

THE UNIVERSITY OF CHICAGO

“Looking to the Clouds: Rainwater Harvesting and Water Politics in Mexico City”

By

John Mensik

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Faculty Adviser: **Brodwyn Fischer**

Thesis Abstract

This thesis is about rainwater harvesting in peripheral Mexico City, Mexico. Since 2009, non-profit organization Isla Urbana has gained attention for its work producing and installing household systems that capture rainwater for domestic purposes. Through programs sponsored by local government and private donors, Isla Urbana distributes their systems in areas of the city that face marginal access to water. I ask whether the practice of rainwater harvesting interrupts the socio-political nexus that has traditionally governed water service and infrastructure in Mexico City, where residents view water provision as an obligation that the state must fulfill. In other words, if residents acquire some portion of their water independently of the state, will they still maintain the same expectations of government officials to provide water service?

My research revealed different answers to this question depending on a variety of factors, but most notably whether a user possessed some degree of legal land tenure for their home. In “formal” communities with legal land tenure, chronically deficient piped water service has helped brew distrust of local government. Municipal officials have partnered with Isla Urbana to provide rainwater harvesting systems to needy families. Residents appreciate the support, but the systems do not entirely resolve their distrust of government nor reshape their expectations of it. In “informal” communities, which lack legal land tenure and piped service, residents have embraced rainwater harvesting systems acquired through private programs as a primary source of water. This discovery has reduced their sense of need to make demands of government, and introduced the possibility that water does not have to be a state service.

This thesis is based on seven weeks of field research in Mexico City in which I conducted 18 interviews with residents, municipal officials, and Isla Urbana staff. My fieldwork was made possible by funding from the Tinker Foundation.

Table of Contents

Introduction	
	2
Chapter 1: Water in an Evolving Urban Landscape	
	20
Chapter 2: Trust and Civilian Participation in Rainwater Harvesting Programs	
	54
Chapter 3: Harvesting Autonomy in Informal Settlements	
	87
Conclusion: Every Last Drop	
	111
Works Cited	
	120

Introduction

I. Installation

Jorge looks pleased. It is nearly 10am and rays of sunshine are just starting to peek over the second story rooftop of his lime-green stucco home, while an early morning chill begins to burn off. Jorge stands next to a table he set up in his driveway with coffee and snacks for the quartet of Isla Urbana workers who have come to install his new rainwater harvesting system. He gazes up at the roof, where one worker fastidiously anchors a long PVC drainpipe into place. On the ground, another worker assembles an intricate network of shorter pipes, couplings, and elbows that will guide rainwater from the roof through Jorge's entrance gate and back to his family's courtyard, where their cistern is located. Next to the cistern's manhole, a third Isla Urbana worker mixes cement with a trowel and then lathers it between concrete blocks that he stacks into two knee-high columns. A fourth worker arrives through the narrow entrance-gate carrying a large blue plastic tank, known as a *tlaloque*, and mounts it on the two cement columns.

The *tlaloque* is the first in a series of filters that make up Isla Urbana's rainwater harvesting system. When rain begins to fall on Jorge's home, the piping will carry dirt and debris-laden water from the roof into the *tlaloque*. After about ten or fifteen minutes of rain, it will fill completely with 200 liters of this dirty water. By that time, most of the rubbish on the roof will have been washed away, and the cleaner rainwater will not be able to enter the full *tlaloque*. Instead, the rainwater will continue through the piping and into Jorge's cistern, where he stockpiles a supply of water. Inside the cistern, a floating dispenser with chlorine pills will disinfect the water. Alongside the dispenser floats a basket-shaped filter connected to a hose that



One of Isla Urbana's tlaloques (left). An Isla Urbana team member installs a rainwater harvesting system (right). Photos by the author, 2018.

runs back out of the cistern to an electric pump. When turned on, the pump will remove water from the cistern, and pass it through two more filters—one to remove microscopic sediments and another carbon filter to purify color and taste. Once through the filters, the water will continue through another series of pipes that return it to Jorge's roof, where it will be stored in a large tank, known as a *tinaco*. The water is unlikely to be potable, but when Jorge wants to do laundry, wash dishes, or bathe, the liquid that fell from the sky will trickle down from the *tinaco*, ready for his immediate usage.

By 12:30, the workers have completed the installation and begin to collect their things in Jorge's driveway. The sun scorches directly overhead and Jorge offers them each a cold glass of Coca-Cola. Then, a young woman carrying a clipboard approaches the house and asks to see the

tlaloque. She is wearing a red hat and brown vest, each emblazoned with a logo indicating that she works for the municipal government of Tlalpan, one of Mexico City's sixteen borough-like *delegaciones* in which Jorge lives. *Delegaciones* share responsibility for water administration with the city government, and most residents turn to local officials from their *delegación* to voice complaints or make demands pertaining to neighborhood matters or domestic services. The woman at Jorge's door explains that she has come on behalf of Tlalpan's rainwater harvesting program to ensure that the installation has been successful. Jorge leads her into the courtyard where she copies down a number etched into the *tlaloque*. Before the woman leaves, she places a sticker on Jorge's front door indicating that he is a beneficiary of the rainwater harvesting program. Meanwhile, the Isla Urbana workers pack up their truck, give Jorge last-minute advice about the system, and then move on to their next installation several blocks away.

II. “*There wasn’t anything but trees*”

It may seem strange that Jorge, a resident of the largest metropolis in North America, decided to harvest rainwater and that his municipal government has encouraged this practice. For most modern city-dwellers, myself included, water arrives from mysterious origins with the turn of a lever, just as electricity arrives with the flip of a switch. Furthermore, urban residents usually expect a municipal authority to administrate water service, rather than accept any personal responsibility themselves beyond payment for the service. Jorge's life history can help illustrate what led him, his *delegación*, and his city to this peculiar moment.

Jorge lives in a neighborhood, or *colonia*, of Tlalpan known as Bosques del Pedregal, which is located in the extreme southwest corner of Mexico City. The neighborhood sits on a mountainside at nearly 2700 meters (about 8,858 feet) of elevation.¹ Jorge's street is well paved,

¹ “Google Maps,” Google, accessed November 10, 2018, <https://www.google.com/maps/@19.2715354,-99.2427599,15.57z/data=!5m1!1e4>.

² Keith Pezzoli, *Human Settlements and Planning for Ecological Sustainability* (Cambridge, MA: Massachusetts



Bosques del Pedregal and the Ajusco Range. Photo by the author, 2018.

but incredibly steep. Walking downhill, he can survey the vast urban expanse of the Valley of Mexico until it disappears into the haze of the capital's infamous smog. Walking uphill, he can see where the city ends and the high alpine forests of the Ajusco Range begin. The Picacho-

Ajusco Highway forms the boundary between Bosques del Pedregal and the sylvan expanse beyond it, a rather ominous seam between nature and the encroaching city.²

When Jorge moved to Bosques del Pedregal as a young boy with his family in the mid-1970s, the area was an undeveloped parcel of a landholding known as San Nicolás Totolapán. San Nicolás was an *ejido*, the term for rural communal lands that had been the central institution of agrarian reforms following the Mexican Revolution of the 1910s.³ Jorge's description of the land's appearance at the time explains the origins of Bosques del Pedregal's name ("Stony Forest"). "It was a hill," Jorge told me, "there wasn't anything but trees and more trees. And the land was, well, very rocky."⁴ Over 2,000 years ago, the nearby Xitle volcano erupted and left behind ashen slabs of basaltic rock that are still abundant throughout the *colonia* today.⁵ The craggy terrain prevented *ejidos* in the area from achieving agricultural productivity, and by the late-20th century *ejidatarios* (*ejido* landholders) began to urbanize some of their parcels through quasi-legal land sales.⁶ The Mexican government started to formally incorporate some of the newly urbanized areas beginning in the early 1970s by granting them legal land tenure, but the expanding metropolis continued to exert pressure on the *ejido* lands near its periphery.⁷

Bosques del Pedregal was founded in 1976, when settlers from an adjacent *colonia* that had been regularized by the government began to spill over its boundary.⁸ Prior to their arrival, Jorge and his family had been living in Coyoacán, a *delegación* in the south-central part of Mexico City, where they rented a home. Bosques del Pedregal offered them the opportunity to

² Keith Pezzoli, *Human Settlements and Planning for Ecological Sustainability* (Cambridge, MA: Massachusetts Institute of Technology, 1998), 17–18.

³ Pezzoli, 213.

⁴ Jorge, interviewed by the author, Tlalpan, CDMX, Mexico, July 28, 2018.

⁵ Pezzoli, *Human Settlements*, 117.

⁶ *Ibid.* 217–19.

⁷ *Ibid.* 213–23.

⁸ *Ibid.* 247–48.

escape paying rent by invading the land on which they now reside. The family built a small makeshift hut, and Jorge described cold nights sleeping on a mattress made out of leaves that he shared with his brothers. Every day began with Jorge and his brothers removing the leaves from the mattress to dry in the sun, and every evening they reinserted the leaves into the mattress before they went to sleep.⁹

The new life that Jorge's family faced was legally and physically precarious. On multiple occasions during the late 1970s, *ejidatarios* sent policemen to expel squatters from Bosques del Pedregal. Jorge remembers three times when policemen came and knocked down his family's hut, forcing them to flee temporarily. Yet, each time they returned to their plot and started anew.¹⁰ The *colonia* had consolidated by the early 1980s, but continued to face the threat of eviction.¹¹ In 1980, Mexico City's government re-designated a vast portion of the Federal District (the former name for the capital territory) as an area for ecological conservation where human settlement would be restricted.¹² Bosques del Pedregal fell within the conservation zone, and the government claimed that the *colonia* threatened the environment and had to be removed.¹³

Water posed a unique set of challenges for Jorge's family during these early years. Initially, they had to walk uphill one kilometer and a half to a mountain spring, where they filled up 19-liter buckets and carried them back home, two per person, using yokes.¹⁴ Meanwhile, community organizations established political leadership in Bosques del Pedregal during the late

⁹ Jorge, interviewed by the author, July 28, 2018.

¹⁰ Ibid

¹¹ Pezzoli, *Human Settlements*, 249–60.

¹² Priscilla Connolly and Jill Wigle, “(Re)Constructing Informality and ‘Doing Regularization’ in the Conservation Zone of Mexico City,” *Planning Theory & Practice* 18, no. 2 (April 3, 2017): 188, <https://doi.org/10.1080/14649357.2017.1279678>; Pezzoli, *Human Settlements*, 170.

¹³ Pezzoli, *Human Settlements*, 266.

¹⁴ Jorge, interviewed by the author, July 28, 2018.

1970s, and undertook tasks to develop the *colonia*.¹⁵ Jorge recalls local leaders recruiting him and his brothers to help them pave and level streets. Once streets were paved, water delivery trucks, known as *pipas*, began to supply the neighborhood. Each family would leave a 200-liter drum at a filling stop along a main thoroughfare several blocks uphill. The drums were connected to each house via a long hose, which would begin to send water down once the *pipa* had made its delivery.¹⁶

During a very active period of community organizing in the early 1980s, political leaders pressed the government to regularize Bosques del Pedregal and supply it with drinking water.¹⁷ Jorge described participating in rallies outside of the Tlalpan *delegación* office to demand water service, which often grew heated. Police clashed with protestors at least once.¹⁸ The government acquiesced to public pressure in the mid-1980s, agreeing to include Bosques del Pedregal in the urban zone instead of the conservation zone, and provide regularized land tenure to its inhabitants.¹⁹ Piped water eventually followed, and the federal government invested heavily in water infrastructure projects around Bosques del Pedregal in the early 1990s as part of a welfare program designed to win political support from poor communities throughout the city.²⁰ Once land tenure and services had been delivered, political mobilization in Bosques del Pedregal declined.²¹

Jorge has piped water in his home today, but he described the service as dysfunctional. Authorities distribute water through a rationing system known as *tandeo*, where service

¹⁵ Pezzoli, *Human Settlements*, 249–60.

¹⁶ Jorge, interviewed by the author, July 28, 2018; Pezzoli, *Human Settlements*, 200.

¹⁷ Pezzoli, *Human Settlements*, 255–56.

¹⁸ Jorge, interviewed by the author, July 28, 2018.

¹⁹ Pezzoli, *Human Settlements*, 246, 292.

²⁰ Jorge, interviewed by the author, July 28, 2018; Pezzoli, *Human Settlements*, 186; Ann Varley, “Delivering the Goods: Solidarity, Land Regularisation and Urban Services,” in *Dismantling the Mexican State?*, ed. Rob Aitken, Nikki Craske, and Gareth Jones (New York: St. Martin’s Press, Inc., 1996), 204–24.

