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RECONCILING ECONOMIC AND ENVIRONMENTAL IMPERATIVES IN BATAM

LEE POH ONN

ISEAS YUSOF ISHAK INSTITUTE

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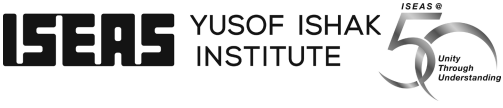

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FOREWORD

The economic, political, strategic and cultural dynamism in Southeast Asia has gained added relevance in recent years with the spectacular rise of giant economies in East and South Asia. This has drawn greater attention to the region and to the enhanced role it now plays in international relations and global economics.

The sustained effort made by Southeast Asian nations since 1967 towards a peaceful and gradual integration of their economies has had indubitable success, and perhaps as a consequence of this, most of these countries are undergoing deep political and social changes domestically and are constructing innovative solutions to meet new international challenges. Big Power tensions continue to be played out in the neighbourhood despite the tradition of neutrality exercised by the Association of Southeast Asian Nations (ASEAN).

The **Trends in Southeast Asia** series acts as a platform for serious analyses by selected authors who are experts in their fields. It is aimed at encouraging policymakers and scholars to contemplate the diversity and dynamism of this exciting region.

THE EDITORS

Reconciling Economic and Environmental Imperatives in Batam

By Lee Poh Onn

EXECUTIVE SUMMARY

- Batam's economic transformation has been accompanied by a marked degradation of its natural environment. Enforcement to protect the environment has often been inadequate on many fronts, exacerbated by population increases.
- Though regulations exist for the provision of public amenities like wastewater and sewerage treatment, existing facilities are run-down and ill-equipped to cope with the present demands.
- The capacity of reservoirs to meet the present demand for water is also strained because of the large population base, with illegal intrusion and squatters further threatening supplies.
- Economic and environmental imperatives can be reconciled if more emphasis and resources are put into enforcing regulations and protecting the environment.

Reconciling Economic and Environmental Imperatives in Batam

By Lee Poh Onn[1]

INTRODUCTION

Batam's economic growth has been nothing short of spectacular. In the 1990s, it experienced an investment boom fuelled by investments from Singapore. This lasted for two decades and transformed the economy and landscape of what was an outpost into a place with a major industrial city of over 1 million inhabitants.

This impressive pace of development has often been accompanied by a marked degradation of the natural environment. Mangrove areas have rapidly disappeared, floods have occurred around the city because of erosion caused by land clearing; illegal squatter settlements have intruded into protected forests, and toxic substances from the offshore cleaning of ships have affected the quality of Batam's coastal waters.

But all is not lost. Economic and environmental imperatives can be reconciled if Batam's development trajectory takes into account the impact of economic growth on the environment. Sustainable development is not impossible.[2]

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[1] Lee Poh Onn is Senior Fellow at ISEAS – Yusof Ishak Institute, Singapore. The author would like to thank Ulla Fionna, Francis E. Hutchinson and Siwage Dharma Negara for their guidance, and Jason Salim and Amoz Hor for translating text gathered from his interview questionnaires in Batam. Thanks also goes to Francis E. Hutchinson and Serina Rahman for very useful feedback on an earlier version of this paper, to Ooi Kee Beng for editing, and to Benjamin Hu for producing the maps on Batam.

[2] A.A. Hezri and S.R. Dovers, "Shifting the Policy Goal from Environment to Sustainable Development", in *Malaysia's Development Challenges: Graduating from the Middle*, edited by Hal Hill, Tham Siew Yean and Ragayah Mat Zin (London and New York: Routledge, 2012), p. 277.

Negative environmental impacts have to be controlled by regulations and by proper enforcement. The institutional framework (regulations and property rights) plays a central role to ensure that negative environmental impacts are accounted for and minimized. Problems generally arise from either an absence of regulations or property rights to regulate the environment or from the absence or lack of enforcement by the relevant authorities.

The Riau Islands Province (PRI) is made up of five rural regencies (*kabupaten*) and two cities or urban municipalities (*kota*). Batam and Tanjung Pinang are the two cities within PRI, while Bintan, Karimun, Lingga, Anambas and Natuna form the five regencies.[3] Batam Island's land area totals 415 km^2 (41,500 hectares).

This paper will examine the various manifestations and causes of environmental degradation against the backdrop of economic transformation, population growth and enforcement (or lack thereof). It also provides a comprehensive update where possible of the present state of environmental affairs in the municipality, and the challenges involved in maintaining the carrying capacity of the environment to cope with development.

Following a discussion of the methodology used in this study, the next section will examine the impact of government policies on economic transformation, and of migration on population growth. Regulations and enforcement measures are then discussed in general, followed by an examination of Batam's environmental management challenges across many fronts. These include industrial pollution (electronics industry); shipyards and pollution; cut and fill and land reclamation; general wastes; water pollution in reservoirs; wastewater and sewage treatment; mangroves and conservation; and air pollution emissions.

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[3] Mulya Amri, "A Periphery Serving Three Cores: Balancing Local, National, and Cross-Border Interests in the Riau Islands", in *The SIJORI Cross-Border Regions: Transnational Politics, Economics, and Culture*, edited by Francis E. Hutchinson and Terence Chong (Singapore: ISEAS – Yusof Ishak Institute, 2016), p. 155.

METHODOLOGY

The methodology for this study includes site visits, gathering of key informant materials from four interviews, and extracting of information from published primary and secondary sources.

Two site visits were conducted in March 2017 and April 2017 primarily to observe and update environmental conditions existing throughout the municipality. This also involved trips to various parts of the island including the fringes of forest areas and reservoirs, and to industrial sites. The first site visit also included discussion with officials at Badan Pengusaha Batam (BP Batam) to understand the present state of economic development and existing challenges faced by development planners.[4] The second visit included an informal interview with an academic/activist who shared deep concerns for the natural environment in Batam. This individual highlighted a number of locations in Batam where negative environmental impacts are visible.

Besides the two site visits, this study involved separately interviewing four individuals from 16 to 19 November 2016: an academic in the law faculty (17 November), two environmental NGOs (18 and 19 November), and a BAPEDAL[5] official (16 November). The interviewing was conducted by a fellow Riau resident to ensure that the respondents felt at ease answering the set of prepared interview questions. These in-depth interviews focussed on identifying major environmental challenges facing Batam, the existence or non-existence of environmental regulations to manage pollution, investigating reasons behind weak enforcement, identifying the various manifestations of environmental degradation and its impacts on communities, and challenges faced by those in charge of managing the environment and natural resources.

Relevant information found in public policy documents, statistical sources, online resources, and also numerous secondary published sources, and newspaper articles were also examined.

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[4] Visit on 8 March 2017 to BP Batam with Dr Francis E. Hutchinson and Dr Siwage Dharma Negara.

[5] Badan Pengendalian Dampak Lingkungan or Government of Indonesia's Environmental Impact Agency.

STATE POLICIES, ECONOMIC TRANSFORMATION, AND POPULATION GROWTH

State Policies and Economic Transformation

Batam's rapid economic growth can be traced back to 1971 when the central government designated it as an industrial zone by presidential decree.[6] The Batam Industrial Development Authority (BIDA) was established that same year to facilitate Batam's industrial development. Batam was thereafter designated by Pertamina, the state-owned oil and natural gas corporation based in Jakarta, as a logistics and operational base for the oil and gas industry.[7]

Policy planners had not anticipated for Batam to achieve rapid transformation in such a short period of time, as has happened. Initially Batam was set up with the intention to compete with Singapore, with the period 1971–75 being documented as the preparation phase during which major infrastructure and institutions in the urban municipality were established.[8] Ibnu Sutowo was the chief of BIDA during this period.[9]

In 1976, Batam was transformed by J.B. Sumarlin, Sutowo's successor, from being Pertamina's gas and oil outpost into an export-oriented industrial zone with manufacturing as its mainstay.[10] This change paled somewhat when compared to the next period of transformation, which was led by Dr B.J. Habibie in 1978.

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[6] Thomas Farole, *The Internal Geography of Trade: Lagging Regions and Global Markets* (Washington, D.C.: World Bank. 2013), pp. 218–19 <http://documents.worldbank.org/curated/en/435791468147845613/The-internal-geography-of-trade-lagging-regions-and-global-markets> (accessed 16 November 2017).

