

5-11-2012

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Recommended Citation

de Lemps, Xavier Huetz (2012) "Waters in Nineteenth Century Manila," *Philippine Studies: Historical and Ethnographic Viewpoints*: Vol. 49: No. 4, Article 2.

DOI: <https://doi.org/10.13185/2244-1638.4287>

Available at: <https://archium.ateneo.edu/phstudies/vol49/iss4/2>

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philippine studies

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Philippine Studies vol. 49, no. 4 (2001): 488–517

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Fri June 30 13:30:20 2008

Waters in Nineteenth Century Manila

Xavier Huetz de Lempis

Simply flying over Manila tells more about the omnipresence of water in the city than would many books: great masses of water in the Bay itself as well as in Laguna de Bay, the silvery ribbon of the Pasig and its briny water tributaries, the *esteros*. If one flies over the city at the time of monsoons, or, better still, after a typhoon, the urban space is dotted with innumerable pools and flooded zones. The landscape is agreeable, even beautiful, but, nearer the ground, this first impression rapidly gives way to disgust: waters that shone under the low-angled sun are in fact dirty, very dirty. The walker who wishes to pass alongside the estero of Binondo has to be very courageous to pursue his promenade alongside putrid mudbanks and mountains of household garbage. No doubt this generalized pollution is today more embarrassing to the smell and the eyes than to the health of the residents, but it presents national and municipal authorities with a real urban adjustment problem.

This degradation of the aquatic environment which pervades Manila is not a recent phenomenon and does not have to be explained in connection with the enormous growth that the city has experienced in the last half-century. Of course, the scale of problems has escalated, one of the consequences of urban extension, but the roots of the problem seem, in fact, to go much deeper. The first testimonies, the first alarmist observations that I have been able to uncover actually date from the early nineteenth century, even if before this period residents of Intramuros certainly complained about the poor evacuation of waters, the strong odors of such or such a street and the nauseating ditches.

From the 1820s onwards, alarmist observations increase and the city waters seem to get inexorably more polluted. By the end of the cen-

ture, the first testimonies of the American colonial administration, highly sensitive to hygiene and to public health, leave no doubt about the extent of water pollution in the city of Manila. This marked degradation has to be placed in context with the change in scale that the urban agglomeration experienced during the nineteenth century (population growth, spacial extension, establishment of services) but it is also conditioned by the extreme fragility of the environment where, by the vagaries of history, a great city came into being. These data explain, but only partly, that the colonial administration was not able to respond efficiently to the problem of the pollution of waters.

The “Venice of the East”: A Gigantic Culture Medium

It is impossible to measure scientifically the real levels of pollution in the waters of nineteenth century Manila. Nevertheless, numerous testimonies underline a double and inextricably linked process: on the one hand, authors are increasingly sensitive to the nuisances and to the degradation of the environment in which they live, and on the other hand, inquiries and descriptions seem to indicate that the sanitary situation of the city of Manila tends to worsen as the century progresses.

One has, first of all, indirect testimonials. Thus, the disappearance of the recreational usage of waterways in Manila is a good indirect indication of the degradation of the environment. Indeed, in the early nineteenth century, the Spanish merchant elite and the high officials owned country houses in the suburbs. These residences, often very luxurious, were established along the Pasig and the esteros. One of the favorite pastimes of the inhabitants, from Easter to the Corpus feast, was swimming. Paul de la Gironière describes with emotion the “small bamboo palaces” built at the end of Binondo wharves where the beautiful Creoles went to bathe.¹ From the middle of the century onwards, these country cottages disappear as a result of the pressures of economic activity, but also because of the growing pollution of waters. Residents travel more upstream (San Miguel and Pandacan, then Santa Ana, San Pedro Macati, San Juan del Monte or Mariquina) to dive into relatively clean water.

However, the principal data at our disposal comes from direct physicians’ testimonies and administrative inquiries motivated by the interest in public hygiene. Indeed, as in European or other colonial cities, physicians are the first ones to worry about water pollution and to alert public authorities about the risks that this situation may have on public health.² Epidemics of cholera that struck the city of Manila

several times (1820–1823, 1842–1844, 1854, 1856, 1863–1865, 1882–1883, 1888–1889) reveal the extent of such threats and provide a means of measuring the degradation of the environment (see De Bevoise 1995, 164–75; Huetz de Lemps 1990). For Spanish physicians of the nineteenth century, water pollution has immediate consequences on public health in two ways: on the one hand, corrupt and stagnant waters supposedly contaminated the air of the city and, on the other hand, the direct consumption by residents of an increasingly polluted water caused many diseases.

The omnipresence of stagnant waters in the very center of the urban agglomeration alarms physicians from the first half of the century. They rightly assert that these swamps are an extremely pathogenic environment. The etiology of tropical diseases and more generally of infectious diseases was unknown until bacteriological discoveries in the 1880s. Therefore the mechanisms of contagion remain vague, but a very close connection is established between stagnant waters, bad odors and disease: putrid muds created by decaying matter deposited during floods and left after evaporation during the dry season, are thought to release miasmatic exhalations, contaminating the air of Manila.³

The attention of Spanish physicians and hygienists is focused particularly on the esteros, more especially the progressive transformation of these waterways into dumps and stagnant sewers. According to the physicians, ditches surrounding the fortified town (Intramuros) were among the worst. Indeed, in the early eighteenth century, these were still accessible to ships as far as the Puerta Real, the situation had degraded by the beginning of the nineteenth century.⁴ Ditches silt up rapidly, aquatic vegetation proliferates and the tide can no longer clean them regularly. They receive the used waters and wastes of Intramuros that settle slowly in the stagnant water.⁵ Mud in this state of putrefaction in the open air during low tide release noxious gases into the air:

(...) habiendose notado no hace mucho tiempo tal fetidez por el punto de la Puerta del Parián que apenas podía pasarse por allí sin taparse el olfato, y siendo indudable que el estancamiento de estas aguas corrompidas son los fomentos poderosos de las enfermedades, pestes y epidemias.⁶

The problem of ditches in fortified towns is long-standing and remains localized (even if aerist doctrines suppose that morbid emanations, entailed by winds, can contaminate faraway zones) but not so the new source of infection that increasingly worries observers: the esteros. From the middle of the century, the latter are accused of be-

ing the main miasmatic sources affecting Manila and, by contaminating the air, putting at risk the health of all the city's residents because of their omnipresence throughout the urban area.⁷ The process is the same as for ditches but on a larger scale: the esteros fill up gradually, and suspended matters or mudbanks less and less often covered by water, release a noxious odor. In the beginning of the 1870s the principal estero of the internal port, that of Binondo, is so shallow that the municipal council plans to clean it, during low tide, by day laborers equipped with spades and, by the beginning of the 1880s, most of the esteros of Manila have become unspeakable cesspools.⁸

For physicians, the progressive transformation of waterways into miasmatic reservoirs result in the recurrence of epidemic diseases in the city of Manila. Observers are thus struck by the concomitance between 1820 and 1843 cholera epidemics and a particularly heavy pollution of the Pasig and the esteros.⁹ At the end of the century, the degradation of the environment is such that some physicians assert that cholera has become endemic in the Manila region.¹⁰

The association between water pollution and sickness is not limited to cholera epidemics. In March-April 1850, military physicians again worry about the pollution of river water and the esteros. They do not hesitate to claim a relationship between the epidemic of smallpox then raging in Manila and the miasmas released by waters and muds in a state of putrefaction. Orders are given for the barracks to hermetically close windows looking onto waterways.¹¹ Spanish physicians therefore went more in fear of particularly dry periods that favored fermentation in the esteros and increased the exhalation from marshy zone. Feared, too, were the first rains to fall on the overheated ground because they produce particularly pernicious emanations. On the other hand, they were much less alarmed by the more and more frequent and increasingly dramatic floods.

