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# Malaria eradication and colonial sanitation projects in Semarang in the early 20th century

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**Abstract**. Malaria was a widespread disease in the coastal cities of the Dutch East Indies, with swampy landscapes making these urban areas particularly susceptible to outbreaks. Semarang was one of the port cities in the Dutch East Indies that underwent an industrial transformation in the plantation sector, which increased the population and changed the environment and public health, especially among the indigenous population. Since the early 20th century, malaria has been a disease that has infected and caused the death of Semarang residents. This malaria spread is exacerbated by the poor living conditions of the indigenous population, leading to outbreaks of other diseases such as cholera, dysentery, and typhus in the early 20th century. This study aims to provide a historical perspective and critical analysis of public health policy in relation to colonial sanitation interventions in the Dutch East Indies. This historical analysis employs a historical method comprising heuristics, source criticism, interpretation, and historiography. The results of this study show that since the early 20th century, Semarang has suffered from severe environmental and sanitation challenges during this transitional period. These problems were intensified by increasing rural migration and the proliferation of slums on the city's periphery. The colonial government's shift in health policy—from curative to hygienic-prophylactic approaches—enabled broader access to health services. The Semarang city government's policy on colonial sanitation projects, including *kampongverbetering* (village improvement), hygiene maintenance, and the provision of a clean water supply, all aimed at improving the overall public health of the urban population.

**Key words:** disease, eradication, malaria, sanitation projects, Semarang

## Introduction

> *"Zonder gezondheid geniet niemand genoegen van zijn aardse goederen"*
>
> Jacobus Bontius.

This quote, meaning "Without health, no one can enjoy the pleasures of earthly goods," reflects the importance of health in the worldview of scientists and physicians in the Dutch East Indies during the early years of colonial rule. Written by Jacobus Bontius, a Dutch physician and pioneer of tropical medicine in Batavia, the statement underscores the significance of health long before it became a central concern of colonial policy. Despite this awareness, neither the Dutch East India Company (VOC) nor the Dutch colonial administration initially possessed a comprehensive understanding of the interrelated problems of health and the environment in the Indies. Up until the late 19th century, the Dutch East Indies was regarded as one of the unhealthiest regions in the world. Among Dutch soldiers, officers, and traders, Batavia was notoriously referred to as the "cemetery of Europeans." This situation was exacerbated by local practices in Batavia, where residents used rivers and canals for waste disposal due to the absence of household toilets (1). Poor environmental conditions and sanitation habits were compounded by the limited medical knowledge among

Europeans, who were largely unaware of the nature and transmission of diseases endemic to the archipelago (2). According to prevailing Western perspectives, the frequent illness and death of Europeans were attributed to the incompatibility between the tropical climate and the European race and physique, making long-term settlement seemingly impossible (3). This acclimatisation theory persisted throughout the 19th century, reinforcing the belief that the tropical environment was only habitable for the indigenous population, who were presumed to be naturally more resilient and healthier than Europeans (4, 5). During this period, various tropical diseases afflicted Europeans, resulting in high mortality rates among the colonial population in the Dutch East Indies.

Malaria was one of the most prominent causes of death during this time. Since the early arrival of Europeans, malaria had been a source of great fear, earning the colony the grim moniker "the cemetery of Europeans." In the 18th century, malaria severely affected Dutch East India Company employees, military personnel, and sailors living in port areas of Batavia. After 1733, malaria outbreaks led to the deaths of over 85,000 VOC residents. These epidemics revealed a clear correlation between topography and disease transmission, prompting the relocation of many Europeans from the low-lying, swampy coastal port areas to higher and drier inland regions of South of Batavia *(Weltevreden)*. Van den Brug concluded that the worsening malaria epidemics were largely due to environmental changes in the coastal region caused by VOC economic activities. These activities resulted in stagnant ponds and clogged canals, which became ideal breeding grounds for mosquitoes—the primary vectors of malaria—thereby intensifying the spread of the disease in Batavia (6).

Malaria was closely linked to the residential environment of local populations, and its spread was often facilitated by topographical and ecological conditions that enabled mosquitoes—known vectors of the disease—to thrive. In his seminal study in the Malay Peninsula, Watson (1911) argued that malaria prevention could be effectively achieved through urban design and proper drainage systems. Sanitation and malaria control initiatives were implemented in areas such as Klang, Kuala Lumpur, Port Swettenham, and in plantation zones across the Peninsula. Rather than relying solely on curative treatments and medications, malaria eradication efforts at the time focused primarily on environmental interventions (7).

