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A FINE CITY IN A GARDEN—ENVIRONMENTAL LAW AND GOVERNANCE IN SINGAPORE

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This paper examines the system of environmental management and governance in the tiny but prosperous city-state of Singapore. Commencing from the early years of self government, environmental management policies were integrated with economic policies, in order to woo investors. Singapore pursued a policy of rapid industrialisation while cleaning up and greening its environment, moving from a "Garden City" to a "City in a Garden". Through the years, it has put in place an effective legal and administrative system to deal with the implementation and enforcement of laws relating to land–use planning, pollution, public health, and nature conservation. But are there inadequacies? To what extent has Singapore succeeded in taking care of its environment? This paper focuses on Singapore's environmental management with particular emphasis on pollution control, water conservation and the conservation of nature. It examines the work of the National Environment Agency, the Public Utilities Board and the National Parks Board. It discusses the laws and their implementation in the context of pollution control, as well as in the conservation of wild flora and fauna. It highlights the inadequacies in the laws, particularly the lack of laws for the separation of wastes, and for the conservation of marine biological diversity and ecological systems. It emphasizes the need for enhanced land stewardship, for greater public participation and for laws that provide for mandatory environmental impact assessments.

"We have built. We have progressed. But there is no hallmark of our success more distinctive and more meaningful than achieving the position as the cleanest and greenest city in South-east Asia."

– Mr. Lee Kuan Yew, Prime Minister of Singapore,
at the launching ceremony of the
"Keep Singapore Clean" Campaign,
1 October 1968

I. INTRODUCTION

Singapore is one of the smallest countries in the world, with a land area of only 699 square kilometres.[1] Strategically sited at the tip of the Malay Peninsula, it is at the cross-roads of South-east Asia. Comprising a main island and some 60 smaller

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1 Singapore has added to its land area by reclamation of land from the sea. Its land area was 581.5 square kilometres (224.5 sq mi) in the 1960s. See online: <http://www.edb.gov.sg/edb/sg/en_uk/index/why_singapore/singapore_facts_.html>.

islands, it is also one of the most densely populated in the world, with a population of 4,553,009 in July 2007[2] and a population density of some 6,500 persons per square kilometre.[3] Eighty-five per cent of the population live in government-subsidized public housing, in 26 new towns built by the Housing & Development Board.[4]

Founded by an employee of the East India Company, Sir Stamford Raffles,[5] in 1819, Singapore was soon made a Crown Colony. It was occupied by the Japanese during the Second World War, achieved self government in 1959, joined Malaysia in 1963, and left on 9th August 1965 to become a sovereign state. It has since been governed by the same political party that won the first elections, the People's Action Party. In the space of some four decades, the country has been transported "from the Third World to the First", as states the title of the autobiography of its first Prime Minister, Mr. Lee Kuan Yew,[6] who was largely the chief architect of its success and continues to play a significant role as Minister Mentor.

Lacking in natural resources, Singapore has built on its strategic location, natural deep harbour, and its people, developing a strong economy based on trade and services. It now has a strong industrial base for electronics and precision engineering, chemical and petrochemicals, pharmaceuticals and biosciences. It has excellent transportation networks, with an efficient Mass Rapid Transit system complemented by a Light Rail System, as well as an excellent network of roads and expressways. It has superb telecommunication facilities and was the first in the world to have a nationwide broadband network.[7] In recent years, Singapore has emphasized research and development in biomedical sciences, water and environmental technology, health care services, educational services, info-communications and the media, logistics and transport engineering as well as precision engineering.[8]

In 2006, with a GDP per capita of US$28,100, it was ranked the most cost-competitive place for business[9] and the world's easiest place to do business.[10] It

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2 See U.S., Central Intelligence Agency, "The World Factbook: Singapore," online: <https://www.cia.gov/library/publications/the-world-factbook/print/sn.html>.

3 See Wikipedia, "List of countries by population density," online: <http://en.wikipedia.org/wiki/List_of_countries_by_population_density>.

4 See the website of the Housing & Development Board, online: <http://www.hdb.gov.sg/fi10/fi10200p.nsf/DefaultHome/HomePageInternet?OpenDocument>.

5 Raffles was Lieutenant-Governor of Java from 1813 to 1816 and was knighted in 1816 by the Prince Regent on his return to England. See NNDB, "Sir Stamford Raffles," online: <http://www.nndb. com/people/709/000104397/>; Encyclopædia Britannica Online, "Sir Stamford Raffles," online: <http://www.britannica.com/eb/article-9062451/Sir-Stamford-Raffles>.

6 Lee Kuan Yew, *From Third World to First—The Singapore Story: 1965-2000—Singapore and the Asian Economic Boom* (New York: Harper Collins Publishers, 2000).

7 This network covers 99 per cent of Singapore and is readily accessible in schools, offices, homes and public libraries. See IDA Singapore, "Infrastructure," online: <http://www.ida.gov.sg/Infrastructure/20060411230420.aspx>; see also speech of RADM Teo Chee Hean, Minister for Education and Second Minister for Defence, "Launch of SINGAREN-VBNS Link," Washington DC (7 November 1997), online: <http://www.ida.gov.sg/News%20and%20Events/20050727150137.aspx?getPagetype=21>.

8 See EDB Singapore, "Why Singapore?," online: <http://www.sedb.com/edb/sg/en_uk/index/why_singapore.html>.

9 By the *KPMG Competitive Alternatives Study 2006*; see Business Facilities, "New Business Cost Study Ranks Location," online: <http://www.businessfacilities.com/bf_06_04_news3.php>; see also online: <http://www.biomed-singapore.com/bms/sg/en_uk/index/singapore_at_a_glance/accolades_rankings.html>.

10 World Bank, *Doing Business 2007: How to Reform*, online: <http://www.doingbusiness.org/documents/DoingBusiness2007_FullReport.pdf>.

has the world's busiest port, an accolade achieved since 1986,[11] and one of the world's best and busiest airports.[12] It is also the world's top bunkering port and the third largest oil refining centre in the world, with more than four major oil companies (Shell, Caltex, BP and ExxonMobil) in operation. These companies have a combined refining capacity of 1.3 million barrels a day.[13]

Other accolades for Singapore include being among the world's top 20 most globalised nations (Singapore ranks 1st)[14] and one of the world's top countries for investment potential (Singapore ranks 2nd after Switzerland);[15] having one of the world's top 20 business environments (Singapore ranks 6th);[16] being listed as one of the world's most "network ready" countries (Singapore ranks 2nd, after the United States);[17] the most competitive Asian economy;[18] the least corrupt country in Asia;[19] the country with the least level of bureaucracy and red tape in Asia;[20] and the country that has the best labour force.[21]

How did Singapore achieve these accolades in so short a time? In the context of the physical environment, in early years, Singapore faced the same problems that beset developing countries today. These include the lack of proper sewage disposal facilities, highly polluted rivers and river basins, indiscriminate waste disposal leading to land contamination and water pollution, poor health management systems leading to outbreaks of typhoid and cholera, polluted air from old and inefficient gas works, and frequent floods due to poor drainage. Today, Singapore's air and water quality are well within World Health Organisation (WHO) standards.[22] All inland waters sustain life, and the physical environment is one that is "clean and green."[23]

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[11] See Maritime and Port Authority Singapore, "About MPA: Achievements," online: <http://www.mpa.gov.sg//aboutmpa/achievements/achievements.htm>.

[12] "Since its opening in 1981, [Singapore's] Changi International Airport has made its mark in the aviation industry as a benchmark for service excellence, winning over 250 awards. This winning streak has continued unabated, including the Business Traveller (UK/Europe) Best Airport of the year award 20 times consecutively." See Changi Airport Singapore, "Awards and Accolades," online: <http://www.changiairport.com/changi/en/about_us/awards_accolades/?_locale=en>.

[13] The major oil refineries have the following capacities: Esso (265,000 bbl/d), Mobil Oil Singapore Pty. Ltd. (300,000 bbl/d), Shell Eastern Petroleum (405,000 bbl/d) and Singapore Refining Co. Ltd. (285,000 bbl/d).

[14] According to the A.T. Kearney/FOREIGN POLICY Magazine Globalization Index 2006; see online: <http://basman.wordpress.com/2006/10/24/at-kearney-ranks-the-top-20-worlds-most-globalized-nations/>.

[15] *BERI Report* (August 2006); see EDB Singapore website, *ibid*.

[16] According to the Economist Intelligence Unit, in its Business Environment Ranking (2006-2010).

[17] World Economic Forum, *The Global Information Technology Report*, 2005-2006, 2006-2007, 2007-2008.

[18] According to the Global Competitiveness Index (GCI); see World Economic Forum, *The Global Competitiveness Report*, 2005-2006, 2006-2007, 2007-2008.

[19] According to the Political and Economic Risk Consultancy, March 2008; see "Singapore still ranks as least corrupt in Asia" *The Straits Times* (11 March 2008).

[20] According to the Political and Economic Risk Consultancy, June 2007; see "Singapore Risk Rating Update," online: <http://www.asiarisk.com/library8.pdf>.

[21] *BERI Labour Force Evaluation Measure (LFEM) Report*; see online: EDB Singapore <http://www.edb.gov.sg/edb/sg/en_uk/index/why_singapore/singapore_rankings.html>.

[22] In 2006, the ambient air in Singapore met all the indicators for good air as prescribed by the US-EPA, with the exception of PM2.5, which was recorded at 23μg/m^3. See NEA, *Annual Report 2006-07*, online: <http://www.nea.gov.sg/ar07/cleangreen-highway.html>.

[23] See National Environment Agency, *Environmental Protection Division Annual Report 2006*, online: <http://www.nea.gov.sg/cms/pcd/EpdAnnualReport2006.pdf> [*EPD Annual Report 2006*].

The fact is that a clean and green environment was part of Prime Minister Lee Kuan Yew's strategy in wooing investors in the early years. A healthy and pleasant living environment continues to play an important role in ensuring that Singapore remains an attractive place for investors, for talented migrants, and for its own citizens. So how did Singapore pursue a policy of rapid industrialization while ensuring the cleaning up of its environment?[24]

Singapore has made full use of the law to control unsociable behaviour. It is well known for its draconian anti-litter policy. Littering is an offence that carries a penalty of a fine of up to S$1,000[25] and the possibility of a Corrective Work Order.[26] The law even requires that buses provide litter bins.[27] It is the only country that has banned chewing gum,[28] and that imposes a fine for not flushing a public toilet after it has been used.[29] Acts of vandalism, where the damage to private or public property is done with an indelible substance, carry a maximum fine of S$2,000 and imprisonment of up to three years, plus mandatory caning (3 to 8 strokes).[30] There are also laws to protect the natural environment. It is an offence to cut or collect any plant or tree in any nature reserve, national park or public park,[31] or to kill, take or keep any wild animal or bird.[32] All these offences, and many more, carry a fine of at least S$1,000. Some offences carry mandatory jail terms for a second or subsequent offence, such as illegal dumping, or discharging a toxic substance into inland waters; both of which entail a fine of up to S$50,000 for a first offence and/or a jail term of up to 12 months; doubling to S$100,000 for a second or subsequent offence plus mandatory jail (at least one month but not more than 12 months).[33] In the case of illegal dumping, the vehicle that was used may also be forfeited.[34] These laws have been judiciously applied by the courts, which have often construed

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24 See Dominic Nathan, "Singapore—Green Paradise or Polluted City?" *The Straits Times Interactive* (12 January 2001), online: <http://www.ecologyasia.com/news-archives/2001/jan-01/straitstimes.asia1.com.sg_singapore_story_0,1870,20114-980805540,00.html>.

25 Section 17 of the *Environmental Public Health Act* (Cap. 95, 2002 Rev. Ed. Sing.) [*EPHA*]. The exchange rate is approximately S$1.40 to US$1.00 in March 2008.

26 *Ibid.* ss. 21A to 21E, and the *Environmental Public Health (Corrective Work Order) Regulations* (2000 Rev. Ed. Sing.). It is also an offence to spit.

27 *EPHA*, *supra* note 25, s. 23.

28 Chewing gum was first banned in 1992, with the passing of the *Control of Export and Imports (Chewing Gum) Order*. Singapore has now partially lifted this ban, and from 1 January 2004, has allowed the sale of therapeutic chewing gum; see *Regulation of Imports and Exports (Chewing Gum) Regulations* (S. 632/2003 Sing.; amended S 407/2006).

29 Regulation 16 of the *Environmental Public Health (Public Cleansing) Regulations* (2000 Rev. Ed. Sing.). Regulation 16A further requires all public toilets to be provided with "adequate toilet paper, soap or liquid detergent, litter bins, and clean towels or hand dryers."

30 *Vandalism Act* (Cap. 341, 1985 Rev. Ed. Sing.).

31 Under s. 2 of the *Parks and Trees Act* (Cap. 216, 2006 Rev. Ed. Sing.), a "public park" is defined to mean: any State land, any land belonging to the Board or any other land, which is:

(a) utilised as a public park, recreation ground, playground, garden, public open space, walk, park connector or green verge; and

(b) managed or maintained by the Board.

32 Section 5 of the *Wild Animals and Birds Act* (Cap. 351, 2000 Rev. Ed. Sing.). Six species of birds are not protected (see the Schedule to the *Act*). It is also an offence to feed or keep pigeons because pigeons may carry the salmonella bacteria: see the *Animals and Birds (Pigeons) Rules* (S. 148/2004 Sing.)

33 *EPHA*, *supra* note 25, ss. 20, 21.

34 EPHA, *supra* note 25 at s.20(2); see also "Illegal dumping: Seized lorry to be auctioned" *The Straits Times* (11 March 2008).

them as imposing strict liability, emphasising the need for Singapore to have a clean environment, and that "it is imperative that courts regard offences of pollution with the utmost gravity."[35]

It is no wonder, then, that Singapore has been labeled "A Fine City", the word "fine" referring to the monetary penalty that is levied on the transgressor of these many laws.[36] However, it is also a truism that Singapore is a "fine" city, in that it is a great place to live. In 2005, it was voted "Asia's best place to live, work and play,"[37] and "the best place to live for Asian expatriates."[38] Its strict laws and their enforcement have ensured a low crime rate and provided a safe environment for its residents. Sound environmental management policies have secured a "clean and green" physical environment. A "clean" government[39] has ensured that funds are available for the building of an excellent environmental infrastructure. Sound economic and land-use planning policies have ensured the preservation of green areas for nature conservation and recreation. Singapore's air and water quality are well within the US-EPA and WHO standards[40] – water is safe to drink from the taps. Refuse is collected daily by licenced contractors, incinerated and the ash sent to an off-shore landfill site. All inland waters support aquatic life, and the coastal waters meet recreational water standards. It has efficient public transport system, excellent transportation networks and telecommunication facilities.[41] In contrast, despite many advantages, increasing pollution in Hong Kong has driven investors to Singapore.[42]

Indeed, studies have shown that good environmental governance is critical, and it is "one reason why highly regulated Singapore has proven far better at combating pollution than laissez-faire Hong Kong."[43]

This paper examines, in some detail, Singapore's environmental governance, focusing in particular on the control and management of pollution, the ensuring of a safe and reliable supply of water, and the protection of its natural resources.[44] Singapore developed its industrial base and achieved high economic growth within a

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35 Per Yong Pung How CJ, in *Jupiter Shipping Pte Ltd v. Public Prosecutor* [1993] 2 Sing. L.R. 69 at para. 12; applied in *Public Prosecutor v. Sinsar Trading Pte Ltd* [2004] SGDC 54.

36 See online: <http://www.expatsingapore.com/general/law.htm>.

37 According to Mercer Human Resource Consulting, 2005-2006; see EDB Singapore, "Why Singapore—Singapore Rankings," online: <http://www.sedb.com/edb/sg/en_uk/index/why_singapore/singapore_rankings.html>.

38 According to ECA International, 2006, *ibid.*

39 Singapore has frequently been voted 'the least corrupt in Asia'; see *ibid.*; see "Singapore still ranks as least corrupt in Asia" *The Straits Times* (11 March 2008).

40 See *supra* note 30.

41 See *supra* note 7, and MAIT, "Broadband in Singapore" (September 2005), online: <http://www.elcot.com/mait-reports/Broadband-Singapre.pdf>; see also Infocomm Development Authority of Singapore, "About Us," online: <http://www.ida.gov.sg/About%20us/20060406102431.aspx>.

42 "Hedge funds flee Hong Kong pollution for Singapore" *Forbes* (8 April 2006), online: <http://www.forbes.com/home/feeds/afx/2006/08/04/afx2927287.html>; "Hong Kong pollution sends expats to Singapore" *The Stalwart* (23 May 2006), online: <http://www.thestalwart.com/the_stalwart/2006/05/hong_kong_pollu.html>.

43 "Asia's Environment – Visions of Green" *TIME* (2 October 2006) at 29.

44 See also Lye Lin Heng, "Chapter 13—'Singapore'," in Terri Mottershead (ed.), *Environmental Law and Enforcement in the Asia-Pacific Rim* (Hong Kong: Sweet & Maxwell Asia, 2002) at 395-435; Lye Lin Heng, "Environmental Pollution Laws in Singapore" *American Bar Association Newsletter* (February 2003) (Section on Environment, Energy & Resources, Special Issue on Environmental Protection in the Asia-Pacific Region).

short span of three decades. Environmental management policies were, at the outset, integrated with the economic policies of the country. Programmes were implemented to protect and clean up the environment at a very early stage. Cleaning up, greening and protecting the environment were indeed a major part of Singapore's strategies for success since, as stated by its first Prime Minister, "[i]n wooing investors, even trees matter."[45]

II. Governance Structure

In order for environmental laws to be effectively enforced, it is essential that an effective system of governance be established, starting with effectively organized government institutions, offices and enforcement agencies.[46] In Singapore, pollution and public health are the province of the Ministry of Environment and Water Resources (MEWR)[47] and its two statutory boards, the National Environment Agency (NEA)[48] and the Public Utilities Board (PUB)[49]. NEA takes charge *inter alia* of pollution and public health while the PUB is in charge of Singapore's water, a precious resource that is carefully conserved and managed. The Ministry of National Development's National Parks Board (NParks)[50] is responsible for nature areas and parks; its Urban Redevelopment Authority (URA)[51] is in charge of land use planning; and its Agri-Food and Veterinary Authority (AVA) ensures the supply of safe food, safeguards the health of animals and plants and facilitates agri-trade, as well as enforces the laws that protect wild animals and birds in Singapore. AVA also enforces the laws that relate to trade in endangered species of wild flora and fauna (plants and animals).[52] The Health Sciences Authority under the Ministry of Health ensures the protection of the nation's health and safety in relation to health services and products.[53]

This section examines the structure and governance of the Ministry of Environment and Water Resources and its agencies (NEA and PUB), and the NParks, as they are the main agencies in charge of pollution, water management and supply, and nature conservation, respectively.

