KEMENTERIAN SUMBER ASLI,
ALAM SEKITAR DAN PERUBAHAN IKLIM
Ministry of Natural Resources,
Environment and Climate Change

JABATAN ALAM SEKITAR
Department of Environment

LAPORAN KUALITI ALAM SEKELILING 2022

ENVIRONMENTAL QUALITY REPORT

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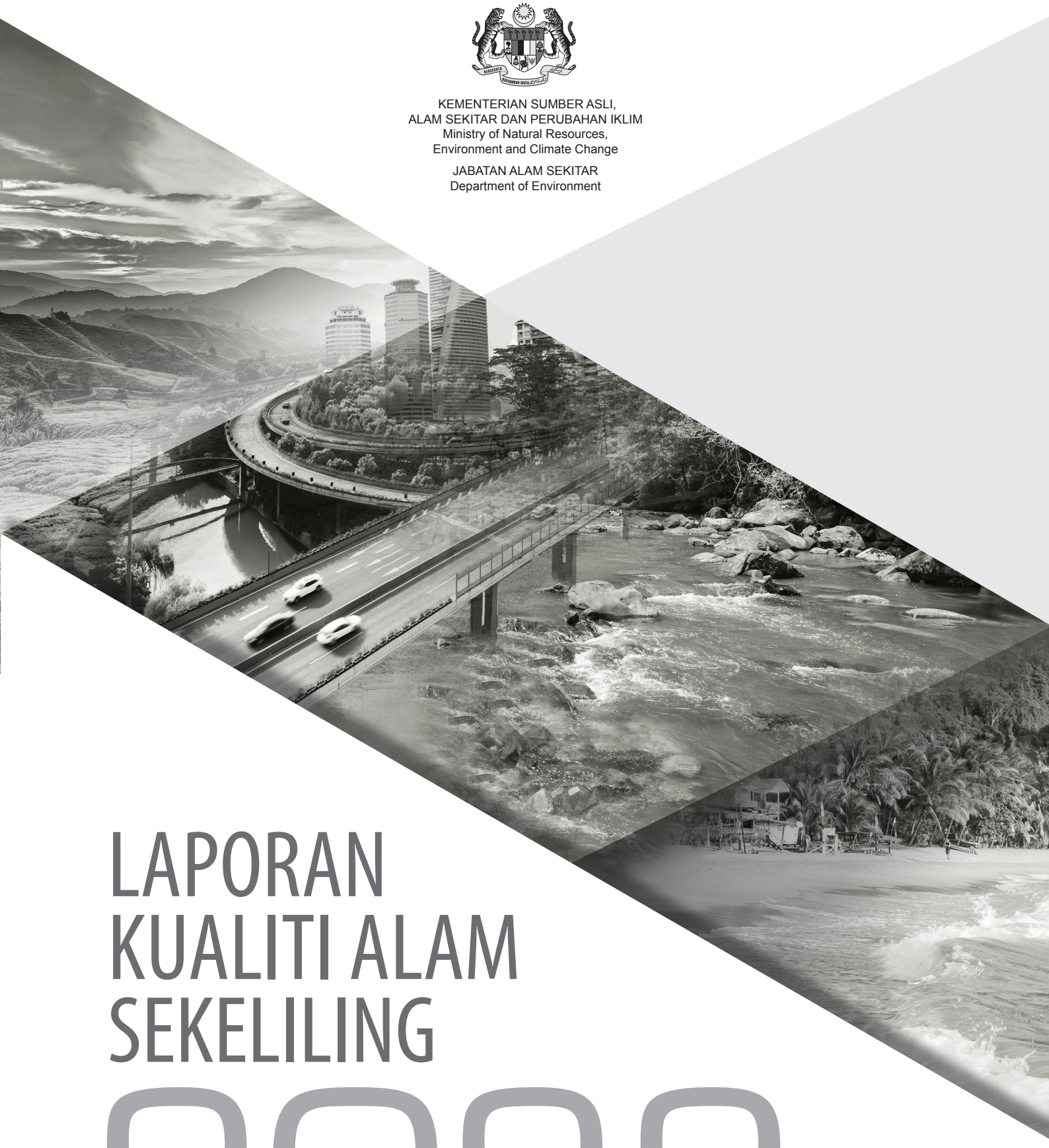


LAPORAN KUALITI ALAM SEKELILING 2022

ENVIRONMENTAL QUALITY REPORT

Sungai Kuantan, Pahang

ISSN 2636-9834

Designed and Printed by:
Sasyaz Holdings Sdn. Bhd. (219275-V)
31-2, Jalan PJU 7/16A,
Mutiara Damansara,
47810 Petaling Jaya, Selangor, Malaysia
T: 03-7803-3754

Printed on Wood-free Paper

KANDUNGAN / CONTENTS

PRAKATA / PREFACE

Saya amat berbesar hati untuk membentangkan Laporan Kualiti Alam Sekeliling 2022 seperti yang dikehendaki di bawah Seksyen 3(1)(i) Akta Kualiti Alam Sekeliling 1974.

Status kualiti udara di Malaysia ditunjukkan menerusi bacaan Indeks Pencemar Udara (IPU). IPU bagi keseluruhan Malaysia pada tahun 2022 telah menunjukkan sedikit peningkatan bagi peratus IPU berstatus baik berbanding tahun 2021. Ini adalah kerana negara mengalami keadaan cuaca yang lebih lembap dan menerima hujan yang lebih banyak berbanding tahun sebelumnya yang mana keadaan ini telah mengurangkan kes-kes pencemaran udara di dalam negara. Tiada kejadian jerebu merentas sempadan direkodkan bagi tahun 2022 dan keadaan ini telah mengurangkan jumlah bilangan titik panas (hotspots) di dalam negara.

Status kualiti air sungai yang ditentukan menerusi Indeks Kualiti Air (IKA) menunjukkan peningkatan pada tahun 2022. Sebanyak 1,353 stesen pengawasan kualiti air manual dipantau dalam tahun 2022.

It is my pleasure to present the Environmental Quality Report 2022 as required under Section 3(1)(i) of the Environmental Quality Act 1974.

The air quality status is reported in terms of Air Pollutant Index (API). The API for the whole of Malaysia in 2022 has shown a slight increase in the percentage of good API status compared to 2021. This is due to the fact that the country experienced more humid weather conditions and received more rain than the previous year thereby reducing cases of air pollution in the country. No transboundary haze incidents were recorded for 2022 and this has reduced the total number of hotspots within the country.

The river quality in terms of Water Quality Index (WQI) showed a slight decrease in 2022. A total of 1,353 river station were monitored for water

"Alam Sekitar,
Tanggungjawab Bersama"

"Environment, Our Shared Responsibility"

DATO' WAN ABDUL LATIFF BIN WAN JAFFAR
Ketua Pengarah Kualiti Alam Sekeliling Malaysia
Director General of Environmental Quality Malaysia

Peratus bilangan sungai bersih adalah 74% pada tahun 2022 berbanding 73% pada tahun sebelumnya. Peratus bilangan sungai tercemar telah berlaku sedikit peningkatan daripada 3% pada tahun 2021 kepada 4% pada tahun 2022.

Pada tahun 2022, pengawasan kualiti air tanah yang dijalankan menunjukkan bahawa semua stesen berada dalam julat nilai pematuhan Standard Kualiti Air Tanah Bagi Rawatan Air Mentah Secara Konvensional (Air Minuman) kecuali bagi parameter arsenik (As), besi (Fe), mangan (Mn), klorida (Cl), sulfat (SO_4^{2-}), dan sebatian fenol mempunyai peratusan julat nilai pematuhan Standard Kualiti Air Tanah Bagi Rawatan Air Mentah Secara Konvensional (Air Minuman) yang rendah bagi guna tanah tertentu.

Dalam tahun 2022, daripada 368 stesen pengawasan kualiti air marin bagi pantai, muara sungai dan pulau di negara ini, sebanyak 149 stesen adalah terbaik, 69 stesen baik, 146 stesen sederhana manakala empat (4) stesen dikategorikan tercemar. Tiga (3) stesen tercemar berada di kawasan muara sungai manakala satu (1) stesen tercemar berada di kawasan pulau.

Sebanyak 5,915,073.84 tan metrik buangan terjadual telah dihasilkan. Ini mewakili penurunan keseluruhan sebanyak 21.19% berbanding 7,505,195.76 tan metrik yang dilaporkan pada 2021.

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

quality in 2022. The percentage of clean river stations is 74% in 2022 compared to 73% in the previous year. The percentage of polluted river stations slightly increased from 3% in 2021 to 4% in 2022.

In 2022, the results derived from the groundwater quality monitoring showed that all stations were within the Groundwater Quality Standards for Conventional Raw Water Treatment (Drinking Water) values except for arsenic (As), iron (Fe), manganese (Mn), chloride (Cl), sulphate (SO_4^{2-}), and phenolics which had a low range of Groundwater Quality Standards for Conventional Raw Water Treatment (Drinking Water) value.

In 2022, out of the 368 marine water quality monitoring stations at coastal, estuary and islands in the country, 149 stations were excellent, 69 were good, 146 were moderate while the remaining four (4) stations were categorised as poor. Three (3) of the poor water quality stations were located at the estuary and one (1) station was located at the island.

A total of 5,915,073.84 metric tonnes of scheduled wastes were generated. This represents an overall decrease of 21.19% as compared to 7,505,195.76 metric tonnes reported in 2021.

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

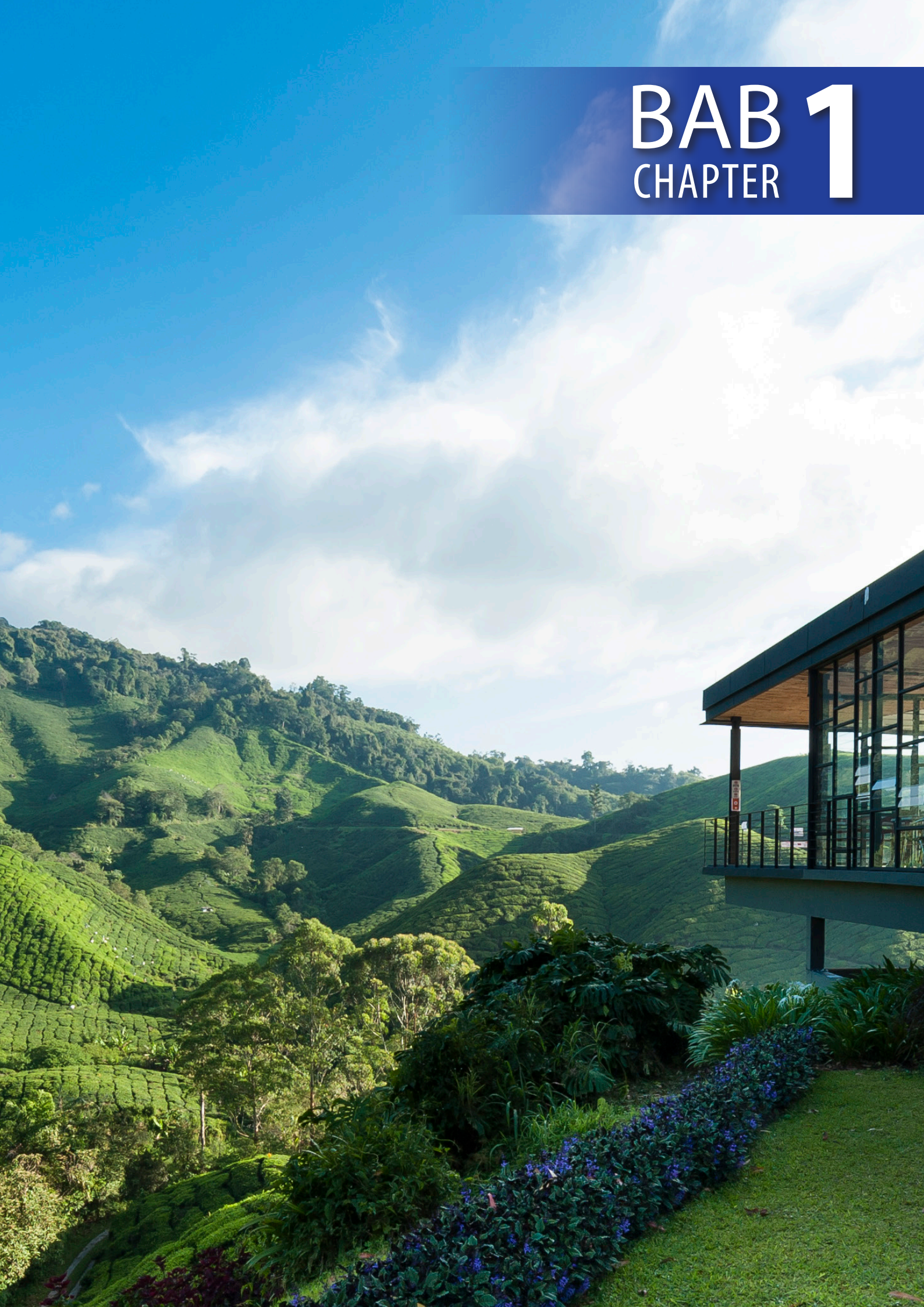
Tasik Chini

Cameron Highlands

KUALITI UDARA

AIR QUALITY

BAB 1
CHAPTER



PENGAWASAN KUALITI UDARA
AIR QUALITY MONITORING

Indeks Pencemar Udara (IPU) bagi keseluruhan Malaysia pada tahun 2022 telah menunjukkan sedikit peningkatan bagi peratus IPU berstatus baik berbanding tahun 2021.

The Air Pollutant Index (API) for the whole of Malaysia in 2022 has shown a slight increase in the percentage of good API status compared to 2021.

IPU adalah dikira berdasarkan kepekatan enam **(6)** bahan pencemar utama / The API is calculated based on concentration of six (6) major pollutants:

- Ozon di Permukaan Bumi (O_3)
  Ground Level Ozone (O_3)
- Karbon Monoksida (CO)
  Carbon Monoxide (CO)
- Nitrogen Dioksida (NO_2)
  Nitrogen Dioxide (NO_2)
- Sulfur Dioksida (SO_2)
  Sulphur Dioxide (SO_2)
- Habuk Halus Bersaiz Kurang dari 10 Mikron (PM_{10})
  Particulate Matter of Less than 10 Microns in Size (PM_{10})
- Habuk Halus Bersaiz Kurang dari 2.5 Mikron ($PM_{2.5}$)
  Particulate Matter of Less than 2.5 Microns in Size ($PM_{2.5}$)

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

68 Stesen pemantauan kualiti udara automatik di seluruh negara / Fully automatic air quality monitoring stations in the country

- **65** Stesen pemantauan tetap / Permanent monitoring stations
- **3** Stesen pemantauan mobil / Mobile monitoring stations

4 Jenis pengkelasan stesen kualiti udara mengikut guna tanah / Types of classification of air quality stations according to land use:

- Industri / Industrial
- Bandar / Urban
- Pinggir Bandar / Suburban
- Luar Bandar / Rural

4 Parameter menunjukkan penurunan kepekatan di udara iaitu PM_{10}, $PM_{2.5}$, O_3 dan CO bagi tahun 2022 berbanding tahun 2021 di antara 1% - 8% / Parameters show a decrease in the level of PM_{10}, $PM_{2.5}$, O_3 and CO for the year 2022 compared to the year 2021 between 1% - 8%

2 Parameter menunjukkan peningkatan kepekatan di udara iaitu SO_2 dan NO_2 bagi tahun 2022 berbanding tahun 2021 di antara 8% - 10% / Parameters show an increase in the concentration of SO_2 and NO_2 for the year 2022 compared to the year 2021 between 8% - 10%

46.1% Stesen menunjukkan IPU baik pada tahun 2022 untuk seluruh Malaysia / Stations show a good API in 2022 throughout of Malaysia

53.7% Stesen menunjukkan IPU sederhana pada tahun 2022 untuk seluruh Malaysia / Stations show a moderate API in 2022 throughout of Malaysia

0.2% Stesen menunjukkan IPU tidak sihat pada tahun 2022 untuk seluruh Malaysia / Stations indicate unhealthy API in 2022 throughout of Malaysia

KUALITI UDARA / AIR QUALITY

PENGAWASAN KUALITI UDARA

Pengawasan status kualiti udara dilaksanakan oleh Jabatan Alam Sekitar (JAS) melalui 65 stesen pengawasan kualiti udara yang ditempatkan di seluruh negara. Stesen-stesen pengawasan kualiti udara tersebut ditempatkan di lokasi yang dikategorikan sebagai kawasan bandar, pinggir bandar, perindustrian dan luar bandar bertujuan untuk mengesan sebarang perubahan ketara ke atas kualiti udara yang mungkin memberi kesan berbahaya kepada kesihatan dan alam sekitar. Satu stesen pengawasan kualiti udara dikategorikan sebagai latarbelakang yang menjadi penunjuk aras bacaan kualiti udara yang tidak terkesan dengan pencemaran udara di persekitaran.

Status kualiti udara di Malaysia ditunjukkan menerusi bacaan Indeks Pencemar Udara (IPU) dan bacaan IPU seluruh negara sentiasa dipaparkan di laman sesawang Jabatan *Air Pollutant Index Management System (APIMS)*. IPU adalah dikira berdasarkan kepekatan enam (6) 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 ($PM_{2.5}$). Pengiraan IPU adalah seperti di **ANNEX**. IPU ini dikategorikan sebagai baik, sederhana, tidak sihat, sangat tidak sihat dan berbahaya seperti yang dinyatakan dalam **Jadual 1.1**.

AIR QUALITY MONITORING

The Department of Environment (DOE) monitors ambient air quality throughout the country at 65 continuous monitoring stations. These monitoring stations are located in areas categorised as urban, sub urban, industrial and rural areas to detect any significant change in the air quality which may be harmful to human health and environment. One air quality monitoring station is classified as a background station, which becomes an indicator of air quality reading levels that are not affected by environmental air pollution.

The air quality status is reported in terms of Air Pollutant Index (API) and is constantly displayed on the Department's Air Pollutant Index Management System (APIMS) website. The API is calculated based on concentration of six (6) major pollutants, which are ground level ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulphur dioxide (SO_2), particulate matter of less than 10 microns in size (PM_{10}) and particulate matter of less than 2.5 microns in size ($PM_{2.5}$). The API calculation is as shown in **ANNEX**. The API is categorised as good, moderate, unhealthy, very unhealthy and hazardous as presented in **Table 1.1**.

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

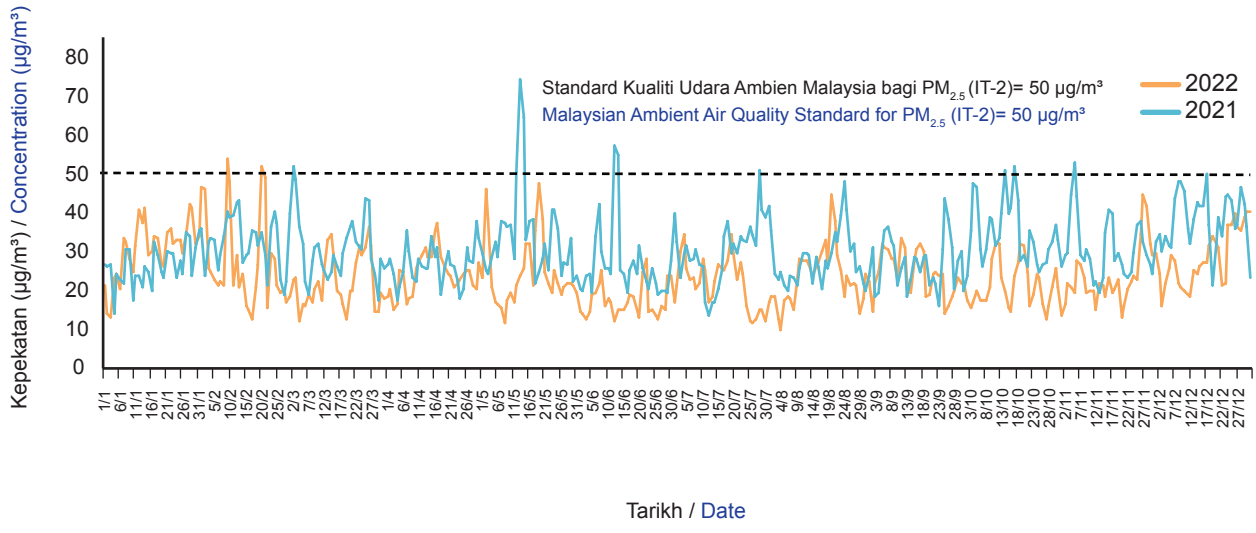
IPU / API	STATUS KUALITI UDARA / AIR QUALITY STATUS
0 – 50	Baik / Good
51 – 100	Sederhana / Moderate
101 – 200	Tidak Sihat / Unhealthy
201 – 300	Sangat Tidak Sihat / Very Unhealthy
> 300	Berbahaya / Hazardous

STATUS KUALITI UDARA

Indeks Pencemar Udara (IPU) bagi keseluruhan Malaysia pada tahun 2022 telah menunjukkan sedikit peningkatan bagi peratus IPU berstatus baik berbanding tahun 2021. Ini adalah kerana negara mengalami keadaan cuaca yang lebih lembap dan menerima hujan yang lebih banyak berbanding tahun sebelumnya yang mana keadaan ini telah mengurangkan kes-kes pencemaran udara di dalam negara. Walau bagaimanapun, pelepasan asap kenderaan, aktiviti perindustrian dan aktiviti pembakaran kawasan perladangan dan tapak pelupusan sampah masih lagi menjadi punca utama penurunan kualiti udara di Malaysia. Siri masa kepekatan purata harian $PM_{2.5}$ di kawasan Klang didapati lebih rendah pada tahun 2022 berbanding dengan tahun 2021 seperti yang ditunjukkan di dalam **Rajah 1.1**. Tiada kejadian jerebu merentas sempadan direkodkan bagi tahun 2022 disebabkan oleh keadaaan cuaca yang lebih lembap sepanjang tahun dan keadaan ini telah mengurangkan jumlah bilangan titik panas (*hotspots*) di dalam negara dan di negara ASEAN terutamanya di Indonesia.

AIR QUALITY STATUS

The Air Pollutant Index (API) for the whole of Malaysia in 2022 has shown a slight increase in the percentage of good API status compared to 2021. This is due to the fact that the country experienced more humid weather conditions and received more rain than the previous year thereby reducing cases of air pollution in the country. However, vehicle emissions, industrial activities and burning activities from plantation areas and landfills were still the main causes of air quality deterioration in Malaysia. The daily average concentration of $PM_{2.5}$ in the Klang area, following scheduled dates, was found to be lower in 2022 compared to 2021 as shown in **Figure 1.1**. In addition, no transboundary haze incidents were recorded for 2022 due to wetter weather conditions throughout the year and this situation has reduced the total number of hotspots within the country and in neighbouring countries in ASEAN, particularly in Indonesia.



Rajah 1.1: Tren Kepekatan 24 jam bagi Habuk Halus ($PM_{2.5}$), Klang 2021 dan 2022
Figure 1.1: Trend of 24-hour Concentration of Particulate Matter ($PM_{2.5}$), Klang 2021 and 2022

Rajah 1.2 menunjukkan perbandingan kepekatan purata harian $PM_{2.5}$ bagi ketiga-tiga jenis kategori stesen terpilih di kawasan bandar (Klang), pinggir bandar (Kuantan) dan luar bandar (Kapit). Tren menunjukkan kepekatan purata harian $PM_{2.5}$ adalah lebih tinggi di kawasan bandar berbanding kawasan pinggir bandar dan luar bandar. Tren kepekatan $PM_{2.5}$ bagi kawasan Klang menunjukkan peningkatan pada masa-masa tertentu sehingga melebihi Standard Kualiti Udara Ambien Malaysia IT-2. Peningkatan $PM_{2.5}$ di pinggir bandar dan di luar bandar pula sering dikaitkan dengan aktiviti pembakaran terbuka di kawasan pertanian yang dilakukan secara sengaja dan tidak sengaja serta menyumbang kepada penurunan kualiti udara di kawasan tersebut.

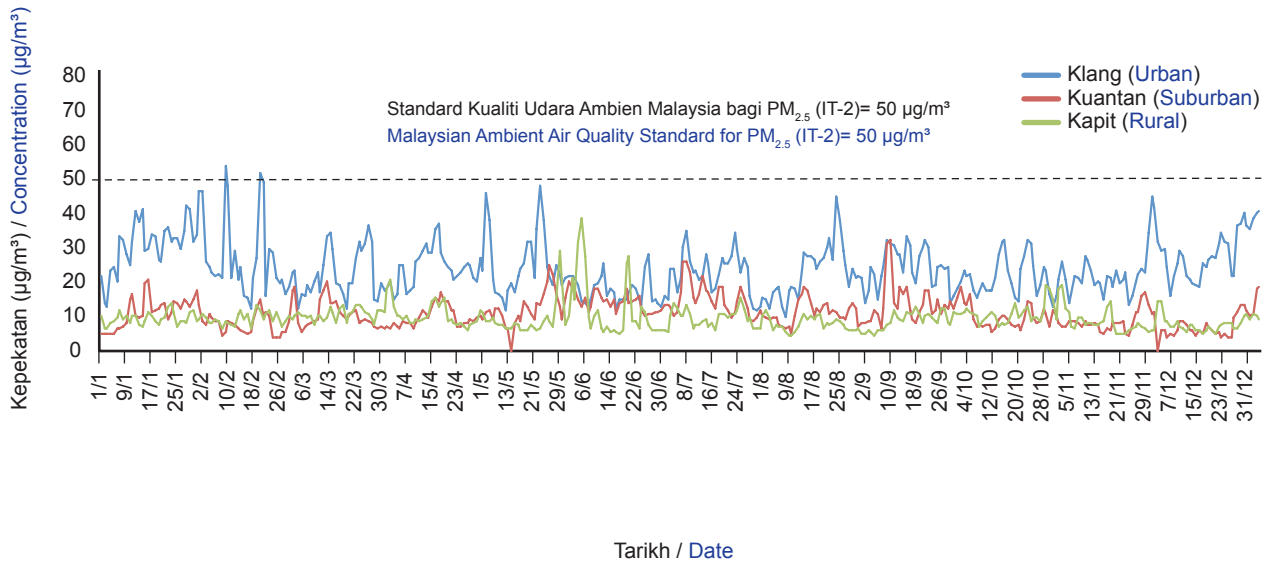
Selain pencemar $PM_{2.5}$, ozon permukaan bumi (O_3) merupakan pencemar udara yang menjadi perhatian. Ia merupakan gas pencemar udara sekunder yang terhasil daripada tindak balas sebatian-sebatian organik meruap (*Volatile Organic Compounds*, VOCs) dan oksid-oksid nitrogen (NO_x) dengan kehadiran cahaya matahari. Cuaca panas menggalakkan lagi pembentukan pencemar O_3. Punca utama VOCs dan NO_x adalah daripada pelepasan industri dan ekzos kenderaan bermotor terutama di bandar-bandar besar. Ini dapat ditunjukkan berdasarkan peningkatan kepekatan O_3 di beberapa lokasi di Lembah Klang seperti yang ditunjukkan di dalam **Rajah 1.3** dan **Rajah 1.4**.

Selain kawasan di Lembah Klang, beberapa kawasan di Kedah, Perak dan Negeri Sembilan menunjukkan kepekatan maksimum harian O_3 dalam tempoh 1 jam yang hampir dan melebihi Standard Kualiti Udara Ambien Malaysia seperti yang ditunjukkan di dalam **Rajah 1.5**. Keadaan ini adalah disebabkan oleh pelepasan gas-gas pencetus ozon aras bumi seperti NO_x dan VOCs di kawasan kepadatan trafik yang tinggi. Selain itu, faktor geografi dan meteorologi juga memainkan peranan penting dalam peningkatan ozon aras bumi di kawasan tersebut.

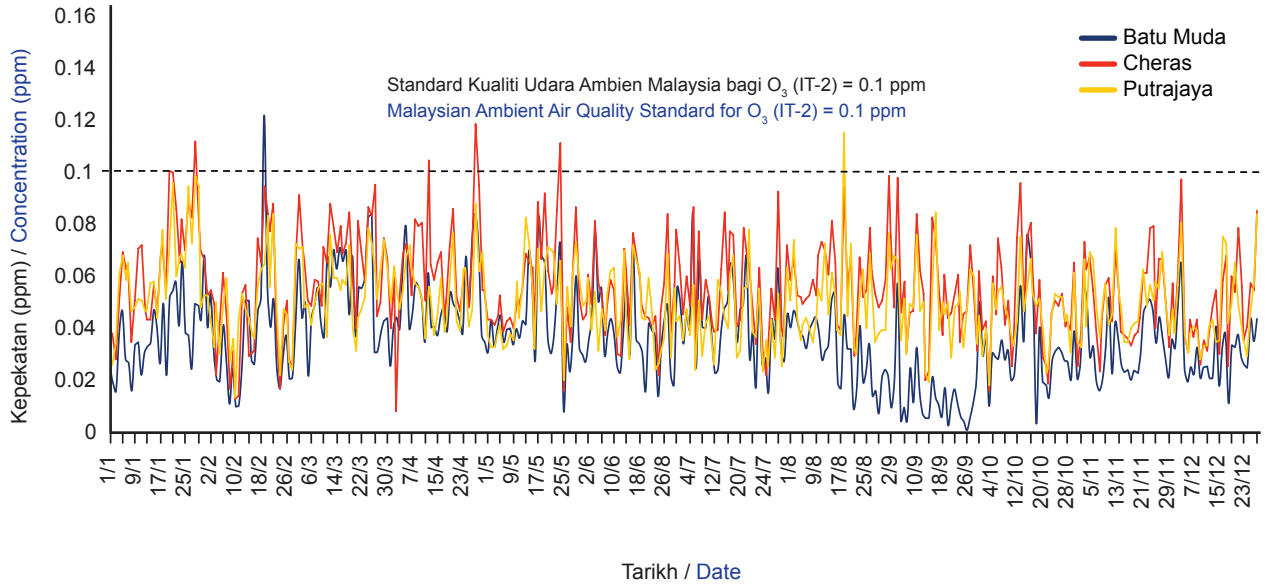
Figure 1.2 shows the daily concentrations of $PM_{2.5}$ for selected stations in three categories: urban (Klang), suburban (Kuantan) and rural (Kapit) in the country. The trend showed higher levels of $PM_{2.5}$ in the urban area compared to the suburban and rural areas. The trend of $PM_{2.5}$ concentrations for the Klang area showed an increase at certain times to exceed the Malaysian Ambient Air Quality Standard IT-2. The increase in $PM_{2.5}$ in the suburban and in rural areas were often associated with open burning activities in agricultural areas carried out intentionally and unintentionally that has contributed to the deterioration of air quality in those areas.

Besides $PM_{2.5}$, ground level ozone (O_3) remained the pollutant of concern. Ground level ozone is a secondary air pollutant that is formed as a result of the chemical reaction between Volatile Organic Compounds (VOCs) and nitrogen oxides (NO_x) in the presence of sunlight. Formation of O_3 enhances during hot and sunny days. Major sources of VOCs and NO_x emissions were from industries and motor vehicles particularly in urban areas. These are reflected in the readings of O_3 at various locations in the Klang Valley as shown in **Figure 1.3** and **Figure 1.4**.

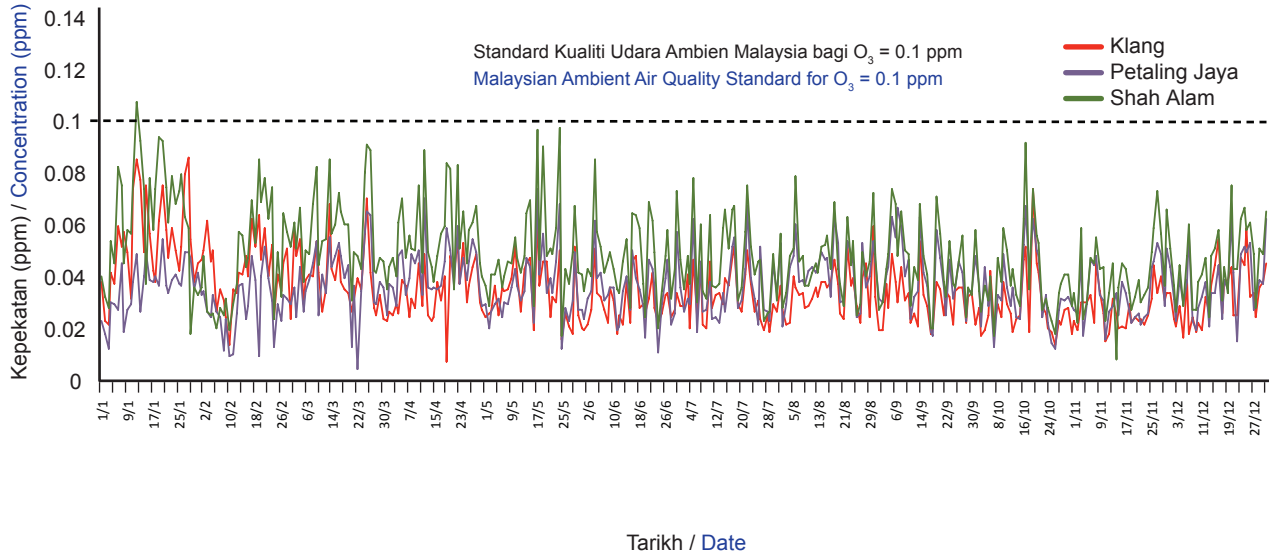
Apart from the Klang Valley, readings in selected areas in Kedah, Perak and Negeri Sembilan indicated daily maximum 1-hour concentration of O_3 which almost and in one instance exceeded the Malaysian Ambient Air Quality Standard as illustrated in **Figure 1.5**. This was due to the release of ground ozone level precursor pollutant gases such as NO_x and VOCs in some areas with heavy traffic volumes. Furthermore, geographical and meteorological factors also play important roles in the increase of ground level ozone in these areas.



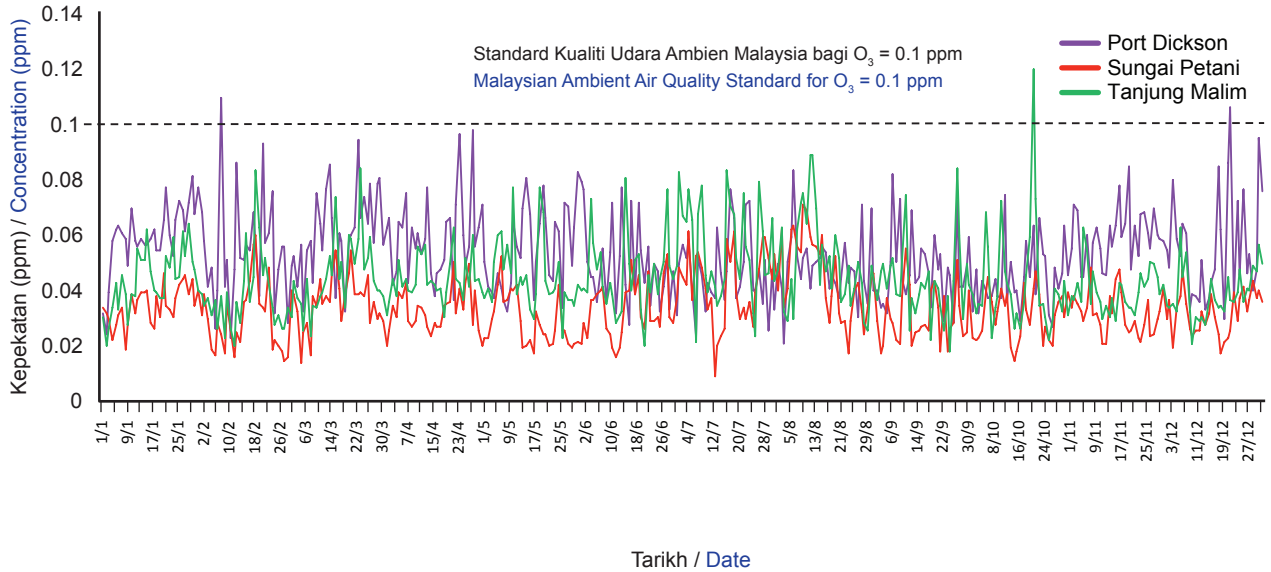
Rajah 1.2: Tren Kepekatan 24 jam bagi Habuk Halus ($PM_{2.5}$), 2022
Figure 1.2: Trend of 24-hour Concentration of Particulate Matter ($PM_{2.5}$), 2022



Rajah 1.3: Tren Kepekatan Maksimum Harian Ozon (O_3) 1 jam, Lembah Klang, 2022
Figure 1.3: Trend of Daily Maximum 1-hour Concentration of Ozone (O_3), Klang Valley 2022



Rajah 1.4: Tren Kepekatan Maksimum Harian Ozon (O_3) 1 jam, Lembah Klang, 2022
Figure 1.4: Trend of Daily Maximum 1-hour Concentration of Ozone (O_3), Klang Valley 2022



Rajah 1.5: Tren Kepekatan Maksimum Harian Ozon (O_3) 1 jam, 2022
Figure 1.5: Trend of Daily Maximum 1-hour Concentration of Ozone (O_3) 2022

STATUS KUALITI UDARA DI PANTAI BARAT

Lembah Klang

Pada tahun 2022, status kualiti udara di Lembah Klang menunjukkan semua stesen mencatatkan bacaan hari IPU sederhana yang lebih tinggi berbanding hari IPU baik sepanjang masa. Status kualiti udara di Lembah Klang secara keseluruhannya ditunjukkan seperti di **Rajah 1.6**. Putrajaya mencatatkan bilangan hari IPU baik yang tertinggi di Lembah Klang iaitu 98 hari manakala Klang mencatatkan bilangan hari IPU sederhana yang tertinggi iaitu 360 hari.

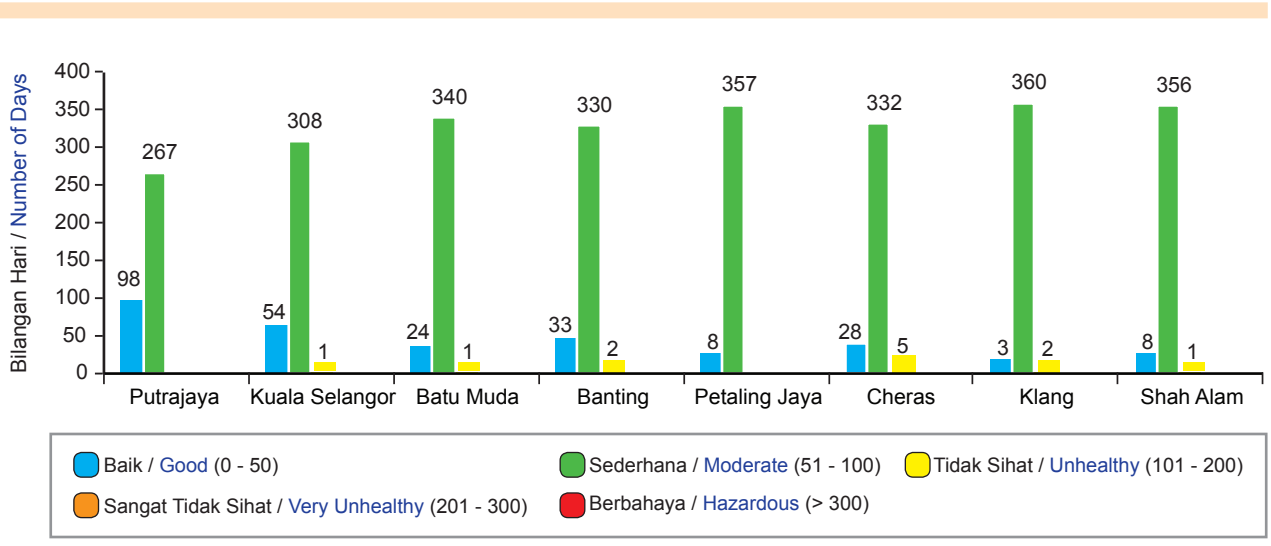
Bilangan hari IPU tidak sihat dengan rekod tertinggi adalah di Cheras (5 hari) dan diikuti oleh Banting dan Klang (2 hari) serta Batu Muda, Shah Alam dan Kuala Selangor (1 hari) seperti yang ditunjukkan di dalam **Rajah 1.7**. Tiada bilangan hari IPU tidak sihat direkodkan di stesen Putrajaya dan Petaling Jaya. Peningkatan bahan pencemar $PM_{2.5}$ seperti di Klang, pembentukan O_3 daripada pelepasan asap kenderaan di kawasan trafik yang tinggi seperti di Cheras, Batu Muda, Shah Alam dan Banting dan aktiviti pembakaran terbuka di kawasan pertanian seperti di Kuala Selangor adalah punca peningkatan bilangan hari IPU tidak sihat di Lembah Klang.

AIR QUALITY STATUS IN THE WEST COAST

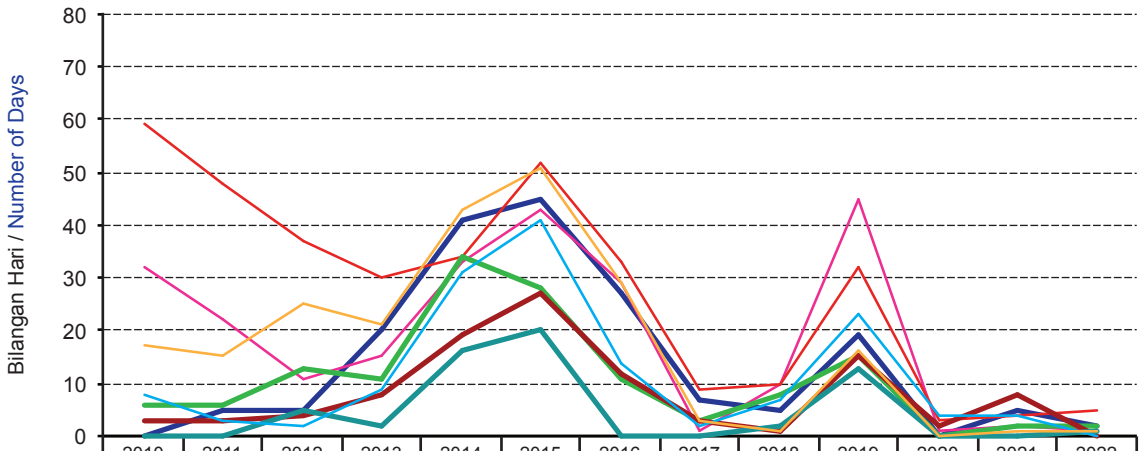
Klang Valley

The air quality status in the Klang Valley shown in **Figure 1.6**. indicates that API readings for 2022 were in the moderate range for most part of the year compared to API readings in the good range. Putrajaya recorded the highest number of 'good' API readings in the Klang Valley at 98 days while Klang recorded the highest number of 'moderate' API readings at 360 days.

The highest 'unhealthy' API reading was recorded in Cheras (5 days), followed by Banting and Klang (2 days) and Batu Muda, Shah Alam and Kuala Selangor (1 day) as shown in **Figure 1.7**. Putrajaya and Petaling Jaya stations recorded zero days of 'unhealthy' readings. Increased $PM_{2.5}$ pollutants such as in Klang, the formation of O_3 from vehicle smoke emissions in high traffic areas such as in Cheras, Batu Muda, Shah Alam and Banting and open burning activities in agricultural areas such as in Kuala Selangor are the cause of the increase in the number of unhealthy days in the Klang Valley.



Rajah 1.6: Status Kualiti Udara, Lembah Klang 2022
Figure 1.6: Air Quality Status, Klang Valley 2022



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Banting	0	5	5	20	41	45	27	7	5	19	0	5	2
Shah Alam	32	22	11	15	33	43	29	1	10	45	1	2	1
Cheras	59	48	37	30	34	52	33	9	10	32	3	4	5
Klang	6	6	13	11	34	28	11	3	8	15	0	2	2
Petaling Jaya	3	3	4	8	19	27	12	3	1	15	2	8	0
Kuala Selangor	0	0	5	2	16	20	0	0	2	13	0	0	1
Putrajaya	8	3	2	9	31	41	14	2	7	23	4	4	0
Batu Muda	17	15	25	21	43	51	29	3	1	16	0	1	1

Rajah 1.7: Bilangan Hari Tidak Sihat, Lembah Klang, 2010-2022
Figure 1.7: Number of Unhealthy Days, Klang Valley, 2010-2022

Putrajaya

Wilayah Utara

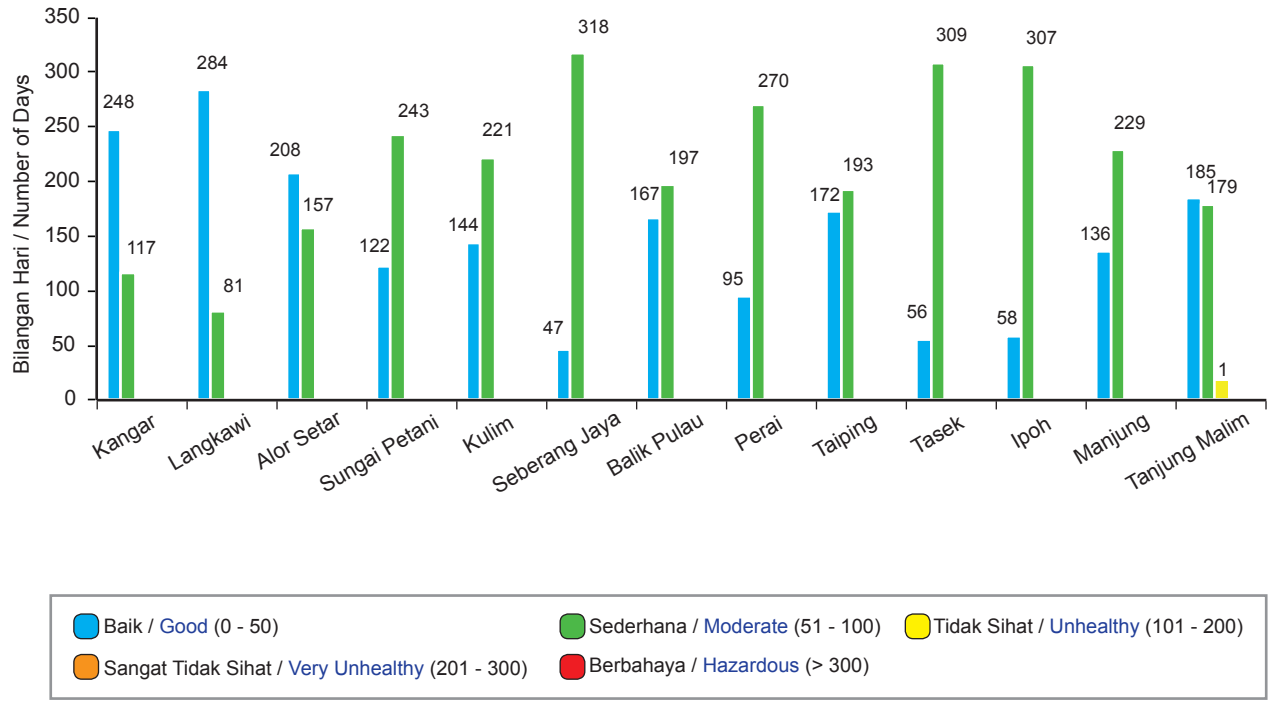
Secara keseluruhan, status kualiti udara di utara Pantai Barat Semenanjung Malaysia yang meliputi Negeri Perlis, Negeri Kedah, Negeri Pulau Pinang dan Negeri Perak adalah pada tahap baik dan sederhana sepanjang masa. Langkawi, Kedah mencatatkan bacaan hari IPU baik yang lebih tinggi (284 hari) berbanding stesen-stesen yang lain manakala Seberang Jaya, Pulau Pinang mencatatkan bacaan hari IPU sederhana tertinggi iaitu 318 hari. Hanya stesen Tanjung Malim, Perak yang mencatatkan bacaan hari IPU tidak sihat iaitu satu (1) hari sepanjang tahun 2022 di utara Pantai Barat Semenanjung Malaysia yang disebabkan oleh peningkatan ozon.

Rajah 1.8 menunjukkan status kualiti udara keseluruhan bagi wilayah utara di Pantai Barat Semenanjung Malaysia.

Northern Region

Overall the air quality status of the northern region of the West Coast of Peninsular Malaysia covering Perlis, Kedah, Pulau Pinang and Perak, were within good and moderate levels most of the time. Langkawi, Kedah recorded the highest number of days with good API readings (284 days) of all other stations while Seberang Jaya, Pulau Pinang recorded the highest number of days with moderate API readings (318 days). Tanjung Malim, Perak was the only location that recorded unhealthy API readings one (1) day during 2022 in the northern region of the West Coast of Peninsular Malaysia due to increased ozone levels.

Figure 1.8 shows the overall air quality status for the northern region of the West Coast of Peninsular Malaysia.



Rajah 1.8: Status Kualiti Udara, Wilayah Utara Pantai Barat Semenanjung Malaysia, 2022
Figure 1.8: Air Quality Status, Northern Region of The West Coast Peninsular Malaysia, 2022

Wilayah Selatan

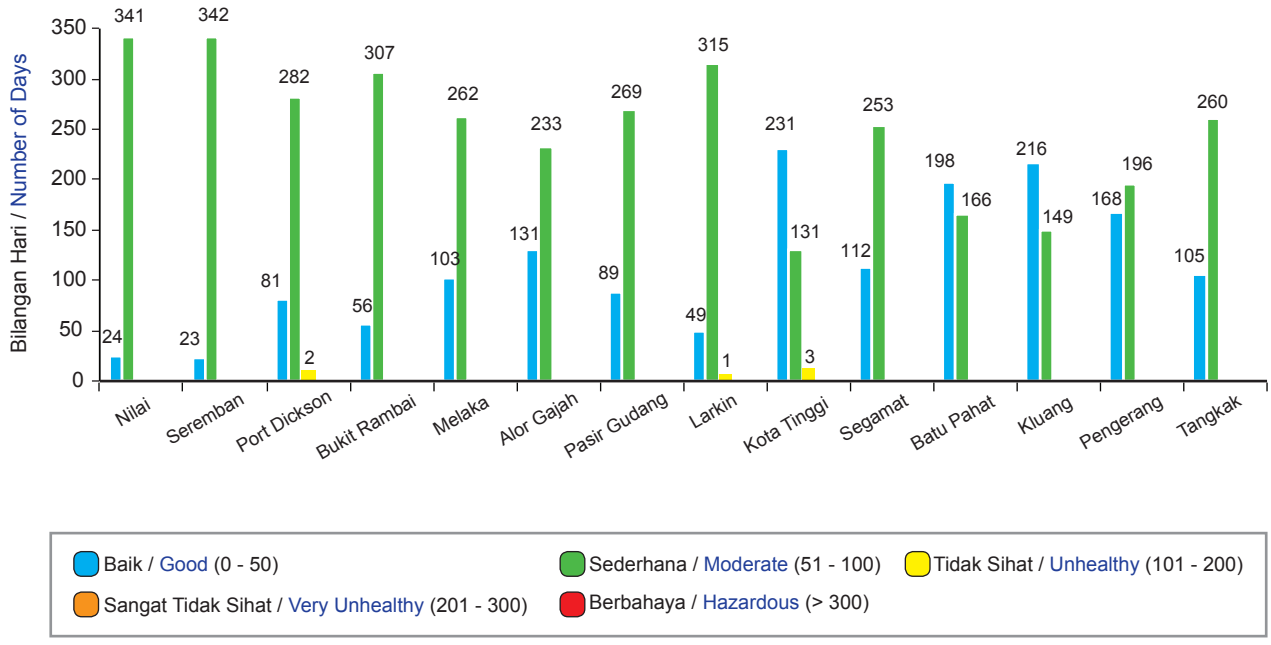
Kualiti udara di Wilayah Selatan Pantai Barat Semenanjung Malaysia (Negeri Sembilan, Negeri Melaka dan Negeri Johor) adalah berada pada tahap IPU baik dan sederhana sepanjang masa. Kota Tinggi, Johor mencatatkan bilangan bacaan hari IPU baik yang tertinggi di wilayah selatan (231 hari) manakala Seremban, Negeri Sembilan mencatatkan bacaan hari IPU sederhana tertinggi (342 hari). Hanya tiga (3) stesen yang mencatatkan bacaan hari IPU yang tidak sihat iaitu Port Dickson, Negeri Sembilan (2 hari) dan Kota Tinggi, Johor (3 hari) yang disebabkan oleh pembentukan O_3 di udara daripada kepadatan trafik yang tinggi dan Larkin, Johor (1 hari) yang disebabkan oleh pelepasan $PM_{2.5}$ daripada aktiviti pembakaran pertanian.

Rajah 1.9 menunjukkan status kualiti udara secara keseluruhan bagi wilayah selatan di Pantai Barat Semenanjung Malaysia.

Southern Region

In the southern region of the West Coast of Peninsular Malaysia (Negeri Sembilan, Melaka and Johor) the air quality API readings were within good and moderate levels most of the time. Kota Tinggi, Johor recorded the highest number of days with good API readings (231 days) in the southern region, while Seremban, Negeri Sembilan recorded the highest number of days with moderate API readings (342 days). Three (3) stations recorded unhealthy API readings namely Port Dickson, Negeri Sembilan (2 days) and Kota Tinggi, Johor (3 days) due to the ozone in the air from high traffic densities, while Larkin, Johor (1 day) due to the release of $PM_{2.5}$ from crop-burning activities.

Figure 1.9 shows the overall air quality status for the southern region of the West Coast of Peninsular Malaysia.



Rajah 1.9: Status Kualiti Udara, Wilayah Selatan Pantai Barat Semenanjung Malaysia, 2022
Figure 1.9: Air Quality Status, Southern Region of The West Coast Peninsular Malaysia, 2022

STATUS KUALITI UDARA DI PANTAI TIMUR

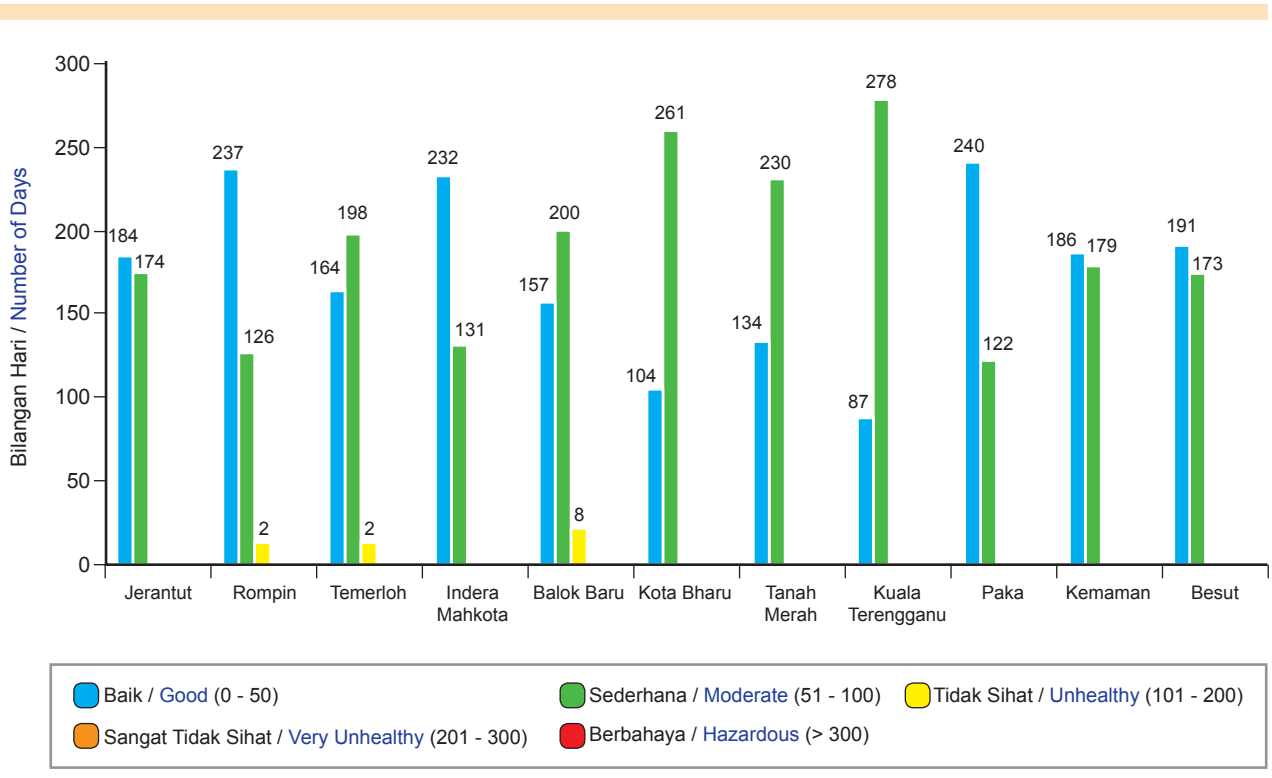
Kualiti udara di Pantai Timur Semenanjung Malaysia (Negeri Pahang, Negeri Terengganu, Negeri Kelantan dan timur Negeri Johor) bagi tahun 2022 berstatus baik dan sederhana pada kebanyakan masa. Paka, Terengganu mencatatkan bilangan bacaan hari IPU baik tertinggi (240 hari) dan Kuala Terengganu, Terengganu merekodkan bacaan hari IPU sederhana tertinggi (278 hari). Tiga (3) stesen mencatatkan status kualiti udara tidak sihat di Pantai Timur Semenanjung Malaysia iaitu Rompin dan Temerloh, Pahang (2 hari) yang disebabkan oleh peningkatan kepekatan $PM_{2.5}$ akibat kebakaran hutan dan belukar di kawasan setempat serta Balok Baru, Pahang (8 hari) akibat daripada peningkatan bacaan gas sulfur dioksida daripada kawasan perindustrian yang berhampiran.

Status kualiti udara di Pantai Timur Semenanjung Malaysia secara keseluruhan adalah seperti di **Rajah 1.10**.

AIR QUALITY STATUS IN THE EAST COAST

In the East Coast of Peninsular Malaysia (Pahang, Terengganu, Kelantan and East Johor) the air quality remained at good and moderate levels most of the time. Paka, Terengganu recorded the highest number of days with good API readings (240 days) in the east coast region. Kuala Terengganu, Terengganu recorded the highest number of days with moderate API readings (278 days). Three (3) stations recorded unhealthy air quality status over the year; namely Rompin and Temerloh, Pahang, with (2 days) each due to the increase in $PM_{2.5}$ concentrations as a result of forest and bush fires in the local areas, while Balok Baru, Pahang recorded (8 days) of very unhealthy API readings due to the high reading of sulphur dioxide gas from nearby industrial areas.

The overall air quality status in the East Coast of Peninsular Malaysia is shown in **Figure 1.10**.



Rajah 1.10: Status Kualiti Udara, Pantai Timur Semenanjung Malaysia, 2022
Figure 1.10: Air Quality Status, East Coast Peninsular Malaysia, 2022

STATUS KUALITI UDARA DI SABAH, LABUAN DAN SARAWAK

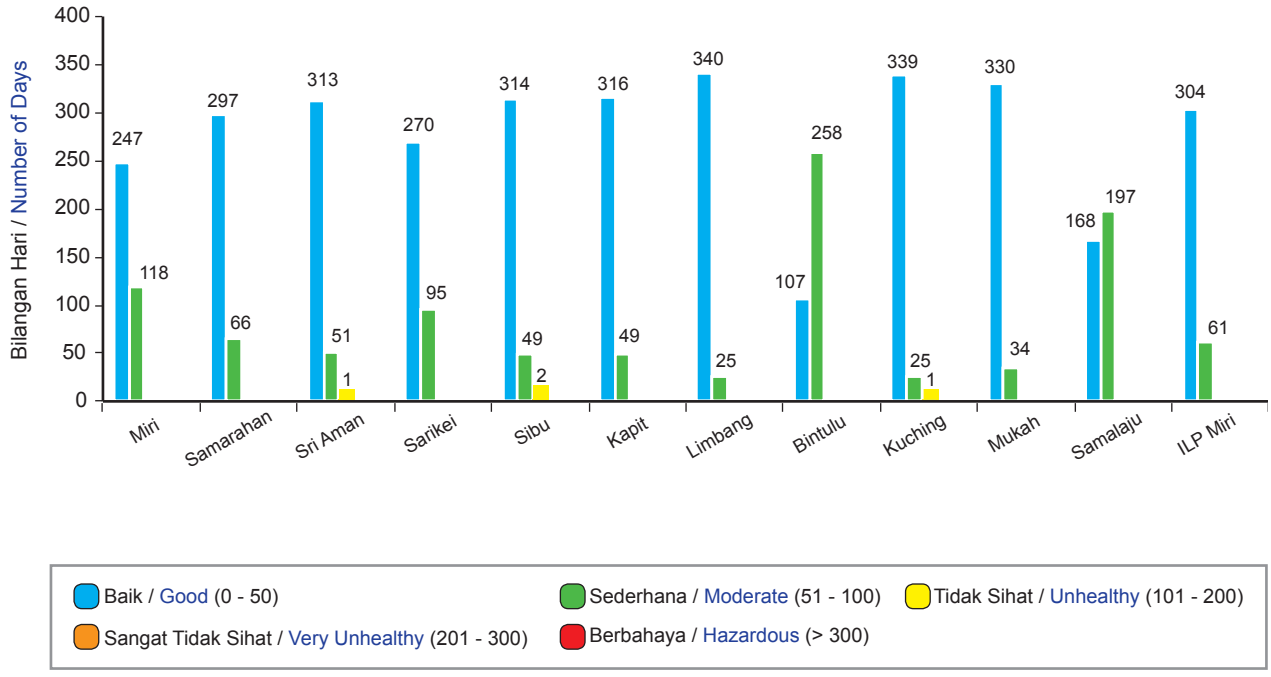
Kualiti udara di Sabah, Labuan dan Sarawak adalah pada tahap baik dan sederhana sepanjang masa bagi tahun 2022. Limbang merekodkan bacaan hari IPU baik yang paling tinggi di Sarawak (340 hari) dan Kimanis merekodkan bacaan hari IPU baik yang tertinggi di Sabah (355 hari). Manakala bagi Labuan, bacaan hari IPU baik lebih tinggi dicatatkan (250 hari) berbanding dengan bacaan hari IPU sederhana iaitu 114 hari. Terdapat tiga (3) stesen di Sarawak yang mencatatkan bacaan tidak sihat bagi tahun 2022 iaitu Sibu (2 hari), Sri Aman dan Kuching (1 hari) yang disebabkan oleh peningkatan kepekatan $PM_{2.5}$ akibat kebakaran hutan dan belukar di kawasan setempat.

Status kualiti udara di Sarawak secara keseluruhan ditunjukkan dalam **Rajah 1.11** dan di Sabah dan Labuan ditunjukkan dalam **Rajah 1.12**.

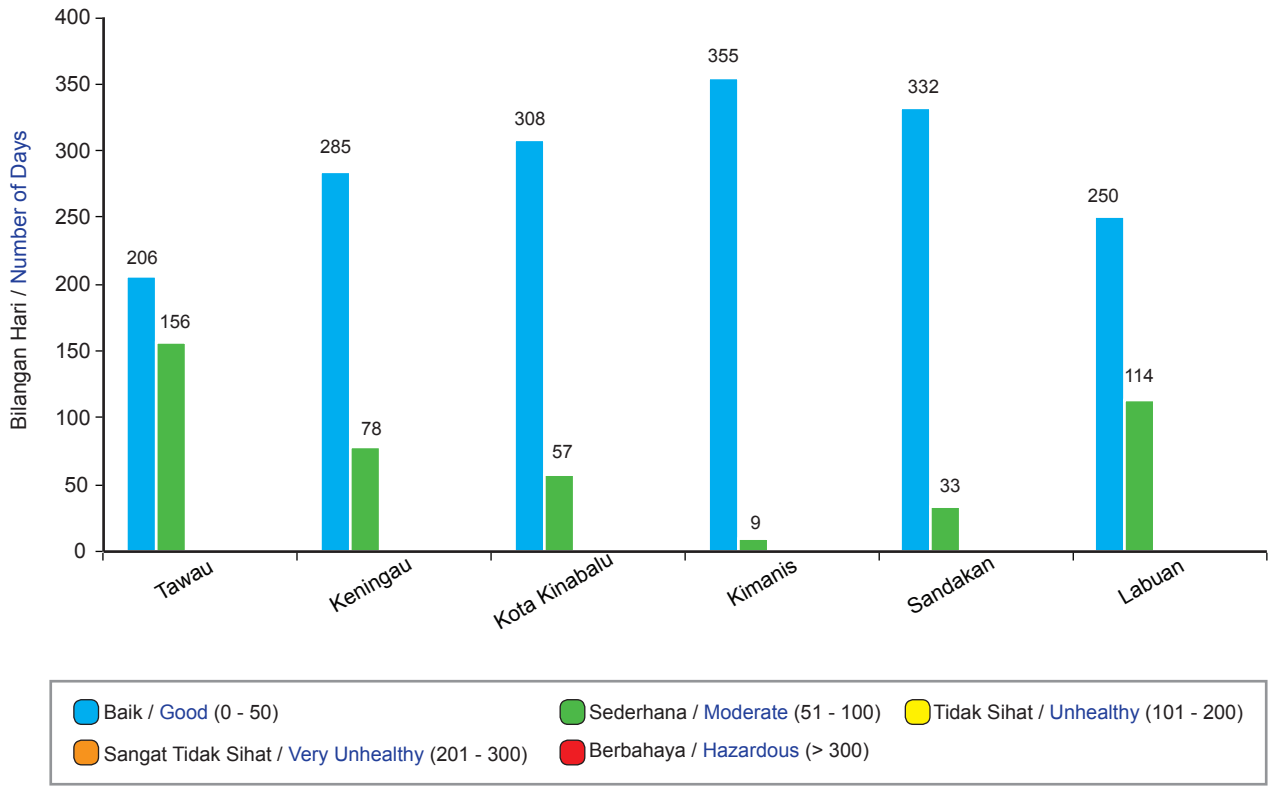
AIR QUALITY STATUS IN SABAH, LABUAN AND SARAWAK

The air quality in Sabah, Labuan and Sarawak remained between good to moderate levels most of the time in the year 2022. Limbang recorded the highest number of days of good API readings (340 days) in Sarawak and Kimanis recorded the highest number of days of good API readings (355 days) in Sabah. For Labuan, though, the number of days with good API readings was higher (250 days) compared to the number of days with moderate API readings, which was 114 days. There were three (3) stations in Sarawak which recorded unhealthy API readings due to the increase in $PM_{2.5}$ concentrations as a result of forest and bush fires in the local areas. These were Sibu (2 days), Sri Aman and Kuching (1 day).

The overall air quality status in Sarawak is shown in **Figure 1.11** and **Figure 1.12** shows the overall air quality in Sabah and Labuan.



Rajah 1.11: Status Kualiti Udara, Sarawak, 2022
Figure 1.11: Air Quality Status, Sarawak, 2022



Rajah 1.12: Status Kualiti Udara, Sabah dan Labuan, 2022
Figure 1.12: Air Quality Status, Sabah and Labuan, 2022

TREN KUALITI UDARA

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 2022 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**. Bagi tahun 2022, Standard Kualiti Udara Ambien Malaysia IT-2 telah digunakan.

AIR QUALITY TREND

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 monitored continuously at 65 locations. Parameters of $PM_{2.5}$ were fully monitored from the year 2018. The air quality trend for the period 2010 to 2022 was computed by averaging annual air quality data received from the monitoring sites and referenced against the Malaysia Ambient Air Quality Standard as shown in **Table 1.2**. For 2022, Malaysia Ambient Air Quality Standard IT-2 was used.

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

PARAMETER	MASA PURATA / TIME AVERAGING	UNIT	GARIS PANDUAN SEDIA ADA / EXISTING GUIDELINES	STANDARD KUALITI UDARA AMBIEN MALAYSIA / MALAYSIAN AMBIENT AIR QUALITY		
				IT-1 (2015)	IT-2 (2018)	IT-3 (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 (PM_{10})

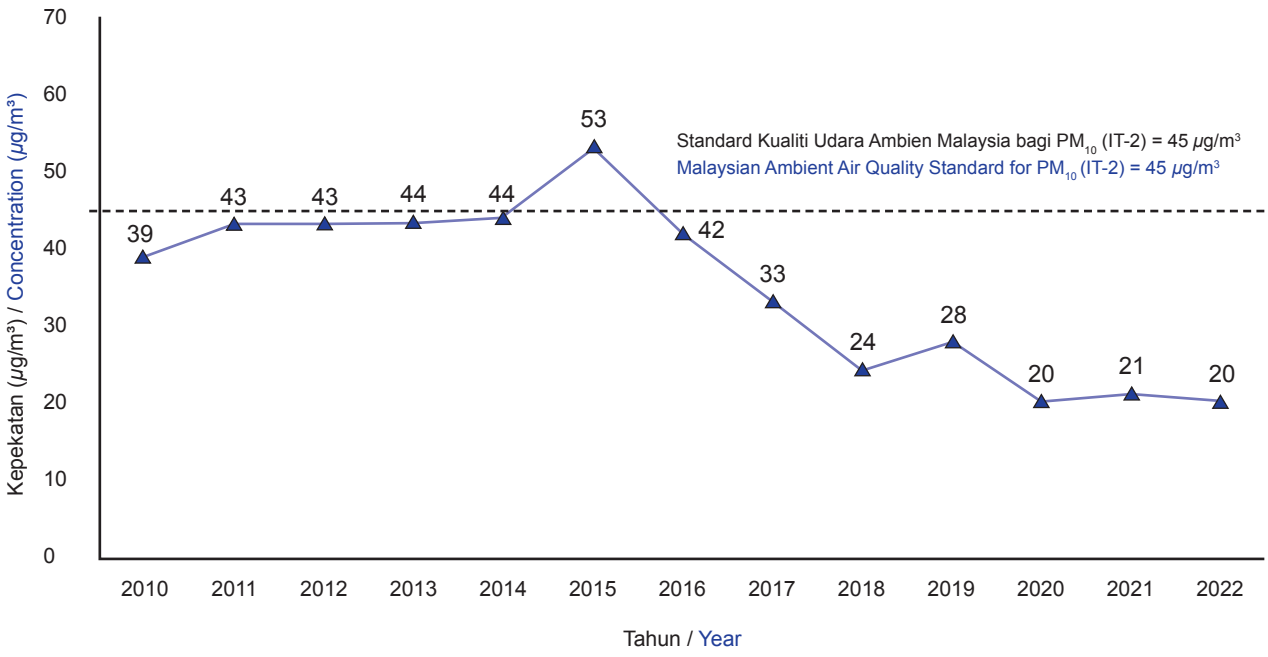
Tren purata tahunan kepekatan PM_{10} dalam udara ambien bagi tahun 2010 hingga tahun 2022 adalah seperti yang ditunjukkan dalam **Rajah 1.13**. Pada tahun 2022, nilai purata kepekatan tahunan PM_{10} dalam udara ambien adalah 20 µg/m³ iaitu masih belum melebihi had yang ditetapkan dalam Standard Kualiti Udara Ambien Malaysia bagi IT-2 iaitu sebanyak 45 µg/m³. Bacaan PM_{10} bagi tahun 2022 menunjukkan sedikit penurunan berbanding tahun 2021.

Berdasarkan kategori guna tanah, kawasan bandar merekodkan bacaan PM_{10} yang lebih tinggi berbanding kawasan yang lain seperti yang ditunjukkan dalam **Rajah 1.14**. Keadaan cuaca yang lembap sepanjang tahun telah menyebabkan pengurangan aktiviti pembakaran terbuka dan menyebabkan pengurangan kepekatan PM_{10} di kawasan pinggir bandar dan pendalaman berbanding tahun 2021.

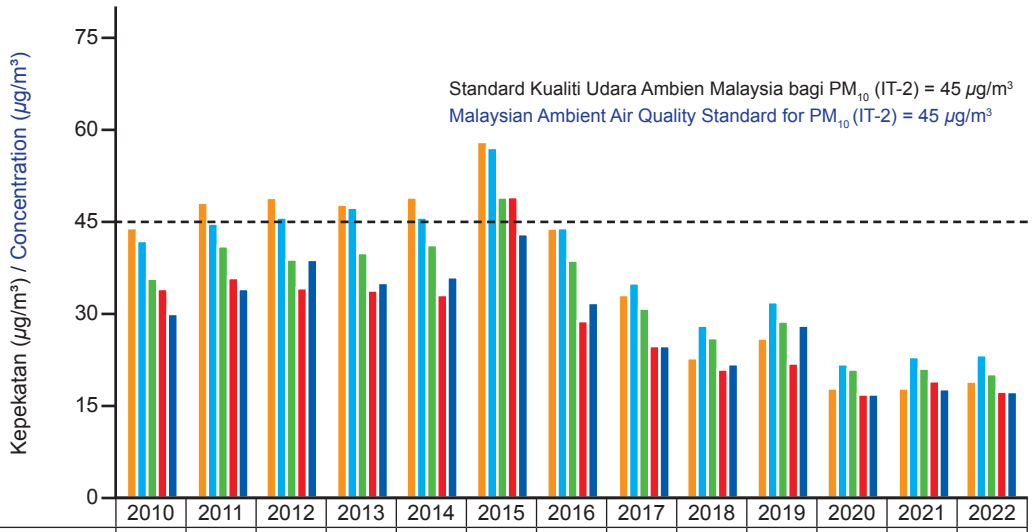
PARTICULATE MATTER (PM_{10})

The trend of the annual average levels of PM_{10} concentration in the ambient air from the year 2010 until 2022 is shown in **Figure 1.13**. In 2022, the annual average value of PM_{10} in the ambient air was 20 µg/m³ which is lower than the Malaysian Ambient Air Quality Standard IT-2 value of 45 µg/m³. The PM_{10} reading for 2022 shows a slight decrease compared to 2021.

Based on land categorisation, urban areas recorded higher PM_{10} readings than other areas as shown in **Figure 1.14**. Wet weather conditions throughout the year have led to a reduction in open burning activities and resulted in a reduction in PM_{10} concentrations in suburban and rural areas compared to 2021.



Rajah 1.13: Purata Kepekatan Tahunan Habuk Halus (PM_{10}), 2010-2022
Figure 1.13: Annual Average Concentration of Particulate Matter (PM_{10}), 2010-2022



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Industri / Industrial	44	48	49	48	49	58	44	33	23	26	18	18	19
Bandar / Urban	42	45	46	48	46	57	44	35	28	32	22	23	23
Pinggir Bandar / Suburban	36	41	39	40	41	49	39	31	26	29	21	21	20
Latarbelakang / Background	34	36	34	34	33	49	29	25	21	22	17	19	17
Luar Bandar / Rural	30	34	39	35	36	43	32	25	22	28	17	18	17

Rajah 1.14: Purata Kepekatan Tahunan Habuk Halus (PM_{10}) mengikut Guna Tanah, 2010-2022
Figure 1.14: Annual Average Concentration of Particulate Matter (PM_{10}) by Land Use, 2010-2022

HABUK HALUS ($PM_{2.5}$)

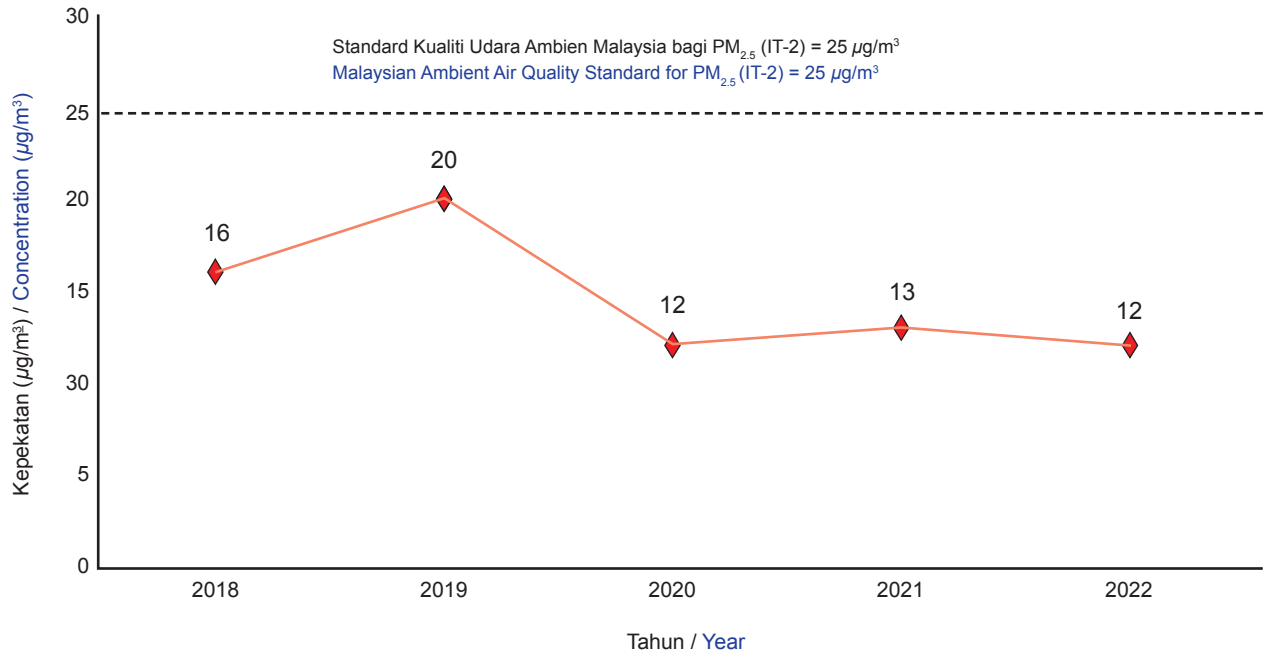
$PM_{2.5}$ mula diukur dan dianalisis bermula pada pertengahan tahun 2017 dan mula dilaporkan di dalam Laporan Kualiti Alam Sekitar bermula pada tahun 2018. Nilai purata tahunan $PM_{2.5}$ dalam udara ambien bagi tahun 2022 adalah 12 µg/m³ iaitu rendah sedikit dari tahun 2021 dan masih belum melebihi had yang ditetapkan dalam Standard Kualiti Udara Ambien Malaysia bagi IT-2 iaitu sebanyak 25 µg/m³ seperti yang ditunjukkan di dalam **Rajah 1.15**.

Berdasarkan kategori guna tanah, nilai purata kepekatan tahunan $PM_{2.5}$ tertinggi adalah di kawasan bandar dan diikuti dengan kawasan pinggir bandar, industri dan luar bandar seperti yang ditunjukkan dalam **Rajah 1.16**. Peningkatan kepekatan $PM_{2.5}$ di udara adalah merujuk kepada aktiviti pembakaran bahan bakar daripada kenderaan, aktiviti kerja tanah dan juga kegiatan pembakaran terbuka perladangan dan tapak pelupusan sampah.

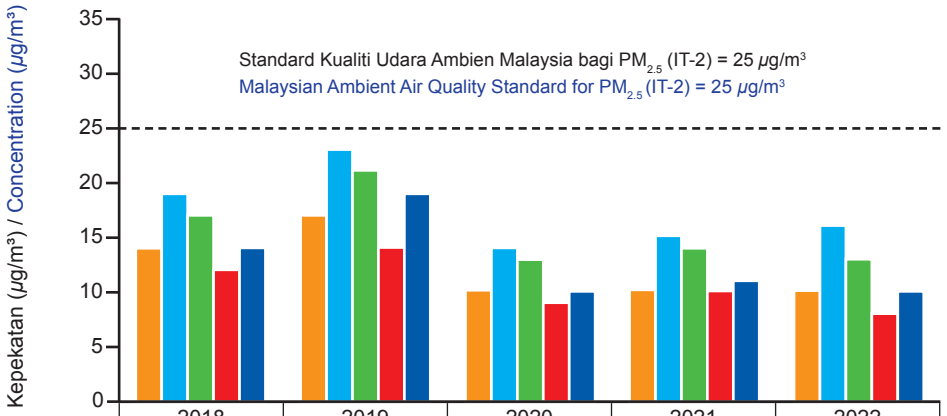
PARTICULATE MATTER ($PM_{2.5}$)

$PM_{2.5}$ began to be measured and analysed in mid-2017 and it was first reported in the Environmental Quality Report in 2018. The annual average value of $PM_{2.5}$ in the ambient air in year 2022 was 12 µg/m³ which was slightly lower than that in 2021 and much lower than the Malaysian Ambient Air Quality Standard value of IT-2 at 25 µg/m³ as shown in **Figure 1.15**.

Based on land categorisation, the highest average annual concentration values of $PM_{2.5}$ was in urban areas, followed by suburban, industrial and rural areas as shown in **Figure 1.16**. The increase in $PM_{2.5}$ concentration in the air is a result of fuel burning activities from vehicles, earthworks activities as well as open burning activities of vegetation and landfills burnings.



Rajah 1.15: Purata Kepekatan Tahunan Habuk Halus ($PM_{2.5}$), 2018-2022
Figure 1.15: Annual Average Concentration of Particulate Matter ($PM_{2.5}$), 2018-2022



	2018	2019	2020	2021	2022
Industri / Industrial	14	17	10	10	10
Bandar / Urban	19	23	14	15	16
Pinggir Bandar / Suburban	17	21	13	14	13
Latarbelakang / Background	12	14	9	10	8
Luar Bandar / Rural	14	19	10	11	10

Rajah 1.16: Purata Kepekatan Tahunan Habuk Halus ($PM_{2.5}$) mengikut Guna Tanah, 2018-2022
Figure 1.16: Annual Average Concentration of Particulate Matter ($PM_{2.5}$) by Land Use, 2018-2022

OZON PERMUKAAN BUMI (O_3)

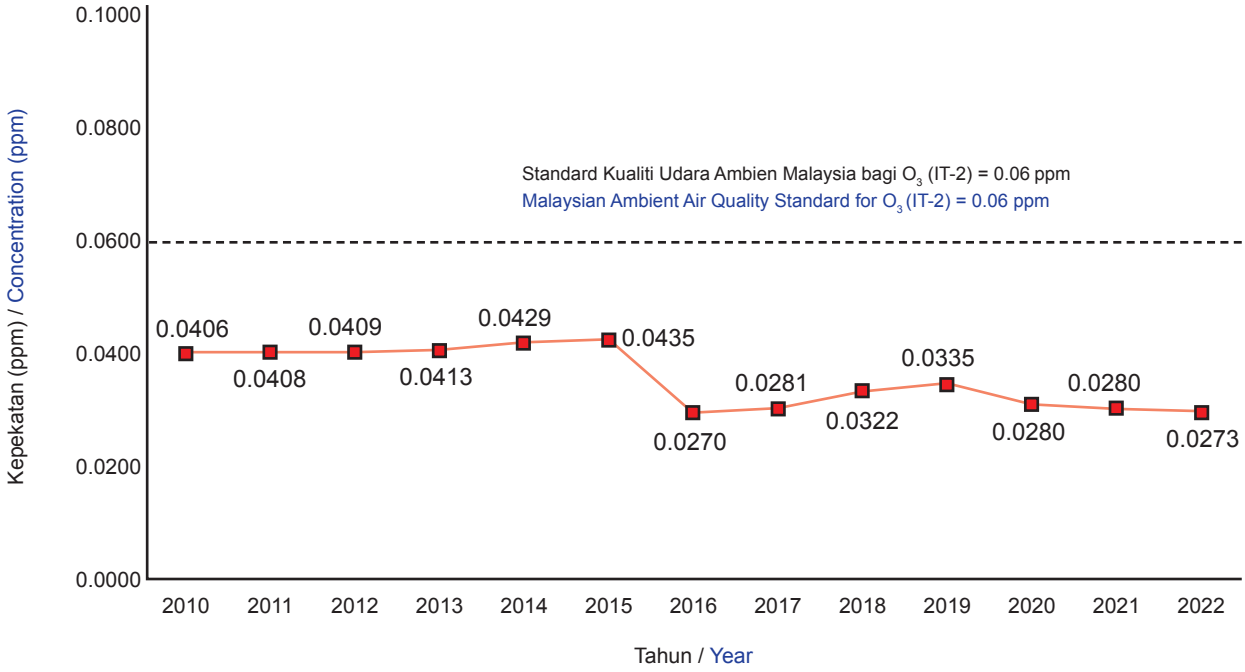
Pada tahun 2022, purata tahunan kepekatan maksimum harian ozon didapati sedikit menurun berbanding dengan tahun 2021 dengan bacaan 0.0273 ppm. Secara keseluruhannya, tren purata tahunan kepekatan maksimum ozon tempoh 8 jam dalam udara ambien adalah mematuhi had sebanyak 0.06 ppm seperti yang ditetapkan dalam Standard Kualiti Udara Ambien Malaysia IT-2 dan seperti yang ditunjukkan dalam **Rajah 1.17**.