[7] Agus P. Sari, "Environmental and Human Right Impacts of Trade Liberalization: A Case Study in Batam Island, Indonesia", A Project of the Earth Council, San Jose, Costa Rica, March 1998, p. 8. See also Francis E. Hutchinson, *Rowing Against the Tide? Batam's Economic Fortunes in Today's Indonesia*, Trends in Southeast Asia, no. 8/2017 (Singapore: ISEAS – Yusof Ishak Institute, 2017), p. 3.

[8] Amri, "A Periphery Serving Three Cores", p. 160.

[9] Ibid.

[10] Ibid.

Under Habibie, Batam was not seen as a competitor of Singapore but as a complementary location to "capture the spillover effects of Singapore's growth".[11] In a presidential decree issued in 1978, Batam was declared a "bonded zone" exempted from a range of taxes (value added tax, luxury tax, and import taxes)[12] and was reoriented as a duty-free zone to take advantage of Singapore's development.

Habibie also envisioned Batam as "a site for environmentally-friendly industries".[13] A Negative Industries List was drawn up then to ensure that polluting industries would not be allowed to set up shop in Batam; however, the list did not provide clear definitions or standards of what constituted a polluting industry.[14]

The late 1980s and early 1990s marked the turning point when Singapore started playing a more active role and began investing in Batam in a big way. In December 1989, the then First Deputy Prime Minister of Singapore, Mr Goh Chok Tong, mooted the concept of the "Growth Triangle", involving Singapore, Johor in Malaysia, and Riau in Indonesia.[15] Investments from Singapore started flowing in, especially after the Riau Agreement was signed on 28 August 1990 between Singapore and Indonesia,[16] which lifted restrictions on foreign ownership. The rapid industrialization of Batam therefore "began in earnest with the involvement of Singapore government-linked companies"[17] and the establishment of the Batamindo industrial estate in 1990.

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[11] Ibid., p. 161.

[12] Ibid.

[13] Sari, "Environmental and Human Right Impacts", p. 13.

[14] Ibid., pp. 12–13.

[15] Wong Poh Kam and Ng Kwan Kee, "Batam, Bintan and Karimun: Past History and Current Development Towards being a SEZ", Asia Competitiveness Institute, Lee Kuan Yew School of Public Policy, National University of Singapore, 2009, p. 3.

[16] Sari, "Environmental and Human Right Impacts", p. 5.

[17] N.A. Phelps, "Archetype for an Archipelago? Batam as Anti-Model and Model of Industrialization in *Reformasi* Indonesia", *Progress in Development Studies* 4, no. 3 (2004), p. 211.

By 1990, the scope and geographical coverage was extended beyond Batam to include neighbouring islands where a Bonded Zone was now declared. After Soeharto stepped down in 1998, Indonesia's centralized structure was replaced by a policy of local autonomy and decentralization, where much of the power was devolved straight to the local government (cities and regencies).

The new laws that declared Batam an autonomous city did not involve BIDA initially. These laws later identified the city government as the main authority in Batam but with it involving BIDA in its activities after some "calls were made by some congress members".[18] Functional and jurisdictional overlaps between both authorities have created problems and confusion. This has impacted, for example, land use rights and also the enforcement of regulations. At present, this overlap has "complicated the local regulatory environment for firms and dampened consumer confidence".[19] It has also resulted in inertia and unclear lines of authority and action.

In July 2005, the status of the Batam Industrial Bonded Zone together with Bintan Industrial Estate and Karimun Industrial Cooperation Zone were upgraded to "Bonded Zone Plus". In 2007, Batam was granted Free Trade Zone (FTZ) status while Bintan and Karimun were granted enclave status.[20] In 2017, the central government began planning to rescind the status of Batam as a FTZ and turn the municipality into a Special Economic Zone (SEZ).[21] It remains to be seen what the exact implications of this move will be on Batam's development prospects.

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[18] Amri, "A Periphery Serving Three Cores", p. 164.

[19] Hutchinson, *Rowing Against the Tide?*, p. 32. Questionnaire Answer from Academic Respondent in December 2016 also highlighted this dualism in permit issuance.

[20] Farole, *The Internal Geography of Trade*, p. 219.

[21] Siwage Dharma Negara and Francis E. Hutchinson, "Will Batam Shake-up Bear Fruit?", *Straits Times*, 2 November 2017 <http://www.straitstimes.com/opinion/will-batam-shake-up-bear-fruit> (accessed 3 November 2017).

Population Growth through Migration

Batam enjoyed impressive double-digit economic growth rates in the 1990s up till the 1998 financial crisis. In recent years, growth has only averaged just above 6 per cent. See Table 1.

The municipality remains attractive though, and the movement of labour to the island has led to far-reaching demographic and environmental changes.[22] Migrant labourers have come from other areas in Indonesia such as West Sumatra, North Sumatra, and Flores Island in East Nusa Tenggara.[23] Even in recent years, Batam has been the fastest-growing municipality in Indonesia, with its population increasing at 11 per cent per year.[24]

In just forty-five years, Batam's population grew from 6,000 people in 1971 to 1.05 million in 2016,[25] representing a 200-fold increase (5.7 times per year). Batam's population is expected to increase further to 2.5 million by 2025.[26] As the ensuing discussion will show, population increase has exerted great pressure on the infrastructure and housing and also on the city's environment and its natural resources.

ENVIRONMENTAL REGULATIONS AND ENFORCEMENT

In Indonesia, the Badan Pengendalian Dampak Lingkungan (BAPEDAL), established by a presidential decree in 1990, is responsible for implementing environmental pollution control measures as well

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[22] Hutchinson, *Rowing Against the Tide?*, p. 18.

[23] Amri, "A Periphery Serving Three Cores", p. 168.

[24] Asian Development Bank (ADB), "Green City Action Plan 2035: City of Batam" (Manila: Asian Development Bank, 2016), p. 6. <https://www.adb.org/sites/default/files/related/72276/green-city-action-plan-gcap-batam.pdf> (accessed 24 August 2017).

[25] Batam Indonesia Free Zone Authority (BIFZA), *Development Progress of Batam*. Edisi II Vol. XXX 2016, (Draft Mei 2017), p. 39. BIFZA is also known as BIDA or BP Batam.

[26] ADB, "Green City Action Plan 2035", p. 11.

Table 1: Batam Economic and Population Indicators, 2012–16

	Remarks	2012	2013	2014	2015	2016
Gross Domestic Regional Product (Current Price)	Trillion Rupiah	83.75	99.66	107.21	121.13	121.13
Economic Growth	Percent	7.40	7.18	7.20	6.75	6.75
Population	People	1,235,651	1,135,412	1,030,528	1,037,187	1,055,040
Water	Litre/second	2,720.53	2,903.25	2,771.90	3,147.16	3,132.50

Source: Batam Indonesia Free Zone Authority (BIFZA), *Development Progress of Batam,* Edisi II Volume XXX 2016 (Draft Mei 2017) (accessed 21 July 2017).

as monitoring the environment and enforcing laws and regulations formulated by the Ministry of Environment. BAPEDAL consists of the Department of Water and Marine Pollution Control, the Department of Air Pollution Control, and the Department of Hazardous and Toxic Wastes Management. There is also the Department of EIA Implementation, which promotes the implementation of environmental impact assessments (EIAs).

Decentralization and Environmental Management

In 1999, the Indonesian government embarked on a decentralization endeavour that affected almost every policy sector including the environment. A considerable amount of autonomy was granted to districts and municipalities.[27] In 2002, BAPEDAL's responsibilities and powers were transferred to regional governments. Districts and municipality authorities known as local BAPEDAL or BAPEDALDA (in Batam, it was sometimes referred to as the Batam BAPELDA) are now directly in charge of enforcement. The Batam section of BAPEDAL directly manages and enforces environmental regulations formulated by the Ministry of Environment. Decentralization was expected to give local governments more empowerment and autonomy to manage environmental resources. Local governments are also supposed to be armed with a better understanding of the areas that they come into contact with. Be that as it may, environmental degradation has however continued to recur.

Perhaps the limited administrative, technical, and legal capacity of local governments on environmental issues hampered management. Not only was there a lack of legal and technical expertise, but most district and municipal governments used their expanded autonomy to "increase their regional incomes, with negative consequences for the environment within their territories".[28] Vested interests were at play. Provincial and

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[27] Nicole Niessen, "Decentralized Environmental Management", in *Environmental Law in Development: Lessons* from the Indonesian Experience, edited by Michael Faure and Nicole Niessen (Cheltenham: Edward Elgar Publishing, 2006), p. 143.

