

## INDEX

---

### A

Active, Beautiful and Clean

(ABC) Waters Programme,  
220, 224–25

design guidelines, 226

*Aedes* mosquitoes, 77, 78, 79

Agency for Science, Technology  
and Research (A\*STAR), 306

Agrifood and Veterinary  
Authority (AVA), 133

air pollutants

reducing concentration levels, 48

air pollution, 249–50

transboundary, 47–48

air pollution control, 22–24

industrial emissions, 27–34

land transport planning, 44–46

lead emissions, 38–40

particulate matter emissions,  
37, 40–44

sulphur dioxide emissions, 35–  
38

vehicular emissions, 37–46

air quality, 21–49

challenges, xxvi, 21–22

high standards, 48

monitoring, 24–27

*Anopheles* mosquitoes, 77

anti-litter laws

enforcement, 56

Anti-Pollution Unit (APU), 7, 8,

12, 23–24

Area Licensing Scheme (ALS), 44

Arthropod Containment

Laboratory, 84

asbestos cement pipes, 173, 174

ASEAN Haze Agreement, 291

ASEAN Summit, 289–93

Asia-Pacific Water Forum, 283

Astronomy Society of Singapore, 109

### B

Baling, 97

barges

transportation of waste to  
Semakau, 107

- Basel Convention, 285–87
- Bedok catchment, 133
- Bedok NEWater Demonstration Plant, 151
- Bedok NEWater Visitor Centre, 150
- Bedok NEWATER Desalination Plant, 151
- Bedok Water Treatment Plant, 133
- Best Management Practice (BMP), 219
- bilateral sharing of expertise, 294–96
- bin centres  
use of compactors, 60
- biodiversity surveys, 139
- biohazardous waste, 118–19
- Biological Agents and Toxins Act, 84
- Biopolis, 84
- “Bring Your Own Bag”  
campaign, 115
- Building and Construction Authority (BCA), 255, 306
- Bukit Timah Canal, 206–207
- Bukit Timah Catchment, 208
- Bukit Timah Flood Alleviation Scheme (BTFAS), 206–208, 228
- Bukit Timah-Rochor Canal, 70
- bus lanes, 45
- C**
- carbon dioxide emissions, 306
- Catchment and Waterways Department, 215
- catchments  
limited size, 126  
protected, 128–29  
unprotected, 129–31  
urbanized, 131–37
- Central Business District  
higher risk of flooding, 204  
tide-gate system, 206
- centralized refuse chute system, 94
- Centre for Advanced Water Treatment (CAWT), 151
- Centre for Environmental Training (CET), 281
- Certificates of Entitlement, 45
- Changi Outfall, 188, 190
- Changi Water Reclamation Plant, 152, 153, 188, 189, 190, 248
- Chassis Dynamometer Smoke Test (CDST), 43
- Chiang Kok Meng, 189
- Chikungunya fever, 84, 87
- Choa Chu Kang waterworks, 131
- cholera, 63
- City Council, 7
- City Engineers Department, 8
- City Health Department, 8
- City in a Garden, 221–23, 268
- Clean Air Act, 31, 49
- Clean Air (Standards) Regulations, 32, 37
- clean and green environment objectives, 5
- Clean and Green Week (CGW), 6, 7, 58, 89, 262
- Clean Rivers Education Programme, 74

