

---

# HANOI'S SEPTIC TANKS - TECHNOLOGY OF A CITY IN FLOW IN THE LATE NINETEENTH CENTURY AND TODAY

---

**Sophie Schramm**

Universität Kassel

Hanoi's septic tanks are part of a wider socio-material cycle that connects the human body with the environment through flows of water. As such they are shaped by and at the same time enable particular urbanization dynamics. Septic tanks were central to French colonial sanitation planning in Hanoi. From the end of the 19th century on they were supposed to replace the then predominant night-soil system and to bring a specific order to the city's sanitary situation. Sanitation planning involved not only the decentralized tanks installed under individual buildings, but a citywide re-ordering of material flows. Today, the tanks have become the city's predominant means of sanitation even though current large-scale sanitation interventions and planning ignore them. However, the actual technology that is known as the septic tank in Hanoi contradicts the imaginations of the 19th century. Hanoi's septic tanks deviate from original planning and defeat planners' imaginations of urban order as they incorporate elements of the night-soil system dismissed by urban engineers since French colonial era. They produce particular dis/orders, which transcend urban-rural boundaries and are constitutive of Hanoi's urbanization dynamics with blurred and constantly changing passages between the urban and the rural rather than fixed boundaries.

#### **Keywords**

Hanoi urbanization, septic tank, sociotechnical infrastructure systems

#### **How to Cite**

Schramm, Sophie. "Hanoi's septic tanks – technology of a city in flow in the late nineteenth century and today". In Carola Hein (ed.) *International Planning History Society Proceedings, 17th IPHS Conference, History-Urbanism-Resilience, TU Delft 17-21 July 2016, V.04 p.345*, TU Delft Open, 2016.

DOI: <http://dx.doi.org/10.7480/iphs.2016.4.1300>

## INTRODUCTION

The simple and stable brick structures of septic tanks contrast the highly complex and dynamic social and material processes going on within and outside them. Bacteria digest wastewaters and perpetually change their composition as they flow from the households through the tanks and the city. Humans shape these dynamics as they build houses, re-construct tanks and drainage systems and with their practices regarding the maintenance of the tanks or their neglect. Wastewaters flow from the human body to the toilet to the tank and from there into a street, a drainage channel, the ground, a water body or green space. The tanks are part of a wider socio-material cycle that connects the human body with the environment through flows of water. As such they are shaped by and at the same time enable particular urbanization dynamics. Septic tanks were central to French colonial sanitation planning in Hanoi. From the end of the 19<sup>th</sup> century on they were supposed to replace the then predominant night-soil system which French engineers dismissed as unhygienic. Thus they were to bring a specific order to the city's sanitary situation. Sanitation planning involved not only the decentralized tanks installed under individual buildings and respective practices, but a citywide re-ordering of material flows. In contrast, current large-scale sanitation interventions and planning neglect septic tanks and attempt to bring order to sanitation in Hanoi with the installation of „central large-scaled wastewater treatment plants“. However, today septic tanks are spread throughout Hanoi; they have become the city's predominant means of sanitation.

In recent decades, urban studies have emphasized the networked character of cities, the interconnections and interdependences of actors and materials, the flows of water, energy, waste and people that constitute urban space<sup>1</sup>. The dynamics of change and stability are a central concern of studies of sociotechnical infrastructure systems. These studies often hint at the durability of pre-designed infrastructure networks and artifacts, which appear to be stable and long-lasting material results of past planning and design decisions “frozen in space”. Notions such as inertia, momentum, obduracy and path-dependency describe the resistance to change of large technological systems<sup>2 3</sup>. Hommels<sup>4</sup> and Leigh Star<sup>5</sup> emphasize that this resistance is rooted in the embeddedness of infrastructure networks and artifacts, which are elements of broader sociotechnical ensembles, closely interconnected with other technologies and social arrangements. At the same time, the study of urban infrastructure systems problematizes particular imaginations of spatial order and in the case of wastewater management and urban sanitation, a vision of the city as a clearly bounded entity separate from a hinterland as the sink of water discharged from the city<sup>6</sup>. Urban infrastructure systems regularly resist such imaginations of urban order and respective plans. However, this resistance to planned change does not mean that they are completely static. As urban actors appropriate infrastructures, they transform them and create new dis/orders<sup>7</sup>.

This paper conceptualizes Hanoi's septic tanks as elements in broader urban sociotechnical ensembles, which constantly change but at the same time perpetually resist formal planning. It examines the history of septic tanks in Hanoi regarding engineers' and planners' ideas and imaginations as well as the tanks' interrelations with urbanization dynamics in the colonial era and today. It contrasts these imaginations with the actual technology that became known as the septic tank in Hanoi and respective practices, which deviate from original planning, defeating planners' imaginations of urban order.