This pollution is all the more worrying to physicians as the esteros and the river constitute, until the construction of a water supply in 1882, the main source of drinkable water for the population, especially of the underprivileged.¹² Indeed, residents of Manila cannot resort to springs or to underground waters. None of the districts of Manila possess springs of sufficient flow.¹³ Water sources that originate not very far down are mainly briny, and the water tables are affected by high tides rendering them hardly drinkable.¹⁴ Most districts and a great number of masonry houses have wells, but they are also used for all forms of domestic tasks such as the washing of linen, and for toi-

lety purposes (White 1962, 104). This operation generally takes place near the well, entailing seepage of used waters:

The wells of Manila are an abomination. Water is usually encountered at a depth of three to four feet below the surface, and its character can readily be imagined. Many of the wells are mere excavations in the soil without walls or facilities for lifting the water, and are constantly contaminated by surface washings.¹⁵

Surface taps also serve to water animals, but the liquid is so bad that even horses refuse it if not softened with molasses.¹⁶

The collection of rainwater is the solution largely employed by the houses of Manila before 1882. Masonry houses always have one or several tanks, in general placed under the *azotea*. However, tanks (*aljibes*) seem to have often been constructed without great care and are frequently fissured by seismic shakes:¹⁷ the potable water then risks contamination especially from cesspools (*pozos negros*).¹⁸ More often than not the water in tanks is of an acceptable quality (Codorniu y Nieto 1857, 76). Indigenous houses constructed from nipa, or all at least many of them, resorted to the same solution. However, the water is polluted by running down the nipa, and there is also the problem of mosquitoes taking advantage of these reservoirs to multiply (Cox 1914, 273–74; Neuvy 1991, 62).

Whatever the quality of the water obtained by collecting rainwater, the volume is limited and extremely seasonal. During the dry season, which can last up to six months, reserves are rapidly exhausted: it then becomes necessary to buy all or part of the domestic supply from water carriers.¹⁹ At this time of the year, the price of drinkable water is high: the capacity of ships supplying water is limited by the shallow depth of the river and its tributaries. Moreover, sources of supply are remote: indeed prices depended on the distance, and the latter conditions the quality of the water. The water drawn from the Pasig beyond the limit of tide influence, between Santa Ana and Guadalupe, is the least expensive (2.5 centavos per *tinaja*) but it is not always very clear and has to be filtered through the sand of the bank before its transportation.²⁰ The small right bank tributaries of the Pasig are of a better quality and the most prized of all is spring water: that of the spring of San Juan costs up to 12.5 cents per *tinaja*.²¹

Demand entails a strong price increase during the dry period: in 1853, an entirely normal year meteorologically, a *tinaja* costs three cents between January and April, in May the price increased to five cents, dropping back again with the first rains to four cents during the

month of June, before returning to its base price of three cents between July to December.²² But, the purchase of carried water does not necessarily guarantee a healthy supply: carriers, and especially Chinese ones, are accused of mixing waters of different origin or of lying about the point of supply, to charge a higher price.²³ Thus, it was often necessary to filter the water again before drinking it.²⁴

The high water prices and the strong rises of the dry season above all affect the poorest people of Manila, who drink water exclusively and who have no other alternatives, for lack of tanks and pesos, than to drink the briny and tainted water of wells, the Pasig and the esteros (Mallat 1846, 133; *Española* 1882). The river remains the main source of supply for the vast majority of the population, who must profit from low tides to draw a water that remains briny and unsavory: *En Manila, (...), la mayoría de los habitantes bebe el agua impura, sapida, apestosa, caliente y hasta pútrida, del río Pasig.*²⁵ In case of prolonged dryness, the situation becomes drastic: in June 1875, the Pasig was so polluted that one could not even use it for washing.²⁶

The first scientific analyses practiced by Spanish physicians confirm the extent of the peril. From the beginning of the 1830s, colonial authorities ask military and civil physicians to analyze the water of the river but, except for the order, we have not found any results of these tasks in the archives. Nevertheless 1859 analyses leave no doubt of the gravity of the situation: not only are the waters of the river bisecting Manila and the esteros unfit for consumption but even upstream, beyond Guadalupe, the water is polluted.²⁷ At the end of the century, the improvement in scientific knowledge reveals less obvious and often more harmful pollution than the bad odor of the corrupted water. For the authorities, the consumption, especially by the poorest people, of such filthy water largely explains the very high death rates among the population:

Hoy así mismo, Exmo. Sor. , se tocan ya las consecuencias de esa aún no satisfecha necesidad: los aljibes se han agotado, los esteros se secan o putrefactan y el río Pasig, único recurso en todos tiempos de las clases proletarias, arrastra en su corriente espesas capas de verdín reconocidamente nocivas a la salud. Y de ahí que en los meses de Abril, Mayo, Junio y Julio, llama todos los años la atención el aumento de inhumaciones en los cementarios públicos.²⁸

The studies of physicians and colonial officials leave no doubt on the growing water pollution in the city of Manila. Moreover historians have only confirmed the very high level of mortality at the end of the

nineteenth century and the succession of mortality crises of great intensity in the last thirty-five years of Spanish colonization.²⁹ Of course, the vectors used by physicians to explain the bond between pollution and disease are not operative, but the degradation of the environment must have played an important role in the fragility of the city's demographic structures. For example, death by infectious diseases of the digestive tract shows a sharp rise during the rain season and during the hot and very dry months of March and April. These peaks of mortality seem directly linked to the lack of drinkable water.

The omnipresence of public health questions in the sources should not hide the other implications of the degradation of the environment. Thus, municipal and colonial authorities are very sensitive to the image presented by the capital. The foreigners might fix on the dirtiness of the city to denounce the backwardness of Spanish colonization. Moreover, the massacres which occurred during the cholera epidemic in 1820, haunt Spanish authorities, and the problem of water thus becomes a political one: the deterioration of the situation, especially scarcity of drinkable water could degenerate into conflicts of public order and provide a pretext: (. . .) *a la malicia de los perversos, que otras ocasiones de menos han tomado motivo para promover disturbios.*³⁰

Finally, there is a need to remember that the esteros are also major means of communication within the conurbation. They are used for the short-haul trade (supply of the city, transportation of inhabitants). They play a fundamental role in the functioning of the internal port: the *cascos* that load and unload deep water ships and the craft used for cabotage ply these waterways continuously (many warehouses are constructed on their banks) and are moored along their length. The filling in of these waterways therefore is also a very serious economic problem. In part, the growing water pollution of Manila is the result of this multiplicity of usages of water within urban area.

Nature and Men: The Agents of Degradation

The topography of Manila explains many of the phenomena observed. The topographic data also tend to increase alongside the impact of people on the environment, making difficult, even impossible, any substantial improvement. Manila is located at the mouth of the short river Pasig (26 kilometers during the studied period), an outlet of a vast lake, the Laguna de Bay, that debouches into the Bay of Manila.³¹ Alluviums of the Pasig and its tributaries, sediments brought

by the sea currents, have gradually formed a great delta between Pasay, to the South, and Malabon-Navotas, to the North. Manila is located at the point this deltaic structure comes in contact with the Bay.³² To the East, this delta rests on a thick tuff bed, the product of the intense volcanic activity of Laguna and Cavite. One finds this "Guadalupe tuff," as it is called, at no great depth beneath the marine sediments around Santa Mesa, Mandaluyong and Makati, slightly heightened zones (three to five meters) as compared to the western part of the delta.

The site of Manila is therefore as flat as it is low. The less raised zone of Intramuros was little less than two meters (seven feet) above sea level during the nineteenth century.³³ In spite of this small elevation, largely artificial, the fortified town is one of the healthiest points of the conurbation because it is built on a sandy strip slightly higher and more stable than surrounding grounds. The other districts are hardly above sea level (from fifty centimeters to one meter) and sometimes below sea level.³⁴ The gradient is non-existent: the water table outcrops and many zones of Manila are occupied by marshes that fill and empty to the rhythm of tides, even if they are not directly connected to the esteros.³⁵

When rains are particularly strong and during powerful tides, the natural drainage system and evacuation of running waters no longer operate: the city then turns into a vast lake and Manileños have to travel by banca.³⁶ Apart from these exceptional circumstances, part of the urban area is built on zones liable to flooding, at least during the rainy season. The river banks, and more particularly Quiapo, Santa Cruz, San Miguel and Paco (especially the district of Concepcion) are exposed: each year during the rainy season, the cigar-makers of the Arroceros workshops have to wear high-heeled sandals to access their place of work.³⁷ These zones liable to flooding and which are particularly marshy, were built during the nineteenth century as demographic growth, economic development and the prohibition of nipa houses in the center, necessitated the settlement of terrains that were traditionally transformed into rice fields or *zacatales*, and led to the appearance of real "aquatic suburbs" (see Huetz de Lempis 1998).