[28] Ibid., p. 166.

regency leaders "whose status and prestige have been elevated by the decentralization movement" have been increasingly observed to engage in rent-seeking behaviour.[29]

A higher degree of local autonomy combined with direct local elections has "shaped the attitude of most local governments to become more revenue oriented".[30] This focus towards local revenue generation resulted in and continues to result in exploitation of natural resources, pollution, and degradation of ecosystems because each local/municipal government considered the generating of income as a top priority.[31] It is therefore not surprising to observe that environmental degradation continued unabated post-decentralization in Indonesia and in Batam itself.

Environmental Regulations

Regulations have existed for a myriad of environmental issues ranging from sanitation to air, water and marine pollution; including the requirement of Environmental Impact Assessments (EIAs) for construction activities. Coverage in terms of regulations has been generally comprehensive. However, enforcement is absent or inadequate in most instances as the ensuing sections will show.

Indonesia's first environmental legislation involved the formulation of Law No. 4 in 1982 on Environmental Management. This was pushed by Dr Emil Salim, the then State Minister for Population and the Environment, who was very influential in shaping environmental

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[29] See Alan Khee-Jin Tan, "Environmental Laws and Institutions in Southeast Asia: A Review of Recent Developments", *The Singapore Year Book of International Law* (Singapore: Faculty of Law, National University of Singapore, 2004), p. 179.

[30] Budi Widianarko, "Democratization, Decentralization and Environmental Conservation in Indonesia", Plenary Presentation at the 9th Asia-Pacific NGO Environmental Conference (APNEC9) and 30th anniversary of Japan Environmental Conference (JEC), Kyoto, 20–21 November 2009, p. 4.

[31] Ibid.

policies, and who was a member of the so-called "Berkeley Mafia",[32] and a close aide to President Soeharto. Government Regulation No. 29 in 1986 on Environmental Impact Assessments supplemented this overarching environmental law. The latter required all new industrial plants to undertake EIAs (Analisis Mengenai Dampak Lingkungan, or AMDAL).[33] The committee of each EIA was to include NGOs (who are on the ground and can monitor infringements), and the affected communities. As Sari pointed out, although AMDAL was strong as a legislation, it was hardly enforced in practice.[34]

Non-enforcement in the 1990s was particularly severe in Batam. Only a handful of companies in Batam actually conducted a full AMDAL process; "the vast majority conducted none".[35] Regulations relating to air pollution have existed since 1999, and there have also been regulations regarding the management of hazardous wastes since 1999 and which were revised in 2008. In 2009, Law No. 32 in 2009 on the Protection of the Environment and Management was implemented, covering a range of issues including sustainable development, conservation, protecting and regulating environmental effects through EIAs, the management and disposal of wastes (including toxic waste substances), water quality standards, protection of the marine environment, and climate change, among other concerns.

The lack of supervision however has made it difficult to control or limit the extent of environmental degradation. Reportedly, there are only about eighteen officers on the entire Batam Island who have been tasked with supervisory/enforcement duties for all environmental matters.[36] Of these, fourteen are inspectors (enforcement officers) and four are investigators. This would amount to one officer to 2,305 hectares of land.

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[32] This was the term given to a group of U.S.-educated Indonesian economists who had great influence on the government of the day.

[33] Sari, "Environmental and Human Right Impacts", p. 17.

[34] Ibid., p. 18.

[35] Ibid.

[36] Questionnaire Answer from BAPEDAL Respondent, December 2016 and also Interview with Academic/Activist, 3 April 2017.

This ratio is however much better than in other instances in Indonesia, where one forester is allocated for every 100,000 to 300,000 hectares of forests.[37]

BATAM'S ENVIRONMENTAL MANAGEMENT RECORD

Batam's economic structure is dominated by manufacturing (56.27 per cent); construction (19.08 per cent); wholesale and retail (cars and motorcycle) (5.94 per cent); transportation and stowage (3.27 per cent); financial services and insurance (3.62 per cent); provision of accommodation, food and beverages (2.18 per cent); and information and communication (2.07 per cent). Where manufacturing is concerned, the electrical and electronic industry, and shipyards easily pose threats to the environment if not carefully managed, notably through the polluting of surrounding water areas and the atmosphere. A direct consequence is the expansion of construction activities which affects surrounding soils and forested areas. Rapid population growth has a huge impact on water usage and leads to an urgent need for proper management of water disposal and sewage. The following sections will cover all of these aspects, and a useful starting point is to discuss a study undertaken in 2000 on how managers perceived Batam's environment in the form of an environmental scorecard.

Environmental Scorecard in 2000

In the early 2000s, after development had already taken off, Batam's natural environment scorecard was perceived to be better relative to Indonesia as a whole.[38] A survey was conducted at that time with three groups of business people to collect their views on the environment.

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[37] Mark Poffenberger, ed., *Communities and Forest Management in Southeast Asia* (Berkeley: World Conservation Union (IUCN), 1998), p. 42.

[38] Robert C. Broadfoot, "Batam: A Formula for Growth", Summary Paper of the Executive Investment Forum in Batam, Political and Economic Risk Consultancy (PERC) Ltd, June 2003.

These were: managers residing in Singapore and Hong Kong with first-hand experience dealing with their Batam operations; managers with foreign direct investments residing in Batam itself; and managers based in Jakarta who were familiar with Batam.

Batam's natural environment was ranked better than Indonesia's in general: the overall grade was 5.27 compared to 9.12 for Indonesia (0 being the best grade and 10 the worst, see Table 2). The quality of the government's environmental protection/enhancement policies was graded 5.61 compared to 9.41 for Jakarta.[39]

Batam's grades, though considerably better than most other countries (except for Singapore's which had a better overall grade of 2.32), still warranted attention. Managers complained about the water quality in particular, as well as its cost. What also contributed to degradation in the quality of the environment was the rapid influx of new immigrants, which affected Batam's existing housing infrastructure and utilities. Such facilities had not developed fast enough to deal with the growing population. These issues have more or less persisted to this day.

Industrial Pollution Management (Electronics Industry)

The electronics industry was surprisingly perceived as "clean" by state planners even when it was known that it produced many toxic and hazardous substances. Batam was not well equipped for disposing of such substances up till the late 1990s. In 1996, BIDA facilitated the formation of Bina Lingkungan Hidup Batam (BILIK), a "semi-formal roundtable in Batam for the industrial community to learn about environmental regulation[s] in Batam".[40] This body was established as an information clearing house and a mediator for environmental conflicts.

But were regulations better enforced through this set-up? Anecdotal evidence suggests that enforcement did take place, but only after an official had first filed a complaint with BILIK. This was a reported incident of accumulated municipal wastes at the Bukit Samyong landfill, which was emitting smoke and noxious fumes and wastes were simply being burned

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[39] Ibid., section 3.8.

[40] Sari, "Environmental and Human Right Impacts", p. 15.

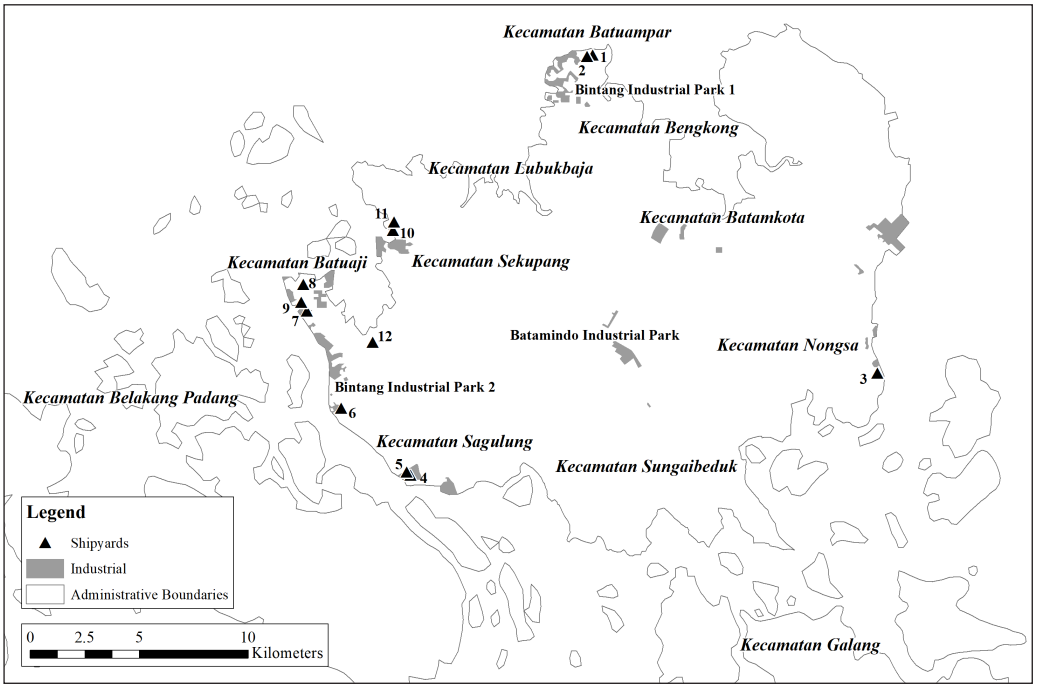
Table 2: Quality of Natural Environment, early 2000