## THE SEPTIC TANK IN THE COLONIAL ERA: AN “ELITE URBAN TECHNOLOGY”

Hanoi is an ancient city founded in 210 AD<sup>8</sup>. After roughly a millennium of Chinese rule, Hanoi became the capital of the state of Vietnam under the name of Thang Long (“Rising Dragon”)<sup>9</sup>. Changing political regimes have brought about dramatic ruptures which have influenced the city’s urban fabric and its society<sup>10</sup>. These influences – almost a millennium of Chinese rule, the French colonial intervention, economic and spatial planning from the Soviet Union, and the current international cooperation largely with Japan – have shaped the sanitation systems and practices of the city<sup>11</sup>.

Hanoi literally means “city in a river”. Due to its location in the delta of the Red River it is an amphibious city which an intense proximity of land and water. In the pre-colonial era, the city’s rivers, streams, ponds and lakes defined urban life: they served as moats for protection, as a means of transport, for farming fish, cultivating rice, decorating pagodas, and as a place for disposing of household wastes<sup>12</sup>. Before French colonialization, feudal Hanoi consisted of the royal enclosure, the people’s city and surrounding peri-urban villages. The royal enclosure exclusively featured water supply and disposal networks and the separation of human manure and stormwater<sup>13</sup>. Throughout the city, night soil collectors have gathered human manure which has regularly been used as fertilizer in agriculture; a practice the French engineer Fayet has dismissed as a “*défi aux règles d’hygiène les plus élémentaires*” already in 1939<sup>14</sup>. After Hanoi was conquered by the French military in 1882, French engineers and planners subjected it to the colonial planning logic. Particularly in the early phase of French rule from 1882 till 1920, the construction of colonial Hanoi did not preserve the pre-existing urban fabric<sup>15</sup>. Grandiose urban plans and large scale extensions, destructions and re-constructions of urban space as well as a socio-spatial segregation were a central part of the French “*mission civilisatrice*” in Hanoi<sup>16</sup>. Socio-spatial segregation of Hanoi was based on the discursive and material construction of two groups, the “colonial elite” and the “*indigènes*”<sup>17</sup>. This oversimplification of complex social structures allowed for the planned segregation of the city. A massive urban expansion toward the south of the people’s city, an area known as the “French quarter” today, was to be reserved exclusively for the colonial elite. This was the case even though in 1889 only approx. 400 French people have resided in the city<sup>18</sup> (Figure 1). The introduction of the paradigm of the “dry and sanitary city”<sup>19</sup> to Hanoi was an integral part of the colonial project. According to this modern paradigm, the construction of a large sewerage system transporting human wastes out of the city as fast as possible serves for the prevention of disease. This conception was fundamental to colonial sanitation planning which considered septic tanks as one central means to achieve sanitation<sup>20</sup>.

The original design of Hanoi’s septic tanks resembled the invention of the French engineer Jean-Louis Mouras who started experimenting in 1860 and has had the “*fosse Mouras*” patented in 1882<sup>21</sup>. This design envisages tanks with two chambers, an inlet connecting to the house’s sinks, and an outlet towards an underground sewerage system (Figure 3). The tanks installed under individual buildings were to be an integral part of a citywide technological network. This integration into a sewerage network has rendered them feasible for densely inhabited urban space according to French urban planning and it distinguishes them from the anglophone version of septic tanks<sup>22 23</sup> (Figure 2). The purpose of the tanks was to treat wastewater in two specific ways. Firstly, the chambers provide the sedimentation of solids within the tank that are thus separated from water, the ‘mechanic treatment’ of wastewater. Secondly, they allow for ‘biological treatment’, the digestion of these solid materials. Bacteria, which live in environments without oxygen, make anaerobic wastewater treatment work. They decompose the organic materials in blackwater, i.e. the fraction of wastewater including faeces. In this process they produce methane and other gasses as well as wastewater sludge<sup>24</sup>. Septic tanks are suited for the drainage of Hanoi’s flat terrain because the installation of tanks under the buildings allows for the vertical flow of water and thus the separation of solids from the wastewater before its direction into the city’s river system. Due to the lack of slope in the city a direct inlet of wastewaters into the rivers of Hanoi leads to the sedimentation of solids which clog the mostly stagnant water bodies. The treatment capacity of the tanks depends on the volume and the composition of the wastewater it receives; the duration, the water stays in the tank; as well as emptying intervals. Bacteria react very sensitively to gradual environmental changes especially regarding the composition of materials they process as well as the temperature.