²¹ Pezzoli, *Human Settlements*, 259.

alternates between different parts of his *colonia* every day. This system can be very erratic, and sometimes Jorge only receives water once a week. Frequent leaks in the pipework can cause longer cutoffs. Quality can be deficient as well—Jorge’s water occasionally arrives brown and dirty. When Jorge’s water service is interrupted, the *delegación* permits him to purchase one *pipa* truck delivery of water per month for a reduced cost of 125 or 150 *pesos*. However, if he and his family use up all of their delivery before the end of the month, they will have to purchase an additional *pipa* at the full cost of 1000 *pesos*. Jorge must constantly maintain a pragmatic vigilance over his water supply to ensure that it will not run dry. When water is running, he fills up his cistern as much as possible and then uses it conservatively.²² “That’s why you have to restrain yourself when there is water,” he explained. “Because guess what? It’s going to run out on you. I mean, take care of it.”²³

The trials and tribulations that Jorge has endured in order to attain water service over the course of his lifetime are relatively commonplace in Mexico City, and allude to themes that will be revisited repeatedly throughout this thesis. In a city that owes roughly half its sprawling development to informal settlements,²⁴ water has served as a key component in a political relationship between poor *defeños* (a term for residents of Mexico City) and the state. Over the past century, federal, city, and *delegación*-level governments have attempted to capitalize on the need for water in self-built communities in order to win support or quell unrest. Residents, on the other hand, have used service delivery as a central criterion to evaluate their government. If their needs are being met, *defeños* might overlook the government’s political intentions or cease making demands of officials. Incessant service interruptions, like those that Jorge currently

²² Jorge, interviewed by the author, July 28, 2018.

²³ Jorge, interviewed by the author, July 28, 2018.

²⁴ Priscilla Connolly, *The Case of Mexico City, Mexico. Case study report prepared for Understanding Slums: Case Studies for the Global Report on Human Settlements, 2003*, 13, accessed January 26, 2019, https://www.ucl.ac.uk/dpu-projects/Global_Report/cities/mexico.htm.

experiences, can pose an enormous risk to popular support for local, city, and even federal government. Yet politics alone do not explain why the Tlalpan *delegación* installed a rainwater harvesting system in Jorge's home instead of improving his piped water service. The city's water supply faces an existential threat, and rainfall may soon become its most reliable source of water.

III. A city running dry

In the late 2000s, Enrique Lomnitz and Renata Fenton were industrial design students at the Rhode Island School of Design (RISD). Both had personal connections to Mexico City, and decided to pursue a project to propose sustainable housing for the capital's low-income neighborhoods to earn their degree.²⁵ This project required that they complete a demographic study, so they travelled to the southern edge of Mexico City to interview residents about issues related to housing.²⁶ "And in the course of all of those interviews," Enrique told me, "we started noticing that people kept on bringing up the water situation as a problem that they had."²⁷ Their interest piqued, Enrique and Renata began to ask more and more residents about water. "We started becoming aware of the scale of the water scarcity issue in these peripheral areas," Enrique said. "And we also started learning more about Mexico City's water situation in general."²⁸

The leaky and inefficient water infrastructure that city residents like Jorge deal with on a daily basis is just one part of Mexico City's water crisis. The city is running out of water. The vast majority of its supply comes from a subterranean aquifer deep beneath its busy streets and crowded plazas.²⁹ With over 20 million residents in the Mexico City metropolitan area, the

²⁵ "Essence of Life in Mexico," *RISD XYZ*, May 29, 2018, 32-33, accessed November 10, 2018, https://issuu.com/risd/docs/risdxyz_springsummer2018_web/32.

²⁶ Enrique Lomnitz (General Director, Isla Urbana), interviewed by the author, Coyoacán, CDMX, Mexico, August 14, 2018.

²⁷ Ibid.

²⁸ Ibid.

²⁹ Connolly, *The Case of Mexico City*, 4.

aquifer is under tremendous duress from too much extraction.³⁰ In fact, its diminished water level has caused parts of the city to slowly sink into the lakebed. Take a stroll through Mexico City's *Centro Histórico*, and you surely will not miss the sight of colonial buildings tilting over at alarming angles, or once-level streets cracked and uprooted.³¹ The Lerma and Cutzamala aqueducts supplement the city's supply by pumping water from the nearby state of Michoacán. However, these aqueducts are frequently criticized for their inefficiency, cost, and the damage they inflict on rural communities. The Cutzamala system, for example, pumps water almost 100 miles and uphill nearly 3,000 feet to reach the city. By October 2018, the Cutzamala system was so badly in need of repairs that the government was forced to shut off the water supply for about half the city's residents for three to five days.³²

While Mexico City's poor bear the greatest burden of the water crisis, people of all social classes are affected in some way. This is perhaps most visible in the near-universal distrust of the city's tap water quality.³³ One middle-class resident of the center city with whom I spoke is brave enough to drink the water from her sink, after passing it through two filters. However, following two months of usage, one of these filters turns completely black, despite the product suggesting a filter replacement every six months and an overall durability of three years.³⁴ Most *defeños* view bottled water as the safer choice. As a result, Mexico has become the largest bottled water market in the world, with a rate of consumption more than twice that of the United

³⁰ Ibid, 3-4.

³¹ Michael Kimmelman, "Mexico City, Parched and Sinking, Faces a Water Crisis," *The New York Times*, February 17, 2017, <https://www.nytimes.com/interactive/2017/02/17/world/americas/mexico-city-sinking.html>.

³² David Barkin, "Mexico City's Water Crisis," *NACLA Report on the Americas* 38, no. 1 (August 2004): 24–28, <http://dx.doi.org/10.1080/10714839.2004.11722401>; Priscilla Connolly, "Mexico City: Our Common Future?" *Environment and Urbanization* 11, no. 1 (1999): 61–64; Carrie Kahn, "Mexico City Goes Days Without Water During Maintenance Shutdown," *National Public Radio (US)*, October 31, 2018, <https://www.npr.org/2018/10/31/662786981/mexico-city-goes-days-without-water-during-maintenance-shutdown>.

³³ Joshua Cullen Greene, "The Bottled Water Industry in Mexico" (Master's thesis, The University of Texas at Austin, 2014), 72, <https://repositories.lib.utexas.edu/handle/2152/26456>.

³⁴ Patricia, interviewed by the author, Benito Juárez, CDMX, Mexico, August 23, 2018.

States.³⁵ The three largest shareholders in Mexico's lucrative bottled water industry include multinationals Groupe Danone, The Coca-Cola Company, and PepsiCo.³⁶ Residents typically purchase bottled water in 19- or 20-liter jugs known as *garrafones*. While affluent *defeños* can likely afford to pay premium prices at the supermarket for a *garrafón* bottled by one of the corporations, poor residents may opt for *garrafones* that have been purified by local entrepreneurs at a reduced cost.³⁷ Buying bottled water can be inconvenient for almost anyone, but as one resident of the periphery told me, drinking tap water can leave you with “a jungle of insects” in your stomach.³⁸

In theory, Mexico City receives enough rain to replenish its parched aquifer.³⁹ Every June, east winds from the Gulf of Mexico blow into the valley carrying moisture and resulting in a rainy season that lasts until October, when drier air returns.⁴⁰ During the wet months, the city receives rainfall on a near-daily basis. Every summer morning, *defeños* are usually greeted by blue sky and sunshine, but by late afternoon or early evening, clouds roll in, followed by powerful thunderstorms. Mexico City sees about 848 millimeters of rain per year, an amount that exceeds London and rivals Seattle.⁴¹ However, because the aquifer is mostly covered by paved surfaces rather than green space, rainfall cannot seep into the ground and recharge it. Instead,

³⁵ Greene, “The Bottled Water Industry in Mexico,” 21.

³⁶ Ibid, 78.

³⁷ Ibid, 79, 128.; Yesenia, interviewed by the author, Tlalpan, CDMX, Mexico, August 22, 2018.

³⁸ Ofelia, interviewed by the author, Xochimilco, CDMX, Mexico, August 6, 2018.

³⁹ Patricia Romero Lankao, “Water in Mexico City: What Will Climate Change Bring to Its History of Water-Related Hazards and Vulnerabilities?,” *Environment and Urbanization* 22, no. 1 (April 2010): 159–61, <https://doi.org/10.1177/0956247809362636>.

⁴⁰ Jacqueline Lafrauga, et. al., “Balance hídrico del valle de México,” in *Anuario IMTA 2003* (Mexico City: IMTA, 2003), 42, accessed November 10, 2018,

<https://web.archive.org/web/20081216230728/http://www.imta.gob.mx/instituto/historial-proyectos/th/2003/HDR1-Balance.pdf>.

⁴¹ “Mexico – Climate Normals (1961-1990) – Mexico (Central) D.F.” WMO Country Profile Database, World Meteorological Organization [WMO], accessed November 10, 2018, <https://www.wmo.int/cpdb/mexico>; “United States of America – Climate Normals (1961-1990) – Seattle/S. – Tacoma, WA.” WMO Country Profile Database, World Meteorological Organization [WMO], accessed November 10, 2018, <https://www.wmo.int/cpdb/united->



A pipa truck. Photo by the author, 2018.

most of the daily deluge is shuttled out of the city through its drainage system in order to prevent flooding.⁴²

Mexico City's rainfall took a central place in Enrique and Renata's thinking. By the time they graduated from RISD, they had completed a series of proposals on how and why Mexico City could and should begin to implement rainwater harvesting as a part of its urban water infrastructure. Renata proposed building a prototype, which they erected in the home of a family that they had interviewed in their study. Their test runs were successful, which encouraged them

[states-of-america](#); "Heathrow climate – averages table" Met Office (UK), accessed November 10, 2018, <https://www.metoffice.gov.uk/public/weather/climate/gcpsvg3nc>.

⁴² Connolly, *The Case of Mexico City, Mexico*, 4; Connolly, "Mexico City: Our Common Future?" 63.

to expand the project further. In 2009, they founded Isla Urbana, an organization dedicated to expanding the use of rainwater harvesting systems in households throughout Mexico City.⁴³

IV. Autonomy in a megacity

Isla Urbana's mission is to provide improved water access for underserved residents without placing additional stress on the aquifer, and thereby combat the twin prongs of Mexico City's water crisis—poor infrastructure and diminishing supply. Their work targets specific areas of the city that suffer from poor water access and attempts to provide at least some liberation from dependence on erratic and unreliable service.⁴⁴ By doing so, Enrique acknowledged, rainwater harvesting systems can be tools for “autonomy.”⁴⁵ The ostensible relationship between rainwater harvesting at the household level and autonomy will be a central theme in this thesis. First, however, it is important to clarify exactly what kind of “autonomy” Isla Urbana's systems might offer their users.

As Enrique noted in our conversation, autonomy can have a wide range of meanings—self-governance, local control, etc.—and is a particularly relevant topic in Mexico.⁴⁶ Yet, in the context of Isla Urbana's work, autonomy may simply mean whole or partial emancipation from the infrastructures—pipes, grids, pressure—and services—*pipa* trucks—that the state has used to provide water to city residents since the 19th century, exactly as Enrique mentioned above. This would imply a degree of independence from the political arrangements that have traditionally guided water infrastructure into place. For most of the past century or so, residents of Mexico City have expected water as a service that the state is obligated to provide. The kind of community mobilization that took place in Bosques del Pedregal was a prevalent form of popular

⁴³ Enrique Lomnitz, interviewed by the author, August 14, 2018; “Essence of Life in Mexico,” *RISD XYZ*; “Isla Urbana,” Isla Urbana, accessed November 30, 2018, <http://islaurbana.org/english/isla-urbana/>.

⁴⁴ Enrique Lomnitz, interviewed by the author, August 14, 2018.

⁴⁵ Ibid.

⁴⁶ Ibid.

engagement with the state to demand this service during the 1980s. But for much of the 20th century, Mexico City's poor attained water service through clientelist links with government officials, while technocratic logics have strongly influenced water provision over the past few decades. Poor *defeños* still depend on the state for a variety of other services—electricity, security, public transportation—over which rainwater harvesting obviously has no impact. But residents' need for water service and their belief that the state must provide it has played a crucial role in shaping their political relationship with government officials.

Despite the possibility for rainwater harvesting to serve as an “autonomous” water source, Enrique explained that Isla Urbana’s purpose is not to reject or supplant Mexico City’s existing water governance or infrastructure. Instead, the organization aims to create an “alternative infrastructure” around rainwater harvesting that will relieve pressure on existing pipework by providing users with an alternate supply of water.⁴⁷

Isla Urbana works closely with *delegación* governments to accomplish this goal. In fact, the *delegaciones* have been the organization’s largest clients for many years.⁴⁸ In 2010, only one year after its founding, Isla Urbana began its first large-scale project in collaboration with the *delegación* of Tlalpan.⁴⁹ “I guess they heard about what we were doing somewhere, and [Tlalpan is] very aware of their delegation’s water problems,” Enrique said. “And I guess they thought it was a good idea.”⁵⁰ Today, Isla Urbana focuses much of its work on major rainwater harvesting programs run by the municipal governments of Tlalpan and Xochimilco, another *delegación* in southern Mexico City. These programs provide rainwater harvesting systems to qualified residents free of charge or at a low cost. Isla Urbana serves as a contractor in these projects, and

⁴⁷ Ibid; Enrique explained Isla Urbana’s goal of creating “alternative infrastructure” in a conversation with the author on July 16, 2018.

