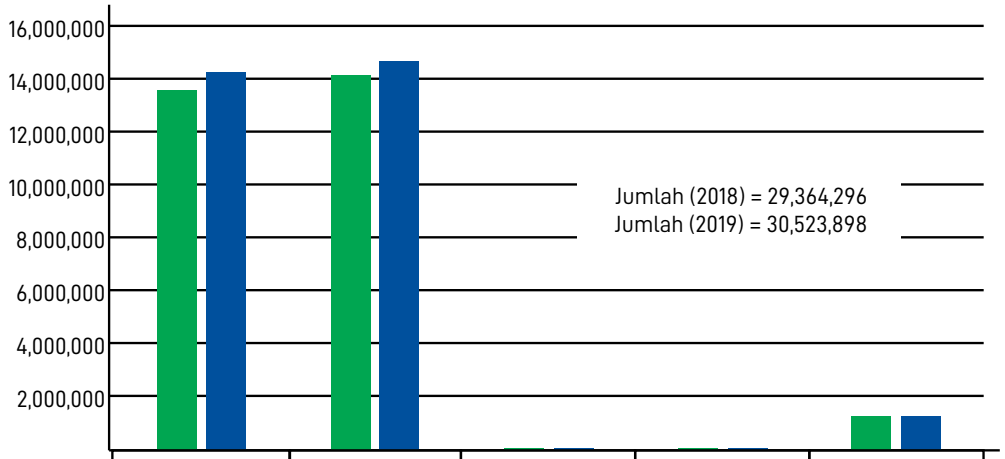
The increasing trend of industrial sources and numbers of motor vehicles can cause severe air pollution if the emission including smoke emission from both sources were not effectively controlled.

As of December 2019, a total of 11,126 industrial sources were emitting air pollutants. The highest pollution sources were in Selangor (2,554:23%) followed by Johor (2143:19%) and Perak (1,362:12%) as indicated in **Figure 5.7.**

In 2019, there was an increase in the overall number of registered motor vehicles. The number of registered taxis and self-driving rental vehicles increased by 0.14%, followed by an increase of 3.59% passenger cars, 4.16% motorcycles, 2.63% freight vehicles, and 1.58% buses compared to 2018. The number of registered vehicles in Malaysia as reported by the Road Transport Department for 2018 and 2019 is shown in **Figure 5.8**. The number of registered in-use vehicles increased by 2.92% compared to 2018. The number of passenger vehicles increased by 2.58%, taxis decreased by 4.50% and motorcycles increased by 4.19%, while other categories decreased compared to the number of 2018. Number of registered in-use vehicles (active) are shown in **Figure 5.9**.



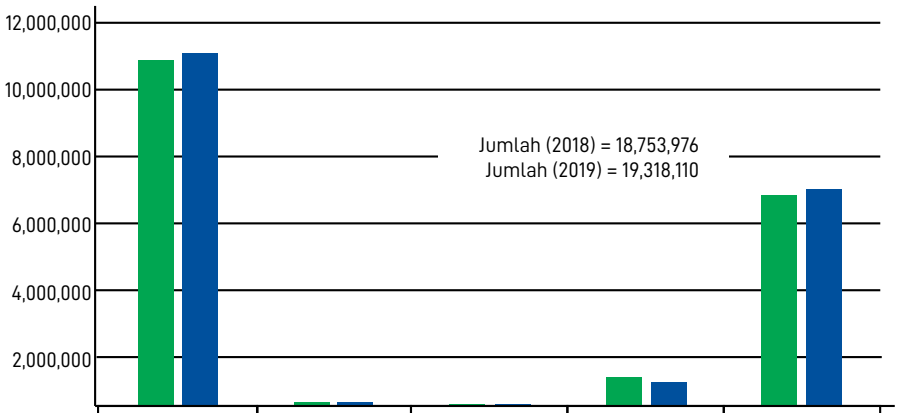
Rajah 5.7 : Punca Pencemaran Udara Industri Mengikut Negeri Tahun 2019
Figure 5.7 : Industrial Air Pollution Sources by State in Year 2019



	Motosikal / Motorcycle	Motokar / Motorcar	Bas / Buses	Teksi dan Kereta Sewa/ Taxi and Rental Car	Kenderaan Barang/ Goods Vehicle
2018	13,725,918	14,189,693	62,022	124,599	1,262,064
2019	14,322,030	14,717,896	63,017	124,779	1,296,176

Rajah 5.8 : Bilangan Kenderaan Berdaftar Pada Tahun 2018–2019
Figure 5.8 : Number of Registered Vehicles In 2018–2019

(Sumber: Jabatan Pengangkutan Jalan, Malaysia 2019)
(Source: Road Transport Department, Malaysia, 2019)



	Motokar / Motorcar	Teksi / Taxi	Bas / Buses	Kenderaan Barang/ Goods Vehicle	Motosikal / Motorcycle
2018	10,878,081	20,583	12,485	794,514	7,048,313
2019	11,166,702	19,696	10,886	764,358	7,356,468

Rajah 5.9: Bilangan Kenderaan Berdaftar Yang Sedang Digunakan (Aktif) Pada Tahun 2018-2019
Figure 5.9: Number of Registered In-Use Vehicles (Active) In 2018-2019

(Sumber: Jabatan Pengangkutan Jalan, Malaysia 2019)
(Source: Road Transport Department, Malaysia, 2019)

BEBAN PENCEMARAN PENCEMAR UDARA
AIR POLLUTION EMISSION LOAD

BEBAN PENCEMARAN SECARA MENYELURUH

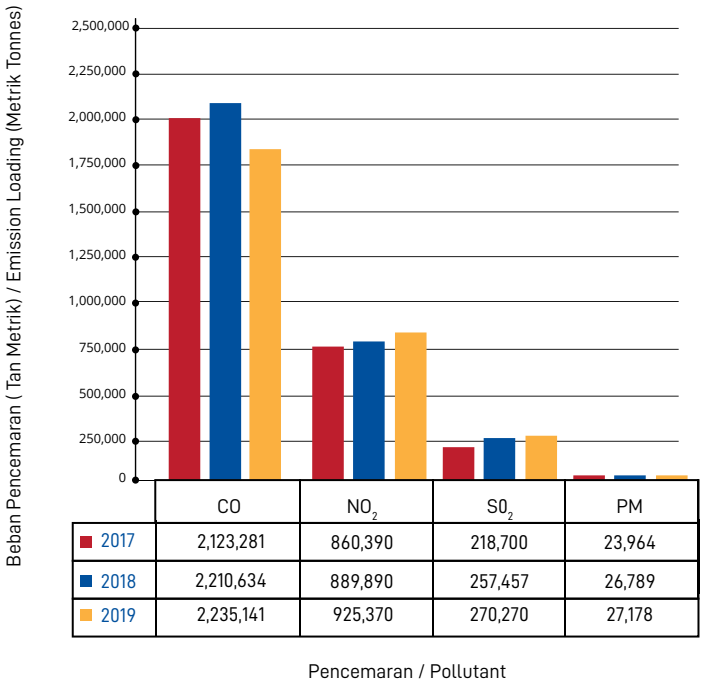
Dianggarkan pada tahun 2019, keseluruhan beban pencemaran yang terkumpul bagi pencemar karbon monoksida (CO) adalah 2,235,141 metrik tan; 925,370 metrik tan bagi nitrogen dioksida (NO_2); 270,270 metrik tan bagi sulfur dioksida (SO_2) dan 27,178 metrik tan bagi jirim zarahan (PM). Perbandingan keseluruhan beban pencemaran bagi tahun 2017, 2018 dan 2019 seperti ditunjukkan dalam **Rajah 5.10**.

Beban pencemaran bagi CO meningkat pada tahun 2019 berbanding dengan 2018. Pada tahun 2019, peningkatan adalah sebanyak 1.1% bagi beban pencemar CO, dan peningkatan 4.0% bagi beban pencemar NO_2. Peningkatan sebanyak 5.0% bagi pencemar SO_2 dan pencemar PM juga menunjukkan peningkatan sebanyak 1.5% berbanding dengan tahun 2018.

OVERALL EMISSION LOAD

It was estimated that in 2019 the overall accumulation of air pollutant emission load was 2,235,141 metric tonnes of carbon monoxide (CO); 925,370 metric tonnes of nitrogen oxides (NO_2); 270,270 metric tonnes of sulphur dioxide (SO_2) and 27,178 metric tonnes of particulate matter (PM). A comparison of the combined air pollutants emission load in 2017, 2018 and 2019 were shown in **Figure 5.10.**

Emission load for CO had increased in 2019 compared to 2018. In year 2019, the increment of CO emission load was 1.1%, 4.0% for NO_2 emission load. Increment of 5.0% for SO_2 and for pollutant PM, the increment was 1.5% compared to year 2018.