The phenomenon is particularly obvious in Tondo, Santa Cruz, Trozo and San Miguel, where the demarcation between the zones assigned to *casas de materiales ligeros* and *casas de materiales fuertes* follows the exact shape of the submersible zone limits.³⁸ It is even likely that the urbanization of these low zones rendered the entire urban area

more sensitive to floods owing to the waterproof surface extension and to the weak coefficient of retention of the new districts.

The balance of this aquatic environment lies largely on the very complicated system of esteros, even if their capacity to evacuate rain-water or used water is naturally limited due to their very weak gradient. The left bank comprises only a small number of these natural evacuation channels (Pandacan, Tripa de Gallina). On the other hand, the right bank system is particularly dense and totals a length of close to nineteen kilometers.³⁹

It can be divided into two inter-connected networks, one centered on the estero of San Jacinto and the other on that of San Miguel.⁴⁰ The first one comprises the estero of Binondo and its prolongation, the canal de la Reina (2700 meters),⁴¹ the esteros of San Jacinto (1200 m.), Meysig (500 m.), Magdalena (2000 m.), Tutuban (800.), Trozo (700 m.), San Lazaro (1000 m.), Dulumbayan and Sibacon (1200 m.). The second is constituted by the esteros of Quiotan (900 m.), Quinta (300 m.), Gunao (150 m.), Quiapo and Curtidor (900 m.), Bilibid (1600 m.), Tanduay (700 m.), San Miguel (1200 m.), Sampaloc and Uli Uli (1400 m.) to which it is necessary to add an arm connecting the estero of Quiapo to that of Tanduay (400 m.) and one crossing Tanduay island (400 m.). The course of these esteros, without human adjustment, is tortuous: they are narrow (10 m. on average) and shallow. The tide has a very perceptible and beneficial influence in these arms since it allows a natural cleaning of the bottom.

This environment tends to evolve naturally and some pollutants have an organic origin. In the first place, river water during the dry season, and strong heat (from March to May) takes on a green coloring and is covered with a thick layer of decomposing organic matter. In this condition, the river exhales a strong stench and often carries dead fish.⁴² Spanish physicians, impressed by the recurrence of the phenomenon, constructed various hypotheses on the causes of this organic pollution: excessive heat, the closing down of the mouths of the Pasig, volcanic eruptions at the bottom of Laguna de Bay that would kill fish etc.⁴³

One point is sure: the upper part of the Pasig was affected during the nineteenth century by natural phenomena of prime importance that could have had important ecological consequences downstream: channels that enabled access to Laguna de Bay had a tendency to silt up from the beginning of the century and did not exceed 1.10 m. depth in Napindan channel during the low water level season (from

March to June) by the end of the century. The cargo of boats sailing on Laguna de Bay had to be transferred to *cascos*.⁴⁴

Similarly, the course of the esteros varied largely and their beds, especially the more minor ones, tend to get filled by alluvium deposits. The estero Tripa de Gallina, on the left bank, is a good example of this process. This waterway was navigable at the beginning of the nineteenth century and even allowed small boats to reach the naval base of Cavite without crossing the bay.⁴⁵ However, this waterway, with its extremely tortuous course, as its name, "Chicken Tripe," indicates, had become unnavigable by the first decades of the century and ameliorating measures proved unfeasible.⁴⁶

These natural phenomena need to be seen in relation to the large scale modifications of the natural environment in the Manila greater region: the development of commercial crops for export or to supply the markets of the capital; the demographic growth of *pueblos* situated in the provinces close to Manila may have had, from the end of the eighteenth century, an unbalancing effect on the environment, especially through the clearing of forest for cultivation. The excessive deforestation of watersheds in the hinterland of Manila without doubt entailed a greater increase in the alluvial load of waterways.

Without further study, however these remarks remain merely hypotheses, but nevertheless they deserve to be taken seriously. Léonard Blussé has shown that urban environmental degradation in Batavia from the 1730s and the sharp rise in mortality rates resulting from it are essentially due to the widespread cultivation of the hinterland of Batavia (the Ommelanden). Plantations, especially sugar cane, deeply modified the natural drainage system of the plain, while deforestation entailed strong erosion upstream. Downstream, the canals of Batavia were slowly filled in till they became stagnant and polluted waterways and the reservoirs for typhoid fever, dysentery and malaria (Blussé 1985).

However, the degradation of the environment cannot be simply connected to strictly natural phenomena and anthropic causes certainly play an essential role (Paskoff 1985, 120–37). The latter are especially clear with regard to the rapid filling in of the esteros during the second half of the century.

The reasons for this phenomenon are numerous. First, the quays that fringed the principal esteros, lined with stones during the eighteenth and the first half of the nineteenth century, were badly maintained and, by the beginning of the 1880s, were virtually useless, even collapsing into waterways and subsequently obstructing them.⁴⁷

Nor had municipal authorities ever managed to establish a satisfying system of street drainage which, instead, had emerged slowly by accretion: some streets have been equipped, little by little, with the addition of gutters and drainage ditches.⁴⁸ However these culverts never functioned well: the water stagnated even in streets with slopes and, where the terrain was marshy, the pavement became a virtual canal. Road surfaces were generally only lightly rendered and did not long resist the monsoon torrential rains, being washed into the esteros despite a system of manholes, grates and gutters.⁴⁹ Nevertheless, the absence of a rendered surface in most streets allowed the slow flow of waters and avoided a rapid saturation of the system of evacuation (Heras y Crespo 1896, 17).

More seriously, especially with regard to public hygiene, waterways were considered as convenient dumps by most of the urban population (Barcones 1895, 218; *Medicina* 1, 1886). Water was soiled by the cleaning and washing of linen, or by being used by both humans and animals as public baths.⁵⁰ Industries, such as tanneries, dyeing factories or breweries, developed during the nineteenth century and contributed to pollute the river.⁵¹ The problem was all the more serious as these establishments were centrally located. The municipality, where merchants and manufacturers constituted a majority, opposed any transfer of such activities to the periphery.⁵² Residues from artisanries and industries were systematically poured into waterways slowing the current and proving a bar to the natural cleansing of the tide. Port authorities attempted to prevent the dumping of damaged ships which subsequently sank.⁵³ Similarly, sailors and captains were prosecuted for throwing all kinds of wastes and especially disposing of ship's ballast while in port.⁵⁴ Prohibitions were reiterated throughout the century, implying a lack of compliance.

Manila Residents

Manila residents had the bad habit of pouring their household garbage into the esteros and, as the city grew, the accumulated volume was probably considerable. Finally, the esteros also lodged a large temporary floating population (crews and their families awaiting the change of monsoon or a return freight) as well as a more stable one.⁵⁵ For this population, the river was the natural dumping place for all refuse.

The lack of public-spiritedness can be partly explained by deficiencies in the collection of household garbage. The Ayuntamiento seems

to have been charged with the care of cleaning the streets at the end of the eighteenth century. In the 1830s, it had some collection carts, but municipality employees had many other responsibilities and the service was carried out only once a week at best.⁵⁶ At the end of the 1860s, garbage collecting was allocated to a contractor: each morning, wagons had to travel up and down the streets; a bell warned servants when to put their dustbins out; the successful tenderer also had to remove any deposit found in the streets.

