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**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 located at latitude 22°12'40"N and longitude 113°32'22"E. Macao time is eight hours ahead of Greenwich Mean Time. The MSAR consists of the Macao peninsula and two islands: Taipa and Coloane. 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"N, and to the north 22°13'01.3"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 30.8 square kilometres in 2017. The Macao peninsula accounts for 9.3 square kilometres (30.2 percent) of the current area, Taipa island for 7.9 square kilometres (25.6 percent), Coloane island for 7.6 square kilometres (24.7 percent), COTAI Reclamation Area for six square kilometres (19.5 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 21.7 square kilometres, accounting for 70.4 percent of the total; granite hills cover six square kilometres, or 19.5 percent; and terraces cover 1.2 square kilometres, or 3.9 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 6.2 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

Due to the development of Macao's coastal areas, reclamation of the New Urban Area and the completion of the Zhuhai-Macao Port Artificial Island of the Hong Kong-Zhuhai-Macao Bridge, the Cartography and Cadastre Bureau is now assessing the coastline of the Macao SAR, and conducting a comprehensive investigation and survey on the current status of Macao's coastline, to facilitate sustainable use and development of the Macao's land and marine resources, and provide important scientific data for formulating maritime planning and management.

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 Organization (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 363.8 millimetres; while January had the least – an average of 26.5 millimetres.

Macao has an average annual temperature of 22.6°C. The coolest month is January, when it averages 15.1°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

General Situation

In 2017, Macao's average annual temperature and the relative humidity were slightly higher than the climate normal, while the total rainfall and the total evaporation level were significantly lower than the climate normal, and the total hours of sunshine was slightly above the climate normal.

Eight tropical cyclones affected Macao in 2017. They were: Severe Tropical Storm Merbok from 11 to 13 June; Tropical Storm Roke from 22 to 23 July; Typhoon Hato from 22 to 23 August;

Tropical Storm Pakhar from 26 to 27 August; Severe Tropical Storm Mawar from 31 August to 4 September; Typhoon Doksuri from 13 to 15 September; a tropical depression from 24 to 25 September; and Typhoon Khanun from 13 to 16 October. Macao suffered from serious damage by Typhoon Hato, during which Typhoon Signal no.10 was issued for the first time since Macao suffered a direct hit by Typhoon York in 1999. Typhoon Signal no.8 was also issued in Macao during the closest approach of Severe Tropical Storm Pakhar and Typhoon Khanun.

As regards storm surge warnings, a black storm surge warning was issued during the direct hit by Typhoon Hato, while yellow storm surge warnings were issued during the passage of Severe Tropical Storm Pakhar and Typhoon Khanun.

Summary of Severe Weather Warnings Issued in 2017			
Warning / Signal Type		Frequency	No. of Warning Reports Issued
Tropical Cyclone Warning	No. 1 Alert Signal	8	50
	No. 3 Strong Wind Signal	4	20
	No. 8 Northeast Gale Signal	3	16
	No. 8 Southeast Gale Signal	2	8
	No. 8 Southwest Gale Signal	0	0
	No. 8 Northwest Gale Signal	0	0
	No. 9 Increasing Gale Signal	1	2
	No. 10 Typhoon Signal	1	3
	All Signals Lowered	8	8
Strong Monsoon Warning (Black Ball)		15	34
Rainstorm Warning		4	16
Thunderstorm Warning		71	168
Storm Surge Warning		3	23

Temperatures

Macao had an average annual temperature of 23°C during 2017, which was 0.4°C higher than the climate normal. The highest and the lowest average temperatures were 28.7°C in August and 16°C in February, respectively. The hottest day was 22 August, when the temperature rose to 38°C, the highest temperature recorded since 1930; whereas the coldest day was 18 February, when the temperature fell to 7.1°C.

Relative Humidity

The average relative humidity during 2017 was 81 percent, which was 2.2 percentage points higher than the climate normal. July saw the highest monthly average relative humidity at 87 percent; whereas the lowest was 65 percent in December.

Rainfall

Total rainfall during 2017 was 1,783.2 millimetres, which was 274.9 millimetres or about 13 percent less than climate normal. The highest monthly rainfall was recorded in September at 367.2 millimetres, 147.7 millimetres above normal. The lowest monthly rainfall was recorded in December, at 0.2 millimetres. The highest daily rainfall was recorded on 4 September, at 166.2 millimetres.

Evaporation

The total evaporation level in 2017 was 801.9 millimetres, which was 143.2 millimetres less than the climate normal. The evaporation levels in February and December 2017 were slightly higher than the climate normal, while the evaporation levels of other months in the year were all lower than the climate normals.

Sunshine

During 2017, Macao had 1,775.1 hours of sunshine, 1.2 hours less than normal. The most hours of sunshine were recorded in August, totalling 217.7 hours, 22.3 hours above normal. The least hours of sunshine were recorded in March, amounting to 58.2 hours, which was 13.3 hours less than normal.

Wind

During 2017, Macao was subject to predominantly north-northeasterly winds in January; northerly winds in February, April and from October to December; easterly winds in March, May, July and September; and southerly winds in June and August. Wind speeds averaged 10.8 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 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 weather reports on the preceding day, which are broadcast daily for the public. The

SMG provided 1,820 weather forecasts and 718 weather forecasts for the Macao coastal area during 2017.

Every day, SMG officers explain the day's weather conditions and the forecast for the following day during the Macao Broadcasting Company's (TDM) morning TV programme. The SMG launched the audio weather information service in 2015, in which forecasters regularly or when necessary record weather information and upload it to the Internet for download and use by different 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).

The SMG issues special weather information on its website in times of adverse weather conditions, including tropical cyclones, strong monsoons (black ball), rainstorms, thunderstorms and storm surges, so that the public are notified of the latest situation. When Typhoon Signal No. 3 or above is issued, the local broadcaster TDM will provide streaming updates on the latest developments concerning the tropical cyclone. To improve delivery of information to the public, a new format of delivery of tropical cyclone information was also adopted.