Beginning in the early 20th century, the Dutch East Indies government began shifting its public health policy toward a hygienic-prophylactic approach. Prior to this period, Dutch colonial health policy had largely emphasized curative care, primarily targeting military personnel, colonial officials, and a small portion of plantation laborers (8, 9). Over time, however, colonial authorities realized that such curative measures only benefited a small fraction of the population. In contrast, preventive action held greater potential for combating endemic diseases and improving public health on a broader scale (10).

Numerous studies have examined the evolution of colonial health paradigms and sanitation policies across various cities in the Dutch East Indies. Notable research on colonial sanitation projects includes works by Hudiyanto (11), Kooy and Bakker (12), Suriani and Anwar (13), Achdian (14), Affandi (5), Budiman (15), Mutawally (16), Hermawan (17), and Amini (18). Collectively, these studies demonstrate that, after the late 19th century, urban planning in the Dutch East Indies increasingly reflected colonial interests, incorporating advancements in piping technologies, sewage systems, clean water supply, and urban sanitation infrastructure. These developments were implemented in major cities such as Batavia, Bandung, Cirebon, Medan, Malang, Surabaya, and Semarang.

Studies on the city of Semarang, from the colonial period to the present day, have been extensively conducted. Recent scholarly works examining the city's history from various perspectives include those by Brommer (19), Tio (20), Amalia (21), Mulyanto (22), and Amini (18). Brommer et al. and Jongki Tio offer chronological accounts of Semarang's development across multiple dimensions. Meanwhile, Amalia and Mulyanto provide analyses focusing on *kampong-verbetering* (village improvement programs), social transformation within urban communities, and the spatial development of Semarang before and after its designation as a *gemeente* (municipality) (21, 22). Most recently, Amini's study explores municipal sanitation policies and the management of clean

water distribution in Semarang since the early 20th century (18).

Building upon this background and scholarly discourse, the present study investigates the policies and actions undertaken by the Semarang city government in its efforts to eradicate malaria and develop an urban sanitation system. Through a comprehensive literature review, this research aims to provide a historical perspective and critical analysis of public health policy in relation to colonial sanitation interventions in the Dutch East Indies.

## Methods

This study employs a qualitative approach, utilizing historical methods to analyze research and studies conducted by doctors and scientists on malaria in Semarang, as well as policies implemented by the Semarang city government. The historical method consisting of four main stages: *heuristic*, source criticism, interpretation, and historiography. Source collection was conducted by examining published works, documents, and archival records related to the city of Semarang, accessible through digital repositories such as www.delpher.nl and https://digitalcollections.universiteitleiden.nl. In addition, sources from medical journals and medical bulletins consisting of reports on malaria research and eradication by doctors in the Dutch East Indies were used. Once relevant sources were identified, source criticism was carried out to assess the credibility and validity of the data. The next step involved interpretation, which included analytical and synthetic processes based on historical data. The final stage was historiography, where verified historical facts were reconstructed into a coherent historical narrative.

## Semarang in the early 20th century

Semarang, located on the northern coast of Java, experienced rapid development in the early 20th century as a major industrial and port city. Its strategic geographic position made it a central gateway for trade in Central Java. From the era of the Mataram Sultanate through the VOC period and into Dutch colonial rule, Semarang continued to grow and attracted migrants from various regions (18, 21). As an industrial hub, the Dutch colonial administration sought to develop Semarang by building a range of facilities and infrastructure to support urban expansion. The city's development reflected both colonial urban planning and the economic interests of plantation capitalism in the surrounding areas.

Parts of Semarang's territory were formed through siltation and sedimentation, which created new lowland areas known as the lower city of Semarang (20). The city's boundaries were defined by the Java Sea to the north, Krapyak to the west, Srondol to the south, and Pedurungan to the east. In 1926, the Dutch colonial government administratively divided Semarang into five districts: West Semarang, East Semarang, North Semarang, South Semarang, and Central Semarang (Figure 1) (21).

Semarang served as a key economic gateway for trade and population mobility in Central Java. This role attracted migrants not only from surrounding areas but also from other regions of the archipelago and abroad. The expansion of plantations around Semarang and the economic growth of its port spurred significant migration into the city during the early 20th century. Among the diverse groups that migrated to Semarang were Chinese, Arabs, Malays, Indians, and Europeans. Nevertheless, the Javanese—being the indigenous population—remained the majority in the city, followed by the Chinese as the second-largest group. Over the course of nearly a century, Semarang's population increased more than tenfold. In 1850, the city had approximately 29,000 inhabitants; by 1941, the population had grown to 280,000. This demographic growth was driven by the development of the trade-based urban economy, the expansion of the plantation industry, and the broader modernization of Semarang as a colonial city (19). The population growth of Semarang between 1850 and 1940 is presented in the Table 1.