	CO	NO_2	SO_2	PM
2017	2,123,281	860,390	218,700	23,964
2018	2,210,634	889,890	257,457	26,789
2019	2,235,141	925,370	270,270	27,178

Rajah 5.10 : Beban Pencemaran Bahan Pencemar Udara dari Semua Punca, 2017-2019
Figure 5.10 : Air Pollutant Emission Load from All Sources, 2017-2019

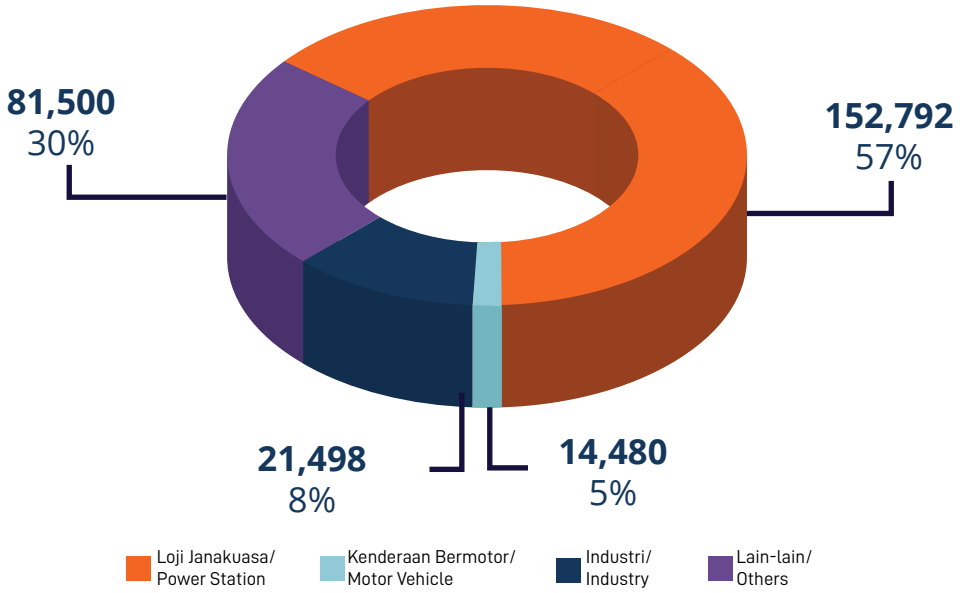
(Sumber: National Energy Balance, 2017)
(Source: National Energy Balance, 2017)

PUNCA BEBAN PENCEMARAN

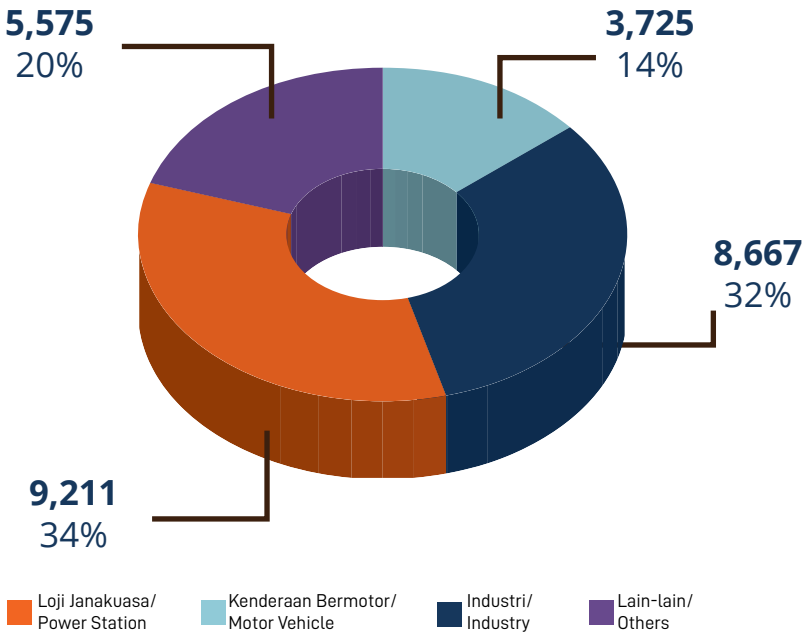
Loji janakuasa merupakan penyumbang utama kepada beban pencemar SO_2 (57%), diikuti dengan lain-lain kategori (30%), industri (8%) dan kenderaan bermotor (5%) **(Rajah 5.11)**. Bagi beban pencemar PM pula, penyumbang terbesar adalah daripada loji janakuasa (34%), industri (32%), diikuti kenderaan bermotor (14%) dan lain-lain kategori (20%) **(Rajah 5.12)**. Penyumbang terbesar bagi NO_2 adalah daripada loji janakuasa (64%) diikuti kenderaan bermotor (24%), industri (8%) dan lain-lain kategori (4%) **(Rajah 5.13)**. Walau bagaimanapun, kenderaan bermotor masih merupakan penyumbang terbesar kepada CO (95.7%) **(Rajah 5.14)**. Punca-punca bagi kategori 'Lain-lain' yang dinyatakan di dalam rajah-rajah adalah merupakan pelepasan bahan pencemar udara dari kawasan perumahan, komersial dan penggunaan bukan tenaga. Anggaran pencemaran yang dihasilkan oleh beban pencemar udara daripada kenderaan bermotor iaitu HC, CO, PM, NO_2 dan SO_2 pada tahun 2018 dan 2019 ditunjukkan dalam **Rajah 5.15**.

EMISSION LOAD BY SOURCES

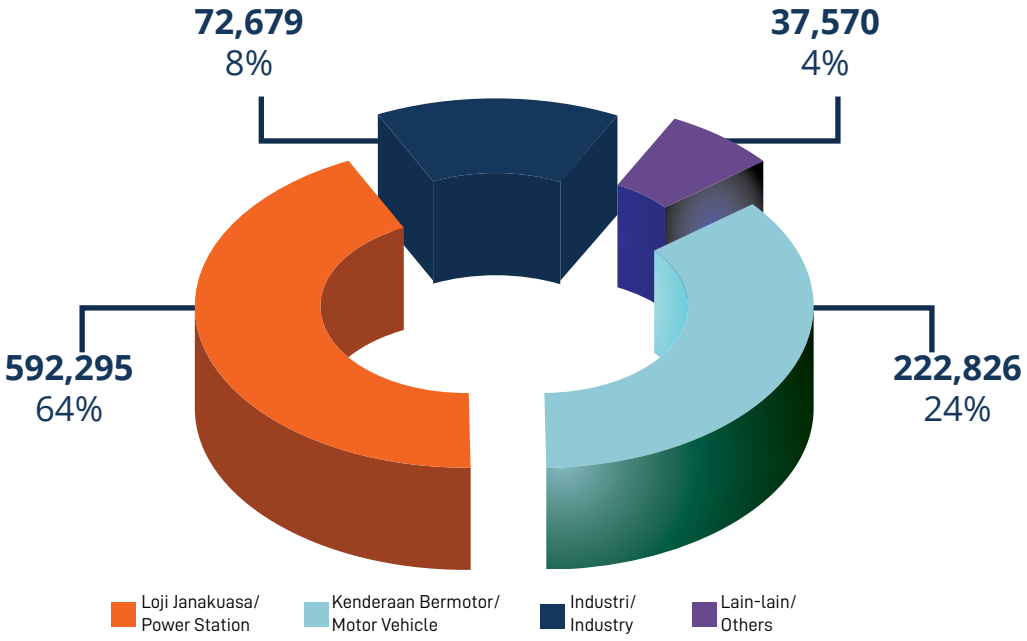
Power plants contributed the highest SO_2 emission load (57%), followed by other categories (30%), industries (8%) and motor vehicles (5%) **(Figure 5.11)**. As for the PM, the highest contributors were power plants (34%) followed by industries (32%), motor vehicles (14%) and others (20%) **(Figure 5.12)**. The highest contributors of NO_2 were power plants (64%) followed by motor vehicles (24%), industries (8%), and others (4%) **(Figure 5.13)**. However, motor vehicles remained the highest contributor of CO (95.7%) **(Figure 5.14)**. 'Others' in the figures represent air pollutant sources from residential, commercial dan non-energy use. The estimated annual air pollutants emission load of PM, SO_2, NO_2, HC and CO from motor vehicles for year 2018 and 2019 is shown in **Figure 5.15**.