In response to special weather conditions (such as a forecast of a substantial drop in temperature), the SMG sends special weather notifications to registered users, social welfare organisations and schools via WeChat and SMS.

Through the round-the-clock Automatic Air Quality Monitoring Network, the SMG announces real-time concentration of air pollutants and summarises daily air quality on its website every day. In addition, an air quality forecast for the following day is reported to the public.

The SMG Aeronautic Meteorological Center at Macao International Airport provides half-hourly weather observations and special reports to aviation organisations and flight crews.

The aeronautical meteorological documents include meteorological maps for every route, as well as upper wind and temperature charts, aviation weather reports and forecasts, and volcanic ash and tropical cyclone advisory information. All international flights departing Macao can receive the most update aeronautical meteorological documents of international standards via the Aviation Weather Information System (AWIS). In 2017, a total of 31,882 aeronautical meteorological documents were downloaded from the system, typically operated at 99.9 percent efficiency.

In recent years, the SMG has introduced the Mobile WebWeather Service, Macao page, on the Weather China website; Macao SMG mobile application (APP) and the official WeChat account, "Macao SMG". An SMS service and the 1311 Telephone Voice Response Weather Information Enquiry Service provide a wide array of weather information and air quality indices. The SMG also cooperates with relevant departments to display up-to-date tropical cyclone and rainstorm warnings on the electronic monitors in the Border Gate checkpoint building and the Outer Harbour Ferry Terminal, in order to help border-crossing commuter to promptly respond to changes in weather.

The SMG also offered the 48-hour Automatic Weather Forecast and Real-time Air Quality Index services, providing the public with temperature and humidity forecasts for the following two days and more timely air quality index on the website. In addition, the Weather Service Centre was established at the Outer Harbour Ferry Terminal, to provide travellers with the latest weather advice and information.

In 2017, the SMG introduced the Marine Weather Forecasts service, providing marine weather forecasts for Macao waters of the day for public reference. In addition, to improve delivery of marine weather information, the SMG also added an option for access to such information through the 1311 Telephone Voice Response Weather Information Enquiry System and the RSS (Really Simple Syndication) Weather Information Broadcast Channel.

Monitoring Network

The SMG collects weather data 24 hours a day via its Automatic Weather Station Network of 14 weather-observation stations in key locations around Macao. Three of these 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.

Regarding meteorological telemetry, the SMG has two ground meteorological reception and processing systems to receive Japanese Himawari-8 satellite information and Chinese FY-2E and FY-2G satellite information, respectively; two dual-polarisation Doppler weather radars; three low-level wind profilers; two microwave radiometers; a cloud height meter; three visibility measuring devices; and two lightning sensors to monitor lightning in the skies over Macao and the vicinity.

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 17 land water level monitoring stations set up at flooding black spots in various districts of Macao, two tide monitoring stations set up along the coast, and one wave monitoring station in the sea.

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 measure major pollutants that jeopardise Macao's air quality. Macao has five automatic air quality monitoring stations, a light detection and ranging (LIDAR) system for monitoring suspended particulates and boundary layers above Macao, a mobile air quality monitoring station and two mobile air monitors to monitor air quality of different districts in Macao. Moreover, in July 2012 the SMG adopted a new air quality standard, raising the air quality standard to WHO interim target-1(IT-1).

Seismological monitoring: The SMG has a seismological monitoring station in its Taipa Grande headquarters on Taipa, equipped with a digital seismograph and a deep shaft (30 metres from 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.

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 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. In 2017, the SMG organised the fourth WMO International Workshop on Tropical Cyclone Landfall Processes, participated in the 17th Session of the WMO Commission for Basic Systems (CBS), the China-ASEAN Meteorological Disaster Prevention Workshop, the 49th Session of ESCAP/WMO Typhoon Committee, the 23rd Conference of the Parties to the UNFCCC, the 13th meeting of the Parties to the Kyoto Protocol and the meeting of the Parties to the Paris Agreement (CMA1-2), the 21st International Civil Aviation Organization Asia Pacific Air Navigation Planning and Implementation Regional Group Meeting, the 12th Integrated Workshop of the ESCAP/WMO Typhoon Committee, the 18th National Scientific Conference on Tropical Cyclones, the South China Region, Guangdong, Hong Kong and Macao Numerical Weather Prediction (NWP) Technology Exchange, the 2017 Academic Committee Meeting of the Regional Key Laboratory for NWP of Guangdong Province and Regional Key Laboratory for NWP of the China Meteorological Administration, the Guangdong-Hong Kong-Macao Bay Area Meteorological Development Planning and Conference, and the Hong Kong-Zhuhai-Macao Bridge Meteorological Protection Conference.

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 disperses pollutants.

During 2017, roadside monitoring stations in Macao recorded "good" air quality on 56.2 percent of days, "acceptable" air quality on 41.3 percent of days, and "poor" air quality on 2.5 percent (nine days). In the high-density residential area of the Macao peninsula, the air quality was "good" on 54.4 percent of days, "acceptable" on 39.2 percent of days, and "poor" air quality on 6.4 percent (23 days).

In the high-density residential area on Taipa, the air quality was "good" on 50.6 percent of days, "acceptable" on 42.6 percent of days, and "poor" on 6.8 percent of days (23 days). Ambient

monitoring stations on Taipa recorded “good” air quality on 51.5 percent of days, “acceptable” air quality on 40.5 percent of days, “poor” air quality on 7.7 percent of days (28 days), and “bad” air quality on 0.3 percent of days (one day). Ambient monitoring stations on Coloane recorded “good” air quality on 46.8 percent of days, “acceptable” air quality on 46.5 percent of days, and “poor” air quality on 6.8 percent of days (24 days). The new Ka Ho roadside monitoring station recorded “good” air quality on 45.2 percent of days, “acceptable” air quality on 39.7 percent of days, and “poor” air quality on 15.1 percent of days (22 days).

