

Geography, Environment and Population

Location

The Macao Special Administrative Region (MSAR) is an integral part of the People's Republic of China. Situated at the mouth of the Pearl River Delta (PRD) and bordering Guangdong Province, Macao is 60 kilometres from Hong Kong, and the time is eight hours ahead of Greenwich Mean Time. The MSAR comprises the Macao peninsula and two islands: Taipa and Coloane. Its origin point is located at latitude 22°22'40"N and longitude 113°32'22"E. Three bridges – Nobre de Carvalho Bridge, Friendship Bridge (Ponte da Amizade) and Sai Van Bridge – link the peninsula to Taipa; while the COTAI Reclamation Area links Taipa and Coloane islands.

According to Chief Executive Notice No.128/2015 dated 20 December 2015: as stipulated in Order No. 665 of the State Council of the People's Republic of China, the Macao Special Administrative Region comprises land and marine areas, with the land area comprising the Border Gate Macao Checkpoint Building section and the Canal dos Patos section, and the marine area comprising six sections: the Inner Harbour section, Cotai channel section, southern Macao waters section, eastern Macao waters section, artificial island section, and northern Macao waters section. The boundary to the west is meridian 113°31'41.4"E, to the east 113°37'48.5"E, to the south parallel 22°04'36.0"N, and to the north 22°13'01.33"N.

Area

Due to reclamation along its coastline, Macao's total land area has grown from 11.6 square kilometres in 1912, when measurements were first taken, to 33 square kilometres in 2021. The Macao peninsula accounts for 9.3 square kilometres (28.2 percent) of the current area; Taipa island for 7.9 square kilometres (23.9 percent); Coloane island for 7.6 square kilometres (23 percent); COTAI Reclamation Area for 6.1 square kilometres (18.5 percent); New Urban Zone Area A for 1.4 square kilometres (4.3 percent); Macao border crossing area on Zhuhai-Macao checkpoint on the Artificial Island of the Hong Kong-Zhuhai-Macao Bridge for 0.7 kilometres (2.1 percent), and the campus of the University of Macau for one square kilometre.

According to Chief Executive Notice No.128/2015 dated 20 December 2015: as stipulated in Order No. 665 of the State Council of the People's Republic of China, the Central People's Government explicitly determines that the area of waters of the Macao Special Administrative Region is 85 square kilometres.

Geology and Topography

Macao mainly comprises flat land, terraces and hills. The area of flat land (including reclaimed land) is 23.9 square kilometres, accounting for 72.4 percent of the total; granite hills cover six square kilometres, or 18.2 percent; and terraces cover 1.2 square kilometres, or 3.6 percent. The terraces are historically areas of denudation, extending along St Augustine, Luis de Camoes Garden, the hill behind Mong Ha Kun Iam Tong Temple, Russa Hill, and the southern part of Taipa island. Their relatively small area, low elevation (20-25 metres) and gentle slopes mean that most of the terraces

are fully utilised. The remaining land – including reserves, monument sites and forests – occupies approximately 1.9 square kilometres, accounting for 5.8 percent of the total land area.

The elevation of Macao increases from the north to the south. Guia Hill, in the north, is the highest point on the Macao peninsula, with an altitude of 90 metres. To the south, Alto de Coloane is the highest hill on Coloane island, as well as the highest point in Macao, with an altitude of 170.6 metres. Taipa Grande, the main peak of Taipa island, has an altitude of 158.2 metres.

Coastline Assessment

According to Executive Order No. 184/2018 enacted on 13 August, the coastline of the Macao SAR was determined by the published Macao Special Administrative Region Coastline Map, dated 1 July 2017. The total length of Macao's coastline is 76.7 kilometres, 18.4 kilometres of which are around the Macao peninsula; 49.9 kilometres are around the two islands (including Taipa Island, Cotai Reclamation Area and Coloane Island); 5.7 kilometres are around New Urban Zone Area A; 2.7 kilometres are around the Macao border crossing area on Zhuhai-Macao Port Artificial Island of the Hong Kong-Zhuhai-Macao Bridge.

There are two types of coastline in the Macao SAR: artificial and natural coastlines. Artificial coastlines predominate, representing 81.5 percent of the total coastline length, and are mainly around the Macao peninsula and fringing eastern and northern Taipa Island. The natural coastlines mainly fringe western Taipa Island and the southern tip of Coloane Island, representing 18.5 percent of the total coastline length.

Climate

Macao is situated in a subtropical zone, with the Asian continent to the north and a wide tropical sea to the south. In winter, Macao experiences northerly winds, cold and dry weather and low rainfall, due to a cold continental high-pressure system at medium and high latitudes. In summer, Macao is mainly subject to south-westerly winds, hot and wet weather and heavy rainfall, due to the influence of oceanic tropical weather systems. The reverse of wind directions in winter and summer, together with minimal temperature variations during the day, give Macao a marine monsoon climate.

According to the climate normals of the World Meteorological Organisation (WMO), calculated with 30 years of data, the average annual precipitation in Macao between 1981 and 2010 was more than 2,000 millimetres, with most rainfall occurring between April and September. June had the most precipitation – an average of 373.7 millimetres; while December had the least – an average of 31.3 millimetres.

Macao has an average annual temperature of 22.8°C. The coolest month is January, when it averages 15.2°C. Most years, Macao has a short cold weather period when temperatures fall below 5°C. The average monthly temperature exceeds 22°C during seven months of the year, indicating that Macao has a short winter but a long summer.

Macao is frequently hit by typhoons. The typhoon season starts in May and ends in October, with July to September as its peak period.

Weather Overview

In 2021, Macao’s average annual temperature was slightly higher than the climate normal; the total rainfall fell within the climate normal; the relative humidity was slightly lower than the climate normal; the total hours of sunshine were higher than the climate normal; and the total evaporation level was slightly above the climate normal.

Eight tropical cyclones affected Macao in 2021. They were: Tropical Storm Koguma from 11 June to 12 June, a tropical depression from 6 July to 7 July, Typhoon Cempaka from 18 July to 21 July, Tropical Storm Lupit from 2 August to 4 August, Severe Tropical Storm Conson from 9 September to 10 September, Tropical Storm Lionrock from 7 October to 10 October, Tropical Storm Kompasu from 11 October to 14 October, and Typhoon Rai from 20 December to 21 December.

The La Niña phenomenon developed in the equatorial band of the Pacific Ocean in autumn 2021, facilitating the formation of autumn typhoons and their entry into the South China Sea. As a result of the combined effect of tropical cyclones and northeast monsoons, Macao set three new records:

- The longest distance from a tropical cyclone for issuing Typhoon Signal No. 8, for Tropical Storm Lionrock (450 kilometres);
- The shortest time between the two issuances of Typhoon Signal No. 8, for Tropical Storm Lionrock and Tropical Storm Kompasu (20 hours and 30 minutes, within two days); and
- The latest tropical cyclone signal issuance in a year, for Super Typhoon Rai (on 20 December).

Regarding storm surge warnings, five blue storm surge warnings were issued – as a result of Tropical Storm Koguma, Typhoon Cempaka, Tropical Storm Lionrock, Tropical Storm Kompasu and Typhoon Rai. Of these, Tropical Storm Kompasu caused the most severe flooding, with the maximum flood height of 0.43 metres recorded in the early hours of 1 August in the south of the Inner Harbour.

A total of 35 rainstorm warnings were issued in Macao in 2021, including the Red Rainstorm Warning Signal in the afternoon of 1 June, in the morning of 22 June, and on 23 June, 24 July, 8 October and 10 October; and the Black Rainstorm Warning Signal in the early morning of 1 June, and on 28 June and 1 August. During the Black Rainstorm Warning that was effective in the early morning of 1 June, Taipa Grande Station recorded the highest hourly cumulative rainfall (119.6 millimetres) and the highest daily cumulative rainfall (423.4 millimetres) in 2021.

Summary of Severe Weather Warnings Issued in 2021

Warning / Signal Type		Frequency	No. of Warning Reports Issued
Tropical Cyclone Warning	No. 1 Alert Signal	8	44
	No. 3 Strong Wind Signal	4	41
	No. 8 Northeast Gale Signal	1	18

(Cont.)

Summary of Severe Weather Warnings Issued in 2021			
Warning / Signal Type		Frequency	No. of Warning Reports Issued
Tropical Cyclone Warning	No. 8 Southeast Gale Signal	1	20
	No. 8 Southwest Gale Signal	0	0
	No. 8 Northwest Gale Signal	0	0
	No. 9 Increasing Gale Signal	0	0
	No. 10 Typhoon Signal	0	0
	All Signals Lowered	8	8
Strong Monsoon Warning (Black Ball)		19	15
Rainstorm Warnings	Yellow Rainstorm Warning Signal	35	65
	Red Rainstorm Warning Signal	9	27
	Black Rainstorm Warning Signal	3	4
	All Warnings Lowered	35	35
Thunderstorm Warning		110	87
Storm Surge Alert		0	0
Storm Surge Warning	Blue Storm Surge Warning	5	29
	Yellow Storm Surge Warning	0	0
	Orange Storm Surge Warning	0	0
	Red Storm Surge Warning	0	0
	Black Storm Surge Warning	0	0
	All Warnings Lowered	5	5

Temperatures

Macao had an average annual temperature of 23.5°C during 2021, which was 0.7°C higher than the climate normal. The highest and the lowest average temperatures were 28.8°C in July and September, and 15.2°C in January, respectively. The hottest day was 27 July, when the temperature rose to 35.8°C; whereas the coldest day was 8 January, when the temperature fell to 6.1°C.

Relative Humidity

The average relative humidity during 2021 was 78 percent, which was two percent lower than the

climate normal. June saw the highest monthly average relative humidity, at 86 percent; whereas the lowest was 60 percent in January.

Rainfall

Total rainfall during 2021 was at a normal level of 2,206.2 millimetres, which was 239.6 millimetres, or about 12 percent above climate normal. The highest monthly rainfall was 679.8 millimetres, recorded in June, 306.1 millimetres above normal, followed by October with 570.8 millimetres of rainfall recorded, 495.7 millimetres above normal. Only trace rainfall was recorded in January, marking the lowest monthly rainfall of the year. The highest daily rainfall was 288.0 millimetres, recorded on 1 June.

