Explanation of Compilation and Calculation

I. Air pollution

Air pollutants can be divided into the two categories: air pollutants and greenhouse gases. Their descriptions are as follows:

(I) Air pollutants

For air pollutants, we primarily compile the accounts for physical flows, emissions, quality and degradation. The physical flow accounts present the comprehensive conditions of flows from the economy into the environment. The emission accounts are compiled by collecting the amount of pollutants that pollution sources emit into various sinks, in order to understand the stress the atmosphere needs to withstand, even after pollution control. The quality accounts are presented via air quality monitoring information, in order to gauge air quality after interactions between pollution emissions and the climate & topography. The Cost-maintenance degradation accounts primarily refer to assessing the costs necessary for proper processing the amount of polluted air that needs to be reduced after deducting the assimilative capacity (self-purification) of the air from pollution emissions. General conditions of the compilation & calculation of the various accounts are described as follows:

1. Physical flow accounts

Physical flow accounts refer to the comprehensive information of flows from the economy into the environment. The related data was provided by the Ministry of Environment, and it was estimated primarily via parameters such as: emission factors for various pollution sources (e.g., amount of combustible materials per unit; product yield per unit; or emissions from activities per unit); activity intensity (e.g., relative activity magnitudes of various pollution sources); and control factors (e.g., integrated control efficiency of a control or preventive device). Moreover, air pollution emissions over the years were estimated according to the MOENV's latest version of the Taiwan Emission Data System (TEDS).

2. Emission accounts

Emission accounts show the conditions of air pollution emissions, via pollutants, pollution sources and sinks. Their data sources were identical to that of the physical

flow accounts.

3. Quality accounts

The air quality account presented the statistical results of verified measurements derived from ambient air quality auto-monitoring stations, as well as air quality manual operation monitoring stations around the country. Up to and including 2011, only air quality monitoring data for Taiwan Island was available, and since 2012, that data for the outer islands was included. The indicators for measurement air quality included: Air Quality Index (AQI), dust-fall, TSP, PM_{10}, $PM_{2.5}$, SO_2, CO, NO_2, O_3, total hydrocarbon (THC), and NMHC. Within these, the annual mean values for "PM_{10}", "$PM_{2.5}$", "SO_2", "CO", "NO_2" and "O_3" were the arithmetic mean of the valid days during the year. The annual mean values for "THC" and "NMHC" were the arithmetic mean of 6 to 9 effective hours per day during the year.

Depending on the characteristics of the pollutants, the following annual mean concentration standards for air quality have been established: PM_{10} at 50 $\mu g/m^3$; $PM_{2.5}$ at 15 $\mu g/m^3$; SO_2 at 20 ppb; and NO_2 at 30 ppb. Besides, the daily mean concentration standard for PM_{10} is 100 $\mu g/m^3$. The 24-hour mean concentration standard for $PM_{2.5}$ is 35 $\mu g/m^3$. The 8-hour mean concentration standard for O_3 is 60 ppb. The hourly mean concentration standard for O_3 is 120 ppb. The 8-hour and hourly mean concentration standards for CO are 9 ppm and 35 ppm, respectively. The formulation of these concentration standards is primary to consider when people expose to air pollution concentrations below these limits for an extended or a short period of time, their poses no effect on human health.

4. Degradation accounts

Air possesses the unique characteristic of assimilative capacity, making it capable of absorbing part of the pollution emissions generated during the course of production and consumption. Therefore, the estimation of degradation needs to deduct the part that has been absorbed by the environment. The DGBAS adopted a Cost-maintenance approach. The degradation account refers to the imputation of the costs associated with the prevention of the pollution emissions requiring reduction; i.e., the environmental degradation values for various pollutants are derived from multiplying the reduction costs per unit by the pollution emissions that need to be reduced. There is a lack of objective standards for the atmosphere's assimilation capacity. The MOENV therefore uses the air quality standards, as required by

regulations, to convert and estimate the emissions of various pollutants under quality standards; these values are then deducted from the emissions of the pollutants, in order to estimate the pollution emissions requiring reduction.