- Cleanest Estate Competition, 58  
cleanliness  
    importance, 51, 307–308  
closed water loop concept, 155  
Code of Practices on the Sanitary  
    Drainage and Plumbing  
    Systems, 193  
Common Service Tunnel (CST)  
    project, 175  
community  
    communication, 258–62  
    empowerment, 265–71  
    engagement with, 262–65  
    environmental education, 261–62  
    Keep Singapore Clean  
        campaign, 54–57, 259–60  
    Water Is Precious campaign,  
        260–61  
    working with, 257–72  
Community Development  
    Councils, 168, 262  
Community Involvement  
    Programme, 265  
compactors, 60  
Concept Plan, 11  
Control of Vectors and Pesticides  
    Act, 79  
Corporate and School Partnership  
    Programme, 267–68  
corporatization, 95–96  
Corrective Work Order (CWO), 62  
cost recovery, 240–41  
cradle-to-grave approach, 119  
Cuba  
    Memorandum of  
        Understanding, 297  
Cured-in-Place Pipe lining (CIPP),  
    184
- D**  
daily-rated employees (DREs), 52  
    difficulty in recruiting, 53  
Deep Tunnel Sewerage System  
    (DTSS), 6, 136, 187–91, 234–35  
    ASEAN Outstanding  
        Engineering Achievement  
        Award, 188  
    cost effectiveness, 188–90  
    environmental considerations,  
        188–190  
    Institution of Engineers  
        Singapore (IES) Prestigious  
        Engineering Achievement  
        Award, 188  
    land use, 188–90  
    North and Spur Tunnels, 188  
    opportunities to develop water  
        industry, 190–91  
dengue  
    *Aedes* mosquitoes, 77, 78, 79  
    collaboration with WHO, 296  
    entomological surveillance, 80  
    Environmental Health Institute  
        (EHI), 82  
    Geographical Information  
        System (GIS), 80  
    preventive efforts, 85–88  
    proactive surveillance, 80  
    surveillance, 79  
Dengue Consortium, 87  
Dengue Prevention Volunteer  
    Group, 269

- desalination, 155–56, 239–40
- Destruction of Disease Bearing  
Insects Act, 78
- diesel  
sulphur content, 38  
ultra-low sulphur, 38
- differential pricing  
solid waste disposal fees, 243–  
44
- dioxins, 102
- Domestic Solid Waste  
Management System, 106
- domestic water consumption  
reduction, 167–69, 176
- drainage  
Best Management Practice  
(BMP), 219  
integration with other uses, 219
- drainage development projects, 6
- Drainage Master Plan and  
Development Control, 209–10
- duck farms, 69
- E**
- Eastern Coastal Park Connector  
Network, 222
- Eco-City in Tianjin, 297–98
- Eco-Friend Award, 271
- Economic Development Board  
(EDB), 12, 29, 306
- economic principles  
application, 233–56  
long-term cost effectiveness,  
234–36  
next best alternative, 236–37  
optimal timing, 238–40  
setting appropriate prices, 240–  
44
- economics  
role in guiding environmental  
policy, xxix
- education  
changing of behaviour, xxiv
- Electronic Road Pricing (ERP),  
44–45
- electronic wastes  
presence of mercury, 103
- Energy Efficiency Programme  
Office, 306
- Energy Market Authority (EMA),  
9, 306
- EnviroAsia, 274
- environment  
priority, xxiii
- Environment and Water  
Regulations and Standards,  
336–42
- Environment Champions, 111, 266
- Environment Ministers, 327
- Environmental Health Act, 65
- Environmental Health Branch, 52
- Environmental Health Institute  
(EHI), 82
- Arthropod Containment  
Laboratory, 84
- attracting right talent, 83
- collaboration with WHO  
WPRO, 88
- development of dengue test kit,  
85
- high-containment laboratory,  
84

- programmes, 83
- Royal Entomological Society Award, 86
- SARS outbreak, 83–85
- surveillance system extended, 86
- environmental health services
  - reorganization, 93
- Environmental Impact Assessment (EIA), 138
- environmental infrastructure
  - building up of, 5
- Environmental Policy and Management Division, 9
- environmental policy-making
  - fundamental principles, xxvi
- environmental pollution control requirements, 12
- Environmental Pollution Control Act, 194
- Environmental Pollution Control (Air Impurities) Regulation, 103
- Environmental Protection and Management Act (EPMA), 117, 194
- Environmental Protection and Management (Control of Noise at Construction Sites) Regulations, 46
- Environmental Protection and Management (Vehicular Emissions) Regulations, 40
- Environmental Public Health Act (EPHA), 59
  - enforcement procedures, 61
- Environmental Public Health (Prohibition on Discharge of Trade Effluents into Water Courses) Regulations, 194
- Environmental Public Health Division (EPHD), 9, 52, 82
  - district offices, 53
- Environmental Public Health (Hawkers) Regulation, 65
- Environmental Public Health (Toxic Industrial Waste) Regulations, 119
- environmental sustainability, 310–14
  - engaging the community, 313–14
  - policy research and innovation, 311–13
  - technology research & development, 310–11
- environmental technologies, 112
- environmentally sustainable ASEAN cities, 292–93
- equatorial climate, 50
- estuarine reservoir, 130
  - financial cost and environmental consequences, 138
- Esty, Daniel, 309
- European Union, 113
  - emphasis on need to recycle, 109
- F**
- farms
  - relocation of, 131