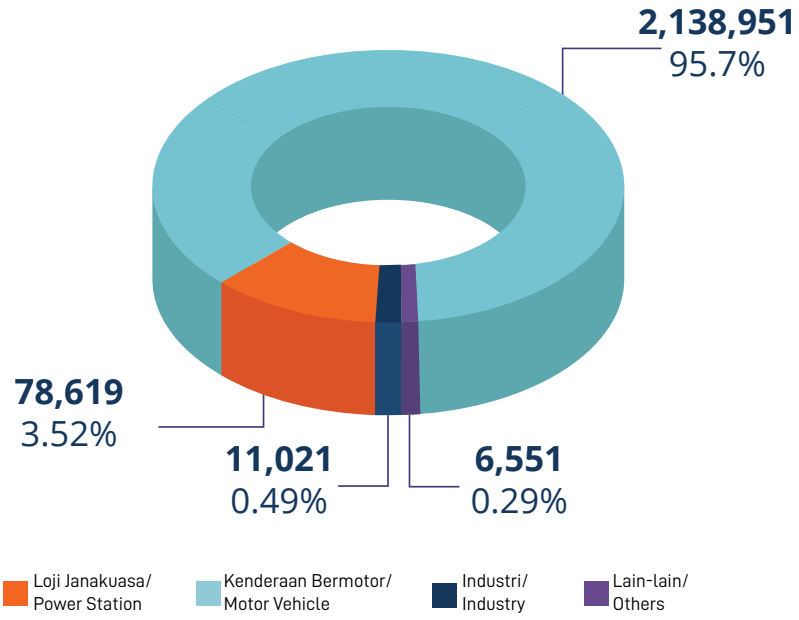
Rajah 5.11 : Punca Beban Pencemaran SO_2 (Metrik Tan), 2019
Figure 5.11 : SO_2 Emission Load by Sources (Metric Tonnes), 2019



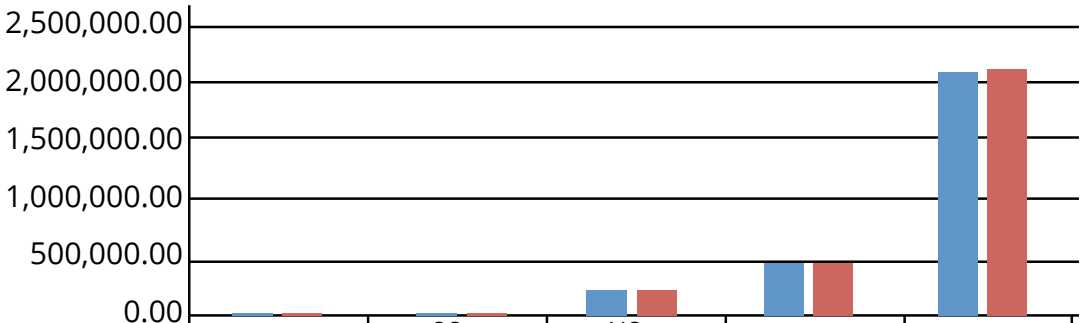
Rajah 5.12 : Punca Beban Pencemaran PM (Metrik Tan), 2019
Figure 5.12 : PM Emission Load by Sources (Metric Tonnes), 2019



Rajah 5.13 : Punca Beban Pencemaran NO_2 (Metrik Tan), 2019
Figure 5.13 : NO_2 Emission Load by Sources (Metric Tonnes), 2019



Rajah 5.14 : Punca Beban Pencemaran CO (Metrik Tan), 2019
Figure 5.14 : CO Emission Load by Sources (Metric Tonnes), 2019



	PM	SO_2	NO_2	HC	CO
2018	3,905.58	14,681.98	226,515.37	465,526.97	2,113,937.17
2019	3,725.31	14,479.64	222,826.76	479,222.76	2,138,950.64

Rajah 5.15 : Beban Pencemar Udara dari Kenderaan Bermotor, 2018 - 2019
Figure 5.15: Air Pollutant Emission Load from Motor Vehicles, 2018 - 2019

INVENTORI
BUANGAN TERJADUAL
SCHEDULED WASTES INVENTORY

Pada tahun 2019, sebanyak 4,013,189.03 tan metrik buangan terjadual telah dihasilkan. Ini mewakili peningkatan keseluruhan sebanyak 41.32% berbanding 2,355,085.21 tan metrik yang dilaporkan pada 2018. Dros/ sanga/ klinker/ abu, buangan gipsum dan enapcemar logam berat merupakan kategori utama dalam kategori buangan yang dihasilkan **(Jadual 5.1).** Negeri Selangor telah menghasilkan jumlah terbesar buangan terjadual (25.42%), diikuti oleh Johor (22.83%), Negeri Sembilan (10.83%), Pulau Pinang (8.15%), Pahang (7.87%), manakala 10 negeri-negeri yang lain menghasilkan sebanyak 24.87%.

Sebanyak 516,585.65 tan metrik (12.87%) daripada jumlah buangan terjadual yang dihasilkan diperoleh kembali di dalam dan luar negara. Ini menunjukkan peningkatan sebanyak 21.30% berbanding 406,565.96 tan metrik pada tahun 2018. Daripada jumlah itu, 501,165.30 tan metrik (12.49%) daripada buangan terjadual yang diperoleh kembali di kemudahan pemerolehan kembali luar tapak tempatan dan 15,420.35 tan metrik (0.38%) telah diberi kebenaran eksport untuk pemerolehan kembali di kemudahan di luar negara.

In 2019, a total of 4,013,189.03 tonnes of scheduled wastes were generated. This represented an overall increase of 41.32% as compared to 2,355,085.21 tonnes reported in 2018. Of the total waste generated, gypsum, dross/ slag/ clinker/ ash, and heavy metal sludge, were the main categories **(Table 5.1)**. The state of Selangor generated the largest amount of scheduled wastes (25.42%), followed by Johor (22.83%), Negeri Sembilan (10.83%), Pulau Pinang (8.15%), and Pahang (7.87%). Meanwhile, the other 10 states generated a total of 24.87% scheduled wastes.

A total of 516,585.65 tonnes (12.87%) of scheduled waste were recovered locally and abroad. This showed an increase of 21.30% as compared to 406,565.96 tonnes in 2018. From the total, 501,165.30 tonnes (12.49%) of scheduled wastes were recovered at local off-site treatment facilities and 15,420.35 tonnes (0.38%) were exported for recovery at foreign facilities.

Sebanyak 182,220.01 tan metrik (4.54%) daripada kuantiti buangan terjadual yang dihasilkan, dirawat dan dilupuskan untuk pelupusan akhir, iaitu di Kualiti Alam Sdn. Bhd (141,854.51 MT), Trienekens (Sarawak) Sdn. Bhd (6,608.51 MT) dan 33,756.99 tan metrik daripada buangan klinikal telah dibakar dan dilupuskan di kemudahan luar tapak yang dilesenkan **(Jadual 5.2)**. Jumlah ini menunjukkan penurunan sebanyak 20.38% daripada sejumlah 219,350.72 tan metrik buangan berjadual dilupuskan pada tahun 2018. Sebanyak 1,330,887.41 tan metrik (33.16%) daripada buangan terjadual terhasil telah diolah di tapak; manakala 472,662.73 tan metrik (11.78%) telah distor di premis pengeluar buangan **(Jadual 5.2)**.

Pada tahun 2019, 1,504,833.23 tan metrik (37.50%) daripada kuantiti buangan terjadual yang dihasilkan telah diberi kelulusan bersyarat di bawah pengurusan khas seperti yang ditetapkan di bawah Peraturan 7, Peraturan Kualiti Alam Sekeliling (Buangan Terjadual), 2005 **(Jadual 5.3)**. Jumlah ini merupakan peningkatan sebanyak 41.53% berbanding 879,844.03 tan metrik pada tahun 2018. Kebanyakan buangan dihasilkan dari enap cemar daripada kemudahan rawatan air minuman (48.92%), loji jana kuasa arang batu (41.15%), dan lain-lain (35.12%) .

A total of 182,220.01 tonnes (4.54%) of scheduled waste were treated and disposed as final disposal, at Kualiti Alam Sdn. Bhd. (141,854.51 MT), Trienekens (Sarawak) Sdn. Bhd. (6,608.51 MT). Clinical wastes with a total of 33,756.99 metric tonnes were incinerated and disposed at off-site licensed facilities **(Table 5.2)**. The amount showed 20.38% decrease from 219,350.72 tonnes of scheduled wastes disposed in 2018. Sum of 1,330,887.41 metric tonnes (33.16%) of scheduled wastes were treated on-site, while 472,662.73 tonnes (11.78%) were stored on-site at waste generators' premises **(Table 5.2)**.

In 2019, 1,504,833.23 tonnes (37.50%) of the total scheduled wastes produced were granted conditional approval to be managed under special management, as stipulated under Regulation 7, Environmental Quality (Scheduled Wastes) Regulations, 2005 **(Table 5.3)**. The amount represented an increase of 41.53% as compared to 879,844.03 tonnes in 2018. These waste streams were mostly generated from sludges at drinking water treatment facilities (48.92%), coal-fired power plants (41.15%) and others (35.12%).

Jadual 5.1 : Kuantiti Buangan Terjadual Yang Dihasilkan Mengikut Kod Buangan Terjadual, 2019
Table 5.1 : Quantity of Scheduled Wastes Generated by Scheduled Waste Code, 2019