The city's rapid development, coupled with the administrative decentralization policies introduced through the *Desentralisatie Wet* (Decentralization Law) of 1903, led to the official designation of Semarang as a *gemeente* (municipality) in 1906. Following

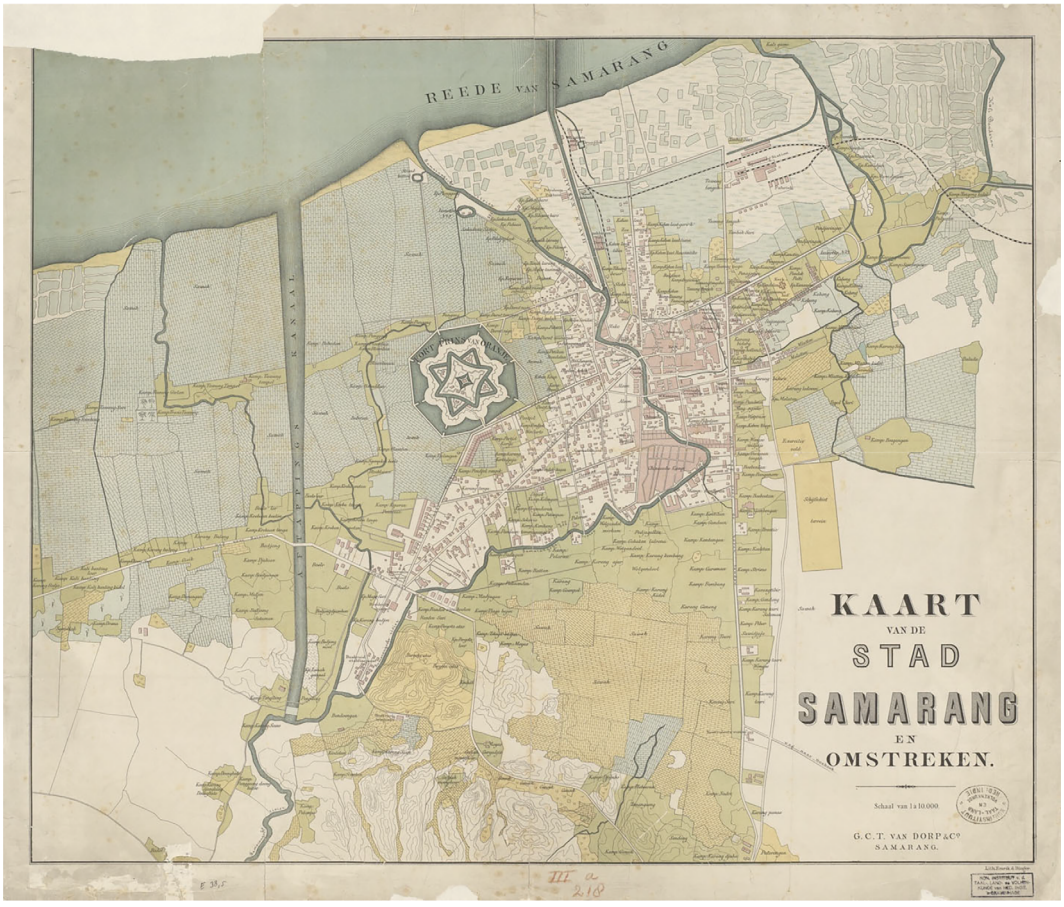


**Figure 1.** Map of Semarang, 1880. Source: KITLV DE 38,5.

**Table 1.** Population in Semarang, 1850–1941

| **Residents** | **1850** | **1890** | **1920** | **1930** | **1941** |
|---|---|---|---|---|---|
| European | 1.550 | 3.565 | 10.151 | 12.587 | 16.500 |
| Chinese | 4.000 | 12.104 | 19.720 | 27.423 | 40.000 |
| Foreign Asian | 1.850 | 1.543 | 1.530 | 2.329 | 2.500 |
| Natives | 20.000 | 53.974 | 126.628 | 175.457 | 221.000 |
| Total | 29.000 | 71.186 | 158.036 | 217.796 | 280.000 |

Source: (19).

this designation, modern residential areas and urban spaces began to emerge, particularly in the southern part of the city—an area that came to be known as "*Kota Baru*" (New City). In this zone, neighborhoods such as Sompok, Ngaglik, Kintelan, and Tjandi developed into modern residential areas, supported by adequate urban infrastructure and public facilities (18).