- farmers
  - resettlement of, 70
- ferrous metals, 98
- finest
  - littering, 60
  - recalcitrant offenders, 61
- flare system
  - refineries, 12
- flood alleviation, 205
  - Bukit Timah Flood Alleviation Scheme, 206–208
  - early schemes, 205–206
  - land constraints, dealing with, 213, 214
  - platform levels and requirements, 212–13
- flood control, xxviii
  - integration of storm water management with water loop, 215
  - maintenance regime, 218–19
  - present day, 214–20
- flood management, xxviii
  - strategy, 204–205
- flood prevention, 201–29
  - Drainage Master Plan and Development Control, 209–10
  - Road Drainage Improvement Task Force, 210–12
- flood response, 217–18
- floods
  - 1969, 202
  - 1978, 202
  - causes, 203, 204
  - geographical elements, 204
  - high sea level, 213
  - prevention of, xxviii
- food waste
  - recycling, 121
- Fort Canning
  - reservoir at, 127
- Four National Taps strategy, xxvii, 156–57
- Free Acceleration Smoke Test (FAST), 43
- Fresh Kills Landfill
  - New York, 107
- Fuel Economy Labelling Scheme, 49
- G**
- Gardens-by-the-Bay, 216, 223
- gasification, 121
- gate fees
  - incineration plants, 242–43
- Geographical Information System (GIS), 80
- Germany-Singapore
  - Environmental Technology Agency, 293–94
- Geylang River, 70
- global community
  - learning from others, 275–80
  - linking, 273–99
  - manpower training, 278–80
- global competitiveness index, 320–21
- glossary, 353–67
- Goh Chok Tong, 7, 16
  - endorsement of NEWater, 150
  - Model Environmental Workers Award Ceremony, 50

government  
  spending on environmental  
  infrastructure, xxiii

Governmental Health

  Department, 7

Great Barrier Reef, 76

Green Mark, 226

Green Vehicle Rebate scheme, 49

gross domestic product (1965), 4,  
  304

Growth Report 2008: Strategies  
  for Sustained Growth and  
  Inclusive Development, 233