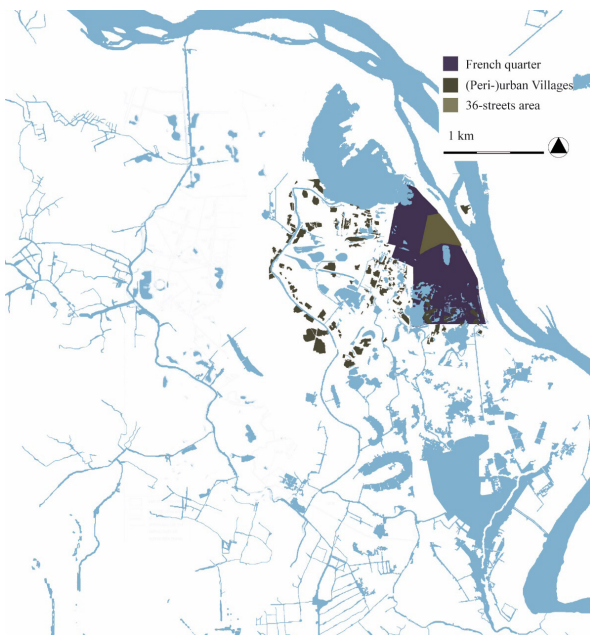


FIGURE 1 Hanoi at the end of the colonial period

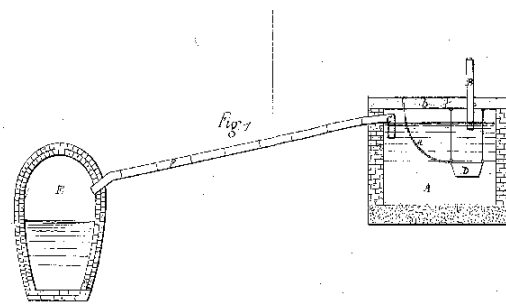
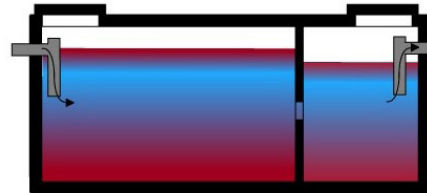


FIGURE 2 The fosse Mouras with connection to the sewerage system  
FIGURE 3 The fosse Mouras in Hanoi



Thus, while the outer appearance of the septic tank – brick or concrete walls, a floor and a top, one inlet and one outlet, sometimes also a baffle to direct wastewater, speaks of simplicity and stability, the internal processes are complicated and fragile. French sanitation planning was based on the notion that the handling of these delicate processes, mostly the emptying of the tank in five-year intervals, could only be mastered by the European population of the city and not by the “indigènes”, as the inhabitants of the people’s city, known today as the 36-streets area, were labelled. As engineer Fayet, then “*chef des Travaux Municipaux*” in Hanoi explicated:

*“[...] l’éducation au point de vue hygiène de la masse annamite n’est pas suffisante pour lui confier le fonctionnement d’appareils qui seraient vite obstrués et mis hors d’usage.”*<sup>25</sup>

At the end of the colonial period, Fayet<sup>26</sup> estimated that only 1.000 of the estimated 10.000 households in Hanoi were equipped with septic tanks and 8.500 with the much despised „*tinettes mobiles*“. In his “*Avant projet sur les Égouts de Hanoi*” he anticipated to eradicate the night soil system. He considered this system to be a major health thread due to two factors, the use of the untreated sludges in agriculture and the illegal dumping of household sludges into the existing sewerage system of the city. This procedure of collection and illegal dumping of night soil provokes Fayet’s particular repugnance:

*“[...] La rencontre à l’heure de la sortie des spectacles de ces véhicules malodorants est des plus désagréables.”*<sup>27</sup>

Based on the socio-spatial segregation of the city already existing in this phase of colonial rule, the “*avant projet*” planned for the substitution of the night soil system with a septic tank system in the French quarter and with a large-scale centralised network “*tout à l’égout*” in the other parts of the city. This network was to separate stormwater and other household wastewaters and its installation was supposed to cost almost one third of the entire project budget<sup>28</sup>. The idea to impose the use of septic tanks on the French quarter was rooted in financial considerations, as

*“[...] L’emploi des fosses septiques sera donc [...] imposé dans les quartiers européens à population diluée où l’installation du tout à l’égout serait ruineuse [...]”*<sup>29</sup>

Fayet considered the large and less dense inhabited European quarters, whose inhabitants mostly resided in lavish villas, as ideal spaces for the septic tanks of Hanoi. The dimensioning of the tanks was adapted to the estimated low population density of the colonial quarters: it was expected that one or maximum two families inhabited the large mansions<sup>30</sup>. Thus, this plan has reinterpreted the septic tank as an elite urban technology. It has assumed a particular socio-spatial order in Hanoi, with a clear segregation between the colonial, European elite and the “indigènes”, two groups with very distinct characteristics concerning their hygienic behaviour. The plan furthermore has supposed that this order was permanent, as long-term sanitation planning was based on it and it was considered a prerequisite for the functionality of sanitation devices such as the septic tank.