⁴⁸ Enrique Lomnitz, interviewed by the author, August 14, 2018.

⁴⁹ “Our Evolution,” Isla Urbana, accessed November 30, 2018, <http://islaurbana.org/english/history/>.

⁵⁰ Enrique Lomnitz, interviewed by the author, August 14, 2018.

responsibility largely falls on the *delegaciones* to decide how many systems to install, and where to install them.⁵¹

Enrique also clarified that full “autonomy” is difficult due to the challenge of relying entirely on rainwater harvesting year-round. Rainfall only occurs for half a year, and intrepid rainwater harvesters would have to have enough storage capacity to maintain a water supply that would last their household through six months of drought.⁵² “You need a really big tank,” Enrique said bluntly, which may not always be viable.⁵³ A household may lack adequate space or funds to acquire this kind of storage capacity.⁵⁴ Full “autonomy” is not impossible, as later chapters in this thesis will show. But in general, rainwater harvesters will have to look to other sources to meet their needs.⁵⁵

The practical constraints of Mexico City’s seasonal rainfall, as well as the active role of the local government in supplying *defeños* with Isla Urbana’s systems, complicate the notion that rainwater harvesting would completely free its practitioners from dependence on the state for water. Nonetheless, at least some relief from the burden of leaky pipes or unpredictable *pipa* deliveries can be expected, assuming that the systems function well. Six or seven months of autonomy is a reasonable goal, Enrique claimed.⁵⁶ It is certainly worth asking how residents’ longstanding expectation of the government to provide water service is impacted when, or if, technology like rainwater harvesting allows them to meet their needs independently of the state.

⁵¹ Ibid.

⁵² Ibid.

⁵³ Ibid.

⁵⁴ Ibid; Elena and Antonio, interviewed by the author, Xochimilco, CDMX, Mexico, August 24, 2018.

⁵⁵ Enrique Lomnitz, interviewed by the author, August 14, 2018.

⁵⁶ Ibid.

VI. *New expectations?*

This thesis will explore whether the use of household rainwater harvesting systems affects the set of state-society relations presented above that have directed water service in Mexico City for much of its modern era. In other words, do city residents' expectations and perceptions of government change as a result of harvesting rain or participating in government rainwater harvesting programs? Each chapter will break this question down into a series of sub-questions, which I have outlined below.

Chapter 1 will explain how water service came to be an expectation of government in 20th century Mexico City, and how the nature of its provision has changed into the 21st century. I show how the city grew through the development of informal settlements, and water provision played a critical role in the “legal” integration of these areas. The state provided piped water infrastructure according to its political whims, and used urban services as a means to exert social control or quell social unrest. Residents would often tolerate these manipulative practices as long as their needs were met, but the state’s perceived failure to fulfill their obligation to provide services could provoke anger and distrust. Over time the city government became more democratic and decentralized. The *delegaciones* have taken on greater responsibility for water provision and help the city administrate it in a technocratic fashion. The expansion of informal settlements are now seen as a threat to the environment, and attempts to control their spread have increasingly made legal land tenure a requirement to receive water services. Enforcement of these policies, however, is hindered by legal ambiguity and the persistence of political opportunism to resolve it.

I then shift focus to rainwater harvesting in present day Mexico City in chapters 2 and 3. These chapters ask what attracted residents to rainwater harvesting, to what extent Isla Urbana’s

systems are adept at meeting residents' needs for water, and what the socio-political consequences of the systems' successes or failures have been. I found different answers depending on the legal status of a community's land tenure. This factor largely determined whether residents obtained a system through a government program or independently, as well as the quality of water service they had been receiving beforehand. Thus, each chapter investigates whether rainwater harvesting has changed expectations of government in communities with particular degrees of "formality" or "informality."

Chapter 2 explores rainwater harvesting programs in Tlalpan and Xochimilco. The *delegaciones* administer these programs exclusively in areas with regularized land tenure in partnership with Isla Urbana. The provision of rainwater harvesting systems follows largely technical criteria and appears devoid of clientelist logic. Still, *delegación* officials see the programs as a way to alleviate residents' distrust of government. In part, this distrust stems from residents' dissatisfaction with the *delegaciones*' responses to water issues, which they consider languid and uncaring. Luckily for the *delegaciones*, residents are mostly pleased to see that rainwater harvesting yields visible benefits, and their misgivings have been somewhat assuaged by the programs' success. Yet, the systems can only partially meet residents' water needs for half the year, and residents view them as a limited solution to their struggles with water. Residents accept the rainwater harvesting programs, but remain skeptical that the government is willing and able to fulfill their obligation to meet public needs.

In chapter 3, I argue that rainwater harvesting systems have a far more pronounced effect in informal communities without legal land tenure. These areas are cut off from piped water service provided by the state, as well as the *delegaciones*' rainwater harvesting programs, by virtue of lacking legal land tenure. Isla Urbana installs systems in irregular settlements

independently of the *delegaciones* through projects that are privately funded. For most residents with whom I spoke, these systems have become their primary source of water, and have afforded them a sense of security that they previously lacked. Yet, their satisfaction with rainwater harvesting has curbed their desire to make demands of the government for improved water service, as they do not urgently need the state to ensure their access to water. The long-term effects of these observations on the relationship between residents and government are yet to be seen. However, rainwater harvesting has introduced at least some residents to the possibility that water does not have to be a government service.

My arguments in chapters 2 and 3 are almost entirely based on field research conducted in Mexico City in July and August 2018 with funding from the Tinker Foundation. I interviewed 15 residents of Tlalpan and Xochimilco who use rainwater harvesting systems or were about to have one installed in their home. I also interviewed officials from the municipal governments of Tlalpan and Xochimilco who oversee their *delegación*'s respective rainwater harvesting programs, as well as Enrique Lomnitz from Isla Urbana. I observed system installations, community meetings, and technical surveys to determine a household's suitability for rainwater harvesting. My research provided an illuminating glimpse into the lives of those who bear the brunt of Mexico City's water crisis, and the work of those striving to mitigate its damage. The realities that they face on a daily basis are fascinating, complex, and troubling all at the same time. I have tried to bring their stories to life as faithfully as possible in the pages that follow.

Chapter 1: Water in an Evolving Urban Landscape

I. *Paving the lakebeds*

If Jorge had gazed out from the site of his family's home in Bosques del Pedregal as recently as the early 20th century, the large but contained urban area of Mexico City would not have been the first thing to catch his eye. Instead, the distant shimmer of water in the powerful sun would have dominated the landscape. The Valley of Mexico is tucked within the high mountains of the Sierra Madre, the mighty *cordillera* that runs the length of the Mexican Republic between its Gulf and Pacific coasts. The present-day center of Mexico City sits at the floor of the valley, at about 2,200 meters (about 7,200 feet) of elevation. Southeast of the city, two massive volcanoes, the active Popocatépetl and dormant Iztacchíhuatl, tower at over 5,000 meters (and over 17,000 feet) in elevation. The valley is a basin, meaning that runoff from the surrounding mountainsides cannot escape. Today, a drainage systems serves as an artificial outlet. But in its natural state, the Valley of Mexico contained a vast chain of lakes.⁵⁷

To José Antonio Alzate y Ramírez, an 18th century Mexican scholar, the valley's lakes were the keystone of a natural environment that was inherently healthy and conducive to human habitation. The lakes not only provided fresh drinking water, he said, but clean air, fish and game to eat, plant material for textiles, and easy transportation via canoe. Such a bounty gave Mexico City a natural advantage in supporting human life. "It is no small favor of the supreme

⁵⁷ The Joint Academies Committee on the Mexico City Water Supply, *Mexico City's Water Supply: Improving the Outlook for Sustainability* (Washington, D.C.: National Academy Press, 1995), 8-9; Connolly, "Mexico City: Our Common Future?", 63.



The view of the valley from Bosques del Pedregal. Photo by the author, 2018.

benignity,” Alzate declared, “to have granted Mexico not only the necessary water, but even leftovers with much excess.”⁵⁸

The Valley of Mexico’s stunning transformation, from the water-rich utopia of Alzate’s time to the sea of concrete that we know today, ironically frames its present-day water crisis.

⁵⁸ José Antonio Alzate y Ramírez, “Descripción Topográfica de México,” in *Observaciones Útiles Para El Futuro de México: Selección de Artículos, 1768-1795*, ed. Miruna Achim (Mexico City: CONACULTA, 2012), 144, 153-56.

Before the arrival of Spanish invaders, the lakes had sustained human populations in the valley for thousands of years, and Mexico City was by no means its first large urban center. During the first millennium AD, Teotihuacán rose up from the *altiplano* in the northeast corner of the valley and burgeoned into one of Mesoamerica's first great empires. Centuries after Teotihuacán's collapse, the Aztecs built their stronghold, Tenochtitlán, on an island near the western shore of Lake Texcoco, the valley's largest lake.⁵⁹ Tenochtitlán fell to the Spanish in 1521, and the conquistadors founded Mexico City upon the ruins of the Aztec capital. The fledgling colonial city also enjoyed the lakes' bountiful sustenance, but the menace of periodic flooding after heavy rainfall often overshadowed these benefits. After a series of severe inundations in the early 1600s damaged property and incurred costly reconstruction, the city began work on a project to drain water from the lakes by channeling it out of the valley. This project, known as the *Desagüe*, took place in fits and starts over the next two centuries.⁶⁰ By 1850 the lake system had been reduced in size by 80 percent.⁶¹ Political chaos during Mexico's initial decades of independence stalled the project once more, but the autocratic rule of Porfirio Díaz between 1876 and 1911 renewed efforts to desiccate the final remnants of the valley's lacustrine past.⁶²

Despite the lakes' demise, water remained a crucial actor in the city's development during the *Porfiriato*, as Mexicans call the period of Díaz's rule. Urban planners and technocrats employed under Díaz's regime strove to transform the post-colonial capital into a modern and sanitary metropolis. Providing clean water to the city's growing population was a vital part of

⁵⁹ Susan Schroeder, "The Mexico That Spain Encountered," in *The Oxford History of Mexico*, ed. William H. Beezley and Michael C. Meyer (New York: Oxford University Press, 2010), 45–72.

⁶⁰ Vera Candiani, *Dreaming of Dry Land: Environmental Transformation in Colonial Mexico City* (Stanford, CA: Stanford University Press, 2014); Elinor G. K. Melville and Bradley Skopyk, "Disease, Ecology, and the Environment," in *The Oxford History of Mexico*, ed. William H. Beezley and Michael C. Meyer (New York: Oxford University Press, 2010), 230.

⁶¹ Matthew Vitz, *City on a Lake: Urban Political Ecology and the Growth of Mexico City* (Durham, NC: Duke University Press, 2018), 4.

⁶² *Ibid.* 31-39.

this agenda, and officials prioritized the upgrade and expansion of hydraulic infrastructure, as well as the enactment of codes and ordinances to establish service standards and authority.⁶³

Residents began to expect water as an essential urban service, and viewed the government as responsible for its provision.⁶⁴

These expectations only grew over the course of the 20th century as Mexico City rapidly took its megalopolitan shape atop the valley's withered lakebeds. The city's population, which numbered 345,000 in 1900, grew to 1.6 million by 1940.⁶⁵ Accelerated growth of Mexico's national population following the Second World War, combined with a steady influx of rural migrants fleeing diminishing economic opportunities in the countryside, multiplied the number of residents in the capital to 8.6 million by 1970.⁶⁶ Mexico City's physical expansion was equally impressive—it occupied a mere 8.5 square kilometers in 1858, but reached 40.5 square kilometers in 1908, 117.5 in 1940, and 746.4 in 1970.⁶⁷ While *defeños* of all social classes took part in this outward push, the urban poor made a decisive imprint on the growing periphery through the development of informal settlements, which housed approximately half the city's population of 3 million by the end of the 1950s.⁶⁸ Informal communities were generally characterized by unauthorized acquisition of land through invasion or illegal purchase, and an initial lack of urban services.⁶⁹ Obtaining access to water and securing legal land tenure were

⁶³ Vitz, *City on a Lake*, 19–50; Emilio De Antuñano, “Planning a ‘Mass City’: The Politics of Planning in Mexico City, 1930–1960” (PhD diss., University of Chicago, 2017), 51.

⁶⁴ Vitz, *City on a Lake*, 48–50.

⁶⁵ Priscilla Connolly, *The Case of Mexico City*, 5.

⁶⁶ Wayne Cornelius, *Politics and the Migrant Poor in Mexico City* (Stanford, CA: Stanford University Press, 1975), 16–17, 27–28; Connolly, “The Case of Mexico City,” 5.

⁶⁷ Vitz, *City on a Lake*, 24; Peter Ward, *Mexico City*, 2nd ed. (New York: John Wiley & Sons, 1998), 57.