(1) The reduction costs per unit, based on the concept of the Cost-maintenance approach, refer to the costs needed for the prevention and control of pollution emissions under the best available control technology. At present, Taiwan still does not have cost data for different degrees of reduction or different areas. So, in application, we only categorize by stationary pollution sources and mobile pollution sources, estimating the average reduction costs per unit. Within these, the Point Source and Plane Source primarily belong to the stationary pollution source category, while the Line Source belongs to the mobile pollution source category.

① The Point Source and Plane Source are based on the average reduction costs per unit for various pollutants for 2000 provided by the MOENV. For other years, these were adjusted by referring to the Implicit Price Deflators Index for GDP generated by the pollution remediation services.

② The Line Source refers to the measures that could lead to pollution reduction, as well as their relative costs needed, within Taiwan's regulatory measures for mobile pollution sources, and then we estimate the reduction costs per unit for the reduction measures, in order to calculate the reduction costs per unit by pollutants via the weights which are the amount of pollution reduction for various measures. They were based on the average reduction costs per unit for various pollutants for 2006 provided by the MOENV. For the other years, these were adjusted by referring to the Implicit Price Deflators Index for GDP generated by the pollution remediation services.

(2) Emissions requiring reduction are the reduction in pollution emissions needed in order to meet the air quality standards.

① When air quality concentrations exceed the standard value, the emissions requiring reduction are calculated as follows:

$A = B \cdot C$

$C = (D - E) / D$

A: Emissions requiring reduction

B: Total annual emissions

C: Proportion of emissions requiring reduction

D: Yearly air quality concentration values

E: National air quality standards

As PM_{10} and O_3 have exceeded air quality standards in recent years, the proportion requiring reduction is primarily focused on these two measurements. Within them, air quality standards for PM_{10} include the annual mean value and the daily mean value, and the standards for O_3 include the hourly mean value and the 8-hour mean value. Their calculation principles are as follows:

a. For PM_{10}, the proportion requiring reduction is decided by whichever is greater of the annual mean value and the daily mean value.

b. For O_3, the proportion requiring reduction will be decided by whichever is greater of the hourly mean value and the 8-hour mean value.

c. For Sox, the proportion requiring reduction is zero. However, considering it is one of the sources of PM_{10} secondary pollutants, its proportion requiring reduction is identical to that for PM_{10}.

d. For NOx, the proportion requiring reduction is zero. However, considering it is one of the sources of PM_{10} secondary pollutants as well as a precursor O_3, its proportion requiring reduction is therefore identical to whichever is greater between PM_{10} and O_3.

e. For NMHC, the estimation is impossible due to the lack of related air quality standards. However, considering it is one of the sources of precursors O_3, its proportion requiring reduction is therefore identical to that of O_3.

f. For TSP, as there are no continuous monitoring concentration results, its proportion requiring reduction is identical to that for PM_{10}, due to its positive correlation with PM_{10}.

② When air quality concentrations are smaller than the standard values, the emissions requiring reduction are zero, meaning air pollution emissions are still within assimilation capacity.

(Ⅱ) Greenhouse gases

We applied the approach of the IPCC Guidelines for National Greenhouse Gas Inventories in estimating greenhouse gas emission figures, using the Reference Approach (by top-down) and the Sectoral Approach (by bottom-up), respectively. Since 2009, the evaluation of greenhouse gas emissions was taken over by various related agencies, and the MOENV was responsible for compiling these statistics.

Among them, the statistics of CO_2 emissions from energy use was conducted by the Energy Administration, Ministry of Economic Affairs, after referencing the Energy Balance Sheet.

II. Water pollution

With water pollution, we focus on compiling four kinds of accounts: physical flows, emissions, quality, and degradation. The physical flow accounts refer to presenting the types and flows of water pollutants generated and discharged by various sectors. The emission accounts are compiled by collecting the quantity of pollutants discharged into receiving bodies of water by various pollution sources, in order to understand the impact social-economic developments have on water pollution, as well as the stress water bodies receive after pollution control. The quality accounts are presented with monitoring data for bodies of water, in order to assess water quality conditions after self-purification by the water bodies (assimilative capacity). The Cost-maintenance degradation accounts mainly refer to assessing the costs necessary for the proper treatment of wastewater (sewage) that has not been properly treated. General conditions of the compilation & calculation of the various accounts are described as follows:

(Ⅰ) Physical flow accounts

For physical flow accounts, the supply and use tables are used to comprehensively organize and present the types and flows of water pollutants generated and discharged by various sectors. The data was from the Ministry of Environment.