Like most municipal services entrusted to private entrepreneurs in Manila, the system functioned badly: the requirements were never respected; underpaid employees showed little zeal; open carts infected streets and were pulled by carabaos that advanced very slowly and had to be bathed several times a day.⁵⁷ Moreover, cleaning was limited to only those districts that paid the tax of *alumbrado y limpieza*. That is, in the late 1860s, limited to the zones of masonry buildings (Intramuros, Binondo, Santa Cruz and Quiapo). In the late 1880s, a district as populated as Tondo had no garbage collecting service.⁵⁸ Indeed, in zones of *materiales ligeros*, the town council fixed a certain number of public dumps where residents, in theory, were to bring their wastes.⁵⁹ In practice, however, natives disposed of a part of their garbage by lighting fires that created frightful stench but were reputed to keep mosquitoes away. A multitude of pigs and errant dogs rummaged in the wastes and "recycled" part of them.⁶⁰

These measures were, of course, insufficient to meet the growing population and the entire urban area was dotted with, in a literal as well as a figurative meaning, "wild" deposits: garbage and carrion ("forgotten" when not thrown out of balconies) in streets, wastegrounds, the yards of the *posesiones*, the ruins of houses, on beaches, on the banks of the esteros or in canals.⁶¹ During the rains, this rubbish tended naturally to be washed into the river and esteros. So, the dirtiness of Manila streets, which struck most travelers and observers, also resulted in the pollution of waterways.⁶²

The situation improved appreciably in the last few years of the Spanish presence. In the 1890s, cleaning services were finally extended to the whole of Manila, at least to its main streets and, in 1897, regular street sweeping led to the removal of horse and carabao excrements.⁶³ The construction of the water supply and the installation of many fire hydrants also allowed a more frequent watering of streets.⁶⁴

The progressive filling in of the esteros is all the more serious as, to their natural draining role, one must add their role as open-sky-collec-

tors for the used waters of the city. Residual waters, the rain fallen from houses and in the patios were normally evacuated to culverts along the public way. Since the end of the eighteenth century, these culverts and their regular cleaning were paid for by proprietors.⁶⁵ Proprietors, as might be expected, proved very unwilling: many houses were not connected and pipings, unmaintained, became obstructed. Streets turned into virtual lakes of dirty water.⁶⁶ The town council vainly tempted to overcome the passive resistance of recalcitrant proprietors and even proposed several times to make the connections itself and then recuperate the expenses incurred from proprietors.⁶⁷

Masonry houses' sanitary facilities were based on fixed cesspools. These infamous *pozos negros*, denounced, at the end of the century, by Anglo-Saxons as symbols of the legendary dirtiness and backward character of Spaniards, provided the only alternative system in the absence of sewers (Younghusband 1899, 53–54). These fixed pools, however, posed serious hygiene problems: they were rarely drained and seismic shakes fissured them, allowing feces to contaminate the soil and air with pestilent emanations.⁶⁸ The *posiciones* had latrines only on the blueprints of municipal architects: tenants attended the call of nature in a discreet corner of the yard, in the nearest street or in ruins and wastegrounds.⁶⁹ The first public urinals were only imported from Europe in the early 1890s and they were reserved to the “shop-window district” of Binondo.⁷⁰ Nipa houses had, in theory, to install a cesspool in order to obtain the building permits, but in practice, they rarely did.⁷¹

El vecindario indígena de los barrios extremos, que habita casas de materiales ligeros, para nada se preocupa de alejar las heces que produce; y vive, estoicamente, en medio de ellas.(Heras y Crespo 1886, 4)⁷²

The pollution of Manila waters resulted therefore, on the one hand, from a progressive loss of the natural means of drainage and purification of sites and, on the other hand, from a lack of public-spiritedness and infrastructure in most Manila buildings. Problems were only exacerbated by high urban growth particularly in the second half of the nineteenth century. Natural systems of sanitation were unable to absorb the constantly increasing volumes of used waters, especially as natural outlets were progressively filled in.

Spanish authorities were not unaware of the deteriorating situation and, from the end of the eighteenth century, ordinances multiplied constraining residents and especially proprietors from polluting their

environment, but the unceasing flow of regulations and the constant number of fines for offenders are indications of the powerlessness of the colonial authority.⁷³ Indeed central and municipal administrations were also hampered from being too severe with individuals since they were incapable of providing the necessary equipment by which to improve the situation.

Spanish Administration Efforts: A Drop in the Ocean

The possibility of eliminating pollution of the Pasig upstream of Manila was not seriously considered, even if military physicians did propose in 1850 deepening the passes of the Pasig and, obsessed with aerist theories, removing topographic obstacles to help the circulation of air or even the planting of trees to isolate marshy zones from which emanated miasmas.⁷⁴ Spanish authorities well understood that an improvement of the situation first of all entailed the creation of an efficient cleansing system for the city, a system to which proprietors would be encouraged to connect their buildings.

The municipality undeniably made efforts throughout the nineteenth century, as is shown in many of the files in the Philippine National Archives (especially the series *Alcantarillas*). However, most studies deal only with short portions of streets, and the only proposal for a grand-scale project on behalf of the Ayuntamiento so far uncovered, concerns the repairing and the completion of a system for Intramuros, made in the early 1850s.⁷⁵ Generally, facilities were reserved to zones of masonry or the main thoroughfares (promenades, Divisoria).

These works were achieved only gradually, often as an emergency measure and always in the most anarchic manner: sometimes workers constructing a new pipe discovered, in the course of their excavations, an ancient abandoned sewer.⁷⁶ Also, results rarely repaid investments, and pipes became rapidly obstructed. Lack of inclination caused many problems: the slow flow of water, especially, did not allow for the self-cleansing of sewers as is necessary with tides, since pipes reverse if mouthpieces were placed too low.

Consciously or unconsciously, Spanish authorities seemed to have judged expenditure on sewers as useless in the absence of great infrastructural works. The filling in of low-lying areas constituted a first step, and was practiced successfully from the sixteenth century. In the nineteenth century, periodic projects were implemented both to level and to raise streets. Household garbage and rubble from build-

ings destroyed by earthquakes were used, but volumes were limited as regards adjustments to be made to unearth Manila.⁷⁷

At the time of the cholera epidemic of 1882, the Governor General Primo de Rivera was determined to act: he summoned a council (*junta*) of specialists to study possible solutions to sanitize the marshy zones of the capital. Proposals were extremely varied, including leveling the entire circumference of the city; processing unhealthy soils with iron sulfate; spreading a layer of lime; removing the contaminated earth entirely (Capelo y Juan 1883, 140; *La Oceania*, 16 September 1882). These solutions seem largely inspired by the successes at Jolo (Sulu City) in the second half of the 1870s, where filling-in and lime gave, according to Spanish authors, excellent results (Barcones 1895, 209). Some improvements were recorded during the last fifteen years of Spanish rule, but the capital's size and its chronic insolvency prevented any resolution of the problems (*La Correspondencia*, July 1894, 100).

The system of *esteros*, mainly blamed by hygienists for the poor health, paradoxically offered an alternative solution. Repairs and improvements would restore to them their previous function of evacuation. They could receive waters collected by draining ditches, allowing them to sanitize vast marshy areas while at the same time acting as the principal means for draining off storm water and faeces. Nevertheless, the authorities were not agreed on this point and some sought yet another solution: the drying-up of all stagnant waterways.

This solution was demanded by the physicians for the ditches ring-ing the fortified town, from as early as the 1820s (Benoit 1832, 16; Hernando 1927, 3). Their concern was expressed in the press and numerous other writings, and their protests became increasingly more strident as an effective defense of the fortified town became utopian (Roca de Togores 1895, 14). Cleaning attempts produced little benefit and even in 1898 the ditches of *Intramuros* continued to infect the atmosphere.⁷⁸

An end to the network of *esteros*, apart from those used for the transportation of goods, was advocated by a part of the colonial administration.⁷⁹ Some *esteros* were effectively filled in during the nineteenth century, as the sections obstructed when the *Divisoria* was constructed.⁸⁰ However this policy caused more problems than it solved. Locals were hostile to draining, which deprived them of a frequented means of communication, at least by *bancas*. Indigenous communities suspected that such cleansing operations masked private entrepreneurial speculations hoping to profit from the reclaimed

lands.⁸¹ Such suspicions were not groundless, and the great proprietors were among the main proponents for drying up the esteros.⁸²

The total drying-up of the esteros supposed the construction of a parallel system of sewers. The need for such a system was evoked from time to time, but the town council rarely went further than dredging some sections of the esteros.⁸³ The new projects for the port of Manila (works began in 1883) and the specific establishment of a separate administration (*Junta de Obras del Puerto de Manila*) endowed with huge financial resources represented the first serious attempt to bring about a solution. The commission charged with studying ways of improving the system of esteros reached a wise and logical conclusion: allowing the esteros to become open-air collectors was not a viable solution but, considering the lack of financial means and insufficient techniques to construct a modern system of underground sewers, public authorities simply had to depend on them to keep the city as clean as possible.

