

Water Worries

Special Issue

Jakarta's water is filthy, festering and flood-prone. Are there any solutions?



A bucket, bowl and foul water is all this boy has to bathe his brother in North Jakarta. JG Photo/Safir Makki

Clean Dreams

Scenes like this shame the capital, but what can be done?

Supply > 4 • Floods > 7 • Sewage > 10 • Garbage > 12 • Tides > 14

Introduction: What's Wrong, and What Can Be Done?

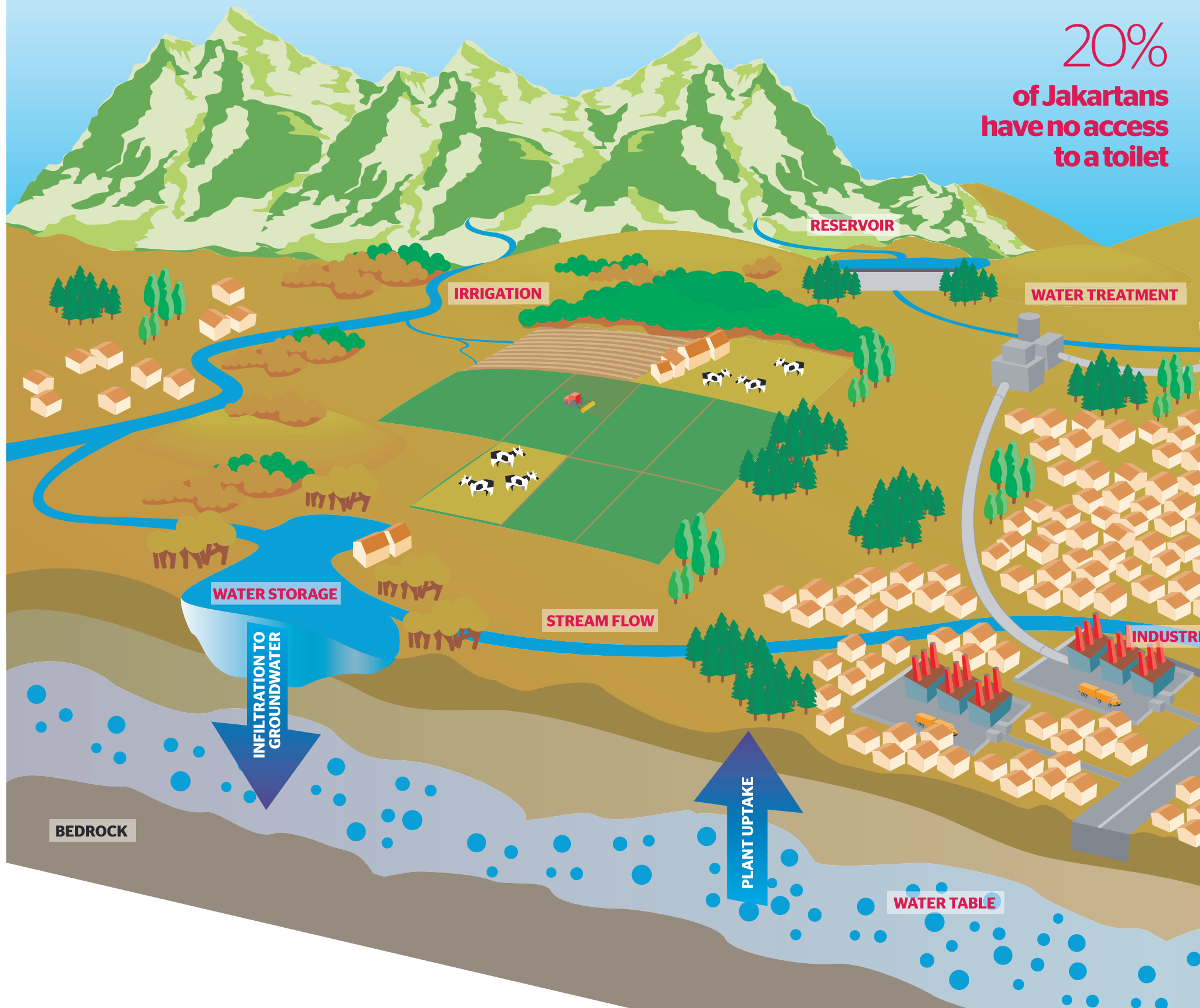
Is there a more crucial natural resource than water? Forgotten, abused or taken for granted, water dwarfs everything else when it comes to sustaining life.

But Jakarta lives with a perpetual water crisis that recalls an African proverb: "Filthy water cannot be washed." For millions of

Jakarta residents this is painfully true. There is not enough clean water for daily living, and dirty water, in the form of contamination and floods, brings disease and disaster.

Jakarta loses hundreds of millions of dollars to floods that seem inevitable. Partially caused by man-made garbage that blocks our canals

20%
of Jakartans
have no access
to a toilet



Inside

4 The Supply

The city's water is contaminated, leaky pipes are too few, and a water mafia preys on those without them

7 The Floods

Used as toilets and dumps, our overused rivers overflow and inundate those, rich or poor, living near them

and waterways, they are a painful reminder of a flawed infrastructure. Floodwater, and the almost total lack of a citywide sewage system, causes health problems, leads to lost productivity and destroys property.

Filthy floodwater pollutes the water system, one of many reasons why we can't drink from

the tap, and contaminates groundwater wells that provide up to 30 percent of the city's water. Those wells, unfortunately, contribute to the gradual sinking of Jakarta, which in turn means that tidal flooding is growing steadily worse.

All of these problems are connected, and there is no simple way to "wash" the crisis clean.

Nothing short of firm central and local government leadership, hard work, public participation and lots of money will save us and our city from disaster.

The following pages give you an idea of how serious the situation is — and what steps we must take. The time to act is now.

35 million
people expected to be living and using water in Greater Jakarta by 2020

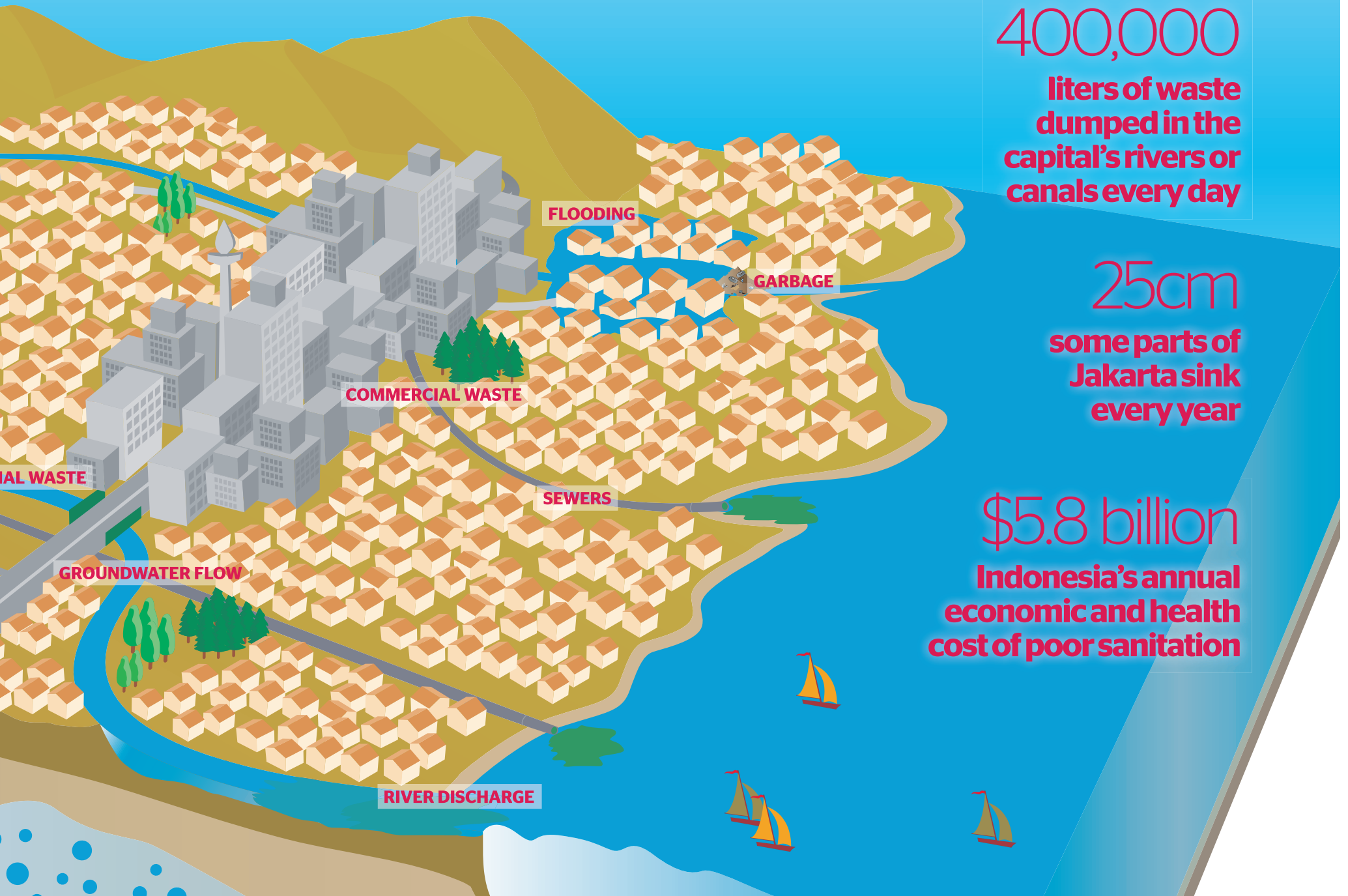
60%
less spending on infrastructure as a proportion of GDP than in Suharto era