## H

Hanta viruses, 84

hawker centres

  construction of, 65

hawkers

  resettlement, 63–67

  completion of project, 66

Hawkers Centres Upgrading  
  Programme (HUP), 67

hazardous substances, 116–19

  enforcement programme, 118

  licensing control, 117–18

  planning and development  
  control, 116–17

  Safety Audit Scheme, 118

  transportation, 117

Hazardous Waste (Control of  
  Export, Import and Transit)  
  Bill, 285

heavy duty diesel vehicles

  PM emission standards, 42

High Containment Laboratory, 84

high-grade industrial water  
  (HGIW), 171

Housing and Development  
  Board, 133

  hawker centres and markets, 65

  Singapore River clean up, 14

human development index

  rankings, 322,

hydrophobic membrane, 157

Hyflux, 156

## I

incineration plants, 97–104

  air-monitoring system, 102

  catalytic baghouse filters, 102

  cost, 98

  design, build, own, and operate  
  (DBOO) model, 104, 105

  German consultants, 99

  large underground reservoirs,  
  102

  privatization, 245–47

  technical and design

  improvements, 101

  technical staff, 105

  technology available, 97, 98, 121

Incineration Services Agreement,  
  105

indoor air pollutants, 88

industrial projects

  submission of Quantitative Risk  
  Assessment (QRA), 117

information asymmetries

  remedying, 252–53

infrastructural improvements,

  resettling hawkers, 63

- innovation  
 importance, 15, 17  
 NEWater, 15, 16  
 indoor air quality, 83  
 Semakau Landfill, 16, 17
- Innovation for Environmental Sustainability (IES) Fund, 112
- Integrated Planning and Development Control Process, 10-14
- integrated solid waste management, 91-122
- inter-agency coordination, 132
- Inter-Agency Dengue Taskforce, 81
- Inter-Ministry Joint Coordinating Committee on Epidemic Diseases, 118
- Islandwide Cleanest Estate Competition (ICEC), 59
- IWA Leading Edge Technology Conference and Exhibition 2007, 282
- J**
- Japanese encephalitis, 83
- Johor  
 supply of water to Singapore, 69, 128, 139-40
- Johor River, 139
- Joint Committee on Flood Alleviation, 205
- Jurong Industrial Estate, 112
- Jurong Industrial Water Works (JIWW), 140
- Jurong Island, 171
- Jurong Town Corporation (JTC), 28  
 Singapore River clean up, 14
- K**
- Kallang Basin, 70, 73  
 clean-up, 67-75  
 duck farms, 72  
 highly polluted, 68  
 physical improvement works, 73
- Kallang River, 69, 224
- Kallang River Reservoir, 127
- Keep Singapore Clean campaigns, 3, 6, 54-59, 62, 89, 259-60  
 activities, 55  
 intersectoral committee, 55
- Keep Singapore Clean and Mosquito Free campaign, 56, 78
- Keppel Seghers Engineering Pte Ltd, 105, 106, 246
- key statistics of Singapore, 5, 319-25
- Kim Chuan Refuse Transfer Station (KCTS), 100
- Kim Chuan Sewage Treatment Works, 181
- Kim Chuan Water Reclamation Plant, 136  
 decommissioning, 137
- Kranji Reservoir, 130, 133
- Kranji Water Reclamation Plants, 152
- Kyoto Protocol, 287



## L

## land

- cleaning up, xxvi
- conjunctive use, 134

## land development

- Concept Plan, 11

## land-saving waste disposal

- methods, 92

## Land Transport Authority (LTA),

- 42, 306
- road drainage, 212

## land transport planning, 44–46

- Area Licensing Scheme (ALS), 44
- Electronic Road Pricing (ERP), 44–45
- integration with land use planning, 46
- restricted zone, 44
- Vehicle Quota System, 45

## land use

- deep tunnel sewerage system, 188
- pressure, 126

## land-use planning, 46

- environmental controls, 11
- protection of catchment area, 13

## law enforcement

- strict, 59–62

## lead emissions, 38–40

- annual average levels, 39

## Lee Ek Tieng, 13, 74, 142, 327

## Lee Hsien Loong, 7, 152, 303

- officiating at the ABC Waters Master Plan opening ceremony, 227

## Lee Kuan Yew, 7, 12, 220

- comment on collection of rainfall, 130
- From Third World to First*, 57
- launch of Keep Singapore Clean campaign, 3
- opening of Upper Peirce Reservoir, 69
- priority on water, xxiii
- statement on Marina Barrage, 74–75

## Lee Yock Suan, 235, 327

*Legionella* infection, 88

## legislation

- Clean Air Act, 31
- Clean Air (Standards) Regulations, 32
- Environmental Policy and Management Division, 9
- Environmental Pollution Control Act, 194
- Environmental Pollution Control (Air Impurities) Regulation, 103
- Environmental Protection and Management Act (EPMA), 117, 194
- Environmental Protection and Management (Control of Noise at Construction Sites) Regulations, 46
- Environmental Protection and Management (Vehicular Emissions) Regulations, 40
- Environmental Public Health Act (EPHA), 59

- Environmental Public Health  
(Prohibition on Discharge  
of Trade Effluents into  
Water Courses)  
Regulations, 194
- Environmental Public Health  
Division (EPHD), 9, 52, 82
- Environmental Public Health  
(Hawkers) Regulation, 65
- Environmental Public Health  
(Toxic Industrial Waste)  
Regulations, 119
- Hazardous Waste (Control of  
Export, Import and  
Transit) Bill, 285
- Poisons Act, 117
- Sewerage and Drainage Act and  
subsidiary legislation, 194
- Trade Effluent Regulations,  
194, 195
- licensing  
  general waste collectors, 94
- Licensing Control, 116  
  hazardous waste, 117–18
- licensing exercise  
  street hawking, 64, 65
- lighter operators, 73
- Lim Chu Kang Dumping Ground,  
106
- Lim Swee Say, 125, 327
- Linggiu Dam, 139–40
- litterbugs  
  punishment, 56
- littering  
  fine for offence, 60  
  prevention of, 51
- Littering Behaviour Survey, 62
- Local Government Integration  
  Ordinance, 59
- long-term planning, 9–15  
  development control process,  
  10–14  
  integrated planning, 10–14  
  Singapore River clean-up, 14,  
  15
- long-term water sustainability,  
  xxvii
- Lorong Halus Dumping Ground,  
108
- low-capacity flushing cisterns  
(LCFCs), 172
- Lower Seletar Reservoir, 132
- M**
- MacRitchie, James, 127
- MacRitchie Reservoir, 127, 224
- Mah Bow Tan, 257, 263–64, 327
- malaria, 77
- Malaria Consortium, 87
- malaria control programme, 77
- Management of Hazardous  
  Substances, 118
- Mandatory Water Efficiency  
  Labelling Scheme, 253
- mangroves  
  Pulau Semakau, 76, 108  
  Sungei Buloh Wetland Reserve,  
  75
- Marina Barrage, 6, 10, 75, 185, 215  
  completion, 185
- Marina Catchment, 135, 215
- Marina Channel, 136