(Ⅱ) Emission accounts

For emission accounts, only the Point Source pollution was collected; BOD, COD and SS were the chosen pollutants. They presented the total emissions and the conditions about various sectors. The data source was identical to that for the physical flow accounts.

(Ⅲ) Quality accounts

1. Rivers and streams

The monitoring results of water quality for 54 rivers and streams were compiled. They were presented in terms of achievement rates for DO, BOD, SS, NH_3-N, pH

value, coliform group, total phosphorus and heavy metals (Cd, Pb, hexavalent chromium, Cu, Zn, Hg, arsenic (As), selenium (Se), Mn and silver (Ag)). The achievement rates are based on the water body classification on the location of the monitoring stations of rivers and streams to calculate the percentage of various monitoring station figures that meet water quality standards of the water body classification. Besides, relevant environmental standards "Protection of the Living Environment" and "Protection of Human Health" are adopted by the general items and the heavy metal items, respectively.

2. Reservoirs

Assessment of water quality for reservoirs was done by using measurements of transparency, chlorophyll-a and total phosphorus to calculate the Carlson Tropical State Index (CTSI), which is intended to represent the level of eutrophication of a reservoir. The higher the CTSI, the worse the water quality. Generally speaking, it can be divided into three grades: CTSI < 40 indicates a state of oligotrophication; 40 ≤ CTSI ≤ 50 indicates a state of mesotrophication; and CTSI > 50 indicates a state of eutrophication.

3. Coastal areas

The coastal areas around Taiwan are divided into 21 areas, for each of which the qualified rates for DO, pH value, heavy metals (Cd, Cu, Pb, Zn, and Hg) are presented. The qualified rates for general items are based on the water body classification on the location of the monitoring stations of coastal areas to calculate the percentage of various monitoring station figures that meet relevant environmental standards "Protection of the Living Environment" of the coastal areas; while the heavy metal items calculate to meet "Protection of Human Health".

(Ⅳ) Degradation accounts

Degradation accounts involve the imputation of pollution cost for pollution discharges that has not been properly treated. The DGBAS currently adopts a Cost-maintenance approach (in addition to a Damage-assessment approach). Theoretically, the reduction costs per unit should be imputed under the best available techniques, multiplied by the amount of emissions requiring reduction. As the collection of the data regarding the amount of emissions that should be reduced was not complete, the actual amount of emissions was used instead, and it was divided into agricultural wastewater, industrial wastewater and municipal sewage by pollution

sources. When data about reduction costs per unit under the best available techniques was not available, the historical cost approach was used instead. This is estimated based on the investment and operating & maintenance costs of pollution control facilities past years. As control of water pollution can treat several pollutants simultaneously, BOD has been chosen as the target in order to avoid duplicate calculating.

1. Agricultural wastewater

For agricultural wastewater, the historical cost approach was adopted. The reduction costs per unit were separately estimated by private and public sectors. The capital costs for public sector were compiled & calculated using data from the public sector, whereas operating & maintenance costs were based on the MOENV's 2006 data from the *Survey of Pollution Control Expenditures*. Adjustments were made by referring to the Implicit Price Deflators Index for GDP generated by the pollution remediation services. For the private sector, data from the Ministry Of Agriculture was used for imputation. Within this, pollution control facilities were divided into the two categories: machinery & equipment and civil engineering facilities, with the service life for imputation set at 4 and 10 years. Depreciation is submitted using the straight-line method to calculate the capital costs of pollution control facilities. The operating & maintenance costs were calculated based on electrical bills, operating wages, and repair costs for households raising more than 200 pigs.

2. Industrial wastewater

The best available techniques were adopted for industrial wastewater. Data on the reduction costs per unit was based on the construction costs and the operating & maintenance costs of sewage treatment systems in industrial parks in 1998. For the remaining years, the capital costs fluctuated with the construction price index, and the adjustments for the operating & maintenance costs were done by referring to the Implicit Price Deflators Index generated by the pollution remediation services.