140 elephants
the weight of raw sewage that goes into Jakarta's ground or waterways daily

400,000
liters of waste dumped in the capital's rivers or canals every day

25cm
some parts of Jakarta sink every year

\$5.8 billion
Indonesia's annual economic and health cost of poor sanitation



10 The Sewage
Illness and death are the result of a shocking lack of sewers or even basic waste treatment

12 The Garbage
Choked rivers come to a standstill as hundreds of thousands use them as everyday trash cans

14 The Tides
Assaulted from the sea, too, sinking Jakarta's cyclical inundations can only get worse

The Supply

How Our Water Is Fouled on Its Way to the Tap

Jakarta's dysfunctional water system hurts the poor the most

Report Joe Cochrane

Nurima's days of lugging water are over. Ever since the 49-year-old housewife moved to the North Jakarta slum of Utan Jati in 1980, she's faced the daily headache of going out with jerry cans to buy clean water from the local water truck for cooking, drinking and bathing her five children.

Those who couldn't afford to buy water from the syndicate of vendors — who charge 20 to 40 times more than what rich Jakartans pay for piped water — used foul river water to wash their clothes or clean their houses, or begged for well water from neighbors. But for drinking water, they had no choice but to buy from the vendors.

Even after PT Palyja, one of the city's two private water companies, installed a giant distribution tank nearby a few years ago, Nurima, who likes to wear brightly-colored jilbabs and even brighter red lipstick, still needed a pushcart to get her jerry cans back home.

Now, however, she and her neighbors need only walk over to the wall of their ramshackle homes and turn a knob. Since March, piped water has come to Utan Jati.

"It's so much cheaper," Nurima said, looking down at the shiny new water meter in her front yard, made possible through a grant program run by the World Bank and Palyja. "It makes everything easier, and the water is cleaner."

Cheaper, yes, but really clean? Not exactly.

A Grim and Dirty Journey

The journey that ends in the buckets that Nurima puts under her water spigot begins about 85 kilometers to the southeast, in the foothills of West Java and the Jati Luhur reservoir and its two billion square meters of reasonably clean water.

By the time it reaches North Jakarta, as well as the fashionable homes of Central and South Jakarta, the water is not potable.

The water gets increasingly filthy as it travels down a 68-kilometer canal filled with trash and human feces and into water treatment plants in the city, where it's purified and becomes drinkable again. But once it goes into the city's 5,500-kilometers of leaky underground pipes, the water can be contaminated by sewage, solid waste and salt water, making it undrinkable.

"Jakarta is facing urbanization that is straining its infrastructure. It is straining it beyond belief," said Hongjoo Hahm, lead infrastructure specialist at the World Bank in Jakarta. "Jakarta has to learn to live with water."

No argument there. City dwellers can survive floods and build giant walls to block tides from the Java Sea from inundating their homes, but they cannot survive unless they have clean water to drink. Jati Luhur reservoir is literally Jakarta's lifeline, supplying up to 60 percent of its water needs, but problems with its long-term quality and consistent flow keep water experts up at night.

Water from the reservoir reaches Jakarta though the West Tarum Canal. However, it enters the canal via the Citarum River, Java's largest and

most polluted waterway. The garbage and raw sewage of millions of people, as well as waste from factories, is dumped into the Citarum, and as some of the river is diverted into the West Tarum, its toxins follow.

Floating islands of waste block the canal's flow by up to 90 percent in some areas. Some canal water is also diverted for irrigation, meaning that polluted water is used to grow crops.

Then there are the human settlements, both legal and illegal, along the canal itself. The homes, restaurants, mini-factories and brothels all use the canal as a toilet, shower, trash can, even burial site. On a recent visit, a Jakarta Globe reporter saw a headless chicken flow down the canal and disappear.

Frighteningly, 25 percent to 30 percent of water going into the city's plants doesn't meet official health and quality standards for untreated water. "The feeling among the people who live along the river is that the river is their backyard," said Budhi Santoso, a senior staffer at the National Development Planning Board (Bappenas). He jokingly noted the "helicopter" problem along the West Tarum — a nickname for the makeshift wooden toilets hanging over the banks of the canal.

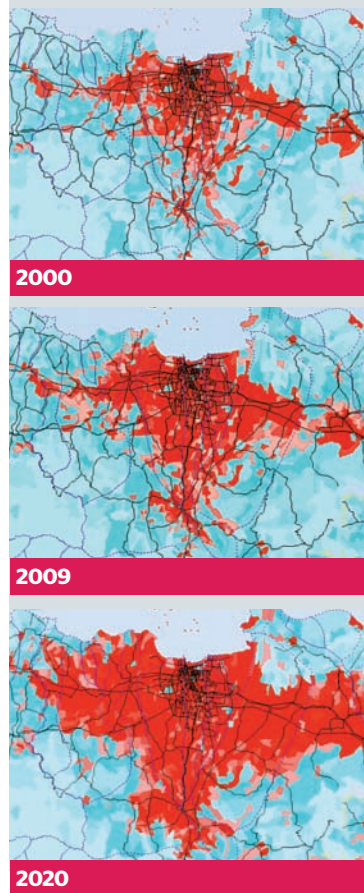
Bappenas and the Asian Development Bank are set to begin a long-term — \$3.5 billion over 15 to 20 years — integrated rehabilitation program in the Citarum River Basin. This will involve cleaning and repairing the banks of the river and canal, relocating thousands of illegal squatters and launching a massive antipollution education program for local communities.

"The story of the Citarum is linked to the story of Jakarta," Budhi said. "If we have a good supply of raw water, it will improve water quality and quantity."

There's talk that the project, scheduled to begin this year with an initial infusion of \$50 million in

Red Alert

Government maps of how Jakarta's population has grown in a decade and is projected to grow in the next. Lightest blue areas are less than 10% urban, darkest red over 90%



40%
of homes in
Jakarta have
no piped water

funding, will be a model for both the country and Southeast Asia.

Another proposal is a 70-kilometer closed pipeline to deliver water from Jati Luhur, which would keep out contaminants but cost \$187 million.

Avoiding Hard Questions

Infrastructure analysts say that government officials, after avoiding Jakarta's water problems for years, are now gung-ho about projects at all levels. The reason, they say a bit cynically, is because Indonesia now has a system of direct elections and politicians have to answer to voters.

Whatever the motivation, their timing is perfect. In April, Jakarta Governor Fauzi Bowo signed an order for a six- to 16-fold increase in tariffs on groundwater extraction by factories, hotels, offices, shopping malls and large homes.

The move, to make the tariffs equal to the price of piped water, is a first step in a multiyear process of weaning the city off of groundwater, the overuse of which has caused some parts of Jakarta to subside by as much as 25 centimeters a year. The World Bank warns that North Jakarta could be overrun by sea tides by 2018 if nothing is done.

"In 1994, the World Bank said, 'Stop the groundwater extraction.' [The city administration] didn't listen," Hahm said. "The message hasn't changed in 15 years."

Aside from the "sinking city" problem, some of the city's freshwater aquifers have been unable to replenish themselves fast enough because of excessive groundwater extraction. As a result, some city residents complain of seawater seeping into their wells.

Nani, a 33-year-old housewife who lives in North Jakarta, recalled peeling soap off her children's skin during bath time due to the high level of salt in the well water. Now her house has piped water.

"For cleaning, we even used



The journey that ends in your bucket. From left: Much of Jakarta's water gets its start in the Jati Luhur reservoir, before flowing into the trash-clogged Citarum River, where riverside toilets are a common sight. The water

groundwater," she said, "even though we knew it was salty."

Government officials and water experts say that Jati Luhur, with the present state of its delivery system, could not meet all of Jakarta's water needs if all groundwater extraction came to a sudden halt. Shockingly, only about 60 percent of Jakarta homes are hooked up to piped water, and as many as 30 percent rely solely on groundwater. The rest are dependent on water truck operators.

An immediate total ban on groundwater extraction could cause chaos due to water shortages, but that is hardly worth worrying about since a ban would be impossible to enforce unless special teams went door-to-door demanding that residents shut down their wells.

"We cannot do it suddenly, it must be done gradually," said Iwan Nursyirwan, director general for water resources at the Ministry of Public Works.

Even with a grace period of several years, the city would still need additional sources of surface water for household demand. The central government is currently negotiating a loan from South Korea to build a new reservoir in Karian, West Java, to service Jakarta.

Private Sector Solutions

Bappenas is also promoting private-sector infrastructure, noting that there are currently 25 water-related projects worth a total of \$775 million in various stages. The board's aim is to get private companies to build and operate new reservoirs and water delivery systems and sell water in bulk to local governments.