Variable in Batam Survey	Batam	Variable in regionwide Survey	CH	India	INDO	MA	PH	SI	TH	VN
Quality of the government's environmental protection/ enhancement policies	5.61	Quality of the government's environmental protection/ enhancement policies	7.67	8.08	9.42	5.71	8.17	3.3	7.56	6.14
Air quality	5.01	Air quality	8.67	8.7	9	4.86	8.92	2	8.22	7.29
Water quality	4.96	Water quality	8.33	8.18	9	5.14	7	1.4	6.22	7.71
Noise pollution	4.84	Noise pollution	7.67	8.37	8.67	3.86	7.33	2.6	7.89	7.71
Traffic congestion	5.92	Traffic congestion	7.33	8.83	9.5	3.86	8.92	2.3	7.67	6
Average Grade	5.27	*Average Grade*	7.93	8.43	9.12	4.69	8.07	2.32	7.51	6.97

Notes: Grades range from 0 to 10, with 0 being the best grade possible and 10 the worst.
(CH=China, INDO=Indonesia, MA=Malaysia, PH=Philippines, SI=Singapore, TH=Thailand, VN=Vietnam)

Source: Robert C. Broadfoot, "Batam: A Formula for Growth", Summary Paper of the Executive Investment Forum in Batam, Political and Economic Risk Consultancy, Ltd, June 2003.

Figure 1: Districts, Shipyards and Industrial Areas in Batam



Source: Map provided by ISEAS – Yusof Ishak Institute. © 2017 ISEAS – Yusof Ishak Institute.

at the landfill without proper toxic and hazardous waste treatment. Facilities that could handle that function were then unavailable in the 1990s. The health hazard of the smoke also severely affected workers in neighbouring factories. Bukit Samyong Landfill is located in the Bukit Ampar Industrial Zone in Kecamatan Batamkota (see Figure 1). In this instance, the overlap in responsibilities between BIDA and the local government hindered immediate action.[41] Eventually, the official filed a complaint to BIDA and the issue was raised there. BILIK members then put pressure on BIDA to take action. Consequently, BIDA accelerated its plan to build a permanent waste management facility at Telaga Punggur, a remote area southeast of Batam.[42]

Electronics industries were sometimes located in close proximity to reservoirs and toxic substances would seep into and contaminate drinking water. There was also no toxic and hazardous waste management system back then in Batamindo Industrial Park, where most of the electronic industries are located. These wastes were either dumped into ordinary municipal waste facilities or piled up in proximity to these industries. When it rained, carcinogenic substances were washed into neighbouring reservoirs.

It was only in 1998 that regulations prohibiting toxic wastes was unveiled and passed. The illegal disposal of toxic wastes has been deemed a criminal activity since 2008 carrying a maximum penalty of Rp5 billion for an infringement against Law No. 18 in 2008 on Waste Management (Article 40).

Toxic industrial wastes are managed and collected by a private entity (PT Prasadha Pamunah Limbah Indonesia) and transported to Cileungsi in the district of Bogor in West Java Province for treatment.[43] It has been stipulated that industries should not be built in zones allocated for housing; however, the issue is with industrial sites that border on housing zones and has spillover impact on residential areas. In terms of zoning, the government has yet to make requirements with regards to the

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[41] Ibid..

[42] Ibid., p. 16.

[43] ADB, “Green City Action Plan 2035”, p. 11.

siting of pollutive industries. EIAs are however required for the setting up of manufacturing industries.[44] However, as noted earlier, only a few companies actually conduct a full EIA.

Interviews conducted reveal that enforcement is still spotty; the lack of staffing and funding constrains effective enforcement.[45] As the BAPEDAL respondent has indicated, whenever superiors choose to be "lenient", subordinates find it difficult to enforce regulations.[46] However, criminal charges have been laid for serious offences, such as the indiscriminate dumping of toxic wastes.

With the electronics industry on the decline in recent years,[47] it may appear that pollution levels are falling. However, measures must still be in place to ensure that regulations are enforced and that wastes are disposed of carefully. In 2016, there were four such cases that came to light.[48] The good news is that that same year, 19.7 hectares of land were allocated for the treatment of industrial toxic and hazardous wastes.[49]

Shipyards and Pollution

Presently, of the 198 shipyards in Indonesia, 110 are located in the Batam FTZ.[50] An EIA is needed before a shipyard can be constructed.[51] The approval comes from BAPEDAL. Figure 1 shows the location of the various shipyards in Batam. They are concentrated in Tanjung Uncang

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[44] Questionnaire Answer from Academic Respondent, December 2016.

[45] Ibid. and Questionnaire Answer from BAPEDAL Respondent, December 2016.

[46] Ibid.

[47] Leo van Grunsven and Francis E. Hutchinson, "The Evolution of the Electronics Industry on Batam Island (Riau Islands Province, Indonesia): An Evolutionary Trajectory Contributing to Regional Resilience?", *GeoJournal* 82 (2017): 475–92.

[48] Questionnaire Answer from BAPEDAL Respondent, December 2016.

[49] BIFZA, *Development Progress of Batam*, p. 30.

[50] *Jakarta Post*, "Govt Plans Incentives for Shipbuilders", 12 November 2014 <http://www.thejakartapost.com/news/2014/11/12/govt-plans-incentives-shipbuilders.html> (accessed 18 July 2017).

[51] Questionnaire Answer from BAPEDAL Respondent, November 2016.

(Nanindah, Batamec, ASL), Kabil (Anggrek Hitam, Labroy), Sekupang (Bandar Victory, Cahaya Samudera), Batu Ampar (McDermott, Bintang Intipersada), and Sagulung (Sentek, Citra, Patria Maritim).[52] Relocated shipyard companies from Singapore have in recent years been blamed for negative impacts on the marine environment and public health.[53] Indeed, one of the biggest sources of pollution are shipyards, as confirmed in the interview with the BAPEDAL official.[54]

Ships have also been disposing toxic wastes generated from offshore ship cleaning.[55] These wastes are not easily soluble and have eventually reached the northern coasts causing pollution and damaging the Putri Island mangrove ecosystem.[56] Not only were the mangroves destroyed, the floating seaweed and beaches around the island were also tainted by these wastes. It was reported that around 365,000 tonnes of waste were disposed off the Riau Islands in 2010, calculated on the assumption that 10,000 ships pass by these islands and dispose of about 10 kg per ship per year.

As an interviewed member of an environmental NGO stated, pollution from the shipyards is as yet not very evident as its levels are still under the threshold, and is not always easily visible.[57] However, sandblasting

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[52] Siwage Dharma Negara, "Can the Decline of Batam's Shipbuilding Industry be Reversed?", *ISEAS Perspective*, no. 4/2017, ISEAS – Yusof Ishak Institute, Singapore, 16 February 2017, p. 4.

[53] *Jakarta Post*, "Shipyard Industry in Batam Faces Restrictions", 15 March 2012 <http://www.thejakartapost.com/news/2012/03/15/shipyard-industry-batam-faces-restrictions.html> (accessed 19 April 2017).

[54] Questionnaire Answer from BAPEDAL Respondent, November 2016.

[55] AntaraNews.Com, "Toxic Wastes Polluted Waters off Northern Cost of Batam", 26 December 2012 <http://www.antaranews.com/en/news/86404/toxic-waste-pollutes-waters-off-northern-coast-of-batam> (accessed 19 October 2017).