In 2017, fine suspended particulates (PM_{2.5}) and ozone (O₃) were the main pollutants that led to “poor” air quality in Macao, with the former primarily affecting Macao in winter while the latter mainly affected Macao in summer and autumn. The ambient monitoring stations on Macao peninsula recorded most of the “poor” and “bad” air quality on eight percent of days (29 days). Overall, over 92 percent of days met the air quality standards (“good” to “acceptable”) in 2017. As compared to 2016, concentrations of respirable suspended particulates and ozone showed a slightly increase, while concentrations of other pollutants were largely unchanged.

Average Pollutant Concentrations in 2017

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	53.1	22.1	---	55.7	---	1.0
High-density residential area of Macao peninsula	47.8	19.9	6.1	49.7	45.8	0.8
High-density residential area of Taipa island	38.3	27.6	5.1	39.7	46.6	0.6
Taipa ambient	43.2	22.9	4.9	30.7	57.1	0.6
Coloane ambient	44.3	26.8	12.4	29.3	55.4	0.6
Ka Ho roadside ^a	62.5	32.3	7.1	32.9	57.8	0.6

a) Ka Ho Roadside Monitoring Station commenced operation since 1 August 2017.

Comparisons between Pollutant Concentrations and the Daily Air Pollution Index						
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 1-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	100	35	40	100	80	5
100	150	75	125	200	160	10
200	350	150	660	750	350	17
300	420	250	1,300	1,500	600	34
400	500	350	1,700	2,000	800	46
500	600	500	2,120	2,500	1,000	57

Air Pollution Index						
Air quality Index	0 ~ 50	51 ~ 100	101 ~ 200	201 ~ 300	301 ~ 400	401 ~ 500
Air quality level	Good	Acceptable	Poor	Bad	Severe	Harmful
Symbol						

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 2017, the Environmental Protection Bureau and the Public Security Police received 8,605 complaints about ambient noise, 314 cases or about 3.79 percent more than the 2016 figure. The Environmental Protection Bureau received 1,304 of these complaints, representing an increase of 217 cases, or 19.96 percent, compared with 2016; whereas the Public Security Police received the remaining 7,301 cases, a figure that was 97 cases or 1.35 percent more than for 2016.

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” (29.7 percent or 2,553 cases), public areas (32.7 percent or 2,812 cases), and industry, commerce and services (17.5 percent or 1,509 cases).

Environmental Noise Monitoring Network

Currently, Macao has six environmental noise monitoring stations – three on the Macao peninsula, one on Taipa island, one in the COTAI Reclamation Area and one in Coloane. Due to the overall planning of the district, the monitoring station on Avenida de Venceslau Morais was moved to Areia Preta on 27 April 2017. These monitoring stations conduct round-the-clock monitoring of ambient noise; road traffic noise; and noise from the mixed industrial, commercial and residential zones, by means of an automated network. Data on such noise readings are published monthly in the Environmental Geographic Information System on the Environmental Protection Bureau’s website. The 2016 Annual Report of the Data Collected by Environmental Noise Monitoring Stations of Macao was also published in 2017.

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

Three automatic water quality monitoring stations are under the management of the Environmental Protection Bureau at Ilha Verde Dockyard, Inner Harbour and Cotai Nature Reserves. Round-the-clock monitoring of water quality is conducted through an automated network. Data on the water quality readings are published monthly in the Environmental Geographic Information System on the Environmental Protection Bureau’s website. The bureau also took over the duty of the related department to monitor coastal water quality from mid 2017.

Monitoring Drinking Water Quality

The Civic and Municipal Affairs Bureau Laboratory 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 other 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 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 223 accreditations.

Wastewater Management

The five sewage treatment facilities in Macao – the Macao Peninsula Sewage Treatment Plant, Taipa Sewage Treatment Plant, Coloane Sewage Treatment Plant, Macau International Airport Sewage Treatment Plant, and Crossborder Industrial Zone Sewage Treatment Plant – can handle 356,000 cubic metres of sewage per day.

In 2017, the Macao Peninsula Sewage Treatment Plant handled 52,712,851 cubic metres of sewage; Taipa Sewage Treatment Plant handled 8,083,188 cubic metres; Coloane Sewage Treatment Plant handled 15,761,379 cubic metres; the sewage treatment plant at Macau International Airport processed 55,641 cubic metres; and the Crossborder Industrial Zone Sewage Treatment Plant handled 430,997 cubic metres.

In 2017, Taipa Sewage Treatment Plant and the Macau International Airport Sewage Treatment Plant underwent operational and maintenance services, while the Coloane Sewage Treatment Plant conducted an open tendering exercise for optimisation, operations and maintenance services.

The Environmental Protection Bureau continued to improve its equipment for handling and treating sewage, upgrade equipment in current sewage treatment plants, gradually increase the capability to treat domestic sewage in Macao, and enhance the quality of treated effluent.

To align with the planning and development of Macao's New Urban Area, the Environmental Protection Bureau has commissioned a consultancy firm to produce a preliminary design of a new sewage treatment plant and its auxiliary facilities on the artificial island of the Hong Kong-Zhuhai-Macao Bridge. A geological survey and an environmental impact assessment for the land lot will be conducted. This process is expected to be completed in 2019, and followed by an open tender process and construction of the sewage treatment plant in phases.

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. The CSR collected about 298,974 tonnes of household waste in Macao during 2017, an average of about 819 tonnes a day.