"Our recent calculations show that we lack infrastructure development and will not reach our [United Nations] Millennium Development Goals by 2015 unless we double investment," said Bastary



Buckets, wells and open troughs characterise daily access to water for many city-dwellers, including this family in Penjaringan, North Jakarta. JG Photo/Safir Makki

Continued overleaf



then flows into the city's treatment plants, where most of the impurities are removed. But in most cases, Jakarta's leaky system of pipes fouls the supply again before it reaches your tap. JG Photos/Safir Makki, Afriadi Hikmal

'The only way forward is to expand the network and make sure everyone has access to piped water. Raising tariffs — that's the only solution.'

Philippe Folliasson, PT Palyja president director

From previous page

Pandji Indra, director of Bappenas's public-private partnership program.

He noted that in the 1980s, during the Suharto era, the nation spent 5.5 percent of its gross domestic product on infrastructure development, but only 2.2 percent over the past five years. Malaysia spends 7 percent, by comparison, and Vietnam 4 percent.

"Electricity is a priority, but so is water," Bastary said. "In Jakarta, Bandung, Bali, we will face a water crisis in the next five years."

There's no shortage of skeptics about public-private partnerships for water infrastructure. Some say that the idea is upside-down, that the private sector shouldn't be selling water to the government. Others say that Indonesia would be hard-pressed to find companies willing to invest \$100 million to build a reservoir unless they had the sole authority to set bulk water tariffs, which is obviously a touchy issue.

"You can't get the private sector to put money in until they have security of contract and they can get a reasonable rate of return on their investment," said Scott Younger, president commissioner of Glendale Partners, a Jakarta-based project development and consulting firm.

He said that the city also needed to think more creatively about water sources, including rainwater.

Aart van Nes, a civil engineer who consults for the city administration on water issues, noted that about half of the water from Jakarta's treatment plants doesn't even get to customers because of leaks in the distribution system and illegal hookups.

Getting the Hookup

Jakarta's water supply is directly linked to the ability of the city's two privately run water providers, Palyja and PT Aetra Air Jakarta, to hook up more homes to piped water.

"To expand coverage, you need additional water. Even if you halt illegal connections and leakage, it's not enough," said Philippe Folliasson, president director of Palyja.

50%
of treated water leaks out before getting to users

Since the city signed contracts with the two water providers in 1997, connections to Jakarta's piped water network have nearly doubled to around 800,000. But the expansion effort is in danger of faltering because the city hasn't approved an increase in water tariffs in two and a half years.

Supporters of tariff increases — who appear to be in the majority both in and outside the government — note that the city's poor who don't have piped water pay 20 times more than the current tariff rate to water truck gangs, and inflation alone dictates that rates must be increased. "The only way forward is to expand the network, increase connections and make sure everyone has access to piped water," Folliasson said. "Raising tariffs — that's the only solution."

Indonesia is not the only country to face this quandary, experts say. Globally, the poor pay far more for water because they must get it through informal sources. But they also say that Indonesian politicians, specifically the Jakarta City Council, are more worried about a backlash from middle-class and high-income voters if their home water bills go up.

"These politicians somehow believe that water should be free. ... They have this skewed notion that they are doing a public service by keeping water prices artificially low," Bastary said. "But all they're doing is preventing poor people from getting access to piped water."

Ahmad Lanti, the founding commissioner of Jakarta's water regulatory body, said, "This is a very difficult puzzle. If you want to raise the tariff on poor people to create equilibrium with rich people, there will be social unrest — even though they are paying more for vendor water. It's a vicious cycle."

Fortunately, more and more slum dwellers are escaping. Water connections and meters subsidized by the Palyja-World Bank scheme are also being installed in Muara Baru, North Jakarta, arguably the city's poorest area, despite threats of violence from local water vendors.

Back in Utan Jati, Sriyati, 37, proudly shows her June water bill of Rp 20,000 (\$2), about half what she used to give to vendors. But it will take time for her to get used to the power of being a paying customer.

"Last week there was a problem, and we didn't have any water for a day," she said. "We just waited." When told that she had the right to call customer service to complain, she seemed stunned. Then she smiled at the thought.



Pipe-filled drums sold to them at relatively punishing prices are many people's only access to clean water. JG Photo/Safir Makki

Pay Up: How the Water Mafia Controls Access

In the "neighborhood unit" called RW 12 in North Jakarta's Penjaringan district, residents live in the most crowded area in the capital, if not Indonesia.

While a neighborhood usually consists of several hundred households, RW 12 is overflowing with 3,201 of them, according to official figures. Based on an average of four people per tiny house, there are at least 12,804 people crammed into these 23 hectares, although one local aid worker estimated the population at closer to 38,000.

It's no surprise that life in this former swamp is pretty dismal. Seawater invades groundwater wells due to excess extraction in North Jakarta, and pollution is frightening because there is an almost complete lack of sanitation facilities.

To add insult to injury, the city-owned water operator, PDAM, used to refuse to provide water connections to most of RW 12 because its residents are illegal squatters.

That's the official line. Under the table, PDAM workers, however, have been known to install connections to anyone who can afford to pay, local residents say. Residential "entrepreneurs" — Jakarta's legendary street mafia, or preman — exploited the situation by selling clean water to residents from their own illegal house connections. Water costs Rp 500 (50 cents) for a 19-liter jerry can or two full buckets, and Rp 1,500 for a cart that holds 120 liters.

Programs by nongovernmental organizations to connect such slums to the city's piped water system are often met with threats and sometimes violence by these low-end operators. As a result, Jakarta's poor pay 20 to 40 times more for their water than rich residents who have a connection.

"Our family spends about Rp

60,000 a month, and it's troubling because we have to go back and forth and queue for water," said Tona, 45, a housewife and mother of three.

Leon Sumihar, who runs the Water for All program in the nearby Muara Baru neighborhood, said that preman regularly threaten workers from his company, Palyja, one of the city's two privately-run water providers, who are installing connections and meters there under a World Bank program.

"The preman operating water sales are low income, low education and they don't care about policemen. They don't care about anybody," Sumihar said.

When the connection program was launched in Muara Baru, a mob of gun-toting water vendors protested and smashed cars. They refused to shut down their water selling businesses even after being offered compensation because the profits are so good.

The connection program finally appears to have the upper hand in Muara Baru, where residents now

pay around Rp 20,000 a month for piped water. Under the tariff program, they receive 15 cubic meters of water per month at the lowest rate, Rp 1,050 per cubic meter. If they use more, the rate goes up.

Back in Penjaringan, RW 12 finally received connections for 60 households three months ago under a program involving PDAM and the International Development Research Center of Canada. The program, called the Communal Master Meter, is similar to the one in Muara Baru, where residents get 24-hour piped water and are billed monthly. It was no easy task to convince water vendors to accept the program.

"It took us about a year because we had to approach and explain to those people," said Vincent Hermanus Pooroo, an urban water and sanitation officer from Mercy Corps, an international aid organization working in the area.

Some local residents and aid workers claim that PDAM staff are also unhappy with the master meter program because they received payoffs from the water vendors to allow them to stay in business.

"They're afraid to lose their income, but they have enjoyed profits for dozens of years. It's time for people to enjoy cheaper water," said Sutarman, a community leader, referring to vendors and the PDAM workers who exploited the situation.

As part of the program, an agreement was reached allowing vendors to continue selling their water while the majority of the houses wait for connections.

The problem is that the water flow is low, only about 12 cubic meters a day, which is less than the expected 17.4 cubic meters from the initial design. One recent weekend, the water didn't flow at all, forcing residents to go back to the vendors. **Hera Diani**



Poor homeowners without metered connections pay more for water.

The Floods

A Swelling City Is at the Root of the Problem

Checking development and migration are key factors in fighting back rising waters

Report **Dewi Kurniawati**

Sarini sat at the backdoor of her one-room shack beside the deceptively calm Muara Kali Adem River in North Jakarta. Under a scorching sun one recent afternoon, the 40-year-old wrapped herself in a discolored piece of batik cloth displaying the motif of her native Indramayu in West Java.

She shares her home of used wooden planks with her husband and two children. Together, they've braved the wrath of the Muara Kali Adem, including the great flood of 2007, and they wonder when the next one will come.

"I remember the last big flood. It was about 10 p.m. and suddenly the water level rose up to our chests. We all rushed out, trying to save ourselves," she said.

The residents of the illegal neighborhood, a squatter area on the flood plain of the river, saved themselves that night by crawling to safety through a hole in a thin wall separating the slum from an upscale housing complex next door.

"We built tents in the streets.

When the water subsided, we all came back here. Where else could we go?" Sarini said.

Sarini and her family are among more than 150 squatters living alongside the Muara Kali Adem in this community. Across North Jakarta, there are 43,480 households, or more than 150,000 people, living in various squatter settlements, many of them near rivers and canals, according to an April 2008 report by MercyCorps, an international aid organization.

Ester Rahayu also lives in North Jakarta, but the 48-year-old stock trader and a mother of two lives in the upscale Kelapa Gading area. She also remembers the 2007 floods. "I was on my way to take my son to school, but the car's engine stopped, and then we had to walk in knee-high dirty water," she said.

Unlike Sarini, Ester and her family were able to check into a nearby hotel to escape the floods. Though the flood was traumatic and inconvenient, Ester said she is not about to move out of Kelapa Gading. "Floods are part of life in Jakarta — where else do you want to go?"