⁶⁸ Antonio Azuela and Rodrigo Meneses-Reyes, “The Everyday Formation of the Urban Space: Law and Poverty in Mexico City,” in *The Expanding Spaces of Law: A Timely Legal Geography*, ed. Irus Braverman et al. (Stanford, CA: Stanford University Press, 2014), 116.

⁶⁹ Ward, *Mexico City*, 54–58, 60–66.

among the most pressing challenges that residents of these settlements faced.⁷⁰ Self-built water infrastructure could bring temporary improvement, but residents generally looked to the state to legally sanction their household through regularization of property and to provide piped water service.⁷¹ Officials in both national and city government saw ample opportunity to cultivate political support through provision of these services, and built clientelist networks that would shape the city's growth until the dawn of the 21st century.

This chapter will focus on water service in irregular settlements, and explore the role that the provision of this vital resource played in the relationship between Mexico City's urban poor and their government during the mid-to-late 20th century and into the new millennium. The history I will tell is lengthy and somewhat complicated, but I will focus on several prevailing trends. First, I will show how the state has continuously played a role in creating and shaping informality in the city through misguided laws, policies, and city plans. However, the existence of "illegal" areas served the state politically for much of the 20th century through the *ad hoc* regularization of irregular communities in exchange for votes and loyalty. Technical and standardized criteria for providing legal land tenure have largely taken the place of patron-client links in recent decades, but the government maintains discretion over what is "formal" or "informal." Second, legal land tenure was not, in practice, a requirement for water service during the mid-20th century, but this began to change in the late 1970s with reforms to city planning and government. Today, receiving piped water service essentially demands regularized property, although legal loopholes and ambiguities allow some informal residents to receive water from the state through other means. Third, municipal governments of Mexico City's *delegaciones*

⁷⁰ Cornelius, *Politics and the Migrant Poor in Mexico City*, 172–73.

⁷¹ Ibid, 47,175; Jill Wigle, "Social Relations, Property and 'Peripheral' Informal Settlement: The Case of Ampliación San Marcos, Mexico City," *Urban Studies* 47, no. 2 (February 2010): 411–36, <https://doi.org/10.1177/0042098009351189>.

have acquired more responsibility for service provision and land regularization over the past four decades, and have become the loci for residents' engagement with government.

Finally, and most importantly, I will show how Mexico City residents came to see water service as a government obligation during the 20th century. Residents were willing to tolerate the loss of political liberties to clientelism as long as the state met this vital need. Yet, civic unrest and distrust of government could arise if residents perceived that the state had reneged on its duty to service their households.

I will begin in the early and mid 20th century with an overview of informality, land regularization, and water service in Mexico City, and the extent to which Mexico's ruling party, the *Partido Revolucionario Institucional* (PRI), used these benefits as a means to cultivate political support. I will then describe the battery of changes to city government brought about in the late 1970s, as well as the steady push for democracy that ran through the late 1990s and ultimately ceded control of the city to an opposition party, the *Partido de la Revolución Democrática* (PRD). I will end with a discussion of how the government administers water and land tenure in the present day, and current problems and complications that arise in these processes.

II. Informality, clientelism, and urban services: 1917-1977

By the time that the Mexican state founded specific government institutions to address the regularization of land tenure in the early 1970s, informal settlements composed a substantial portion of Mexico City's expanding physical space.⁷² Yet, the decision to establish formal bureaucratic channels dedicated to issues of land tenure was far from the first time that the government had intervened in the lives of informal residents. As Antonio Azuela and Rodrigo

⁷² Azuela and Meneses-Reyes, "The Everday Formation of the Urban Space," 118; Ann Varley, "The Political Uses of Illegality: Evidence from Urban Mexico," in *Illegal Cities: Law and Urban Change in Developing Countries*, ed. Edésio Fernandes and Ann Varley (New York: St. Martin's Press, Inc., 1998), 174–76.

Meneses-Reyes argued, informal communities were not disconnected from state institutions on account of their “illegal” nature, but stood in an “ambiguous situation in relation to them.”⁷³ This overview will show how informal settlements in Mexico City were created by legal and planning miscues, and then continuously shaped by residents’ engagement with government officials and the laws and policies that they enacted. From the 1930s through the 1970s, informal residents attained legal land tenure and water service from the government largely through networks of political patronage. Regularized land tenure was only tenuously a condition to receive water service, but the two were nonetheless intertwined as settlers’ most pressing needs that they sought from the state. The PRI government, in turn, distributed these services throughout the city in a rather sporadic, *ad hoc* fashion according to their political whims. For the party, informality was a benefit—property regularization and water service were coveted means to exact social and political control over the urban poor.

Government officials bore considerable responsibility for creating the idea of “informality” in Mexico City during the first half of the 20th century. The city’s first significant period of outward growth during the late 19th century was partially due to real estate developers who began to build working class neighborhoods on the city’s periphery.⁷⁴ These neighborhoods were not illegal, but at the time city government possessed neither sufficient codes to control their development nor sufficient funds to provide them with services.⁷⁵ Instead, officials granted special permission for their construction while withholding urban services.⁷⁶ As demands for housing increased following the end of the Mexican Revolution in 1917, this formula repeated itself. In one notable instance during the 1920s, for example, the government attempted to

⁷³ Azuela and Meneses-Reyes, “The Everday Formation of the Urban Space,” 116.

⁷⁴ De Antuñano, “Planning a ‘Mass City’,” 36–41.

⁷⁵ Ibid, 37–38.

⁷⁶ Ibid, 38.

partner with a developer to construct a housing project on a former horseracing track north of the city center. When the government's plan fell through, the developer privately sold off lots on the property to over one hundred families. The newly arrived residents later decried the developer as exploitative and accused him of embezzling community funds, but efforts by the government to reclaim control of the neighborhood's development were only marginally successful.⁷⁷

As planners attempted to blueprint the city's territory over the next few decades, incomplete knowledge of recently built neighborhoods like the racetrack meant that these areas were unevenly or inaccurately included in urban plans. Such mistakes could prove to be enormously consequential in shaping the extent to which officials perceived these communities as legitimate in the future.⁷⁸ Meanwhile, a series of laws and codes passed in the early 1940s that were designed to guide housing development ended up pushing new *colonias* further toward an "informal" status. The *Reglamento de Fraccionamientos* (1941) enacted guidelines for subdivision and development that were unclear and hard for developers and residents to correctly follow.⁷⁹ The *Reglamento de Colonias* (1941) helped set up a corporatist structure by which neighborhoods could be "created" (even those that already existed) through engagement between residents and the city government's *Oficina de Colonias*, which had been founded to streamline housing requests for the purpose of social and political control.⁸⁰ Seeing opportunity to win political support from the poor, the PRI government used its powers of eminent domain to expropriate land for nearly 28,000 new or pre-existing lots by the late 1940s.⁸¹ Thus, a process for housing development that had been tolerated during the *Porfiriato* and into the post-

⁷⁷ Vitz, *City on a Lake*, 89–93; De Antuñano, "Planning a 'Mass City,'" 46–49.

⁷⁸ De Antuñano, "Planning a 'Mass City,'" 79–119, 149–50.

⁷⁹ *Ibid.*, 74.

⁸⁰ *Ibid.*, 130–37, 149–165.

⁸¹ Azuela and Meneses-Reyes, "The Everyday Formation of the Urban Space," 116–18; Antonio Azuela, "Evolución de Las Políticas de Regularización," in *El Acceso de Los Pobres Al Suelo Urbano*, ed. Antonio Azuela and François Tomas (Mexico City: Universidad Nacional Autónoma de México, 1997), 222.

Revolutionary period began to drift toward a sort of legal ambiguity in the 1940s due to laws and plans that did not coincide with the social realities of the city. Neighborhoods that suddenly found themselves “outside the law” could only correct their status through political channels like the *Oficina de Colonias*.

Wholesale administrative changes within city government following the Mexican Revolution also shaped urban politics in the capital during the early and mid 20th century. In 1928, Mexico City converted from a state to a special political entity, the *Federal District* (DF). As part of this reform, the city’s municipal governments consolidated into a centralized, district-wide authority referred to as the *Department of the Federal District* (DDF).⁸² The city would have no elected officials. Instead, the president would appoint a mayor, or *regente*, while the National Congress would oversee legislative functions for the Federal District.⁸³ Calls to democratize city government grew later in the century.⁸⁴ As sociologist Peter Ward wrote in 1998, “Few places in the democratic world have less local democracy than Mexico City.”⁸⁵ The PRI continually responded to these criticisms by offering *defeños* the feeble justification that the president was effectively elected governor of the Federal District as well.⁸⁶ Nonetheless, centralization meant that for most of the 20th century, city politics and national politics were inextricably bound.⁸⁷

The new DDF government served the PRI politically, as the party could consolidate rule over the capital without the electoral threat of a political opposition.⁸⁸ However, concerns about

⁸² Vitz, *City on a Lake*, 104–5; Ward, *Mexico City*, 105.

⁸³ Ward, *Mexico City*, 104–5.

⁸⁴ Ibid, 116–22.

⁸⁵ Ibid, 117.

⁸⁶ Ibid, 106.

⁸⁷ Ibid, 87.

⁸⁸ Ibid, 105.

effective administration of urban services, including water, also played an important role in the decision to centralize the city government. A series of hydraulic disasters in the 1920s had shaken faith in the competence of municipal governance among state officials and members of the public.⁸⁹ For example, an accident at the city's water pump in November 1922 cut off service to hundreds of thousands of city residents, sparking riots and protests over the government's perceived failure to meet their needs. Calls for a new government more capable of delivering services ensued.⁹⁰ The creation of the DDF attempted to meet this demand by placing responsibility for the city's piped water network in the hands of the centralized city government, instead of its *delegaciones*.⁹¹ This administrative structure would remain in place until the late 1970s.⁹²

In the city's settlements, water provision followed a series of shifting logics that were anything but clear-cut. The *Reglamento de Fracciones* had ordered developers to provide services in 1941. But developers often defied these rules, which could leave residents without almost any kind of water service.⁹³ By the mid-1940s, however, the government had reclaimed responsibility for service provision under a new legal regime, and planners from the Office of Public Works sought to install infrastructure in communities that the *Oficina de Colonias* had "established."⁹⁴ Yet, planners were often overwhelmed by the volume of neighborhoods that the politically-minded *Oficina de Colonias* certified, and with residents obligated to foot the bill for service installation, many Public Works projects did not get off the ground until the 1950s.⁹⁵ The

⁸⁹ Vitz, *City on a Lake*, 94–108.

⁹⁰ Ibid, 95-100.

⁹¹ Ibid, 104–5.

⁹² Peter Ward, *Welfare Politics in Mexico City: Papering Over the Cracks* (London: Allen & Unwin, 1986), 89–93.

⁹³ De Antuñano, "Planning a 'Mass City,'" 74, 125.

⁹⁴ Ibid, 128-29, 141-42.

⁹⁵ Ibid, 123-24, 143.

erratic patterns of water service provision in informal settlements that developed during the 1940s would continue over the next few decades. While codes and ordinances established requirements for a neighborhood to attain services, clientelist practices offered a means to sidestep the rules and receive water through *ad hoc* political intervention.⁹⁶

During the 1950s, the government took a more hostile posture toward settlements. Mayor Ernesto P. Uruchurtu, who governed between 1952 and 1966, refused to introduce water service to communities that had not been regularized, as part of a restrictive agenda that aimed to curb the city's growth by cracking down on new subdivisions.⁹⁷ In addition, a 1951 Supreme Court case ruled that government expropriation of land for the purpose of creating new settlements was unconstitutional.⁹⁸ Settlements continued to grow in number in this antagonistic climate despite dimmer prospects for regularization.⁹⁹ Residents increasingly acquired illegally subdivided parcels on *ejidos*.¹⁰⁰ Until 1992, members of the *ejidatarios* were prohibited from privately selling their land, and sales were not legally recognized.¹⁰¹ *Ejidatarios* in the Federal District nonetheless continued to subdivide their land and sell to settlers, whom they referred to as *avecindados*.¹⁰² According to one estimate, 91% of *ejidal* land in the capital had begun to urbanize between 1950 and 1970.¹⁰³

⁹⁶ Ibid, 142–43.

⁹⁷ De Antuñano, 144–45; Ward, *Mexico City*, 198; Ward, *Welfare Politics in Mexico City*, 60–61.

⁹⁸ Azuela and Meneses-Reyes, “The Everday Formation of the Urban Space,” 116.

⁹⁹ Azuela and Meneses-Reyes, “The Everday Formation of the Urban Space,” 118; Antonio Azuela and Emilio Duhau, “Tenure Regularization, Private Property and Public Order in Mexico,” in *Illegal Cities: Law and Urban Change in Developing Countries*, ed. Edésio Fernandes and Ann Varley (New York: St. Martin’s Press, Inc., 1998), 158; Ward, *Mexico City*, 65.