Rajah 1.18 menunjukkan kepekatan ozon permukaan bumi untuk pelbagai kategori guna tanah dari tahun 2010 hingga 2022. 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 padat dan keadaan atmosfera yang kondusif menyebabkan pembentukan ozon. Pencemaran ozon permukaan bumi juga ketara di beberapa kawasan pinggir bandar disebabkan oleh pergerakan angin yang membawa pencetus pencemar ozon aras bumi iaitu oksida nitrogen (NO_x) dan sebatian organik meruap (VOC) yang kebanyakannya dilepaskan daripada kenderaan bermotor dan industri.

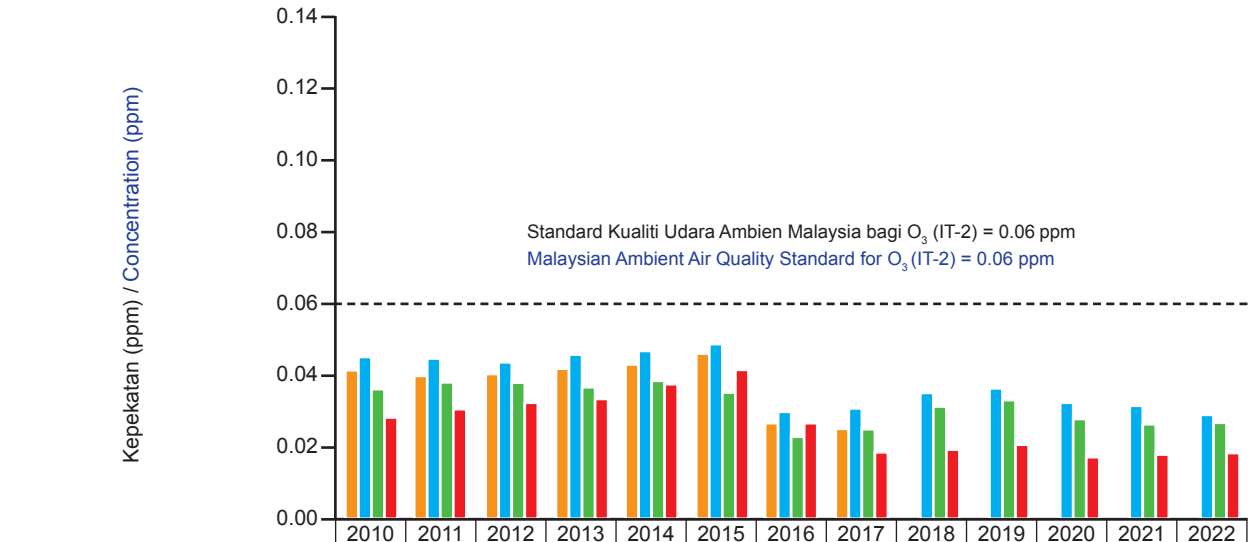
GROUND LEVEL OZONE (O_3)

In 2022, the annual average concentration of ozone decreased slightly compared to that of 2021 with the reading of 0.0273 ppm. The overall trend on the annual average daily maximum eight-hour ozone concentrations in ambient air were well below the limit of 0.06 ppm as stipulated in the Malaysia Ambient Quality Standard IT-2 and as shown in **Figure 1.17**.

Figure 1.18 shows the ground level ozone concentration for various land use categories between 2010 and 2022. From 2018, there has been no monitoring of ozone in industrial areas as the priority was given to the urban area monitoring. Urban areas recorded higher levels of ground level ozone due to dense traffic volume and a conducive atmospheric condition resulting in ozone formation. Ground level ozone pollution was also dominant in some sub urban areas due to downwind effect transporting ground level ozone pollutant precursors namely nitrogen oxides (NO_x) and volatile organic compound (VOC), emitted mainly from motor vehicles and industries.



Rajah 1.17: Purata Kepekatan Tahunan Ozon (O_3), 2010-2022
Figure 1.17: Annual Average Concentration of Ozone (O_3), 2010-2022



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Industri / Industrial	0.0412	0.0402	0.0407	0.0417	0.0431	0.0463	0.0270	0.0254	0.0000	0.0000	0.0000	0.0000	0.0000
Bandar / Urban	0.0453	0.0447	0.0441	0.0457	0.0469	0.0489	0.0300	0.0309	0.0353	0.0367	0.0325	0.0317	0.0292
Pinggir Bandar / Suburban	0.0364	0.0383	0.0386	0.0370	0.0388	0.0354	0.0230	0.0254	0.0316	0.0330	0.0278	0.0266	0.0269
Latarbelakang / Background	0.0287	0.0309	0.0327	0.0335	0.0378	0.0316	0.0270	0.0193	0.0197	0.0212	0.0175	0.0180	0.0189

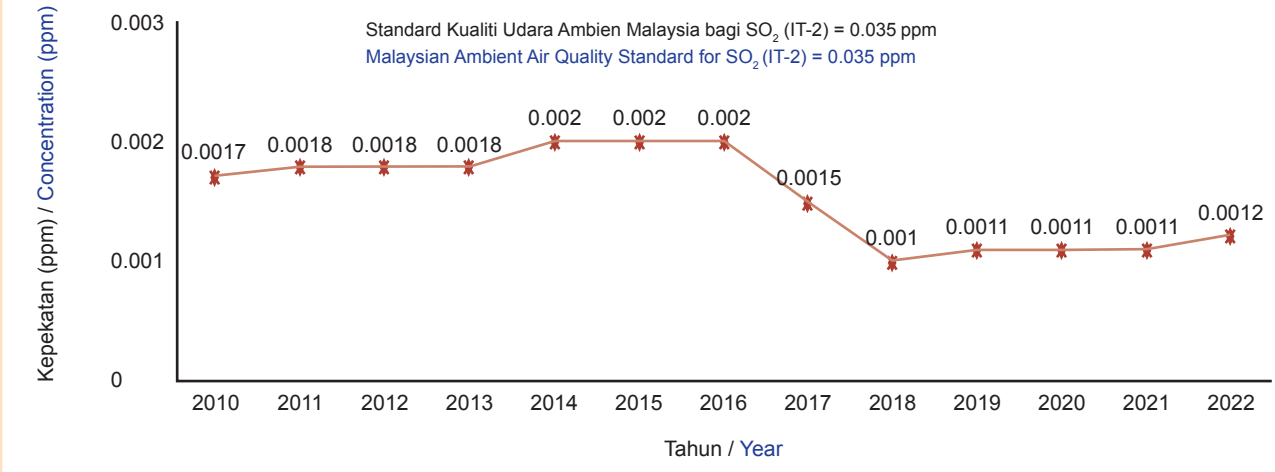
Rajah 1.18: Purata Kepekatan Tahunan Ozon (O_3), Mengikut Guna Tanah 2010-2022
Figure 1.18: Annual Average Concentration of Ozone (O_3) by Land Use, 2010-2022

SULFUR DIOKSIDA (SO_2)

Purata kepekatan tahunan SO_2 yang direkodkan pada tahun 2022 adalah tinggi sedikit dibandingkan dengan tahun 2021 iaitu 0.0012 ppm. Walau bagaimanapun, ia masih jauh di bawah had sebanyak 0.035 ppm seperti yang ditetapkan dalam Standard Kualiti Udara Ambien Malaysia IT-2 (**Rajah 1.19**). JAS dan beberapa agensi berkaitan telah melaksanakan beberapa strategi dalam mengurangkan kepekatan SO_2 di Malaysia dan di antaranya adalah menggalakkan penggunaan bahan api berkualiti dan menggalakkan penggunaan gas asli secara meluas dalam proses industri dan kegunaan kenderaan. Mulai Januari 2020, EURO4M RON95 yang mengandungi kandungan sulfur kurang dari 50 mg/l telah dilaksanakan. Pada 1 April 2021, EURO5 Diesel yang mengandungi kandungan sulfur kurang dari 10 mg/l pula telah diperkenalkan di pasaran. Strategi-strategi ini sedikit sebanyak mempengaruhi tren pelepasan SO_2 di kawasan industri dan bandar yang menunjukkan pelepasan SO_2 hampir sentiasa menurun.

SULPHUR DIOXIDE (SO_2)

The average annual concentration of SO_2 recorded in 2022 is slightly higher when compared with 2021 which is 0.0012 ppm. However, it is still well below the limit of 0.035 ppm as stipulated in the Malaysian Ambient Air Quality Standard IT-2 (**Figure 1.19**). DOE and several related agencies have implemented several strategies to help reduce the concentration of SO_2 in Malaysia and among them is to encourage the use of better fuel quality and encourage the use of natural gas for industrial combustion processes and vehicles. Beginning January 2020, petrol EURO4M RON 95 with the sulfur content of less than 50 mg/l has been implemented. EURO5 Diesel with the sulfur content of less than 10 mg/l has been introduced in the market on 1st April 2021. These strategies to some extent have influenced the trend of SO_2 emissions in industrial and urban areas, which show that SO_2 emission is mostly on a constant decline.



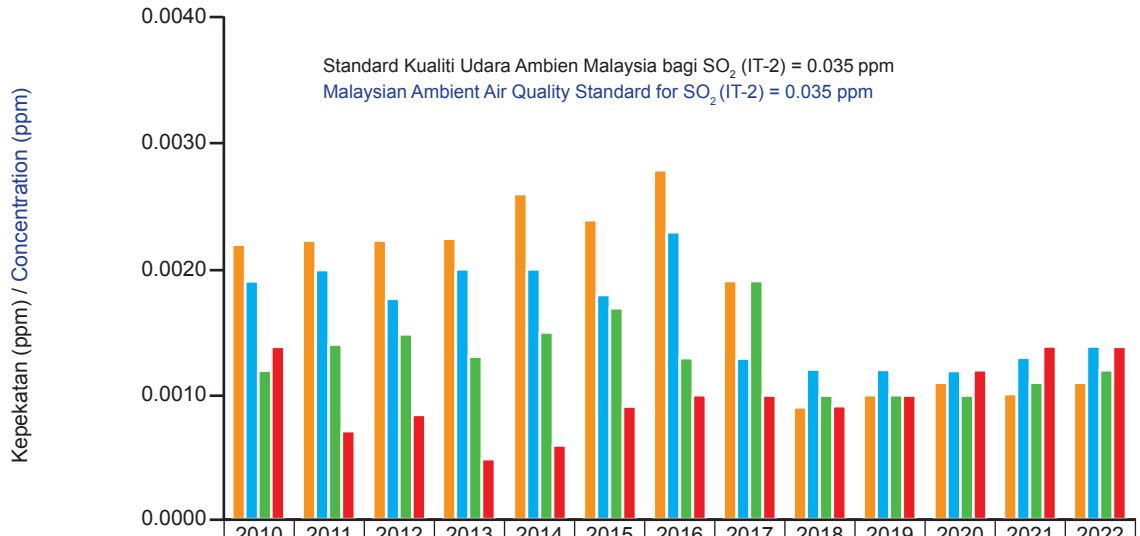
Rajah 1.19: Purata Kepekatan Tahunan Sulfur Dioksida (SO_2), 2010-2022
Figure 1.19: Annual Average Concentration of Sulphur Dioxide (SO_2), 2010-2022

Rajah 1.20 menunjukkan kepekatan purata tahunan bagi SO_2 mengikut kategori guna tanah. Berdasarkan kepada rajah tersebut, keadaan menunjukkan bahawa kepekatan SO_2 di kawasan-kawasan industri, bandar dan pinggir bandar pada tahun 2022 adalah lebih tinggi sedikit

Figure 1.20 shows the annual average concentrations of SO_2 from different categories of land use. Readings show that the concentration of SO_2 in industry, urban and sub urban areas in 2022 were slightly higher than that in 2021. This indicates that the gas release from the industries

berbanding dengan tahun 2021. Ini menunjukkan bahawa pelepasan gas daripada kawasan industri dan peningkatan bilangan kenderaan di jalan raya memberi kesan kepada peningkatan gas SO_2 di udara.

and the increase in the number of vehicles on the road has affected the increase in SO_2 gas in the air.



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Industri / Industrial	0.0022	0.0022	0.0022	0.0022	0.0026	0.0024	0.0028	0.0019	0.0009	0.0010	0.0011	0.0010	0.0011
Bandar / Urban	0.0019	0.0020	0.0018	0.0020	0.0020	0.0018	0.0023	0.0013	0.0012	0.0012	0.0012	0.0013	0.0014
Pinggir Bandar / Suburban	0.0012	0.0014	0.0015	0.0013	0.0015	0.0017	0.0013	0.0019	0.0010	0.0010	0.0010	0.0011	0.0012
Latarbelakang / Background	0.0014	0.0007	0.0009	0.0006	0.0008	0.0009	0.0010	0.0010	0.0009	0.0010	0.0012	0.0014	0.0014

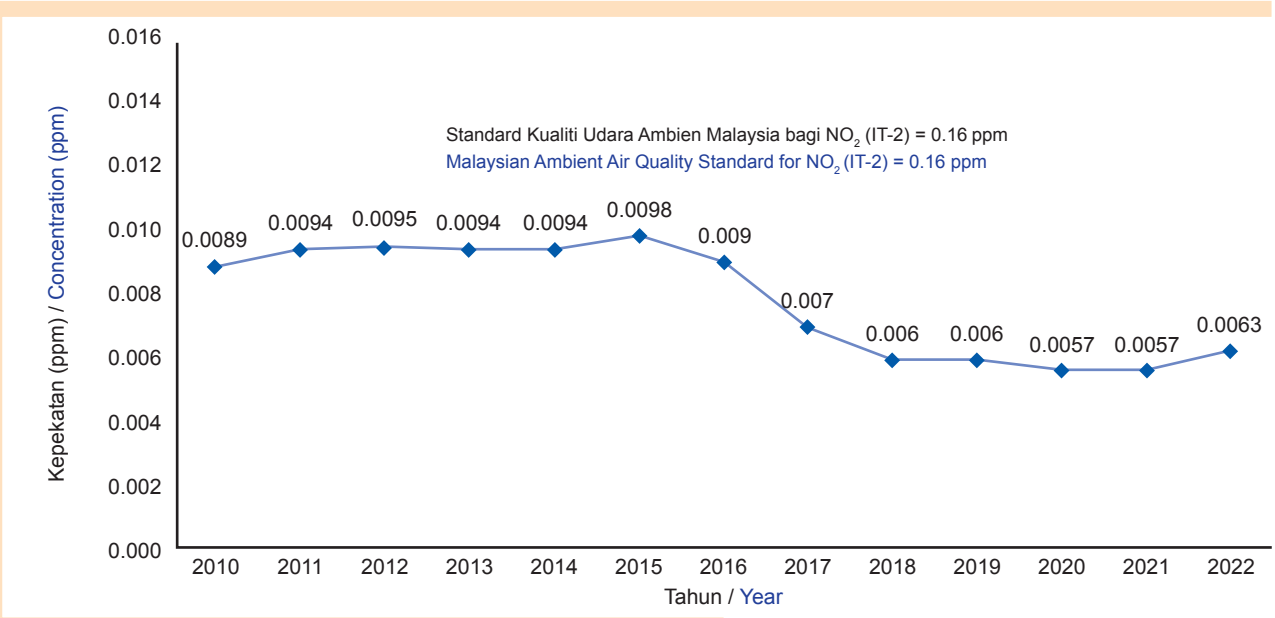
Rajah 1.20: Purata Kepekatan Tahunan Sulfur Dioksida (SO_2) mengikut Guna Tanah, 2010-2022
Figure 1.20: Annual Average Concentration of Sulfur Dioxide (SO_2) by Land Use, 2010-2022

NITROGEN DIOKSIDA (NO_2)

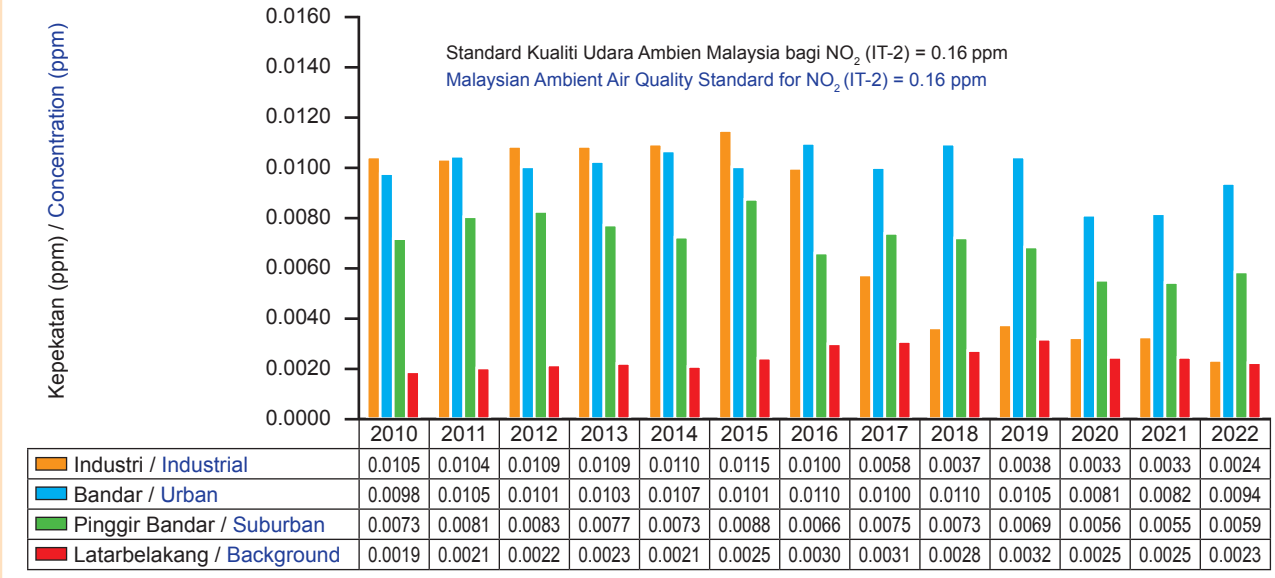
Pada tahun 2022, kepekatan purata tahunan NO_2 adalah tinggi sedikit dibandingkan dengan tahun 2021 iaitu dengan bacaan 0.0063 ppm dan jauh berada di bawah had yang ditetapkan dalam Standard Kualiti Udara Ambien Malaysia IT-2 seperti yang ditunjukkan di dalam **Rajah 1.21**. Walau bagaimanapun, kepekatan NO_2 kekal tinggi di kawasan bandar seperti yang ditunjukkan di dalam **Rajah 1.22**. Keadaan ini mungkin berpunca daripada pelepasan asap kenderaan bermotor yang mempunyai bilangan kenderaan yang amat tinggi di kawasan bandar. Anggaran beban pelepasan NO_2 menunjukkan sebanyak 67 peratus adalah daripada loji janakuasa, 25 peratus daripada pelepasan kenderaan bermotor, 7 peratus daripada industri dan 1 peratus adalah daripada lain-lain sumber.

NITROGEN DIOXIDE (NO_2)

In 2022, the NO_2 annual average concentration was slightly higher compared to 2021 which was at 0.0063 ppm, well below the Malaysia Ambient Air Quality Standard IT-2 level, as shown in **Figure 1.21**. However, NO_2 concentrations remained high in urban areas as shown in **Figure 1.22**. This situation may be due to smoke emissions from motors with a high number of vehicles in urban areas. Estimation of NO_2 emission load indicated that 67 percent were from powerplants while 25 percent from motor vehicles, 7 percent from industries and 1 percent from other sources.



Rajah 1.21: Purata Kepekatan Tahunan Nitrogen Dioksida (NO_2), 2010-2022
Figure 1.21 : Annual Average Concentration of Nitrogen Dioxide (NO_2), 2010-2022



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Industri / Industrial	0.0105	0.0104	0.0109	0.0109	0.0110	0.0115	0.0100	0.0058	0.0037	0.0038	0.0033	0.0033	0.0024
Bandar / Urban	0.0098	0.0105	0.0101	0.0103	0.0107	0.0101	0.0110	0.0100	0.0110	0.0105	0.0081	0.0082	0.0094
Pinggir Bandar / Suburban	0.0073	0.0081	0.0083	0.0077	0.0073	0.0088	0.0066	0.0075	0.0073	0.0069	0.0056	0.0055	0.0059
Latarbelakang / Background	0.0019	0.0021	0.0022	0.0023	0.0021	0.0025	0.0030	0.0031	0.0028	0.0032	0.0025	0.0025	0.0023

Rajah 1.22: Purata Kepekatan Tahunan Nitrogen Dioksida (NO_2) mengikut Guna Tanah, 2010-2022
Figure 1.22: Annual Average Concentration of Nitrogen Dioxide (NO_2) by Land Use, 2010-2022

KARBON MONOKSIDA (CO)

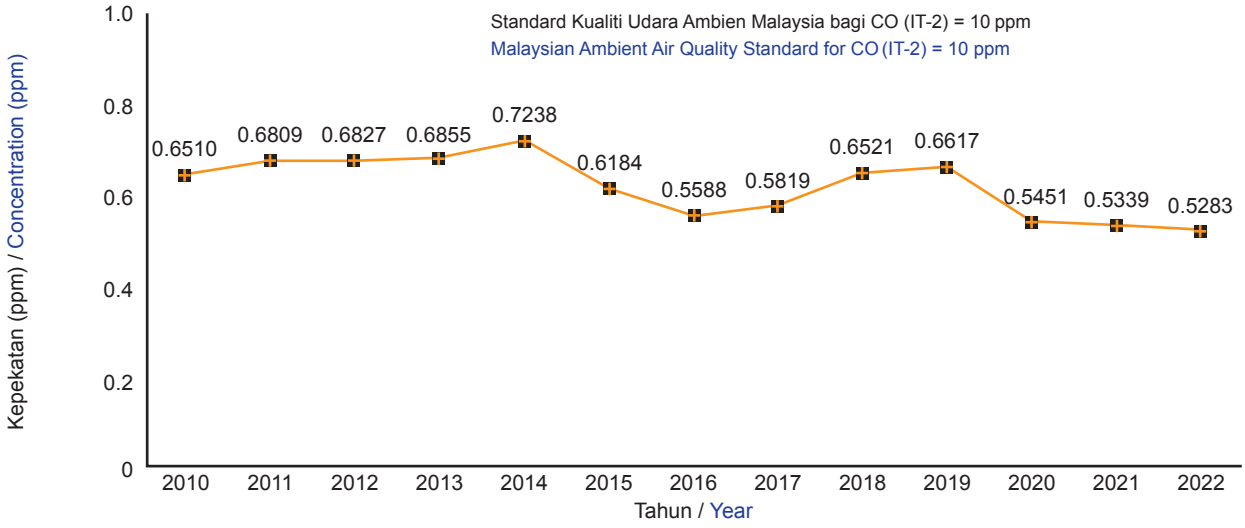
Kepekatan purata tahunan CO pada tahun 2022 menunjukkan sedikit penurunan berbanding tahun 2021 iaitu dengan bacaan 0.5283 ppm dan mematuhi Standard Kualiti Udara Ambien Malaysia IT-2 (**Rajah 1.23**). Bermula pada tahun 2018, tiada lagi bacaan CO direkodkan di kawasan industri.

CARBON MONOXIDE (CO)

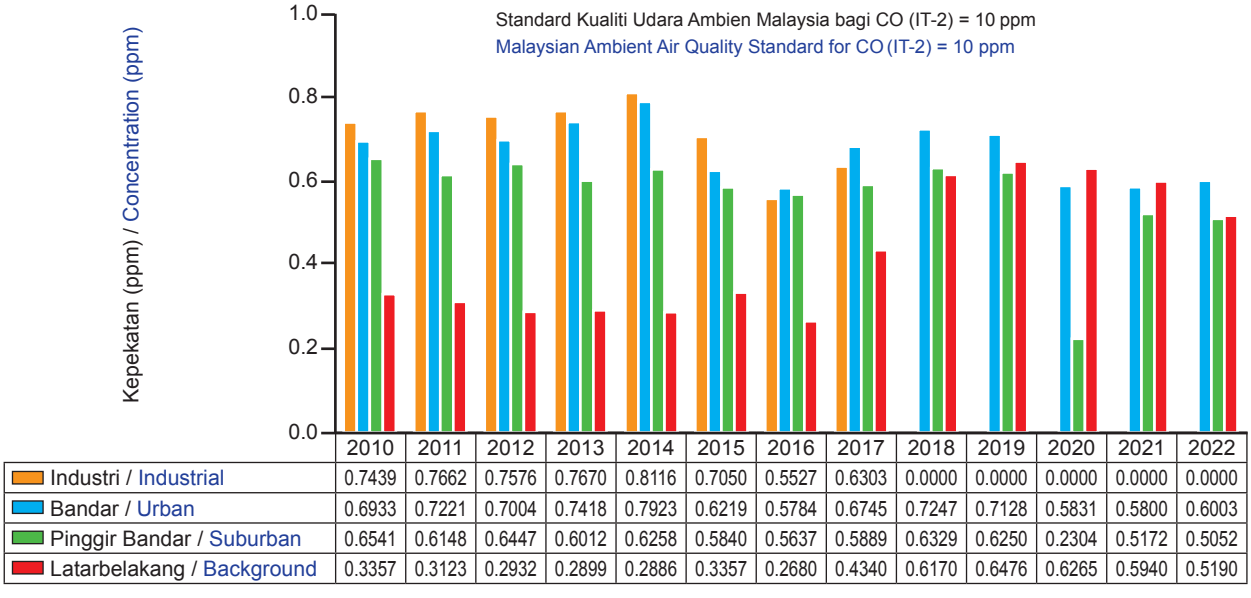
There was a slight decrease of CO levels in 2022 compared to 2021 with a reading of 0.5283 ppm and well in compliance with the Malaysian Ambient Air Quality Standard IT-2 (**Figure 1.23**). From 2018 onwards, no more CO readings were being recorded for industrial areas.

Rajah 1.24 menunjukkan kepekatan CO untuk pelbagai kategori guna tanah di mana kawasan bandar masih merekodkan bacaan purata tahunan CO tertinggi berbanding dengan kawasan yang lain. Kepekatan CO yang signifikan adalah disebabkan oleh pelepasan dari ekzos kenderaan motor yang menyumbang sebanyak 97 peratus daripada beban pelepasan CO pada tahun 2022.

Figure 1.12 (a) shows CO concentrations for various categories of land use where urban areas still recorded the highest annual average CO readings compared to others. The significant concentration of CO was due to motor vehicle emissions that contributed to 97 percent of the CO emission load in 2022.



Rajah 1.23: Purata Kepekatan Tahunan Karbon Monoksida (CO), 2010-2022
Figure 1.23: Annual Average Concentration of Carbon Monoxide (CO), 2010-2022



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Industri / Industrial	0.7439	0.7662	0.7576	0.7670	0.8116	0.7050	0.5527	0.6303	0.0000	0.0000	0.0000	0.0000	0.0000
Bandar / Urban	0.6933	0.7221	0.7004	0.7418	0.7923	0.6219	0.5784	0.6745	0.7247	0.7128	0.5831	0.5800	0.6003
Pinggir Bandar / Suburban	0.6541	0.6148	0.6447	0.6012	0.6258	0.5840	0.5637	0.5889	0.6329	0.6250	0.2304	0.5172	0.5052
Latarbelakang / Background	0.3357	0.3123	0.2932	0.2899	0.2886	0.3357	0.2680	0.4340	0.6170	0.6476	0.6265	0.5940	0.5190

Rajah 1.24: Purata Kepekatan Tahunan Karbon Monoksida (CO) mengikut Guna Tanah, 2010-2022
Figure 1.24: Annual Average Concentration of Carbon Monoxide (CO) by Land Use, 2010-2022

Sungai Tembeling

BAB 2
CHAPTER

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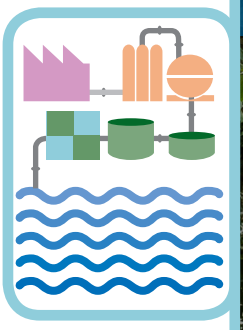

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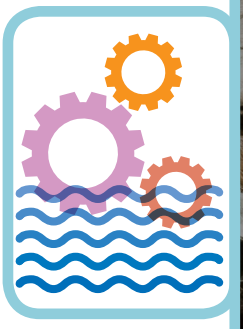
STESEN / STATIONS

PENGAWASAN KUALITI AIR SUNGAI MANUAL

MANUAL RIVER WATER QUALITY MONITORING



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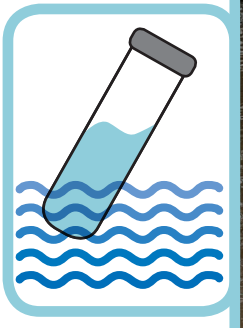
PERSAMPELAN / SAMPLING

KUALITI AIR SUNGAI

RIVER WATER QUALITY



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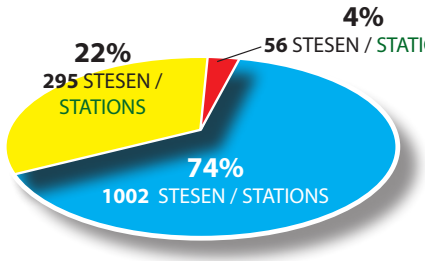
CLASSIFICATION OF RIVER WATER QUALITY BY STATION



Kategori IKA / WQI Category

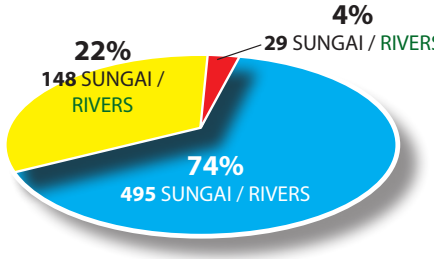
	B / C	Bersih / Clean
	ST / SP	Sederhana Tercemar / Slightly Polluted
	T / P	Tercemar / Polluted

INDEKS KUALITI AIR MENGIKUT STESEN
WATER QUALITY INDEX BY STATION

	KELAS I / CLASS I	292 STESEN / STATIONS	(21.6%)
	KELAS II / CLASS II	792 STESEN / STATIONS	(58.5%)
	KELAS III / CLASS III	253 STESEN / STATIONS	(18.7%)
	KELAS IV / CLASS IV	15 STESEN / STATIONS	(1.1%)
	KELAS V / CLASS V	1 STESEN / STATION	(0.1%)

PENGKELASAN KUALITI AIR SUNGAI MENGIKUT SUNGAI

CLASSIFICATION OF RIVER WATER QUALITY BY RIVER



Kategori IKA / WQI Category

	B / C	Bersih / Clean
	ST / SP	Sederhana Tercemar / Slightly Polluted
	T / P	Tercemar / Polluted

INDEKS KUALITI AIR MENGIKUT SUNGAI
WATER QUALITY INDEX BY RIVER

	KELAS I / CLASS I	132 SUNGAI / RIVERS	(19.6%)
	KELAS II / CLASS II	403 SUNGAI / RIVERS	(60.0%)
	KELAS III / CLASS III	129 SUNGAI / RIVERS	(19.2%)
	KELAS IV / CLASS IV	8 SUNGAI / RIVERS	(1.2%)
	KELAS V / CLASS V	0 SUNGAI / RIVER	(0.0%)

KUALITI AIR SUNGAI / RIVER WATER QUALITY

PENGAWASAN KUALITI AIR SUNGAI MANUAL

Jabatan Alam Sekitar (JAS) meneruskan program pengawasan kualiti air sungai pada tahun 2022 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 mengambil kira enam (6) parameter, iaitu oksigen terlarut (DO), keperluan oksigen biokimia (BOD), keperluan oksigen kimia (COD), ammoniakal nitrogen (AN), pepejal terampai (SS) dan pH.

STATUS KUALITI AIR SUNGAI

Pada tahun 2022, kualiti air sungai telah dinilai berdasarkan 8,136 sampel air sungai yang telah diambil daripada 1,353 stesen pengawasan manual yang merangkumi 672 sungai di Malaysia.

Sejumlah 495 (74%) sungai daripada 672 sungai yang dipantau telah menunjukkan IKA bersih, 148 (22%) adalah sederhana tercemar, manakala 29 (4%) tercemar (**Rajah 2.1**).

Parameter BOD, AN dan SS adalah masih menjadi indikator utama yang diukur kerana ia sangat berkaitan dengan pencemaran akibat pelepasan beban bahan pencemar sama ada daripada punca tetap atau punca tidak tetap yang boleh menjejaskan kualiti air sungai.

BOD adalah jumlah oksigen yang diperlukan oleh bakteria atau mikro organisma yang lain untuk

MANUAL RIVER WATER QUALITY MONITORING

The Department of Environment (DOE) continued the river water quality monitoring programme in 2022, which is done 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 measurement and sent to the laboratory as well, for analysis aimed at determining the criteria based on the sciences of physic-chemical and biological. The Water Quality Index (WQI) is used to indicate the level of pollution and the corresponding suitability in terms of water use according to the National Water Quality Standards for Malaysia (NWQS) (**ANNEX**).

The WQI takes into consideration six (6) parameters including dissolved oxygen (DO), biochemical oxygen demand (BOD), chemical oxygen demand (COD), ammoniacal nitrogen (AN), suspended solids (SS) and pH.

RIVER WATER QUALITY STATUS

In 2022, the river water quality was assessed based on 8,136 samples taken from a total of 1,353 manual monitoring stations covering 672 rivers in Malaysia.

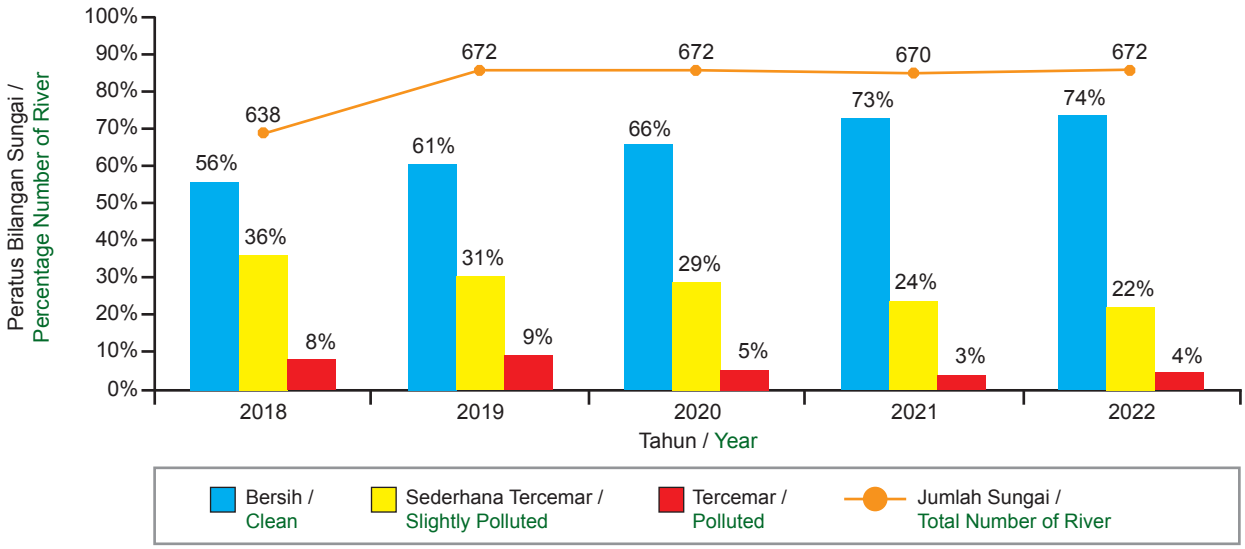
Out of the 672 rivers monitored, 495 (74%) showed clean WQI, 148 (22%) were slightly polluted, while 29 (4%) were polluted (**Figure 2.1**).

BOD, AN and SS parameters are still the main indicators measured because they are closely related to pollution due to the discharge of pollutant loads either from point sources or non-point sources that can affect river water quality.

BOD is the amount of oxygen required by bacteria or other microorganisms to decompose organic matter. High BOD concentrations are often

menguraikan bahan organik. Kepekatan BOD yang tinggi kerap kali dikaitkan dengan pelepasan efluen yang berterusan daripada industri. AN adalah dikaitkan dengan aktiviti penternakan haiwan berkaki dan kumbahan domestik. Manakala SS dikaitkan dengan kerja-kerja tanah yang tidak teratur dan aktiviti pembukaan tanah yang tidak terkawal.

associated with continuous discharge of effluents from industries. AN is associated with livestock farming activities and domestic sewage, while SS is caused by improper earthworks and uncontrolled land clearing activities.



Rajah 2.1: Tren Kualiti Air Sungai, 2018-2022
Figure 2.1: River Water Quality Trend, 2018-2022

STATUS PENGAWASAN KUALITI AIR SUNGAI MANUAL MENGIKUT STESEN

Sebanyak 1,353 stesen pengawasan kualiti air sungai manual yang dipantau pada tahun 2022. **Jadual 2.1** menunjukkan senarai stesen pengawasan kualiti air sungai manual dan status kualiti air sungai mengikut negeri. Daripada 1,353 stesen, 1,002 (74%) adalah bersih, 295 (22%) sederhana tercemar dan 56 (4%) tercemar (**Rajah 2.2**).

Merujuk kepada status stesen pengawasan kualiti air sungai yang ditentukan berdasarkan IKA terdapat sedikit penurunan peratus kualiti air sungai pada stesen-stesen yang dipantau pada tahun 2022 walaupun kualiti air sungai sebanyak 672 batang sungai yang dipantau adalah meningkat. Ini memandangkan terdapat stesen-stesen yang sebelum ini tidak dikategorikan sebagai tercemar di sungai yang tercemar telah menjadi kategori tercemar (sungai yang melebihi satu stesen atau lebih).

STATUS OF MANUAL RIVER WATER QUALITY MONITORING STATIONS

A total of 1,353 manual river water quality monitoring stations were monitored in 2022. **Table 2.1** shows the list of manual river water quality monitoring stations and river water quality status by state. Out of the 1,353 stations, 1,002 (74%) were clean, 295 (22%) slightly polluted and 56 (4%) polluted (**Figure 2.2**).

With reference to the status of river water quality monitoring stations that were determined based on WQI, there was a slight decrease in the river water quality at monitored stations in 2022, even though the river water quality of 672 monitored rivers has increased. This is because there are stations that were not previously categorised as polluted in the polluted river have now been categorised as polluted (river with one or more stations).

KUALITI AIR SUNGAI

Peratus bilangan stesen sungai bersih adalah 74% pada tahun 2022 berbanding 75% pada tahun sebelumnya. Peratus bilangan stesen sungai yang tercemar juga telah berlaku sedikit peningkatan daripada 3% pada tahun 2021 kepada 4% pada tahun 2022.

The percentage of clean river stations is 74% in 2022 compared to 75% in the previous year. The percentage of polluted river stations also slightly increased from 3% in 2021 to 4% in 2022.

Peningkatan ini adalah disebabkan oleh beberapa faktor seperti pembukaan sektor ekonomi yang meliputi aktiviti industri, pembangunan dan kegiatan harian yang dibuka semula selepas pendemik COVID-19 berakhir.

The increase is due to several factors such as the opening up of the economic sector which includes industrial activities, development and daily activities that have resumed after the end of the COVID-19 pandemic.

Bagi pengkelasan stesen pengawasan kualiti air sungai pula, sebanyak 292 (21.6%) adalah Kelas I, 792 (58.5%) Kelas II, 253 (18.7%) Kelas III, 15 (1.1%) Kelas IV dan 1 (0.1%) Kelas V.

As for the water quality monitoring stations, 292 (21.6%) were categorised as Class I, 792 (58.5%) as Class II, 253 (18.7%) as Class III, 15 (1.1%) as Class IV and 1 (0.1%) as Class V.

Jadual 2.1: Status Kualiti Air Sungai Mengikut Stesen, 2022
Table 2.1: Water Quality Status by Stations, 2022

NEGERI / STATE	LEMBANGAN / BASIN	SUNGAI / RIVER	NOMBOR STESEN / STATION NUMBER	NILAI IKA / WQI VALUE					KATEGORI IKA (2022) / WQI CATEGORY (2022)
				2018	2019	2020	2021	2022	
Perlis	Sg. Perlis	Sg. Arau	1RPLS012	79	80	79	88	85	B/C
		Sg. Arau	1RPLS014	88	87	91	92	93	B/C
		Sg. Empangan Timah Tasoh	1RPLS015	89	87	93	95	96	B/C
		Sg. Jarum	1RPLS006	85	83	88	91	89	B/C
		Sg. Jernih	1RPLS004	88	86	92	92	95	B/C
		Sg. Jernih	1RPLS005	89	86	90	95	94	B/C
		Sg. Kok Mak	1RPLS007	84	86	88	87	88	B/C
		Sg. Korok	1RPLS013	70	71	75	76	74	ST/SP
		Sg. Ngulang	1RPLS002	85	82	90	92	93	B/C
		Sg. Pelarit	1RPLS008	92	91	94	96	96	B/C
		Sg. Perlis	1RPLS001	72	72	76	77	78	ST/SP
		Sg. Serai	1RPLS003	82	76	82	86	90	B/C
		Sg. Terusan Mada	1RPLS010	84	84	88	91	92	B/C
		Sg. Terusan Mada	1RPLS011	87	87	89	92	89	B/C
		Sg. Wang Kelian	1RPLS009	93	94	95	97	97	B/C
Kedah	Sg. Kedah	Sg. Ahning	1KKDH011	88	88	92	96	95	B/C
		Sg. Changlun	1KKDH016	79	77	87	88	87	B/C
		Sg. Janing	1KKDH007	90	91	93	97	97	B/C
		Sg. Kedah	1KKDH001	65	64	70	77	76	ST/SP
		Sg. Napoh	1KKDH017	76	80	82	89	90	B/C
		Sg. Padang Terap	1KKDH002	86	87	87	91	89	B/C
		Sg. Padang Terap	1KKDH003	86	88	88	91	90	B/C
		Sg. Padang Terap	1KKDH004	86	89	85	96	95	B/C
		Sg. Padang Terap	1KKDH009	74	70	74	81	78	ST/SP

Jadual 2.1: Status Kualiti Air Sungai Mengikut Stesen, 2022
Table 2.1: Water Quality Status by Stations, 2022

NEGERI / STATE	LEMBANGAN / BASIN	SUNGAI / RIVER	NOMBOR STESEN / STATION NUMBER	NILAI IKA / WQI VALUE					KATEGORI IKA (2022) / WQI CATEGORY (2022)
				2018	2019	2020	2021	2022	
Kedah	Sg. Kedah	Sg. Padang Terap	1KKDH012	89	91	92	97	95	B/C
		Sg. Pedu	1KKDH005	87	90	91	95	94	B/C
		Sg. Pendang	1KKDH008	78	77	81	82	85	B/C
		Sg. Sintok	1KKDH018	81	81	92	96	95	B/C
		Sg. Tekai	1KKDH006	82	80	88	94	93	B/C
		Sg. Temin	1KKDH010	78	77	84	89	89	B/C
		Sg. Terusan Lengkuas	1KKDH014	88	89	86	92	92	B/C
		Sg. Terusan Mada Selatan	1KKDH013	86	88	89	92	90	B/C
		Sg. Terusan Tengah	1KKDH015	87	89	88	93	93	B/C
	Sg. Kerian	Sg. Kerian	1KKER001	93	93	94	95	96	B/C
	Sg. Kisap	Sg. Kisap	1KKSP001	91	90	95	97	97	B/C
	Sg. Kuah	Sg. Kuah	1KKUA001	66	74	81	79	81	B/C
	Sg. Merbok	Sg. Bakar Arang	1KMBK008	56	59	56	69	66	ST/SP
		Sg. Batu	1KMBK002	49	66	70	64	59	T/P
		Sg. Bongkok	1KMBK003	73	63	71	75	71	ST/SP
		Sg. Bukit Merah	1KMBK006	81	80	92	92	89	B/C
		Sg. Bukit Nanas	1KMBK011	93	93	95	97	97	B/C
		Sg. Korok	1KMBK009	69	69	65	71	66	ST/SP
		Sg. Merbok	1KMBK001	74	77	79	81	81	B/C
		Sg. Petani	1KMBK007	57	54	63	68	64	ST/SP
		Sg. Tok Pawang	1KMBK004	82	88	90	95	94	B/C
		Sg. Tok Pawang	1KMBK005	88	88	90	95	96	B/C
		Sg. Tupah	1KMBK010	93	93	94	97	97	B/C
	Sg. Muda	Sg. Chepir	1KMUD012	89	87	89	91	92	B/C
		Sg. Gunung Inas	1KMUD021	91	92	93	93	95	B/C
		Sg. Jerong	1KMUD002	65	61	66	75	73	ST/SP
		Sg. Jerong	1KMUD003	68	69	74	78	70	ST/SP
		Sg. Karangan	1KMUD009	81	81	85	91	83	B/C
		Sg. Ketil	1KMUD007	85	85	87	93	91	B/C
		Sg. Muda	1KMUD001	84	85	86	92	90	B/C
		Sg. Muda	1KMUD004	85	85	85	90	91	B/C
		Sg. Muda	1KMUD005	86	87	88	94	95	B/C
		Sg. Muda	1KMUD013	85	86	86	92	91	B/C
		Sg. Muda	1KMUD014	87	89	90	91	94	B/C
		Sg. Muda	1KMUD015	85	87	88	92	94	B/C
		Sg. Muda	1KMUD016	87	86	85	90	91	B/C
		Sg. Muda	1KMUD018	84	86	86	94	91	B/C
		Sg. Muda	1KMUD019	89	88	90	93	96	B/C
		Sg. Muda	1KMUD023	85	85	87	92	91	B/C
		Sg. Muda	1KMUD024	83	84	85	90	91	B/C
		Sg. Muda	1KMUD025	89	85	89	94	95	B/C
		Sg. Pegang	1KMUD011	92	93	95	97	97	B/C

Jadual 2.1: Status Kualiti Air Sungai Mengikut Stesen, 2022
Table 2.1: Water Quality Status by Stations, 2022

NEGERI / STATE	LEMBANGAN / BASIN	SUNGAI / RIVER	NOMBOR STESEN / STATION NUMBER	NILAI IKA / WQI VALUE					KATEGORI IKA (2022) / WQI CATEGORY (2022)
				2018	2019	2020	2021	2022	
Kedah	Sg. Muda	Sg. Sedim	1KMUD008	85	88	90	93	91	B/C
		Sg. Sedim	1KMUD017	85	87	89	91	93	B/C
		Sg. Tawar	1KMUD006	89	90	89	91	92	B/C
		Sg. Tawar	1KMUD010	83	88	88	89	94	B/C
		Sg. Tawar	1KMUD020	88	90	88	90	93	B/C
	Sg. Perai	Sg. Jarak	1KPRI018	68	74	74	77	69	ST/SP
		Sg. Jarak	1KPRI019	73	74	74	76	69	ST/SP
		Sg. Jarak	1KPRI024	70	73	72	70	71	ST/SP
		Sg. Keladi	1KPRI015	76	74	78	81	82	B/C
		Sg. Kulim	1KPRI014	77	75	77	82	78	ST/SP
		Sg. Kulim	1KPRI016	88	92	90	91	92	B/C
		Sg. Kulim	1KPRI017	89	92	91	93	94	B/C
		Sg. Kulim	1KPRI023	89	91	90	92	91	B/C
		Sg. Kulim	1KPRI025	89	92	88	94	94	B/C
		Sg. Seluang	1KPRI021	62	64	64	67	65	ST/SP
		Sg. Seluang Bawah	1KPRI020	65	67	67	71	66	ST/SP
	Sg. Ulu Melaka	Sg. Chenang	1KMLK006	53	69	78	84	77	ST/SP
		Sg. Melaka	1KMLK002	79	77	81	90	85	B/C
		Sg. Melaka	1KMLK003	85	81	87	91	91	B/C
		Sg. Melaka	1KMLK007	93	92	96	97	97	B/C
		Sg. Petang	1KMLK001	93	93	96	97	98	B/C
		Sg. Saga	1KMLK004	85	76	81	92	88	B/C
		Sg. Tuba	1KMLK005	90	88	94	96	97	B/C
P. Pinang	Sg. Bayan Lepas	Sg. Bayan Lepas	1PBLS003	70	76	64	74	69	ST/SP
		Sg. Tiram	1PBLS001	77	78	77	76	78	ST/SP
		Sg. Tiram	1PBLS002	71	65	67	67	71	ST/SP
	Sg. Jawi	Sg. Chempedak	1PJWI003	34	54	47	41	36	T/P
		Sg. Jawi	1PJWI001	47	49	55	52	57	T/P
		Sg. Junjong	1PJWI002	62	62	64	60	57	T/P
		Sg. Junjong	1PJWI004	55	47	57	52	58	T/P
		Sg. Junjong	1PJWI006	92	92	94	95	96	B/C
		Sg. Machang Bubok	1PJWI007	71	70	76	72	68	ST/SP
		Sg. Tengah	1PJWI005	48	61	49	58	47	T/P
	Sg. Juru	Sg. Ara	1PJRU006	70	66	67	77	75	ST/SP
		Sg. Juru	1PJRU001	55	60	68	69	66	ST/SP
		Sg. Juru	1PJRU012	59	53	64	65	70	ST/SP
		Sg. Kilang Ubi	1PJRU002	58	68	70	69	68	ST/SP
		Sg. Kilang Ubi	1PJRU003	66	71	75	70	68	ST/SP
		Sg. Kilang Ubi	1PJRU009	91	92	93	97	96	B/C
		Sg. Kilang Ubi	1PJRU010	55	58	63	60	61	ST/SP
		Sg. Kilang Ubi	1PJRU011	62	56	66	69	68	ST/SP
		Sg. Pasir	1PJRU004	58	61	65	75	66	ST/SP

Jadual 2.1: Status Kualiti Air Sungai Mengikut Stesen, 2022
Table 2.1: Water Quality Status by Stations, 2022

NEGERI / STATE	LEMBANGAN / BASIN	SUNGAI / RIVER	NOMBOR STESEN / STATION NUMBER	NILAI IKA / WQI VALUE					KATEGORI IKA (2022) / WQI CATEGORY (2022)
				2018	2019	2020	2021	2022	
P. Pinang	Sg. Juru	Sg. Permatang Rawa	1PJRU008	62	61	53	60	55	T/P
		Sg. Permatang Rawa	1PJRU013	77	69	66	90	87	B/C
		Sg. Rambai	1PJRU005	48	49	57	57	56	T/P
		Sg. Rambai	1PJRU007	60	54	56	62	55	T/P
	Sg. Kerian	Sg. Kechil	1PKER002	86	86	87	90	91	B/C
		Sg. Kechil	1PKER005	80	78	84	87	84	B/C
		Sg. Kerian	1PKER003	84	83	88	89	87	B/C
		Sg. Kerian	1PKER004	83	84	85	89	92	B/C
		Sg. Kerian	1PKER006	76	85	86	89	89	B/C
		Sg. Kerian	1PKER009	76	73	80	84	82	B/C
		Sg. Kerian	1PKER014	81	77	85	86	85	B/C
		Sg. Serdang	1PKER007	76	73	71	80	83	B/C
	Sg. Kluang	Sg. Ara	1PKLU002	93	91	95	97	97	B/C
		Sg. Ara	1PKLU003	74	65	68	69	72	ST/SP
		Sg. Dua Besar	1PKLU005	64	57	64	68	67	ST/SP
		Sg. Kluang	1PKLU001	72	63	65	68	52	T/P
		Sg. Relau	1PKLU004	82	66	66	68	69	ST/SP
	Sg. Perai	Sg. Air Melintas	1PPRI007	51	54	58	57	60	ST/SP
		Sg. Jarak	1PPRI009	73	69	74	79	71	ST/SP
		Sg. Jarak	1PPRI011	66	70	72	70	74	ST/SP
		Sg. Jarak	1PPRI012	66	68	71	71	76	ST/SP
		Sg. Kereh	1PPRI006	50	51	47	59	57	T/P
		Sg. Kereh	1PPRI008	55	57	55	60	56	T/P
		Sg. Kereh	1PPRI024	61	65	64	66	64	ST/SP
		Sg. Kubang Semang	1PPRI005	60	64	64	66	68	ST/SP
		Sg. Perai	1PPRI003	56	62	64	74	62	ST/SP
		Sg. Perai	1PPRI004	62	63	67	70	62	ST/SP
		Sg. Pertama	1PPRI022	54	59	65	69	52	T/P
		Sg. Seluang Bawah	1PPRI010	51	62	61	68	67	ST/SP
	Sg. Pinang	Sg. Air Itam	1PPNG006	69	72	70	74	69	ST/SP
		Sg. Air Itam	1PPNG011	70	76	76	76	65	ST/SP
		Sg. Air Itam	1PPNG018	92	94	96	97	96	B/C
		Sg. Air Terjun	1PPNG019	94	93	95	97	97	B/C
		Sg. Batu Feringghi	1PPNG001	80	79	80	82	81	B/C
		Sg. Batu Feringghi	1PPNG002	92	92	95	96	96	B/C
		Sg. Dondang	1PPNG012	83	84	83	86	54	T/P
		Sg. Dondang	1PPNG013	83	84	84	87	58	T/P
		Sg. Dondang	1PPNG014	73	71	71	79	75	ST/SP
		Sg. Dondang	1PPNG015	69	72	73	75	73	ST/SP
		Sg. Dondang	1PPNG016	70	74	71	73	68	ST/SP
		Sg. Dondang	1PPNG017	68	72	67	63	61	ST/SP
		Sg. Jelutong	1PPNG010	69	64	63	65	68	ST/SP

Jadual 2.1: Status Kualiti Air Sungai Mengikut Stesen, 2022
Table 2.1: Water Quality Status by Stations, 2022

NEGERI / STATE	LEMBANGAN / BASIN	SUNGAI / RIVER	NOMBOR STESEN / STATION NUMBER	NILAI IKA / WQI VALUE					KATEGORI IKA (2022) / WQI CATEGORY (2022)
				2018	2019	2020	2021	2022	
P. Pinang	Sg. Pinang	Sg. Pinang	1PPNG003	87	88	88	94	92	B/C
		Sg. Pinang	1PPNG008	68	62	69	67	61	ST/SP
		Sg. Pinang	1PPNG021	62	66	55	63	56	T/P
		Sg. Satu	1PPNG020	92	93	96	97	97	B/C
		Sg. Titi Kerawang	1PPNG004	65	63	68	75	63	ST/SP
Perak	Sg. Bernam	Sg. Bernam	1ABNM001	69	69	64	73	74	ST/SP
		Sg. Bernam	1ABNM002	64	67	72	66	63	ST/SP
		Sg. Bernam	1ABNM003	76	70	80	81	82	B/C
		Sg. Bernam	1ABNM004	84	86	86	93	93	B/C
		Sg. Bernam	1ABNM005	83	83	86	93	93	B/C
		Sg. Bernam	1ABNM006	87	87	90	97	96	B/C
		Sg. Gelinting	1ABNM015	89	87	92	96	96	B/C
		Sg. Inki	1ABNM012	93	93	94	97	97	B/C
		Sg. Slim	1ABNM007	86	86	87	94	95	B/C
		Sg. Slim	1ABNM008	87	87	88	94	95	B/C
		Sg. Slim	1ABNM011	85	79	89	94	91	B/C
		Sg. Trolak	1ABNM009	88	90	91	96	96	B/C
		Sg. Trolak	1ABNM010	88	91	92	97	95	B/C
		Sg. Trolak	1ABNM014	91	91	93	96	96	B/C
	Sg. Bruas	Sg. Bruas	1ABRU001	74	77	72	75	69	ST/SP
		Sg. Bruas	1ABRU004	90	90	91	94	95	B/C
		Sg. Bruas	1ABRU005	93	94	96	97	97	B/C
		Sg. Dandang	1ABRU006	90	86	91	94	95	B/C
		Sg. Licin	1ABRU007	94	95	96	97	97	B/C
		Sg. Rotan	1ABRU002	91	91	92	96	94	B/C
		Sg. Rotan	1ABRU003	85	86	83	88	83	B/C
	Sg. Kerian	Sg. Selama	1AKER011	83	82	86	88	86	B/C
		Sg. Selama	1AKER012	83	85	87	88	89	B/C
		Sg. Selama	1AKER016	94	93	94	97	97	B/C
		Sg. Semang	1AKER013	83	76	81	80	81	B/C
		Sg. Terusan Bagan Serai	1AKER015	91	91	93	93	93	B/C
	Sg. Kurau	Sg. Air Hitam	1AKRU007	93	92	95	98	97	B/C
		Sg. Ara	1AKRU001	88	92	92	96	94	B/C
		Sg. Ara	1AKRU006	92	93	95	97	97	B/C
		Sg. Kurau	1AKRU002	72	77	77	76	78	ST/SP
		Sg. Kurau	1AKRU003	75	82	77	78	79	ST/SP
		Sg. Kurau	1AKRU004	89	89	91	94	93	B/C
		Sg. Kurau	1AKRU005	88	89	91	91	90	B/C
	Sg. Perak	Sg. Batang Padang	1APRK003	77	76	83	86	87	B/C
		Sg. Batang Padang	1APRK006	90	88	90	95	96	B/C
		Sg. Batang Padang	1APRK009	79	81	87	90	90	B/C
		Sg. Behrang	1APRK077	93	94	97	97	98	B/C
		Sg. Berok	1APRK068	93	92	96	97	97	B/C
		Sg. Bidor	1APRK002	73	76	71	84	87	B/C

Jadual 2.1: Status Kualiti Air Sungai Mengikut Stesen, 2022
Table 2.1: Water Quality Status by Stations, 2022

NEGERI / STATE	LEMBANGAN / BASIN	SUNGAI / RIVER	NOMBOR STESEN / STATION NUMBER	NILAI IKA / WQI VALUE					KATEGORI IKA (2022) / WQI CATEGORY (2022)
				2018	2019	2020	2021	2022	
Perak	Sg. Perak	Sg. Bidor	1APRK004	78	81	88	89	91	B/C
		Sg. Bidor	1APRK005	85	86	91	88	87	B/C
		Sg. Chenderiang	1APRK012	91	91	94	95	94	B/C
		Sg. Chenderiang	1APRK013	84	91	92	93	94	B/C
		Sg. Chepor	1APRK056	94	94	96	97	96	B/C
		Sg. Cuar	1APRK046	84	83	87	96	95	B/C
		Sg. Ibol	1APRK066	93	93	94	97	96	B/C
		Sg. Kampar	1APRK031	90	89	93	95	96	B/C
		Sg. Kampar	1APRK032	84	82	90	94	93	B/C
		Sg. Kangsar	1APRK043	84	86	89	93	94	B/C
		Sg. Kangsar	1APRK044	87	85	90	91	93	B/C
		Sg. Kangsar	1APRK079	94	93	96	97	97	B/C
		Sg. Kepayang	1APRK037	75	71	79	86	78	ST/SP
		Sg. Kepayang	1APRK038	76	69	78	83	78	ST/SP
		Sg. Kerbau	1APRK064	94	93	94	96	95	B/C
		Sg. Kerbau	1APRK078	92	90	93	94	91	B/C
		Sg. Kerdah	1APRK041	69	67	74	73	69	ST/SP
		Sg. Kerdah	1APRK053	81	78	86	85	86	B/C
		Sg. Kinjang	1APRK055	93	94	96	97	97	B/C
		Sg. Kinta	1APRK019	75	76	78	86	83	B/C
		Sg. Kinta	1APRK022	91	90	90	95	96	B/C
		Sg. Kinta	1APRK024	74	75	86	85	67	ST/SP
		Sg. Kinta	1APRK025	68	66	75	79	78	ST/SP
		Sg. Kinta	1APRK033	76	70	78	84	84	B/C
		Sg. Kinta	1APRK034	75	78	81	85	83	B/C
		Sg. Kinta	1APRK057	67	70	80	83	80	ST/SP
		Sg. Kinta	1APRK058	75	76	82	83	85	B/C
		Sg. Kinta	1APRK063	92	91	92	95	96	B/C
		Sg. Klah	1APRK014	88	88	91	95	90	B/C
		Sg. Klah	1APRK015	89	90	91	95	91	B/C
		Sg. Klian Baru	1APRK016	75	75	82	84	80	ST/SP
		Sg. Klian Baru	1APRK017	70	76	78	84	77	ST/SP
		Sg. Klian Gunong	1APRK081	94	93	96	97	96	B/C
		Sg. Kuang	1APRK042	84	80	81	88	85	B/C
		Sg. Manong	1APRK060	92	95	95	97	97	B/C
		Sg. Nyamok	1APRK052	73	68	76	77	74	ST/SP
		Sg. Pari	1APRK023	76	76	79	83	87	B/C
		Sg. Pari	1APRK028	67	68	80	79	83	B/C
		Sg. Pelus	1APRK039	87	85	82	86	89	B/C
		Sg. Pelus	1APRK040	86	86	89	91	87	B/C
		Sg. Perak	1APRK001	82	82	84	86	88	B/C
		Sg. Perak	1APRK018	86	85	87	90	92	B/C
		Sg. Perak	1APRK020	85	88	90	92	94	B/C
		Sg. Perak	1APRK045	90	88	88	94	95	B/C

Jadual 2.1: Status Kualiti Air Sungai Mengikut Stesen, 2022
Table 2.1: Water Quality Status by Stations, 2022

NEGERI / STATE	LEMBANGAN / BASIN	SUNGAI / RIVER	NOMBOR STESEN / STATION NUMBER	NILAI IKA / WQI VALUE					KATEGORI IKA (2022) / WQI CATEGORY (2022)
				2018	2019	2020	2021	2022	
Perak	Sg. Perak	Sg. Perak	1APRK047	82	82	86	88	86	B/C
		Sg. Perak	1APRK048	89	91	90	94	94	B/C
		Sg. Perak	1APRK049	89	89	86	92	92	B/C
		Sg. Perak	1APRK051	88	89	87	94	94	B/C
		Sg. Perak	1APRK059	91	92	95	97	97	B/C
		Sg. Perak	1APRK065	87	87	88	95	95	B/C
		Sg. Perak	1APRK069	85	85	88	91	86	B/C
		Sg. Perak	1APRK070	85	87	89	92	93	B/C
		Sg. Perak	1APRK071	87	87	88	92	92	B/C
		Sg. Perak	1APRK072	86	88	86	93	94	B/C
		Sg. Perak	1APRK074	87	88	87	92	92	B/C
		Sg. Perak	1APRK080	92	93	95	97	97	B/C
		Sg. Perak	1APRK082	92	94	95	96	96	B/C
		Sg. Perak	1APRK086	91	93	96	94	96	B/C
		Sg. Pinji	1APRK021	67	69	75	75	77	ST/SP
		Sg. Pinji	1APRK036	67	64	72	78	79	ST/SP
		Sg. Pulau	1APRK067	92	94	95	97	97	B/C
		Sg. Raia	1APRK030	85	82	89	90	93	B/C
		Sg. Raia	1APRK035	85	83	86	89	89	B/C
		Sg. Rui	1APRK084	92	93	95	96	93	B/C
		Sg. Rui	1APRK085	84	84	86	91	88	B/C
		Sg. Seluang	1APRK050	66	58	72	62	62	ST/SP
		Sg. Serokai	1APRK026	60	65	71	71	77	ST/SP
		Sg. Serokai	1APRK027	77	74	77	86	87	B/C
		Sg. Sintang	1APRK054	66	65	72	72	67	ST/SP
		Sg. Sungkai	1APRK007	90	92	95	95	94	B/C
		Sg. Sungkai	1APRK008	78	84	90	91	91	B/C
		Sg. Sungkai	1APRK073	85	85	92	93	92	B/C
		Sg. Sungkai	1APRK075	86	90	91	93	93	B/C
		Sg. Sungkai Mati	1APRK010	73	71	57	65	67	ST/SP
		Sg. Sungkai Mati	1APRK011	85	82	92	87	89	B/C
		Sg. Tapah	1APRK076	95	95	96	97	96	B/C
		Sg. Teja	1APRK083	76	78	82	88	85	B/C
		Sg. Tesong	1APRK062	94	94	96	97	97	B/C
		Sg. Tumboh	1APRK029	69	71	73	73	76	ST/SP
		Sg. Woh	1APRK061	92	94	96	97	98	B/C
	Sg. Raja Hitam	Sg. Derhaka	1ARHT004	76	67	79	78	74	ST/SP
		Sg. Derhaka	1ARHT006	77	69	76	79	75	ST/SP
		Sg. Manjong	1ARHT001	83	85	85	88	87	B/C
		Sg. Manjong	1ARHT002	80	82	86	86	85	B/C
		Sg. Nyior	1ARHT007	93	95	96	97	97	B/C
		Sg. Raja Hitam	1ARHT003	71	73	76	81	78	ST/SP
		Sg. Raja Hitam	1ARHT005	66	68	72	84	78	ST/SP
		Sg. Raja Hitam	1ARHT008	30	20	52	39	30	T/P
	Sg. Sepetang	Sg. Batu Tegoh	1ASPT006	73	69	85	87	84	B/C

Jadual 2.1: Status Kualiti Air Sungai Mengikut Stesen, 2022
Table 2.1: Water Quality Status by Stations, 2022

NEGERI / STATE	LEMBANGAN / BASIN	SUNGAI / RIVER	NOMBOR STESEN / STATION NUMBER	NILAI IKA / WQI VALUE					KATEGORI IKA (2022) / WQI CATEGORY (2022)
				2018	2019	2020	2021	2022	
Perak	Sg. Sepetang	Sg. Batu Tegoh	1ASPT007	83	79	87	92	91	B/C
		Sg. Batu Tegoh	1ASPT009	82	76	87	90	89	B/C
		Sg. Batu Tegoh	1ASPT012	93	94	96	97	97	B/C
		Sg. Batu Tegoh	1ASPT016	94	95	95	97	97	B/C
		Sg. Jana	1ASPT004	73	76	72	68	72	ST/SP
		Sg. Jana	1ASPT013	94	95	95	97	97	B/C
		Sg. Lidin	1ASPT008	78	75	84	86	84	B/C
		Sg. Limau	1ASPT014	89	90	91	96	96	B/C
		Sg. Malai	1ASPT002	70	76	77	82	77	ST/SP
		Sg. Malai	1ASPT019	70	73	73	77	73	ST/SP
		Sg. Nyior	1ASPT018	92	95	97	97	98	B/C
		Sg. Nyior	1ASPT020	86	87	88	94	92	B/C
		Sg. Sepetang	1ASPT001	71	72	76	75	72	ST/SP
		Sg. Sepetang	1ASPT003	82	81	83	84	83	B/C
		Sg. Temerloh	1ASPT010	88	89	90	96	95	B/C
		Sg. Temerloh	1ASPT011	77	83	86	92	92	B/C
		Sg. Trong	1ASPT015	90	90	92	96	94	B/C
		Sg. Trong	1ASPT017	93	95	96	97	97	B/C
	Sg. Wangi	Sg. Deralik	1AWGI001	71	73	71	70	77	ST/SP
		Sg. Deralik	1AWGI002	65	73	76	79	74	ST/SP
		Sg. Wangi	1AWGI003	74	70	82	82	75	ST/SP
		Sg. Wangi	1AWGI004	79	80	79	68	65	ST/SP
Selangor	Sg. Bernam	Sg. Bernam	2BBNM013	83	83	84	92	91	B/C
		Sg. Bernam	2BBNM016	84	83	84	91	90	B/C
		Sg. Dusun	2BBNM017	86	85	91	95	95	B/C
	Sg. Buloh	Sg. Buloh	2BBLH001	58	59	58	67	55	T/P
		Sg. Buloh	2BBLH002	56	49	54	61	51	T/P
		Sg. Buloh	2BBLH003	48	51	57	47	46	T/P
		Sg. Buloh	2BBLH004	45	52	59	43	45	T/P
		Sg. Buloh	2BBLH005	74	72	79	82	84	B/C
		Sg. Buloh	2BBLH006	47	47	57	55	50	T/P
	Sg. Klang	Sg. Ampang	2BKLG032	54	59	63	64	64	ST/SP
		Sg. Ampang	2BKLG042	63	67	70	76	81	B/C
		Sg. Anak Air Batu	2BKLG047	73	72	81	89	80	ST/SP
		Sg. Batu	2BKLG007	91	93	93	97	97	B/C
		Sg. Batu	2BKLG036	91	92	92	96	97	B/C
		Sg. Damansara	2BKLG008	57	60	62	71	68	ST/SP
		Sg. Damansara	2BKLG009	57	60	66	71	66	ST/SP
		Sg. Damansara	2BKLG017	52	54	64	64	65	ST/SP
		Sg. Damansara	2BKLG055	62	64	66	71	70	ST/SP
		Sg. Damansara	2BKLG067	90	89	92	95	95	B/C
		Sg. Gombak	2BKLG020	92	90	93	97	97	B/C
		Sg. Gombak	2BKLG027	89	89	93	97	95	B/C
		Sg. Jinjang	2BKLG044	77	77	81	84	86	B/C
		Sg. Kerayong	2BKLG013	43	44	51	55	50	T/P

Jadual 2.1: Status Kualiti Air Sungai Mengikut Stesen, 2022
Table 2.1: Water Quality Status by Stations, 2022

NEGERI / STATE	LEMBANGAN / BASIN	SUNGAI / RIVER	NOMBOR STESEN / STATION NUMBER	NILAI IKA / WQI VALUE					KATEGORI IKA (2022) / WQI CATEGORY (2022)
				2018	2019	2020	2021	2022	
Selangor	Sg. Klang	Sg. Kerayong	2BKLG051	63	56	66	65	63	ST/SP
		Sg. Keroh	2BKLG030	91	90	95	97	97	B/C
		Sg. Klang	2BKLG005	88	88	93	97	96	B/C
		Sg. Klang	2BKLG006	75	75	84	84	91	B/C
		Sg. Klang	2BKLG016	64	57	58	64	77	ST/SP
		Sg. Klang	2BKLG022	55	52	58	60	61	ST/SP
		Sg. Klang	2BKLG023	56	50	56	61	63	ST/SP
		Sg. Klang	2BKLG024	56	57	55	60	66	ST/SP
		Sg. Klang	2BKLG034	56	55	61	67	64	ST/SP
		Sg. Klang	2BKLG050	52	49	52	56	60	ST/SP
		Sg. Kuyoh	2BKLG011	51	51	59	69	72	ST/SP
		Sg. Penchala	2BKLG019	42	56	53	72	60	ST/SP
		Sg. Penchala	2BKLG054	61	63	57	73	75	ST/SP
		Sg. Pusu	2BKLG021	71	67	71	80	78	ST/SP
		Sg. Rasau	2BKLG003	76	74	83	87	93	B/C
		Sg. Rumput	2BKLG033	91	91	92	97	95	B/C
		Sg. Semelah	2BKLG025	83	80	83	87	90	B/C
	Sg. Langat	Sg. Anak Chuau	2BCHU004	74	83	89	94	94	B/C
		Sg. Balak	2BLGT025	61	56	71	70	71	ST/SP
		Sg. Batang Labu	2BLGT028	74	72	79	75	83	B/C
		Sg. Batang Labu	2BLGT030	69	65	74	80	81	B/C
		Sg. Batang Labu	2BLGT031	62	61	69	71	78	ST/SP
		Sg. Batang Labu	2BLGT032	65	60	66	65	79	ST/SP
		Sg. Batang Labu	2BLGT033	79	76	86	91	88	B/C
		Sg. Batang Labu	2BLGT035	85	82	91	94	91	B/C
		Sg. Chuau	2BCHU001	87	89	91	94	94	B/C
		Sg. Chuau	2BCHU002	83	85	91	93	94	B/C
		Sg. Langat	2BLGT002	74	73	77	82	85	B/C
		Sg. Langat	2BLGT003	70	74	77	82	80	ST/SP
		Sg. Langat	2BLGT004	62	58	70	72	76	ST/SP
		Sg. Langat	2BLGT005	64	60	68	71	79	ST/SP
		Sg. Langat	2BLGT006	90	90	93	96	97	B/C
		Sg. Langat	2BLGT007	75	72	83	84	84	B/C
		Sg. Langat	2BLGT008	89	90	95	95	93	B/C
		Sg. Langat	2BLGT026	70	72	73	78	80	ST/SP
		Sg. Langat	2BLGT027	61	60	72	72	74	ST/SP
		Sg. Limau Manis	2BCHU003	78	74	71	75	82	B/C
		Sg. Rinching	2BLGT014	75	76	81	84	80	ST/SP
		Sg. Rinching	2BLGT015	91	92	94	97	94	B/C
		Sg. Semenyih	2BLGT010	77	77	83	88	85	B/C
		Sg. Semenyih	2BLGT011	81	74	82	86	84	B/C
		Sg. Semenyih	2BLGT012	83	79	84	86	89	B/C
		Sg. Sering	2BLGT034	64	60	69	72	80	ST/SP
	Sg. Selangor	Sg. Air Hitam	2BSEL002	78	78	74	80	74	ST/SP

Jadual 2.1: Status Kualiti Air Sungai Mengikut Stesen, 2022
Table 2.1: Water Quality Status by Stations, 2022

NEGERI / STATE	LEMBANGAN / BASIN	SUNGAI / RIVER	NOMBOR STESEN / STATION NUMBER	NILAI IKA / WQI VALUE					KATEGORI IKA (2022) / WQI CATEGORY (2022)
				2018	2019	2020	2021	2022	
Selangor	Sg. Selangor	Sg. Air Hitam	2BSEL024	78	82	76	80	79	ST/SP
		Sg. Batang Kali	2BSEL003	87	87	90	96	93	B/C
		Sg. Guntong	2BSEL021	77	73	80	81	83	B/C
		Sg. Kanching	2BSEL007	84	84	90	96	93	B/C
		Sg. Kerling	2BSEL006	91	93	94	97	96	B/C
		Sg. Kundang	2BSEL012	68	66	70	71	77	ST/SP
		Sg. Rangkap	2BSEL016	91	92	95	96	97	B/C
		Sg. Rawang	2BSEL013	73	70	77	81	81	B/C
		Sg. Selangor	2BSEL001	77	75	77	81	80	ST/SP
		Sg. Selangor	2BSEL004	89	90	92	96	96	B/C
		Sg. Selangor	2BSEL005	89	91	95	97	96	B/C
		Sg. Selangor	2BSEL010	77	78	79	83	86	B/C
		Sg. Selangor	2BSEL011	81	80	82	91	91	B/C
		Sg. Selangor	2BSEL014	78	81	80	84	85	B/C
		Sg. Selangor	2BSEL015	90	91	93	97	96	B/C
		Sg. Selangor	2BSEL017	89	89	92	95	94	B/C
		Sg. Selangor	2BSEL018	82	79	86	88	88	B/C
		Sg. Selangor	2BSEL023	77	77	80	83	85	B/C
		Sg. Sembah	2BSEL009	72	69	74	80	80	ST/SP
		Sg. Sembah	2BSEL019	77	77	76	83	84	B/C
		Sg. Serendah	2BSEL008	86	87	90	96	95	B/C
	Sg. Sepang	Sg. Sepang	2BSPG001	84	78	85	83	88	B/C
		Sg. Sepang	2BSPG002	77	77	73	78	81	B/C
		Sg. Sepang	2BSPG003	76	68	76	80	83	B/C
	Sg. Tengi	Sg. Tengi	2BTGI001	75	74	76	80	72	ST/SP
		Sg. Tengi	2BTGI002	92	91	92	96	96	B/C
		Sg. Tengi	2BTGI003	81	81	79	84	82	B/C
		Sg. Tengi	2BTGI004	88	89	92	94	95	B/C
W.P. Kuala Lumpur	Sg. Klang	Sg. Air Busuk	2WKLG041	58	59	41	40	52	T/P
		Sg. Batu	2WKLG028	63	61	63	58	64	ST/SP
		Sg. Batu	2WKLG056	65	54	59	67	72	ST/SP
		Sg. Batu	2WKLG061	70	68	68	61	78	ST/SP
		Sg. Belongkong	2WKLG040	61	67	69	73	65	ST/SP
		Sg. Bunos	2WKLG006	47	49	71	63	44	T/P
		Sg. Bunos	2WKLG039	64	71	68	75	71	ST/SP
		Sg. Bunos	2WKLG043	74	73	73	85	83	B/C
		Sg. Gombak	2WKLG018	59	59	61	65	67	ST/SP
		Sg. Gombak	2WKLG026	59	60	73	74	80	ST/SP
		Sg. Gombak	2WKLG060	64	59	61	69	70	ST/SP
		Sg. Jinjang	2WKLG014	66	65	61	69	67	ST/SP
		Sg. Jinjang	2WKLG031	63	63	62	70	70	ST/SP
		Sg. Jinjang	2WKLG045	63	63	56	59	63	ST/SP
		Sg. Kerayong	2WKLG046	59	54	58	61	64	ST/SP
		Sg. Kerayong	2WKLG058	52	55	62	64	58	T/P

Jadual 2.1: Status Kualiti Air Sungai Mengikut Stesen, 2022
Table 2.1: Water Quality Status by Stations, 2022

NEGERI / STATE	LEMBANGAN / BASIN	SUNGAI / RIVER	NOMBOR STESEN / STATION NUMBER	NILAI IKA / WQI VALUE					KATEGORI IKA (2022) / WQI CATEGORY (2022)
				2018	2019	2020	2021	2022	
W.P. Kuala Lumpur	Sg. Klang	Sg. Keroh	2WKLG015	63	56	62	65	61	ST/SP
		Sg. Keroh	2WKLG048	49	54	61	61	65	ST/SP
		Sg. Klang	2WKLG001	59	57	63	67	72	ST/SP
		Sg. Klang	2WKLG002	63	62	65	69	70	ST/SP
		Sg. Klang	2WKLG003	57	57	67	68	74	ST/SP
		Sg. Klang	2WKLG004	64	61	67	75	70	ST/SP
		Sg. Klang	2WKLG049	67	63	66	69	72	ST/SP
		Sg. Kuyoh	2WKLG052	52	55	64	70	66	ST/SP
		Sg. Penchala	2WKLG010	85	88	92	92	89	B/C
		Sg. Toba	2WKLG037	62	59	61	69	63	ST/SP
		Sg. Untut	2WKLG038	56	54	64	73	78	ST/SP
N. Sembilan	Sg. Langat	Sg. Batang Benar	3NLGT013	72	67	74	74	76	ST/SP
		Sg. Batang Labu	3NLGT009	71	71	81	87	85	B/C
		Sg. Batang Labu	3NLGT025	88	87	90	94	89	B/C
		Sg. Batang Nilai	3NLGT023	74	77	83	87	83	B/C
		Sg. Batang Nilai	3NLGT024	72	72	76	75	75	ST/SP
		Sg. Beranang	3NLGT019	79	76	82	87	85	B/C
		Sg. Buan	3NLGT022	76	76	80	83	85	B/C
		Sg. Jijan	3NLGT026	82	78	85	82	88	B/C
		Sg. Pajam	3NLGT020	76	75	82	85	86	B/C
		Sg. Pajam	3NLGT021	54	54	60	56	58	T/P
	Sg. Linggi	Sg. Batang Penar	3NLGI009	75	77	81	89	84	B/C
		Sg. Batang Penar	3NLGI010	87	84	92	95	91	B/C
		Sg. Batang Penar	3NLGI020	77	78	84	92	89	B/C
		Sg. Batang Penar	3NLGI021	85	90	95	95	93	B/C
		Sg. Batang Penar	3NLGI027	92	92	94	96	97	B/C
		Sg. Batang Penar	3NLGI034	80	75	80	78	84	B/C
		Sg. Batu Hampar	3NLGI024	86	88	93	91	93	B/C
		Sg. Chembong	3NLGI012	84	83	93	88	89	B/C
		Sg. Empangan Terip	3NLGI022	73	72	80	82	85	B/C
		Sg. Jelai	3NLGI025	81	84	89	86	88	B/C
		Sg. Kayu Ara	3NLGI016	71	62	77	80	84	B/C
		Sg. Kenaboi	3NLGI032	80	80	83	87	85	B/C
		Sg. Kepayong	3NLGI007	69	73	78	80	79	ST/SP
		Sg. Kepayong	3NLGI023	91	91	94	97	97	B/C
		Sg. Kundur Besar	3NLGI013	90	86	91	92	92	B/C
		Sg. Linggi	3NLGI001	83	81	83	87	86	B/C
		Sg. Linggi	3NLGI002	77	79	82	86	86	B/C
		Sg. Linggi	3NLGI003	76	78	83	85	87	B/C
		Sg. Linggi	3NLGI004	77	77	77	85	85	B/C
		Sg. Linggi	3NLGI005	73	68	78	82	82	B/C
		Sg. Linggi	3NLGI006	71	74	77	82	83	B/C
		Sg. Muar	3NLGI026	87	90	88	93	91	B/C
		Sg. Ngoi Ngoi	3NLGI040	71	73	76	80	83	B/C

Jadual 2.1: Status Kualiti Air Sungai Mengikut Stesen, 2022
Table 2.1: Water Quality Status by Stations, 2022

NEGERI / STATE	LEMBANGAN / BASIN	SUNGAI / RIVER	NOMBOR STESEN / STATION NUMBER	NILAI IKA / WQI VALUE					KATEGORI IKA (2022) / WQI CATEGORY (2022)
				2018	2019	2020	2021	2022	
N. Sembilan	Sg. Linggi	Sg. Paroi	3NLGI018	75	76	78	80	85	B/C
		Sg. Pedas	3NLGI014	84	83	90	94	93	B/C
		Sg. Rembau	3NLGI011	86	82	91	92	91	B/C
		Sg. Senawang	3NLGI017	74	74	73	77	81	B/C
		Sg. Simin	3NLGI015	76	77	82	85	87	B/C
		Sg. Temiang	3NLGI019	73	76	83	85	87	B/C
		Sg. Temiang	3NLGI033	60	60	68	61	70	ST/SP
	Sg. Lukut	Sg. Lukut	3NLKT001	73	69	74	73	80	ST/SP
	Sg. Melaka	Sg. Dusun	3NMLK017	87	86	93	94	94	B/C
		Sg. Kemunting	3NMLK039	86	87	92	92	91	B/C
		Sg. Tampin	3NMLK038	90	92	95	96	95	B/C
		Sg. Tampin	3NMLK041	74	84	81	83	84	B/C
	Sg. Muar	Sg. Gemas	3NMUA041	68	68	70	71	76	ST/SP
		Sg. Gemencheh	3NMUA043	83	86	82	91	88	B/C
		Sg. Gemencheh	3NMUA045	78	80	82	90	85	B/C
		Sg. Jelai	3NMUA054	85	83	88	92	91	B/C
		Sg. Kelamah	3NMUA044	75	79	71	88	79	ST/SP
		Sg. Muar	3NMUA042	88	90	91	95	96	B/C
		Sg. Muar	3NMUA046	81	85	84	90	84	B/C
		Sg. Muar	3NMUA047	80	85	86	90	85	B/C
		Sg. Muar	3NMUA048	83	85	85	86	86	B/C
		Sg. Muar	3NMUA049	82	84	88	89	89	B/C
		Sg. Muar	3NMUA050	77	83	85	88	87	B/C
		Sg. Muar	3NMUA051	85	85	86	90	86	B/C
		Sg. Muar	3NMUA052	82	88	85	91	90	B/C
		Sg. Muar	3NMUA053	81	87	85	90	90	B/C
		Sg. Muar	3NMUA055	84	81	84	91	91	B/C
	Sg. Pahang	Sg. Pertang	3NPHG002	82	87	89	92	91	B/C
		Sg. Serting	3NPHG003	77	71	80	87	82	B/C
		Sg. Serting	3NPHG004	76	71	79	86	81	B/C
		Sg. Serting	3NPHG005	70	66	77	81	77	ST/SP
		Sg. Triang	3NPHG006	84	86	84	93	89	B/C
	Sg. Sepang	Sg. Rambai	2BSPG004	28	21	25	25	60	ST/SP
Melaka	Sg. Baru	Sg. Baru	3MBAR001	71	68	74	70	75	ST/SP
	Sg. Duyong	Sg. Duyong	3MDYG001	64	71	63	69	72	ST/SP
		Sg. Duyong	3MDYG002	59	55	58	65	66	ST/SP
		Sg. Duyong	3MDYG003	77	79	77	84	87	B/C
		Sg. Gapam	3MDYG004	86	87	88	92	93	B/C
		Sg. Punggur	3MPGR001	44	47	52	67	58	T/P
		Sg. Punggur	3MPGR002	48	53	49	58	56	T/P
	Sg. Kesang	Sg. Chin-Chin	3MKSG006	68	59	62	53	66	ST/SP
		Sg. Chin-Chin	3MKSG008	85	80	79	87	84	B/C
		Sg. Chin-Chin	3MKSG009	79	79	78	89	86	B/C
		Sg. Chohong	3MKSG004	82	80	86	91	93	B/C

Jadual 2.1: Status Kualiti Air Sungai Mengikut Stesen, 2022
Table 2.1: Water Quality Status by Stations, 2022