According to the principle of "waste reduction at source, sorting and recycling", the bureau is committed to promoting recycle and reuse. The Macao Solid Waste Resources Management

Programme (2017-2026) was announced in 2017 to formulate waste reduction policies and action plans for the coming 10 years.

Waste Classification

The Civic and Municipal Affairs Bureau continued to optimise public sorting and recycling facilities in the community. The number of public collection points in Macao was increased to 346. The bureau also invited schools, government departments, associations, private organisations and buildings to participate in the reusable waste sorting and recycling programme, aiming to provide the public with convenient ways to recycle waste. During 2017, 2,395.3 tonnes of waste paper, 153.4 tonnes of metals and 214.4 tonnes of plastic were recycled through various reusable waste sorting and recycling programmes.

The Civic and Municipal Affairs Bureau continued its glass bottle recycling programme. Participants include hotels, schools, bars and karaoke parlours. Public collection points for glass bottles have been set up throughout Macao. A total of 491 tonnes of waste glass were recycled during 2017. To reduce the volume of organic waste, a wet market food waste recycling programme, a school food waste recycling programme and a community food waste recycling (pilot) programme were launched; they processed a total of 50 tonnes of food waste during the year. Also, a programme for reusing clothes was jointly launched with the Macao Salvation Army, to improve the system for reusing clothes in Macao; about 562 tonnes of used clothes were collected during the year.

The Environmental Protection Bureau also implemented a “lai see packet recycle programme” from 2 February to 4 March 2017. Through more than 200 collection points throughout Macao, 1.53 million used lai see packets were collected. After sorting, about 610,000 lai see packets collected can be reused.

From 10 May to 15 August 2017, the Environmental Protection Bureau conducted a motorcycle helmet recycle scheme, to recall those motorcycle helmets that fail to meet the required standard and cannot be used under By-law No. 16/2016 “Approval of Models of Protective Helmets for Drivers and Passengers of Light and Heavy Motorcycles.” Within the three-month recycling period, about 7,100 old and used motorcycle helmets were collected.

Macao Waste Incineration Centre

Macao Incineration Centre is responsible for processing all Macao’s solid waste, together with some solid waste collected from the sea by the Marine and Water Bureau. It comprises two plants, with a total processing capacity of 1,728 tonnes of waste per day. During 2017, the centre collected 526,773 tonnes of municipal solid waste, an average of 1,443 tonnes a day.

The waste heat produced by the round-the-clock incineration centre 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 21MW per hour of electricity at full load to the public grid – sufficient to meet the needs of over 33,000 households in Macao. During 2017, the incineration centre supplied 16,570 units (16,570 kWh) of electricity to the public grid.

In 2017, the Environmental Protection Bureau continued with the design of the incineration centre’s phase-3 expansion project, formulation of technical specifications, implementation of

environmental impact assessments, and inclusion of more corporate participants – which are not ready to be equipped with their own food waste processing systems – in the food waste recycling scheme. In 2017, the food waste collection network was expanded to serve more hotels, restaurants, and the Food Festival. The pilot scheme to provide a food waste processor for the Seac Pai Van Public Housing Estate was completed, resulting in the collection of scientific data for future development of food waste collection in the community.

Macao Special and Hazardous Waste Treatment Centre

The Macao Special and Hazardous Waste Treatment Centre, adjacent to the Taipa Incineration Centre, commenced operation in 2007. It handles special waste according to the latest European Union incineration standards, including medical waste, slaughterhouse waste, discarded tyres, carcasses of animals such as horses and dogs, oil residue, and other solid and liquid special wastes. In 2017, the waste treatment centre's total treatment capacity (including medical waste) was 2,628 tonnes, with discarded tyres comprising 23 percent of the treatment capacity.

To make used battery collection more convenient for residents, the Environmental Protection Bureau continued expanding its collection network, with about 900 used battery collection points, covering schools, organisations, residential and commercial buildings, supermarkets, convenient stores and public departments in all districts of Macao.

To collect and process more electronic waste, the Macao Computer and Communication Equipment Recycling Scheme was launched in October 2017. Old and used computers and communication equipment were collected from the public, government departments, schools and non-profit organisations for dismantling and processing. The recyclable materials will be transported to other regions by the transboundary movements stipulated in the Basel Convention for reuse and recycling.

Treatment of Construction Waste

The construction waste landfill is located on Avenida do Aeroporto in Taipa. Since it commenced operations in March 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 and marine clay. In 2017, about 3.02 million cubic metres of construction waste were disposed of in the landfill.

Automatic Solid Waste Collection System

The pilot scheme for automatic solid waste collection in the Areia Preta New Reclamation Zone (NATAP) was established in 2006. The system comprises a number of inlet valves connecting with a network of underground tubes. The waste is transported by means of air suction to a collection station between Ponte da Amizade Avenue and Macao Wastewater Treatment Plant, from where it is taken by trucks to the incineration centre.

Legislation and Pollution Control

The Environmental Law (Law No. 2/91/M) gazetted on 11 March 1991 sets guidelines and

basic principles for the protection of Macao's environment. Subsequent subsidiary legislation covering other environmental issues includes:

- Formulation of Measures to Control and Minimise the Use of Substances Destructive to the Ozone Layer (Decree-Law No. 62/95/M, 4 December 1995);
- Rules and Regulations on Water Supply and Drainage in Macao (Decree-Law No. 46/96/M, 19 August 1996);
- Regulations on Prohibition Against Dropping and Discharging Harmful Substances in Marine Jurisdictions (Decree-Law No. 35/97/M, 25 August 1997);
- Identification of Features of and Formulation of Requirements on Unleaded Petrol, Provisions on the Import and Registration of Vehicles Consuming Unleaded Petrol starting from 1 January 1995 (Decree-Law No. 44/94/M, 22 August 1994);
- Provisions on the Sulphur Content of Vehicular Light Diesel Fuel (Executive Order No. 4/2006);
- Emission Limits of Exhaust Pollutants by Newly Imported Heavy and Light Motorcycles (By-law No. 1/2008);
- Approval of the Table of Parameters of Emissions of Exhaust Pollutants for Vehicles with Four-stroke Engines to Supersede Schedule 1 and 2 of Annex 1 of Executive Order No.1/2008 (Executive Order No. 356/2010);
- Regulations on Tailpipe Emissions of New Imported Vehicles (By-law No. 1/2012);
- Amendment to Regulations on Motor Vehicle Tax (Law No. 1/2012);
- Environmental Emission Standard for New Light Vehicles (Executive Order No. 41/2012);
- Air Pollutant Emission Standard and Facility Management Regulations for Cement Manufacturing Premises (Executive Order No. 12/2014); and
- Prevention and Control of Environmental Noise (Law No. 8/2014) and Standard for Acoustics approved by Executive Order No. 248/2014, to supersede Regulations on Prevention and Control of Environmental Noise (Decree-Law No. 248/2014, 14 November 1994) and Standard for Acoustics (Decree-Law No. 241/94/M), respectively.

These laws have been enacted to reduce and control pollution in waste treatment, water, fuel, noise and the atmosphere, and to achieve the objective of environmental protection.

In 2016, the Rules Concerning Unleaded Petro and Light Diesel for Vehicles (By-law No. 15/2016), to replace Decree-Law No. 44/94/M (promulgated on 22 August, Executive Order No. 4/2006, and the Limit for Exhaust Gas Emissions from In-use Vehicles and Methods of Measurement (By-law No. 30/2016), were promulgated. Import and transshipment to the MSAR of hazardous wastes listed in Annex 1 of the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal are prohibited by Executive Order No. 410/2016.

The Government established the Environmental Protection and Energy Conservation Fund with By-law No. 21/2011, and the Environmental Protection, Energy-saving Products and Equipment Subsidy Scheme with By-law No. 22/2011 in 2011; and launched the Subsidy Scheme for Elimination of Two-stroke Heavy and Light Motorcycles with By-law No. 2/2017

in 2017.

International Treaties

Several international agreements and treaties to address global environmental problems have been made applicable to Macao. These include:

- Vienna Convention for the Protection of the Ozone Layer;
- Montreal Protocol on Substances that Deplete the Ozone Layer;
- Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer;
- London Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer;
- Copenhagen Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer;
- Montreal Amendment to Montreal Protocol on Substances that Deplete the Ozone Layer;
- Beijing Amendment to Montreal Protocol on Substances that Deplete the Ozone Layer;
- United Nations Framework Convention on Climate Change;
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES);
- Convention on Biological Diversity;
- Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal and the amendments to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal passed on 22 September 1995, 27 February 1998, 13 December 2002, 29 October 2004, and 10 May 2013;
- Plant Protection Agreement for the Asia and Pacific Region (with amendments made in 1967, 1979 and 1983);
- Stockholm Convention on Persistent Organic Pollutants (POPs) and its amendments passed on 8 May 2009, 29 April 2011 and 10 May 2013;
- Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade;
- Minamata Convention on Mercury;
- Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques;
- International Plant Protection Convention;
- Protocol on Environmental Protection to the Antarctic Treaty;
- Kyoto Protocol to the United Nations Framework Convention on Climate Change; and
- Paris Agreement.

International treaties on maritime safety related to marine environment protection applicable to Macao include:

- International Convention on Oil Pollution Preparedness, Response and Co-operation 1990;
- Protocol of 1978 relating to the International Convention for the Prevention of Pollution from Ships 1973 (MARPOL);
- Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (1972) and its 1978 and 1980 amendments;
- International Convention on Civil Liability for Bunker Oil Pollution Damage, 2001; and
- Convention on the Conservation of Antarctic Marine Living Resources.

Environmental Protection Bureau

The Environmental Protection Bureau (DSPA) is charged with studying, planning, executing, coordinating and promoting environment policies.

Advisory Council on the Environment

The Advisory Council on the Environment is chaired by the Director of 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 opinions from different social sectors regarding Macao's environmental protection, and providing recommendations on the study, formulation, implementation, coordination and promotion of environmental policies.

Environmental Protection and Energy Conservation Fund

The Government established the Environmental Protection and Energy Conservation Fund through By-law No. 21/2011, and established the Environmental Protection, Energy-saving Products and Equipment Subsidy Scheme through By-law No. 22/2011, to subsidise enterprises and community groups in Macao to increase their capability for protecting the environment; and to introduce environmental protection techniques and devices.

The Environmental Protection, Energy-saving Products and Equipment Subsidy Scheme was the first subsidy scheme since the establishment of the Environmental Protection and Energy Conservation Fund. It targets commercial enterprises and community organisations. According to Order No. 63/2014 of the Secretary for Transport and Public Works, the application deadline for the Environmental Protection, Energy-saving Products and Equipment Subsidy Scheme was extended to 31 December 2015, receiving over 7,600 applications for subsidies. As at the end of 2017, 7,400 applications were handled, of which over 5,000 were approved, involving subsidies of more than 400 million patacas.

In 2017, the Government established the Subsidy Scheme for Elimination of Two-stroke Heavy and Light Motorcycles with By-law No. 2/2017. During the application period from 15 February to 30 June 2017, more than 5,700 applications were received. All applications were processed by the end of August 2017, of which over 5,500 were approved, involving subsidies of more than 19 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 293 events in 2017, with a total of 163,081 participants.

In 2017, the Environmental Protection Bureau organised three training programmes on eco-friendly procurement for public departments. The bureau also cooperated with the Pension Fund to promote the Civil Service Provident Fund System – Electronic Account Document Service. As of the fourth quarter of 2017, more than 11,000 contributors to the provident fund system participated in this programme, saving a total of 421,708 pieces of environmentally-friendly A4 paper, 164,579 pieces of A3 matte paper, and 164,327 envelopes.