¹⁰⁰ Azuela and Meneses-Reyes, “The Everday Formation of the Urban Space,” 118; Azuela and Duhau, “Tenure Regularization, Private Property and Public Order in Mexico,” 158; Ward, *Mexico City*, 194–95.

¹⁰¹ Azuela and Duhau, “Tenure Regularization,” 158.

¹⁰² Azuela, “Evolución de Las Políticas de Regularización,” 224.

¹⁰³ Ibid, 224.

By the early 1960s, government officials increasingly defined settlements as “informal” and “illegal.”¹⁰⁴ Yet, the regularization and servicing of settlements through clientelism persisted. In response to public pressure, Mayor Uruchurtu relaxed his antagonistic stance toward settlements during the latter years of his term, and began to permit services in irregular communities.¹⁰⁵ Uruchurtu’s mayoral successors continued his liberal posture during the late 1960s and early 1970s.¹⁰⁶ While servicing the settlements did not become a government priority, scholars who researched Mexico City during this period observed that clientelist links between poor communities and the state were quite strong.¹⁰⁷

Political scientist Wayne Cornelius studied clientelist interactions between informal settlements and government authorities between 1970 and 1972. His 1975 book, *Politics and the Migrant Poor in Mexico City*, described how community leaders, referred to as “urban *caciques*”, served as mediators between residents and the government—facilitating the exchange of community participation in political events and elections in return for government benefits. Water service tended to rank near the top of residents’ concerns, although Cornelius reported that yet-to-be-regularized settlements saw legal land tenure as their most pressing need by a significant margin.¹⁰⁸ Engagement with the government could help realize these changes, but the community generally had to be well-organized under effective leadership with excellent connections to government officials.¹⁰⁹ Furthermore, a settlement’s demands tended to be one-off, parochial, and small-scale. Residents usually ceased their petition of the government after

¹⁰⁴ De Antuñano, “Planning a ‘Mass City,’” 130–31.

¹⁰⁵ Ward, *Welfare Politics in Mexico City*, 60, 92.

¹⁰⁶ Ward, *Welfare Politics in Mexico City* 91–92; Cornelius, *Politics and the Migrant Poor in Mexico City*, 203.

¹⁰⁷ Ward, *Welfare Politics in Mexico City: Papering Over the Cracks*, 91.

¹⁰⁸ Cornelius, *Politics and the Migrant Poor in Mexico City*, 172–73, 180.

¹⁰⁹ *Ibid.*, 196.

land tenure and basic services had been obtained.¹¹⁰ The government's response could be erratic, and their decision to extend services to one community never led to wholesale policy changes that recognized similar needs in other parts of the city.¹¹¹ Nonetheless, Cornelius found that contact with the political system could lead to increased support, greater trust, and more favorable perception of government among the urban poor, while offering the PRI opportunity to win new supporters.¹¹²

The possibility for political cooptation of Mexico City's poor resulting from these exchanges deeply troubled Susan Eckstein, a sociologist who conducted her research during the same period as Cornelius. When residents successfully made demands for land tenure and urban services, she argued, it usually meant that the community's organization and leadership would be formally coopted within the PRI political apparatus. Then, the community would be unlikely to receive further benefits from the party, and would lose its main instrument for voicing demands. Receiving water service came at the tremendous cost of being silenced, demobilized, and controlled by the PRI.¹¹³

In 1973, the sheer number of irregular settlements, a series of scandals involving illegal land sales, and a greater government emphasis on urban poverty led President Luis Echeverría to institutionalize procedures for legalizing land tenure.¹¹⁴ This reform formally recast regularization of informal settlements as a government priority and offered communities seeking land tenure a new, discrete set of resources to engage with.¹¹⁵ Echeverría's administration

¹¹⁰ Ibid, 197.

¹¹¹ Ibid, 192, 197.

¹¹² Ibid, 219-225.

¹¹³ Susan Eckstein, *The Poverty of Revolution: The State and the Urban Poor in Mexico* (Princeton, NJ: Princeton University Press, 1977), 83–102.

¹¹⁴ Azuela and Meneses-Reyes, “The Everday Formation of the Urban Space,” 118; Azuela and Duhau, “Tenure Regularization,” 159.

¹¹⁵ Varley, “The Political Uses of Illegality,” 172–74; Azuela and Duhau, “Tenure Regularization,” 158–60.

established a series of agencies to address the issue, most notably the *Commission for Regularization of Land Tenure* (CORETT).¹¹⁶ As a federal agency, CORETT specifically worked to regularize settlements built on *ejidal* land, while communities built on private property fell under the jurisdiction of the Federal District's *General Directorate for Territorial Regularization* (DGRT).¹¹⁷ Yet, the battery of new agencies did little to conceal or change the political logic that had been fundamental to regularization for decades. Regularization still served as a way for the PRI to cultivate political support and demobilize community organization or political opposition.¹¹⁸ The agencies continued to issue titles in an *ad hoc* fashion that heavily considered patron-client links between agency personnel and settlers.¹¹⁹ Moreover, the introduction of these agencies (many of whose responsibilities overlapped) allowed the state to appear that they were making a sincere effort to meet the needs of the urban poor.¹²⁰ Institutionalization continued one-off acts of regularization, which did little to address underlying causes of informality in Mexico City. Legalizing land tenure was a relatively easy and inexpensive way for the government to attend to informality while bringing poor communities into greater contact with the central government.¹²¹ In fact, some observers argue that regularization afforded greater benefits to the state than to the urban poor.¹²²

Water services were relatively unaffected by the institutionalization of land tenure legalization procedures. Peter Ward indicated that poorly serviced communities were still subject to the political considerations that Cornelius described, and Echeverría's reforms allowed land

¹¹⁶ Azuela and Duhau, "Tenure Regularization," 159; Ward, *Mexico City*, 202.

¹¹⁷ Azuela and Duhau, "Tenure Regularization," 159–60.

¹¹⁸ Varley, "The Political Uses of Illegality," 172–85.

¹¹⁹ Ward, *Welfare Politics in Mexico City*, 64–66; Ward, *Mexico City*, 197.

¹²⁰ Ward, *Welfare Politics in Mexico City*, 64–65; Varley, "The Political Uses of Illegality," 175–76.

¹²¹ Azuela and Duhau, "Tenure Regularization," 161.

¹²² Ward, *Welfare Politics in Mexico City*, 66.

tenure to eclipse water service as a priority among both residents and government officials.

Major changes to water administration would not occur until decentralization of the city

government began in 1977.¹²³

Echeverría's reforms did little to alter the prevailing reality of the mid-20th century that I have described above, in which political considerations guided a rather erratic distribution of urban services. These clientelist practices meant that attaining water service did not necessarily depend on the legality of a settlement's land tenure. Instead, access to political leadership and party officials was the most important factor that determined a community's level of servicing. Yet, while observers like Eckstein pointed out the risk that clientelism posed to political freedom, Cornelius' research demonstrates the extent to which some residents viewed these exchanges as worthwhile transactions. The successful delivery of services was a critical element that shaped residents' perception of government.¹²⁴ As Cornelius bluntly stated, residents would overlook a cacique's exploitative behavior or corruption as long as "he [got] things done."¹²⁵ While the PRI's clientelist behemoth began to crumble during the late 20th century, this utilitarian view of government by no means disappeared.

III. Technocratic approaches to the urban environment: 1977-present

Political reforms that decentralized Mexico City's government during the late 1970s marked one of the first milestones in a push for democratic governance in the capital that would endure for the next twenty years. The PRI clamored to maintain its grip on the Federal District, but ultimately saw it slip with the election of a PRD mayor in 1997. While the PRD continued to practice clientelism in some areas of government, city administration took on a more

¹²³ Ibid, 66, 92.

¹²⁴ Cornelius, *Politics and the Migrant Poor in Mexico City*, 53–72, 201–25.

¹²⁵ Ibid, 153.

technocratic and localized shape. These changes would alter the way that poor *defeños* interacted with their government. By the first decades of the 21st century, municipal governments produced their own urban plans, and had taken major responsibility for the provision of legal land tenure and water service through procedures that appear technically rigorous. Meanwhile, officials had begun to problematize irregular settlements as an environmental threat during the late 1970s.

“Informality” increasingly referred to settlements built within the city’s newly established “conservation zone,” an area designed to halt urban expansion in the name of ecological preservation. Officials’ reluctance to recognize illegal settlements within the conservation zone sparked conflicts, especially during the 1980s. Today, codes and laws prohibit government authorities from providing water services to these areas until the lengthy process of regularization has been completed. In practice, this has meant that irregular settlements cannot receive piped water without legal land tenure. However, some communities still receive service from *pipa* trucks provided by the *delegaciones*. This may be the result of numerous contradictions in the laws that govern city water service and the conservation zone. The persistence of legal ambiguity, as well as some political considerations in the provision of land tenure, serve as reminders of Mexico City’s past amidst the growth of technocratic governance.

a. Decentralization, democratization, and the conservation zone: 1977-1997

In 1977, the PRI began to decentralize certain administrative functions of Mexico City’s government in response to mounting criticism about the lack of democracy in the city. However, the party sought a way to pursue this agenda without having to surrender political power in the Federal District.¹²⁶ Mayor Hank González resuscitated a local governance structure known as the *juntas de vecinos* as a way to deflect accountability away from city government and towards the

¹²⁶ Ward, *Mexico City*, 116–22.

municipal governments of each *delegación*.¹²⁷ The *juntas de vecinos* were composed of members appointed by the elected representatives of each neighborhood association (*jefes de manzana*). The *junta* would work alongside the leader of each *delegación*, a presidential-appointee referred to as the *delegado*. Together, they would determine policies and service programs for communities within the *delegación*.¹²⁸ The mayor's hope was that community-level demands and pressure would be directed toward these local governments, while the city would maintain control of resources and budgets.¹²⁹ Thus, the party could claim to have strengthened "local democracy" while preserving its hegemony.¹³⁰

The *delegaciones* took on more responsibility for water services under these reforms. *Delegados* would make decisions about the distribution of water to domestic users, while the city's central water agency maintained control of financing.¹³¹ Technical criteria for improving the city's inadequate infrastructure were introduced as well. For example, the Federal District Water Plan aimed to extend service to over a million *defeños* by 1982. However, Peter Ward argued that poor communities continued to receive water service according to political criteria. *Delegados* could easily sidestep the ineffective *juntas de vecinos* and determine the rate and order of local servicing according to their own preferences.¹³² Regardless, the shift toward greater municipal responsibility for servicing was an important one. As subsequent chapters of this thesis will show, and as other scholars have noted, *defeños* today perceive local officials as immediately responsible for water service or land regularization.¹³³

¹²⁷ Ibid, 118.

¹²⁸ Ward, *Welfare Politics in Mexico City*, 98.

¹²⁹ Ibid, 99.

¹³⁰ Ward, *Mexico City*, 118.

¹³¹ Ward, *Welfare Politics in Mexico City*, 92.

¹³² Ward, *Welfare Politics in Mexico City*, 92–93; Ward, *Mexico City*, 112.

¹³³ Connolly and Wigle, "(Re)Constructing Informality," 193; Pezzoli, *Human Settlements*, 299.

A series of broad reforms to city planning and zoning during the late 1970s would have a momentous effect on informal settlements as well. As historian Brodwyn Fischer noted, informal settlements in Latin America have often been problematized through prevailing social or political crises of a given historical era—urban sanitation at the turn of the 20th century, or communist unrest during the Cold War.¹³⁴ In late 20th century Mexico City, the perceived threat that settlements posed to the environment emerged as the predominant paradigm. A wave of new legislation and urban plans designed to slow the city’s sprawling growth quickly followed.¹³⁵ The General Law of Human Settlements, passed at the federal level in 1976, awarded the state the authority to intervene in the planning of settlements, and delegated specific responsibilities for policy making to federal, state, conurban, and municipal levels.¹³⁶ Mexico City responded to this law in 1980, when it passed a “Master Plan” for the Federal District.¹³⁷ The plan aimed to keep the Federal District’s population limited to 14 million by the year 2000 and control urban expansion in the semi-rural southern half of the District.¹³⁸ To accomplish this goal, the plan divided the District into two primary zones—one for urban development and another for ecological conservation.¹³⁹ Virtually all of the “conservation zone” would be located in the south, covering large parts of Tlalpan and Xochimilco in particular.¹⁴⁰ Illegal settlements in the

¹³⁴ Brodwyn Fischer, “A Century in the Present Tense: Crisis, Politics, and the Intellectual History of Brazil’s Informal Cities,” in *Cities From Scratch: Poverty and Informality in Urban Latin America*, ed. Brodwyn Fischer, Bryan McCann, and Javier Auyero (Durham, NC: Duke University Press, 2014), 9–67.

¹³⁵ Pezzoli, *Human Settlements*, 165–66.

¹³⁶ Ward, *Mexico City*, 163–64; Pezzoli, *Human Settlements*, 168–69; Connolly and Wigle, “(Re)Constructing Informality,” 188.

¹³⁷ Pezzoli, *Human Settlements*, 170.