Although they are worlds apart — rich and poor — Ester and Sarini



Floods like this one in Kelapa Gading in 2007, which submerged main roads and dozens of blocks, are likely to continue unless development is halted. JG Photo

are linked by the massive flood that hit the capital in early February 2007, killing 52 people, displacing 450,000 residents and leaving untold numbers sickened by illnesses ranging from diarrhea to dengue fever. The National Development

Planning Agency estimated economic losses from the flood at Rp 8.8 trillion (\$871.2 million).

While Jakarta has been shaken by the occasional earthquake, flooding has so far been the city's gravest threat. Severe floods in

January 1996, February 2002 and February 2007 were particularly dreadful. In 2007, almost 60 percent of the city was plunged into water up to seven meters deep in some areas.

North Jakarta, where Sarini and Ester live, bore the brunt of both the 2002 and 2007 floods, when 39 percent of the district was under water. Those floods, triggered by 72 hours of continuous rain, finally forced the central government and city officials to pay serious attention to this recurring problem, but tackling urban flooding is incredibly complex. In a democratic era, however, city leaders can either do something to tackle flooding or face being voted out of office.

Nature vs. Mankind

Tarjuki, the head of water resource maintenance with the city's Public Works Department, says the factors that cause the flooding issue are multilayered, and are underpinned by the fact that 40 percent of the city lies below sea level. Second, 13 rivers enter and flow through the city from Bogor, Depok, Tangerang and Bekasi, in West Java and Banten provinces. Bad habits and sheer human pressure makes matters worse.

"We can always build new infrastructure such as canals or Data dams, but in my opinion, it's hardest to control people's behavior, which plays a major role in Jakarta's floods," Tarjuki said.

Rapid urban development is really the heart of the problem. As the

Continued overleaf

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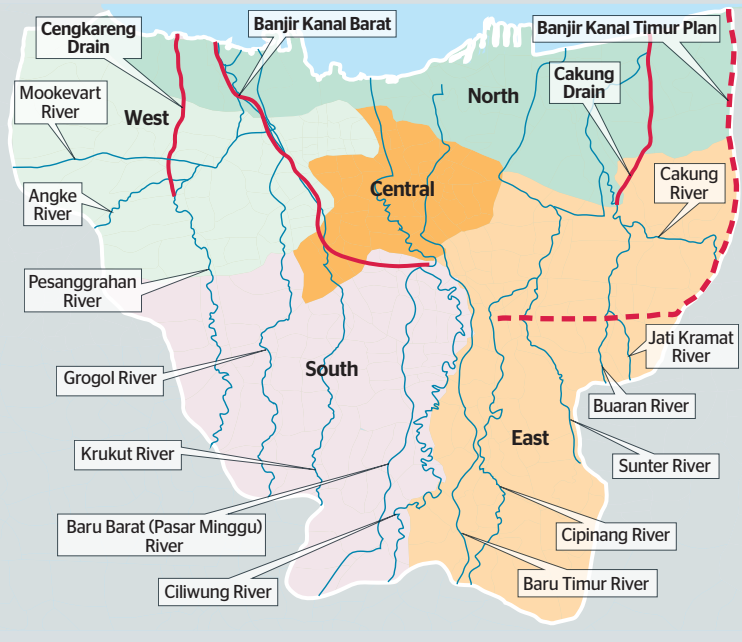
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Lifeblood, but Life-Threatening

The major rivers flowing into Jakarta all now have potential flood points as inhabitation along the banks has grown so fast and the city has sunk so far.

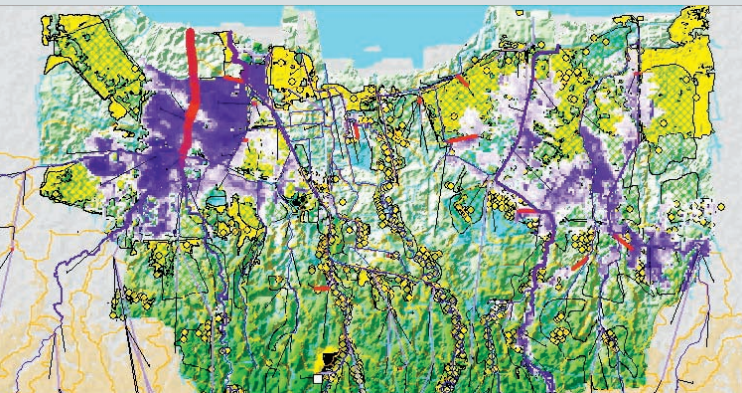


2007: A Pattern of Disaster

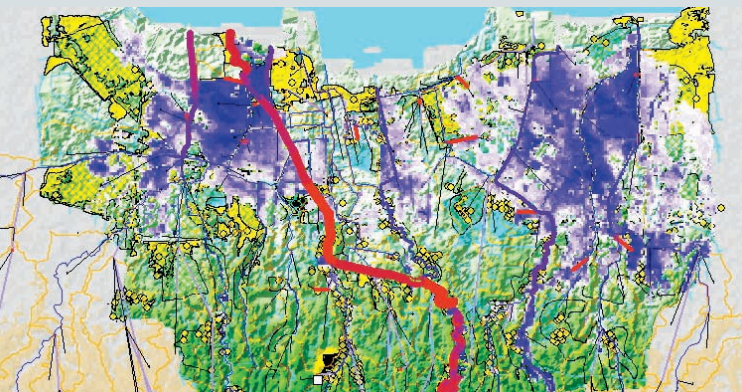
Parts of Jakarta most prone to river-flooding are demonstrated by these images of the catastrophic floods of early February 2007. Shown are areas of most flooding (in blue) and rivers with worst swelling (in red)



Midnight, February 1



Midnight, February 3



Midnight, February 5

‘We are going to help by dredging the city’s rivers and canals, but if the city doesn’t come up with good solutions to the solid waste problem, within five years we’ll be back at square one’

World Bank water expert Risyana Sukarma

From previous page

Suharto regime centralized the economy, Jakarta increasingly became a destination for throngs of Indonesians seeking a better life. In short order a city that was built by Dutch colonizers to accommodate 800,000 people has been engulfed by more than nine million residents, and up to 12 million during the work week.

According to a World Bank report, around 250,000 people move into the Greater Jakarta area each year. This gives rise to growing squatter areas where people have scant access to infrastructure or government services.

There are now more than 25 million people living in Greater Jakarta, which includes Bogor, Depok, Tangerang and Bekasi. By 2020, that number is expected to balloon to 35 million. Unchecked urbanization results in housing complexes and shopping malls that block or pave over natural catchment areas.

People like Sarini and her family, who can’t afford proper housing, simply squat along river banks and find jobs as day laborers. Soon, these mini-communities multiply. This exacerbates water contamination and flooding because squatters dump trash and human waste into the waterways.

Over time, the rivers narrow due to the accumulation of waste and silt, their flows lessen, and ultimately water overflows the banks. Experts have said that if Jakarta’s rivers and canals had been dredged regularly, the number of people directly affected by the 2007 floods would have dropped from 2.6 million to only one million.

Data from the Public Works Department shows Jakartans produce 30,000 cubic meters of solid waste per day, 1,800 cubic meters of which ends up in rivers and canals. The city administration says it can only remove about 1,400 cubic meters a day, leaving 400 cubic meters of waste to accumulate every day in the rivers.

Given that a cubic meter is equivalent to 1,000 liters of liquid, that adds up to 400,000 liters of trash collecting in Jakarta’s rivers every day. It all adds up to a mess.

“We are going to help by dredging the city’s rivers and canals, but if the city administration doesn’t come up with good solutions to the solid waste problem, within five years we’ll be back at square one,” said Risyana Sukarma, a water

management and environment consultant at the World Bank.

To make matters worse, Jakarta is sinking. Groundwater extraction from 140 meters deep or more by factories, hotels, shopping centers and other developments, as well as backyard wells, has caused the land to sink by an average of 5 to 10 centimeters a year, according to World Bank studies, and up to 25 centimeters or more in the worst-hit areas.

Some areas have already sunk between one and two meters over the past few decades. This subsidence reduces the capacity of the land to absorb rain and floodwater, which in turn increases dependence on dikes and water pumps.

Can Anything Be Done?

For starters, a three-year emergency dredging program, called the Jakarta Emergency Dredging Initiative (JEDI) and nicknamed “No Regrets,” is slated to begin later this year. “We hope this will return those rivers and canals to their original capacity,” said Tarjuki, an official with the Public Works Department.

The city administration is allocating Rp 200 billion for dredging at 76 locations, and the World Bank will fund the rest with a \$150 million loan. But it would be hard to blame city residents for their skepticism: for years, they’ve heard claims from city officials that dredging was going to be carried out or was already under way, but it never happened.

In its defense, the city was

previously unable to accept World Bank help because central government regulations prohibit local administrations from accepting foreign loans for projects unless it’s a revenue-generating venture. Officials worked around the regulation by arguing Jakarta could be spared billions of dollars in future flood damage, said Hong Joo Hahm, lead infrastructure specialist at the World Bank in Jakarta.

Dredging, however, is not enough, Hahm said. “To make Jakarta flood-free, there are three more major things to do,” he said. These include building an 800-meter waterway connecting the East and West flood canals, and renovating the Manggarai sluice gate in South Jakarta, the Cengkareng drain in West Jakarta and the Cakung drain in East Jakarta.

The city has also floated the possibility of a second landfill to lift pressure on the one at Bantar Gebang in Bekasi, just outside Jakarta, which has reached 90 percent of its capacity.