## SEPTIC TANKS TODAY: APPROPRIATIONS OF A COMMON TECHNOLOGY

Like in the French colonial era, urban planning of Hanoi in the command economy was characterized by gigantic, oversized and unrealistic plans designed by foreign planning experts. In contrast to the plans, planned urbanization integrating urban infrastructure provision and urban design almost came to a halt between the early 1930s – the beginning of organized resistance against the colonial regime, and the early 1990s – the economic upturn in the wake of “doi moi” (renewal), the introduction of state and economic reforms towards market socialism from 1986 on<sup>31</sup>. At the end of the American war in 1975, when urban planning of Hanoi was supported by the Soviet Union, sustaining financial and economic difficulties as well as an ambivalent stance of the regime towards urbanization inhibited substantial urban re-constructions and expansions<sup>32</sup>. Formal urbanization in the planned economy was reduced to the selective construction of “socialist living quarters” outside the existing urban core. Thus, rapid urban growth in the course of the 1970s and 1980s led to a largely self-organized re-construction and expansion of houses in the core areas of Hanoi as well as a densification of peri-urban villages. At the beginning of the 1990s, living conditions were tense in Hanoi’s core: instead of one family, up to 120 people lived in the formerly luxurious colonial villas<sup>33</sup>. The advent of doi moi in 1986 led to accelerated urbanization and urban expansion of Hanoi, as relaxed influx controls and new economic opportunities have motivated people to migrate to the city<sup>34</sup>. Massive urbanization particularly of the western and southern edges of Hanoi has been shaped by the construction of planned estates and the incremental densification and expansion of urban space beyond planning (Figure 4). Systems of sanitation and wastewater disposal and particularly septic tanks reflect and shape these urbanization dynamics.

One of the first socialist living quarters, Kim Lien, had been equipped with a local wastewater treatment plant and an underground sewer system separating stormwater and household wastewaters. However, this system remained functional for a short time only<sup>35</sup> and the subsequent living quarters were equipped with a new generation of septic tanks. This model of the septic tank consists of one chamber of concrete or of brick. It has no filter and is designed to receive only blackwater from a flush toilet. The absence of filters means that on the one hand the tanks do not clog as easily and on the other hand the blackwater flows almost untreated into the river system, if the tanks are not emptied every year or every two years<sup>36</sup>. Also most of the tanks under the villas in the French quarter have been adapted to the drastic rise of inhabitants. In order to reduce the wastewaters in the tank, only blackwater flows into them, while greywater, kitchen and bathroom wastewater without urine or faeces, flows directly into the drainage system. The more solid substance of the material flowing into the tanks requires the de-installation of filters. Tanks without filters have thus become the norm in Hanoi since 1954 (Figure 5).

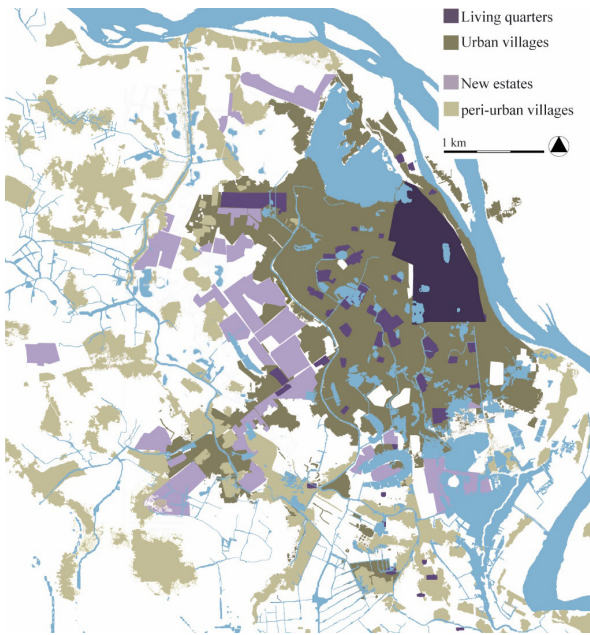


FIGURE 4 Hanoi southwest of the Red River today

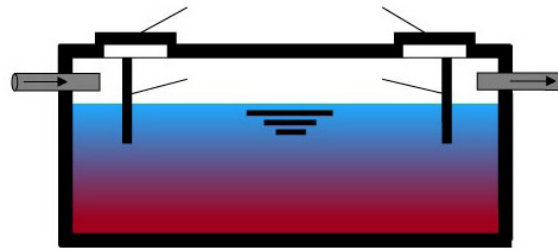


FIGURE 5 The Hanoian septic tank today

The re-constructions of the septic tanks in the French quarter were pragmatic from the point of view of the villas' inhabitants as the absence of filters allowed for the sewerage to flow into the city's system more smoothly. The adaptation of the tanks to a drastically changed situation disproves the French regime's imaginations concerning the possibility to construct a lasting urban order. This idea of order is reflected in the installation of septic tanks, which require a certain stability of population densities to function. The French planners had not anticipated the massive rise of inhabitants and the transformation of the colonial quarter from an elite neighbourhood to an overcrowded popular area during the planned economy. This fundamental change was facilitated by the reconstruction of the tanks and their appropriation by inhabitants of Hanoi, who have created and established a new version of the septic tank. However, as wastewater flows largely untreated from the households through the tanks into the city's sewerage system, their contribution to Hanoi's sanitation is marginal.

