The debut of ‘modern water’ in early 20th century Mexico City: the Xochimilco potable waterworks

Jeffrey M. Banister*a and Stacie G. Widdiﬁeldb,∗

aSouthwest Center, School of Geography and Development, Latin American Studies, University of Arizona, Tucson, AZ 85721, USA
bSchool of Art, Latin American Studies, University of Arizona, Tucson, AZ 85721-0002, USA

Abstract

In September 1910, during the Centennial celebration of Mexico’s independence, Mexico City witnessed the inauguration of the Xochimilco Potable Waters Supply Works, marking the debut of ‘modern water’ in the capital. This was a shift from the traditional notion of water as a heterogeneous element expressive of diverse geographies and histories—waters, that is—to an understanding of water as a placeless, timeless natural substance. The transition to modern water and hydraulic control could never be a completed process. Rather, it would continue to evolve in tension with the great diversity of hydraulic histories and geographies of Mexico City. Different from most studies that analyze the Xochimilco system in the context of modernity, we see it as also a fundamentally visual phenomenon, an interaction among technologies of construction, representation, and access. This includes the architecture, its photographic representation, as well as an 1884 study that set forth the concept of ‘potable waters’ and argued a case for creating a modern network to deliver it. The Xochimilco works promised a ﬂow as stable as its delivery system and as permanent as its photographic record. Drawing from Science and Technology Studies, recent work on the hydrosocial cycle, visual geography, and art history, we explore these waterworks’ technologies as a novel but unstable conﬂuence of objects, narratives, people, and places. For all the apparent durability of this network, the Xochimilco springs would run dry by the early 1930s. Instead of seeing water, we now see a collection of historical artifacts in the landscape and the archive.

Keywords: Porﬁriato; Mexico City; Water infrastructure; Visuality; Modern water; Hydrosocial; Xochimilco

In September 1910, during the centennial celebration of Mexico’s independence, Mexico City residents and visitors witnessed the inauguration of a host of modern ‘durable, useful, and beautiful’ public works.1 One of these, the new Obras de Provisión de Aguas Potables, the Potable Waters Supply Works, was useful and durable, and it was certainly deemed beautiful. More concretely, it was necessary for ensuring a stable future for the quickly expanding capital.2 The city’s population, around 369,000 in 1900, had grown to nearly one-half million by 1910. The extant water infrastructure could hardly keep up.3 Before the new Obras came on line, the infrastructure had been a patchwork of masonry aqueducts, wooden sluice-works, canals, public fountains, clay and in some cases metal pipes, and shallow wells.4 Much of this infrastructure, repaired and cobbled together over the years, could be traced as far back as the Spanish colonial period. Mexico City is situated at the low point of a large volcanic basin and was constructed over a series of ancient lakes. Its numerous and complex waterworks served simultaneously as a mode of transportation, a source of water for human consumption, and as a means of waste disposal.5 Water quality in most areas was therefore deplorable—a soupy mixture of human and industrial waste—and waterborne disease was quite common, particularly in the poorest neighborhoods.

* Corresponding author.
E-mail address: staciew@email.arizona.edu.

1 G. García, Crónica Oficial del Primer Centenario de Independencia de México, México, 1911, 208. Other public works officially inaugurated included: the General Asylum, the General Hospital, the National Post Ofﬁce, the Ministry of Communication and Public Works, and the Seismological Institute.
2 A. Peña y L. Asiain, Memoria sobre las Aguas Potables de la Capital de México, Secretaría de Fomento, 1884.
3 Mexico’s overall population was 13,606,000 and 15,160,000, respectively. J. Lear, Mexico City: space and class in the Porﬁrian capital, 1884–1910, Journal of Urban History 22 (1996) 464.
5 S. Abedrop, El Gran Reto del Agua en la Ciudad de México, Ciudad de México, 2012.
Pressured to act, in the early 1880s the Ministry of Development (Secretaría de Fomento) funded a study by a respected scientist, Antonio Peñafiel, to explore the relationship between hydraulic infrastructure and public health. Subsequently, Ministry officials used Peñafiel’s study to construct a modern potable network, the Obras, combining state-of-the art science, engineering, and materials. By the time of the centennial, most of the network was up and running, ready to move water at an unprecedented volume for delivery into around 12,000 of the city’s formally registered 14,000 buildings that were either connected or soon to be drawn into the new water network.6 Once in operation, the Obras was an impressive spectacle for the public to witness, and scientists and civic leaders assured centennial celebrants that what they beheld was indeed the solution to the capital’s historic water woes.

Witnessing the inauguration of the potable waterworks was not merely a matter of hearing a speech in front of a single building in the capital, however. Instead, it involved touring the works’ different sites and viewing multiple objects as they were connected together across the countryside. The tour thus traversed space and time, directing participants to draw connections among the various parts and to create a total picture of potable water delivery as an integrated system. The trip took its elite group of visitors outside the city proper, moving them away from the political stronghold of the metropolis core and into the hinterlands of Xochimilco, in the southernmost part of the Basin of Mexico. The excursion necessitated three special trains each with four cars pulled by an engine. These 12 cars were necessary to accommodate the many invitees, among whom was Mexico’s vice president, the ministers of Development, Foreign Relations, and Communications, as well as foreign ambassadors, special envoys and their staff and their families.7 From their open-air carros de verano, they would have a clear view of Xochimilco, the new source of the potable supply, an area renowned for its lakes and lush springs. The route moved along a railroad line built to transport laborers and material along the nearly 30 km of fully enclosed reinforced-concrete aqueduct now connecting Xochimilco to the city. Centennial celebrants saw first hand the operation of state-of-the-art engineering housed in multiple, ornately decorated structures. They were also treated to copies of a small commemorative album, written by the Obras’ chief engineer, Manuel Marroquín, describing the technological achievement in some detail.

The inauguration of the waterworks was in many respects the public debut of what Hamlin, Linton, and others have described as ‘modern water.’ This was a shift from the traditional notion of water as a heterogeneous element expressive of diverse geographies and histories — waters, that is — toward an understanding of water as a placeless, timeless ‘natural’ substance.8 For Mexico City, this substance was clear and pure ‘potable water,’ a new object of technological and political control that the federal government had invested a fortune to study, extract, and deliver. Modern potable water was, however, always much more than a singular substance; it was a simultaneously powerful and unstable nexus of ideas, objects, people, places, politics, and, importantly, of representations. As we suggest here, it was a fundamentally visual phenomenon anchored in technologies that embed a tension central to modernizing projects. On one hand, such technologies are an attempt to render water ‘legible,’ creating a conceptual purification by which it may seem easily controllable and extractable for the apparently apolitical ends of public health and urban expansion. On the other, they reflect the impossibility of fully abstracting water from its diverse social histories and variegated physical geographies.9 Such deterritorialization would thus prove especially difficult given Mexico’s complex hydraulic history and geography, which are profoundly shaped by the volcanic-basin lake complex over which the city is constructed.

Moving through the Obras’ multiple sites along the centennial route was a physically extracted and figuratively abstracted ‘resource,’ an official calculation of quality and quantity that would ostensibly last into the future, and that required politically centralized and scientifically based management. The centennial tour was, therefore, the inauguration of much more than physical waterworks. What participants saw was a nexus of material objects, the terrain they traversed, and of texts claiming the right to water by federal authorities, both in the landscape as well as in photographs of that landscape. The human eyes of viewers in Mexico City proper could at least make the pretense of capturing the totality of a single building. By contrast, only the technological eye — afforded by train travel across the route of the network in the landscape, or the camera producing multiple views and multiple parts packaged in sequence — could approximate the monumental totality of the Xochimilco waterworks. At the same time, it was only through the microscope that the waters’ purity could be seen and verified.