Established since 2007, number of awardees of the Macau Green Hotel Awards significantly increase from eight to 47, demonstrating remarkable performance of the award-winning hotels in environmental protection. Apart from saving operational costs and enhancing corporate image, adopting environmentally-friendly measures also bring about environmental efficiency for customers and society. In 2017, the Macau Green Hotel Awards first launched its premium “Platinum Award”.

To enhance awareness of cherishing food among hotel workers, the Environmental Protection Bureau joined hands with local training institutions to organise the Food Wise Ambassador training programme of the Macau Green Hotel Awards.

To continue encouraging the public to use fewer plastic bags, the Environmental Protection Bureau cooperated with various public departments, associations and organisations to launch the “Use fewer plastic bags” campaign for the fifth consecutive year. Over 230 stores participated in the campaign in 2017, including pharmacies, department stores, food souvenir shops and other shopping venues. During the past five years, the campaign attracted more than 190,000 participants, resulting in over 190,000 fewer plastic bags being used.

In addition, the Environmental Protection Bureau launched a children’s story book, *The Baby Spoonbill Discovered*, with environmental protection as the theme, to foster young children’s awareness of the impact of plastic bags on the environment and the importance of using fewer plastic bags.

The Environmental Protection Bureau continued holding a series of environmental education activities for eco-schools, including green lectures, storytelling about environmental protection, drama tour and panel exhibitions, which were participated by more than 20,000 teacher and students in 2017.

This was the second year in which the Environmental Protection Bureau held the Eco-school Recognition Scheme. In all, 14 schools received the Eco-school Honour Award, and nine schools received the Eco-school Excellent Performance Award. The bureau also developed the “It’s Easy

to Reduce Waste on Campus” scheme, to intensify waste reduction in schools.

Under the “It’s Easy to Reduce Waste” scheme, the Environmental Protection Bureau established waste reduction partnership with more than a dozen government departments and associations. More than 150 organisations from various sectors, including schools, hotels and shops, actively supported and participated in the scheme, to jointly facilitate collection of recyclable waste, old and used batteries, food waste and used lai see packets, and promote the concept of cherishing food.

The Environmental Protection Bureau continued implementing the Environmental Protection Fun Bonus Point Scheme for collection of recyclable waste. By the end of December 2017, there were more than 8,500 members joining the scheme. The second phase of the scheme – environmentally-friendly moves – encouraged people from all walks of life to join the scheme’s frontline team (Environmental Protection Fans) to assist in providing a guided tour service in Cotai Nature Reserve. They promoted environmental messages to the public during environmental festivals such as World Wetland Day, Earth Day and World Environment Day, and traditional festivals such as Lunar New Year, Mid-Autumn Festival and Christmas, and encouraged the public to participate in environmental activities and put environmental protection into practice.

Regional Cooperation on Environmental Protection

The 2017 Macao International Environmental Co-operation Forum (2017 MIECF) was held from 30 March to 1 April. The theme was “Innovative Green Development for a Sustainable Future”, which advocated “Thinking Green, Going Clean, Living Cool”.

Celebrating its 10th anniversary, MIECF has become an important international environmental protection event, leveraging its function as a green platform, and was a winner of Macao Convention and Exhibition Commendation Awards in the green forum category. The event organised eight forums and one special session, with 55 leading international speakers from more than a dozen countries and regions delivering speeches and giving their views on specific topics. During the event, the Ministry of Science and Technology cooperated with the Environmental Protection Bureau to host the Showcase Area for the 12th Five-Year Plan Environmental Technology Achievements.

Regarding the PPRD region cooperation in environmental protection, the Environmental Protection Bureau participated in the 12th and 13th Meetings and the 13th Coordinator Working Meeting of the Joint Conference on Pan-Pearl River Delta Regional Environmental Protection Cooperation, and the PPRD Environmental Technology Exchange during the year.

Guangdong, Hong Kong and Macao jointly announced the 2016 Report of the Guangdong-Hong Kong-Macao Pearl River Delta Regional Air Quality Monitoring Network in May 2017. The parties will continue to manage and maintain the regional air quality monitoring network.

Under the Framework Agreement on Cooperation Between Guangdong and Macao in Environmental Protection, the two parties held the Guangdong-Macao Environmental Cooperation Task Force Meeting in November 2017. During the meeting, issues related to regional air quality monitoring, inter-regional disposal of scrapped vehicles, and management of aquatic environments, were discussed, together with issues of concern to people from both regions, with the hope of enhancing cooperation and making joint efforts to improve the regional

environment. In March 2017, both parties signed the Guangdong-Macao Cooperation Agreement on Environmental Protection (2017-2020), to boost exchanges and cooperation in various areas related to environmental protection.

Hong Kong and Macao also cooperated in environmental protection. In July 2017, the two sides attended the Ninth Meeting on Environmental Protection Cooperation between Hong Kong and Macao. In accordance with the Hong Kong-Macao Environmental Protection Co-operation Agreement, both parties have achieved good results and will make progress in exchanges and cooperation in environmental protection policy making, enforcement of environmental laws and regulations, environment monitoring, environmental impact assessment, waste treatment and disposal, environmental protection industry and promotion of environmental protection education. The meeting also developed a plan for future technical exchanges and cooperation. During the year, the Environmental Protection Bureau organised a delegation of 30 members to attend the Eco Expo Asia 2017 and the Eco Asia Conference in Hong Kong.