The pragmatic adaptation of the septic tanks to the changed condition in Hanoi has rendered them dysfunctional in terms of sanitation. This motivates the Japan International Cooperation Agency and the Government of Vietnam to dismiss this technology. In a recent large-scale wastewater planning project, they envision Hanoi as a city served by a centralized large technological sewerage network complete with centralized plants at the outskirts of the city collecting and treating the city's sewage before directing it into rivers in the city's hinterland<sup>37</sup>. The septic tank has no place in this modernist vision – a feasibility study grants the city's tanks hardly any attention, just casually mentioning that they „do not function satisfactorily and can reduce pollutants only slightly”<sup>38</sup>. However, the septic tanks are the most common and, in absence of a functional centralized wastewater treatment system, almost exclusive wastewater treatment technology in Hanoi. The current septic tank system overcomes the urban-rural divide imagined by formal sanitation planning in the colonial era and present.



FIGURE 6 Septic tank emptying



FIGURE 7 HSDC staff with sewage sludge

## TRACING SEPTIC TANK SLUDGE BEYOND URBAN-RURAL BOUNDARIES

The septic tanks' simple brick structure contradicts the complex processes happening within them as bacteria do their work carefully calibrated to the composition of sludge and temperature conditions. Furthermore, also the current septic tanks are not isolated from broader urban relations and flows. As sewerage flows from the tanks into the city's channels and rivers the septic tank system is not limited by the brick walls of the actual tanks. Due to the ever changing composition and materiality of sewerage sludge and the perpetually provisional and dynamic condition of the sewerage system itself it is extremely difficult to follow their ways through the city. Furthermore, humans shape the urban flows of wastewater, adding complication to the issue not least because of the stigma attached to the handling of human wastes. In traditional Vietnamese village societies, night soil collectors had a low social rank, comparable to that of thieves<sup>39</sup>. As this is a topic that people in Hanoi avoid to talk about directly, especially not to strangers, several rumours evolve about it.

The opacity of the ways of the sludge through the city reflects the complex institutional structures of the operation of septic tanks. The 'Hanoi Sewerage and Drainage Company' is responsible for de-sludging the city's sewerage channels and rivers and states that it also empties septic tanks<sup>40</sup> (Figure 7). However, a visit to the utility's landfill at Hanoi's northern edge reveals that it is completely empty, a vast stretch of land without any trace of sludge. According to the Environmental Law, it is the waste management utility of Hanoi, the 'Urban Environmental Company' (URENCO) that is formally responsible for septic tanks<sup>41</sup>. This company runs a composting plant at the western edge of the city where sewerage sludge can be treated together with organic waste to produce fertilizer. However, an expert in the sector explains that hardly any sludge arrives there apart from the one that the URENCO collects from public toilets throughout the city<sup>42</sup>. The idea of gathering and treating the sludge from septic tanks at the edge of the city is in accord with imagined divide between the city as place of production of wastewaters and the open spaces outside the city. However, it does not actually appear to be a functioning concept for sludge management of Hanoi. The capricious ways of the sludge through the city are not under control or even known by the public utilities.

While two different utilities claim to manage septic tank sludges, small-scale companies are in fact the most important contacts for people wishing to have their household tanks emptied (Figure 6). These companies advertise their services all across the city, often by spraying their telephone numbers or by posting notes on walls, trees and any spaces available. An entrepreneur in the sector explains that he or his workers have actually never brought the sludge to a formal landfill or plant, but occasionally pay a fine for “illegal dumping” of sludge. This fine is a calculated risk he takes, as time and fuel spent on transporting the sludge from a household to a legal dumping site far from the urban core would possibly accrue to even higher costs, compromising the profitability of his business<sup>43</sup>. He does not name the locations where he actually dumps the sludge. However, newspaper articles provide further hints as to where the sludge from septic tanks of Hanoi’s households actually ends up. One article reports that not one small-scale entrepreneur had signed a contract with the composting plant. Rather, apart from the city’s rivers and lakes, the sewerage lines of newly constructed housing estates at the western edge of the city are preferred locations for the dumping of sludge<sup>44</sup>. This is because the modern underground sewerage networks of the housing estates are easily accessible through the gully. This is a situation, night soil collectors in the French colonial period had discovered already. A newspaper close to the communist party of Vietnam decries the “horrors” of human faeces being used as fertilizer for fresh vegetables – just like in the colonial era. The newspaper also observes carelessness among farmers who continue these practices despite a formal ban by the Ministry of Health in 2008<sup>45</sup>. Of particular concern for the newspaper is the fact these practices allow faecal bacteria to travel back to the city and risk the health of citizens consuming the vegetables produced in the city’s peri-urban spaces. While the article denounces such practices as non-modern, it does not elaborate on the question where the sludge actually has been collected and how it arrived on the fields of peri-urban Hanoi. However, a turn to literature sheds more light on this issue. The Author Nguyen Hui Thiep describes a market that takes place in the early morning hours at a highway outside the city where people buy human faeces from the city for growing vegetables, especially eggplant. The market chief states: “Not religious, not political, not greedy, not sexy’ Mr. Mong told me, ‘Scooping up shit is the best profession in the world!’”<sup>46</sup> (own translation from German)