[56] Mangrove consists of trees or shrubs growing in tidal flats of tropical and sub-tropical coastal regions that become inundated at high tides. Indonesia has about 25 per cent of the total distribution of mangroves in the world (4.5 million hectares of mangrove forests).

[57] Questionnaire Answer from NGO Respondent 2, December 2016. While travelling and observing seas at the coastal areas during my Batam fieldwork on 8 March 2017 and 3 April 2017, pollution was not visible to the naked eye.

(with silica) from the shipbuilding industry has visibly caused pollution. Rust from sandblasting has also been disposed in the sea. Rust is a toxic and hazardous waste, classified as B3 waste, potentially dangerous to marine life. A member of another environmental NGO that was interviewed commented that seafood from Tanjung Uncang should be avoided because of the high arsenic content found in the water, caused by sandblasting.[58] The media has reported that the seas around Batam have indeed been polluted with arsenic.[59] Marine pollution is most evident in Batu Ampar, Tanjung Uncang, Tanjung Sekupang, and Sagulung where shipyards are located.[60] Pollution from shipyards has also affected fishing activities.[61] It has been difficult to fully enforce environmental regulations in relation to shipyards because of a lack of personnel and funding. Only the bigger operators are supervised on a case-by-case basis by BAPEDAL.[62] Again, although the penalties are severe, regulations are not widely enforced.[63] About twenty sanctions are given out for breaches in quality standards or breaches concerning permits every year.[64] The NGO respondent suggests that funding be provided to increase the size of BAPEDAL's enforcement.[65]

Land Clearance, Construction, Cut and Fill, and Land Reclamation

Construction in Batam has had an extensive impact on soil erosion, after forested areas are cleared. In this instance, regulations have skewed behaviour towards activities that are environmentally destructive and

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[58] Questionnaire Answer from NGO Respondent 1, December 2016.

[59] Questionnaire Answer from Academic Respondent, December 2016.

[60] Questionnaire Answer from NGO Respondent 1 and Academic Respondent, December 2016.

[61] Questionnaire Answer from NGO Respondent 2, December 2016.

[62] Questionnaire Answer from Academic Respondent and BAPEDAL Respondent, December 2016.

[63] Questionnaire Answer from NGO Respondent 2, December 2016.

[64] Questionnaire Answer from BAPEDAL Respondent, December 2016.

[65] Questionnaire Answer from NGO Respondent 2, December 2016.

generally unproductive. In Batam, land is leased from the government for an initial thirty-year term, subsequently extendable to fifty and eighty years. BIDA stipulates that such leased lands have to be developed immediately. This was to discourage the acquisition of land for speculation. However, this rule was not accompanied by clear stipulations, which has allowed for transgressions to occur. In order to demonstrate that efforts are being made to develop the land, leasees sometimes simply clear the land, and keep it cleared upon receipt of the concession with no further follow-up activity.[66]

To measure the magnitude of this problem, an audit of lease arrangements was conducted to free up unused land including an estimated 7,000 hectares that had been allocated but had reportedly not been built upon.[67] All in all, 300 cases of unused land were uncovered.[68] Such cleared lands were prone to soil erosion, and cause deterioration of soil fertility, sedimentation of coastal waters and in reservoirs. Also, such eroded soils made areas "almost impossible to regreen" because of its loose texture.69 This has not only affected soils but caused sedimentation which destroys many coral reefs, fish habitats, and mangrove areas. The destruction of mangrove areas has been particularly evident to this author during his two field trips to Batam. Mangroves were destroyed by construction works, and some mangrove areas have now been completely wiped out.[70]

Rapid population growth leads immediately to a hugely increased need for housing. If this need for housing was met early, environmental impacts may have been better regulated. However, housing needs are met merely through the building of squatter settlements known as RULI or Rumah Liar.[71] Based on 2000 values, building a RULI costs Rp3 million

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[66] Sari, "Environmental and Human Right Impacts", p. 13.

[67] Hutchinson, *Rowing Against the Tide?*, p. 31.

[68] Ibid.

[69] Sari, "Environmental and Human Right Impacts", p. 13.

[70] Interview with Academic/Activist, 3 April 2017.

[71] Amri, "A Periphery Serving Three Cores", p. 169.

in Batam, compared to Rp185 million for constructing a proper house in the city and Rp80 million in the suburbs. There were 50,000 RULI in Batam in 2000 spread across sixty areas.[72]

In January 2017, it was reported that the municipal government had begun compiling a record of illegal squatter housing in Batam. This represented a first step for understanding the extent of the problem and will hopefully lead to the construction of formal housing for these squatters.[73] To date, 147 households in Lubok Baja alone are classified as squatters.[74] Squatters have not only destroyed and decreased protected forests and Batam's water catchment areas, they have also created problems for investors who have leased land from BIDA. These investors have to pay financial compensation to these illegal settlers if they wish to "reclaim" the leased land for investment purposes. In such instances, as the division of authority between BIDA and the municipal government is unclear, each side has had to be "nudged" to take action against squatters, and this has caused delays to the investment process.[75]

Unlawful construction has also placed strains on water supplies. Batam does not have many hills and natural water springs to generate supplies. Areas that serve as water catchments for reservoirs are also encroached upon by squatter constructions. The Batam land use plan classifies about 60 per cent of its 415 km^2 land area as water catchment areas and protected forests, while the remaining 40 per cent is zoned for development purposes.[76] Presently, perhaps just over 33 per cent of land in Batam is covered in forest.[77] Another more optimistic estimate places

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[72] Ibid.

[73] *Tribun Batam*, "Rumah Liar di Kota Batam Akan Ditata Tahun 2017. Ini Target ke Depan", 10 January 2017 <http://batam.tribunnews.com/2017/01/10/rumah-liar-di-kota-batam-akan-ditata-tahun-2017-ini-target-ke-depan> (accessed 2 September 2017).

[74] Single Data Rumah Liar, Pemerintah Kota Batam <http://perakimtan.batam.go.id/ruli/index.php?page=home> (accessed 16 January 2018).

[75] Amri, "A Periphery Serving Three Cores", p. 170.

[76] Ibid.

[77] Questionnaire Answer from BAPEDAL Respondent, November 2016.

forest coverage at about 50 per cent.[78] In 2000 alone, squatters illegally damaged about 20.57 km^2 of protected forests, and the government had to allocate Rp3 billion in 2001 to replant trees in these areas.[79]

Cut and fill is a widespread activity that occurs in Batam.[80] Land is cut not only for shipyard building but also for real estate projects like housing and the construction of hotels or for new streets. Huge areas of lands have been reclaimed along the coastlines of Batam for such developments. This has had "enormous impact on the environment and has influenced the landscapes appearance enormously. When driving around the island, you will see half erased hills all over the place."[81] This phenomenon was also clearly visible on a recent field trip made by this author in 2017.[82]

Batam's land belongs to BIDA, which decides where soil can be removed (or cut) from, and the investor is thereafter responsible for the filling process. BIDA also decides on spatial planning, where the best sites are reserved for industrial purposes while the municipal government is left with commercially less attractive and with areas and slopes that are harder to develop.[83]

The overlap in responsibilities between BIDA and the municipal government of Batam creates confusion for potential investors. It happens that investors who have purchased land from BIDA are subsequently informed by the municipal government that the land they just purchased

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[78] Personal conversation with Informant in Batam who obtained information from official in the Ministry of Forestry in Batam, 10 April 2017.

[79] Amri, "A Periphery Serving Three Cores", p. 170.

[80] *BatamNews*, "Kegiatan Cut and Fill 12 Perusahaan di Batam Juga Disetop, Ini Daftarnya", 5 December 2016 <http://batamnews.co.id/berita-18282-kegiatan-cut-and-fill-12-perusahaan-di-batam-juga-disetop-ini-daftarnya-.html> (accessed 16 April 2017).

[81] Milica Topalovic, Marcel Jaeggi, Martin Knuesel, Livio de Maria, Martin Garcia, Guila Luraschi,Magnus Nickl, Staphanie Schenk and Karl Wruck, "Singapore, Indonesia and Malaysia Project 1", ETH Zurich, Spring 2012, p. 52.

[82] Fieldwork travels to Batam on 8 March 2017 and 3 April 2017.