A. *Agencies for Pollution, Public Health and Water Management*

It is significant that while the Ministry of Environment (ENV) was formed in 1972 (and it should be noted that this was the year of the first international meeting of

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45 Senior Minister Lee Kuan Yew on the 35th Anniversary of the Economic Development Board (1 August 1996). See Koh Kheng Lian, "From Garden City to Model Green City," ESCAP Virtual Conference (19-21 March, 2001).

46 "Singapore has once again come out on top in our annual survey of key political and economic institutions in Asia"; Bruce Gale, "Evaluating Singapore's National Institutions" PERC (28 July 1999).

47 This was formerly the Ministry of Environment, established in 1972. See Ministry of Environment, *Singapore—My Clean and Green Home* (1997). It was renamed on 1 September, 2004 when the Ministry's role expanded to include water management.

48 NEA was formed on 1 July 2002 "to focus on the implementation of environmental policies." See online: <http://app.nea.gov.sg/cms/htdocs/category_sub.asp?cid=2>.

49 See online: PUB <http://www.pub.gov.sg/home/index.aspx>.

50 See online: NParks <http://www.nparks.gov.sg>.

51 See online: URA <http://www.ura.gov.sg>.

52 See online: AVA <http://www.ava.gov.sg>.

53 See online: HSA <http://www.hsa.gov.sg>.

world leaders on the environment in Stockholm),[54] the Anti-Pollution Unit (APU) was established two years earlier, in 1970, and brought under the control of the Prime Minister's office. It was not until 1986 that APU was merged with ENV. This clearly indicates the importance PM Lee placed on pollution control. On 1 September, 2004, ENV was renamed Ministry of Environment and Water Resources (MEWR), with two statutory boards under its purview, the National Environment Agency (NEA) and the Public Utilities Board (PUB). Its vision is "A clean environment. Water for all. Together, a sustainable Singapore,"[55] and its two statutory boards have a joint mission—"[t]o deliver and sustain a clean and healthy environment and water resources for all in Singapore."[56]

1. *The National Environment Agency*

The NEA focuses on the implementation of environmental policies. It comprises three main divisions, namely:[57]

- Environmental Protection;
- Environmental Public Health; and
- Meteorological Services.

Administratively, it also comprises the divisions of Policy and Planning, Corporate Services, Human Resources and the Singapore Environment Institute.

(a) *The Environmental Protection Division*:[58] The Environmental Protection Division (EPD) implements programmes to monitor, reduce and prevent environmental pollution. It is also responsible for the operation of the four refuse incineration plants and an off-shore sanitary landfill in Singapore. In order to conserve energy resources and landfill space, this Division implements programmes to minimize waste generation, and maximize recycling and energy conservation. Its five departments are: the Pollution Control Department (PCD), Resource Conservation Department, Waste Management Department, Emergency Preparedness Unit, Environmental Technology Unit, and the Centre for Radiation Protection and Nuclear Science.[59]

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[54] This was the United Nations Conference on the Human Environment 1972, which resulted in the *Stockholm Declaration on the Human Environment*, leading to the formation of the United Nations Environment Programme See online: <http://www.unep.org/Documents.multilingual/Default.asp?DocumentID=97&ArticleID=1492&l=en>. Twenty years later, world leaders met at Rio de Janeiro (the United Nations Conference on Environment and Development) and adopted the *Rio Declaration on Environment and Development* and Agenda 21 (Earth's Action Plan). See online: <http://www.un.org/documents/ga/conf151/aconf15126-1annex1.htm>. The *Convention on Biological Diversity* and the *UN Framework Convention on Climate Change* were put forth for signature. Ten years thereafter, the world community met again to discuss the environment, at Johannesburg, South Africa. This was the World Summit on Sustainable Development, 2002. See http://www.un.org/events/wssd/.

[55] MEWR, "About MEWR," online: <http://app.mewr.gov.sg/web/contents/contents.aspx?ContId=2>.

[56] *Ibid.*

[57] NEA, "Our Divisions," online: <http://app.nea.gov.sg/cms/htdocs/category_sub.asp?cid=21>.

[58] See online: NEA <http://app.nea.gov.sg/cms/htdocs/category_sub.asp?cid=115>.

[59] This was formerly the Centre for Radiation Protection under the Health Sciences Authority. It was brought under NEA on 1 July 2007. See online: NEA <http://app.nea.gov.sg/cms/htdocs/category_sub.asp?cid=263>. For organizational charts of the Pollution Control Department, the Resource Conservation Department and the Waste Management Department, see *EPD Annual Report 2006*, *supra* note 23, Appendix.

(b) *The Environmental Public Health Division*:[60] The Environmental Public Health Division is responsible for public health and overall cleanliness in Singapore. It ensures a high standard of hygiene in the food retail industry, and enhances the living environment through programmes such as the upgrading of hawker centres and food courts, and the clean public toilets programme. It comprises three departments: the Environmental Public Health Department, the Environmental Health Institute, and the Hawkers Department.

(c) *The Meteorological Services Division*:[61] The Meteorological Services Division provides information on the weather and issues alerts on air pollution, notably, the haze caused by the burning of forests in Indonesia. It also provides vital meteorological services to the aviation and maritime communities and the military. It has 2 departments, *viz.* Business and Technical Services, and Operational Services.

(d) *The Policy and Planning Division*:[62] The Policy and Planning Division formulates policies and plans on issues relating to environmental protection and public health, enhances Singapore's environmental interests at the bilateral, regional and international levels, and drives corporate planning and strategic management processes and organizational development initiatives. It has 3 departments: Corporate Development, International Relations, and Policy.

At the international level, Singapore has signed and ratified a number of multilateral environmental agreements (MEAs) such as the *Convention on International Trade in Endangered Species of Wild Flora and Fauna*, the *Convention on Marine Pollution*, the *Vienna Convention on Ozone Depleting Substances, the Convention on Biological Diversity*, and the *Framework Convention on Climate Change*. Singapore takes her international obligations seriously. Implementing legislation at the national level is usually passed soon after ratification of or accession to an international agreement. These MEAs guide domestic policy, as far as they are not contrary to national objectives. Officials from the relevant Ministries attend Meetings of the Parties and amendments to the laws will be passed where necessary to ensure compliance. Singapore ratified the Kyoto Protocol to the *U.N. Framework Convention on Climate Change* on 12 April 2006 and it entered into force on 11 July 2006.

(e) *The Singapore Environment Institute*:[63] The Singapore Environment Institute (SEI) was established in February 2003, as the training arm of NEA. It provides environmental courses for NEA staff as well as persons working in industries. The SEI also offers general environmental awareness courses on weather, resource conservation, and environmental laws to the general public. It also actively promotes knowledge transfer among global and regional partners, and offers capacity-building programmes to government officials from other countries as well.

The SEI's key training areas focus on Pollution Management, Solid Waste Management, Environmental Public Health Management, Urban Environmental Management, and Weather & Meteorological Services. Since its inception, the SEI has provided more than 30,000 course placements to NEA/MEWR staff and the local

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60 See online: NEA <http://app.nea.gov.sg/cms/htdocs/category_sub.asp?cid=116>.
61 See online: NEA <http://app.nea.gov.sg/cms/htdocs/category_sub.asp?cid=13>.
62 See online: NEA <http://app.nea.gov.sg/cms/htdocs/category_sub.asp?cid=253>.
63 NEA "About SEI," online: <http://www.nea.gov.sg/cms/sei/Aboutus.html>.

industries and has helped train more than 600 international participants from over 60 countries.[64]

2. *The Public Utilities Board*

The mission of the PUB is to ensure an efficient, adequate and sustainable supply of water at an affordable cost for Singaporeans. Its vision is "Water for All: Conserve, Value, Enjoy."[65] It has three broad structural divisions:

1. water supply;
2. sewerage; and
3. drainage.

In relation to water sustainability, its portfolios are:

- Water Resource Planning & Development;
- Water Production;
- Catchment and Reservoir Management;
- Water Distribution and Demand; and
- Used Water Collection and Treatment.

These will be considered in some detail below.

B. *Agencies for Nature Conservation*

The greening of modern Singapore was the responsibility of the Parks and Trees Unit of the Public Works Department (PWD) in June 1967.[66] This became the Parks and Trees Division in the PWD in 1970. The thrust then was to plant trees extensively along the sides of roads, to provide shade, reduce heat and enhance the physical environment aesthetically. In 1973, the Botanic Gardens merged with the Parks and Trees Division to form the Parks and Recreation Division under the PWD. Work commenced on East Coast Park and Fort Canning Park. In 1976, the Division became an independent department under the Ministry of National Development, and in 1990, the National Parks Board (NParks) was formed to take charge of Singapore's two national parks (the Botanic Gardens and Fort Canning Park) and the nature reserves. It was reconstituted on 1 July 1996, following the merger of the Parks and Recreation Department and the former National Parks Board.[67]

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[64] The National University of Singapore's Asia-Pacific Centre for Environmental Law, Faculty of Law, and the School of Design and Environment's multi-disciplinary M.Sc. (Env. Mgt.) programme are partners with the SEI in its capacity-building programmes, and regularly conduct courses for the SEI.

[65] PUB, "About Us—Corporate Statement," online: <http://www.pub.gov.sg/about_us/CorporateStatement.aspx?l1=1&l2=2>.

[66] Ling Sing Kong & Chua Sian Eng, *More than a Garden City*, (Singapore: Parks and Recreation Department, Ministry of National Development, 1992) at 126; see also Tan Wee Kiat, *Naturally Yours* (Singapore: National Parks, 1992); Shawn Lum & Ilsa Sharp, eds., *A View from the Summit—The Story of Bukit Timah Nature Reserve* (Singapore: National Parks Board, 1996).

[67] See *National Parks Board Act* (Cap. 198A, 1997 Rev. Ed. Sing.).

Today, NParks is the agency responsible for the maintenance of these green expanses. Its mission is "Let's Make Singapore Our Garden."[68] NParks is responsible for providing and enhancing the greenery of the Garden City. NParks is also Singapore's scientific authority on nature conservation, and monitors and coordinates measures to ensure the health of designated nature areas. However, the Agri-Food and Veterinary Authority is the enforcement agency for the *Wild Animals and Birds Act*[69] as well as the *Endangered Species (Import and Export) Act*.[70] The former protects all wild animals and birds in Singapore, with the exception of 6 birds, while the latter is the implementing legislation for the *Convention on International Trade in Endangered Species of Wild Flora and Fauna*.

Despite competing land needs, space has been set aside for parks, trees and greenery. Through the years, NParks and its predecessors have developed a highly efficient system of maintenance and management for some 1,763 hectares of parks, connectors and open spaces, including some 300 parks and playgrounds. NParks also manages 3,326 hectares of nature reserves,[71] and 4,278 hectares of roadside greenery and vacant state land. Under the Concept Plan 2001, 4400 hectares of parkland will be set aside when Singapore's population reaches 5.5 million. NParks is also the lead agency in the efforts to continually upgrade the Landscape and Horticulture Industry in Singapore. It works closely with industry partners to promote good work practices and create a thriving, creative, innovative and professional industry that will support Singapore's aspirations of being a City in a Garden.[72]

Within NParks, the Parks and Trees Regulatory Section[73] is responsible for:

- Securing roadside greenery for all types of development projects;
- Securing public open spaces in new housing developments, and ensuring that parks, amenities and landscaping are provided within these open spaces;
- Securing greenery within the compounds of public development projects and ensuring the landscaping of these compounds; and
- Enforcing the *Parks and Trees Act*, particularly to ensure that mature trees within the Gazetted Tree Conservation Areas and trees maintained by the Board are not felled unless absolutely necessary.

Mindful that large trees and tree-lined roads are a part of our heritage, NParks has designated some 56 tree-lined roads as "Heritage Roads," fully appreciating that "the preservation of Heritage Roads will add an element of permanence to the landscape which will contribute to Singapore's sense of identity, history and continuity."[74] This is complemented by the Heritage Tree Scheme, announced on 17 August 2001. Under this scheme, majestic trees can be designated "Heritage Trees" upon recommendation by a Panel.[75] A Heritage Trees Fund has been established with a grant from the Hong Kong and Shanghai Bank.

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68 NParks, "Let's Make Singapore Our Garden," online: <http://www.nparks.gov.sg/gardencity.asp>.

69 Cap. 351, 2000 Rev. Ed. Sing.

70 Cap. 92A, 2008 Rev. Ed. Sing.

71 Singapore has 4 nature reserves (Central Catchment NR, Bukit Timah NR, Laborador Park NR and Sungei Buloh Wetland Reserve), and 2 national parks (Botanic Gardens and Fort Canning Park.

72 NParks, "About Us," online: <http://www.nparks.gov.sg/corporate_info.asp#2>.

73 NParks, "Parks & Regulatory," online: <http://www.nparks.gov.sg/plants_trees_regulatory.asp>.

74 NParks, "Heritage Roads," online: <http://www.nparks.gov.sg/heritage_roads.asp>.

75 NParks, "Heritage Trees," online: <http://www.nparks.gov.sg/heritage_trees.asp>.

NParks is now encouraging "sky-rise gardens" on roof tops, balconies and the sides of high-rise buildings. This will, again, help reduce the heat as well as beautify the environment for residents. NParks has set up a website with tips on how this can be done.[76]

NParks has also established the National Biodiversity Reference Centre[77] as the focal point for biodiversity conservation which provides information on the indigenous biodiversity of Singapore. Its website also serves as the Singapore node of the Clearing-house Mechanism of the *Convention on Biological Diversity*.

A challenging new project is forthcoming for NParks. This is the "Gardens by the Bay" project,[78] which will be at Marina Bay, adjacent to the new Integrated Resort that will soon be built. It will comprise three inter-connected gardens around Marina Bay including first, a conservatory of flowering plants from cooler climates, secondly, gardens with a water theme, and lastly, a linear garden to link the cultural core at the Esplanade Theatres to the Kallang Basin.[79]

III. Environmental Governance—Singapore's Environmental Management System for Pollution Control

Singapore's success in managing the environment stems from sound environmental management policies and effective implementation. This translates into an effective environmental management system (EMS). In relation to pollution control, Singapore's EMS comprises four integrated strategies, as follows:

- Prevention;
- Monitoring;
- Enforcement; and
- Public education.

A. *Prevention*

The prevention of pollution starts with careful land-use planning and identification of the kinds of industries that can or should be allowed, and where they should be located.[80] Singapore has been guided by a number of different land use plans, which include the 1958 Master Plan, the 1971 Concept Plan, and the 1991 Revised Concept Plan.[81] The latest Master Plan was approved on 1 December 2003, and it

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[76] See NParks, "Singapore, The Garden City—Starting Your Own Skyrise Garden in Your Home," online: <http://www.nparks.gov.sg/gardencity_f.asp>.

[77] See online: <http://www.nbrcnparks.org/>.

[78] See Ministry of National Development, "Speech by Mr Mah Bow Tan, Minister for National Development, at the Launch of the Gardens by the Bay International Design Competition on 20 January 2006," online: <http://www.mnd.gov.sg/newsroom/speeches/speeches_2006_M_20012006.htm>.

[79] URA, "Garden By the Bay" *Skyline* (January to February 2006) at 14, online: <http://www.ura.gov.sg/skyline/skyline06/skyline06-01/text/pg14.html>.

[80] It is fitting that the NEA, *Code of Practice on Pollution Control*, 3d ed. (February 2004) starts with "Judicious Siting of Industries". See online: <http://www.nea.gov.sg/cms/pcd/coppc_2002.pdf>.

[81] For a detailed assessment of the role of land-use planning in the Singapore environmental context, see Lye Lin Heng, "Land-use Planning, Environmental Management and the Garden City as an Urban Development Approach in Singapore" in Nathalie J. Chalifour *et al.*, eds., *Land Use Law for Sustainable Development* (New York: Cambridge University Press, 2007) at 374-397.

now comprises one Written Statement and 55 Development Guide Plans, the latter detailing the land use for 55 areas covering all of Singapore. The Master Plan is reviewed every five years. It guides Singapore's development in the medium term (*i.e.* over the next 10 to 15 years), translating the broad, long-term strategies set out in the Concept Plan into detailed implementable plans for Singapore.

While the Economic Development Board (EDB)[82] identifies the kinds of industries that Singapore should attract, there are close consultations with other ministries to ensure that environmental considerations are incorporated at the land use planning, development control and planning stages, so as to minimize the impact of pollution on the surrounding land use.[83] Discussions are held with officers from the Ministry of Environment and Water Resources' NEA to see if the pollution that ensues from new industries can be controlled; with planners from the Ministry of National Development's URA to establish the possible sites for these industries; with the Jurong Town Corporation (JTC) (the largest landlord of industrial premises), the Housing & Development Board (HDB) (Singapore's public housing agency), and private industrial estate developers, to discuss the physical logistics of location for these factories; and with the Ministry of Manpower to ascertain the impacts of these new industries on the workforce.

Planners from the URA will check with the NEA's Pollution Control Department (PCD) on the siting of these new industries or development projects to ensure their compatibility with the surrounding land use.[84] This is part of the planning process, to ensure that industries are suitably located. Highly pollutive industries must be sited in specially designated areas such as Jurong Island[85] with measures to control, manage and minimize pollution as well as to maximize industrial and technological synergies.[86] In particular, the PCD will examine measures to control air, water and noise pollution, the management of hazardous substances, and the treatment and disposal of toxic wastes.

To guide land use planning and to assist in the selection of suitable industrial premises, industries are classified, based on the impact of residual emissions of fumes, dust, and noise on surrounding land use, into 4 categories: clean, light, general and special industries.[87] Buffer zones are prescribed for each of these categories, except for clean industries. Special industries require a buffer zone of at least 500 m between the boundaries of a factory and the nearest industrial building. Special industries that can potentially cause serious pollution, such as oil refineries, petrochemical and chemical plants, toxic industrial waste treatment facilities, and sewage treatment works, require a buffer zone of at least 1 km from the nearest residential building. Special industries which handle large quantities of hazardous substances are sited

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82 EDB Singapore, "About Us," online: <http://www.edb.gov.sg/edb/sg/en_uk/index/about_us.html>.

83 NEA, *Environmental Protection Division Annual Report 2004* at 8, online: <http://www.nea.gov.sg/cms/pcd/EPDAnnualReport2004.pdf> [*EPD Annual Report 2004*].

84 See online: <http://www.ura.gov.sg>.

85 Jurong Island is an amalgamation of several small islands to form a specialized complex for the petrochemical industry. See online: <http://www.jurongisland.com/aboutJI.asp>.

86 Lye Lin Heng, "Singapore: Long Term Environmental Policies" in Genevieve Dubois-Taine & Christian Henriot, eds.,*Cities of the Pacific Rim—Diversity & Sustainability* (Pacific Economic Cooperation Council (PECC) Sustainable Cities Taskforce, 2001) at 155-168.

87 See examples of these categories in the *Code of Practice for Pollution Control*, online: <http://app.nea.gov.sg/cms/htdocs/category_sub.asp?cid=47>.

on off-shore islands or in industrial estates which are located away from residential estates.