BIL/ NO	NAMA BUANGAN/ NAME OF WASTE	KOD BUANGAN/ WASTE CODE	KUANTITI BUANGAN/ QUANTITY OF WASTE	
			(MT/TAHUN)/ (MT/YEAR)	PERATUSAN (%)/ PERCENTAGE (%)
1	Dros / sanga / klinker / abu Dross/Slag/Clinker/Ash	SW104	1,634,987.58	40.74
2	Minyak Pelincir Terpakai/ Spent Lubricating oil	SW305	382,519.82	9.53
3	Gipsum/ Gypsum	SW205	370,537.86	9.23
4	Enap cemar logam berat/ Heavy Metal Sludges	SW204	331,072.55	8.25
5	Buangan getah atau lateks yang mengandungi logam berat/ Rubber/Latex Waste Containing Heavy Metal	SW321	199,065.66	4.96
6	Campuran buangan terjadual dan buangan tidak terjadual/ Mixture of Scheduled Waste & Non-Scheduled Waste	SW422	105,610.61	2.63
7	Enap cemar yang mengandungi fluoride/ Sludge Containing Fluoride	SW207	96,338.52	2.40
8	Buangan minyak atau enap cemar berminyak/ Waste oil/Oily sludges	SW311	92,733.23	2.31
9	Buangan elektronik/ E-Waste	SW110	89,956.35	2.24
10	Buangan pelarut organic bukan terhalogen/ Waste of Non-Halogenated Solvent	SW322	73,866.94	1.84
11	Asid Terpakai/ Spent Acids	SW206	69,256.81	1.73
12	Bekas tercemar/ Used Container	SW409	68,789.87	1.71
13	Kain buruk, plastik, kertas atau turas tercemar/ Rags/Plastics/Papers contaminated with Scheduled Waste	SW410	58,180.19	1.45
14	Buangan mangkin/ Waste Catalyst	SW202	57,100.09	1.42
15	Buangan bateri asid plumbum/ Waste of acid lead batteries	SW102	55,584.82	1.39
16	Emulsi minyak mineral-air terpakai/ Spent mineral oil-water emulsion	SW307	53,136.77	1.32
17	Buangan patogenik / klinikal Pathogenic Clinical Waste	SW404	33,756.99	0.84
18	Enap cemar mineral/ Mineral Sludges	SW427	31,638.94	0.79
19	Sisa dari pengolahan atau pemerolehan kembali buangan terjadual/ Residue from Recovery	SW501	28,395.64	0.71
20	Buangan dakwat dan cat/ Waste of Inks & Paints	SW417	26,913.53	0.67
21	Buangan fotografi/ Photographic Waste	SW423	21,781.73	0.54
22	Campuran minyak-air/ Oil -Water mixture	SW309	16,164.75	0.40
23	Enap cemar dakwat dan cat/ Ink & Paints Sludges	SW416	15,741.87	0.39
24	Buangan kimia/ Lab Waste	SW429	12,228.44	0.30
25	Minyak hidraulik terpakai/ Spent Hydraulic oil	SW306	8 ,186.13	0.20

Jadual 5.1 : Kuantiti Buangan Terjadual Yang Dihasilkan Mengikut Kod Buangan Terjadual, 2019
Table 5.1 : Quantity of Scheduled Wastes Generated by Scheduled Waste Code, 2019

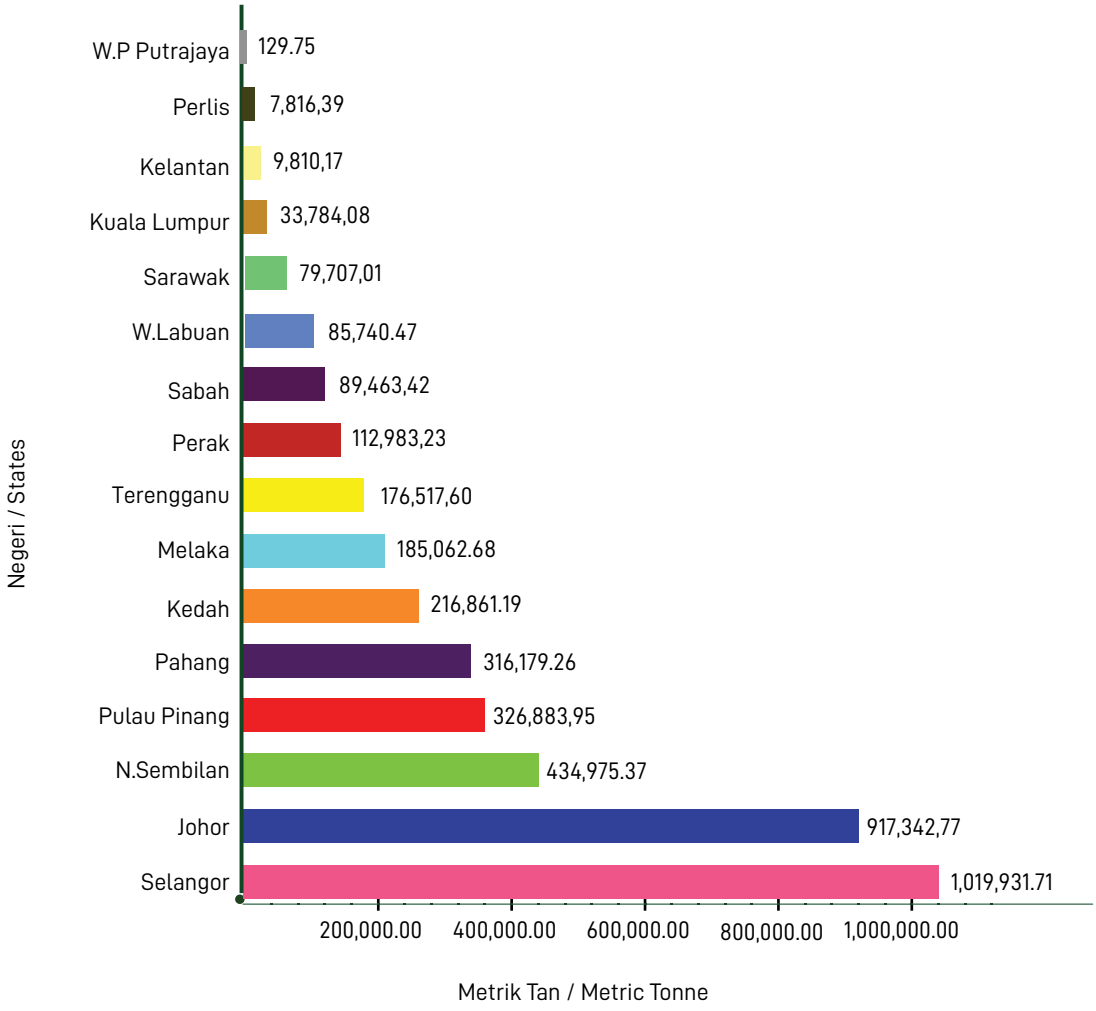
BIL/ NO	NAMA BUANGAN/ NAME OF WASTE	KOD BUANGAN/ WASTE CODE	KUANTITI BUANGAN/ QUANTITY OF WASTE	
			(MT/TAHUN)/ (MT/YEAR)	PERATUSAN (%)/ PERCENTAGE (%)
26	Produk dakwat, cat, pigmen atau lakuer yang tidak mengikut spesifikasi yang mengandungi pelarut organik/ Discarded of Ink/Paint/Pigment/Lacquer Containing Organic Solvent	SW418	7,496.03	0.19
27	Buangan pelarut organik terhalogen/ Waste of Halogenated Solvents	SW323	6,836.09	0.17
28	Tanah/puing tercemar/ Contaminated Land/oil	SW408	6,818.90	0.17
29	Minyak/Enapcemar daripada loji penapisan minyak/ Oil/Sludges from Oil Refinery	SW314	6,307.18	0.16
30	Buangan cecair terma/ Waste of Thermal Fluids	SW327	5,700.58	0.14
31	Campuran buangan terjadual/ Mixture of Scheduled Waste	SW421	5,589.70	0.14
32	Alkali terpakai/ Spent Alkalis	SW401	4,349.63	0.11
33	Buangan resin yang mengandungi pelarut organik/ Waste of Resin Containing Organic Solvent	SW325	4,143.32	0.10
34	Buangan kimia/ Waste Of Batteries Containing Cadmium/Hg/Lithium	SW103	3,649.28	0.09
35	Alkali terpakai dengan pH ≥ 11.5/ Spent Alkalis with PH > 11.5	SW402	3,245.64	0.08
36	Klinker, sanga dan abu dari penunu buangan terjadual/ Clinker/Slag/Ashes from Incinerator	SW406	2,948.81	0.07
37	Buangan pelekat / glu yang mengandungi pelarut organik/ Adhesive/Glue Containing Organic Solvent	SW303	2,839.54	0.07
38	Asid organik terpakai/ Spent Organic Acids	SW301	2,805.30	0.07
39	Sisa berminyak dari bengkel automotive/ Oily Residue from Workshop	SW312	2,742.78	0.07
40	Buangan mengandungi merkuri/ Waste containing Mercury/Compound	SW109	2,418.77	0.06
41	Karbon teraktif terpakai/ Contaminated Active Carbon	SW411	2,148.72	0.05
42	Larutan alkali berair terpakai yang mengandungi sianida/ Spent Aqueous alkaline Containing Cyanide	SW414	1,390.25	0.03
43	Enap cemar dari tangki penyimpanan minyak mineral/ Sludges from mineral oil storage tank	SW310	1,223.41	0.03
44	Buangan Asbestos/ Asbestos	SW201	1,039.81	0.03
45	Tar atau sisa bertar dari loji penapisan minyak/ Tar Residue from Oil Refinery/Petrochemical Plant	SW315	1,021.31	0.03
46	Buangan mengandungi formaldehid/ Waste Containing Formaldehyde	SW320	806.92	0.02
47	Buangan sisa penyulingan tidak berair terhalogen atau bukan terhalogen/ Waste of halogenated or unhalogenated non-aqueous distillation residues arising from organic solvents recovery process	SW324	705.30	0.02
48	Buangan makmal/ Chemical Waste	SW430	642.69	0.02

Jadual 5.1 : Kuantiti Buangan Terjadual Yang Dihasilkan Mengikut Kod Buangan Terjadual, 2019
Table 5.1 : Quantity of Scheduled Wastes Generated by Scheduled Waste Code, 2019