Waterways in the capital were divided into four categories. The first group comprised esteros used for navigation and was assigned to the *Junta de Obras del Puerto*. They had to be recalibrated to a width of twelve to twenty-five meters (so as to allow for both the parking and circulation of *cascos*) and an average depth of two meters. Their quays had to be widened and strengthened.⁸⁴

The second group consisted of the esteros of Gunao (from the estero of San Miguel to the bridge of Quiapo), San Sebastian (until the del Marques bridge), Quiapo and Curtidor. With a minimum depth of 1.5 meters, these were seen as both a means of cleansing the districts they crossed and as being accessible to small-size ships.

The esteros of Trozo, Dulumbayan, Sibacon and Quiotan, were to become the backbone of the future system. The esteros of Magdalena, San Lazaro, Bilibid, and Sampaloc were to be transformed into simple ditches, so as to drain the numerous swamps along their banks. All the other canals and cutoffs were to be allowed to dry out.⁸⁵

Management of these last three categories was to be entrusted to the *Ayuntamiento*. Those esteros to be retained had to be channeled, regularized and their course rectified by shortening. To solve the crucial problem of cleaning, the town council considered placing sieves to retain the waves from the high tide and only to release them at low tide: the current so created being sufficient to clean the canals.⁸⁶

This ambitious program was far from being realized on the eve of the revolution. The esteros used primarily for navigation had been

appreciably improved because they played an essential economic role in the functioning of the port. The municipality yards progressed far more slowly. In 1895, just the esteros of Curtidor and San Sebastian had been improved. The draining of the estero of Quiotan, not envisaged under the 1882 plan, proved to be a real catastrophe: on the one hand, it played an important regulatory role in period of flood and, on the other hand, it occupied an ideal site to act as a sewer.⁸⁷ Delays and errors can be explained as due to the lack of a general plan, the town council being unable to decide in what order works should be realized.⁸⁸

Desde los pozos negros filtrantes, construidos a la ligera, muchos de ellos en la vía pública, hasta las alcantarillas, hechas sin ajustarse a ningún plan, de dimensiones y trazado caprichosos y con las fábricas más impropias ; todo lo que hay, en materia de saneamiento, revela falta de estudio y descuido de los detalles constructivos de esta clase de obras. (Heras y Crespo 1896, 4)

On the eve of the revolution, the author of this observation, the municipal engineer Carlos de las Heras y Crespo, decided that Manila required a comprehensive plan to provide for the cleansing of the city and he proposed a plan of work. His *Ante-proyecto de saneamiento de Manila* is as realistic as it is clear, even if none of the solutions proposed are really revolutionary.⁸⁹

He commented that the esteros of the city centre remained an immense dumping site that disfigured the city and were responsible for the poor sanitary state of Manila and the high rates of mortality (Heras y Crespo 1896, 3, 5, 13). Aware of the imperfections of the network then being constructed, he still refused all radical reforms. The pozos negros of masonry houses were certainly prejudicial to public hygiene, but had the merit of avoiding a massive quantity of faecal matter pouring into the esteros, and municipal authorities were unable to insist on the use of the new sanitary equipment without first introducing basic equipment.⁹⁰ Similarly, the use of esteros to establish a system of open sewers was certainly not the most hygienic solution but the only practicable one as Spanish authorities would never find necessary funds for the realization of two separate systems, one for used water and the other for rainwater (Heras y Crespo 1896, 8).

Instead, his proposed solutions were realistic and achievable. The classification between "useful" and "useless" esteros was retained as was the idea of reservoirs where tidal flows could be stored to insure the drainage of sewers (Heras y Crespo 1896, 7-8). The central idea was to solve the main drawback of the site of Manila, its lack of un-

evenness. Vast zones were to be embanked to raise profiles above the average level of the tide and thus allow a flow by gravity. The city was to be criss-crossed by a system of sewers, as short as possible, so that they could have sufficient slope. It was therefore necessary to avoid reducing the number of esteros too much and, on the contrary, to dig new collectors. All in all, Carlos de las Heras y Crespo foresaw the construction of 120 kilometers of pipes for a total cost of a bit over one million pesos (27, 34–35).

The belated date of this project really forbids any real appreciation of the scheme. However, the mileage of piping increased rapidly during the second half of the 1890s, partly due to the use of cast-cement piping which allowed work to progress more rapidly and efficiently.⁹¹

From the late nineteenth century, the authorities and inhabitants of Manila became aware of the consequences of an uncontrolled urbanization in a very frail tropical environment. Through the promptings of the medical profession, colonial authorities took action to resolve the problem of water pollution. Yet, except for the inauguration of the *traida de aguas* in 1882, these efforts did not materially improve the situation much, nor curb the degradation of the urban sanitary environment. Natural obstacles and local topography were mainly responsible for the failure: only very large scale works would have restored the system of esteros to a sanitary state and create a coherent and efficient drainage network. Spanish authorities simply could not afford such expenditure, nor was the project feasible until the very end of the nineteenth century.

American Assessment

The assessment made by the Americans at the beginning of their colonial domination was very harsh with regard to the work undertaken by the Spanish authorities.⁹² These reports generally agreed on the carelessness of the previous administration as far as sanitation was concerned, and the authors were convinced that the new US administration domination would be able to solve any problem, thanks to its efficiency and technical knowhow. Very soon, however, the same people were forced to admit that the cleaning of the capital was no easy task (*Annual Reports* 1903, 8–9).

Yet the American authorities added a new dimension to the problem of water pollution: the social factor. They were aware of the chronic state of sanitary under-equipment in the poorer districts, where rain water, liquid waste, faeces and all sorts of refuse piled up under the

batalanes of the nipa huts, turning into large ponds during the rainy season and putrid quagmires during the dry one (Worcester 1898, 37; *Annual Reports* 1903, vol. 5:86–89; vol. 6:9). The cleaning of these districts became a priority of the American administration.

The link between social problems and the degradation of the environment had never been made as clearly by Spanish authorities: Carlos de las Heras's plan, the most ambitious and the most modern of the Spanish period, was only concerned with improving the area designated for masonry buildings.⁹³ More generally, the town council, recruited exclusively from the social elite, paid little attention to the question of water pollution, perhaps because councilors and their families lived in districts far enough away from such nuisances.

Finally, this study highlights the importance of an awareness of natural factors in urban history: the history of the built-up environment and the history of the natural environment are inseparable. The strong urban growth of Manila in the nineteenth century entailed a profound transformation of the site of the city, and its inhabitants experienced a lasting degradation of the urban ecosystem, including a multiplication of epidemics (cholera) and especially endemics (typhus, typhoid, malaria), increasing nuisance, and a greater vulnerability to natural hazards, and above all, floods.

All in all, a study of the causes of urban degradation in nineteenth century Manila underlines the importance of assessing town planning in relation to environment data and highlighting the need to disturb as little as possible the very complex natural mechanisms that govern the life of an estuary. The improvement of Manila's current situation cannot be undertaken without an appreciation and understanding of these geographical data, especially the primary role played by the esteros in cleansing the city, and due consideration of the mistakes made in the past.

Notes

I owe a debt of gratitude to my friend Greg Bankoff who did a thorough proofreading of the draft. He actually translated my "Frenglish" into English while improving the substance of this paper.

1. "Venice of the East" is a cliché frequently used in travel narratives and in historical records. The district of Binondo is sometimes called "little Venice." This comparison is commonplace in the descriptions of towns of South-East Asia: Bangkok like Manila, is the Venice of the East.

La Gironière 1853, 26. See also Lapérouse (quoted in Camagay 1982, 216); Martinez de Zuñiga 1893, 279; Buzeta 1850–1851, 48; Wilkes 1850, 303.

2. On Spanish America, see Clement 1983, 79–82, 86 and *La Ciudad Hispano-americana* . . . 1989, 164–68.

3. Codorniu y Nieto 1857, 78–79. The link between stagnant waters and malaria is clearly understood: the germs of the disease reportedly come from decaying organic matters (PNA *Memorias Médicas* no. 19, Report of the incumbent doctor of the province of Bulacan, 1884). These ideas are similar to those prevailing then in Europe in the works of medical topography (Goubert 1975, 117 and 1989; Curtin 1985, 594–97; Pinol 1991, 149).

4. After the Seven Years War, the ditches were improved thanks to sieves (*compuertas*) which kept the water level stable even at low tide, and a new ditch was dug along the beach. Intramuros thus became a vast island (*Revista de Filipinas* I, 9; Diaz-Trechuelo 1959, 123–48).