Industrial premises that are located close to residential areas and within the water catchment areas may only be occupied by clean or light industries.[88] Food industries are also classified into light, general or special categories, depending on their scale of operations and pollutive capacity. In order to prevent cross-contamination, food industries are sited in industrial premises in areas designated as food zones or in areas with compatible industrial uses.

Before a proposed development can be built, the developer is required to submit Building Plans of the proposed works to the Building Plan and Management Division of the Building and Construction Authority for approval.[89] These Building Plans must also be submitted to and approved by various authorities, including the Fire Safety Bureau, the National Parks Board, and NEA's Central Building Plan Unit (CBPU). The CBPU examines all building plans to ensure they comply with sewerage, drainage, environmental health and pollution control requirements. In particular, the CBPU will screen prospective industries to ensure that they:

- are sited in designated industrial estates, and are compatible with the surrounding land use;
- adopt clean technology to minimize the use of hazardous chemicals and the generation of wastes;
- adopt processes which facilitate the recycling, reuse and recovery of wastes;
- do not pose unmanageable health and safety hazards and pollution problems; and
- install pollution control equipment to comply with discharge or emission standards.

When the factory building is completed, inspectors from the CBPU will inspect the premises to check if the structure has been built in compliance with the requirements of the Sewerage, Drainage, Environmental Health, and Pollution Control Departments. Only when this is approved will the factory be given a Temporary Occupation Permit or a Certificate of Statutory Completion.

In 2006, CBPU processed 7,839 plans for residential and industrial developments, and 4,895 applications for allocation of industries in JTC, HDB and private industrial estates.[90] It also evaluated the Quantitative Risk Assessment studies of 24 chemical plants and held consultations with owners or occupiers of 35 highly pollutive industries that occupied "scheduled premises."[91]

B. *Monitoring and Enforcement*

Singapore's second strategy in pollution control is Monitoring. Air and water quality are constantly monitored.

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88 See the NEA's *Code of Practice on Pollution Control*, *ibid.*, for examples of these classifications.

89 See *Building Control Act* (Cap. 29, 1999 Rev. Ed. Sing.).

90 *EPD Annual Report* 2006, *supra* note 23 at 7-10.

91 Section 26 of the *Environmental Protection and Management Act* (Cap. 94A, 2002 Rev. Ed. Sing.) [*EPMA*] requires owners or occupiers of hazardous installations to carry out impact analysis studies, termed 'Quantitative Risk Assessment (QRA)' in the *Code of Practice on Pollution Control*, *supra* note 80. Scheduled premises are listed in the Schedule of the *EPMA* and comprise 3 categories of highly pollutive industries.

The ambient air in Singapore is monitored through a telemetric network of 13 remote air monitoring stations strategically located in different parts of Singapore, and linked to a Central Control System *via* dial-up telephone lines. Eleven of the stations monitor ambient air quality and two stations measure roadside air quality. Automatic analysers and equipment in the stations measure air pollutants such as sulphur dioxide, nitrogen dioxide, ozone, carbon monoxide and particulate matter of 10 microns or smaller in size (PM 10). These pollutants are used in the determination of the Pollutant Standard Index (PSI). The PSI, an indicator of air quality developed by the US-EPA, is made available to members of the public daily, *via* the Internet. On days where pollution is especially severe, as may happen when forests are burning in Indonesia, the PSI reading is revised every 3 hours and is readily accessible on the NEA website and on television.[92]

1. *Air Pollution Control*

(a) *Industrial premises*: Although Singapore's air quality is well within WHO and US-EPA Guidelines, air pollution continues to be a concern and air quality is constantly monitored. The main sources of air pollution are industries, power plants, motorised vehicles and the seasonal burning of forests in Indonesia. Pollution is generated from the burning of fossil fuel for heat generation in industries, electricity generation and transportation.[93] The main air pollutants are sulphur dioxide, oxides of nitrogen, carbon monoxide, ozone, lead, hydrocarbons and particulates.

In 2006, air quality was rated "Good" in 85% of the total number of days, with 14% rated as "Moderate," and 1% as "Unhealthy."[94] In 2004 and 2005, the PSI was "Good" for 88% and "Moderate" for 12% of the total number of days.[95] There were no "Unhealthy" days in 2004 and 2005.[96] But there are increasing concerns on fine particulates of PM 2.5 as Singapore has yet to meet the US-EPA recommended standards for PM 2.5.[97] As more than 50% of PM 2.5 come from emissions of diesel engines, steps have been taken to ensure cleaner diesel fuel and vehicles.[98]

Singapore's first air pollution law was the *Clean Air Act*, passed in 1972. This was replaced by the *Environmental Pollution Control Act*[99] which took effect from 1 April

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92 See online: <http://app.nea.gov.sg/cms/htdocs/article.asp?pid=2779>.

93 NEA, "FAQ on Air Quality," online: <http://app.nea.gov.sg/cms/htdocs/category_sub.asp?cid=29>.

94 *EPD Annual Report 2006*, *supra* note 23 at 28. The Report also contains the 2006 readings for sulphur dioxide, nitrogen dioxide, respirable suspended particles (PM 10), low-level ozone and carbon monoxide. The unhealthy days were due to forest fires in Indonesia.

95 NEA, *Environmental Protection Division Annual Report 2005* at 23, online: <http://www.nea.gov.sg/cms/pcd/EPDAnnualReport2005.pdf> [*EPD Annual Report 2005*]. The 2005 readings for sulphur dioxide, nitrogen dioxide, respirable suspended particles (PM 10), low-level ozone and carbon monoxide are at 28-35.

96 A PSI value of 0-50 is 'Good'; 51-100 is 'Moderate'; 101-200 is 'Unhealthy'; 201-300 is 'Very Unhealthy'; and above 300 is 'Hazardous'. See NEA, "Frequently Asked Questions on the Haze," online: <http://app.nea.gov.sg/cms/htdocs/article.asp?pid=1253>.

97 One of the targets for the 2012 Revised Singapore Green Plan 2012 (2006 edition) is to reduce the ambient PM 2.5 level to within an average of 15 μg/Nm^3 by 2014. See online: MEWR <http://www.mewr.gov.sg/SGP2012/index_2006.htm>.

98 See the main text below at paragraph 1(b): "Vehicular emissions".

99 No. 9 of 1999. See Lye Lin Heng, "Singapore's New Environmental Pollution Control Law: The Environmental Pollution Control Act, 1999" [2000] S.J.L.S. 1.

1999. This was recently renamed the *Environmental Protection and Management Act* (*EPMA*) from 1 January 2008. More stringent air emission standards were passed to take effect from 1 January 2001.[100] Industries or premises which have the capacity to cause serious air pollution are classified as "Scheduled Premises" under the *EPMA*.[101] An owner or occupier of Scheduled Premises must first obtain a Licence from the PCD before operations can commence. A Licence will only be granted when all pollution control requirements have been complied with. The *EPMA* also requires that owners/occupiers of factories maintain fuel burning equipment and air pollution control equipment in an efficient condition.[102]

It is an offence to allow dark smoke to be emitted from a chimney, or to allow emissions in excess of the legal limits.[103] Dark smoke is defined as smoke darker than shade No. 1 on the Ringlemann Chart.[104] Operators of industrial boilers with a steam-generating capacity of 2,300 kg/h or more (these fall within the definition of "Scheduled Premises") are required to monitor their smoke emissions. Smoke density meters are installed in their chimneys to ensure continuous monitoring of the smoke intensity. The height of chimneys and exit velocity of flue gases are also checked by the PCD to ensure they are properly dispersed.

The Director-General of Environmental Protection is given wide powers to require that remedial measures be taken to reduce air pollution. This includes the alteration of the height or dimension of chimneys, change in fuel quality, alteration of any operation or process, installation of specific equipment and the keeping of records.[105] The type of fuel oil is also regulated, to ensure that emissions of sulphur oxides are controlled. Industries located in designated industrial estates must use fuel oil containing not more than 1% sulphur by weight. Industries located near residential areas must use cleaner fuel, *i.e*. diesel with 0.05 per cent less sulphur content, or town gas. Industries on Jurong Island and Tuas Industrial Estate may use natural gas, a clean fuel. Industries may also be required to install air pollution control equipment to comply with emissions standards.[106]

To encourage changes to cleaner technology, the *Income Tax Act*[107] grants a 100% allowance on the capital expenditure for the installation of any "efficient pollution control equipment or device" or any "certified energy-efficient equipment."[108] In 2005, the CBPU approved the installation of 105 pieces of air pollution control

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100 *Environmental Pollution Control (Air Emissions) Regulations* (S. 593/00 Sing.). These standards are listed in the *Code of Practice on Pollution Control*, *supra* note 80, and also in the *EPD Annual Report 2004*, *supra* note 83.

101 EPMA, *supra* note 91.

102 *Ibid.* at s. 10.

103 *EPMA*, *supra* note 91, at s. 13.

104 It was shade No. 2 on the Ringlemann Chart under the old *Clean Air (Air Emissions) Regulations 1972*.

105 *EPMA*, *supra* note 91, at s. 13.

106 The *Environmental Protection and Management (Air Impurities) Regulations 2001* (2008 Rev. Ed. Sing.), r. 3. Such equipment may include a smoke density indicator, recorder and alarm, which will provide adequate indication in the boiler room, furnace room or control room of the density of smoke being discharged from the chimney; or a closed circuit television installation with the receiver located in the boiler room, furnace room or control room.

107 Cap. 134, 2008 Rev. Ed. Sing.

108 *Ibid.*, s. 19A(5) and (6).

equipment (bringing the total to 3508)[109] and 39 new fuel-burning equipment, including 18 boilers, 10 ovens, 6 furnaces and 5 incinerators.[110]

(i) *Tests and inspections of factories*: The PCD carries out regular inspections on industrial and non-industrial premises to ensure that pollution control equipment are properly maintained and operated. The PCD also conducts source tests on gaseous emissions, fuel analyses and smoke observations on chimneys. Highly pollutive industries are inspected more frequently. The law requires every owner or occupier of industrial or trade premises to provide the Director or his officers ready access to the premises and to any pollution control equipment, as well as to provide such assistance and facilities as they may reasonably require. From January 1997, industries were required to conduct source emission tests, which required regular monitoring of emissions to ensure they take remedial measures where necessary to comply with emission standards. This was extended to all new industries in Jurong Island in 1999. In 2006, 204 companies were required to conduct source emission tests, as compared to 191 in 2004.

In 2006, 18,595 inspections were conducted on industrial premises (factories, trade premises, *etc.*) and 3,530 inspections on non-industrial premises such as farms and domestic premises. A total of 1,284 tests were conducted, comprising 402 isokinetic tests and 882 tests on gaseous emissions. Six companies failed the tests and were prosecuted and made to comply.[111] PCD also conducted 523 fuel analyses and smoke observation of chimneys. Only one failed to comply with the prescribed standards for smoke emissions (compared with 4 in 2004).[112] Again, the offender was prosecuted and made to comply.[113]

(ii) *Open burning and odorous emissions*: The open burning of waste materials has been prohibited in Singapore under the *Clean Air Act*, and now, under the *EPM (Prohibition on the Use of Open Fires) Order 1999*.[114] The burning of joss sticks and candles is also regulated, as only joss sticks and candles of certain sizes are allowed.[115] In 2006, 3 burning incidents were detected and the offenders were prosecuted (compared to 11 incidents in 2004). Fugitive or residual emissions of odorous substances may constitute a public nuisance under the *Environmental Public Health Act* (*EPHA*).[116] Factories in breach of these laws will be required to install odour control equipment.

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[109] These include bag filter dust collectors, inertial collectors, electrostatic precipitator, scrubbers, and smoke density meters.

[110] "Pollution Control" in *EPD Annual Report 2006*, *supra* note 23 at 13.

[111] Compare these figures with those for 2004: In 2004, 22,646 inspections were conducted on industrial premises and 2,483 inspections on non-industrial premises. A total of 539 tests were conducted, comprising 189 isokinetic tests and 350 tests on gaseous emissions. All the companies were found to be in compliance with the emission standards. The PCD also conducted 438 fuel analyses and smoke observation of chimneys, of which 52 were for sulphur content in fuel analysis, 33 were for lead content in petrol analysis, and 353 were for smoke observation. Of these. four failed to comply with the prescribed standards for smoke emissions. All four were prosecuted and required to take remedial action. See "Pollution Control" in *EPD Annual Report 2005*, *supra* note 95, at 13.

[112] "Pollution Control" in *EPD Annual Report 2004*, *supra* note 83 at 12-13.

[113] "Pollution Control" in *EPD Annual Report* 2006, *supra* note 23 at 12.

[114] S.161/99 Sing.

[115] *Environmental Public Health (Burning of Joss Sticks and Candles) Regulations* (2000 Rev. Ed. Sing.), r. 1.

[116] *EPHA*, *supra* note 25, ss. 44 and 45.

(iii) *Enforcement:* In 2006, 875 complaints of pollution were received by PCD. Of these, 47 related to air pollution, 437 related to odours, 199 related to fumes and dust, and 242 related to smoke and soot.[117] This compares with 780 complaints in 2005.

(b) *Vehicular emissions*: Singapore was one of the first countries to implement the "polluter pays" principle in relation to vehicular pollution. All motor vehicles are subject to various taxes to ensure that the costs of owning and operating a car are prohibitive.[118] Road taxes increase with the engine capacity of the car as well as the age of the car. Singapore is a pioneer in congestion pricing. To ensure that vehicles are kept in good condition, cars are subject to mandatory checks when they are three years old, and thereafter they must be inspected every two years for exhaust emissions and roadworthiness.[119] These policies help reduce road congestion as well as pollution from vehicular emissions.[120]

As diesel vehicles contribute to about 50% of the total PM 2.5 emissions, a number of measures have been instituted to reduce pollution from these sources. A system of certification has been implemented to ensure that only motor workshops with trained mechanics, proper equipment and procedures are accredited for the maintenance of diesel-driven vehicles.[121] A more stringent smoke test for diesel vehicles caught emitting black smoke was imposed from 1 September 2000—the Chassis Dynometer Smoke Test (CDST), which replaces the free acceleration smoke test. From 1 January 2007, all diesel-driven vehicles must undergo the CDST. In 2006, 69,361 vehicles were tested, and some 75% passed on the first attempt.

(i) *Encouraging cleaner vehicles*: The PCD is in charge of vehicular emissions, under the *Environmental Protection and Management (Vehicular Emissions) Regulations*.[122] Emission standards have been tightened over the years. From 1 January 2001, all petrol and diesel-driven vehicles are required to comply with the Euro II exhaust emission standard (as specified in the European Directive 96/698/EC) for passenger cars and light duty vehicles with maximum laden weight (MLW) of 3,500 kg or less. Heavy vehicles with MLW exceeding 3,500 kg must comply with 91/542/EEC Stage II before they are allowed to be registered for use in Singapore. To comply with these standards, all petrol-driven vehicles are to be equipped with 3-way catalytic converters.

From 1 July 2003, all motorcycles/scooters must comply with the European Directive 97/24/EC exhaust emission standards before they can be registered for use in

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[117] See Table 5, "Pollution Control" in *EPD Annual Report 2006*, *supra* note 23 at 14.

[118] See the main text below at paragraph 1(b)(iv): "Reducing vehicular pollution through innovative taxation and other measures".

[119] *Road Traffic Act* (Cap. 276, 2004 Rev. Ed. Sing.), ss. 90, 91 [*Road Traffic Act*]; *Road Traffic (Motor Vehicles, Compulsory Inspection) Rules* (S. 562/2003 Sing.).

[120] For a detailed account of these measures and the laws that apply, see Lye Lin Heng, "Environmental Taxation in the Regulation of Traffic and the Control of Vehicular Pollution in Singapore" in Jane Milne *et al.*, eds., *Critical Issues in Environmental Taxation—International and Comparative Perspectives*, vol. 1 (Richmond Law & Tax: Richmond, 2002); see also the Land Transport Authority's websites, online: <http://www.lta.gov.sg/>; <http://www.onemotoring.com.sg/publish/onemotoring/en.html>.

[121] The PCD initiated the formation of an industry-led Motor-Industry Certification Board (MICB). Motor Workshops may apply for certification under this scheme, which started on 1 September 2000. Some 30 workshops have been registered.

[122] S. 291/99 Sing.

Singapore. As diesel vehicles contribute to some 50% of the total PM 2.5 emissions in Singapore, the more stringent Euro IV emission standards will be applied to all diesel vehicles registered from 1 October 2006.

Controls are also imposed on automotive fuel quality. Unleaded petrol was introduced in January 1991 and leaded petrol was phased out on 1 July 1998. The permissible sulphur content in diesel was reduced from 0.3% to 0.05% by weight on 1 March 1999. On 1 January 2001, the more stringent Euro II emission standards were imposed. From 1 December 2005, the permissible sulphur content in diesel was further reduced to 0.005% by weight, to pave the way for the introduction of even stricter Euro IV emission standards for diesel vehicles.[123] The government is also encouraging the use of compressed natural gas (CNG) in buses and taxis.

In April 2002, a pilot project to introduce CNG buses in Jurong was launched with the opening of the first CNG refilling station in Jurong Island.[124] Tax incentives for both CNG buses and Euro IV vehicles were announced in March 2004 and 2005.[125] In 2006, the SMART taxi company brought in 102 CNG taxis, and NEA approved the sum of S$2 million under the Innovation for Environmental Sustainability (IES) Fund, to facilitate the setting up of CNG refuelling stations on the main island.[126] The IES Fund is administered by NEA's Environmental Technology Unit. It seeks to encourage and assist Singapore-registered companies to undertake innovative environmental projects that could help to meet the government's goal of environmental sustainability. The IES Fund provides assistance through grants to cover a percentage of the qualifying cost of the project at three levels of funding. The assistance is based on the various levels of support for different components of allowable cost, up to a maximum of S$2 million for each project. Projects must not exceed 3 years in duration.[127]

(ii) *Vehicular emissions—enforcement*: It should be noted that, each day, a considerable number of motor vehicles from Malaysia are driven into Singapore, traveling across the Causeway or the new Second Link at Tuas. Much of the vehicular pollution comes from these Malaysian-registered vehicles.

In surveys conducted in 2003, it was found that 4.4% of motorcycles emitted smoke in excess of the permitted standards. Of these, only 1.1% were Singapore-registered while 3.3% were Malaysian-registered. Of the other motor vehicles, 2.8% were smoky; and of these, only 0.5% were Singapore-registered, while 2.3% were

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[123] NEA, "Ultra Low Sulphur Diesel to be Made Mandatory From 1 December 05" News Release No. 26/2005 (16 June 2005), online: <http://app.nea.gov.sg/cms/htdocs/article.asp?pid=2553>.