BIL/ NO	NAMA BUANGAN/ NAME OF WASTE	KOD BUANGAN/ WASTE CODE	KUANTITI BUANGAN/ QUANTITY OF WASTE	
			(MT/TAHUN)/ (MT/YEAR)	PERATUSAN (%)/ PERCENTAGE (%)
49	Tanah yang dicemari dengan minyak daripada penapisan semula/ Contaminated Oil from re-refining/used lubricating Oil	SW313	493.92	0.01
50	Dadah terbuang/ Expired Drug	SW403	471.20	0.01
51	Buangan farmaseutikal/ Discarded Drug	SW405	431.00	0.01
52	Enap cemar dari tangki minyak / Oil tankers sludges	SW308	376.13	0.01
53	Enap cemar yang distabilkan/ Stabilized Sludges	SW203	257.57	0.01
54	Buangan racun perosak/ Pesticide	SW425	1 92.71	0.00
55	Buangan fluks/ Flux Waste	SW302	166.68	0.00
56	Sisa dari pemerolehan kembali likuor penjerukan asid/ Residue from Recovery of Acid Pickling Liquor	SW106	111.00	0.00
57	Produk racun perosak yang tidak mengikut spesifikasi/ Used Pesticide/Herbicides/Biocides	SW426	101.59	0.00
58	Diisosianat terpakai/ Spent di-Isocyanates	SW419	34.02	0.00
59	Buangan yang mengandungi peroksida/ Waste Containing Peroxides	SW432	29.03	0.00
60	Enap cemar asid/ Waste Containing Peroxides	SW316	24.63	0.00
61	Buangan fenol/ Waste of Phenols/Its Compound	SW319	19.40	0.00
62	Buangan daripada opearsi pengawetan kayu/ Waste from Wood Containing Heavy Metals	SW428	15.83	0.00
63	Enap cemar galvani/ Galvanic sludges	SW105	12.69	0.00
64	Buangan yang mengandungi arsenik/ Waste containing arsenic	SW101	12.68	0.00
65	Buangan sebatian fosforus organik/ Waste of Organic phosphorus compound	SW326	11.54	0.00
66	Agen pengoksidaan terpakai/ Spent Oxidizing Agent	SW424	6.32	0.00
67	Enap cemar yang mengandungi sianida/ Sludges Containing Cyanide	SW412	2.74	0.00
68	Sanga kuprum/ Slag of Copper	SW107	1.02	0.00
69	Garam terpakai yang mengandungi sianida/ Spent salt containing Cyanide	SW413	0.96	0.00
70	Minyak pelindapan terpakai yang mengandungi sianida/ Spent quenching Oil Containing Cyanide	SW415	0.31	0.00
71	Sisa dari pemprosesan zink/ Zink Residue	SW108	0.29	0.00
72	Sebatian organologam terpakai/ Spent of Organometallic compound	SW317	0.10	0.00
73	Buangan yang mengandungii dioksin atau furan/ Waste Containing Dioxins Or Furans	SW407	0.00	0.00

Jadual 5.1 : Kuantiti Buangan Terjadual Yang Dihasilkan Mengikut Kod Buangan Terjadual, 2019
Table 5.1 : Quantity of Scheduled Wastes Generated by Scheduled Waste Code, 2019

BIL/ NO	NAMA BUANGAN/ NAME OF WASTE	KOD BUANGAN/ WASTE CODE	KUANTITI BUANGAN/ QUANTITY OF WASTE	
			(MT/TAHUN)/ (MT/YEAR)	PERATUSAN (%)/ PERCENTAGE (%)
74	Kek tekan daripada prapengolahan lai sabun gliserol/ Press cake from Glycerol Soap lye	SW304	-	0.00
75	Buangan yang mengandungi BFT dan TFT/ Waste containing PCB or PCT	SW318	-	0.00
76	Larutan resap dari tapak pelupusan buangan terjadual/ Leachate from Scheduled Waste Landfill	SW420	-	0.00
77	Buangan dari pengilangan bahan letupan/ Waste from Manufacturing/Processing or use of explosive	SW431	-	0.00
JUMLAH			**4,013,189.02**	**100.00**



Rajah 5 .15: Penghasilan Buangan Terjadual Mengikut Negeri 2019
Figure 5.15: Generation of Scheduled Waste by State 2019

Jadual 5.2: Kuantiti Buangan Terjadual Yang Dihasilkan Mengikut Jenis Industri, 2019
Table 5.2 : Quantity of Scheduled Wastes Generated by Industry, 2019

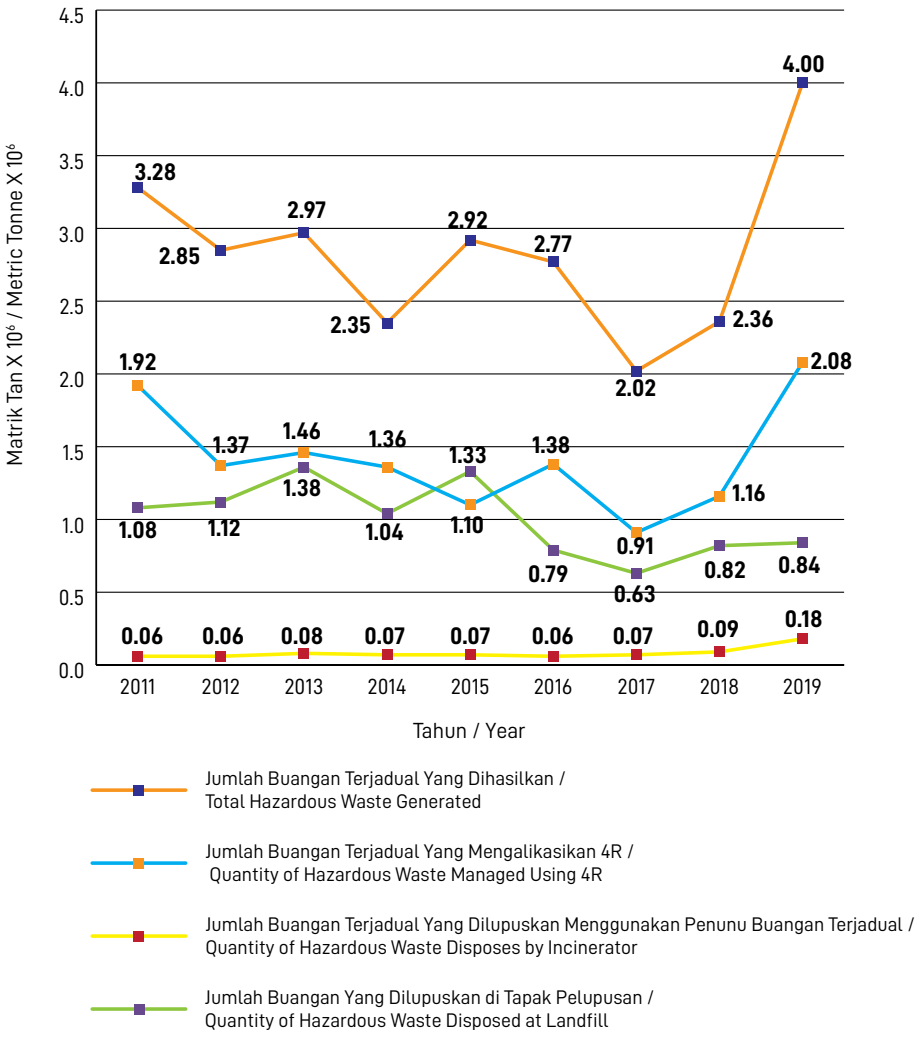
BIL/ NO	JENIS INDUSTRI/ TYPE OF INDUSTRY	KUANTITI BUANGAN/ QUANTITY OF WASTE	
		(MT/TAHUN)/ (MT/YEAR)	PERATUS (%)/ PERCENTAGE (%)
1	Loji Janakuasa/ Power Plant	969,435.61	24.16
2	Pengilangan Logam/ Metal Refinery	490,348.96	12.22
3	Industri Kimia/ Chemical Industry	428,068.97	10.67
4	Elektrik Dan Elektronik/ Electric And Electronic	403,438.00	10.05
5	Bengkel / Workshop Workshop	306,363.22	7.63
6	Premis Buangan Terjadual (PYDT)/ Scheduled Waste Treatment And Disposal Facilities	225,866.90	5.63
7	Berasaskan Getah/ Rubber Base	199,066.32	4.96
8	Kenderaan/ Vehicle	166,356.59	4.15
9	Lain-lain/ Others	160,343.63	4.00
10	Penapisan Petroleum/ Petroleum Refinery	130,592.43	3.25
11	Jentera/ Machinery	85,139.80	2.12
12	Gudang/ Warehouse	69,310.21	1.73
13	Kertas/ Paper	64,598.40	1.61
14	Penyudahan Logam Dan Sadur Elektrik/ Metal Finishing and Coating	49,507.64	1.23
15	Fabrikasi Logam/ Metal Fabrication	44,644.86	1.11
16	Perubatan/ Health Care Service	33,756.99	0.84
17	Percetakan/ Printing	32,694.18	0.81
18	Perkhidmatan/ Services	32,293.44	0.80
19	Perlombongan/ Mining	16,756.45	0.42
20	Galian Bukan Logam/ Excavation Non Metal	13,656.21	0.34
21	Loji Rawatan Air/ Water Treatment Plant	12,948.82	0.32
22	Makanan & Minuman/ Food & Drink	11,863.13	0.30