## CONCLUSION

Hanoi’s septic tanks are shaped by and shape urbanization dynamics beyond formal visions of urban order in multiple ways. French engineers have conceptualized the tanks as a modern urban technology contrasting the night soil system, which according to planners has belonged into rural spaces only. However, the current version of septic tanks unites characteristics of both systems and thus overcomes the rural-urban divide that planners during and after the colonial period have imagined: like regular latrines, the tanks are simple structures that consist of only one chamber instead of two. As opposed to the original design, they receive only blackwater and not the entirety of household wastewater. Furthermore, they have no filters, just like the latrines, which changes the composition of sludge inside the tanks and renders smaller emptying intervals necessary. This is the case because bacteria no longer decompose the materials inside the tanks the way engineers have expected as they designed Hanoi’s septic tanks. Thus, the processes going on inside the tanks are more similar to those happening in the latrines than those the designers of the tank had anticipated. Unlike imagined by planners, septic tank sludge is not handled by formal utilities, but by small-scale entrepreneurs, who operate outside the formal legal system, dumping sludges into the sewerage system or facilitating their use as fertilizer in agriculture – practices that have been common before, during and since the colonial era and that French engineers have deemed unworthy of modern urban living and have intended to eradicate with the formalization of the septic tank system. They remain illegal, but common in the city of Hanoi to date. Entrepreneurs in the sector contribute to a blurring of urban-rural divides as they dump the sludge into the city’s sewerage system instead of transporting it to landfills or treatment plants at the urban edge. Thus, it is not only the style of construction, but also the complex and volatile journey of sludge and bacteria through the city, from the households to the sewerage system to peri-urban fields and aquacultures and via vegetables or fish back to the urban households, which overcomes the idea of city as the site of production and the rural space as the sink of wastewaters (Figure 8).





FIGURE 8 Aquaculture in Hanoi

Hanoi's septic tanks reflect the city's urbanization dynamics beyond any urban-rural dichotomy. Since their introduction in the colonial era, they have become an integral component of the urban sanitation system of Hanoi, closely embedded in broader urban socio-material flows, artifacts and practices. At the same time, they have resisted formal urban planning and respective modernist imaginations of urban socio-spatial order in the French colonial period as well as today. Urban sanitation planning in both periods has been based on the idea of a fixed urban space that is clearly delimited from rural space, which can be controlled via planning by state agencies, and whose inhabitants act in accord with legal provisions. In the French colonial era, the septic tank was an emblem of such modern urbanization, which was to replace the dismissed night soil system. In contrast, current sanitation planners consider the septic tank as an obstacle to the creation of urban socio-spatial order and hence exclude it from formal urban sanitation planning. However, the tanks remain an integral part of Hanoi's sanitation system beyond these changing ascriptions. The historic development of the septic tanks reveals that their resistance to planned change does not imply that they are static or fixed. The inertia of the septic tank system despite its current dismissal by formal urban sanitation planning is not rigid but flexible as it has allowed for the emergence of urban sociotechnical dis/orders intermingling urban and rural technologies, practices, and spaces beyond modern imaginations. These dis/orders are constitutive of Hanoi's urbanization dynamics with blurred and constantly changing passages between the urban and the rural rather than firm boundaries.

## Disclosure Statement

No potential conflict of interest was reported by the author.

## Notes on contributor

Sophie Schramm does research on urban infrastructure systems with a focus on the global south. She studied Urban and Regional Planning at the HafenCity University in Hamburg. In 2008, she joined the TU Darmstadt, where she has been working in research projects. In 2014, she published her dissertation thesis "City in flow – Hanoi's wastewater system in light of social and spatial transformations". Till April 2016, she was working as a research associate at the chair for Spatial and Infrastructure Planning, TU Darmstadt. Currently, she is a post-doc researcher at the University Kassel in the project "Dis/ordering African Cities".