[124] MEWR, "Speech by Mr Lim Swee Say, Minister for the Environment at the Launch of CNG Bus and Taxis Pilot Project at SembCorp Gas CNG Refueling Station, Jurong Island on 22 April 2002 at 10am" News Release No. 043/2002 (22 April 2002), online: <http://app.mewr.gov.sg/press.asp?id=SAS35>.

[125] NEA, "Press Release: Further Tax Incentives to Promote CNG and Euro IV Diesel Vehicles" News Release No. 11/2004 (18 March 2004), online: <http://app.nea.gov.sg/cms/htdocs/article.asp?pid=2466>; see also *EPD Annual Report 2004*, *supra* note 83 at 18; and NEA, News Release No. 44/2005, "Press Release: Extension of Green Vehicle Rebate" (3 Oct. 2005), online: <http://app.nea.gov.sg/cms/htdocs/article.asp?pid=2900>. See the Table in *EPD Annual Report 2006*, *supra* note 23 at 17.

[126] See *EPD Annual Report 2006*, *ibid.* at 16.

[127] See NEA, "Innovation for Environment Sustainability (IES) Fund," online: <http://app.nea.gov.sg/cms/htdocs/category_sub.asp?cid=42>.

Malaysian-registered vehicles. In 2004, the figures improved, with 4% of motorcycles found to be smoky, of which 1% were Singapore-registered and 3% were Malaysian-registered. In 2005, 0.7% were Singapore-registered motorcycles and 3% Malaysian-registered motorcycles. The Traffic Police as well as NEA officers enforce these laws, and concerned citizens are encouraged to report errant vehicles to NEA, *via* a "hotline" that is manned 24 hours a day.[128] Complaints are swiftly attended to. In 2005, 6,356 motor vehicles and 7,650 motor cycles were booked and fined for emitting excessive smoke.[129] In 2006, 3,314 Singapore-registered and 2,671 Malaysian-registered motor vehicles were fined for excessive smoke, totaling 5,985. As for motorcycles, 3,834 Singapore-registered and 2,411 Malaysian-registered motorcycles were booked (totalling 6,245).[130] These figures show that pollution from vehicular sources appears to be declining, assuming the same level of enforcement is maintained.

(iii) *Reducing vehicular pollution through innovative taxation and other measures*: Singapore has effectively managed to control the growth and usage of motor vehicles, by a series of measures directed, firstly, at the ownership of motor vehicles, and secondly, at the use of such vehicles. Indeed, it was one of the first countries to implement a system of congestion pricing, but it has done more than this.

Measures directed at discouraging car ownership include the imposition of high taxes on cars as well as the requirement of obtaining a Certificate of Entitlement (COE) in order to purchase a car. The taxes imposed on the purchase of a car include an import tax, a registration fee, an additional registration fee of 140% of the market value, and a road tax that is based on the vehicle's engine capacity.[131] Added to these taxes is the cost of the COE. Only a limited number of COEs are available for sale each month, and prospective owners of new vehicles must bid for its purchase. Each COE has a life-span of only 10 years, after which the vehicle owner must purchase another COE (for another 5 or 10 years).[132]

Measures directed at the use of motor vehicles include congestion pricing, high fuel costs, and high parking charges. Motor vehicles that go into the Central Business District, busy roads and expressways must pay to get in. An Electronic Road Pricing system has been established, with payment deducted electronically from a stored "cash card," *via* a machine (called an "In-Vehicle Unit" or IVU) that sits on the dashboard of each vehicle.[133] Specially mounted cameras at the gantries to these roads will take a photograph of the licence plate of errant vehicles and offenders will be sent notices of their breach of the law, and fined.

Together, these measures make the purchase and re-sale of motor vehicles a complicated and costly experience. Coupled with road pricing, they exemplify the implementation of the "polluter pays" principle advocated by environmentalists.[134]

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[128] The telephone number is 1-800-2255632. This same line will hear complaints on all aspects relating to pollution as well as public health, including noise, dust, smells and other nuisances.

[129] *EPD Annual Report 2005*, *supra* note 95 at 14.

[130] *EPD Annual Report 2006*, *supra* note 23 at 18.

[131] See *ibid.* at 15.

[132] See Lye Lin Heng, *supra* note 120 at 387-389.

[133] *Road Traffic Act*, *supra* note 119, ss. 34 and 140(1); *Road Traffic (Electronic Road Pricing) Rules* (S. 176/98 Sing.). Foreign registered cars will have to either install the IVU or pay a daily fee of $10 to drive on Singapore roads. See http://www.lta.gov.sg/images/FAQ.pdf.

[134] See Lye Lin Heng, *supra* note 120 at 387-89.

2. *Water Pollution Control*

(a) *Ground and surface water*: The discharge of wastewater into public sewers and watercourses is strictly controlled by the *EPMA*, the *Sewerage and Drainage Act* (*SDA*) and their subsidiary laws.[135] It is an offence to discharge trade effluent without a licence and the laws are drafted to shift the onus of proof on the owner or occupier.[136] Standards for discharge are prescribed by the subsidiary laws, depending on whether they are discharged into a sewer, a watercourse, or a controlled watercourse.[137] Contravention of these Regulations entail a fine of up to S$10,000 on the first offence, and a daily fine of S$300 if the offence continues after conviction. For a second or subsequent conviction, the fine is doubled to S$20,000 plus a daily fine of S$500 if the offence continues after conviction. Stricter penalties are contained in the *EPMA*, with fines ranging from S$50,000 to S$100,000, plus mandatory imprisonment ranging from 1 month to 12 months in the case of discharging a toxic substance into inland waters.[138]

Due to strict planning laws, industries which have the capacity to cause pollution are located in designated industrial estates according to their pollutive capacity. These industrial estates are sited outside water catchment areas and are served by public sewers. Only clean or light industries are allowed within water catchments.[139]

Industries may be required to install on-site treatment plants to treat their effluent to the stipulated standards before they are allowed to be discharged. These would have to be installed prior to the operation of the factories. Where the biochemical oxygen demand and total suspended solids exceed the stipulated limits, industries may apply to discharge into sewers on payment of a tariff.[140]

(b) *Monitoring water quality*: Singapore's inland waters are monitored by the PCD from 37 streams and 13 ponds in the water catchment areas. The water quality of the 14 reservoirs within the water catchment areas is jointly monitored by the PCD and the PUB every quarter. The water is analysed for pH levels, dissolved oxygen, Biochemical Oxygen Demand (BOD), Total Suspended Solids (TSS) and other properties. The 20 rivers and streams in non-water catchment areas are also monitored quarterly. The results show that in 2006, the dissolved oxygen in water catchment streams met the requirements (> 2 mg/l) 100% of the time; the BOD met the requirements (< 10 mg/l) 100% of the time; and the TSS met the requirements (< 200 mg/l) 99% of the time. For non-water catchment streams, the figures were 94%, 89% and 100% respectively. Clearly, Singapore's rivers and streams have low pollution levels and are able to sustain aquatic life.

Samples of trade effluent may also be collected by the PCD for analysis. In 2004, the PCD collected 859 trade effluent samples of which 49 (about 6%) failed to meet the required standards. In 2005, 858 trade effluent samples were collected and only

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[135] The *Environmental Protection and Management (Trade Effluent) Regulations* (S. 159/99 and S. 265/05 Sing.); the *Sewerage and Drainage (Trade Effluent) Regulations* (S. 170/99 Sing.); and the *Sewerage and Drainage (Surface Water Drainage) Regulations* (S. 169/99 Sing.).

[136] *EPMA*, *supra* note 91, ss. 15-19.

[137] A controlled watercourse is a watercourse from which water is supplied by the Public Utilities Board (PUB): *Environmental Protection and Management (Trade Effluent) Regulations*, *supra* note 135, r. 2.

[138] *EPMA*, *supra* note 91 at s. 17.

[139] See *Code of Practice on Pollution Control*, *supra* note 80 at 9: "Judicious siting of industries."

[140] See the Third Schedule of the *Sewerage and Drainage (Trade Effluent) Regulations*, *supra* note 135.

25 (2.9%) failed to meet the standards. In 2006, 260 trade effluent samples were analysed. Only 4 samples (1.4%) failed the standards. Offenders were required to take remedial measures to prevent recurrence, and enforcement action was taken against those found exceeding the standards. In 2004, the PCD approved 33 trade effluent treatment plants, in 2005, it approved 46, and in 2006, it approved 43, bringing the total number of such approved plants to 2,643.[141]

Coastal waters are monitored monthly by the PCD from 16 sampling points along the Straits of Johor and 12 sampling points along the Straits of Singapore. These samples are subject to physical, chemical and microbiological examinations. In 2006, the faecal coliform count met the requirement ($<$ 1,000 per 100 ml) 92% of the time for the Straits of Johor East was, and 70% of the time for the Straits of Johor West and 93% of the time for the Straits of Singapore.[142]

In 2004, there were 95 complaints of water pollution, of which 26 were substantiated. In 2005, the PCD received 131 complaints of water pollution of which 17 were substantiated. In 2006, there were 116 complaints of which 9 were substantiated. Most of the incidents were due to illegal discharge or spillage of industrial wastewater or chemical/oil into drains. The PCD required the offenders to clean up the pollution and they were also prosecuted.

(c) *Marine waters*: As one of the world's busiest port in terms of shipping tonnage, pollution of the marine environment is a serious concern, stemming from oil and chemical spills, and collisions at sea. The Straits of Malacca and the Straits of Singapore are extremely busy waterways. Despite the large traffic volume and the increase in ship fuelling and bunkering operations, there are few cases of oil pollution, illegal dumping of slop and sludge from tanker cleaning operations,[143] or pollution by garbage thrown from ships at sea.[144]

A host of laws and regulations govern pollution from oil tankers and from ships at sea. The *Prevention of Pollution of the Sea Act* (*PPSA*)[145] was passed in 1980, and is administered by the Maritime and Port Authority. It prescribes measures to prevent pollution of Singapore waters, from both land-based sources and apparatus as well as from dumping from ships. Its regulations govern Oil,[146] Noxious Liquid Substances in Bulk,[147] Reporting of Pollution Incidents,[148] Reception Facilities and Garbage Facilities,[149] Oil Pollution Preparedness, Response and Cooperation,[150] Composition of Offences,[151] and Garbage.[152] In recent years, the following new regulations

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141 *EPD Annual Report 2005*, *supra* note 95 at 17, *EPD Annual Report 2006*, *supra* note 23 at 20.

142 *EPD Annual Report 2006*, *ibid.* at 36-38.

143 See the main text below at paragraph 4(c): "Tanker-cleaning activities and the disposal of sludge and slop oil".

144 A system of waste collection from ships is in place. Barges collect garbage from ships at sea daily. These are taken to incineration facilities onshore, and the ash thereafter is taken on barges to the off-shore landfill at Pulau Semakau.

145 Cap. 243, 1999 Rev. Ed. Sing.

146 S. 685/2006 Sing., amended by S. 393/2007 Sing.

147 S. 686/2006 Sing.

148 S. 60/1991 Sing., amended by S. 71/91 Sing., S. 391/1997 Sing.

149 S. 61/1991 Sing., amended by S. 72/1991 Sing., S. 364/1999 Sing., S. 687/2006 Sing.

150 S. 271/1999 Sing.

151 S. 63/1999 Sing., amended by S. 73/199 Sing., S. 272/1999 Sing., S. 365/1999 Sing., S. 132/2005 Sing., S. 133/2005 Sing., S. 688/2006 Sing.

152 S. 363/1999 Sing., amended by S. 95/2002 Sing., S. 257/2005 Sing.

were passed: the *PPS Hazardous and Noxious Substances (Pollution Preparedness, Response and Co-operation) Regulations 2004*,[153] the *PPS (Air) Regulations 2005*,[154] the *PPS (Sewage) Regulations 2005*,[155] the *PPS (Oil) Regulations 2006*,[156] and the *PPS (Noxious Liquid Substances in Bulk) Regulations 2006*.[157]

The *Merchant Shipping (Civil Liability and Compensation for Oil Pollution) Act*[158] provides for civil liability for oil pollution by merchant ships, and gives effect to the *International Convention on Civil Liability for Oil Pollution Damage 1992*, and the *International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage 1992*. Section 13 requires all ships carrying bulk cargo exceeding 2,000 tonnes of oil to be insured (for owner's liability) before it can enter or leave Singapore waters. The penalty is a fine of up to S$1 million.

Through the years, an efficient emergency response plan has been instituted to deal with such incidents. The concerted actions of the NEA, PUB, the Maritime and Port Authority and the Singapore Civil Defence Force ensure that oil and other spills are dealt with quickly to limit and contain the environmental pollution that arises.[159] The oil companies too, have their emergency response plans, as has Jurong Island.[160] Exercises are held at regular intervals.[161] The Oil Spill Response and East Asia Response Limited (OSR/ EARL) run special courses for dealing with such emergencies.[162]

3. *Hazardous Substances and Toxic Waste Management*

The PCD controls the import, transport, sale, storage and use of hazardous substances. Hazardous substances are regulated by the *EPMA*[163] and the *Environmental Protection and Management (Hazardous Substances) Regulations*.[164] A Hazardous Substances Licence or Permit from the PCD is required for any of these activities.

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153 S. 120/2004 Sing., amended by S. 689/2006 Sing.

154 S. 134/2005 Sing., amended by S. 620/2006 Sing.

155 S. 135/2005 Sing., amended by S. 394/2007 Sing.

156 S. 685/2006 Sing., amended by S. 393/2007 Sing., and S. 26/2008 Sing.

157 S. 686/2006 Sing.

158 Cap 180, 1999 Rev. Ed. Sing.

159 The worst oil spill in Singapore waters occurred on 15 October 1997. A collision between two oil tankers, the "Evoikos" and the "Orapin Global" in the Singapore Straits resulted in the spillage of 28,500 tonnes of heavy marine fuel oil only 2 km from Singapore's southern shores. The concerted action of "16 ministries/agencies, oil terminals, salvage companies, oil spill response companies and one foreign agency, led by MPA, and some 80 craft and 650 personnel, implementing the Marine Emergency Action Procedure" resulted in a successful cleanup within 3 weeks. See Capt. Mark Heah Eng Siang, "Prevention and Combat of Oil Pollution in Singapore and the 'Evoikos' Oil Spill Incident on 15 October 1997" (Paper presented to the PAJ Oil Spill Symposium '98, Tokyo, Japan, 15 October 1998), online: <http://www.pcs.gr.jp/doc/esymposium/12172/98_mark-heau-e.pdf>. See also the response of Semco, online: <http://www.pcs.gr.jp/doc/esymposium/12172/98_chris-richard-e.pdf>.

160 See JTC, "Jurong Island—Fast Facts," online: <http://www.jtc.gov.sg/portfolio/jurongisland/fastfacts/comprehensiveinfra/pages/index.aspx>.

161 See, for example, "MPA tests contingency plan on how to handle major oil spill" *Yahoo! Asia News* (30 September 2005), online: <http://asia.news.yahoo.com/060930/5/singapore233202.html>.

162 See http://www.osrlearl.com/prepared_training.html/ (oil spill response courses at operational, supervisory or managerial level).

163 *Supra* note 91, Part VI, ss. 21-27.

164 S. 159/99 Sing. [*EPM (Hazardous Substances) Regulations*].

Applications can be submitted through the Internet.[165] A list of hazardous substances is found in the Schedule to the *EPM (Hazardous Substances) Regulations*. The PCD's approval is required for the transportation of hazardous substances in excess of the specified limits contained in the said *Regulations*. Transportation of hazardous substances is strictly regulated—specially approved vehicles must be used, drivers must have received special training,[166] a specific route must be followed, there are also requirements on packing, maximum allowable loads, timing and emergency plans, to ensure safety. Breach of provisions in the *EPMA* carry penalties of a fine up to S$50,000, or imprisonment up to 2 years, or both fine and imprisonment, and a daily fine of up to S$2,000 where the offence continues after conviction. Breach of the *Regulations* carry a fine of up to S$30,000 or imprisonment of up to 2 years or both fine and imprisonment, and a daily fine of up to S$1,000. The PCD conducts surprise road checks with the Land Transport Authority and the Singapore Civil Defence Force to ensure compliance.

In 2006, the PCD issued 659 Hazardous Substances Licences and 951 Hazardous Substances Permits. The PCD also electronically processed 70,590 (46,966 in 2005) inward/outward declarations for the import/export of chemicals and chemical products through the TradeNet computerized network system.[167] A total of 193 (166 in 2005) transport approvals were issued.

The law also requires that records of hazardous substances be carefully kept. The PCD conducted 999 (886 in 2005) surprise inspections to audit the records of hazardous substances kept by the holders of Hazardous Substances Licences and Permits. Of these, 58 (47 in 2005) were not in order. The PCD issued written warnings to 55 offenders and verbally warned one offender.[168]

4. *Toxic Waste Management*

The *EPHA* regulates waste management in Singapore. The *Environmental Public Health (Toxic Industrial Waste) Regulations* require all toxic industrial waste collectors to be licenced.[169] Again, as in the case of hazardous substances, approval is required to transport toxic industrial wastes that exceed the quantities stipulated in the *Regulations*. A list of toxic industrial waste is contained in the Schedule. Failure to comply with the *Regulations* is an offence, carrying a penalty of a fine up to S$2,000 and a daily fine of S$100 for every day that the offence continues after conviction. Permission is also required to transport toxic industrial wastes that exceed specified quantities.

In 2006, the PCD granted and renewed licences to 159 toxic industrial waste collectors who were allowed to treat, reprocess and dispose of toxic industrial waste.

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[165] See online: <http://app1.env.gov.sg/pcls/controller?event=WELCOME>.

[166] One-day courses are organised by the SCDF and Port of Singapore Authority (PSA) Institute. Persons who have successfully completed the course will be granted a HAZMAT Transportation Driver Permit (HTDP), which is valid for 2 years. They are required to undergo the course every 2 years before their HTDP can be renewed, to ensure 'refresher' training.

[167] See online: <http://www.tradenet.gov.sg>.

[168] *EPD Annual Report 2005*, *supra* note 95; *EPD Annual Report 2006*, *supra* note 23.

[169] See guidelines online: <http://app.nea.gov.sg/cms/htdocs/article.asp?pid=1531#OVERVIEW>.

(a) *Industrial waste chemicals*: The main industrial waste chemicals are waste solvents, spent etchants, acids, alkali and other obsolete chemicals. Licenced collectors are encouraged to reuse, recycle and recover waste chemicals to reduce the amount of wastes that require treatment and disposal. In 2006, some 413,000 tonnes (up from 338,000 in 2005) of waste chemicals were collected by licenced collectors from local industries. These were be treated for recovery, encapsulated or incinerated, as appropriate.

(b)*Bio-hazardous wastes*: Bio-hazardous wastes from hospitals and polyclinics are segregated at source, stored in colour-coded bags and then collected by 3 licenced bio-hazardous waste disposal companies. They are incinerated in special incinerators[170] at very high temperatures. In 2006, some 17,200 cubic metres (down from 19,800 in 2005) of bio-hazardous wastes were collected and disposed of locally, by licenced bio-hazardous waste disposal companies.