The scholarly literature tends to understand the process of modern water in terms of the two most obvious and fundamental objects and developments that facilitated its debut in 1910 Mexico City: an influential publication on water and public health as well as the new physical waterworks.10 Rarely does this literature approach ‘modernity’ as a fundamentally visual experience, nor does it consider visual rhetoric and its integral importance to processes of environmental governance and politics. Antonio Peñafiel’s 1884 report drew a critical distinction between a past characterized by colonial water approaches, to which he attributed insalubrity and insecurity, and a healthy and more secure future made so by the advent of modern potable water. Marroquín’s infrastructure, meanwhile, would collapse the space between the distant source, Xochimilco’s springs, and the capital. How Peñafiel wrote about water and what Marroquín’s infrastructure looked like worked together to condense a diverse array of elements into a unifying vision of the capital’s social-hydraulic transformation and of its future urban geography. Crucial also was the commemoration of the state-of-the-art delivery network made possible by the eyewitnesses of the centennial tour and the photographic album. The train trip allowed visitors to see a new hydraulic landscape while the camera froze multiple points in that landscape into the neat package of a souvenir album. The transitory nature of waters was therefore apparently fixed in place and time by the new technologies of infrastructure and representation, as if to suggest that water would always flow into the city, forever available, by means that were ‘durable, useful, and

---


7 García, Genaro, Crónica Oficial de las Fiestas del Primer Centenario de la Independencia de México, Talleres del Museo Nacional, Mexico, 1911, 213.


9 On the concept of legibility, see J.C. Scott, Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed, Yale, 1998.

beautiful.’ But while officials claimed to have found the source of water to ensure the city’s future, they may also be seen as celebrating the consummation of centralized hydropower.

In this paper, we examine Peñaflor’s study, the Xochimilco waterworks, and the visuality of modern water as integrative to this process of political centralization taking place during the late-nineteenth and early-twentieth centuries, and focused intensely on Mexico City. This was a time during which Mexican political and social life was largely dominated by the dictatorship of Porfirio Díaz, a period known as the Porfiriato lasting nearly three decades (1876–1911), ending shortly after the outbreak of the Mexican Revolution in 1910, and Díaz’s exile in 1911. The theoretical framework through which we have approached representation in hydraulic governance draws from environmental geography, political ecology, art history, and the field of science and technology studies (STS). We use this framing to demonstrate how even a quintessentially modern water control project such as the Obras – developed using the latest scientific advances and engineering technologies, and backed by the full flexing of federal political and financial muscle – was a tense articulation of contradictory socio-natural and socio-technological processes and objects.

Central to persuading the broader public of the need for and benefits of Mexico City’s new hydraulic control technologies was modern visual rhetoric. This rhetoric, we suggest, was integral to the governance of water resources, whether in the eclectic architectural styles of the Xochimilco pump houses or in the discourse of ‘potable water.’ It was at one and the same time a crucial part of the modern infrastructure itself and also crucial to its constitution as a larger nexus of socio-technological objects and sites of water control. Such rhetoric, moreover, revealed a range of assumptions and ideals about space and society, which, in turn, were rendered concrete within the infrastructure. Therefore, when we ask, how can we see the relationship between humans and water, we are also asking, by what means and in what ways are humans persuaded to see ‘water,’ including the work it performs, in society? In the case of the Obras, such means include a corpus of interacting objects, texts and sites of water control that would physically link the city to an exploited hinterland, while discursively keeping them separate in time and across the space of the basin.

Yet, the Obras was not a fully accomplished project that created, once and for all, a modern water ‘system’ or ‘solution.’ Instead, it was a network that brought together objects, people and places in novel ways, requiring a particular historized vision of a troubled hydraulic-social past and problematic hydraulic geography set against a program for a secure future. That future never came, however, for the Obras depleted the springs and dramatically transformed Xochimilco’s once lush lacustrine environment in less than two decades. As even the Obras’ title suggests, there could never be a singular ‘potable water’ for the growing capital, only many ‘waters.’ Significant elements of the network of modern waterworks inaugurated at the centennial, including fragments of the original Obras, endure in Mexico City’s present-day water-control structure, revealing hydraulic modernity to be a stratigraphy of ongoing and connected approaches. Those many and diverse waters today come from both within and far outside of the Basin of Mexico.

Linton describes the transition toward ‘modern water’ as having ‘taken place throughout the industrialized world by the end of the nineteenth century,’ a categorization which typically excludes Mexico.11 The Obras, however, in many ways exemplify the hydraulic megaprojects under construction that Linton and others see as one of the major indices of modern water in the ‘industrialized world.’ Such projects were built to simultaneously address major urban water provision and hygiene problems, and to demonstrate the advent of modernity in their respective metropoles. This dual function is illustrated quite well, for example, by the Croton Aqueduct, which was completed in 1906 to supply New York City, and by the Marathon Dam, completed in 1925 to bring water to Athens, Greece.12 The ‘moment of delivery’ of water into these cities took place in spectacular fountains or reservoirs, symbolically and perpetually inaugurating the entrance into modernity. And like the Obras, both the Croton and Marathon systems traversed large swaths of terrain, creating new hydraulic landscapes between water source and delivery site. Yet, even if the Xochimilco project is one among many worldwide, it also had to respond to Mexico City’s complex hydraulic situation.

A history of Mexico City’s complicated water situation

The Mexico City metropolitan area and larger Federal District today cover much of the Basin of Mexico. Elevations start at 2,200 m on the basin floor and reach 5,000 m at the peaks of the volcanic mountains forming its perimeter. This is a convergence zone of intense hydraulic and seismic activity, bringing together tropical latitudes, temperate altitudes, active volcanoes, and fault lines. Some parts of the metropolitan area might experience water shortages and rationing while others reel from damaging floods. Over the years, earthquakes have rearranged whole parts of the drainage and potable infrastructure, and estimates suggest that water lost to leaks in the network might be as much as 35%, or over 11,000 of a total 32,000 cubic liters-per-second of flow.13 Scarcity and superabundance have always been the Janus face of water control projects and politics here, with each human intervention in the hydraulic landscape seeming to necessitate yet another of grander scale. The Xochimilco Obras accelerated this cycle, opening the door to increasingly larger water-provision projects, including widely contested inter-basin transfer schemes, starting in the 1950s. Similarly, it set in place the juridical and physical infrastructure that would make the city increasingly dependent on groundwater exploitation. Because this is the seat of national political and economic power, officials have spared little expense to bring to fruition some of the largest and most socially costly water control efforts in the world.14 By 1913, when Xochimilco was fully operational, the total costs had...

---

11 Linton, Water (note 8), 20; see Aboites, El Agua (note 10), for other cities in Mexico that were developing or that already had modern water structures by the early twentieth century.


14 The Xochimilco Obras cost nearly 18 million pesos by the time they were finished, an enormous sum for that time. The figure comes from: J. L. Cossío, El entubamiento de las aguas, inc: Hira de Gortari Rabiela and Regina Hernández (Eds), Memoria y Encuentros: La Ciudad de México y El Distrito Federal (1824–1928), Departamento del Distrito Federal y Instituto de Investigaciones Dr. José María Luis Mora, 1988. For a discussion of the dominance of Mexico City in national finances, see J. Kandell, La Capital: The Biography of Mexico City, Random House, 1988; for analysis of Mexico City’s exploitative and highly inequitable hydrosocial order, see: P. Romero Lankao, Obra Hidráulica en la Ciudad de México y Su Impacto Socio-Ambiental, 1880–1990, Instituto Mora; also see, P. Romero Lankao, Water in Mexico City: what will climate change bring to its history of water-related hazards and vulnerabilities, Environment and Urbanization 22 (2010) 157–179.
reached close to 19 million pesos. In today’s U.S. dollars this would be nearly 250 million.  

