Resilient Cities

Putrid Lakes Offer Sweet Relief to a City Lacking Water Treatment Plants

BY DANIEL OTIS | RESILIENT CITIES | NOVEMBER 18, 2013

Boaters traverse the 2,600-hectare Boeung Tumpun lake in Phnom Penh.

The water flows thick and black, with viscous froth and Styrofoam drifting amidst a miscellany of natural and artificial flotsam. The smell is sharp and putrescent, and when it rains the air becomes saturated with the stench. For a kilometer, this rancid cocktail runs through an open concrete channel, past shops and homes, before transforming into a canal where banana plants and ramshackle stilt houses emerge from a litter-strewn shore.

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Khuoch Seng, 43, has lived here since 1984.

"When I first moved to the area from the countryside, the smell was unbearable," she says. "I've gotten used to it now."

Khuoch Seng lives along a canal through which much of the city's waste water is channeled.

The matriarch, who shares a single-room house with her family of nine, makes her living selling blood cockles on the streets of Phnom Penh. Her house is composed of recycled material: bits of rotting wood, rusting scrap metal, old sheets of tarpaulin. When it rains, Seng says that local children go swimming in the noxious water flowing under her neighborhood's tumbledown homes.

"Everyone here is always sick with diarrhea and fevers," Seng says. "I'd like to move, but where am I going to find the money?"

Whenever a toilet is flushed or a sink is drained in Phnom Penh, most of the resulting waste water is conveyed through **an aging sewer system** to a channel that runs alongside a central north-south street. A swath of chain-link fence at the channel's southern end filters out larger debris before waste water enters the canal where Seng lives. Some of this water is absorbed into the marshy Boeung Trabek lake, but most is pumped under a busy thoroughfare into the 2,600-hectare Boeung Tumpun lake, where several thousand people living in stilt houses farm aquatic vegetables such as morning glory and water mimosa. The effluvium then works its way through an extensive network of natural wetlands before entering the 3,400-hectare Boeung Choeung Ek — Phnom Penh's largest lake and the site of Cambodia's most notorious Khmer Rouge killing field. From here, the water filters into the Tonle Bassac river, which eventually drains into the South China Sea in Vietnam.

An agro laborer on Boeung Tumpun lake.

According to a 2008 report, 234 tons of feces, 2,335 cubic meters of urine and 8,154 cubic meters of gray water are produced daily in Phnom Penh. When combined with storm runoff, this creates more than one million cubic meters of waste water per day. Approximately 80 percent of this – along with the treated and untreated waste of some 3,000 industrial enterprises – enters the aforementioned system of lakes and wetlands. The remainder is pumped directly into the Tonle Sap and Mekong rivers without being treated. Only three municipalities in Cambodia – Sihanoukville, Siem Reap and Battambang – possess artificial waste water treatment facilities.

Surprisingly, Phnom Penh's ad hoc approach to dealing with waste water is relatively successful. A 2009 study coordinated by Thailand's **Asian Institute of Technology** concluded that "Boeng Cheung Ek (sic) is effectively reducing pollutant loads in Phnom Penh's wastewater before it reaches the Bassac River."

Much like constructed wetlands found elsewhere, Phnom Penh's natural lakes have proven to be an effective (albeit unintentional) bio-filter. Grown on a network of ropes and floats, aquatic vegetables, which cover much of the city's peri-urban lakes and wetlands, greatly benefit from the nitrogen and nutrients contained in the city's waste water. These vegetables also inadvertently bolster the

effectiveness of this waste water treatment system. According to the Asian Institute of Technology report, “Much of the treatment was being done in association with the dense morning glory fields within 350 m of the input to the [Boeung Choeung Ek] wetland.”

Crops growing on Boeung Tumpun. The lake acts as a natural bio-filter for the city's waste water.

Consumption of these vegetables, however, poses potential health concerns. A government study from 2004 states that 20 percent of Phnom Penh’s total daily vegetable intake comes from the city’s network of lakes, while a 2007 paper in Tropical Medicine & International Health reported high concentrations of thermotolerant coliforms (such as E. Coli) in morning glory collected in the southern end of the city. Protozoan parasites were also detected, with giardia being particularly prevalent. The paper, however, did note that “natural biological and physical processes in the lake” reduced thermotolerant coliform counts at wastewater exit points, thus adding credence to studies of the system’s effectiveness. Regardless, if not properly washed and thoroughly cooked, such vegetables remain hazardous for human consumption.