(c) *Tanker-cleaning activities and the disposal of sludge and slop oil*: As a major oil refining centre, Singapore ensures that the cleaning of tankers and the disposal of sludge and slop oil from such cleaning is carefully controlled. Since 4 April 1993, permits for the cleaning of tankers have only been issued by the Maritime and Port Authority to contractors that are registered with the PCD, and tanker cleaning can only be carried out in designated areas. Sludge and slop oil must be sent to approved reception facilities for treatment and disposal.[171] Ships or vessels entering Singapore in a "clean condition" for repairs will only be allowed entry if they can show proof that the sludge and slop oil from their tanker cleaning activities have been disposed of at approved cleaning facilities.

In 2006, 41 companies (29 in 2005, 46 in 2004) were registered to carry out tanker cleaning activities. About 25,600 tonnes of oil sludge (26,700 in 2005, 15,200 tonnes in 2004) were sent to approved reception facilities for treatment and disposal.[172]

5. *Land Contamination*

Section 20 of the *EPMA* states that NEA:

> …may, with the approval of the Minister, make regulations to control the pollution of land whereby the condition of the land is so changed as to make or be likely to make the land or the produce of the land obnoxious, noxious or poisonous.

No regulations have been passed. However, the *Code of Practice on Pollution Control* has a section on "Control of Land Pollution and Remediation of Contaminated Sites."[173] It states that where a site that is used for pollutive activities is to be

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[170] See NEA guidelines for special incinerators, online: <http://www.nea.gov.sg/cms/pcd/guideline_waste_incinerator_2001.pdf>.

[171] *Prevention of Pollution of the Sea (Reception Facilities and Garbage Facilities) Regulations* (2001 Rev. Ed. Sing.). See also the *Maritime and Port Authority of Singapore (Dangerous Goods, Petroleum & Explosives) Regulations 2005* (S. 24/2005 Sing.); the *Prevention of Pollution of the Sea (Air) Regulations 2005* (S. 134/2005 Sing.); and the *Prevention of Pollution of the Sea (Sewage) Regulations 2005* (S. 135/2005 Sing.).

[172] *EPD Annual Report 2006*, *supra* note 23 at 23; *EPD Annual Report 2005*, *supra* note 95 at 19; *EPD Annual Report 2004*, *supra* note 83 at 24-25.

[173] *Code of Practice on Pollution Control*, *supra* note 80 at 21-22.

redeveloped, rezoned or re-used for a non-pollutive activity, a study shall be conducted on the site to assess extent of land contamination. If the site assessment study shows that the site is contaminated, the contaminated site shall be cleaned up to standards acceptable for the intended use. A list of pollutive activities is in Appendix 21. These include oil installations and other oil stations storing or handling large quantities of oil or similar hydrocarbon products; chemical plants, chemical warehouses or terminals; shipyards and grit blasting works, gas works, power stations, toxic wastes treatment facilities, scrap yards, landfills and facilities for the treatment of sewage.

Owners/occupiers or the prospective buyers/lessees may carry out the site assessment study and clean up using in-house or second party experts. The use of in-house or second party experts is subject to approval from the PCD. Alternatively, they may engage a third party specialist consultant "with recognised competence in site assessment studies and remediation of contaminated sites to carry out the site assessment study and clean up of the site". A report of the site assessment study and clean-up plan shall be submitted to the PCD and there are guidelines as to what it should contain. Several standards and technical guidelines may be adopted for site assessment and remediation of contaminated sites, including the Dutch Guidelines for Soil Protection, ASTM-E Standard Practice for Environmental Site Assessments; and Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand. There is also a List of Third Party Specialist Consultants for site assessment studies and remediation of contaminated sites,[174] who have to certify that the sites have been remediated to meet the required standards. If the land belongs to JTC or other agencies, they may impose specific guidelines and requirements with respect to the contaminated sites.

NEA is also building capacity in the decontamination of lands in the event that a toxic chemical is released. The initial response will be from the Singapore Civil Defence Force which will seek to save lives as first priority and contain the affected areas. NEA will then move in to decontaminate the terrain.[175]

6. *Solid Waste Management*

The *EPHA* and its regulations govern the management of domestic solid wastes in Singapore.[176] Refuse/garbage is collected daily by licenced general waste contractors.[177] The island is divided into nine geographical sectors and pre-qualified waste collection companies compete to provide refuse collection services for the designated domestic and trade premises. Successful bidders are awarded tenders to serve the respective sectors for a period of 5 to 7 years. They are also required to provide door-to-door collection services for recyclable materials from the households in

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[174] See "Table A: Consultants for Both Site Assessment and Site Remediation," online: <http://www.nea.gov.sg/cms/pcd/consultant.pdf >, referred to in the *Code of Practice on Pollution Control*, *supra* note 80 at 22.

[175] See *EPD Annual Report 2006*, *supra* note 23 at 25.

[176] These include the *Environmental Public Health (Public Cleansing) Regulations* (2000 Rev. Ed. Sing.); and the *Environmental Public Health (General Waste Collection) Regulations* (2000 Rev. Ed. Sing.).

[177] See online: <http://app.nea.gov.sg/cms/htdocs/category_sub.asp?cid=75>; see also NEA, *Code of Practice for Licensed General Waste Collectors*, online: <http://www.nea.gov.sg/cms/esd/cop_general_waste_collector.pdf>.

their sectors under the National Recycling Programme. Presently, four public waste collectors are providing the collection services in the nine sectors. However, there are no laws for the mandatory separation of wastes, and recycling is still voluntary.

The average person in Singapore used to generate 1.1 kg of solid waste each day. This has since been reduced to 0.89 kg per day in 2005. The last landfill on the main island reached capacity in 1999, and a new 350 hectare landfill was built on the off-shore island of Pulau Semakau. It was created by constructing a 7 km perimeter rock bund that encloses the sea between the two islands of Pulau Semakau and Pulau Sakeng. It is lined with an impermeable membrane and clay; leachate produced is processed at a treatment plant, and regular samples of water are collected for testing to ensure the integrity of the liners. Designed to hold 63 million metric tones of waste, the landfill began operations in April 1999 and is expected to last up to 2040, and beyond, if waste is minimized and the 3Rs are applied, *i.e*. waste is "reduced, re-used and recycled."

Land-scarce Singapore has adopted incineration as the most viable policy for Singapore's waste management, as it reduces the volume of waste by as much as 90% and therefore helps to conserve land. All refuse is first incinerated in one of four incineration plants.[178]

Some S$1.83 billion has been spent on the building of these four incinerating plants, and another S$610 million for the off-shore landfill at Semakau. It was announced in January 1999 and April 2000 that refuse disposal fees will be increased progressively to encourage waste minimization and to partially offset the high costs of building the refuse disposal infrastructure.

In 2005, a total of 2.55 million tonnes of waste were disposed of, or about 6,982 tonnes per day, although the combined incineration capacity of the 4 plants is 8,200 tonnes per day. Of this total, 90% was incinerated while the rest had to be landfilled. Of the total of 2.55 million tonnes of refuse collected and disposed of in 2005, 55.6% was generated from residential premises, food centres and markets. Commercial and industrial premises accounted for the remaining 44.4%. The daily average for refuse disposal was 6,982 tonnes per day for 2005, an increase of 2.9% over the amount of refuse disposed of in 2004. In 2006, the daily average of refuse for disposal was 7,023 tonnes.

Incineration produced some 963 million kWh of electricity, representing 2 to 3% of the total electricity generated in Singapore. However, more energy can be produced from incineration if wet wastes such as food and other organic wastes, are first sorted out and separately treated. Legislation mandating this would greatly ease the efforts of the private sector to collect and appropriately treat such wastes.[179] Some 16,500 tonnes of scrap metal were also recovered from the incineration process. The incineration plants are equipped with advanced air pollution control equipment such as dry lime reactors, electrostatic precipitators and catalytic bag filters to ensure compliance with the *Environmental Protection and Management (Air Impurities) Regulations*.

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[178] See notes on the new Tuas South Incineration Plant: MEWR, News Release No. 161/2000, "New Features in Singapore's Largest and Newest Incineration Plant" (22 November 2000), online: <http://app.mewr.gov.sg/press.asp?id=SAS591>.

[179] A local corporation has developed expertise to treat organic wastes by a process of bio-methanisation. See http://www.iutglobal.com/

(a) *Actions against Littering*: It was earlier mentioned that littering offences are viewed very strictly and a substantial fine of up to S$1,000[180] or a Corrective Work Order[181] (CWO) may be ordered. At the second reading of the amendment bill introducing the CWO, Dr Ahmad Mattar, then Minister for the Environment said that with this new law:

> … recalcitrant littering offenders and those who commit serious littering offences which directly cause pollution or give rise to cleansing problems will be liable to be issued with a Corrective Work Order by the court…This Bill, presented before Parliament, seeks to introduce a greater deterrent against those who litter…. A serious littering offence is one which will directly cause pollution or give rise to cleansing problems…[182]

The Minister then continued:

> … A serious littering offence is one which will directly cause pollution or give rise to cleansing problems…What the Environment Ministry may consider as minor littering offences would be littering with cigarette butts, or car park coupon tabs, and things like that.

A CWO can only be imposed on a person who is above 16 years old and charged with littering or illegal dumping of waste. It will be issued:

> if the Court …. is satisfied that it is expedient with a view to his reformation and the protection of the environment and environmental public health that he should be required to perform unpaid work in relation to the cleaning of any premises.[183]

The work is to be performed under the supervision of a supervision officer, and:

> the supervision officer may request any offender who in the officer's opinion fails to carry out the work in a satisfactory manner to leave the place of work and any work done shall not be counted towards fulfilling the number of hours of work required under the corrective work order.[184]

How are these laws enforced? Enforcement officers from the Waste Management Department, dressed in ordinary clothes, station themselves in places with high human traffic such as the vicinity of bus interchanges, bus and train stations, shopping malls and hawker centres. Members of the public are encouraged to report offenders, if they can be identified (*e.g.*, throwing out litter from a passing car, where the licence number is noted).

Where the offending litter is small, such as a bus-ticket, matchstick, cigarette butt, parking coupon tab, or sweet wrapper (*i.e.* litter that does not give rise to serious public health problems), a composition fine of S$200[185] may be offered, but if the

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[180] *EPHA*, *supra* note 25, ss. 1, 19, 21.

[181] *Ibid.*, ss. 21A to 21E; *Environmental Public Health (Corrective Work Order) Regulations* (2000 Rev. Ed. Sing.) [*EPH (CWO) Regulations*]. See *Public Prosecutor v. Lim Niah Liang* [1997] 1 Sing. L.R. 534—improperly disposing of a cigarette butt may warrant a CWO if there is evidence of commission of previous offences.

[182] 14 September 1992, Parliamentary Debates, Vol. 60 Cols. 203-204.

[183] EPHA, *supra* note 25 at section 21A(1).

[184] *EPH (CWO) Regulations*, *supra* note 181 at r. 6(2).

[185] See *Environmental Public Health (Composition of Offences) Rules* (S. 495/2000 Sing.).

offending litter is large, such as food wastes, cans, drink cups, tissue papers and others (*i.e*. litter which can give rise to vermin infestation, mosquito breeding) they are not offered the composition fine of $200 but are instead, sent to Court where prosecutors will ask for a CWO sentence. The Court may also impose a fine of up to S$1,000 over and above the CWO, though this is quite rare.

It has been held that the offence of littering is a strict liability offence. The only mental element required for a littering offence under s. 18(1) (1) EPHA is the basic intent to commit the physical act of depositing, dropping, placing or throwing refuse. The prosecution had only to show that an accused committed the physical act of throwing away refuse voluntarily and deliberately, not out of accident or automatism. Once the act of throwing away refuse was shown to be a deliberate (and not accidental) act, the prosecution need not go further to show the presence of some blameworthy state of mind.[186]

An offender with an earlier minor littering offence that was compounded may be given a CWO. Yong Pung How CJ, has taken a robust interpretation of this law, emphasising that:

> As a general rule, it may be said that the more callous or cavalier the offender in his act of littering, the more culpable he is. Together with factors such as the number of previous offences and the seriousness of the littering offence, this would be relevant in determining the length of time to which he will be ordered to perform a corrective work order.[187]

This was said in the case of *Public Prosecutor v. Lim Niah Liang,* where the accused had pleaded guilty to one charge of throwing a cigarette butt into a drain, in contravention of s. 18(2) EPHA. He had committed the same offence four years ago, and the offence was compounded for $200. For this second offence, the prosecution applied for a CWO under s. 21A(1) EPHA, contending that he was a "repeat offender." This was rejected by the Magistrate, who took the view that the prosecution had failed to discharge its burden that a CWO should be imposed, as there was only one previous compounded offence, committed four years ago. This was reversed on appeal, Yong CJ stating that evidence of previous convictions was not a pre-condition for the imposition of a CWO; that the implementation of s. 21A(1) depended either on evidence of commission of previous similar offences, or on evidence that a serious littering offence had been committed. For the purpose of showing that an offender was "recalcitrant," it would suffice to rely on evidence that he had previously committed the same offence on at least one occasion. He need not have been convicted of the offence. Yong CJ imposed a two- hour CWO and returned the respondent the fine of $300 imposed by the magistrate.

In 2005, 3,819 persons were ticketed for littering.[188] Of these, 3,462 chose to pay the composition fine of $200. Since the introduction of the CWO in 1992 to 20 September 2006, 4,225 persons have been sentenced to the Corrective Work Order.

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[186] *Public Prosecutor v. Yong Heng Yew* [1996] 3 Sing. L.R. 566, Yong Pung How CJ.

[187] [1997] 1 Sing. L.R. 534 at 541.

[188] The writer wishes to thank Mr. Satish Apoo, Head, Environmental Health Department, NEA, for providing this information.

(b) *Illegal Dumping*—Section 20(1) EPHA makes it an offence to dump or dispose of any refuse, waste or any other articles from a vehicle in a public place or to use a vehicle for the purposes of such dumping. This is a serious offence and persons may be arrested without warrant by any police officer or public health officer. It entails a heavy fine of $50,000 or imprisonment up to 12 months or both, and possible forfeiture of the vehicles used. Imprisonment is mandatory (1 month to 1 year) for a subsequent offence and a fine up to $100,000.[189] Again, the courts have taken a robust interpretation to ensure that illegal dumping is punished. Thus, it has been held that state land is a "public place,"[190] and a military training area which is a protected place, is also a "public place". On the latter, Yong Pung How CJ stated that any place to which the public had access, whether in fact or in right, was a "public place" for the purposes of s. 20(1) EPHA. Therefore, it followed that a place could qualify as a "public place" even if the public did not have a right of access, as long as it was established that they did in fact go there.[191] On the question whether the vehicle used in the illegal dumping should be forfeited, the courts have been fair and have held that forfeiture is not mandatory - the judge has the discretion to decide.[192]

(c) *Public Health—Clean Public Toilets*: One of the early goals when Singapore attained self government in 1959, was to provide modern sanitation facilities and improve the public toilets. As Singapore embarked on building a new city and townships with modern facilities, the last of the nightsoil buckets were phased out in January 1987. Owners of factories and workplaces were required to provide sufficient toilet facilities within their premises.[193] Laws were passed to make it mandatory for the owner, occupier or principal tenant to ensure that toilets were in working order, as well as properly maintained.[194]

In July 1989, laws were passed to ensure clean toilets, making it an offence not to flush a public toilet after its use, and requiring public toilets to be kept clean and provided with adequate amounts of soap and toilet paper.[195] How is this law enforced? As with most laws, the authorities first ensure that there is considerable publicity prior to its coming into effect. To ensure that toilets were flushed after use, in the early days when the law was first passed, enforcement officers were stationed in public toilets to ensure compliance. Offenders were charged in court, the media was alerted, the offenders sentenced and publicly embarrassed, and the message was soon made clear that public toilets had to be flushed after use. At the same time, programmes to "Keep the Toilets Clean" were launched to inform members of the

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[189] These penalties were raised from a $1,000 fine to a maximum fine of $20,000 in 1996 (Act 2 of 1996, with effect from 2 February 1996 (S 38/96), and further increased in 1999 (Act 22 of 1999).

[190] *Toh Teong Seng v. Public Prosecutor* [1995] 2 Sing. L.R. 273.

[191] *Public Prosecutor v. Lim Ah Heng and Another* [1999] 1 Sing. L.R. 827; *Chandra Kumar v. Public Prosecutor* [1995] 3 Sing. L.R. 123; *Ang Poh Chuan v. Public Prosecutor* [1996] 1 Sing. L.R. 326.

[192] *Toh Teong Seng v. Public Prosecutor* [1995] 2 Sing. L.R. 273; *Chandra Kumar v. Public Prosecutor* [1995] 3 Sing. L.R. 123; *Ang Poh Chuan v. Public Prosecutor* [1996] 1 Sing. L.R. 326.

[193] See the *Factories Act*, now replaced by the *Workplace Safety and Health Act* (Cap. 354A, 2007 Rev. Ed. Sing.); and the *Workplace Safety and Health (General Provisions) Regulations* (S. 134/2006 Sing.), r. 8.

[194] *EPHA*, *supra* note 25, s. 54, 55.

[195] *Environmental Public Health (Public Cleansing) Regulations* (2000 Rev. Ed. Sing.), r. 16, 16A. See NEA, "The Horizontal Society: Citizens, Civility and Public Toilets—Speech by Simon Tay, Chairman NEA during World Toilet Summit 2004, Beijing, China," online: <http://app.nea.gov.sg/cms/htdocs/article.asp?pid=2469>.

public and promote a sense of civic responsibility.[196] Talks and exhibitions were held at community centres and other public places, posters and other publicity materials are displayed in toilets.

NEA officers conduct regular inspections of public toilets to ensure they are clean. It has been held (by Yong Pung How CJ) that the duty to maintain public conveniences in a building under s. 58(2) EPHA (now s. 55) is one of strict liability and non-delegable.[197] Thus, the management corporation of a building could not absolve themselves of liability by employing cleaners to clean the public conveniences and by implementing a regular cleaning scheme. The offence is committed once the conveniences are not maintained to the requisite standards.

Today, continued policing for toilet flushing has not been found to be necessary, particularly as automatic flushing sensors are now installed in public toilets. The government continues to upgrade public toilets and encourages the private sector to do so. Posters reminding the public to keep the toilet clean continue to be displayed, and are updated and renewed regularly. One of the objectives of the Revised Singapore Green Plan 2012 (2006 Edition) is to improve public toilet cleanliness standards through ways such as a grading system, awards and training.

7. *Noise Management*

Singapore has passed laws to control noise from factories,[198] construction sites[199] and traffic.[200] Noise is first controlled by land use planning and the careful siting of factories in appropriate industrial estates, and ensuring that they are built to comply with noise abatement measures and allowable boundary noise limits. The PCD conducts regular checks on factories to ensure that noise control equipment is properly operated and maintained.