Under the framework of the Zhuhai-Macao Environmental Protection Cooperation Agreement, the Zhuhai-Macao Environmental Cooperation Working Group Meeting 2017 was held in April 2017, to exchange views on cooperation in areas related to water pollution, communication on and handling of environmental emergencies, exchanges on ecological issues, environmental protection industry and promotion of environmental protection education. As agreed by both sides, a barrier net was installed at the estuary of Canal dos Patos in mid January 2017, to reduce environmental impacts caused by dead fish carried in by tidal movements. In addition, the Environmental Protection Bureau organised a delegation of representatives from 14 eco-schools in Macao, to visit their counterparts in Zhuhai. In December 2017, the bureau attended the Guangdong-Hong Kong-Macao Wetland Ecological Conservation Symposium in Zhuhai.

Environmental Protection Planning in Macao

In 2017, the Environmental Protection Bureau continued to implement the long-term tasks in the Environmental Protection Plan of Macao (2010-2020).

Examination of Environmental Data

Complaints received by Environmental Protection Bureau in 2017:

Category	Number of cases
Noise	1,195
Air pollution	450
Noise and air	95
Noise and other	14
Air and other	17
Environmental hygiene	22

Category	Number of cases
Other	88
Total	1,881

Technical advice provided at the request of other departments in 2017:

Department	Premises and projects	Nos.
Tourist Office	Premises including karaoke bars, bars, hotels, restaurants, sauna and massage establishments, dance halls and health clubs.	299
	Inspections before issuance or renewal of licences	118
Economic Services Bureau	Technical advice	8
	Inspection of industrial sites	12
	Technical advice on applications for import of HCFCs defined as controlled substances under Decree-Law No. 62/95/M	12
Lands, Public Works and Transport Bureau	Projects including piling foundations, environmental protection projects and applications for extension of construction time, construction plans, expansion plans, modification / legalisation of construction projects	111
Civic and Municipal Affairs Bureau	Technical advice on licensed premises	222
	Site inspections	182

Flora

Macao abounds in plant species. By 2004, researchers from the Civic and Municipal Affairs Bureau and the South China Institute of Botany under the Chinese Academy of Sciences had identified 1,508 species of flora 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 pedata*). 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, according to research conducted until 2010 by the Civic and Municipal Affairs Bureau and

researchers from the Shenzhen Fairy Lake Botanical Garden, 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. 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. 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 elliotii* × *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*), Golden Dewdrops (*Duranta repens* ‘variegata’), Purple Knight (*Alternanthera dentata*), *Fagraea ceilanica* and Painted Copper Leaf (*Acalypha wilkesiana*) – 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 Indian Azalea (*Rhododendron simsii*), *Cordyline fruticosa*, Small Allamanda, *Lantana montevidensis* and *Ruellia brittoniana* in recent years. The view looks more layered with the addition of these flowers, accompanied by other trees such as Golden Trumpet Trees, Terminalia mantaly, Camel’s Foot Tree (*Bauhinia variegata*) and Chinese Banyan (*Ficus microcarpa*).

Green Week

Green Week in Macao is an annual event organised by the Civic and Municipal Affairs Bureau with the assistance from various organisations in the community. The 36th Green Week in Macao was held from 18 to 26 March 2017, with the theme “Green Macao, Attractive Home”. The event featured over 30 activities, and was attended by some 30,000 participants. During the event, 1,060 seedlings were planted on land, 2,040 mangrove trees were planted along the waterfront, 5,425 pots of plants were given away, and a series of educational activities were held to encourage public participation in greening Macao.

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 five commonest species are Asian Common Toad (*Bufo melanostictus*), Gunther’s Frog (*Rana guentheri*), Brown Tree Frog (*Rhacophorus megacephalus*), Paddy Frog (*Fejervarya limnocharis*) and Asian Painted Frog (*Kaloula pulchra*). In the hilly forest area of

Coloane, the Civic and 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. In 2013, Chinese Rufous Horseshoe Bat (*Rhinolophus sinicus*) was newly recorded. 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. Large-spotted Cat Snake (*Boiga multimaculata*) and Many-banded krait (*Bungarus multicinctus*), which are relatively rare, were recorded in Coloane in 2013. 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. Dominant species were Chinese bulbul (*Pycnonotus sinensis, terrestrial*) and Little Egret (*Egretta garzetta, waterbirds*). There were nine common species, of which terrestrial birds outnumbered waterbirds. Among these, five common species were terrestrial birds – Japanese White-eye (*Zosterops japonicus*), Crested Myna (*Acridotheres cristatellus*), Common Tailorbird (*Orthotomus sutorius*), Eurasian Tree Sparrow (*Passer montanus*) and Chinese Hwamei (*Garrulax canorus*); and four were waterbirds: Kentish Plover (*Charadrius alexandrinus*), Black-crowned Night Heron (*Nycticorax nycticorax*), Grey Heron (*Ardea cinerea*), and Chinese Pond Heron (*Ardeola bacchus*). There were 11 species newly recorded in 2013: Fujian Niltava (*Niltava davidi*), Black-faced Bunting (*Emberiza spodocephala*), Eastern Water Rail (*Rallus indicus*), Saunders's Gull (*Chroicocephalus saundersi*), Common Snipe (*Gallinago gallinago*), Ruddy Turnstone (*Arenaria interpres*), Savanna Nightjar (*Caprimulgus affinis*), Ashy Minivet (*Pericrocotus divaricatus*), Chinese Grosbeak (*Eophona migratoria*) and Chinese Blue Flycatcher (*Cyornis glaucicomans*). Since 2006, over 216 species of birds from 14 orders and 50 families have been recorded.

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 500 species of insects, which are widely distributed in Macao, including 78 butterfly 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 20 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. Decree-Law No. 56/84/M, gazetted on 30 June 1984, and Decree-Law No. 83/92/M, amended on 31 December 1992, which designated the part of Coloane island with an altitude of over 80 metres as a conservation area;
3. The Environmental Law, approved by the Legislative Assembly on 6 November 1990 and gazetted by Decree-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; and
5. By-law No. 40/2004 on Sanitary and Phytosanitary Control enacted on 14 December 2004, which defined the Civic and Municipal Affairs Bureau's role in the sanitary and phytosanitary control of merchandise.