3. Municipal sewage

Municipal sewage encompasses households, the public administration and the services sector. Each of them has different pollution control situations, with varying reduction costs per unit. About the reduction costs per unit for the accommodation & food service activities and for the human health & social work activities, they referred to the results from the *Study Plan for the Implementation of the Environmental Value Matrix & Index System in the Green National Income Account* entrusted by the DGBAS, and 2003 costs are used as the basis while the capital costs for the remaining

years were adjusted in line with the construction price index. Adjustments for operating & maintenance costs were done by referring to the Implicit Price Deflators Index generated by the pollution remediation services. In addition to the aforementioned sectors, costs for the construction of sewers and septic tanks were also collected, and capital costs per unit were imputed from the relative saturation rate of both. The construction cost of sewers was provided by the National Land Management Agency, Ministry of the Interior. Data for septic tanks is based on the costs per unit in 1999, and adjustments were made for the remaining years by the construction price index. Operating & maintenance costs were imputed with the public administration data and the total budget committed by the private sector, from the MOENV's *Survey of Environmental Protection Expenditures*. For the total budget committed by the private sector, the average cost required per household in 1998 was used as the basis; for the remaining years, imputation was done by multiplying the number of households at year's end by the cost, and this was then adjusted by the Consumer Price Household Operation Expenditure Category Index.

Status of data for accounts

Accounts / Pollution sources / Receiving body of water	Emission accounts				Quality accounts	Degradation accounts (Cost-maintenance approach)			
	Point source			Non-point source		Point source			Non-point source
	Agricultural	Industrial	Municipal			Agricultural	Industrial	Municipal	
Rivers and streams	BOD COD SS	BOD COD SS	BOD COD SS		DO; BOD; SS; NH_3-N; pH value; coliform group; heavy metal items	BOD	BOD	BOD	
Reservoirs					Carlson Trophic State Index (CTSI)				
Coastal areas					DO; pH values; heavy metals				

Note: The shaded sections indicated that compilation & calculation was not possible, temporary.

Ⅲ. Solid waste

The accounts compiled for solid waste are main four kinds: physical flows, emissions, recycling quantities, and degradation. The physical flow accounts refer to the supply and use table to comprehensively organize flow information related to the generation and treatment of various solid wastes. The emission accounts primarily document the amount of waste generated and treated. In order to achieve the goal of "reduction at the source", recycling accounts show the general circumstances of resource recycling for the government and the private sectors. The degradation accounts monetize the quantity of waste that are not properly treated in order to understand the relation between economic development and environmental loading. The general conditions of the compilation & calculation of various accounts are described below:

(Ⅰ) Physical flow accounts

Physical flow accounts use the supply and use table to comprehensively organize related flow information about the generation and treatment of various solid wastes. The data for municipal, industrial and medical waste was from the MOENV, or reports from project programs commissioned by the MOENV; the data for agricultural and construction waste was provided by the Ministry of Agriculture and by the National Land Management Agency, Ministry of the Interior.

(Ⅱ) Emission accounts

Emission accounts state the situations for various solid wastes in terms of the amounts generated, the amount that has been properly treated, and the amount not properly treated. The amount that has been properly treated refers to the portion of generated waste that is able to be properly treated through incineration, landfill, composting, recycling for reuse, and the cleaning & treatment organizations. The amount of waste generated, minus the amount of waste that has been properly treated, equals the amount not properly treated. The sources for the data are identical to those of the physical flow accounts.

(Ⅲ) Recycling accounts

In order to present the circumstances of resource recycling, the recycling accounts are planned in accordance with the promulgated standards for what should be recycled. Currently, there are two avenues to obtain the data volume of resource recycling. One is the direct recycling quantity data from the cleaning units under local

implementing agencies, communities, schools, organizations, and county (municipal) Environmental Protection Bureaus. The other is the tally of certified recycled waste and containers from the certified organizations that have been entrusted by central governing authority. As these two in the recycling sources have overlap, the accounts for the volume of waste recycled are presented by the implementing agencies and by the certified organizations respectively.