Public infrastructure and facilities were developed to support the city's growing economy. The development of the Semarang port included the construction of the *Kleine Boom* terminal, as well as the integration of canal systems and existing railway lines. These rail and port infrastructures were essential for supporting economic activities in Central Java at the time.

The port of Semarang functioned as a central hub for trade and logistics, while the railway network served as a vital land transportation system that supported the distribution of goods and fostered the growth of the plantation and industrial economy in Semarang and across Java (22).

The rapid population growth and urban expansion of Semarang as a colonial city in the early 20th century brought about significant challenges, particularly in the area of public health. The spatial reorganization of residential zones was marked by the increasing concentration of European settlements, which led to the displacement of indigenous communities. The native population was largely confined to areas such as Bulu, Pandean, Ambengan, and Karangsari. This surge in population density gave rise to overcrowded slums and poor access to sanitation facilities (21). H.F. Tillema, a pharmacist and member of the Semarang city council, reported that residents lived in densely packed kampongs with narrow streets and alleys. These conditions were further exacerbated by seasonal changes, where the roads would turn dusty during the dry season and swampy during the rainy season (23).

**Tropical diseases and the spread of malaria**

The poor living conditions of indigenous settlements were a major concern in the development of cities across the Dutch East Indies during the early 20th century. This problem was not unique to Semarang; similar conditions were observed in Batavia, Medan, and other colonial urban centers. In Batavia, indigenous residential areas were segregated and served as a buffer for European districts. While the European population resided in Weltevreden, indigenous communities were concentrated in areas like Gambir and Jatinegara. These neighborhoods were characterized by unclean, muddy, and poorly organized infrastructure (24). In Medan, slum conditions were attributed to poor housing construction and environmental degradation. The situation was worsened by inadequate lighting, muddy access roads, and the absence of proper sanitation and waste disposal systems (25). Semarang's native neighborhoods faced similar challenges. By the second decade of the 20th century, most indigenous houses in Semarang did not meet the minimum requirements for proper habitation. These homes were typically constructed from bamboo, lacked ventilation, and had earthen floors. This prompted concern from colonial authorities and became the subject of investigation by the Semarang city council member, H.F. Tillema (Figure 2) (26).

The expansion of indigenous settlements was, at times, intentionally orchestrated by the Dutch colonial administration to serve as a natural buffer against the spread of infectious diseases. In general, urban spatial planning in the Dutch East Indies was divided into two main zones. First, European residential areas were developed in the city center, equipped with public facilities and open spaces. These zones became the locus of colonial governance and the embodiment of European urban ideals. Second, the peripheral zones were designated for indigenous populations, typically referred to as kampongs within the city. These kampongs encircled the urban core and were located on the city's outskirts. Urban development projects and facility improvements were primarily focused on enhancing the quality of life in European quarters. In contrast, improvements in indigenous settlements were motivated by the need to prevent disease outbreaks and mitigate environmental conditions that might threaten the health and hygiene of European districts (28).

In cities across the Dutch East Indies—including Semarang—European neighborhoods were markedly different from indigenous ones. European housing was designed to resemble cities in the Netherlands, with orderly layouts, paved streets, drainage ditches, and canals that demarcated residential blocks. Houses were built with permanent materials such as brick, both to reduce fire hazards and to promote healthier living conditions. In stark contrast, indigenous dwellings were typically semi-permanent, constructed from bamboo, and lacked adequate ventilation. Such conditions were frequently associated with the spread of disease and poor urban sanitation (29).

Poor housing conditions had a direct impact on public health. They facilitated the rapid and widespread transmission of disease. According to Tillema, homes that lacked exposure to sunlight and were persistently damp were highly susceptible to environmental threats such as poor air quality and disease

**Figure 2.** Resident's activities at the riverbanks of Semarang, 1928. Source: (27).

vectors—including mosquitoes, lice, and rats. Overcrowding, along with the presence of domestic animals such as pigs and poultry, further increased the risk of disease transmission and posed serious health threats to inhabitants. Tillema documented a range of diseases associated with such living conditions, including malaria, hookworm, dysentery, typhoid, cholera, respiratory infections, and tuberculosis. Additionally, the common practice among some indigenous residents of spitting or chewing *sirih* (betel nut) indoors worsened sanitary conditions and heightened the risk of disease spread (23).