5. PNA *Ay* no. 32, *Libro de Actas* of 1844, 1 February meeting; SHM, CGD, no. 7244, Pedro Munarriz, *Memoria sobre los medios de verificar la limpia de los fosos de la plaza de Manila y de proporcionar el desagüe de la población*, 18 April 1850; Codorniu y Nieto 1857, 83; AHN no. 5204, tax project on the houses bordering the esteros, memo of the harbor master's office, 21 November 1864.

6. PNA *Ay* no. 7, *Junta Municipal de Sanidad*, 5 July 1824 meeting. See also Codorniu Y Nieto 1857, 83.

7. PNA *Sanidad y Vacuna*, report from the *Junta de Sanidad*, 1842; PNA *Ay* no. 74, *Composición general de las calles de Manila*, Juan Mendoza y Gralajes's project, 20 August 1850; Codorniu y Nieto 1857, 83; PNA *Ay* no. 14, *calenturas* epidemic in Meysig barracks, 1863; *El Resumen*, 20 December 1890, I, no. 143.

8. PNA *OP* no. V9, 1865–1871. Ten years later, the *estero* of Binondo and the canal of la Reina are virtually dried up (PNA *OP* no. 162, report from the Junta de Obras Públicas, 19 July 1881 and *Ay* no. 53, report from the town council on the esteros, February 1881).

Revista de Filipinas I, 441–44; AHN no. 576 #56, *Informe de la Comisión nombrada . . . para el estudio de clasificación y mejora de los esteros de Manila*, 31 January 1882; Montano 1885, 42.

9. PNA *Ay* no. 49, *Copiador de Oficios*, 3 March 1844; Santiago Artiaga 1932, 268 and 270.

10. See Huetz de Lempis 1990, 312–14. The main advocates of the thesis of endemicity are Massip y Walls 1896 and Worcester 1909, 128 et seq.

11. PNA *SM* no. 8, letter from the director of the army's medical profession Antonio Codorniu y Nieto, March 1850, analysis of the waters of the Pasig practiced by the military physicians José María de la Rubia and Miguel López de Roda, April 1850. See also Codorniu y Nieto 1857, 76. The indigenous people also seem to have established in an empiric way, the link between the lack of drinking water and the disease (*Historical Data Papers* no. 54, 350).

12. It would be too long to expand on the numerous debates which took place before the establishment of the water supply. I will present the results of my study on this subject in a forthcoming paper.

13. Manila suburbs have just two meagre springs: that of Lico, on the hill North of Santa Cruz, near the Chinese cemetery and that of Galalangin in the district of Tondo; one must then go to San Juan del Monte to find spring water again (PNA *Ay* no. 23, a *Manileño* to the *Corregidor*, 19 April 1833; *Ilustración Filipina*, I, no. 18, 15 November 1859, 153).

14. The two wells of San Nicolás seem to give a good quality of water since the ships and people of the neighborhood use it. The inhabitants of Tondo have to go to Caloocan to find a well of drinking water (AHN no. 5237, petition of the *Indios gobernadorcillo* of Tondo, May 1875).

15. *Annual Reports* 1903, 4. In the early twentieth century, the Americans are scared of the sanitary conditions of common wells, contaminated by surface liquid waste. They are accused of being the main factors of the propagation of diseases (Cox 1914, 273–74; Maramag 1988).

16. PNA Ay no. 23, a *Manileño* to the *Corregidor*, 19 April 1833; Bowring 1876, 21.

17. SHM, CGD, no. 7196: Mariano de Goicoechea *Memoria sobre noticias geográficas, estadísticas, topográficas de las Islas de que se compone la Capitanía General de Filipinas* (22 November 1840) chap. 18; AHN no. 522 #335, report from the army engineer G. Verdú, 20 October 1863; Neuvy 1991, 62.

18. On the *pozos negros*, see below.

19. The commerce of water is very active in Manila: it is conveyed on barges, in big jugs (*tinajas*) containing 48 litres. The water is then retailed by carriers who carry it in long bamboos (*bombon*) (Mac Hale 1962, 27; Wilkes 1850, 302); see the photograph in Atkinson 1905, 189.

20. Wilkes 1850, 302; Artiaga 1932, 264; AHN no. 492 #1/2, report from the *Junta Consultativa de Caminos, Canales y Puertos*, 16 October 1871.

21. Rivers of Maybonga, San Juan and Diliman to which one may add the river of Tala or Tanza, which has its source around Novaliches and whose mouth is situated North of Caloocan, in Tinajeros.

The spring water of Mariquina is much praised (Buzeta 1850–1851, I, 24; *Ilustración Filipina* 1869, I, no. 14: 119; Gutierrez Gay 1881, 46–47; Artiaga 1932, 264.

22. PNA Ay no. 2, state of municipal expenditure for the year 1853, public works of the Calzada.

Prices seem quite stable throughout the century. For the early 1870s, Ramón Gonzalez Fernández talks of an average price of 3 cents per tinaja (Gonzalez Fernández 1875, 270).

23. PNA Ay no. 32, *Libro de Actas* of 1844, 4 March meeting; PNA *Abastecimiento de Aguas* no. 8 1868–1891, July 1861; *La Oceanía Española*, 23 July 1882; Rizal 1887, 44.

24. PNA Ay no. 23, a *Manileño* to the *Corregidor*, 19 April 1833.

25. Codorniu y Nieto 1857, 190. Only the *pueblo* of Malate still uses wells (*Ilustración Filipina* 1859, I, no. 20: 171. Carrying water is an exhausting chore: water has to be drawn upstream, conveyed in bamboos, patiently filtered, then kept in jugs (*banga*) (Abella 1869, 102); Historical Data Papers no. 54, 321.

26. AHN no. 5237.

27. PNA Ay no. 23, 1833.

PNA *Abastecimiento de Aguas* no. 8 1868–1891, Genaro Palacios to the Civil Engineer, 25 March 1867; Artiaga 1932, 274.

28. PNA Ay no. 7, the *corregidor* to the governor general. This letter is not dated but indications suggest that the date is either 1875 or 1876. See also AHN no. 492 #1/2, report of the *Junta Consultativa de Obras Públicas* on G. Palacios' project, 17 December 1869 and PNA Ay no. 7, the incumbent doctor of the province of Manila to the *corregidor*, 15 June 1875. The Philippines undergo a new dry period in 1877–1878 (AHN no. 5233 #90).

29. This point is mentioned in the pages 144–69 of my thesis (Huetz de Lempis 1994). I am now working on the publication of these results. For the general context, see the works of Peter C. Smith, particularly “Crisis Mortality in the Nineteenth Century Philippines: Data From Parish Records” (*Journal of Asian Studies* 28, no. 1 [1978]: 51–76).

30. PNA *Ay* no. 23, town council to governor general, 30 April 1833.

31. Laguna de Bay is very probably an ancient arm of the sea that was closed during the Quaternary by the uprising of the region of Cavite. The geomorphology of the site of Manila is analyzed, without major differences, in the following publications: Peralta 1974, Patanñe 1975, 3–13; Wernstedt 1967.

The continuous water supply of the Laguna de Bay entails a strong current even at the mouth. The tide can be felt until Santa Ana, 5.5 kilometers from Manila. The current reverses only during the tides of the summer solstice, which correspond to the low-water period of the Pasig (Arana 1879, 135 and PNA *OP* no. F 2, *Proyecto de un dique sumersible, en prolongación del malecón del norte del río Pasig, para encauzar el canal de la barra*, E. López Navarro, 25 January 1895).

32. Manila subsoil is made up of sand, gravel, clay and mud.

33. PNA *Ay* no. 74, *Composición general de las calles de Manila, report from the Dirección Subinspección de Ingenieros*, 24 August 1850. It is the area between the gateway of the Parián and Almacenes.

34. AHN no. 492 c#1/2, report from the *Junta Consultativa de Caminos, Canales y Puertos*, 16 October 1871; Roca de Togores 1895, 39–40.

35. PNA *Ay* no. 14.

36. *Revista de Filipinas* I, 97 (1865 typhoon); AHN no. 5218 #106, letter of the governor general, 13 August 1872; AHN no. 5212, 28–29–30 September 1871 typhoons and AHN no. 5211, 24 September 1870 typhoon; Camagay 1982, 24.