Developing reliable water solutions for what is today a ‘mega-city’ of 21 million people has proved elusive since the fourteenth century, when pre-Hispanic forerunners of the Aztecs, the Mexico, founded their city-state of Tenochtitlán on an island in middle of Lake Texcoco. Texcoco was one of five ancient lakes running through the largest volcanic basin on Mexico’s temperate central plateau. It was there in 1521 that the Spaniards established their colonial capital of New Spain, *La Ciudad de México*. As much of the historical literature points out, in myth, popular lore, and urban historiography Tenochtitlán (later, Mexico City) became virtually synonymous with its hydraulic foundation. It has often been described and pictured as a magnificent city on a lake surrounded by a sprawling network of arroyos, acequias, aqueducts, and canals, as well as countless springs, marshes, and wetlands. The city has consumed more and more of this watery geography as it continues to expand outward. Nonetheless, for centuries surface water connected people, places and processes across the great expanse of the Basin of Mexico. Contact with it in a variety of forms was an unavoidable feature of everyday life.

With the city under Spanish rule by 1521, many of the earliest projects were focused on controlling the seasonal ebb and flow of water in the lakes. During the rainy season, too much water could leave locals battling floodwaters at their doorsteps. The dry months, by contrast, were often marked by the stench of desiccated aquatic life left exposed on the salt flats of Lake Texcoco, at the city’s eastern edge. A lackluster rainy season could make transportation by boat quite difficult, reduce harvests, and leave the city thirsty. To remedy the situation, in 1607 colonial officials initiated a project to tunnel through the mountains to the far north of the basin as a way to drain the lakes, check against seasonal late water levels. This feat of human ingenuity and labor, ultimately known as the *Gran Canal de Desagüe* (Great Drainage Canal), was not fully completed until 1900.

As Manuel Perlé Cohen has written, the Desagüe produced ‘a long and deep scar on the geography of the Valley of Mexico,’ and in many respects represented a Faustian bargain with hydrology. The negative socio-environmental effects of lake drainage would become clearer as time went on. Now, water moving into the city as ‘waste’— either metabolized by humans or flowing as storm runoff— could be flushed out of the basin entirely. By draining part of the lakes and redirecting runoff, the Desagüe dramatically altered historical relationships between humans and the aquatic environment. It fixed in the landscape prevailing notions of ‘nature,’ a particular politics of hydraulic control, and, critically, it strongly determined future water-control possibilities and urban development more generally. Efforts to control ‘modern water’ thus at once constituted an argument against and an integration of the water solutions that came before. We certainly see this tension expressed Peñaflor’s study and embodied in the Obras themselves, both of which we examine in detail in the following two sections.

Like the Spanish colonial period (1521–1821), then, the late-nineteenth and early-twentieth centuries constituted a pivotal time of transformation for the valley’s urban and hydraulic landscapes. Before that, the lake environment had provided everything from building materials and fiber to medicinal herbs and basic foodstuffs, creating the basis for a robust regional economy. Drainage would greatly diminish transportation by boat, which had long characterized trade between the city and its southern hinterland, and would alter centuries-old networks of food production and provision for urban residents. The contradictions set in motion by the modern drainage projects have thus understandably garnered significant scholarly and popular attention. For example, much has been written on the connections between economic transformation, hydraulic politics, and the social effects of infrastructure.

Historians and geographers have paid far less attention to the other crucial feature, in some ways the antipode, of the city’s modern approach to hydraulics: the Obras de Provisión de Aguas Potables. Moreover, research generally has not taken up the matter of how particular visions of water, water control, and infrastructure— the way things look, that is— have informed the political process of creating and stabilizing centralized and exploitative networks of hydraulic-social control. Focusing on the Obras, we suggest that three interlinked processes drove hydraulic-landscape transformation at the turn of the last century, changes that would ultimately remove water from most parts of the urban landscape: 1) the centralization of water governance within federal agencies; 2) the emergence of a modern, scientific-managerialist epistemology of water control and provision; and 3) new developments in technology and infrastructure.

On the matter of Mexico’s hydraulic centralization, historian Luis Aboites writes that expanding federal authority in matters of water management involved ‘norms that violate and attempt to erase local traditions, superimposing the weight of an external, alien bureaucratic authority [that became…] an inevitable protagonist in local life.’ A raft of new legislation provided the

---


17 An ‘acequia’ generally refers to an irrigation ditch or canal. An aqueduct can either be a bridge-like structure made for delivering water over an uneven terrain, or an enclosed water pipe. Water carried in aqueducts can also be used for irrigation, but in contrast to an acequia, the water in an aqueduct is typically accessible at limited points along its course.


19 Abedrop, *El Gran Reto* (note 5).


22 Tortolero Villaseñor, *Tierra, Agua* (note 21).

23 For example, C. Agostoni and E. Speckman Guerra (Eds), *Modernidad, Tradición y Alteridad: La Ciudad de México en el Cambio de Siglo* (XIX–XX), UNAM, 2001; Agostoni, *Monumentos* (note 10).

24 Scholars who deal with some aspect of the visual in relation to nineteenth- and twentieth-century waterworks, though not the Chichimilco Obras, include: M. Gandy, *Rethinking Urban Metabolism: Water, Space, and the Modern City*, Paris Sewers 83 (2004), 363–379; Kaika, Dams as symbols of modernization (note 12); Reséndiz, Lo Húmedo y lo seco (note 18); and Salazar, *La inundación* (note 18).

juridical means to appropriate water sources by claiming, in the name of federal government, the territory that water flowed over, under, and through. In large part catalyzing the reform process was the 1888 law on _vías generales de comunicación_ (loosely, law on boundaries and waterways), which increased the federal government’s authority and territorial reach. Now, any canal built with federal funds, and any lake or river that was ‘navigable’ or constituted an international or interstate boundary, could feasibly fall under federal control and be subject to regulation (though technically, these bodies of water would not be considered federal property outright). The navigation criterion constituted a legal wedge for federal intervention, but only rarely was it an actual concern of regulation.\(^{26}\) With subsequent federal laws in 1894, 1902, and 1908, surface water came to be considered a public good that could only be secured by a federal concession. Before this time, water use and control had remained mostly within the realm of civil law and the remit of municipalities.

Such centralized authority, in other words, came at the expense of a long tradition of relative local autonomy.\(^ {27}\) The new water laws coincided with the emergence of the governing unit of the Federal District (DF), created in 1824 but whose authority was consolidated during the late nineteenth century. The DF’s power and spatial reach were expanded through promulgation of the 1903 Law of Municipal Organization. Whereas ayuntamientos (city councils) had heretofore been relatively autonomous elected bodies, by the early twentieth century, in towns across the valley, they were finding their ability to govern curtailed by the new federal structure. ‘Real power,’ according to John Lear, thus ‘passed into the hands of the Superior Council... of the Federal District, which consisted of the governor, the president of the Council of Public Health, and the director of general public works, all of offices appointed by President Díaz and funded by the federal government.\(^ {28}\) This move proved decisive for ensuring potable water and drainage for the city’s emerging middle- and upper-class urban developments, especially since such modern amenities came at a high social and economic cost for communities elsewhere in the valley who found themselves lacking political representation.