NEGERI / STATE	LEMBANGAN / BASIN	SUNGAI / RIVER	NOMBOR STESEN / STATION NUMBER	NILAI IKA / WQI VALUE					KATEGORI IKA (2022) / WQI CATEGORY (2022)
				2018	2019	2020	2021	2022	
Melaka	Sg. Kesang	Sg. Chohong	3MKSG005	90	89	90	94	94	B/C
		Sg. Kesang	3MKSG001	66	63	72	82	83	B/C
		Sg. Kesang	3MKSG002	80	76	79	88	84	B/C
		Sg. Kesang	3MKSG003	78	72	77	88	88	B/C
		Sg. Tangkak	3MKSG007	67	64	67	77	74	ST/SP
	Sg. Linggi	Sg. Simpang Ampat	3MLGI029	82	79	83	87	84	B/C
		Sg. Siput	3MLGI030	86	84	87	90	91	B/C
		Sg. Siput	3MLGI031	84	85	86	92	89	B/C
		Sg. Tuang	3MTUG002	71	57	57	62	70	ST/SP
	Sg. Melaka	Sg. Batang Melaka	3MMLK008	78	82	90	91	91	B/C
		Sg. Batang Melaka	3MMLK027	88	80	87	91	91	B/C
		Sg. Batang Melaka	3MMLK028	76	80	86	89	92	B/C
		Sg. Durian Tunggal	3MMLK011	76	73	79	86	88	B/C
		Sg. Malim	3MMLK014	51	55	67	71	70	ST/SP
		Sg. Malim	3MMLK034	61	63	67	68	71	ST/SP
		Sg. Melaka	3MMLK007	64	65	72	71	74	ST/SP
		Sg. Melaka	3MMLK009	89	87	91	93	92	B/C
		Sg. Melaka	3MMLK010	90	93	93	96	96	B/C
		Sg. Melaka	3MMLK012	60	59	70	72	71	ST/SP
		Sg. Melaka	3MMLK013	66	66	63	68	73	ST/SP
		Sg. Melaka	3MMLK015	76	72	81	82	84	B/C
		Sg. Melaka	3MMLK021	75	73	81	85	86	B/C
		Sg. Melaka	3MMLK022	78	79	83	86	87	B/C
		Sg. Melaka	3MMLK023	68	66	72	72	67	ST/SP
		Sg. Melaka	3MMLK024	58	61	59	69	72	ST/SP
		Sg. Melaka	3MMLK025	77	77	79	84	84	B/C
		Sg. Melaka	3MMLK026	75	71	80	81	83	B/C
		Sg. Melaka	3MMLK030	80	73	82	84	85	B/C
		Sg. Melaka	3MMLK032	62	59	70	67	68	ST/SP
		Sg. Putat	3MMLK029	65	62	62	74	68	ST/SP
		Sg. Putat	3MMLK033	58	53	59	63	64	ST/SP
		Sg. Rembia	3MMLK035	68	68	73	82	77	ST/SP
		Sg. Rembia	3MMLK036	72	61	68	54	82	B/C
		Sg. Tampin	3MMLK031	87	85	91	94	90	B/C
	Sg. Merlimau	Sg. Merlimau	3MMLU001	50	47	60	55	57	T/P
		Sg. Merlimau	3MMLU002	52	46	52	56	51	T/P
		Sg. Merlimau	3MMLU003	57	49	40	58	61	ST/SP
		Sg. Merlimau	3MMLU004	52	54	58	58	63	ST/SP
		Sg. Merlimau	3MMLU005	52	49	67	68	66	ST/SP
	Sg. Seri Melaka	Sg. Air Salak	3MSMK001	69	65	62	79	78	ST/SP
		Sg. Seri Melaka	3MSMK002	59	65	65	66	69	ST/SP
		Sg. Sg. Udang	3MSUD001	87	81	87	86	91	B/C
	Sg. Tuang	Sg. Tuang	3MTUG001	67	58	59	63	75	ST/SP
Johor	Sg. Air Baloi	Sg. Air Baloi	3JABL001	59	52	60	56	55	T/P
		Sg. Air Baloi	3JABL002	49	48	59	52	56	T/P

Jadual 2.1: Status Kualiti Air Sungai Mengikut Stesen, 2022
Table 2.1: Water Quality Status by Stations, 2022

NEGERI / STATE	LEMBANGAN / BASIN	SUNGAI / RIVER	NOMBOR STESEN / STATION NUMBER	NILAI IKA / WQI VALUE					KATEGORI IKA (2022) / WQI CATEGORY (2022)
				2018	2019	2020	2021	2022	
Johor	Sg. Air Baloi	Sg. Air Baloi	3JABL003	58	49	60	57	61	ST/SP
	Sg. Batu Pahat	Sg. Amran	3JBPT018	70	74	75	81	80	ST/SP
		Sg. Bantang	3JBPT020	94	91	96	97	97	B/C
		Sg. Batu Pahat	3JBPT001	59	56	66	64	61	ST/SP
		Sg. Bekok	3JBPT005	74	63	79	84	81	B/C
		Sg. Bekok	3JBPT008	62	59	57	67	58	T/P
		Sg. Bekok	3JBPT016	88	82	85	91	85	B/C
		Sg. Bekok	3JBPT017	85	83	87	91	90	B/C
		Sg. Bekok	3JBPT019	89	90	92	94	93	B/C
		Sg. Bekok	3JBPT023	64	58	57	63	60	ST/SP
		Sg. Berlian	3JBPT007	78	79	78	77	79	ST/SP
		Sg. Chaah	3JBPT010	79	83	88	93	90	B/C
		Sg. Kahang	3JBPT022	84	86	90	92	82	B/C
		Sg. Lenik	3JBPT011	81	82	82	91	90	B/C
		Sg. Merek	3JBPT009	83	81	88	89	88	B/C
		Sg. Merpo	3JBPT006	84	81	91	90	91	B/C
		Sg. Panchor	3JBPT025	61	58	59	63	59	T/P
		Sg. Semberong	3JBPT003	66	53	57	64	63	ST/SP
		Sg. Semberong	3JBPT004	69	58	64	77	72	ST/SP
		Sg. Semberong Dam	3JBPT021	89	85	89	91	89	B/C
		Sg. Simpang Kanan	3JBPT002	62	60	58	62	59	T/P
		Sg. Simpang Kanan	3JBPT013	57	54	59	60	59	T/P
		Sg. Simpang Kiri	3JBPT012	69	73	81	82	80	ST/SP
		Sg. Simpang Kiri	3JBPT014	64	60	65	71	76	ST/SP
		Sg. Simpang Kiri	3JBPT015	58	55	60	64	66	ST/SP
		Sg. Temehel	3JBPT024	45	48	57	54	59	T/P
	Sg. Benut	Sg. Benut	3JBNT001	86	82	86	92	92	B/C
		Sg. Benut	3JBNT002	73	72	79	86	86	B/C
		Sg. Benut	3JBNT005	65	60	64	66	68	ST/SP
		Sg. Benut	3JBNT006	59	60	69	62	62	ST/SP
		Sg. Machap Dam	3JBNT008	85	91	92	94	93	B/C
		Sg. Parit Hj.Yassin	3JBNT004	81	77	85	81	81	B/C
		Sg. Pinggan	3JBNT007	59	61	60	59	63	ST/SP
		Sg. Ulu Benut	3JBNT003	77	79	89	90	86	B/C
	Sg. Danga	Sg. Danga	3JDGA001	48	47	58	62	66	ST/SP
		Sg. Danga	3JDGA002	48	45	55	59	62	ST/SP
	Sg. Endau	Sg. Anak Sg. Semberong	3JEND007	76	84	84	85	84	B/C
		Sg. Dengar	3JEND010	82	80	84	91	90	B/C
		Sg. Empangan Labong	3JEND027	92	92	89	91	91	B/C
		Sg. Endau	3JEND019	85	88	85	88	89	B/C
		Sg. Endau	3JEND022	86	87	87	90	91	B/C
		Sg. Endau	3JEND023	93	93	93	96	92	B/C
		Sg. Jasin	3JEND024	94	94	94	97	96	B/C
		Sg. Jebong	3JEND005	71	61	74	82	75	ST/SP
		Sg. Kahang	3JEND020	89	89	90	89	89	B/C

Jadual 2.1: Status Kualiti Air Sungai Mengikut Stesen, 2022
Table 2.1: Water Quality Status by Stations, 2022

NEGERI / STATE	LEMBANGAN / BASIN	SUNGAI / RIVER	NOMBOR STESEN / STATION NUMBER	NILAI IKA / WQI VALUE					KATEGORI IKA (2022) / WQI CATEGORY (2022)
				2018	2019	2020	2021	2022	
Johor	Sg. Endau	Sg. Kahang	3JEND026	88	86	90	94	92	B/C
		Sg. Kahang	3JEND028	87	83	90	88	88	B/C
		Sg. Lenga	3JEND008	75	60	68	69	74	ST/SP
		Sg. Lenggor	3JEND009	84	87	82	89	89	B/C
		Sg. Lenggor	3JEND029	84	86	81	88	90	B/C
		Sg. Mamai	3JEND015	86	86	87	88	89	B/C
		Sg. Melatai	3JEND017	68	63	70	71	73	ST/SP
		Sg. Mengkibol	3JEND001	85	84	88	89	92	B/C
		Sg. Mengkibol	3JEND002	72	74	77	84	82	B/C
		Sg. Mengkibol	3JEND003	65	65	69	75	77	ST/SP
		Sg. Paloh	3JEND016	76	81	82	85	85	B/C
		Sg. Pamol	3JEND011	68	65	72	76	73	ST/SP
		Sg. Selai	3JEND025	90	92	92	94	94	B/C
		Sg. Semberong	3JEND004	84	86	89	90	87	B/C
		Sg. Semberong	3JEND006	81	83	84	84	80	ST/SP
		Sg. Semberong	3JEND012	68	63	76	80	77	ST/SP
		Sg. Semberong	3JEND018	82	84	85	88	88	B/C
		Sg. Semberong	3JEND021	75	83	84	88	89	B/C
		Sg. Singol	3JEND013	80	55	79	83	87	B/C
		Sg. Tamok	3JEND014	86	91	91	90	91	B/C
	Sg. Jemaluang	Sg. Jemaluang	3JJML001	86	88	81	90	90	B/C
		Sg. Jemaluang	3JJML002	78	78	81	86	80	ST/SP
	Sg. Johor	Sg. Anak Sg. Sayong	3JJHR023	76	79	86	92	92	B/C
		Sg. Anak Sg. Sayong	3JJHR032	67	69	75	84	72	ST/SP
		Sg. Belitong	3JJHR038	85	86	83	89	86	B/C
	Sg. Johor	Sg. Berangan	3JJHR013	63	67	71	82	81	B/C
		Sg. Bukit Besar	3JJHR007	59	57	61	60	56	T/P
		Sg. Bukit Besar	3JJHR009	83	93	90	95	95	B/C
		Sg. Chemangar	3JJHR019	72	72	70	73	77	ST/SP
		Sg. Johor	3JJHR011	81	83	83	89	91	B/C
		Sg. Johor	3JJHR014	81	82	85	89	91	B/C
		Sg. Johor	3JJHR015	80	84	86	91	92	B/C
		Sg. Johor	3JJHR040	82	78	84	87	88	B/C
		Sg. Johor	3JJHR041	82	85	82	89	88	B/C
		Sg. Johor	3JJHR042	82	83	85	90	88	B/C
		Sg. Layang	3JJHR001	87	89	93	93	93	B/C
		Sg. Layau Kiri	3JJHR017	87	84	87	92	89	B/C
		Sg. Lebam	3JJHR020	83	85	79	87	88	B/C
		Sg. Linggiu	3JJHR030	85	88	84	93	92	B/C
		Sg. Panti	3JJHR037	80	72	79	87	86	B/C
		Sg. Papan	3JJHR034	81	83	81	86	87	B/C
		Sg. Pelepah	3JJHR039	94	93	95	97	97	B/C
		Sg. Pelepah	3JJHR043	81	89	86	87	87	B/C
		Sg. Pelepah	3JJHR044	83	89	87	88	90	B/C

Jadual 2.1: Status Kualiti Air Sungai Mengikut Stesen, 2022
Table 2.1: Water Quality Status by Stations, 2022

NEGERI / STATE	LEMBANGAN / BASIN	SUNGAI / RIVER	NOMBOR STESEN / STATION NUMBER	NILAI IKA / WQI VALUE					KATEGORI IKA (2022) / WQI CATEGORY (2022)
				2018	2019	2020	2021	2022	
Johor	Sg. Johor	Sg. Pelepah	3JJHR045	88	92	90	92	93	B/C
		Sg. Penggeli	3JJHR028	85	90	89	87	90	B/C
		Sg. Penggeli	3JJHR031	82	85	89	88	89	B/C
		Sg. Remis	3JJHR026	83	86	86	89	89	B/C
		Sg. Santi	3JJHR022	87	85	89	87	90	B/C
		Sg. Sayong	3JJHR024	81	81	82	85	82	B/C
		Sg. Sayong	3JJHR025	82	85	78	84	88	B/C
		Sg. Sayong	3JJHR027	78	88	82	84	88	B/C
		Sg. Sayong	3JJHR033	82	87	83	88	89	B/C
		Sg. Sebol	3JJHR029	76	69	73	80	79	ST/SP
		Sg. Seluyut	3JJHR035	76	77	83	87	83	B/C
		Sg. Semangar	3JJHR008	81	82	81	92	90	B/C
		Sg. Semenchu	3JJHR018	69	35	66	85	86	B/C
		Sg. Sening	3JJHR021	89	83	89	93	96	B/C
		Sg. Serai	3JJHR002	66	57	67	60	62	ST/SP
		Sg. Telor	3JJHR012	84	84	88	89	93	B/C
		Sg. Temoh	3JJHR016	63	64	74	84	88	B/C
		Sg. Tiram	3JJHR003	68	67	71	79	77	ST/SP
		Sg. Tiram	3JJHR004	85	87	86	91	89	B/C
		Sg. Tiram	3JJHR005	67	69	69	68	77	ST/SP
		Sg. Tiram	3JJHR006	87	90	88	93	92	B/C
	Sg. Kaw. Pasir Gudang	Sg. Buluh	3JPGD002	25	41	41	43	40	T/P
		Sg. Latoh	3JPGD004	64	58	62	68	71	ST/SP
		Sg. Masai	3JPGD005	55	50	63	60	63	ST/SP
		Sg. Perembi	3JPGD001	37	42	57	47	59	T/P
		Sg. Tukang Batu	3JPGD003	22	37	42	35	34	T/P
	Sg. Kempas	Sg. Kempas	3JKPS001	39	36	29	33	39	T/P
		Sg. Kempas	3JKPS002	55	44	37	42	43	T/P
	Sg. Kim-Kim	Sg. Kim-Kim	3JKIM001	36	43	51	66	57	T/P
		Sg. Kim-Kim	3JKIM002	83	83	85	90	89	B/C
	Sg. Mersing	Sg. Empangan Congok	3JMSG004	76	84	85	88	86	B/C
		Sg. Mersing	3JMSG001	91	90	87	95	93	B/C
		Sg. Mersing	3JMSG002	82	80	84	88	81	B/C
		Sg. Mersing	3JMSG003	89	85	83	92	87	B/C
	Sg. Muar	Sg. Air Panas	3JMUA035	90	92	94	97	96	B/C
		Sg. Belemang	3JMUA051	89	90	94	95	94	B/C
		Sg. Gemas	3JMUA036	71	65	80	85	86	B/C
		Sg. Jementah	3JMUA040	91	91	93	96	95	B/C
		Sg. Juasseh	3JMUA014	88	89	94	96	92	B/C
		Sg. Juasseh	3JMUA037	91	88	93	95	95	B/C
		Sg. Juasseh	3JMUA045	89	86	94	95	94	B/C
		Sg. Labis	3JMUA011	81	79	89	88	87	B/C
		Sg. Labis	3JMUA012	81	77	89	89	88	B/C
		Sg. Labis	3JMUA015	85	82	87	87	82	B/C

Jadual 2.1: Status Kualiti Air Sungai Mengikut Stesen, 2022
Table 2.1: Water Quality Status by Stations, 2022

NEGERI / STATE	LEMBANGAN / BASIN	SUNGAI / RIVER	NOMBOR STESEN / STATION NUMBER	NILAI IKA / WQI VALUE					KATEGORI IKA (2022) / WQI CATEGORY (2022)
				2018	2019	2020	2021	2022	
Johor	Sg. Muar	Sg. Meda	3JMUA034	86	82	82	85	80	ST/SP
		Sg. Merbudu	3JMUA030	69	65	63	77	72	ST/SP
		Sg. Merlimau	3JMUA020	55	59	70	66	73	ST/SP
		Sg. Muar	3JMUA017	79	81	82	86	81	B/C
		Sg. Muar	3JMUA019	81	82	85	87	76	ST/SP
		Sg. Muar	3JMUA022	81	84	85	89	82	B/C
		Sg. Muar	3JMUA026	81	82	84	89	85	B/C
		Sg. Muar	3JMUA027	78	77	85	84	83	B/C
		Sg. Muar	3JMUA028	77	81	83	81	83	B/C
		Sg. Muar	3JMUA029	74	81	75	84	85	B/C
		Sg. Muar	3JMUA031	73	81	77	83	84	B/C
		Sg. Muar	3JMUA033	79	80	73	77	80	ST/SP
		Sg. Muar	3JMUA039	79	81	82	85	82	B/C
		Sg. Muar	3JMUA041	77	82	80	86	84	B/C
		Sg. Muar	3JMUA042	77	81	78	86	85	B/C
		Sg. Muar	3JMUA043	77	82	79	83	85	B/C
		Sg. Muar	3JMUA046	76	78	86	89	83	B/C
		Sg. Muar	3JMUA047	77	78	81	87	84	B/C
		Sg. P. Mengkuang	3JMUA018	80	67	89	92	91	B/C
		Sg. Pagoh	3JMUA049	70	67	66	74	76	ST/SP
		Sg. Palong	3JMUA024	83	82	88	89	87	B/C
		Sg. Palong	3JMUA025	78	81	84	85	81	B/C
		Sg. Pendol	3JMUA050	83	89	90	95	93	B/C
		Sg. Sarang Buaya	3JMUA038	64	70	58	60	60	ST/SP
		Sg. Segamat	3JMUA016	83	82	89	90	86	B/C
		Sg. Segamat	3JMUA044	87	88	91	94	89	B/C
		Sg. Segamat	3JMUA048	87	89	92	95	91	B/C
		Sg. Senarut	3JMUA021	74	66	75	77	79	ST/SP
		Sg. Serom	3JMUA032	54	55	63	63	63	ST/SP
		Sg. Simpang Loi	3JMUA023	76	78	77	84	73	ST/SP
		Sg. Tenang	3JMUA013	66	68	79	76	81	B/C
	Sg. Paloi	Sg. Paloi	3JPAL001	85	80	89	90	90	B/C
	Sg. Pontian Besar	Sg. Air Hitam	3JPBS001	67	76	71	74	73	ST/SP
		Sg. Ayer Merah	3JPBS005	53	46	43	54	54	T/P
		Sg. Pontian Besar	3JPBS002	63	63	65	65	63	ST/SP
		Sg. Pontian Besar	3JPBS003	87	77	80	85	78	ST/SP
		Sg. Pontian Besar	3JPBS004	81	77	86	84	85	B/C
		Sg. Pontian Besar	3JPBS006	57	60	64	63	60	ST/SP
		Sg. Pontian Besar	3JPBS007	70	70	73	73	74	ST/SP
	Sg. Pontian Kecil	Sg. Pontian Kecil	3JPKC001	85	84	86	84	85	B/C
		Sg. Pontian Kecil	3JPKC002	74	60	76	75	70	ST/SP
	Sg. Pulai	Sg. Pulai	3JPLI001	74	79	82	83	86	B/C
		Sg. Pulai	3JPLI002	72	71	72	77	82	B/C
		Sg. Pulai Dam	3JPLI004	92	93	95	95	96	B/C

Jadual 2.1: Status Kualiti Air Sungai Mengikut Stesen, 2022
Table 2.1: Water Quality Status by Stations, 2022

NEGERI / STATE	LEMBANGAN / BASIN	SUNGAI / RIVER	NOMBOR STESEN / STATION NUMBER	NILAI IKA / WQI VALUE					KATEGORI IKA (2022) / WQI CATEGORY (2022)
				2018	2019	2020	2021	2022	
Johor	Sg. Pulai	Sg. Ulu Choh	3JPLI003	68	67	72	72	74	ST/SP
	Sg. Rambah	Sg. Rambah	3JRBH001	75	73	75	69	78	ST/SP
		Sg. Rambah	3JRBH002	66	55	65	63	70	ST/SP
	Sg. Sanglang	Sg. Sanglang	3JSLG001	63	60	59	57	51	T/P
	Sg. Sedili Besar	Sg. Ambat	3JSBE005	88	88	86	84	76	ST/SP
		Sg. Dohol	3JSBE001	85	88	89	90	86	B/C
		Sg. Mupur	3JSBE009	52	47	67	73	73	ST/SP
	Sg. Sedili Besar	Sg. Pasir Panjang	3JSBE010	85	87	88	87	76	ST/SP
		Sg. Sedili Besar	3JSBE002	82	82	86	86	86	B/C
		Sg. Sedili Besar	3JSBE004	86	89	91	93	91	B/C
		Sg. Sedili Besar	3JSBE006	79	76	82	87	85	B/C
		Sg. Sedili Besar	3JSBE007	73	65	74	72	70	ST/SP
		Sg. Sedili Besar	3JSBE008	82	85	87	89	85	B/C
		Sg. Sedili Besar	3JSBE011	85	88	90	88	87	B/C
		Sg. Temubor Kanan	3JSBE003	88	90	93	95	93	B/C
	Sg. Sedili Kecil	Sg. Anak Sedili Kecil	3JSKE005	29	30	25	24	74	ST/SP
		Sg. Anak Sedili Kecil	3JSKE006	78	76	79	85	75	ST/SP
		Sg. Bahan	3JSKE002	62	75	78	73	64	ST/SP
		Sg. Bahan	3JSKE004	57	76	74	78	76	ST/SP
		Sg. Sedili Kecil	3JSKE001	85	87	89	88	83	B/C
		Sg. Sedili Kecil	3JSKE003	77	77	80	76	78	ST/SP
	Sg. Segget	Sg. Segget	3JSGT001	68	55	81	71	64	ST/SP
		Sg. Segget	3JSGT002	68	55	77	68	72	ST/SP
		Sg. Segget	3JSGT003	51	50	59	67	65	ST/SP
		Sg. Segget	3JSGT004	57	54	63	78	76	ST/SP
		Sg. Segget	3JSGT005	51	50	54	65	72	ST/SP
	Sg. Skudai	Sg. Melana	3JSKU008	89	85	91	95	94	B/C
		Sg. Melana	3JSKU009	57	45	61	59	66	ST/SP
		Sg. Skudai	3JSKU001	52	44	55	63	65	ST/SP
		Sg. Skudai	3JSKU002	53	49	66	71	65	ST/SP
		Sg. Skudai	3JSKU003	61	58	61	74	74	ST/SP
		Sg. Skudai	3JSKU004	87	86	89	90	93	B/C
		Sg. Skudai	3JSKU005	73	65	72	79	81	B/C
		Sg. Skudai	3JSKU006	65	58	66	76	77	ST/SP
		Sg. Skudai	3JSKU007	43	44	43	54	63	ST/SP
		Sg. Skudai	3JSKU010	56	52	55	62	61	ST/SP
		Sg. Skudai	3JSKU011	89	91	92	92	95	B/C
	Sg. Tebrau	Sg. Bala	3JTRU008	46	42	55	47	55	T/P
		Sg. Pandan	3JTRU007	44	43	46	43	58	T/P
		Sg. Plentong	3JTRU004	53	52	56	66	67	ST/SP
		Sg. Sebulung	3JTRU009	47	38	53	58	62	ST/SP
		Sg. Sengkuang	3JTRU011	29	35	52	53	50	T/P
		Sg. Tampoi	3JTRU010	48	44	52	60	58	T/P
		Sg. Tebrau	3JTRU001	38	40	44	65	57	T/P

Jadual 2.1: Status Kualiti Air Sungai Mengikut Stesen, 2022
Table 2.1: Water Quality Status by Stations, 2022

NEGERI / STATE	LEMBANGAN / BASIN	SUNGAI / RIVER	NOMBOR STESEN / STATION NUMBER	NILAI IKA / WQI VALUE					KATEGORI IKA (2022) / WQI CATEGORY (2022)
				2018	2019	2020	2021	2022	
Johor	Sg. Tebrau	Sg. Tebrau	3JTRU002	60	61	55	72	54	T/P
		Sg. Tebrau	3JTRU003	58	61	65	72	68	ST/SP
		Sg. Tebrau	3JTRU005	49	49	57	65	62	ST/SP
		Sg. Tebrau	3JTRU006	58	58	64	69	71	ST/SP
Pahang	Sg. Anak Endau	Sg. Anak Endau	4CAED001	88	92	94	95	95	B/C
		Sg. Anak Endau	4CAED002	78	81	84	87	86	B/C
	Sg. Balok	Sg. Balok	4CBLK001	68	68	66	82	74	ST/SP
	Sg. Balok	Sg. Balok	4CBLK002	69	69	70	77	77	ST/SP
		Sg. Panjang	4CBLK004	79	86	76	78	72	ST/SP
		Sg. Yior	4CBLK003	64	64	62	75	74	ST/SP
	Sg. Bebar	Sg. Bebar	4CBBR001	76	79	76	86	83	B/C
		Sg. Bebar	4CBBR002	84	85	82	92	89	B/C
		Sg. Merba	4CBBR005	75	86	85	91	88	B/C
		Sg. Serai	4CBBR003	80	80	75	85	74	ST/SP
		Sg. Serai	4CBBR004	82	83	85	88	86	B/C
	Sg. Cherating	Sg. Cherating	4CCHE001	83	79	81	86	85	B/C
	Sg. Kuantan	Sg. Belat	4CKTN001	83	79	80	86	88	B/C
		Sg. Charu	4CKTN006	86	92	93	96	95	B/C
		Sg. Galing Besar	4CKTN003	67	64	63	70	76	ST/SP
		Sg. Galing Besar	4CKTN004	68	61	64	62	76	ST/SP
		Sg. Kenau	4CKTN010	89	90	94	97	96	B/C
		Sg. Kuantan	4CKTN002	82	85	88	93	87	B/C
		Sg. Kuantan	4CKTN015	83	84	87	93	87	B/C
		Sg. Kuantan	4CKTN016	85	88	90	93	94	B/C
		Sg. Kuantan	4CKTN017	87	91	93	96	96	B/C
		Sg. Kuantan	4CKTN018	91	92	94	96	97	B/C
		Sg. Kuantan	4CKTN019	81	81	80	85	87	B/C
		Sg. Kuantan	4CKTN020	84	87	86	93	87	B/C
		Sg. Kuantan	4CKTN021	83	83	85	88	89	B/C
		Sg. Pandan	4CKTN012	86	83	87	93	94	B/C
		Sg. Pinang	4CKTN005	85	89	80	88	88	B/C
		Sg. Reman	4CKTN014	82	86	87	91	90	B/C
		Sg. Riau	4CKTN007	83	84	84	88	88	B/C
		Sg. Talam	4CKTN013	80	69	72	70	76	ST/SP
	Sg. Merchong	Sg. Merchong	4CMCO002	77	85	82	92	86	B/C
		Sg. Merchong	4CMCO003	80	87	89	93	89	B/C
	Sg. Pahang	Sg. Anak Sg. Lepar	4CPHG136	84	84	85	93	89	B/C
		Sg. Batu	4CPHG056	82	79	84	92	91	B/C
		Sg. Belayar	4CPHG135	91	89	94	94	92	B/C
		Sg. Bentong	4CPHG040	89	92	92	95	95	B/C
		Sg. Bentong	4CPHG045	81	82	87	91	89	B/C
		Sg. Bentong	4CPHG092	82	84	92	95	90	B/C
		Sg. Bentong	4CPHG133	85	79	86	93	94	B/C
		Sg. Bentong	4CPHG134	91	86	92	96	96	B/C

Jadual 2.1: Status Kualiti Air Sungai Mengikut Stesen, 2022
Table 2.1: Water Quality Status by Stations, 2022

NEGERI / STATE	LEMBANGAN / BASIN	SUNGAI / RIVER	NOMBOR STESEN / STATION NUMBER	NILAI IKA / WQI VALUE					KATEGORI IKA (2022) / WQI CATEGORY (2022)
				2018	2019	2020	2021	2022	
Pahang	Sg. Pahang	Sg. Bentong	4CPHG144	81	82	86	89	88	B/C
		Sg. Benus	4CPHG047	82	82	91	91	91	B/C
		Sg. Benus	4CPHG118	90	85	94	94	92	B/C
		Sg. Benus	4CPHG152	89	87	93	96	91	B/C
		Sg. Bera	4CPHG019	79	82	83	86	85	B/C
		Sg. Bera	4CPHG020	80	82	84	86	89	B/C
		Sg. Bera	4CPHG058	80	85	85	86	88	B/C
		Sg. Bera	4CPHG059	83	88	85	91	85	B/C
		Sg. Bera	4CPHG063	86	85	85	86	85	B/C
		Sg. Berkelah	4CPHG098	92	92	93	97	97	B/C
		Sg. Bertam	4CBTM002	86	88	91	94	89	B/C
		Sg. Bertam	4CBTM010	76	81	74	79	78	ST/SP
		Sg. Bertam	4CBTM011	93	94	96	96	97	B/C
		Sg. Bertam	4CBTM013	92	94	97	97	97	B/C
		Sg. Bilut	4CPHG119	84	82	83	88	85	B/C
		Sg. Bilut	4CPHG129	85	87	85	92	92	B/C
		Sg. Burung	4CBTM005	91	92	96	96	95	B/C
		Sg. Chini	4CPHG004	80	86	82	84	85	B/C
		Sg. Gapoi	4CPHG086	92	94	94	97	96	B/C
		Sg. Habu	4CBTM004	88	88	90	96	94	B/C
		Sg. Jelai	4CPHG0130	88	88	90	93	93	B/C
		Sg. Jelai	4CPHG096	83	86	86	91	88	B/C
		Sg. Jelai	4CPHG125	82	87	88	90	90	B/C
		Sg. Jempol	4CPHG049	84	86	83	91	90	B/C
		Sg. Jempol	4CPHG050	86	90	93	97	94	B/C
		Sg. Jempol	4CPHG087	87	89	93	95	93	B/C
		Sg. Jempol	4CPHG088	83	89	90	95	91	B/C
		Sg. Jempol	4CPHG121	86	79	85	95	94	B/C
		Sg. Jengka	4CPHG041	86	88	92	95	93	B/C
		Sg. Jengka	4CPHG051	84	85	86	89	90	B/C
		Sg. Kecau	4CPHG091	82	74	83	87	91	B/C
		Sg. Kecau	4CPHG116	81	80	84	87	84	B/C
		Sg. Kecau	4CPHG151	85	84	89	89	95	B/C
		Sg. Kelau	4CPHG117	86	86	88	91	94	B/C
		Sg. Kelau	4CPHG145	82	82	82	86	86	B/C
		Sg. Kelau	4CPHG146	88	85	91	93	94	B/C
		Sg. Kelau	4CPHG153	81	83	84	89	84	B/C
		Sg. Kertam	4CPHG014	83	90	91	91	93	B/C
		Sg. Koyan	4CPHG033	89	88	89	94	92	B/C
		Sg. Krau	4CPHG003	89	90	92	94	92	B/C
		Sg. Kundang	4CPHG018	86	86	79	82	85	B/C
		Sg. Lenggok	4CBTM003	90	91	93	96	92	B/C
		Sg. Lepar	4CPHG006	87	91	92	91	93	B/C
		Sg. Lipis	4CPHG029	81	85	85	90	89	B/C

Jadual 2.1: Status Kualiti Air Sungai Mengikut Stesen, 2022
Table 2.1: Water Quality Status by Stations, 2022

NEGERI / STATE	LEMBANGAN / BASIN	SUNGAI / RIVER	NOMBOR STESEN / STATION NUMBER	NILAI IKA / WQI VALUE					KATEGORI IKA (2022) / WQI CATEGORY (2022)
				2018	2019	2020	2021	2022	
Pahang	Sg. Pahang	Sg. Lipis	4CPHG030	86	86	88	91	91	B/C
		Sg. Lipis	4CPHG035	89	91	93	96	94	B/C
		Sg. Luit	4CPHG015	85	89	91	93	92	B/C
		Sg. Maran	4CPHG016	85	90	93	96	96	B/C
		Sg. Mentiga	4CPHG005	80	85	80	77	83	B/C
		Sg. Mentiga	4CPHG042	83	87	85	86	88	B/C
		Sg. Mentiga	4CPHG089	85	82	85	87	89	B/C
		Sg. Pahang	4CPHG007	82	83	82	90	88	B/C
		Sg. Pahang	4CPHG008	87	86	93	93	91	B/C
		Sg. Pahang	4CPHG010	84	86	87	90	92	B/C
		Sg. Pahang	4CPHG011	83	85	88	93	89	B/C
		Sg. Pahang	4CPHG012	85	90	89	93	90	B/C
		Sg. Pahang	4CPHG013	79	86	89	91	90	B/C
		Sg. Pahang	4CPHG021	85	83	87	92	90	B/C
		Sg. Pahang	4CPHG022	78	88	87	91	91	B/C
		Sg. Pahang	4CPHG023	91	91	91	94	92	B/C
		Sg. Pahang	4CPHG027	87	83	88	94	92	B/C
		Sg. Pahang	4CPHG054	85	87	87	90	88	B/C
		Sg. Pahang	4CPHG055	80	83	86	91	90	B/C
		Sg. Pahang	4CPHG097	83	84	88	93	89	B/C
		Sg. Pahang	4CPHG100	85	83	84	89	88	B/C
		Sg. Pahang	4CPHG104	87	87	87	91	90	B/C
		Sg. Pahang	4CPHG111	80	83	89	92	93	B/C
		Sg. Pahang	4CPHG113	85	84	87	92	88	B/C
		Sg. Pahang	4CPHG124	88	87	89	91	91	B/C
		Sg. Pahang	4CPHG126	81	89	88	92	91	B/C
		Sg. Pahang	4CPHG127	85	84	89	88	96	B/C
		Sg. Pahang	4CPHG131	81	84	88	88	89	B/C
		Sg. Pahang	4CPHG137	82	85	86	93	90	B/C
		Sg. Pahang	4CPHG138	83	84	85	90	89	B/C
		Sg. Pahang	4CPHG139	84	82	83	90	89	B/C
		Sg. Pahang	4CPHG141	79	83	87	91	93	B/C
		Sg. Pahang	4CPHG148	82	85	88	92	88	B/C
		Sg. Pahang	4CPHG150	83	86	87	89	89	B/C
		Sg. Penjuring	4CPHG044	91	87	94	97	97	B/C
		Sg. Pertang	4CPHG132	83	79	91	90	91	B/C
		Sg. Perting	4CPHG120	90	91	94	96	97	B/C
		Sg. Raub	4CPHG123	89	89	93	95	95	B/C
		Sg. Retang	4CPHG105	87	87	92	93	94	B/C
		Sg. Ringlet	4CBTM001	83	82	83	91	89	B/C
		Sg. Salak	4CPHG122	86	89	87	91	91	B/C
		Sg. Semantan	4CPHG025	83	83	87	92	88	B/C
		Sg. Semantan	4CPHG036	89	90	91	92	93	B/C
		Sg. Semantan	4CPHG061	85	84	87	90	85	B/C

Jadual 2.1: Status Kualiti Air Sungai Mengikut Stesen, 2022
Table 2.1: Water Quality Status by Stations, 2022

NEGERI / STATE	LEMBANGAN / BASIN	SUNGAI / RIVER	NOMBOR STESEN / STATION NUMBER	NILAI IKA / WQI VALUE					KATEGORI IKA (2022) / WQI CATEGORY (2022)
				2018	2019	2020	2021	2022	
Pahang	Sg. Pahang	Sg. Semantan	4CPHG084	84	86	88	93	88	B/C
		Sg. Serting	4CPHG101	80	80	84	85	86	B/C
		Sg. Serting	4CPHG102	83	83	85	84	86	B/C
		Sg. T. Paya Bungor	4CPHG002	84	85	91	91	92	B/C
		Sg. Tahan	4CPHG109	87	88	91	92	94	B/C
		Sg. Tanglir	4CPHG048	86	87	88	94	90	B/C
		Sg. Tanglir	4CPHG053	83	87	89	87	89	B/C
		Sg. Tanglir	4CPHG057	83	84	87	84	89	B/C
		Sg. Tanglir	4CPHG106	80	86	88	86	87	B/C
		Sg. Tanglir	4CPHG107	84	86	88	88	90	B/C
		Sg. Tasik Bera	4CPHG140	84	86	91	88	89	B/C
		Sg. Tasik Chini	4CPHG043	88	89	92	88	93	B/C
		Sg. Tasik Chini	4CPHG060	90	90	93	90	92	B/C
		Sg. Tasik Chini	4CPHG071	89	90	91	92	93	B/C
		Sg. Tasik Chini	4CPHG108	88	90	92	93	93	B/C
		Sg. Tasik Chini	4CPHG110	89	90	91	87	93	B/C
		Sg. Tasik Chini	4CPHG112	89	90	93	89	92	B/C
		Sg. Tasik Chini	4CPHG114	90	89	92	92	93	B/C
		Sg. Tasik Chini	4CPHG115	90	91	92	90	92	B/C
		Sg. Tasik Chini	4CPHG130	92	89	92	90	92	B/C
		Sg. Tasik Chini	4CPHG143	89	89	92	87	90	B/C
		Sg. Teh	4CPHG090	80	90	93	94	94	B/C
		Sg. Tekal	4CPHG062	83	81	85	89	87	B/C
		Sg. Telang	4CPHG032	89	90	91	94	93	B/C
		Sg. Telemong	4CPHG046	89	86	94	96	95	B/C
		Sg. Telemong	4CPHG093	85	91	93	93	93	B/C
		Sg. Telemong	4CPHG094	91	89	91	97	94	B/C
		Sg. Telom	4CBTM008	86	86	86	95	94	B/C
		Sg. Telom	4CBTM009	83	83	86	93	92	B/C
		Sg. Tembeling	4CPHG142	84	88	91	90	94	B/C
		Sg. Teranum	4CPHG038	88	87	95	96	96	B/C
		Sg. Teras	4CPHG037	90	87	93	96	95	B/C
		Sg. Teras	4CPHG147	88	88	91	96	96	B/C
		Sg. Teris	4CPHG081	89	87	91	94	95	B/C
		Sg. Teris	4CPHG082	87	87	92	95	94	B/C
		Sg. Teris	4CPHG083	88	88	92	94	94	B/C
		Sg. Terla	4CBTM007	91	91	92	95	97	B/C
		Sg. Terla	4CBTM012	92	88	95	97	97	B/C
		Sg. Triang	4CPHG024	84	85	88	91	85	B/C
		Sg. Triang	4CPHG074	83	86	88	91	84	B/C
		Sg. Tringkap	4CBTM006	85	82	89	94	96	B/C
		Sg. Ulong	4CBTM014	93	94	96	97	97	B/C
	Sg. Rompin	Sg. Aur	4CRPN005	84	86	86	91	90	B/C
		Sg. Bakar	4CRPN016	80	71	75	69	92	B/C

Jadual 2.1: Status Kualiti Air Sungai Mengikut Stesen, 2022
Table 2.1: Water Quality Status by Stations, 2022

NEGERI / STATE	LEMBANGAN / BASIN	SUNGAI / RIVER	NOMBOR STESEN / STATION NUMBER	NILAI IKA / WQI VALUE					KATEGORI IKA (2022) / WQI CATEGORY (2022)
				2018	2019	2020	2021	2022	
Pahang	Sg. Rompin	Sg. Jekatih	4CRPN012	83	86	87	91	92	B/C
		Sg. Jekatih	4CRPN013	84	84	87	90	91	B/C
		Sg. Jeram	4CRPN006	84	88	88	93	90	B/C
		Sg. Kepasing	4CRPN010	79	81	88	90	92	B/C
		Sg. Keratong	4CRPN011	83	82	84	87	91	B/C
		Sg. Keratong	4CRPN018	83	86	84	91	91	B/C
		Sg. Keratong	4CRPN021	82	85	86	93	90	B/C
		Sg. Keratong	4CRPN022	81	83	88	93	90	B/C
		Sg. Pontian	4CRPN003	86	87	85	90	84	B/C
		Sg. Pukin	4CRPN014	80	83	87	90	92	B/C
		Sg. Pukin	4CRPN015	79	83	84	90	94	B/C
		Sg. Pukin	4CRPN017	84	83	87	89	94	B/C
		Sg. Rompin	4CRPN004	82	86	78	88	87	B/C
		Sg. Rompin	4CRPN007	84	88	79	92	88	B/C
		Sg. Rompin	4CRPN008	83	86	85	93	91	B/C
		Sg. Rompin	4CRPN020	82	87	83	93	91	B/C
		Sg. Rompin	4CRPN030	84	86	86	90	91	B/C
		Sg. Sepayang	4CRPN002	82	84	77	84	86	B/C
	Sg. Tonggok	Sg. Tonggok	4CTGK001	69	73	80	82	67	ST/SP
		Sg. Tonggok	4CTGK002	66	63	65	80	75	ST/SP
Terengganu	Sg. Besut	Sg. Besut	4TBST002	88	89	91	93	94	B/C
		Sg. Besut	4TBST003	89	91	92	94	93	B/C
		Sg. Besut	4TBST004	90	91	93	96	93	B/C
		Sg. Besut	4TBST005	87	91	92	93	95	B/C
		Sg. Besut	4TBST006	84	89	92	94	95	B/C
		Sg. Jertih	4TBST001	85	84	88	92	91	B/C
	Sg. Chukai	Sg. Bungkus	4TCKI006	80	82	80	83	81	B/C
		Sg. Chukai	4TCKI003	79	80	80	87	88	B/C
		Sg. Ibok	4TCKI001	80	79	81	87	89	B/C
		Sg. Ibok	4TCKI002	84	86	91	91	87	B/C
		Sg. Ruang	4TCKI004	76	74	74	80	80	ST/SP
		Sg. Ruang	4TCKI005	74	73	65	80	79	ST/SP
	Sg. Dungun	Sg. Dungun	4TDGN002	88	90	92	96	95	B/C
		Sg. Dungun	4TDGN003	90	88	91	95	93	B/C
		Sg. Dungun	4TDGN004	88	88	90	94	91	B/C
		Sg. Dungun	4TDGN005	91	90	90	94	92	B/C
		Sg. Dungun	4TDGN006	90	85	91	94	91	B/C
		Sg. Telemboh	4TDGN001	83	86	86	89	89	B/C
	Sg. Ibai	Sg. Ibai	4TIBI001	72	77	81	75	73	ST/SP
		Sg. Ibai	4TIBI002	76	81	79	84	83	B/C
		Sg. Ibai	4TIBI003	81	79	85	82	87	B/C
	Sg. Kemaman	Sg. Cherul	4TKMM003	87	84	90	92	92	B/C
		Sg. Cherul	4TKMM004	85	85	91	91	90	B/C
		Sg. Cherul	4TKMM010	87	81	89	90	91	B/C

Jadual 2.1: Status Kualiti Air Sungai Mengikut Stesen, 2022
Table 2.1: Water Quality Status by Stations, 2022

NEGERI / STATE	LEMBANGAN / BASIN	SUNGAI / RIVER	NOMBOR STESEN / STATION NUMBER	NILAI IKA / WQI VALUE					KATEGORI IKA (2022) / WQI CATEGORY (2022)
				2018	2019	2020	2021	2022	
Terengganu	Sg. Kemaman	Sg. Kemaman	4TKMM007	90	90	92	95	95	B/C
		Sg. Kemaman	4TKMM008	83	85	87	94	89	B/C
		Sg. Kemaman	4TKMM009	81	82	86	90	92	B/C
		Sg. Neram	4TKMM005	73	31	75	86	85	B/C
		Sg. Perasing	4TKMM006	85	82	82	92	94	B/C
		Sg. Ransan	4TKMM001	70	64	65	78	79	ST/SP
		Sg. Ransan	4TKMM002	88	87	91	95	95	B/C
	Sg. Kertih	Sg. Kertih	4TKTH001	84	84	82	88	91	B/C
		Sg. Kertih	4TKTH002	85	83	87	83	86	B/C
	Sg. Kluang	Sg. Kluang	4TKLU005	82	83	88	84	84	B/C
	Sg. Marang	Sg. Kerak	4TMRG001	70	81	79	82	85	B/C
		Sg. Marang	4TMRG002	85	83	88	89	94	B/C
		Sg. Temala	4TMRG003	85	87	91	92	91	B/C
	Sg. Merang	Sg. Merang	4TMER001	81	77	82	77	77	ST/SP
	Sg. Merchang	Sg. Landas	4TMCA001	69	65	71	87	87	B/C
		Sg. Merchang	4TMCA002	70	72	71	80	73	ST/SP
	Sg. Paka	Sg. Besul	4TPKA001	87	86	92	96	96	B/C
		Sg. Paka	4TPKA005	84	84	87	88	89	B/C
		Sg. Paka	4TPKA006	85	84	88	92	91	B/C
		Sg. Paka	4TPKA007	89	87	88	90	91	B/C
		Sg. Rasau	4TPKA003	83	79	83	85	86	B/C
		Sg. Rasau	4TPKA004	75	79	77	83	79	ST/SP
		Sg. Rengat	4TPKA002	87	85	84	91	91	B/C
	Sg. Setiu	Sg. Bari	4TSTU002	90	91	92	95	95	B/C
		Sg. Chalok	4TSTU001	90	86	85	94	91	B/C
		Sg. Chalok	4TSTU005	89	89	90	92	93	B/C
		Sg. Chalok	4TSTU006	82	84	83	83	85	B/C
		Sg. Setiu	4TSTU004	86	84	87	93	93	B/C
		Sg. Setiu	4TSTU007	90	86	90	94	93	B/C
		Sg. Tarom	4TSTU003	89	88	89	94	95	B/C
	Sg. Terengganu	Sg. Berang	4TTGG002	88	91	89	92	96	B/C
		Sg. Berang	4TTGG011	92	90	92	97	96	B/C
		Sg. Nerus	4TTGG004	88	84	85	91	87	B/C
		Sg. Nerus	4TTGG005	89	91	92	95	96	B/C
		Sg. Nerus	4TTGG006	89	91	89	93	95	B/C
		Sg. Nerus	4TTGG010	68	60	66	68	72	ST/SP
		Sg. Nerus	4TTGG014	85	87	90	94	94	B/C
		Sg. Nerus	4TTGG015	88	90	91	94	95	B/C
		Sg. Pueh	4TTGG007	63	65	70	82	86	B/C
		Sg. Pueh	4TTGG008	75	72	77	89	93	B/C
		Sg. Telemong	4TTGG012	84	89	88	93	91	B/C
		Sg. Terengganu	4TTGG001	85	86	87	91	90	B/C
		Sg. Terengganu	4TTGG003	90	91	90	95	96	B/C
		Sg. Terengganu	4TTGG009	84	87	87	88	89	B/C

Jadual 2.1: Status Kualiti Air Sungai Mengikut Stesen, 2022
Table 2.1: Water Quality Status by Stations, 2022

NEGERI / STATE	LEMBANGAN / BASIN	SUNGAI / RIVER	NOMBOR STESEN / STATION NUMBER	NILAI IKA / WQI VALUE					KATEGORI IKA (2022) / WQI CATEGORY (2022)
				2018	2019	2020	2021	2022	
Terengganu	Sg. Terengganu	Sg. Terengganu	4TTGG013	88	89	89	92	93	B/C
Kelantan	Sg. Golok	Sg. Golok	4DGLK002	83	87	86	93	91	B/C
		Sg. Golok	4DGLK003	90	90	94	97	94	B/C
		Sg. Golok	4DGLK004	86	82	87	93	89	B/C
		Sg. Golok	4DGLK005	80	86	89	93	90	B/C
		Sg. Golok	4DGLK006	83	84	86	91	88	B/C
		Sg. Jedok	4DGLK008	86	88	90	95	95	B/C
		Sg. Lanas	4DGLK007	85	86	84	94	90	B/C
		Sg. Tasik Garu	4DGLK001	78	76	80	85	82	B/C
	Sg. Kelantan	Sg. Aring	4DKLT013	76	76	79	80	83	B/C
		Sg. Belatop	4DKLT020	79	80	83	89	87	B/C
		Sg. Belatop	4DKLT021	86	86	87	96	93	B/C
		Sg. Belatop	4DKLT046	77	74	78	82	82	B/C
		Sg. Ber	4DKLT018	79	84	87	91	91	B/C
		Sg. Berok	4DKLT016	75	79	81	83	85	B/C
		Sg. Berok	4DKLT019	80	82	88	90	90	B/C
		Sg. Berok	4DKLT022	79	81	81	84	81	B/C
		Sg. Betis	4DKLT017	83	84	86	93	92	B/C
		Sg. Chiku	4DKLT037	84	83	88	88	90	B/C
		Sg. Chiku	4DKLT043	86	87	89	90	92	B/C
		Sg. Galas	4DKLT014	84	83	89	89	81	B/C
		Sg. Galas	4DKLT031	88	86	89	90	92	B/C
		Sg. Galas	4DKLT032	85	87	87	92	87	B/C
		Sg. Galas	4DKLT033	83	79	84	81	91	B/C
		Sg. Galas	4DKLT034	82	81	82	79	92	B/C
		Sg. Isos	4DKLT049	68	73	73	73	78	ST/SP
		Sg. Kelantan	4DKLT001	79	82	82	83	87	B/C
		Sg. Kelantan	4DKLT006	81	78	78	87	89	B/C
		Sg. Kelantan	4DKLT010	82	81	84	83	82	B/C
		Sg. Kelantan	4DKLT045	81	78	80	84	87	B/C
		Sg. Kelantan	4DKLT054	84	87	88	89	91	B/C
		Sg. Kelantan	4DKLT055	85	85	85	93	90	B/C
		Sg. Kelantan	4DKLT056	79	78	81	83	87	B/C
		Sg. Kelesa	4DKLT015	80	84	87	94	91	B/C
		Sg. Kenkren	4DKLT047	89	88	92	93	94	B/C
		Sg. Kerilla	4DKLT002	89	87	92	94	94	B/C
		Sg. Kerilla	4DKLT003	89	90	91	94	93	B/C
		Sg. Ketil	4DKLT036	86	86	90	97	90	B/C
		Sg. Ketil	4DKLT053	86	84	90	96	90	B/C
		Sg. Lebir	4DKLT026	85	89	92	94	91	B/C
		Sg. Lebir	4DKLT027	80	78	85	87	79	ST/SP
		Sg. Lebir	4DKLT028	84	85	88	94	94	B/C
		Sg. Lebir	4DKLT029	82	82	84	87	81	B/C
		Sg. Lebir	4DKLT058	88	85	88	95	91	B/C

Jadual 2.1: Status Kualiti Air Sungai Mengikut Stesen, 2022
Table 2.1: Water Quality Status by Stations, 2022

NEGERI / STATE	LEMBANGAN / BASIN	SUNGAI / RIVER	NOMBOR STESEN / STATION NUMBER	NILAI IKA / WQI VALUE					KATEGORI IKA (2022) / WQI CATEGORY (2022)
				2018	2019	2020	2021	2022	
Kelantan	Sg. Kelantan	Sg. Muring	4DKLT059	88	84	85	92	90	B/C
		Sg. Nal	4DKLT007	87	89	89	93	90	B/C
		Sg. Nal	4DKLT008	81	85	88	91	89	B/C
		Sg. Nal	4DKLT009	83	85	87	91	88	B/C
		Sg. Nenggiri	4DKLT023	77	82	82	83	86	B/C
		Sg. Nenggiri	4DKLT024	80	80	83	86	87	B/C
		Sg. Nenggiri	4DKLT025	79	80	80	78	91	B/C
		Sg. Pehi	4DKLT011	89	87	88	92	91	B/C
		Sg. Pehi	4DKLT044	84	88	86	90	91	B/C
		Sg. Pelaur	4DKLT048	90	88	90	96	95	B/C
		Sg. Penangau	4DKLT050	81	82	78	87	89	B/C
		Sg. Pergau	4DKLT004	91	93	91	96	97	B/C
		Sg. Pergau	4DKLT005	90	89	90	95	94	B/C
		Sg. Pergau	4DKLT038	89	92	94	96	97	B/C
		Sg. Pergau	4DKLT039	91	92	94	97	97	B/C
		Sg. Pergau	4DKLT040	92	93	94	97	97	B/C
		Sg. Pergau	4DKLT041	86	87	90	94	93	B/C
		Sg. Pergau	4DKLT051	92	92	91	96	97	B/C
		Sg. Pergau	4DKLT052	90	88	92	94	94	B/C
		Sg. Rasau	4DKLT061	78	81	80	80	85	B/C
		Sg. Relai	4DKLT012	80	83	90	91	88	B/C
		Sg. Relai	4DKLT030	86	86	88	91	94	B/C
		Sg. Sokor	4DKLT042	87	83	86	89	89	B/C
		Sg. Tuang	4DKLT035	89	87	90	94	91	B/C
	Sg. Kemasin	Sg. Gali	4DKMS006	76	76	79	75	83	B/C
		Sg. Kemasin	4DKMS001	83	83	84	90	90	B/C
		Sg. Kemasin	4DKMS003	77	73	75	76	76	ST/SP
		Sg. Semerak	4DKMS002	86	84	85	91	88	B/C
		Sg. Semerak	4DKMS004	88	83	86	89	89	B/C
		Sg. Semerak	4DKMS005	85	88	80	77	80	ST/SP
	Sg. Pengkalan Chepa	Sg. Alor B	4DPCH003	57	48	65	63	59	T/P
		Sg. Alor Lintah	4DPCH004	62	61	76	68	70	ST/SP
		Sg. Keladi	4DPCH002	79	78	76	84	89	B/C
		Sg. Pengkalan Chepa	4DPCH005	62	50	68	70	70	ST/SP
		Sg. Pengkalan Chepa	4DPCH006	71	69	75	82	76	ST/SP
		Sg. Raja Gali	4DPCH001	72	73	79	87	81	B/C
	Sg. Pengkalan Datu	Sg. Pasir Hor	4DPDT004	78	67	73	77	75	ST/SP
		Sg. Pengkalan Datu	4DPDT001	75	76	83	86	88	B/C
		Sg. Pengkalan Datu	4DPDT002	80	73	83	87	85	B/C
		Sg. Pengkalan Datu	4DPDT003	80	77	86	86	87	B/C
Sarawak	Sg. Balingian	Sg. Balingian	6QBLG001	75	83	90	87	84	B/C
		Sg. Balingian	6QBLG002	88	88	88	86	89	B/C
	Sg. Baram	Sg. Baram	6QBRM001	83	86	79	81	83	B/C
		Sg. Baram	6QBRM002	80	85	81	83	83	B/C

Jadual 2.1: Status Kualiti Air Sungai Mengikut Stesen, 2022
Table 2.1: Water Quality Status by Stations, 2022

NEGERI / STATE	LEMBANGAN / BASIN	SUNGAI / RIVER	NOMBOR STESEN / STATION NUMBER	NILAI IKA / WQI VALUE					KATEGORI IKA (2022) / WQI CATEGORY (2022)
				2018	2019	2020	2021	2022	
Sarawak	Sg. Baram	Sg. Baram	6QBRM003	86	90	89	89	88	B/C
		Sg. Baram	6QBRM004	85	92	90	88	88	B/C
		Sg. Tutuh	6QBRM005	85	92	90	-	87	B/C
	Sg. Kayan	Sg. Kayan	6QKYN001	75	77	77	76	76	ST/SP
		Sg. Kayan	6QKYN002	76	79	82	83	84	B/C
		Sg. Kayan	6QKYN003	87	85	87	88	87	B/C
	Sg. Kemena	Sg. Kemena	6QKMN001	83	82	82	82	82	B/C
		Sg. Kemena	6QKMN002	83	84	89	83	84	B/C
		Sg. Kemena	6QKMN003	89	86	81	80	85	B/C
		Sg. Kemena	6QKMN004	88	89	91	83	84	B/C
		Sg. Sibiu	6QKMN005	87	83	81	79	83	B/C
	Sg. Kerian	Sg. Kerian	6QKRN014	77	80	82	81	86	B/C
		Sg. Kerian	6QKRN015	89	86	89	84	88	B/C
		Sg. Seblak	6QKRN016	85	82	84	88	87	B/C
		Sg. Selalang	6QKRN017	93	91	92	92	90	B/C
	Sg. Lawas	Sg. Lawas	6QLWS001	88	91	89	87	90	B/C
		Sg. Lawas	6QLWS002	86	90	87	88	91	B/C
		Sg. Lawas	6QLWS003	86	91	89	90	92	B/C
	Sg. Limbang	Sg. Limbang	6QLBG001	84	90	88	86	88	B/C
		Sg. Limbang	6QLBG002	84	91	87	86	88	B/C
		Sg. Limbang	6QLBG003	87	91	88	90	89	B/C
		Sg. Limbang	6QLBG004	88	92	90	91	88	B/C
		Sg. Limbang	6QLBG005	90	92	92	88	90	B/C
	Sg. Lupar	Sg. Ai	6QLPR001	91	92	89	91	88	B/C
		Sg. Ai	6QLPR002	92	92	91	91	89	B/C
		Sg. Lupar	6QLPR003	82	81	77	83	88	B/C
		Sg. Lupar	6QLPR004	80	81	82	85	87	B/C
		Sg. Lupar	6QLPR005	90	91	89	85	90	B/C
		Sg. Sekerang	6QLPR006	90	91	92	88	87	B/C
		Sg. Seterap	6QLPR007	86	86	82	86	89	B/C
		Sg. Undup	6QLPR008	91	88	91	85	89	B/C
	Sg. Miri	Sg. Adong	6QMRI001	54	70	83	78	57	T/P
		Sg. Dalam	6QMRI002	71	74	84	83	80	ST/SP
		Sg. Lutong	6QMRI003	72	86	80	82	83	B/C
		Sg. Lutong	6QMRI004	72	86	77	80	74	ST/SP
		Sg. Miri	6QMRI005	56	75	87	88	56	T/P
		Sg. Miri	6QMRI006	60	76	88	88	60	ST/SP
		Sg. Padang Liku	6QMRI007	80	90	89	88	83	B/C
	Sg. Mukah	Sg. Mukah	6QMKH001	78	81	85	80	81	B/C
		Sg. Mukah	6QMKH002	71	83	89	82	86	B/C
		Sg. Mukah	6QMKH003	77	85	89	81	86	B/C
		Sg. Mukah	6QMKH004	87	88	89	87	88	B/C
		Sg. Mukah	6QMKH005	85	83	89	84	87	B/C
	Sg. Niah	Sg. Niah	6QNIA001	89	90	86	87	85	B/C

Jadual 2.1: Status Kualiti Air Sungai Mengikut Stesen, 2022
Table 2.1: Water Quality Status by Stations, 2022

NEGERI / STATE	LEMBANGAN / BASIN	SUNGAI / RIVER	NOMBOR STESEN / STATION NUMBER	NILAI IKA / WQI VALUE					KATEGORI IKA (2022) / WQI CATEGORY (2022)
				2018	2019	2020	2021	2022	
Sarawak	Sg. Niah	Sg. Niah	6QNIA002	88	90	86	86	86	B/C
		Sg. Sekaloh	6QNIA003	71	69	68	64	79	ST/SP
		Sg. Sekaloh	6QNIA004	85	83	87	86	84	B/C
	Sg. Oya	Sg. Oya	6QOYA001	81	82	79	76	83	B/C
		Sg. Oya	6QOYA002	72	84	89	81	87	B/C
		Sg. Oya	6QOYA003	86	91	89	89	86	B/C
	Sg. Rajang	Sg. Baloi	6QRJG019	84	89	89	-	89	B/C
		Sg. Binatang	6QRJG004	89	89	89	89	87	B/C
		Sg. Daro	6QRJG021	63	76	80	62	66	ST/SP
		Sg. Jemoreng	6QRJG022	61	78	80	63	66	ST/SP
		Sg. Julau	6QRJG005	91	90	88	86	85	B/C
		Sg. Kanowit	6QRJG006	87	88	89	87	87	B/C
		Sg. Meradong	6QRJG003	84	86	80	82	85	B/C
		Sg. Pakan	6QRJG020	91	89	88	89	88	B/C
		Sg. Pila Parit	6QRJG023	69	81	62	77	78	ST/SP
		Sg. Rajang	6QRJG008	86	82	83	86	86	B/C
		Sg. Rajang	6QRJG009	86	80	84	86	87	B/C
		Sg. Rajang	6QRJG010	86	85	82	86	85	B/C
		Sg. Rajang	6QRJG011	84	86	80	85	87	B/C
		Sg. Rajang	6QRJG012	73	78	85	84	89	B/C
		Sg. Rajang	6QRJG013	85	85	87	86	87	B/C
		Sg. Rajang	6QRJG014	84	85	85	84	86	B/C
		Sg. Rajang	6QRJG015	85	88	85	83	84	B/C
		Sg. Rajang	6QRJG016	83	88	85	86	87	B/C
		Sg. Rajang	6QRJG017	85	88	90	86	86	B/C
		Sg. Rajang	6QRJG018	86	87	90	84	87	B/C
		Sg. Salim	6QRJG007	77	80	83	81	86	B/C
		Sg. Sarikei	6QRJG001	84	83	80	86	87	B/C
		Sg. Sarikei	6QRJG002	88	90	89	90	88	B/C
	Sg. Sadong	Sg. Karangan	6QSDG001	66	71	68	69	76	ST/SP
		Sg. Karangan	6QSDG002	81	83	87	87	88	B/C
		Sg. Sadong	6QSDG003	75	75	73	81	84	B/C
		Sg. Sadong	6QSDG004	65	71	72	66	78	ST/SP
		Sg. Sadong	6QSDG005	90	87	88	90	87	B/C
		Sg. Sadong	6QSDG006	91	89	90	91	88	B/C
		Sg. Tarat	6QSDG007	92	90	91	90	90	B/C
	Sg. Sarawak	Sg. Kelantan	6QSWK017	86	84	74	59	68	ST/SP
		Sg. Kuap	6QSWK009	84	83	79	88	86	B/C
		Sg. Kuap	6QSWK010	89	87	87	88	89	B/C
		Sg. Maong Kiri	6QSWK011	68	76	72	73	82	B/C
		Sg. Samarahan	6QSWK013	66	68	65	63	66	ST/SP
		Sg. Samarahan	6QSWK014	83	79	80	85	87	B/C
		Sg. Sarawak	6QSWK001	85	83	81	84	84	B/C
		Sg. Sarawak	6QSWK003	86	85	83	85	87	B/C

Jadual 2.1: Status Kualiti Air Sungai Mengikut Stesen, 2022
Table 2.1: Water Quality Status by Stations, 2022

NEGERI / STATE	LEMBANGAN / BASIN	SUNGAI / RIVER	NOMBOR STESEN / STATION NUMBER	NILAI IKA / WQI VALUE					KATEGORI IKA (2022) / WQI CATEGORY (2022)
				2018	2019	2020	2021	2022	
Sarawak	Sg. Sarawak	Sg. Sarawak	6QSWK004	91	86	88	87	88	B/C
		Sg. Sarawak	6QSWK006	85	82	84	80	84	B/C
		Sg. Sarawak	6QSWK007	92	89	90	88	91	B/C
		Sg. Sarawak	6QSWK008	91	90	91	89	90	B/C
		Sg. Sarawak Kanan	6QSWK002	86	85	82	84	85	B/C
		Sg. Sarawak Kiri	6QSWK005	92	87	88	87	87	B/C
		Sg. Semadang	6QSWK016	93	90	89	90	90	B/C
		Sg. Semenggoh	6QSWK012	67	77	71	78	83	B/C
		Sg. Tabuan	6QSWK015	80	73	77	76	78	ST/SP
		Sg. Tapah	6QSWK018	89	89	89	91	90	B/C
	Sg. Saribas	Sg. Layar	6QSRB002	79	86	85	88	87	B/C
		Sg. Layar	6QSRB003	91	90	87	90	88	B/C
		Sg. Saribas	6QSRB001	78	80	74	79	87	B/C
	Sg. Semunsam	Sg. Semunsam	6QSMS001	89	85	87	80	85	B/C
	Sg. Sibuti	Sg. Kabuloh	6QSBT001	56	64	76	61	70	ST/SP
		Sg. Kabuloh	6QSBT002	88	72	69	64	87	B/C
		Sg. Kejapil	6QSBT003	85	90	88	89	85	B/C
		Sg. Satap	6QSBT004	79	86	88	84	84	B/C
		Sg. Sibuti	6QSBT005	82	88	82	84	77	ST/SP
		Sg. Sibuti	6QSBT006	85	86	87	88	84	B/C
	Sg. Similajau	Sg. Similajau	6QSML001	90	89	90	86	86	B/C
		Sg. Similajau	6QSML002	88	88	89	84	88	B/C
	Sg. Suai	Sg. Suai	6QSUA001	84	89	88	87	85	B/C
	Sg. Tatau	Sg. Tatau	6QTTU001	86	87	88	85	86	B/C
	Sg. Trusan	Sg. Trusan	6QTSN001	90	92	88	88	90	B/C
Sabah	Sg. Apas	Sg. Apas	5SAPS001	89	91	89	90	92	B/C
	Sg. Balung	Sg. Balung	5SBLU001	89	93	87	91	92	B/C
	Sg. Bengkoka	Sg. Bengkoka	5SBKK001	88	88	90	91	90	B/C
		Sg. Bengkoka	5SBKK002	87	85	86	86	88	B/C
	Sg. Bingkongan	Sg. Bandau	5SBKG001	91	90	91	92	92	B/C
		Sg. Bingkongan	5SBKG005	92	92	92	94	93	B/C
		Sg. Bingkongan	5SBKG006	92	93	91	94	94	B/C
		Sg. Menggaris	5SBKG002	93	91	93	93	90	B/C
		Sg. Menggaris	5SBKG003	91	92	92	92	93	B/C
		Sg. Tandek	5SBKG004	90	90	91	91	91	B/C
	Sg. Bongawan	Sg. Bongawan	5SBGW001	90	88	87	87	88	B/C
	Sg. Brantian	Sg. Brantian	5SBTN001	86	91	86	84	90	B/C
	Sg. Kalabakan	Sg. Kalabakan	5SKBK001	86	89	85	85	90	B/C
		Sg. Kalabakan	5SKBK002	85	85	84	84	86	B/C
		Sg. Kalabakan	5SKBK003	84	85	82	83	86	B/C
	Sg. Kalumpang	Sg. Kalumpang	5SKLP001	85	90	86	86	91	B/C
		Sg. Kalumpang	5SKLP002	84	92	86	90	88	B/C
		Sg. Kalumpang	5SKLP003	86	87	84	85	86	B/C
		Sg. Pang Burong 1	5SKLP004	87	89	83	86	86	B/C

Jadual 2.1: Status Kualiti Air Sungai Mengikut Stesen, 2022
Table 2.1: Water Quality Status by Stations, 2022

NEGERI / STATE	LEMBANGAN / BASIN	SUNGAI / RIVER	NOMBOR STESEN / STATION NUMBER	NILAI IKA / WQI VALUE					KATEGORI IKA (2022) / WQI CATEGORY (2022)
				2018	2019	2020	2021	2022	
Sabah	Sg. Kalumpang	Sg. Pang Burong 2	5SKLP005	74	76	69	85	80	ST/SP
	Sg. Kedamaian	Sg. Kedamaian	5SKDI004	92	93	90	93	92	B/C
		Sg. Tempasuk	5SKDI001	91	91	87	93	91	B/C
		Sg. Tempasuk	5SKDI002	92	93	91	92	92	B/C
		Sg. Wariu	5SKDI003	92	91	91	93	93	B/C
	Sg. Kimanis	Sg. Kimanis	5SKMA001	92	89	87	90	92	B/C
	Sg. Kinabatangan	Sg. Karamuak	5SKBT006	91	92	91	92	92	B/C
		Sg. Kinabatangan	5SKBT001	83	87	85	86	83	B/C
		Sg. Kinabatangan	5SKBT002	82	88	82	84	85	B/C
		Sg. Kinabatangan	5SKBT004	83	88	84	87	84	B/C
		Sg. Kinabatangan	5SKBT005	84	90	86	85	83	B/C
		Sg. Koyah	5SKBT003	85	88	87	89	88	B/C
		Sg. Leepang	5SKBT009	84	88	84	85	84	B/C
		Sg. Menanggul	5SKBT008	86	87	81	86	86	B/C
		Sg. Pin	5SKBT010	86	85	86	87	86	B/C
		Sg. Takala	5SKBT007	86	88	85	88	87	B/C
	Sg. Labok	Sg. Kinipir	5SLBK001	90	91	90	91	90	B/C
		Sg. Kinipir	5SLBK002	92	91	86	91	91	B/C
		Sg. Labok	5SLBK006	90	89	87	86	88	B/C
		Sg. Liwagu	5SLBK003	92	91	88	89	86	B/C
		Sg. Liwagu	5SLBK004	90	91	88	88	91	B/C
		Sg. Maliau	5SLBK005	91	93	92	94	93	B/C
		Sg. Tungud	5SLBK007	91	90	88	91	85	B/C
	Sg. Lakutan	Sg. Lakutan	5SLKT001	91	90	89	93	88	B/C
	Sg. Likas	Sg. Darau	5SLKS008	85	76	80	83	83	B/C
		Sg. Inanam	5SLKS001	83	77	79	81	80	ST/SP
		Sg. Inanam	5SLKS002	85	82	84	87	90	B/C
		Sg. Inanam	5SLKS003	92	93	92	93	93	B/C
		Sg. Likas	5SLKS004	75	70	77	73	78	ST/SP
		Sg. Likas	5SLKS005	77	85	78	77	80	ST/SP
		Sg. Menggatal	5SLKS006	86	85	81	87	89	B/C
		Sg. Menggatal	5SLKS007	93	91	87	91	92	B/C
	Sg. Lingkungan	Sg. Bukau	5SLKG002	91	90	88	92	87	B/C
		Sg. Lingkungan	5SLKG001	92	89	91	93	89	B/C
	Sg. Membakut	Sg. Membakut	5SMBT001	90	87	85	87	89	B/C
	Sg. Menggalong	Sg. Menggalong	5SMGL001	86	86	86	91	85	B/C
		Sg. Menggalong	5SMGL002	91	93	92	93	92	B/C
	Sg. Merotai	Sg. Merotai	5SMRT001	91	87	88	90	91	B/C
		Sg. Merotai	5SMRT002	91	89	92	94	92	B/C
		Sg. Merotai	5SMRT003	89	84	87	90	87	B/C
	Sg. Mounad	Sg. Mounad	5SMND001	87	86	85	89	88	B/C
		Sg. Mounad	5SMND002	87	88	86	86	89	B/C
	Sg. Moyog	Sg. Moyog	5SMYG001	91	90	86	88	91	B/C
		Sg. Moyog	5SMYG002	92	92	89	92	91	B/C

Jadual 2.1: Status Kualiti Air Sungai Mengikut Stesen, 2022
Table 2.1: Water Quality Status by Stations, 2022

NEGERI / STATE	LEMBANGAN / BASIN	SUNGAI / RIVER	NOMBOR STESEN / STATION NUMBER	NILAI IKA / WQI VALUE					KATEGORI IKA (2022) / WQI CATEGORY (2022)
				2018	2019	2020	2021	2022	
Sabah	Sg. Moyog	Sg. Moyog	5SMYG003	93	92	92	94	93	B/C
		Sg. Moyog	5SMYG004	92	93	92	94	92	B/C
	Sg. Padas	Sg. Bunsit	5SPDS001	91	92	91	93	92	B/C
		Sg. Liawan	5SPDS002	92	91	91	91	92	B/C
		Sg. Padas	5SPDS003	89	86	86	87	88	B/C
		Sg. Padas	5SPDS004	89	88	88	90	88	B/C
		Sg. Padas	5SPDS005	87	89	86	88	82	B/C
	Sg. Padas	Sg. Padas	5SPDS011	88	86	85	88	87	B/C
		Sg. Pangatan	5SPDS006	88	86	87	88	87	B/C
		Sg. Pegalan	5SPDS008	89	90	89	91	90	B/C
		Sg. Pegalan	5SPDS009	90	88	87	86	86	B/C
		Sg. Pegalan	5SPDS010	89	86	86	87	84	B/C
		Sg. Tandulu	5SPDS007	92	90	91	92	92	B/C
	Sg. Paitan	Sg. Paitan	5SPTN001	88	88	85	91	90	B/C
	Sg. Papar	Sg. Papar	5SPPR001	92	91	89	91	90	B/C
		Sg. Papar	5SPPR002	89	91	90	91	90	B/C
		Sg. Papar	5SPPR003	91	91	89	90	88	B/C
		Sg. Papar	5SPPR004	92	92	90	91	93	B/C
		Sg. Papar	5SPPR005	93	93	92	91	93	B/C
	Sg. Sapi	Sg. Sapi	5SSAP002	84	87	85	85	83	B/C
		Sg. Sapi	5SSAP003	84	86	86	86	84	B/C
		Sg. Sapi	5SSAP004	88	89	87	88	87	B/C
		Sg. Sualong	5SSAP001	89	91	92	92	93	B/C
	Sg. Segaliud	Sg. Segaliud	5SSLD001	82	87	86	85	81	B/C
		Sg. Segaliud	5SSLD002	82	87	87	86	84	B/C
	Sg. Segama	Sg. Segama	5SSGM001	86	91	86	87	86	B/C
		Sg. Segama	5SSGM002	84	91	85	88	87	B/C
		Sg. Segama	5SSGM003	86	91	85	88	87	B/C
	Sg. Sembulan	Sg. Sembulan	5SSBL001	73	81	84	81	74	ST/SP
		Sg. Sembulan	5SSBL002	74	73	74	80	69	ST/SP
	Sg. Silabukan	Sg. Silabukan	5SSBK001	87	89	86	87	83	B/C
		Sg. Silabukan	5SSBK002	91	90	89	91	91	B/C
	Sg. Sugut	Sg. Bongkud	5SSUG001	91	92	91	92	93	B/C
		Sg. Lohan	5SSUG002	91	92	91	92	93	B/C
		Sg. Merali	5SSUG003	88	92	88	91	90	B/C
		Sg. Sugut	5SSUG004	89	91	91	91	91	B/C
		Sg. Sugut	5SSUG005	91	91	88	92	91	B/C
		Sg. Sugut	5SSUG006	91	90	85	89	87	B/C
	Sg. Tawau	Sg. Tawau	5STWU001	78	83	77	83	78	ST/SP
		Sg. Tawau	5STWU002	87	85	83	88	88	B/C
		Sg. Tawau	5STWU003	91	92	91	93	92	B/C
		Sg. Tawau	5STWU004	93	92	91	93	93	B/C
	Sg. Telipok	Sg. Telipok	5STLP001	71	66	70	70	82	B/C

Jadual 2.1: Status Kualiti Air Sungai Mengikut Stesen, 2022
Table 2.1: Water Quality Status by Stations, 2022

NEGERI / STATE	LEMBANGAN / BASIN	SUNGAI / RIVER	NOMBOR STESEN / STATION NUMBER	NILAI IKA / WQI VALUE					KATEGORI IKA (2022) / WQI CATEGORY (2022)
				2018	2019	2020	2021	2022	
Sabah	Sg. Telipok	Sg. Telipok	5STLP002	88	88	90	90	91	B/C
	Sg. Tenghilan	Sg. Tenghilan	5STHL001	92	91	92	92	90	B/C
	Sg. Tingkayu	Sg. Tingkayu	5STKY001	85	89	84	85	85	B/C
		Sg. Tingkayu	5STKY002	84	89	86	86	84	B/C
	Sg. Tuaran	Sg. Damit	5STUA001	87	88	89	87	88	B/C
		Sg. Damit	5STUA002	89	89	87	87	90	B/C
		Sg. Song Sai	5STUA003	90	91	90	92	92	B/C
	Sg. Tuaran	Sg. Tuaran	5STUA004	93	92	92	93	93	B/C
		Sg. Tuaran	5STUA005	94	93	92	93	93	B/C
	Sg. Tungku	Sg. Tungku	5STKU001	89	87	89	90	88	B/C
		Sg. Tungku	5STKU002	89	90	90	89	90	B/C
	Sg. Umas-Umas	Sg. Umas Umas	5SUSM001	81	90	83	84	89	B/C

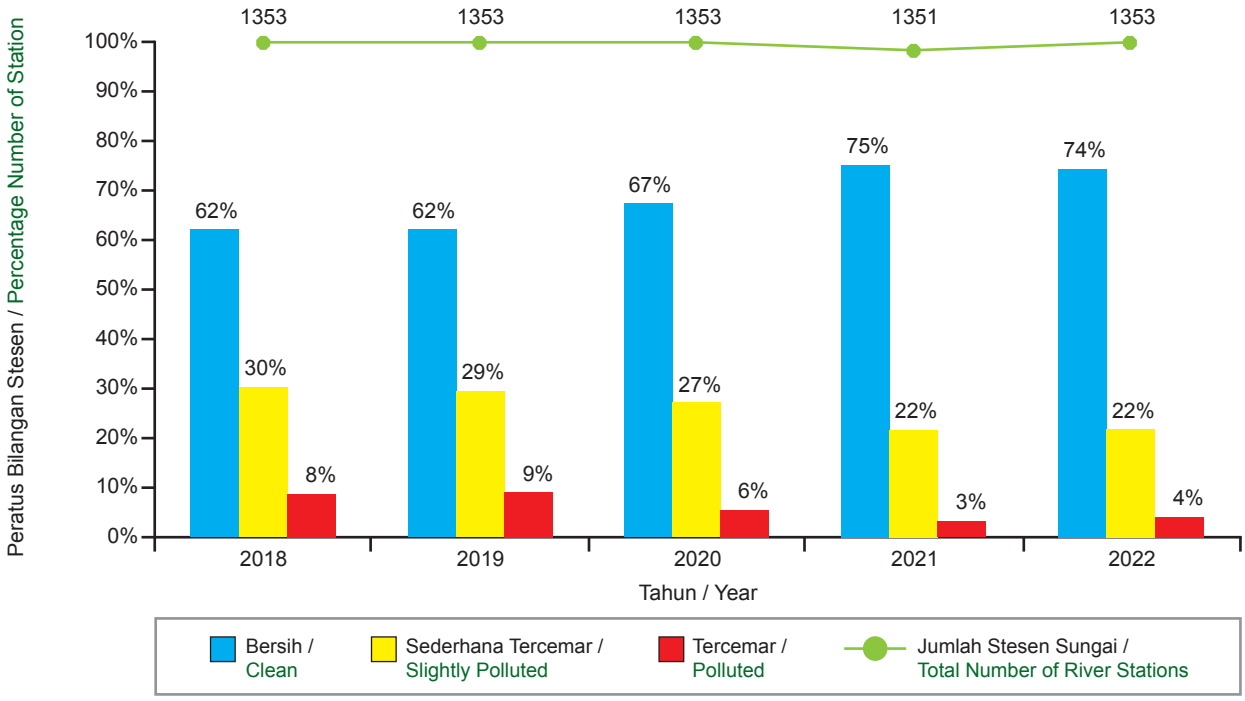
Nota / Note:

Kategori IKA / WQI Category

	B / C	Bersih / Clean
	ST / SP	Sederhana Tercemar / Slightly Polluted
	T / P	Tercemar / Polluted

Nilai IKA / WQI Value

	> 92.7	Kelas I / Class I
	76.5 - 92.7	Kelas II / Class II
	51.9 - 76.5	Kelas III / Class III
	31.0 - 51.9	Kelas IV / Class IV
	> 31.0	Kelas V / Class V
	–	Tiada Data / No Data



Rajah 2.2: Tren Stesen Kualiti Air Sungai, 2018-2022
Figure 2.2: River Water Quality Stations Trend, 2018-2022

STESEN PENGAWASAN KUALITI AIR SUNGAI KATEGORI TERCEMAR

Jadual 2.2 menunjukkan sebanyak 56 stesen pengawasan kualiti air sungai tercemar pada tahun 2022. Dari segi IKA, 40 dalam Kelas III, 15 Kelas IV dan satu (1) adalah Kelas V.

Berdasarkan sub-indeks BOD, 13 stesen sungai dikategorikan sebagai Kelas II, sembilan (9) Kelas III, 21 Kelas IV, manakala 13 Kelas V.

Dari segi sub-indeks AN pula, tiga (3) stesen sungai dikategorikan sebagai Kelas I, lima (5) Kelas II, tujuh (7) Kelas III, 19 Kelas IV, manakala 22 Kelas V.

Dari segi sub-indeks SS, 32 stesen sungai dikategorikan sebagai Kelas I, 19 Kelas II, lima (5) Kelas III.

Kesimpulannya, daripada 56 stesen sungai yang tercemar ini, penyumbang terbesar kemerosotan stesen pengawasan kualiti air sungai kepada Kelas V adalah berpunca daripada parameter AN iaitu sebanyak 39% dan diikuti parameter BOD iaitu sebanyak 23%.

WATER QUALITY MONITORING STATIONS CATEGORISED AS POLLUTED

Table 2.2 shows a total of 56 river water quality monitoring stations categorised as polluted in 2022. In terms of WQI, 40 stations were in Class III, 15 in Class IV and one (1) in Class V.

Based on the BOD sub-index, 13 river stations were classified as Class II, nine (9) as Class III, 21 as Class IV, while 13 were in Class V.

In terms of the AN sub-index, three (3) river stations were classified as Class I, five (5) as Class II, seven (7) as Class III, 19 as Class IV, and 22 as Class V.

In terms of SS sub-index, 32 river stations were classified as Class I, 19 as Class II, and five (5) as Class III.

In conclusion, of the 56 polluted river stations, the largest contributor to the deterioration of river water quality monitoring stations to Class V is the AN parameter with a reading of 39%, followed by the BOD parameter of 23%.