- Marina Reservoir Scheme, 135–36,  
184, 185, 215–16
- marine ecosystem  
Semakau landfill, 108
- market competition  
incineration plants, 245–47  
NEWater plants, 247–49  
waste collection, 244, 245
- market failure  
dealing with, 249–55
- mass burn technology  
incineration plants, 98
- Mass Rapid Transit (MRT), 45
- Master Plan, 11  
cleaning up Singapore River,  
70
- mechanical road sweepers, 53
- Ministerial Committee, strategies  
for sustainable development,  
xxv
- Medical and Veterinary  
Entomology, 86
- membrane bioreactor, 199
- membrane distillation, 157
- membrane filtration, 131
- membrane technology  
developments, 239
- Mercer quality of living survey,  
323
- mercury  
danger from, 103
- Milestones, 330–35
- Ministry of Communications and  
Information (MICA), 71
- Ministry of the Environment, 7  
Singapore River clean up, 14
- Ministry of the Environment and  
Water Resources, xiii, 9  
organization structure, 326
- Ministry of Law, 71
- Ministry of National  
Development (MND), 8, 71
- Ministry of Trade and Industry  
(MTI), 8, 71
- modern sanitation, xxviii, 183
- Montreal Protocol, 283–85  
Outstanding Ozone Unit  
Award, 252
- mosquito-borne diseases, 77
- Multilateral Environmental  
Agreements, 274, 283–88
- N**
- National Environment Agency  
(NEA), 9, 62, 79  
environmental health officers, 80  
road drainage, 212
- National Recycling Programme  
(NRP), 110
- National Sports Associations  
(NSAs), 222
- National Weather Study Project,  
267
- natural heritage  
conservation of, 75–76
- Nature Society (Singapore), 109
- NEWater, 15, 16, 125, 140, 238–39  
micro-filtration, 145  
plant operators, 146  
production of, xxiii, 144–47  
Public Communications Plan,  
148–50

- publicity programme, 15
- reverse osmosis, 145
- ultra filtration, 145
- ultra pure water, 151
- USEPA standards, 144
- WHO drinking water standards, 144
- NEWater plants
  - privatization, 247-49
- noise, 46-47
  - construction sites, 46
  - traffic noise, 47
- North and Spur Tunnels, 188
- O**
- Occoquan Reservoir, 278
- offshore landfill, 16, 106
- Opera Estate Outlet Drain Project, 213-14
- Orange County Water District, 142, 278
- organic solvents, 197
- ozonation, 133
  - packaging waste, 114
- ozone depleting substances, 251-52
- P**
- Pandan Reservoir, 130
- Pandan River, 130
- Parks and Recreation Department, 73
- Parks and Waterbodies Plan, 221-23
- particulate matter (PM) emissions
  - annual average levels, 41
  - comparison of levels, 41
  - control, 37, 40-44
  - heavy duty diesel vehicles, 42
- Paya Lebar Pumping Station, 181
- Peirce Reservoir, 127, 129
- Pelton, F., 208
- Pelton Canal, 70, 208
- People Sector
  - ABC Water Programme, 227
- People's Association, 168
- petrol, unleaded, 38
- pig farms, 69
  - phasing out, 133
- Planning and Development Control, 116
- Plant a Tree programme, 268
- plasma arc, 121
- plastic bags
  - environmental problem, 114
- Pneumatic Refuse Conveyance System, 96
- Poisons Act, 117
- pollution
  - keeping in check, xxv
  - pollution control, 308-309
  - polyvinyl chloride (PVC), 102
- Pontian catchments, 139
- population density, 92
- Port of Singapore Authority (PSA)
  - Singapore River clean up, 14
- port-related activities, 68
- Porter, Michael, 309
- post-independence period, xxiv
- potable water
  - pricing, 241-42