¹³⁸ Ward, *Mexico City*, 170; Pezzoli, *Human Settlements*, 179.

¹³⁹ Connolly and Wigle, “(Re)Constructing Informality,” 188; Pezzoli, *Human Settlements*, 170.

¹⁴⁰ Jill Wigle, “The ‘Graying’ of ‘Green’ Zones: Spatial Governance and Irregular Settlement in Xochimilco, Mexico City: Irregular Settlement in Xochimilco, Mexico City,” *International Journal of Urban and Regional Research* 38, no. 2 (March 2014): 573, <https://doi.org/10.1111/1468-2427.12019>; Adrian Guillermo Aguilar and Clemencia Santos, “Informal Settlements’ Needs and Environmental Conservation in Mexico City: An Unsolved Challenge for Land-Use Policy,” *Land Use Policy* 28, no. 4 (October 2011): 653, <https://doi.org/10.1016/j.landusepol.2010.11.002>.

conservation zone would be outlawed, and unlike urban plans of the 1930s and 1940s, specific institutions were created in the 1980s that appeared capable of enforcing policy.¹⁴¹ However, as urban scholar Keith Pezzoli observed, the “misleading dualism” of ecology without humans and humans without ecology that the conservation zone established proved quixotic in Mexico City.¹⁴² Controlling the growth of human settlements in this “ecological” area would be difficult.

Settlement of the conservation zone continued during the 1980s, as confusion about the territory’s scope and function hindered already-feeble oversight of the area. Many settlers and developers had never heard of the new regulations, and definitive maps of the zone were not drawn up until 1987.¹⁴³ The institutions created to protect the zone appeared woefully out of touch with the social realities of those who lived within it. To begin with, the conservation zone was (and still is) not an area of pure “wild nature” but a patchwork of forests and rivers, agricultural land, some industry, rural towns with pre-Hispanic origins, and other human settlements, both “formal and “informal.”¹⁴⁴ During the mid-1980s, the *Program for the Urban Restructuring and Ecological Protection of the Federal District* (PRUPE) exemplified this misunderstanding by proposing to expropriate most of the conservation zone for strict ecological protection, which put an array of human settlements and activities in jeopardy. After predictable outrage, including criticism from academics and environmental organizations, PRUPE modified its plan to permit many preexisting settlements while limiting further urbanization.¹⁴⁵ However,

¹⁴¹ Pezzoli, *Human Settlements*, 170–83; De Antuñano, “Planning a ‘Mass City’,” 80; Ward, *Welfare Politics in Mexico City*, 47.

¹⁴² Pezzoli, *Human Settlements*, 208; Connolly and Wigle, “(Re)Constructing Informality,” 190.

¹⁴³ Ward, *Mexico City*, 173–74; Connolly and Wigle, “(Re)Constructing Informality,” 188.

¹⁴⁴ Connolly and Wigle, “(Re)Constructing Informality,” 189.

¹⁴⁵ Pezzoli, *Human Settlements*, 178-81; Ward, *Mexico City*, 174.

in spite of these rules, settlers continued to encroach upon the conservation zone in the decades that followed.¹⁴⁶

The 1980s also saw *defeños* increasingly turn to public protest and civil disobedience as means to articulate demands for water and land, rather than traditional channels of clientelism. On September 19, 1985, an 8.1 magnitude earthquake rocked the city, leaving 20,000 casualties and damaging 95,000 homes.¹⁴⁷ Public dissatisfaction with the government's response led to a surge of activity among civil society groups and grassroots organizations that lasted for years.¹⁴⁸ Water service was a central issue for these popular movements. One study by sociologist José Esteban Castro documented thousands of protest events over water throughout the capital region between 1985 and 1992. Most took the form of "denunciations," where a community or group would make damaging public claims about the government officials that had been ignoring their demands in order to spur those officials into action, but rallies and mass mobilization also occurred.¹⁴⁹ The participants mostly demanded that the government introduce or improve water service.¹⁵⁰ For example, a group of neighbors in Ecatepec, State of Mexico (a conurban area just outside the Federal District) denounced local authorities to the press in 1986 for repeatedly ignoring their petitions for water service.¹⁵¹ In 1987, a local group in Tultitlán, State of Mexico rallied against their mayor after water service had been interrupted for three weeks.¹⁵²

During the same period, Bosques del Pedregal and its surrounding communities in the conservation zone mobilized to demand legal land tenure, as I noted in the introduction. Keith

¹⁴⁶ Pezzoli, *Human Settlements*, 187, 207, 210.

¹⁴⁷ Pezzoli, 119–20.

¹⁴⁸ Pezzoli, 148–49; Roderic Ai Camp, "The Time of the Technocrats and Deconstruction of the Revolution," in *The Oxford History of Mexico*, ed. William H. Beezley and Michael C. Meyer (Oxford University Press, 2010), 571–73; José Esteban Castro, *Water, Power, and Citizenship* (New York: Palgrave Macmillan, 2006), 98–100.

¹⁴⁹ Castro, *Water, Power, and Citizenship*, 110–12.

¹⁵⁰ *Ibid.*, 110.

¹⁵¹ *Ibid.*, 115.

¹⁵² *Ibid.*, 118.

Pezzoli documented the sophistication of local organizing in the area. Bosques del Pedregal's neighborhood organization was democratically structured and offered proposals to develop the area in an ecologically sustainable manner in order to counter the government's argument that the settlement was an "environmental threat."¹⁵³ Once the government agreed to regularize Bosques del Pedregal in the mid-1980s, the struggle shifted to institutional avenues in order to negotiate the best possible terms for land tenure.¹⁵⁴ Pezzoli argues that this sort of local social movement was indicative of two prevailing trends during the 1980s. First, like other social movements around the world during this time, activists in Mexico City achieved a "depth of critique" and proposed alternative forms of development.¹⁵⁵ Second, popular groups began to engage with the state through more structured and technocratic links, rather than clientelist ones, as was the case in Bosques del Pedregal.¹⁵⁶

The growth of popular mobilization may have helped broaden the ways in which *defeños* articulated their demands of the state, but the fundamental need for water and the belief that its service was a government obligation remained the central driving force behind civilian activity. Castro noted in his study of water protests that "the main motivation for the actions of most protagonists of the events" was simply "to ensure a continued access to the essential services of safe water supply and sanitation."¹⁵⁷ High tariff costs, service interruptions, poor water quality, or government indifference all impeded residents' ability to access one of their most important needs. Frustration with the government's failure to fulfill their perceived obligation to resolve

¹⁵³ Pezzoli, *Human Settlements*, 251–76.

¹⁵⁴ Ibid, 292.

¹⁵⁵ Ibid, 149.

¹⁵⁶ Ibid, 148-80.

¹⁵⁷ Castro, *Water, Power, and Citizenship*, 127.

these issues propelled mobilization.¹⁵⁸ On the other hand, mobilization can die down once residents have received what they demand from the state, as Pezzoli's history of Bosques del Pedregal shows. After the government regularized land tenure and introduced water service in Bosques del Pedregal following its revision to PRUPE in 1985, the imminent danger that had prompted mobilization suddenly passed. Organizing in the community declined and disbanded, and the proposed initiatives for sustainable planning never materialized.¹⁵⁹ Indeed, Bosques del Pedregal reveals how the government could use the provision of water or land tenure to quell social unrest. Despite the innovative arguments and tactics employed by activists during the 1980s, if the acute threat posed by a lack of water or the specter of eviction had passed, and residents perceived the government to be meeting its obligation to attend to their needs, the urgency that drove people to take to the streets might quickly dissipate.

All the while, calls for the PRI to democratize city government intensified late in the 20th century, and the party's grip on power in the capital looked increasingly vulnerable. Left-wing *PRIistas* (PRI members) split from the party during the 1980s to found the PRD, and their presidential candidate, Cuahemoc Cárdenas, won the majority of votes in the Federal District during the 1988 election.¹⁶⁰ Despite anxiety and embarrassment over their electoral performance, the PRI resolved to maintain control of the city, and enacted only cosmetic changes to city government.¹⁶¹ Nonetheless, groundswell was building for sweeping political reform in the coming years.

The PRI turned to regularization programs as a way to bolster their political support in Mexico City. During the 1980s, regularization had won increasing acceptance as a technocratic

¹⁵⁸ Ibid, 112-27.

¹⁵⁹ Pezzoli, *Human Settlements*, 191-312.

¹⁶⁰ Ward, *Mexico City*, 93-94, 122-27.

¹⁶¹ Ibid, 93, 119.

measure to alleviate poverty and inadequate housing around the world. The World Bank regarded regularization as positive, while the UN's *Human Settlements Programme* (UN-Habitat) acknowledged self-help housing upon its founding in 1978.¹⁶² In Mexico, sociologist Emilio Duhau noted that by the 1980s, informal housing had become a "market" of its own where buyers could purchase property, build a home, and reasonably expect to receive land tenure from the government at some point.¹⁶³ Regularization reached its peak during the presidency of Carlos Salinas de Gortari following his election in 1988. During his six-year tenure, state institutions more than doubled the number of land authorizations that his predecessors had overseen.¹⁶⁴ In the wake of the 1988 election, these policies had clear political intentions.¹⁶⁵ Geographer Ann Varley described how Salinas used well-publicized efforts to provide land tenure and services in poor areas of the Mexico City region to recover votes for the 1991 congressional elections.¹⁶⁶ In the conurban municipality of Chalco, State of Mexico, for example, the president personally arrived to "switch on" the new electricity system in 1990, and the PRI performed extraordinarily well at the ballot box the following year.¹⁶⁷ Even in the twilight of its hegemony, informality continued to benefit the PRI.

Local democracy finally arrived in Mexico City during the 1990s. A plebiscite in 1993 saw 84% vote for direct elections and the creation of a city legislature.¹⁶⁸ The legislature (*Representative Assembly*) arrived in 1994, and in 1996 it was announced that mayoral elections

¹⁶² De Antuñano, "Planning a 'Mass City,'" 127; Azuela and Duhau, "Tenure Regularization," 162.

¹⁶³ Emilio Duhau, "The Informal City: An Enduring Slum or a Progressive Habitat?," in *Cities From Scratch: Poverty and Informality in Urban Latin America*, ed. Brodwyn Fischer, Bryan McCann, and Javier Auyero (Durham, NC: Duke University Press, 2014), 153.

¹⁶⁴ Varley, "The Political Uses of Illegality," 173.

¹⁶⁵ Ibid, 178–85.

¹⁶⁶ Ibid, 181–84; Ann Varley, "Delivering the Goods," 204–24.

¹⁶⁷ Varley, "Delivering the Goods: Solidarity," 215–16.

¹⁶⁸ Ward, *Mexico City*, 121.

would take place the following year.¹⁶⁹ In July 1997, former PRD presidential candidate Cuauhtemoc Cárdenas was elected mayor in a landslide victory, wresting Mexico City from PRI control for the first time in generations.¹⁷⁰

b. Planning and water service in present day Tlalpan and Xochimilco

Democratization reached Mexico City's *delegaciones* in the late 1990s as well, and *delegados* are now elected to three-year terms.¹⁷¹ Today, the *delegaciones* play critical roles in the administration of services and land tenure to their residents. Both Tlalpan and Xochimilco have produced their own urban plans since the 1990s.¹⁷² Xochimilco released its most recent plan in 2005, while Tlalpan's most recent plan was published in 2010.¹⁷³ These plans contain extensive socio-demographic information about the *delegaciones* and stipulate zoning regulations for their territory.¹⁷⁴ They also contain detailed maps that convey the zoning types in each section of the municipality.¹⁷⁵ The maps divide inhabited areas into “polygons” with numbers that are referenced to socio-demographic data.¹⁷⁶ The conservation zone within each

¹⁶⁹ Ibid, 122.

¹⁷⁰ Ibid, 127.

¹⁷¹ Ricardo Nurko and Analiese Richard, “Public Space and Democracy in Mexico City: Political Time,” Mexican Cities Initiative, Harvard Graduate School of Design, February 17, 2016, <https://research.gsd.harvard.edu/mci/public-space-and-democracy-in-mexico-city-political-time/>, accessed February 5, 2019.

¹⁷² Aguilar and Santos, “Informal Settlements’ Needs,” 655; Wigle, “The ‘Xochimilco Model’,” 342.

¹⁷³ Programa Delegacional de Desarrollo Urbano para la Delegación del Distrito Federal en Xochimilco [Delegational Program of Urban Development for the Federal District Delegation of Xochimilco], Gaceta Oficial del Distrito Federal [GODF] 06-05-2005, <http://www.data.seduvi.cdmx.gob.mx/portal/index.php/programas-de-desarrollo/programas-delegacionales>; Programa Delegacional de Desarrollo Urbano para la Delegación Tlalpan del Distrito Federal [Delegational Program of Urban Development for the Tlalpan Delegation of the Federal District], Gaceta Oficial del Distrito Federal [GODF] 13-08-2010, <http://www.data.seduvi.cdmx.gob.mx/portal/index.php/programas-de-desarrollo/programas-delegacionales>.