Jadual 2.2: Stesen Sungai Tercemar dan Kelas Kualiti Air Berdasarkan Sub-Indeks BOD, AN dan SS, 2022
Table 2.2: Polluted River Stations and Classes Based on BOD, AN and SS Sub-Indexes, 2022

NEGERI / STATE	LEMBANGAN / BASIN	SUNGAI / RIVER	NOMBOR STESEN / STATION NUMBER	2022			KELAS BERDASARKAN / CLASS BASED ON		
				IKA / WQI	KATEGORI / CATEGORY	KELAS / CLASS	BOD	AN	SS
Kedah	Sg. Merbok	Sg. Batu	1KMBK002	59	T/P	III	III	V	I
P. Pinang	Sg. Juru	Sg. Rambai	1PJRU005	56	T/P	III	IV	V	I
		Sg. Rambai	1PJRU007	55	T/P	III	IV	V	I
		Sg. Permatang Rawa	1PJRU008	55	T/P	III	III	III	I
	Sg. Jawi	Sg. Jawi	1PJWI001	57	T/P	III	IV	V	II
		Sg. Junjong	1PJWI002	57	T/P	III	IV	IV	II
		Sg. Chempedak	1PJWI003	36	T/P	IV	V	IV	III
		Sg. Junjong	1PJWI004	58	T/P	III	IV	IV	II
		Sg. Tengah	1PJWI005	47	T/P	IV	V	V	III
	Sg. Kluang	Sg. Kluang	1PKLU001	52	T/P	III	IV	V	I
	Sg. Pinang	Sg. Dondang	1PPNG012	54	T/P	III	IV	IV	I
		Sg. Dondang	1PPNG013	58	T/P	III	IV	IV	I
		Sg. Pinang	1PPNG021	56	T/P	III	III	III	I
	Sg. Perai	Sg. Kereh	1PPRI006	57	T/P	III	IV	V	II
		Sg. Kereh	1PPRI008	56	T/P	III	IV	V	II
		Sg. Pertama	1PPRI022	52	T/P	III	IV	V	II

Jadual 2.2: Stesen Sungai Tercemar dan Kelas Kualiti Air Berdasarkan Sub-Indeks BOD, AN dan SS, 2022
Table 2.2: Polluted River Stations and Classes Based on BOD, AN and SS Sub-Indexes, 2022

NEGERI / STATE	LEMBANGAN / BASIN	SUNGAI / RIVER	NOMBOR STESEN / STATION NUMBER	2022			KELAS BERDASARKAN / CLASS BASED ON		
				IKA / WQI	KATEGORI / CATEGORY	KELAS / CLASS	BOD	AN	SS
Perak	Sg. Raja Hitam	Sg. Raja Hitam	1ARHT008	30	T/P	V	II	IV	I
Selangor	Sg. Buloh	Sg. Buloh	2BBLH001	55	T/P	III	V	IV	II
		Sg. Buloh	2BBLH002	51	T/P	IV	V	IV	II
		Sg. Buloh	2BBLH003	46	T/P	IV	V	IV	II
		Sg. Buloh	2BBLH004	45	T/P	IV	V	IV	II
		Sg. Buloh	2BBLH006	50	T/P	IV	V	IV	II
	Sg. Klang	Sg. Kerayong	2BKLG013	50	T/P	IV	IV	V	I
W.P. Kuala Lumpur	Sg. Klang	Sg. Bunos	2WKLG006	44	T/P	IV	IV	IV	I
	Sg. Klang	Sg. Air Busuk	2WKLG041	52	T/P	III	V	V	II
	Sg. Klang	Sg. Kerayong	2WKLG058	58	T/P	III	IV	V	I
N. Sembilan	Sg. Langat	Sg. Pajam	3NLGT021	58	T/P	III	III	IV	II
Melaka	Sg. Merlimau	Sg. Merlimau	3MMLU001	57	T/P	III	III	V	I
		Sg. Merlimau	3MMLU002	51	T/P	IV	III	V	I
	Sg. Duyong	Sg. Punggur	3MPGR001	58	T/P	III	II	IV	II
		Sg. Punggur	3MPGR002	56	T/P	III	II	IV	II
Johor	Sg. Air Baloi	Sg. Air Baloi	3JABL001	55	T/P	III	II	I	III
		Sg. Air Baloi	3JABL002	56	T/P	III	II	I	III
	Sg. Batu Pahat	Sg. Simpang Kanan	3JBPT002	59	T/P	III	II	III	I
		Sg. Bekok	3JBPT008	58	T/P	III	II	II	I
		Sg. Simpang Kanan	3JBPT013	59	T/P	III	II	III	I
		Sg. Temehel	3JBPT024	59	T/P	III	III	IV	II
		Sg. Panchor	3JBPT025	59	T/P	III	II	III	I
	Sg. Johor	Sg. Bukit Besar	3JJHR007	56	T/P	III	II	III	I
	Sg. Kim-Kim	Sg. Kim-Kim	3JKIM001	57	T/P	III	II	III	I
	Sg. Kempas	Sg. Kempas	3JKPS001	39	T/P	IV	V	V	I
		Sg. Kempas	3JKPS002	43	T/P	IV	V	V	I
	Sg. Pontian Besar	Sg. Ayer Merah	3JPBS005	54	T/P	III	III	II	I
	Sg. Kaw. Pasir Gudang	Sg. Perembi	3JPGD001	59	T/P	III	IV	IV	I
		Sg. Buluh	3JPGD002	40	T/P	IV	V	II	I
		Sg. Tukang Batu	3JPGD003	34	T/P	IV	V	V	I
	Sg. Sanglang	Sg. Sanglang	3JSLG001	51	T/P	IV	III	I	III
	Sg. Tebrau	Sg. Tebrau	3JTRU001	57	T/P	III	IV	IV	II
		Sg. Tebrau	3JTRU002	54	T/P	III	IV	IV	II
		Sg. Pandan	3JTRU007	58	T/P	III	IV	V	I
		Sg. Bala	3JTRU008	55	T/P	III	IV	V	II
		Sg. Tampoi	3JTRU010	58	T/P	III	IV	V	I
		Sg. Sengkuang	3JTRU011	50	T/P	IV	V	V	I
Kelantan	Sg. Pengkalan Chepa	Sg. Alor B	4DPCH003	59	T/P	III	IV	V	I
Sarawak	Sg. Miri	Sg. Adong	6QMRI001	57	T/P	III	II	II	I
		Sg. Miri	6QMRI005	56	T/P	III	II	II	I

TREN PENCEMARAN STESEN PENGAWASAN KUALITI AIR SUNGAI

Berdasarkan sub-indeks BOD, 1,060 (78%) stesen sungai dikategorikan sebagai bersih telah meningkat pada tahun 2022 berbanding 1,049 (78%) pada tahun sebelumnya (**Rajah 2.3**). Bilangan stesen sungai yang tercemar dari segi sub-indeks BOD telah meningkat daripada 127 (9%) pada tahun 2021 kepada 145 (11%) pada tahun 2022.

Dari segi sub-indeks AN, bilangan stesen sungai bersih telah menurun daripada 685 (51%) pada tahun 2021 kepada 641 (47%) pada tahun 2022 (**Rajah 2.4**). Bilangan sungai yang tercemar telah menurun daripada 398 (29%) pada tahun 2021 kepada 389 (28.7%) pada tahun 2022.

Dari segi sub-indeks SS pula, bilangan stesen sungai yang dikategorikan bersih telah menurun sebanyak 1% daripada 1,037 (77%) pada tahun 2021 kepada 1,028 (76%) pada tahun 2022 (**Rajah 2.5**). Bilangan stesen sungai yang dikategorikan sebagai tercemar meningkat daripada 191 (14%) pada 2021 kepada 207 (15%) pada tahun 2022.

Kesimpulannya, didapati kebanyakan stesen pengawasan kualiti air sungai mengalami kemerosotan kualiti air bagi tahun 2022 berbanding 2021. Pengoperasian semula industri selepas Perintah Kawalan Pergerakan (PKP) pada tahun 2021 boleh menjadi faktor penyumbang dalam peningkatan pelepasan jumlah beban pencemar seterusnya menyebabkan penurunan kualiti air di stesen sungai khususnya di kawasan yang berdekatan dengan industri.

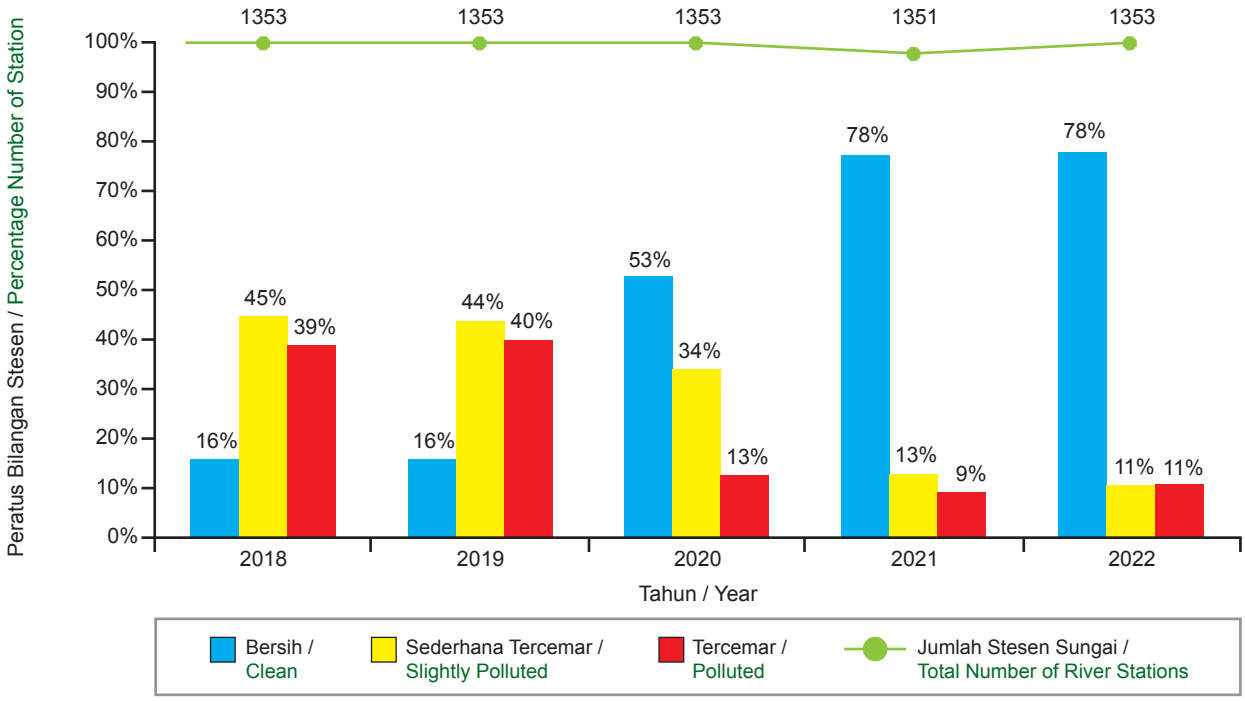
POLLUTION TRENDS OF RIVER WATER QUALITY MONITORING STATIONS

In terms of the BOD sub-index, 1,060 (78%) river stations were categorised as clean in 2022; this is an increase when compared to 1.049 (78%) river stations the year before (**Figure 2.3**). The number of polluted river stations in terms of BOD sub-index increased from 127 (9%) in 2021 to 145 (11%) in 2022.

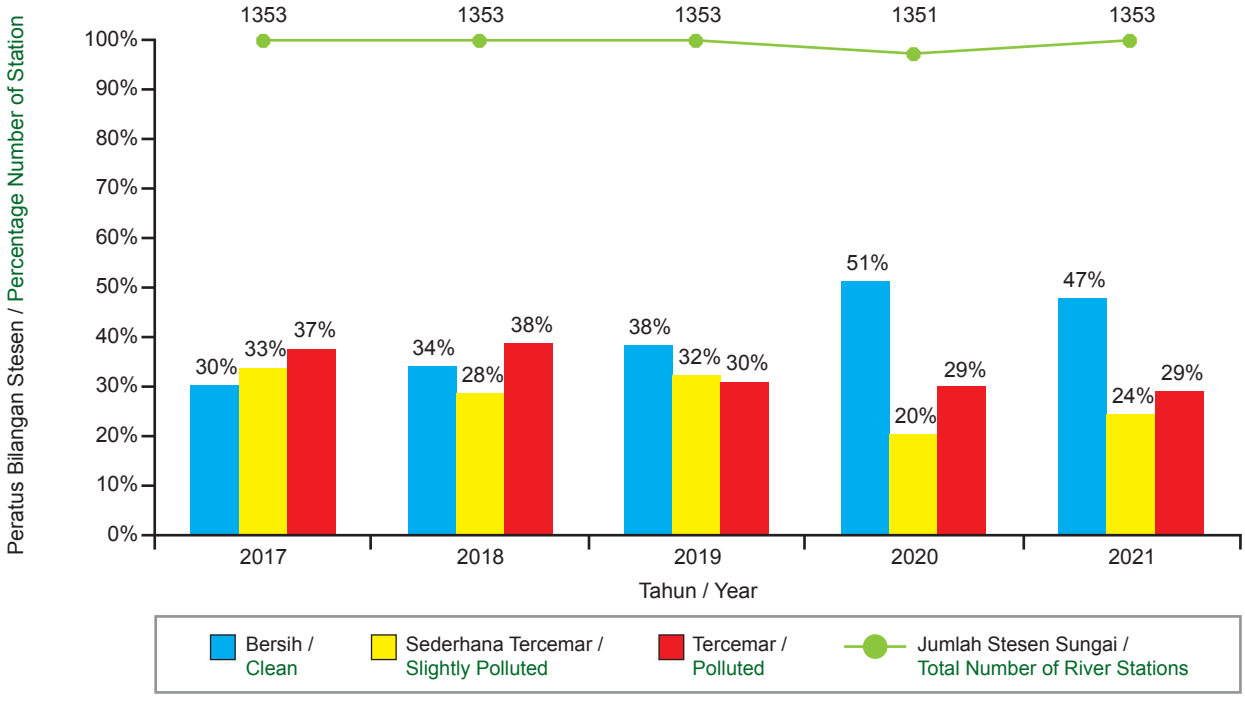
In terms of the AN sub-index, the number of clean river stations significantly decreased from 685 (51%) in 2021 down to 641 (47%) in 2022 (**Figure 2.4**) The number of polluted rivers has decreased from 398 (29%) in 2021 down to 389 (28.7%) in 2022.

In terms of the SS sub-index, the number of clean river stations decreased from 1,037 (77%) in 2021 to 1,028 (76%) in 2022 (**Figure 2.5**). The number of polluted river stations has increased from 191 (14%) in 2021 to 207 (15%) in 2022.

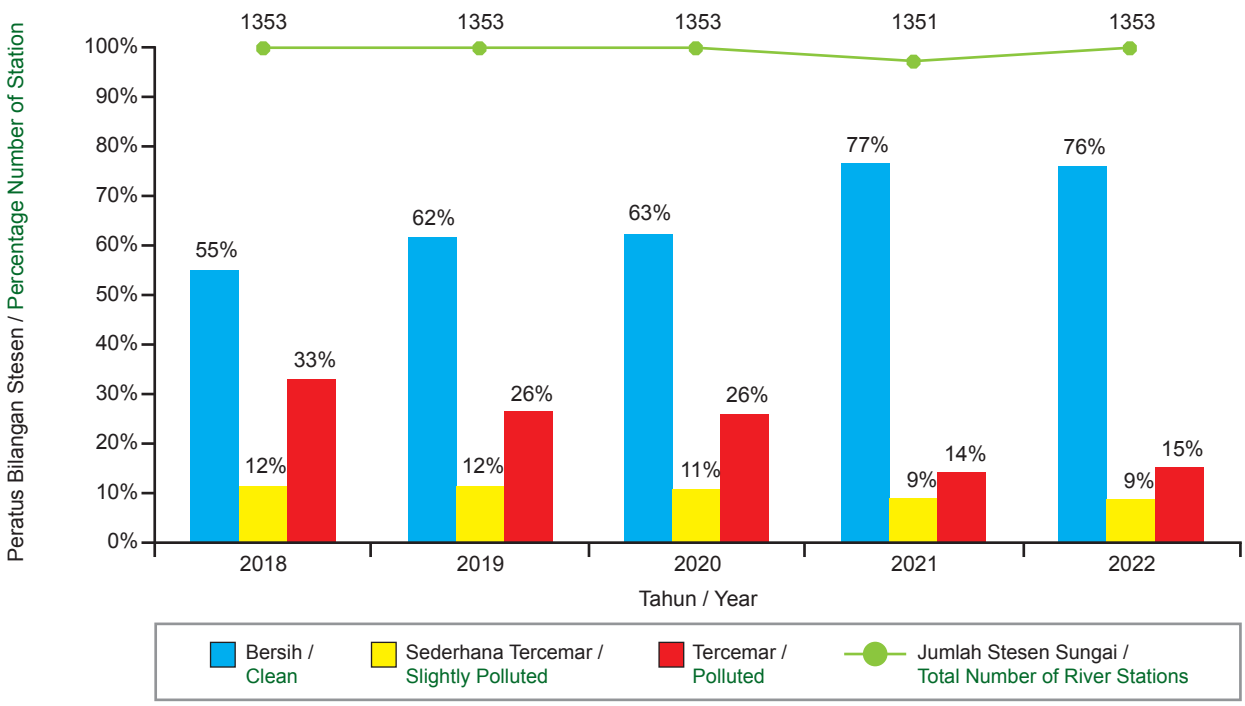
In conclusion, most of river water quality monitoring stations showed a significant deterioration in water quality in 2022 compared to 2021. Re-operation of the industry after the Movement Control Order (MCO) imposed in 2021 can be one of the contributing factors in increasing pollutant load and thus deterioration in water quality at river stations located in areas close to industries.



Rajah 2.3: Tren Stesen Kualiti Air Sungai Berdasarkan Sub-Indeks BOD, 2018-2022
Figure 2.3: River Water Quality Stations Trend on BOD Sub-Index, 2018-2022



Rajah 2.4: Tren Stesen Kualiti Air Sungai Berdasarkan Sub-Indeks AN, 2018-2022
Figure 2.4: River Water Quality Stations Trend on AN Sub-Index, 2018-2022



Rajah 2.5: Tren Stesen Kualiti Air Sungai Berdasarkan Sub-Indeks SS, 2018-2022
Figure 2.5: River Water Quality Stations Trend on SS Sub-Index, 2018-2022

Sungai Benus, Janda Baik

ANALISIS LOGAM BERAT DI STESEN PENGAWASAN KUALITI AIR SUNGAI

Pada tahun 2022, sebanyak 8,136 sampel kualiti air mewakili 1,353 stesen pengawasan sungai manual setiap negeri diambil bagi memantau kandungan beberapa jenis logam berat seperti raksa (Hg), arsenik (As), kadmium (Cd), kromium (Cr), plumbum (Pb) dan zink (Zn). Pematuhan dipantau dengan merujuk Standard Kualiti Air Kebangsaan (NWQS) (**Jadual 2.3**).

Bagi parameter raksa dan zink, semua stesen sungai di seluruh negara telah menunjukkan pematuhan penuh. Parameter As, Cd, Cr dan Pb menunjukkan julat pematuhan 90.1% hingga 100%.

ANALYSIS OF HEAVY METAL AT RIVER WATER QUALITY MONITORING STATIONS

In 2022, a total of 8,136 water quality samples of 1,353 manual river water quality stations for each state were taken to monitor a few heavy metal concentrations such as mercury (Hg), arsenic (As), cadmium (Cd), chromium (Cr), plumbum (Pb) and zinc (Zn). Compliance was monitored with reference to the National Water Quality Standards (NWQS) (**Table 2.3**).

For mercury and zinc parameters, all river stations in country showed full compliance. Parameters of As, Cd, Cr and Pb showed a compliance in the range of 99.2% to 100%.

Jadual 2.3: Peratusan Pematuhan Parameter Logam Berat mengikut Negeri
Table 2.3: Percentage of Heavy Metal Parameter Compliance by State

NEGERI / STATE	BIL. STESEN / NO OF STATIONS	BIL. PERSAMPELAN / NO OF SAMPLING	PEMATUHAN KELAS II (%) / COMPLIANCE OF CLASS II (%)					
			RAKSA / MERCURY (Hg)	ARSENIK / ARSENIC (As)	KADMIUM / CADMIUM (Cd)	KROMIUM / CHROMIUM (Cr)	PLUMBUM / PLUMBUM (Pb)	ZINK / ZINC (Zn)
Perlis	15	90	100%	100%	100%	100%	100%	100%
Kedah	74	444	100%	100%	100%	100%	100%	100%
P. Pinang	66	396	100%	100%	99.7%	99.4%	99.7%	100%
Perak	150	900	100%	97.6%	100%	100%	99.8%	100%
Selangor	95	570	100%	96.7%	100%	100%	100%	100%
W.P. Kuala Lumpur	27	162	100%	90.1%	100%	100%	100%	100%
N. Sembilan	66	396	100%	99.7%	100%	100%	99.2%	100%
Melaka	54	324	100%	100%	100%	98.2%	100%	100%
Johor	227	1362	100%	100%	100%	99.9%	99.9%	100%
Pahang	192	1163	100%	99.9%	100%	100%	99.7%	100%
Terengganu	69	414	100%	100%	100%	100%	100%	100%
Kelantan	83	505	100%	100%	100%	100%	98.8%	100%
Sarawak	117	702	100%	100%	100%	100%	99.9%	100%
Sabah	118	708	100%	100%	100%	100%	100%	100%

KUALITI AIR SUNGAI BAGI STESEN DI HULU MUKA SAUK

Pada tahun 2022, 52 (94.5%) daripada 55 stesen pengawasan kualiti air di hulu muka sauk telah menunjukkan indeks kualiti air bersih, sementara tiga (3) (5.5%) sederhana tercemar. Berdasarkan IKA, 28 (50.9%) Kelas I dan 25 (45.5%) Kelas II, manakala dua (2) (3.6%) adalah Kelas III. **Jadual 2.4** menunjukkan status kualiti air di stesen hulu muka sauk terpilih berdasarkan IKA.

Bagi sub-indeks BOD, 54 (98.2%) stesen telah menunjukkan kualiti air pada Kelas II dan satu (1) (1.8%) Kelas III. Berdasarkan sub-indeks AN, sebanyak 43 (78.3%) stesen menunjukkan kualiti air pada Kelas I, 11 (20.0%) Kelas II dan satu (1) (1.8%) Kelas III. Dari segi sub-indeks SS, 36 (65.5%) stesen telah dikategorikan sebagai Kelas I, 13 (23.6%) Kelas II, empat (4) (7.3%) Kelas III dan dua (2) (3.6%) Kelas IV (**Rajah 2.6**).

RIVER WATER QUALITY FOR STATIONS LOCATED UPSTREAM OF WATER INTAKES

In 2022, 52 (94.5%) of the 55 water quality monitoring stations located upstream of water intakes, showed clean water quality index, while three (3) (5.5%) were slightly polluted. Based on the WQI, 28 (50.9%) were in Class I and 25 (45.5%) in Class II, while two (2) (3.6%) were in Class III. **Table 2.4** shows the water quality status at selected upstream stations based on WQI.

In terms of the BOD sub-index, 54 (98.2%) stations showed water quality at Class II and one (1) (1.8%) station was at Class III. Based on the AN sub-index, a total of 43 (78.3%) stations showed water quality in Class I, 11 (20.0%) in Class II and one (1) (1.8%) in Class III. In terms of the SS sub-index, 36 (65.5%) stations were categorised as Class I, 13 (23.6%) as Class II, four (4) (7.3%) as Class III and two (2) (3.6%) as Class IV (**Figure 2.6**).

Sungai Pontian, Rompin

Jadual 2.4: Status Kualiti Air di Hulu Muka Sauk, 2022
Table 2.4: Water Quality Status of Upstream Water Intake, 2022

NEGERI/ STATE	LEMBANGAN SUNGAI/ RIVER BASIN	SUNGAI/ RIVER	STATION ID BARU/ NEW ID STATION	MUKA SAUK/ WATER INTAKE	NILAI IKA/ WQI VALUE	SUB-INDEKS 2022 (%) / SUB-INDEX 2022 (%)		
						SUB-INDEKS BOD / BOD SUB-INDEX	SUB-INDEKS AN / AN SUB-INDEX	SUB-INDEKS SS / SS SUB-INDEX
Perlis	Sg. Perlis	Sg. Terusan Mada	1RPLS010	Loji Rawatan Air Arau Fasa IV	92	96	97	91
		Sg. Terusan Mada	1RPLS011	Loji Rawatan Air TTPC, Sg. Baru	89	96	97	91
Kedah	Sg. Ulu Melaka	Sg. Melaka	1KMLK003	Ulu Melaka	91	96	98	91
		Sg. Saga	1KMLK004	Padang Saga	88	96	91	87
	Sg. Kedah	Sg. Ahning	1KKDH011	Padang Sanai	95	96	99	92
		Sg. Padang Terap	1KKDH012	Kuala Nerang	95	96	95	90
		Sg. Temin	1KKDH010	Changloon	89	96	85	85
	Sg. Muda	Sg. Muda	1KMUD014	Jeneri	94	96	96	80
		Sg. Muda	1KMUD015	Jeniang	94	96	96	80
		Sg. Muda	1KMUD016	Bukit Selambau	91	96	96	80
		Sg. Muda	1KMUD018	Pinang Tunggal	91	96	96	80
		Sg. Muda	1KMUD019	Nami	96	96	96	80
		Sg. Sedim	1KMUD017	Bikan	93	96	93	82
P. Pinang	Sg. Pinang	Sg. Satu	1PPNG020	Batu Feringgi	97	96	99	97
Perak	Sg. Bernam	Sg. Gelinting	1ABNM015	Loji Rawatan Air Ulu Slim	96	96	99	91
		Sg. Trolak	1ABNM014	Loji Rawatan Air Trolak Timur	96	96	99	92
	Sg. Kurau	Sg. Air Hitam	1AKRU007	Loji Rawatan Air Jelai	97	96	99	96
	Sg. Perak	Sg. Manong	1APRK060	Loji Rawatan Air Manong	97	96	99	96
		Sg. Perak	1APRK059	Loji Rawatan Air Sauk	97	96	99	85
		Sg. Tesong	1APRK062	Loji Rawatan Air Sg. Klah	97	96	99	96
		Sg. Woh	1APRK061	Loji Rawatan Air Kuala Woh	98	96	99	96
	Sg. Sepetang	Sg. Batu Tegoh	1ASPT016	Loji Rawatan Air Bukit Larut	97	96	71	96
Selangor	Sg. Klang	Sg. Gombak	2BKLG020	Loji Rawatan Air Gombak	97	83	59	85
	Sg. Langat	Sg. Batang Labu	2BLGT028	Loji Rawatan Air Salak Tinggi	83	88	69	71
		Sg. Semenyih	2BLGT010	Loji Rawatan Air Semenyih	85	92	84	57

Jadual 2.4: Status Kualiti Air di Hulu Muka Sauk, 2022
Table 2.4: Water Quality Status of Upstream Water Intake, 2022

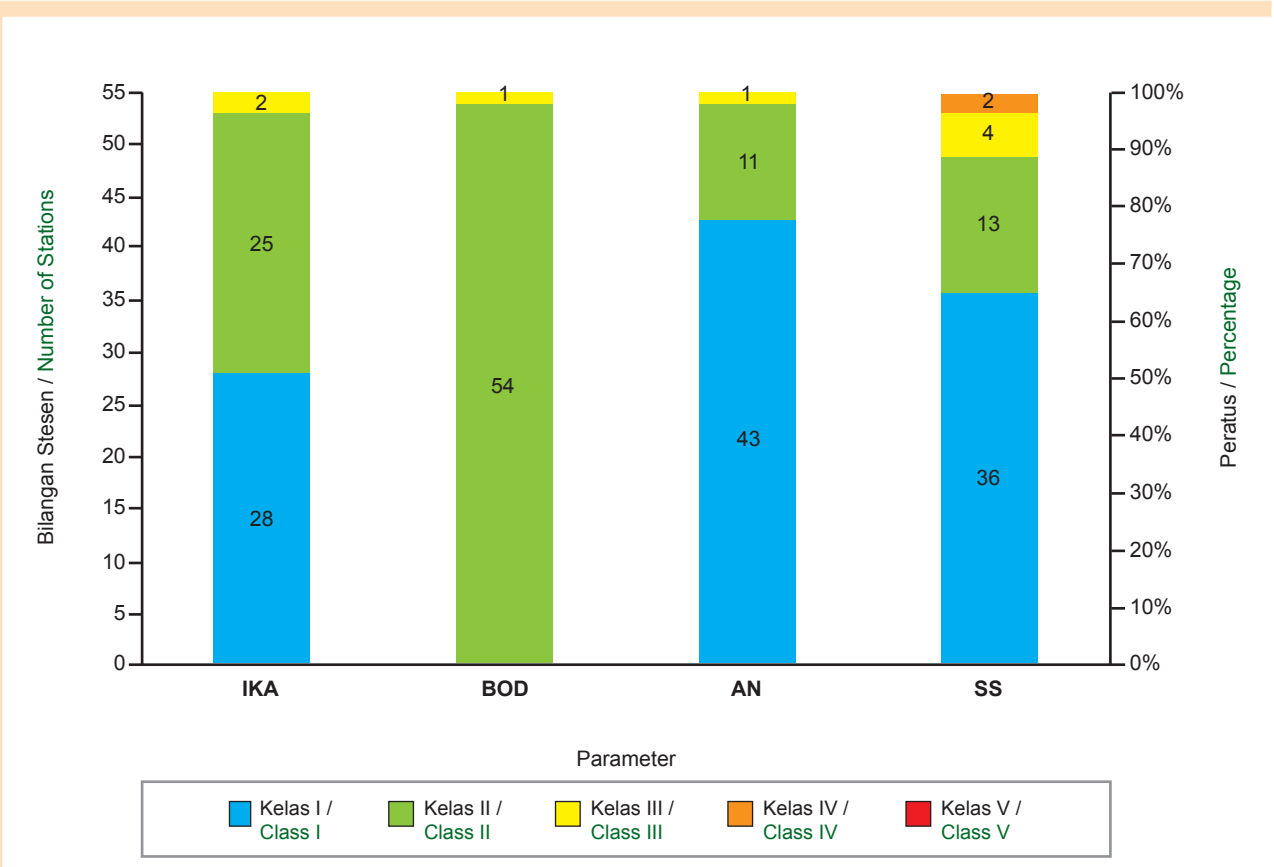
NEGERI/ STATE	LEMBANGAN SUNGAI/ RIVER BASIN	SUNGAI/ RIVER	STATION ID BARU/ NEW ID STATION	MUKA SAUK/ WATER INTAKE	NILAI IKA/ WQI VALUE	SUB-INDEKS 2022 (%) / SUB-INDEX 2022 (%)		
						SUB-INDEKS BOD / BOD SUB-INDEX	SUB-INDEKS AN / AN SUB-INDEX	SUB-INDEKS SS / SS SUB-INDEX
Johor	Sg. Batu Pahat	Sg. Semberong Dam	3JBPT021	Semberong Dam	89	88	99	93
	Sg. Benut	Sg. Machap Dam	3JBNT008	Machap Dam	93	96	99	91
	Sg. Endau	Sg. Kahang	3JEND026	Jalan Felda Kahang Timur, Kluang	92	96	95	88
	Sg. Muar	Sg. Jelai	3NMUA054	Loji Rawatan Air Dangi	91	96	98	79
		Sg. Jementah	3JMUA040	Loji Rawatan Air Jementah	95	96	99	92
		Sg. Muar	3JMUA039	Loji Rawatan Air Gombang	82	96	93	86
	Sg. Pulai	Sg. Pulai Dam	3JPLI004	Pulai Dam	96	96	98	96
Melaka	Sg. Kesang	Sg. Chin-Chin	3MKSG008	Muka sauk Loji Rawatan Air Chin-chin	84	92	87	76
Pahang	Sg. Pahang	Sg. Bertam	4CBTM013	Loji Rawatan Air Habu	97	96	99	94
		Sg. Gapoi	4CPHG086	Muka sauk Loji Rawatan Air Gapoi	96	96	99	97
		Sg. Jempol	4CPHG087	Loji Air Sg Jerik	93	96	99	78
		Sg. Jempol	4CPHG088	Loji Air Jengka 3	91	96	99	78
		Sg. Mentiga	4CPHG089	Loji Air Chini	89	96	95	74
		Sg. Terla	4CBTM012	Loji Rawatan Air Kuala Terla	97	96	99	96
		Sg. Triang	4CPHG074	Loji Rawatan Air Sg. Triang	84	96	97	52
		Sg. Ulong	4CBTM014	Brinchang Dam	97	96	99	97
Terengganu	Sg. Terengganu	Sg. Terengganu	4TTGG013	Loji Air Serada	93	96	94	92
Kelantan	Sg. Golok	Sg. Golok	4DGLK003	Syarikat Air Kelantan	94	96	95	80
	Sg. Kelantan	Sg. Chiku	4DKLT043	Felda Ciku 2	92	96	96	80
		Sg. Kelantan	4DKLT045	Loji Air Kelar, Pasir Mas	87	96	95	50
		Sg. Pehi	4DKLT044	Loji Air Pahi	91	96	98	58
Sabah	Sg. Padas	Sg. Padas	5SPDS011	Water Intake Jabatan Air Beaufort	87	96	92	56
	Sg. Papar	Sg. Papar	5SPPR004	Sekolah Kebangsaan Mandalipau	93	96	95	85
		Sg. Papar	5SPPR005	Water Intake Kogopon	93	96	95	85
Sarawak	Sg. Kerian	Sg. Selalang	6QKRN017	Selalang Water Intake	90	96	75	94
	Sg. Mukah	Sg. Mukah	6QMKH005	Mukah Water Intake	87	96	73	85

Jadual 2.4: Status Kualiti Air di Hulu Muka Sauk, 2022
Table 2.4: Water Quality Status of Upstream Water Intake, 2022

NEGERI/ STATE	LEMBANGAN SUNGAI/ RIVER BASIN	SUNGAI/ RIVER	STATION ID BARU/ NEW ID STATION	MUKA SAUK/ WATER INTAKE	NILAI IKA/ WQI VALUE	SUB-INDEKS 2022 (%) / SUB-INDEX 2022 (%)		
						SUB-INDEKS BOD / BOD SUB-INDEX	SUB-INDEKS AN / AN SUB-INDEX	SUB-INDEKS SS / SS SUB-INDEX
Sarawak	Sg. Rajang	Sg. Daro	6QRJG021	Daro Water Intake	66	96	72	88
		Sg. Jemoreng	6QRJG022	Jemoreng Water Intake	66	96	75	90
		Sg. Pakan	6QRJG020	Pakan Water Intake	88	96	70	89
		Sg. Pila Parit	6QRJG023	Igan Water Intake	78	96	72	85

Nota / Note:
Kelas IKA / WQI Classes

Kelas I / Class I | Kelas II / Class II | Kelas III / Class III | Kelas IV / Class IV | Kelas V / Class V



Rajah 2.6: Kualiti Air Sungai di Stesen Hulu Muka Sauk, 2022
Figure 2.6: River Water Quality at Upstream Water Intake Stations, 2022

STATUS PENGAWASAN KUALITI AIR SUNGAI AUTOMATIK

Rajah 2.7(**a**) dan **Rajah 2.7**(**b**) menunjukkan lokasi 30 stesen pengawasan sungai automatik serta takat pengambilan air yang disenaraikan seperti dalam **Jadual 2.5**.

Pada tahun 2022, status kualiti air sungai bagi 30 stesen pengawasan sungai automatik telah dinilai berdasarkan peratusan pematuhan kepada Kelas II. Parameter yang diukur adalah pH, DO, BOD, COD, AN dan jumlah pepejal terampai (TSS). Pematuhan ini ditunjukkan seperti pada **Jadual 2.6**.

Dari segi pematuhan Kelas II, stesen yang menunjukkan pematuhan 90% atau lebih kepada kualiti air Kelas II pada tahun 2022 adalah di dapati di 15 (50%) stesen iaitu CR03K, CR05A, CR06A, CR15N, CR17M, CR18J, CR20J, CR22C, CR23C, CR25T, CR26D, CR27S, CR29Q, CR30Q dan CR31S.

DO adalah salah satu penunjuk kepada kehadiran BOD yang disebabkan oleh bahan pencemar organik. Julat pematuhan DO yang rendah didapati di 18 (60%) stesen iaitu CR01K, CR02K, CR03K, CR04P, CR05A, CR08B, CR09B, CR10B, CR11B, CR12W, CR13N, CR16M, CR17M, CR19J, CR21J, CR23C, CR24T dan CR30Q.

Ammonium (NH_4) adalah satu bentuk ammonia (NH_3) yang telah terion. Pengukuran NH_4 memberi petunjuk kepada potensi kehadiran pencemar NH_3 atau AN dalam air sungai apabila pH dan suhu air berubah. Julat pematuhan yang rendah bagi AN didapati di 14 (46.7%) stesen iaitu CR04P, CR05A, CRO7B, CR08B, CR09B, CR10B, CR11B, CR12W, CR13N, CR14N, CR16M, CR17M, CR20J, dan CR21J.

pH adalah ukuran bagi keasidan dan kealkalian mengikut skala pH. Julat pematuhan yang rendah bagi pH diperhatikan di tujuh (7) (23.3%) stesen iaitu CR01K, CR04P, CR05A, CR20J, CR23C, CR24T dan CR25T.

Kekeruhan digunakan sebagai penunjuk kehadiran SS di dalam sungai. Bagi julat pematuhan TSS yang direkodkan adalah rendah bagi semua stesen.

Rajah 2.8 hingga **Rajah 2.13** menunjukkan peratus pematuhan Kelas II mengikut zon.

CONTINUOUS RIVER WATER QUALITY MONITORING STATUS

Figure 2.7(**a**) and **Figure 2.7**(**b**) show the location of the 30 continuous river monitoring stations and subsequent water intakes as listed in **Table 2.5**.

In 2022, the river water quality status of the 30 continuous river water quality monitoring stations were assessed based on percentage of compliance with Class II. The measured parameters are pH, DO, BOD, COD, AN and total suspended solid (TSS). The compliance is shown in **Table 2.6**.

In terms of Class II compliance, 15 (50%) stations showed a 90% compliance or more in 2022. These were the CR03K, CR05A, CR06A, CR15N, CR17M, CR18J, CR20J, CR22C, CR23C, CR25T, CR26D, CR27S, CR29Q, CR30Q and CR31S stations.

Dissolved Oxygen (DO) is one of the indicators of the presence of BOD which is caused by organic pollutants. Low range compliance with DO was observed at 18 (60%) stations CR01K, CR02K, CR03K, CR04P, CR05A, CR08B, CR09B, CR10B, CR11B, CR12W, CR13N, CR16M, CR17M, CR19J, CR21J, CR23C, CR24T and CR30Q.

Ammonium (NH_4) is an ionized form of ammonia (NH_3). The measurement of NH_4 indicates the potential presence of NH_3 or AN pollutants in rivers when the pH and temperature changes. Low range compliance with AN were observed at 14 (46.7%) stations, namely CR04P, CR05A, CRO7B, CR08B, CR09B, CR10B, CR11B, CR12W, CR13N, CR14N, CR16M, CR17M, CR20J, and CR21J.

pH is a measurement of acidity and alkalinity based on the pH scale. Relatively low compliance with pH ranges were observed at seven (7) (23.3%) stations - CR01K, CR04P, CR05A, CR20J, CR23C, CR24T and CR25T.

Turbidity is used as an indicator of SS presence in a river. Low range compliance with TSS were recorded at all stations.

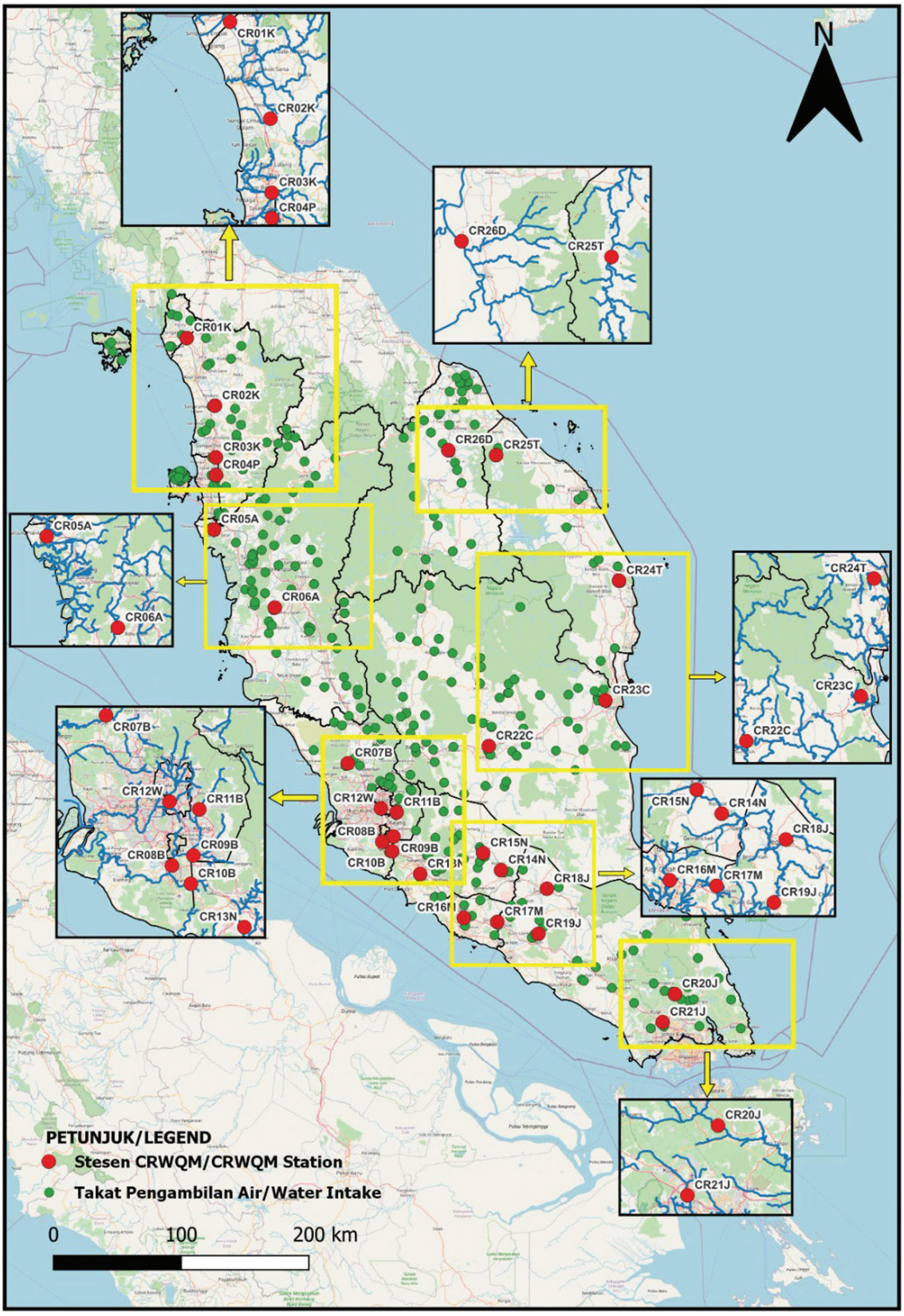
Figure 2.8 to **Figure 2.13** showed the percentage of Class II compliance by region.

Jadual 2.5: Lokasi CRWQMS: ID Stesen, Sungai bagi Stesen dan Takat Pengambilan Air
Table 2.5: CRWQMS Locations: Station IDs, the Rivers and Water Intake Areas

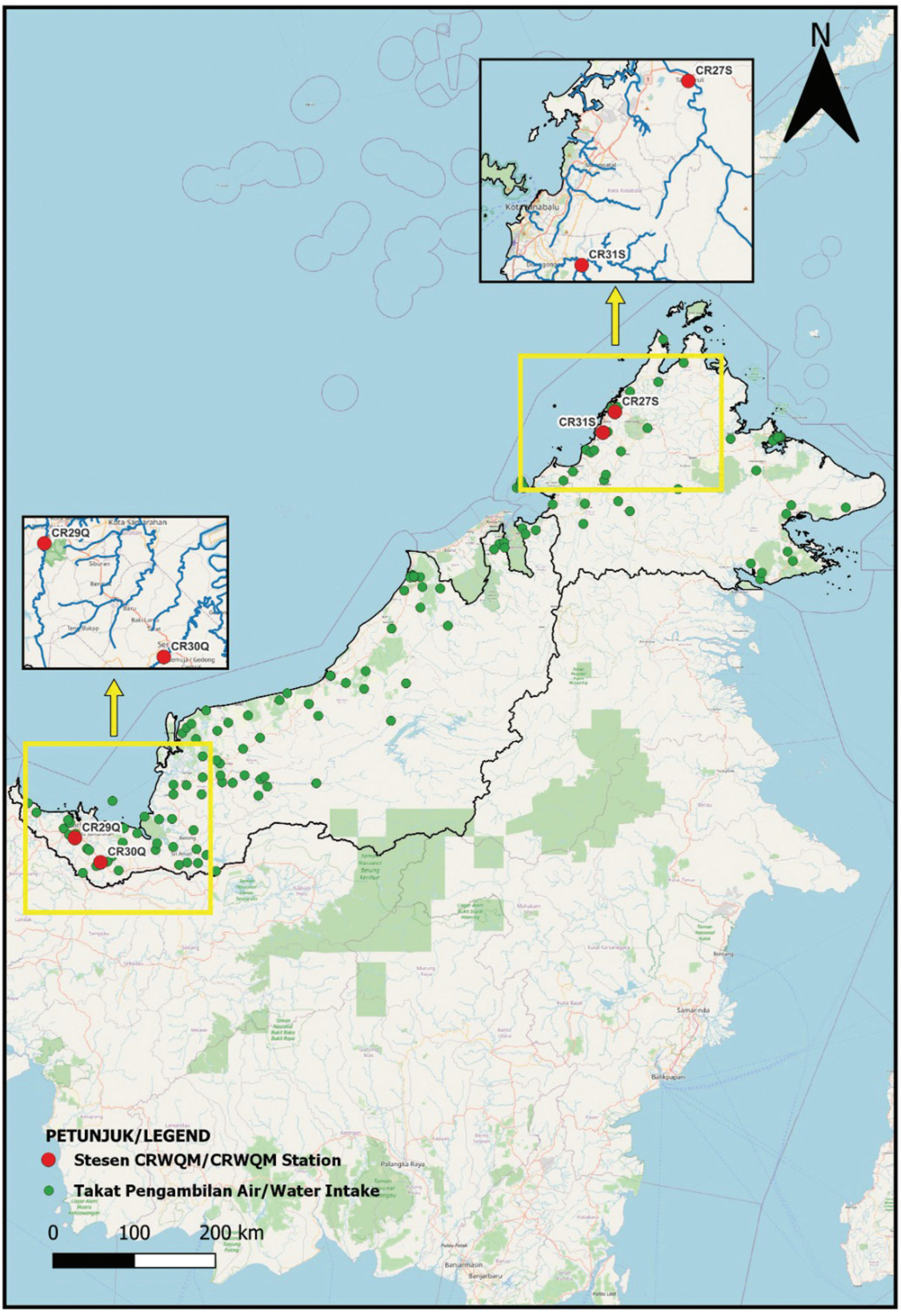
NEGERI / STATE	ID STESEN / ID STATION	SUNGAI / RIVER	TAKAT PENGAMBILAN AIR / WATER INTAKE
Kedah	CR01K CR02K CR03K	Terusan MADA Terusan MADA Sungai Muda	Arau Fasa IV Bukit Jenun Kulim Hi-Tech
P. Pinang	CR04P	Sungai Kulim	Toh Along
Perak	CR05A CR 06A	Sungai Bogak Sungai Perak	Parit Buntar Sultan Idris
Selangor	CR07B CR08B CR09B CR10B CR11B	Sungai Selangor Sungai Langat Sungai Semenyih Sungai Labu Sungai Langat	Sg. Selangor Fasa 1,2,3 Bukit Tampoi Jenderam Labu Lanjut Cheras Batu 11
W.P. Kuala Lumpur	CR12W	Sungai Klang	Tiada Berkenaan / *Not Applicable*
N. Sembilan	CR13N CR14N CR15N	Sungai Linggi Sungai Muar Sungai Muar	Linggi Pasir Besar Jelai Jempol
Melaka	CR16M CR17M	Sungai Melaka Sungai Kesang	Durian Tunggal Chin Chin
Johor	CR18J CR19J CR20J CR21J	Sungai Segamat Sungai Muar Sungai Johor Sungai Sekudai	Segamat Panchor Semanggar Skudai
Pahang	CR22C CR23C	Sungai Pahang Sungai Kuantan	Lubuk Kawah Semambu
Terengganu	CR24T CR25T	Sungai Paka Sungai Besut	Bulit Bauk Bukit Bunga
Kelantan	CR26D	Sungai Kelantan	Sokor
Sabah	CR27S CR31S	Sungai Tuaran Sungai Moyog	Telibong Kasigui
Sarawak	CR29Q CR30Q	Sungai Sarawak Sungai Batang Sadong	Sarawak Kiri Tebekang

Jadual 2.6: Peratus Pematuhan Kelas II mengikut Stesen
Table 2.6: Percentage of Compliance with Class II by Station

NEGERI / STATE	ID STESEN / STATION ID	PEMATUHAN KELAS II (%) / COMPLIANCE WITH CLASS II (%)					
		DO sat (%)	BOD	COD	TSS	AN	pH
Kedah	CR01K	51	100	97	30	95	86
	CR02K	76	75	100	37	91	93
	CR03K	83	100	100	14	91	95
P. Pinang	CR04P	44	1	100	8	9	31
Perak	CR05A	89	92	100	74	77	47
	CR06A	100	100	100	59	99	100
Selangor	CR07B	97	0	100	4	23	95
	CR08B	76	8	100	9	29	100
	CR09B	78	78	100	20	25	99
	CR10B	45	66	96	39	1	99
	CR11B	89	1	100	31	84	100
W.P. Kuala Lumpur	CR12W	2	0	71	48	1	100
N. Sembilan	CR13N	75	3	100	30	13	99
	CR14N	98	100	100	3	74	94
	CR15N	97	100	100	13	91	98
Melaka	CR16M	78	84	98	16	54	91
	CR17M	90	100	100	46	86	96
Johor	CR18J	96	93	100	51	92	96
	CR19J	0	99	100	41	100	95
	CR20J	97	56	100	43	85	52
	CR21J	47	40	96	60	1	93
Pahang	CR22C	100	97	100	11	97	100
	CR23C	61	100	100	28	93	67
Terengganu	CR24T	85	100	100	43	94	3
	CR25T	96	100	99	80	94	61
Kelantan	CR26D	100	100	100	3	100	100
Sabah	CR27S	100	100	100	71	100	100
	CR31S	100	95	100	67	100	100
Sarawak	CR29Q	96	100	100	55	99	100
	CR30Q	82	97	100	75	96	99

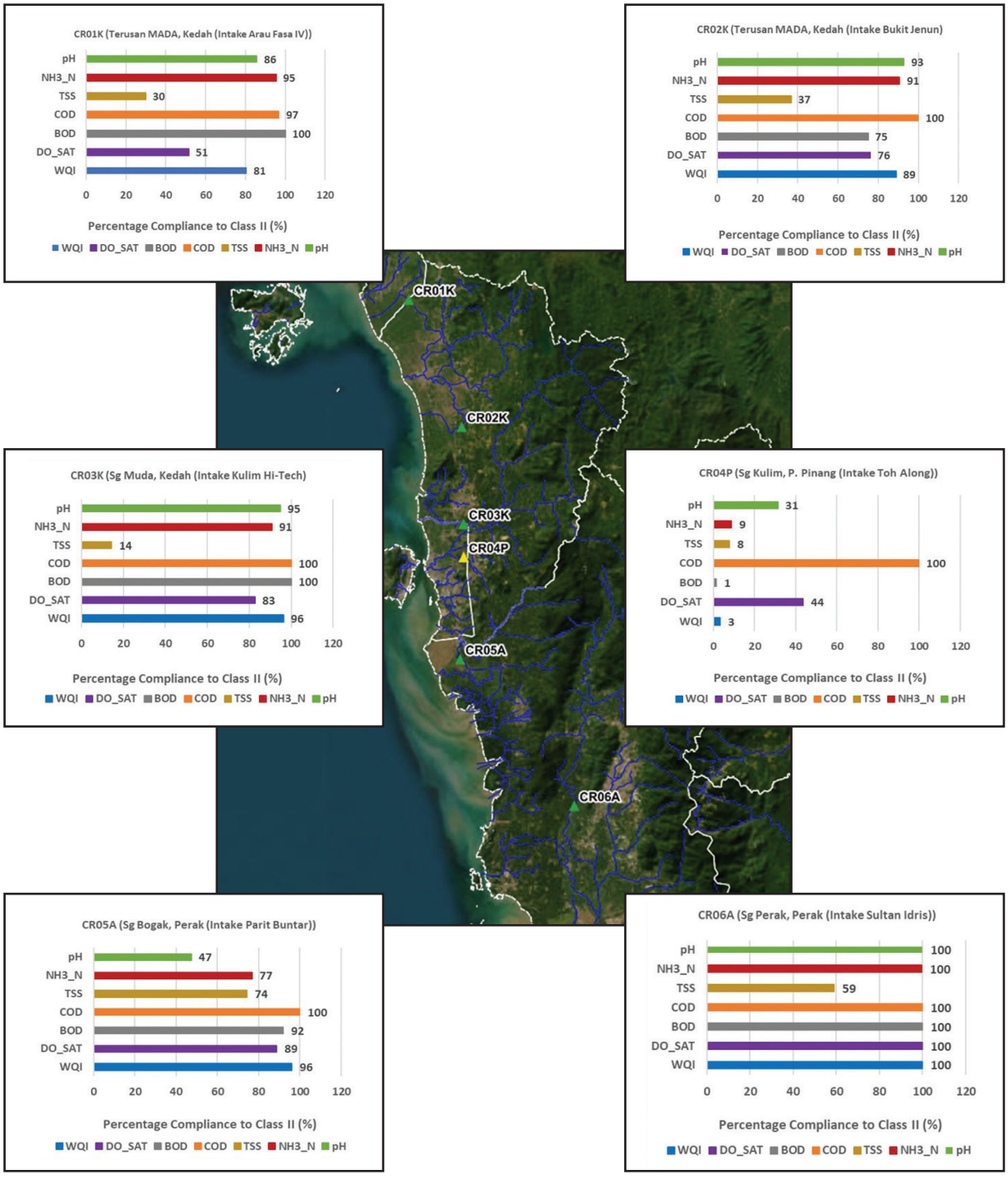


Rajah 2.7(a): Stesen Pengawasan Kualiti Air Sungai Automatik dan Takat Pengambilan Air
Figure 2.7(a): Continuous Water Quality Stations and Water Intakes



Rajah 2.7(b): Stesen Pengawasan Kualiti Air Sungai Automatik dan Takat Pengambilan Air
Figure 2.7(b): Continuous Water Quality Stations and Water Intakes

CRWQM 2022 (WILAYAH UTARA)



Petunjuk / Legend

Kelas IKA / WQI Class

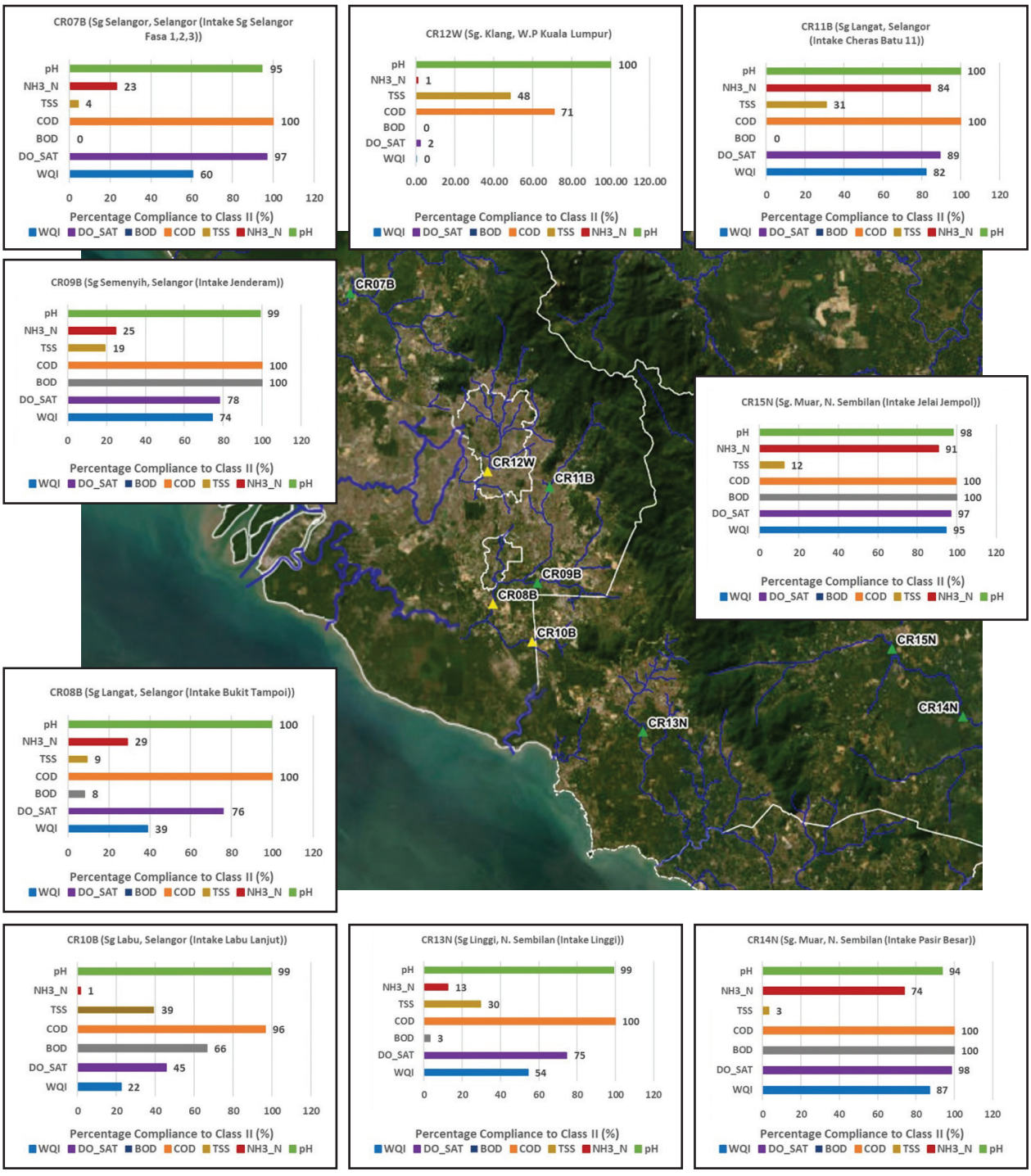
- Kelas I / Class I
- Kelas II / Class II
- Kelas III / Class III
- Kelas IV / Class IV
- Kelas V / Class V

---- Sempadan Negeri / State Boundary

0 100 200 km

Rajah 2.8: Peratus Pematuhan Kelas II (Wilayah Utara)
Figure 2.8: Percentage of Compliance with Class II (Northern Region)

CRWQM 2022 (WILAYAH TENGAH)



Petunjuk / Legend

Kelas IKA / WQI Class

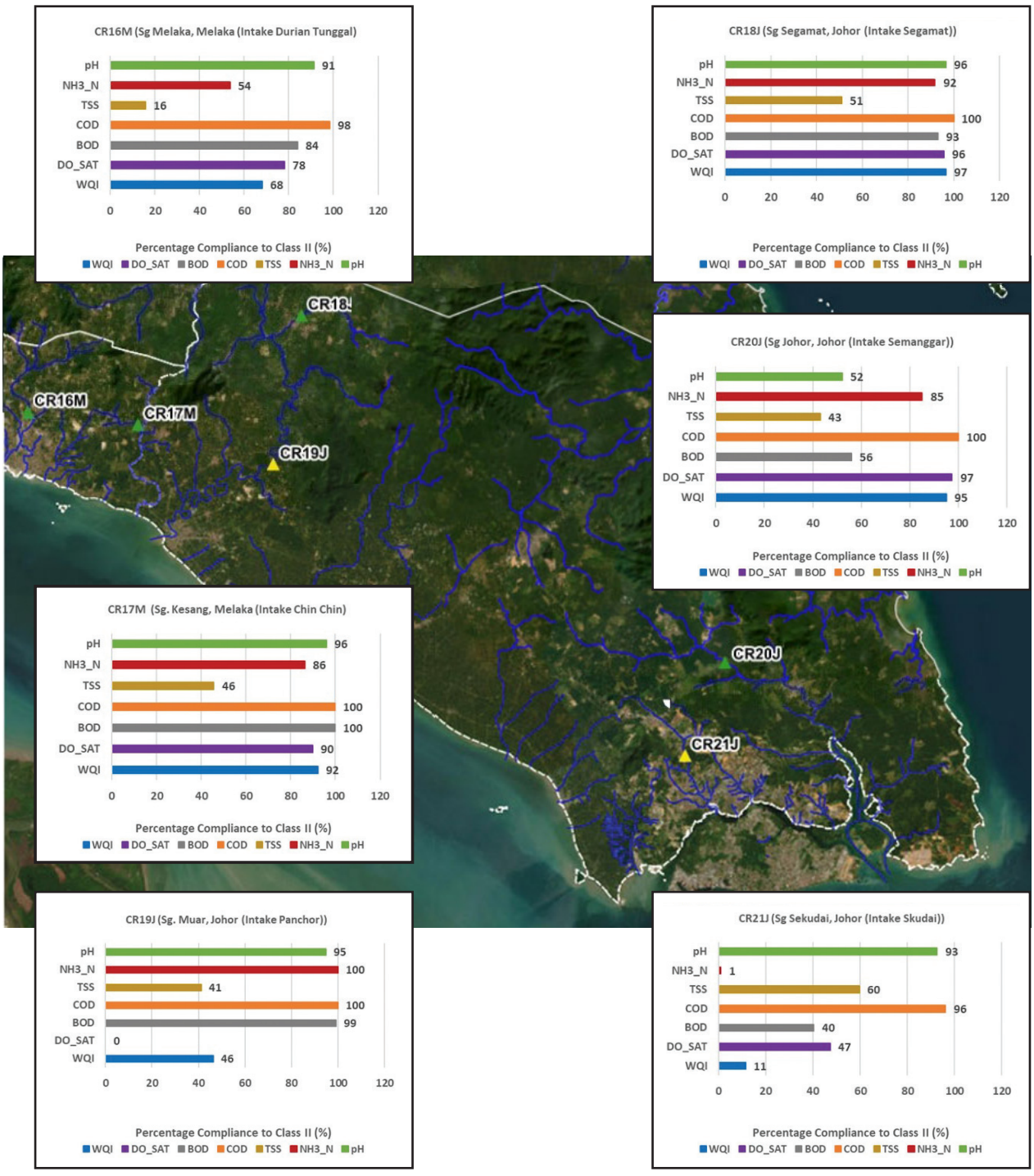
- Kelas I / Class I
- Kelas II / Class II
- Kelas III / Class III
- Kelas IV / Class IV
- Kelas V / Class V

---- Sempadan Negeri / State Boundary

0 100 200 km

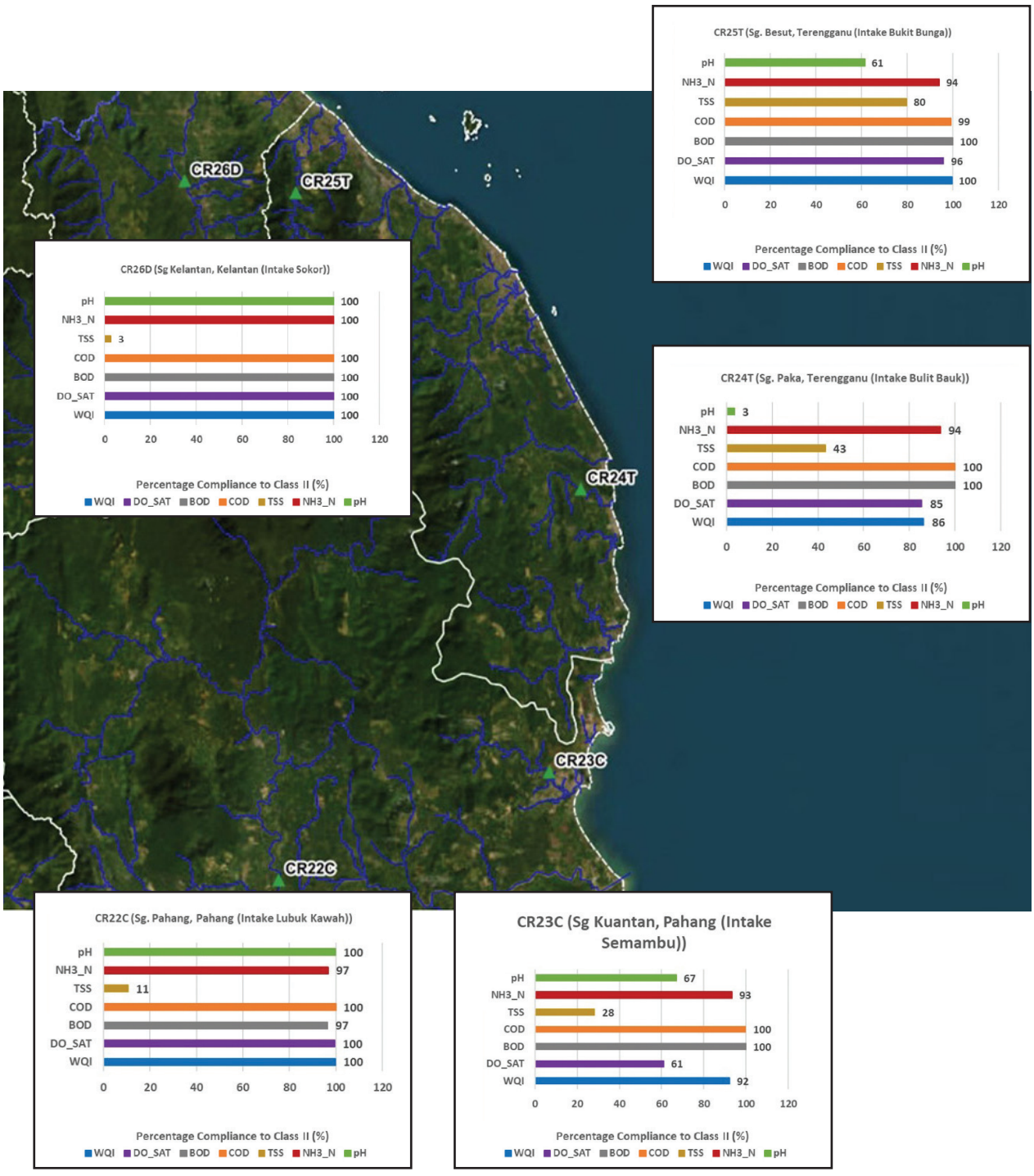
Rajah 2.9: Peratus Pematuhan Kelas II (Wilayah Tengah)
Figure 2.9: Percentage of Compliance with Class II (Central Region)

CRWQM 2022 (WILAYAH SELATAN)



Rajah 2.10: Peratus Pematuhan Kelas II (Wilayah Selatan)
Figure 2.10: Percentage of Compliance with Class II (Southern Region)

CRWQM 2022 (WILAYAH TIMUR)



Petunjuk / Legend

Kelas IKA / WQI Class

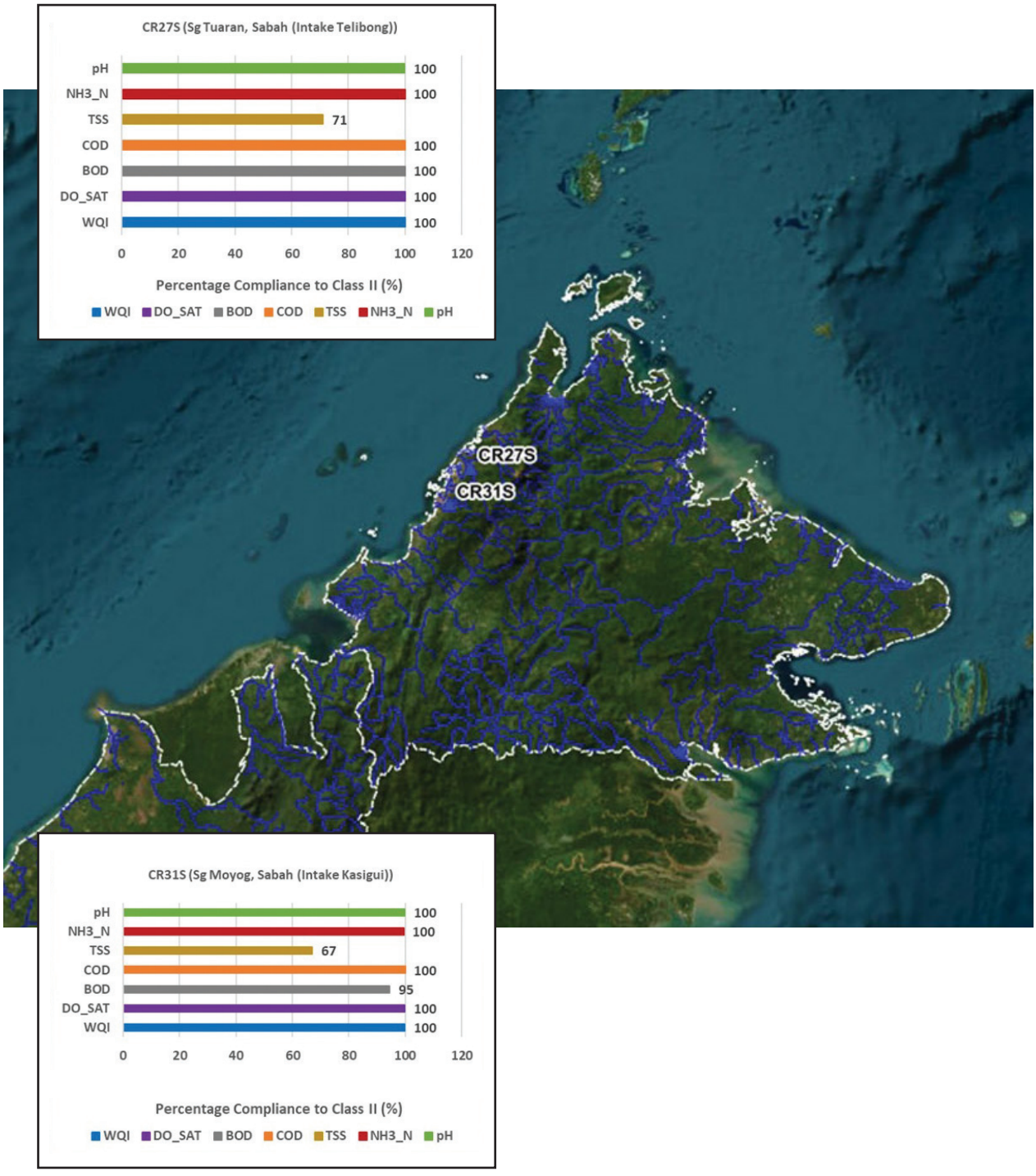
- Kelas I / Class I
- Kelas II / Class II
- Kelas III / Class III
- Kelas IV / Class IV
- Kelas V / Class V

---- Sempadan Negeri / State Boundary

0 100 200 km

Rajah 2.11: Peratus Pematuhan Kelas II (Wilayah Timur)
Figure 2.11: Percentage of Compliance with Class II (Eastern Region)

CRWQM 2022 (WILAYAH SABAH)



Petunjuk / Legend

Kelas IKA / WQI Class

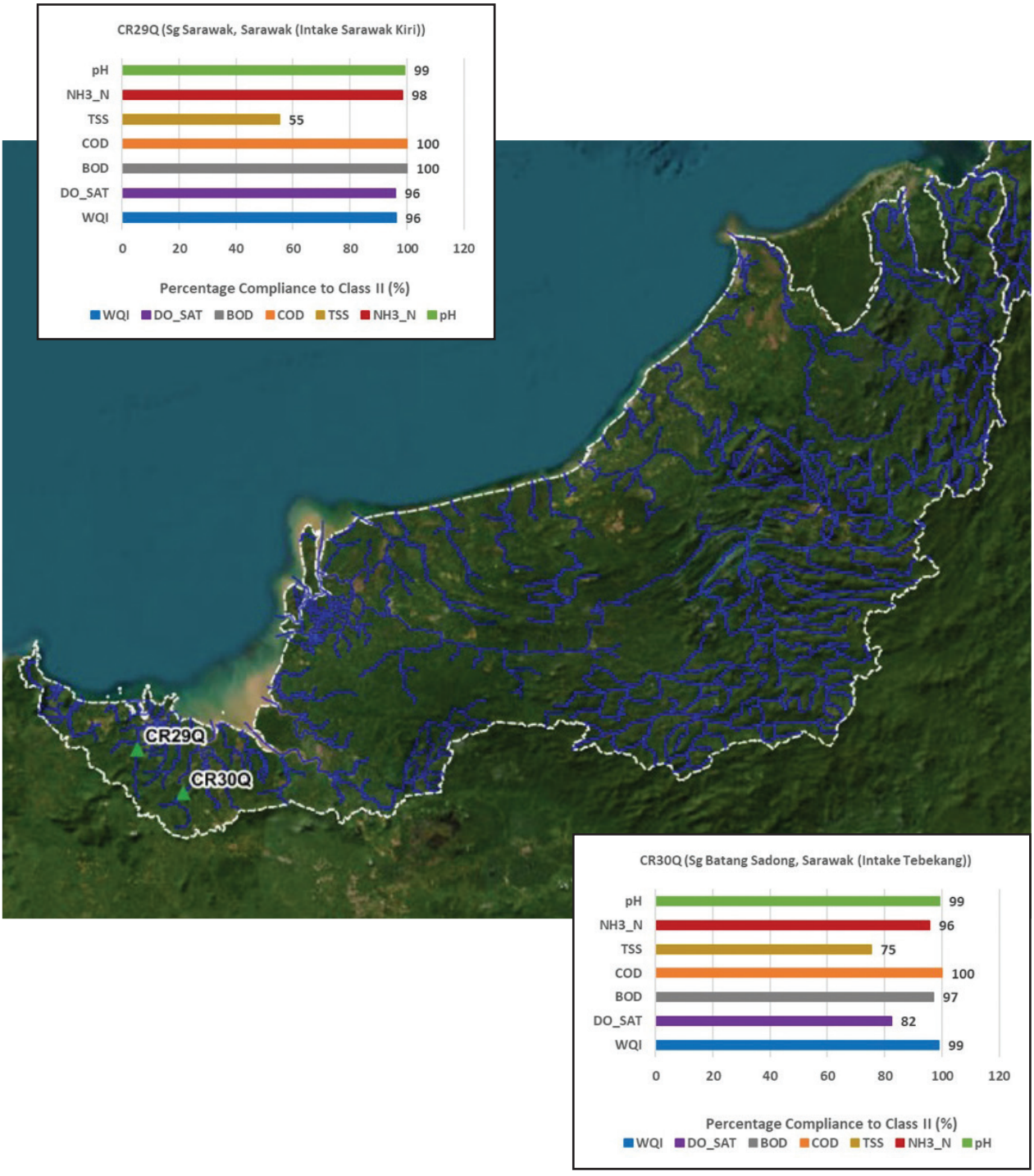
- Kelas I / Class I
- Kelas II / Class II
- Kelas III / Class III
- Kelas IV / Class IV
- Kelas V / Class V

---- Sempadan Negeri / State Boundary

0 100 200 km

Rajah 2.12: Peratus Pematuhan Kelas II (Wilayah Sabah)
Figure 2.12: Percentage of Compliance with Class II (Sabah Region)

CRWQM 2022 (WILAYAH SARAWAK)



Petunjuk / Legend

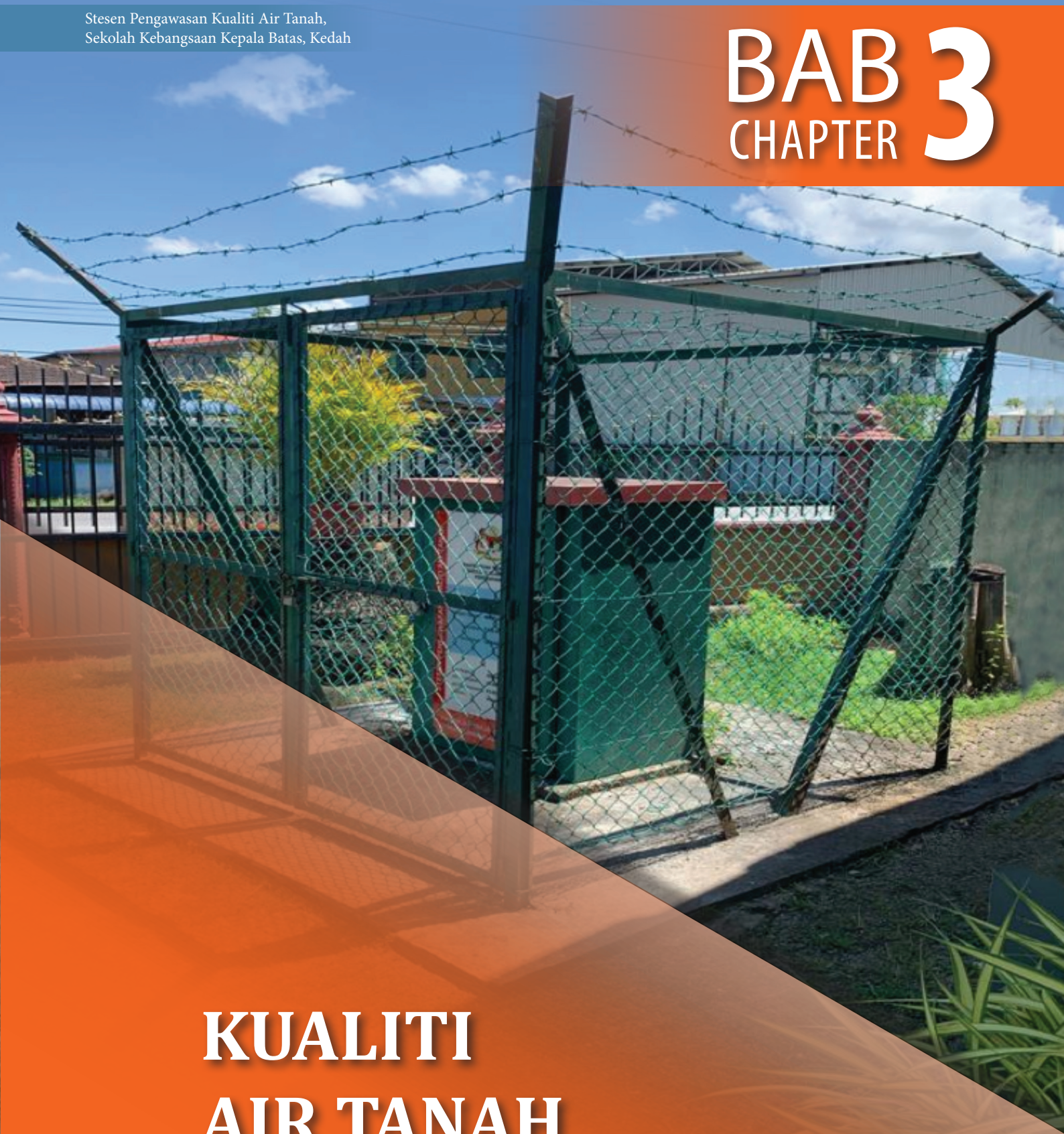
Kelas IKA / WQI Class

- Kelas I / Class I
- Kelas II / Class II
- Kelas III / Class III
- Kelas IV / Class IV
- Kelas V / Class V

---- Sempadan Negeri / State Boundary

0 100 200 km

Rajah 2.13: Peratus Pematuhan Kelas II (Wilayah Sarawak)
Figure 2.13: Percentage of Compliance with Class II (Sarawak Region)



Stesen Pengawasan Kualiti Air Tanah,
Sekolah Kebangsaan Kepala Batas, Kedah

BAB 3
CHAPTER

KUALITI AIR TANAH

GROUNDWATER QUALITY

PENGAWASAN KUALITI AIR TANAH
GROUNDWATER QUALITY MONITORING

120
Stesen di Seluruh Negara
Stations (Wells) Nationwide

12
Jenis Guna Tanah
Land Use Category

406
Bilangan Sampel Air Tanah dianalisa
Number of Groundwater Samples Analysed

KAWASAN PERTANIAN
AGRICULTURAL AREA

3	Sangat Baik / Excellent
8	Baik / Good
3	Sederhana / Moderate

BEKAS TAPAK PELUPUSAN SAMPAH
USED SOLID WASTE LANDFILL

0	Sangat Baik / Excellent
15	Baik / Good
6	Sederhana / Moderate

AKUAKULTUR
AQUACULTURE

0	Sangat Baik / Excellent
5	Baik / Good
2	Sederhana / Moderate

BEKAS LOMBONG EMAS
USED GOLD MINES

0	Sangat Baik / Excellent
3	Baik / Good
0	Sederhana / Moderate

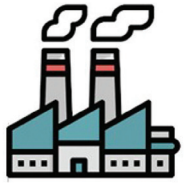
BANDAR & PINGGIR BANDAR
URBAN & SUBURBAN AREA

0	Sangat Baik / Excellent
10	Baik / Good
2	Sederhana / Moderate

PADANG GOLF
GOLF COURSES

0	Sangat Baik / Excellent
5	Baik / Good
1	Sederhana / Moderate

TAPAK PERINDUSTRIAN
INDUSTRIAL SITES



1	Sangat Baik / Excellent
9	Baik / Good
11	Sederhana / Moderate

BEKALAN AIR
WATER SUPPLY

0	Sangat Baik / Excellent
4	Baik / Good
0	Sederhana / Moderate

LUAR BANDAR
RURAL

0	Sangat Baik / Excellent
4	Baik / Good
1	Sederhana / Moderate

KAWASAN PERANGINAN
RESORTS

0	Sangat Baik / Excellent
1	Baik / Good
1	Sederhana / Moderate

BEKAS TAPAK PELUPUSAN BANGKAI HAIWAN
USED ANIMAL BURIAL SITES

0	Sangat Baik / Excellent
10	Baik / Good
4	Sederhana / Moderate

KUALITI AIR TANAH / GROUNDWATER QUALITY

PENGAWASAN KUALITI AIR TANAH

Program Pengawasan Kualiti Air Tanah Kebangsaan telah dimulakan semenjak tahun 1997. Tapak stesen pengawasan yang telah dipilih adalah mewakili jenis guna tanah spesifik di mana terdapat 120 buah stesen pengawasan kualiti air tanah (telaga) di seluruh negara. Pada tahun 2022 hanya 109 stesen telah dijalankan persampelan kualiti air tanah. Ini memandangkan terdapat stesen pengawasan kualiti air tanah yang tiada luahan air akibat faktor pembangunan yang mengakibatkan 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.

Pada tahun 2022, sebanyak 406 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).

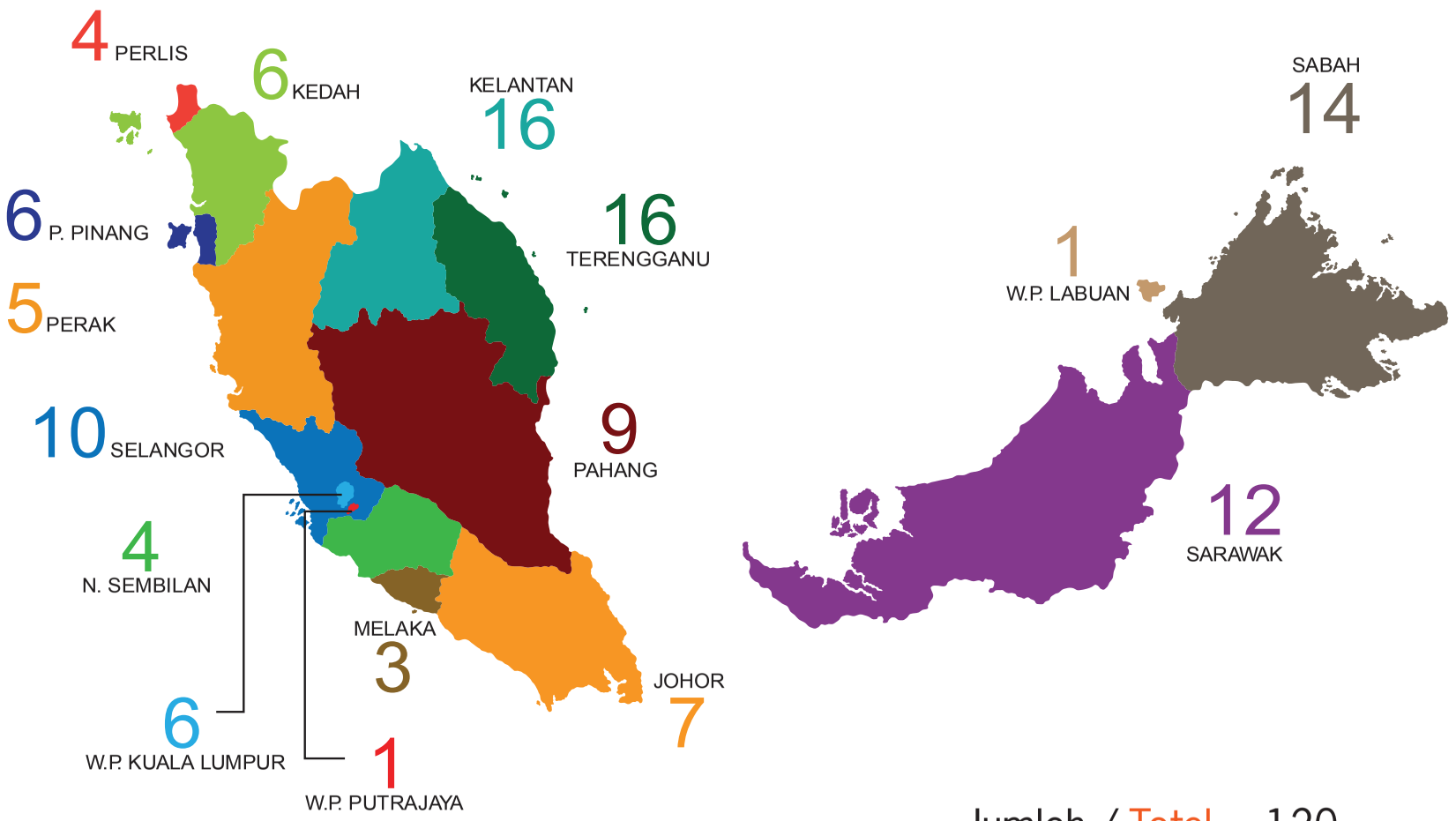
Indeks Kualiti Air Tanah (IKAT) digunakan sebagai satu kaedah menentukan kategori dan status kualiti air tanah. IKAT dibangunkan berdasarkan tujuh (7) parameter utama iaitu pH, Besi, Jumlah Pepejal Terlarut, Nitrat, E. Coli, Fenol dan Sulfate. IKAT yang berskala 0 hingga 100 akan menentukan kategori kualiti air tanah dari sangat baik hingga sangat tercemar (**Jadual 3.2**).

GROUNDWATER QUALITY MONITORING

Groundwater Water Quality Monitoring was established in 1997. The sites were selected based on specific land use. Out of a total of 120 groundwater quality monitoring stations (wells) nationwide, only 109 stations conducted groundwater quality sampling in 2022. This is because there was 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) in all states in Malaysia based on land use.

In 2022, 406 samples were analysed 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).

The Malaysia Groundwater Quality Index (GWQI) is used as a benchmark to determine the groundwater quality status and its category. GWQI was developed based on seven (7) parameters which are pH, Iron, Total Dissolved Solids, Nitrate, E. Coli, Phenol and Sulphate. GWQI with a scale quality ranging from 0 to 100 will identify the quality of the groundwater from the range of excellent to very poor (**Table 3.2**).