37. Aragon 1819, 10, 27; PNA *Alcantarillas* no. 7, Quiapo 1866; Cavada y Mendez de Vigo 1876, 52–53; Buzeta 1850–1851, t. II supplement, 17; *Ilustración Filipina* I, no. 18 (1859): 154–55 et no. 19, 163.

The area was filled up by the Chinese from the sixteenth century (Reed 1978, 57).

Montano 1886, 46. When the rains last, the water goes up to the knees and the cigar-makers travel by *banca* (AHN no. 5320, project of building a slaughterhouse in Arroceros, report from the *Subdelegado de Medicina y Cirujía*, 1872).

38. AHN no. 576 #56, *Informe de la Comisión nombrada...* op. cit.; Roca de Togores 1895, 14; *La Oceanía Española*, 19 September 1882; *El Resumen*, 1 October 1890. In Tondo, the districts of Sapa, Lemery, Aguila, Lecheros, Caleros, Bancusay, Meysic, Palomar and Tutuban are real marshes. During the great flood of 1867, the inhabitants of the area of *materiales ligeros* have to seek shelter in the masonry districts (AMFAE *Correspondance Commerciale, Manille* no. 3 f. 353, 16 October 1867).

39. The proposed lengths correspond to the main waterways at the end of the century and do not take into account the numerous little ditches.

40. AHN no. 576 #56, *Informe de la Comisión nombrada...* op. cit. and *Junta Consultativa de Obras Públicas*, 15 February 1882.

41. The *Canal de la Reina* is an artificial waterway. It was dug in 1866 under the direction of the town architect Felix Roxas and links Binondo to the *laguna* of Dagatdagatan and to Vitas. It replaced the former *río* de Tondo entirely sanded up by the erosion of the dune stretch (1831). The Canal de la Reina, which was rapidly

sanded up, plays an important economic role till the opening of the Manila-Dagupan railway in 1892, because it communicates through the river of Binoanga with the deltas of the rivers Pampanga, Angat and Bulacan, thus connecting the port of Manila with its hinterland (Tambobong and Navotas) and with the provinces of the centre of Luzon.

42. PNA Ay no. 23, a *Manileño* to the *corregidor*, 19 April 1833; PNA SM no. 8, letter of the director of the army's medical profession Antonio Codorniu y Nieto, March 1850; Buzeta 1850-1851, t. II, 48. During some periods of the year, the river also carries considerable masses of *quiapo* and other floating herbs.

43. A. del Rosario y Sales "Los olores del Pasig. Ensayos micro-químicos" *Boletín de la Real Sociedad Económica de Amigos del País* IVe année, no. 8, 1 December 1885, 157-58.

44. There were five channels in the nineteenth century: Uauang-Tapayan, Napindan, Tipas, Taguig and Hagonoy. Only those of Napindan and Taguig were navigable; the others were networks of narrow branches only accessible to the bancas (Ugaldezubiaur 1880, 17). In 1802, Taguig channel was canalized and groynes were built to accelerate the flow of water. These laying-outs did not result in a noticeable improvement of navigability (PNA SM no. 8).

AHN no. 574 #56, 13 November 1880; Junta de Obras... (1890).

45. This estero meets Manila bay south of the church of Parañaque and the river Zapote, south of the *pueblo* of Las Piñas.

46. Martinez De Zuñiga 1893, 19; Mariano Goicoechea, *Memoria sobre noticias geográficas...* AUST-SHM, 330; MN no. 1757 *Apuntes sobre varios negocios principales...* f. 37; Ugaldezubiaur 1880, 21.

47. PNA OP no. 162, 1881 and AHN no. 586 #60. In the late 1830s, Charles Wilkes, and, in the late 1850s, John Bowring, had, on the contrary, praised the solid granite structure of the quays (Wilkes 1850, 302; Bowring 1876, 26).

48. PNA *Alcantarillas* no. 7, report from the *Junta Consultativa de Obras Públicas* on the projected layout of San Luis avenue, 1896.

See the files of *Alcantarillas* in the PNA and PNA Ay no. 17, layout of Jolo street, 1867.

49. The famous paving stones of Chinese granite only paved (from the late eighteenth century) a tiny proportion of the pavements and roadways of the city. Even by the end of the nineteenth century, some of Intramuros's thirty-three streets were not yet paved and, in other districts, only a few streets in Binondo had a granite surface (Escolta, Rosario, San Vicente, Anloague streets and a small part of the *calle Nueva*). By the early 1890s, only 20,000 square meters of the 1,800,000 square meters of public roads in the city, were paved. The surface of other streets consisted of a simple roadbed, sometimes covered by a cement layer like in the *Paseo de Santa Lucia*, with a stoned passage for pedestrians often constructed at the entrance of the street. European innovations came to the Philippines in mid-century: asphaltting could not be made for lack of raw material, but the Mac Adam system tested on Rosario street was a distinct improvement and this technique spread rapidly. However, roadways were rarely heightened or cambered enough. Hand rolling was very insufficient and stones were not sufficiently joined so that the surface was soon ripped off. At the very end of the century, the town council eventually decided to buy heavy equipment and, in particular, a steamroller which remedied this situation. In the outlying districts reserved to the *casas de caña y nipa*, the streets were simply levelled, most of the time without any previous topographic study of the slope profile, to allow waters to flow out as

easily as possible, and without any sufficient embankment. As a consequence, the inhabitants had to lay out raised bamboo or plank passages, in order to get their houses. On this topic, see Huetz de Lempis 1994, 633–40.

SHM, CGD no. 7196: Mariano de Goicoechea, *Memoria...* op. cit.; SHM, CGD no. 7244: Pedro Munarriz *Memoria...* op. cit.; PNA *Alcantarillas* no. 7, building of a sewer in Magallanes street (Intramuros), 1869.

50. By mid-century, hundreds of people and horses bathed each morning in the mouth of the estero of Binondo in the Pasig (*Ilustración Filipina*, no. 19, 1 December 1859, 157).

51. PNA SM no. 8, analysis of the waters of the Pasig conducted by the military physicians José María de la Rubia and Miguel López de Roda, April 1850; *La Vida Industrial en Filipinas* I, no. 17, 10 March 1896, 132; *Annual Reports...* 1903, 6:6, 95; Cox 1914, 273–74.

52. PNA *Construcciones de Casas, Quiapo*, decision of the *corregidor*, 24 August 1871. Only tanneries were regularly persecuted perhaps because they were Chinese-owned.

53. AGMAB Puertos no. 34, *Manila*, letter of the harbour master, 24 October 1823.

54. AGMAB Puertos no. 34, Manila, 1823 fines and letter of the harbour master, 24 October 1823; *Disposiciones sobre policía urbana...* (1867) “Disposiciones relativas a la limpieza de las calles y plazas” art. 7. The esterios are also used, in spite of repeated prohibitions, as floating timber yards (PNA *Varias Provincias*, Tondo no. 1, 1841).

55. It is very difficult to appraise the number of inhabitants who lived on the water. The 1861 census enumerates 4,159 inhabitants (*Nomenclator...* 1865), that of 1903, over 15,000 (*Census of the Philippine Islands...* 1905).

56. PNA SM no. 8, *Bando* dated 12 November 1787; PNA Ay no. 47, 1811; PNA Ay no. 32, *Libro de Actas* of 1838, 10 January meeting and PNA Ay no. 76, 1838.

57. PNA Ay no. 17, terms and conditions of the cleaning contract of the department for 1867–1869; PNA Ay no. 50, 1896.

58. PNA Ay no. 13.

59. PNA *Policía Urbana* no. 6, 15 November 1866; *Disposiciones sobre policía urbana...* (1867) “Disposiciones relativas a la limpieza de las calles y plazas.”

60. PNA Ay no. 12, 1895 fines; Govantes 1887, no. LXXXI.

61. PNA *Policía Urbana* no. 6, 15 November 1866; *Disposiciones sobre policía urbana...* (1867) “Disposiciones relativas a la limpieza de las calles y plazas” particularly article no. 8; Rodoreda 1895, 81, 108.