(Ⅳ) Degradation accounts

Degradation accounts refer to documenting the costs necessary to enforce control measures, in order to prevent and control the damage caused by pollution from various solid wastes. The DGBAS currently adopts a Cost-maintenance approach here. In principle, the degradation value is to multiply the treatment costs per unit under the best available techniques by the amount not properly treated (from the aforementioned emission accounts). In terms of treatment costs per unit, the treatment costs vary due to differences in the nature of waste and the treatment methods, and the explanations are stated below:

1. Municipal, agricultural, construction and medical waste

References to the results of the *Study Plan for the Implementation of the Environmental Value Matrix & Index System in the Green National Income Account*, implemented by the DGBAS, the estimated costs per unit for the treatment of various solid wastes in 2003 were used as the basis. The costs per unit for the remaining years were adjusted by referring to the Implicit Price Deflators Index for GDP generated by the pollution remediation services.

2. Industrial waste

References to data from the Industrial Development Bureau of the MOEA regarding building and operating cost data for general treatment centers of industrial waste in northern, central and southern Taiwan, the DGBAS estimated the costs per unit for general industrial and various hazardous industrial waste in 2003, as a benchmark; the costs per unit for the remaining years were adjusted by referring to the Implicit Price Deflators Index for GDP generated by the pollution remediation services.

Ⅳ. Soil and groundwater pollution

Quality accounts are formulated for soil & groundwater pollution and they are presented based on the pollution sites, polluted medium, pollution types, and groundwater pollution monitoring data.

(Ⅰ) Pollution sites statistics

This includes compilation results of the 4 types (limited-time improvement sites, control sites, remediation sites, and restricted groundwater usage zones) of announced pollution sites.

(Ⅱ) Polluted medium and pollutant types statistics

Based on cross-references of the pollutant media and pollutant types, the statistics revealed that pollutant types include heavy metals (copper, nickel, zinc, chromium, cadmium, etc.), organic compounds (total petroleum hydrocarbons, dimethylbenzene, benzene, methylbenzene, ethylbenzene, etc.), pesticides (2,4-dichlorophenoxy, carbofuran, chlordane, and diazinon, etc.), general items (nitrate nitrogen, nitrite nitrogen, fluoride, etc.), and other organic compounds (dioxin and polychlorinated biphenyls).

(Ⅲ) Groundwater pollution monitoring statistics

Groundwater in Taiwan is divided into 12 water regions. The ratio of monitoring values for total hardness, total dissolved solids, chloride, ammonia nitrogen, nitrate nitrogen, sulfate, total organic carbon, total phenol, fluoride, heavy metals (arsenic, cadmium, chromium, copper, lead, zinc, iron, manganese, mercury, and nickel), etc., that are lower than the pollution monitoring standards are presented here.

Ⅴ. Mineral and earth & rock resources

The compilation for mineral and earth & rock resources is primary three accounts: physical flow accounts, physical asset accounts, and depletion accounts. The physical flow accounts refer to documenting various energy flows by physical units in order to observe the circumstances of their supply and use. The physical asset accounts view mineral and earth & rock resources as a kind of asset as well as national capital. With these accounts, we can understand the variation in resource reserves within the accounting periods. The depletion accounts observe the relation between economic development and the utilization of mineral and earth & rock resources during the accounting periods, through items of flow to estimate their

utilization and service value. The general conditions of the compilation & calculation for the various accounts are described as follows:

(Ⅰ) Physical flow accounts

Physical flow accounts document the flows of energy related to production, manufacturing, supply, consumption and usage with regard to Natural Inputs, Energy Products, and Residues, between the environment and the economy. Energy for natural input–refers to the natural input flows of resources as they are exploited or collected from the environment and then input into the economy. This includes the inputs of natural resources, renewable energy, and other natural input. The energy products refer to products produced within the economy for energy supply and utilization (such as fuels, power generation, and the supply of thermal energy to third parties). The energy residues refer to energy residues that return to the environment.