The data presented in the Table 2 shows the death rates per one thousand residents in the city of Semarang from 1906 to 1911, following its designation as a *gemeente* (municipality). The figures reveal particularly high mortality rates among the indigenous and Chinese populations, although European residents also experienced relatively high rates of death. These deaths were primarily caused by infectious diseases such as malaria, smallpox, typhoid, hookworm, and cholera (21). In 1909, a field survey reported that in North Semarang alone, 69 deaths occurred due to a variety of causes. The breakdown included: malaria (22 cases), tuberculosis (8 cases), convulsions (4 cases), typhoid (4 cases), diphtheria (4 cases), dysentery (3 cases), smallpox (3 cases), pneumonia (3 cases), cancer and gastrointestinal issues (2 cases), and one case each of heart disease, kidney failure, intestinal bleeding, and neurological disorders. Additionally, 12 cases had unknown causes of death (31). The disease also spread to other areas, particularly East-North Semarang. The diseases that broke out were malaria, typhus, dysentery, and cholera. At a meeting of the Semarang City Council on 29 January 1909, Dr. W.T. de Vogel stated that the cholera epidemic had a significant impact on the indigenous population due to poor housing

**Table 2.** Resident's death rates (per thousand) in Semarang, 1906–1911

| Residents | 1906 | 1907 | 1908 | 1909 | 1910 | 1911 |
|---|---|---|---|---|---|---|
| European | 36,6 | 31 | 32,7 | 31,2 | 47,2 | 36,6 |
| Chinese | 39,7 | 52,3 | 46,9 | 58,2 | 76 | 64,3 |
| Natives | 59,2 | 43 | 38,7 | 56 | 74,2 | 58,8 |

Source: (30).

and environmental conditions. The poor hygiene habits of the population and the open latrines near their homes caused contamination of groundwater and wells (32).

The mortality rate in Semarang was three to four times higher than in other cities in the Dutch East Indies. The causes were the unhealthy living conditions of the Chinese and indigenous communities, such as poor lighting and ventilation, inadequate waste and sewage disposal, and stagnant water in swamps and rice fields, which were breeding grounds for malaria (32). The topography of Semarang, with parts of the city located along the coast and swamps, as well as canals running through the eastern and western parts of the city, posed a significant risk for the spread of malaria. Based on investigations conducted by Dr. Swellengrebel, malaria cases in Semarang were first documented in the early 20th century through spleen examinations of patients by Dr. Terburgh in 1903 and malaria case records by Dr. Lim at Semarang City Hospital from 1913 to 1917 (33).

During five years of malaria case investigations in Semarang, it was found that malaria transmission began to increase every June, reaching its peak in August. These months coincided with the dry season (33). Semarang is a coastal area in northern Java where the soil consists of a layer of quaternary soil containing artesian water. During the rainy season, water accumulates because the area lacks adequate drainage systems. These waterlogged areas persist into the dry season. These waterlogged areas serve as breeding grounds for mosquitoes that carry the malaria parasite. In larger pools, there are swamp fish that can clean up the mosquito larvae. However, during the dry season, the hot sun makes it impossible for fish to survive in ponds at temperatures above 41°C, while mosquito larvae can survive at temperatures up to 46°C (34). Waterlogged areas on low-lying hillsides often also serve as breeding grounds for malaria-carrying mosquitoes. Additionally, riverbanks and thickets along rural areas provide ideal habitats for Anopheles mosquitoes. Meanwhile, hilly areas with steep slopes are typically free from malaria mosquito breeding sites (35).

Dr. Swellengrebel's investigation found that the most common type of mosquito found in Semarang is M. ludlowi (Anopheles sundaicus). This mosquito was found in swampy terrain and waterlogged areas near rice fields. In addition to this species, other mosquito species were also found, including M. rossi, M. indefinita, M. aconita, M. minima, N. maculatus, and M. barbirostris (33). Some of these mosquito species, such as M. ludlowi, M. rossi, and M. indefinita, were commonly found in South Asia and Southeast Asia at that time (36). Dr. Swellengrebel also found that in settlements directly adjacent to malaria mosquito breeding sites, without any barriers or other settlements in between, the spleen index in malaria patients was higher than in settlements with barriers, even when the distance was shorter. This was observed in villages in West Semarang, East Semarang, and the city centre of Semarang (37).