Jumlah / Total = 120

(Bagi 12 jenis guna tanah / For 12 types of land use)

Jumlah Telaga Pengawasan bagi Setiap Negeri Seluruh Malaysia, 2022

Total Number of Monitoring Wells for Each State of Malaysia, 2022

Jadual 3.1: Taburan Stesen Pengawasan Kualiti Air Tanah di Seluruh Negeri di Malaysia mengikut Jenis Kategori Guna Tanah, 2022
Table 3.1: Distribution of Groundwater Quality Monitoring Stations (Wells) Throughout the States in Malaysia based on Land Use, 2022

KATEGORI / CATEGORY	BILANGAN TELAGA / NUMBER OF WELLS	NEGERI / STATE	BILANGAN TELAGA / NUMBER OF WELLS
Kawasan Pertanian / Agricultural Area	15	Sabah	2
		Terengganu	5
		Pahang	1
		Kedah	3
		Perlis	1
		Kelantan	2
		Selangor	1
Bandar & Pinggir Bandar / Urban & Suburban Area	12	Sabah	1
		Terengganu	2
		Pahang	1
		Kedah	1
		Perlis	2
		Kelantan	2
		Selangor	2
		W.P. Putrajaya	1
Tapak Perindustrian / Industrial Sites	22	W.P. Labuan	1
		Terengganu	5
		Johor	2
		Kedah	1
		Kelantan	2
		Melaka	1
		Selangor	3
		P. Pinang	3
		N. Sembilan	1
		Perak	1
		Pahang	1
		Perlis	1
Bekas Tapak Pelupusan Sampah / Used Solid Waste Landfill	26	Sabah	7
		Sarawak	2
		Terengganu	2
		Johor	2
		Kelantan	3
		Perak	1
		W.P. Kuala Lumpur	5

Jadual 3.1: Taburan Stesen Pengawasan Kualiti Air Tanah di Seluruh Negeri di Malaysia mengikut Jenis Kategori Guna Tanah, 2022
Table 3.1: Distribution of Groundwater Quality Monitoring Stations (Wells) Throughout the States in Malaysia based on Land Use, 2022

KATEGORI / CATEGORY	BILANGAN TELAGA / NUMBER OF WELLS	NEGERI / STATE	BILANGAN TELAGA / NUMBER OF WELLS
Bekas Tapak Pelupusan Sampah / Used Solid Waste Landfill		N. Sembilan	3
		Melaka	1
Padang Golf / Golf Courses	7	Sabah	2
		Kelantan	4
		W.P. Kuala Lumpur	1
Luar Bandar / Rural	6	Terengganu	1
		Kelantan	3
		Melaka	1
		Selangor	1
Bekas Lombong Emas / Used Gold Mine	3	Sarawak	3
Bekalan Air / Water Supply	5	Sabah	1
		Sarawak	4
Bekas Tapak Pelupusan Bangkai Haiwan / Used Animal Burial Sites	14	Sarawak	2
		Johor	3
		Perak	3
		Selangor	3
		P. Pinang	3
Akuakultur / Aquaculture	7	Pahang	6
		Terengganu	1
Tapak Pelupusan Radioaktif / Radioactive Landfills	1	Perak	1
Kawasan Peranginan / Resorts	2	Sabah	1
		Kedah	1
		Jumlah / Total	**120**

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

KATEGORI / CATEGORY	IKAT / GWQI	POTENSI KEGUNAAN / POTENTIAL USE
Sangat Tercemar / Very Poor	0-15	Kajian air terperinci sebelum digunakan / Investigation needed before use
Tercemar / Poor	16-39	Pengairan / Pertanian / Irrigation
Sederhana / Moderate	40-69	Penggunaan Industri / Industrial Use
Baik / Good	70-89	Berpontensi sebagai air minuman / Potential use as drinking water
Sangat Baik / Excellent	>90	Air berkualiti untuk semua kegunaan / High quality water for all purpose

STATUS KUALITI AIR TANAH BAGI KAWASAN PERTANIAN

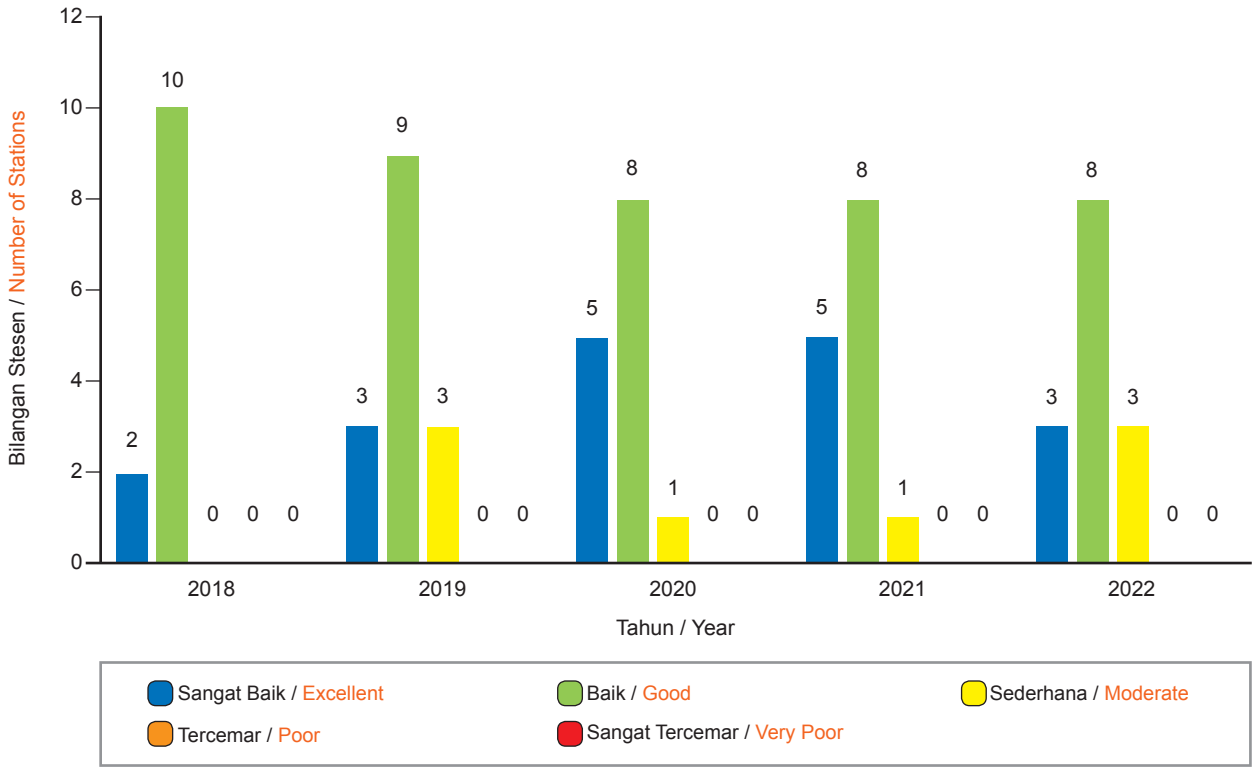
Tren IKAT mulai tahun 2018 hingga 2022 bagi kawasan pertanian adalah seperti yang ditunjukkan dalam **Rajah 3.1**. Berdasarkan **Rajah 3.1**, didapati bilangan stesen sangat baik telah menurun berbanding dengan tahun sebelumnya, baik adalah sama seperti tahun sebelumnya dan sederhana meningkat berbanding tahun sebelumnya, dan tiada stesen tercemar dan sangat tercemar pada tahun 2022.

Pada tahun 2022, sebanyak 14 stesen kawasan pertanian telah dipantau. Hasil program pengawasan yang telah dijalankan menunjukan tiga (3) stesen (21%) dikategorikan sebagai sangat baik, lapan (8) stesen (57%) dikategorikan sebagai baik dan tiga (3) stesen (21%) dikategorikan sebagai sederhana (**Jadual 3.3**).

STATUS OF GROUNDWATER QUALITY INDEX FOR AGRICULTURE

GWQI trend for agriculture from the year 2018 until 2022 is shown in **Figure 3.1**. Based on **Figure 3.1**, the number of stations ranked excellent in 2022 has decreased compared to the previous year, while the number stations ranked good is the same as the previous year and those ranked moderate has increased compared to the previous year. There were no stations ranked poor and very poor in the year 2022.

In 2022, a total of 14 stations under agriculture were monitored. The monitoring results indicated that three (3) stations were categorised as excellent (21%), eight (8) stations as good (57%) and three (3) stations as moderate (21%) (**Table 3.3**).



Rajah 3.1: Tren Indeks Kualiti Air Tanah Kawasan Pertanian, 2018-2022
Figure 3.1: Trends of Groundwater Quality Index for Agriculture, 2018-2022

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

NEGERI / STATE	KLASSIFIKASI STESEN / STATION CLASSIFICATION	KAWASAN / AREA	NOMBOR STESEN / STATION NUMBER	NILAI IKAT / GWQI VALUE					KATEGORI (2022) / CATEGORY (2022)
				2018	2019	2020	2021	2022	
Perlis	Pertanian / Agriculture	Rimba Mas, Padang Besar	MW(7)-R3-1-15.72	83	92	96	86	90	Sangat Baik / Excellent
Kedah	Pertanian / Agriculture	Padang Mat Sirat, Langkawi	MW(7)-KV-1-5.80	81	89	97	97	91	Sangat Baik / Excellent
		Padang Mat Sirat, Langkawi	MW(7)-KV-1-12.09	79	79	95	95	78	Baik / Good
		*Sek. Keb. Kepala Batas	MW(7)-R610014-2-9.34	–	81	73	91	81	Baik / Good
Selangor	Pertanian / Agriculture	*Masjid Jameul Huda, Parit 7, Sekinchan	MW(7)-S310105-1-13.70	–	60	60	63	65	Sederhana / Moderate
Pahang	Pertanian / Agriculture	Sek. Keb. Lepar	MW(7)-C7-1-6.64	95	88	88	90	91	Sangat Baik / Excellent
Kelantan	Pertanian / Agriculture	Kampong Jembal Kota Bharu.	MW(7)-D6-1-7.58	80	97	82	79	79	Baik / Good
		Sek. Keb. Beris Lalang Bachok	MW(7)-D15-1-4.05	75	80	–	–	–	Tiada Data / No Data
Terengganu	Pertanian / Agriculture	Kg. Merang, Setiu	MW(7)-T8-1-8.56	82	79	79	78	82	Baik / Good
		Sek. Keb. Alor Peroi Kg. Gajah Mati	T21-1-45.82	82	60	78	77	61	Sederhana / Moderate
		Sek. Keb. Alor Peroi Kg. Gajah Mati	T21-1-22.13	83	63	72	80	63	Sederhana / Moderate
		Sek. Keb. Alor Peroi Kg. Gajah Mati	T21-1-6.16	82	80	91	97	80	Baik / Good
		Sek. Keb. Telaga Hulu Terengganu	MW(7)-T510216-1-9.06	–	78	82	72	79	Baik / Good
Sabah	Pertanian / Agriculture	Limbawang Agriculture Stesen, Beaufort	MW(7)-H511511-1-7.50	81	82	76	81	70	Baik / Good
		Yongs Farm, Tawau	MW(7)-H411712-1-16.2	93	97	97	79	83	Baik / Good

Nota / Note:
* Stesen Baru / New Station
– Tiada Data / No Data:
i. Tiada Air / No Water
ii. Stesen Rosak / Destroyed Station

STATUS KUALITI AIR TANAH BAGI BANDAR DAN PINGGIR BANDAR

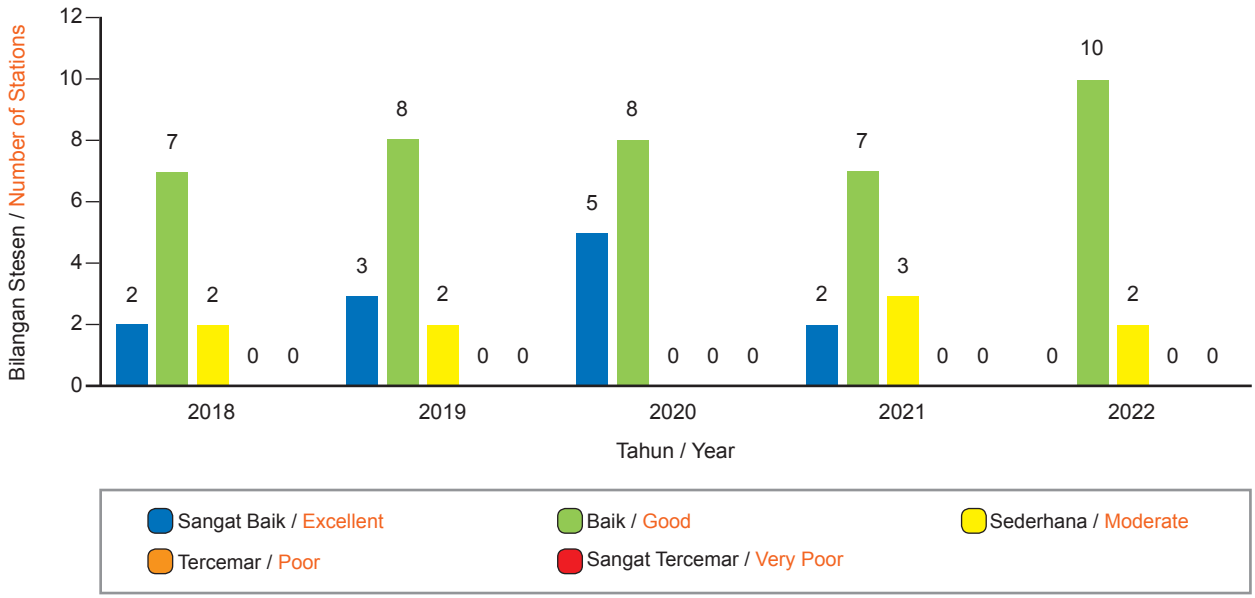
Tren IKAT mulai tahun 2018 hingga 2022 bagi bandar dan pinggir bandar adalah seperti yang ditunjukkan dalam **Rajah 3.2.** Berdasarkan **Rajah 3.2** didapati bilangan stesen baik telah meningkat manakala bilangan stesen sederhana telah menurun dibandingkan tahun sebelumnya. Tiada stesen dalam kategori sangat baik, tercemar dan sangat tercemar pada tahun 2022.

Pada tahun 2022, sebanyak 12 stesen guna tanah bandar dan pinggir bandar telah dipantau. Hasil program pengawasan yang telah dijalankan menunjukan 10 stesen (83%) dikategorikan sebagai baik, dua (2) stesen (17%) dikategorikan sebagai sederhana (**Jadual 3.4**).

STATUS OF GROUNDWATER QUALITY INDEX FOR URBAN AND SUBURBAN

GWQI trend for urban and suburban from year 2018 until 2022 is shown in **Figure 3.2**. Based on **Figure 3.2** the number of stations ranked good has increased in 2022, while the number of stations ranked moderate has decreased compared to the previous year. There were no stations ranked excellent, poor or very poor in 2022.

In 2022, a total of 12 stations under urban and suburban land use were monitored. The monitoring results indicate that 10 stations (83%) were ranked good and two (2) stations were categorised as moderate (17%) (**Table3.4**).



Rajah 3.2: Tren Indeks Kualiti Air Tanah bagi Bandar dan Pinggir Bandar, 2018-2022
Figure 3.2: Trends of Groundwater Quality Index for Urban and Suburban, 2018-2022

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 (2022) / CATEGORY (2022)
				2018	2019	2020	2021	2022	
Perlis	Bandar & Pinggir Bandar / Urban & Suburban	Arau , Perlis	MW(7)-R4-1-5.41	77	76	75	68	68	Sederhana / Moderate
		Arau , Perlis	MW(7)-R4-1-19.80	93	87	93	88	87	Baik / Good
Kedah	Bandar & Pinggir Bandar / Urban & Suburban	Sek. Keb. Darul Uloom Kepala Batas	MW(7)-K2-1-6.22	55	75	74	82	77	Baik / Good
Selangor	Bandar & Pinggir Bandar / Urban & Suburban	Saujana Golf Resort, Subang	MW(7)-S13-1-5.45	69	79	78	80	78	Baik / Good
		Saujana Golf Resort, Subang	MW(7)-S13-1-12.67	78	97	97	89	83	Baik / Good
W.P. Putrajaya	Bandar & Pinggir Bandar / Urban & Suburban	*Taman Wetland	MW(7)-W210103-1-10.0	–	72	80	–	–	Tiada Data / No Data
Pahang	Bandar & Pinggir Bandar / Urban & Suburban	Nenasi	MW(7)-C13-1-45.97	90	88	93	85	88	Baik / Good
Kelantan	Bandar & Pinggir Bandar / Urban & Suburban	Sek. Men. Keb. Rantau Panjang	MW(7)-D7-1-5.50	82	96	97	80	85	Baik / Good
		Sek. Men. Keb. Rantau Panjang	MW(7)-D7-1-20.23	81	86	82	79	80	Baik / Good
		*Sek. Men. Keb. Cherang Ruku, Pasir Puteh	MW(7)-D510202-1-7.96	–	67	88	68	76	Baik / Good
Terengganu	Bandar & Pinggir Bandar / Urban & Suburban	Kg. Raja, Besut	MW(7)-T1-1-7.25	84	79	88	96	76	Baik / Good
		Kg. Raja, Besut	MW(7)-T1-1-31.79	85	64	73	64	64	Sederhana / Moderate
Sabah	Bandar & Pinggir Bandar / Urban & Suburban	Sek. Keb. Inanam	MW(7)-H511601-9-7.50	80	93	91	92	84	Baik / Good

Nota / Note:
* Stesen Baru / New Station
– Tiada Data / No Data:
i. Tiada Air / No Water
ii. Stesen Rosak / Destroyed Station

STATUS KUALITI AIR TANAH BAGI TAPAK PERINDUSTRIAN

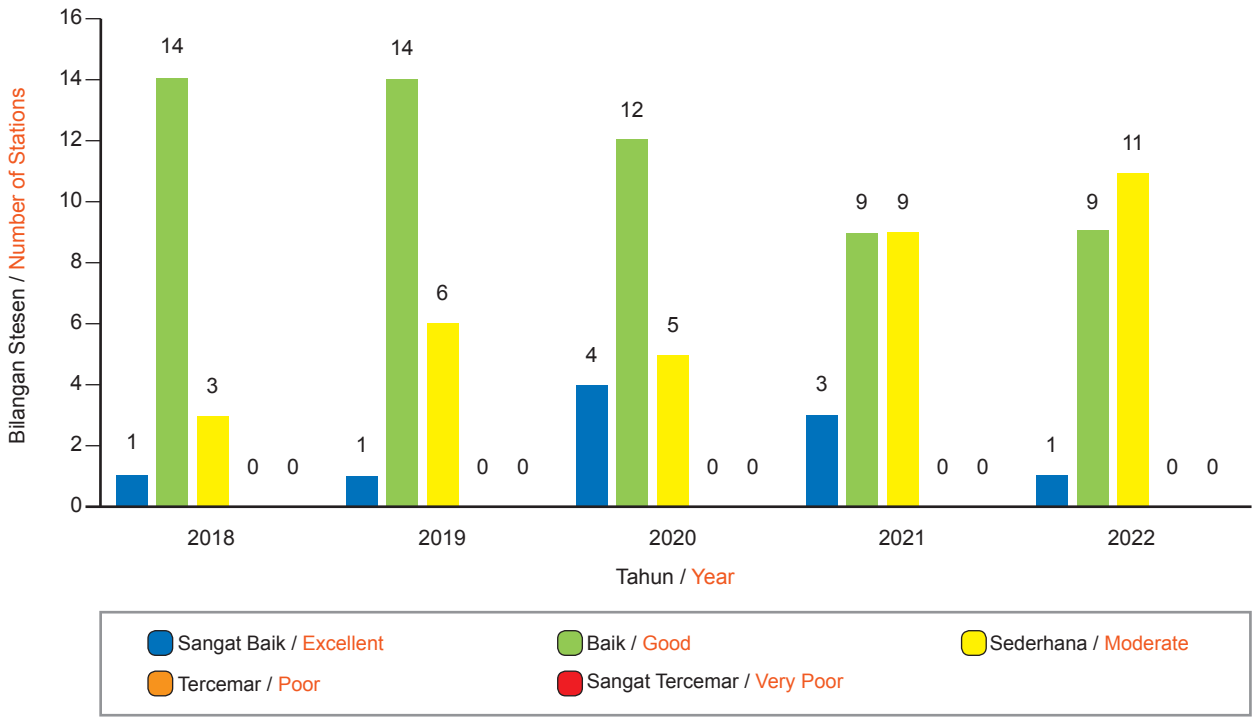
Tren IKAT mulai tahun 2018 hingga 2022 bagi tapak perindustrian adalah seperti yang ditunjukkan dalam **Rajah 3.3**. Berdasarkan **Rajah 3.3** didapati bilangan stesen sangat baik telah menurun dan bilangan stesen sederhana meningkat. Tiada stesen dalam kategori tercemar dan sangat tercemar pada tahun 2022.

Pada tahun 2022, sebanyak 21 stesen tapak perindustrian telah dipantau sama seperti tahun 2021. Hasil program pengawasan yang telah dijalankan menunjukan satu (1) stesen (5%) dikategorikan sebagai sangat baik dan sembilan (9) stesen (43%) dikategorikan sebagai baik dan 11 stesen (52%) dikategorikan sebagai sederhana (**Jadual 3.5**).

STATUS OF GROUNDWATER QUALITY INDEX FOR INDUSTRIAL SITES

GWQI trend for industrial sites from year 2018 until 2022 is shown in **Figure 3.3**. Based on **Figure 3.3**, the number of stations ranked excellent has decreased, while the moderate category has increased compared to the previous year. No station was categorised under poor and very poor in the year 2022.

In 2022, a total of 21 stations for industrial sites were monitored, the same number as the previous year. The monitoring result indicates that one (1) station (5%) was categorised as excellent, nine (9) stations (43%) categorised as good and 11 stations (52%) were categorised as moderate (**Table 3.5**).



Rajah 3.3: Tren Indeks Kualiti Air Tanah bagi Tapak Perindustrian, 2018-2022
Figure 3.3: Trends of Groundwater Quality Index for Industrial Sites, 2018-2022

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 (2022) / CATEGORY (2022)
				2018	2019	2020	2021	2022	
Perlis	Tapak Perindustrian / Industrial Sites	*Felda Chuping	MW(7)-R610006-2-7.32	–	71	90	76	84	Baik / Good
Kedah	Tapak Perindustrian / Industrial Sites	Kulim Hi-Tech	MW(7)-K3-1-8.45	70	82	72	82	76	Baik / Good
P. Pinang	Tapak Perindustrian / Industrial Sites	Mak Mandin (MAGRI)	MW(7)-P1-2-4.50	76	69	78	78	65	Sederhana / Moderate
		Mak Mandin (KASTAM)	MW(7)-P1-1-6.50	77	74	79	84	74	Baik / Good
		Bayan Lepas	MW(7)-P2-1-4.34	87	78	98	95	77	Baik / Good
Selangor	Tapak Perindustrian / Industrial Sites	SK Seksy. 20, Shah Alam	MW(7)-S9A-1-8.20	67	82	73	62	75	Baik / Good
		CIAST, Seksy. 19, Shah Alam	MW(7)-S9-1-20.21	67	81	81	66	78	Baik / Good
		CIAST, Seksy. 19, Shah Alam	MW(7)-S9-1-5.97	66	54	78	53	68	Sederhana / Moderate
N. Sembilan	Tapak Perindustrian / Industrial Sites	Senawang Edible Oil	MW(7)-N4-1-6.44	71	81	65	72	66	Sederhana / Moderate
Melaka	Tapak Perindustrian / Industrial Sites	Petronas Oil Refinery, Melaka	MW(7)-M1-1-8.10	71	64	64	82	64	Sederhana / Moderate
Johor	Tapak Perindustrian / Industrial Sites	Tg. Puteri, Pasir Gudang	MW(7)-J5-1-7.34	99	73	85	90	91	Sangat Baik / Excellent
		Tg. Puteri, Pasir Gudang	MW(7)-J5-2-7.49	72	70	60	48	64	Sederhana / Moderate
Pahang	Tapak Perindustrian / Industrial Sites	*LYNAS, Gebeng	MW(7)-C310302-1-6.50	–	66	62	77	68	Sederhana / Moderate
Kelantan	Tapak Perindustrian / Industrial Sites	Eastern Garment MFG. Pkln.Chepa	MW(7)-D6-2-51.38	70	87	71	57	67	Sederhana / Moderate
		Eastern Garment MFG. Pkln.Chepa	MW(7)-D6-2-4.24	80	79	71	68	81	Baik / Good
Terengganu	Tapak Perindustrian / Industrial Sites	TCOT Kerteh, Kemaman	MW(7)-T15-1-5.68	82	88	97	80	84	Baik / Good
		TCOT Kerteh, Kemaman	MW(7)-T15-1-24.89	85	82	82	65	68	Sederhana / Moderate
		KSB Telok Kalong, Kemaman	MW(7)-T16-1-5.57	87	64	82	64	69	Sederhana / Moderate
		KSB Telok Kalong, Kemaman	MW(7)-T16-1-18.76	83	61	69	60	66	Sederhana / Moderate
		*Sek. Keb. Bari, Setiu	MW(7)-T510208-1-7.97	–	74	78	78	78	Baik / Good
W.P. Labuan	Tapak Perindustrian / Industrial Sites	Asian Supply Base W.P. Labuan	MW(7)-H511509-1-6.80	81	91	94	91	69	Sederhana / Moderate

STATUS KUALITI AIR TANAH BAGI BEKAS TAPAK PELUPUSAN SAMPAH

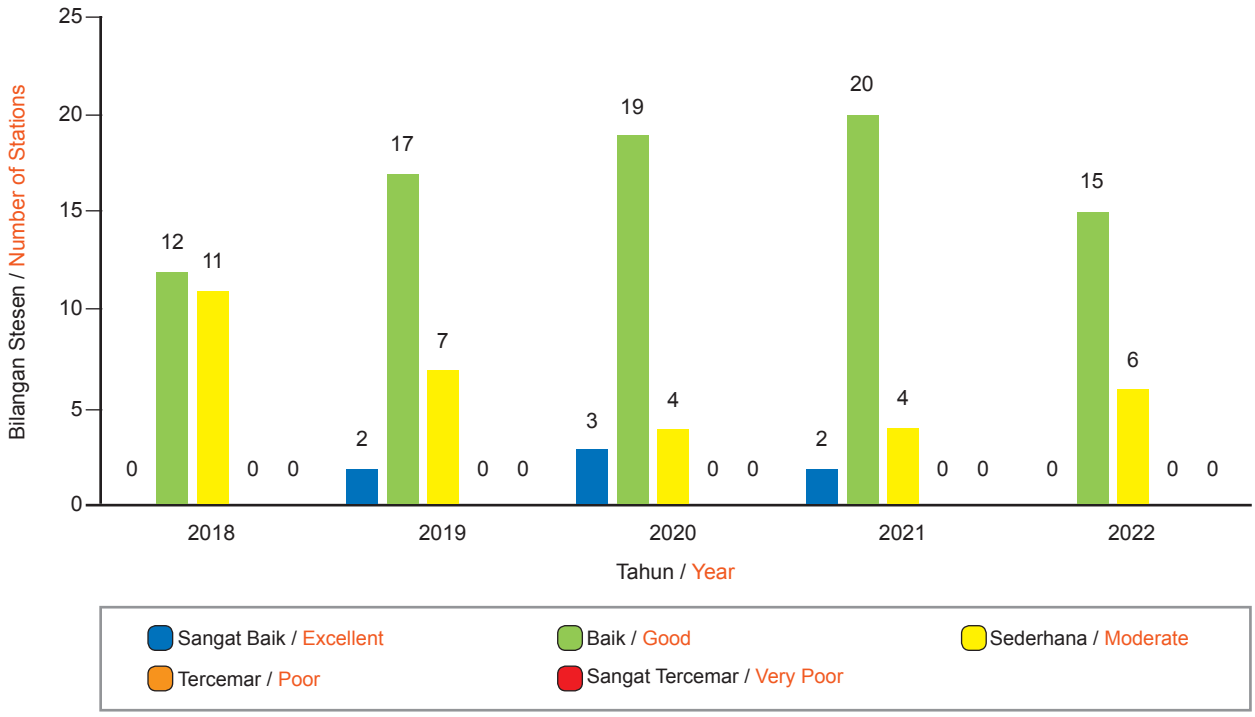
Tren IKAT mulai tahun 2018 hingga 2022 bagi bekas tapak pelupusan sampah adalah seperti yang ditunjukkan dalam **Rajah 3.4**. Berdasarkan **Rajah 3.4** didapati bilangan stesen baik menurun manakala bilangan stesen sederhana meningkat berbanding tahun sebelumnya. Tiada stesen dalam kategori sangat baik, tercemar dan sangat tercemar pada tahun 2022.

Pada tahun 2022, sebanyak 21 stesen bekas tapak pelupusan sampah telah dipantau. Hasil program pengawasan yang telah dijalankan menunjukan 15 stesen (71%) dikategorikan sebagai baik dan enam (6) stesen (29%) dikategorikan sebagai sederhana (**Jadual 3.6**)

STATUS OF GROUNDWATER QUALITY INDEX FOR USED SOLID WASTE LANDFILLS

GWQI trend from 2018 to 2022 for used solid waste landfills is as shown in **Figure 3.4**. Based on **Figure 3.4**, the number of stations ranked good decreased while the number of stations ranked moderate increased compared to the previous year. There were no stations in the excellent, polluted and very polluted categories in 2022.

In 2022, a total of 21 stations for used solid waste landfills were monitored. The results of the monitoring programme that was conducted showed that 15 stations (71%) were categorised as good and six (6) (29%) were categorised as moderate (**Table 3.6**).



Rajah 3.4: Tren Indeks Kualiti Air Tanah bagi Bekas Tapak Pelupusan Sampah, 2018-2022
Figure 3.4: Trends of Groundwater Quality Index for Used Solid Waste Landfills, 2018-2022

Jadual 3.6: Status Indeks Kualiti Air Tanah bagi Guna Tanah Bekas Tapak Pelupusan Sampah

Table 3.6: Status of Groundwater Quality Index for Used Solid Waste Landfills

NEGERI / STATE	KLASSIFIKASI STESEN / STATION CLASSIFICATION	KAWASAN / AREA	NOMBOR STESEN / STATION NUMBER	NILAI IKAT / GWQI VALUE					KATEGORI (2022) / CATEGORY (2022)
				2018	2019	2020	2021	2022	
Perak	Bekas Tapak Pelupusan Sampah / Used Solid Waste Landfills	Pusing, Batu Gajah	MW(7)-A11-1-6.05	70	59	73	79	67	Sederhana / Moderate
W.P. Kuala Lumpur	Bekas Tapak Pelupusan Sampah / Used Solid Waste Landfills	Jln Sg. Besi	MW(7)-S11-1-5.50	51	86	79	64	–	Tiada Data / No Data
		Jln Sg. Besi	MW(7)-S11-1-5.54	59	82	74	73	–	Tiada Data / No Data
		Jln Sg. Besi	MW(7)-S11-1-5.57	65	93	74	82	–	Tiada Data / No Data
		Tmn Beringin, Kepong	MW(7)-S13-1-7.26	58	95	84	73	–	Tiada Data / No Data
		Tmn Beringin, Kepong	MW(7)-S13-2-6.10	56	87	75	77	–	Tiada Data / No Data
N. Sembilan	Bekas Tapak Pelupusan Sampah / Used Solid Waste Landfills	Kualiti Alam	MW(7)-N5-1-8.00	64	84	79	83	81	Baik / Good
		Kualiti Alam	MW(7)-N5-1-7.55	64	64	64	82	70	Baik / Good
		*TPS Tanah Merah (CYPARK), Port Dickson	MW(7)-N210108-2-10.03	–	69	70	71	66	Sederhana / Moderate
Melaka	Bekas Tapak Pelupusan Sampah / Used Solid Waste Landfills	*Tapak Pelupusan Sampah, Sungai Udang	MW(7)-M210209-1-7.68	–	62	75	56	64	Sederhana / Moderate
Johor	Bekas Tapak Pelupusan Sampah / Used Solid Waste Landfills	Kg. Batu 4, Kota Tinggi	MW(7)-J4-1-6.94	82	65	89	61	73	Baik / Good
		*Tapak Pelupusan Sisa Pepejal, Ladang CEP, Simpang Renggam	MW(7)-J110302-1-7.02	–	64	63	64	72	Baik / Good
Kelantan	Bekas Tapak Pelupusan Sampah / Used Solid Waste Landfills	Panji Landfill, Panji Kota Bharu	MW(7)-D6-3-13.43	83	89	82	73	86	Baik / Good
		Panji Landfill, Panji Kota Bharu	MW(7)-D6-3-5.34	80	89	82	73	74	Baik / Good
		P.Mas Landfill, Kg.Pusu 40, P.Mas	MW(7)-D8-1-5.22	76	89	94	72	76	Baik / Good
Terengganu	Bekas Tapak Pelupusan Sampah / Used Solid Waste Landfills	Kg. Kubang Badak, K.Terengganu	MW(7)-T10-1-5.45	67	78	98	75	74	Baik / Good
		Kg. Kubang Badak, K.Terengganu	MW(7)-T10-1-22.89	81	78	97	76	73	Baik / Good

Jadual 3.6: Status Indeks Kualiti Air Tanah bagi Guna Tanah Bekas Tapak Pelupusan Sampah
Table 3.6: Status of Groundwater Quality Index for Used Solid Waste Landfills

NEGERI / STATE	KLASSIFIKASI STESEN / STATION CLASSIFICATION	KAWASAN / AREA	NOMBOR STESEN / STATION NUMBER	NILAI IKAT / GWQI VALUE					KATEGORI (2022) / CATEGORY (2022)
				2018	2019	2020	2021	2022	
Sabah	Bekas Tapak Pelupusan Sampah / Used Solid Waste Landfills	ITAC, Kg. Duvanson, Penampang	MW(7)-H511601-1-8.80	70	82	82	82	77	Baik / Good
		ITAC, Kg. Duvanson, Penampang	MW(7)-H511601-2-14.0	82	82	82	82	70	Baik / Good
		ITAC, Kg. Duvanson, Penampang	MW(7)-H511601-3-8.00	85	86	85	85	75	Baik / Good
		ITAC, Kg. Duvanson, Penampang	MW(7)-H511601-4-17.3	84	85	85	84	72	Baik / Good
		ITAC, Kg. Duvanson, Penampang	MW(7)-H511601-5-19.0	76	73	80	80	69	Sederhana / Moderate
		ITAC, Kg. Duvanson, Penampang	MW(7)-H511601-6-10.2	69	80	80	96	69	Sederhana / Moderate
		ITAC, Kg. Duvanson, Penampang	MW(7)-H511601-7-10.3	73	82	82	97	84	Baik / Good
Sarawak	Bekas Tapak Pelupusan Sampah / Used Solid Waste Landfills	Kemuyang, No.1	MW(7)-QS-K1-11.10	58	53	53	84	61	Sederhana / Moderate
		Kemuyang, No.2	MW(7)-QS-K2-10.78	51	72	69	83	70	Baik / Good

STATUS KUALITI AIR TANAH BAGI PADANG GOLF

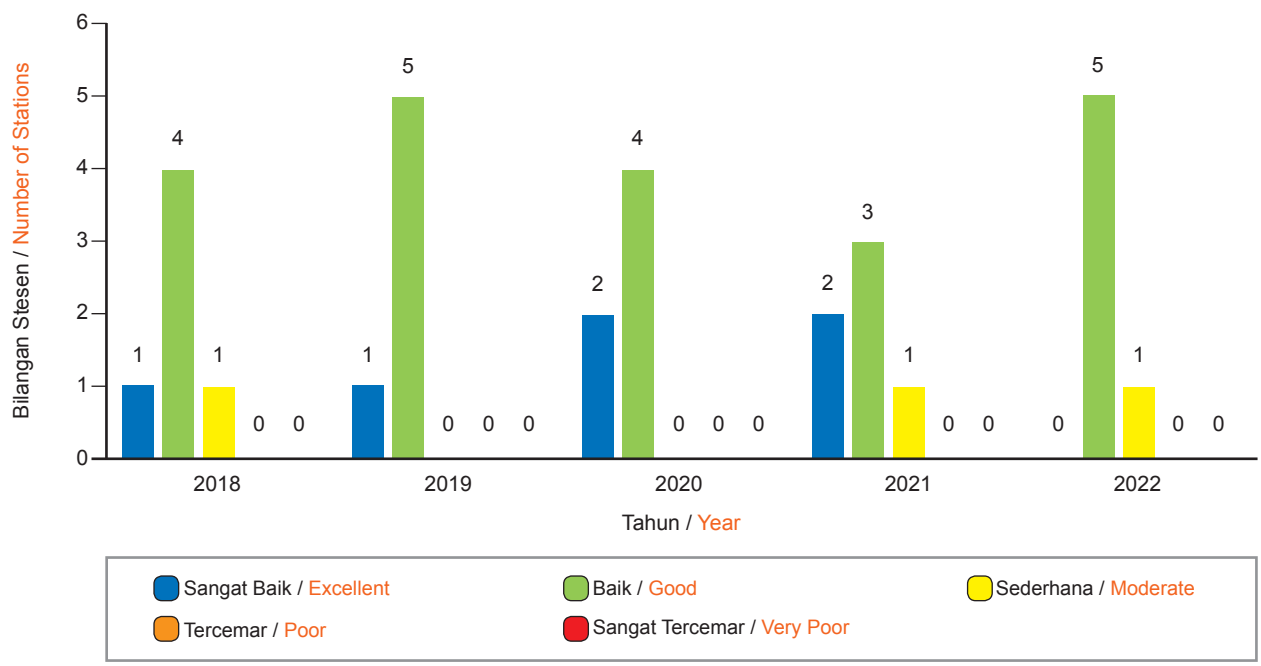
Tren IKAT mulai tahun 2018 hingga 2022 bagi padang golf adalah seperti yang ditunjukkan dalam **Rajah 3.5**. Berdasarkan **Rajah 3.5**, didapati bilangan stesen dalam kategori baik meningkat berbanding tahun sebelumnya manakala bilangan stesen yang berada dalam kategori sederhana tiada perubahan. Tiada stesen dalam kategori sangat baik, tercemar dan sangat tercemar pada tahun 2022.

Pada tahun 2022, sebanyak enam (6) stesen yang dipantau. Hasil program pengawasan yang telah dijalankan menunjukan lima (5) stesen (83%) dikategorikan sebagai baik dan satu (1) stesen sederhana (17%) (**Jadual 3.7**).

STATUS OF GROUNDWATER QUALITY INDEX FOR GOLF COURSES

The GWQI trend from 2018 to 2022 for golf courses is as shown in **Figure 3.5**. Based on **Figure 3.5**, the number of stations falling under the good category in 2022 increased compared to the year before, while there was no change to the number of stations in the moderate category. No station was categorised as excellent, poor and very poor category in the year 2022.

In the year 2022, six (6) stations were monitored. The monitoring results indicate that five (5) stations (83%) were categorised as good and one (1) station was ranked moderate (17%) (**Table 3.7**).



Rajah 3.5: Tren Indeks Kualiti Air Tanah bagi Padang Golf, 2018-2022
Figure 3.5: Trends of Groundwater Quality Index for Golf Courses, 2018-2022

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 (2022) / CATEGORY (2022)
				2018	2019	2020	2021	2022	
W.P. Kuala Lumpur	Padang Golf / Golf Courses	Royal Selangor Golf Club	MW(7)-S12-1-5.37	–	–	–	–	–	Tiada Air
Kelantan	Padang Golf / Golf Courses	Kelab Golf & Desa Pkln.Chepa	MW(7)-D3-1-6.90	82	89	82	79	86	Baik / Good
		Kelab Golf & Desa Pkln.Chepa	MW(7)-D3-1-6.37	71	84	71	62	82	Baik / Good
		Kelab Golf D'Raja Kubang Kerian	MW(7)-D6-4-31.29	65	82	82	75	64	Sederhana / Moderate
		Kelab Golf D'Raja Kubang Kerian	MW(7)-D6-4-9.05	75	85	81	90	76	Baik / Good
Sabah	Padang Golf / Golf Courses	Sandakan Golf Club, Sandakan	MW(7)-H511801-1-8.82	79	81	96	81	76	Baik / Good
		Sandakan Golf Club, Sandakan	MW(7)-H511801-2-8.60	96	96	95	95	78	Baik / Good

Nota / Note:
* Stesen Baru / New Station
– Tiada Data / No Data:
i. Tiada Air / No Water
ii. Stesen Rosak / Destroyed Station

STATUS KUALITI AIR TANAH BAGI LUAR BANDAR

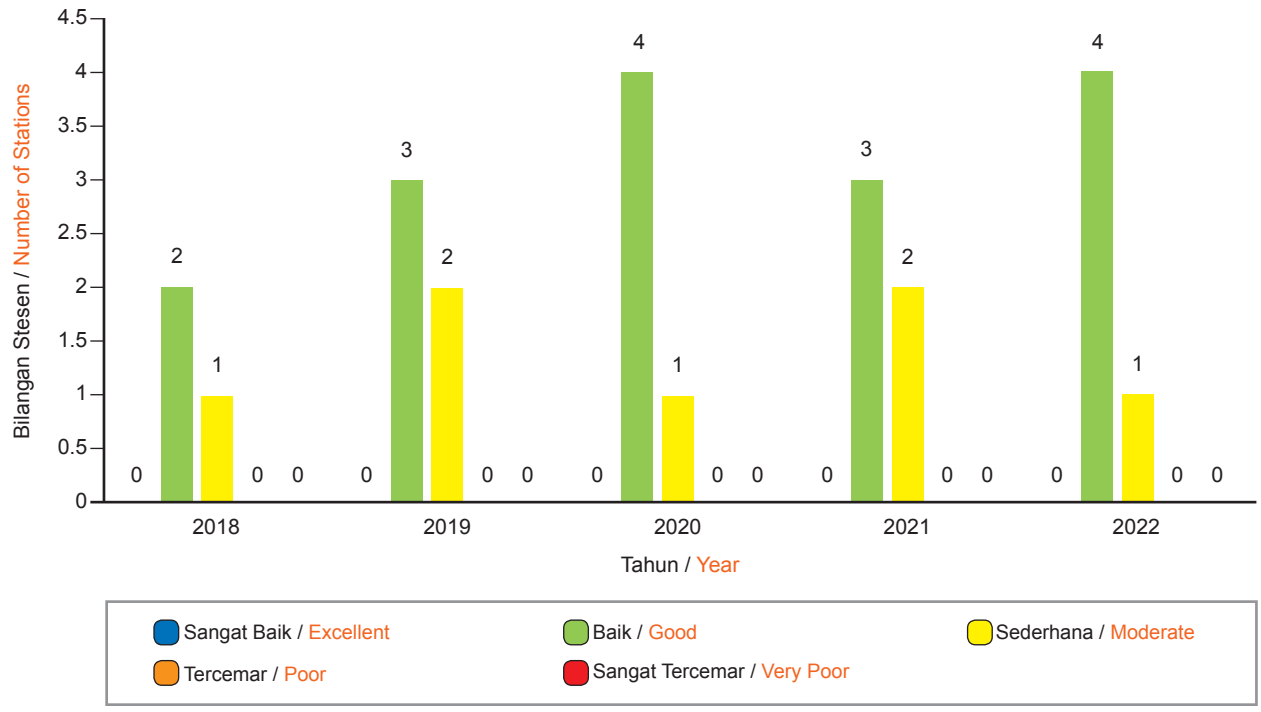
Tren IKAT mulai tahun 2018 hingga 2022 bagi kawasan luar bandar adalah seperti yang ditunjukkan dalam **Rajah 3.6**. Bilangan stesen baik menunjukkan peningkatan berbanding tahun sebelumnya dan bilangan stesen sederhana menurun berbanding tahun lepas. Tiada stesen dalam kategori sangat baik, tercemar dan sangat tercemar pada tahun 2022.

Pada tahun 2022, sebanyak lima (5) stesen kawasan luar bandar telah dipantau. Hasil program pengawasan yang telah dijalankan menunjukan empat (4) stesen (80%) dikategorikan sebagai baik dan satu (1) stesen (20%) dikategorikan sebagai sederhana (**Jadual 3.8**).

STATUS OF GROUNDWATER QUALITY INDEX FOR RURAL

GWQI trend for rural area from the year 2018 until 2022 is shown in **Figure 3.6**. The number of stations categorised under good has increased while the number of stations categorised under moderate has decreased compared to the previous year. No station fell under the excellent, poor and very poor categories in the year 2022.

In 2022, a total of five (5) stations under rural area was monitored. The monitoring results indicate that four (4) stations (80%) were categorised as good and one (1) station (20%) was categorised as moderate (**Table 3.8**).



Rajah 3.6: Tren Indeks Kualiti Air Tanah bagi Luar Bandar, 2018-2022
Figure 3.6: Trends of Groundwater Quality Index for Rural, 2018-2022

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

NEGERI / STATE	KLASSIFIKASI STESEN / STATION CLASSIFICATION	KAWASAN / AREA	NOMBOR STESEN / STATION NUMBER	NILAI IKAT / GWQI VALUE					KATEGORI (2022) / CATEGORY (2022)
				2018	2019	2020	2021	2022	
Kelantan	Luar Bandar / Rural Areas	Sek. Keb. Jelawat Bachok	MW(7)-D11-1-6.10	81	80	79	73	84	Baik / Good
		Sek. Men. Keb. Jelawat Bachok	MW(7)-D11-2-5.09	65	65	81	58	79	Baik / Good
Selangor	Luar Bandar / Rural Areas	*Institut Alam Sekitar Malaysia, EiMAS, UKM Bangi	MW(7)-S210104-1-20.40	–	72	85	76	73	Baik / Good
Melaka	Luar Bandar / Rural Areas	*Pusat Kecemerlangan Buangan Terjadual, JAS Taboh Naning	MW(7)-M210209-2-21.10	–	49	42	63	45	Sederhana / Moderate
Terengganu	Luar Bandar / Rural Areas	Kg. Padang Pak Wan, Bkt. Payung, Marang	MW(7)-T14-1-6.99	81	80	88	79	85	Baik / Good

Nota / Note:
* Stesen Baru / New Station
– Tiada Data / No Data:
i. Tiada Air / No Water
ii. Stesen Rosak / Destroyed Station

STATUS KUALITI AIR TANAH BAGI BEKAS LOMBONG EMAS

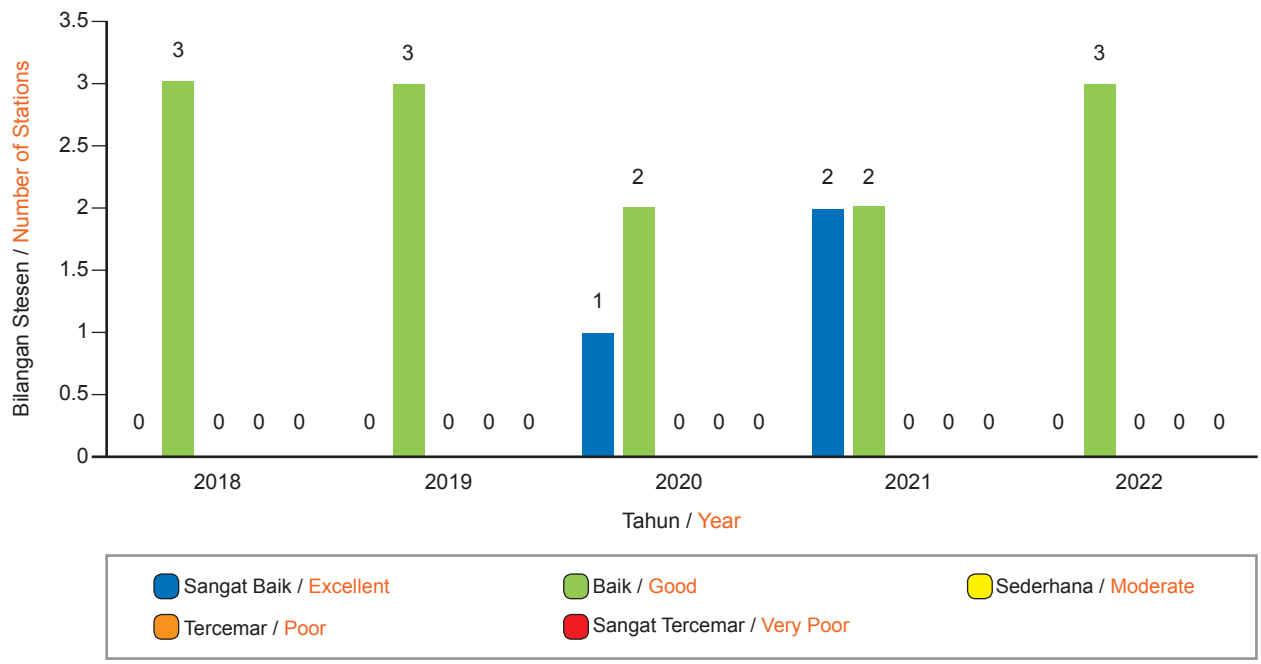
Tren IKAT mulai tahun 2018 hingga 2022 bagi bekas lombong emas adalah seperti yang ditunjukkan dalam **Rajah 3.7**. Berdasarkan **Rajah 3.7** didapati stesen bagi kategori baik meningkat berbanding tahun sebelumnya. Tiada stesen dalam kategori sangat baik, sederhana, tercemar dan sangat tercemar pada tahun 2022 bagi kategori ini.

Pada tahun 2022, sebanyak tiga (3) stesen bekas lombong emas telah dipantau. Hasil program pengawasan yang telah dijalankan menunjukkan ketiga-tiga stesen dikategorikan sebagai baik (**Jadual 3.9**).

STATUS OF GROUNDWATER QUALITY INDEX FOR USED GOLD MINE

GWQI trend for used gold mine from the year 2018 until 2022 is shown in **Figure 3.7**. Based on **Figure 3.7**, the number of stations ranked good increased compared to the previous year. No station was categorised as excellent, moderate, poor or very poor in the year 2022.

In 2022, a total of three (3) stations for used gold mine were monitored. The monitoring results indicate that all stations were categorised as good (**Table 3.9**).



Rajah 3.7: Tren Indeks Kualiti Air Tanah bagi Bekas Lombong Emas, 2018-2022
Figure 3.7: Trends of Groundwater Quality Index for Used Gold Mine, 2018-2022

Jadual 3.9: Status Indeks Kualiti Air Tanah bagi Bekas Lombong Emas
Jadual 3.9: Status of Groundwater Quality Index for Used Gold Mine

NEGERI / STATE	KLASSIFIKASI STESEN / STATION CLASSIFICATION	KAWASAN / AREA	NOMBOR STESEN / STATION NUMBER	NILAI IKAT / GWQI VALUE					KATEGORI (2022) / CATEGORY (2022)
				2018	2019	2020	2021	2022	
Sarawak	Bekas Lombong Emas / Used Gold Mine	Bau, No. 1	MW(7)-QK-B1-27.27	82	85	88	92	87	Baik / Good
		Bau, No. 2	MW(7)-QK-B2-29.50	82	84	93	87	84	Baik / Good
		Bau	MW(7)-QK-B3-29.00	73	82	82	82	87	Baik / Good

Nota / Note:
* Stesen Baru / New Station
– Tiada Data / No Data:
i. Tiada Air / No Water
ii. Stesen Rosak / Destroyed Station

STATUS KUALITI AIR TANAH BAGI BEKALAN AIR

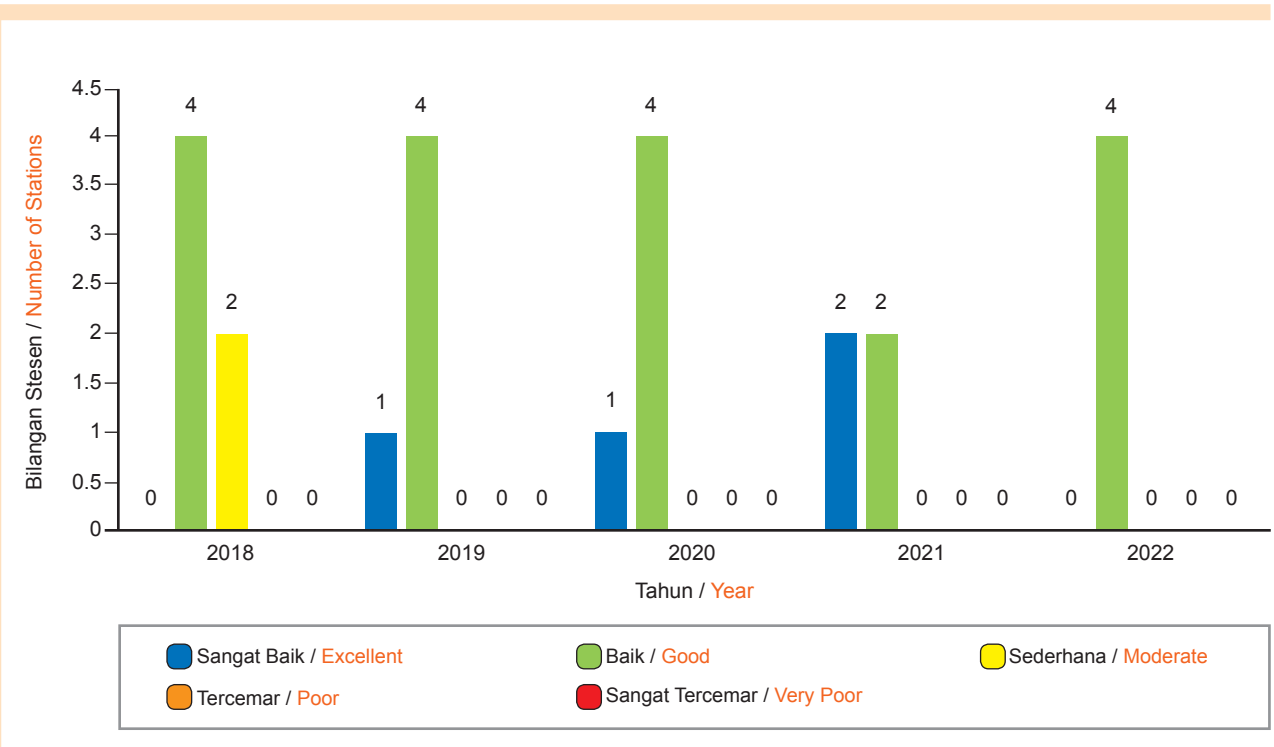
Tren IKAT mulai tahun 2018 hingga 2022 bagi bekalan air adalah seperti yang ditunjukkan dalam **Rajah 3.8**. Berdasarkan **Rajah 3.8** didapati stesen bagi kategori baik meningkat berbanding tahun sebelumnya. Tiada stesen dalam kategori sangat baik, sederhana, tercemar dan sangat tercemar pada tahun 2022.

Pada tahun 2022, sebanyak empat (4) stesen bekalan air telah dipantau. Hasil program pengawasan yang telah dijalankan menunjukan empat (4) stesen (100%) dikategorikan sebagai baik (**Jadual 3.10**).

STATUS OF GROUNDWATER QUALITY INDEX FOR WATER SUPPLY

GWQI trend for water supply from the year 2018 until 2022 is shown in **Figure 3.8**. Based on **Figure 3.8**, stations categorised as good have increased compared to the previous year. No stations were categorised under excellent, moderate, poor or very poor in the year 2022.

In 2022, a total of four (4) stations for water supply was monitored. The monitoring results indicate that all four (4) stations (100%) were categorised as good (**Table 3.10**).



Rajah 3.8: Tren Indeks Kualiti Air Tanah bagi Bekalan Air, 2018-2022
Figure 3.8: Trends of Groundwater Quality Index for Water Supply, 2018-2022

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 (2022) / CATEGORY (2022)
				2018	2019	2020	2021	2022	
Sabah	Bekalan Air Tempatan / Municipal Water Supply	Kg. Tajau Laut, Kudat	MW(7)-H511604-1-4.5	75	87	88	97	77	Baik / Good
Sarawak	Bekalan Air Tempatan / Municipal Water Supply	Kabong, No. 1	MW(7)-QB-K1-6.70	79	84	70	79	70	Baik / Good
		Pusat Rawatan Air.JKR, No. 1, Miri	MW(7)-QL-L1-7.53	56	92	99	–	–	Tiada Data / No Data
		Pusat Rawatan Air.JKR, No. 2, Miri	MW(7)-QL-L2-7.90	70	–	–	–	–	Tiada Data / No Data
		LAKU (Lambir), No. 1, Miri	MW(7)-QM-L1-30.50	59	75	83	93	80	Baik / Good
		Kg. Lusut Kiri, No. 3, Miri	MW(7)-QM-L3-28.30	82	77	87	76	70	Baik / Good

Nota / Note:
* Stesen Baru / New Station
– Tiada Data / No Data:
i. Tiada Air / No Water
ii. Stesen Rosak / Destroyed Station

STATUS KUALITI AIR TANAH BAGI BEKAS TAPAK PELUPUSAN BANGKAI HAIWAN

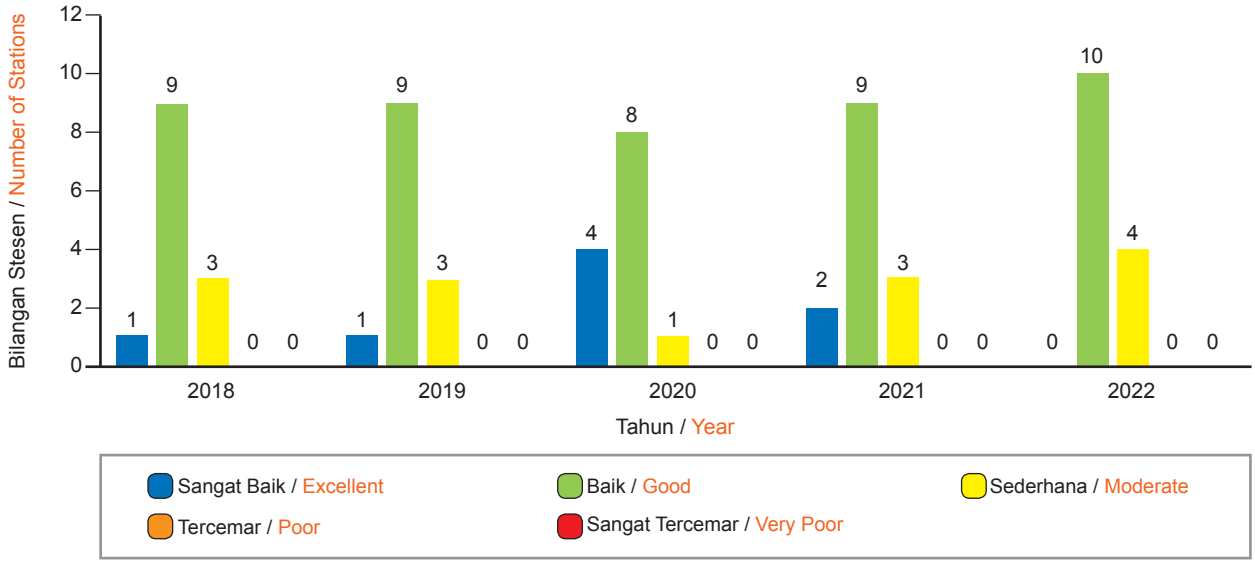
Tren IKAT mulai tahun 2018 hingga 2022 bagi bekas tapak pelupusan bangkai haiwan adalah seperti yang ditunjukkan dalam **Rajah 3.9**. Berdasarkan **Rajah 3.9** didapati jumlah stesen dalam kategori sangat baik menurun daripada tahun sebelumnya. Bilangan stesen baik dan sederhana meningkat pada tahun ini. Tiada stesen dalam kategori sangat baik, tercemar dan sangat tercemar pada tahun 2022.

Pada tahun 2022 sebanyak 14 stesen yang dipantau. Berdasarkan **Jadual 3.11**, yang telah dijalankan menunjukan 10 stesen (71%) dikategorikan sebagai baik dan empat (4) stesen (29%) sebagai sederhana (**Jadual 3.11**).

STATUS OF GROUNDWATER QUALITY INDEX FOR USED ANIMAL BURIAL SITES

GWQI trend for used animal burial sites from the year 2018 until 2022 is shown in **Figure 3.9**. Based on **Figure 3.9**, stations in the excellent category, decreased while the number of good and moderate has increased in 2022, when compared to 2021. No stations were in the excellent, poor and very poor categories in the year 2022.

In the year 2022, 14 stations were monitored. Based on **Table 3.11**, 10 stations (71%) were categorised as good and four (4) stations (29%) were categorised as moderate (**Table 3.11**).



Rajah 3.9: Tren Indeks Kualiti Air Tanah bagi Bekas Tapak Pelupusan Bangkai Haiwan, 2018-2022
Figure 3.9: Trends of Groundwater Quality Index for Used Animal Burial Sites, 2018-2022

Jadual 3.11: Status indeks Kualiti Air Tanah bagi Bekas Tapak Pelupusan Bangkai Haiwan
Table 3.11: Status of Groundwater Quality Index for Used Animal Burial Sites

NEGERI / STATE	KLASSIFIKASI STESEN / STATION CLASSIFICATION	KAWASAN / AREA	NOMBOR STESEN / STATION NUMBER	NILAI IKAT / GWQI VALUE					KATEGORI (2022) / CATEGORY (2022)
				2018	2019	2020	2021	2022	
Perak	Bekas Tapak Pelupusan Bangkai Haiwan / Used Animal Burial Sites	Tapak Bazar Seramik Tambun	MW(7)-A(IP)-1-5.92	69	69	78	73	67	Sederhana / Moderate
		Tapak Bekas Wabak JE Jalong	MW(7)-A(SS)-2-3.14	–	–	–	88	73	Baik / Good
		Tapak Bekas Wabak JE Jalong	MW(7)-A(SS)-1-7.65	85	83	87	84	74	Baik / Good
P. Pinang	Bekas Tapak Pelupusan Bangkai Haiwan / Used Animal Burial Sites	Perkampungan Ldg Valdor (Kelapa)	MW(7)-P(LV)-1-7.45	89	96	96	93	72	Baik / Good
		Perkampungan Ldg Valdor (Tengah)	MW(7)-P(LV)-2-6.78	88	74	90	92	75	Baik / Good
		Perkampungan Ldg Valdor (Jalan)	MW(7)-P(LV)-3-7.30	91	72	90	81	74	Baik / Good
Johor	Bekas Tapak Pelupusan Bangkai Haiwan / Used Animal Burial Sites	Ulu Choh (Pintu)	MW(7)-JPN-1-6.90	82	62	73	81	63	Sederhana / Moderate
		Ulu Choh (Kolam)	MW(7)-JPN-2-6.10	81	70	70	62	71	Baik / Good
		Ulu Choh (Sungai)	MW(7)-JPN-3-6.71	82	78	83	82	69	Sederhana / Moderate
Selangor	Bekas Tapak Pelupusan Bangkai Haiwan / Used Animal Burial Sites	Stesen Kg. Sg. Keroh, Sepang	MW(7)-S(SE)-1-5.67	63	59	52	62	62	Sederhana / Moderate
		TNB Sepang	MW(7)-S(SE)-2-6.95	71	79	96	68	76	Baik / Good
		Ladang Sepang	MW(7)-S(SE)-3-5.60	78	78	87	72	77	Baik / Good
Sarawak	Bekas Tapak Pelupusan Bangkai Haiwan / Used Animal Burial Sites	Oya Road, No. 1, Sibu	MW(7)-QS-Y1-10.00	55	79	79	89	71	Baik / Good
		Oya Road, No. 2, Sibu	MW(7)-QS-Y2-9.17	71	78	83	82	72	Baik / Good

Nota / Note:
* Stesen Baru / New Station
– Tiada Data / No Data:
i. Tiada Air / No Water
ii. Stesen Rosak / Destroyed Station

STATUS KUALITI AIR TANAH BAGI AKUAKULTUR

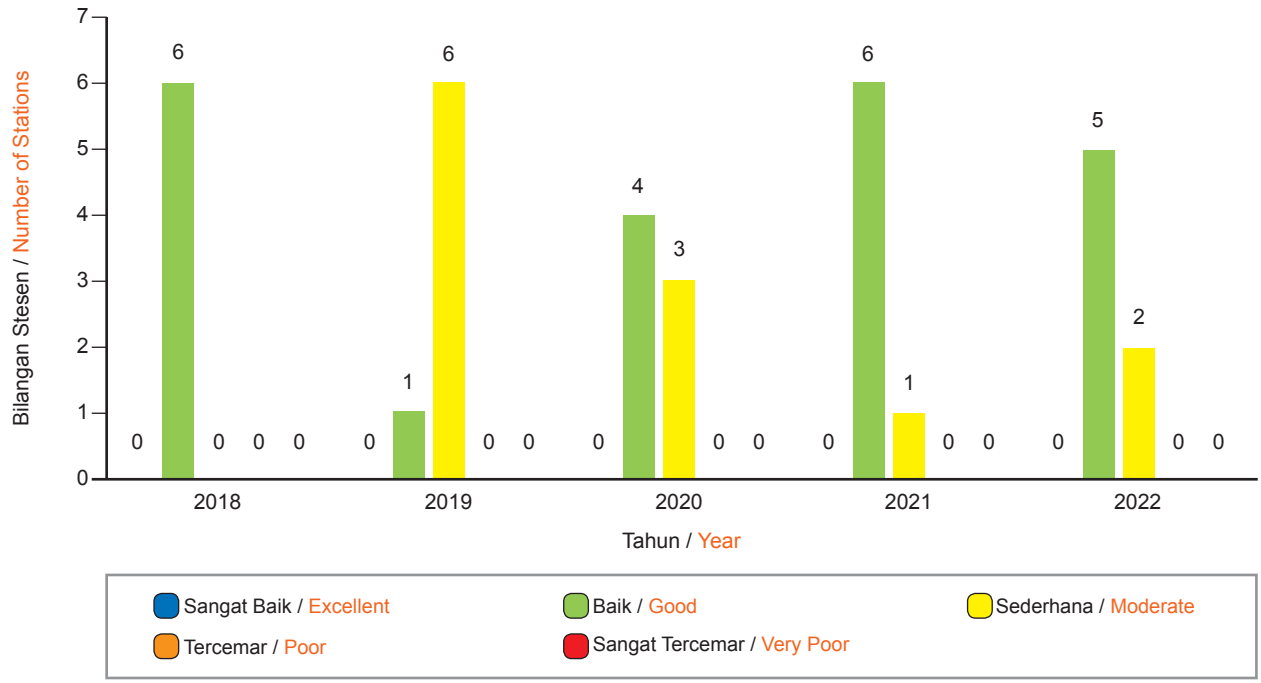
Tren IKAT mulai tahun 2018 hingga 2022 bagi akuakultur adalah seperti yang ditunjukkan dalam **Rajah 3.10**. Berdasarkan **Rajah 3.10** didapati bahawa stesen dikategori sebagai baik menurun berbanding tahun sebelumnya dan stesen yang dikategorikan sebagai sederhana meningkat berbanding tahun sebelumnya. Tiada stesen dalam keadaan sangat baik, tercemar dan sangat tercemar pada tahun 2022.

Pada tahun 2022, sebanyak tujuh (7) stesen bagi akuakultur telah dipantau. Hasil program pengawasan yang telah dijalankan, lima (5) stesen (71%) dikategorikan sebagai baik, manakala dua (2) stesen (29%) dikategorikan sebagai sederhana (**Jadual 3.12**).

STATUS GROUNDWATER QUALITY FOR AQUACULTURE

GWQI trend for aquaculture from the year 2018 until 2022 is shown in **Figure 3.10**. Based on **Figure 3.10**, in 2022, the number of stations categorised as good decreased compared to the previous year and stations categorised as moderate increased compared to the previous year. No stations were in very good, polluted and very polluted condition in 2022.

In 2022, a total of seven (7) stations for aquaculture were monitored. The monitoring results indicates that five (5) stations (71%) were categorised as good while two (2) stations (29%) were categorised as moderate (**Table 3.12**).



Rajah 3.10: Tren Indeks Kualiti Air Tanah bagi Akuakultur, 2018-2022
Figure 3.10: Trends of Groundwater Quality Index for Aquaculture, 2018-2022

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 (2022) / CATEGORY (2022)
				2018	2019	2020	2021	2022	
Pahang	Kolam Akuakultur / Aquaculture Farms	Nenasi (Agrobest)	MW(7)-C16-2-10.5	81	62	61	79	68	Sederhana / Moderate
		Nenasi (Agrobest)	MW(7)-C16-3-43	80	68	74	79	73	Baik / Good
		Nenasi (Agrobest)	MW(7)-C16-4-38	83	72	76	82	76	Baik / Good
		Nenasi (Agrobest)	MW(7)-C16-5-10	79	60	58	76	73	Baik / Good
		Nenasi (Agrobest)	MW(7)-C16-6-10	82	64	82	82	76	Baik / Good
		Nenasi (Agrobest)	MW(7)-C16-7-29	88	69	80	86	80	Baik / Good
Terengganu	Kolam Akuakultur / Aquaculture Farms	*Blue Archipelago (i-Sharp, Setiu)	MW(7)-T510208-2-14.00	–	66	68	59	61	Sederhana / Moderate

Nota / Note:
* Stesen Baru / New Station
– Tiada Data / No Data:
i. Tiada Air / No Water
ii. Stesen Rosak / Destroyed Station

STATUS KUALITI AIR TANAH BAGI KAWASAN PERANGINAN

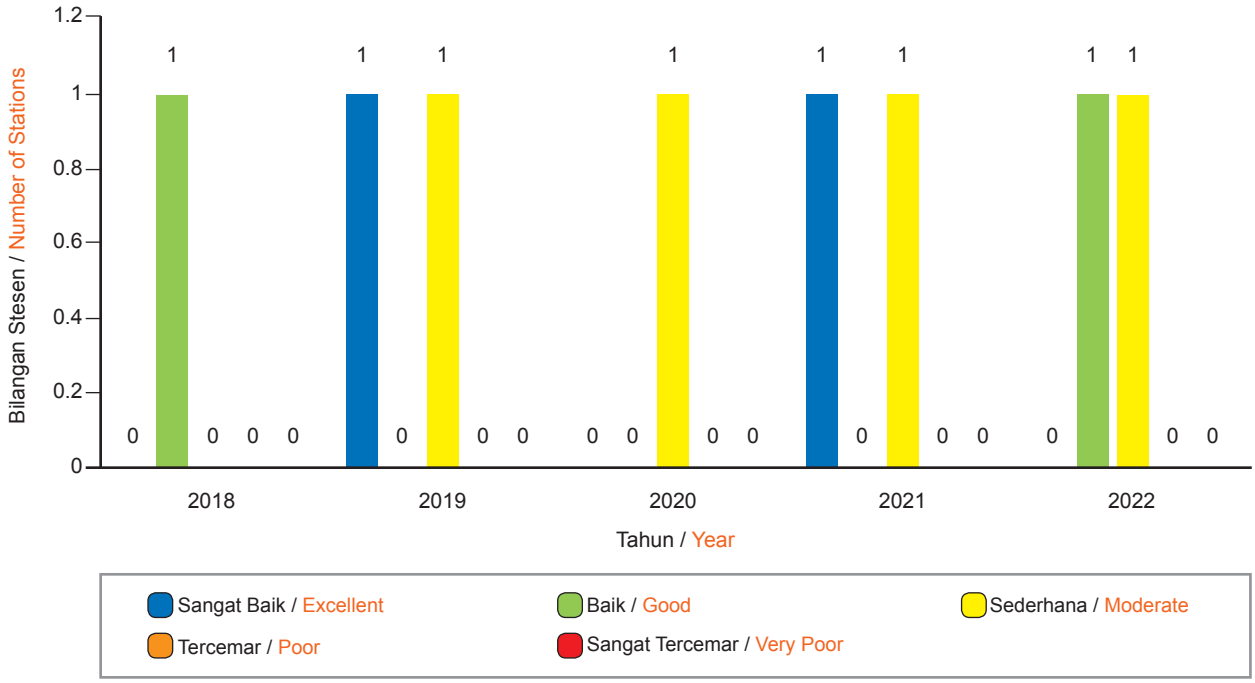
Tren IKAT mulai tahun 2018 hingga 2022 bagi kawasan peranginan adalah seperti yang ditunjukkan dalam **Rajah 3.11**. Berdasarkan **Rajah 3.11**, daripada dua (2) stesen yang dipantau satu (1) stesen dalam baik serta satu (1) lagi dalam kategori sedehana. Tiada stesen dalam kategori sangat baik, tercemar dan sangat tercemar.

Pada tahun 2022, sebanyak dua (2) stesen bagi kawasan peranginan telah dipantau berbanding satu (1) stesen pada tahun 2021. Hasil program pengawasan yang telah dijalankan, satu (1) stesen dikategorikan sebagai baik, manakala satu (1) stesen lagi dikategorikan sebagai sederhana (**Jadual 3.13**).

STATUS OF GROUNDWATER QUALITY INDEX FOR RESORTS

GWQI trend from 2018 to 2022 for resorts is shown in **Figure 3.11**. Based on **Figure 3.11**, out of the two (2) stations monitored one (1) station was in the good category and the other was in the moderate category. There were no stations in the excellent, poor and very poor categories.

In 2022, a total of two (2) stations for resorts were monitored compared to one (1) station in 2021. As a result of the monitoring programme conducted, one (1) station was categorised as good, while the other station was categorised as moderate (**Table 3.13**).



Rajah 3.11: Tren Indeks Kualiti Air Tanah bagi Kawasan Peranginan, 2018-2022
Figure 3.11: Trends of Groundwater Quality Index for Resorts, 2018-2022

Jadual 3.13: Status Indeks Kualiti Air Tanah bagi Kawasan 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 (2022) / CATEGORY (2022)
				2018	2019	2020	2021	2022	
Sabah	Kawasan Peranginan / Resort	Pulau Manukan	MW(7)-H511601-8-6.50	85	93	–	95	82	Baik / Good
Kedah	Kawasan Peranginan / Resort	*Kuarters Imigresen Tanjung Rhu, Langkawi	MW(7)-KV 69912-1-10.10	–	68	57	79	65	Sederhana / Moderate

Nota / Note:
* Stesen Baru / New Station
– Tiada Data / No Data:
i. Tiada Air / No Water
ii. Stesen Rosak / Destroyed Station

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.

Table 3.14 shows the Groundwater Quality Standards for Conventional Treatment of Raw Water (Drinking Water) with Reference to Significant Parameters in Assessing Groundwater Quality Status.

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: Groundwater Quality Standards for Conventional Treatment of Raw Water (Drinking Water) with Reference to Significant Parameters in Assessing 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	1.0	mg/l
Keliatan / Hardness	$CaCO_3$	500	mg/l
Mangan / Manganese	Mn	0.2	mg/l
Nitrit / Nitrate	NO_3	0.4#	mg/l
Raksa / Mercury	Hg	0.001	mg/l
Kadmium / Cadmium	Cd	0.003	mg/l
Arsenik / Arsenic	As	0.01	mg/l
Plumbum / Lead	Pb	0,05	mg/l
Kromium / Chromium	Cr	0.05	mg/l
Kuprum / Copper	Cu	1.0	mg/l
Zink / Zinc	Zn	3.0	mg/l
Sulfat / Sulphate	SO_4^-	250	mg/l
Selenium / Selenium	Se	0.01	mg/l
Sebatian Fenol / Phenolics	–	0.002	mg/l

STATUS KUALITI AIR TANAH

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).

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

GROUNDWATER QUALITY STATUS

The assessment of groundwater quality is based on the percentage value that exceeds the acceptance limit in the National Standards for Groundwater Quality Standards for Conventional Raw Water Treatment (Drinking Water).

The value of the percentage is shown in the **Table 3.15**.

Jadual 3.15: Peratusan Julat Nilai Pematuhan, 2022
Table 3.15: Percentage of Compliance, 2022

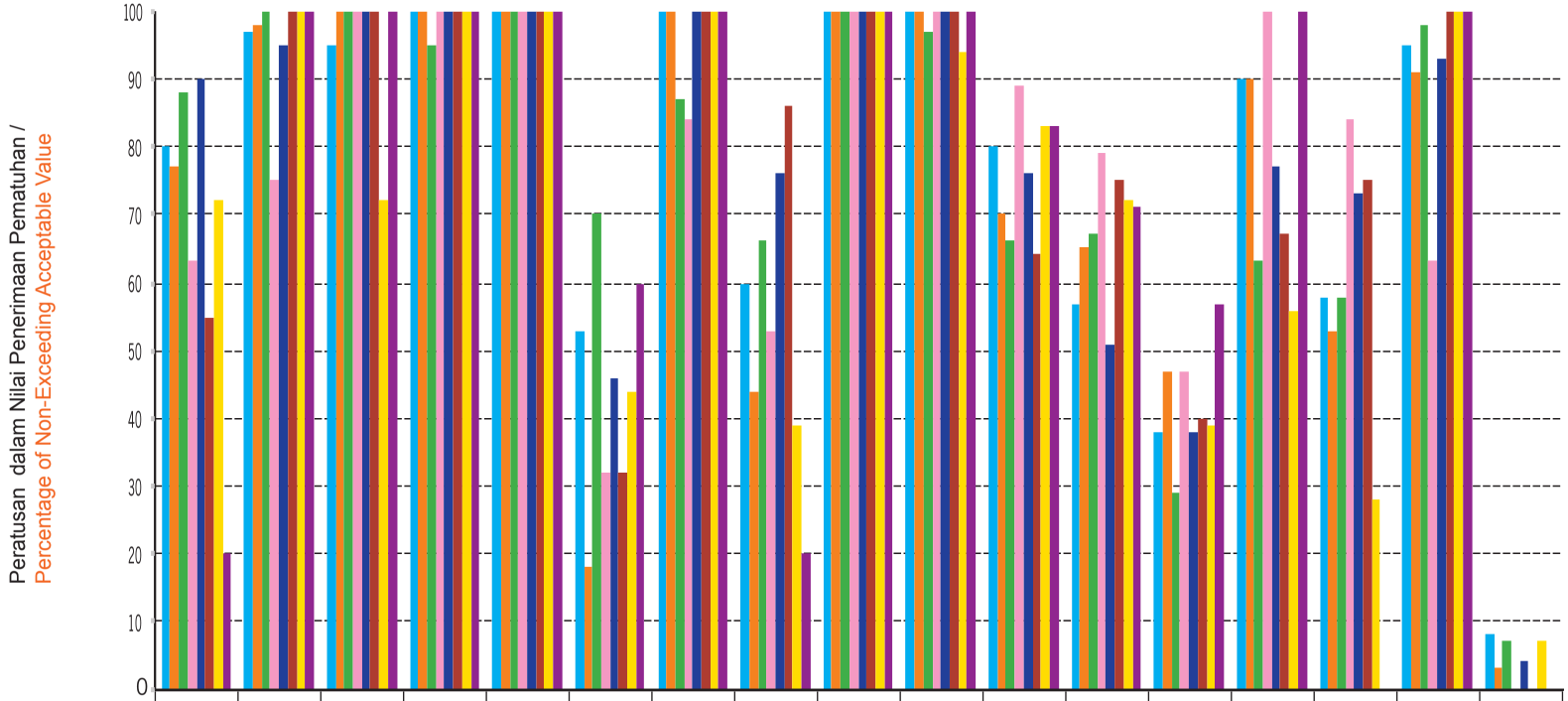
PERATUSAN JULAT NILAI PEMATUHAN (%) / PERCENTAGE OF COMPLIANCE (%)	KATEGORI / CATEGORY
0% - 49%	Rendah / Low
50% - 79%	Sederhana / Moderate
80% - 100%	Tinggi / High

ANALISIS PERATUSAN NILAI PEMATUHAN MENGIKUT PARAMETER BERDASARKAN JENIS GUNA TANAH

Berdasarkan **Jadual 3.15**, analisis peratusan nilai pematuhan mengikut parameter berdasarkan jenis guna tanah adalah seperti di **Rajah 3.12**. Berdasarkan rajah tersebut, parameter Fenol berada pada Kategori Rendah (0-49%) bagi semua jenis guna tanah.

PERCENTAGE ANALYSIS OF COMPLIANCE VALUE BY PARAMETER BASED ON TYPE OF LAND USE

Based on **Table 3.15**, the analysis of the percentage of compliance values by parameter based on land use type is as in **Figure 3.12**. Based on the diagram, Phenol is in the Low Category (0-49%) for all types of land use.



	As	Hg	Cd	Cr	Cu	Fe	Pb	Mn	Zn	Se	$CaCO_3$	TDS	Cl	NO_3	SO_4	T-Coliform	Phenol
Tapak Perindustrian / Industrial Sites	80	97	95	100	100	53	100	60	100	100	80	57	38	90	58	95	8
Bekas Tapak Pelupusan Sampah / Used Solid Waste Landfills	77	98	100	100	100	18	100	44	100	100	70	65	47	90	53	91	3
Kawasan Pertanian / Agriculture	88	100	100	95	100	70	87	66	100	97	66	67	29	63	58	98	7
Bekalan Air / Water Supply	63	75	100	100	100	32	84	53	100	100	89	79	47	100	84	63	0
Bandar dan Pinggir Bandar / Urban and Suburban	90	95	100	100	100	46	100	76	100	100	76	51	38	77	73	93	4
Padang Golf / Golf Course	55	100	100	100	100	32	100	86	100	100	64	75	40	67	75	100	0
Luar Bandar / Rural	72	100	72	100	100	44	100	39	100	94	83	72	39	56	28	100	7
Bekas Lombong Emas / Used Gold Mine	20	100	100	100	100	60	100	20	100	100	83	71	57	100	0	100	0

Rajah 3.12: Peratusan Pematuhan oleh Pencemar Terpilih Mengikut Guna Tanah, 2022
Figure 3.12: Percentage of Compliance of Selected Contaminants by Land Use, 2022

Kuala Kemaman

BAB 4
CHAPTER

KUALITI AIR MARIN BAGI PULAU, PANTAI DAN MUARA SUNGAI

MARINE WATER QUALITY FOR ISLAND, COASTAL AND ESTUARY

KUALITI AIR MARIN
MARINE WATER QUALITY

PENGAWASAN KUALITI AIR MARIN MANUAL
MANUAL MARINE WATER QUALITY MONITORING (MMWQM)

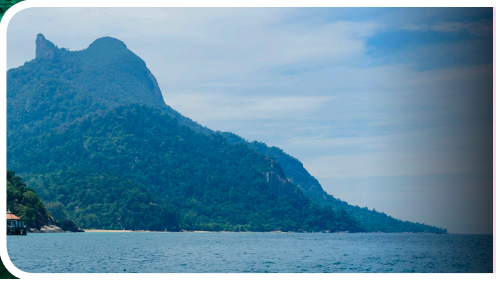
29 PARAMETER DIPANTAU / MONITORED

188
Stesen Pantai
Coastal Station

1128
Persampelan Stesen Pantai
Coastal Station Sampling

85
Stesen Muara Sungai
Estuary Station

510
Persampelan
Stesen Muara Sungai
Estuary Station Sampling



95
Stesen Pulau
Island Station

570
Persampelan Stesen Pulau
Island Station Sampling

PENGAWASAN KUALITI AIR MARIN AUTOMATIK
CONTINUOUS MARINE WATER QUALITY MONITORING (CMWQM)

10 STESEN AUTOMATIK
CONTINUOUS STATIONS

14 PARAMETER DIPANTAU
PARAMETER MONITORED

STESEN TERBAIK AIR MARIN
EXCELLENT MARINE WATER STATION

Stesen Pantai / Coastal Station

BIL. NO.	NEGERI /STATE	LOKASI / LOCATION
1	Terengganu	Pantai Rantau Abang
2	Terengganu	Tanjung Bidara
3	Negeri Sembilan	Port Dickson Batu 10
4	Terengganu	Kelulut
5	Terengganu	Kuala Abang
6	Terengganu	Pantai Teluk Kalong
7	Terengganu	Pantai Kemasik
8	Negeri Sembilan	Pantai Seri Purnama
9	Terengganu	Tok Jembal
10	Terengganu	Teluk Ketapang

Stesen Muara Sungai / Estuary Station

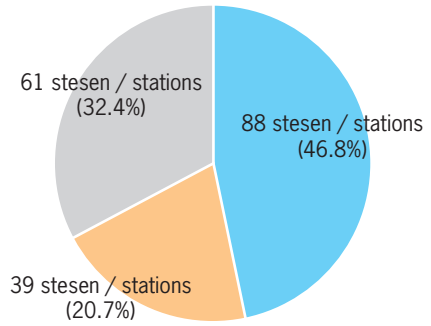
BIL. NO.	NEGERI /STATE	LOKASI / LOCATION
1	Terengganu	Tioxide Utara (Kg. Bukit Kuang, Kijal)
2	Terengganu	Tioxide Tengah (Pupuk Semangat, Kijal)
3	Terengganu	Tioxide Selatan (KSB, T. Kalong)
4	Johor	Kuala Sungai Johor
5	Pahang	Kuala Nenasi
6	Selangor	Kuala Sungai Sepang (Kawalan)
7	Sarawak	Kuala Sungai Santubong

Stesen Pulau / Island Station

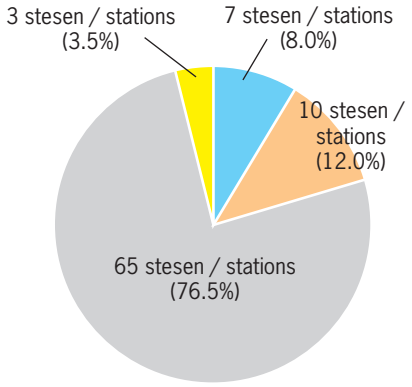
BIL. NO.	NEGERI /STATE	LOKASI / LOCATION
1	Johor	Babi Tengah
2	Kedah	Dangli
3	Pahang	Labas
4	Pahang	Cebeh
5	Pahang	Sembilang
6	Terengganu	Redang (Selatan / South)
7	Terengganu	Lang Tengah
8	Terengganu	Ekor Tebu
9	Terengganu	Lima
10	Terengganu	Kapas

STATUS KUALITI AIR MARIN
MARINE WATER QUALITY STATUS

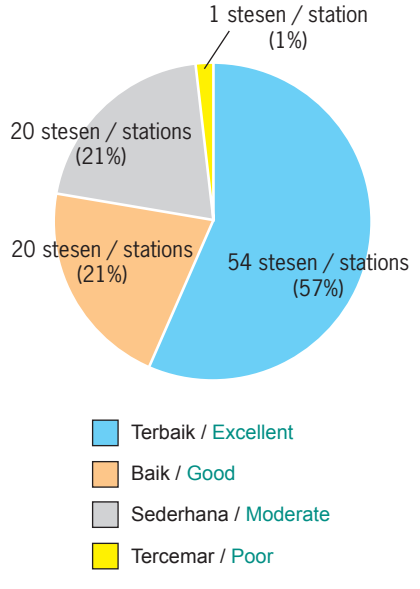
Stesen Pantai / Coastal Station



Stesen Muara Sungai / Estuary Station



Stesen Pulau / Island Station



KUALITI AIR MARIN BAGI PULAU, PANTAI DAN MUARA SUNGAI / MARINE WATER QUALITY FOR ISLAND, COASTAL AND ESTUARY

PENGAWASAN KUALITI AIR MARIN

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 terhadap kemampanan ekosistem dari segi kesihatan dan biodiversiti persekitaran marin.