Jadual 5.2: Kuantiti Buangan Terjadual Yang Dihasilkan Mengikut Jenis Industri, 2019
Table 5.2 : Quantity of Scheduled Wastes Generated by Industry, 2019

BIL/ NO	JENIS INDUSTRI/ TYPE OF INDUSTRY	KUANTITI BUANGAN/ QUANTITY OF WASTE	
		(MT/TAHUN)/ (MT/YEAR)	PERATUS (%)/ PERCENTAGE (%)
23	Plastik/ Plastic	11,589.95	0.29
24	Berasaskan Kayu/ Wood Base	9,752.61	0.24
25	Penapisan Minyak Makan/ Edible Oil Refinery	9,098.95	0.23
26	Kilang Kelapa Sawit (PYDT)/ Palm Oil Mill	7,560.07	0.19
27	Kuari/ Quarry	6,311.23	0.16
28	Pembuatan Payung dan Lain-lain Industri Pembuatan/ Others Manufacturing	5,974.31	0.15
29	Pertanian/ Agriculture	5,819.35	0.15
30	Tekstil/ Textiles	3,855.16	0.10
31	Simen/ Cement	2,488.55	0.06
32	Kilang Getah (PYDT)/ Rubber Factory	1,661.18	0.04
33	Peralatan Sukan Dan Permainan/ Sports Equipment and Games	542.80	0.01
34	Peralatan Pejabat dan Alat Tulis/ Office Supplies and Stationery	540.13	0.01
35	Kulit/ Leather	316.73	0.01
36	Loji Pengolahan Kumbahan (IWK, Majari, PBT)/ Sewage Treatment Plant (IWK,Majari,PBT)	201.34	0.01
37	Rokok Dan Tembakau/ Cigarettes and Tobacco	134.87	0.00
38	Loji Pengolahan Kumbahan Persendirian/ Private Sewage Treatment Plant	126.43	0.00
39	Makanan Ternakan/ Livestock Food	65.94	0.00
40	Hotel/ Hotel	39.18	0.00
41	Tapak Pelupusan Sampah/ Sanitary Landfill	33.20	0.00
42	Kilang Padi/ Rice Mill	22.11	0.00
43	Perikanan/ Fishery	3.93	0.00
44	Restoran/ Restaurant	0.22	0.00

Jadual 5.2: Kuantiti Buangan Terjadual Yang Dihasilkan Mengikut Jenis Industri, 2019
Table 5.2 : Quantity of Scheduled Wastes Generated by Industry, 2019

BIL/ NO	JENIS INDUSTRI/ TYPE OF INDUSTRY	KUANTITI BUANGAN/ QUANTITY OF WASTE	
		(MT/TAHUN)/ (MT/YEAR)	PERATUS (%)/ PERCENTAGE (%)
45	Penternakan/ Husbandry	0.05	0.00
46	Perhutanan/ Forestry	-	-
JUMLAH		4,013,189.02	100.00



Rajah 5.16 Tren Pengurusan Buangan Terjadual, 2011-2019
Rajah 5.16: Scheduled Waste Management Trend, 2011-2019

Jadual 5.3 : Kemudahan yang Mengendalikan Buangan Terjadual, 2019
Table 5.3 : Facilities Handling Scheduled Wastes, 2019

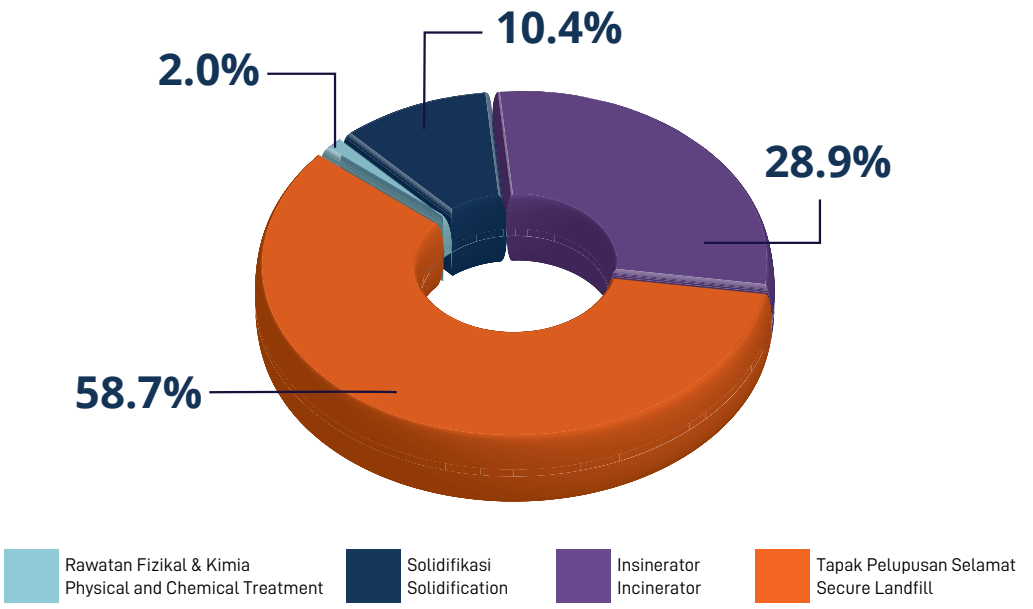
BIL/ NO	FASILITI/ FACILITY	TAN METRIK/ METRIC TONNES	PERATUSAN (%)/ PERCENTAGE(%)
1	Pengurusan Khas/Special Waste Management	1,504,833.23	37.50
2	Pengolahan DalamTapak/OnSite Treatment	1,330,887.41	33.16
3	Kemudahan Pemerolehan Kembali Luar Tapak Tempatan/ Local Off-Site Recovery Facilities	501,165.30	12.49
4	Penstoran Dalam Tapak/On Site Storage	450,520.05	11.23
5	Kualiti Alam Sdn Bhd	147,854.51	3.68
6	Kemudahan Buangan Klinikal (Penunu Buangan Klinikal, Gelombang Mikro dan Tapak Pelupusan Selamat)/Off-Site Clinical Waste Facilities (Incinerator, Microwave and Secured Landfill)	33,756.99	0.84
7	Kemudahan Luar Negara (Ekspot)/Foreign Facilities (Export)	20,957.04	0.52
8	Trienekens (Sarawak) Sdn Bhd	23,214.49	0.58
JUMLAH/TOTAL		4,013,189.02	100

Jadual 5.4: Buangan Terjadual Yang Diuruskan Di Bawah Pengurusan Khas 2019
Table 5.4 Malaysia: Generated Scheduled Waste Managed Under Special Management, 2019

BIL/ NO.	WASTE CATEGORY/ KATEGORI BUANGAN	KOD BUANGAN/ WASTE CODE	SUMBER/ SOURCE	METRIK TAN/ TONNE METRIC	PERATUS (%)/ PERCENTAGE (%)	KAEDAH PELUPUSAN/ METHOD OF DISPOSAL
1	Fly Ash & Bottom Ash	SW 104	Loji Janakuasa elektrik	619,272.64	41.15	Guna semula sebagai bahan mentah pembuatan produk/ Reuse as raw material for product
			Industri	80,524.78	5.35	
2	Enap cemar Logam Berat/ Heavy Metal Sludge	SW 204	Loji Rawatan Air Minuman	736,171.59	48.92	Tapak Pelupusan Sanitari/ Sanitary Landfill
			Industri	11,766.92	0.78	
				47,674.66	3.17	Guna semula sebagai bahan mentah pembuatan produk/ Reuse as raw material for product
3	Gypsum	SW 205	Industri	257.14	0.02	Guna semula sebagai bahan mentah pembuatan produk/ Reuse as raw material for product
4	Abu dari enapcemar kertas/ Ash of Paper Sludge	SW 406	Industri	4,354.08	0.29	Tapak Pelupusan Sanitari/ Sanitary Landfill
5	Enap Cemar Mineral/ Mineral sludge	SW 427	Industri	963.20	0.06	Gunasemula sebagai agen peneutralan/ Reuse as neutralizing agent
6	Buangan yang mengandungi formaldehid, resin, serbuk epoksi terbuang/ Waste Containing Formaldehyde, resin, discarded epoxy powder	SW 320, 325, 418	Industri	847.92	0.06	Tapak Pelupusan Sanitari/ Sanitary Landfill
7	Activated Carbon Terpakai/ Spent activated carbon	SW411	Industri	2,991.50	0.20	Guna semula sebagai bahan mentah pembuatan produk/ Reuse as raw material for product
8	Kelengkapan yang dicemari dengan buangan terjadual/ Equipment contaminated with scheduled waste	SW409	Industri	0.10	0.00	Guna semula sebagai bahan mentah pembuatan produk/ Reuse as raw material for product
9	Buangan daripada bahan letupan terpakai/ Waste use of explosive	SW431	Industri	8.70	0.00	Kaedah Slow Burning/ Slow Burning Method
JUMLAH				**1,504,833.23**	**100.00**	

Kategori buangan terjadual yang dihantar ke premis berlesen (Kualiti Alam Sdn Bhd dan Trinekens (Sarawak) Sdn Bhd) untuk pelupusan akhir adalah seperti enapcemar yang mengandungi satu atau beberapa logam berat, campuran buangan terjadual, debu / sanga / dros atau abu yang mengandungi arsenik / merkuri dan asid bukan organik terpakai. Buangan tersebut sama ada dibakar, dirawat secara fizikal dan kimia, distabilkan atau dilupuskan di tapak pelupusan selamat bergantung kepada ciri-ciri tertentu. Seperti yang ditunjukkan dalam **Rajah 5.17**, kebanyakan sisa dihantar ke Kualiti Alam Sdn Bhd dan Trienekens Sdn Bhd adalah ke tapak pelupusan (58.7%), diikuti dibakar (28.9%), solidifikasi (10.4%) dan rawatan secara fizikal dan kimia (2%).