[83] ADB, "Green City Action Plan 2035", p. 7.

is actually part of a forestry reserve. Such disputes have affected up to 22,000 land titles in Batam.[84] Such discrepancies show that a greater level of coordination will need to take place.

In 2004, the local government of Batam approved a reclamation project in Bengkong District for the development of an integrated area of housing, public facilities, and services.[85] Reclamation activities along the coast of sub-districts Bengkong Laut, Sadai and Tanjung Buntung triggered slope deformation, river sedimentation, and soil erosion, and destroyed mangroves while reducing the fishery caught.[86] The size of the mangrove forest in these sub-districts dwindled from 24,000 m^2 to 2,500 m^2.[87] About 90 per cent of the mangrove disappeared. The loss of mangroves affected the communities relying on them for their day-to-day living. Mangrove wood is used as charcoal, firewood, building material and also for traditional medicine.[88] Flooding frequencies have also increased. Coral reefs which play an important role as spawning, feeding, and nursery ground for coastal organisms including fish were also badly affected.

In this case, development plans had not seriously considered conserving the mangroves in this area. The coastal areas, which had 23.24 per cent of reef coverage saw all the reefs eradicated. Fish catch was reportedly reduced by 55 per cent after reclamation. The catch of *belanak* fish (mullets), a species that thrives in mangrove areas, was reduced by 70 per cent.

Incomes for the fishers were also reduced. Previously, a fisher's earnings ranged from RM720 to RM900 (Rp2 million to Rp2.5 million).

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[84] Hutchinson, *Rowing Against the Tide?*, p. 17.

[85] Alpano Priyandes and M. Rafee Majid, "Impact of Reclamation Activities on the Environment Study Area: Northern Coast of Batam, Indonesia", *Jurnal Alam Bina* X, no. 1 (2009), p. 2. Data collection was undertaken through field observation, questionnaires, and in-depth interviews.

[86] Priyandes and Majid, "Impact of Reclamation Activities on the Environment Study Area", p. 4.

[87] Ibid.

[88] Ibid., p. 6.

Post reclamation, this stood at between RM360 and RM540 (Rp1 million to RP1.5 million) per month. Fishers who were able to catch 15 kg of seafood before the reclamation were only able to catch 5 kg after the reclamation. Some have had to diversify their income sources by working as labourers, and others as small-time traders.[89] Developers obtained their backfill materials from the surrounding hills (Districts of Bengkong and Batu Ampar), and it was reported that there was severe erosion and sedimentation as well as an increase in flooding, around the Bengkong District.[90] Elsewhere, sea water reportedly turned brownish red after reclamation.[91]

In December 2016, "cut and fill" activities were stopped by Batam City Government and considered a cause of flooding. In most cases, permission was not obtained in the first place. Separately, in March 2017, cut and fill was again causing flooding in Batam City and again, developers were not following regulations fully.[92] In addition, garbage in the drainage system was compounding the flooding problem. Cut and fill was also increasing sedimentation.

Land reclamation for ports comes under BP Batam, and BAPEDAL enforces the law to the extent it can.[93] However, enforcement activities are sometimes frustrated by companies using their "backing" — political or otherwise — to circumvent regulations.

The impact of the growing tourism sector in Batam on the environment needs to be carefully watched in the years to come. Batam is still viewed as an industrial/business zone rather than a tourist destination, though pockets of tourist activities exist. It is also difficult to isolate the impact of tourism on the environment due to a dearth of information. Also,

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[89] Ibid., p. 10.

[90] Ibid., p. 7.

[91] Questionnaire Answer from NGO Respondent 2, December 2016.

[92] *Tribun Batam*, "Titik Banjir di Kota Batam Terus Bertambah. BP dan Pemko Akan Lakukan Ini", 21 March 2017 <http://batam.tribunnews.com/2017/03/21/titik-banjir-di-kota-batam-terus-bertambah-bp-dan-pemko-akan-lakukan-ini> (accessed 16 April 2017).

[93] Questionnaire Answer from BAPEDAL Respondent, November 2016.

the construction of hotels is often lumped under general construction activities. Construction has indeed seen reasonably healthy growth rates averaging 7.55 per cent (estimated) over the period 2010–14.[94]

There is however increasing recognition of the tourism potential in Batam, and companies continue to invest and construct apartments and hotels. Sinarmas Land, for example, is involved in a S$400 million five-year project consisting of a high-end residential development with premium serviced apartments, commercial and retail outlets, and a wide range of hotels and condotels in Nuvasa Bay in Nongsa, Batam.[95] For Bintan, the potential of the tourism sector is great, and the eco-tourism and spa sector has been burgeoning in the past decade.

General Wastes

Currently, general wastes are disposed of in a controlled and managed landfill site of about 40 hectares in Telaga Punggur by the City Sanitation Department.[96] About 12 hectares have already been utilized.[97] Industries have to deposit their wastes in a special site (Kabil) owned by BIDA and managed by a private operator.

It is estimated that within five years, there will be no landfill space left for Batam City to dump its wastes. Currently, the municipal sanitation agency collects about 750 tons of household waste, 140 tons of non-toxic industrial wastes, and 50 tons of yard and street wastes daily.[98] Given the limited land resource for landfills, the cost of investment and operations of a landfill site and the need to recover material waste as

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[94] *Batam Economic Outlook: 2011–2014*, Tim Batam Outlook PPDSI, BP Batam, 2011, p. 37.

[95] *Business Times*, "Sinarmas Land to Invest at Least 4 Trillion Rupiah in Batam Project", 15 December 2015 <http://www.businesstimes.com.sg/real-estate/sinarmas-land-to-invest-at-least-4-trillion-rupiah-in-batam-project> (accessed 17 January 2017).

[96] ADB, "Green City Action Plan 2035", p. 10.

[97] Questionnaire Answer from NGO Respondent 1 and Academic Respondent, December 2016.

[98] ADB, "Green City Action Plan 2035", p. 10.

a useful resource, the government is looking into converting municipal waste to energy (WTE) using the appropriate and scientifically approved technology.[99] Batam is also considering the establishment of a General Municipal Public Service Body following the example of other cities. A WTE plant is planned, with a capacity of 700 tons per day expected to generate 15 MW of power that will be sold to the national electric company.

However, the authorities have to increase fees and identify ways to improve fee collection and reduce operating expenditures. There is also a need to ensure that collection regulations are effectively enforced and monitored. According to 2015 reports, the collection of solid wastes was insufficient, causing overspills and public health hazards.[100]

Water Pollution in Reservoirs

Batam's reservoirs can reportedly meet the demand of 1 million people.[101] However, reservoir capacity is already being strained, and the unofficial population now actually stands at more than 1.2 million. To make matters worse, space and catchment area constraints limit the construction of new reservoirs.[102]

Water supplies operate under a concession granted by BP Batam (BIFZA) to PT Adhya Tirta Batam (ATB) for twenty-five years from 1995 to 2020. The company serves 99.5 per cent of Batam's population, accounting for 260,000 connections. (The location of reservoirs in Batam is shown in Figure 2.)

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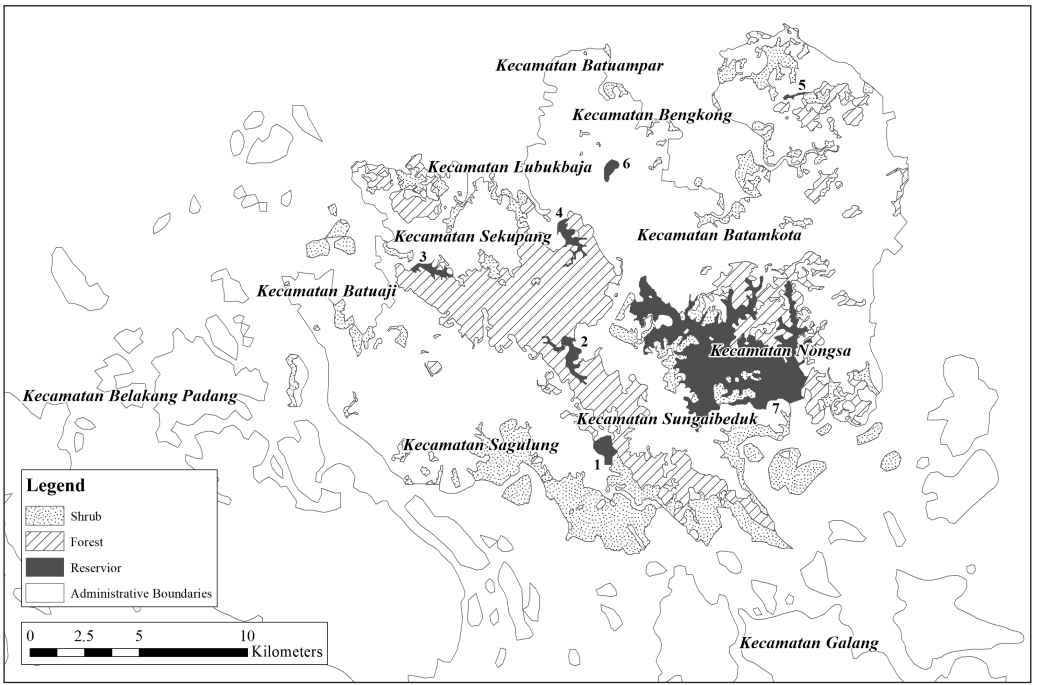
[99] Ibid., p. 41.