Tied to the changing legal structure was the emergence of a modern epistemology that posited water as a scientifically comprehensible and technologically manageable substance, which ‘Nature’ had supposedly made available to the city.\(^ {29}\) Derek Gregory writes that the modern discourse of ‘water’ conjured a technically manageable natural resource, an approach within which ‘there would be no place for ‘local’ knowledge...’.\(^ {30}\) As it was in many cities throughout the world, discourses of hygiene, bacteriology, and public health included the ideal of clear and clean potable water, and with delivery infrastructure designed to ensure this purity. Before this, as Melosi has written, water quality had largely been understood through direct observation, and was a matter of color, taste, texture, and place(s) of origin.\(^ {31}\) Over time, then, the idea of experiencing water sensually, and as a flow connecting people and places, would fade.\(^ {32}\)

Modern hydraulic thought became especially persuasive and transformative in Mexico City at the turn of the last century for its situation within a changing institutional and legal landscape, articulation with new public infrastructure projects, and its popularity within politically influential ‘communities of knowledge,’ nearly all of which were based in the capital.\(^ {33}\) Scientific discourse formed part of an unprecedented and globally networked ‘institutional impulse,’ turning the city into one large laboratory for distilling and tackling the most pressing problems. The elite _Sociedad Científica Antonio Alzate_ constituted a vibrant professional forum for discussing the issues and for devising solutions to them. Research in statistics, geography, natural history, and anthropology, meanwhile, were receiving direct support from the state. The _Sociedad Mexicana de Geografía e Estadística_ (The Mexican Society of Geography and Statistics) had by the 1890s surveyed much of Mexico’s territory and was regularly publishing maps of the republic. The National Medical Institute, meanwhile, had opened in 1884 to study Mexico’s ‘flora’ as well as its ‘diseases.’ Researchers working in the areas of hygiene and bacteriology lobbied intensely for water control and provision, and supported large-scale public works to address the problems of urban growth and development. Indeed, the shelves of the newly revamped museums of archeology and natural history began to brim with pre-Columbian artifacts unearthed by workers building the city’s new water projects.\(^ {34}\) Modernity and antiquity thus issued from the same landscape.

**Towards an understanding of modern water**

We find recent work in geography and political ecology focused on the so-called ‘hydrosocial cycle’ useful for exploring the tensions condensed within the Obras network. Researchers have developed the hydrosocial cycle concept as a way to analyze the relationship of politics to hydrological processes, and to explore the work of water in sustaining inequality within capitalist social relations. Their research inserts a conception of the social into a typically asocial and apolitical hydrology, and takes seriously the combined ideational and material means by which ‘water’ is constituted. Here, water’s materiality (its diverse ‘natures’) is considered inseparable from the ‘social’ geographies it traverses, ties together, or forces apart.\(^ {35}\) This research has been deeply informed by the work of Bruno Latour, and the field of science and technology studies (STS) more broadly, in assessing the influence of non-human nature on modern environmental control efforts and infrastructure. Within such a purview, the Obras cannot be analyzed in terms of discrete natural or social forces. Rather, it is better understood as a conjunction of practices that, in both a parallel and contradictory motion, efface such distinctions while reflecting an epistemology that aggressively posits their separation. Following Linton, then, we

---

26 Aboites, _El Agua_ (note 10).
28 Lear, _Mexico City_ (note 3), 465.
29 Peñaflé, _Memoria_ (note 2).
31 M. Melosi, _The Sanitary City: Urban Infrastructure in American from Colonial Times to the Present_, 2000; see also, Hamlin, _Waters or water_ (note 8).
32 Hamlin, _Waters or water_ (note 8); Linton, _Water_ (note 8).
33 See Linton, _Water_ (note 8), 14, on the connections between the persausiveness of modern water and its institutional situation.
34 M. Tenorio-Trillo, _I Speak of the City: Mexico City at the Turn of the Twentieth Century_, 2012, 285.
view the thought and practice of modern water as drawing together a variety of ‘things’ that are neither purely ‘natural’ nor strictly ‘social,’ and placing these in tension with discursive maneuvers directed at ensuring that these realms remain distinct.36

On one hand, therefore, we have a modern epistemological divide that creates distinctions — in this case, between so-called pre-modern and modern approaches, and between bodies, technology, infrastructure, and the urban order. On the other is an ontology that collapses them in practice. Over time, as Erik Swyngedouw has argued, modernity has nonetheless come to dominate the realm of ontology as well.37

This tension becomes most pronounced within what Latour calls the process of ‘translation,’ or how modern thought, under the umbrella of a single concept, ‘Nature,’ actually condenses ideas, objects and forces that are ‘simultaneously real, like nature, narrated, like discourse, and collective, like society.’38 Such ‘hybrids’ are, strictly speaking, neither ‘natural’ nor ‘cultural.’ Instead, they are typically unstable networks of dissimilar ‘things’ and processes whose connections the modern worldview would disavow. Latour in turn refers to such artifacts, and documents. At that moment, Mexico City’s potable water network is a prime example of this. Heavy groundwater pumping in many places has caused the city’s substrate to collapse, destroying foundations, causing flooding, and major breaks in the potable network itself. Moreover, bringing water in from ever-greater distances over time become increasingly untenable both politically and socially.39

With this in mind, we take modern ‘potable water’ to be a process that brought together heterogeneous elements. This modern water was showcased at the centennial through a collaboration of visual conventions and practices, including objects, artifacts, and documents. At that moment, Mexico City’s assorted politicians and técnicos working on water control saw themselves as crossing a threshold from one historical stage to another, enshrining history and geography as they emerged, like the water that was to sustain them, facing the future. The scholarship concerning turn-of-the-century architecture, urban planning, as well as the great structural amalgams of modernity and history — worlds’ fairs — points to the interplay between new technologies and old language.40 This is precisely what we see in the photographic representation and architecture of the Xochimilco Obras, as well as in Peñafl’s study. It is not just a matter of building or even engineering technologies, but of the means by which modernity could be affirmed and managed through its representation, namely through the technology of the photograph and in Peñafl’s research. Multiple studies of architectural photography, particularly construction photography, as well as photographic albums, demonstrate how the use of new visual technologies also collaborated to shape modernity, just as they historicized it.41

The display and picturing of modern water turned pre-modern water — its histories and geographies — into a relic, replacing it with the ideal of an unspoiled, unpopulated and ever-present ‘nature’ there for the taking.

In sum, the Obras network constituted a nexus of modern scientific thought and diverse technologies, yet also brought these into tension with historical forms of knowing and seeing, with ontologies and epistemologies rooted in the diversity and complexity of hydraulic spaces, places and historical practices that defined the Basin of Mexico. These modern projects would, over time, remove water from view both through the desiccation of the surrounding lakes and the expansion of the underground potable network. Certainly, previous ways of knowing and relating to water had little place within the modern view. Nevertheless, they could never be erased outright. Just as federal projects de-territorialized, centralized and ultimately rendered water less visible in the landscape, they also made it visible and geographically situated in new ways through this hybrid combination of texts, sites, and objects.42

Setting the stage for modern water’s debut was Antonio Peñafl’s influential 1884 study, the first to systematically describe Xochimilco as a source of ‘potable water’ and to argue a case for the new infrastructure that would soon deliver it. We see in Peñafl an ambivalence that would trouble the shift to modern water: was potable water a sensuous experience and the result of complex histories and geographies, or a pure substance that would continue to flow in sufficient quantities to secure the capital’s future? We take up these questions and this ambiguity in the following section.

Antonio Peñafl’s study of Xochimilco: from waters to water

Even into the early twentieth century, daily life in the capital remained attuned to the workings of a flagging water system whose primary features were rooted in colonial-period public works. Compared to the modern potable network coming on line, large portions of the colonial infrastructure were open to the elements and, as a result, made water a more broadly visible and sensuous part of quotidian existence, most notably in and around the city’s complex of acequias, aqueducts, canals, fountains, and public wash areas.43 The old network was exposed to the elements and was frequently used for dumping toxic substances and materials. This same quality of openness, however, also afforded residents opportunities to see water and, importantly, to perceive its connections with the basin’s dramatic hydro-climatic fluctuations.