Also, 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.

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 December 2017, the Cotai Nature Reserve's known biodiversity included 164 planktonic algae, 374 land plants (*embryophyte*), 109 plankton, 92 zoobenthos, 438 insects, 70 fishes, five amphibians, 20 reptiles and 10 mammals. This diversity attracted 172 species of birds to the nature reserve, including the Black-faced Spoonbill (*Platalea minor*).

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

Adjacent to Seac Pai Van Road in western Alto de Coloane, Seac Pai Van Country Park covers an area of about 198,000 square metres, and provides a wide range of facilities. Its animal facilities comprise the Giant Panda Pavilion, a zoo, and an aviary. Its exhibitions facilities feature the Giant Panda Information Centre and the Museum of Nature and Agriculture. Other leisure facilities include a children's playground, a large picnic area and a snack bar.

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 of 13,000 square metres between Ponta da Cabrita Road, Governador Nobre de Carvalho Avenue and Padre Estevao Eusebio Situ Road. The park houses a native fish breeding zone, 56 sculptures representing the 56 Chinese ethnicities, Taipa Grande exhibition hall, barbecue area, grass skiing slope, children's playground and a memorial pavilion for Mr. Henry Fok. It is 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.

Chinese Ethnic Sculpture Park

Located within Taipa Grande Nature Park, the Chinese Ethnic Sculpture Park is Macao's first ethnic-themed sculpture park. It is divided into a sculpture gallery and an exhibition hall.

Hac Sa Reservoir Country Park

Hac Sa Reservoir Country Park is situated in a hilly forest area on the southeastern slopes of the central mountain of Coloane. The park occupies 371,000 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 81.8 hectares.

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.

Population

Macao's resident population was estimated to be 653,100 as at the end of 2017, representing an increase of 8,200 or 1.3 percent over the previous year. On the same date, an estimated 47 percent of Macao's population were males, and 53 percent were females.

Natural factors form one reason for the increase in population. In 2017, there were 6,529 newborn babies, 8.6 percent fewer than in 2016, and 2,120 deaths, representing a decrease of 5.7 percent. The natural population growth rate was therefore 0.68 percent.

On top of this increase, there was a change in immigration, another factor influencing population. The net number of immigrants increased by 3,800, in contrast to a net number of emigrants recorded in 2016.

Most residents lived in Our Lady of Fatima Parish, comprising 37.8 percent of the total population.

Birth and Death Rates

In 2017, the birth rate and death rate were one percent and 0.33 percent, respectively.

Population Ageing

Macao's population is ageing because of the increasing life expectancy. In 2017, 12.7 percent of the entire population was aged between 0 and 14, with senior citizens aged over 65 making up 10.5 percent of the population; compared with 12.5 percent and 9.8 percent in 2016, respectively. During the year, the population of young children increased by 0.2 percentage points, and the population of elderly residents increased by 1.8 percentage points.

Identification Bureau

Under the Basic Law of the Macao SAR, the MSAR 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 operation of activities 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 2017, the Identification Bureau had issued 633,724 MSAR Passports and 44,772 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 434,983 such permits as at 31 December 2017.

The Identification Bureau is also responsible for issuing Macao SAR Resident ID cards. As at 31 December 2017, there were 710,052 Macao SAR Resident ID card cardholders. Between 1 January and 31 December 2017, 14,439 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 2017, 1,090 applications for naturalisation were

approved; 534 people restored their Chinese nationality; 81 renounced their Chinese nationality; 2,797 successfully applied to adopt Chinese nationality; 65 opted for Portuguese nationality; and there were four 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 2017, the Identification Bureau issued 78,566 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 2017, the bureau issued a total of 87,321 certificates of criminal record. Of these, 67,945 were public applications, and 19,376 were agency applications. Among the 34 certificates of special record for minors that were issued, 12 were to individual applicants, and 22 to public bodies.

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.

By 31 December 2017, citizens of 79 countries enjoyed visa-free access to Macao. Citizens of the Republic of Ecuador were newly granted visa-free access to Macao for a maximum stay of 30 days. 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

During 2017, 4,206 legal immigrants arrived from mainland China, of whom 895 were aged between 0 and 18; 1,934 between 19 and 37; 1,356 between 38 and 75; and 21 over 75. Of these, 2,674 were females, representing 63.5 percent of the total. Some 68.1 percent and 12.3 percent of the immigrants came from Guangdong province and Fujian province, respectively.

Overstaying and Illegal Entry

In 2017, 27,209 overstayers were repatriated. They included 4,093 mainland Chinese, 67 Taiwan (China) residents, 60 Hong Kong residents, 1,678 foreign nationals, and 21,311 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. The registry registered 6,570 births during 2017.

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 3,883 marriages were registered during 2017.

Death Registration

Family dependents or other relatives of a deceased person may register his or her death with the Civil Registry or its staff assigned to the registry's branches at Conde S. Januario Hospital and Kiang Wu Hospital. There were 2,195 death registrations during 2017.

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 762 divorce applications during 2017.



GIANT PANDA FAMILY





Two lovely new members joined the “happy family” of giant pandas in Macao, as the giant panda pair Kai Kai and Xin Xin gave birth to twin cubs named Jian Jian and Kang Kang on 26 June 2016.

Jian Jian and Kang Kang are now over one year old, and are active and energetic. The twins are close to each other. They always play with each other, and even cuddle up to sleep. Jian Jian likes hugging a ball, while Kang Kang likes resting on a tree. They greet the public every Sunday from 2:30pm to 4:30pm, and irregularly at other times, according to the nursery schedule.

As the cubs exercise, panda keepers are always there to help them learn and practise climbing, in order to avoid them getting hurt.