## Endnotes

- 1 Simon Graham and Simon Marvin, *Splintering Urbanism. Networked infrastructures, technological mobilities and the urban condition* (London: Routledge, 2001).
- 2 Thomas P. Hughes, *Networks of Power. Electrification in Western Society, 1880-1930* (Baltimore: Johns Hopkins University Press, 1983)
- 3 Jochen Monstadt, "Großtechnische Systeme der Infrastrukturversorgung: Übergreifende Merkmale und räumlicher Wandel," in *Wandel der Stromversorgung und räumliche Politik*, ed. D. Gust. (ARL Forschungs- und Sitzungsberichte Band 227, 2007), 7–34.
- 4 Anique Hommels, "Changing obdurate urban objects: the attempts to reconstruct the highway through Maastricht," in *Urban Assemblages*, ed. I. Farias, T. Bender. (London: Routledge, 2010), 139–160.
- 5 Susan Leigh Star, "The Ethnography of Infrastructure," *American Behavioral Scientist* 43 (1999).
- 6 Graham and Marvin, *Splintering Urbanism*.
- 7 Thomas G. Kirsch, "»Illegal Connections«: Conflicts over Electricity in Soweto," *Soziale Welt* 16 (2006), 194.
- 8 Nguyen Quang and Hans D. Kammeier, "Changes in the political economy of Vietnam and their impacts on the built environment of Hanoi," *Cities* 19(2002), 377.
- 9 Nguyen P. Vinh, *Hanoi Past and Present* (Hanoi: The Gioi, 2004).
- 10 Christian Pédelahore, "Hanoi: Mirror of Indochinese Architecture," *Vietnamese Studies* (1993).
- 11 William S. Logan, *Hanoi: Bibliography of a City* (Seattle: University of Washington Press, 2000).
- 12 L. Fayet, "Avant-Projet sur les Egouts de Hanoi," Hanoi: Imprimerie d'extrême Orient, 1939. National Archive Vietnam, Centre I Hanoi, (078692-03).
- 13 Vinh, *Hanoi*.
- 14 Fayet, *Egouts de Hanoi*, 16.
- 15 Christian Pédelahore, "Constituent Elements of Hanoi City," *Vietnamese studies* (1986), 104–159.
- 16 Gwendolin Wright, *The politics of design in French colonial urbanism* (Chicago: University of Chicago Press, 1991), 190.
- 17 Fayet, *Egouts de Hanoi*.
- 18 Logan, *Hanoi*.
- 19 Elisabeth Heidenreich, *Fliessräume: die Vernetzung von Natur, Raum und Gesellschaft seit dem 19. Jahrhundert* (Frankfurt/ Main: Campus, 2004).
- 20 Fayet, *Egouts de Hanoi*.
- 21 Nguyen Viet Anh, *Septic Tanks and Baffled Septic Tanks with Anaerobic Filters (BASTAF)*. (own translation, original Vietnamese: *Bể tự hoại và bể tự hoại cải tiến*) (Hanoi: Construction Publishing House, 2007).
- 22 Ibid.
- 23 Fayet, *Egouts de Hanoi*.
- 24 Viet Anh, *Septic Tanks*.
- 25 Fayet, *Egouts de Hanoi*, 25.
- 26 Ibid. 9.
- 27 Ibid. 21.
- 28 Conseil Municipal, "Session ordinaire de Novembre 1938, Extrait du procès-verbal des délibérations prises en séance du 18 Janvier 1939," National Archive Vietnam, Centre I Hanoi, (078692-03), 8.
- 29 Fayet, *Egouts de Hanoi*, 25.
- 30 Viet Anh, *Septic Tanks*.
- 31 William S. Logan, "Hanoi, Vietnam," *Cities* 13 (2009), 88.
- 32 Logan, *Hanoi*, 217.
- 33 Ibid. 223.
- 34 Quang and Kammeier, "Built environment Hanoi".
- 35 Interview Tran Duc Ha, Professor Institute for Environmental Science & Engineering (IESE), Hanoi University of Civil Engineering (HUCE), 2010.
- 36 Viet Anh, *Septic Tanks*.
- 37 Socialist Republic of Vietnam/ People's Committees of Hanoi (SRV/HPC). "Feasibility Study for the Construction Project of central large-scaled wastewater treatment plants for Hanoi environmental improvement - Final report summary." Hanoi: NIPPON KOEI; VIWASE, 2009.
- 38 Ibid. 1.
- 39 Le Hong Ly and Hue-Tam Ho Tai, "The Revenge of the Object Villagers and Ethnographers in Đồng Kỵ Village," *Asian Ethnology* 67 (2008).
- 40 Hanoi People's Committee/Ha Noi Sewerage and Drainage one-member state company ltd.) (HPC/HSDC), "De-sludging and treatment of waste sludge of Ha Noi's drainage system," Hanoi, August 2008.
- 41 National Assembly of the Socialist Republic of Vietnam, "Law on Environmental Protection," Hanoi, 2005 (52/2005/QH11).
- 42 Interview Pham Van Duc, ENTECH waste management company, 2009.