37 Swyngedouw, Social Power (note 35).
42 See Swyngedouw, Social Power (note 35).
43 This is not to suggest that the city had no piped water or enclosed drainage. Indeed, there was a good deal of enclosed infrastructure in place, some which dated to the pre-independence years. But it was not until the Porfian period that the city launched its large-scale waterworks projects that would replace most of the old infrastructure. See Cossío, Memoria y Encuentros (note 14).
Changes in water clarity and color, for example, were indices of these larger processes: winter versus summer rains, flooding or drought fluctuating industrial water pollution.\(^44\) Infrastructure connected to the two primary sources of fresh water for the city (the springs at Santa Fe and Los Leones), located in the hills to the southwest, was open and exposed to runoff and silt, which meant that water quality was continuously and visibly changing. Official studies published around the turn of the last century situated these subtle and experiential encounters into a history of pre-modern water.\(^45\) Within this history, the once state-of-the-art colonial infrastructure that made water visible and easily accessible became an artifact signifying contamination and lack of proper control. Similarly, the lakes in the southern end of the basin are represented as another dimension of the city's water-control problems and are, thereby, conceptually cleaved from the Xochimilco springs and the people that depended on them, even though Peñaflie's study addresses deforestation and its relationship to the springs.

Peñaflie's Memoria sobre las Aguas Potables de la Capital de México was published by the Ministry of Development in 1884, an important and at the time influential illustration of the relationship between the emerging epistemology of modern water and the practices, ideals, and infrastructures that came before.\(^46\) The Ministry commissioned Peñaflie and his team to produce a detailed study of the connections between water provision and public health. The study effectively certified that the water from Xochimilco met modern standards of potability, and justified creating a system for its delivery as a way to ‘save the City of Mexico’ and ensure its future. In order to make these claims, Peñaflie and his team developed a narrative of temporal and spatial difference necessary for advancing the new project.

Dr. Antonio Peñaflie's training prepared him well for assembling the authoritative study that would establish, scientifically, the ‘potability’ of Xochimilco’s water, and, politically, its role in the ‘salvation’ and ‘stability’ of a growing national capital with many and complex water woes. Peñaflie was a polymath, trained as a medical doctor but probably known best for his work in statistics. His interests and abilities ranged across the disciplines of history, geography, linguistics, and public health, which he wove together into a totalizing picture of modern Mexico. In his exhaustive study, which would ultimately support the federal takeover of Xochimilco's complex of springs, Peñaflie and his team had to respond to the problem of how to represent and rationalize modern water's figurative and literal abstraction. He set forth the problem in his first chapter, entitled simply, ‘Hygiene,’ with a straightforward but causally-connected question: What, he asks, is the ‘influence’ of ‘waters for domestic use’ on the capital’s public health?\(^47\)

This question had been posed originally at an 1882 meeting of the Academia de Medicina de México. To answer it, Peñaflie had to navigate between at least two ways of comprehending and describing. The first, for which his deep interest in history and geography certainly prepared him, was an experiential sensitivity and an eye for the role of water in the city’s social and economic life, and for its peculiarities as a function of a unique environment. The second, for which his statistician's work and medical training prepared him, was to take samples and test them in a laboratory setting, and to abstract and quantify. In so doing, Peñaflie's study established what in Latour’s terms could be understood as the ‘Great Divide,’ a constitutional moment whereby old forms of knowing and relating to water were ‘translated' and 'purified' for the modern water user. The resulting study conflated Xochimilco and ‘potable water’; both became knowable and exploitable as a gift of nature for the general benefit of society.\(^48\)

Peñaflie’s report began by moving the analysis of Xochimilco’s water into the broader geography of the city and basin and, ultimately, the nation and world. Answering the question about domestic uses and hygiene, he noted, would ‘embrace the entire Hydrology [sic] of the Capital of the Republic and also the hygiene future of Mexico’ over all. Mexico, he said, has a ‘special Hydrology.’ There are no ‘great rivers,’ and the city’s ‘economic uses’ of water were from the many streams and arroyos that drained basin’s steep mountainsides, forming its many ‘springs…artesian and common wells, and…the water remaining in its lakes.’ This distinctive geography also brought together a ‘peculiar’ combination: volcanic rock, high altitude, heat, and ‘intertropical light.’ Indeed, it was a wholly different place from where flowed the ‘great rivers of the continents.’ This natural distinctiveness gave Mexico City’s water both its ‘positive and negative’ aspects. The negative characteristics, the study showed, had caused widespread ‘insalubrity.’\(^49\)

He also assessed the effects of deforestation around the valley as well, and in so doing made the case for using all of the human senses in research. The cutting of trees for construction, industry, and cooking, he found, contributed to the desiccation of many water sources. One of the consequences was the city’s notoriously severe flooding during the rainy season.\(^50\) In point of contrast, he discussed the vast quantity of cypress trees one could see growing in the Xochimilco area as an index of the abundance of high quality water and the health of the surrounding environment. In the same way, the health of a local spring could be measured, at least in part, by its ability to sustain certain highly visible species of flora and fauna. Water, he suggested, had to be understood as an amalgam of taste, smell, color, feel, and clarity, even though its potability was, in the last analysis, verified through the use of technical devices and modern methods.

While Peñaflie’s Memoria is a careful study of the basin’s water history and geography, its primary objective is to create the case for potable water and a new delivery system as crucial for the city's salvation. The study was not meant to highlight water as a sensual experience. Nor was it or to describe the city’s hydraulic politics; too detailed an examination of water politics might be disruptive to the hydraulic future being envisioned. And yet all of these things were present: hydraulic politics, history, geography, and the idea of water as a sensual experience. Indeed, in Peñaflie's text they are transformed into a realm of socio-spatial difference against which the city must build its new hydraulic future. The study was nonetheless tacitly political in that it was staking a claim for a particular space whose springs would be used to sustain urban growth and development elsewhere. Its most powerful and influential conclusions, therefore, did not simply derive from the data on Xochimilco’s water quality and quantity that were so carefully marshaled using the latest scientific techniques. More important is the way in

---

\(^{44}\) The Memoria y Encuentros contains several observers’ accounts of the city’s water situation made between the late colonial period and the first quarter of the twentieth century.

\(^{45}\) See Cossío, Memoria y Encuentros (note 14).

\(^{46}\) Peñaflie, Memoria (note 2). The study was actually written by both Peñaflie and Lamberto Asiain, but scholars generally refer to it as Peñaflie’s.

\(^{47}\) Peñaflie, Memoria (note 2), v.

\(^{48}\) Latour, Modern (note 38).

\(^{49}\) Peñaflie, Memoria (note 2), vi.

\(^{50}\) This was not a unique or novel notion by any means. Long before Peñaflie’s time, for example, Alexander von Humboldt had made the same observation, as did water authorities. See Peñaflie, Memoria (note 2).
which these data were used to develop a narrative of ‘potable water’ (and potability) as a naturally pure and abundant substance, and, subsequently, to let this narrative of purity and abundance stand in for the historical geography of water that otherwise permeates the pages of the Memoria.

For Peñaflé it was imperative that the old structure of water be replaced so that the basin’s social and hydro-climatic dynamics be prevented from contaminating the new substance. In 1830 the capital reportedly had 769 private and 42 public fountains, as well as nine different aqueduct complexes connecting the inner city to its wider basin hinterland, and much of this infrastructure remained in place when Peñaflé conducted his research. The waters flowing in the old aqueducts and spouting from the fountains, according to the report, were ‘highly unfavorable to public health.’ They were thought to pick up ‘organic and gaseous materials from the swampy atmosphere on the outskirts of the capital.’

The city’s interior was the most contaminating space, however. As they made their way through the ‘long and uncovered aqueduct,’ the ‘soft waters’ of the old springs of Santa Fe and Los Leones, in the foothills southwest of the basin, were especially contaminated by women using them to launder clothes. As a result, these waters picked up ‘all of the filth from that use, and... the germs of infectious disease.’ The capital’s future survival required that Xochimilco’s naturally pure waters be extracted and moved to another place, to the city center, and, most especially (though not stated explicitly) to the city’s elite suburban development edge, to the northwest of the springs.