The categories of wastes sent to licensed premises (Kualiti Alam Sdn. Bhd. and Trienekens (Sarawak) Sdn. Bhd.) for final disposal are sludges which contain one or several heavy metals, mixed wastes, dust/slag/dross or ash which contain arsenic/ mercury and spent inorganic acid. Such wastes are incinerated, physically and chemically treated, solidified or disposed in secured landfills, depending on their characteristics. As shown in **Figure 5.17,** most wastes sent to Kualiti Alam Sdn. Bhd. and Trienekens Sdn. Bhd. were landfilled (58.7%), followed by incinerated (28.9%), solidified (10.4%) or physically and chemically treated (2%).



Rajah 5.17 Kualiti Alam dan Trienekens : Jenis Rawatan dan Pelupusan Buangan Terjadual, 2019
Rajah 5.17 Kualiti Alam and Trienekens : Types of Treatment and Disposal Of Water, 2019

ANNEX

ANNEX

NATIONAL WATER QUALITY STANDARDS FOR MALAYSIA

PARAMETER	UNIT	CLASS				
		I	IIA/IIB	III#	IV	V
Al	mg/l	NATURAL LEVEL OR ABSENT	-	(0.06)	0.5	LEVEL ABOVE IV
As	mg/l		0.05	0.4 (0.05)	0.1	
Ba	mg/l		1	-	-	
Cd	mg/l		0.01	0.01* (0.001)	0.01	
Cr (VI)	mg/l		0.05	1.4 (0.05)	0.1	
Cr (III)	mg/l		-	2.5	-	
Cu	mg/l		0.02	-	0.2	
Hardness	mg/l		250	-	-	
Ca	mg/l		-	-	-	
Mg	mg/l		-	-	-	
Na	mg/l		-	-	3 SAR	
K	mg/l		-	-	-	
Fe	mg/l		1	1	1 (Leaf) 5 (Others)	
Pb	mg/l		0.05	0.02* (0.01)	5	
Mn	mg/l		0.1	0.1	0.2	
Hg	mg/l		0.001	0.004 (0.0001)	0.002	
Ni	mg/l		0.05	0.9*	0.2	
Se	mg/l		0.01	0.25 (0.04)	0.02	
Ag	mg/l		0.05	0.0002	-	
Sn	mg/l		-	0.004	-	
U	mg/l		-	-	-	
Zn	mg/l		5	0.4*	2	
B	mg/l		1	(3.4)	0.8	
Cl	mg/l		200	-	80	
Cl_2	mg/l		-	(0.02)	-	
CN	mg/l		0.02	0.06 (0.02)	-	
F	mg/l		1.5	10	1	
NO_2	mg/l		0.4	0.4 (0.03)	-	
NO_3	mg/l		7	-	5	
P	mg/l		0.2	0.1	-	
Silica	mg/l		50	-	-	
SO_4	mg/l		250	-	-	
S	mg/l		0.05	(0.001)	-	
CO_2	mg/l		-	-	-	
Gross-α	Bq/l		0.1	-	-	
Gross-β	Bq/l		1	-	-	
Ra-226	Bq/l		< 0.1	-	-	
Sr-90	Bq/l		< 1	-	-	
CCE	mg/l		500	-	-	-
MBAS/BAS	mg/l		500	5000 (200)	-	-
O & G (Mineral)	mg/l		40; N	N	-	-
O & G (Emulsified Edible)	mg/l		7000; N	N	-	-
PCB	mg/l		0.1	6 (0.05)	-	-
Phenol	mg/l		10	-	-	-
Aldrin/Dieldrin	mg/l		0.02	0.2 (0.01)	-	-
BHC	mg/l		2	9 (0.1)	-	-
Chlordane	mg/l		0.08	2 (0.02)	-	-
t-DDT	mg/l		0.1	(1)	-	-
Endosulfan	mg/l		10	-	-	-
Heptachlor/Epoxide	mg/l		0.05	0.9 (0.06)	-	-
Lindane	mg/l		2	3 (0.4)	-	-
2,4-D	mg/l		70	450	-	-
2,4,5-T	mg/l		10	160	-	-
2,4,5-TP	mg/l		4	850	-	-
Paraquat	mg/l		10	1800	-	-

Notes :

* = At hardness 50 mg/l $CaCO_3$

\# = Maximum (unbracketed) and 24-hour average (bracketed) concentrations

N = Free from visible film sheen, discolouration and deposits

NATIONAL WATER QUALITY STANDARDS FOR MALAYSIA

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*	µS/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 °C	-	Normal + 2 °C	-	-
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

Notes :

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

WATER CLASSES AND 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.

ANNEX

DOE WATER QUALITY CLASSIFICATION BASED ON WATER QUALITY INDEX

SUB INDEX & WATER QUALITY INDEX	INDEX RANGE		
	CLEAN	SLIGHTLY POLLUTED	POLLUTED
Biochemical Oxygen Demand (BOD)	91 - 100	80 - 90	0 - 79
Ammoniacal Nitrogen (NH_3-N)	92 - 100	71 - 91	0 - 70
Suspended Solids (SS)	76 - 100	70 - 75	0 - 69
Water Quality Index (WQI)	81 - 100	60 - 80	0 - 59

DOE WATER QUALITY INDEX CLASSIFICATION

PARAMETER	UNIT	CLASS				
		I	II	III	IV	V
Ammoniacal Nitrogen	mg/l	< 0.1	0.1 – 0.3	0.3 – 0.9	0.9 – 2.7	> 2.7
Biochemical Oxygen Demand	mg/l	< 1	1 – 3	3 – 6	6 – 12	> 12
Chemical Oxygen Demand	mg/l	< 10	10 – 25	25 – 50	50 – 100	> 100
Dissolved Oxygen	mg/l	> 7	5 – 7	3 – 5	1 – 3	< 1
pH	-	> 7.0	6.0 – 7.0	5.0 – 6.0	< 5.0	> 5.0
Total Suspended Solid	mg/l	< 25	25 – 50	50 – 150	150 – 300	> 300
Water Quality Index (WQI)		> 92.7	76.5 – 92.7	51.9 – 76.5	31.0 – 51.9	< 31.0

WQI FORMULA AND CALCULATION

FORMULA

WQI = (0.22 * SIDO) + (0.19 * SIBOD) + (0.16 * SICOD) + (0.15 * SIAN) + (0.16 * SISS) + (0.12 * SIpH)
where;

SIDO = Subindex DO (% saturation)
SIBOD = Subindex BOD
SICOD = Subindex COD
SIAN = Subindex NH_3-N
SISS = Subindex SS
SIpH = Subindex pH
$0 \leq WQI \leq 100$

Best Fit Equations for the Estimation of Various Subindex Values

Subindex for DO (in % saturation)

SIDO = 0 for $x \leq 8$
SIDO = 100 for $x \geq 92$
SIDO = $-0.395 + 0.030x^2 - 0.00020x^3$ for $8 < x < 92$

Subindex for BOD

SIBOD = 100.4 - 4.23x for $x \leq 5$
SIBOD = 108 * exp(-0.055x) - 0.1x for $x > 5$

Subindex for COD

SICOD = -1.33x + 99.1 for $x \leq 20$
SICOD = 103 * exp(-0.0157x) - 0.04x for $x > 20$

Subindex for NH_3-N

SIAN = 100.5 - 105x for $x \leq 0.3$
SIAN = 94 * exp(-0.573x) - 5 * | x – 2 | for $0.3 < x < 4$
SIAN = 0 for $x \geq 4$

Subindex for SS

SISS = 97.5 * exp(-0.00676x) + 0.05x for $x \leq 100$
SISS = 71 * exp(-0.0016x) - 0.015x for $100 < x < 1000$
SISS = 0 for $x \geq 1000$

Subindex for pH

SIpH = 17.2 - 17.2x + $5.02x^2$ for $x < 5.5$
SIpH = -242 + 95.5x - $6.67x^2$ for $5.5 \leq x < 7$
SIpH = -181 + 82.4x - $6.05x^2$ for $7 \leq x < 8.75$
SIpH = 536 - 77.0x + $2.76x^2$ for $x \geq 8.75$