Evaporation

The total evaporation level in 2021 was 885.2 millimetres, which was 30.3 millimetres higher than the climate normal. Other than from June to October, the monthly evaporation levels were slightly above the climate normal.

Sunshine

During 2021, Macao had 2,101.7 hours of sunshine, 352.4 hours above normal. The most hours of sunshine were recorded in May, totalling 241 hours, which was 105.5 hours above normal, followed by February with 198.5 hours of sunshine, which was 112.8 hours above normal. The least hours of sunshine were recorded in October, amounting to 137.7 hours, which was 54.5 hours fewer than normal.

Wind

During 2021, Macao was subject to predominantly easterly winds in February, March, April and September; north-north-easterly winds in January and December; southerly winds in May, June and August; south-south-easterly winds in July, and northerly winds in October and November. Wind speeds averaged 10.4 kilometres per hour.

Weather Services

Meteorological and Geophysical Bureau

The Meteorological and Geophysical Bureau (SMG) is supervised by the Secretary for Transport and Public Works. It provides weather reports, monitors air quality and radiation, and conducts research into climate, climate change and earthquakes.

Apart from hourly real-time weather information, the SMG issues various types of daily weather forecasts for the public, government departments and private institutions. These include five weather reports and forecasts, two marine and weather forecasts for the Macao coastal area, as well as daily

weather reports over the past year, which are broadcast daily for the public. The SMG provided 816 weather forecasts for Macao and 723 weather forecasts for the Macao coastal area during 2021.

The SMG continued cooperating with the Macao Broadcasting Company's (TDM). Every day, SMG officers explain the day's weather conditions and the forecast for the following day during the Macao Broadcasting Company's morning TV programme. The SMG forecasters also record weather information regularly, or when necessary, and upload it to the Internet for download and use by various media. This information includes a weather review of the day, a two-day weather forecast and air quality report; a weekly weather forecast; and special weather information (on typhoons, rainstorms, very hot and cold weather).

In response to special weather conditions (such as information on movements of tropical cyclones before they enter the South China Sea, rainstorm warning alerts and significant changes in temperature), the SMG sends special weather notifications to registered users, social welfare organisations and schools via WeChat, mobile apps, SMS and the Meteorological and Geophysical Bureau Telegram Channel.

Whenever a tropical cyclone develops in the northwest Pacific Ocean, the SMG will monitor and produce a forecast track reporting its location and intensity in real time and for the next 120 hours. When a tropical cyclone signal is required, the SMG will provide a warning signal forecast for the following one to two days, based on a table with forecasts for tropical cyclones and storm surges that is released on its official website. Citizens can learn about the potential impact of tropical cyclones during particular hours and make necessary preparations as soon as possible. When Typhoon Signal No.3 or above is issued, TDM uses split-screen views to announce the latest tropical cyclone news.

The SMG also worked with relevant departments to show the latest weather warnings on electronic display screens in the Border Gate checkpoint building and the Outer Harbour Ferry Terminal, such as tropical cyclone and rainstorm warnings, to keep passengers informed regarding the weather.

The SMG further optimised special tweets by releasing not only the "Holiday Weather Outlook", but also articles on meteorological knowledge, to provide in-depth analyses of the processes and causes of severe weather in Macao, to enhance the public's knowledge of meteorology.

The SMG strived to educate the public about weather and disaster relief, and cooperated with schools, government departments and community organisations in holding talks to introduce common adverse weather conditions and corresponding safety measures.

In 2021, the SMG continued working with the Science Museum to organise activities such as Campus Weather Monitoring Competition, a weather drama – "Storm Chasing Guardians", "FamilyGo" and a Science Museum summer course, to enhance students' knowledge of meteorological science and disaster prevention through interactive, diverse approaches. Notably, the play – "Storm Chasing Guardians" attracted 1,939 spectators.

Through the "Weather Fun Facts" column, the SMG provides the public with knowledge of meteorology, air quality, earthquakes, radiation, and tsunamis in a light-hearted way, explaining and exploring the causes of various weather phenomena. In 2021, the SMG arranged 57 visits for students who could play the role of "Little Weather Reporters", receiving a total of about 1,667 visitors.

Since 2018, the SMG has posted Storm Surge Alert labels onto the 130 Civil Protection CCTV poles in low-lying areas, and worked with the Social Welfare Bureau to post and regularly update Storm Surge Alert Labels outside more than 40 of its local social service facilities in low-lying areas, to provide the public with information on the areas and heights of possible flooding while storm surge warnings are in effect. In addition, the SMG produces promotional videos and places advertisements on some buses to promote storm surge warnings and response measures to the public.

The SMG has established the Aeronautic Meteorological Center at Macau International Airport to provide aviation weather services for airport operators and flight crews.

All international flights departing Macao can receive the most up-to-date, international standard aeronautical meteorological documents via the Aviation Weather Information System (AWIS). In 2021, the system typically operated at 99.9 percent efficiency.

During the fourth quarter of 2021, the SMG Aeronautic Meteorological Center expanded the service provided to users by issuing airport weather warnings (including thunderstorm warnings and strong wind warnings) and alerts regarding severe convective weather at the airport via Telegram.

The SMG also offered the 48-hour Automatic Weather Forecast, providing the public with weather forecasts for the following two days – including temperature, humidity, wind speed and direction – on the website.

To ensure the basic and emergency services of the 24-hour Meteorological Monitoring Centre would continue during the special circumstances, the SMG developed a series of contingency plans and conducted drills to ensure it could maintain essential services in the event of an emergency during the pandemic.

Monitoring Network

The SMG collects weather data 24 hours a day via its Automatic Weather Station Network of 16 weather-observation stations in key locations around Macao, 13 of which provide real-time meteorological information to the public, while stations in Mount Fortress, Taipa Grande and Ka Ho automatically send information every 15 minutes to destinations worldwide using the international SYNOP code and the Global Telecommunications System (GTS). This forms part of the Pearl River Delta Real-time Automatic Weather Station Network, which was jointly established to exchange meteorological data by the Guangdong Provincial Meteorological Bureau, the Hong Kong Observatory and the Macao SMG.

The SMG also teamed up with the Hong Kong Observatory to establish a substation of the Pearl River Delta Lightning Location Network in Macao. The system operates around the clock, and provides real-time lightning information for the Pearl River Delta. To enhance the lightning monitoring of aviation meteorology, a new lightning system with a real-time display interface was added to the original two display systems.

Regarding meteorological telemetry, the SMG has two ground meteorological reception and processing systems to receive Japanese Himawari-8 satellite information and Chinese FY-2G and FY-4 satellite information, respectively; two dual-polarisation Doppler weather radars; three low-level wind profilers; two microwave radiometers; two cloud height meters; four visibility

measuring devices; and two lightning sensors to monitor lightning in the skies over Macao and the vicinity. In addition, the SMG joined hands with the Zhuhai Meteorological Bureau to install four X-band phased array weather radars in Zhuhai, forming a network of phased array radars to monitor weather conditions over Macao and nearby regions. In terms of meteorological analysis systems, the SMG owns an integrated analysis system for tropical cyclones and storm surges, and an ensemble system for predicting storm surges in Macao, which are used to monitor and analyse real-time meteorological and maritime weather changes.

The SMG cooperates with related departments to establish the Water Level and Tide Monitoring Network, to provide round-the-clock real time data on flooding and tides in flooding black spots and coastal area. The network includes 20 land water level monitoring stations set up at flooding black spots in various districts of Macao (with 18 of these stations providing real-time flooding information to the public), and two tide monitoring stations set up along the coast.

In addition, the SMG cooperated with the Pearl River Water Resources Research Institute to commence work on marine meteorological observations. Real-time monitoring data was received from the marine buoy stations in the Macao and Pearl River Water regions, expanding monitoring from land-based meteorology to include nearby sea areas, including hydrology, and providing real-time data as a reference for storm surge monitoring and issuing alerts.

Air quality monitoring

The SMG established the Air Quality Monitoring Project in partnership with Companhia de Electricidade de Macau (CEM). The SMG employs a fully automated air monitoring network to effectively measure major pollutants that jeopardise Macao's air quality. Macao has six automatic air quality monitoring stations and a light detection and ranging (LIDAR) system for monitoring suspended particulates and mixing layers above Macao.

Seismological monitoring

The SMG has a seismological monitoring station in its Taipa Grande headquarters on Taipa, equipped with a deep shaft (30 metres below ground level) digital seismograph. In 2014, the deep shaft digital seismograph was upgraded and became a monitoring station of the Pearl River Delta Earthquake Early Warning Network. In addition, a seismic information sharing portal was introduced, to receive earthquake information for the entire country. In 2020, the SMG Taipa Grande headquarters was equipped with a strong motion seismograph, and introduced an earthquake-induced tsunami forecast system.

Environmental radiation monitoring

The SMG's headquarters is equipped with an environmental radiation monitoring station, mainly for detecting Gamma radiation dose rates in the atmosphere and announcing the results on the website. A baseline survey on Macao's atmospheric radiation began in 2013. Regular monitoring of Macao's atmospheric radiation is then conducted every year in different districts.

Regional and International Cooperation

The SMG is a member of the WMO. It actively participates in promoting technology, research, training and applications relating to meteorology. Every year, it sends delegations to meetings, seminars, workshops and training programmes arranged by the WMO, mainland China and overseas meteorological agencies and academic organisations.

The SMG is also a member of the ESCAP/WMO Typhoon Committee. The committee secretariat moved to Macao in 2007.

The SMG keenly takes part in meteorological science meetings and exchange activities conducted by its mainland China and overseas counterparts. Domestic meetings included the Guangdong-Hong Kong-Macao Seminar on Meteorological Science and Technology and the Guangdong - Hong Kong - Macao Meeting on Cooperation in Meteorological Operations organised alternately by the three parties.