In 2006, the PCD received 338 complaints of noise pollution from factories (there were 334 complaints in 2005), of which 12 were substantiated incidents (25 were substantiated in 2005), mostly due to the improper siting of mechanical equipment and/or poor maintenance of the equipment. The owners or occupiers were required to take remedial action to reduce noise to comply with the allowable noise limits.

To reduce traffic noise from expressways, the PCD has instituted the following measures:

- Tightening noise emission standards for motor vehicles;
- Using noise-absorptive porous asphalt materials for road surfacing;
- Siting multi-storey carparks, electrical substations or other non-residential structures to screen traffic noise from new residential buildings;
- Setting back new residential buildings from expressways; and

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[196] Indeed, in his 1996 National Day Rally Speech, the then Prime Minister (now Senior Minister) Mr. Goh Chok Tong emphasized that the state of public toilets is one of the indicators of a gracious society.

[197] *MC Strata Title No. 641 v. Public Prosecutor* [1993] 2 Sing. L.R. 650, Yong Pung How, CJ.

[198] *EPMA*, *supra* note 91, ss. 28-30; *Environmental Protection and Management (Boundary Noise Limits for Factory (Premises)) Regulations* (S. 156/99 Sing.).

[199] *Environmental Protection and Management (Control of Noise at Construction Sites) Regulations* (2008 Rev. Ed. Sing.).

[200] *Environmental Protection and Management (Vehicular Emissions) Regulations* (S. 291/99 Sing.).

- Designing new flat layouts so that living rooms and bedrooms are located away from traffic noise.

Noise pollution from construction sites is regulated by the *EPMA* and the *Environmental Protection and Management (Control of Noise at Construction Sites) Regulations*.[201] Under the *EPMA*, the Director of Pollution Control may, by written notice, specify the plant or machinery that can or cannot be used, the hours during which the works may be carried out, and the level of noise or vibration which may be emitted from the premises (or at any specified part of those premises) during specified hours. Failure to comply entails a daily fine of up to S$10,000, or imprisonment of up to 3 months, or both.[202]

The *Regulations* specify the allowable noise standards that can be emanated from a construction site. These standards were amended on 1 October 2001[203] and on 1 October 2007[204] to provide for more stringent noise limits for noise generated at night for construction sites that are within 150 m of residential premises. These regulations do not require that all construction work cease at night, but they do require that contractors schedule their construction activities such that they comply with the permissible noise limits at all times.

In 2006, the PCD received 6,160 complaints of noise pollution from construction sites, Of these, 267 complaints against 92 construction sites were substantiated. In 2005, there were 4,953 complaints, of which 207 complaints against 84 construction sites were found to be substantiated, as noise levels had exceeded the permissible limits. These were mainly due to concreting works carried out late at night. The contractors were prosecuted and required to reschedule their activities to ensure compliance with the permissible noise limits.

C. *Public Education*

Public education is an important component of Singapore's success in managing the environment. As the Singapore community has historically been non-homogenous, being formed from the poor diaspora of China and the Indian sub-continent, together with the native Malays, each with different cultures and mindsets, it is essential to inculcate a sense of civic consciousness and responsibility.[205] The government instituted various campaigns, such as "Keep Singapore Clean" and "Keep Our Toilets Clean," so as to rally the people and involve them in the cleaning and greening of Singapore. At the same time, environmental education began in schools.[206] Non-government organizations were established to promote the environmental cause, such as the Singapore Environment Council, Green Volunteers, and Jalan Hijau. Specific

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[201] 2008 Rev. Ed. Sing.

[202] *EPMA*, *supra* note 91, s. 28.

[203] S. 276/2001 Sing.

[204] S. 145/2007 Sing.

[205] "Other cities had clean and green suburbs that gave their residents respite from city centers. Singapore's size forced us to work, play and reside in the same small place, and this made it necessary to preserve and clean and gracious environment for rich and poor alike."; Lee Kuan Yew, *supra* note 6 at 181.

[206] "To overcome the initial indifference of the public, we educated their children in schools by getting them to plant tress, to care for them, and grow gardens. They brought the message home to their parents."; *ibid.* at 176.

programmes were also initiated by various industries and professional bodies such as the Responsible Care Programme of the Singapore Chemical Industry, environmental health and safety programmes under the Regional Institute of Environmental Technology. Various Awards are given to individuals and corporations in recognition of their contributions to the environment and to spur others to do the same, *e.g.*, the Singapore Green Plan Award, the Singapore Environmental Achievement Award, and the Environmental Reporting Awards.

The NEA has established an educational institute, the Singapore Environment Institute (SEI).[207] The SEI works together with other organizations to teach courses relating to the environment. These partners include the National University of Singapore's (NUS) Asia-Pacific Centre for Environmental Law[208] in the Faculty of Law, and the NUS multi-disciplinary Master of Science in Environmental Management Programme,[209] hosted by the School of Design and Environment,

D. *The Singapore Green Plan 2012*

The Singapore Green Plan (SGP) 2012 identified and published some 155 action programmes under 24 thrusts for six areas, namely clean air, clean water, waste management, conserving nature, public health and international environmental relations. Public participation is emphasized, starting with public representation on the Singapore Green Plan's Six Working Groups. In 2002, the emphasis was on environmental education, environmental technology, resource conservation, clean technologies, environmental noise and nature conservation. The Revised SGP 2012 had three Focus Groups (on air, water and clean land, nature and public health). The SGP 2012 (2006 Edition) has recently been released.[210] It covers six focus areas: Air and Climate Change, Water, Waste Management, Nature, Public Health and International Environmental Relations. Arising from the review, four new targets have been added:

1. Reduce the ambient Particulate Matter 2.5 level to within an average of 15 μg/Nm 3 by 2014;
2. Improve carbon intensity (*i.e.* carbon dioxide emission per GDP dollar) by 25% from 1990 level by 2012;
3. Reduce Singapore 's per capita domestic water consumption from 162 litres per day in 2004 to 155 litres per day by 2012; and
4. Partner the 3P sectors to generate greater awareness of the importance of conserving, valuing and enjoying water and develop a sense of shared ownership of our water resources.

There is a strong emphasis on working with the people. Stemming from the SARS episode in 2003, a campaign to heighten awareness for public cleanliness and to promote the widespread adoption of good hygiene practices was launched under

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[207] See online: <http://www.nea.gov.sg/cms/sei/index.html>.

[208] See online: <http://law.nus.edu.sg/apcel/>.

[209] See online: <http://www.sde.nus.edu.sg/MEM/index.htm>. The writer chairs the programme's Management Committee.

[210] See MEWR, "Singapore Green Plan 2012 (2006 Edition)," online: <http://www.mewr.gov.sg/SGP2012/index_2006.htm>.

the banner "Singapore's OK." This continues today, specifically targeting public toilets, pre-schools, food shops, condominiums, markets, construction sites, hotels and dormitories.[211]

IV. Environmental Governance—Water Management

A. *Integrated water management*

The Public Utilities Board (PUB) manages, in an integrated manner, the nation's reservoirs, waterworks, rivers, drainage system, water reclamation plants and sewerage system so as to optimise Singapore's limited water resources. Its strategy is to ensure sustainable water supply for Singapore by diversifying supply sources, and managing demand. Singapore's "unaccounted for" water is only about 5 per cent, which an expert on water has declared to be the world's lowest.[212] Most developed countries recorded at least 12 per cent. About half of Singapore's total land area is set aside as water catchment to harness water supply. Water is also imported from the neighbouring state of Johor, Malaysia, to supplement the local water resources. These two sources form Singapore's first two National Taps.

As water is a major concern in Singapore, considerable efforts have been spent on developing alternative sources of water. NEWater and desalinated water are the third and fourth National Taps. In the PUB's own words:

> PUB's strategy for expanding Singapore's water supply is based on an addition and multiplication approach. Addition is through securing new water sources which can be through desalination, expansion of water catchments for collection of more rainwater, local or otherwise. Multiplication is through water reclamation, taking advantage of advances in membrane technologies. PUB can achieve this multiplication effect through managing, in an integrated manner, the reservoirs, waterworks, rivers, drains, sewerage system and water reclamation plants. Being 100% sewered, Singapore is able to collect and treat used water using advanced membrane processes to produce high-grade reclaimed water called NEWater.[213] With NEWater, Singapore has closed the water loop.[214]

NEWater is primarily supplied to non-domestic sectors such as wafer fabrication parks, industrial estates and commercial buildings for industrial and air-cooling purposes. A small percentage of NEWater is also mixed with reservoir water for Indirect Potable Use before being treated at the waterworks for drinking water supply. An

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[211] See NEA, "Update of Singapore's OK campaign—2006," online: <http://app.nea.gov.sg/cms/htdocs/category_sub.asp?cid=220>.

[212] According to Prof. Biswas, as reported in "S'pore No. 1 in managing water resources: Expert" *The Straits Times* (23 August 2006). See also online: <http://www.pub.gov.sg>.

[213] See PUB, "NEWater: Sustainable Water Supply," online: <http://www.pub.gov.sg/NEWater_files/index.html>.

[214] See PUB, "About Us: Overview," online: <http://www.pub.gov.sg/about_us/ProfileOverviewofDrainage.aspx?l1=1&l2=1&l3=1>.

additional source of supply, desalinated water, became available in September 2005 with the opening of the Tuas Seawater Reverse Osmosis Desalination Plant.[215]

Singapore was recently commended for having a highly workable and efficient water management system, receiving the coveted Stockholm Industry Water Award in 2007.[216] Singapore also signed an agreement with the World Health Organisation to help improve public health worldwide through the proper management of drinking water, thus garnering praise from the WHO. Under the agreement, which will run till 2015, Singapore will conduct workshops and train personnel to be deployed to water-scarce developing nations, as well as send its own resident experts to water crisis areas.

1. *Water Conservation*

Water conservation is a national policy in Singapore, due to its limited water resources. The PUB emphasizes water conservation and has in place an overall water demand management programme to address demand growth. This helps to stretch Singapore's limited water resources to the fullest. The efficient management of the water demand includes proper handling of the transmission and distribution network to minimise losses and implementation of water conservation measures. Singapore's per capita consumption of water in households has been effectively maintained at 165 litres per day for the last 5 years. Such an achievement is largely due to the PUB's active water conservation efforts to curb the growth of water demand. Nonetheless, the SGP 2012 (2006 Edition) aims to reduce Singapore 's per capita domestic water consumption to 155 litres per day by 2012.

Since 1981, a comprehensive water conservation plan was formulated to check growing water demand and ensure that water is being used efficiently. The many water conservation measures implemented under the plan are continually being reviewed and new measures are introduced.[217] The water conservation plan contains 6 strategies:

1. public education and publicity;
2. mandatory installation of water saving devices;
3. re-use and recycling of water;
4. substitution of potable water with alternative sources;
5. regular auditing by PUB officers of water consumption for large customers consuming more than 5,000 m^3/mth of potable water; and
6. checks on excessive flow rates.

(a) *Public Education & Publicity Programme*: The PUB reminds customers to conserve water as a way of life through mailers and pamphlets which are enclosed with their monthly bills. These contain information on water in Singapore and tips on

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[215] This plant is able to meet some 10% of Singapore's water demand. It is highly energy efficient enabling it to achieve the lowest desalination cost in the world. It won a distinction in the 2006 Global Water Awards. See http://www.water-technology.net/projects/tuas/.

[216] "Singapore wins kudos for water expertise" *The Straits Times* (16 August 2007), online: <http://www.straitstimes.com/Free/Story/STIStory_148742.html>.

[217] See PUB, "Conservation Measures—Introduction," online: <http://www.pub.gov.sg/conservation/ConservationMeasuresIntroduction.aspx?l1=3&l2=19&l3=18>.

how to save water. Customers are actively encouraged to read their water meters regularly to monitor their own consumption so that unusually high consumption, which may be due to leaks, can be promptly detected. Talks on water conservation are regularly organised for schools and private and public organizations. Month-long Save Water campaigns and sustained publicity with activities for all sectors of the economy are also held to further reinforce the message that water conservation is vital to Singapore.

(b) *Mandatory Installation of Water Saving Devices***:** All non-domestic premises are required to install water-saving devices such as self-closing delayed action taps and constant flow regulators. Since 1992, low capacity flushing cisterns of 3.5 to 4.5 litres per flush have been installed in all new public housing apartments. These cisterns are an improvement over the dual flush cisterns that use 4.5 or 9 litres of water per flush. With effect from April 1997, installation of these cisterns was made mandatory for all new premises and on-going building projects, including all residential premises, hotels, commercial buildings and industrial establishments.

(c) *Reuse & Recycling of Water*: Industries are encouraged to re-use their process water through various means such as cascading systems, counter flow systems, reverse osmosis treatment, *etc*. As an incentive to encourage industries to reuse and recycle their process water, a Water Efficiency Fund has been set up as part of the PUB's efforts to encourage and assist companies to look into efficient ways of managing their water demand, which includes potable water, NEWater and Industrial Water, through recycling, use of alternate sources of water supply as well as initiative to promote water conservation in the community.[218]

(d) *Substitution of Potable Water with Alternative Sources*: Industries are also actively encouraged to substitute their potable water requirement with alternative sources such as industrial water, sea water and NEWater wherever possible.

The PUB is encouraging the use of NEWater for air conditioning cooling towers in buildings and for suitable process water use in industrial premises. It has planned for a separate NEWater pipeline network to be built which will eventually reach these buildings and industrial premises. All new commercial and industrial development proposals are required to provide a dedicated NEWater pipe system to take in NEWater when the supply becomes available. For locations where the NEWater pipeline network will only be available after 2011, the PUB requires space provisions to be made now for the new development proposals to facilitate the installation of NEWater pipes in the future.

(e) *Water Audits*: As part of the PUB's efforts to promote water conservation, regular water auditing is carried out by PUB officers for large customers consuming more than 5,000 m^3/mth of potable water. Water auditing is a market-oriented programme to obtain the feedback of industries on the water supply and it enables PUB to work with customers on the implementation of water conservation measures within their

[218] See PUB, "Water Efficiency Fund," online: <http://www.pub.gov.sg/conservation/water_effciency_fund.aspx>; see also EnterpriseOne, "Government Assistance—Grants—Water Efficiency Fund (WEF)," online: <http://www.business.gov.sg/EN/Government/GovernmentAssistance/TypeOfAssistance/Grants/ProductDevelopmentNInnovation/gp_pub_wef.htm>.

premises. Customers who would like a water audit can simply fill out an online request form or make a phone call.

(f) *Checks on Excessive Flow Rates*: The PUB has found that a flow rate of 2 litres/min at the wash basin taps in staff and public toilets is sufficient for normal washing purposes. The reduced flow rate will not only cut down on the water bills but more importantly conserve water. They strongly urge customers to reduce the flow rate at the wash basin taps on their premises to 2 litres/minute so as to help to reduce water consumption, prevent water wastage and cut down on water bills. Customers are also encouraged to check on the water fittings in their premises to ensure that the flow rates are not excessive. A table of the best water conservation flow rates for the various fittings are given to customers and appear on the PUB's website.[219] Information is also given on how to measure the flow rate.

V. Environmental Governance—Provision of Information, Avenues for Complaints, Feedback and Adequacy of Response

A reliable indicator of good environmental governance is whether the government agency provides relevant information and guidance to members of the public and whether there are provisions for complaints and feedback, and the adequacy and efficacy of its response.

The NEA and the PUB have excellent websites that provide information and guidance on its policies, organizational structure, services, and 24-hour telephone hotlines for public complaints or feedback.

NEA has an excellent website that provides information on its various departments/divisions and their portfolios; the various campaigns and programmes mounted, various educational materials; it even has a section for children (Captain Green's "Green Circle"). Best of all, it provides access to all the laws that the Ministry enforces including subsidiary legislation, and government publications such as annual reports, codes of practice and guidelines.[220] NEA provides three avenues for feedback: a 24-hour telephone "hotline," an email address and an electronic feedback form.[221]

The PUB's "PUB One" website assures the public that:

> Our officers will be available round the clock to assist you with complaints relating to the following:
>
> - Water supply failure, damaged water-mains, water quality, poor water pressure, water services
> - Sewerage matters, sewage overflow, damaged sewers, sewer chokes
> - Drainage matters, flooding
> - Deep Tunnel Sewerage System
> - NEWater.[222]

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[219] *Supra* note 217.

[220] See online: <http://www.nea.gov.sg>.

[221] See NEA, "Contact Us," online: <http://app.nea.gov.sg/cms/htdocs/category_sub.asp?cid=4>.

[222] See PUB, "Welcome to PUB One," online: <http://www.pub.gov.sg/home/cindy/Pub-One.htm>. The writer sent a query to the PUB via email and received a response within 2 hours on the same day. The

The PUB provides six avenues for feedback: email, telephone (24-hour), SMS (Short Messaging Service), fax, Live-Chat,[223] and VO-IP (Voice-Over Internet Protocol).[224]

As for NParks, its website contains relevant information, but there is little information on the laws that protect its parks. However, there is a 24-hour helpline with specific numbers for complaints relating to trees that have fallen, faulty park lights, applications for the use of parks, information on fines and tenders and general feedback. There is also an on-line feedback form.

VI. Environmental Governance—Greening Singapore: The Garden City and Nature Conservation

A. *Introduction*

The Garden City was conceptualized by Singapore's first Prime Minister, Mr. Lee Kuan Yew, as a strategy to woo foreign investors as well as to make the environment more pleasant, particularly to reduce the heat of the tropics.[225] Inspired by the gardens of Cambridge where he studied Law, and by the cleanliness of Switzerland and the discipline of its people, Lee modeled Singapore on Switzerland. He used the concept of a well-manicured garden to demonstrate that the people of Singapore had the necessary discipline to make things work. He recognized that it took care and discipline to maintain a garden. This, he hoped, would impress investors sufficiently to invest in Singapore.

The greening of Singapore as a government policy was declared in Parliament in 1968 when, during the second reading of the Environmental Public Health Bill, the Minister stated, "The improvement in the quality of our urban environment and the transformation of Singapore into a garden city—a clean and green city—is the declared objective of the Government."[226]

PUB response had an end-note that read: "PUB-One is a 24Hrs one stop contact center of Public Utilities Board. Call us at our Toll free hotline no. 1800 284 66 00 or email at address PUBONE@singnet.com.sg to give your feedback / queries or visit our Website at http://www.pub.gov.sg to get the latest information and update on PUB related matters."

223 See online: PUB One <http://203.125.253.43/pubone/chat.htm>.

224 See online: PUB One <http://203.125.253.43/pubone/VoIP.aspx>.

225 See Lee Kuan Yew, *supra* note 6 at 176:

> To achieve First World standards in a Third World region, we set out to transform Singapore into a tropical garden city…We planted millions of trees, palms and shrubs. Greening raised the morale of people and gave them pride in their surroundings. We taught them to care for and not vandalize the area. We did not differentiate between middle-class and working class areas. The British had superior white enclaves… that were cleaner and greener than the "native" areas. That would have been politically disastrous for an elected government. We kept down flies and mosquitoes and cleaned up smelly drains and canals. Within a year, there was a distinct spruceness of public spaces.