“That is very important because on rainy days we can collect up to 10 huge dump trucks [worth of garbage] from rivers and canals,” Tarjuki said. “But I think it is more important to educate people to keep from littering in the rivers. Or not to litter at all.”

However, trouble is brewing because the forthcoming dredging project also calls for relocating tens of thousands of squatters living illegally along riverbanks.

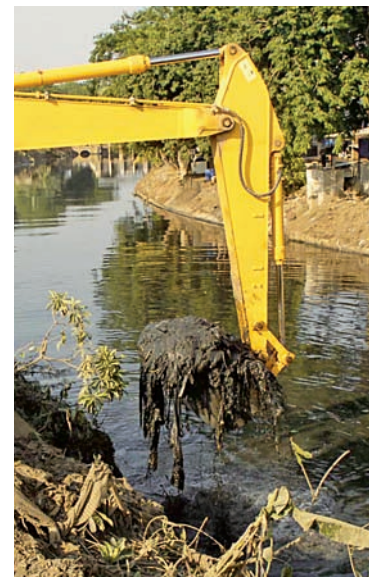
“The problem is, these people are not scared of floods. They see flooding as part of their lives,” said Ida Ayu Dharmapatni, a senior operations officer with the World Bank, which is helping the city to tackle the sensitive relocation issue.

The city will have to tread a fine line in enforcing the law without violating human rights or creating a public uproar.

“The most difficult problem is, after we relocate them, they keep coming back to the riverbanks,” said Heru Utara, head of public facilities for North Jakarta district.

Because relocation could take months or even years to resolve, the city agreed to begin dredging in squatter-free areas first. As city residents already know all too well, the clock is ticking on this issue because floods always recur.

“I do hope the Jakarta administration does its best to overcome this problem,” said Ester, the Kelapa Gading stock trader. “It would definitely ease our nerves.”



Dredging mud at a flood-prone part of the Ciliwung River. But is it enough?



Stilt houses built by squatters from scavenged materials surround the Pluit reservoir in North Jakarta. An estimated 150,000 people live illegally near the city's waterways. Antara Photo

Dredging the Rivers Means Uprooting Thousands of Squatters

Lasemi recalls when she first moved to the banks of the Pluit reservoir in North Jakarta six years ago.

"In those days, I couldn't eat anything," the 41-year-old said, recalling the stench coming from tons of solid waste choking the reservoir's gate, which lies about a meter from the backdoor of the one-room shanty that is home to her and her husband, a bajaj (auto-rickshaw) driver, and their four children. "When I first moved in here, the piles of solid waste were higher than my house."

Lasemi, who came to Jakarta from Central Java in 1995, is one of about 20,000 squatters who live suspended over a portion of the reservoir. For the Rp 2 million (\$200) the couple pay a year in rent, they get a close-up view of the reservoir gate and the layers of garbage that clog it.

"We're all used to floods," she said.

The city government would like to move Lasemi and other squatters away from rivers and reservoirs as part of a World Bank-funded dredging program to ease flooding. The bank, however, does not allow forced relocation of squatters because such moves are considered to be impractical and inhumane. But building new homes for the estimated

150,000 people who live near waterways illegally is costly and difficult, city officials say.

For now, people like Juliawati, 36, who lives in the Pantai Indah Kapuk area of North Jakarta, have no intention of moving. A native Betawi, she has lived along the Muara Kali Adem River since 1990 with her unemployed husband and family. They eke out a living and say it's the best they can find.

The city government has raided the area several times, but the community of about 600 people keeps coming back. "Everything is free here. We don't have to pay rent, and we've got a water supply," Juliawati said. "This is far better than roaming the city streets."

But living free comes at a price. Floods are a reality of life. The squatters survive by building their shacks as high as they can with scavenged planks.

Juliawati and Lasemi likely do not grasp that they are partially to blame for the flooding that plagues their lives. Illegal settlements near waterways jam rivers with garbage that leads to sedimentation, ultimately blocking the rivers' flow.

The Jakarta Emergency Dredging Initiative, partially funded by a \$150 million loan from the World Bank, mandates that the city resettle the

20,000
squatters living
on the banks of
Pluit reservoir

squatters. The bank does not want to see people suffer injustice as a result of river dredging.

"If you affect people, you have to relocate them — this project should not make them worse off," said Ida Ayu Dharmapatni, a senior operations officer at the World Bank who is involved in the relocation program. She and her team are hoping to reach an agreement on resettlement with city officials by September.

"Technically, if we have to enforce

the law, we can wipe out those squatters in a day," said Heru Utara, head of public facilities for the North Jakarta district. "But this problem is far more complex than that."

Opting for the humane approach, Heru said the city administration needed massive funding to provide low-cost housing for the Pluit reservoir squatters. "It's not 'mission impossible,' but where do we get the money from?" he asked.

Heru cited a successful relocation program under former Governor Sutedjo's administration in 2003, in which thousands of squatters were moved from the banks of the Angke River to apartments in Cengkareng.

"To be able to do that again, we need good locations and a huge amount of funds," he said.

In Jakarta, however, building low-cost apartments near the Pluit reservoir would be very expensive. Building housing too far afield would be pointless because the squatters work near their homes and would balk at leaving their neighborhoods.

Despite the potential hardships, many squatters still yearn for a fair and dignified solution.

"We never dreamed of having this kind of life, and we will surely move out if the government can provide housing for us," Juliawati said.

Dewi Kurniawati



Residents getting ferried out of Muara Baru in North Jakarta after a peak tide inundated the area in January this year.. JG Photo/Afriadi Hikmal

The Sewage

Poor Sanitation Means Illness and High Costs

A city drowning in its own filth, Jakarta needs to address its sewage issues

Report Hera Diani

Jakarta is a two-faced city, people say. On one side are the modern office towers and luxury shopping malls; on the other are overcrowded, squalid slums.

No where is this contrast more apparent than in Kelapa Gading, North Jakarta. Right next to the Jalan Yos Sudarso overpass is Mal Artha Gading shopping center: attractive and colorful, embellished with giant animal figures.

Next door, separated by just a narrow street, is Pulau Kandang, where the blackened water of the Sunter Canal runs. On land that used to be a swamp stand dozens of houses on wooden stilts, which have to be patched frequently to prevent them from falling into the rancid water below. The ground is covered in human feces and garbage.

"People here think that it's OK to throw garbage underneath their houses, as the garbage will eventually harden and turn into soil," said Aduma Lestari, a sanitation engineer with the Tirta Lestari Foundation, a local NGO.

Here, clean water is considered a luxury for residents, who are mostly garbage scavengers living on Rp 20,000 (\$2) or less a day, and so are clean toilets, which are communal.

Housewife Nurhayati, 32, her husband and their two young children share a 1.5-square-meter bathroom with three other families, splitting the Rp 100,000 monthly water bill.

"The water connection sometimes breaks, so we have to buy it from a vendor for Rp 3,000 a bucket," Nurhayati said. "Sometimes we ask from a neighbor who has a drilled water well underneath his house. But the quality is so bad that we have to filter it with sand. Still, it's not drinkable."

The bathroom itself is said to be connected to a septic tank, which is basically a pit. The waste is not treated or processed at all.



Makeshift public toilets at Angke Beach contribute to pollution in North Jakarta's waters. JG Photo/Afriadi Hikmal

Nurhayati said her children are prone to diarrhea and skin diseases, especially during the flood season. The entire Kelapa Gading area floods annually.

The burden of poor urban sanitation is something Nurhayati shares with millions of other Jakartans, regardless of their economic situation. Experts say that confusion about which government body is in charge, lack of political will and public awareness, as well as budget shortages, have led to a shocking absence of modern and clean public sanitation across the capital.

It shows that the two-sided city analogy is much more than cosmetic. Jakarta may look more modern every day, but its sewage system is still almost nonexistent. Less than 3 percent of the entire city — homes, offices, malls — has a sewage connection, the second-lowest coverage in Southeast Asia after the Laotian capital Vientiane, according to the World Bank. And it is even worse than it sounds: Vientiane's population is less than 400,000, while Jakarta's is more than nine million.

The absence of a sewage system has knock-on effects. With dwellings relying on septic tanks that are often little more than traditional pits or gutters, contamination of groundwater is a constant problem.

Some 20 percent of Jakartans do not even have access to a toilet, forcing them to use whatever space they can find, according to the Ministry of Public Works. The ministry's 2008 data showed that 1.46 million households in the capital dispose of raw sewage into closed gutters, 784,568 dump it into open gutters, while 56,139 households flush their waste directly into the ground or nearby rivers and canals.

Nugroho Tri Utomo, head of the sanitation development technical

team at the National Development Planning Board (Bappenas), said 714 tons of human waste go directly into the ground or waterways each day without being processed. "It's equal to 140 elephants, so go figure," Nugroho joked darkly.

Makeshift Infrastructure

Jakarta does have a makeshift system of gutters, but unfortunately most are not connected to sewage treatment plants. There's only one treatment plant in Jakarta, located in Setiabudi, South Jakarta, and waste treatment facilities are only available in Pulo Gebang, East Jakarta, and Duri Kosambi, West Jakarta. The waste from gutters is channeled into the city's 13 rivers or canals, causing massive pollution.

"Eighty percent of shallow water is polluted with E. coli bacteria, indicating fecal contamination," Nugroho said.