- 43 Interview Septic Tank emptying entrepreneur, 2009.
- 44 “Where does the waste from Septic Tanks go in Hanoi? (own translation, original Vietnamese: Chất thải từ bể phốt ở Hà Nội... đi đâu?).” VIET-BAO, August, 26, 2008, accessed September 5, 2008, <http://vietbao.vn/Xa-hoi/Chat-thai-tu-be-phot-o-Ha-Noi-di-dau/20800545/157/>.
- 45 “Horrors of fresh vegetables (own translation, original Vietnamese: Kinh hoàng rau tươi phân tươi).” XALUAN, Mai, 14, 2009, accessed November 4, 2009, <http://www.xaluan.com/modules.php?name=News&file=article&sid=120402#ixzz1PuuvIKbz>.
- 46 Nguyen Hui Thiep, *Der pensionierte General* (Halle: Mitteldeutscher Verlag, 2009), 210.

## Bibliography

- Conseil Municipal, “Session ordinaire de Novembre 1938, Extrait du procès-verbal des délibérations prises en séance du 18 Janvier 1939,” National Archive Vietnam, Centre I Hanoi, (078692-03)
- Fayet, L. “Avant-Projet sur les Egouts de Hanoi,” Hanoi: Imprimerie d’extrême Orient, 1939. National Archive Vietnam, Centre I Hanoi, (078692-03).
- Graham, Simon and Simon Marvin. *Splintering urbanism. Networked infrastructures, technological mobilities and the urban condition*. London: Routledge, 2001.
- Hanoi People’s Committee/Ha Noi Sewerage and Drainage one-member state company ltd.) (HPC/HSDC), “De-sludging and treatment of waste sludge of Ha Noi’s drainage system.” Hanoi, August 2008.
- Heidenreich, Elisabeth. *Fließräume: die Vernetzung von Natur, Raum und Gesellschaft seit dem 19. Jahrhundert*. Frankfurt/ Main: Campus, 2004.
- Hommels, Anique “Changing obdurate urban objects: the attempts to reconstruct the highway through Maastricht,” in *Urban Assemblages*, edited by I. Fariás, T. Bender, 139-160. London: Routledge, 2010.
- Hughes, Thomas P. *Networks of Power: Electrification in Western Society, 1880-1930*. Baltimore: Johns Hopkins University Press, 1983.
- Kirsch, Thomas G. “»Illegal Connections«: Conflicts over Electricity in Soweto.” *Soziale Welt* 16 (2006), 193-208.
- Leigh Star, Susan. “The Ethnography of Infrastructure.” *American Behavioral Scientist* 43 (1999), 377-91.
- Logan, William S. *Hanoi: Bibliography of a City*. Seattle: University of Washington Press, 2000.
- Logan, William S. “Hanoi, Vietnam”, *Cities* 13 (2009), 87-94.
- Ly, Le Hong and Hue-Tam Ho Tai. “The Revenge of the Object Villagers and Ethnographers in Đồng Kỵ Village,” *Asian Ethnology* 67 (2008), 323-343.
- Monstadt, Jochen. “Großtechnische Systeme der Infrastrukturversorgung: Übergreifende Merkmale und räumlicher Wandel.” in *Wandel der Stromversorgung und räumliche Politik*, edited by D. Gust , 7-34. ARL Forschungs- und Sitzungsberichte Band 227, 2007.
- National Assembly of the Socialist Republic of Vietnam. “Law on Environmental Protection,” Hanoi, 2005 (52/2005/QH11).
- Pédelahore, Christian. “Hanoi: Mirror of Indochinese Architecture.” *Vietnamese Studies* (1993), 26-56.
- Pédelahore, Christian. “Constituent Elements of Hanoi City,” *Vietnamese studies* (1986), 104-159.
- Quang, Nguyen and Hans D. Kammeier. “Changes in the political economy of Vietnam and their impacts on the built environment of Hanoi,” *Cities* 19 (2002), 373-388.
- Thiep, Nguyen Hui. *Der pensionierte General*. Halle: Mitteldeutscher Verlag, 2009.
- Vinh, Nguyen P. *Hanoi Past and Present*. Hanoi: The Gioi, 2004.
- Viet Anh, Nguyen. *Septic Tanks and Baffled Septic Tanks with Anaerobic Filters (BASTAF)*. (own translation, original Vietnamese: Bể tự hoại và vá bể tự hoại cải tiến). Hanoi: Construction Publishing House, 2007.
- Wright, Gwendolin. *The politics of design in French colonial urbanism*. Chicago: University of Chicago Press, 1991.

## Image Sources

- Figure 1: own image based on Fayet 1939.
- Figure 2: Extract of patent of Jean-Louis Mouras, No. 144,904, filed September 22, 1881 to the Ministry of Agriculture and Commerce, France ‘Archives INPI’, aquired from [https://fr.wikipedia.org/wiki/Fosse\\_Mouras](https://fr.wikipedia.org/wiki/Fosse_Mouras), accessed 10 May 2016.
- Figure 3: adapted from Viet Anh 2007.
- Figure 4: own image based on Google aerial picture 2010, Fayet 1939; Quang/Kammeier 2002.
- Figure 5: adapted from Viet Anh 2007.
- Figure 6: own image.
- Figure 7: own image.
- Figure 8: own image.