Skin conditions such as dermatitis seemed quite common during my recent visit to Boeung Trabek and Boeung Tumpun, though residents attributed such afflictions to causes as diverse as alcoholism and poor nutrition. According to the World Health Organization’s (WHO) Cambodian office, diarrheal diseases, hepatitis A, worms and protozoan infections are commonly found in communities living near water that exhibits a high degree of human fecal contamination.

Despite these public health concerns, the lakes seem to be doing their job – for now. But with a rapidly growing population that has doubled to over two million since 1998, the system will likely become strained in coming years. Exacerbating this, developers are in the midst of filling portions of Boeung Tumpun with sand dredged from the rivers that front the city. Google satellite imagery shows that work is well underway on this two-year-old land reclamation project, which aims to have more than half the lake filled by 2020, leaving only 1,500 hectares to treat the city’s waste water. When I visited Boeung Tumpun in October, bulldozers and dump trucks could be seen working to achieve this goal, while septic trucks could be seen emptying the fetid contents of their tanks directly into the lake at its northern end.

Morning glory grown on Boeung Tumpun being readied for sale at one of the city's markets.

In Cambodia, development projects like the one at Boeung Tumpun are generally initiated without adequate investigations into the infrastructural stresses they could cause. In a May article in the Cambodia Daily, a city hall spokesman was quoted as saying that Phnom Penh "does not have the budget" for a mechanical sewage treatment plant. "If there is any company who would like to work on the project, we welcome them," he said. In that, the city may be in luck. Earlier this year, the **Japan International Cooperation Agency** (JICA) began conducting a feasibility study into creating such a plant in Phnom Penh. The study will be completed in 2015.

Until then, the city is beholden to its natural waste-treatment infrastructure. "Phnom Penh is quite lucky to have lakes that provide a huge buffer between the city's untreated sewage and the water course it ends up in," says Steven Iddings, an environmental engineer and team leader at WHO's Cambodian office. While Iddings makes a point of highlighting the public health concerns associated with the current system, he also notes that it is incredibly cost-effective. Mechanical alternatives, he points out, are very expensive to build and maintain. "The city could stay lucky if the population doubles again," Iddings adds, "but not if it continues to fill its lakes with sand."

Soa Chan, 55, has lived in a stilt house perched above the vegetation-thick waters of Boeung Tumpun since 1979. Like many of the people inhabiting the informal settlements in Phnom Penh's semi-aquatic periphery, Chan arrived in the capital following the Vietnamese overthrow of the bloody Khmer Rouge regime. The farmer supports his family by growing morning glory. He says that he is able to make a comfortable five to 14 dollars a day.

As Phnom Penh fills in the lakes, it may lose a critical component of its waste water treatment system.

Around him, other houses made of cement, wood, bamboo, corrugated iron and thatch stand in rows above the murky water, connected by electricity poles leaning at unlikely angles. Small wooden boats ply the community's watery roads, while mobile vendors peddle snacks and drinks. Wage laborers bring huge bundles of aquatic vegetables to the shore, where middlemen balance them on motorbikes before zipping off to the city's bustling markets.

Compared to the deplorable slum-like conditions I witnessed at Seng's home near the undiluted sewage canal, life at Boeung Tumpun is rather bucolic. Wild waterfowl hide in the rows of morning glory, children paddle around aimlessly, while chickens and ducks cluck from floating platforms. The water, it seems, is being cleaned, though the future of the lake's inhabitants is far from certain. Most lack formal titles to their homes, and in Cambodia, land reclamation projects often go hand-in-hand with **forced evictions**. This could mean the end of vegetable cultivation at Boeung Tumpun, further limiting the city's ability to recycle waste water.

"The authorities tell us that we can stay," Chan says. I'm not sure if he believes his words – from the front of his house, after all, he can see trucks at work filling the lake.

"The water keeps getting dirtier," he adds, "and there are less fish here than there used to be. Still, I like it here and I can make a good living. There's nowhere else I'd rather be."

Photos by Daniel Otis

Resilient Cities is made possible with support from The Rockefeller Foundation.

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