One of the study’s central conclusions was that the capital’s ‘extraordinary mortality’ was the result of the ‘poor state of the distribution of waters.’ Distribution was not, however, discussed in the explicitly historical social or political terms, as question of human settlement and the dramatic and growing socio-spatial instability of the capital. Rather, this was largely a result of the way nature had situated water in the landscape (a common refrain amongst water planners today). Xochimilco’s springs would solve two problems at once. First, they would provide clean and clear (that is, ‘potable’) water in abundance. Second, they provided sufficient flow volume to wash and maintain the city’s drains. Solving the problems in this way, the report suggested, would make use of the waters of sister lakes Chalco and Xochimilco, waters purportedly not only ‘useless’ but also ‘threatening’ due to their flood potential. Of course, the residents of the southern lake zone generally did not agree that their waters were useless or threatening, and they certainly did not see the proposed redistribution as simply addressing a shortcoming of nature. The political view expressed in the report — which by its recommendations separated the lakes from the springs and the people from the lakes — soon would prove devastating to the region’s social structure, and to the basin’s economy over all. Peñaflé nonetheless understood many of the hydrological connections between the lakes and springs. However, the recommendation he made in the report qualitatively separated the two, bringing the springs into the modern city’s future. The modern future of the lakes (Chalco and Xochimilco), therefore, would mean desiccation. In short, such waters would have to become invisible in order for potable water’s appearance in the city.

Peñaflé’s study thus brings into confrontation distant and proximate views, the abstracted data and laboratorial process with an accounting of the diverse qualities and quantities of Xochimilco’s water. On one hand, he arranged water on a universal scientific armature of diagrams, charts, taxonomies, and formulae, providing flow rates, chemical analyses, etc. On the other, he spoke of water in sensual terms, knowable also through direct human experience. Peñaflé dedicated an entire chapter to experiencing water organoleptically, that is, through the senses. For example, he says ‘Potable waters should be: transparent and diaphanous, uncolored, without odor, fresh, and of an agreeable and light flavor, aerated, or with oxygenated air, and as far as possible without organic materials.’ After air, he continues, water is the most crucial nutrient for humans. Water of poor quality affects human development, and by extension, even national progress. Indeed, Peñaflé’s argument for tapping Xochimilco’s water rests on the assumption that water has a moral content, so there is a moral imperative to exploit that resource on behalf of the nation (writ Mexico City).

Of course, the research could never capture the full scope of the spring system or of Mexico City’s water problem. His idea of an organoleptical assessment largely ignored some of the most crucial aspects, including the people, the water users, of Xochimilco itself. Peñaflé and his contemporaries certainly acknowledged several of the negative environmental effects of previous water control measures. But even with the best science and engineering, they could not anticipate that the city’s future population growth would mean the rapid depletion of Xochimilco’s springs. As it turned out, the springs would not in fact be ‘the first and last recourse for the stability of the capital.’

This is not to suggest, however, that Mexico’s turn-of-the-century water woes were socially constructed but somehow not real or, more cynically, invoked as a justification for costly infrastructure. Observers’ accounts and the archival record — the Archivo Histórico del Distrito Federal, especially — include numerous references to insufficient supply for residents across the city, and to conflicts among municipal government, neighborhoods, factory owners, and outlying towns. While conflicts between factories and neighborhoods often were often over quantity, as the number of factories increased so too did the number of conflicts over quality. Residents of the San Ángel neighborhood, for instance, found themselves in a particularly vulnerable position vis-à-vis the many factories being built to take advantage of the motor force and drainage potentials of the Guadalupe and Magdalena Rivers, on the city’s southwestern flank. In one case, residents claimed that the industries had rendered the once ‘pure and crystalline water’ there completely ‘impotable,’ contaminating the rivers with ‘acids’ and ‘colorants;’ and making their waters useless for the city’s many ‘fields and gardens.’ They also complained that the companies were difficult to fight, cowing dissenters by threatening to close the shop doors and thereby eliminating jobs. ‘Capital,’ as one resident noted, ‘is sacred, but their [factory owners’] power should be limited by the general good [which is] even more sacred.’
Meanwhile, a factory upstream from the barrio of Tacubaya, in the same general area, had called for blending together the waters from the springs of Santa Fe with those of Los Leones. Mixing the two would provide the factory with greater volume and motor force. Yet, to the consternation of many in the neighborhood, this would sully Tacubaya’s famously clean water, which city elites had long enjoyed, even building country homes in the area to take advantage of its lushest. Businessmen countered that, ‘if Tacubaya lost the transparency of its waters, it would in turn gain in available quantity.’

Residents were quick to point out, however, that the ‘dirty’ waters of the Los Leones springs ‘lacked the condition of healthiness that the crystalline waters of Santa Fe’ recommended.

Peñaflael does bring up the problem of factory contamination in the Memoria, as well as that of over-consumption of the city’s water supply. On the east side of the city center, where the Canal de la Viga introduced waters of lakes Xochimilco and Chalco into the San Lázaro Canal, stood a large ‘gas plant.’ Peñaflael and his team took water samples at points up- and downstream of the canals’ intersection, finding extremely high downstream levels of ‘liquidos cumburudos.’ The contaminated water, which the Memoria describes as a ‘black stripe [running] between two banks of scarce vegetation,’ had created a zone of contamination stretching from San Lázaro to the site of the future Texcoco. Here was a place where ‘no living being of a superior order could survive.’

Then there was the Belén Paper Factory, also in the west. According to Peñaflael, Belén had diverted at least one half of the Santa Fe/Leones aqueduct to run its mills. Peñaflael does note that in most instances, such as that of Belén, the factories availing themselves of hydropower returned much of the water back either to the original aqueduct or arroyo from which it was drawn. Yet, these matters of contamination and loss of quantity were still quite troublesome, and the Memoria urges that the ‘interests of the city’ should take precedence over the needs of the ‘private [sector] whatever their category.” The needs of the city were quite varied and never take definition in the report, however. In the end, a conclusion that the Memoria returns to most often is that washing, bathing, the dumping of fecal matter, as well as blowing dust were chief sources of contamination. Clothes washing receives particular attention.

Given the combination of perennial shortage and poor quality, it is clear from the archival record that people throughout the city, especially after construction had begun on the Obras, were asking for Xochimilco’s aguas potables, often by name. To illustrate, in 1915 a group of residents from Colonia La Bolsa who had not yet been connected to the Obras complained that for too long they had suffered from chronic gastrointestinal disease. This was a condition they attributed to the dilapidated state of water provision in their area, and to their ongoing exploitation at the hands of private water vendors who had taken advantage of the situation. It is significant that part of their complaint draws from ideas about bacteria and disease in circulation at the time, and to their connections to the water supply. The complaint describes the colonia as a place, ‘where everything is sludge and filth and a focus of infection.’ La Bolsa’s water had ‘never been analyzed’ for the harmful ‘microbes’ that it was introducing into residents’ stomachs, making them ill. Moreover, fixing the problem fell squarely within the ‘duty of hygiene’ assigned to the city’s health council, the Consejo Superior de Salubridad. The complainant goes on to ask that, in the name of humanity,’ residents be hooked into the network and be given ‘the water of Xochimilco,’ which was in fact already being delivered into the ‘center’ of the colonia. The petition, then was that authorities should arrange to deliver it directly into their homes, just as it was in the wealthier neighborhoods.

The visuality of modern water

The next phase of making Xochimilco’s ancient waters modern was to enclose them, to remove them, and then bring them back into a carefully constructed view. Despite the ambivalence reflected in Peñaflael’s study, modern water was about visuality, the ability of something to be seen, to be made, present, as a commodity and a technologically manageable natural resource. New technologies insured both the controlled usage and viewing experience. The viewing experience was also an enactment of the history and conquest of water as a substance. The 30 km between water uses and users and water sources was the spatial and temporal distance between the modern, urban, and sophisticated capital and its pre-modern, rural, and traditional hinterland. Xochimilco and its waters are to the south, distant, and in the past. Indeed, as the engineering language made clear, the waters were there to be collected or captured and brought into the up-to-date urban area.