Note:
* means multiply with

MALAYSIAN MARINE WATER QUALITY STANDARDS

PARAMETER (µG/L) UNLESS OTHERWISE STATED	CLASSIFICATION					
	CLASS 1	CLASS 2	CLASS 3	INTERIM CLASS E1	INTERIM CLASS E2	INTERIM CLASS E3
	SENSITIVE MARINE HABITATS	FISHERIES (INCLUDING MARICULTURE)	INDUSTRY, COMMERCIAL ACTIVITIES & COASTAL SETTLEMENTS	ESTUARIES		
				COASTAL PLAIN	LAGOON	COMPLEX DISTRIBUTARY NETWORK
Dissolved Oxygen (mg/l)	>6.0	>5.0	>3.0	>5.0	>5.0	>5.0
Suspended Solids (mg/l)	25.0	50.0	100.0	30.0	30.0	30.0
Phosphate	5.0	75.0	670.0	100.0	180.0	180.0
Nitrate	10.0	60.0	700.0	200.0	570.0	430.0
Ammonia	35.0	50.0	320.0	5.0	10.0	10.0
Mercury	0.04	0.04	0.04	0.04	0.04	0.04
Cadmium	0.50	2.00	3.00	1.00	1.00	1.00
Chromium (VI)	0.14	10.00	20.00	10.00	10.00	10.00
Copper	1.30	2.90	8.00	1.00	1.00	1.00
Cyniade	2.00	7.00	14.00	5.00	5.00	5.00
Lead	2.20	8.50	12.00	1.30	2.00	2.00
Zinc	7.00	50.00	100.00	16.00	5.00	5.00
Arsenic (III)	1.00	3.00	3.00	3.00	1.00	1.00
Aluminium	27.0	27.0	55.0	27.0	27.0	27.0
TBT	0.001	0.010	0.050	0.002	0.002	0.002
PAH	100.0	200.0	1000.0	5.0	5.0	5.0
Total Phenol	1.0	10.0	100.0	10.0	10.0	10.0
Oil & Grease (mg/l)	0.01	0.14	5.00	1.00	1.00	1.00
Faecal Coliform (cfu/100ml)	70	70	70	70	70	70
Temperature (°C)	≤ 2 °C increase over maximum ambient					
pH	6.5 - 9.0					
Marine Litter	Free from marine litter					

MALAYSIAN MARINE WATER QUALITY INDEX (MMWQI) FORMULA AND CALCULATION

MMWQI = q*i* DO$^{0.18}$ x q*i* FC$^{0.19}$ x q*i* $NH_3$$^{0.15}$ x q*i* $NO_3$$^{0.16}$ x q*i* $PO_4$$^{0.17}$ x q*i* TSS$^{0.15}$

whereby;

q*i* DO	= Subindex Dissolved Oxygen
q*i* FC	= Subindex Faecal Coliform
q*i* NH_3	= Subindex Unionized Ammonia
q*i* NO_3	= Subindex Nitrate
q*i* PO_4	= Subindex Phosphate
q*i* TSS	= Subindex Total Suspended Solids

*Salinity of the marine water quality data shall be higher than 10 ppt

BEST FIT EQUATIONS FOR THE ESTIMATION OF VARIOUS SUBINDEX VALUES

Dissolved Oxygen (DO) in mg/l

q*i* DO = -85.816 + 55.4768(DO) – 4.142(DO)^2

If DO is less than (<) 3 mg/l, or more than (>) 10 mg/l, q*i* DO= 10

Faecal Coliform (FC) in cfu/100ml

q*i* FC = 100*EXP$^{(-0.005(\text{Faecal Coliform}))}$

If FC is more than (>) 500 cfu/100ml, q*i* FC = 8

Unionized Ammonia (NH_3) in µg/l

q*i* NH_3 = 100*EXP$^{(-0.0046(\text{Unionized Ammonia}))}$

If Ammoniacal Nitrogen (NH3-N) is measured, convert the value into unionized ammonia.

Nitrate (NO_3) in µg/l

q*i* NO3 = 94.8*EXP$^{(-0.00035(\text{Nitrate}))}$

Phosphate (PO_4) in µg/l

q*i* PO4 = 95.2*EXP$^{(-0.002(\text{Phosphate}))}$

If PO_4 is more than (>) 900 µg/l, q*i* PO_4 = 10

Total Suspended Solids (TSS) in mg/l

q*i* TSS = 95.8*EXP$^{(-0.0043(\text{Total Suspended Solid}))}$

If TSS is more than (>) 100 mg/l, q*i* TSS = 20

UNIONIZED AMMONIA CALCULATION

In order to convert the concentration of total ammoniacal nitrogen into unionized ammonia, calculate (a), (b),
(c) and (d). Substitute the results into equation 1.

a. Calculation of Ionic Strength (IS)

$$IS = \frac{19.9273*Salinity}{(1000-1.005109*Salinity)}$$

Salinity in part per thousand (ppt)

b. Calculation of PKa

$$PKa = (0.0901821 + \frac{2729.92}{(Temp+273.15)} + IS(0.1552-0.000314*Temp)$$

Temperature in °C

c. Calculation of working pH

pHsw = pH – (0.0007 x IS) – 0.131

d. Calculation of mole fraction for unionized ammonia

Mole Fraction =

equation 1:

Ammoniacal nitrogen (NH_3-N) x mole fraction x 17/14

Ammoniacal nitrogen should be measured in µg/l

GROUNDWATER QUALITY STANDARDS FOR CONVENTIONAL RAW WATER TREATMENT (DRINKING WATER)

PARAMETER	STANDARD (mg/L)
Total coliform	5000 MPN/100 ml
E coli	5000 MPN/100 ml
Kekeruhan	1000 NTU
Warna	300 TCU
pH	5.5-9.0
Suhu	Normal ± 2^0C
Konduktiviti	1000 µS/cm#
Jumlah Pepejal Terlarut	1500
Klorida	250
Ammonia	1.5
Nitrat	10
Besi	1.0
Fluorida	1.5
Kekerasan	500
Mangan	0.2
COD	10
MBAS	1.0
BOD	6
Nitrit	0.4#
Raksa	0.001
Kadmium	0.003
Arsenik	0.01
Sianida	0.07
Plumbum	0.05
Kromium	0.05
Kuprum	1.0
Zink	3.0
Natrium	200
Sulfat	250
Selenium	0.01
Perak	0.05
Magnesium	150
Minyak	0.3
Racun Perosak (Pesticides)	0.00003-0.03*
Fenol	0.002
Nikel	0.05
Gross alpha	0.1 Bq/l
Gross beta	1.0 Bq/l

*Aldrin/dieldrin, DDT, Heptachlor,Methoxychlor,Lindane,Chlordane,Endosulfan, hexachlorobenzene,2,4,5–T,2,4-D,2,4-DB,Alachlor,Aldicarb,Carbofuran,MCPA, Permethrin

#Diambil dari *Class IIA, National Water Quality Standards*

GROUNDWATER QUALITY INDEX (GWQI) FORMULA AND CALCULATION

To calculate the GWQI, the additive equation is used as follows:

$$GWQI = \sum W_i q_i$$

or

GWQI = 0.13Si(pH) + 0.17Si(Fe) + 0.17Si(*E. coli*)+ 0.04Si(TDS) + 0.09Si(SO_4^{2-}) + 0.22Si(NO_3) + 0.17 Si (Phenol)

The sub-indices of all the parameters used for generating the GWQI are as follows

pH Sub Index

pH	*Si(pH)*	
<3.0	0	Acidic
3 – 4	10	
4 – 5.5	30	
5.5 – 9	100	
9 – 10	30	Alkaline
10 – 11	10	
>11.0	0	

Iron Sub Index

Si (Fe) = (1- C_i/5.0) x 100

Si (Fe) = 0, if Ci exceeds 5.0 mg/L; Ci is the concentration of iron determined in the groundwater sample.

Total Dissolved Solid Sub Index

Si (TDS) = (1- C_i/3000) x 100

Si (TDS) = 0, if Ci exceeds 3000 mg/L; Ci is the concentration of total dissolved solid determined in the groundwater sample.

Nitrate Sub Index

Si (NO_3^-) = (1 - C_i/100) x 100

Si (NO_3^-) = 0, if C_i exceeds 100 mg/L; C_i is the concentration of nitrate determined in the groundwater sample.

Sulfate Sub Index

Si (SO_4^{2-}) = (1- C_i/1000) x 100

Si (SO_4^{2-}) = 0, if Ci exceeds 1000 mg/L; C_i is the concentration of sulfate determined in the groundwater sample.

Phenol Sub Index

Si (Phenol) = (1- C_i/0.015) x 100

Si (Phenol) = 0, if Ci exceeds 0.015 mg/L; Ci is the concentration of phenol determined in the groundwater sample.

***E. coli* Sub Index**

Si (*E. coli*) = (1- C_i/5000) x 100

Si (*E. coli*) = 0, if Ci exceeds 5000 MPN/100ml; Ci is the MPN *E. coli* measured in the groundwater sample.

JABATAN ALAM SEKITAR
Kementerian Alam Sekitar dan Air

Aras 1 - 4, Podium 2 & 3,
Wisma Sumber Asli,
No.25, Persiaran Perdana, Presint 4,
Pusat Pentadbiran Kerajaan Persekutuan,
62574 Putrajaya,
Malaysia.

www.doe.gov.my