- price setting
    - gate fees at incineration plants, 242–43
    - potable water, 241–42
  - Primary Production Department (PPD), 133
    - Singapore River clean up, 14
  - Prime Minister's Office, 7
  - private sector
    - ABC Waters Programme, 226, 227
  - Private Sewer Rehabilitation Programme, 185
  - privatization, 95–96
    - household waste collection services, 95, 244–45
    - incineration plants, 245–47
    - NEWater plants, 242–49
  - PSI, 27
    - good range, 47
  - public
    - engagement with, xxix
  - public cleanliness, 51
  - public cleansing service
    - outsourcing of, 54
    - provision of, 52–54
  - public education
    - need to keep environment clean, 54–59
  - public goods, 253–54
  - public health problem
    - street hawking, 63
  - public recycling bins, 111
  - public sector
    - ABC Waters programme, 225
  - public transport
    - improvement, 45
  - Public Utilities Board, 8, 9
    - Code of Practice on Surface Water Drainage, 226
    - establishment, 126
  - public waste collectors (PWCs), 96, 111
  - Public Works Department (PWD), 7
    - flood alleviation works, 205
    - Singapore River clean-up, 14
  - Pulau Semakau, 76, 107
  - Pump Drainage System, 213
  - Punggol, 106
  - Punggol-Serangoon Reservoir Scheme, 136–37
  - pyrolysis, 121
- Q**
- Qatar
    - integrated waste management system, provision for, 106
  - Qualified Earth Control Professional (QECP), 219
  - Quantitative Risk Assessment (QRA), 117
- R**
- Raffles Museum of Biodiversity Research, 109
  - recycled water, 15
  - recycling, 109–13
    - centralized recycling bins, 110, 111
    - food waste, 121
    - households, 110
    - recycling collection services, 111

- Recycling Corner Programme, 111
- recycling rate, 113
- refuse chamber, 94
- refuse collection fees, 95
- Registry of Vehicles, 40, 42
- remote-sensing, 48
- reservoir creation
- environmental challenges, 137–39
- Reservoir Integration Scheme (RIS), 135
- resettlement
- farmers, 70
  - hawkers, 63–67
  - squatters, 70
- Resettlement Policy, 71
- resource conservation, 309–10
- reverse osmosis, 142, 145
- Road Drainage Improvement Task Force, 210–12
- cleansing of road drainage facilities, 211
  - improving outlet drains, 211
  - improving road drainage facilities, 211
  - patching up depressions, 211
  - raising low-lying roads, 211
- Rural Board, 7
- Rural Health Department, 8
- S**
- Safety Audit Scheme
- hazardous substances, 118
- sanitary systems
- building in Singapore, 192
  - Sanitary Works Regulations, 195
- Save Water campaigns, 167–69
- schools
- engaging, 264–65
  - environmental initiatives, 266, 267
- scientific research
- disease control, 81–83
- seagrass species, 76
- Seashore Life Programme, 265
- seawater desalting, 154–56
- Seletar Reservoir, 127
- Seletar/Bukit Timah Expressway, 134
- Seletar Water Reclamation Plant, 152
- Semakau Landfill, 16, 17, 104, 106–109, 276–77
- Garbage of Eden, 17
  - minimal impact on marine ecosystem, 108
  - renewable green energy system, 109
- Sembcorp Utilities, 153, 171
- Senoko Incineration Plant, 100
- Serangoon Sludge Treatment Works, 136, 181
- decommissioning, 137
- Severe Acute Respiratory Syndrome (SARS), 83–85, 119, 179
- averting crisis, 191–93
- Sewage Disposal Works, 181
- Sewage Treatment Works, 178
- Sewer Rehabilitation Programme, 184–85