Regional and international meetings included:

- The 53rd Session of ESCAP/WMO Typhoon Committee;
- The First Session of the Commission for Observation, Infrastructure and Information Systems (INFCOM) of WMO – Part Three;
- The First Session of the Commission for Weather, Climate, Water and Related Environmental Services and Applications – Part Two;
- The 17th Session of the Forum on Regional Climate Monitoring-Assessment-Prediction for Asia (FOCRAlI);
- The 17th Session of the WMO Regional Association II (Asia);
- Extraordinary Session of the World Meteorological Congress;
- The 25th Meeting of the Meteorology Sub-group of the Asia Pacific Air Navigation Planning and Implementation Regional Group;
- The Fourth Session of the Meeting of Meteorological Working Group of the Typhoon Committee; and
- The 16th Typhoon Committee Integrated Workshop and Roving Seminar.

Air

Population density, scarcity of land, narrow streets and busy traffic all affect Macao's air quality. However, this is offset to some extent by the low discharge of industrial pollutants. The air quality is therefore generally quite good. Every winter, a comparatively high level of airborne pollutants raises the air pollution index; while in summer the air quality improves, with lower pollution index readings, as the convective precipitation of the tropical climate dispels pollutants.

The SMG revised the definition of the Air Quality Index (AQI) in accordance with the published "Macao Environmental Quality Standards - Ambient Air Quality Standards (trial version)"; the

revised AQI was officially adopted from 1 January 2021. The new index further restricts the concentrations of pollutants corresponding to each air quality level, and improves the related preventive measures, and is disseminated hourly via the SMG website and mobile app.

During 2021, roadside monitoring stations in Macao recorded “good” air quality on 61 percent of days, “acceptable” air quality on 36 percent of days, and “poor” air quality on three percent of days (11 days). In the high-density residential areas of the Macao peninsula, the air quality was “good” on 58 percent of days, “acceptable” on 38 percent of days, and “poor” on four percent of days (13 days).

In the high-density residential area on Taipa, the air quality was “good” on 46 percent of days, “acceptable” on 50 percent of days, and “poor” on four percent of days (15 days). Ambient monitoring stations on Taipa recorded “good” air quality on 42 percent of days, “acceptable” air quality on 51 percent of days, and “poor” air quality on seven percent of days (24 days). Ambient monitoring stations on Coloane recorded “good” air quality on 44 percent of days, “acceptable” air quality on 52 percent of days, and “poor” air quality on four percent of days (15 days). The Ka Ho roadside monitoring station recorded “good” air quality on 48 percent of days, “acceptable” air quality on 49 percent of days, and “poor” air quality on three percent of days (10 days).

In 2021, ozone (O₃) was the main pollutant that led to “poor” air quality in Macao, primarily affecting Macao in summer and autumn. The Taipa ambient monitoring stations recorded most of the “poor” air quality, on seven percent of days respectively (24 days). Overall, over 93 percent of days met the air quality standards (“good” to “acceptable”) across different districts in 2021. As compared to 2020, concentrations of various types of pollutants were largely unchanged.

Average Pollutant Concentrations in 2021

Monitoring Station	Respirable suspended particulates (µg/ m ³)	Fine suspended particulates (µg/ m ³)	Sulphur dioxide (µg/ m ³)	Nitrogen dioxide (µg/ m ³)	Ozone (µg/ m ³)	Carbon monoxide (mg/m ³)
Roadside	42.4	18.6	---	51.2	---	1.1
High-density residential area of Macao peninsula	46.5	16.8	5.8	33.1	29.1	0.7
High-density residential area of Taipa island	52.3	16.5	5.1	29.2	42.7	0.7
Taipa ambient	32.3	14.9	4.8	22.8	63.9	0.6
Coloane ambient ⁽ⁱ⁾	36.6	17.6	5.6	22.0	56.9	0.7
Ka Ho roadside ^a	35.7	14.0	5.4	24.3	54.8	0.7

Comparisons between Pollutant Concentrations and the Daily Air Pollution Index (adopted since 1 January 2021)

Air quality index	Respirable suspended particulates 24-hour average ($\mu\text{g}/\text{m}^3$)	Fine suspended particulates 24-hour average ($\mu\text{g}/\text{m}^3$)	Sulphur dioxide 24-hour average ($\mu\text{g}/\text{m}^3$)	Nitrogen dioxide 24-hour average ($\mu\text{g}/\text{m}^3$)	Ozone 8-hour average ($\mu\text{g}/\text{m}^3$)	Carbon monoxide 8-hour average (mg/m^3)
0	0	0	0	0	0	0
50	50	25	20	100	80	5
100	100	50	50	200	160	10
200	250	115	150	700	240	17
300	350	150	475	1,200	400	34
400	420	250	800	2,000	600	46
500	500	350	1,600	2,500	800	57

Air Pollution Index

Air quality index	0 ~ 50	51 ~ 100	101 ~ 200	201 ~ 300	301 ~ 400	401 ~ 500
Air quality level (Macao standards)						

Environment

Environmental Protection Bureau

The Environmental Protection Bureau (DSPA) is a public department in charge of studying, planning, executing, coordinating and promoting environment policies. The duties of the former Office for the Development of the Energy Sector have been incorporated into the Environmental Protection Bureau, with effect from 1 January 2021.

Advisory Council on the Environment

The Advisory Council on the Environment is chaired by the Director of the Environmental Protection

Bureau. Members include a maximum of seven representatives of other entities or government departments, and a maximum of 20 other prominent social figures in the environmental protection field.

The major responsibility of the Advisory Council on the Environment is consulting different social sectors regarding Macao's environmental protection, and providing recommendations on the study, formulation, implementation, coordination and promotion of environmental policies.

Noise

There are many reasons for noise pollution in Macao. Urban characteristics – such as population density, busy traffic, narrow streets and the large number of high-rise buildings – create conditions for noise transmission.

In 2021, the Environmental Protection Bureau and the Public Security Police received 13,015 complaints about ambient noise, about 1.3 percent fewer than the 2020 figure. The Environmental Protection Bureau received 2,247 of these complaints, representing an increase of 16.7 percent compared with 2020; whereas the Public Security Police received the remaining 10,768 cases, a figure that was 4.5 percent fewer than in 2020.

Complaints received by the Environmental Protection Bureau and the Public Security Police were primarily related to “activities of daily life and pets in residential buildings” (34.9 percent or 4,547 cases), “public areas” (33.3 percent or 4,334 cases), and “industry, commerce and services” (13.9 percent or 1,812 cases).

Environmental Noise Monitoring Network

In order to assess the ambient noise level in different districts, the DSPA has set up six environmental noise monitoring stations – three on the Macao peninsula, one on Taipa island, one in the COTAI reclamation area and one in Coloane. These monitoring stations conduct round-the-clock monitoring of ambient noise, road traffic noise, and noise from the residential zones, by means of an automated network.

Apart from the monthly release of the data on these noise readings in the Environmental Geographic Information System and on the Environmental Protection Bureau's website, the 2020 Annual Report on Data Collected by Environmental Noise Monitoring Stations of Macao and the 2020 Environmental Noise Census were also published, in March and May 2021, respectively.

Water Quality and Wastewater Treatment

Water Quality

Situated at the mouth of the Pearl River, Macao occupies a peninsula and nearby islands facing Lingdingyang to the east and the South China Sea to the south; there is a wide expanse of water. Water exchanges resulting from tidal flows dilute pollutants entering the area. The Inner Harbour to the west of Macao is a favourite berthing place for Zhuhai and Macao fishing boats. The sluice of the Zhuhai Qianshan River lies upstream of the Inner Harbour channel, and when this is closed

the area is partially blocked off. The poor exchange of its waters with the sea results in conditions in which pollutants can accumulate. When the sluice is open, Macao's water quality is determined by the quality of the water in the Qianshan River. Pollutants that have accumulated will then flow to neighbouring waters.

Based on the geographic features of Macao, the Public Health Laboratory of the Health Bureau adopts Category 3 Water Quality Standard of the Sea Water Quality Standard of China (GB3097-97), to assess individual indicators, nutrition indicators and comprehensive indicators of the water quality at each monitoring station.

Water Quality Monitoring Network

In 2021, the Environmental Protection Bureau continued monitoring the water quality of managed waters of Macao. Regarding the environmental water quality monitoring network, the Environmental Protection Bureau has set up three automatic environmental water quality monitoring stations – at Ilha Verde Dockyard, Inner Harbour and Cotai Nature Reserve. Round-the-clock monitoring of water quality is conducted through an automated network. In addition, in August 2021 the bureau took over the management of the two automatic water quality monitoring stations in Canal dos Patos, to constantly monitor the water quality in the area.

Also, apart from the monthly release of data on the water quality readings in the Environmental Geographic Information System and on the Environmental Protection Bureau's website, the 2020 Annual Report on Data Collected by Automatic Water Quality Monitoring Stations of Macao was published in March 2021.

Monitoring Drinking Water Quality

The Laboratory Division of the Municipal Affairs Bureau is responsible for the public water supply network; inspecting the water quality of public water sources and wells; and – if necessary – recommending the closure of these facilities in the public interest. It regularly monitors the quality of water processed by the water supply company, and the public water supply networks and reservoirs in the territory, to verify whether the quality complies with the requirements stipulated in the Rules and Regulations on Water Supply and Drainage in Macao (Decree-Law No. 46/96/M).

Since being awarded the ISO/IEC 17025 Certificate of Laboratory Accreditation by the China National Accreditation Committee for Laboratories (CNAL; now China National Accreditation Service for Conformity Assessment) in 2003, the Laboratory Division has enhanced its analytical performance and its quality management system. The laboratory also continued to participate in proficiency tests held by renowned organisations in mainland China and countries including the United States, the United Kingdom and Australia. The laboratory's inspection technology has fulfilled international requirements. Currently, it possesses 91 and 204 accreditations on water quality certificates and various food certificates, respectively.

Wastewater Management

The four sewage treatment facilities in Macao – the Macao Peninsula Sewage Treatment Plant,

Taipa Sewage Treatment Plant, Coloane Sewage Treatment Plant, and the Crossborder Industrial Zone Sewage Treatment Plant – can handle 356,000 cubic metres of sewage per day.