As a result, he said, illnesses caused by poor sanitation are high, especially among children. Nationwide, children under the age of 5 suffer on average 2.5 cases of diarrhea per year. It inflicts a double whammy on poor families because they lose income from lost work days if they or their children are sick, and they also spend more on health care.

And the sanitation crisis is not confined to Jakarta alone — it is a nationwide problem. According to "Economic Impacts of Sanitation in

Southeast Asia," published in August 2008 by the World Bank's Water and Sanitation Program, Indonesia loses more than Rp 58 trillion every year, or the equivalent of Rp 265,000 for every man, woman and child, due to lack of sanitation. Health and water resources contribute the most to overall economic losses, as the public is forced to seek medical treatment more often and pay more for access to clean water.

The economic impact from illness alone is \$3.3 billion per year. Poor sanitation causes at least 120 million cases of disease and 50,000 premature deaths annually, according to the World Bank report. Diarrhea-related diseases are the most common, with 89 million cases nationwide every year, followed by skin disorders and trachoma, a contagious bacterial conjunctivitis that can lead to blindness.

Poor sanitation also contributes significantly to water pollution, increasing the cost of safe water for households and reducing fish numbers in rivers and lakes. The economic cost of polluted water attributed to poor sanitation is \$1.5 billion a year. In addition, the country loses \$1.2 billion annually in "welfare losses" — the productive time lost from having to walk to and queue at public toilets.

There is also an estimated loss of \$166 million a year in tourism as travelers warn others away from places with poor sanitation. Productive land lost to pollution adds another \$96 million in annual losses.

Experts say that other major cities like Bandung, Solo, Denpasar and Medan are in fact ahead of Jakarta because they have begun fixing and expanding their existing sewage systems. They also say the city's administration has been slow in moving sanitation up from the bottom of its list of priorities.

Fast Growth, Poor Planning

The paucity of sewage connections in Jakarta, experts say, is the result of bad urban planning and fast growth. Sewage systems should be built in the early stages of development, but the only connections in Jakarta are in parts of Kuningan and Sudirman districts.

There have been efforts to develop an underground piped sewage system. In 1991, the Jakarta administration established a city-owned sewage company, PD PAL Jaya. Not long after that, the city, working with the Japanese International Cooperation Agency

56,000 households flush their sewage straight into the ground



Clockwise from left:
Children playing in the polluted Ciliwung River.
 JG Photo/Afriadi Hikmal

Residents living along the flood-prone Sunter Canal.
 Pembaruan/Luther Ulag

Men fishing at Sunter Lake in North Jakarta.
 JG Photo/Safir Makki



and World Bank, designed a master plan for the project.

"Nearly two decades have passed but the master plan never came to fruition," said Setyo Duhkito, head of the program and development division at PD PAL Jaya.

The first problem, he said, is the expense. A single connection costs between \$600 and \$800 a home, although the price goes down for each additional home hooked up to the system.

A heavily-traveled and densely populated urban area like Jakarta would also require a special pipe jacking system to build sewers in a way that would not disrupt traffic. This system is also expensive, costing between Rp 6 million and Rp 10 million per meter of piping.

Setyo estimated that the total investment needed for a citywide sewer system would come to about

Rp 14 trillion — still far less than the nationwide economic losses caused by poor sanitation. "It is indeed a lot of money, but it's necessary given the impacts on health and the environment," he said. "However, the Jakarta administration has never made it a priority, thinking that a sanitation project is only an expense that doesn't generate profits."

Setyo also pointed to the bureaucratic nightmare in which city agencies overlap on sanitation issues, such as the Health and Public Works departments, and have limited direct contact.

"It's very difficult to come up with the same vision, like who's taking care of the funding and who's in charge of the technical part," Setyo said. "The bottom line is, the commitment and awareness of the Jakarta administration is seriously lacking."

\$600
low-end cost
to connect a
home to piped
sewage system

Budi Yuwono, director general of housing at the Public Works Ministry, said while other cities were expanding their systems, authorities in Jakarta seemed indifferent and instead focused on other infrastructure projects like roads and public transportation.

"On the other hand, the issue of sanitation should not just be the responsibility of the local government, given the amount of budget needed," Budi said. "The central government must increase investment in sanitation. At the moment, there is no special budget allocation for sanitation."

Is There a Solution?

Jakarta, which celebrated its 482nd anniversary last month, cannot afford many more without a citywide sewage system, experts say, and development must start now. If not, it

will only become more complicated and expensive.

Bappenas's Nugroho said that while a comprehensive system was indeed costly to implement, it would cost the city's residents even more not to have one.

"For every Rp 1 invested, the benefit is Rp 11," he said. "The failure to overcome the sanitation problem, however, will increase the cost by 36 times."

First and foremost, the city must adopt new regulations on sanitation, and map out priority areas.

"There is yet to be a good database on water and sanitation, and the mapping is essential before we come to planning and action," PAL Jaya's Setyo said. "The master plan must also be more detailed and definitive, stipulating who's in charge, funding and so on. The existing master plan only deals with technical matters."

Nugroho said there should also be alternatives to a citywide system, such as a small-scale or communal system for between 100 and 200 households that can be connected to the larger central sewage system.

Community-based sanitation involves the central government, local administration and community sharing costs. Currently, this model is being carried out in Bekasi, just outside of Jakarta, and in other cities.

"We have to make slum areas a priority because they are a high risk for bad sanitation," Nugroho said.

The city administration must also address the problem of weak law enforcement and poor oversight of housing developments.

"The Jakarta administration should have been stricter with developers. The existing [septic tank] systems in Jakarta must be monitored and fixed," Nugroho said. "A sewer system must be water resistant, there should be a minimum proximity from water wells and housing, and building developers must be obliged to develop small-scale wastewater processing installations."

Isabel Blackett, from the World Bank's Water and Sanitation Program, said a mixed approach was needed for Jakarta, which means different sewage systems being used to supplement a main piped system.

"At this point, the central government must interfere, given the magnitude of the problem," Blackett said. "Sanitation should not be seen as a private matter, and you cannot leave it to individuals. Strong political support is needed."

The Garbage

Our Waste Mountains Can Be Better Handled

One community is cleaning up by turning waste into fertilizer, but it is an exception to the norm

Report Kafil Yamin

Like most urban dwellers, Jakartans want nothing to do with garbage. They don't want it in their homes, in their hands or even in plain sight. That might explain why the city's streets, rivers, canals, roads and underpasses are full of solid waste — but all that trash only comes back to haunt city residents because garbage is a major cause of flooding and a source of contaminated drinking water.

But the residents of Neighborhood Unit 3 in Rawajati, South Jakarta, are the exception. "We need more waste," said Ninik Nuryanto, head of the local women's association.

Since 2004, residents of Rawajati have been processing domestic waste into organic fertilizer. In the beginning, the fertilizer was just for personal use, a way to help cultivate the flowers in their front yards. But eventually, production exceeded demand, so they started selling it.

The business is a hit. The women's association makes about Rp 800,000 (\$79) a month selling bags of fertilizer, plus Rp 20 million a month hawking flower seeds, plants and

trees. Buyers come back because the fertilizer is both of good quality and cheaper than other brands. And the community reaps the benefits.

The money raised from the association's sales goes into its administrative fund, which it uses for public services such as paving roads, building sewage canals and even setting aside land for a park. As people from other neighborhoods began visiting Rawajati, which lies on the south side of the Ciliwung River, to enjoy the scenery, it dawned on the locals that they had created an agritourism attraction.

Just across the river, however, in the Cililitan Kecil kampong, it's quite a different story. Boxes and bags of trash are piled up or scattered on the riverbank, just waiting for rainwater to push it into the Ciliwung River. Solid waste bobs in the water that communities up and down the river use for cleaning, bathing and washing clothes.

The 3,000 families of the kampong dump their garbage on the riverbank every day. With no trash removal service, towers of rotting garbage are picked through by alley cats, stray dogs and rats before being blown into the water or pushed in by the rain.

"We don't have other any place to dispose of our waste but here," complained Busoro, the head of Cililitan Kecil's Neighborhood Unit 16. "Now it's even worse because someone bought some of the land here, so our dump site is smaller."

With the access road to the makeshift garbage pile so narrow that trucks are unable to remove the waste, Busoro said only *pemulung* (trash scavengers) can get through with their small carts to search for usable items. He added that a local city-run waste station, which is three kilometers away, was just too far. "Going to the station just to dump a plastic bag of waste is very tiring. No one here will go there," he said.

Lack of waste disposal sites is a major problem in Jakarta. The population of around nine million people produces about 6,250 tons of waste a day, according to the city's Public Works Department. Jakarta has only 1,200 waste drop-off stations and two landfills outside the city limits in Bekasi and Tangerang.

According to Endang Setyaningrum, head of the sub-directorate of Settlement Health Services at the Ministry of Public Works, the typical excuse is that the

city government doesn't have enough money to open more waste stations. But in reality, as Endang puts it, "The Jakarta administration doesn't have an incentive when it comes to waste. They continue to spend budget allocations on waste without earning income from it."

The Jakarta administration has the responsibility of hauling the garbage from the waste stations to the landfills, but it only does so once a week. "Ideally, waste should be taken from the waste stations twice a day. But with the administration having only 851 trucks, they can hardly do it," said Wahyu Pujiastuti, head of Jakarta's sanitation technology division, adding that the fleet is also aging.