¹⁷⁴ Programa Delegacional [...] Xochimilco; Programa Delegacional [...] Tlalpan.

¹⁷⁵ “Delegación Xochimilco - Plano de Divulgación,” Programas Delegacionales de Desarrollo Urbano, Secretaría de Desarrollo Urbano y Vivienda [SEDUVI], accessed January 29, 2019, <http://www.data.seduvi.cdmx.gob.mx/portal/index.php/programas-de-desarrollo/programas-delegacionales>; “Delegación Tlalpan - Plano de Divulgación,” Programas Delegacionales de Desarrollo Urbano, Secretaría de Desarrollo Urbano y Vivienda [SEDUVI], accessed January 29, 2019, <http://www.data.seduvi.cdmx.gob.mx/portal/index.php/programas-de-desarrollo/programas-delegacionales>.

¹⁷⁶ Wigle, “The ‘Graying’ of ‘Green’ Zones,” 580; Connolly and Wigle, “(Re)Constructing Informality,” 191.

delegación is not strictly for ecological protection, nor is it entirely off-limits to human habitation. Instead, Tlalpan and Xochimilco divide their conservation territory into zones for ecological protection, agriculture, and rural habitation.¹⁷⁷ Both *delegaciones* contain many of the aforementioned historic rural towns within their conservation zone.¹⁷⁸

The urban plans also stipulate procedures to regularize informal settlements in the conservation zone. The *delegaciones* and the city's *Secretariat of the Environment* (SEDEMA) monitor the growth of settlements through surveys and photographs, and their locations are indicated on the *delegaciones*' zoning maps.¹⁷⁹ In Xochimilco, settlements are categorized into specific zones for "special regulation," "specific studies," and "control."¹⁸⁰ "Special regulation" zones are the most densely populated and consolidated communities.¹⁸¹ Not only does this status protect them from relocation, but it grants them eligibility to receive legal land tenure once they pass a series of studies.¹⁸² These studies determine the urban and environmental impacts of a community's regularization, and propose mitigation measures and payments for environmental damages.¹⁸³ Once the studies are complete, a committee composed of officials from the *delegación*, SEDEMA, and the city's *Secretariat of Urban Development and Housing* (SEDUVI) makes a final decision as to whether to grant land tenure.¹⁸⁴ It is the *delegación*, however, that faces the most direct pressure from constituents throughout the process.¹⁸⁵

¹⁷⁷ Programa Delegacional [...] Xochimilco, p. 84–85; Programa Delegacional [...] Tlalpan, p. 101; Wigle, "The 'Graying' of 'Green' Zones," 579.

¹⁷⁸ Programa Delegacional [...] Tlalpan, p. 13; Programa Delegacional [...] Xochimilco, p. 12.

¹⁷⁹ Wigle, "The 'Graying' of 'Green' Zones," 580; Connolly and Wigle, "(Re)Constructing Informality," 191; SEDUVI, "Delegación Xochimilco – Plano de Divulgación"; SEDUVI, "Delegación Tlalpan – Plano de Divulgación."

¹⁸⁰ Wigle, "The 'Graying' of 'Green' Zones," 580.

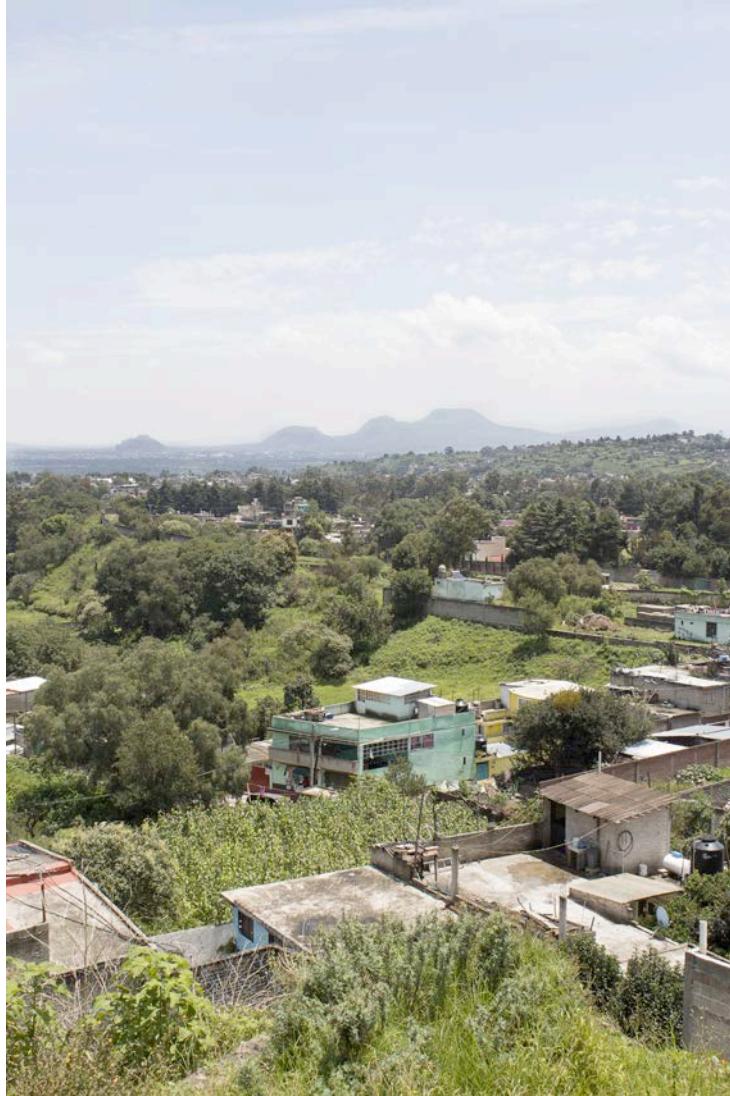
¹⁸¹ Wigle, "The 'Xochimilco Model,'" 343–44.

¹⁸² Ibid, 343–44; Wigle, "The 'Graying' of 'Green' Zones," 580.

¹⁸³ Wigle, "The 'Graying' of 'Green' Zones," 580; Connolly and Wigle, "(Re)Constructing Informality," 192–93.

¹⁸⁴ Wigle, "The 'Graying' of 'Green' Zones," 580–81; Connolly and Wigle, "(Re)Constructing Informality," 193.

¹⁸⁵ Connolly and Wigle, "(Re)Constructing Informality," 193.



An informal settlement in Xochimilco's conservation zone. Photo by the author, 2018.

In contrast to “special regulation areas,” “specific study” zones are less consolidated communities, and face a longer and more uncertain road to regularization.¹⁸⁶ They must undergo more rigorous studies, and if the committee issues a negative decision they may be subject to containment measures or reclassified as zones subject to “control.”¹⁸⁷ “Control” areas are not

¹⁸⁶ Wigle, “The ‘Graying’ of ‘Green’ Zones,” 581; Wigle, “The ‘Xochimilco Model’,” 343–44.

¹⁸⁷ Wigle, “The ‘Graying’ of ‘Green’ Zones,” 581; Wigle, “The ‘Xochimilco Model’,” 343–44.

eligible for regularization, and may be subject to strict containment or even eviction.¹⁸⁸ Tlalpan adopted an identical structure for classifying and regularizing informal settlements in its 2010 plan.¹⁸⁹ The only significant difference seems to be that Tlalpan uses “zones subject to diagnosis,” instead of “control” zones, and allows these areas the possibility to graduate to “specific study” zones with committee approval.¹⁹⁰ In both *delegaciones*, however, regularization is an exceedingly slow process that can take years, even the better part of a decade, for a decision to be reached.¹⁹¹

Water service in Mexico City is divided between the city and the *delegaciones*. The city’s water agency, *Sistema de Aguas de la Ciudad de México* (SACMEX), is responsible for maintaining and improving the “primary” piped water network—which carries water from the source to distribution tanks.¹⁹² The agency also oversees the city’s water supply, determines rates and fees, and updates registries of users.¹⁹³ The *delegaciones* must maintain “secondary networks” that distribute water from the tanks to households, and field complaints from users, but the authority to construct new water infrastructure rests with SACMEX.¹⁹⁴ These responsibilities are outlined in the city’s Water Law of the Federal District, which was enacted in 2003.¹⁹⁵

In law, informal settlements in the conservation zone must possess legal land tenure in order to obtain water service. The 2003 Water Law states, “Water services that are the

¹⁸⁸ Wigle, “The ‘Graying’ of ‘Green’ Zones,” 581; Wigle, “The ‘Xochimilco Model’,” 344.

¹⁸⁹ Programa Delegacional [...] Tlalpan, p. 136–37; Connolly and Wigle, “(Re)Constructing Informality,” 190.

¹⁹⁰ Programa Delegacional [...] Tlalpan, p. 137; Connolly and Wigle, “(Re)Constructing Informality,” 192.

¹⁹¹ Connolly and Wigle, “(Re)Constructing Informality,” 192–95.

¹⁹² Ley de Aguas del Distrito Federal [LADF] [Water Law of the Federal District], Art. 16, Gaceta Oficial del Distrito Federal [GODF], 27-05-2003.

¹⁹³ Ibid.

¹⁹⁴ LADF, Art. 16, Art. 18.

¹⁹⁵ Ley de Aguas del Distrito Federal [LADF] [Water Law of the Federal District], Gaceta Oficial del Distrito Federal [GODF], 27-05-2003.

responsibility of the authorities cannot be provided to persons living in irregular human settlements on conservation land.”¹⁹⁶ In policy and practice, this means that a community must attain formal land tenure status before it receives piped water.¹⁹⁷ Infrastructure is seen as an implicit sanction of a settlement in the conservation zone, which can lead to further urban growth.¹⁹⁸ The General Program for Ecological Planning in the Federal District (2003), one of the main policies that governs land use in the conservation zone, emphasizes the importance of “[avoiding] the establishment of human settlements, as well as the introduction of [urban] services and infrastructure that will affect the ecological value of the zone.”¹⁹⁹ Scholars point out that this is one of several environmental protocols that stress the need to halt the “anarchic urbanization” and “disorderly growth” that informal settlements incur upon the conservation zone.²⁰⁰ Ironically, water also serves as a principal justification for measures to contain urban sprawl. Officials argue that the conservation zone is critical for recharging the city’s aquifer and claim that settlements threaten to destroy this vital green space.²⁰¹ These concerns are certainly valid, but scholars have pointed out that the Mexican state has a tendency to problematize informal communities in the conservation zone while turning a blind eye to development by commercial or affluent parties.²⁰²

¹⁹⁶ Adrian Guillermo Aguilar and Flor M. López, “Water Insecurity Among the Urban Poor in the Peri-Urban Zone of Xochimilco, Mexico City,” *Journal of Latin American Geography* 8, no. 2 (2009): 117; Ley de Aguas del Distrito Federal, Art. 50.

¹⁹⁷ Wigle, “The ‘Xochimilco Model’,” 343; Aguilar and López, “Water Insecurity,” 107, 109, 117–18.

¹⁹⁸ Sandra (Official, Tlalpan Rainwater Harvesting Program), interviewed by the author, Tlalpan, CDMX, Mexico, August 27, 2018; Aguilar and López, “Water Insecurity.”

¹⁹⁹ Gobierno del Distrito Federal [GDF], *Programa general de ordenamiento ecológico del Distrito Federal (2000-2003)* [General Program for Ecological Planning of the Federal District (2000-2003)], (Mexico City: Secretaría de Medio Ambiente [SEDEMA], 2000), 22, accessed February 24, 2019, www.paot.org.mx/centro/programas/pgoedf.pdf

²⁰⁰ Wigle, “The ‘Graying’ of ‘Green’ Zones,” 579; Aguilar and Santos, “Informal Settlements’ Needs,” 653.

²⁰¹ Wigle, “The ‘Graying’ of ‘Green’ Zones,” 579; Connolly and Wigle, “(Re)Constructing Informality,” 190.

²⁰² Connolly and Wigle, “(Re)Constructing Informality,” 189.

²⁰² Pezzoli, *Human Settlements*, 187, 236; Connolly and Wigle, “(Re)Constructing Informality,” 183–85.

Scholars have also criticized the fact that the conservation zone has too many statutes and policies to govern it.²⁰³ Aspects of the General Program for Ecological Planning contradict those laid out in the General Program of Urban Development of the Federal District (2003), another document of principal importance to the conservation zone.²⁰⁴ Each *delegación*'s urban plan is supposed to coincide with these policies, but coordination has proved difficult in some areas.²⁰⁵ Meanwhile, the presence of *ejidal* and communal property in the conservation zone further complicates matters, as these traditional landholders' interests often conflict with those of both settlers and the state.²⁰⁶ Chapter 3 of this thesis will describe how rural *comuneros* (communal landholders) paradoxically sell properties to informal settlers while criticizing the encroachment of settlements in their communities.