The relationship between visuality and modern water, especially as framed by the self-conscious national moment of the 1910 centennial, is emblematized by the Xochimilco system’s pump houses and the photographic documentation of the system’s construction, in the context of the celebratory excursion to the waterworks. The pump houses were a pivotal part of the tour, and the photographic album distributed to tour participants provided a souvenir as well as a confirmation of their participation as eyewitnesses to the achievements of Mexico. Modern water was not just a function of concrete pipes or mechanical engineering; it was also formed at a nexus of tour, pump house, and photo album. Each indexes a significant, global, and state-of-the-art technology: the train, formed and reinforced-concrete, and the half-tone photo block. Efficiencies of movement, construction, and representation brought the ancient waters of Xochimilco forward literally and symbolically into the present and future of Mexico City.

The specially outfitted trains sped the excursion from Chapultepec south to Xochimilco, where the tour began before heading north again to Mexico City. Stops were made at the first (the most distant from the capital) and third pump houses. From there, the train followed the route of the underground aqueduct and above-ground ventilation chimneys, reaching the monumental pump house in the Colonia Condesa, which bordered Chapultepec. The
These eyewitnesses confirmed the undeniable ability of Mexican engineers to solve the most difficult scientific problems, even when natural obstacles seemed insurmountable. This insurmountability included, as Peña Peral noted, the fact that Mexico had no great rivers, and therefore no monumental reservoir, the hallmark of hydraulic megaprojects such as New York City’s New Croton Dam (1896) or the Marathon Dam that brought water to Athens (1925). We might imagine that the train journey itself created moments of viewing monumentality from the array of disparate objects in the landscape of the waterworks, but the journey could not conjure a single, visible, monumental site of the gathering waters.

Water was instead collected at four reinforced and formed concrete pump houses situated adjacent to luxuriant and very visible springs, called ojos de agua (literally an eye of water), about 2–3 km apart around the southern edge of Lake Xochimilco. As time was of the essence to build the pump houses to save Mexico City and its future, the project documentation prepared by Marroquín and chief architect Alberto Pani designed pump houses and pipes in concrete which fostered the rapid construction of a durable infrastructure resistant to seismic activity. Like the multiple public and private structures built in Mexico City around the turn of the century, the pump houses also exhibited eclectic historical styles, here, neo-Renaissance and a synthesis of neo-Romanesque and neo-Baroque. Three of the pump houses were modeled on Italian Renaissance palaces with their characteristic rustication and quoining (Fig. 1); the fourth adapts the surface polychromy and elaborate molding of a Romanesque-Baroque church. (Fig. 2) If at this point in our research we cannot confirm precisely why Pani specifically chose to design the pump house exteriors after Renaissance palaces and a Baroque church, we can suggest how they contributed to a particular presentation of Xochimilco’s waters. Certainly, we should not reduce this Porfiriato eclecticism to the idea that buildings in historicized styles are merely functional objects clad in arbitrarily decorative skins.

The pump houses and aqueduct were responses to in situ hydraulic conditions and suggest a need to simultaneously present modern water as something easily visible and accessible, while also controlling both view and access, much like water in a large reservoir. Building three of the four pump houses like rectangular Renaissance palaces implies an intention to create a uniform style and presence for a public work that was scattered in parts across the landscape. The cruciform plan of the church-like pump house apparently disrupts this uniformity. In fact, the plan of both types of pump houses took their cues from the needs of water extraction engineering. The project documentation prepared by Marroquín shows that the three palace-like pump houses each enclosed a rectangular collection well, and so had a rectangular plan. (Fig. 3) The fourth pump house has a cruciform plan outlining what in a church would be a nave crossed by two short arms as well as a polygonal space at its end, similar to an apse (Fig. 4). Marroquín’s documentation tells us that this water collection well specifically

68 García, Crónica Oficial (note 1), 212–213.
69 On the Croton and Marathon systems, see: Bone, Water-Works (note 12); Galusha, Liquid Assets (note 12); Kaika, Dams as symbols of modernization (note 12).
70 On the use of concrete in the Xochimilco system, see Pani, Apuntes Autobiográficos (note 67), 49–55; and H. Ramírez de Alba, Estado Actual de las Obras del Sistema de Aprovisionamiento de Agua Para la Ciudad de México, Mexico, 2003.
72 Bonnet Correa, La Arquitectura de la Época Porfiriana (note 40), 22. Bonnet Correa also points out that regional structures often mimicked those in Mexico City and could be made from cheaper materials. This is very suggestive for understanding the relationship between the pump houses in Xochimilco and other structures in Mexico City itself. We take this up in our larger study.
required an octagonal structure. Pani designed this building to accommodate the collection well by locating it in the apse. Thus, the collection wells, and more specifically, the extraction machinery used to draw the water into view, were accommodated by specific floor plans. The so-called cladding Pani chose to frame them was completely appropriate in the logic of turn-of-the-century architectural practices. The pump houses bracketed off the landscape of water, framed it with authority through the interplay of secular and sacred geometries and historical styles.

Bringing Xochimilco’s waters into view through the pump houses is evident in other ways as well. The structures were imposing but human-scaled, two stories to the roofline, and dramatically punctured by multiple windows on all sides. From the outside the windows invited the curious to see what was inside the buildings. On the inside they created open and brightly lit contexts for the various engineering components. Of particular importance to Marroquín and his team was the visibility of the water in the collection well. A viewer could look down through the rectangular or octagonal opening in the floor to see the water below. A polished brass railing both called a viewer’s attention to the opening and protected them from falling into it. And while it is not likely that hordes of tourists made the journey to see these waterworks after the centennial tour, the pump houses were constructed and outfitted as if a viewing public was expected to see a performance there. The collaboration of the material structure of the building, of penetrating daylight, the polished surfaces of fittings, and the engineering works themselves enacted what engineers called the ‘alumbramiento del agua’ the bringing to light of water, the bringing of hidden (subterranean) water to the surface. Xochimilco’s spring waters were transformed from object to process, from placid ojos del agua to a ‘functioning of the powerful machinery that makes the water spring up in a clean and plentiful torrent.’ And at the end of the tour when participants reached the distribution tanks, and descended into one to hear the grand oratory about Marroquín’s Obras, the space was illuminated by hundreds of incandescent light bulbs. These allowed the crowd of almost 1000 people to appreciate the scale and ingenuity of the engineering, bringing the objects, users, and uses of modern water to light.

Genaro García’s dramatic declamation above about what tourists saw at the waterworks was published in a huge 1911 volume dedicated to the activities of the centennial. Like most commercially printed publications of the period, the book included text and images. The photographs were placed throughout the pages.

---

73 M. Marroquín y Rivera, Memoria Descriptiva de las Obras de Provisión de Aguas Potables para la Ciudad de México, Mexico, 1914, 58–64.
74 In our larger project we explore the bracketing off of the wells in the pump houses and the transformative associations of water. This is most poignant in the octagonal well in the apse-end of the Natititas pump house with its evident baptismal associations. Additionally, the pump houses will also be explored in relation to decorative motifs that invoke both pre-Hispanic and baroque architectural models and practices in Mexico. For example, the pump house at La Noria incorporates the slope and batter (talud/tablero) characteristic of Teotihuacan architecture. At Natititas, the polychromy and ornate stepped molding evoke the high Baroque of the Sagrario, built by Lorenzo Rodríguez adjacent to the Metropolitan Cathedral in the Plaza Mayor in the eighteenth century.
75 García, Crónica Oficial (note 1), 213.
76 Inauguración de obras para el abasto de aguas de Metrópoli, El Pue, September 22, 1910, 3.
Fig. 4. Plan of the Pump house at Nativitas, reproduced in: M. Marroquín y Rivera Memoria Descriptiva de las Obras de Provisión de Aguas Potables para la Ciudad de México, Mexico 1914. Courtesy of Stanford University Libraries.