Endang said there are garbage removal fees to be earned from residents of housing complexes and middle and upper-class neighborhoods. But instead of going into the city government coffers, private companies collect the garbage of the well-heeled for a fee and dump it at the public waste stations free of charge. "Some of them might also dump waste illegally on abandoned land and other places," she said, because that is easier than getting through traffic to dump their collection at the waste stations and they save money on gasoline.

This adds up to an environmental disaster. Risyana Sukarna, a water and environment consultant for the World Bank, said that nearly 20 percent of the city's daily waste ends

up in local rivers, canals and waterways, reducing their ability to handle floodwater and drainage by as much as 50 percent. The foul-smelling, polluted waters also cause health problems for people who use the rivers for bathing and washing clothes.

"When you see all these problems, you feel desperate," said Risyana, who used to work at the Ministry of Public Works. "You have to be patient because you work in Indonesia."

In Cililitan Kecil, where nobody — public or private — picks up the trash, it all piles up quickly. When heavy rains fall, the mini-mountains of waste wash into the Ciliwung River. Inevitably, the water rises, inundating neighborhoods along both sides of the river, including the homes of the entrepreneurial trash recyclers of Rawajati across the way.

"We are often flooded even worse than the kampong across the river, because our land lies on a lower plain than theirs," said Awarso, a resident of Rawajati.

Unfortunately, the recycling ethos of Rawajati is highly unusual in Jakarta. The majority of riverside slums and neighborhoods use the river as a toilet, shower, laundry room and trash can.

The suffering Ciliwung hasn't been dredged in decades and no one takes ownership of the river. Endang said that river dredging is the Jakarta administration's responsibility. However, Wahyu said





1) At Rawajati, fertilizer-making starts with piles of biodegradable waste.



2) Larger pieces go through a chipper before being added to the heap.



3) Additives such as lime help the waste matter break down more effectively.



4) The finished product is allowed to mature then is measured and bagged.



5) The compost is sold or used to enrich Rawajati's soil. JG Photos/Afriadi Hikmal

20%
of the city's daily
waste ends up
in local rivers,
reducing their
flow rate up to
50%

Two young scavengers, below, collecting salvageable items, mostly plastic cups and bottles, from a polluted river in Jakarta. AFP Photo/Adek Berry

that it falls under the authority of the Ministry of Public Works. "They should get on with it," Wahyu said.

Endang said private initiatives, like Rawajati's cottage industry, would go a long way to solving the waste problem, but "neighborhoods with high environmental awareness like Rawajati make up less 2 percent of Jakarta's riverside dwellers. We need more neighborhoods like Rawajati in Jakarta."

Actually, the city, and the entire country for that matter, could benefit from a massive public awareness campaign about the social, environmental and economic consequences of littering, a technique that has had some success in Western countries.

"It goes back to social lifestyle," said Sarwo Handhayani, assistant secretary for development in the Jakarta administration. "You have to change people's mind-sets."

In addition, there's no incentive for city dwellers to change their habits. Often, no one will come to remove their garbage and no one enforces a city regulation that prohibits dumping anything into the city's waterways.

"The law is there, but without effort and real measures to enforce it, it's all in vain," Endang said. "No one goes to court for throwing trash into the river. No truck driver is arrested for dumping trash into the river."

Building landfills in each of Jakarta's five districts might be one solution, but Endang said this is

unlikely because there is no room for them. Provincial and local governments outside the city are unlikely to welcome a landfill in their backyard, but in any event, they are as guilty as Jakartans in dumping their waste in rivers.

Meanwhile, in Rawajati, a community park hosts a huge display of teak tree seeds, flowers and packages of fertilizer, a symbol of what can be done with something as unglamorous as waste. Since 2006, the neighborhood has received large orders for seeds and fertilizer from central government agencies including the Forestry Ministry, which means this village wants more trash to meet demand.

So well managed is the waste that neighborhood houses divide it into two buckets: non-plastics, mainly biodegradable waste including old vegetables and food, and man-made plastic waste, which is removed and resold by garbage scavengers. The organic waste goes into fertilizer production while the men from the neighborhood administration take the plastic to a waste processing plant next to the park. Every day, 70 people, mostly women, are involved in this processing operation, which provides more jobs — as well as clean homes.

Meanwhile, walk through Rawajati and look at what you don't see — no garbage clogging drainage ditches. No mounds of trash waiting to pollute the river. This is a lesson worth learning.

Creative Use of Trash Helps Clogged Rivers Keep Moving

Didin Nurohim loves David Beckham. But when the 11-year-old unveiled a picture of the English football star it was the frame he proudly pointed to and the sketch of colorful flowers along its border.

"Me and my classmates made it," said the student of Perguruan Rakyat II Elementary School in Melayu Kecil, South Jakarta. Didin beamed with pride when he said his "team" was able to make 10 picture frames out of used cardboard rescued from the school's trash cans.

In the past four months, 90 pupils at four elementary schools in a flood-prone area of Melayu Kecil have been learning to reduce solid waste by recycling it to make handicrafts.

Three NGOs — Plan International, the Indonesia Disaster Awareness Foundation (YTBI) and the Information Center for Indonesia's Environment (PILI) — are helping students learn to cope with flooding, but more importantly, how to prevent floods in the first place.

Experts say about 20 percent of Jakarta's daily solid waste ends up in the city's rivers and canals, blocking their flow and reducing their ability to deal with floodwater by up to 50

percent. This program shows students the link between littering and natural disaster, and teaches them how to recycle waste materials and also what to do in the event of a major flood.

"They are always excited to learn these lessons," said Sherly Leo, an activist with YTBI.

The four schools taking part in the program — SD Manggarai 03, SD Muhammadiyah 52, Perguruan Rakyat II and SD Manggarai 04 — are all located near the Ciliwung River and are no strangers to flooding. During the massive floods of 2007, Perguruan Rakyat II was closed for two weeks.

"I'm confident more schools will join this program," Sherly said, noting that the schools' teachers also took pride in the fact that their campuses were cleaner since their students joined the waste recycling project.

Nuryanti, the principal of Perguruan Rakyat II, said the trash and litter scattered around campus had been reduced by 70 percent since the program began because the students were recycling trash and using some of it to make handicrafts.

"They separate paper and plastic waste from organic waste. Their new attitude encourages teachers to do the same. Our students are good examples to their teachers," she said. **Kafil Yamin**



The Tides

Efforts Never End to Repel an Invading Sea

It's a race against time to build defenses against the growing threat of tidal floods

Report Putri Prameshwari

Although most of Jakarta's street vendors begin their days soon after sunrise, Maesaroh is forced to wait for the water that inundates her kiosk every night to dry before customers can step into her stall without soaking their feet. The wait is painful, for her nerves and her purse.

"Imagine how many potential customers I lose," she said.

It's been like this since Maesaroh, 25, moved to the Muara Baru slum area in North Jakarta seven years ago. Almost every night, she said, the floor of her house, which is attached to her stall, is submerged under 30 centimeters to 50 centimeters of water. "[The flooding] usually starts at midnight and ends at 11 a.m.," she said, "and it goes on for two, three weeks every month."

In other words, she and her neighbors spend at least half of every month living in floodwater.

"I used to sell cooked food for breakfast as well," she said, but since the floods have come more regularly in the past two years, she attracts few early-morning customers.

Some might think Muara Baru, arguably the worst slum in Jakarta, is cursed, as the rest of the capital only deals with the specter of flooding on an annual or biannual basis. But this area lies on the city's northern coastline, leaving it at the mercy of tidal surges.

Whenever the Java Sea rises during the monthly lunar tidal cycle, water rushes inland and inundates parts of Muara Baru, which like 40 percent of Jakarta lies below sea level, according to Fakhrurozi, head of the water resources division at Jakarta's Public Works Department.

Jakarta is living on borrowed time, experts say. Nine years from now it will be at the mercy of an upswing in the tides unless city and national government officials finally do something about it. International experts predict tides will surge far inland without a new sea defense wall in Jakarta Bay.

The areas of the city most vulnerable to tidal flooding,

Fakhrurozi said, are Muara Baru, Muara Karang, Penjaringan, Pademangan, Tanjung Priok, Pluit, Koja and Kapuk Muara. Most are industrial areas surrounded by densely populated villages.

Those likely to be most affected will be people like Maesaroh, who can least afford it. Hoping for a better life, Maesaroh, who is married with a young son, moved to Jakarta from Garut, West Java, in 2002. But she and thousands of other people in her community are forever struggling with tidal floods. People in many other low-lying areas in the north experience the same problem.

"My sister moved here first," she said. "I thought at that time: 'Who wouldn't want to seek better opportunity in Jakarta?'"

Tika, 27, who also operates a little shop in Muara Baru, thought the same thing when she moved to the capital in 1994. Tidal flooding has been a part of her life ever since.

"Never in those 15 years has a month gone by without flooding," Tika said as she played with her two children inside her stall.

Amid the stench from the ever-present saltwater and a nearby prawn vendor, Tika sells everything from snacks to shampoo to cooked food. Her house and kiosk are in a small alley in the neighborhood that she says collects the deepest floodwater, up to 1 meter high during particularly strong tides.

"It's like a small tsunami," she

said, adding that the current is so strong that it usually drags away shoes, sandals and other items left outside people's homes. "The worst one happened earlier this year. I lost my refrigerator and a mattress to the flood." A refrigerator, she said, is vital for kiosk owners like herself, who keep stocks of food and beverages to sell. Otherwise, her food is at the mercy of insects that roam freely inside the kiosk.