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

1. Stesen Pantai
2. Stesen Muara Sungai
3. Stesen Pulau

Stesen pantai terletak di sepanjang pantai kira-kira 100 meter dari gigi air laut dan ia mestilah sekurang-kurangnya 500 meter dari punca yang berpotensi sebagai punca pencemaran.

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.

Stesen pulau pula dibahagikan kepada empat (4) kategori iaitu Kawasan Dilindungi, Taman Laut, Pembangunan dan Resort:

MARINE WATER QUALITY MONITORING

The Department of Environment (DOE) has been monitoring marine water quality since 1978 in Peninsular Malaysia and since 1985 in Sabah and Sarawak. The main objective of this marine water quality monitoring programme is to assess the status of marine water quality and to further determine the level of pollution from sources on land and sea. The causes of this pollution can pose a threat to the sustainability of the ecosystem in terms of the health and biodiversity of the marine environment.

Monitoring stations established under the Marine Water Quality Monitoring Program are classified into three (3) categories as followed:

1. Coastal Stations
2. Estuary Stations
3. Island Stations

Coastal stations are located along the coastline; approximately 100 meters from the water edge and it must be at least 500 meters away from potential point source(s).

Estuary stations are located within an estuarine environment where the freshwater and seawater interact. The estuarine stations have been impacted by the riverine ecosystem.

The island stations are divided into four (4) categories namely Protected Area, Marine Park, Development and Resort:

i. Stesen Pulau (Kawasan Dilindungi) adalah stesen yang dibangunkan di dalam Kawasan Perlindungan Perikanan di bawah Peraturan-Peraturan Perikanan (Kawasan Larangan) 1994.

ii. Stesen Pulau (Taman Laut) adalah stesen pengawasan yang dibangunkan di kawasan Taman Laut yang ditetapkan di bawah Perintah Taman Laut Malaysia 1994.

iii. 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; dan/ atau pulau-pulau yang ada kepentingan ekonomi.

iv. Stesen Pulau (Resort) adalah stesen pengawasan di sekitar pulau yang dibangunkan untuk pelancongan, yang mempunyai pusat peranginan dan chalet sebagai pemacu ekonomi setempat bagi pulau tersebut.

Standard Kualiti Air Marin Malaysia (SKAMM) merupakan standard ambien, memberi fokus pada perlindungan dan kelestarian ekosistem akuatik serta perkhidmatan ekosistem tersebut kepada masyarakat dan mengambilkira faktor ekonomi, praktikal dan sosial.

Pemakaian SKAMM berdasarkan pra penentuan pengelasan air marin mengikut kegunaan di persekitaran tersebut (**Rajah 4.1**). Terdapat lima (5) kelas dikategorikan dalam SKAMM iaitu:-

i. 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.

ii. Kelas 2 merangkumi air yang ada aktiviti perikanan dan marikultur yang berdasarkan pada zon penangkapan ikan yang diterbitkan oleh Jabatan Perikanan Malaysia sebagai panduan. Perairan dalam Kelas 2 terdiri daripada sebahagian zon pemuliharaan (termasuk `Kawasan Larangan Perikanan') sehingga ke Zon Ekonomi Eksklusif (ZEE).

i. Island Stations (Protected Area) are those stations established within the Fisheries Protected Area under the Fisheries (Prohibited Area) Regulation, 1994.

ii. Island Stations (Marine Park) are those established within the designated Marine Park area under the Marine Park Malaysia Order, 1994.

iii. Island Stations (Development) are monitoring stations established around Islands that are at least 90 km^2 with a total population of more than 20,000 people; and/ or islands of economic importance.

iv. Island Stations (Resort) are those stations that have been established surrounding islands that developed for tourism; with resorts and chalets developed on the islands as the key driver of economy for the islands.

The Malaysian Marine Water Quality Standards (MMWQS) are ambient standards, with a focus on the protection and the sustainability of the aquatic ecosystem; the importance of the ecosystem for society; and to accomplish it in an economical, practical and socially relevant manner.

The application of the MMWQS is based on the pre-determined marine water classification according to the use in the environment (**Figure 4.1**). Five (5) classes are categorised in MMWQS:

i. Class 1 water comprises the gazetted and statutory protected waters; and non-gazetted areas with the presence of a sensitive ecosystem including coral reefs, sea grass, turtle landing sites and water specific to habitats and feeding grounds of sensitive marine organisms.

ii. Class 2 water encompasses both fisheries and mariculture activities, based on the fishing zone established by the Department of Fisheries as a guide. Its water comprises the conservation zone (including 'Fisheries Prohibited Area') right up to the Economic Exclusive Zone (EEZ). Mariculture activities are defined within the

Aktiviti marikultur yang ditakrifkan sebagai Kelas 2 adalah aktiviti dalam badan air marin tersebut (seperti penternakan ikan dalam sangkar dan penternakan kerang) dan tidak termasuk aktiviti akuakultur perikanan darat.

iii. Kelas 3 ialah standard 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.

iv. Kelas E (Interim) adalah standard 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, Kelas E terhasil adalah berdasarkan ciri-ciri kualiti air muara sungai yang boleh mewakili persekitaran yang belum terganggu. Kawasan muara sungai sebegini akan dijadikan Tapak Rujukan untuk mewakili tiga (3) 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 memiliki rangkaian kompleks.

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

Indeks Kualiti Air Marin 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 enam (6) parameter kualiti air iaitu oksigen terlarut, faecal coliform, ammonia tidak terion, nitrat, fosfat dan jumlah pepejal terampai.

marine water bodies such as marine cage and cockle culture; but excluding land aquaculture activities.

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

iv. Class E (Interim) is the standard for estuarine water subject to both seasonal and diurnal variation. In addition, the geological characteristics and water circulation patterns also contribute to the dynamic nature of these waters. Based on these natural variations, the standards derived from the water quality is characteristic of estuarine waters deemed to represent relatively undisturbed environment. These sites, which are referred to as Reference Sites, are selected to represent the three (3) major estuary types in Malaysia. Hence, Class E1 is taken to be representative of coastal plain, Class E2 represents the lagoon type estuary while Class E3 is to be referred to when assessing estuaries with large and complex distributary network.

v. Class R is the standard for recreational use of marine waters. It is based on the National Standards for Water Quality for Nature-based Recreation and Guidelines for Monitoring for Nature-based Recreation (Marine and Freshwater) by the Ministry of Health, Malaysia.

Malaysian Marine Water Quality Index (MMWQI) is an aggregation of the most relevant marine water quality parameters aimed at providing information pertinent to the marine water quality status of a water body. The index is derived based on six (6) water quality parameters, which are dissolved oxygen, faecal coliform, unionized ammonia, nitrate, phosphate and total suspended solids.

Pengagregatan IKAMM adalah 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 95 stesen pulau telah dipantau pada tahun 2022. Terdapat enam (6) frekuensi persampelan bagi setiap stesen dengan jumlah sampel sebanyak 1,128 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 (6) frekuensi.

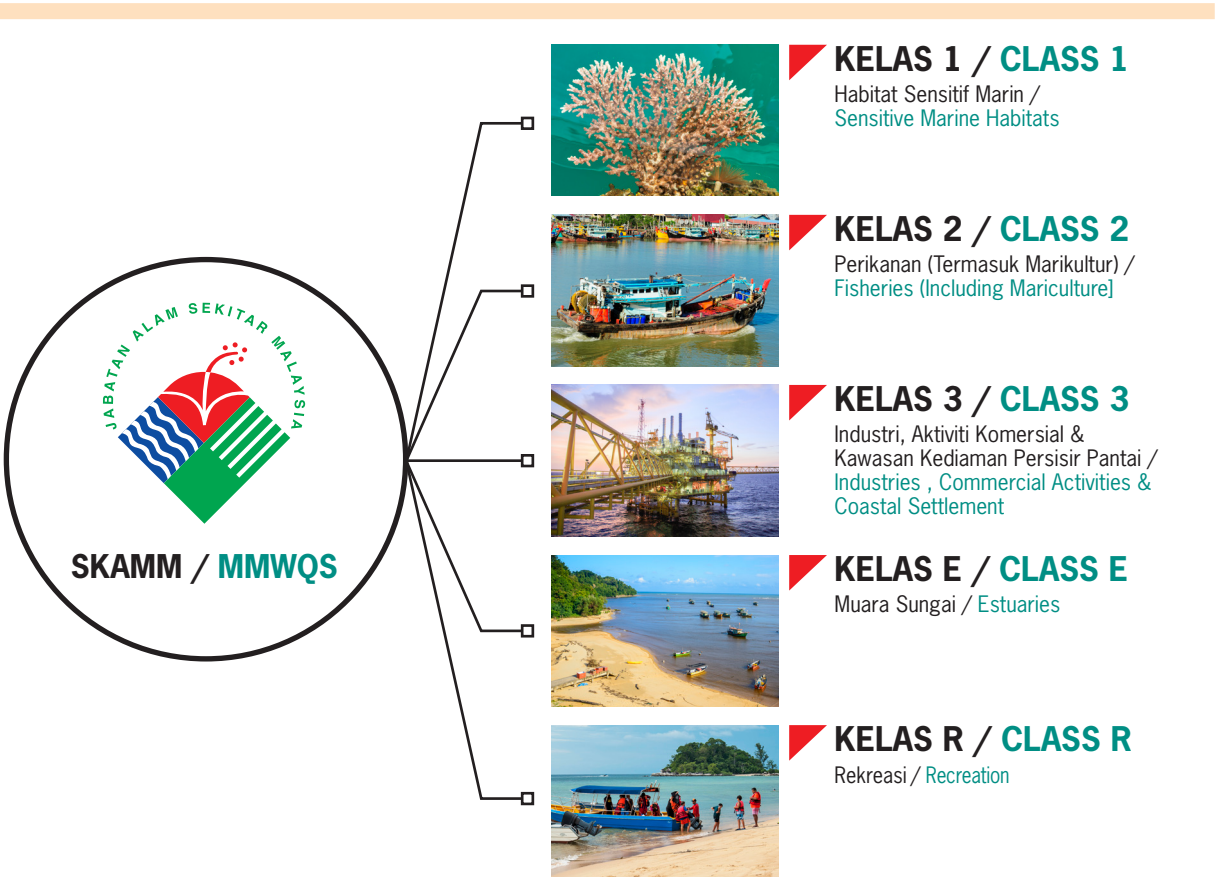
Rajah 4.2 menunjukkan lokasi Stesen Pengawasan Kualiti Air Marin Manual di Malaysia.

The MMWQI aggregation is scaled from 0 to 100 where 0 indicates poor water quality while 100 indicates excellent water quality (**Table 4.1**).

Table 4.2 shows Malaysian Marine Water Quality Standards.

A total of 188 coastal stations, 85 estuary stations and 95 island stations were monitored in the year 2022. There were six (6) sampling frequencies in total for each monitoring station amounting to 1,128 samples for coastal stations, 510 samples for estuary stations and 570 samples for island stations. The samples were analysed and results were summarised based on MMWQI of the six (6) frequencies.

Figure 4.2 shows the location of the Manual Marine Water Quality Stations in Malaysia.



Rajah 4.1: Pemakaian Standard Kualiti Air Marin Malaysia (SKAMM) berdasarkan Pra Penentuan Pengelasan Air Marin
Figure 4.1: The Application of the Malaysian Marine Water Quality Standards (MMWQS) based on the Pre-determined Marine Water Classification

Jadual 4.1: Klasifikasi Indeks Kualiti Air Marin Malaysia (IKAMM)

Table 4.1: Malaysian Marine Water Quality Index (MMWQI) 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 (SKAMM)

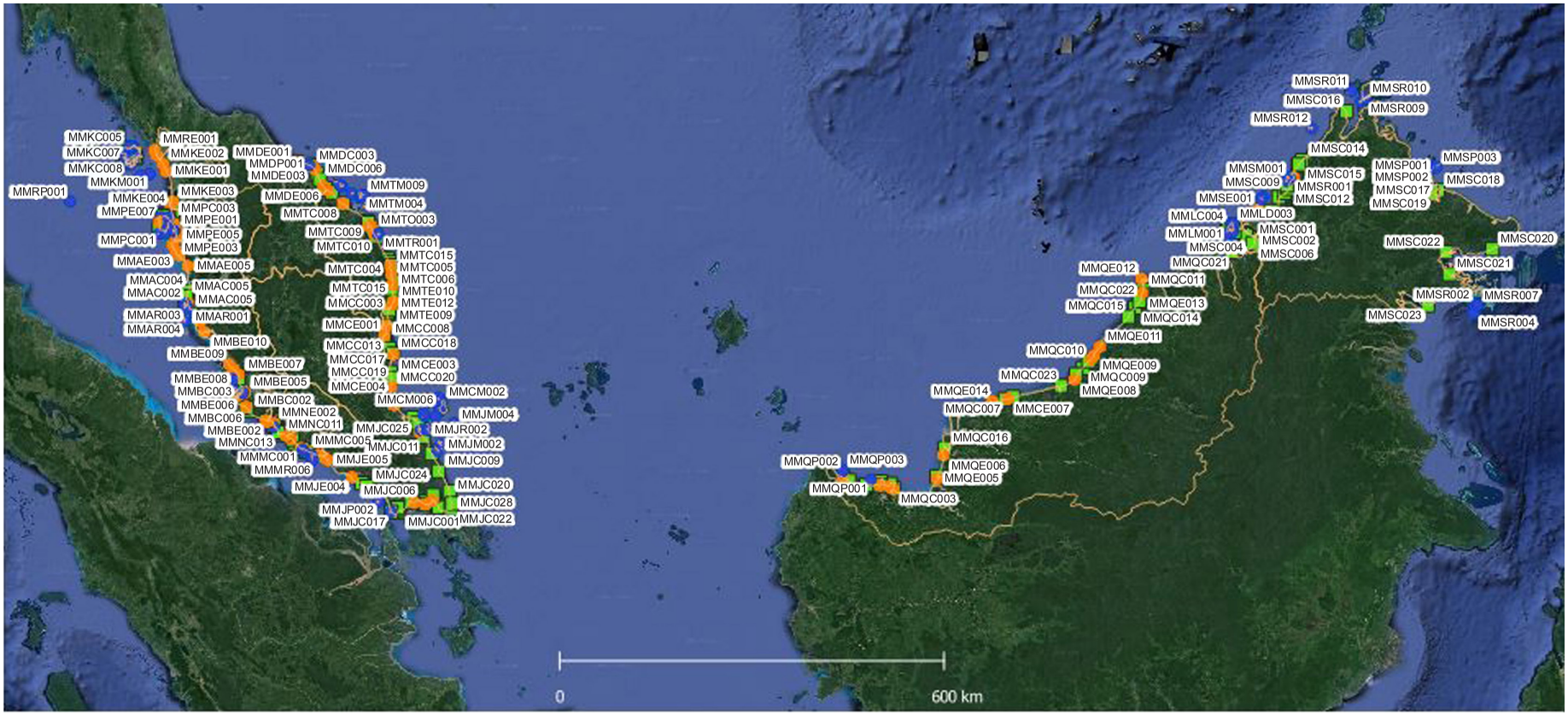
Table 4.2: Malaysian Marine Water Quality Standards (MMWQS)

PARAMETER (µg/l) melainkan dinyatakan sebaliknya / PARAMETERS (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 / Industrial, 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 / Cyanide	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	27.00	27.00	55.00	27.00	27.00	27.00

Jadual 4.2: Standard Kualiti Air Marin Malaysia (SKAMM)
Table 4.2: Malaysian Marine Water Quality Standards (MMWQS)

PARAMETER (µg/l) melainkan dinyatakan sebaliknya / PARAMETERS (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 / Industrial, Commercial Activities & Coastal Settlements	Muara Sungai / Estuaries		
				Dataran Pantai / Coastal Plain	Lagun / Lagoon	Rangkaian Kompleks / Complex Distributary Network
Tributyltin (TBT)	0.001	0.010	0.050	0.002	0.002	0.002
Polycyclic Aromatic Hydrocarbons (PAHs)	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					

Muara Sungai Linggi, Melaka



188 Stesen Pantai / Coastal Stations

95 Stesen Pulau / Island Stations

85 Stesen Muara Sungai / Estuary Stations

Rajah 4.2: Lokasi Stesen Pengawasan Kualiti Air Marin Manual di Malaysia 2022
Figure 4.2: Location of Manual Marine Water Quality Stations in Malaysia, 2022

Pantai Cherating, Pahang

Pulau Tioman

STATUS STESEN-STESEN PENGAWASAN KUALITI AIR MARIN

Dalam tahun 2022, daripada 368 stesen pengawasan kualiti air marin bagi pantai, muara sungai dan pulau di negara ini, sebanyak 149 stesen adalah terbaik, 69 stesen baik, sementara 146 stesen adalah sederhana manakala empat (4) stesen tercemar. Bilangan stesen yang tercemar bagi tahun 2022 menunjukkan penurunan berbanding tahun sebelumnya iaitu daripada lima (5) stesen tercemar kepada empat (4) stesen tercemar bagi tahun ini.

Stesen-stesen tercemar berada di kawasan muara sungai iaitu tiga (3) dan di kawasan pulau iaitu satu (1) stesen. Stesen-stesen tercemar ini terletak di Selangor iaitu tiga (3) stesen manakala satu (1) stesen di Johor.

Faecal coliform dan kandungan nutrien yang tinggi adalah parameter utama yang menyebabkan kemerosotan kualiti air marin di muara sungai yang berpunca daripada aktiviti di daratan di hulu sungai tersebut yang kemudiannya menjejaskan kualiti air marin di muara sungai.

Secara amnya, kualiti air marin yang dipantau di bawah rangkaian MMWQM menunjukkan status keseluruhan kualiti air yang terbaik di persekitaran marin Malaysia.

Jadual 4.3, **Jadual 4.4** dan **Jadual 4.5** menunjukkan senarai stesen pantai, muara sungai dan pulau yang mencapai kategori terbaik berdasarkan IKAMM bagi tahun 2022.

Rajah 4.3 - 4.8 menunjukkan status kualiti air marin berdasarkan IKAMM mengikut lokasi stesen pengawasan bagi pantai, muara sungai dan pulau-pulau tahun 2022.

STATUS OF MARINE WATER QUALITY MONITORING STATIONS

In 2022, out of 368 marine water quality monitoring stations at coastal, estuary and islands in the country, 149 stations coastal were categorised as excellent, 69 stations as good while 146 stations were categorised as moderate and the remaining four (4) stations were categorised as poor. The number of poor stations showed a reduction from five (5) stations in the previous year, down to four (4) stations this year.

Of the four (4) poor water quality stations, three (3) were located at the estuary, while one (1) was at the island. Three (3) of these stations were located in Selangor and one (1) station in Johor.

High faecal coliform and nutrient concentration levels are the main parameters that cause deterioration of marine water quality in river estuaries due to land-based activities flowing into rivers in turn affecting the quality in river estuaries.

In general, the marine water quality monitored under the MMWQM network showed an overall excellent water quality in the marine environment of Malaysia.

Table 4.3, Table 4.4 and **Table 4.5** show the list of coastal, estuary and island stations in the excellent category based on MMWQI in 2022.

Figures 4.3 - 4.8 show the marine water quality status based on MMWQI according to coastal, estuary and island monitoring stations in 2022.

Jadual 4.3: Senarai Stesen Pengawasan Kualiti Air Marin bagi Pantai dengan Status Kategori Terbaik, 2022
Table 4.3: List of Marine Water Quality Monitoring of Coastal Stations with Status of Excellent, 2022

BIL. / NO.	NEGERI / STATE	LOKASI / LOCATION
1	Terengganu	Pantai Rantau Abang
2	Terengganu	Tanjung Bidara
3	N. Sembilan	Port Dickson Batu 10
4	Terengganu	Kelulut
5	Terengganu	Kuala Abang
6	Terengganu	Pantai Teluk Kalong
7	Terengganu	Pantai Kemasik
8	N. Sembilan	Pantai Seri Purnama
9	Terengganu	Tok Jembal
10	Terengganu	Teluk Ketapang

Nota / Notes:
Senarai menunjukkan sepuluh (10) stesen teratas dengan status kategori terbaik /
The list shows the top ten (10) stations in the excellent category

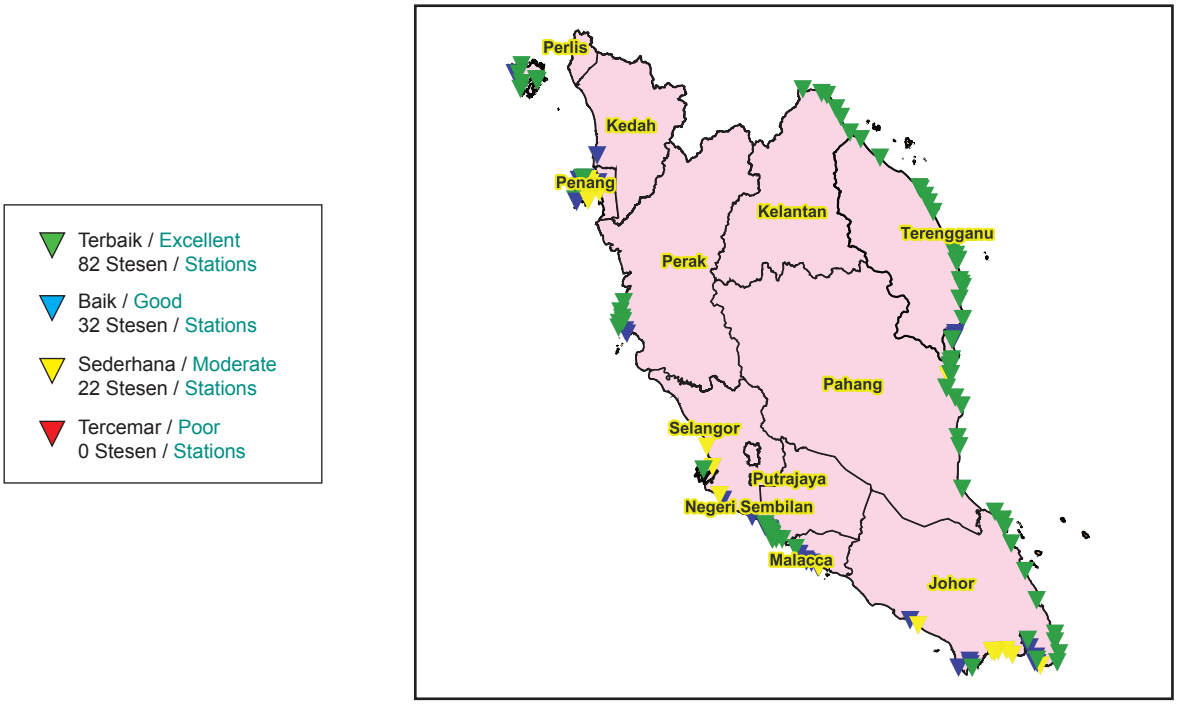
Jadual 4.4: Senarai Stesen Pengawasan Kualiti Air Marin bagi Muara Sungai dengan Status Kategori Terbaik, 2022
Table 4.4: List of Marine Water Quality Monitoring of Estuary Stations with Status of Excellent, 2022

BIL. / NO.	NEGERI / STATE	LOKASI / LOCATION
1	Terengganu	Tioxide Utara (Kg. Bukit Kuang, Kijal)
2	Terengganu	Tioxide Tengah (Pupuk Semangat, Kijal)
3	Terengganu	Tioxide Selatan (KSB, T. Kalong)
4	Johor	Kuala Sungai Johor
5	Pahang	Kuala Nenasi
6	Selangor	Kuala Sungai Sepang (Kawalan)
7	Sarawak	Kuala Sungai Santubong

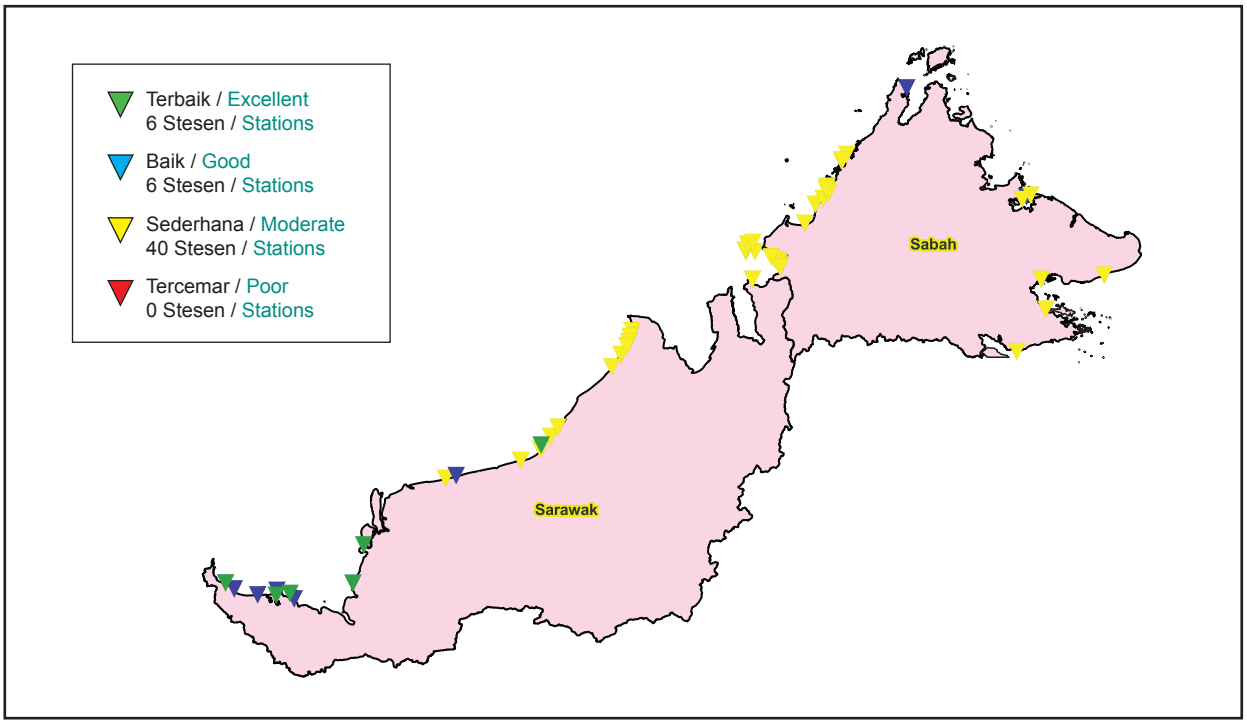
Jadual 4.5: Senarai Stesen Pengawasan Kualiti Air Marin bagi Pulau dengan Status Kategori Terbaik, 2022
Table 4.5: List of Marine Water Quality Monitoring of Island Stations with Status of Excellent, 2022

BIL. / NO.	NEGERI / STATE	LOKASI / LOCATION
1	Johor	Babi Tengah
2	Kedah	Dangli
3	Pahang	Labas
4	Pahang	Cebeh
5	Pahang	Sembilang
6	Terengganu	Redang (Selatan / South)
7	Terengganu	Lang Tengah
8	Terengganu	Ekor Tebu
9	Terengganu	Lima
10	Terengganu	Kapas

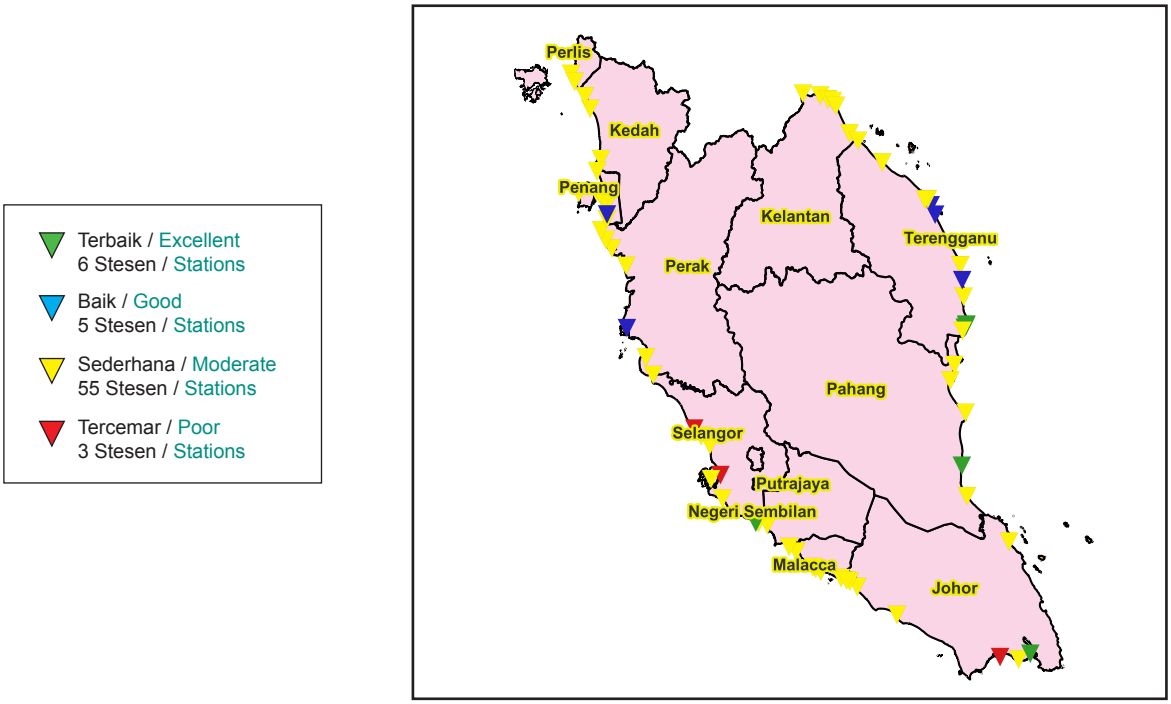
Nota / Notes:
Senarai menunjukkan sepuluh (10) stesen teratas dengan status kategori terbaik /
The list shows the top ten (10) stations in the excellent category



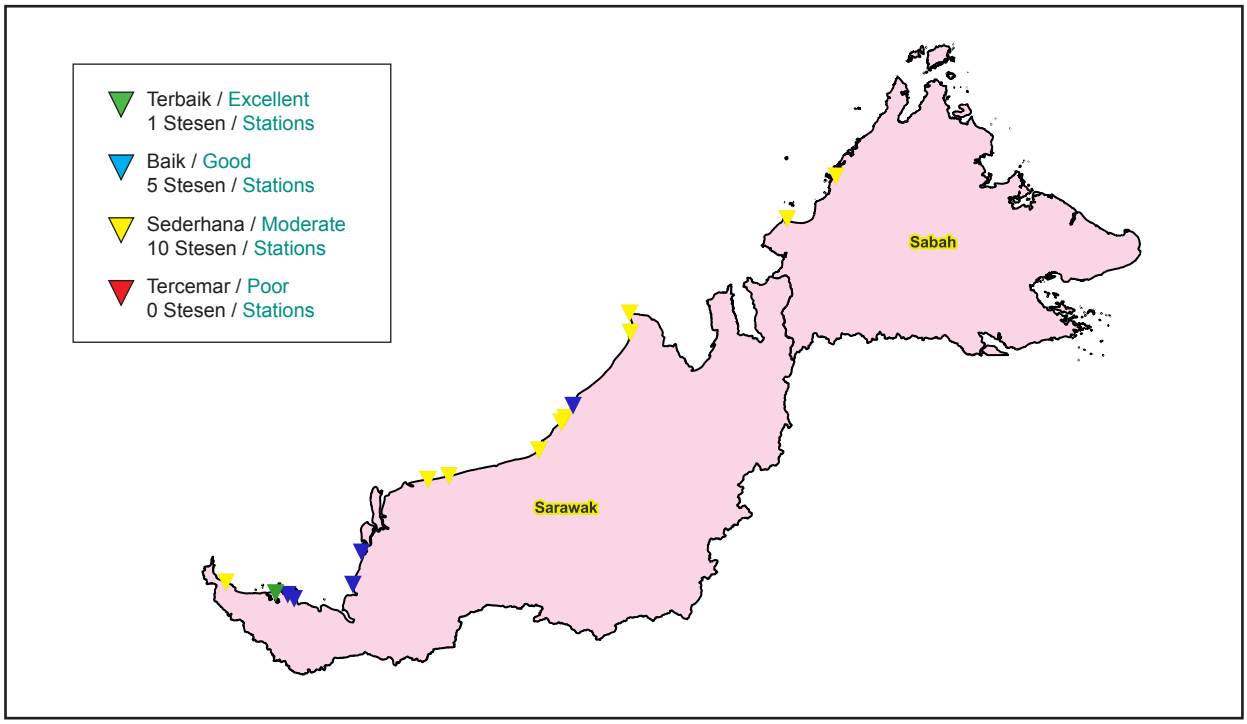
Rajah 4.3: Status Kualiti Air Marin mengikut Lokasi Stesen Pengawasan bagi Pantai di Semenanjung Malaysia
Figure 4.3: Marine Water Quality Status based on the Location of Coastal Monitoring Stations in Peninsular Malaysia



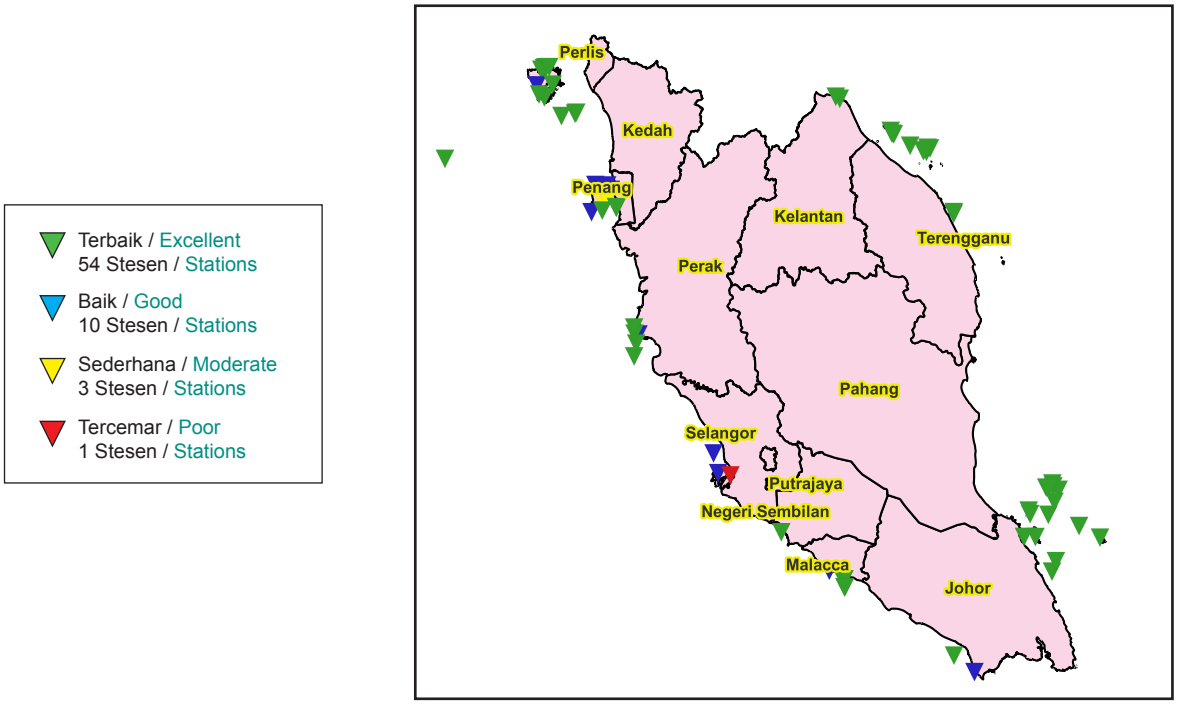
Rajah 4.4: Status Kualiti Air Marin mengikut Lokasi Stesen Pengawasan bagi Pantai di Sabah, Sarawak dan W.P. Labuan
Figure 4.4: Marine Water Quality Status based on the Location of Coastal Monitoring Stations in Sabah, Sarawak and Labuan



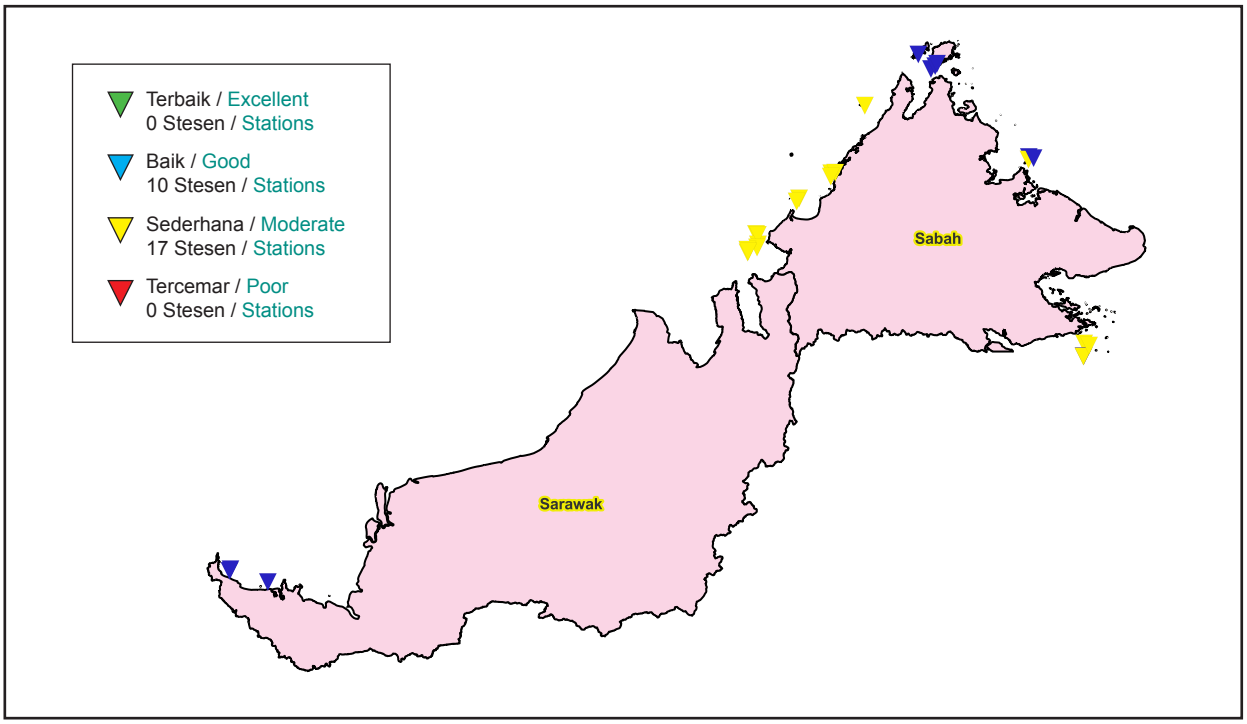
Rajah 4.5: Status Kualiti Air Marin mengikut Lokasi Stesen Pengawasan bagi Muara Sungai di Semenanjung Malaysia
Figure 4.5: Marine Water Quality Status based on the Location of Estuary Monitoring Stations in Peninsular Malaysia



Rajah 4.6: Status Kualiti Air Marin mengikut Lokasi Stesen Pengawasan bagi Muara Sungai di Sabah dan Sarawak
Figure 4.6: Marine Water Quality Status based on the Location Monitoring Stations for Estuary at Sabah and Sarawak



Rajah 4.7: Status Kualiti Air Marin mengikut Lokasi Stesen Pengawasan bagi Pulau di Semenanjung Malaysia
Figure 4.7: Marine Water Quality Status based on the Location of Island Monitoring Stations in Peninsular Malaysia



Rajah 4.8: Status Kualiti Air Marin mengikut Lokasi Stesen Pengawasan bagi Pulau di Sabah, Sarawak dan W.P. Labuan
Figure 4.8: Marine Water Quality Status based on the Location of Island Monitoring Stations in Sabah, Sarawak and Labuan

STATUS KUALITI AIR MARIN BAGI PANTAI

Sebanyak 188 stesen pantai dipantau pada tahun 2022. Daripada 188 stesen pantai, 88 stesen (46.8%) terbaik, 39 stesen (20.7%) baik, 61 stesen (32.4%) sederhana manakala tiada stesen dikategorikan sebagai tercemar (**Jadual 4.6**).

MARINE WATER QUALITY STATUS OF COASTAL AREAS

A total of 188 coastal stations were monitored for water quality in 2022. Of this number, 88 stations (46.8%) ranked excellent, 39 stations (20.7%) ranked good, 61 stations (32.4%) ranked moderate and no station was ranked poor (**Table 4.6**).

Jadual 4.6: Status Kualiti Air Marin bagi Pantai, 2022
Table 4.6: Marine Water Quality Status of Coastal Area, 2022

NEGERI / STATE	KLASSIFIKASI STESEN / STATION CLASSIFICATION	KAWASAN / AREA	NOMBOR STESEN / STATION NUMBER	NILAI IKAMM / MMWQI VALUE					KATEGORI (2022) / CATEGORY (2022)
				2018	2019	2020	2021	2022	
Kedah	Pantai / Coastal	Pantai Merdeka	MMKC001	91	79	71	85	88	Baik / Good
		Langkawi Island Resort	MMKC002	94	90	93	94	94	Terbaik / Excellent
		Pantai Kok	MMKC003	94	92	95	90	83	Baik / Good
		Pantai Kuah	MMKC004	94	84	89	88	90	Terbaik / Excellent
		Pantai Pasir Tengkorak	MMKC005	94	68	93	96	93	Terbaik / Excellent
		Pantai Teluk Burau	MMKC006	94	83	89	94	86	Baik / Good
		Pantai Teluk Nibong	MMKC007	84	91	94	86	92	Terbaik / Excellent
		Pantai Tengah	MMKC008	94	92	96	92	92	Terbaik / Excellent
		Pantai Beras Basah	MMKC009	94	92	95	92	96	Terbaik / Excellent
P. Pinang	Pantai / Coastal	Gertak Sanggul	MMPC001	81	58	84	81	83	Baik / Good
		Kawasan Perindustrian Bayan Lepas 1	MMPC002	59	56	56	72	60	Sederhana / Moderate
		Pantai Bersih	MMPC003	66	58	58	75	86	Baik / Good
		Pantai Miami	MMPC004	93	69	81	70	86	Baik / Good
		Pantai Pasir Panjang	MMPC005	93	81	81	93	95	Terbaik / Excellent
		Batu Feringgi (Casuarina)	MMPC006	67	60	58	83	82	Baik / Good
		Luar Pantai Teluk Bahang	MMPC007	93	57	83	81	88	Baik / Good
		Persiaran Gurney	MMPC008	66	58	59	60	79	Sederhana / Moderate
		Rumah Pam Baru Perai	MMPC009	64	56	61	68	76	Sederhana / Moderate
		Rumah Pam Lama Perai	MMPC010	65	57	60	65	59	Sederhana / Moderate
		Selat PP Selatan (Jelutong)	MMPC011	59	57	55	59	59	Sederhana / Moderate
		Tanjung Bungah	MMPC012	67	57	70	67	72	Sederhana / Moderate
		Teluk Tempoyak	MMPC013	75	57	69	70	63	Sederhana / Moderate
		Batu Maung	MMPC014	62	57	56	69	58	Sederhana / Moderate

Jadual 4.6: Status Kualiti Air Marin bagi Pantai, 2022

Table 4.6: Marine Water Quality Status of Coastal Area, 2022

NEGERI / STATE	KLASSIFIKASI STESEN / STATION CLASSIFICATION	KAWASAN / AREA	NOMBOR STESEN / STATION NUMBER	NILAI IKAMM / MMWQI VALUE					KATEGORI (2022) / CATEGORY (2022)
				2018	2019	2020	2021	2022	
P. Pinang	Pantai/ Coastal	Pantai Sungai Batu Ferringhi 3	MMPC015	93	83	84	86	92	Terbaik / Excellent
		Pantai Sungai Batu Ferringhi 2	MMPC016	93	70	74	90	94	Terbaik / Excellent
		Pantai Sungai Batu Ferringhi 1	MMPC017	85	71	85	91	91	Terbaik / Excellent
Perak	Pantai / Coastal	Pantai Pasir Bogak	MMAC001	92	80	93	95	94	Terbaik / Excellent
		Pantai Teluk Dalam	MMAC002	93	88	89	94	92	Terbaik / Excellent
		Pantai Teluk Batik	MMAC003	92	62	84	78	89	Baik / Good
		Pantai Tanjung Batu	MMAC004	94	61	83	93	94	Terbaik / Excellent
		Pantai Teluk Rubiah	MMAC005	92	62	92	90	81	Baik / Good
		Pantai Damai Laut	MMAC006	92	70	93	94	91	Terbaik / Excellent
		Pantai Teluk Senangin	MMAC007	93	67	90	90	93	Terbaik / Excellent
		Pantai Pasir Panjang	MMAC008	93	70	94	91	95	Terbaik / Excellent
Selangor	Pantai / Coastal	Pantai Bagan Lalang	MMBC001	88	81	91	84	84	Baik / Good
		Pantai Morib	MMBC002	87	61	68	68	84	Baik / Good
		Selat Pulau Babi	MMBC003	90	73	73	87	91	Terbaik / Excellent
		Selat Klang Utara	MMBC004	62	56	55	62	56	Sederhana / Moderate
		Pantai Remis	MMBC005	90	58	63	83	79	Sederhana / Moderate
		Pantai Klanang	MMBC006	82	58	71	74	69	Sederhana / Moderate
N. Sembilan	Pantai / Coastal	Bagan Pinang	MMNC001	91	82	85	91	90	Terbaik / Excellent
		Telok Sinting	MMNC002	88	71	86	87	94	Terbaik / Excellent
		Port Dickson Bandar	MMNC003	68	60	74	88	88	Baik / Good
		Port Dickson Batu 4	MMNC004	90	81	86	88	89	Baik / Good
		Port Dickson Batu 5	MMNC005	68	63	67	73	81	Baik / Good
		Port Dickson Batu 6	MMNC006	92	77	90	90	93	Terbaik / Excellent
		Port Dickson Batu 7	MMNC007	88	86	92	93	95	Terbaik / Excellent
		Port Dickson Batu 8	MMNC008	87	86	85	93	95	Terbaik / Excellent
		Port Dickson Batu 10	MMNC009	89	84	92	92	97	Terbaik / Excellent
		Port Dickson Janakuasa TNB	MMNC010	68	59	89	70	90	Terbaik / Excellent
		Telok Pelanduk	MMNC011	90	87	83	91	94	Terbaik / Excellent
		Pantai Cermin	MMNC012	92	70	83	94	94	Terbaik / Excellent

Jadual 4.6: Status Kualiti Air Marin bagi Pantai, 2022
Table 4.6: Marine Water Quality Status of Coastal Area, 2022

NEGERI / STATE	KLASSIFIKASI STESEN / STATION CLASSIFICATION	KAWASAN / AREA	NOMBOR STESEN / STATION NUMBER	NILAI IKAMM / MMWQI VALUE					KATEGORI (2022) / CATEGORY (2022)
				2018	2019	2020	2021	2022	
N. Sembilan	Pantai / Coastal	Pantai Teluk Kemang	MMNC013	67	83	94	91	95	Terbaik / Excellent
		Pantai Seri Purnama	MMNC014	93	80	90	92	96	Terbaik / Excellent
Melaka	Pantai / Coastal	Pantai Rombang	MMMC001	85	68	89	88	88	Baik / Good
		Pantai Kundur	MMMC002	82	77	90	89	83	Baik / Good
		Pantai Tanjung Bidara	MMMC003	93	78	90	69	87	Baik / Good
		Teluk Gong	MMMC004	93	76	83	60	90	Terbaik / Excellent
		Pulau Melaka Point A1	MMMC005	67	60	91	89	83	Baik / Good
		Pulau Melaka Point A2	MMMC006	81	60	79	80	83	Baik / Good
		Pulau Melaka Point B1	MMMC007	62	57	58	58	57	Sederhana / Moderate
		Pulau Melaka Point B2	MMMC008	58	57	57	57	57	Sederhana / Moderate
		Pantai Klebang	MMMC009	81	58	78	87	89	Baik / Good
Johor	Pantai / Coastal	Tanjung Bin	MMJC001	92	81	90	90	91	Terbaik / Excellent
		Pelabuhan Tanjung Pelepas	MMJC002	92	67	92	91	82	Baik / Good
		Hadapan Jabatan Laut	MMJC003	88	77	87	82	81	Baik / Good
		Pantai Stulang Laut	MMJC004	63	49	48	56	55	Sederhana / Moderate
		Jeti Teluk Jawa	MMJC005	62	52	62	70	59	Sederhana / Moderate
		Pelabuhan Pasir Gudang	MMJC006	65	54	57	59	66	Sederhana / Moderate
		Hadapan HSAJB	MMJC007	59	36	49	58	51	Sederhana / Moderate
		Pantai Lido	MMJC008	52	37	44	54	50	Sederhana / Moderate
		Pantai Teluk Mahkota	MMJC009	94	72	90	93	95	Terbaik / Excellent
		Pantai Tanjung Leman	MMJC010	93	87	83	97	94	Terbaik / Excellent
		Pantai Sri Pantai	MMJC011	94	87	87	91	95	Terbaik / Excellent
		Tanjung Merak	MMJC012	73	60	89	85	89	Baik / Good
		Tanjung Pengelih	MMJC013	93	77	90	92	88	Baik / Good
		Pantai Tanjong Stapa	MMJC014	93	86	91	72	77	Sederhana / Moderate
		Pantai Teluk Gorek	MMJC015	94	92	83	93	93	Terbaik / Excellent
		Pantai Air Papan	MMJC016	94	92	95	92	93	Terbaik / Excellent
		Jeti Kukup	MMJC017	89	58	59	62	83	Baik / Good
		Pasir Gogok	MMJC018	93	74	92	89	89	Baik / Good

Jadual 4.6: Status Kualiti Air Marin bagi Pantai, 2022

Table 4.6: Marine Water Quality Status of Coastal Area, 2022

NEGERI / STATE	KLASSIFIKASI STESEN / STATION CLASSIFICATION	KAWASAN / AREA	NOMBOR STESEN / STATION NUMBER	NILAI IKAMM / MMWQI VALUE					KATEGORI (2022) / CATEGORY (2022)
				2018	2019	2020	2021	2022	
Johor	Pantai / Coastal	Tanjung Buai	MMJC019	92	63	75	91	87	Baik / Good
		Pantai Desaru	MMJC020	94	81	95	94	95	Terbaik / Excellent
		Tanjung Sepang	MMJC021	93	87	92	90	93	Terbaik / Excellent
		Tanjung Penyusup	MMJC022	93	62	83	93	93	Terbaik / Excellent
		Pantai Sungai Lurus	MMJC023	91	59	74	88	85	Baik / Good
		Punggur	MMJC024	87	59	69	90	79	Sederhana / Moderate
		Pantai Penyabung	MMJC025	93	80	82	95	96	Terbaik / Excellent
		Tanjung Resang	MMJC026	94	93	90	92	94	Terbaik / Excellent
		Tanjung Balau	MMJC027	93	84	93	94	94	Terbaik / Excellent
		Batu Layar	MMJC028	94	62	90	92	95	Terbaik / Excellent
		Tanjung Sengat	MMJC029	91	60	72	85	92	Terbaik / Excellent
Pahang	Pantai / Coastal	Pantai Cherating (Club Med A)	MMCC001	94	88	91	95	80	Baik / Good
		Pantai Cherating (Club Med B)	MMCC002	94	85	94	97	87	Baik / Good
		Pantai Cherating (Legend A)	MMCC003	94	88	96	93	93	Terbaik / Excellent
		Pantai Cherating (Legend B)	MMCC004	94	94	96	95	94	Terbaik / Excellent
		Pantai Muhibbah Balok A	MMCC005	89	59	73	90	93	Terbaik / Excellent
		Pantai Muhibbah Balok B	MMCC006	83	59	67	74	90	Terbaik / Excellent
		Pantai Batu Hitam A	MMCC007	87	75	76	92	93	Terbaik / Excellent
		Pantai Batu Hitam B	MMCC008	91	62	73	84	96	Terbaik / Excellent
		Pantai Berserah A	MMCC009	90	74	76	93	93	Terbaik / Excellent
		Pantai Berserah B	MMCC010	90	80	60	90	90	Terbaik / Excellent
		Pantai Teluk Cempedak A	MMCC011	88	83	84	94	95	Terbaik / Excellent
		Pantai Teluk Cempedak B	MMCC012	91	90	95	93	95	Terbaik / Excellent
		Pantai Teluk Gelora A	MMCC013	77	75	60	72	70	Sederhana / Moderate
		Pantai Teluk Gelora B	MMCC014	76	62	59	59	59	Sederhana / Moderate
		Pantai Sepat A	MMCC015	93	81	92	94	96	Terbaik / Excellent
		Pantai Sepat B	MMCC016	93	88	92	95	95	Terbaik / Excellent
		Pantai Legenda A	MMCC017	94	93	97	92	95	Terbaik / Excellent
		Pantai Legenda B	MMCC018	94	92	96	92	95	Terbaik / Excellent

Jadual 4.6: Status Kualiti Air Marin bagi Pantai, 2022
Table 4.6: Marine Water Quality Status of Coastal Area, 2022

NEGERI / STATE	KLASSIFIKASI STESEN / STATION CLASSIFICATION	KAWASAN / AREA	NOMBOR STESEN / STATION NUMBER	NILAI IKAMM / MMWQI VALUE					KATEGORI (2022) / CATEGORY (2022)
				2018	2019	2020	2021	2022	
Pahang	Pantai / Coastal	Pantai Kuala Api-Api	MMCC019	93	58	85	94	95	Terbaik / Excellent
		Pantai Tanjung Batu	MMCC020	94	72	85	94	92	Terbaik / Excellent
		Pantai Chendor	MMCC021	94	84	87	92	84	Baik / Good
		Pantai Lanjut	MMCC022	92	86	85	94	91	Terbaik / Excellent
Terengganu	Pantai / Coastal	Pantai Batu Buruk	MMTC001	93	59	93	88	95	Terbaik / Excellent
		Pantai Bukit Keluang	MMTC002	94	86	95	96	95	Terbaik / Excellent
		Pantai Chendering	MMTC003	94	69	93	95	95	Terbaik / Excellent
		Pantai Rantau Abang	MMTC004	94	85	95	96	97	Terbaik / Excellent
		KIPC Utara	MMTC005	94	92	78	95	94	Terbaik / Excellent
		KIPC Tengah	MMTC006	94	90	88	94	94	Terbaik / Excellent
		KIPC Selatan	MMTC007	94	94	88	95	95	Terbaik / Excellent
		Pantai Rhu 10	MMTC008	94	89	95	97	90	Terbaik / Excellent
		Pantai Tok Jembal	MMTC009	94	95	96	95	96	Terbaik / Excellent
		Pantai Kelulut	MMTC010	94	95	93	96	97	Terbaik / Excellent
		Pantai Teluk Ketapang	MMTC011	94	80	95	96	96	Terbaik / Excellent
		Pantai Kuala Abang	MMTC012	94	88	94	95	97	Terbaik / Excellent
		Pantai Teluk Kalong	MMTC013	94	94	94	95	97	Terbaik / Excellent
		Pantai Sura	MMTC014	94	89	94	94	96	Terbaik / Excellent
		Pantai Tanjung Bidara	MMTC015	94	93	93	94	97	Terbaik / Excellent
		Pantai Kemasik	MMTC016	88	86	90	97	97	Terbaik / Excellent
Kelantan	Pantai / Coastal	Pantai Seri Tujuh	MMDC001	93	88	84	93	94	Terbaik / Excellent
		Pantai Cahaya Bulan	MMDC002	93	87	92	95	95	Terbaik / Excellent
		Pantai Sabak	MMDC003	93	88	89	95	95	Terbaik / Excellent
		Pantai Irama Bachok	MMDC004	93	89	66	95	93	Terbaik / Excellent
		Pantai Bisikan Bayu	MMDC005	94	95	83	95	94	Terbaik / Excellent
		Pantai Melawi	MMDC006	94	85	83	95	95	Terbaik / Excellent
Sarawak	Pantai / Coastal	Pantai Sematan	MMQC001	90	91	72	93	90	Terbaik / Excellent
		Pantai Pandan	MMQC002	91	91	75	92	86	Baik / Good
		Pantai Pasir Putih	MMQC003	87	91	80	84	85	Baik / Good

Jadual 4.6: Status Kualiti Air Marin bagi Pantai, 2022

Table 4.6: Marine Water Quality Status of Coastal Area, 2022

NEGERI / STATE	KLASSIFIKASI STESEN / STATION CLASSIFICATION	KAWASAN / AREA	NOMBOR STESEN / STATION NUMBER	NILAI IKAMM / MMWQI VALUE					KATEGORI (2022) / CATEGORY (2022)
				2018	2019	2020	2021	2022	
Sarawak	Pantai / Coastal	Pantai Bako	MMQC004	89	91	85	89	91	Terbaik / Excellent
		Pantai Damai	MMQC005	91	91	68	86	89	Baik / Good
		Pantai Tanjung Kembang	MMQC006	85	88	86	77	90	Terbaik / Excellent
		Pantai Harmoni Mukah	MMQC007	86	89	60	67	73	Sederhana / Moderate
		Pantai Tanjung Batu	MMQC008	89	88	56	81	74	Sederhana / Moderate
		Pantai Likau	MMQC009	89	87	62	88	66	Sederhana / Moderate
		Pantai Emas	MMQC010	90	90	62	75	66	Sederhana / Moderate
		Pantai Piasau	MMQC011	89	87	70	85	74	Sederhana / Moderate
		Pantai Brighton	MMQC012	88	80	79	75	56	Sederhana / Moderate
		Pantai Esplaned	MMQC013	82	88	70	83	56	Sederhana / Moderate
		Pantai Beraya	MMQC014	88	90	65	83	57	Sederhana / Moderate
		Pantai Bungai	MMQC015	87	88	68	75	66	Sederhana / Moderate
		Pantai Belawai	MMQC016	88	90	66	67	92	Terbaik / Excellent
		Pantai Mukah	MMQC017	88	87	49	89	89	Baik / Good
		Tanjung Kidurong	MMQC018	90	87	63	80	90	Terbaik / Excellent
		Pasir Pandak	MMQC019	90	90	74	91	91	Terbaik / Excellent
		Rambungan	MMQC020	90	89	69	93	83	Baik / Good
		Sri Tanjung Lawas	MMQC021	86	78	71	68	67	Sederhana / Moderate
		Pantai Luak	MMQC022	78	88	77	84	56	Sederhana / Moderate
		Pasir Panjang	MMQC023	88	91	55	86	78	Sederhana / Moderate
Sabah	Pantai / Coastal	Pantai Teluk Brunei 1	MMSC001	92	85	67	73	61	Sederhana / Moderate
		Pantai Teluk Brunei 2	MMSC002	93	94	69	84	67	Sederhana / Moderate
		Pantai Teluk Brunei 3	MMSC003	92	81	62	75	67	Sederhana / Moderate
		Pantai Teluk Brunei 4	MMSC004	93	78	72	84	60	Sederhana / Moderate
		Pantai Teluk Brunei 5	MMSC005	93	88	64	69	59	Sederhana / Moderate
		Pantai Teluk Brunei 6	MMSC006	93	94	67	58	59	Sederhana / Moderate
		Borneo Golf Seawater	MMSC007	92	88	72	59	67	Sederhana / Moderate
		Pantai Manis Papar	MMSC008	91	92	60	59	60	Sederhana / Moderate
		Pantai Melinsung	MMSC009	93	90	67	70	59	Sederhana / Moderate
		Pantai Tanjung Aru (Roll Skating)	MMSC010	93	92	67	65	57	Sederhana / Moderate

Jadual 4.6: Status Kualiti Air Marin bagi Pantai, 2022
Table 4.6: Marine Water Quality Status of Coastal Area, 2022

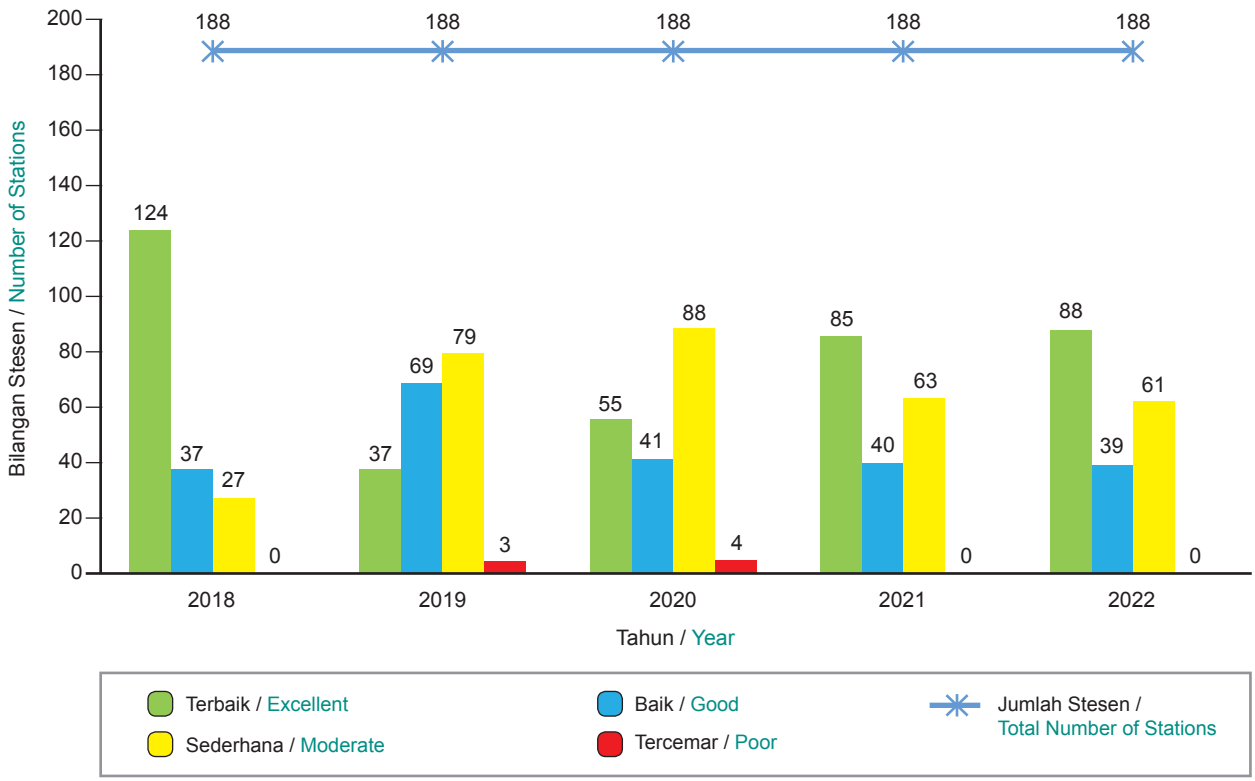
NEGERI / STATE	KLASSIFIKASI STESEN / STATION CLASSIFICATION	KAWASAN / AREA	NOMBOR STESEN / STATION NUMBER	NILAI IKAMM / MMWQI VALUE					KATEGORI (2022) / CATEGORY (2022)
				2018	2019	2020	2021	2022	
Sabah	Pantai / Coastal	Pantai Tanjung Aru (No. 3)	MMSC011	93	88	64	76	57	Sederhana / Moderate
		Pantai Lok Kawi	MMSC012	93	87	72	65	58	Sederhana / Moderate
		Pantai Dalit Tuaran	MMSC013	93	88	78	58	58	Sederhana / Moderate
		Mangrove Paradise	MMSC014	93	87	73	58	58	Sederhana / Moderate
		Pantai Sabandar	MMSC015	93	95	75	58	58	Sederhana / Moderate
		Pantai Bak-Bak Kudat	MMSC016	93	85	62	76	85	Sederhana / Moderate
		Pasir Putih Sandakan	MMSC017	92	84	63	83	82	Baik / Good
		Pantai TLDM	MMSC018	92	67	72	75	62	Sederhana / Moderate
		Pantai Batu Sapi	MMSC019	93	93	61	76	75	Sederhana / Moderate
		Pantai Ulu Tungku	MMSC020	92	70	66	57	58	Sederhana / Moderate
		Pantai Sarina Kunak	MMSC021	93	84	74	58	58	Sederhana / Moderate
		Pantai Kg. Lamak	MMSC022	91	79	64	57	61	Sederhana / Moderate
		Pantai Tinagat	MMSC023	93	78	58	58	68	Sederhana / Moderate
		Pantai Tanjung Aru (Rest Lido)	MMSC024	93	79	63	69	58	Sederhana / Moderate
W.P. Labuan	Pantai / Coastal	Pulau Papan	MMLC001	92	68	62	59	58	Sederhana / Moderate
		Kiamsam	MMLC002	93	64	68	58	58	Sederhana / Moderate
		Sungai Pagar	MMLC003	92	83	61	58	59	Sederhana / Moderate
		Layang-Layangan	MMLC004	92	82	69	57	58	Sederhana / Moderate
		Tanjung Aru	MMLC005	91	59	58	59	60	Sederhana / Moderate

Nota / Notes

Terbaik / Excellent | Baik / Good | Sederhana / Moderate | Tercemar / Poor

Rajah 4.9 menunjukkan status kualiti air marin bagi pantai berdasarkan IKAMM dan bilangan stesen pengawasan pantai. Bilangan stesen terbaik meningkat daripada 85 stesen pada tahun 2021 kepada 88 stesen pada tahun 2022. Walau bagaimanapun, stesen dengan status kualiti air baik menurun daripada 40 stesen pada tahun 2021 kepada 39 stesen pada tahun 2022. Tiada stesen tercemar yang direkodkan pada tahun 2022.

Figure 4.9 depicts the trend of marine water quality status of coastal areas based on MMWQI and the number of monitoring stations. The number of stations ranked excellent increased from 85 stations in 2021 to 88 stations in 2022. Nevertheless, the number of stations that were ranked good decreased from 40 stations in 2021 to 39 stations in 2022. No station was ranked poor in 2022.



Rajah 4.9: Tren Status Kualiti Air Marin bagi Kawasan Pantai, 2018-2022
Figure 4.9: The Marine Water Quality Status Trend for Coastal Area, 2018-2022

STATUS KUALITI AIR MARIN BAGI MUARA SUNGAI

Sebanyak 85 stesen muara sungai dipantau pada tahun 2022. Daripada 85 stesen pengawasan bagi muara sungai, tujuh (7) stesen (8%) terbaik, 10 stesen (12%) baik, 65 stesen (76.5%) sederhana manakala tiga (3) stesen (3.5%) tercemar (**Jadual 4.7**).

MARINE WATER QUALITY STATUS OF ESTUARY

A total of 85 estuary stations were monitored in the year 2022 and of this number, seven (7) stations (8%) were ranked excellent, 10 stations (12%) were ranked good, 65 stations (76.5%) were moderate, while the remaining three (3) stations (3.5%) were ranked poor (**Table 4.7**).

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

NEGERI / STATE	KLASSIFIKASI STESEN / STATION CLASSIFICATION	KAWASAN / AREA	NOMBOR STESEN / STATION NUMBER	NILAI IKAMM / MMWQI VALUE					KATEGORI (2022) / CATEGORY (2022)
				2018	2019	2020	2021	2022	
Perlis	Muara Sungai / Estuary	Kuala Sungai Baru	MMRE001	50	56	57	57	57	Sederhana / Moderate
		Kuala Sungai Perlis	MMRE002	58	54	57	57	57	Sederhana / Moderate
Kedah	Muara Sungai / Estuary	Kuala Kedah	MMKE001	53	53	57	57	56	Sederhana / Moderate
		Kuala Jerlun	MMKE002	50	57	55	55	54	Sederhana / Moderate
		Kuala Segantang Garam	MMKE003	57	70	69	69	72	Sederhana / Moderate
		Kuala Sungai Muda	MMKE004	62	58	56	56	57	Sederhana / Moderate
P. Pinang	Muara Sungai / Estuary	Kuala Sungai Jawi	MMPE001	46	38	43	43	52	Sederhana / Moderate
		Kuala Sungai Juru	MMPE002	51	30	42	42	53	Sederhana / Moderate
		Kuala Sungai Kerian	MMPE003	52	54	56	56	73	Sederhana / Moderate
		Kuala Sungai Pinang	MMPE004	52	53	52	52	54	Sederhana / Moderate
		Kuala Sungai Perai	MMPE005	53	43	55	55	55	Sederhana / Moderate
		Kuala Sungai Tengah	MMPE006	52	52	57	57	81	Baik / Good
		Kuala Sungai Pinang (Balik Pulau)	MMPE007	50	48	56	56	58	Sederhana / Moderate
Perak	Muara Sungai / Estuary	Kuala Sungai Manjung	MMAE001	71	75	73	73	85	Baik / Good
		Kuala Sungai Gula	MMAE002	55	53	54	54	79	Sederhana / Moderate
		Kuala Sungai Kurau	MMAE003	54	53	54	54	64	Sederhana / Moderate
		Kuala Sungai Tanjung Piandang	MMAE004	51	38	45	45	50	Sederhana / Moderate
		Kuala Sungai Sepetang	MMAE005	46	48	55	55	53	Sederhana / Moderate
		Kuala Sungai Perak	MMAE006	53	58	55	55	75	Sederhana / Moderate
Selangor	Muara Sungai / Estuary	Kuala Sungai Sepang	MMBE001	60	57	66	66	72	Sederhana / Moderate
		Kuala Sungai Sepang (Kecil)	MMBE002	61	88	80	80	58	Sederhana / Moderate
		Kuala Sungai Sepang (Kawalan)	MMBE003	70	88	81	81	91	Terbaik / Excellent
		Kuala Sungai Langat (Jugra)	MMBE004	50	44	54	54	58	Sederhana / Moderate
		Kuala Sungai Klang	MMBE005	38	35	40	40	43	Tercemar / Poor
		Kuala Sungai Langat (Lumut)	MMBE006	49	45	54	54	55	Sederhana / Moderate
		Kuala Sungai Buloh	MMBE007	44	58	57	57	56	Sederhana / Moderate
		Kuala Sungai Selangor	MMBE008	45	45	43	43	51	Sederhana / Moderate
		Kuala Sungai Tengi	MMBE009	49	43	51	51	48	Tercemar / Poor
		Kuala Sungai Bernam	MMBE010	52	55	55	55	61	Sederhana / Moderate

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

NEGERI / STATE	KLASSIFIKASI STESEN / STATION CLASSIFICATION	KAWASAN / AREA	NOMBOR STESEN / STATION NUMBER	NILAI IKAMM / MMWQI VALUE					KATEGORI (2022) / CATEGORY (2022)
				2018	2019	2020	2021	2022	
N. Sembilan	Muara Sungai / Estuary	Kuala Sungai Linggi	MMNE001	52	64	68	68	55	Sederhana / Moderate
		Kuala Sungai Lukut	MMNE002	52	52	56	56	53	Sederhana / Moderate
Melaka	Muara Sungai / Estuary	Kuala Sungai Melaka	MMME001	55	56	60	60	63	Sederhana / Moderate
		Kuala Sungai Sri Melaka	MMME002	45	53	50	50	54	Sederhana / Moderate
		Kuala Sungai Merlimau	MMME003	52	55	58	58	57	Sederhana / Moderate
		Kuala Sungai Kesang	MMME004	54	85	74	74	57	Sederhana / Moderate
		Kuala Sungai Sebatu	MMME005	56	63	63	63	75	Sederhana / Moderate
		Kuala Sungai Melaka 2	MMME006	52	54	56	56	54	Sederhana / Moderate
		Kuala Sungai Baru	MMME007	55	56	57	57	64	Sederhana / Moderate
		Kuala Sungai Lereh	MMME008	55	57	55	55	56	Sederhana / Moderate
Johor	Muara Sungai / Estuary	Kuala Sungai Segget	MMJE001	33	41	51	51	46	Tercemar / Poor
		Kuala Sungai Laloh	MMJE002	39	42	55	55	54	Sederhana / Moderate
		Kuala Sungai Johor	MMJE003	72	88	92	92	92	Terbaik / Excellent
		Kuala Sungai Batu Pahat	MMJE004	57	67	58	58	57	Sederhana / Moderate
		Kuala Sungai Muar	MMJE005	55	57	57	57	55	Sederhana / Moderate
		Kuala Sungai Mersing	MMJE006	59	62	59	59	59	Sederhana / Moderate
Pahang	Muara Sungai / Estuary	Kuala Kuantan	MMCE001	56	59	58	58	58	Sederhana / Moderate
		Kuala Rompin Kecil	MMCE002	69	79	72	72	79	Sederhana / Moderate
		Kuala Pahang	MMCE003	59	59	57	57	59	Sederhana / Moderate
		Kuala Nenasi	MMCE004	63	93	85	85	91	Terbaik / Excellent
		Kuala Sungai Balok	MMCE005	57	59	55	55	65	Sederhana / Moderate
Terengganu	Muara Sungai / Estuary	Kuala Sungai Besut	MMTE001	58	59	74	74	70	Sederhana / Moderate
		Kuala Sungai Dungun	MMTE002	59	60	69	69	59	Sederhana / Moderate
		Kuala Sungai Ibai	MMTE003	85	77	90	90	87	Baik / Good
		Kuala Sungai Kerteh	MMTE004	59	73	58	58	75	Sederhana / Moderate
		Kuala Sungai Marang	MMTE005	67	71	84	84	84	Baik / Good
		Kuala Sungai Paka	MMTE006	58	73	65	65	87	Baik / Good
		Kuala Sungai Setiu	MMTE007	86	64	92	92	75	Sederhana / Moderate
		Kuala Sungai Terengganu	MMTE008	59	59	66	66	59	Sederhana / Moderate
		Kuala Sungai Kemaman / Chukai	MMTE009	59	60	58	58	59	Sederhana / Moderate

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

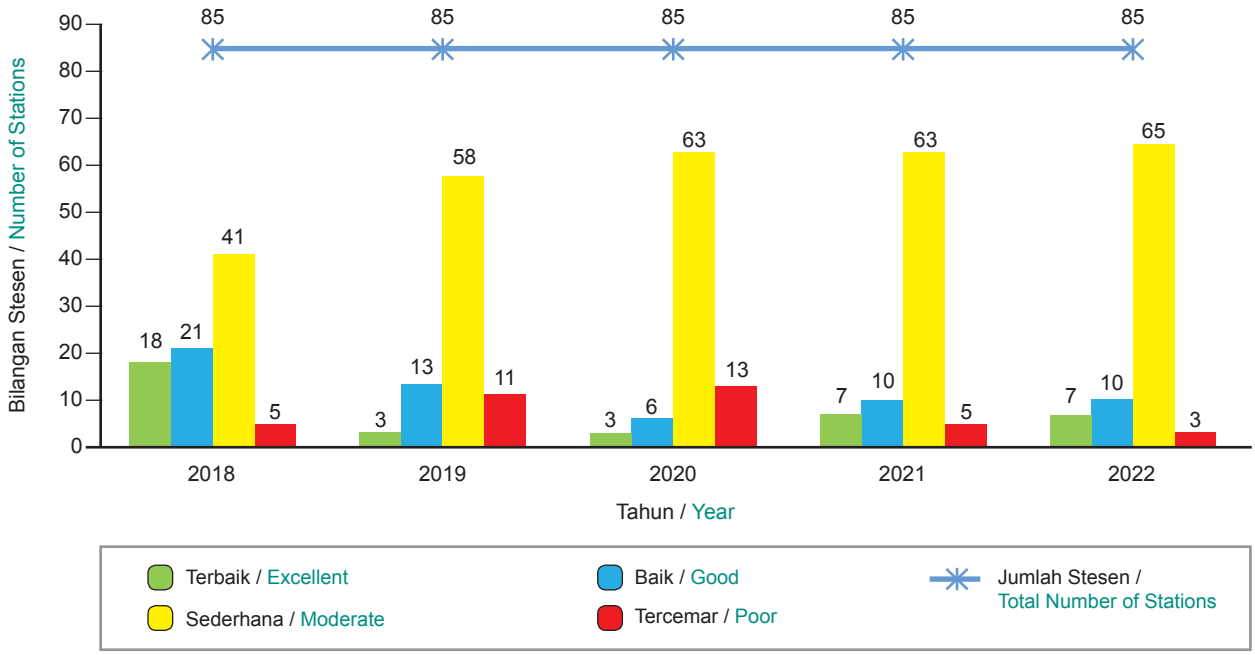
NEGERI / STATE	KLASSIFIKASI STESEN / STATION CLASSIFICATION	KAWASAN / AREA	NOMBOR STESEN / STATION NUMBER	NILAI IKAMM / MMWQI VALUE					KATEGORI (2022) / CATEGORY (2022)
				2018	2019	2020	2021	2022	
Terengganu	Muara Sungai / Estuary	Tioxide Utara (Kg. Bukit Kuang, Kijal)	MMTE010	95	94	94	94	97	Terbaik / Excellent
		Tioxide Tengah (Pupuk Semangat, Kijal)	MMTE011	94	87	93	93	96	Terbaik / Excellent
		Tioxide Selatan (KSB, T. Kalong)	MMTE012	85	94	86	86	95	Terbaik / Excellent
		Pulau Duyung	MMTE013	58	59	59	59	60	Sederhana / Moderate
Kelantan	Muara Sungai / Estuary	Kuala Sungai Golok	MMDE001	58	59	79	79	65	Sederhana / Moderate
		Kuala Sungai Kelantan	MMDE002	55	58	70	70	57	Sederhana / Moderate
		Kuala Sungai Pengkalan Chepa	MMDE003	53	56	64	64	59	Sederhana / Moderate
		Kuala Sungai Pengkalan Datu	MMDE004	68	59	59	59	69	Sederhana / Moderate
		Kuala Sungai Kemasin	MMDE005	39	56	59	59	58	Sederhana / Moderate
		Kuala Sungai Semerak	MMDE006	69	59	85	85	60	Sederhana / Moderate
Sarawak	Muara Sungai / Estuary	Kuala Sungai Semantan	MMQE001	91	65	90	90	70	Sederhana / Moderate
		Kuala Sungai Sarawak	MMQE002	86	64	85	85	82	Baik / Good
		Kuala Sungai Bako	MMQE003	63	56	79	79	88	Baik / Good
		Kuala Sungai Santubong	MMQE004	87	76	90	90	90	Terbaik / Excellent
		Kuala Batang Krian (Kabong)	MMQE005	80	83	71	71	87	Baik / Good
		Kuala Batang Rejang	MMQE006	89	66	85	85	82	Baik / Good
		Kuala Mukah	MMQE007	76	50	62	62	70	Sederhana / Moderate
		Kuala Batang Kemena	MMQE008	83	53	58	58	55	Sederhana / Moderate
		Kuala Tanjung Similajau	MMQE009	84	55	85	85	67	Sederhana / Moderate
		Kuala Sungai Panipah	MMQE010	87	55	83	83	64	Sederhana / Moderate
		Kuala Pantai Nyalau	MMQE011	83	58	71	71	84	Baik / Good
		Kuala Sungai Baram	MMQE012	74	57	76	76	55	Sederhana / Moderate
		Kuala Sungai Miri	MMQE013	74	68	63	63	54	Sederhana / Moderate
		Kuala Sungai Trusan	MMQE014	80	54	64	64	56	Sederhana / Moderate
Sabah	Muara Sungai / Estuary	Kuala Penyu	MMSE001	83	63	58	58	66	Sederhana / Moderate
		Muara Sungai Inanam	MMSE002	75	57	59	59	58	Sederhana / Moderate

Nota / Notes

Terbaik / Excellent Baik / Good Sederhana / Moderate Tercemar / Poor

Rajah 4.10 menunjukkan tren status kualiti air marin bagi muara sungai berdasarkan IKAMM dan bilangan stesen pengawasan muara sungai. Bilangan stesen terbaik dan baik pada tahun 2022 adalah sama dengan sebelumnya iaitu tujuh (7) stesen terbaik dan 10 stesen baik. Namun terdapat peningkatan stesen sederhana pada tahun 2022 iaitu dengan 65 stesen berbanding 63 stesen pada tahun 2021. Manakala bilangan stesen tercemar telah menurun dari lima (5) stesen pada tahun 2021 kepada tiga (3) stesen pada tahun 2022.

Figure 4.10 shows the marine water quality status trend for estuaries based on MMWQI and the number of monitoring stations. The number of excellent and good stations in 2022 is the same as previous year which seven (7) excellent stations and 10 good stations. However, there is an increase in moderate stations in 2022 with 65 stations compared to 63 stations in 2021. While the number of poor stations has decreased from five (5) stations in 2021 to three (3) stations in 2022.



Rajah 4.10: Tren Status Kualiti Air Marin bagi Muara Sungai, 2018-2022
Figure 4.10: The Marine Water Quality Status Trend for Estuary, 2018-2022

STATUS KUALITI AIR MARIN BAGI PULAU

Sebanyak 95 stesen pengawasan kualiti air marin bagi pulau dibangunkan yang meliputi 79 pulau yang telah dipantau pada tahun 2022. **Jadual 4.8** menunjukkan senarai stesen pengawasan kualiti air marin bagi pulau. Daripada 95 stesen pengawasan, 54 stesen (57%) terbaik, 20 stesen (21%) baik, 20 stesen (21%) sederhana, manakala satu (1) stesen tercemar pada tahun 2022 (**Jadual 4.9**).

MARINE WATER QUALITY STATUS OF ISLAND

A total of 95 island water quality monitoring stations were established for the surrounding the 79 islands that were monitored in the year 2022. **Table 4.8** shows the list of marine water quality monitoring stations for islands. Out of the 95 monitoring stations, 54 stations (57%) ranked excellent, 20 stations (21%) ranked good, the remaining 20 stations (21%) were ranked moderate while one (1) station was ranked poor in 2022 (**Table 4.9**).