62. Laplace 1848, 151; *Medicina y Farmacia*, 30 July 1886, I, no. 4, 16; *El Resumen*, t. I, no. 131, 5 December 1890.

63. PNA Ay no. 7, 1895; PNA Ay no. 19, 1897.

64. Before 1882, indeed, proprietors had to water (in the morning and the evening during the dry season) their doorsteps and the stretch of street corresponding to their facade in order to fight against dust. This regulation, however, was never respected and some Spanish physicians and officials even denounced this practice as a health hazard, since the steam which overheated roadways gave off was suspected of conveying germs (17 March 1789 ordinance [PNA Ay no. 23, terms and conditions of the contract of the sewers cleaning for 1853]; AHN no. 5173 #106; PNA *Varias Provincias*, Tondo no. 2 and 9, 1821).

65. 17 March 1789 ordinance (PNA Ay no. 23); PNA Ay no. 71, *Bando* dated 25 October 1845; PNA Ay no. 20, 1897; *Disposiciones sobre policía urbana...* (1867)

“Disposiciones relativas a la edificación y ornato” art. 13. From the 1880s, the incumbent doctor of the province and the town architect visited new houses before giving authorization to occupy them (PNA Ay no. 34).

66. PNA *Alcantarillas* no. 6, *alcalde primero* to *corregidor*, 17 September 1869; PNA Ay no. 34, *Libro de Actas* of 1850, 20 September, 1 and 17 October meetings; PNA Ay no. 74, *Composición general de las calles de Manila*, 1850.

67. PNA Ay no. 34, *Libro de Actas* of 1850, 20 September, 1 and 17 October meetings; PNA Ay no. 74, *Composición general de las calles de Manila*, 1850; PNA Ay no. 23, terms and conditions of the contract for cleaning the sewers for 1853.

68. The town council even considers in 1897 to set up the emptying of the pozos negros, in exchange of a tax (PNA Ay no. 19, 1897).

PNA Ay no. 13, municipal budget for 1868–1869. Latrines are often set above the street (Govantes 1887, no. CX).

69. The *posesiones* were one-story structures with an interior court where a few facilities were centralized. These structures were divided into tiny living compartments. The structure was usually badly constructed and ill-maintained.

PNA Ay no. 51, recruitment of six *celadores de policía urbana* 1864.

70. PNA Ay no. 1, 1890.

71. PNA Ay no. 12, 1889; no. 21, 1878; no. 14 transfer licence of Prudencio de Leon’s house, 28 January 1898; PNA *Construcciones de Casas, Planos* no. 1, building licence of a nipa house (Magdalena Street, San José).

72. See also *El Resumen*, 5 October 1890, I, no. 81.

73. PNA *Varias Provincias, Tondo* no. 1, ordinance dated 9 May 1794 and circular letter dated 23 February 1830; PNA *Corregimiento* no. 1 and 2.

74. PNA SM no. 8, analysis of the waters of the Pasig practiced by the military physicians José María de la Rubia and Miguel López de Roda, April 1850; Codorniu y Nieto 1857, 76.

75. PNA Ay no. 34, *Libro de Actas* of 1850, 20 September, 1 October and 17 October meetings; PNA Ay no. 74, *Composición general de las calles de Manila*, 1850.

76. PNA *Alcantarillas* no. 7, sewer of San Fernando street, 1867–1868 and cleaning up of Intramuros sewers, 1867.

77. PNA Ay no. 28, 1848; AHN no. 5182 #105; *La Oceanía Española*, 19 September 1882. The archaeological excavations made in the zone of the Parián gate show that some layers are made up of household refuse (Dizon 1989, 2).

PNA *Corregimiento de Manila* no. 1.

78. SHM, CGD no. 7244: Pedro Munarriz *Memoria...* op. cit. The author considers allowing the ditches to dry up during peace time. See also Hamm 1898, 27 and Foreman 1906, 343.

The cleaning up of ditches was a priority of the American authorities. After considering diverting the waters of the Pasig to flush them, they decided to dry them up (Musser 1903, 29).

79. AHN no. 576 #56, *Informe de la Comisión nombrada...* op. cit.; PNA Ay no. 25, *Libro de Actas* of 1893, 15 November meeting.

80. *Esteros* of Tutuban and of Aceiteros (AHN no. 576 #56, *Informe de la Comisión nombrada...* op. cit.; PNA Ay no. 45, *Libro de Actas* of 1870, f. 10).

81. The inhabitants of Quiapo strongly resisted the proposals of Antonio Canals and Matías Menchacatorre y Cía to dry up the estero of Quiapo without giving any

compensation to the pueblo between 1855-1868. The project received the approval of the town council (PNA *Varias Provincias*, Tondo no.; PNA *Construcciones de Casas* no. 2).

82. PNA *Ay* no. 53, illegal drying up of a section of an estero by Margarita Roxas, 1866; PNA *Ay* no. 25, *Libro de Actas* of 1893, 6 December meeting.

83. PNA *Ay* no. 3, *Libro de Actas* of 1819, 1 February meeting; PNA *Ay* no. 34, *Libro de Actas* of 1851, 3 July meeting; PNA *Alcantarillas* no. 6, construction of the sewer network of La Quinta market and of Quiapo square, 1867; SHM, CGD no. 7248 f. 9 v.: *Comisión de Deslinde de Jurisdicciones y de Nuevo Trazado de los Arrabales de Manila* report dated 4 July 1868; PNA *Ay* no. 39, *Libro de Actas* of 1872, f. 118.

PNA *Ay* no. 14, 1863; AHN no. 576 #56; AHN no. 5222 Rafael Izquierdo's *Memoria sobre la Gobernación General de Filipinas*, 33-34; PNA *Ay* no. 53, 1871.

84. AHN no. 576 #56, *Informe de la Comisión nombrada...* op. cit. and Eduardo López Navarro *Proyecto definitivo del nuevo puerto*, dated 27 May 1882; AHN no. 586 #60.

85. AHN no. 576 #56, *Informe de la Comisión nombrada...* op. cit.; PNA *OP* no. T 2, Carlos de las Heras' *Proyecto de mejora del estero de San Sebastián entre la calle de Carcer y la plaza del Carmen*, dated 5 April 1895; AHN no. 586 #60.

86. The commission also considered building a large canal north of the city which would provide water for the whole network (AHN no. 576 #56, *Informe de la Comisión nombrada...* op. cit.; PNA *OP* no. V9).

87. PNA *Ay* no. 13, 1895; Carlos de las Heras, *Proyecto de mejora del estero de San Sebastián entre la calle de Carcer y la plaza del Carmen*, 05/04/1895 (PNA *OP* no. T 2).

88. PNA *OP* no. V9, memo of the *Junta Consultativa de Obras Públicas* on the projected layout of the estero of San Sebastián, 1895. A general ruling for esteros had not been written even by 1895.

89. The solutions proposed by José Roca de Togores were very similar (1895, 41-47).

90. Heras y Crespo (1896, 6). The author simply offered to improve the ditches by introducing siphons, spiracles and ventilation pipes. He also advised the use of the famous "automatic cesspool emptiers" (the former septic tanks) invented by the mysterious Louis Mouras and marketed, in the early 1880s, by the abbot Moigno (Guerrand 1983, 74). This advice was put into practice for new buildings from 1897 (PNA *Alcantarillas* no. 6, municipal ordinance dated 8 July 1897).

91. PNA *Ay* no. 56, 1896; PNA *Alcantarillas* no. 7, memo of the *Junta Consultativa de Obras Públicas* on the projected layout of San Luis avenue, 1896; PNA *Ay* no. 15, 1898; PNA *Ay* no. 41, 1897.

92. Worcester 1898, 37; 1914, 408; *Annual Reports...* 1903, 6: 8; Whitmarsh 1899, 920; Maramag 1988, chap. 3, "The Changing Landscape of Manila."

93. The only considered improvements consist in filling up some areas and in digging some draining canals.

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AHN: Archivo Histórico Nacional (Madrid)

#X: expediente no. X

AMFAE: Archives du Ministère Français des Affaires Etrangères (Paris)

Historical Data Papers: Philippine National Library (Manila)

MN: Museo Naval (Madrid)

PNA: Philippine National Archives (Manila)

Ay: Ayuntamiento

OP: Obras Públicas

SM: Spanish Manila

SHM: Servicio Histórico Militar (Madrid)

CGD: Colección General de Documentos

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