[100] Fieldwork travels to Batam on 8 March 2017 and 3 April 2017 confirmed that such wastes are still left uncollected around parts of the city; and ADB, "Green City Action Plan 2035", p. 46.

[101] The construction of these reservoirs have been enabled with cooperation between the Batam Industrial Development Authority (BIDA) now known as the Batam Indonesia Free Zone Authority (BIFZA), and local and international companies. See "Infrastructure and Facilities" at <http://www.batam-center.web.id/geninfo_facilities.html> (accessed 15 April 2017).

[102] Interview with Academic/Activist, 3 April 2017.

Figure 2: Reservoirs and Forested Areas in Batam



Source: Map provided by ISEAS – Yusof Ishak Institute. © 2017 ISEAS – Yusof Ishak Institute.

Batam depends solely on rainfall collected in dams for water, which makes production, distribution and water conservation a huge challenge. The ATB expects Batam to be in a water crisis after 2020. As the population continues to grow, there will be additional strains on supplies, and it is critical that the government plan for an increase in future supplies, or shortages in water supplies will be inevitable.

What is more worrisome is the pollution of the Duriangkang reservoir (in operation since 2001), which is the island's main source of water, supplying 75 per cent of Batam's freshwater (Table 3). The area of the reservoir is about 23.4 km^2. Pollution sources include industrial and human activities in the catchment. Storage capacity has also been affected by silting of the reservoir due to land clearance and construction near the catchment. The lack of enforcement has resulted in the illegal construction of housing and fishponds in the water catchment protected area, which has in turn impacted its water quality. Construction within the drainage catchments of the reservoir (linked to the sanitation programme) and poorly constructed and managed off-site sanitation facilities located within the catchment area has also affected water quality severely. The current average quality is rated poor: COD is 134.61 mg/l; BOD5, 58.22 mg/l, and ammonia, 10.5 mg/l.[103] The BOD levels in the reservoir has been known to exceed the acceptable standard by fifty times. BP Batam is responsible for managing the area surrounding the reservoir and has been facing constant problems with unauthorized intrusions, unregulated disposal of household and livestock waste (pig rearing), and illegal logging.[104] There is the case of the Baloi Reservoir where water sources there became so polluted that it had in effect become a "septic tank".[105]

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[103] ADB, "Green City Action Plan 2035", p. 27. The current average quality has been rated as poor: COD: 134.61mg/l, BOD5: 58.22 mg/l, and ammonia: 10.5 mg/l. BOD refers to Biochemical Oxygen Demand while COD refers to Chemical Oxygen Demand.

[104] *Batam Pos*, "ATB Berkewajiban Mengolah Air Baku, Pemeliharaan Waduk dan Sekitarnya Tanggungjawab Pemerintah", 9 January 2017 <https://batampos.co.id/2017/01/09/atb-berkewajiban-mengolah-air-baku-pemeliharaan-waduk-dan-sekitarnya-tanggungjawab-pemerintah/> (accessed 15 January 2018).

[105] Ibid.

Table 3: Reservoirs in Batam

Reservoir	Volume	Design Capacity	Capacity Installed	Production Capacity
Sei Harapan Reservoir	3,600,000 m^3	210 L/sec	210 L/sec	202.23 L/sec
Sei Ladi Reservoir	9,490,000 m^3	240 L/sec	270 L/sec	217.84 L/sec
Mukakuning Reservoir	12,270,000 m^3	310 L/sec	310 L/sec	300.83 L/sec
Sei Nongsa Reservoir	720,000 m^3	60 L/sec	110 L/sec	30.34 L/sec
Tanjung Piayu	Water from Duriangkang	375 L/sec	375 L/sec	290.30 L/sec
Duriangkang Reservoir	78,180,000 m^3	3,000 L/sec	2,200 L/sec	2,090.95 L/sec
Baloi Reservoir	270,000 m^3	30 L/sec	60 L/sec	—
Tembesi Planned Reservoir	41,876,080 m^3	600 L/sec	—	—
Rempang Reservoir	5,166,400 m^3	232 L/sec	—	—
Sei Gong Reservoir	—	20 L/sec	—	—
Total	151,572,480 m^3	4,682 L/sec	3,535 L/sec	3,132.50 L/sec

Source: Batam Indonesia Free Zone Authority (BIFZA), *Development Progress of Batam,* Edisi II Volume XXX 2016, (Draft Mei 2017) (accessed 21 July 2017).

Wastewater and Sewerage Treatment

Presently, Batam has an existing sewerage system at Batam Centre, which however is run down and does not operate efficiently.[106] More than 50 per cent of the city's domestic wastes also enters the Duriangkang reservoir which has drastically reduced the water quality and now require a greater treatment intensity. Many parts of the city have basic onsite systems like septic tanks and pit latrines. About 75 per cent of unconnected households use private septic tanks. The total waste management capacity at Batam stood at only 12 per cent of the required capacity in 2015.[107] To date, effective regulation does not exist to ensure that "sludge (or septage) is removed (pumped) at regular intervals, and the operation of tankers for septage pumping is not well managed."[108] About 70 per cent of the septic tanks has contaminated the ground water. Assuming the population to be about 1.2 million, there are in effect about 300,000 homes pumping out wastes.[109]

In 2012, the Directorate General of Human Settlements in the Ministry of Public Works and Housing provided technical assistance through Indii (AusAid) to prepare a master plan and feasibility study for the city's sewerage system. Four locations for a wastewater treatment plant have been identified, including one in the Batam Centre (Kecamatan Batamkota) and another in Bengkong. The government plans to provide a citywide central sewerage system by 2020. The 2020 target also includes increasing sewage pipeline to 81 km from 2 km in 2015, providing sewer house connections to 11,000 households from the present zero households in 2015 (which would then serve 16 per cent of the total population), and providing regular septage customers to

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[106] Ibid., p. 33.

[107] This is based on a population of 1,030,528 and water consumption of 150 litres per capita daily, and assuming that 80 per cent of the water is converted into waste. The daily human waste production will be about 123,000 m^3, while total waste management capacity stands at 14,720 m^3 per day or 12 per cent of the total capacity, ibid., p. 10.

[108] Ibid.

[109] Questionnaire Answer from BAPEDAL Respondent, December 2016.

5,000 household from 1,500 families in 2015.[110] Current human waste management capacity is 33 litres per second, and is only connected to 2.3 per cent of the population. By law, industries are required to build their own human waste management facilities, but again, controls have not been stringently applied.[111]

Actions are in place for the implementation of the preparatory stage for the sanitation programme which will take place from 2016 to 2018,[112] and the establishment of the regular septage pumping (desludging system) and management system from 2016 to 2017. Septic tanks will remain the principal form of urban sanitation as the sewer network is not extensive.[113] Septic tanks also require regular removal, hence a coordinated septage management system is required or this may not result in improved sanitation, health and environmental protection. Private companies will also be considered to provide septage collection and transport services. Communal septic tanks will be provided in the Cagar-Budaya area where an older village exists.

In 2016, BP Batam was reported to be completing a Waste Water Treatment Plant at Batam Centre.[114] To date, the Batam Wastewater Investment Master Plan, Stage 1 project, has been completed in Batam Centre, Bengkong and Sei Beduk and will continue to Stage 2. The Stage 2 Wastewater Treatment Plants are located at Batu Ampar, Sagulung, Sekupang, and Batam Centre (expansion of current facility).[115] These will take four years to complete, with an estimated investment of US$157 million.