In 2021, the Macao Peninsula Sewage Treatment Plant handled 53,875,706 cubic metres of sewage; Taipa Sewage Treatment Plant handled 8,726,034 cubic metres; Coloane Sewage Treatment Plant handled 10,837,166 cubic metres, and the Crossborder Industrial Zone Sewage Treatment Plant handled 789,485 cubic metres.

The enhancement of the Macao Peninsula Sewage Treatment Plant was completed in 2021. The newly built sewage treatment facility was put in operation to effectively improve the overall output quality of the plant.

In addition, the preliminary design and ground investigation for the in-situ enhancement of the Coloane Sewage Treatment Plant were completed. The open tender for the enhancement project is expected to be launched in 2022.

To tie in with the latest planning of the Hong Kong-Zhuhai-Macao Bridge Macao Port Management Area, after adjusting the location of the new sewage treatment plant at Macao port, the Environmental Protection Bureau started revising the preliminary design and supplementary ground investigation for the construction of the new sewage treatment plant; the project is expected to proceed to an open tender in 2022.

The first temporary sewage treatment plant near the Outer Harbour Ferry Terminal in Macao was completed and put into operation in late December 2021, to improve the water quality and odour problem in the coastal area.

Waste Management

Companhia de Sistemas de Resíduos, Lda. (CSR) has been contracted to undertake Macao's household waste collection and conveyance, urban cleaning operations and the cleaning and maintenance of public waste containers, under the Government's supervision. According to statistics provided by the Municipal Affairs Bureau in 2021, the CSR collected about 283,478 tonnes of household waste in Macao during the year, an average of about 777 tonnes a day.

To support the “Waste reduction at source and recycling” environmental protection policy, various waste sorting and recycling activities of the Municipal Affairs Bureau – including the public collection points for waste recycling and glass bottles in Macao, the Recyclable Waste Separation and Recycling Programme in Schools, Community and Government Departments, and the Household Waste Sorting and Recycling Programme – were handed over to the Environmental Protection Bureau in July 2021. The used clothes recycling scheme jointly organised between the Municipal Affairs Bureau and the Macau Salvation Army was also handed over to the Environmental Protection Bureau for centralised follow-up. Additionally, the Municipal Affairs Bureau worked with the Environmental Protection Bureau to promote food waste recycling, with a total food waste disposal capacity of 12.46 tonnes in 2021.

To help implement the Macao Solid Waste Resources Management Programme (2017-2026) and promote the policy of “Waste reduction at source, sorting and recycling”, the Environmental Protection Bureau launched the Recycling Industry Equipment and Vehicles Subsidy Scheme in

2018. This provides subsidies to the recycling industry for purchasing certain recycling equipment, and the application deadline was extended to 25 November 2022 according to Order No. 31/2020 from the Secretary for Transport and Public Works.

Since 1 January 2021, the Environmental Protection Bureau has been accepting plastic products (excluding styrofoam) with recycling labels numbered 1 to 6 at all collection points. The items included plastic bottles for all beverages and cleaning products, transparent bubble wrap, fruit nets, plastic wrap and food zipper bags.

Starting from 10 December 2021, plastic egg cartons without recycling labels can be recycled. After sorting, the reusable egg cartons will be transferred to suppliers for reuse. In addition, the Environmental Protection Bureau organised training for collection point staff, to exchange and share experience in daily operations.

In April 2021, the Environmental Protection Bureau launched the “Recycling Food Waste is Very Easy” campaign, introducing a new household food waste collection service (excluding food waste from restaurants) in the Environmental Protection Fun corners, with a daily collection limit of three kilogrammes per citizen.

In addition, a total of 161 restaurants participated in the Restaurant Food Waste Recycling Pilot Project by the end of 2021. The project entailed recycling industrial and commercial food waste from small to medium-size restaurants through centralised treatment. After treatment, the food waste is converted to organic fertiliser to be distributed to the public and landscaping companies, free of charge. Over 71,000 bags (100 grammes per bag) and 4,400 (20 kilogrammes per bag) of free fertiliser were distributed by the end of 2021.

The Environmental Protection Bureau again organised the “Recycling Red Packets is Easy” event during Chinese New Year in 2021, setting up more than 840 collection points across Macao. About 2.20 million red packets were collected (weighing over 6.48 tonnes). After sorting, about 410,000 red packets (weighing over 1.2 tonnes) could be distributed to the public in the following year for reuse, while the rest were sent for recycling.

The Environmental Protection Bureau continued organising the “Recycling Mooncake Boxes is Easy” event during Mid-Autumn Festival in 2021, setting up over 950 mooncake box collection points across Macao. During the campaign, 13,900 used mooncake boxes (weighing approximately 5,000 kilogrammes) were collected and recycled.

Macao Waste Incineration Centre

Macao Incineration Centre is responsible for processing all Macao’s solid waste. It comprises a new plant and an old plant, each with three incineration facilities, with a total processing capacity of 1,728 tonnes of waste per day. During 2021, the centre processed 518,281 tonnes of solid waste, of which municipal solid waste amounted to 453,151 tonnes. The waste heat produced during the treatment of the municipal solid waste can be recovered and used for power generation.

The power generated by the centre can supply up to 28.7MW per hour of electricity at full load, of which 7MW are used for operation, and the remaining 21.7MW are transferred to the public grid – sufficient to meet the needs of over 33,000 households in Macao. During 2021, the incineration

centre supplied 16,960 units (10,000 kWh) of electricity to the public grid.

In 2021, the Environmental Protection Bureau continued the third-phase expansion of the incineration centre, with the completion of the construction of a new weighing station, and work beginning on constructing a new substation and a treatment centre for special and hazardous waste. In addition, the Government planned to build an organic resources recycling centre at the construction waste landfill, mainly using anaerobic digestion to generate biogas for electricity. An open tender is expected to be carried out in 2022.

Special and Hazardous Waste Treatment

The Macao Special and Hazardous Waste Treatment Centre commenced operation in 2007. It uses superheating techniques to treat waste materials that cannot be processed by the incineration centre, including discarded tyres, solid and liquid hazardous waste, carcasses of animals such as horses and dogs, slaughterhouse waste, medical waste, oil residue, and other special and hazardous wastes.

In 2021, the waste treatment centre processed a total of 2,877 tonnes of waste (including medical waste), with discarded tyres comprising 10 percent of the total.

Apart from the 22 fixed collection points and mobile collection vehicles, the Electronic and Electrical Equipment Recycling Programme also offered free appointment-based pick-up services for large appliances from residents, schools, government departments, public corporations, public utilities, and non-profit organisations. By the end of 2021, about 272,000 items of used electronic and electrical equipment were collected.

Since the Environmental Protection Bureau introduced the Used Battery Collection Scheme, over 1,300 collection points have been set up in schools, merchants, shops, residential and commercial zones, public departments, and public refuse tips in various districts of Macao. By the end of 2021, over 128,000 kilogrammes of used batteries had been collected through the scheme.

By the end of 2021, over 860 collection points had been set up for used lamps, including fluorescent tubes and lamps, LED lamps, incandescent lamps, halogen lamps, high-intensity discharge (HID) lamps and other mercury-containing lamps under the “Disposing Used Lamps is Easy” event. The treated lamps will be exported to qualified treatment plants for recycling to harmless materials. More than 41,000 kilogrammes of used lamps were collected through the scheme.

By the end of 2021, a total of 138 organisations had participated in the “Recycling Glass Bottles is Easy” event. Crushed glass from recycled bottles will be used as road construction material in Macao, and the remainder of the bottles will be exported to qualified treatment plants for recycling.

Treatment of Construction Waste

Since the construction waste landfill commenced operations in 2006, it has been mainly used for the disposal of non-combustible inert solid waste produced through excavation, demolition, and construction. The solid waste includes debris, cement blocks, soft soil, marine clay and furnace slag. In 2021, about 2.87 million cubic metres of construction waste were disposed of in the landfill.

The By-law No. 22/2020 on Macao’s Construction Waste Management System, enacted on 17 January 2021, regulates the use and charging system of construction waste landfill, and strengthens the mechanism for monitoring and punishment of illegal disposal of construction waste, encouraging waste producers to economically reduce construction waste at source.

The Environmental Protection Bureau and relevant departments conduct joint inspections and enforcement at several construction waste disposal black spots across Macao, to monitor the implementation of the regulations.

Legislation and Pollution Control

Legislation enacted in 2021 covering environmental issues included:	
1.	Regulations on Air Pollutant Emission Standards and Facility Management for Cement Manufacturing Establishments (By-law No. 17/2021);
2.	Amendment to Table I of the Schedule of By-law No.30/2016 – Tailpipe Emission Limits and Measurement of Exhaust Pollutants by Vehicles in-use, approved by Executive Order No. 130/2018 and Executive Order No. 80/2019 (Executive Order No. 79/2019);
3.	Amendment to By-law No. 21/2011 on the Environmental Protection and Energy Conservation Fund (By-law No. 25/2021);
4.	Technical Regulation on Gas-Fired Installations in Buildings (By-law No. 27/2021);
5.	Air Pollutant Emission Standards for Boilers in Industrial and Commercial Establishments (By-law No. 28/2021);
6.	Prohibition of the Import and Trans-shipment of Non-Degradable Disposable Plastic Drinking Straws and Stirrers to the Macao Special Administrative Region (Executive Order No. 122/2021); and
7.	Application Deadline for the Recycling Industry Equipment and Vehicles Subsidy Scheme extended to 25 November 2022, in accordance with Article 7 of By-law No. 32/2018 – Recycling Industry Equipment and Vehicles Subsidy Scheme (Order No. 31/2021 of the Secretary for Transport and Public Works).

International Treaties

Newly added international agreements and treaties made applicable to Macao in 2021 included:	
1.	Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer (Kigali Amendment); and
2.	Agreement to Prevent Unregulated High Seas Fisheries in the Central Arctic Ocean.