In order to fully show the information on energy physical flows, energy physical flow accounts present the complete flows of energy resources, from supply to usage, by energy categories; the data for the aforementioned accounts was all provided by the Energy Administration, Ministry of Economic Affairs.

(II) Physical asset accounts

Physical asset accounts are presented in terms of opening assets; closing stocks; and the factors affecting stock changes and their variations within the accounting period. Within these, opening (closing) stocks refer to discovered resource stocks with enough economic value for exploitation, and which can be exploited with existing technologies. The factors affecting stock changes can be divided into "extraction" and "other changes in volume". The "extraction" refers to the quantities of ores mined from their ore bodies, while "other changes in volume" include re-estimated resource stocks or the discovery of new lodes.

1. Non-metallic mineral resources

The compilation for non-metallic minerals was completed with data such as the opening stocks, closing stocks, and other changes in volume of various minerals provided by the Geological Survey and Mining Management Agency, Ministry of Economic Affairs. In the extraction section, the marble, serpentine, and limestone are each divided into two categories: industrial raw materials and stone raw materials, and the dolomite has only the category of industrial raw materials.

2. Energy mineral resources

This was compiled from data such as opening stocks, extraction, and other changes in volume for natural gas and condensed oil, provided by the CPC Corporation, Taiwan.

3. Earth and rock resources

The data about earth & rocks on the land; in coastal regions and marines was compiled using data such as opening (closing) stocks, extraction, and other changes in volume, provided by the Geological Survey and Mining Management Agency, Ministry of Economic Affairs. The data about earth & rocks in rivers and lakes was compiled from data such as opening (closing) stocks, extraction, and other changes in volume, provided by the Water Resources Agency of the Ministry of Economic Affairs.

(III) Depletion accounts

The depletion accounts for mineral and earth & rock resources primarily involve estimation of the utilization and service value provided by environmental assets. Currently, the Net Price Method has been adopted, i.e., estimation by subtracting Exploitation Costs from Exploitation Revenues.

1. Non-metallic mineral resources

Due to the unavailability of exploitation costs, estimation of the depletion value of various minerals was therefore done by multiplying exploitation revenues by profit margins. The figures for exploitation revenues were provided by the Geological Survey and Mining Management Agency, Ministry of Economic Affairs; the profit margins for minerals were estimated from the results of the DGBAS census on industrial and commercial services, as well as from national income statistical data.

2. Energy mineral resources

The depletion values are derived by multiplying extraction by profit per unit. The profit per unit equals prices per unit minus costs per unit; this was estimated from the prices and costs per unit of natural gas and condensed oil, respectively. However, as there were not yet sales of home-made minerals, natural gas and condensed oil, their prices per unit were estimated by referencing related data.

3. Earth and rock resources

The method of estimating the depletion value here is akin to that of non-metallic

mineral resources. The profit margins were also estimated from the results of the DGBAS census on industrial and commercial services, as well as national income statistical data.

Ⅵ. Water resources

Per international guidelines, the compilation for water resources includes physical reserve accounts for water resources; physical asset accounts for reservoirs; major rivers in Taiwan and their hydrological characteristics; physical asset accounts for groundwater; and depletion accounts for groundwater. However, as the collection of such related data is incomplete, the compilation of statistical data on physical asset accounts for reservoirs, statistical data on hydrological characteristics for major rivers in Taiwan, statistical data on river runoff, the physical asset accounts for groundwater, and the depletion accounts for overdraft groundwater is therefore conducted based on available data; this is in order to understand supply and demand of water resources. An explanation of general conditions of the compilation & calculation is as follows:

(Ⅰ) Physical asset accounts

1. Reservoirs

In addition to preserving water resources and rectifying predicaments associated with uneven rainfall, reservoirs also serve functions such as flood prevention, hydro power, irrigation, public water supply, sightseeing & travel, etc. Data for the physical asset accounts for reservoirs divides national reservoirs into the northern, central, southern, eastern and outer islands areas. The data also presents aspects including: stored water at the beginning of a year; water inflow; water used for power generation; water consumption for all purposes (including agricultural, domestic, and industrial water supply); other flow discharge; flood flushing volume; loss of water; stored water at year's end. These items are defined as follows:

(1) Stored water at the beginning (end) of a year: This refers to the volume of stored water at reservoirs, at the beginning or end of a year.
(2) Water inflow: This refers to water flowing from upstream or rainfall into reservoirs.
(3) Water used for power generation:
①Flow discharge: The volume of water drawn from a reservoir for the purpose of power generation.