The malaria epidemic in Semarang occurred in 1917. The spread of malaria in coastal areas is permanent because the topography and terrain allow malaria-carrying mosquitoes to thrive. This contrasts with the topography of other areas in the city centre and the mountains towards the interior. The highest number of malaria cases was found in North Semarang. The topography of North Semarang consists of coastal areas, partial swamps, and frequent waterlogging when the tide rises to the coastal surface. The phenomenon observed by Dr. Terburgh in 1903 remains consistent with the data from Dr. Lim between 1913 and 1917. The areas with the lowest incidence of malaria were the city centre and hilly regions. Meanwhile, coastal areas, swampy areas, rice fields (especially where buffalo are grazed), and parts of the hillside slopes typically have malaria transmission (33).

In 1918, Semarang was struck by a dual epidemic of malaria and influenza. These outbreaks resulted in daily death tolls of 40 to 60 people. That year, the Spanish Flu pandemic was spreading rapidly across the Dutch East Indies. One of the key drivers of transmission was the high volume of human mobility between port cities (21). As a prominent port with significant movement of goods and people, Semarang was especially vulnerable to the spread of these diseases. The malaria lifecycle was understood to involve a consistent interaction among these three elements. However, experiences with malaria outbreaks in South America and South Asia later revealed that topographical and environmental conditions also played a crucial role in

the transmission of the disease. These additional environmental factors were increasingly recognized between the 1880s and 1900s (38).

Malaria eradication efforts in the Dutch East Indies—including Semarang—focused on large-scale sanitation programs, particularly around port areas. These initiatives included environmental interventions targeting brackish swamps formed by port construction, wharves, and peripheral urban zones where indigenous populations resided. Public education campaigns were also launched to raise awareness of the dangers of malaria, encouraging local community participation in health promotion efforts. After conducting malaria research, we identified the areas where malaria-vector-bearing mosquitoes breed and explored potential strategies to eradicate this disease. In 1927, a dedicated malaria eradication program was implemented at the Port of Semarang. By 1928, these efforts expanded into a broader sanitation exploitation campaign that included the regular filtration of seawater, algae control, and the introduction of predatory fish in Semarang's fishponds to curb mosquito populations (38).

**Colonial sanitation project**

The Ethical Policy, implemented in the early 20$^{th}$ century, was ostensibly intended to improve the welfare of the indigenous population under Dutch colonial rule. Specifically in the field of public health, this policy aimed to promote the general well-being of the native population. The Ethical Policy coincided with the broader dissemination of public sanitation ideas, which had been developing since the advent of modern medical technologies in the late 19th century. By the 1880s, it became widely understood that the spread of epidemics was not determined by climate, race, or skin color, but rather by microbes and environmental factors. This growing scientific awareness gave rise to various initiatives for improving urban environments and residential areas. These included the construction of drainage systems, regulation of building structures, provision of clean water, improvements in nutrition, and the establishment of public health services (4).

One of the most impactful policies related to both public health and urban environmental planning in colonial cities was the implementation of urban sanitation systems. Sanitation refers to measures aimed at improving health—particularly the health of communities—through environmental interventions. In the colonial context, sanitation emphasized urban infrastructure development as a means of enhancing population health. James Hanley identifies sanitation as closely associated with urban infrastructure designed to improve hygiene, including: clean water supply, wastewater disposal, and management of waste and excreta (39). According to Melosi, the technical systems that transformed urban environments were shaped by technological advancements developed in response to the challenges of urban growth during the 19$^{th}$ and 20$^{th}$ centuries. Additionally, he argues that urban sanitation emerged as a response to changing environmental conditions brought about by industrial economies, colonial expansion, population growth, and the development of urban infrastructure (Figure 3) (40).

Efforts to improve public health were institutionalized by the Dutch colonial government through the regulation of hygiene, beginning in the early 20$^{th}$ century. J.J. van Loghem categorized colonial health policy into two main components: analytical measures and technical measures. Analytical actions involved the systematic recording of mortality and birth statistics, identification of causes of death, and mapping of disease distribution. Technical measures, on the other hand, focused on the provision of clean water, drainage management, residential sanitation, and workplace hygiene (41). These two components were regarded as mutually reinforcing and essential to public health policy. Stam further elaborated that technical interventions, such as the supply of clean water and the construction or repair of drainage systems, were critical not only for the eradication of infectious diseases but also for the disposal of waste and human excreta. These measures were specifically aimed at reducing morbidity and mortality rates associated with diseases such as malaria, typhoid, cholera, and dysentery (42).