- Sewerage and Drainage Act, 194
- Sewerage and Drainage (Trade Effluent) Regulations, 251
- Sewerage Department, 133
- Sewerage Master Plan, 177, 182, 183
- Singapore
- economic and social indicators, 320
  - global hydrohub, 16
  - growing population, 126
  - key statistics, 319–24
  - sharing experience, 18
  - wealth of biodiversity, 76
- Singapore Botanic Gardens, 222
- Singapore Chemical Industry Council (SCIC), 118
- Singapore Dragon Boat Association, 222
- Singapore Environment Institute (SEI), 117, 281–82
- Singapore Green Plan, 263–64, 289
- Singapore International Water Week, 16, 274, 296
- Singapore National Research Foundation (NRF), 310
- Singapore Packaging Agreement, 115
- Singapore Productivity and Standards Board, 252
- Singapore River, 135
- agencies involved, 14
  - Clean Rivers Education Programme, 74
  - clean up of, 6, 10, 14, 15, 67–75
  - early industries, 68
  - solving pollution problem, 89
- Singapore Sailing Federation, 222
- Singapore Sports Council, 222
- Singapore Technical Assistance Programme, 280
- Singapore Water Association, 282
- Small Island Developing States Technical Cooperation Programme, 280–81
- smoky vehicles, 42
- test, 43
- solar energy, 157, 311
- solid waste
- disposal fees, 243
  - management system, xxvii, 91–122
- split incentives, 254–55
- Sport Fishing Association, 109
- squatters
- resettlement of, 72
- Stamford Canal, 219
- Stockholm Conference, 7
- Stockholm Water Prize, 159
- storm water, 179
- street cleaners, 52
- street hawkers
- resettlement, 63–67
- street hawking, 63
- licensing exercise, 64
  - problems caused, 64
- street-hawking licences
- temporary, 65
- Student Environment Champions, 266
- sulphur dioxide emissions, 37–38

- annual average levels, 36
- comparison of levels between
  - selected cities, 36
- control, 35–38
- USEPA standards, 35
- Sungei Api Api, 221
- Sungei Buloh wetlands, 75, 138, 266
- Sungei Punggol, 221
- Sungei Seletar-Bedok Water Scheme, 132–34
- Surface Water Drainage Regulations, 195–96
- T**
- tax system
  - promotion of use of unleaded petrol, 39
- take-or-pay agreements
  - incineration plant agreements, 105, 245–46
- Tan Gee Paw, 142, 328
- Tan Kim Seng, 127
- Tebrau River, 69
- technical assistance programmes, 280–81
- Tender and Quota Allocation System (TAS), 252
- Teo Chee Hean, 273, 327
- Tianjin's Binhai New Area, 297
- tide-gate system
  - flood prevention for Central Business District, 206
- toxic industrial waste, 116, 117
- Trade Effluent Tariff Scheme, 195, 251
- Traffic Police, 42
- transboundary haze, 47–48, 290–92
  - ASEAN Haze Agreement, 291
- Tree Planting Day, 6, 58
  - launch of, 57
- trevally, 108
- Tuas Marine Transfer Station, 104, 107, 277
- Tuas South Incineration Plant (TSIP), 101, 103
- typhoid, 63
- U**
- ultra pure water (UPW), 151
- Ulu Pandan Incineration Plant (UPIP), 99, 100
- Ulu Pandan NEWater Plant, 153
- Ulu Pandan Sewage Treatment Works, 182
- Ulu Pandan Water Reclamation Plant (UPWRP), 140
- UN/ECF Regulation No. 24.03, 40
- unaccounted-for-water, 172–75, 235
- United Nations Conference on Environment and Development, 288
- United Nations Convention on the Law of the Sea (UNCLOS), 289
- United Nations Education, Science and Cultural Organization (UNESCO), 283
- United Nations Framework Convention on Climate Change, 287–88, 305
- United States Environmental Protection Agency (USEPA), 21–22