②Backflow: The volume of water that flows back to rivers/creeks or downstream reservoirs after power generation.

(4) Water consumption for all purposes: This refers to the water in a reservoir, divided by purpose into the following three categories:

①Agricultural water supply: This refers to water supplied to agriculture, forestry, fishing and animal husbandry.

②Domestic water supply: This refers to water supplied for general activities associated with the people's livelihood.

③Industrial water supply: This refers to water supplied for cooling, consumption, and wastewater treatment, for operations in factories and mines.

(5) Other flow discharge: This refers to unused water, that is, water that is not used for power generation or any of the specified purposes; and which flows directly into or is discharged into river courses, or the flow discharge supplies downstream reservoirs with the water needed for various purposes such as ecological flows, flow discharge for sediment releasing, flow discharge for river courses, etc.

(6) Flood flushing volume: This refers to the water discharged to protect a reservoir when its water level reaches the saturation point. Spontaneous overflow is also considered part of flood flushing.

(7) Loss of water: This refers to the volume of water evaporated or lost from reservoirs.

2. River basins

As they are dominated by the raining season, the volume of water and flows for rivers in Taiwan vary dramatically. In addition, under the influence of terrain, rivers are predominantly short and steep. Even though flows expand significantly during a typhoon or a flood, the majority of the water flows into the ocean immediately, making it difficult to estimate storage data; therefore, only the volume of river runoff is tallied. This is also divided into the volume of water adjusted by reservoirs; the volume of river water drawn; and the volume of water directly flowing into the ocean.

3. Groundwater

Statistical data on groundwater reserves is non-existent at the moment. The physical asset accounts for groundwater are therefore based on the nine major groundwater regions and the outer islands. The volume drafted, recharged and

over-drafted is explored, and the data is from the Water Resources Agency of the Ministry of Economic Affairs. The overdraft volume equals the drafted volume less the recharge volume; when the drafted volume is less than the recharged volume, there is no the overdrafting, meaning the overdraft volume is zero. The national overdraft volume equals the sum of overdraft volumes from the different groundwater regions.

(Ⅱ) Depletion accounts

The depletion value of groundwater is imputed with the net price concept, meaning it is derived via multiplying the discrepancy between the price of water resources and the average cost of groundwater drafting by the overdraft volume. Currently, the price of water resources is imputed based on the price of tap water. The cost of drafting is based on the costs estimated by the Water Resources Agency of the Ministry of Economic Affairs in 2001. The costs for the remaining years have been adjusted in accordance with consumer price indexes; the costs include power expenses, the maintenance cost of machinery & equipment, etc.

Ⅶ. Forest Resources

Forest resources are compiled in accordance with international standards for physical asset accounts of forest land and physical asset accounts of forest growing stock. However, as collection of related information has not been completed, the current information is first adopted to compile simple physical asset accounts of forest land, physical asset accounts of forest growing stock, forest recreation, natural reserve areas, and protected wildlife to understand the conditions in the forests. General conditions of the compilation and calculation, as well as the fact sheets for the various accounting statements are described as follows:

(Ⅰ) Physical asset accounts of forest land

Forest land is divided into forest areas and non-forest areas. As results of Taiwan's forest resource survey are published once every five years, forest areas and non-forest areas cannot be distinguished in the intervening years, and only the total value of forest areas can be displayed. The reason that caused changes in the stock is based on the classification of the *Yearbook of Forestry Statistics* published by the Forestry and Nature Conservation Agency, Ministry of Agriculture each year and corrected when the results of the following survey is announced.

(Ⅱ) Physical asset accounts of forest growing stocks

Forest growing stocks are classified into natural forests, plantation forests, and bamboo & tree forests or classified into forests and bamboo to reflect the changes in forest growing stocks.

(Ⅲ) Forest recreation statistics

The number of visitors and related revenue created through recreation and leisure functions of forests.