Analytical measures on health conditions in Semarang were obtained from population health records in the form of mortality rates, the spread of tropical diseases, particularly malaria, and debates within the

**Figure 3.** Floodgate on a canal in Semarang, 1927. Source: KITLV 84086.

Semarang City Council regarding the future of the city's population health. In general, the problem of maintaining the health of the indigenous population was caused by inadequate health infrastructure, a lack of trained indigenous health workers, and the indigenous population's distrust of European medicine and doctors. Stokvis-Cohen Stuarts noted in his records that the challenges faced by European doctors were the rejection of treatment and superstitious beliefs regarding the spread of infectious diseases. The indigenous population adopted a passive behaviour, hiding their illnesses and refusing to be treated by doctors. They preferred to die at home rather than be treated by doctors or taken to hospitals. The responsibility for maintaining the health of the indigenous population should be carried out jointly by the government, the private sector, and European and indigenous healthcare practitioners. In addition, the response of the community and the approach of healthcare practitioners are important aspects, given the rejection and superstitious beliefs within the community (43).

In Semarang, municipal sanitation policy focused primarily on three key areas: *kampongverbetering* (village improvement), hygiene maintenance, and clean water supply. These efforts were supported by population resettlement initiatives, notably the relocation of residents to the newly developed Tjandi Baru (*Nieuwe Tjandi*) area. The *kampongverbetering* program was introduced as a strategy to combat the spread of infectious diseases, including malaria, and to address the deteriorating condition of indigenous settlements. This program went beyond simply upgrading residential housing; it also involved the construction of drainage systems, clean water supply, waste disposal facilities, and proper infrastructure for kitchens, bathing, laundry, and sanitation. It also included improvements to public open spaces, road access, and overall sanitary conditions (21).

The *kampongverbetering* (village improvement) program and the development of a new area in Tjandi Baru *(Nieuwe Tjandi)* had been conceived since the early 20th century. Discussions were fraught with

debate between idealists and pragmatists. The idealistic group, represented by Dr. T.W. de Vogel, proposed relocating residents to a new site on the hillside known as Tjandi Baru *(Nieuwe Tjandi)*. The practical group, represented by Dr. Terburgh, believed that relocating residents to a new site was not urgent. He emphasised improving the living conditions of residents in addressing public health issues. These two idealistic and practical perspectives sparked debate in the formulation of sanitation and health development policies in the city of Semarang. With limited city funds, the Semarang City Council calculated and decided on a policy to either build new settlements in the hills of *Nieuwe Tjandi* or improve existing settlements through enhanced environmental hygiene. (32).

The *Nieuwe Tjandi* area is planned to have 490 houses built in the villages of Bendoengan, Gadjamoengkoer, and Genoek. This housing complex is intended for high-income Europeans. The Semarang City Voters Association *(Kiesvereeniging)* has indicated that more than 1,000 Europeans live in poor conditions and are classified as poor. This places a burden on the government in the process of relocating European residents living in poor conditions, such as in East-North Semarang. The relocation of residents poses serious issues due to the distance between the new residential area in *Nieuwe Tjandi* and their current workplaces (32).

Importantly, the *kampongverbetering* program not only improved public health but also aimed to alter the cultural practices of the indigenous population as part of a broader colonial modernization agenda. Prior to these reforms, it was common for residents to bathe, wash clothes, and collect drinking water directly from rivers. Following the implementation of the improvement program, these traditional practices were gradually replaced by the use of government-built facilities for bathing, washing, and household waste disposal (Figure 4) (21).

Efforts to provide clean water in Semarang included the establishment of a municipal water company, *Gemeente Waterleiding Semarang*, which operated under the jurisdiction of the Department of Civil Public Works (*Burgerlijke Openbare Werken*). The water source identified for urban distribution was located in the Oengaran area, near Semarang (18). The urgency of constructing the Oengaran clean water channel was driven by epidemics that occurred before 1910.

**Figure 4.** Public bathroom and toilet on Hawa Street, Semarang, 1927. Source: KITLV 84137.

The outbreak of infectious diseases such as malaria, cholera, typhus, and dysentery resulted in the deaths of government officials and European residents. In addition to these disease outbreaks, the drainage and sewer systems in the Semarang East-North area along Jalan Karreweg and the East Flood Canal *(Oosterbandjirkannal)* were in very poor condition. On 26 April 1909, the City Council allocated funds amounting to f. 267,610 for the provision of clean water and drainage improvements in this area. This budget also included the excavation of drainage channels in the rivers of Semarang (32).