Environmental Protection and Energy Conservation Fund

The Government established the Environmental Protection and Energy Conservation Fund through By-law No. 21/2011. On 26 July 2021, By-law No. 25/2021, amending Administrative Regulation No. 21/2011, was promulgated to improve the operation and management of the Environment and Energy Conservation Fund.

The Environment and Energy Conservation Fund established the Environmental Protection, Energy-saving Products and Equipment Subsidy Scheme, and the Subsidy Scheme for Elimination of Two-stroke Heavy and Light Motorcycles, with the completion of all approvals and disbursement of related subsidies. In addition, the Recycling Industry Equipment and Vehicles Subsidy Scheme was introduced by the Environment and Energy Conservation Fund in 2018, with the subsidy ceiling raised to three million patacas according to the Amendment to the Subsidised Equipment Annex approved by Executive Order No. 54/2020. The application period was extended to 25 November 2022 by Order No. 31/2021 of the Secretary for Transport and Public Works. By the end of 2021, a total of 35 applications were received. All applications were handled and approved, involving subsidies of approximately 16 million patacas.

Promotion of Environmental Protection Education

With the theme “Building a Low Carbon Macao and Embracing a Green Life”, the Environmental Protection Bureau organised 371 diverse events during 2021, attended by 347,879 participants.

The by-law on Construction Waste Management System came into effect on 17 January 2021. The Environmental Protection Bureau organised briefings to promote the regulation before and after its enactment.

Executive Order on the Prohibition on the Import and Transhipment of Non-degradable Disposable Plastic Drinking Straws and Stirrers to the Macao SAR came into effect on 1 January 2022. The Environmental Protection Bureau held a briefing session for trade associations and suppliers, to ensure the effective implementation of the measure.

The by-law of Technical Regulation on Gas-Fired Facilities in Buildings came into effect on 23 September 2021. The Environmental Protection Bureau held a workshop to introduce the key aspects of the regulation to members of the industry and exchange views with them.

Since the law on Restrictions on Using Plastic Bags came into effect, Macao communities have increased awareness of plastic reduction and developed the habit of bringing their own shopping bags. With the ongoing law promotion, the Environmental Protection Bureau held briefings and exhibitions with the Macao Trade and Investment Promotion Institute (IPIM) to publicise the law, whilst encouraging enterprises and businesses to donate the “plastic bag levy” to environmental protection or social welfare organisations.

Since the Green School Project was introduced in 2010, 100 schools have participated, while a series of related environmental education events and the Green Award Project have been organised. The theme for the Green School Award Project 2021 was “Reduce Waste, Save Energy and Be Food-Wise Together”, and there was a record high of 35 award-winning schools. Three schools were awarded the new Green School Platinum Award, with 20 receiving the Green School Honour

Award, and 12 receiving the Outstanding Green School Award. Also, 26 teams and 51 groups were awarded the Environment Education Pedagogical Project Awards and Green Campus Fun Awards, respectively.

The 14th Macao Green Hotel Awards 2020 were presented to 13 hotels, of which five received gold awards; two received silver awards; two received bronze awards, and two received merit awards, together with two budget hotels receiving awards. In all, there are now 57 award-winning hotels (as awards remain valid for three years), accounting for nearly half of all hotels in Macao.

The award-winning hotels have made significant achievements in energy saving, emission reduction and food waste management to support the environmental protection policy of the MSAR Government. About 60 percent of the award-winning hotels spent the amount collected from the “plastic bag levy” to support environmental protection or social welfare.

The Environmental Protection Bureau has introduced the Scheme for Recognition of Eco-Supermarkets for three consecutive years. By the end of 2021, a total of 123 supermarkets participated in the scheme. After the judging, a total of 33 supermarkets received awards under the Scheme for Recognition of Eco-Supermarkets 2020, with one store receiving the gold award; 11 stores receiving the silver awards; 13 stores receiving the bronze awards; and eight stores receiving the participation awards.

The award-winning supermarkets invested in various environmental protection measures, spanning environmental management, reduction of fruit and vegetable packaging, waste reduction and recycling, and energy saving, with donations of the “plastic bag levy” to support environmental protection or social welfare, thereby building a green consumer culture.

The Environmental Protection Bureau created a WeChat official account at the end of 2021, which features “Recycling Tips”, “Member Zone” and “Green Zone”.

Since the launch of the Environmental Protection Fun Bonus Points Scheme, the number of members exceeded 23,500 by the end of 2021.

Environmental Protection Fun – Waste Reduction and Recycling Scheme aims to encourage waste sorting and recycling among the public. Also, Environmental Protection Fun – Moving Towards Being Environmentally-friendly encourages people to assist with providing guided tour services in a nature reserve.

In addition, mobile recycling vehicles park at 16 different locations in Macao on a monthly rotating basis, to provide Environmental Protection Fun recycling services in addition to the recycling of small and large appliances, computers, communication equipment, used batteries, lamps, glass bottles and three-coloured recyclables (plastic bottles, aluminium/iron cans and paper). They also offer an Environmental Protection Fun Bonus Point cards issuance or re-issuance service, to encourage the public to practise green recycling.

In 2021, the Environmental Protection Bureau set up three new Environmental Protection Fun corners in Iao Hon Tranquilidade Plaza, Rua De Inácio Baptista in S. Lourenço and Rua da Ponte Negra in Taipa, which are equipped with 24-hour recycling zones. By the end of 2021, there were 48 community collection points (including Environmental Protection Fun collection points, Environmental Protection Fun corners, Environmental Protection Fun clean collection spots and

mobile recycling vehicles) in Macao.

In the fourth quarter of 2021, the Environmental Protection Bureau upgraded the existing plastic recycling machines into smart recycling machines that can recycle plastic bottles and metal drink cans. These were incorporated into the Environmental Protection Fun Bonus Point Scheme, to provide a more accessible recycling channel. By the end of 2021, a total of 58 smart recycling machines were put into operation, collecting more than 270,000 plastic bottles and 8,000 metal cans.

The Environmental Protection Bureau launched the “Recycling in Buildings is Easy” programme in early 2020 to promote the installation of three-coloured bins and glass bottle recycling bins in buildings and arrange for regular collection of recyclables. By the end of 2021, over 800 buildings participated in the programme.

In October 2021, the Environmental Protection Bureau launched the “Recycling Used Clothes is Very Easy” programme, introducing a new collection service at its Environmental Protection Fun corners, with 24-hour used clothes collection bins in Environmental Protection Fun corners of Iao Hon Tranquilidade Plaza and Rua De Inácio Baptista in S. Lourenço. The bureau also partnered with non-profit organisations to sort the collected used clothes. In addition, the street bins were centrally managed by the Environmental Protection Bureau. By the end of 2021, a total of 139 tonnes of clothes were collected.

In June 2021, the Environmental Protection Bureau launched the “Cherishing Food is Easy” programme, to encourage the catering industry to develop “food-friendly restaurants” through management, staff training and cooperation, and promotions to customers, in order to jointly become food-wise and reduce food waste.

Since the Environmental Protection Bureau introduced the “Reducing Plastic is Easy” event in 2018, it has been well received. As at the end of 2021, the event had received over 1.3 million customer requests for “plastic reduction” and saved an estimated 2.9 million sets of disposable utensils.

The Environmental Protection Bureau has also launched “Bringing Your Own Water Bottles is Easy”. By the end of 2021, 62 drinking water dispensers had been installed across Macao, saving more than 1.35 million plastic bottles.

The Environmental Protection Bureau has been promoting the Scheme on Food Waste Reduction in Macao Food Festival for 12 consecutive years, to highlight environmental messages, including on reducing the use of disposable utensils, waste sorting and recycling, food waste recycling and food saving. The bureau carried forward the practice of recycling food waste from food stalls for resource treatment, setting up waste sorting and recycling bins, and arranging staff to assist the public with proper recycling. In addition, nearly 30 students, teachers and parents took part in the Enjoying Food Festivals with DSPA Mascot event.

Also, the bureau promoted environmental messages to the public during environmental festivals such as World Wetlands Day, Earth Day and World Environment Day, and encouraged the public to participate in environmental activities and put environmental protection into practice.

In response to the World Wetlands Day, on 30 January 2021 the Environmental Protection Bureau held the Launch Ceremony of World Wetlands Day 2021 - Environmental Fans Recognition

and Recycling Red Packets is Very Easy, in Taipa-Coloane Wetland Reserve, to acknowledge the outstanding environmental volunteers who assisted in tour guiding at the Taipa-Coloane Wetland Reserve.

The Government has supported the Earth Hour campaign launched by World Wide Fund for Nature (WWF) for 13 consecutive years. Under the coordination of the Environmental Protection Bureau, the campaign mobilised government departments, corporations, banks and hotels to turn off unnecessary lights for one hour, from 8:30 pm to 9:30 pm, on 27 March 2021.

In response to World Environment Day, the Environmental Protection Bureau launched the Activity Series of World Environment Day 2021, which included “Lights-off for 1 Hour” campaign, “Casual Clothing in Summer for Energy Conservation”, “5% Energy Saving” lucky draw, and Festival of the World Environment Day of the Greater Bay Area, to promote energy saving, emission reduction, waste reduction and other environmental protection messages.

Regional Cooperation on Environmental Protection

The Macau International Environmental Co-operation Forum and Exhibition 2021 (MIECF 2021) was organised by the MSAR Government, with the National Development and Reform Commission, the Ministry of Science and Technology, the Ministry of Industry and Information Technology, and the Ministry of Ecology and Environment as special sponsors; the Pan-Pearl River Delta provincial/regional governments as co-organisers; and the Macao Trade and Investment Promotion Institute, and the Environmental Protection Bureau as official contractors. The event was held from 5 August 2021 to 7 August 2021 under the theme of “Towards a Green and Low Carbon New Era” through online exhibitions and cloud matching sessions.

Regarding environmental cooperation in the Pan-Pearl River Delta Region, the Environmental Protection Bureau attended the 17th Coordinator Working Meeting of the Joint Conference on Pan-Pearl River Delta Regional Environmental Protection Cooperation and the 17th meeting of the Joint Conference on Pan-Pearl River Delta Regional Environmental Protection Cooperation through video conferencing in July and August 2021, respectively.