Jadual 4.8: Stesen-Stesen Pengawasan Kualiti Air Marin bagi Pulau, 2022
Table 4.8: Marine Water Quality Monitoring Stations for Island, 2022

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	11	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	Lembu**	7KM05	NA	Taman Laut / Marine Park
		1	Pasir*	NA	MMKP001	Dilindungi / Protected
		1	Gasing*	NA	MMKP002	Dilindungi / Protected
		1	Dangli*	NA	MMKP003	Dilindungi / Protected
P. 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
		1	Lumut	7BR03	MMBR003	Peranginan / Resort
N. Sembilan	1	1	Arang	7NP01	MMNP001	Dilindungi / Protected

Jadual 4.8: Stesen-Stesen Pengawasan Kualiti Air Marin bagi Pulau, 2022

Table 4.8: Marine Water Quality Monitoring Stations for Island, 2022

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
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
			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

Jadual 4.8: Stesen-Stesen Pengawasan Kualiti Air Marin bagi Pulau, 2022
Table 4.8: Marine Water Quality Monitoring Stations for Island, 2022

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
Kelantan	2	1	Panjang	7DP01	MMDP001	Dilindungi / Protected
		1	Kundur	7DP02	MMDP002	Dilindungi / Protected
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	Dilindungi / Protected
		1	Gulisan	7SP18	MMSP002	Dilindungi / Protected
		1	Bakungan Kecil	7SP19	MMSP003	Dilindungi / Protected
W.P. 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
		4	Pohon Batu	7LD01	MMLD001	Pembangunan / Development
			Water Front	7LD02	MMLD002	Pembangunan / Development
			LubukTemiang	7LD03	MMLD003	Pembangunan / Development
			Ranca-Ranca	7LD04	MMLD004	Pembangunan / Development

Nota / Notes:
* (Stesen baru / New station)
** (Stesen tutup / Closed station)
NA (Tidak berkenaan / Not available)

Jadual 4.9: Status Kualiti Air Marin bagi Pulau, 2022
Table 4.9: Marine Water Quality Status of Island, 2022

NEGERI / STATE	KLASSIFIKASI STESEN / STATION CLASSIFICATION	KAWASAN / AREA	ID STESEN / STATION ID	NILAI IKAMM / MMWQI VALUE					KATEGORI (2022) / CATEGORY (2022)
				2018	2019	2020	2021	2022	
Kedah	Pulau / Island	Pantai Kuah	MMKD001	94	85	92	93	91	Terbaik / Excellent
		Pantai Chenang	MMKD002	82	73	93	91	89	Baik / Good
		Tanjung Rhu	MMKD003	94	91	93	91	91	Terbaik / Excellent
		Teluk Ewa	MMKD004	94	95	94	92	96	Terbaik / Excellent
		Payar	MMKM001	94	92	96	95	96	Terbaik / Excellent
		Kaca	MMKM002	94	86	95	95	94	Terbaik / Excellent
		Segantang	MMKM003	94	83	95	96	96	Terbaik / Excellent
		Pasir	MMKP001	94	94	96	96	96	Terbaik / Excellent
		Gasing	MMKP002	94	94	95	92	97	Terbaik / Excellent
		Dangli	MMKP003	94	95	95	91	97	Terbaik / Excellent
		Singa Besar	MMKR001	93	84	92	88	90	Terbaik / Excellent
		Dayang Bunting	MMKR002	93	90	87	95	91	Terbaik / Excellent
		Dayang Bunting 2	MMKR003	93	84	94	92	94	Terbaik / Excellent
		Pulau Perak	MMRP001	94	93	89	92	96	Terbaik / Excellent
P. Pinang	Pulau / Island	Batu Maung	MMPD001	62	55	57	57	59	Sederhana / Moderate
		Padang Kota	MMPD002	65	58	67	60	81	Baik / Good
		Teluk Bahang	MMPD003	82	59	85	83	87	Baik / Good
		Tanjung Tokong	MMPP001	66	57	71	68	83	Baik / Good
		Aman	MMPR001	88	60	72	72	92	Terbaik / Excellent
		Jerejak	MMPR002	65	57	58	76	59	Sederhana / Moderate
		Kendi	MMPR003	93	77	93	92	85	Baik / Good
		Rimau	MMPR004	93	85	90	92	93	Terbaik / Excellent
		Gedong	MMPR005	86	56	84	82	91	Terbaik / Excellent
Perak	Pulau / Island	Tukun Perak	MMAP001	93	88	93	96	96	Terbaik / Excellent
		Pantai Teluk Gedong	MMAR001	92	69	79	88	84	Baik / Good
		Pantai Puteri Dewi	MMAR002	94	90	95	95	94	Terbaik / Excellent
		Pangkor Laut	MMAR003	92	86	93	96	95	Terbaik / Excellent
		Sembilan	MMAR004	94	82	91	94	96	Terbaik / Excellent
Selangor	Pulau / Island	Ketam	MMBR001	89	57	68	72	85	Baik / Good
		Angsa	MMBR002	92	71	59	89	83	Baik / Good
		Lumut	MMBR003	54	47	46	50	47	Tercemar / Poor
N. Sembilan	Pulau / Island	Arang	MMNP001	92	81	92	94	92	Terbaik / Excellent

Jadual 4.9: Status Kualiti Air Marin bagi Pulau, 2022
Table 4.9: Marine Water Quality Status of Island, 2022

NEGERI / STATE	KLASSIFIKASI STESEN / STATION CLASSIFICATION	KAWASAN / AREA	ID STESEN / STATION ID	NILAI IKAMM / MMWQI VALUE					KATEGORI (2022) / CATEGORY (2022)
				2018	2019	2020	2021	2022	
Melaka	Pulau / Island	Upeh (Point A)	MMMR001	85	59	87	77	77	Sederhana / Moderate
		Upeh (Point B)	MMMR002	84	70	80	87	85	Baik / Good
		Besar (Point A)	MMMR003	94	84	95	96	95	Terbaik / Excellent
		Besar (Point B)	MMMR004	93	71	95	94	94	Terbaik / Excellent
		Undan (Point A)	MMMR005	94	83	96	96	94	Terbaik / Excellent
		Undan (Point B)	MMMR006	94	91	96	95	94	Terbaik / Excellent
Johor	Pulau / Island	Dayang	MMJM001	94	88	94	95	93	Terbaik / Excellent
		Nanga Besar	MMJM002	94	70	78	78	94	Terbaik / Excellent
		Sibu Tengah	MMJM003	94	86	86	96	96	Terbaik / Excellent
		Pemanggil	MMJM004	94	91	95	94	95	Terbaik / Excellent
		Kukup	MMJP001	87	58	62	70	89	Baik / Good
		Pisang	MMJP002	93	58	94	86	90	Terbaik / Excellent
		Setindan	MMJR001	94	91	95	97	97	Terbaik / Excellent
		Babi Tengah	MMJR002	94	94	94	93	97	Terbaik / Excellent
Pahang	Pulau / Island	Tioman (Teluk Salang)	MMCM001	94	94	89	96	96	Terbaik / Excellent
		Tioman (Kg. Nipah)	MMCM002	94	83	95	96	97	Terbaik / Excellent
		Tulai	MMCM003	94	94	95	97	97	Terbaik / Excellent
		Labas	MMCM004	94	91	95	97	97	Terbaik / Excellent
		Cebeh	MMCM005	94	95	96	96	97	Terbaik / Excellent
		Sepui	MMCM006	94	95	96	97	96	Terbaik / Excellent
		Sembilang	MMCM007	94	96	94	97	97	Terbaik / Excellent
		Seri Buat	MMCM008	94	94	93	97	97	Terbaik / Excellent
		Tokong Bahara	MMCM009	94	69	69	95	97	Terbaik / Excellent
Terengganu	Pulau / Island	Perhentian Besar (South)	MMTM001	94	86	95	97	96	Terbaik / Excellent
		Perhentian Besar (West)	MMTM002	94	92	96	96	97	Terbaik / Excellent
		Perhentian Kecil	MMTM003	94	91	96	97	97	Terbaik / Excellent
		Redang (North)	MMTM004	94	88	96	96	97	Terbaik / Excellent
		Redang (South)	MMTM005	94	85	95	96	97	Terbaik / Excellent
		Lang Tengah	MMTM006	94	75	96	97	97	Terbaik / Excellent
		Pinang	MMTM007	94	94	95	96	97	Terbaik / Excellent
		Ekor Tebu	MMTM008	94	87	97	97	97	Terbaik / Excellent
		Lima	MMTM009	94	97	96	97	97	Terbaik / Excellent
		Kapas	MMTM010	93	90	94	96	97	Terbaik / Excellent
		Gemia	MMTR001	94	96	90	94	97	Terbaik / Excellent

Jadual 4.9: Status Kualiti Air Marin bagi Pulau, 2022
Table 4.9: Marine Water Quality Status of Island, 2022

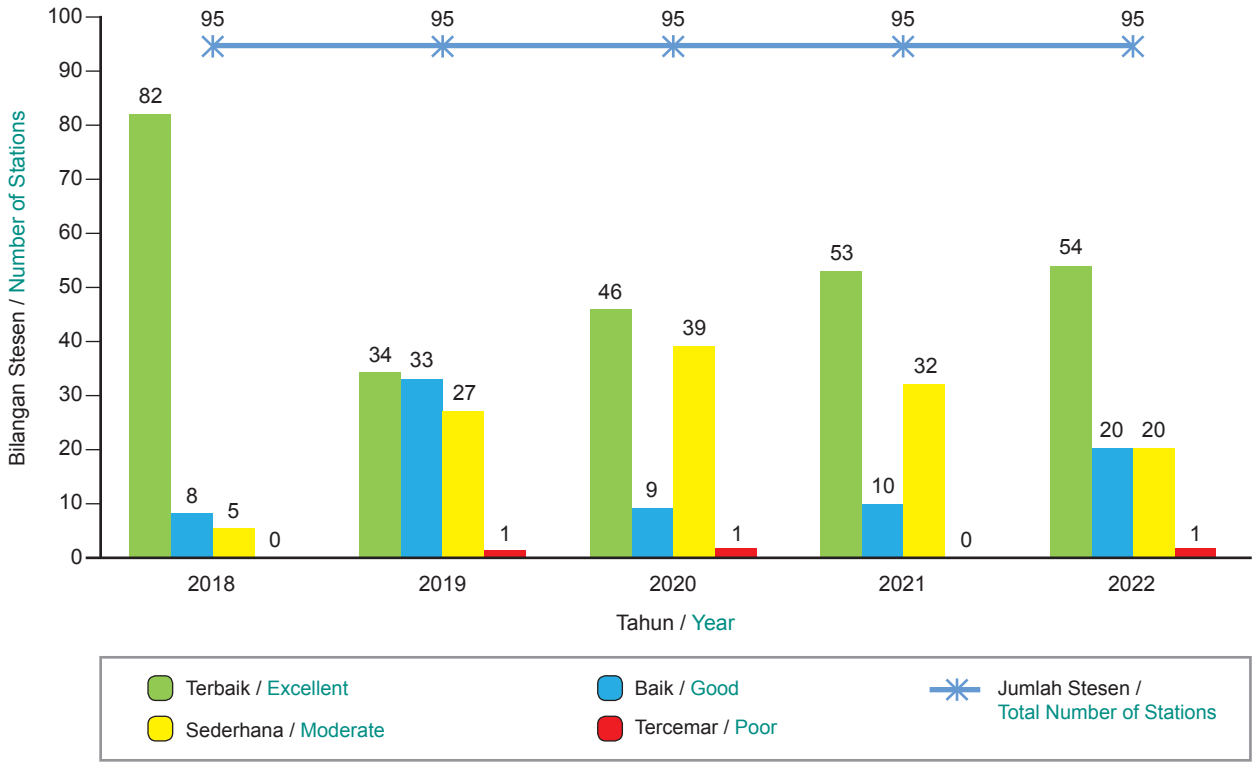
NEGERI / STATE	KLASSIFIKASI STESEN / STATION CLASSIFICATION	KAWASAN / AREA	ID STESEN / STATION ID	NILAI IKAMM / MMWQI VALUE					KATEGORI (2022) / CATEGORY (2022)
				2018	2019	2020	2021	2022	
Kelantan	Pulau / Island	Panjang	MMDP001	93	82	77	92	95	Terbaik / Excellent
		Kundur	MMDP002	93	84	84	92	96	Terbaik / Excellent
Sarawak	Pulau / Island	Satang	MMQP001	90	91	76	86	89	Baik / Good
		Talang-Talang Kecil	MMQP002	91	92	69	93	86	Baik / Good
		Talang-Talang Besar	MMQP003	90	90	79	93	80	Baik / Good
Sabah	Pulau / Island	Sapi	MMSM001	93	85	65	81	58	Sederhana / Moderate
		Kalampunian Besar	MMSM002	93	89	67	58	64	Sederhana / Moderate
		Selingan	MMSP001	93	85	60	74	81	Baik / Good
		Gulisan	MMSP002	93	80	65	70	72	Sederhana / Moderate
		Bakungan Kecil	MMSP003	93	83	59	75	88	Baik / Good
		Gaya	MMSR001	93	86	68	72	58	Sederhana / Moderate
		Mabul	MMSR002	93	60	58	71	74	Sederhana / Moderate
		Sipadan (N)	MMSR003	93	63	59	66	86	Baik / Good
		Sipadan (W)	MMSR004	93	77	58	61	62	Sederhana / Moderate
		Manukan	MMSR005	93	85	75	86	57	Sederhana / Moderate
		Tiga	MMSR006	92	87	72	58	61	Sederhana / Moderate
		Kapalai	MMSR007	93	77	58	77	69	Sederhana / Moderate
		Molleangan Besar	MMSR008	93	91	61	61	85	Baik / Good
		Banggi (South)	MMSR009	93	79	65	58	81	Baik / Good
		Banggi (East)	MMSR010	93	93	75	60	85	Baik / Good
		Balambangan	MMSR011	93	88	69	71	85	Baik / Good
		Mantanani Besar	MMSR012	93	95	72	58	58	Sederhana / Moderate
W.P. Labuan	Pulau / Island	Pohon Batu	MMLD001	92	86	67	58	58	Sederhana / Moderate
		Water Front	MMLD002	92	61	59	58	63	Sederhana / Moderate
		LubukTemiang	MMLD003	92	67	69	58	63	Sederhana / Moderate
		Ranca-Ranca	MMLD004	92	90	59	60	59	Sederhana / Moderate
		Kuraman	MMLM001	93	88	67	58	58	Sederhana / Moderate
		Rusukan Besar	MMLM002	93	88	59	58	64	Sederhana / Moderate
		Rusukan Kecil	MMLM003	92	90	64	58	59	Sederhana / Moderate

Nota / Notes

Terbaik / Excellent Baik / Good Sederhana / Moderate Tercemar / Poor

Rajah 4.11 menunjukkan tren status kualiti air marin bagi pulau berdasarkan IKAMM dan bilangan stesen pengawasan pulau. Bilangan stesen sebagai terbaik meningkat daripada 53 stesen pada tahun 2021 kepada 54 stesen pada tahun 2022 manakala stesen sebagai baik juga meningkat dari 10 stesen pada tahun 2021 kepada 20 stesen pada tahun 2022. Bagi stesen sederhana pula, terdapat tren penurunan iaitu dari 32 stesen pada tahun 2021 kepada 20 stesen pada tahun 2022. Terdapat satu (1) stesen tercemar telah direkodkan pada tahun 2022.

Figure 4.11 displays the trend of marine water quality status for islands based on MMWQI and the number of monitoring stations. The number of stations ranked excellent increased from 53 stations in 2021 to 54 stations in 2022, while, the number of stations ranked good also increased from 10 stations in 2021 to 20 stations in 2022. As for stations that were ranked moderate, there was a downward trend from 32 stations in 2021 to 20 stations in 2022. There was one (1) station ranked poor in 2022.



Rajah 4.11: Tren Status Kualiti Air Marin bagi Pulau, 2018-2022
Figure 4.11: The Trend of Marine Water Quality Status for Island, 2018-2022

Jadual 4.10 menunjukkan status kualiti air marin mengikut bilangan stesen dan kategori stesen bagi tahun 2021 dan 2022. **Jadual 4.11** menunjukkan status kualiti air marin mengikut peratusan bilangan stesen dan kategori stesen bagi tahun 2021 dan 2022.

Table 4.10 shows the marine water quality status by number of stations and station categories for 2021 and 2022 while **Table 4.11** shows the marine water quality status by of number of stations and station categories on a percentage basis for 2021 and 2022.

Jadual 4.10: Status Kualiti Air Marin Mengikut Bilangan Stesen dan Kategori Stesen, 2021-2022

Table 4.10: Marine Water Quality Status by Number of Stations and Station Categories, 2021-2022

KATEGORI STESEN / STATION CATEGORY	TERBAIK / EXCELLENT		BAIK / GOOD		SEDERHANA / MODERATE		TERCEMAR / POOR	
	2021	2022	2021	2022	2021	2022	2021	2022
Pantai / Coastal	85	88	40	39	63	61	0	0
Muara Sungai / Estuary	7	7	10	10	63	65	5	3
Pulau / Island	53	54	10	20	32	20	0	1
Pulau - Pembangunan / Island - Development	4	3	1	3	6	5	0	0
Pulau - Taman Laut / Island - Marine Park	25	26	1	5	5	0	0	0
Pulau - Dilindungi / Island - Protected	10	9	2	7	5	1	0	0
Pulau - Peranginan / Island - Resort	14	16	6	10	16	9	0	1
Jumlah / Total	**145**	**149**	**60**	**69**	**158**	**146**	**5**	**4**

Jadual 4.11: Status Kualiti Air Marin Mengikut Peratusan Bilangan Stesen dan Kategori Stesen, 2021-2022

Table 4.11: Marine Water Quality Status by Number of Stations on Percentage Basis and Station Categories 2021-2022

KATEGORI STESEN / STATION CATEGORY	TERBAIK / EXCELLENT (%)		BAIK / GOOD (%)		SEDERHANA / MODERATE (%)		TERCEMAR / POOR (%)	
	2021	2022	2021	2022	2021	2022	2021	2022
Pantai / Coastal	45	47	21	21	34	32	0	0
Muara Sungai / Estuary	8	8	12	12	74	76	6	4
Pulau / Island	56	57	11	21	34	21	0	1
Pulau - Pembangunan / Island - Development	36	27	9	27	55	45	0	0
Pulau - Taman Laut / Island - Marine Park	81	84	3	16	16	0	0	0
Pulau - Dilindungi / Island - Protected	59	53	12	41	29	6	0	0
Pulau - Peranginan / Island - Resort	39	44	17	28	44	25	0	3
Jumlah / Total	**39**	**40**	**16**	**19**	**43**	**40**	**1**	**1**

Jadual 4.12 menunjukkan status kualiti air marin mengikut bilangan stesen dan kategori stesen untuk negeri bagi tahun 2021 dan 2022**. Jadual 4.13** menunjukkan status kualiti air marin mengikut peratusan bilangan stesen dan kategori stesen untuk negeri bagi tahun 2021 dan 2022.

Table 4.12 shows the marine water quality status by number of stations and station categories for the states for 2021 and 2022. **Table 4.13** shows the marine water quality status of stations and station categories for the state for 2021 and 2022 on a percentage basis.

Jadual 4.12: Status Kualiti Air Marin Mengikut Bilangan Stesen dan Kategori Stesen untuk Negeri, 2021-2022
Table 4.12: Marine Water Quality Status by Number of Stations and Station Category for the State, 2021-2022

BIL. / NO.	NEGERI / STATE	STATUS KUALITI AIR MARIN / KATEGORI STESEN MARINE WATER QUALITY STATUS / STATION CATEGORY	TERBAIK / EXCELLENT		BAIK / GOOD		SEDERHANA / MODERATE		TERCEMAR / POOR	
			2021	2022	2021	2022	2021	2022	2021	2022
1.	Perlis		1	1	0	0	2	2	0	0
		Pantai / Coastal	-	-	-	-	-	-	-	-
		Muara Sungai / Estuary	0	0	0	0	2	2	0	0
		Pulau / Island	1	1	0	0	0	0	0	0
		Pulau - Dilindungi / Island - Protected	1	1	1	0	0	0	0	0
2.	P. Pinang		5	7	6	10	20	16	2	0
		Pantai / Coastal	3	4	4	5	10	8	0	0
		Muara Sungai / Estuary	0	0	0	1	5	6	2	0
		Pulau / Island	2	3	2	4	5	2	0	0
		Pulau - Pembangunan / Island - Development	0	0	1	2	2	1	0	0
		Pulau - Dilindungi / Island - Protected	0	0	0	1	1	0	0	0
		Pulau - Peranginan / Island - Resort	2	3	1	1	2	1	0	0
3.	Kedah		18	18	4	4	4	4	0	0
		Pantai / Coastal	6	6	3	3	0	0	0	0
		Muara Sungai / Estuary	0	0	0	0	4	4	0	0
		Pulau / Island	12	12	1	1	0	0	0	0
		Pulau - Pembangunan / Island - Development	4	3	0	1	0	0	0	0
		Pulau - Taman Laut / Island - Marine Park	3	3	0	0	0	0	0	0
		Pulau - Dilindungi / Island - Protected	3	3	0	0	0	0	0	0
		Pulau - Peranginan / Island - Resort	2	3	1	0	0	0	0	0

Jadual 4.12: Status Kualiti Air Marin Mengikut Bilangan Stesen dan Kategori Stesen untuk Negeri, 2021-2022

Table 4.12: Marine Water Quality Status by Number of Stations and Station Category for the State, 2021-2022

BIL. / NO.	NEGERI / STATE	STATUS KUALITI AIR MARIN / KATEGORI STESEN MARINE WATER QUALITY STATUS / STATION CATEGORY	TERBAIK / EXCELLENT		BAIK / GOOD		SEDERHANA / MODERATE		TERCEMAR / POOR	
			2021	2022	2021	2022	2021	2022	2021	2022
4.	Perak		11	10	1	4	6	5	1	0
		Pantai / Coastal	7	6	0	2	1	0	0	0
		Muara Sungai / Estuary	0	0	0	1	5	5	1	0
		Pulau / Island	4	4	1	1	0	0	0	0
		Pulau - Dilindungi / Island - Protected	1	1	0	0	0	0	0	0
		Pulau - Peranginan / Island - Resort	3	3	0	1	1	0	0	0
5.	Selangor		0	2	6	4	11	10	2	3
		Pantai / Coastal	0	1	3	2	3	3	0	0
		Muara Sungai / Estuary	0	1	2	1	6	7	2	2
		Pulau / Island	0	0	1	2	2	0	0	1
		Pulau - Peranginan / Island - Resort	0	0	0	2	2	0	0	1
6.	N. Sembilan		0	12	3	3	4	2	0	0
		Pantai / Coastal	0	11	3	3	2	0	0	0
		Muara Sungai / Estuary	0	0	0	0	2	2	0	0
		Pulau / Island	0	1	0	0	0	0	0	0
		Pulau - Dilindungi / Island - Protected	0	1	0	0	0	0	0	0
7.	Melaka		4	5	6	7	13	11	0	0
		Pantai / Coastal	0	1	5	6	4	2	0	0
		Muara Sungai / Estuary	0	0	0	0	8	8	0	0
		Pulau / Island	4	4	1	1	1	1	0	0
		Pulau - Peranginan / Island - Resort	4	4	1	1	1	1	0	0
8.	Johor		23	22	6	9	14	11	0	1
		Pantai / Coastal	17	14	5	8	7	7	0	0
		Muara Sungai / Estuary	1	1			5	4	0	1
		Pulau / Island	5	7	1	1	2	0	0	0
		Pulau - Taman Laut / Island - Marine Park	3	4	0	0	1	0	0	0
		Pulau - Dilindungi / Island - Protected	0	1	1	1	1	0	0	0
		Pulau - Peranginan / Island - Resort	2	2	0	0	0	0	0	0

Jadual 4.12: Status Kualiti Air Marin Mengikut Bilangan Stesen dan Kategori Stesen untuk Negeri, 2021-2022
Table 4.12: Marine Water Quality Status by Number of Stations and Station Category for the State, 2021-2022

BIL. / NO.	NEGERI / STATE	STATUS KUALITI AIR MARIN / KATEGORI STESEN MARINE WATER QUALITY STATUS / STATION CATEGORY	TERBAIK / EXCELLENT		BAIK / GOOD		SEDERHANA / MODERATE		TERCEMAR / POOR	
			2021	2022	2021	2022	2021	2022	2021	2022
9.	Pahang		27	27	2	3	7	6	0	0
		Pantai / Coastal	18	17	1	3	3	2	0	0
		Muara Sungai / Estuary	0	1	1	0	4	4	0	0
		Pulau / Island	9	9	0	0	0	0	0	0
		Pulau - Taman Laut / Island - Marine Park	7	9	0	0	0	0	0	0
10.	Terengganu		30	30	3	3	7	7	0	0
		Pantai / Coastal	15	16	2	0	0	0	0	0
		Muara Sungai / Estuary	4	3	1	3	7	7	0	0
		Pulau / Island	11	11	0	0	0	0	0	0
		Pulau - Taman Laut / Island - Marine Park	10	10	0	0	0	0	0	0
		Pulau - Peranginan / Island - Resort	1	1	0	0	0	0	0	0
11.	Kelantan		8	8	1	0	5	6	0	0
		Pantai / Coastal	6	6	0	0	0	0	0	0
		Muara Sungai / Estuary	0	0	1	0	5	6	0	0
		Pulau / Island	2	2	0	0	0	0	0	0
		Pulau - Dilindungi / Island - Protected	2	2	0	0	0	0	0	0
12.	Sabah		0	0	5	9	43	34	0	0
		Pantai / Coastal	0	0	3	2	21	22	0	0
		Muara Sungai / Estuary	0	0	0	0	2	2	0	0
		Pulau / Island	0	0	2	7	15	10	0	0
		Pulau - Taman Laut / Island - Marine Park	0	0	1	0	1	2	0	0
		Pulau - Dilindungi / Island - Protected	0	0	0	2	3	1	0	0
		Pulau - Peranginan / Island - Resort	0	0	1	5	11	7	0	0
13.	Sarawak		8	7	17	13	15	20	0	0
		Pantai / Coastal	4	6	12	5	7	12	0	0
		Muara Sungai / Estuary	2	1	4	5	8	8	0	0
		Pulau / Island	2	0	1	3	0	0	0	0
		Pulau - Dilindungi / Island - Protected	2	0	1	3	0	0	0	0

Jadual 4.12: Status Kualiti Air Marin Mengikut Bilangan Stesen dan Kategori Stesen untuk Negeri, 2021-2022
Table 4.12: Marine Water Quality Status by Number of Stations and Station Category for the State, 2021-2022

BIL. / NO.	NEGERI / STATE	STATUS KUALITI AIR MARIN / KATEGORI STESEN MARINE WATER QUALITY STATUS / STATION CATEGORY	TERBAIK / EXCELLENT		BAIK / GOOD		SEDERHANA / MODERATE		TERCEMAR / POOR	
			2021	2022	2021	2022	2021	2022	2021	2022
14	W.P. Labuan		0	0	0	0	12	12	0	0
		Pantai / Coastal	0	0	0	0	5	5	0	0
		Muara Sungai / Estuary	-	-	-	-	-	-	-	-
		Pulau / Island	0	0	0	0	7	7	0	0
		Pulau - Pembangunan / Island - Development	0	0	0	0	4	4	0	0
		Pulau - Taman Laut / Island - Marine Park	0	0	0	0	3	3	0	0

Jadual 4.13: Peratusan Status Kualiti Air Marin berdasarkan Kategori Stesen Mengikut Negeri, 2021-2022
Table 4.13: Marine Water Quality Status of Station Categories by State on Percentage Basis 2021-2022

BIL. / NO.	NEGERI / STATE	STATUS KUALITI AIR MARIN/ KATEGORI STESEN MARINE WATER QUALITY STATUS/ STATION CATEGORY	TERBAIK / EXCELLENT (%)		BAIK / GOOD (%)		SEDERHANA / MODERATE (%)		TERCEMAR / POOR (%)	
			2021	2022	2021	2022	2021	2022	2021	2022
1.	Perlis		33.33	33.33	0	0	66.67	66.67	0	0
		Pantai / Coastal	-	-	-	-	-	-	-	-
		Muara Sungai / Estuary	0	0	0	0	100	100	0	0
		Pulau / Island	100	100	0	0	0	0	0	0
		Pulau - Dilindungi / Island - Protected	100	100	0	0	0	0	0	0
2.	P. Pinang		15.15	21.21	18.18	30.30	60.61	48.48	6.06	0
		Pantai / Coastal	17.65	23.53	23.53	29.41	58.82	47.06	0	0
		Muara Sungai / Estuary	0	0	0	14.29	71.43	85.71	28.57	0
		Pulau / Island	22.22	33.33	22.22	44.44	55.56	22.22	0	0
		Pulau - Pembangunan / Island - Development	0	0	33.33	66.67	66.67	33.33	0	0
		Pulau - Dilindungi / Island - Protected	0	0	0	100	100	0	0	0
		Pulau - Peranginan / Island - Resort	40.00	60	20.00	20.00	40.00	20.00	0	0

Jadual 4.13: Peratusan Status Kualiti Air Marin berdasarkan Kategori Stesen Mengikut Negeri, 2021-2022

Table 4.13: Marine Water Quality Status of Station Categories by State on Percentage Basis 2021-2022

BIL. / NO.	NEGERI / STATE	STATUS KUALITI AIR MARIN/ KATEGORI STESEN MARINE WATER QUALITY STATUS/ STATION CATEGORY	TERBAIK / EXCELLENT (%)		BAIK / GOOD (%)		SEDERHANA / MODERATE (%)		TERCEMAR / POOR (%)	
			2021	2022	2021	2022	2021	2022	2021	2022
3.	Kedah		69.23	69.23	15.38	15.38	15.38	15.38	0	0
		Pantai / Coastal	66.67	66.67	33.33	33.33	0	0	0	0
		Muara Sungai / Estuary	0	0	0	0	100	100	0	0
		Pulau / Island	92.31	92.31	7.69	7.69	0	0	0	0
		Pulau - Pembangunan / Island - Development	100	75.00	0	25	0	0	0	0
		Pulau - Taman Laut / Island - Marine Park	100	100	0	0	0	0	0	0
		Pulau - Dilindungi / Island - Protected	100	100	0	0	0	0	0	0
		Pulau - Peranginan / Island - Resort	66.67	100	33.33	0	0	0	0	0
4.	Perak		57.89	52.63	5.26	21.05	31.58	26.32	5.26	0
		Pantai / Coastal	87.50	75.00	0	25.00	12.50	0	0	0
		Muara Sungai / Estuary	0	0	0	16.67	83.33	83.33	16.67	0
		Pulau / Island	80.00	80.00	20.00	20.00	0	0	0	0
		Pulau - Dilindungi / Island - Protected	100	100	0	0	0	0	0	0
		Pulau - Peranginan / Island - Resort	75.00	75.00	25.00	25.00	0	0	0	0
5.	Selangor		0	10.53	31.58	21.05	57.89	53.63	10.53	15.79
		Pantai / Coastal	0	16.67	50.00	33.33	50.00	50.00	0	0
		Muara Sungai / Estuary	0	10.00	20.00	0	60.00	70.00	20.00	20.00
		Pulau / Island	0	0	33.33	66.67	66.67	33.33	0	0
		Pulau - Peranginan / Island - Resort	0	0	33.33	66.67	66.67	33.33	33.33	0
6.	N. Sembilan		58.82	70.59	17.65	17.65	23.53	11.76	0	0
		Pantai / Coastal	64.29	78.57	21.43	21.43	14.29	0	0	0
		Muara Sungai / Estuary	0	0	0	0	100	100	0	0
		Pulau / Island	100	100	0	0	0	0	0	0
		Pulau - Dilindungi / Island - Protected	100	100	0	0	0	0	0	0

Jadual 4.13: Peratusan Status Kualiti Air Marin berdasarkan Kategori Stesen Mengikut Negeri, 2021-2022

Table 4.13: Marine Water Quality Status of Station Categories by State on Percentage Basis 2021-2022

BIL. / NO.	NEGERI / STATE	STATUS KUALITI AIR MARIN/ KATEGORI STESEN MARINE WATER QUALITY STATUS/ STATION CATEGORY	TERBAIK / EXCELLENT (%)		BAIK / GOOD (%)		SEDERHANA / MODERATE (%)		TERCEMAR / POOR (%)	
			2021	2022	2021	2022	2021	2022	2021	2022
7.	Melaka		17.39	21.74	26.09	30.43	56.52	47.83	0	0
		Pantai / Coastal	0	11.11	55.56	66.67	44.44	22.22	0	0
		Muara Sungai / Estuary	0	0	0	0	100	100	0	0
		Pulau / Island	66.67	66.67	16.67	16.67	16.67	16.67	0	0
		Pulau - Peranginan / Island - Resort	66.67	66.67	16.67	16.67	16.67	16.67	0	0
8.	Johor		53.49	51.16	13.95	20.93	32.56	25.58	0	2.33
		Pantai / Coastal	58.62	48.28	17.24	27.59	24.14	24.14	0	0
		Muara Sungai / Estuary	16.67	16.67	0	0	83.33	66.67	0	16.67
		Pulau / Island	62.50	87.50	12.50	12.50	25.00	0	0	0
		Pulau - Taman Laut / Island - Marine Park	75.00	100.00	0	0	25.00	0	0	0
		Pulau - Dilindungi / Island - Protected	0	50.00	50.00	50.00	50.00	0	0	0
		Pulau - Peranginan / Island - Resort	100.00	100.00	0	0	0	0	0	0
9.	Pahang		75.00	75.00	5.56	8.33	19.44	16.67	0	0
		Pantai / Coastal	81.82	77.27	4.55	13.64	13.64	9.09	0	0
		Muara Sungai / Estuary	0	20.00	20.00	0	80.00	80.00	0	0
		Pulau / Island	100	100	0	0	0	0	0	0
		Pulau - Taman Laut / Island - Marine Park	100	100	0	0	0	0	0	0
10.	Terengganu		75.00	75.00	7.50	7.50	17.50	17.50	0	0
		Pantai / Coastal	93.75	100	6.25	0	0	0	0	0
		Muara Sungai / Estuary	30.77	23.08	15.38	23.08	53.85	53.85	0	0
		Pulau / Island	100	100	0	0	0	0	0	0
		Pulau - Taman Laut / Island - Marine Park	100	100	0	0	0	0	0	0
		Pulau - Peranginan / Island - Resort	100	100	0	0	0	0	0	0

Jadual 4.13: Peratusan Status Kualiti Air Marin berdasarkan Kategori Stesen Mengikut Negeri, 2021-2022
Table 4.13: Marine Water Quality Status of Station Categories by State on Percentage Basis 2021-2022

BIL. / NO.	NEGERI / STATE	STATUS KUALITI AIR MARIN/ KATEGORI STESEN MARINE WATER QUALITY STATUS/ STATION CATEGORY	TERBAIK / EXCELLENT (%)		BAIK / GOOD (%)		SEDERHANA / MODERATE (%)		TERCEMAR / POOR (%)	
			2021	2022	2021	2022	2021	2022	2021	2022
11.	Kelantan		57.14	57.14	7.14	0	35.71	42.86	0	0
		Pantai / Coastal	100	100	0	0	0	0	0	0
		Muara Sungai / Estuary	0	0	16.67	0	83.33	100	0	0
		Pulau / Island	0	100	0	0	0	0	0	0
		Pulau - Dilindungi / Island - Protected	0	100	0	0	0	0	0	0
12.	Sabah		0	0	11.63	20.93	88.37	79.07	0	0
		Pantai / Coastal	0	0	12.50	8.33	87.50	91.67	0	0
		Muara Sungai / Estuary	0	0	0	0	100	100	0	0
		Pulau / Island	0	0	11.76	41.18	88.24	58.82	0	0
		Pulau - Taman Laut / Island - Marine Park	0	0	50	0	50	100	0	0
		Pulau - Dilindungi / Island - Protected	0	0	0	66.67	100	33.33	0	0
		Pulau - Peranginan / Island - Resort	0	0	8	41.67	92	58.33	0	0
13.	Sarawak		20.00	17.50	42.50	32.50	37.50	50.00	0	0
		Pantai / Coastal	17.39	26.09	52.17	21.74	30.43	52.17	0	0
		Muara Sungai / Estuary	14.29	7.14	28.57	35.71	57.14	57.14	0	0
		Pulau / Island	66.67	0	33.33	100	0	0	0	0
		Pulau - Dilindungi / Island - Protected	66.67	0	33.33	100	0	0	0	0
14	W.P. Labuan		0	0	0	0	100	100	0	0
		Pantai / Coastal	0	0	0	0	100	100	0	0
		Muara Sungai / Estuary	-	-	-	-	-	-	-	-
		Pulau / Island	0	0	0	0	100	100	0	0
		Pulau - Pembangunan / Island - Development	0	0	0	0	100	100	0	0
		Pulau - Taman Laut / Island - Marine Park	0	0	0	0	100	100	0	0

Stesen Marin dalam Kategori Tercemar

Jadual 4.14 menunjukkan terdapat empat (4) stesen marin tercemar iaitu tiga (3) merupakan stesen muara sungai dan satu (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 ini juga menunjukkan semua stesen marin yang mengalami kemerosotan adalah disebabkan oleh parameter faecal coliform. Selain itu, nitrat dan fosfat yang juga turut mempengaruhi nilai IKAMM.

Stesen muara sungai di Kuala Sungai Segget, Johor adalah stesen yang menerima kesan daripada tiga (3) parameter manakala stesen yang lain terkesan daripada satu (1) parameter sahaja.

Marine Stations in the Poor Category

Table 4.14 shows the list of four (4) marine stations that were ranked poor, of which three (3) stations are estuary stations and one (1) being an island station. Sub-index projection percentages are used on a scale of 0 to 100%. A sub-index of 49% and below is the benchmark and marked in red to indicate a decline in MMWQI.

The table shows that this degradation is primarily due to the faecal coliform parameter. In addition, nitrate and phosphate also have had a slight impact on the value of the MMWQI.

The estuary station of Kuala Sungai Segget, Johor was most impacted by three (3) parameters, while other stations were mostly impacted by one (1) parameter only.

Jadual 4.14: Senarai Stesen Pengawasan Kualiti Air Marin dengan Status Kategori Tercemar dan Peratusan Sub-Indeks Mengikut Parameter, 2022
Table 4.14: List of Marine Water Quality Monitoring Stations under the Category of Poor Status and their Sub-Index Percentages by Parameter, 2022

NEGERI / STATE	KLASIFIKASI STESEN / STATION CLASSIFICATION	LOKASI / LOCATION	STESEN ID / ID STATION	IKAMM / MMWQI	PERATUSAN SUB-INDEKS (%) / SUB-INDEX PERCENTAGE (%)					
					OKSIGEN TERLARUT / DISSOLVED OXYGEN	AMMONIA (TIDAK TERION) / AMMONIA (UNIONIZED)	FAECAL COLIFORM	JUMLAH PEPEJAL TERAMPAI / TOTAL SUSPENDED SOLID	NITRAT / NITRATE	FOSFAT / PHOSPHATE
Selangor	Muara Sungai / Estuary	Kuala Sungai Klang	MMBE005	43	61	95	8	88	76	72
	Muara Sungai / Estuary	Kuala Sungai Tengi	MMBE009	48	81	98	8	62	70	82
	Pulau / Island	Lumut	MMBR003	47	54	94	23	89	89	73
Johor	Muara Sungai / Estuary	Kuala Sungai Segget	MMJE001	46	80	88	8	93	50	50

PENGAWASAN KUALITI AIR MARIN AUTOMATIK

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

Jadual 4.15 menyenaraikan lokasi stesen-stesen pengawasan kualiti air marin automatik dan kategori kelas kegunaan air marin berdasarkan SKAMM manakala **Rajah 4.11** menunjukkan lokasi Stesen CMWQM.

Pada tahun 2022, purata dan median untuk parameter kualiti air marin yang dipantau di semua stesen CMWQM menunjukkan pematuhan yang tinggi bagi setiap kelas kualiti air marin sepertimana yang dinyatakan dalam SKAMM.

Kepekatan untuk kebanyakan parameter yang direkodkan di stesen adalah tipikal mengikut sifatnya mengambil kira gangguan potensi yang terdapat berhampiran stesen. Kualiti air marin yang dipantau dalam Rangkaian Kualiti Air Marin Automatik telah terjejas oleh musim tengkujuh.

Kualiti air marin untuk stesen CMWQM dilaporkan mempunyai tahap turun naik yang lebih tinggi semasa Monsun Timur Laut disebabkan oleh isipadu hujan yang lebih tinggi. Kualiti air marin secara relatifnya adalah stabil di kebanyakan stesen kecuali CM04K di Tanjung Piai, Johor, CM05J di Tanjung Pengelih, Johor, CM10S di Wilayah Persekutuan Labuan, CM11Q Santubong, Sarawak, CM12A di Pulau Mentagor, Perak dan CM13T Pulau Kapas, Terengganu. Stesen-stesen ini tertakluk kepada pengaruh input sungai.

Kualiti air marin di stesen CM11Q yang terletak di Santubong, Sarawak menunjukkan pengaruh pasang surut yang jelas disebabkan oleh interaksi yang kompleks antara air tawar dan air laut yang seterusnya membentuk ciri hidrologi muara Santubong.

Parameter oksigen terlarut (DO), jumlah pepejal terampai (TSS) dan polycylic aromatic hydrocarbon (PAHs) didapati mematuhi SKAMM. Seperti yang direkodkan pada tahun sebelumnya,

CONTINUOUS MARINE WATER QUALITY MONITORING

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

Table 4.15 lists the location of the continuous marine water quality monitoring stations and its respective class categories based on MMWQS while **Figure 4.11** shows the location of the CMWQM stations.

In 2022, the average and median of all water quality parameters monitored by the CMWQM network showed high conformance to their respective marine water quality classes as defined by the MMWQS.

Concentration for most of the parameters recorded at the stations were typical of its nature considering potential disturbances present nearby the stations. Marine water quality monitored by the Continuous Marine Water Quality Network was affected by the monsoon seasons.

Marine water quality of the CMWQM stations reported a higher degree of fluctuation during the North-East Monsoon due to higher volume of precipitation. Marine water quality is relatively stable in most of the stations except for CM04K at Tanjung Piai, Johor, CM05J at Tanjung Pengelih, Johor, CM10S at Wilayah Persekutuan Labuan, CM11Q Santubong, Sarawak, CM12A at Pulau Mentagor, Perak and CM13T Pulau Kapas, Terengganu. These stations are subjected to the influent of riverine inputs.

The marine water quality at station CM11Q located in Santubong, Sarawak shows clear tidal influences due to the complex interaction between freshwater and seawater, which subsequently forms the hydrological characteristics of the Santubong estuary.

Dissolved oxygen (DO), total suspended solids (TSS), and polycyclic aromatic hydrocarbons (PAHs) all met the MMWQS. As recorded in the previous year, the highest non-compliance of

ketidakpatuhan DO adalah paling tinggi di CM11Q Santubong oleh perubahan sifat hidrologi hasil daripada kitaran pasang surut. Selain stesen CM11Q Santubong, stesen CM12A Pulau Mentagor dan CM13T Pulau Kapas juga telah menunjukkan tren ketidakpatuhan DO.

Berdasarkan kepada SKAMM, semua stesen melaporkan pematuhan PAH yang sangat baik iaitu melebihi 90% mengikut kelas masing-masing. Tahap ketidakpatuhan tertinggi dikenalpasti pada stesen CM11Q Santubong diikuti oleh stesen CM04J Tanjung Piai dan CM03N Port Dickson.

Pada tahun 2022, kualiti air marin yang dipantau secara keseluruhannya di semua rangkaian CMWQM adalah berada pada status baik. Tiada amaran pencemaran yang dijana oleh rangkaian CMWQM pada tahun 2022.

Jadual 4.16 menunjukkan tahap pematuhan stesen CMWQM terhadap kelas masing-masing pada tahun 2022.

DO was observed in CM11Q Santubong due to changes in hydrological characteristics caused by the tidal cycle. Apart from the CM11Q Santubong station, the CM12A Pulau Mentagor and CM13T Pulau Kapas stations have also shown trends of DO non-compliance.

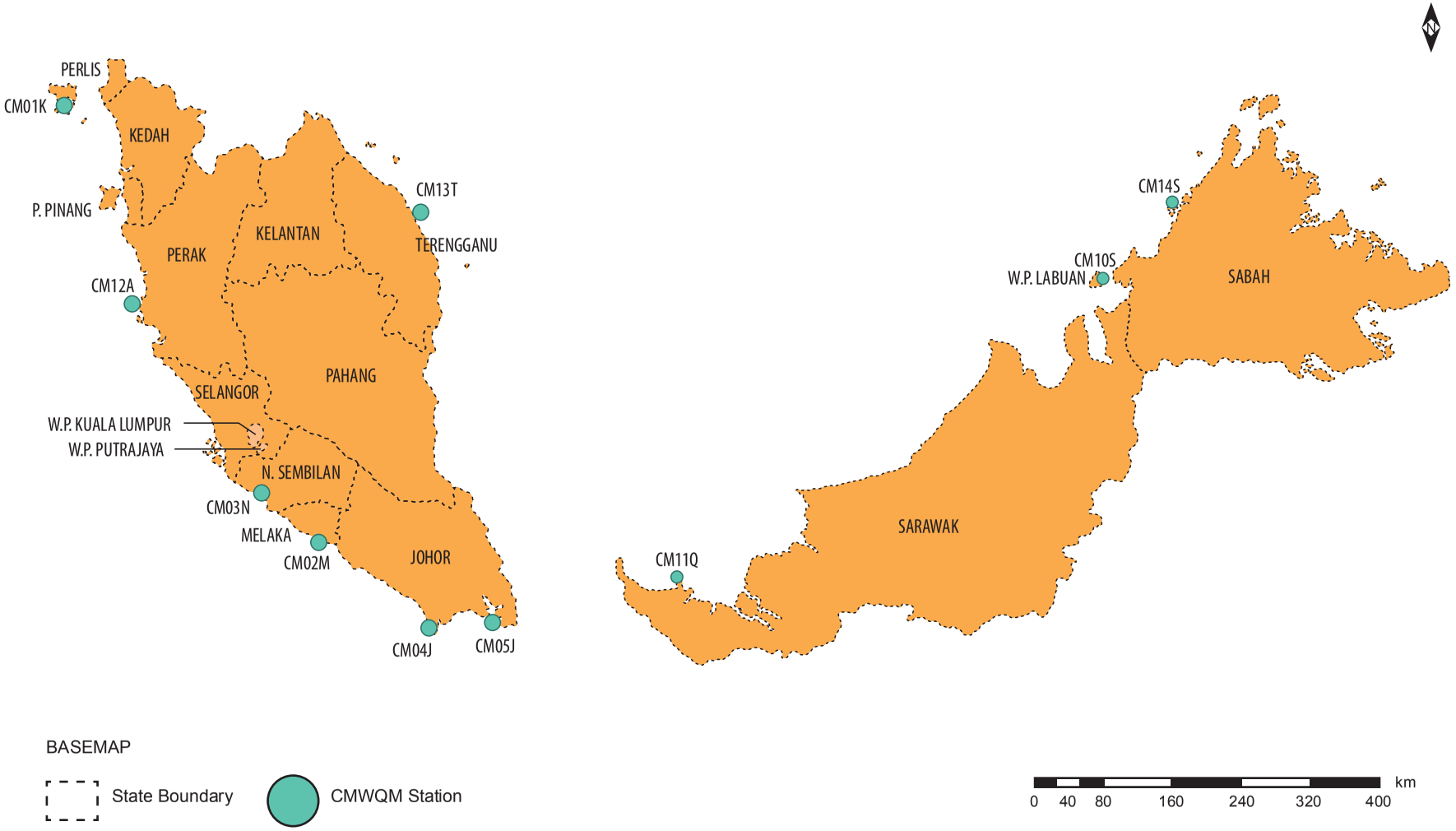
According to the MMWQS, all stations reported excellent PAH compliance of more than 90% with their respective water quality classes (MMWQS). The higher levels of non-conformance were found in CM11Q Santubong followed by CM04J Tanjung Piai and CM03N Port Dickson.

In 2022, the overall marine water quality monitored by the CMWQM network was deemed good. There were no pollution warnings generated under the CMWQM network in 2022.

Table 4.16 shows the status of CMWQM stations were in compliance with their respective classes in 2022.

Jadual 4.15: Stesen Pengawasan Kualiti Air Marin Automatik
Table 4.15: Continuous Marine Water Quality Monitoring Stations

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



Rajah 4.11: Lokasi Stesen Pengawasan Kualiti Air Marin Automatik

Figure 4.11: Location of Continuous Marine Water Quality Monitoring Stations

Jadual 4.16: Peratusan Pematuhan Parameter DO, TSS dan PAHs mengikut Kelas (SKAMM)

Table 4.16: Percentage of DO, TSS and PAHs Parameters Compliance according to Their Station Classes (MMWQS)

NEGERI / STATE	LOKASI STESEN / STATION LOCATION	ID STESEN / STATION ID	KELAS / CLASS	PERATUSAN PEMATUHAN (%) / PERCENTAGE OF COMPLIANCE (%)		
				OKSIGEN TERLARUT / DISSOLVED OXYGEN (DO)	JUMLAH PEPEJAL TERAMPAI / TOTAL SUSPENDED SOLID (TSS)	POLYCYLIC AROMATIC HYDROCARBONS (PAHs)
Kedah	Pulau Langkawi	CM01K	2	97.19	99.80	100
Melaka	Jeti Pulau Undan	CM02M	2	99.96	95.76	100
N. Sembilan	Port Dickson	CM03N	2	100	99.88	99.82
Johor	Tanjung Piai	CM04J	E	99.94	92.77	82.61
	Tanjung Pengelih	CM05J	3	100	99.82	100
W.P. Labuan	W.P. Labuan	CM10S	3	100	99.98	100
Sarawak	Santubong	CM11Q	E	42.74	98.86	99.46
Perak	Pulau Mentagor	CM12A	2	82.51	99.64	100
Terengganu	Pulau Kapas	CM13T	1	87.34	99.35	100
Sabah	Teluk Sepanggar	CM14S	3	100	99.92	100

Kampung Genting, Pulau Tioman

Loji Penapisan Minyak / Oil Refinery Plant

BAB 5
CHAPTER

INVENTORI PUNCA PENCEMARAN

INVENTORY OF POLLUTION SOURCES

INVENTORI PUNCA PENCEMARAN
INVENTORY OF POLLUTION SOURCES

3 Parameter Utama
Main Parameters

- BOD
- SS
- AN

PARAMETER / PARAMETERS	PUNCA UTAMA / MAIN SOURCES
BOD & AN	Sistem Pengolahan Kumbahan Sewage Treatment Systems
SS	Ternakan Babi Pig Farming

Jumlah Beban dalam Tan/Hari
Total Load in Tonnes/Day

BOD 667.35	SS 915.17	AN 274.61

KUALITI UDARA
AIR QUALITY

65 **Stesen Pengawasan Kualiti Udara** / Air Quality Monitoring Stations

4 **Punca Utama Pencemaran Udara**
Main Sources of Air Pollution

- Loji Janakuasa / Power Plants
- Industri / Industry
- Kenderaan Bermotor / Motor Vehicle
- Lain-Lain / Other

4 **Parameter Utama**
Main Parameters

SO_2	PM
NO_2	CO

PARAMETER / PARAMETERS	PUNCA UTAMA / MAIN SOURCES
SO_2	Loji Janakuasa / Power Plants
NO_2	Loji Janakuasa / Power Plants
PM	Industri / Industry Loji Janakuasa / Power Plants
CO	Kenderaan Bermotor / Motor Vehicle

JUMLAH BEBAN DALAM TAN METRIK / TOTAL LOAD IN METRIC TONNES

CO 2,070,909 | NO_2 846,864 | SO_2 217,490 | PM 23,715

BUANGAN TERJADUAL
SCHEDULED WASTES

5,915,073.84 MT
BUANGAN TERJADUAL YANG TERHASIL
SCHEDULED WASTES GENERATED

Debu, sanga, dros atau abu merupakan kategori buangan yang dihasilkan dengan kuantiti tertinggi iaitu = **47.01%**

Jumlah BT yang mengaplikasikan konsep 4R (Reduce, Reuse, Recycle, Recover) = **2.67 MT x 10^6**

Dust, slag, dross or ash is the category of waste produced with the highest quantity which is 47.01%

Total BT that applies the 4R concept (Reduce, Reuse, Recycle, Recover) = 2.67 MT x 10^6

INVENTORI PUNCA PENCEMARAN / INVENTORY OF POLLUTION SOURCES

PENGIRAAN BEBAN PENCEMARAN

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

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.

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, akuakultur, pertanian serta menampung keperluan sistem ekologi.

Punca beban pencemaran air terbahagi kepada dua (2) kategori utama, iaitu punca tetap dan punca tidak tetap. Punca tetap beban pencemaran air adalah punca-punca yang mempunyai takat pelepasan yang boleh dikenal pasti dan tidak berubah dalam masa yang singkat seperti sektor industri, ternakan, sistem pengolahan kumbahan dan sebagainya.

POLLUTION LOAD CALCULATION

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

This assimilative capacity is co-related to the pollution load which is defined as the concentration of pollutants carried over a given time. Pollution load is influenced by the water body flow rate and the concentrations of pollutants carried by the water body.

Water pollution load is one of the important criteria in prioritising strategies and planning the mode of action for pollution prevention and control. The implementation of the pollution load control is one of the efforts to enhance the river water quality in order to maintain the beneficial uses of river as a source of water supply, recreation, aquaculture, agriculture as well as sustenance of the ecological system.

Sources of water pollution load can be divided into two (2) main categories which are point sources and non-point sources. Point sources can be described as the pollution sources that have specific identifiable discharge points which are unchanged over time. Sectors such as industry, livestock and sewage treatment system fall under this category.

Manakala punca tidak tetap seperti aktiviti pertanian, kerja tanah, perlombongan dan air limbah (air cucian selain kumbahan) tidak mempunyai takat pelepasan yang tetap dan sering berubah-ubah yang menyukarkan anggaran pelepasan beban pencemaran dibuat. Kajian berkaitan beban pencemaran di bawah kategori ini di Malaysia tidak banyak dijalankan dan kurang rujukan pada masa kini.

BEBAN PENCEMARAN AIR

Untuk tahun 2022, sebanyak lima (5) jenis punca pencemaran air ditumpukan dalam pelaporan status beban pencemaran air, iaitu industri pembuatan, industri berasaskan pertanian, sistem pengolahan kumbahan, aktiviti ternakan babi dan pasar basah.

Sumber data industri pembuatan dan industri berasaskan pertanian diperolehi daripada JAS Negeri manakala bagi sistem pengolahan kumbahan adalah daripada pihak operator loji seperti Indah Water Konsortium Sdn. Bhd., Pihak Berkuasa Tempatan dan operator loji persendirian. Data-data berkaitan aktiviti ternakan babi diperolehi daripada Jabatan Perkhidmatan Veterinar dan Kementerian Pembangunan Kerajaan Tempatan (KPKT) pula 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 (AN).

Meanwhile, the non-point sources such as agricultural activities, earthworks, mining, and sullage (domestic wastewater other than sewage) do not have specific identifiable discharge points and the locations are varied over time. This makes it difficult to estimate the amount of pollution load released. Studies on this particular category for Malaysia are currently not widely available for reference.

WATER POLLUTION LOAD

For the year of 2022, five (5) types of water pollution sources have become the focus of the report on the status of the water pollution load. These are the manufacturing industries, agricultural-based industries, sewage treatment systems, pig farming activities and wet markets.

The source of data for manufacturing industries and agricultural-based industries were from the DOE State offices while data for sewage treatment systems were obtained from Indah Water Konsortium Sdn. Bhd., the Local Authorities and private sewage operators. All data regarding pig farming activities were provided by Department of Veterinary Services and data on wet markets were acquired from the Ministry of Local Government Development.

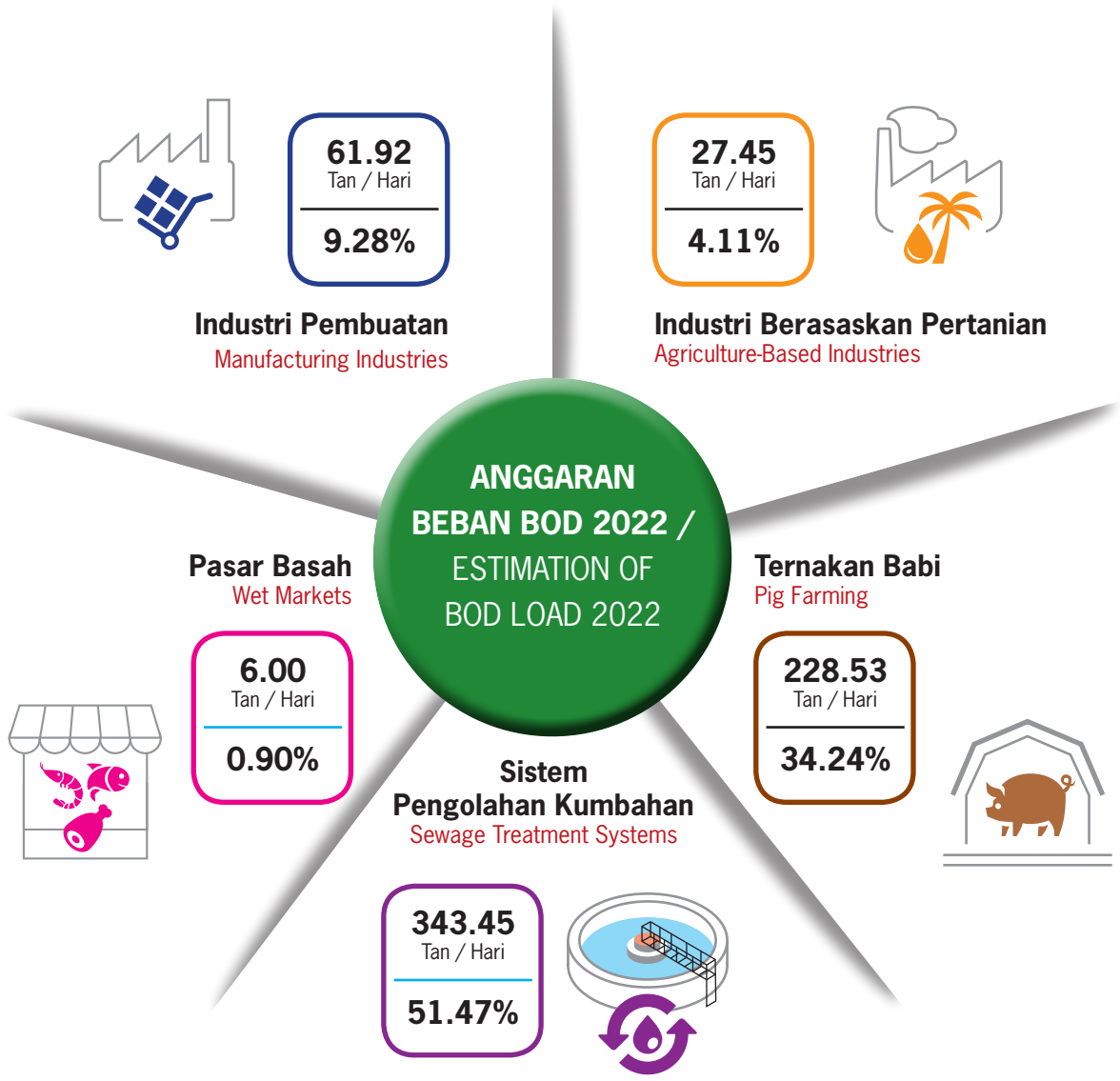
Calculation of pollution load is mainly focused on three (3) main parameters that have significant impact on the river water quality, namely Biochemical Oxygen Demand (BOD), Suspended Solids (SS) and Ammoniacal Nitrogen (AN).

Beban Keperluan Oksigen Biokimia

Pada tahun 2022, anggaran jumlah beban pencemaran BOD terhasil adalah sebanyak 667.35 tan/hari. Pelepasan daripada sistem pengolahan kumbahan adalah penyumbang beban pencemaran BOD tertinggi iaitu sebanyak 343.45 tan/hari (51.47%), diikuti dengan aktiviti ternakan babi 228.53 tan/hari (34.24%), industri pembuatan 61.92 tan/hari (9.28%), industri berasaskan pertanian 27.45 tan/hari (4.11%) dan pasar basah 6.00 tan/hari (0.90%) (**Rajah 5.1**).

Biochemical Oxygen Demand Load

In the year 2022, an estimated BOD pollution load of 667.35 tonnes/day was generated. Sewage treatment systems remain the largest BOD load contributor with a total load of 343.45 tonnes/day (51.47%), followed by pig farming activities which contributed 228.53 tonnes/ day (34.24%), manufacturing industries 61.92 tonnes/day (9.28%), agriculture-based industries 27.45 tonnes/day (4.11%) and wet markets 6.00 tonnes/ day (0.90%) (**Figure 5.1**).



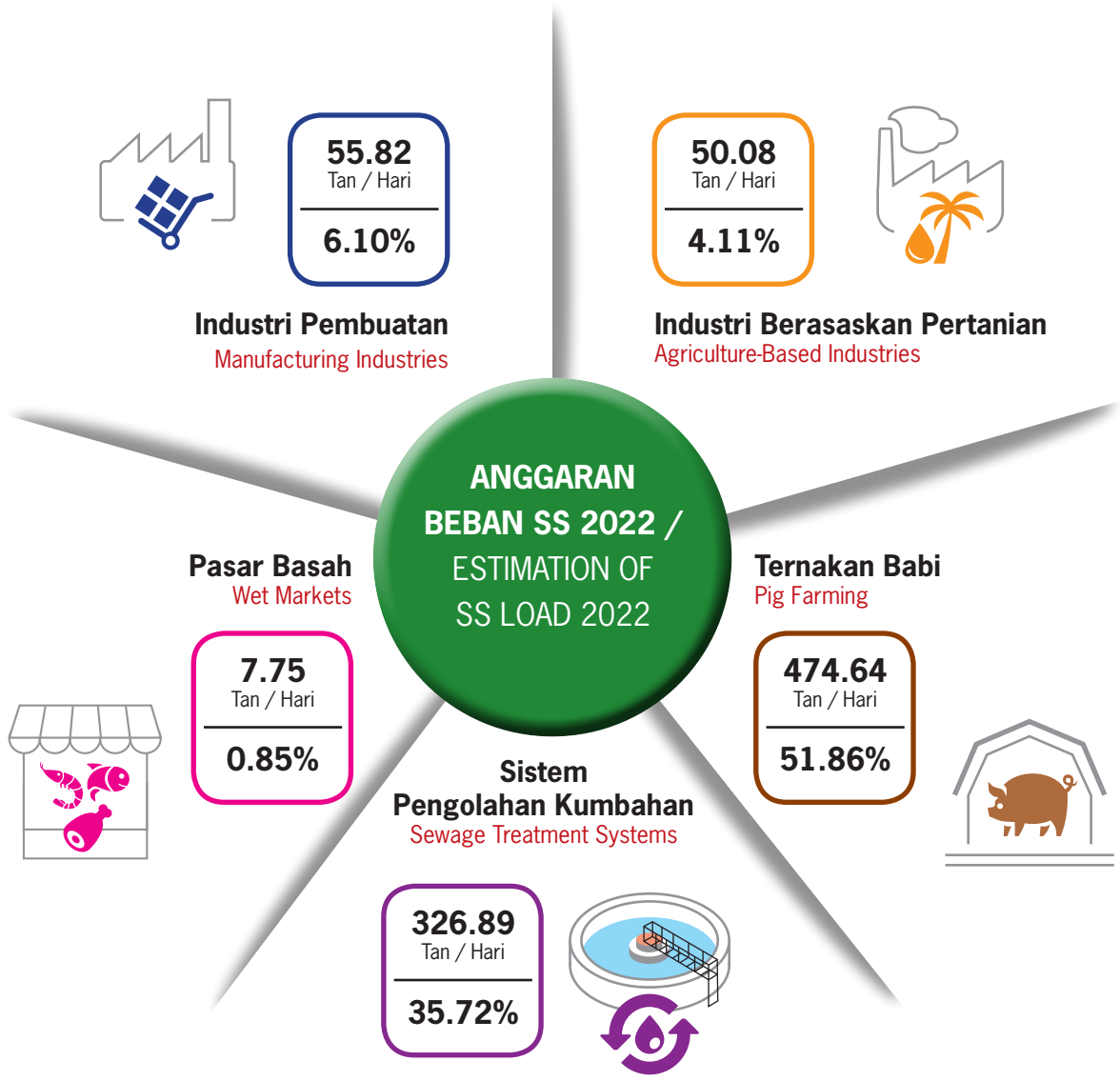
Rajah 5.1: Anggaran Beban BOD (Tan/Hari) mengikut Punca Pencemaran Air, 2022
Figure 5.1: Estimation of BOD Load (Tonnes/Day) based on Sources of Water Pollution, 2022

Beban Pepejal Terampai

Pada tahun 2022, anggaran beban pencemar bagi SS adalah sebanyak 915.17 tan/hari. Jumlah beban pencemaran daripada ternakan babi adalah yang tertinggi iaitu sebanyak 474.64 tan/hari (51.86%) diikuti dengan sistem pengolahan kumbahan 326.89 tan/hari (35.72%). Industri pembuatan pula adalah sebanyak 55.82 tan/hari (6.10%), industri berasaskan pertanian 50.08 tan/hari (4.11%) dan pasar basah 7.75 tan/hari (0.85%) (**Rajah 5.2**).

Suspended Solids Load

The overall estimation in the year 2022 for SS load was 915.17 tonnes/day. Total pollution load from pig farming activities shows the highest load 474.64 tonnes/day (51.86%) followed by the sewage treatment systems with 326.89 tonnes/day (35.72%). Manufacturing industries contributed 55.82 tonnes/day (6.10%), followed by agriculture-based industries 50.08 tonnes/day (4.11%) and wet markets 7.75 tonnes/day (0.85%) (**Figure 5.2**).



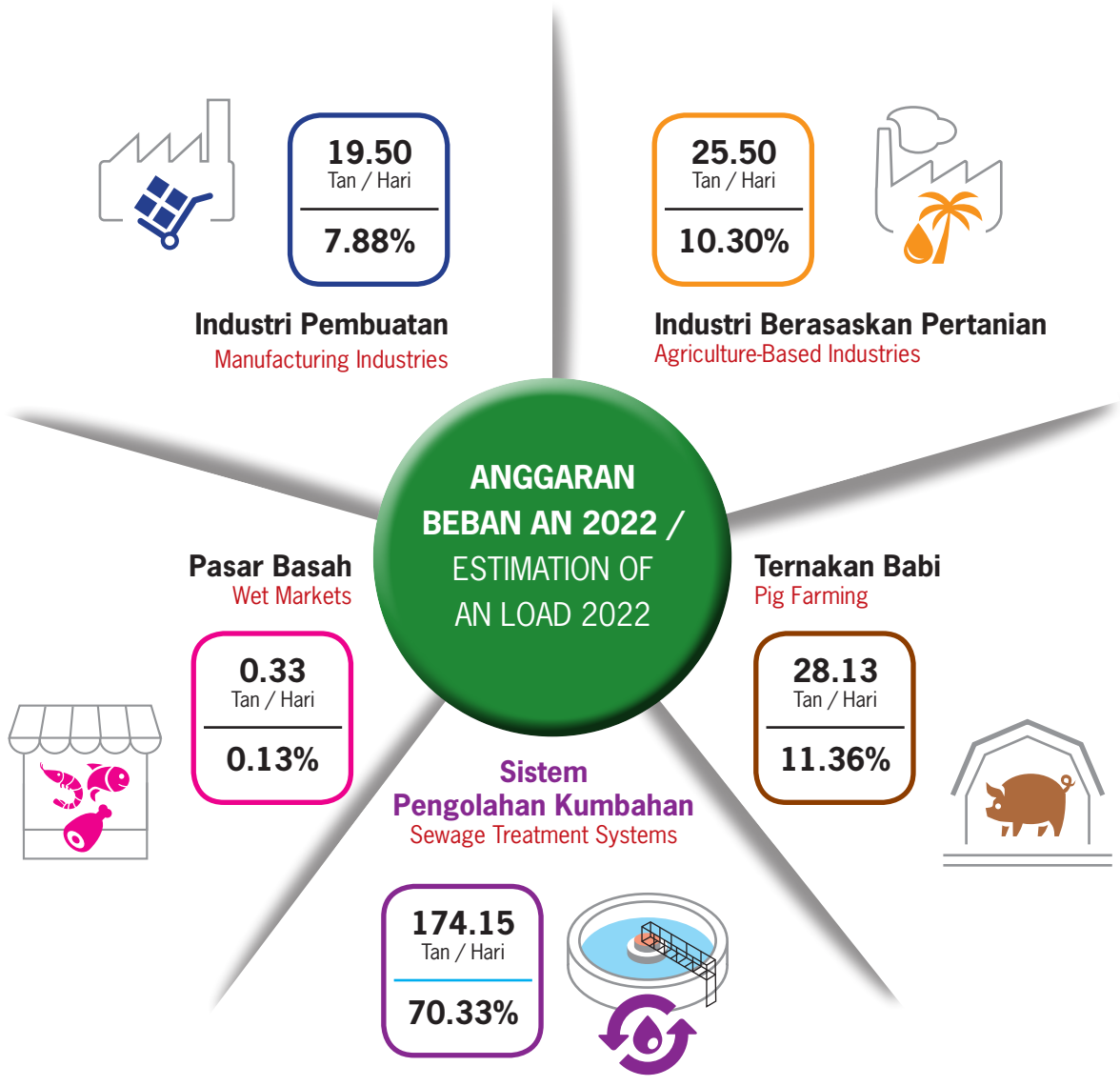
Rajah 5.2: Anggaran Beban SS (Tan/Hari) mengikut Punca Pencemaran Air, 2022
Figure 5.2: Estimation of SS Load (Tonnes/Day) based on Sources of Water Pollution, 2022

Beban Ammoniakal Nitrogen

Pada tahun 2022, anggaran beban pencemar AN adalah sebanyak 274.61 tan/hari di mana pelepasan sistem pengolahan kumbahan adalah penyumbang terbesar beban AN dengan jumlah sebanyak 174.15 tan/hari (70.33%), diikuti aktiviti ternakan babi iaitu 28.13 tan/hari (11.36%), industri berasaskan pertanian 25.50 tan/hari (10.30%), industri pembuatan 19.50 tan/hari (7.88%) dan pasar basah 0.33 tan/hari (0.13%) (**Rajah 5.3**).

Ammoniacal Nitrogen Load

In 2022, the AN load was estimated to be 274.61 tonnes/day in which sewage treatment systems remained the largest contributor with a total load of 174.15 tonnes/day (70.33%), followed by pig farming activities 28.13 tonnes/day (11.36%), agriculture-based industries 25.50 tonnes/day (10.30%), manufacturing industries 19.50 tonnes/day (7.88%) and wet markets 0.33 tonnes/day (0.13%) (**Figure 5.3**).



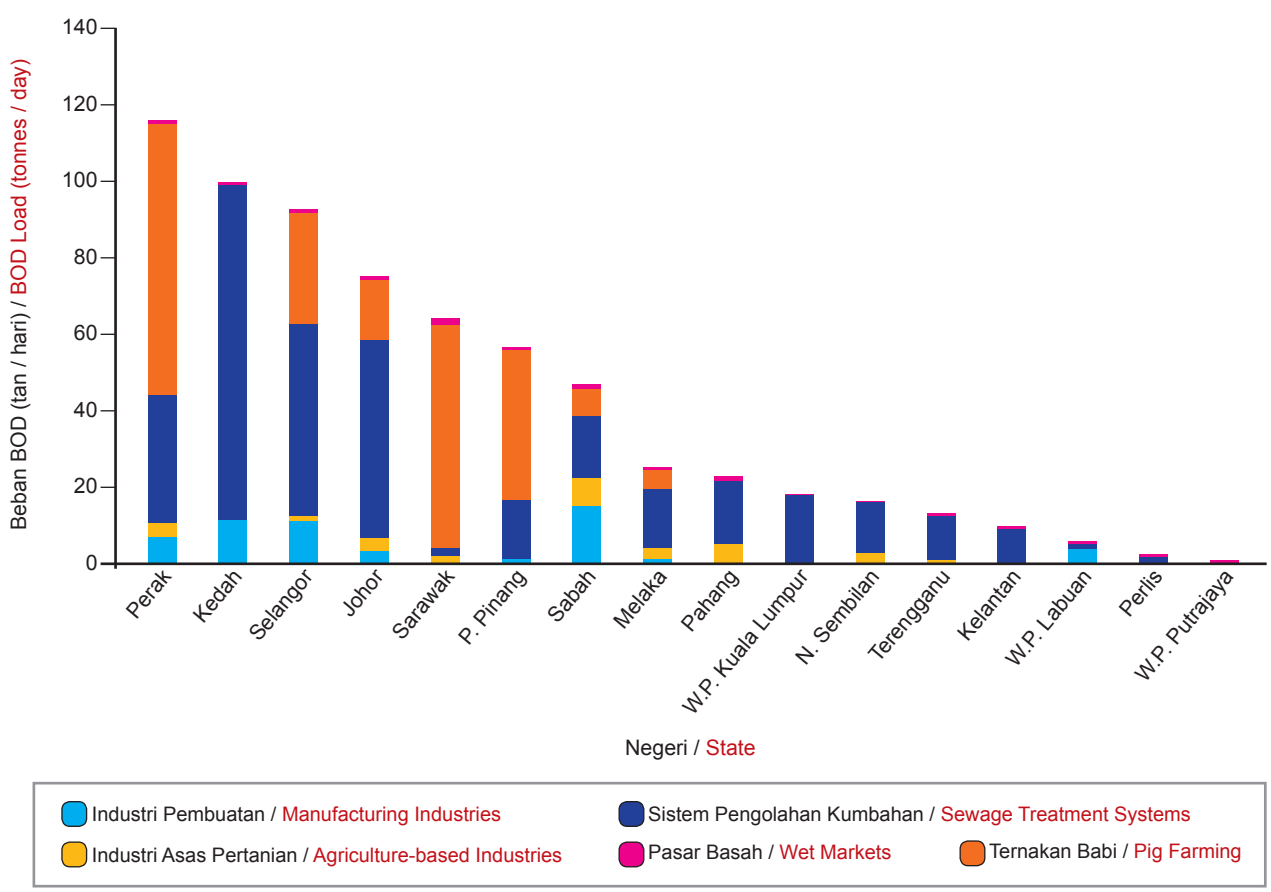
Rajah 5.3: Anggaran Beban AN (Tan/Hari) mengikut Punca Pencemaran Air, 2022
Figure 5.3: Estimation of AN Load (Tonnes/Day) based on Sources of Water Pollution, 2022

Beban Pencemaran Keperluan Oksigen Biokimia mengikut Negeri

Pada tahun 2022, anggaran penghasilan beban BOD di Perak adalah tertinggi iaitu sebanyak 116.23 tan/hari, diikuti Kedah 99.66 tan/ hari, Selangor 92.66 tan/hari, Johor 75.45 tan/hari, Sarawak 64.35 tan/ hari dan Pulau Pinang 56.96 tan/hari. Beban BOD untuk lain-lain negeri termasuk Wilayah Persekutuan Putrajaya dan Labuan adalah kurang daripada 47.08 tan/ hari. Beban pencemar BOD mengikut negeri ditunjukkan pada **Rajah 5.4**.

Biochemical Oxygen Demand Load by States

In the year 2022, the estimation of BOD loads generated in Perak was recorded to be the highest with a value of 116.23 tonnes/day, followed by Kedah 99.66 tonnes/day, Selangor 92.66 tonnes/ day, Johor 75.45 tonnes/day, Sarawak 64.35 tonnes/day and Pulau Pinang 56.96 tonnes/day. BOD load for the rest of the states including Federal Territory of Putrajaya and Labuan was less than 47.08 tonnes/day. BOD pollution load based on states is shown in **Figure 5.4**.



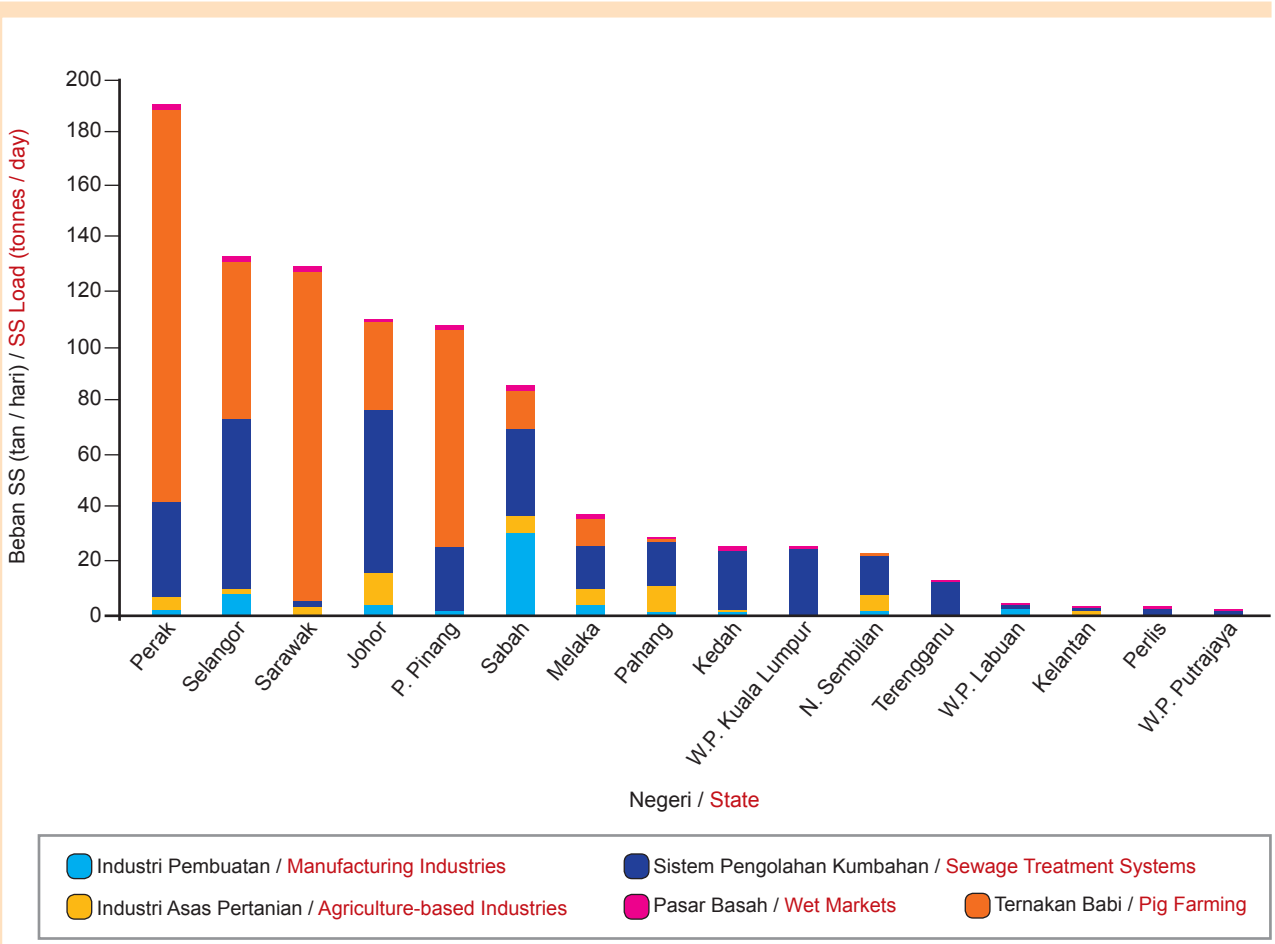
Rajah 5.4: Taburan Anggaran Beban BOD (Tan/Hari) dan Punca Pencemaran Air mengikut Negeri, 2022
Figure 5.4: Distribution of BOD Load (Tonnes/Day) Estimation and Sources of Water Pollution by State, 2022

Beban Pencemaran Pepejal Terampai mengikut Negeri

Anggaran penghasilan beban SS di Negeri Perak adalah tertinggi iaitu sebanyak 189.57 tan/hari, diikuti Selangor 133.59 tan/hari, Sarawak 129.72 tan/hari, Johor 110.04 tan/hari dan Pulau Pinang 107.54 tan/hari. Beban SS untuk lain-lain negeri termasuk Wilayah Persekutuan Putrajaya dan Labuan adalah kurang daripada 85.19 tan/hari. Beban pencemar SS mengikut negeri ditunjukkan pada **Rajah 5.5**.

Suspended Solids Load by State

The estimated SS loads generated in Perak was recorded to be the highest with a value of 189.57 tonnes/day, followed by Selangor 133.59 tonnes/day, Sarawak 129.72 tonnes/day, Johor 110.04 tonnes/day and Pulau Pinang 107.54 tonnes/day. The SS load for the rest of the states including Federal Territory of Putrajaya and Labuan generated less than 85.19 tonnes/day. SS pollution loads according to states is shown in **Figure 5.5**.



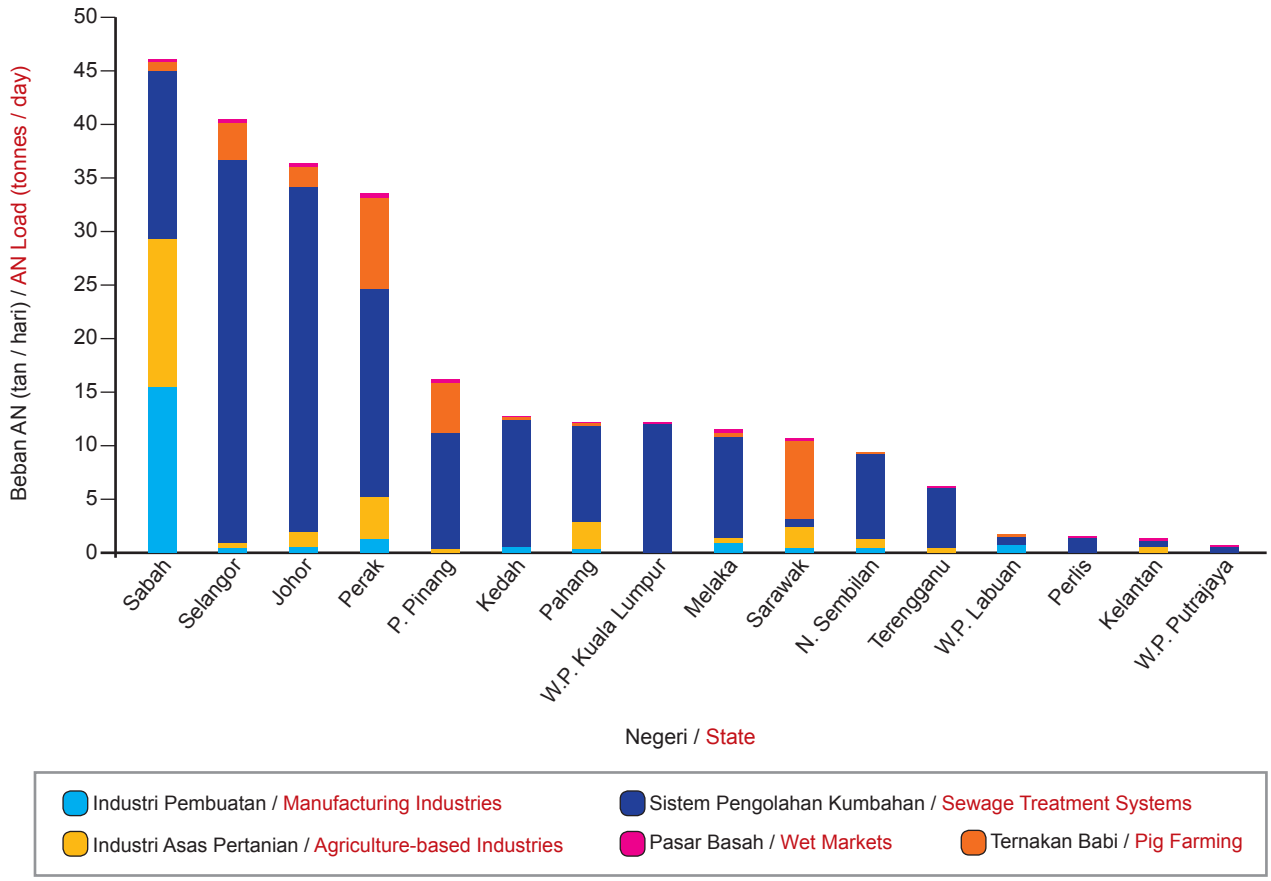
Rajah 5.5: Taburan Anggaran Beban SS (Tan/Hari) dan Punca Pencemaran Air mengikut Negeri, 2022
Figure 5.5: Distribution of SS Load (Tonnes/Day) Estimation and Sources of Water Pollution by State, 2022

Beban Pencemaran Ammoniakal Nitrogen mengikut Negeri

Anggaran penghasilan beban AN di Sabah adalah tertinggi iaitu sebanyak 45.93 tan/hari, diikuti Selangor 40.19 tan/hari, Johor 36.10 tan/hari, Perak 33.36 tan/hari dan Pulau Pinang 15.82 tan/hari. Beban AN untuk lain-lain negeri termasuk Wilayah Persekutuan Putrajaya dan Labuan adalah kurang daripada 12.40 tan/hari. Beban pencemar AN mengikut negeri ditunjukkan pada **Rajah 5.6**.