Government officials were warned about the potentially catastrophic tidal flooding back in 1994, said Hongjoo Hahm, the lead infrastructure specialist at the World Bank in Jakarta, "but they didn't listen."

How bad could it get? Imagine the State Palace having a sea-front view, he said. "This is nothing like river water — this is unstoppable. This thing is a monster of an event."

And these "killer tides" didn't

150cm
depth the city
has sunk in
some parts over
the last decade



A temporary levee shows how the sea level has defeated parts of Marunda, North Jakarta, left. Workers brave the waters to plant mangroves at Kapuk Mangrove Natural Tourism and Conservation Park in North Jakarta. Rehabilitating damaged mangrove forests could help protect against tidal floods. JG Photos/Afriadi Hikmal, Safir Makki

appear from nowhere. They pose a multibillion dollar threat to the capital's northern areas because these areas are continually sinking due to excessive extraction of groundwater by industry.

According to the Jakarta administration's own estimates, the city has sunk by as much as 1.5 meters in the past decade — and not coincidentally, by about 2 meters near the site of the former Bintang beer factory in Pluit. (Take a guess why.)

Jan Jaap Brinkman, a Dutch water expert and adviser to the Ministry of Public Works, said North Jakarta desperately needs a comprehensive early warning system because about five million people are vulnerable to tidal flooding that could strike without warning. "[Parts of the area] sank 26 centimeters between September 2007 and August 2008," Brinkman said.

He warns that Jakarta could sink even lower in the coming decades, and that without better management, areas located up to five kilometers inland could be submerged and rendered uninhabitable.

And that's bad news for people like Maesaroh and Tika. While the inhabitants of luxury apartments and villas in northern areas such as Kelapa Gading can, and have, moved into five-star hotels to temporarily escape floods, Maesaroh, whose husband works in a nearby fish market, said they have nowhere else to go.

"I've lived on this side of town since I first stepped foot in Jakarta," she said. "I don't think I want to start over somewhere else."

The situation is even more dire for Tika, whose husband is unemployed, and whose parents live with them.

"My husband doesn't work so this

kiosk is our only way to earn money," she said. "Otherwise, how could I put my children through school?"

Originally from Semarang, Central Java, Tika believes her future still lies in Jakarta, despite the frequent inundation by seawater.

Almost without thinking, she said, she packs up all her wares from the kiosk when the tides come in and puts them in a safe, dry place inside her house. "It's something we just have to deal with," she said.

Unfortunately, her endless patience and stoicism won't be enough to stop the tides from swamping North Jakarta. Brinkman said the central and city governments have developed a strategic plan that could be used to defend the city from the sea.

"One of the ideas is to create a small reservoir in the Jakarta Bay and build an off-shore dike," he said.

He said the reservoir would be used to store water to prevent it from flooding the city. The water in the reservoir, he said, would then be pumped back into the sea using pumps erected on the dike.

The Public Works Ministry, the Jakarta administration and the National Development Planning Agency are assessing the plan, and Brinkman said they will meet in September to discuss how to make it happen.

Others, however, have a different perspective on the potential tidal calamity threatening the city. Andjo Wurjanto, a lecturer at Bandung Institute of Technology's Ocean Engineering Department, notes that Jakarta has always had tides, even before it had people.

"Why are they flooding Jakarta now? That's the question," he said.

Andjo claims the answer is that





A man braves the floodwaters to collect boards from his wrecked shed in North Jakarta. Slum residents inevitably suffer the most from tidal floods because they have nowhere else to go. JG Photo/Safir Makki

rising sea levels caused by global warming are partially to blame for the tidal floods. "Add to that the descending ground levels, and water could easily inundate the city," he said.

The World Bank's Hahm emphatically refuses this suggestion. "It's absolutely and categorically false," he said. "Global warming has not even made sea levels increase anywhere in the world yet, so how can it have some localized effect? If that were the case, Singapore and Batam would be under water by now."

For their part, the people of Muara Baru couldn't care less about the scientific explanations of the tidal floods. Edi Junaedi, who is in his 40s, sells meatball soup from a cart in the neighborhood. His biggest fear is losing his cart to floodwaters, as he did in 2007. "It was the worst one to ever come," Edi said, standing behind his cart in front of a kiosk.

Edi's wife and daughter live in East Java, but he said he chose to stay in Muara Baru because his friends did, too. After nine years in the city, Edi said he still has a hard time pushing his cart through the flooded streets.

Andojo said it would be impossible to relocate people living

Continued overleaf

How Earth, Sun and Moon Conspire Against the Sinking City

Tides can cause flooding even in the middle of a long dry spell. The reason is simple: tidal floods aren't caused by weather, but by the gravitational pull of the moon and the sun.

The earth's rotation is also a factor. As the planet spins it creates a centrifugal force that causes the oceans to shift like water inside a spinning glass.

"It's basically the interaction among the oceans, sun and the moon," said Sugarin, head of the data and information division at the Meteorology and Geophysics Agency's maritime department.

Although they don't get as much publicity as floods caused by rains that lead to overflowing rivers, tidal floods are potentially far more dangerous for Jakarta because the city continues to sink by 5 centimeters to 10 centimeters a year, and as much as 25 centimeters in some areas.

The tidal cycle affecting Jakarta lasts about 18 years, swinging between periods of higher and lower tides every nine years or so. The latest downswing began last year, so Jakarta residents can expect to see the tides begin their next



Hundreds of residents crammed into trucks are ferried through the flooded streets of Muara Baru. The area suffers regular floods as a result of high tides.

upswing in 2018. Meanwhile, Jakarta will have been steadily sinking.

In other words, the city has nine years to avoid devastating flooding, especially in northern Jakarta, said Hongjoo Hahm, lead infrastructure specialist at the World Bank in Jakarta. "Imagine the sea rising and the ground sinking," he said.

There are separate sea walls along the shores of Muara Baru and Pluit, but they can no longer keep water out because of continuing land subsidence across the city, said Jan Jaap Brinkman, a hydrology expert who works closely with the Ministry of Public Works.

"The temporary walls aren't strong

enough," he said, adding that sinking land poses a far greater threat than the rising tides.

While simple tidal flooding can create devastation on its own, its effects can be multiplied by weather such as a cyclone or even strong winds, Sugarin said.

Strong winds even far offshore can cause sea waves to grow much bigger. For example, a cyclone far away in the South China Sea can produce higher waves in Jakarta. Add such conditions to regular tidal flooding, and the results could be catastrophic, especially for Jakartans living along the waterfront.

"Imagine there's water on a plate, and we blow from one end," Sugarin said. "Water on the other end will rumble depending on how strong we blow on it."

However, Sugarin declined to speculate on whether Jakarta could be doomed by tidal flooding.

"There are many factors that trigger a tidal flood," he said, including inadequate sea walls, land subsidence and the quality of city drainage.

Putri Prameshwari



Three boys picking their way along the beach near a newly built sea wall in Muara Baru designed to hold back the tidal surges that plague the area. In Ancol, North Jakarta, tide levels inundated a cemetery earlier this year. Bajajs surfing the waves of tidal surges are a common sight in Muara Baru. Tidal flooding in northern parts of the city has become more common. JG Photos/Yudhi Sukma Wijaya, Safir Makki, Afriadi Hikmal

From previous page

in Muara Baru, so the government must maintain dozens of special pumps across North Jakarta to keep even more water from flooding the streets. "People in Muara Baru are very dependent on the government because they cannot afford to pay for maintenance [of the pumps]," he said.

Andojo said the city has an obligation to make data on tidal flooding available to residents. However, Edi, Tika, and Maesaroh

have never used a computer and are incapable of looking up tide forecasts on the Internet. "All we do is just look to the sea," Tika said, pointing to the water visible from her house. "When the water level is high and the wind is strong, we have to start preparing for the worst."

Fakhrurozi said a dam or sea wall must be constructed along the coast of North Jakarta to prevent the sea from inundating the city. "The problem is, we don't have pumps installed in every river," he said.

Fakhrurozi said the Jakarta administration allocates Rp 15 billion (\$1.5 million) a year from the provincial budget to maintain pumps and floodgates across the city. "We manage the funds for 316 pumps and 34 floodgates," he said, adding there is also an emergency fund of Rp 3 billion to repair broken equipment.

Fakhrurozi said the government built one sea wall along Jakarta's northern coastline, and that it was made taller in 2007. But even that didn't work. "In 1998, we expanded

the sea wall by one meter but due to the sinking ground, the sea level reached 1.2 meters in 2007," he explained. "It's like we are playing catch-up with nature."

Fakhrurozi said the seawall is now three meters high. According to Jakarta's Public Works Department, the sea level off Jakarta Bay rose by four centimeters from 1998 to 2007.

Andojo said that aside from maintaining pumps and floodgates, the government must also think about alternative solutions to the

flooding, such as dredging riverbeds across Jakarta. "There needs to be an integrated solution to the city's flooding problem," he said.

The flooding in Muara Baru worsens during the rainy season, when water can reach up to more than one meter.

Maesaroh said she can only hope that the government will repair and maintain the pumps. "Maybe they should try living here for a few days during the floods," she said. "Then they will finally care about us."

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