Regarding environmental cooperation and participation in technical exchanges, in December 2021 the Environmental Protection Bureau and the South China Institute of Environmental Sciences of the Ministry of Ecology and Environment signed a letter of intent to provide technical support to Macao’s environmental protection work, and initiated cooperation in environmental protection.

In June 2021, Guangdong, Hong Kong and Macao jointly announced the 2020 Report of the Guangdong-Hong Kong-Macao Pearl River Delta Regional Air Quality Monitoring Network. The parties will continue to manage and maintain the regional air quality monitoring network.

In addition, the bureau attended the sixth Guangdong-Hong Kong-Macao Wetland Ecological Conservation Symposium in December 2021, and shared views on strengthening Guangdong-Hong Kong-Macao cooperation on ecological and environmental protection and management of coastal nature reserves.

Regarding environmental cooperation between Guangdong and Macao, the Environmental Protection Bureau and the Department of Ecology and Environment of Guangdong Province

exchanged views on environmental protection. In addition, the bureau continued stepping up regional energy cooperation in 2021, and planned construction of the third circuit of the 220kV Macao-Zhuhai electric power transmission channel. The construction of the substation was completed at the end of 2021; and it is expected to commence operation in the third quarter of 2022, and fulfil Macao's electricity demand until 2025.

Regarding Hong Kong-Macao environmental cooperation, in July 2021 bureau officials convened the 13th Meeting on Environmental Protection Cooperation between Hong Kong and Macao through video conferencing. The parties exchanged views on environmental conditions, air pollution, electric vehicles, waste reduction, and environmental exhibitions and seminars, and discussed plans for future cooperation. The Environmental Protection Bureau also attended Eco Asia Video Conference 2021 of Eco Expo Asia and Hong Kong Awards for Environmental Excellence (HKAEE) and Hong Kong Green Organisation Certification (HKGOC) Presentation Ceremony through video conferencing.

Under the framework of the Zhuhai-Macao Environmental Protection Cooperation Agreement, the Zhuhai-Macao Environmental Cooperation Working Group Meeting 2021 was held in November 2021. The two parties reviewed the environmental cooperation projects in the past year, and exchanged views on marine pollution governance, atmospheric environment quality and monitoring, communication on environmental emergencies, exchanges on ecological issues, environmental protection industry and promotion of environmental protection education. There were also discussions on plans for cooperation in the coming year.

Environmental Protection Planning in Macao

In 2021, the Environmental Protection Bureau completed the study on concluding the implementation of the Environmental Protection Plan of Macao (2010-2020). Also, a draft of the Environmental Protection Plan of Macao (2021-2025) was prepared, to formulate the environmental protection policies for the next five years.

Environmental Data

Complaints received by the Environmental Protection Bureau in 2021:

Category	Number of cases
Noise	2,002
Air pollution	516
Noise and air	129
Noise and other	116
Air and other	42
Environmental hygiene	76
Other	219
Total	3,100

Technical advice provided at the request of other departments in 2021:

Department	Premises and projects	Nos.
Tourist Office	Premises including karaoke bars, bars, hotels, restaurants, sauna and massage establishments, dance halls and health clubs.	403
	Inspections before issuance or renewal of licences	167
Economic and Technological Development Bureau	Technical advice	21
	Inspection of industrial sites	22
Lands, Public Works and Transport Bureau	Project plans including piling foundation (environmental protection) projects and applications for extension of construction time, construction plans, expansion plans, modification of / legalisation on construction projects	158
	Maps of urban conditions	117
	Draft by-law	1
	Technical advice	1
Municipal Affairs Bureau	Technical advice on licensed premises	326
	Site inspections	187
	Project plans	1
	Technical advice	14
Infrastructure Development Office	Project plans	6
	Technical advice	206
Other departments	Technical advice	29

Moreover, the Environmental Protection Bureau provided 594 technical recommendations on environmental planning assessment areas, and received 17 environmental impact assessment reports on new projects and related information in 2021.

Flora

Macao abounds in plant species. More than 1,500 species of vascular plants have been identified in Macao. These are mainly found in woodlands, parks and leisure grounds. Most of Macao's vegetation

belongs to the evergreen broad-leaf woodland, tree, shrub and coastal bush groups, including such species as Rose Myrtle (*Rhodomyrtus tomentosa*), Blood-red Melastoma (*Melastoma sanguineum*), Oblong leaved Litsea (*Litsea rotundifolia* var. *oblongifolia*), Pop-gun Seed (*Bridelia tomentosa*), Hong Kong Hawthorn (*Rhaphiolepis indica*) and Linear Forked Fern (*Dicranopteris*). The most common species of cultivated plants are the Chinese Hibiscus (*Hibiscus rosa-sinensis*), Hong Kong Orchid Tree (*Bauhinia blakeana*), Sunshine Tree (*Cassia surattensis*) and False Groundnut (*Desmodium heterocarpon*).

Also, Macao has 104 species of bryophytes which belong to 34 genera and 63 families. Rare species include *Fissidens macaoensis*, *Kurzia sinensis*, *Phaeoceroa laevis*, *Notothylas japonica* horik, *Micromitrium* and *Vesicularia*. *Fissidens macaoensis* is a new species to science which was officially announced in 2011. As it was discovered in Macao, its Latin name includes “Macao”.

The terrestrial vegetation in Macao has a relatively diverse plant community. Types of vegetation can be identified: coniferous forests, mixed conifer–broadleaf forests, evergreen broadleaf forests, mixed evergreen -deciduous plants and scrublands. Forest areas on Taipa and Coloane have undergone a compositional transformation. A firebreak was set up, and many indigenous tree species were introduced, including Melia-leaved Evodia (*Tetradium glabrifolium*), Hong Kong Gordonia (*Gordonia axillaris*), Acronychia (*Acronychia pedunculata*), Morris’s Persimmon (*Diospyros morrisiana*), India Carallia (*Carallia brachiata*), Yanmin (*Dracontomelon duperreanum*), Persimmon-leaved Litsea (*Litsea monopetala*), *Michelia chapensis*, Burmese Rosewood (*Pterocarpus indicus*), Heterophyllous Winged-seed Tree (*Pterospermum heterophyllum*), Silver-back Artocarpus (*Artocarpus hypargyreus*), *Pinus elliottii*×*Pinus oaribaea*, Common Fig (*Ficus carica*), Horse-tail Pine (*Casuarina equisetifolia*), Chinese Holly (*Ilex rotunda*), *Michelia macclurei* and Chinese Guger Tree (*Schima superba*).

In addition to leafy plants that were commonly used in the past – namely the Dwarf Yellow (*Duranta repens*), Golden Leaves (*Ficus microcarpa*), Bridal Wreath (*Stephanotis floribunda*), Fukien Tea (*Ehretia monopyrena*), Cochin-china Excoecaria (*Excoecaria cochinchinensis*) and Ivy Tree (*Schefflera heptaphylla*) – colours were added to the green belts to improve greening of streets in Macao and create a better view by growing colourful flowering shrubs, such as Ti Plant (*Cordyline fruticosa*), Britton’s Wild Petunia (*Ruellia brittoniana* Leonard), Hawaiian Hibiscus (*Hibiscus rosa-sinensis*), Yellow Allamanda (*Allamanda cathartica*), Purple Allamanda (*Allamanda blanchetii*), Indian Canna (*Canna indica*) and Dwarf Umbrella Tree (*Schefflera arboricola* ‘*Variegata*’) in recent years. The view looks more layered with the addition of these flowers, together with trees such as Terminalia (*Terminalia mantaly* H. Perrier), Chinese Holly (*Ilex rotunda*), Chittagong Chickrassy (*Chukrasia tabularis*) and Lance-leaved Sterculia (*Sterculia lanceolata*).

Woodland Recovery

Macao was hit by strong typhoons Hato and Mangkhut in 2017 and 2018 respectively, which caused severe damage to forest ecosystems.

In the fourth quarter of 2018, with support from the Chinese Academy of Forestry of Guangdong Province, which is directly under the Forestry Administration of Guangdong Province, the Municipal Affairs Bureau commenced the first stage of woodland recovery.

The recovery work was completed in two phases. In the first phase of the woodland recovery, guided by the Forestry Administration of Guangdong Province, with the assistance of Chinese Academy of Forestry of Guangdong Province, a total of 35,000 saplings were replanted or transplanted. Damaged woodland within five metres of 11 trails was restored, covering a total area of 35 hectares. The recovery work was completed in September 2019, with a remarkable result of over 98 percent survival rate of the saplings, which bloomed and grew fruits in spring and summer 2020.

The second phase of woodland recovery commenced in the fourth quarter of 2019, as planned by the Municipal Affairs Bureau, covering an area of about five hectares. In all, 5,000 saplings were replanted or transplanted.

After completion of the first stage of emergency ecological recovery, the second stage of woodland ecology recovery commenced in the fourth quarter of 2021, focused on overall improvement and enhancement. It is expected this will be completed in about five to ten years, with the goal of restoring an area of at least 120 hectares by 2024. With the assistance of the Guangdong Forestry Science Academe, the third stage of woodland recovery commenced in September 2021, according to the forestry design plan, and included the thinning and removal of dead trees, covering an area of about 15 hectares. A total of approximately 15,000 saplings was replanted or transplanted.

Fauna

Macao is small. The development of land and expansion of urbanisation affect and damage the survival and scope of activities of wild animals. The numbers of species and populations of wild animals in Macao are decreasing.

The scarcity of unpolluted waters in Macao leads to a decrease in the diversity and numbers of amphibians. The commonest species are Asian Common Toad (*Bufo melanostictus*) and Ornate Pygmy Frog (*Microhyla ornata*). In the hilly forest area of Coloane, the Municipal Affairs Bureau has constructed artificial freshwater wetlands as better habitats for amphibians.