(Ⅳ) Biodiversity maintenance statistics

Statistics on natural reserve areas and the number of species of protected wildlife are used to understand the status of the maintenance of biodiversity. Natural reserve areas are classified into Wildlife Refuges, Major Wildlife Habitats, Forest Reserves, Nature Reserves, National Parks, and National Nature Parks in accordance with the Cultural Heritage Preservation Act. In accordance with the Wildlife Conservation Act, protected wildlife is classified into mammals (land), birds, reptiles, amphibians, freshwater fish, and invertebrates.

(Ⅴ) Depletion accounts

Depletion accounts are estimates of the use of natural resources that exceed their growth. However, timbers in forest resources are renewable natural resources and depletion will not occur as long as the timbers logged volume is equivalent to the regenerated volume. In addition, as losses caused by natural damages are not caused by economic activities, they are not included in the calculation of natural resource depletion in accordance with SEEA regulations. However, changes in the natural resource reserves generated by natural damages must be recorded in the physical asset accounts.

Ⅷ. Environmental protection expenditures

In recent years, statistical data on Taiwan's environmental protection expenditure is primary from relevant surveys commissioned by the MOENV. The data from 2018 to 2021 are from the *Statistical Survey Report of Pollution Abatement and Control Expenditures*, and the data of 2022 is from the *Statistical Survey Report of Environmental Protection Expenditures*; the both reports in the items, definitions and scopes are slightly different. In order to display the complete time series data in our report (*Taiwan's Environmental-Economic Account*) edited in 2023, the data on the

environmental protection expenditures will present as closely as possible the same classification with the *Statistical Survey Report of Pollution Abatement and Control Expenditures*.

Ⅸ. Environmental payments to the government (including permits for using natural resources)

Explanation of the compilation & calculation, and data sources for the tax items included in the accounts, are as follows:

(Ⅰ) Energy category

Tax (fee) item	Source	Explanation of compilation & calculation
Tariffs under the energy category	Customs Administration, Ministry of Finance	Energy products consistent with the definition are chosen from mineral fuels, mineral oils and their distilled products (including bituminous substances and mineral waxes), per chapter 27 of the Customs Import Tariff.
Commodity taxes under the oil and gas category	Department of Statistics, Ministry of Finance	Oil- and gas-related products, excluding solvents, are calculated and listed, including gasoline, diesel oil, kerosene, jet fuel, fuel oil, liquefied petroleum gas (LPG), etc.
Oil funds under the energy category	Energy Administration, Ministry of Economic Affairs	Crude oil used for refining and light oil used as raw materials have been excluded. Items consistent with the definition, such as gasoline, diesel oil, kerosene, jet fuel, fuel oil, and LPG, have been included.

(Ⅱ) Transportation category

Tax (fee) item	Source	Explanation of compilation & calculation
Transportation vehicle tariffs	Customs Administration, Ministry of Finance	Vehicles, aircraft, vessels and related transport equipment listed under Section XVII (chapter 86~89) of the Customs Import Tariff are calculated and listed, but the components; accessories; parts; and non-motor transport equipment; as well as vehicle goods in chapter 98, regarding tariff quota goods, are excluded.
Vehicle commodity taxes	Department of Statistics, Ministry of Finance	Vehicle commodity taxes, excluding chassis and bodies of motor vehicles, are calculated and listed.
Vehicle license taxes	Department of Statistics, Ministry	Vehicle license taxes and vehicle fuel fees are routine taxes associated with ownership and usage

Tax (fee) item	Source	Explanation of compilation & calculation
	of Finance	of transport equipment. Therefore, they are included in the compilation.
Vehicle fuel fees	Ministry of Transportation and Communications	

(Ⅲ) Pollution category

Data for the pollution category is compiled and calculated from the final account reports of the MOENV, local governments, and Ministry of Transportation and Communications.

(Ⅳ) Resource category

Data for the resource category is compiled and calculated by referencing the *Annual Statistical Report of Mineral* published by the Geological Survey and Mining Management Agency of the Ministry of Economic Affairs and the *Statistic of Water Resources* published by the Water Resources Agency.