See also Lee Sing Kong, "Concept of the Garden City" in Ooi Giok Ling, ed., *Environment and the City: Sharing Singapore's Experience and Future Challenges* (Singapore: Times Academic Press, 1995) at 133.

226 Mr. Chua Sian Chin, Minister for the Environment, in Sing., *Parliamentary Debates*, vol. 28 at col. 396 (16 December 1968).

These policies to improve the natural environment were implemented by the then Parks and Recreation Department of the Ministry of National Development. [227]

Said Lee,

> I sent them (government officers) on missions all along the Equator and the tropical, subtropical zones, looking for new types of trees, plants, creepers and so on. From Africa, the Caribbean, Latin, Middle, Central America, we've come back with new plants. It's a very small sum. But if you get the place greened up, if you get all those creepers up, you take away the heat, you'll have a different city.[228]

Lee started the first Tree Planting Day in 1967 even before it became fashionable in the developed world. An Annual Tree Planting Day was launched on the first Sunday of November 1971. "In wooing investors, even trees matter," reaffirmed Lee on 1 August 1996, when the Economic Development Board celebrated its 35th Anniversary.[229]

B. *The Greening of Singapore*

A comprehensive strategy was devised to green Singapore in rapid time. Fast growing, indigenous trees were nurtured and transplanted along the roads, leading to the term "instant trees". They were selected for their colour, ability to provide shade, fast growth factor and ease of maintenance.[230] At the same time, road codes were developed to ensure that adequate planting areas were provided along new roads. Car parks had to be planted with trees to reduce the heat of the tropic sun. Even the grounds of car park lots had to be planted with grass, to reduce heat from the asphalt. Concrete structures such as flyovers and retaining walls were to be covered with creepers. Overhead bridges were provided with planter boxes for flowering shrubs (the bougainvillea remains a popular choice today). Parks were developed in the Central Business District as well as in outer suburbs, to provide "green lungs" for the people. Developers of residential areas were required to plant roadside trees and set aside land for open space. Existing parks were improved upon and many new parks were developed. The emphasis was on the provision of shade in the ambiance of a garden. Thus, the planting extended beyond trees to flowering and fragrant plants as well as to fruit trees. These were planted all over the island, in parks, residential suburbs, schools, hospitals, police stations and community centres.

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[227] See NParks, "Singapore, The Garden City—The Initial Years," online: <http://www.nparks.gov.sg/gardencity_a.asp>.

[228] "The grass has got to be mown every other day, the trees have to be tended, the flowers in the gardens have to be looked after so they know this place gives attention to detail.": Lee Kuan Yew, quoted in Han Fook Kwong, Warren Fernandez & Sumiko Tan, *Lee Kuan Yew—The Man and His Ideas* (Singapore: Times Editions, 1998) at 12.

[229] Cited in Koh Kheng Lian, "Singapore: Fashioning Landscape for the "Garden City" in IUCN Commission on Environmental Law, *Landscape Conservation Law—Present Trends and Perspectives in International and Comparative Law* (IUCN Environmental Policy and Law Paper No. 39, March 2000) at 40. See also Chan Chin Bock, *Heart Work—Stories of How EDB Steered the Singapore Economy from 1961 to the 21st Century* (Singapore: Economic Development Board, 2002); Koh Kheng Lian, "Singapore: From Garden City to City in a Garden—An Aspect of Sustainable Development?" *Bayan*, vol. 5 (March 2007) at 83-100.

[230] *Infra* note 235.

Even industrial sites had to be greened. All factories had to landscape their grounds and plant trees before they could commence operations.[231] More trees and shrubs were introduced from other tropical countries. Planting was done in new housing estates, along highways, and even within new industrial and commercial sites. Even walls and overhead bridges were adorned with creepers and climbers, and flowering shrubs were added for colour. New parks were added, and the landscaping of Changi International Airport was carefully tended to.

C. *Reconciling Development with Conservation*

As with other cities, one of the biggest challenges for Singapore is allowing for development while conserving its natural environment. The lack of physical space brings development into confrontation with conservation. The SGP pledged to set aside 5% of the land for nature conservation. This was closely followed by its Action Programmes which identified 19 nature sites and 4 coral reefs as worthy of conservation. However, only 3.8 percent of the nature sites have legal protection, and there is no protection of marine areas as entire eco-systems.[232]

The problems are exacerbated as Singapore's laws do not provide for mandatory environmental impact assessments (EIAs) for projects that may have an adverse impact on the environment. The nearest statutory equivalents to the EIA are found in sections 26 and 36 of the *EPMA*, both of which relate to impact assessments in relation to environmental pollution and hazardous installations.

D. *Nature Conservation Laws*

Laws to protect Singapore's wild flora and fauna were passed over a hundred years ago.[233] As Singapore developed, these laws were re-examined. The *Wild Animals and Birds Act* was passed in 1965,[234] making it an offence for anyone to "kill, take or keep" a wild animal or bird without a licence. The *Parks and Trees Act* was passed in 1975 "to provide for the development, protection and regulation of public parks and gardens and for the preservation and growing of trees and plants and for matters connected therewith."[235]

Today, almost all wild fauna are protected in Singapore, with the exception of six birds. There are also laws protecting trees and other plants. The extent of protection depends on their precise location in this island-state, as different laws and regulations apply. The greatest protection is in nature reserves and national parks, where breaches of the laws will entail a fine of up to S$50,000 or imprisonment of up to six months or both fine and imprisonment under the *Parks and Trees Act*. Flora and fauna in public parks are protected to a lesser extent under the *Parks and Trees Act*. Separate

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[231] Lee Kuan Yew, *supra* note 6 at 181.

[232] Lye Lin Heng "Legal Protection of the Natural Environment" in Clive Briffett & Ho Hua Chew, eds., *State of the Natural Environment in Singapore* (Singapore: Nature Society, 1999) at 83-95.

[233] Lye Lin Heng, "Wildlife Protection Laws in Singapore" [1991] S.J.L.S. 287; see also Lye Lin Heng, *ibid*.

[234] Ordinance 5 of 1965. It should be noted that the first laws to protect wildlife was passed in 1878—this was the Wild Birds Ordinance. *Ibid.*

[235] No. 14 of 1975.

laws protect parks in Sentosa Island[236] and parks administered by the Jurong Town Corporation[237] and the Public Utilities Board.[238] Lastly, there are laws governing particular areas in Singapore, such as tree conservation areas and bird sanctuaries.[239]

The *Parks and Trees (Preservation of Trees) Order 1991*, designated two areas of Singapore as tree conservation areas.[240] It is an offence to cut down a tree with a girth that exceeds 1 metre, measured a half metre from the ground, if it is growing on vacant land or in a tree conservation area. After the passing of the new *Parks and Trees Act* in 2005, the offence now carries a maximum fine of S$50,000 for each tree (up from S$10,000 in 1991). Such trees can only be felled with the permission of the Commissioner of Parks and Recreation. The *Parks and Trees Act* also empowers the Commissioner to order any person to maintain or preserve a tree in a tree conservation area. Again the penalty for non-compliance is a fine of up to S$50,000.

The *Parks and Trees Rules*[241] regulate the use of parks, and also provide for the planting and care of trees. They prohibit persons from excavating, cementing or sealing up any ground within a radius of 2 meters from the collar of a tree planted on vacant land on which a street or car park is to be made, or near a public street.[242]

The *National Parks Act* was passed in 1990, raising the status of the Botanic Gardens and Fort Canning Park to National Parks, and instituting the National Parks Board. Together, the National Parks Board and the Parks and Recreation Department further developed the greening of Singapore. Six years later, in 1996, a new *National Parks Act* was passed to provide for the merger of the two bodies into one, the National Parks Board. The new *Act* provided for the transfer of the property, rights and liabilities of the Parks and Recreation Department to the National Parks Board. It established four nature reserves[243] (including two which were given legal protection for the first time) and the two national parks.[244] This law has recently been amended, with the passing of the new *Parks and Trees Act* in 2005.

The *Parks and Trees Act* of 2005[245] was passed on 1 August 2005, "to provide for the planting, maintenance and conservation of trees and plants within national parks, nature reserves, tree conservation areas, heritage road green buffers and other specified areas, and for matters connected therewith." It provides for the appointment of a Commissioner of Parks and Recreation.[246] National parks and nature reserves now fall under the jurisdiction of this *Act*, which also provides for tree conservation

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236 The *Sentosa Development Corporation Regulations* (S. 454/97 Sing.).

237 The *Jurong Town Corporation (Parks) Regulations* (S. 285/88 Sing.).

238 The *Public Utilities (Catchment Area) Parks Regulations 2006* (S. 401/2006 Sing.), formerly the *Public Utilities (Catchment Area Parks) Regulations* (S. 48/89 Sing.).

239 See Lye Lin Heng, *supra* notes 232, 233.

240 1998 Rev. Ed. Sing. The two tree conservation areas are: (1) The area bounded by Dunearn Road, Whitley Road, Mt. Pleasant Road, Thomson Road, Lornie Road, Pan Island Expressway, Clementi Road, Pasir Panjang Road, Telok Blangah Road, Lower Delta Road, Ayer Rajah Expressway, Alexandra Road, River Valley Road, Fort Canning Road and Selegie Road; (2) The area bounded by Netheravon Road, Cranwell Road, Loyang Avenue, Loyang Way, Upper Changi Road North and Changi Village Road.

241 1998 Rev. Ed. Sing.

242 *Ibid.*, r. 11.

243 These are the Bukit Timah Nature Reserve, Central Catchment Nature Reserve, Labrador Nature Reserve and Sungei Buloh Wetland Reserve.

244 These are the Botanic Gardens and Fort Canning Park.

245 (No. 4 of 2005, Sing.).

246 *Ibid.*, s. 4.

areas and heritage roads green buffers, and requires the provision and protection of "planting areas" and the protection of "green verges" alongside roads. Penalties for breaches are enhanced, with fines raised from S$10,000 to S$50,000.

E. *Enforcement of Nature Conservation Laws*

The *Parks and Trees (Officers to Exercise Powers of Police Officer within Public Park) Notification* empowers the Commissioner of Parks and Recreation, various management officers of the National Parks Board, as well as park rangers, "to exercise within any public park all the powers of a police officer."[247] The *Parks and Trees (Officers to Perform Duties and Functions of Commissioner of Parks and Recreation) Notification* empowers officers of the National Parks Board "to perform the duties and functions of the Commissioner of Parks and Recreation under the Parks and Trees Act."[248]

Most members of the public, including members of the police force, are unaware that laws exist to protect the natural environment, beyond nature reserves and national parks. A real estate corporation was fined the maximum S$10,000 (under the old law) for cutting down the last Changi tree in a tree conservation area.[249] While the laws relating to trade in endangered species and the protection of flora and fauna in designated parks and nature reserves have been greatly enhanced,[250] the general protection for wildlife afforded by the *Wild Animals and Birds Act* is inadequate and needs urgent revision. Many of its provisions are unclear and outdated. It may also be asked whether the AVA is the best agency to enforce this law. NParks may be the more appropriate agency to take on this responsibility.

VII. Beyond the Garden City—Land Stewardship

Singapore's concerted efforts to green the city have been highly successful, and today the National Parks Board declares that its mission "has evolved from realising a vision for a Garden City to creating A City in a Garden where the island's seamless green infrastructure of parks and streetscapes play an essential part of Singaporeans' lives, homes, workplaces and playgrounds."[251] However, the Garden City concept has also been criticized as being "more successful in "taming and manicuring" the urban environment with greenery and less so with protecting the ecological integrity of the natural heritage of Singapore."[252] It has been asserted that "Notwithstanding Singapore's "clean and green" image, the urbanized areas are

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[247] Notification 1, G.N. No. 347/1996, with effect from 1 July 1996.

[248] Notification 2, G.N. No. 346/1996 Sing., with effect from 1 July 1996.

[249] Happily, some seedlings have been collected and are now growing well.

[250] See the new *Endangered Species (Import and Export) Act 2006* (No. 5 of 2006, Sing.); and the new *Parks and Trees Act 2005* (No. 4 of 2005, Sing.), and its subsidiary laws.

[251] See NParks, "Singapore, The Garden City – Looking Ahead," online: <http://www.nparks.gov.sg/gardencity_d.asp>; see also "'City in a Garden Plan' set out for Singapore" *The Straits Times* (11 December 1998); "Look Up, See the Green" *The Straits Times* (24 February 2001); and "Green Piece" *The Straits Times* (5 October 2002).

[252] Joseph Chun, "Enhancing the Garden City: Towards a Deeper Shade of Green" (2006) 18 Sing. Ac. L.J. 248 at 250.

ecologically impoverished", leading to rises in temperature, impairment of the soil conditions and loss of biodiversity.[253]

Another criticism, and one that has been frequently made, is that Singapore does not have any law mandating environmental impact assessments (EIAs).[254] Environmental assessment is a procedure that ensures that the environmental implications of decisions are taken into account before the decisions are made. The process involves an analysis of the likely effects on the environment, recording those effects in a report, undertaking a public consultation exercise on the report, taking into account the comments and the report when making the final decision and informing the public about that decision afterwards.[255] The essence of the EIA is to "Look before you Leap," and it is a very important tool in planning for development projects.

The nearest approximations of the EIA in Singapore are contained in sections 26 and 36 of the *EPMA*. Section 26 relates to impact analysis studies of hazardous installations.[256] It empowers the Director of Pollution Control to require the owner or occupier of a hazardous installation to carry out impact analysis studies identifying all possible hazards, estimating their frequency or probability, quantifying the consequences and risk levels, evaluating the effects of fires or other disasters, and identifying all necessary preventive measures. The Director may also require that measures be undertaken to prevent, reduce or control potential hazards. Section 36 empowers the Director to require any person intending to carry out any activity that is "likely to cause substantial pollution" to carry out a study on environmental pollution control and to submit a proposal for the reduction or control of pollution.

Both provisions are quite different from requiring an EIA as they focus only on industries or projects with high polluting capacity, whereas EIAs require a comprehensive, integrated and detailed study of all potential impacts on the environment, including ecological and sociological impacts. It is also a hallmark of EIA laws that they allow some measure of public participation, whereas sections 26 and 36 do not involve any third parties.

Many multilateral environmental instruments have called for states to implement EIAs. Principle 17, Rio Declaration on Environment and Development, 1992 states "Environmental impact assessment, as a national instrument, shall be undertaken for proposed activities that are likely to have a significant adverse impact on the environment and are subject to a decision of a competent national authority." The ASEAN Agreement on Nature and Natural Resources 1985, the Convention on Biological Diversity, and Agenda 21 (Earth's Action Plan), which Singapore signed, ratified and endorsed respectively, have all emphasized the importance of EIAs and public participation.[257] The United Nations Environment Program (UNEP) promotes the

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253 *Ibid.* at 251.

254 See Foo Kim Boon., Koh Kheng Lian. & Lye Lin Heng, "Environmental Protection—The Legal Framework" in Ooi Giok Ling, ed., *Environment and the City: Sharing Singapore's Experience and Future Challenges* (Singapore: Times Academic Press, 1995), c. 2; Joseph Chun, "Beyond Real Estate: Sowing the Legal Seeds for an Ethical Public Land Stewardship in Singapore" (2006) 3 Macquarie J. Int'l. & Comp. Envtl L. 1; Joseph Chun, "Reclaiming the Public Trust in Singapore" (2005) 17 Sing. Ac. L.J. 717.

255 See guidelines from the European Union - http://ec.europa.eu/environment/eia/

256 The *Code of Practice on Pollution Control*, *supra* note 88 at 11, refers to Quantitative Risk Assessments ("QRA Study) without making reference to section 26 of the *EPMA*. .

257 See Article 14 of the ASEAN Agreement; Article 14 of the *CBD*; and Section III of the Agenda 21.

application of the EIA process to major projects, and has recommended that it should be used during the entire project cycle from planning through operation to eventual closure.[258]

Environmental lawyers and planners have often lamented the lack of EIA laws in Singapore.[259] The issue came to the fore in 1992 when there was a proposal to convert part of the Lower Peirce Reservoir, which was gazetted as a nature reserve, into a golf course. In response to calls for environmental impact studies to be undertaken, the authorities agreed to commission an EIA but declared that the results would be confidential. This prompted the Nature Society to undertake and publish its own EIA Report which revealed that considerable damage to the eco-system and loss of biological diversity would ensue, which would be irreparable.[260] While the project has been shelved for the time being, it is clear that such issues may well arise in the future. And indeed, it has arisen as a national as well as a trans-national issue. The latter involved a dispute between Malaysia and Singapore over Singapore's reclamation works in Pulau Tekong and Tuas View. It was claimed that Singapore's reclamation works impinged on Malaysia's territorial waters and caused pollution and other adverse harm to the marine environment in the Straits of Johor. Malaysia invoked the provisions of the 1982 UN Convention on Law of the Sea and referred the matter to arbitration, under Annex VII of the Convention. Malaysia subsequently applied to the International Tribunal for Law of the Sea (ITLOS) for interim measures to stop Singapore's works pending the outcome of the arbitration. The Tribunal's decision was announced on 8 October 2003. It required, *inter alia*, that "Malaysia and Singapore shall cooperate and shall, for this purpose, enter into consultations forthwith in order to:… (b) exchange, on a regular basis, information on, and assess risks or effects of, Singapore's land reclamation works."[261] Reclamation works brought the EIA issue to the forefront again in 2001, with the government's proposal to reclaim a stretch of beach called Tanjong Chek Jawa, in the off-shore island of Pulau Ubin.[262]

The proposed reclamation of Chek Jawa generated much interest and controversy. Concerned citizens, educators and non-government organizations like the Nature Society, tried hard to persuade the authorities to reverse its decision.[263] One described the sandflats thus: "There were numerous large carpet anemones, different colored peacock anemones, huge horned sea stars, common sea stars, sand stars, brittle sea

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[258] See http://www.unep.fr/pc/pc/tools/eia.htm.

[259] See *supra* note 254; see also Malone-Lee Lai Choo, "Environmental Planning" in Donna G. Craig, Nicholas A. Robinson & Koh Kheng-Lian, eds., *Capacity Building for Environmental Law in the Asian and Pacific Region—Approaches and Resources,* vol. 1 (Manila: Asian Development Bank, 2002) at 606-615.

[260] See *Proposed Golf Course at Lower Peirce Reservoir—An Environmental Impact Assessment* (Singapore: Nature Society, 1992).

[261] See the decision at http://www.itlos.org/news/press_release/2003/press_release_84_en.doc. See also Tommy Koh & Jolene Lin, "The Land Reclamation Case—Thoughts and Reflections" (2006) 10 S.Y.B.I.L. 1.