The commonest wild mammals are bats, rats and Red-bellied Tree Squirrels. Bats mainly inhabit Coloane and Taipa. The Japanese House Bat (*Pipistrellus abramus*) and Short-nosed Indian Fruit Bat (*Cynopterus sphinx*) can be found on the Macao peninsula. The former frequents gaps between buildings and lives on mosquitoes and flies, helping to limit populations of harmful insects. The latter eat fruits in parks or woods, and may help spread their seeds, contributing to the city environment and natural environment of the woods. The Red-bellied Tree Squirrel is an exotic species, formerly imported as a pet. It is now wild in Macao. Its lack of natural enemies poses a threat to other animal species, especially birds, as the squirrels eat their eggs.

Reptiles, especially snakes, play an important ecological role in controlling the number of rats. The common Chinese Rat Snake (*Ptyas korros*), Oriental Rat Snake (*Ptyas mucosa*) and Asiatic Water Snake (*Fowlea piscator*) are non-venomous, while common venomous species include White-lipped Pit Viper (*Trimeresurus albolabris*) and Taiwan Cobra (*Naja atra*). Two rare species, Many-banded Krait (*Bungarus multicinctus*) and Burmese python (*Python bivittatus*), were recorded several times in 2019. However, Macao's dense population poses an enormous threat to their dwelling and foraging areas. In addition, some people's misunderstanding and fear about snakebites have caused

the number of snakes to decrease most significantly among all wild animals in Macao.

Previous studies recorded over 300 species of birds in Macao. A total of over 275 species of birds in 15 orders and 57 families has been recorded from 2006 to the present. Dominant species were Chinese bulbul (*Pycnonotus sinensis*, terrestrial) and Little Egret (*Egretta garzetta*, waterbirds). There were 11 common species, five of which were terrestrial birds – Spotted dove (*Spilopelia chinensis*), Swinhoe’s White-eye (*Zosterops japonicus*), Crested Myna (*Acridotheres cristatellus*), Common Tailorbird (*Orthotomus sutorius*) and Eurasian Tree Sparrow (*Passer montanus*); and six species were waterbirds: Kentish Plover (*Charadrius alexandrinus*), Pied Avocet (*Recurvirostra avosetta*), Eurasian Teal (*Anas crecca*), Great Egret (*Ardea alba*), Grey Heron (*Ardea cinerea*) and Black-crowned Night Heron (*Nycticorax nycticorax*). Among common species, waterbirds outnumbered terrestrial birds.

In 2021, a total of 143 species of birds in 14 orders and 40 families were recorded in Macao, 57 of which were residents, and 86 of which were migrants. Gadwall (*Mareca strepera*), Blyth’s pipit (*Anthus godlewskii*), Collared crow (*Corvus torquatus*), Slaty-breasted rail (*Lewinia striata*) and Red-necked phalarope (*Phalaropus lobatus*) were newly recorded species in 2021.

There are abundant fish stocks in Macao, which can be categorised into saltwater fish, brackish fish and freshwater fish. Saltwater fish and brackish water fish mainly refer to the fish off the coast of Macao. There are approximately 200 species of these fish. Freshwater fish most need protection in the natural environment. Although the habitats of freshwater fish and amphibians are similar to each other, the former have a narrower sphere of activities. Whenever the environment is destroyed or altered by human activities, they are often affected most directly.

There are over 700 species of insects, which are widely distributed in Macao, including 150 ant species, over 100 butterfly species and more than 40 dragonfly species.

Laws Governing Nature Conservation

Macao began to enact laws and regulations on nature conservation – including the establishment of nature reserves and the protection of flora and fauna of special interest – more than 30 years ago. New by-laws were promulgated in 2004 to replace older ones. They are as follows:

1. Decree-Law No. 33/81/M, gazetted on 19 September 1981; Decree-Law No. 30/84/M, amended on 28 April 1984; and Decree-Law No. 3/99/M, revised on 25 January 1999, which designated a 196,225-square-metre area of Seac Pai Van Country Park as a conservation area of outstanding educational, ecological, scenic and scientific value;
2. Law No. 11/2013, approved by the Legislative Assembly on 13 August 2013, and By-law No. 31/2018 enacted on 4 May 2018, designated part of Coloane island with an altitude of 80 metres or above as a buffer zone. Under the same law, Executive Order No. 168/2021 – List of Protected Old and Valuable Trees, promulgated on 8 November 2021, provides effective protection for the listed trees;
3. The Environmental Law, approved by the Legislative Assembly on 31 January 1991 and gazetted by Law No. 2/91/M on 11 March 1991, which set out general guidelines and basic principles for the formulation of environmental policies;

4. General Regulations Governing Public Places (By-law No. 28/2004) enacted on 28 July 2004, which established general principles for behaviour to be observed when using and enjoying public places;
5. By-law No. 40/2004 on Sanitary and Phytosanitary Control enacted on 14 December 2004, which regulates the sanitary and phytosanitary control of merchandise, and implements Chief Executive Order No. 245/2014 on the List of Plant Pests for Regulation as Quarantine Pest Organisms of the Macao SAR;
6. The Animal Protection Law (Law No. 4/2016) came into effect on 1 September 2016, with regulations on keeping, managing and selling animals, and the use of animals in public exhibitions and scientific applications. In addition, the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), the Convention on Biological Diversity, and the International Plant Protection Convention have been made applicable to Macao, thus ensuring that Macao's nature conservation policies conform to international practices; and
7. To ensure the enforcement of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) in Macao, the Legislative Assembly of the Macao SAR deliberated and passed Law No. 2/2017 regarding the convention.

Nature Reserve

The Taipa-Coloane Wetland Reserve managed by the Environmental Protection Bureau is situated adjacent to the Lotus Flower Bridge in Taipa and Coloane. It has a total area of 55 hectares, including a 40-hectare bird foraging area that is regarded as zone two of the reserve, on the west coast of reclaimed area between Taipa and Coloane. Next to this zone is a 15-hectare bird habitat, regarded as zone one of the reserve, which provides different bird species (including the rare Black-faced Spoonbill) with suitable habitats.

As at the end of 2021, the Cotai Nature Reserve's known plant species included 273 species of planktonic algae, four species of bryophyte, 20 species of pterophyte, 11 species of gymnosperm, and 351 species of flowering plants. Regarding animal species, 142 plankton species, 133 zoobenthos species, 536 species of insects, 88 species of fish, five species of amphibians, 21 species of reptiles and 11 species of mammals were recorded. The abundant food sources attracted 188 species of birds to forage and roost in the nature reserve, including the globally rare Black-faced Spoonbill (*Platalea minor*).

To enrich education on ecology, a series of events in nature reserves were held monthly, including the Cotai Nature Reserves Open Day, the "Nature School" family workshop, and bird watching in nature reserves during migratory bird seasons from November to April the following year, while Ichthyology Workshops were held in other seasons to raise public awareness of environment protection.

Country Parks

There are four country parks in Macao: Seac Pai Van Country Park, Taipa Grande Nature Park,

Hac Sa Reservoir Country Park, and Ka Ho Reservoir Country Park.

Seac Pai Van Country Park

Situated to the west of Coloane, Seac Pai Van Country Park is bounded by quarries to the north, Seac Pai Van Road to the west, Estrada do Alto de Coloane to the south, and Estrada do Militar to the east, covering an area of approximately 198,000 square metres. The park was established by legislation as a reserved zone in 1981 for its educational, ecological, scenic and scientific values, pioneering nature education in Macao. In 1984, it became the first country park in Macao.

Giant Panda Pavilion

Set against a hill side in Seac Pai Van Park of Coloane, with a fan-shaped layout and an area of about 3,000 square metres, Macao Giant Panda Pavilion is designed to combine the terrain's natural undulations with the architectural characteristics. The pavilion comprises two 330-square metre indoor activity quarters and a 600-square metre outdoor yard. The appearance of the Macao Giant Panda Pavilion is designed to mimic nature, and it features green elements with leisure facilities such as pools and wooden climbing frames for the pandas.

Taipa Grande Nature Park

Taipa Grande Nature Park is on the east of Taipa island, and covers a wooded and hilly area between Ponta da Cabrita Road, Governador Nobre de Carvalho Avenue and Padre Estevao Eusebio Situ Road. The park is famous for its sunrise and sunset views, along with views of herons, and planes landing and take-offs. It has an observation deck, a viewing pavilion, a children's playground, a barbecue area, a circular plaza, a green promenade, a grass skiing slope, and Taipa Grande Trail, while serving as a multifunctional park for relaxation, exercise, environmental protection, education, and retreat. It is also an ideal destination for Macao residents to enjoy forest scenery to the full, embrace nature and enrich their leisure time. The total area is approximately 559,000 square metres.

Hac Sa Reservoir Country Park

Hac Sa Reservoir Country Park is situated in a hilly forest area on the south-eastern slopes of the central mountain of Coloane. The park occupies 377,000 square metres between the entrance of the Westin Resort Macau on Hac Sa Road to the east, and Chu Ku Tong pond, in front of Man Hong Un, to the south. The Hac Sa aquatic plant zone and aquatic plant watching zone are for nature protection and education.

Ka Ho Reservoir Country Park

Ka Ho Reservoir Country Park is situated on the northeast of Coloane island. The park faces Ka Ho Village to the east, separated by Barragem de Ka Ho Road. Seac Pai Van Reservoir lies to its west; and the golf course and Alto de Coloane Road lie to its south. It is bordered by a road that leads to the youth challenge centre in the north; and it stretches all the way down to a wooded and

hilly area by the shoreline. Ka Ho Reservoir Country Park has an area of 506,000 square metres.

With Ka Ho Reservoir as its central point, the park boasts various facilities, including the Ka Ho Reservoir Trail, Northeast Trail, Dam Mural, Waiting Square, and Little Spring; as well as barbecue, and picnic areas; the Blossom Bridge; diversity games zone; Ka Ho Reservoir Outdoor Experimental Camp; and the Freshwater-Wetland Ecological Zone. With its educational and recreational features, Ka Ho Reservoir Country Park is an ideal place to spend leisure time.

As work proceeded on expansion of Ka Ho Reservoir, Ka Ho Reservoir Country Park – including Ka Ho Reservoir Trail, Outdoor Experimental Camp and the Freshwater-Wetland Ecological Zone, which are managed by the Municipal Affairs Bureau – closed to the public from 17 September 2019 until completion of the project.