This drainage and culvert project is continuing with plans to install pipes in several areas of Semarang. The areas to be developed are Bodjong, Randoesari, and Karangbidara. This sanitation development plan will cost f. 1,000,000. In addition to water drainage issues, environmental problems in the village occur due to flooding in the residents' rice fields. These waterlogged areas serve as breeding grounds for Anopheles mosquitoes, which are vectors for malaria. Dr. Terburgh proposed that these rice fields be purchased by the government to be converted into residential areas or urban parks (32).

The lack of funds was a serious problem for the Semarang City Government. The Semarang City Council meeting on 21 March 1910 formed a committee responsible for proposing temporary improvements to the city's sanitation. The meeting decided that the Chairman of the Semarang City Council, Mr Kern, and City Council Member Mr Steinmetz would travel to Bogor to meet with the Governor-General of the Dutch East Indies. These two representatives of the Semarang City Council conveyed the need for sanitation development in the city of Semarang and the Oengaran pipeline. On 14 May 1910, the Governor-General sent a telegram proposing funding for the Oengaran water pipeline project in the amount of f. 150,000,- so that the work could be carried out immediately (32).

The provision of clean water through the construction of a municipal water pipeline network *(Gemeente Waterleiding Semarang)* was successfully carried out by the Semarang city government. In 1937, the government had built a 236 km-long water network. With this water network, water was distributed to 18,825 points. However, this was not enough to meet the water needs of the entire city population. Poor residents living in slum areas did not receive clean water from the pipeline network. Along with the slum improvement policy *(kampongverbetering)*, the government built public bathrooms throughout the city (Figure 4). Unlike the poor, wealthy residents enjoyed clean water from their pipelines (18).

Under the decentralization policy, the provision and operation of clean water piping systems became the responsibility of municipal governments. This placed a financial burden on local administrations throughout the Dutch East Indies. As a result, water distribution became commercialized when municipal and central government budgets were insufficient to provide clean water access to the entire urban population. Responsibility for the provision of public facilities—such as communal bathrooms and public toilets—remained with the central colonial government.

Collaboration between the municipal and central governments was carried out primarily through the exchange of information and technical assistance coordinated by the Department of Civil Public Works (*Burgerlijke Openbare Werken*), specifically via the Technical Department and the Public Health Department. Prior to 1924, the Public Health Department was known as the Civil Medical Service (*Burgerlijke Geneeskundige Dienst*), which held authority over drainage infrastructure (*rioleering*), clean water provision (*drinkwatervoorziening*), land sanitation (*bodemsanering*), public housing (*volkshuisvesting*), and population statistics (*bevolkingsstatistiek*) (36). The colonial sanitation policies implemented in Semarang contributed significantly to improving public health, especially among the indigenous population. Health improvements included the suppression of tropical diseases such as malaria, typhoid, cholera, and dysentery.

## Conclusion

The growth of Semarang as a city driven by plantation-based industry and its function as a gateway for export-import trade contributed to a significant increase in population, urban expansion, and environmental and public health challenges—particularly for

the indigenous population. The population surge led to the proliferation of slum settlements, which created unsanitary living conditions and increased the risk of spreading various tropical diseases such as cholera, typhoid, dysentery, and malaria. Malaria, in particular, caused a notably high mortality rate, and past epidemic experiences in Batavia and other regions heightened the colonial government's concern about the disease.

The spread of malaria in Semarang is most prevalent in coastal areas, swamps, settlements near rice fields, and hillsides. This malaria spread is exacerbated by the poor living conditions of the indigenous population, leading to outbreaks of other diseases such as cholera, dysentery, and typhus in the early 20th century. Malaria cases increase during the dry season from June to August and see another surge toward the end of the year. Malaria eradication efforts in Semarang were carried out through the development of public sanitation infrastructure, especially in port areas. These included environmental interventions targeting brackish water stagnation in nearby swamps, as well as sanitation exploitation measures such as regular seawater filtration, algae control, and the introduction of predatory fish in local fishponds. Furthermore, the Semarang municipal government implemented broader sanitation projects, including *kampongverbetering* (village improvement), hygiene maintenance, and the provision of clean water supply—all aimed at improving the overall public health of the urban population.

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