- USEPA Drinking Water Standards, 146
- USEPA recommended ambient quality standard, 39
- USEPA standard, air pollution, 47
- USEPA standard, particulate matter concentration level, 44
- USEPA standard, sulphur dioxide, 35
- unleaded petrol, 38
- Upper Peirce Reservoir, 69, 129
- Upper Seletar Reservoir, 132, 134
- Urban Redevelopment Authority (URA), 11, 133
  - Singapore River clean up, 14
- urbanization, 13
  - cap, 13
  - rapid, 79
- used water management system, 177–200
  - effective use of legislation, 180, 193–96
  - membrane bioreactor, 199
  - sludge management, 198, 199
  - technological developments, 179–80
- Used Water Masterplan, 182, 200
- used water quality
  - control at source, 196–97
- Utilities Save (U-Save), 167
- V**
- Variable Salinity Plant, 137, 158–59
- vector-borne diseases, 76–88
- Vector Control and Research Department (VCRD), 81
- Vector Control Unit (VCU), 78
  - history, 81
- Vehicle Quota System, 45
- vehicles
  - smoky, 42
- video recordings
  - evidence in court, 43
- Vienna Convention on the Protection of the Ozone Layer, 283
- volatile organic compounds, 197
- W**
- wafer fabrication industry
  - use of NEWater, 150–51
- waste collection, 93–95, 244, 245
  - daily, 92
  - households, 95
  - system, overhaul, 120
- waste collectors
  - disposal of incinerable waste, 103
  - licensing of, 94
- waste disposal, 16, 96–109
  - non-subsidy, 110
- waste disposal services
  - private-public-partnership approach, 104
- waste disposal technologies, 121
- waste management
  - integrated, 91–122
- Waste Management and Recycling Association of Singapore (WMRAS), 112
- waste management system, 120
  - integrated, 105

- waste minimization, 109, 113–16
  - main strategy, 122
- water
  - imported, 139–40
- Water Agreements, 139
  - expiration, 140
- Water Catchment Policy, 13, 14
- water conservation, 164–65
  - campaigns, 8
  - non-domestic sector, 169–71
- water conservation tax, 165, 241
- Water Conservation Unit, 164
- water consumption
  - domestic sector, 162
- water demand management, 161–76
  - save water campaigns, 163–64
- water distribution system
  - managing leaks, 173
- Water Efficiency Fund, 170, 171
- Water Efficiency Labelling Scheme, 169
- Water Efficient Buildings programme, 170, 176
- Water Efficient Homes programme, 168, 175, 176, 260–61
- Water is Precious campaign, 163
- water management policy, xxviii
- water management system, xxviii
- Water Master Plan, 129, 155, 160
- Water Planning Unit, 129, 160
- Water Pollution Control and Drainage Act, 194
- water pollution, 250–51
- water rationing, 125, 162–63
- Water Reclamation Plants, 178
  - buffer zones reduced, 186, 237
  - compact covered, 186
  - improving designs, 185–87
  - odour control, 186–87
- water recycling, 140–54
  - dual membrane demonstration plant, 142
  - history, 142–43
  - multiplier effect, 147
  - NEWater production, 144–47
  - NEWater uses, 146–47
  - public education, 148–50
  - studies, 143
  - use by wafer fabrication industry, 150–51
- water reserves
  - insufficiency, 69
- water resources
  - conventional, 127–29
  - history, 127–28
  - protected catchments, 128–29
  - unprotected catchments, 129–31
  - urbanized catchments, 131–37
- water supply
  - Four National Taps strategy, xxvii, 156–57
  - maximizing, 137
  - sources, xxvii
- water sustainability, 125–76
  - reservoir integration, 134–35
  - technological innovations, 157–59
- water tariffs
  - helping low income, 166
  - pricing review, 165–66, 241–42

- water treatment infrastructure, 6  
water treatment plants, xxiii  
Water Volunteer Groups (WVG),  
168  
WaterHub, 282–83  
Waterbodies Design Panel  
(WDP), 221  
Watermark Award, 271  
Watershed Managers, 228  
Waterways Watch Society, 218,  
269, 270  
West Nile virus, 83, 84  
Western Catchments scheme, 130  
Whampoa River, 70  
WHO Western Pacific Regional  
Office, 88  
Woodleigh Waterworks, 128
- World Bank  
assistance, 183  
loan for incineration plant, 98  
loan for PUB projects, 128  
report on solid waste  
management, 91
- World Health Organization  
(WHO), 77  
ambient air quality guidelines,  
22
- Y**  
Yaacob Ibrahim, 190–91, 201, 327
- Z**  
Zhangjiagang Water Supply  
Project, 298