Population

Macao's resident population was 683,200 at the end of 2021, representing an increase of 100, or 0.01 percent, over the previous year. An estimated 47 percent of Macao's population were males, and 53 percent were females.

The local population was 570,100 at the end of the year, representing an increase of 6,000, or 1.1 percent, over the previous year. The number of foreign employees residing in Macao declined by nine percent to 93,500, while the number of foreign students residing in Macao increased by 20 percent to 19,600.

Natural factors are among the reasons for the increase in population. In 2021, there were 5,026 new-born babies, 9.4 percent fewer than in 2020, and 2,320 deaths, four percent more in 2020. The natural population growth rate saw a decline since 2015, with a drop of 0.08 percent compared to the 0.4 percent growth in 2020.

On top of this increase, there was a change in immigration, another factor influencing population. The net number of immigrants was 2600 in 2021, largely attributed to fewer foreign employees residing in Macao.

Regarding the population distribution by statistical district, most residents lived in Baixa da Taipa, with 75,900 residents, comprising 11.1 percent of the total population, followed by Areia Preta New Reclamation Zone (10.4 percent) and Areia Preta and Iao Hon Districts (10.1 percent). Ilha Verde and Coloane Districts saw the largest rise in population, which increased by 7.9 percent and six percent year-on-year from 2020, respectively.

Birth and Death Rates

In 2021, the birth rate was 0.74 percent, representing a drop of 0.07 percentage points, while the death rate was 0.34 percent, 0.01 percentage points lower than the previous year.

Population Ageing

Macao's population is ageing because of the increasing life expectancy. Senior citizens (aged 65

years or above) made up 12.2 percent of the population, 0.5 percent points more than the previous year; the number of other adults (aged 15-64 years) dropped by 0.9 percentage points, representing 73.3 percent of the population. The ageing index increased by 0.9 percentage points to 83.7 percent of the population over the previous year, marking the 25th consecutive year this index has increased.

The ageing in the population of Macao people is more significant, with 14.6 percent represented by senior citizens (aged 65 years or above), and 68 percent by other adults (aged 15-64 years). The elderly dependency ratio of the population of Macao people was 21.5 percent, which means there was one senior citizen for every five adults.

Identification Bureau

Under the Basic Law of the Macao SAR, the Macao Special Administrative Region Government is authorised by the central government to issue MSAR Passports to Chinese citizens who hold MSAR Permanent Resident ID cards, and to issue other types of MSAR travel permits to other legal residents of Macao. MSAR Passports and travel permits are valid for worldwide travel, and entitle their holders to return to Macao.

The Identification Bureau is under the administration of the Secretariat for Administration and Justice, and is responsible for the overall planning and work relating to the civil and criminal identification of Macao residents. It issues ID cards and certificates of criminal record, certificates to substantiate the facts stated in official record, MSAR Passports, and other travel permits to Macao residents. It also responsible for handling nationality applications from MSAR residents, receiving and handling applications for Certificate of Entitlement to Right of Abode and issuing the related certificates, arranging the registration of associations and syndicates qualified as juridical persons and issuing the related certificates, as well as other duties as vested by law.

Personal Identity Cards

Only Chinese citizens who are permanent residents in Macao with a Macao Resident ID card are eligible to apply for an MSAR Passport. A Chinese citizen who is a Macao Resident ID cardholder, but not a permanent resident of Macao and not eligible for other travel permits, may apply for an MSAR travel permit.

By 31 December 2021, the Identification Bureau had issued 788,515 MSAR Passports and 56,664 travel permits.

Under the Nationality Law of the People's Republic of China and the Interpretation by the Standing Committee of the National People's Congress on Several Questions Relating to the Application of the Nationality Law of the People's Republic of China in the Macao Special Administrative Region, any permanent resident of Macao with Chinese nationality and a Portuguese travel document may travel to other countries or regions with the Portuguese travel document as before. Therefore, such people may hold both a Macao SAR Passport and a Portuguese travel document at the same time.

The Identification Bureau is responsible for issuing Visit Permits for Residents of the Macao

SAR to the Hong Kong SAR (also known as “Visit Permits to the HKSAR”). Residents of the MSAR who are either Chinese or Portuguese citizens and who hold a Macao Resident ID card or an MSAR Resident ID card may apply for Visit Permits to the HKSAR. The bureau had issued 449,681 such permits as at 31 December 2021.

The Identification Bureau is also responsible for issuing Macao SAR Resident ID cards. As at 31 December 2021, there were 740,021 Macao SAR Resident ID card cardholders. Between 1 January 2021 and 31 December 2021, 8,314 residents received Macao SAR Resident ID cards for the first time.

Nationality

Under Law No. 7/1999, the Identification Bureau is responsible for handling nationality applications from MSAR residents, including applications by foreign nationals or stateless persons for naturalisation; applications by Chinese citizens to renounce Chinese nationality; applications by foreigners who previously had Chinese nationality to restore Chinese nationality; applications by MSAR residents of both Chinese and Portuguese descent to choose either Chinese or Portuguese nationality; and applications by original Macao residents who are Chinese citizens with other nationalities to adopt Chinese nationality.

Between 20 December 1999 and 31 December 2021, 1,331 applications for naturalisation were approved; 568 people restored their Chinese nationality; 101 renounced their Chinese nationality; 3,543 successfully applied to adopt Chinese nationality; 72 opted for Portuguese nationality; and there were five applications for change of nationality.

Certificate of Entitlement to Right of Abode

A certificate of entitlement to right of abode confirms the status of a permanent resident of the MSAR. Any person who claims to have right of abode in the MSAR but does not hold a valid Macao Resident ID card or MSAR Resident ID card and who does not live in any other region of the People’s Republic of China (except the Hong Kong SAR and Taiwan) must apply for a certificate of entitlement to right of abode.

Such people include Chinese citizens who have ordinarily resided in Macao for seven consecutive years before or after the establishment of the Macao SAR; children of Chinese nationality born outside Macao whose parents are Chinese nationals and permanent residents of Macao; people of both Chinese and Portuguese descent who have ordinarily resided in Macao for seven consecutive years before or after the establishment of the MSAR; and children of Chinese nationality or children born outside Macao who have not selected a nationality but intend to reside in Macao permanently and whose parents are permanent Macao residents of either Chinese citizenship or Portuguese descent. The certificate of entitlement to right of abode indicates its date of effectiveness, prior to which holders of the certificate have no right to enter or reside in Macao.

Between 20 December 1999 and 31 December 2021, the Identification Bureau issued 83,502 certificates of entitlement to right of abode.

Certificate of Criminal Record

In August 1996, the Identification Bureau started to issue certificates of criminal record and certificates of special record for minors.

The former is the sole and sufficient document to prove whether an applicant has any criminal record; while the latter is applicable to those under 16.

Between 1 January and 31 December 2021, the bureau issued a total of 67,613 certificates of criminal record. Of these, 52,173 were public applications, and 15,440 were agency applications. Among the 83 certificates of special record for minors that were issued, three were to public bodies, and 80 were to minors applying through an agency.

Immigration Controls

According to the Basic Law of the Macao SAR, the Government may impose restrictions on people from other countries or regions entering, staying in, and leaving Macao. The Immigration Department of the Public Security Police is responsible for entry and exit in Macao.

The MSAR Immigrant Department records the entry and exit of non-residents, as well as their passport, visa, or other relevant documents for reference. The period of stay is granted according to stipulations in By-law No. 5/2003.

By 31 December 2021, citizens of 81 countries enjoyed visa-free access to Macao. Valid passport holders of these countries and regions may enter and stay in Macao for 14 to 90 days, while those from certain countries may stay for up to six months. PRC passport or travel permit holders who have a valid air ticket and visa issued by the country or region of destination may stay for a maximum of seven days in Macao.

Legal Immigration

In 2021, the number of new immigrants from mainland China holding one-way permits decreased by 346 from the previous year, to 2,627, with the number of new immigrants from Guangdong province decreasing by 405 to 1,705, 63.75 percent of whom were female. Among new immigrants, 31.94 percent were aged below 30 years, representing a drop of 3.36 percentage points.

Overstaying and Illegal Entry

In 2021, 18,243 overstayers were repatriated. They included 17,455 mainland China residents, 72 Taiwan (China) residents, 131 Hong Kong residents, 585 foreign nationals, and 11,773 voluntarily repatriated mainland Chinese.

Civil Registration

The Civil Registry is responsible for implementing regulations relating to the civil registration of births, parentage, adoption and child custody, marriage agreements, deaths, legal certification of

the deaths of missing persons, and issuing relevant certified documents.

Birth Registration

The Birth Registry is responsible for the registration of births in Macao, as well as the re-registration of births of people aged 14 or over. The Civil Registry should be verbally notified of any birth in Macao by the parents or guardians within 30 days. There were 5,049 registered births during 2021.

Marriage Registration

The Civil Registry is responsible for handling applications for marriages, approving marriage registrations, hosting ceremonies for the signing of marriage certificates and registering marriages. A total of 3,277 marriages were registered during 2021.

Death Registration

Family dependents or other relatives of a deceased person may register his or her death with the Civil Registry. There were 2,383 death registrations during 2021.

Divorce by Mutual Consent

The Civil Registry has the authority to process divorce by mutual consent. Applicants who have been married for over one year, have no children aged under 18, and have reached agreement on maintenance payments and ownership of their residences may submit applications to the Civil Registry. There were 627 divorce applications during 2021.



**The Kun lam Statue Waterfront
Leisure Area**





The Kun Lam Statue Waterfront Leisure Area, which spans an area from the Science Center to the Kun Lam Statue, opened on 29 April 2021. Its total area is about 15,000 square metres, and facilities include a children's play area, footpaths, cafes, multi-purpose playgrounds, fitness and recreation areas, a gateball court, a roller-skating rink and other leisure and recreational spaces. The children's play area has novel amusement facilities, such as parent-child integration play equipment suiting different age groups, for children to learn different skills and exercise through playing.