Ammoniacal Nitrogen Load by States

The estimation of AN loads generated in Sabah was recorded to be the highest with a value of 45.93 tonnes/day, followed by Selangor at 40.19 tonnes/day, Johor at 36.10 tonnes/day, Perak at 33.36 tonnes/day and Pulau Pinang 15.82 tonnes/day. AN loads for the rest of the states including Federal Territory of Putrajaya and Labuan generated less than 12.40 tonnes/day. AN pollution load based on states is shown in **Figure 5.6**.



Rajah 5.6: Taburan Anggaran Beban AN (Tan/Hari) dan Punca Pencemaran Air mengikut Negeri, 2022
Figure 5.6: Distribution of AN (Tonnes/Day) Estimation and Sources of Water Pollution by State, 2022

PUNCA-PUNCA PENCEMARAN UDARA

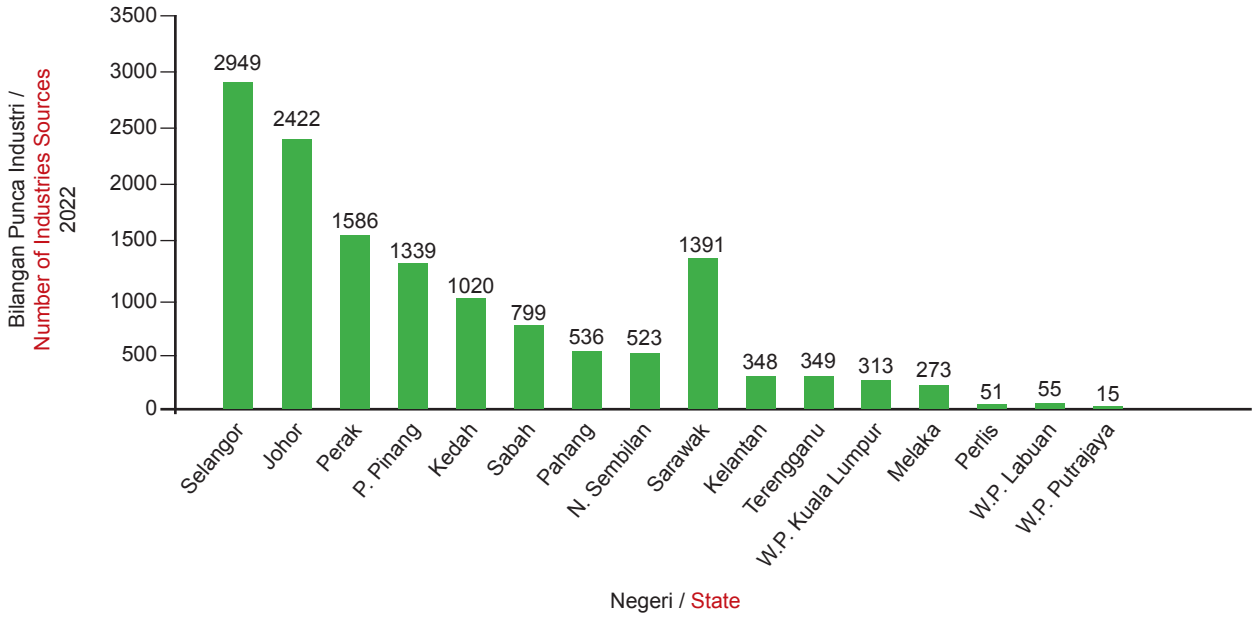
Peningkatan punca industri boleh menyebabkan pencemaran udara yang teruk jika pelepasan pencemar udara dari aktiviti industri tidak dikawal dengan berkesan.

Sehingga Disember 2022, jumlah punca industri yang melepaskan bahan pencemar ke udara adalah sebanyak 13,989. Bilangan punca pencemar yang tertinggi adalah di Selangor (2,949:21.1%) diikuti Johor (2,442:17.5%) dan Perak (1,586:11.3%) seperti ditunjukkan dalam **Rajah 5.7**.

SOURCES OF AIR POLLUTION

The increase in industrial activities could cause severe air pollution if the emission of pollutants from these activities are not effectively controlled.

As at December 2022, a total of 13,989 sources of industrial activities emitted air pollutants. The highest pollution sources were in Selangor (2,949:21.1%) followed by Johor (2,442:17.5%) and Perak (1,586:11.3%) as indicated in **Figure 5.7**.



Rajah 5.7: Punca Pencemaran Udara Industri mengikut Negeri Tahun 2022
Figure 5.7: Industrial Air Pollution Sources by State 2022

Kenderaan Bermotor

Kenderaan bermotor adalah salah satu faktor penyebab pencemaran udara. Masyarakat moden amat bergantung kepada pengangkutan bermotor dalam menjalankan aktiviti harian. Setiap pergerakan kenderaan motor akan menyebabkan pembakaran bahan api fosil untuk pergerakan yang menghasilkan asap yang dapat mencemarkan udara. Semakin tinggi kenderaan berdaftar yang digunakan dalam Malaysia bermaksud potensi pencemaran ke udara juga semakin tinggi.

Motorised Vehicles

Motorised vehicles are one of the factors causing air pollution. Increasingly, society is getting highly dependent on motorised transportation in their daily activities. Every movement of motorised vehicles causes burning of fossil fuel that produces smoke and thereby pollutes the air. The greater the number of registered vehicles used in Malaysia, the higher the severity of air pollution.

Pada tahun 2022, terdapat peningkatan bagi jumlah terkumpul keseluruhan kenderaan bermotor yang berdaftar berbanding tahun sebelumnya. Jumlah terkumpul keseluruhan kenderaan bermotor berdaftar bagi tahun 2022 adalah sebanyak 34,206,872 sementara tahun 2021 adalah sebanyak 32,763,382.

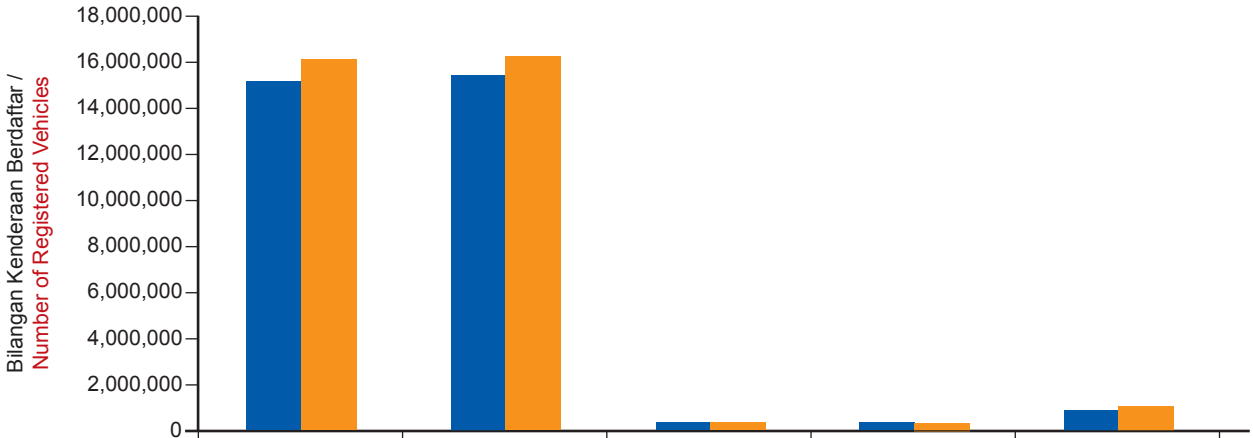
Bilangan motosikal, motokar termasuk van dan bas didapati merekodkan pertambahan iaitu masing-masing sebanyak 4.50%, 3.98% dan 1.76%. Sementara Itu bilangan kereta sewa / pandu sendiri serta kenderaan barangan termasuk lori turut menunjukkan peningkatan iaitu sebanyak 4.33% dan 9.15%. Walau bagaimanapun, bilangan teksi mencatatkan pengurangan iaitu sebanyak 3.54% berbanding dari tahun sebelumnya. Bilangan terkumpul kenderaan bermotor yang berdaftar yang direkodkan oleh Jabatan Pengangkutan Jalan pada tahun 2021 dan 2022 adalah seperti yang ditunjukkan dalam **Rajah 5.8**.

Sementara itu, jumlah kenderaan berdaftar yang sedang digunakan (aktif) bertambah sebanyak 28.18% berbanding dengan tahun 2021 di mana jumlah kenderaan berdaftar aktif yang dilaporkan pada tahun 2022 adalah sebanyak 21,488,340 sementara tahun sebelumnya adalah sebanyak 16,764,491. Jumlah peningkatan kenderaan aktif ini adalah didorong oleh aktiviti ekonomi dan sosial yang telah dibuka semula sepenuhnya. Peningkatan bilangan kenderaan aktif ini merangkumi semua kategori kenderaan yang mana bilangan kereta persendirian meningkat sebanyak 17.48%. Teksi meningkat sebanyak 20.70%, bas mencatatkan peningkatan tertinggi iaitu sebanyak 65.66%, kenderaan barangan menunjukkan peratusan peningkatan dari tahun sebelumnya iaitu sebanyak 33.68% dan motosikal juga turut meningkat sebanyak 48.84%. Bilangan kenderaan berdaftar yang sedang digunakan (aktif) adalah seperti ditunjukkan dalam **Rajah 5.9**.

In 2022, there was an increase in the overall cumulative number of registered motorised vehicles. Total cumulative number of registered motorised vehicles for 2022 was 34,206,872 compared to 32,763,382 in 2021.

The number of registered motorcycles, motorcars, as well as vans and buses increased by 4.50%, 3.98% and 1.76% respectively. Rental cars and freight vehicles including lorries increased as well by 4.33% and 9.15% respectively. Meanwhile, taxis decreased by 3.54% compared to 2021. The cumulative number of registered motorised vehicles recorded by the Road Transport Department in 2021 and 2022 is as shown in **Figure 5.8**.

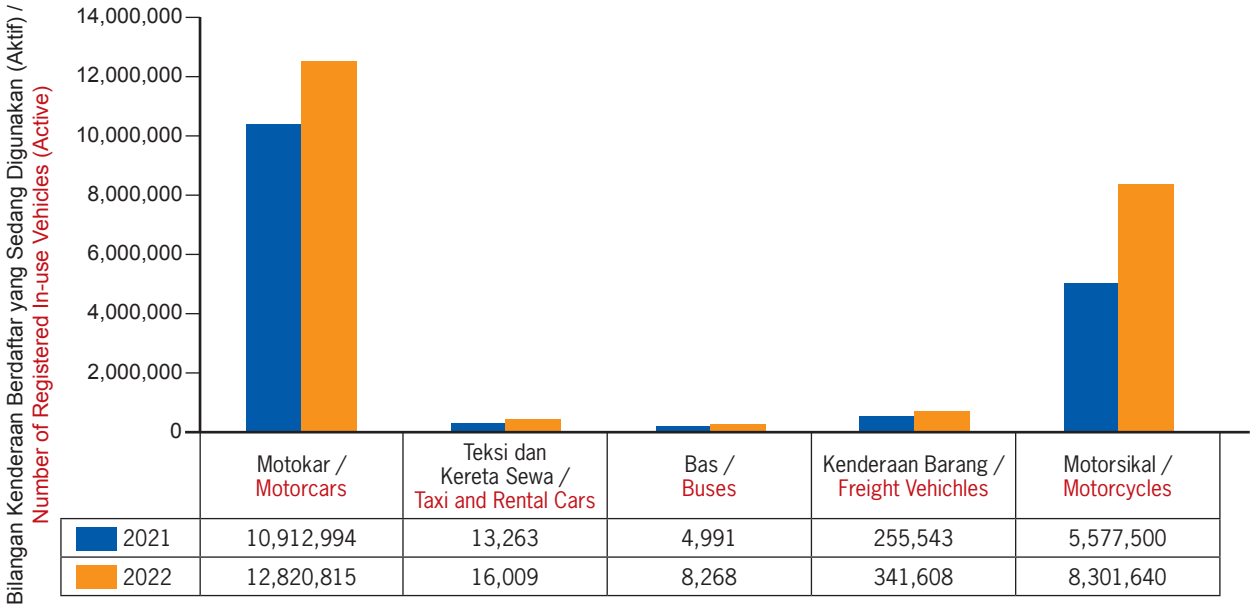
The number of registered in-use (active) vehicles increased by 28.15% in 2022 compared to the year 2021, from 16,764,491 to 21,488,340. The increase in the number of active vehicles is driven by economic and social activities that have been fully reopened by the Malaysia Government. The increase in the number of active vehicles includes all vehicle categories, with the number of private cars increasing by 17.48% and taxis by 20.70%. Buses showed the highest increase of 65.66%, followed by motorcycles with 48.84%, while freight vehicles increased by 33.68% compared to the year before. The number of registered in-use vehicles (active) is shown in **Figure 5.9**.



	Motorsikal / Motorcycles	Motokar / Motorcars	Bas / Buses	Teksi dan Kereta Sewa / Taxi and Rental Cars	Kenderaan Barang / Freight Vehichles
2021	15,506,498	15,806,527	61,700	114,647	1,274,010
2022	16,205,228	16,435,568	62,787	112,737	1,390,552

(Sumber: Jabatan Pengangkutan Jalan, Malaysia 2022)
(Source: Road Transport Department, Malaysia, 2022)

Rajah 5.8: Bilangan Kenderaan Berdaftar Terkumpul, 2021-2022
Figure 5.8: Number of Registered Vehicles, 2021-2022



	Motokar / Motorcars	Teksi dan Kereta Sewa / Taxi and Rental Cars	Bas / Buses	Kenderaan Barang / Freight Vehichles	Motorsikal / Motorcycles
2021	10,912,994	13,263	4,991	255,543	5,577,500
2022	12,820,815	16,009	8,268	341,608	8,301,640

(Sumber: Jabatan Pengangkutan Jalan, Malaysia 2022)
(Source: Road Transport Department, Malaysia, 2022)

Rajah 5.9: Bilangan Kenderaan Berdaftar yang Sedang Digunakan (Aktif), 2021-2022
Figure 5.9: Number of Registered In-Use Vehicles (Active), 2021-2022

BEBAN PENCEMARAN PENCEMAR UDARA

Beban Pencemaran Secara Keseluruhan

Dianggarkan pada tahun 2022, keseluruhan beban pencemaran yang terkumpul bagi pencemar karbon monoksida (CO) adalah 2,070,909 tan metrik, 846,864 tan metrik bagi nitrogen dioksida (NO_2), 217,490 tan metrik bagi sulfur dioksida (SO_2) dan 23,715 tan metrik bagi jirim zarahan (PM). Perbandingan keseluruhan beban pencemaran bagi tahun 2020, 2021 dan 2022 seperti ditunjukkan dalam **Rajah 5.10**.

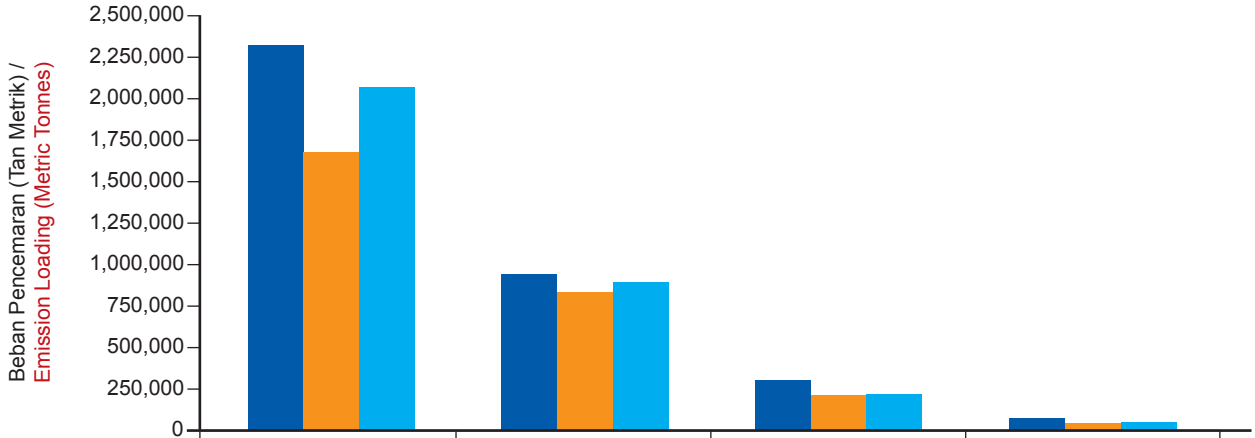
Secara keseluruhannya, beban pencemar bagi parameter CO, NO_2, SO_2 dan PM didapati meningkat pada tahun 2022 berbanding tahun 2021 dimana terdapat penurunan. Peningkatan adalah sebanyak 22.7% bagi beban pencemar CO dan 5.8% bagi beban pencemar NO_2. Manakala, beban pencemar SO_2 menunjukkan peningkatan sebanyak 1.4% dan beban pencemar PM menunjukkan peningkatan sebanyak 4.7% berbanding dengan tahun 2021.

AIR POLLUTION EMISSION LOAD

Overall Emission Load

It was estimated that in 2022 the overall cumulative air pollutant emission load was 2,070,909 metric tonnes of carbon monoxide (CO), 846,864 metric tonnes of nitrogen dioxide (NO_2), 217,490 metric tonnes of sulphur dioxide (SO_2) and 23,715 metric tonnes of particulate matter (PM). A comparison of the combined air pollutants emission load in 2020, 2021 and 2022 is shown in **Figure 5.10**.

Overall, emission load for CO, NO_2, SO_2 and PM increased in year 2022 compared to year 2021 where there was a decrease. The increment of emission load for CO and NO_2 was 22.7% and 5.8% respectively, while the emission load of SO_2 pollutant increased by 1.4% and PM pollutant increased by 4.7% compared to year 2021.



	CO	NO_2	SO_2	PM
2020	2,307,440	935,747	292,651	29,266
2021	1,687,860	800,177	214,392	22,649
2022	2,070,909	846,864	217,490	23,715

(Sumber: *National Energy Balance* 2019)
(Source: National Energy Balance 2019)

Rajah 5.10: Beban Pencemaran Bahan Pencemar Udara dari Semua Punca, 2020-2022
Figure 5.10: Air Pollutant Emission Load from All Sources, 2020-2022

Punca Beban Pencemaran

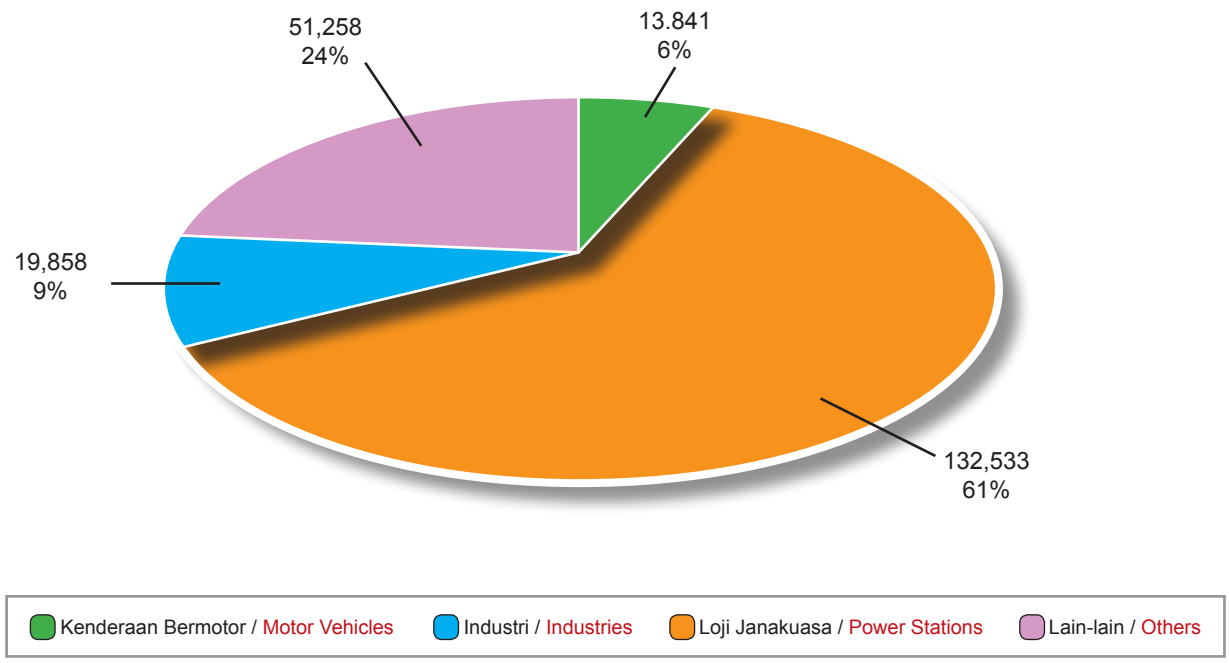
Loji janakuasa merupakan penyumbang utama kepada beban pencemar SO_2 (61%), diikuti dengan lain-lain kategori (24%), industri (9%) dan kenderaan bermotor (6%) (**Rajah 5.11**). Bagi beban pencemar PM pula, penyumbang terbesar adalah daripada loji janakuasa (36%), industri (33%), diikuti kenderaan bermotor (16%) dan lain-lain kategori (15%) (**Rajah 5.12**).

Penyumbang terbesar bagi NO_2 adalah daripada loji janakuasa (67%) diikuti kenderaan bermotor (25%), industri (7%) dan lain-lain kategori (1%) (**Rajah 5.13**). Walau bagaimanapun, kenderaan bermotor masih merupakan penyumbang terbesar kepada CO (96.4%) (**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 2021 dan 2022 ditunjukkan dalam **Rajah 5.15**.

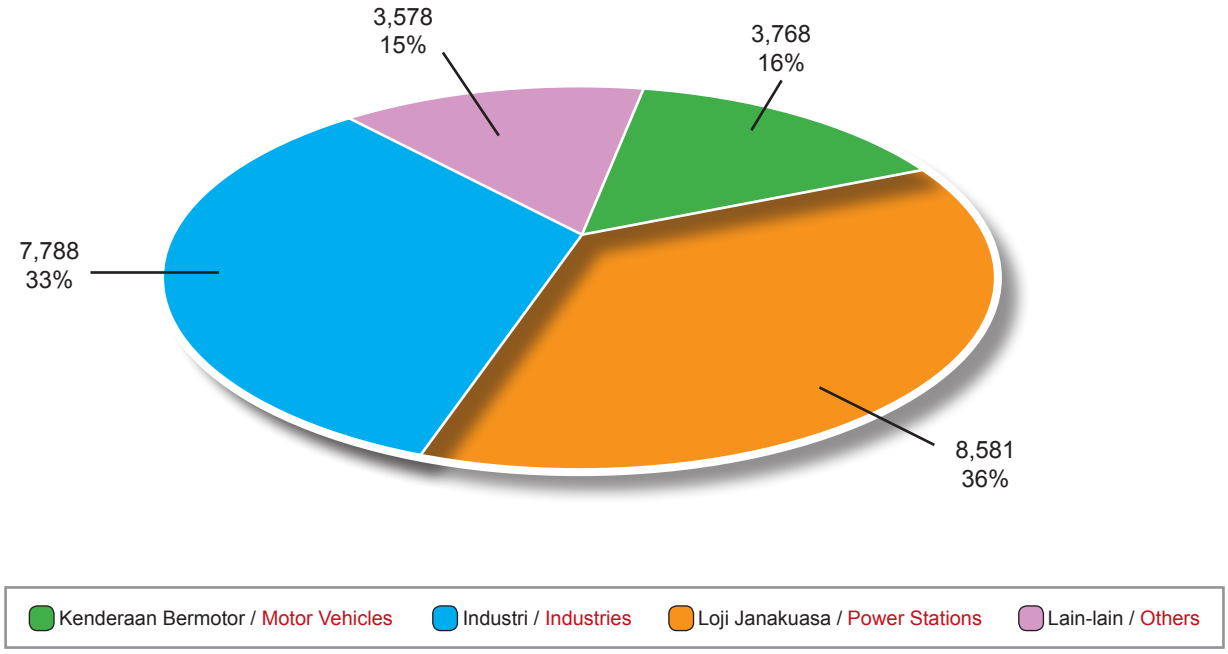
Emission Load by Sources

Power plants contributed the highest SO_2 emission load (61%), followed by other categories (24%), industries (9%) and motor vehicles (6%) (**Figure 5.11**). As for PM, the highest contributors were power plants (36%) followed by industries (33%), motor vehicles (16%) and others (15%) (**Figure 5.12**).

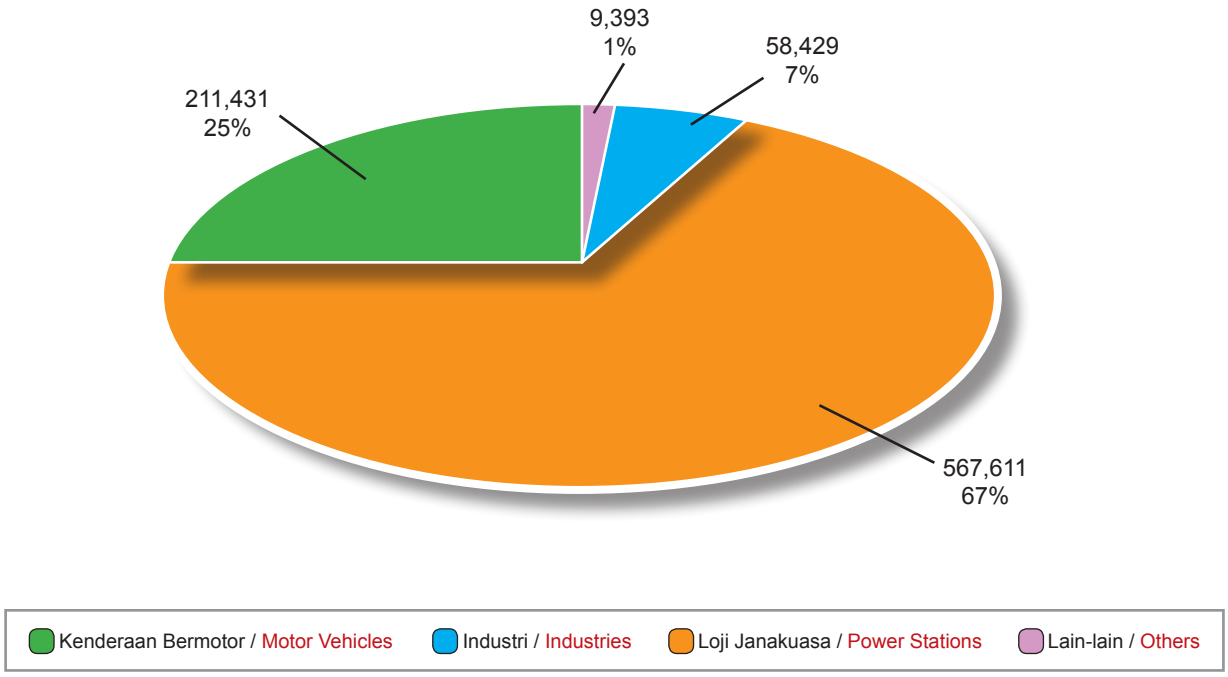
The highest contributors of NO_2 were power plants (67%) followed by motor vehicles (25%), industries (7%), and others (1%) (**Figure 5.13**). However, motor vehicles remained the highest contributor of CO (96.4%) (**Figure 5.14**). 'Others' in the figures represent air pollutant emission from residential, commercial and non-energy use sources. The estimated annual air pollutant emission loads of HC, CO, PM, NO_2 and SO_2 from motor vehicles for 2021 and 2022 are shown in **Figure 5.15**.



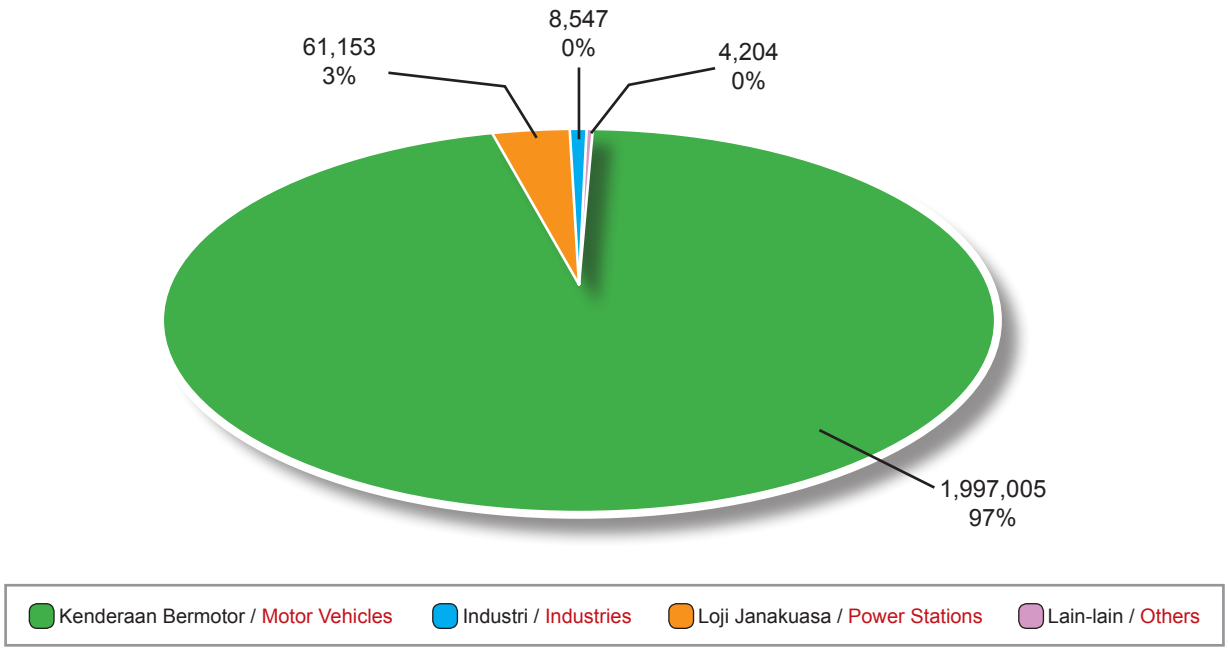
Rajah 5.11: Punca Beban Pencemaran SO_2 (Tan Metrik), 2022
Figure 5.11: SO_2 Emission Load by Sources (Metric Tonnes), 2022



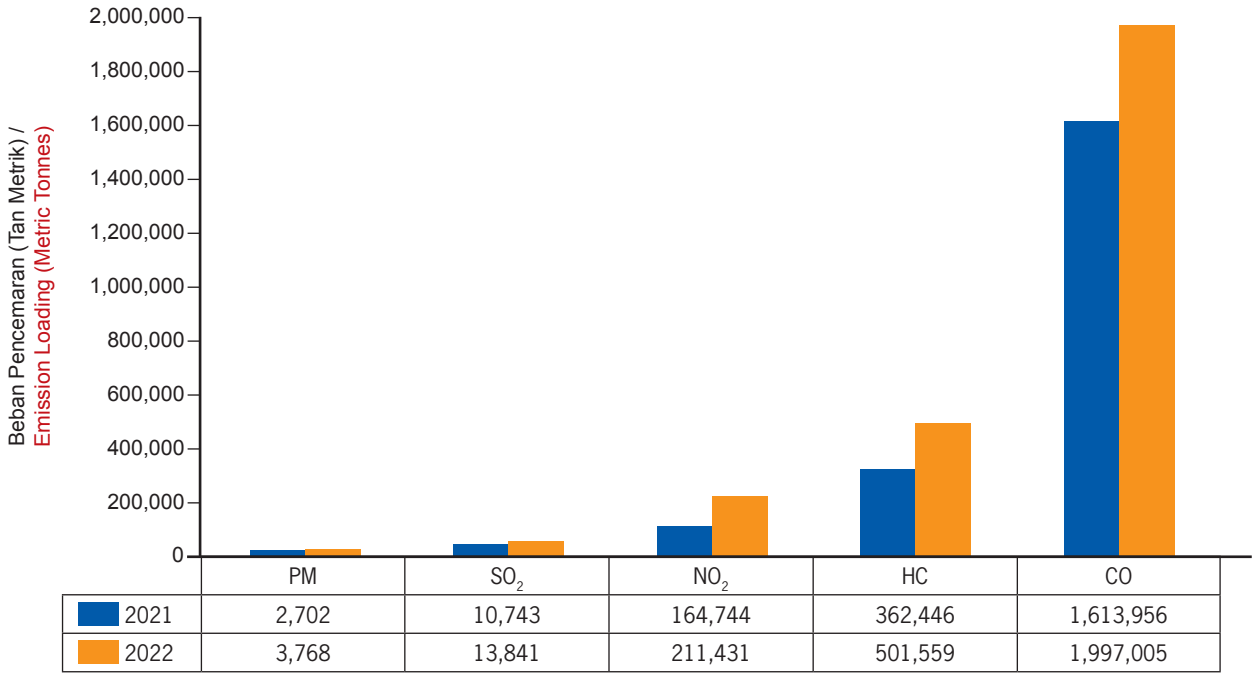
Rajah 5.12: Punca Beban Pencemaran PM (Tan Metrik), 2022
Figure 5.12: PM Emission Load by Sources (Metric Tonnes), 2022



Rajah 5.13: Punca Beban Pencemaran NO_2 (Tan Metrik), 2022
Figure 5.13: NO_2 Emission Load by Sources (Metric Tonnes), 2022



Rajah 5.14: Punca Beban Pencemaran CO (Tan Metrik), 2022
Figure 5.14: CO Emission Load by Sources (Metric Tonnes), 2022



	PM	SO_2	NO_2	HC	CO
2021	2,702	10,743	164,744	362,446	1,613,956
2022	3,768	13,841	211,431	501,559	1,997,005

Rajah 5.15: Beban Pencemar Udara dari Kenderaan Bermotor, 2021-2022 (Tan Metrik), 2022
Figure 5.15: Air Pollutant Emission Load from Motor Vehicles, 2021-2022 (Metric Tonnes), 2022

INVENTORI BUANGAN TERJADUAL

Pada tahun 2022 sebanyak 5,915,073.84 tan metrik buangan terjadual telah dihasilkan. Ini merupakan penurunan sebanyak 21.19% berbanding pada 2021. Kategori utama buangan yang dihasilkan adalah dros/sanga/klinker/abu, enapcemar logam berat dan buangan gipsum (**Jadual 5.1**). Negeri Selangor telah menghasilkan jumlah terbesar buangan terjadual (27%), diikuti oleh Johor (22%), Negeri Sembilan (11%), Perak (10%), Sarawak (9%), Pulau Pinang (5%) manakala 10 negeri yang lain menghasilkan sebanyak (16%) (**Rajah 5.16**). Berdasarkan jumlah buangan terjadual yang dihasilkan mengikut jenis industri, loji janakuasa didapati menghasilkan buangan terjadual yang tertinggi sebanyak 2,025,501.45 tan metrik diikuti pengilangan logam 778,653.17 tan metrik dan elektrik dan elektronik 694,967.89 tan metrik (**Jadual 5.2**). Tren pengurusan buangan terjadual dalam negara adalah seperti di **Rajah 5.17**.

Sebanyak 421,536.62 tan metrik (7.12%) daripada jumlah buangan yang dihasilkan diperoleh kembali di dalam dan luar negara. Ini menunjukkan penurunan sebanyak 17.60% berbanding 511,617.94 tan metrik pada tahun 2021. Daripada jumlah itu, 417,207.62 tan metrik (7.05%) daripada buangan terjadual yang diperoleh kembali di kemudahan pemerolehan kembali luar tapak tempatan manakala 4,329.00 tan metrik (0.07%) telah diberi kebenaran eksport untuk pemerolehan kembali di kemudahan di luar negara.

Sebanyak 271,648.18 tan metrik (4.6%) daripada jumlah buangan terjadual yang dihasilkan, dirawat dan dilupuskan di Premis Yang Ditetapkan iaitu di Kualiti Alam Sdn. Bhd. (189,088.00 tan metrik) dan Trienekens (Sarawak) Sdn. Bhd. (33,428.56 tan metrik). Manakala 49,131.62 tan metrik daripada buangan klinikal telah dibakar dan dilupuskan di kemudahan luar tapak yang dilesenkan (**Jadual 5.3**). Jumlah ini menunjukkan peningkatan sebanyak 5.8% daripada sejumlah 256,653.03 tan metrik buangan berjadual dilupuskan pada tahun 2021. Sebanyak 1,297,809.64 tan metrik (21.94%) daripada buangan terjadual terhasil telah diolah di tapak; manakala 2,828,424.64 tan metrik (47.82%) distor di premis pengeluar buangan (**Jadual 5.3**).

INVENTORY OF SCHEDULED WASTES

In 2022, a total of 5,915,073.84 metric tonnes of scheduled wastes were generated. This represents an overall decrease of 21.19 % as compared to 2021. The main categories of wastes generated were dross/slag/clinker/ash, heavy metal sludge and gypsum (**Table 5.1**). The state of Selangor generated the largest amount of scheduled wastes (27%), followed by Johor (22%), Negeri Sembilan (11%), Perak (10%), Sarawak (9%), Pulau Pinang (5%) while the other 10 states generated the remaining 16% (**Figure 5.16**). Based on the scheduled wastes generated by industry, power plants generated the largest with a total of 2,025,501.45 metric tonnes followed by metal refinery with 778,653.17 metric tonnes and electric and electronic with 694,967.89 metric tonnes (**Table 5.2**). The scheduled wastes management trend in the country is as shown in **Figure 5.17**.

A total of 421,536.62 metric tonnes (7.12%) of scheduled wastes had gone through recovery process both locally and abroad. This showed a decrease of 17.60% as compared to 511,617.94 metric tonnes in 2021. About 417,207.62 metric tonnes (7.05%) of scheduled wastes were recovered at local off-site facilities while 4,329.00 metric tonnes (0.07%) were given consent for recovery abroad.

A total of 271,648.18 metric tonnes (4.6%) of waste were treated and finally disposed at Prescribed Premises at Kualiti Alam Sdn. Bhd. (189,088.00 metric tonnes) and Trienekens (Sarawak) Sdn. Bhd. (33,428.56 metric tonnes), while 49,131.62 metric tonnes of clinical wastes were managed at licensed off-site facilities (**Table 5.3**). The amount showed an increase of 5.8% from a total of 256,653.03 metric tonnes of scheduled waste disposed in 2021. A sum of 1,297,809.64 metric tonnes (21.94%) of scheduled wastes were treated on-site; while 2,828,424.64 metric tonnes (47.82%) were stored on-site at waste generators' premises (**Table 5.3**).

Daripada jumlah buangan terjadual yang dihasilkan pada tahun 2022, 1,095, 654.76 tan metrik (18.52%) telah diberi kelulusan bersyarat di bawah pengurusan khas seperti yang ditetapkan di bawah Peraturan 7, Peraturan-Peraturan Kualiti Alam Sekeliling (Buangan Terjadual), 2005 (**Jadual 5.4**). Jumlah ini merupakan penurunan sebanyak 45.29% berbanding 2,002, 552.33 tan metrik pada tahun 2021. Buangan yang terlibat adalah kebanyakannya abu dari loji jana kuasa arang batu (86.25%), enap cemar daripada kemudahan rawatan air minuman (13.12%), dan lain-lain (0.64%).

Of the total wastes produced in 2022, 1,095, 654.76 metric tonnes (18.52%) were granted conditional approval to be managed under special management as stipulated under Regulation 7, Environmental Quality (Scheduled Wastes) Regulations, 2005 (**Table 5.4**). The amount represented a decrease of 45.29% as compared to 2,002, 552.33 metric tonnes in 2021. These waste streams are mostly ashes from coal-fired power plant (86.25%), sludges from drinking water treatment facilities (13.12%), and others (0.64%).

Jadual 5.1: Jumlah Buangan Terjadual yang Dihasilkan Mengikut Kod Kategori Buangan Terjadual, 2022
Table 5.1: Quantity of Scheduled Wastes Generated by Scheduled Waste Category Code, 2022

BIL. / NO.	NAMA BUANGAN / NAME OF WASTE	KOD KATEGORI BUANGAN / WASTE CATEGORY CODE	KUANTITI BUANGAN / QUANTITY OF WASTE	
			(MT / TAHUN) / (MT / YEAR)	PERATUSAN (%) / PERCENTAGE (%)
1	Debu, sanga, dros atau abu yang mengandungi arsenic, raksa, plumbum, kadmium, kromium, nikel, kuprum, vanadium, berilium, antimony, tellurium, talium, atau selenium, tidak termasuk sanga daripada kilang besi dan keluli / Dust, slag, dross or ash containing arsenic, mercury, lead, cadmium, chromium, nickel, copper, vanadium, beryllium, antimony, tellurium, thallium or selenium excluding slag from iron and steel factory	SW 104	2,780,750.61	47.01
2	Enap cemar yang mengandungi satu atau beberapa logam termasuklah kromium, kuprum, nikel, zink, plumbum, kadmium, aluminium, timah vanadium dan berilium / Sludges containing one or several metals including chromium, copper, nickel, zinc, lead, cadmium, aluminium, tin, vanadium and beryllium	SW 204	549,179.77	9.28
3	Buangan gypsum yang terhasil daripada proses industri kimia atau loji janakuasa / Waste gypsum arising from chemical industry or power plant	SW 205	441,008.40	7.46
4	Buangan daripada pemasangan elektrikal dan elektronik yang mengandungi komponen seperti akumulator, suis raksa, kaca daripada tiub sinar katod dan kaca teraktif atau kapasitor bifenil terpoliklorin yang lain, atau yang dicemari dengan kadmium, raksa, plumbum, nikel, kromium, kuprum, litium, perak, mangan, atau bifenil terpoliklorin / Waste from electrical and electronic assemblies containing components such as accumulators, mercury-switches, glass from cathode-ray tubes and other activated glass or polychlorinated biphenyl-capacitors, or contaminated with cadmium, mercury, lead, nickel, chromium, copper, lithium, silver, manganese or polychlorinated biphenyl	SW 110	286,205.84	4.84
5	Buangan atau enap cemar getah atau lateks yang mengandungi pelarut organic atau logam berat / Rubber or latex wastes or sludge containing organic solvents or heavy metals	SW 321	210,857.10	3.56
6	Campuran buangan terjadual dan buangan tidak terjadual / A mixture of scheduled and non-scheduled wastes	SW 422	195,006.96	3.30
7	Minyak pelincir terpakai / Spent lubricating oil	SW 305	176,910.62	2.99
8	Emulsi minyak mineral-air terpakai / Spent mineral oil-water emulsion	SW 307	171,056.62	2.89
9	Dadah terbuang yang mengandungi bahan psikotrofik atau yang mengandungi bahan yang bertoksik, berbahaya, karsinogenik, mutagenik atau teratogenik / Discarded drugs containing psychotropic substances or containing substances that are toxic, harmful, carcinogenic, mutagenic or teratogenic	SW 403	113,578.01	1.92
10	Buangan pelarut organik bukan terhalogen / Waste of non-halogenated organic solvents	SW 322	112,332.01	1.90

Jadual 5.1: Jumlah Buangan Terjadual yang Dihasilkan Mengikut Kod Kategori Buangan Terjadual, 2022
Table 5.1: Quantity of Scheduled Wastes Generated by Scheduled Waste Category Code, 2022

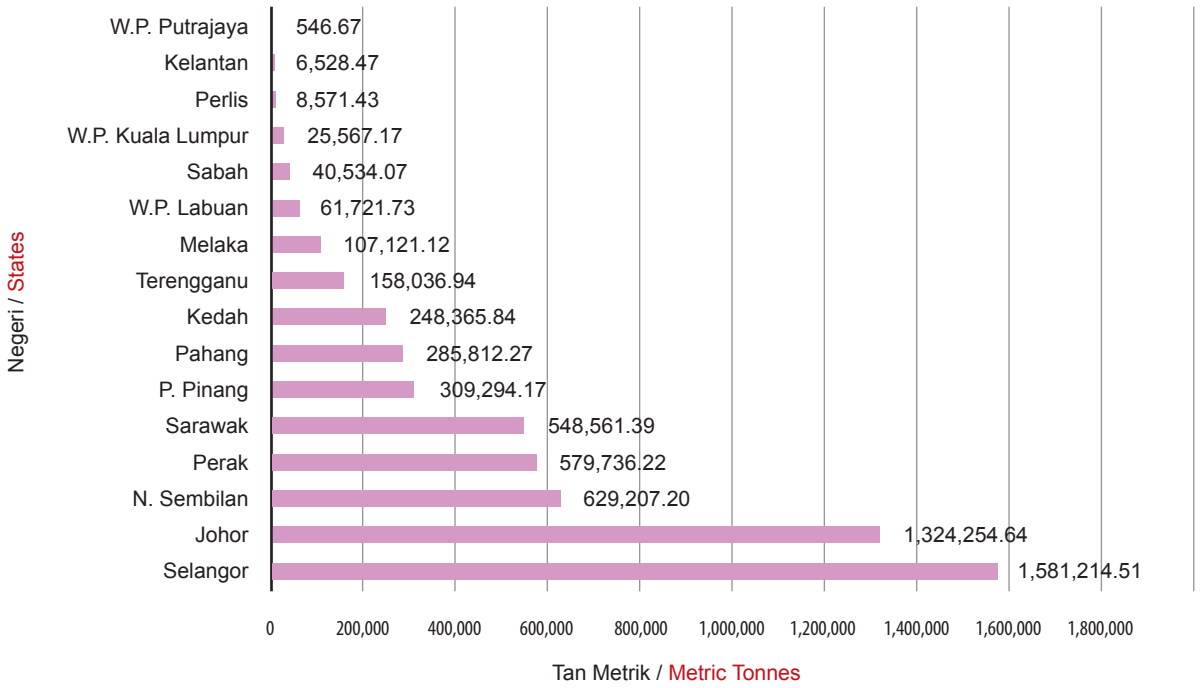
BIL. / NO.	NAMA BUANGAN / NAME OF WASTE	KOD KATEGORI BUANGAN / WASTE CATEGORY CODE	KUANTITI BUANGAN / QUANTITY OF WASTE	
			(MT / TAHUN) / (MT / YEAR)	PERATUSAN (%) / PERCENTAGE (%)
11	Bekas, beg atau kelengkapan yang dilupuskan yang dicemari dengan bahan kimia, racun mahkluk perosak, minyak mineral atau buangan terjadual / Disposed containers, bags or equipment contaminated with chemicals, pesticides, mineral oil or scheduled wastes	SW 409	110,984.24	1.88
12	Enap cemar yang mengandungi fluorida / Sludges containing fluoride	SW 207	97,441.27	1.65
13	Asid tidak organik terpakai / Spent inorganic acids	SW 206	76,253.92	1.29
14	Buangan minyak atau enap cemar berminyak / Waste oil or oily sludge	SW 311	63,716.61	1.08
15	Enap cemar mineral termasuklah enap cemar kalsium hidroksida, enap cemar pemfosfatan, enap cemar kalsium sulfit dan enap cemar karbonat / Mineral sludges including calcium hydroxide sludges, phosphating sludges, calcium sulphite sludges and carbonates sludges	SW 427	62,728.56	1.06
16	Kain buruk, plastik, kertas atau turas yang dicemari dengan buangan terjadual / Rags, plastics, papers or filters contaminated with scheduled wastes	SW 410	62,310.77	1.05
17	Buangan pelekat atau glu yang mengandungi pelarut organic tidak termasuk bahan polimer pepejal / Adhesive or glue waste containing organic solvents excluding solid polymeric materials	SW 303	53,760.99	0.91
18	Buangan patogenik, buangan klinikal atau bahan yang dikuarantinkan / Pathogenic wastes, clinical wastes or quarantined materials	SW 404	49,131.62	0.83
19	Apa-apa sisa daripada pengolahan atau pemerolehan kembali buangan terjadual / Any residues from treatment or recovery of scheduled wastes	SW 501	36,096.37	0.61
20	Buangan dakwat, cat, pigmen, lakuer, perwarna atau varnis / Waste of inks, paints, pigments, lacquer, dye or varnish	SW 417	35,899.13	0.61
21	Karbon teraktif yang terpakai tidak termasuk karbon daripada pengolahan air boleh diminum dan proses industri makanan dan penghasilan vitamin / Spent activated carbon excluding carbon from the treatment of potable water and processes of the food industry and vitamin production	SW 411	25,874.85	0.44
22	Buangan resin tidak matang yang mengandungi pelarut organic atau logam berat termasuklah resin epoksi dan resin fenolik / Uncured resin waste containing organic solvents or heavy metals including epoxy resin and phenolic resin	SW 325	22,373.39	0.38
23	Larutan pemprosesan terpakai, bahan kimia fotografi terbuang atau buangan fotografi terbuang / Spent processing solution, discarded photographic chemicals or discarded photographic wastes	SW 423	21,068.81	0.36
24	Enap cemar dakwat, cat pigmen, lakuer, perwarna atau varnis / Sludges of inks, paints, pigments, lacquer, dye or varnish	SW 416	19,658.67	0.33
25	Buangan mangkin / Waste catalysts	SW 202	18,779.80	0.32
26	Campuran minyak-air seperti air ballast / Oil-water mixture such as ballast water	SW 309	16,952.62	0.29
27	Bahan kimia yang terbuang atau tidak mengikut spesifikasi / Chemicals that are discarded or off-specification	SW 429	16,528.46	0.28
28	Produk dakwat, cat, pigmen, lakuer, perwarna atau varnish yang terbuang atau yang tidak mengikut spesifikasi yang mengandungi pelarut organic / Discarded or off-specification inks, paints, pigments, lacquer, dye or varnish products containing organic solvent	SW 418	10,523.83	0.18
29	Alkali terpakai yang mengandungi logam berat / Spent alkalis containing heavy metals	SW 401	9,497.01	0.16
30	Minyak hidroulik terpakai / Spent hydraulic oil	SW 306	8,611.06	0.15
31	Buangan pelarut organik terhalogen / Waste of halogenated organic solvents	SW 323	6,384.81	0.11
32	Campuran buangan terjadual / A mixture of scheduled wastes	SW 421	6,228.84	0.11
33	Buangan cecair terma (pemindahan haba) seperti glikol etilena / Waste of thermal fluids (heat transfer) such as ethylene glycol	SW 327	5,738.18	0.10
34	Tanah, puing, atau bahan tercemar yang terhasil daripada pembersihan tumpahan bahan kimia, minyak mineral, atau buangan terjadual / Contaminated soil, debris or matter resulting from cleaning-up of a spill of chemical, mineral oil or scheduled wastes	SW 408	5,284.59	0.09

Jadual 5.1: Jumlah Buangan Terjadual yang Dihasilkan Mengikut Kod Kategori Buangan Terjadual, 2022
Table 5.1: Quantity of Scheduled Wastes Generated by Scheduled Waste Category Code, 2022

BIL. / NO.	NAMA BUANGAN / NAME OF WASTE	KOD KATEGORI BUANGAN / WASTE CATEGORY CODE	KUANTITI BUANGAN / QUANTITY OF WASTE	
			(MT / TAHUN) / (MT / YEAR)	PERATUSAN (%) / PERCENTAGE (%)
35	Buangan bateri asid plumbum dalam bentuk sempurna atau hancur / Waste of lead acid batteries in whole or crushed form	SW 102	5,275.11	0.09
36	Minyak atau enap cemar daripada operasi penyenggaraan loji penapisan minyak / Oil or sludge from oil refinery plant maintenance operation	SW 314	4,005.99	0.07
37	Alkali terpakai dengan pH yang lebih daripada atau sama dengan 11.5 yang mengakis atau berbahaya / Spent alkalis with pH more or equal to 11.5 which are corrosive or hazardous	SW 402	3,332.82	0.06
38	Klinker, sangan, abu, dari penunu buangan terjadual / Clinker, slag and ashes from scheduled wastes incinerator	SW 406	3,282.45	0.06
39	Buangan bateri yang mengandungi kadmium dan nikel atau raksa atau litium / Waste of batteries containing cadmium and nickel or mercury or lithium	SW 103	3,280.33	0.06
40	Sisa berminyak dari bengkel automotif, stesen servis minyak atau perangkap gris / Oily residue from automotive workshop, service station, oil or grease interceptor	SW 312	2,578.59	0.04
41	Asid organic terpakai dengan pH yang kurang daripada atau sama dengan 2 yang mengakis atau berbahaya / Spent organic acids with pH less or equal to 2 which are corrosive or hazardous	SW 301	2,475.12	0.04
42	Larutan alkali berair terpakai yang mengandungi sianida / Spent aqueous alkaline solution containing cyanide	SW 414	1,719.55	0.03
43	Buangan yang mengandungi formadehid / Waste containing formaldehyde	SW 320	1,681.03	0.03
44	Buangan yang mengandungi raksa atau sebatiannya / Waste containing mercury or its compound	SW 109	1,411.70	0.02
45	Enap cemar dari tangki penyimpanan minyak mineral / Sludge from mineral oil storage tank	SW 310	1,380.70	0.02
46	Enap cemar kapal tangki minyak / Oil tanker sludges	SW 308	1,070.14	0.02
47	Buangan asbestos dalam bentuk enap cemar, debu atau gentian / Asbestos wastes in sludges, dust or fibre forms	SW 201	959.24	0.02
48	Buangan yang terhasil daripada peyedian dan pengeluaran barangan farmaseutikal / Waste arising from the preparation and production of pharmaceutical product	SW 405	818.11	0.01
49	Buangan terjadual tidak boleh bergerak termasuklah enap cemar yang ditetapkan secara kimia, dikapsulkan, dipejalkan atau distabilkan / Immobilized scheduled wastes including chemically fixed, encapsulated, solidified or stabilized sludges	SW 203	639.30	0.01
50	Tar atau sisa bertar dari loji penapisan minyak atau loji petrokimia / Tar or tarry residues from oil refinery or petrochemical plant	SW 315	608.92	0.01
51	Bahan kimia makmal yang usang / Obsolete laboratory chemicals	SW 430	424.06	0.01
52	Buangan sisa penyulingan tidak berair terhalogen atau bukan terhalogen yang terhasil daripada proses permeolehan kembali pelarut organik / Waste of halogenated or unhalogenated non-aqueous distillation residues arising from organic solvents recovery process	SW 324	323.21	0.01
53	Tanah yang dicemari minyak daripada penapisan semula minyak pelincir terpakai / Oil contaminated earth from re-refining of used lubricating oil	SW 313	277.65	0.00
54	Buangan fluks yang mengandungi campuran asid organic, pelarut atau sebatian ammonium klorida / Flux waste containing mixture of organic acids, solvents or compounds of ammonium chloride	SW 302	204.17	0.00
55	Buangan daripada pengeluaran, formulasi, perdagangan atau penggunaan racun mahkluk perosak, racun herba atau biosid / Wastes from the production, formulation, trade or use of pesticides, herbicides or biocides	SW 425	164.67	0.00
56	Sisa daripada pemerolehan kembali likuor penjerukan asid / Residues from recovery of acid pickling liquor	SW 106	126.58	0.00

Jadual 5.1: Jumlah Buangan Terjadual yang Dihasilkan Mengikut Kod Kategori Buangan Terjadual, 2022
Table 5.1: Quantity of Scheduled Wastes Generated by Scheduled Waste Category Code, 2022

BIL. / NO.	NAMA BUANGAN / NAME OF WASTE	KOD KATEGORI BUANGAN / WASTE CATEGORY CODE	KUANTITI BUANGAN / QUANTITY OF WASTE	
			(MT / TAHUN) / (MT / YEAR)	PERATUSAN (%) / PERCENTAGE (%)
57	Produk yang tidak mengikut spesifikasi daripada pengeluaran, formulasi, perdagangan, atau penggunaan racun mahkluk perosak, racun herba, atau biosid / Off-specification products from the production, formulation, trade or use of pesticides, herbicides or biocides	SW 426	67.19	0.00
58	Diisosianat terpakai dan sisa sebatian isosianat tidak termasuk bahan berpolimer pepejal daripada proses pengilangan busa / Spent di-isocyanates and residues of isocyanate compounds excluding solid polymeric material from foam manufacturing process	SW 419	56.34	0.00
59	Enap cemar asid / Acid sludge	SW 316	51.53	0.00
60	Buangan fenol atau sebatian fenol termasuklah klorofenol dalam bentuk cecair atau enapcemar / Waste of phenols or phenol compounds including chlorophenol in the form of liquids or sludges	SW 319	39.96	0.00
61	Buangan yang mengandungi arsenic atau sebatiannya / Waste containing arsenic or its compound	SW 101	34.81	0.00
62	Buangan yang mengandungi, yang terdiri daripada, atau yang dicemari dengan peroksida / Waste containing, consisting of or contaminated with, peroxides	SW 432	22.41	0.00
63	Buangan daripada pengilangan atau pempresesan atau penggunaan bahan letupan / Waste from manufacturing or processing or use of explosives	SW 431	21.78	0.00
64	Agen pengoksidaan terpakai / Spent oxidizing agent	SW 424	17.53	0.00
65	Enap cemar yang mengandungi sianida / Sludges containing cyanide	SW 412	4.07	0.00
66	Sanga daripada pemprosesan kuprum bagi pemprosesan lanjut atau penapisan yang mengandungi arsenic, plumbum, atau kadmium / Slags from copper processing for further processing or refining containing arsenic, lead or cadmium	SW 107	1.26	0.00
67	Sisa larutan resap daripada pemprosesan zink dalam bentuk debu dan enap cemar / Leaching residues from zinc processing in dust and sludges form	SW 108	1.15	0.00
68	Garam terpakai yang mengandungi sianida / Spent salt containing cyanide	SW 413	0.96	0.00
69	Buangan sebatian fosforus organik / Waste of organic phosphorus compound	SW 326	0.89	0.00
70	Sebatian organologam terpakai termasuklah plumbum tetraetil, plumbum tetrametil dan sebatian organotimah / Spent organometallic compounds including tetraethyl lead, tetramethyl lead and organotin compounds	SW 317	0.10	0.00
71	Buangan yang mengandungi dioksin dan furan / Waste containing dioxins or furans	SW 407	0.09	0.00
72	Enap cemar galvani / Galvanic sludges	SW 105	-	0.00
73	Kek tekan daripada prapengolahan lai sabun gliserol / Press cake from pretreatment of glycerol soap lye	SW 304	-	0.00
74	Buangan, bahan dan artikel yang mengandungi atau yang dicemari dengan bifenil terpoliklorin (BFT) atau trifenil terpoliklorin (TFT) / Waste, substances and articles containing or contaminated with polychlorinated biphenyls (PCB) or polychlorinated triphenyls (PCT)	SW 318	-	0.00
75	Minyak pelindapan terpakai yang mengandungi sianida / Spent quenching oils containing cyanides	SW 415	-	0.00
76	Larutan resap dari tapak pelupusan buangan terjadual / Leachate from scheduled waste landfill	SW 420	-	0.00
77	Buangan daripada operasi pengawetan kayu yang menggunakan garam tidak organik yang mengandungi kuprum, kromium, atau arsenik daripada sebatian fluoride atau yang menggunakan sebatian yang mengandungi fenol berklorin atau kreosot / Wastes from wood preserving operation using inorganic salts containing copper, chromium or arsenic of fluoride compounds or using compound containing chlorinated phenol or creosote	SW 428	-	0.00
JUMLAH / TOTAL			**5,915,073.84**	**100**



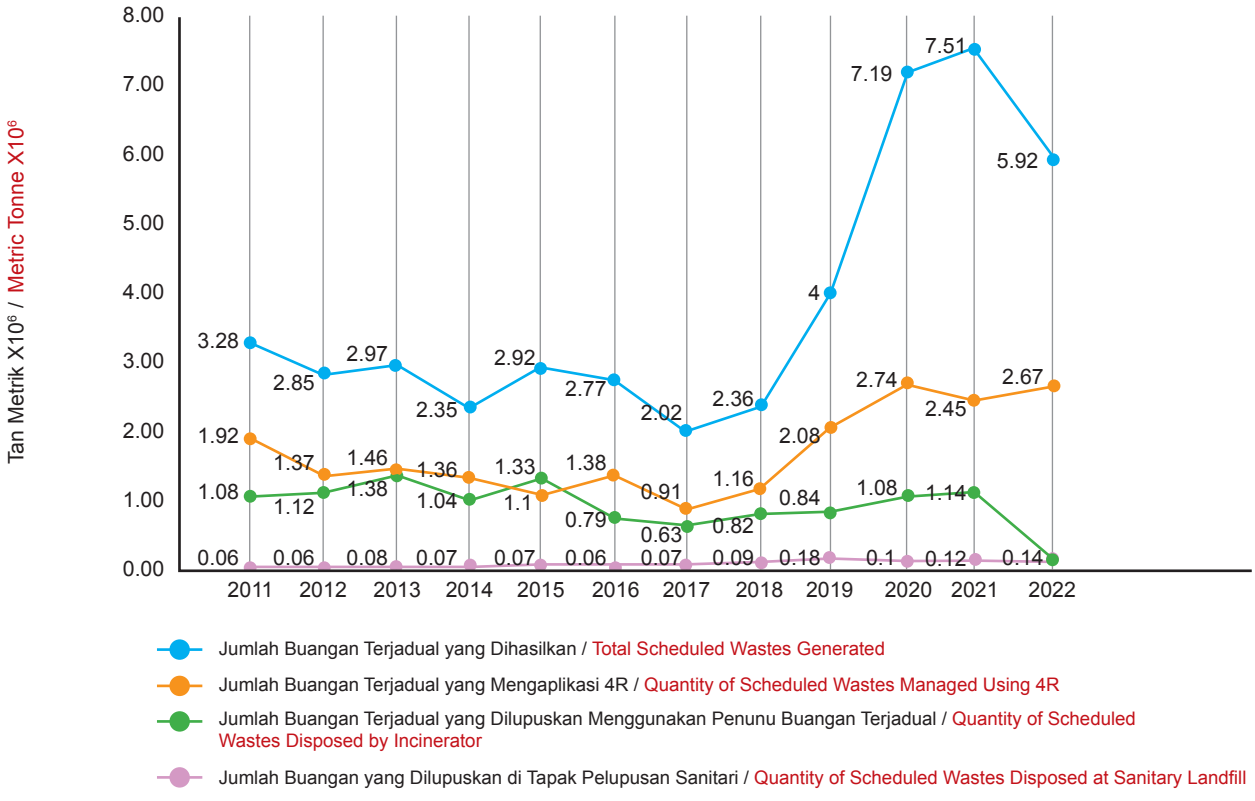
Rajah 5.16: Penghasilan Buangan Terjadual Mengikut Negeri 2022
Figure 5.16: Distribution of Scheduled Waste Generated by State 2022

Jadual 5.2: Jumlah Buangan Terjadual yang Dihasilkan Mengikut Jenis Industri, 2022
Table 5.2: Quantity of Scheduled Wastes Generated by Industry, 2022

BIL. / NO.	JENIS INDUSTRI / TYPE OF INDUSTRY	MT / TAHUN MT / YEAR	PERATUSAN (%) / PERCENTAGE (%)
1	Loji Janakuasa / Power Plant	2,025,501.45	34.24%
2	Pengilangan Logam / Metal Refineries	778,653.17	13.16%
3	Elektrik dan Elektronik / Electric and Electronic	694,967.89	11.75%
4	Industri Kimia / Chemical Industries	559,783.95	9.46%
5	Premis Buangan Terjadual (PYDT) / Scheduled Waste Treatment and Disposal Facilities	394,926.41	6.68%
6	Berasaskan Getah / Rubber Based	229,888.29	3.89%
7	Kenderaan / Vehicles	201,561.87	3.41%
8	Loji Rawatan Air / Water Treatment Plants	182,986.87	3.09%
9	Lain-lain / Others	119,565.79	2.02%
10	Bengkel / Workshops	116,659.02	1.97%
11	Penapisan Petroleum / Petroleum Refineries	104,339.00	1.76%
12	Jentera / Machinery	77,756.87	1.31%
13	Perubatan / Health Care Services	72,867.80	1.23%

Jadual 5.2: Jumlah Buangan Terjadual yang Dihasilkan Mengikut Jenis Industri, 2022
Table 5.2: Quantity of Scheduled Wastes Generated by Industry, 2022

BIL. / NO.	JENIS INDUSTRI / TYPE OF INDUSTRY	MT / TAHUN MT / YEAR	PERATUSAN (%) / PERCENTAGE (%)
14	Penyudahan Logam dan Sadur Elektrik / Metal Finishing and Electroplating	69,058.20	1.17%
15	Gudang / Warehouses	52,876.24	0.89%
16	Kertas / Paper	39,031.17	0.66%
17	Galian Bukan Logam / Non Metal Mines	36,007.87	0.61%
18	Percetakan / Printing	30,681.90	0.52%
19	Plastik / Plastic	24,086.51	0.41%
20	Fabrikasi Logam / Metal Fabrication	22,509.07	0.38%
21	Penapisan Minyak Makan / Edible Oil Refineries	18,682.74	0.32%
22	Perlombongan / Mining	11,650.94	0.20%
23	Makanan & Minuman / Food & Beverage	10,139.46	0.17%
24	Tekstil / Textiles	9,033.55	0.15%
25	Kilang Kelapa Sawit (PYDT) / Palm Oil Mills	7,083.75	0.12%
26	Pertanian / Agriculture	4,904.38	0.08%
27	Kuari / Quarry	4,676.41	0.08%
28	Berasaskan Kayu / Wood Based	3,910.34	0.07%
29	Pembuatan Payung dan Lain-lain Industri Pembuatan / Umbrella Manufacturing and Other Manufacturing	3,073.06	0.05%
30	Simen / Cement	2,559.96	0.04%
31	Kilang Getah (PYDT) / Rubber Factories	1,834.01	0.03%
32	Perkhidmatan / Services	1,634.54	0.03%
33	Peralatan Sukan dan Permainan / Sports Equipment and Games	1,076.96	0.02%
34	Kulit / Leather	381.51	0.01%
35	Peralatan Pejabat dan Alat Tulis / Office Supplies and Stationery	214.40	0.00%
36	Tapak Pelupusan Sampah / Waste disposal Sites	175.87	0.00%
37	Loji Pengolahan Kumbahan (IWK, Majari, PBT) / Sewage Treatment Plant (IWK,Majari,PBT)	137.95	0.00%
38	Loji Pengolahan Kumbahan Persendirian / Private Sewage Treatment Plants	81.13	0.00%
39	Rokok dan Tembakau / Cigarettes and Tobacco	46.13	0.00%
40	Makanan Ternakan / Livestock Food	42.74	0.00%
41	Hotel / Hotels	12.16	0.00%
42	Kilang Padi / Rice Mills	7.03	0.00%
43	Perhutanan / Forestry	4.41	0.00%
44	Perikanan / Fishery	0.78	0.00%
45	Restoran / Restaurants	0.21	0.00%
46	Penternakan / Animal Husbandry	0.10	0.00%
JUMLAH / TOTAL		**5,915,073.84**	**100.00%**



Rajah 5.17: Tren Pengurusan Buangan Terjadual, 2011-2022
Figure 5.17: Scheduled Waste Management Trend, 2011-2022

Jadual 5.3: Kemudahan yang Mengendalikan Buangan Terjadual, 2022
Table 5.3: Facilities Handling Scheduled Wastes, 2022

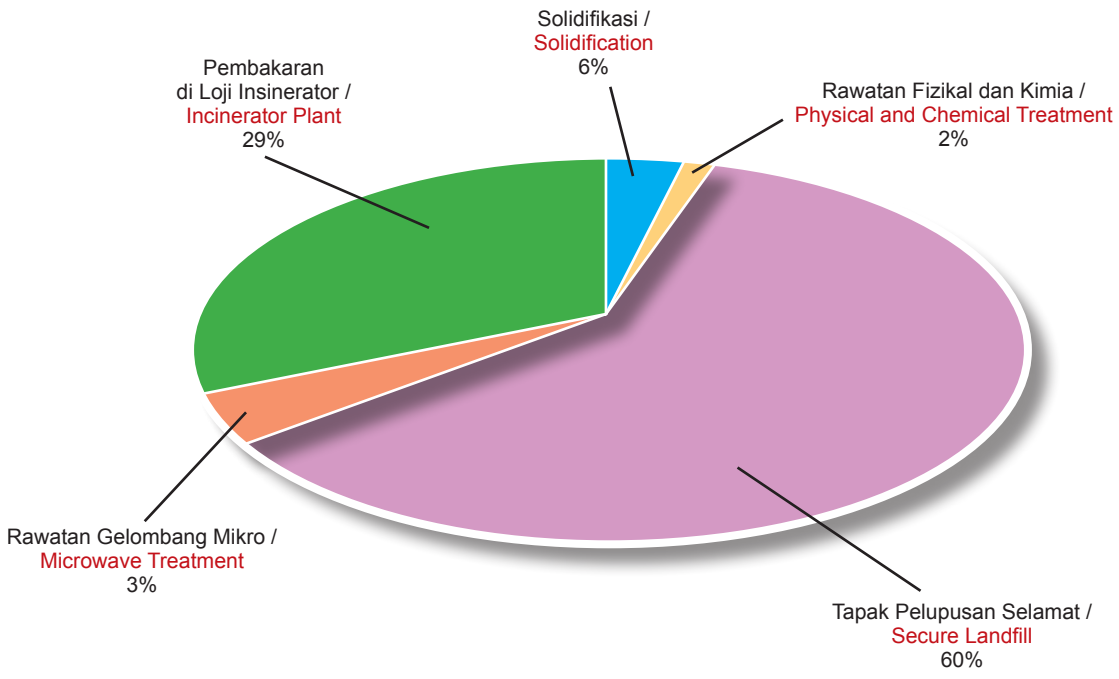
BIL. / NO.	KEMUDAHAN / FACILITIES	(MT/TAHUN) / (MT/YEAR)	PERATUSAN (%) / PERCENTAGE (%)
1	Pengurusan Khas / Special Waste Management	1,095,654.76	18.52%
2	Pengolahan Dalam Tapak / On Site Treatment	1,297,809.64	21.94%
3	Kemudahan Pemerolehan Kembali Luar Tapak Tempatan / Local Off-Site Recovery Facilities	417,207.62	7.05%
4	Penstoran Dalam Tapak / On Site Storage	2,828,424.64	47.82%
5	Kualiti Alam Sdn. Bhd.	189,088.00	3.20%
6	Kemudahan Buangan Klinikal (Penunu Buangan Klinikal, Gelombang Mikro dan Tapak Pelupusan Selamat) / Off-Site Clinical Waste Facilities (Clinical Waste Incinerator, Microwave and Secure Landfills)	49,131.62	0.83%
7	Kemudahan Luar Negara (Eksport) / Foreign Facilities (Export)	4,329.00	0.07%
8	Trienekens (Sarawak) Sdn. Bhd.	33,428.56	0.57%
JUMLAH / TOTAL		**5,915,073.84**	**100.00%**

Jadual 5.4: Buangan Terjadual yang Diuruskan Di Bawah Pengurusan Khas 2022
Table 5.4: Scheduled Waste Managed Under Special Management, 2022

BIL / NO.	KATEGORI BUANGAN / WASTE CATEGORY	KOD BUANGAN / WASTE CODE	PUNCA / SOURCE	TAN METRIK / METRIC TONNES	PERATUSAN / PERCENTAGE (%)	KAEDAH PELUPUSAN / METHOD OF DISPOSAL
1	Enap cemar yang mengandungi satu atau beberapa logam termasuklah kromium, kuprum, nikel, zink, plumbum, kadmium, aluminium, timah vanadium dan berilium / Sludges containing one or several metals including chromium, copper, nickel, zinc, lead, cadmium, aluminium, tin, vanadium and beryllium	SW 204	Loji Rawatan Air Minuman / Drinking Water Treatment Plant	138,387.20	12.6	Tapak Pelupusan Sanitari / Sanitary Landfill
			Industri / Industries	3,686.39	0.3	
				1,591.06	0.2	Guna semula sebagai bahan mentah pembuatan produk / Reuse as raw material for products
2	Debu, sanga, dros atau abu yang mengandungi arsenic, raksa, plumbum, kadmium, kromium, nikel, kuprum, vanadium, berilium, antimony, tellurium, talium, atau selenium, tidak termasuk sanga daripada kilang besi dan keluli / Dust, slag, dross or ash containing arsenic, mercury, lead, cadmium, chromium, nickel, copper, vanadium, beryllium, antimony, tellurium, thallium or selenium excluding slag from iron and steel factory	SW 104	Loji Janakuasa Arang Batu / Coal-Fired Power Plant	743,761.26	67.9	Guna semula sebagai bahan mentah pembuatan produk / Reused as raw material for product
			Industri / Industries	201,253.78	18.4	
3	Buangan yang mengandungi formadehid / Waste containing formaldehyde Buangan resin tidak matang yang mengandungi pelarut organic atau logam berat termasuklah resin epoksi dan resin fenolik / Uncured resin waste containing organic solvents or heavy metals including epoxy resin and phenolic resin Produk dakwat, cat, pigmen, lakuer, perwarna atau varnish yang terbuang atau yang tidak mengikut spesifikasi yang mengandungi pelarut organic / Discarded or off-specification inks, paints, pigments, lacquer, dye or varnish products containing organic solvent	SW 320 SW 325 SW 418	Industri / Industries	749.43	0.1	Tapak Pelupusan Sanitari / Sanitary Landfill
4	Bekas, beg atau kelengkapan yang dilupuskan yang dicemari dengan bahan kimia, racun mahkluk perosak, minyak mineral atau buangan terjadual / Disposed containers, bags or equipment contaminated with chemicals, pesticides, mineral oil or scheduled wastes	SW 409	Industri / Industries	0.16	0.00	Guna semula sebagai bahan mentah pembuatan produk / Reused as raw material for product
5	Karbon teraktif yang terpakai tidak termasuk karbon daripada pengolahan air boleh diminum dan proses industri makanan dan penghasilan vitamin / Spent activated carbon excluding carbon from the treatment of potable water and processes of the food industry and vitamin production	SW 411	Industri / Industries	6,204.00	0.6	Guna semula sebagai bahan mentah pembuatan produk / Reused as raw material for product
6	Buangan daripada pengilangan atau pempresesan atau penggunaan bahan letupan / Waste from manufacturing or processing or use of explosives	SW 431	Industri / Industries	21.48	0.00	Kaedah Pembakaran / Burning method
JUMLAH / TOTAL				**1,095,654.76**	**100.00**	

Kategori buangan terjadual yang dihantar ke 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. Seperti yang ditunjukkan dalam **Rajah 5.18**, sisa dihantar ke Kualiti Alam Sdn. Bhd. dan Trienekens (Sarawak) Sdn. Bhd. adalah dibakar dengan menggunakan kaedah tapak pelupusan selamat (60%), pembakaran di loji insinerator (29%), solidifikasi (6%), rawatan gelombang mikro (3%) dan kaedah rawatan fizikal dan kimia (2%).

The categories of wastes sent to the Kualiti Alam Sdn. Bhd. and Trienekens (Sarawak) Sdn. Bhd. for final disposal were sludges containing one or several heavy metals, mixed wastes, dust/slag/dross or ash containing arsenic/ mercury and spent inorganic acid. As shown in **Figure 5.18**, wastes sent to Kualiti Alam Sdn. Bhd. and Trienekens (Sarawak) Sdn. Bhd. were secure landfilled (60%), followed by incinerator plant (29%), solidification (6%), microwave treatment (3%) and physical and chemical treatment (2%).



Rajah 5.18: Kualiti Alam Sdn. Bhd. dan Trienekens (Sarawak) Sdn. Bhd.: Jenis Rawatan dan Pelupusan Buangan Terjadual, 2022

Figure 5.18: Kualiti Alam Sdn. Bhd. and Trienekens (Sarawak) Sdn. Bhd.: Types of Scheduled Wastes Treatment and Disposal, 2022

ANNEX

PENGIRAAN INDEKS PENCEMAR UDARA (IPU) / AIR POLLUTANT INDEX (API) CALCULATION

Pengiraan IPU ini berdasarkan system *Pollution Standard Index* (PSI) yang diterimapakai di peringkat antarabangsa oleh United States Environmental Protection Agency (USEPA).
API calculation is based on Pollution Standard Index (PSI) that has been accepted at the international level by United States Environmental Protection Agency (USEPA)

PENGUKURAN 6 PARAMETER PENCEMAR / MEASUREMENT OF 6 POLLUTANT PARAMETERS

Sulfur Dioksida / Sulphur Dioxide
Habuk Halus (PM_{10}) / Particulate Matter (PM_{10})
Habuk Halus ($PM_{2.5}$) / Particulate Matter ($PM_{2.5}$)
Ozon / Ozone
Nitrogen Dioksida / Nitrogen dioxide
Karbon Monoksida / Carbon monoxide

- Kiraan purata bagi setiap parameter diambil mengikut tempoh masa berlainan.
  The average calculation for each parameter is taken at different range of periods.

- Hal ini kerana had tempoh pendedahan yang berlainan yang boleh diterima oleh manusia.
  This is because they have different exposure periods that are acceptable to humans.

PARAMETER PENCEMAR / POLLUTANT PARAMETERS	TEMPOH PURATA / AVERAGING PERIOD
Sulfur Dioksida / Sulphur Dioxide	1 Jam / 1 Hour
Habuk Halus (PM_{10}) / Particulate Matter (PM_{10})	24 Jam / 24 Hours
Habuk Halus ($PM_{2.5}$) / Particulate matter ($PM_{2.5}$)	24 Jam / 24 Hours
Ozon / Ozone	8 Jam / 8 Hours
	1 Jam / 1 Hour
Nitrogen Dioksida / Nitrogen Dioxide	1 Jam / 1 Hour
Karbon Monoksida / Carbon Monoxide	8 Jam / 8 Hours

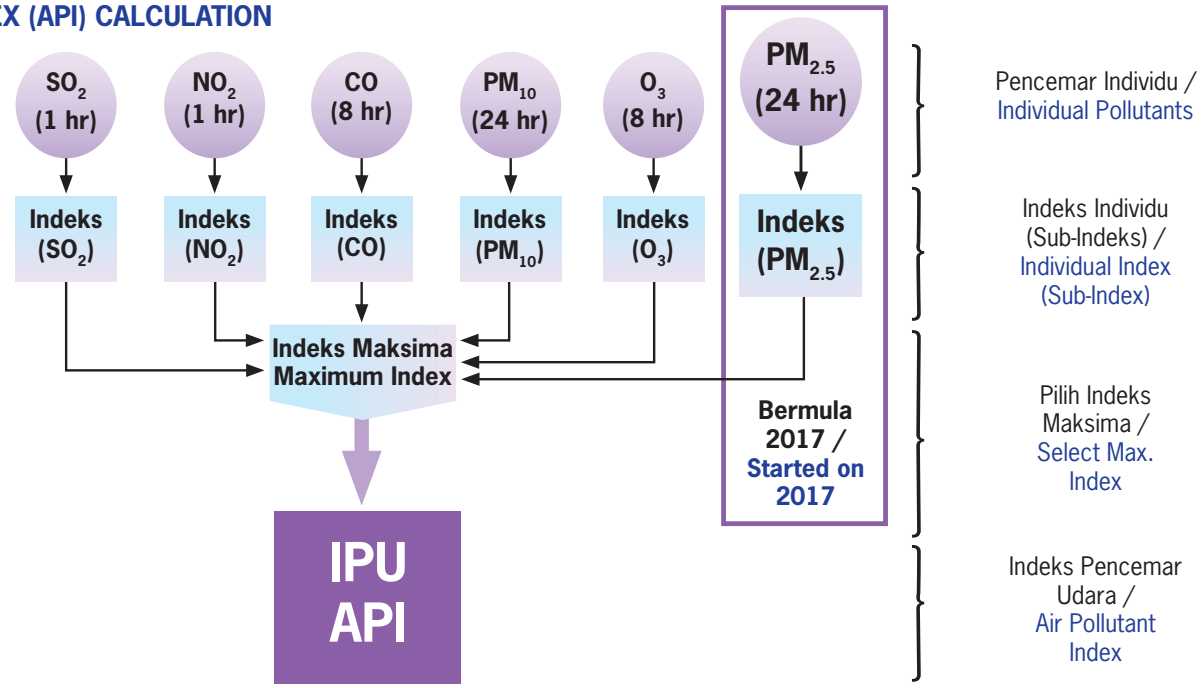
- Purata kepekatan bagi setiap pencemar mengikut tempoh yang tertentu ini seterusnya diseragamkan menggunakan formula matematik khusus bagi menghasilkan satu nilai yang tidak berunit yang dinamakan sebagai **SUB-INDEKS**.
  The average concentration of each pollutant over a given period is then standardized using a specific mathematical formula to produce a non-unitary value called SUB-INDEX.

- Setiap pencemar akan menghasilkan sub-indeks tersendiri.
  Each pollutant will produce its sub-index.

- Sub-index tertinggi secara relatif akan diambilkira sebagai bacaan IPU.
  The highest relative sub-index will be considered as API reading.

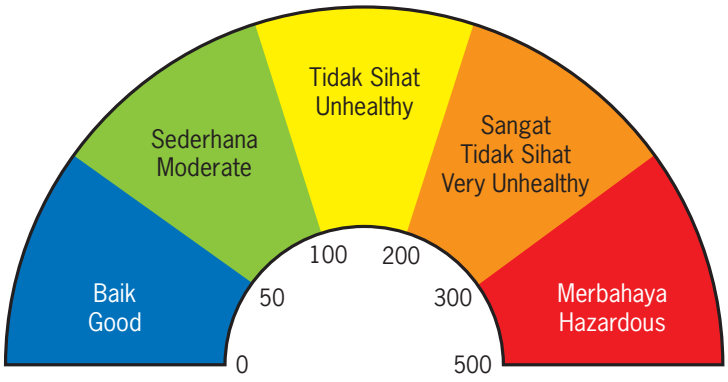
- Lazimnya, bacaan IPU adalah ditentukan oleh **kepekatan habuk halus** yang merupakan pencemar dominan pada kebanyakan masa terutamanya semasa berlakunya jerebu di Malaysia.
  Usually, API readings are determined by the **concentration of particulate matter** that is the dominant pollutant most of the time especially during haze in Malaysia.

PENENTUAN PENGIRAAN INDEKS PENCEMAR UDARA (IPU) / DETERMINATION OF AIR POLLUTION INDEX (API) CALCULATION



FORMULA SUB-INDEKS BAGI $PM_{2.5}$ YANG TELAH DIMODIFIKASI MENGIKUT STANDARD USEPA / SUB-INDEX FORMULA FOR $PM_{2.5}$ THAT HAS BEEN MODIFIED ACCORDING TO USEPA STANDARD

API	Breakpoint of Concentration	Equation for API
X = $PM_{2.5}$ (24 h average, unit: $\mu g/m^3$)		
0 - 50	0 ≤ X ≤12.0	API = 4.1667 x X
51 - 100	12.1 ≤ X ≤ 75.5	API = 0.7741 x (X - 12.1) + 51
101 - 200	75.5 ≤ X ≤ 150.4	API = 1.3218 x (X - 75.5) + 101
201 - 300	150.5 ≤ X ≤ 250.4	API = 0.9909 x (X- 150.5) + 201
301 - 400	250.4 ≤ X ≤ 350.4	API = 0.9909 x (X - 250.5) + 301
401 - 500	350.5 ≤ X ≤ 500.4	API = 0.6604 x (X - 350.5) + 401



PETUNJUK STATUS KUALITI UDARA
AIR QUALITY STATUS INDICATION

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
# = 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.

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 ≤ 20
SICOD = 103*exp(- 0.0157x) - 0.04x for x > 20

Subindex for NH_3 -N

SIAN = 100.5 - 105x for x ≤ 0.3
SIAN = 94*exp(- 0.573x) - 5 * I x – 2 I for 0.3 < x < 4
SIAN = 0 for x ≥ 4

Subindex for SS

SISS = 97.5*exp(- 0.00676x) + 0.05x for x ≤ 100
SISS = 71*exp(- 0.0016x) - 0.015x for 100 < x < 1000
SISS = 0 for x ≥ 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 ≤ x < 7
SIpH = - 181 + 82.4x - $6.05x^2$ for 7 ≤ x < 8.75
SIpH = 536 - 77.0x + $2.76x^2$ or x ≥ 8.75

Note:
*means multiply with

MALAYSIAN MARINE WATER QUALITY STANDARDS

PARAMETER (µ G/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	27.00	27.00	55.00	27.00	27.00	27.00
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					

ANNEX

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* NO_3 = 94.8*EXP$^{(-0.00035(\text{Nitrate}))}$

Phosphate (PO_4) in µg/l
q*i* PO_4 = 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 C lass 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

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

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

$Si(Fe) = (1 - C_i/5.0) \times 100$

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

$Si(TDS) = (1 - C_i/3000) \times 100$

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

$Si(NO_3^-) = (1 - C_i/100) \times 100$

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

$Si(SO_4^{2-}) = (1 - C_i/1000) \times 100$

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

$Si(Phenol) = (1 - C_i/0.015) \times 100$

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**

$Si(\textit{E.coli}) = (1 - C_i/5000) \times 100$

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

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