[262] "Discovered only last December, the unique mud and sand flat at Chek Jawa may be the last of its kind here. Too bad its destined for the bulldozer:" see "'Check' out this hidden Eden" *The Sunday Times* (8 July 2001). See other examples mentioned in Joseph Chun "Beyond Real Estate: Sowing the Legal Seeds for an Ethical Public Land Stewardship in Singapore" (2006) 3 Macquarie J. Int'l. & Comp. Envtl. L. 1.

[263] Dr. Geh Min, President, Nature Society (Singapore), Letter to the Forum, "Chek Jawa's natural beach should be preserved" *The Straits Times* (16 July 2001).

stars, sponges, sea cucumbers, coral fishes, an assortment of crabs, sand dollars and much more…."[264] In contrast, the Urban Redevelopment Authority maintained that reclamation would proceed, as a careful study had been commissioned, and revealed that the area did not appear to have a resident population of dugongs, the sea grass was patchy and not abundant, and the area "[did] not have any established coral reefs or reef communities nor would the conditions favour the development of such."[265] The publicity generated from newspaper reports compelled citizens to flock to the tiny beach, taking with them sea shells and other souvenirs, as there was little hope that the area would be saved from reclamation.

Fortunately, at the very last minute, the authorities decided not to proceed with the project, and announced that Chek Jawa would not be reclaimed, at least for the next ten years. While this respite is clearly welcome, albeit for an uncertain duration, the fact remains that the lack of any procedures for a proper EIA to be undertaken and the lack of legal protection for the area, had caused damage to the eco-system as specimens of flora and fauna were removed from the beach with impunity. Unlike the Lower Peirce region, which was (and still is) legally protected, Chek Jawa was not (and still is not) legally protected. With the decision not to proceed with the reclamation, NParks was placed in charge of Chek Jawa. A walkway for public viewing of the beach has since been built at considerable expense, to encourage public appreciation for this nature site and at the same time, reduce further damage to the eco-systems.[266]

Today, EIAs continue to be done on an *ad hoc* basis, but increasingly, access has been given to non-government organizations such as the Nature Society. It would appear that the authorities and responsible NGOs have started to work at achieving a workable partnership in caring for the environment. Announcements have been made on the Government Gazette informing readers that the EIA report can be viewed.[267] However, as there is no legislation mandating environmental impact studies, there is no system in place for the proper facilitation of such studies. There is no spelling out of the roles of the different parties, the right of the public to be informed and to be allowed to participate in the process of deliberation. This is a glaring inadequacy in our laws.

The challenges of further urbanization and depletion of the natural environment have led to calls for more rigorous environmental planning procedures.[268] These include:

- Establishing a coordinating body which deals comprehensively and authoritatively with environmental planning matters;

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[264] Chua Ee Kiam, Letter to the Forum, "Destruction of Chek Jawa will be a loss for all" *The Straits Times* (28 July 2001).

[265] Ang Hwee Suan, for the CEO, Urban Redevelopment Authority, Letter to the Forum, "Chek Jawa reclamation decided after careful study" *The Straits Times* (27 July 2001).

[266] Websites have been set up for Chek Jawa; see online: <http://chekjawa.nus.edu.sg/>; <http://www.wildsingapore.com/chekjawa/>; a film has been made, see online: <http://rememberchekjawa.wordpress.com/>.

[267] See the EIA commissioned by Jurong Town Corporation, relating to the reclamation of Pulau Ular. This appeared in the Government *Gazette* on 13 July 2006, informing the public that the EIA can be viewed at their office; see online: <http://www.egazette.com.sg/Document/gg/2006/065016.pdf>.

[268] See Malone-Lee Lai Choo, *supra* note 259; see also Joseph Chun, "Reclaiming the Public Trust in Singapore" (2005) 17 Sing. Ac. L.J. 717.

- Establishing a definitive set of procedures that require developers and implementation agencies to adhere to, to ensure a high degree of environmental sensitiveness when undertaking major infrastructure construction;
- Ensuring the systematic collection and sharing of environmental data among the various agencies; and
- Introducing environmental impact studies as an integral part of the planning process.

There are also calls for ethical public land stewardship in Singapore, using the concept of the public trust, wherein the government is viewed as a trustee of all publicly-owned lands, for present and future generations of citizens, and is under an obligation to give due consideration to ecological concerns and involve the public in its deliberations on land-use.[269] Indeed, the EIA and public participation in its deliberation should be viewed positively, as a means for the authorities to obtain all relevant information so as to assist in their making of sound and reasoned decisions, after considering all possible alternatives and mitigating factors. Thus, there are cogent and pressing reasons for the argument that EIAs should be legally mandated. The usual fears that the consultative process may prolong the development and obstruct decision actions can easily be resolved by clear laws and procedures with strict timelines for public consultation and feedback.

VIII. Conservation of Marine Species and Ecosystems

Yet another area of inadequacy is the protection of the marine environment. The Sungei Buloh Wetland Reserve is protected under the *Parks and Trees Act*. However, there are no marine protected areas, although four coral reefs were identified for conservation under the SGP in 1992. [270] While one site[271] has been declared a Marine Nature Area by the Urban Redevelopment Authority, it is unclear what this means. Another site identified under the SGP, Pulau Semakau, has since been turned into an off-shore dump-site which has received considerable accolades.[272]

To date, there are no laws protecting a particular marine area or ecosystem, nor is there a designated authority in charge.[273] The only laws that apply to marine areas are:

- The *State Lands (Encroachment) Act*: Section 14 prohibits the digging or taking from any State land of "…any mineral, gravel, stone, coral, shell, sand, loam, brick-earth or other product" without a permit from the Land Office. The penalty is a fine of S$2,000. In practice, permission is only granted for scientific, educational or conservation purposes.

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269 Joseph Chun, *ibid*.

270 These are the areas surrounding Pulau Hantu, St John's Island, Pulau Sudong and Pulau Semakau. See Chou Loke Ming, "Coral Reefs" in *State of the Natural Environment in* Singapore, op. cit. n 230 at 35-48.

271 This is the site of the two 'twin' islands called Sisters Island, declared a Marine Nature Area in the 2003 Master Plan.

272 See Wild Singapore, "Pulau Semakau—Introduction," online: <http://www.wildsingapore.com/places/semakau.htm>.

273 See "Wanted: Body set up to protect marine life" *The Straits Times* (28 July 2001).

- The *Fisheries Act*[274] and its regulations: these provide considerable control over the fishing industry. The term "fish" is defined to "include any of the varieties of marine, brackish water or fresh water fishes, crustacea, aquatic mollusca, turtles, marine sponges, trepang and any other form of aquatic life and the young and eggs thereof." These laws require persons who use fishing gear to obtain a licence. Fishing vessels plying at any port in Singapore also require a licence. The trapping of fish by explosives or poisons, and the use of trawl nets are prohibited. Penalties include a fine of up to S$10,000 and/or imprisonment of up to 12 months. There may be a daily fine of S$50 and where the offence continues for a period exceeding 10 days after conviction the offender shall be liable to a term of imprisonment not exceeding 6 months. It is an offence to keep dangerous fish such as the piranha, and the penalty is a fine of up to S$50,000 and/or imprisonment up to 12 months.[275]

Apart from these, no laws exist to specifically protect Singapore's marine life, either as individual specimens or species or as an entire ecosystem.

It is still unclear which government agency is responsible for marine conservation. The Singapore Land Authority is responsible for issuing licences for removal of the substrate (sand, rock, coral) but not for living organisms on the substrate or in the water column. The National Parks Board is assuming increasing responsibility for surveys and data collection on marine life, protection and rehabilitation projects. The Agri-Food and Veterinary Authority (AVA) is responsible for the *Fisheries Act* but there is little commercial fishery within Singapore waters.

IX. The Future

A. *The Evolving Concept of the Garden City*

The concepts of Singapore as a Garden City or a City in a Garden are constantly evolving as city planners, park administrators and other authorities are challenged to improve the living environment in this tiny but dynamic island. The Urban Redevelopment's Parks and Waterbodies Plan 2003, "Painting Our Island Green and Blue," suggested ways to further improve Singapore's green spaces, waters and living environment by making the most of its natural assets. The key proposals were to:

- make areas of natural beauty more accessible;
- provide a variety of parks—waterfront parks, nature parks, town parks;
- develop five new parks near to homes;
- extend popular parks;
- link parks to bring them closer to people; and
- make our roads and buildings "greener."

Four years later, Prime Minister Lee Hsien Loong's vision is to transform Singapore into a City of Gardens and Water. In adding blue to green, the PUB has taken the

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[274] Cap. 111, 2002 Rev. Ed. Sing.

[275] *Fishing (Piranha) Rules* (S. 150/71 Sing.).

lead. In its own words:

> In the last few decades, Singapore has successfully branded itself internationally as a clean and green city. Now add blue to the landscape. Imagine flowing waterways as you look out of the window of your HDB flat. Paddle on a kayak at a reservoir and take in the sights and sounds of Mother Nature. Go for a romantic stroll on the boardwalk with your loved one while your children splash around by the water's edge. A distant dream? Think again. Indeed, such scenes will soon become a reality in the next five years as PUB, the national water agency, rolls out the Active, Beautiful, Clean (ABC) Waters Programme with more than 20 projects carried out islandwide. This programme will transform Singapore's pervasive network of canals, drains and reservoirs into picturesque and clean streams, rivers and lakes. A whole range of recreational and lifestyle activities bringing people closer to water will become possible.[276]

At the same time, NParks is encouraging skyrise gardens. In its words:

> Singapore, like many other highly dense cities around the world, has begun to create a three-dimensional garden for our urban environment. Like Chicago, Toronto, Tokyo and Germany, we have incorporated landscaped rooftop gardens and other forms of skyrise greenery in our urban landscapes. In recent years, both private and governmental projects have increasingly reflected these elements.
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> As the custodian responsible for providing and enhancing greenery of the Garden City, the National Parks Board (NParks) continues to improve upon a quality urban landscape. In tandem with urban intensification, NParks has also stepped up greening efforts to maintain the greenery and lushness of the urban environment. NParks' greening approach has been moving upwards through the greening of rooftops and sides of high-rise buildings, which allows optimal land use, and improves the environment for quality living. Urban dwellers or pedestrians can thus still appreciate greenery at ground level, or at rooftops, in spite of urban intensification.[277]

It is clear that Singapore's environment is never static. Even as old buildings are torn down to make way for new ones, and the new Integrated Resort takes shape, the challenges of climate change, global warming and sea level rise loom large.

B. *Climate Change*

As a small island state, Singapore is especially concerned about the effects of climate change and sea level rise. Singapore signed and ratified the *Framework Convention on Climate Change 1992*, and submitted its Initial Report to the *U.N. Framework Convention on Climate Change* in August 2000.[278] On 12 April 2006, Singapore acceded to the Kyoto Protocol.

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[276] PUB, *Annual Report 2007* at 1, online: <http://www.pub.gov.sg/annualreport2007/Features_clean_and_green.html>.

[277] NParks, "Singapore, The Garden City—Skyrise Greenery," online: <http://www.nparks.gov.sg/gardencity_e.asp>.

[278] Ministry of the Environment, *Singapore's Initial National Communication Under the United Nations Framework Convention on Climate Change* (August 2000); available online: <http://unfccc.int/resource/docs/natc/sinnc1.pdf>.

A National Energy Efficiency Committee (NEEC) was set up in 2001 to spearhead programmes to encourage more efficient use of energy by industries, homes, commercial buildings and vehicles. This was restructured from the Inter-agency Committee on Energy Efficiency, formed in 1998. With the announcement of Singapore's accession to the Kyoto Protocol in 2006, the NEEC has been expanded in scope to cover climate change issues and has been renamed the National Climate Change Committee (NCCC) to better reflect its expanded function.[279] NCCC will (i) promote greater energy efficiency and less carbon-intensive energy in key sectors; (ii) raise awareness amongst the people, private and public sectors on the impacts and opportunities arising from climate change, and the actions they can take; (iii) build competency in Singapore to better respond to climate change such as through promoting research and development of low-carbon technologies; and (iv) understand Singapore's vulnerability to climate change and facilitate the adaptation actions needed.[280] An association has also been formed to promote energy efficiency and awareness in construction, manufacturing and service sectors.[281] An Inter-Ministerial Committee on Sustainable Development was established on 24 January 2008.[282] At the international level, Singapore is helping China build an Eco-city in Tianjin[283] And at the national level, Singapore is seeking to turn itself into an eco-city without sacrificing economic growth.[284]

It is clear that the environment will be at the forefront of public and private interests and will be a focus for teaching and research in tertiary and research institutions. Part of Singapore's strategy is to invite world experts as advisors and also to spearhead research and development in the field of environmental technology. Tertiary institutions have launched various research and development initiatives. NUS has established the NUS Environment Research Institute, and recently launched its Solar Energy Research Institute of Singapore.[285] The Nanyang Technological University (NTU) has established the NTU-NEA Environmental Engineering Research Centre. Efforts to build capacity in environmental law began in the Law Faculty, National University of Singapore (NUS) in 1994. The Faculty established the Asia-Pacific Centre for Environmental Law (APCEL)[286] in 1996, in close cooperation and collaboration with the IUCN-Commission on Environmental Law and the United Nations Environment Programme (UNEP). Its main objectives include serving as a regional centre for teaching and research in environmental law. APCEL is a founding member

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279 See the National Climate Change Committee's website, online: <http://www.nccc.gov.sg/main.shtm>.

280 MEWR, "Climate Change," online: <http://app.mewr.gov.sg/view.asp?cid=148&pid=118&nid=120&id=SAS453>.

281 Sustainable Energy Association of Singapore. See online: <http://www.seas.org.sg>.

282 MEWR, News Release No. 01/2008, "Formation of Inter-Ministerial Committee on Sustainable Development" (24 January 2008), online: <http://app.mewr.gov.sg/view.asp?id=CDS5977>.

283 See Ministry of National Development, News Release, "First Meeting of the Sino-Singapore Tianjin Eco-City—Joint Working Committee in Tianjin" (31 January 2008), online: <http://www.mnd.gov.sg/newsroom/newsreleases/2008/news31012008.htm>.

284 Christie Loh, "Turn Singapore into eco-city without sacrificing economic growth: PM" *Today Online* (25 January 2008), online: http://www.todayonline.com/articles/234172.asp; see also, Ministry of National Development, News Release, "Agreements to Develop Eco-City in China Signed" (18 November 2007), online: <http://www.mnd.gov.sg/Newsroom/newsreleases/2007/news181107.htm>.

285 See "Propelling Singapore as a clean energy hub" *NUS Newshub* (22 February 2008), online: <http://newshub.nus.edu.sg/headlines/0802/solar_22feb08.htm>.

286 See http://www.law.nus.edu.sg/apcel/.

of the IUCN Academy of Environmental Law.[287] The Faculty now offers several courses on environmental law and APCEL seeks to help build local and regional capacity in teaching and research in environmental law. NUS has also started a multi-disciplinary graduate programme on environmental management, the Master of Science in Environmental Management (MEM), hosted by the School of Design and Environment.[288] The programme's first intake of students was in 2001. Half of the students come from abroad, mostly from developing countries in Asia.

This emphasis on teaching and research sees advances in environmental technology as a growth area that will contribute to sustainable development as well as help boost the economy.[289]

X. Conclusion

In the short time-span of 30 to 40 years, Singapore has not only attained economic success but has also enhanced its living environment by cleaning up pollution, taking care of its natural environment and greening the urban areas by the judicious planting of trees and shrubs. This was possible because of the vision and wisdom of its leaders, particularly its first Prime Minister Lee, who saw a clean and green environment as a means to attract investments as well as a balm for the urban soul. That the primary motivator was economics is beyond doubt.[290] Singapore's success was (and continues to be) motivated by the need for economic growth. A robust economy is needed to ensure Singapore's survival as a nation, and its attainment requires political stability, an educated workforce, an efficient and intelligent civil service, the rule of law, effective law enforcement, and a system of checks and balances on the government. In the field of environmental management, particularly in the context of pollution control, it can clearly be said that Singapore has a creditable environmental management system that works, and its environmental laws as well as their implementation and enforcement constitute an important part of this system. However, there are still inadequacies which need to be addressed. In particular, laws need to be passed to require the separation of wastes and recycling; poorly drafted laws such as the Wild Animals and Birds Act need to be amended.

It is also clear that Singapore's physical, economic and social environment are constantly evolving and its administrators, civil servants and political leaders have to meet the challenges that arise. Much will depend on whether the right policies have been conceptualised and whether they are properly implemented in a constantly changing world.

A recent book on Singapore's success has emphasized that Singapore's success stems from an elitist leadership, for the government has rewarded the intelligentsia, who were (and continue to be) given high positions in the political leadership and the

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[287] See http://www.iucnael.org/. The writer is a member of its Board of Governors.

[288] See http://www.sde.nus.edu.sg/MEM/index.htm. The writer chaired the programme's Steering Committee and now chairs its Programme Management Committee.

[289] See "Dutch expertise to manage Marina area" *The Straits Times* (27 June 2006).

[290] See Goh Keng Swee, *The Economics of Modernization* (Singapore: Federal Publications, 1995). Goh was Singapore's Finance Minister and Minister for Defence in the early years. This book is a collection of speeches he made from 1959 to 1971.

civil service.[291] It was this "elite" who thought of and implemented policies for the advancement of the young city-state. The system worked because leadership in the Singapore context is merit-based, and there are checks and balances to ensure a clean government. As good governance stems from good leadership, so the success of Singapore in taking care of its environment is due in large measure to the well-educated civil servants from the relevant ministries and agencies who have, in the course of time, worked out an environmental management system that works well, guided by the policies of the political leaders. These educated "Mandarins" have, to a large extent, proven their mettle; they have helped the government achieve its aims.[292] They have also established that they are capable of creative thinking and innovation; they have devised laws and policies tailored to Singapore's special needs, and implemented them judiciously. Singapore's success in managing its environment owes as much to its administrative service (particularly the civil servants in the various environmental agencies) as to its political leadership.

However, even more can be done for the future. There is a need for civil servants to have a broader education. In particular, managers of public lands need a better understanding of land ethics and ecology. They must take into consideration the ecological impact of their decisions and functions. It is time our laws require the conduct of environmental impact assessments (EIAs) before any development project is allowed to proceed. This is especially critical as climate change is a reality, and decisions on land use must be very carefully considered with the fullest possible information. There is therefore a need for public participation in environmental decision-making, as a true measure of the partnership between the state and the people. This will be in the spirit of Agenda 21, with the government and citizens as co-stewards of the land for future generations of Singaporeans.

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[291] Henri Ghesquierre, *Singapore's Success: Engineering Economic Growth* (Singapore: Thomson Learning, 2007). See review by Andy Ho, "Economic success is hard to quarrel with" *The Straits Times* (4 October 2006).

[292] See Ngiam Tong Dow, *A Mandarin and the Making of Public Policy: Reflections by Ngiam Tong Dow* (Singapore: NUS Press, 2006).