Fig. 5. Photograph of the Interior of the Pump House at La Noria, reproduced in: M. Marroquín y Rivera Obras de Provisión de Aguas Potables para la Ciudad de México, Mexico 1910.
showing multiple views of people, places, and events, even to the point of redundancy. The technology of the half-tone photo block allowed the publication of such a work because the text and images could be printed together—a far more efficient and cost-effective process than collotype printing. Illustrations were ever more important and visible, a particularly significant advance utilized in the numerous volumes of architectural photography produced globally around the turn of the century. Half-tone photo block printing allowed more visual information to be woven throughout the text, visually spread throughout it. As Ackerman and Elwall point out, it changed the presentation of views of buildings from the single iconic image to multiple views of the same object, driving an expanded economy of architectural photography. This is nowhere more clear than in Manuel Marroquín’s 1914 official publication on the development, design, and building of the Xochimilco system. Over one hundred photos of different sizes were spread throughout the 600 pages of text, plans, and tables.

We know that Marroquín had been preparing this study for several years, since he had already published a very condensed version of it in 1910. This was the book given to the centennial tour participants described in Genaro García’s chronicle of the centennial. It is oriented horizontally, just shy of 9 × 11 inches with 27 pages of photographs, 2 fold-out maps and 26 pages of text. The text briefly describes various aspects of the history, participants in, and engineering of the project. Marroquín will occasionally refer the reader to the accompanying vistas or grabados to demonstrate what he is talking about, but the text and images effectively appear as discrete sections that can stand on their own. Double rules frame the photographs; this is true even when two or three small photos appear on one page. The rules tidy them into a visually uniform format. This presentation of the

waterworks simulates the personal souvenir travel album with its traditional tipped in photographs. It makes use of modern technology to create an historical artifact in much the same way that modern reinforced, formed concrete was used to construct pump houses in historical styles.

The photos, taken between 1907 and 1910 when the system was still under construction, were organized in a sequence that represents the network from spring to distribution lines in the city. The book’s organization parallels the geographic itinerary of the tour itself, and rehearse the argument for controlling Xochimilco’s waters. The photographs narrate a natural and political history that orders the picture of water from most to least visible and from pre-modern to modern. The first photo shows a lone boater paddling across the rippling surface of a spring, the picture of natural abundance as yet untouched by the technology of modern water. [Fig. 7] It is structured through the conventions of pictorialist photography of the nineteenth century, emphasizing a horizontal landscape scene, with subject matter underpinning the trope of Xochimilco as picturesque and fertile. This represents the ‘water that nature has put within our reach,’ there and available to view ‘since time immemorial.’ The last photo in the album shows the installation of the final section of pipe downtown in Mexico City, where the container now substitutes for the thing it carries.

The pump houses were framed to capture the greatest possible expanse of the buildings, from a distance and at oblique angles, so that they appear much larger and more imposing than they did in person. This was the typical format found in nineteenth-century albums destined to be enjoyed by tourists after the fact, to make continually present their travels to distant lands and great monuments. Photos of two of the pump houses include well-dressed men, women and children posed around the entrances. [Figs. 8 and 9]

77 García, Crónica Oficial (note 1), 213.
78 Elwall, Building with Light (note 41).
79 See Ackerman, Origins (note 41); and Elwall, Building with Light (note 41).
80 Marroquín y Rivera, Memoria Descriptiva (note 73).
81 García, Crónica Oficial (note 1), 213. As Reese and Reese, Revolutionary urban legacies (note 40), note Garcia pointed out in his introduction that because of budget constraints he could not publish all of the photographs originally taken of Centennial events.
Fig. 7. Photograph of the Springs at Nativitas, reproduced in: M. Marroquín y Rivera Obras de Provisión de Aguas Potables para la Ciudad de México, Mexico 1910.

Fig. 8. Photograph of the Pump House at Nativitas with visitors, reproduced in: M. Marroquín y Rivera Obras de Provisión de Aguas Potables para la Ciudad de México, Mexico 1910.
**Fig. 9.** Photograph of the Pump House at La Noria with visitors, reproduced in: M. Marroquín y Rivera Obras de Provisión de Aguas Potables para la Ciudad de México, Mexico 1910.

**Fig. 10.** Photograph of Ventilation Chimney on the main aqueduct route between Santa Cruz and the Condesa with visitor, reproduced in: M. Marroquín y Rivera Obras de Provisión de Aguas Potables para la Ciudad de México, Mexico 1910.
They are shown as if they have just left or are just entering the buildings, and embody the importance of witnessing the capture of water within, just as the tour participants did along their journey. This album availed itself of traditional conventions of tourist albums, turning views of modern waterworks into views of monumental wonders. A sturdy fellow jauntily sporting a boater, for example, stands next to one of the colossal ventilation chimneys that marked the route of the aqueduct. [Fig. 10] Another similarly attired fellow is posed inside one of the four distribution tanks in Chapultepec, leaning leisurely against a supporting column, framed by the dramatic contrast between light and dark. [Fig. 11] He is dwarfed by the concentric circles of the columns in such a way that the view takes on the archaeological allure of ancient temples and mosques. A reporter who accompanied the participants into the tank during the centennial tour said it was as if one found oneself entering ‘subterranean mysteries,’ a view that this photo enhances. The tourists become discoverers. Moreover, the image is the opposite and yet the same as the image of the lone boater on the spring that opens Marroquín’s album; together they bookend the technological and representational process of bringing Xochimilco’s waters to light in distant Mexico City. Once water could no longer be seen always and everywhere it required the photograph to make a permanent record of what it was and what it became. Indeed, the representation of water proved to be just as ‘durable, useful, and beautiful’ as any public work.

Conclusion

Standing in the empty storage tank that September day in 1910, with its interior illuminated by electric light bulbs, were the elite witnesses to and users of Xochimilco’s waters. This moment was the result of a process formally initiated in Peñafiel’s 1884 study, and represented and rendered material in Marroquín’s Obras. Modern water in Mexico City was now officially written, constructed, and pictured. The crowd had arrived at that moment through a process of historicizing space and spatializing history. Mexico City’s colonial water structure and its hydraulic geography had first to be made visible as the problem so that Xochimilco could in turn be developed as the solution. Once that solution was in place (the potable network), the problems associated with the pre-modern hydraulic landscape could be forgotten, just as water both disappeared from the urban landscape and became ubiquitous as a ‘natural’ resource in the growing city. Peñafiel’s study and the Obras made clear that nature had put those waters there for society’s use. Nature would thus stand in for society such that only certain places in the valley, certain people, would have access to the new potable water, while others would increasingly go without. The Xochimilco springs were, however, evanescent, nearly disappearing in just over two decades after the Obras’ 1910 inauguration. The hybrid of modern water was but a momentary apparition, at best a temporary stabilization of the diverse objects, people, places, and things making up the Obras network.

Though successful in many respects, large-scale projects like the Obras de Aguas Potables tended to move the city’s water problems around in space and project them into the future. For a growing number of outlying communities that were either supplying water to the capital or absorbing their runoff and waste, then, hydraulic modernity often brought the destruction of life-ways and livelihoods. Xochimilco was but the first to fall. What today remains of the Obras network is a scattering of artifacts in the urban landscape,
as well as archives of photographs and texts. Perhaps most enduring is the periodic re-enactment of modern water, following the script that seems taken straight from the early twentieth century. From the time of the Xochimilco project, efforts to bring fresh water into and drain wastewater out of Mexico City have created a great network of pipes and infrastructure, and their visual record. From that time onward, the capital grew increasingly dependent on water resources brought in through inter-basin transfer schemes covering ever-greater distances. Today's water and drainage system is thus a direct expression of the groundwork laid during the Obras period. Water-control infrastructure has involved a process of grafting new objects onto old, forming a stratigraphy of approaches. And so it has continued to be for a number of outlying communities either supplying water to the capital or absorbing its runoff and waste, as modern water in one area has often meant destruction for another.