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[110] ADB, "Green City Action Plan 2035", p. 35.

[111] Ibid., p. 10.

[112] This includes a review of the current sanitation master plan and feasibility study, establishment of a City Sanitation Committee, creation of a sanitation baseline, and the undertaking of a public campaign and socialization programme. Ibid., p. 36.

[113] Ibid., p. 38.

[114] Questionnaire Answer from Bapaedal Respondent, December 2016.

[115] *Jakarta Post*, "BP Batam Invests in Water, Waste Water Management", 12 December 2016 <http://www.thejakartapost.com/adv/2016/12/12/bp-batam-invests-in-water-waste-water-management.html> (accessed 12 December 2016).

Mangroves and Conservation

Forested mangrove areas in Batam have been reduced from 24 per cent of the total island size in 1970 to about 4.2 per cent in 2015.[116] Activities like construction, piling for the development of tourism, sand mining (cut and fill), logging, and dam building have been identified as culprits. In 2015 alone, Batam's Environmental Agency, BAPEDAL, reported that the island had lost about 800 hectares of its forests. Over 620 hectares have been lost from Tembesi in Sagulung itself because of constructions and where a dam was built. The Head of BAPEDAL, Dendi Prunomo, however reiterated that BAPEDAL took strict action against violators, though such violations have continued to recur.

To be fair, efforts have been made by the Batam authorities to conserve its natural areas wherever possible. In a Clean Development Mechanism (CDM)[117] project, the Ministry of Forestry (MoF) of Batam City (local government support), and YL Invest Co. Ltd. Japan (the funder) implemented a conservation and mangrove reforestation project on three Indonesian islands.

PT. Yamamoto Asri was then established by YL Invest Co., to implement this particular project in Batam. PT. Yamamoto Asri collaborated with the community in implementing this project. The total area covers 115 hectares, with the boundaries decided with Batam City officials and the local community involving three islands, Sekenah, Teraling and Tenggau in Batam City[118] Mangrove reforestation was

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[116] Tempo.Co, "Batam Loses 800 Hectares of its Mangrove Forests", 15 June 2015 <https://en.tempo.co/read/news/2015/06/15/206675016/Batam-Loses-800-Hectares-of-Its-Mangrove-Forest> (accessed 19 October 2016).

[117] CDM is designed to promote projects that reduce greenhouse gas emissions. An example of a CDM would be a replanting activity where bare areas are replanted with trees.

[118] Clean Development Mechanism Project Design Document Form for Small-Scale Afforestation and Reforestation Project Activities (CDM-SSC-AR-PDD) (Version 02), "Small Scale and Low-Income Community-Based Mangrove Afforestation project on Tidal Flats of Three Islands Around Batam City, Riau Islands Province, Republic of Indonesia" (Version 05, 15 April 2010), pp. 3–4.

carried out where such trees have never existed. There is no further documentation on this CDM project; however, the first stage of the project was completed successfully where healthy trees of up to 1.3 metres were recorded, covering an area of 29 hectares. There are also conservation efforts in Bintan, a regency in Riau Island Province to increase its mangrove forests.[119]

Air Pollution Emissions

Batam has been facing growing traffic congestion and air pollution.[120] This has been caused by an increase in motorized vehicles (currently over 1 million, and fivefold in comparison to 2000). The Green City Action plan noted that the "[c]ontinued reliance on, and uncontrolled growth, of private motorized transport is deemed unsustainable".[121]

A study on air pollutant emissions in Batam[122] published in 2015 (based on data collected in 2012) however identified the major sources of pollution in the municipality to be industries and power plants.

In this study, emissions were identified at their source: point source for individual source with large emission, area source for individual sources with small emissions, and mobile sources for emitters that move from one place to another.[123] The pollutants that were inventoried included nitrogen oxides (NO_x), sulphur oxides (SO_x), volatile organic compounds (VOC), 10 mm particulates (PM10), carbon monoxide (CO) and carbon dioxide (CO_2).[124]

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[119] See Ahmad Faisal Siregar, "Activity Report: Review and Policy Analysis of Community-Based Mangrove Ecosystem Management in Bintan District", MoF-ITTO PROJECT RED PD 064/11 Rev. 2 (F), 2013 (accessed 17 October 2016).

[120] ADB, "Green City Action Plan 2035", p. 59.

[121] Ibid., p. 59.

[122] Andy Triwinarko, Dwi Kartikasari, Didi Intardi, Syafei Ghozali and Dian Mulyaningtyas, "Air Pollutant Emissions in Batam: An Overview", *Jurnal Teknologi* 77, no. 23 (2015): 71–76.

[123] Ibid., p. 73.

[124] Results were also obtained from the local environmental agency the Badan Pengedalian Dampak Lingkungan (BAPEDAL) of Batam Municipality.

In terms of pollutants, industries and power plants produced 99 per cent of pollutant emissions (NO_x, SO_x, VOC, PM10, and CO) and 99 per cent of greenhouse gas (CO_2). See Table 4.

For emissions from mobile sources, 64 per cent of emissions of NO_x emissions came from roads (cars, buses, and heavy-duty vehicles) while 30 per cent came from the ports (marine transportation).

In terms of SO_x, 83 per cent came from road sources, 13.8 per cent from port sources; for HC, 99 per cent came from road sources; for PM10, 77 per cent came from road sources, and 22 per cent from port sources; for CO, 98 per cent came from road sources, and for CO_2, 30 per cent came from road sources and 68 per cent from port sources.[125]

It is important that the government identifies and then focuses on the main sources of pollution. However, as supervision is lacking for enforcement of violations in air pollution, this will remain a challenging task.[126]

Conclusion

Batam's spectacular growth in the 1990s has been accompanied by significant population increases, with negative impacts on the environment. The transformation of Batam's economy has not come without its costs, the most visible of these across all fronts in the form of environmental degradation.

It has been challenging for Batam to reconcile environmental concerns with economic development. Rapid population increases due to the economic opportunities available in Batam created strains on the carrying capacity of the environment, notably on water supplies, sewage and waste treatment and illegal land clearance activities. Construction activities increased in tandem with growth, with land clearance and cut and fill activities creating soil erosion and floods in the city. Mangrove

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[125] Total emissions for NO_x, SO_x, VOC, PM10, CO and CO_2 were 2,263.76 tons/year, 78.92 tons/year, 13,296.65 tons/year, 201.60 tons/year, 25,453.09 tons/year and 1,571,544.77 tons/year, ibid., p. 74.

[126] Questionnaire Answer from NGO Respondent 2, December 2016.

Table 4: Sources of Air Pollutants

Point Source	Industries and Power Plants	Other Sources (Hospital, University, Bank, Shopping Mall)	Total Emission Rates (ton/year)
Air Pollutant Emissions: Nitrogen oxides (NO_x), carbon monoxide (CO), 10mm particulates (PM10), Sulfur oxides (SO_x) hydro carbons (HC)	99% (for all chemicals and particulates)	1% (for all chemicals and particulates)	NO_x: 6,623.03 CO: 992.28 PM10: 203.62 SO_x: 4,376.51 HC: 2,506.63
Greenhouse Gas Emissions: Carbon Dioxide (CO_2)	99% (for all chemicals and particulates)	1% (for all chemicals and particulates)	CO_2: 3,453,688.43

forests have also been massively cleared from 24 per cent of the total land area to just 4.2 per cent in 2015.

The situation was exacerbated not only by increases in population but by the number of squatters who illegally occupied land and polluted waterways and cleared forested areas illegally in order to build their homes. Coupled with the inadequate wastewater treatment plants, with domestic wastes polluting the reservoirs, the problem remains unresolved.

Regulations that only encouraged land clearing without follow up created problems when lands were left exposed without any further construction activity. Soil erosion and sedimentation in turn affected waterways and destroyed coral and fish habitats.

In Batam, it was interesting to note that enforcement was weak or non-existent in many instances. For environmental degradation to be regulated, and for development to be sustainable, the Indonesian government will have to devote more resources towards supervision and enforcement.

Also, the carrying capacity of Batam's public amenities like waste and water treatment plants was incapable of meeting present demand. With population expected to increase to 2.5 million by 2025, there is even greater urgency to ensure that not only enforcement is in place but that additional amenities are constructed in time to ensure that population pressures do not affect environmental amenities. Also, the issue of squatters will need to be resolved.

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