The 2003 Water Law contains contradictions as well. The law makes the lofty claim that every city resident has a right to water, but clarifies that the government can only provide water infrastructure and services to those who "comply with the legal provisions set out in relation to land use where they live" and specifically disqualifies irregular settlements in the conservation zone from servicing, as mentioned above.²⁰⁷ The evident tension between acknowledging water as a universal "right" but restricting access to it, as well as persistent ambiguities as to which exact communities are excluded from which kinds of services, may explain why the *delegaciones* provide *pipa* truck service to some informal settlements where piped water is withheld. "It's kind of like a weird loophole," Enrique claimed, "because they're not building

²⁰³ Aguilar and Santos, "Informal Settlements' Needs," 653; Connolly and Wigle, "(Re)Constructing Informality," 189.

²⁰⁴ Aguilar and Santos, "Informal Settlements' Needs," 653; Connolly and Wigle, "(Re)Constructing Informality," 189.

²⁰⁵ Connolly and Wigle, "(Re)Constructing Informality," 189.

²⁰⁶ Connolly and Wigle, 189; Turid Hagene, "Everyday Political Practices, Democracy and the Environment in a Native Village in Mexico City," *Political Geography* 29, no. 4 (May 2010): 209–19, <https://doi.org/10.1016/j.polgeo.2010.04.004>.

²⁰⁷ Aguilar and López, "Water Insecurity," 117; Ley de Aguas del Distrito Federal, Art. 5, Art. 6.

infrastructure, so [the *delegaciones* are] allowed to [provide *pipas*].”²⁰⁸ Still, it is unclear how *pipas* fail to qualify as a prohibited “service” under the law.

Furthermore, the Water Law does not specify whether communities with varying degrees of informality or legal recognition are excluded from services. Sandra, an official from the Tlalpan municipal office, said that irregular communities must be in the “process” of regularization in order to receive *pipas*, although it was unclear whether she meant “special regulation,” “specific study,” or “diagnostic” areas.²⁰⁹ Tlalpan’s urban plan indicates that *pipas* will be provided to informal households as long as they are registered in the census.²¹⁰ Xochimilco’s urban plan does not contain quite as clear a policy surrounding *pipas*, but a municipal official indicated to me that at least some settlements receive this service.²¹¹ Amidst this confusion, the Water Law’s forbiddance of “water services that are the responsibility of the authorities” to informal settlements becomes less coherent. The statute’s prohibition of piped water service to irregular communities is largely carried out in practice, but *pipa* trucks seem to be a more legally ambiguous enterprise.

Despite the appearance of a technocratic approach to land use in the conservation zone, there remains room for political considerations and discretion. Officials have the power to define the polygons that designate which parts of a settlement are under consideration for regularization.²¹² These boundaries are among the subjects discussed in negotiations between communities and government officials as an informal settlement works towards land tenure, and

²⁰⁸ Enrique Lomnitz, interviewed by the author, August 14, 2018.

²⁰⁹ Sandra (Official, Tlalpan Rainwater Harvesting Program), interviewed by the author, Tlalpan, CDMX, Mexico, August 27, 2018.

²¹⁰ Programa Delegacional [...] Tlalpan, p. 162.

²¹¹ Roberta (Official, Xochimilco Rainwater Harvesting Program) and Leo (Official, Xochimilco Rainwater Harvesting Program), interviewed by the author, Xochimilco, CDMX, Mexico, August 13, 2018.

²¹² Wigle, “The ‘Graying’ of ‘Green’ Zones,” 582; Connolly and Wigle, “(Re)Constructing Informality,” 191–92.

some believe their drafting is subject to political judgment.²¹³ Moreover, when residents become aware of the boundaries, settlement within the polygon tends to increase.²¹⁴ The polygon boundaries can have enormous consequences for water provision, as pending regularization offers a more feasible path to urban services.²¹⁵ For example, I visited one informal community in Xochimilco where the area designated for “specific study” does not appear to include the whole settlement, meaning that some residents face a more uncertain path to regularization and services than others. Patricia Connolly and Jill Wigle note that residents’ perceptions of the regularization system’s flaws or discretions may lead to distrust of the program and the officials who administer it. They describe how one Xochimilco community with a 16th century chapel was made “irregular” by a 1987 zoning map, leading residents to scoff at the process of “regularization.” This tension has only been exacerbated by residents’ perception that officials only appear to conduct studies during election season.²¹⁶

City government and the *delegaciones* may have different political objectives with regularization as well. For example, in January 2017, Xochimilco’s *delegado*, Abelino Méndez, led a rally in the center of Mexico City in which residents of informal communities demanded that the city’s new constitution—which was being drafted at the time and took effect in September 2018—include measures for regularization of land tenure.²¹⁷ Enrique claimed that this was example of how the *delegaciones* often want to regularize irregular areas in order to win political support. Many communities even have allies in local government trying to help them, he

²¹³ Connolly and Wigle, “(Re)Constructing Informality,” 193–94.

²¹⁴ Ibid, 191–92.

²¹⁵ Wigle, “The ‘Graying’ of ‘Green’ Zones,” 580; Connolly and Wigle, “(Re)Constructing Informality,” 193–94.

²¹⁶ Connolly and Wigle, “(Re)Constructing Informality,” 194.

²¹⁷ Cinthya Stettin, “Piden a Constituyentes Regular Asentamientos En Xochimilco,” *Milenio* (Mexico City), January 16, 2017, <http://www.milenio.com/estados/piden-a-constituyentes-regular-asentamientos-en-xochimilco>.

added.²¹⁸ Clientelist practices have continued in Mexico City under PRD governance, and continue to shape water service in some areas of the city.²¹⁹ I did not encounter any evidence of clientelism during my fieldwork in Tlalpan and Xochimilco, nor did clientelist links appear to play a role in the provision of rainwater harvesting systems in these *delegaciones*. Nonetheless, the 2017 rally is a reminder that political calculations can still play a role in the processes for land regularization and water services, which otherwise appear to be technocratic on the surface.

The persistence of legal ambiguity and the use of political opportunism to resolve it reveal how the conditions that created informality during the early 20th century still persist. Even the advent of satellite imagery and geo-referencing data does not ensure that planners will create “formality” in an impartial and realistic manner. Meanwhile, the ongoing struggle to govern the conservation zone in a way that is both coherent and congruous with social reality allows for seemingly contradictory practices to continue. In current law and practice, piped water generally requires legal land tenure. Yet, in subsequent chapters it will be important to keep in mind that the logic that guides service provision, while largely technocratic, may contain peculiar idiosyncrasies.

IV. Conclusion

This chapter has conveyed a lengthy and detailed history of water provision and land regularization in poor, largely informal areas of Mexico City throughout the 20th century and up to today. As I move forward into a description of rainwater harvesting in present day Mexico City, there are several important themes from this history to keep in mind.

²¹⁸ Enrique Lomnitz, interviewed by the author, August 14, 2018.

²¹⁹ George H. Beane, “Infrastructure as a Vehicle for Community Building: An Urban Design Strategy for Iztapalapa, Mexico City” (Master’s thesis, Massachusetts Institute of Technology, 2015)

<https://dspace.mit.edu/handle/1721.1/99057> ; Tina Hilgers, “Causes and Consequences of Political Clientelism: Mexico’s PRD in Comparative Perspective,” *Latin American Politics and Society* 50, no. 4 (2008): 123–53.

First, government officials created informality in Mexico City during the early 20th century through plans and policies that did not align with the socio-spatial realities of the city. This produced “illegal” areas that could only be “legalized” through government intervention, a fact that benefitted the government politically for much of the 20th century. Informality continues to be shaped by law and policy’s inability to achieve congruity with the city they are designed to govern. Most notably, the conservation zone took a misguided and badly executed approach to “ecological preservation” that has not succeeded at halting informality or urban growth, but has instead created new kinds of informality recast as environmental threats. Technical planning has replaced the patron-client links of decades past as the means by which the government extracts residents from informality, but there remains room for subjective considerations by officials as to what constitutes “formality” or “informality”. Some of these considerations may be political at times.

Second, the *delegaciones* have taken greater responsibility for tenure regularization and service provision over the course of the 20th century, especially since the 1977 reforms and the arrival of democracy in 1997. Concurrently, *delegaciones* have also become the loci for residents’ engagement with government. City agencies have substantial authority over land regularization and water service, but *delegaciones* serve as the conduit through which residents participate in these processes.

Third, legal land tenure has become more of a necessary condition to receive piped water over the past few decades. Until the late 1970s, this was not the case, in practice, as water was provided through the same *ad hoc* political whims as land tenure. Today, authorities cannot legally provide water to informal settlements in the conservation zone, which is where a large number of the city’s irregular settlements reside. However, there are still legal ambiguities that

surround the city's Water Law, which may explain why *pipa* trucks from the *delegaciones* service some informal settlements, even if they cannot receive piped water.

Fourth, and most importantly, Mexico City residents came to see water service as a government obligation during the 20th century. As Wayne Cornelius demonstrated, *defeños* were willing to suffer the loss of political freedoms to PRI patrons as long as the government met their need for the vital liquid. However, the state's perceived failure to honor its obligation to meet this need could lead to civic unrest and distrust. This was the case during the water protests of the 1980s. At the same time, granting water service could serve as a means to quell social unrest, as it did in Bosques del Pedregal. The government's ability to meet *defeños* expectations for water service has been the difference between a tranquil, even complacent, populace and an angry, mistrustful, and resentful one.

The next chapter will specifically focus on the theme of civic distrust of government in the present day, its connections to water service, and the efficacy of the *delegaciones*' rainwater harvesting programs at resolving this distrust. The other themes will be interwoven throughout my analysis as well. While Isla Urbana's rainwater harvesting systems may be new technologies, their effects cannot be properly understood without reference to the past.

Chapter 2: Trust and Civilian Participation in Rainwater Harvesting Programs

I. “*So then whose obligation is it?*”

Delfín parked his car along the shore of the Cuemanco lagoon, and together he and I unloaded an audio speaker, presentation slides, food, and drinks from his trunk. Across the lagoon, the epileptic pulse of an enduring all-night rave agitated the otherwise calm and cool Sunday morning air. A short distance from the car, a large white tent had been erected in the grass. Esteban, the head of the Xochimilco *delegación*’s rainwater harvesting program, stood under the tent beside a stack of folding chairs that waited to be arranged. As Delfín and I approached carrying our supplies, Esteban greeted us warmly and said he expected a large crowd at the day’s event.

The sun emerged above the trees as the three of us laid out the folding chairs in rows under the tent, and the morning air grew increasingly warmer. Colorful *trajinera* boats paraded down the lagoon carrying tourists and Sunday visitors. Cuemanco is just a sliver of a wider network of lagoons and canals that crisscross much of the Xochimilco *delegación*, forming one of the few present-day remnants of the Valley of Mexico’s chain of lakes. Xochimilco’s communities have built their identities around the lagoons, the *trajineras* that lazily meander their waters, and traditional *chinampera* agriculture practiced along their shores. Indeed, the history and culture surrounding these ancient waters are a source of pride and purpose for those who live in the *delegación*.

Water was also the reason that dozens of Xochimilco residents trickled into to the lagoon-side park this August morning. These residents were new beneficiaries of Xochimilco’s rainwater harvesting program, and they were due to have a system installed in their home within the next month. Delfín, who runs Isla Urbana’s *Carpa Azul* educational program, was to give

them a presentation explaining how to use and maintain the system. Before taking their seats, the new beneficiaries signed a *Cedula de Captación*, a document that signified their attendance. Then, they each received a baseball hat and t-shirt emblazoned with a *delegación* logo that said “*La participación eres tú, Dirección Ejecutativa de Participación Ciudadana*” (“Participation is you, Executive Directorate of Citizen Participation”). I had offered to help record Delfín’s presentation on video, and I stood behind the crowd adjusting the camera and tripod before the presentation began. I exchanged glances with several residents whom I had met previously during my fieldwork, and they waved to me with a smile. A few others came up to greet me and offered me food and soft drinks that they had brought.

For the next two hours, Delfín explained Isla Urbana’s system in intricate detail. Above all, he stressed that the system provided by the program would allow users to feel a sense of independence from a dysfunctional public water network. However, it was up to each beneficiary to ensure that their system functioned properly and that the quality of the water that they collected was acceptable. The roof had to be kept clean. The *tlaloque* had to be emptied after every rain to remove dirty water. A worried resident expressed concern about whether rainwater was safe for household use, but Delfín reiterated that water quality depended upon system upkeep.

After Delfín finished speaking, Esteban joined him to field questions from the audience. In his closing remarks, Esteban gave an impassioned speech emphasizing the importance of Xochimilco’s rainwater harvesting program and extolling its success. When he first began working on the program, he said, residents reacted to it with bitterness, suspicion, and even insults, believing the whole program to be a lie. At one point, a particularly caustic response from one household reduced one of Esteban’s coworkers to tears. Now, he said, these same

people greet the *delegación* with open arms because they have seen the rainwater harvesting program's success.

Rainwater harvesting is an important practice for Xochimilco, Esteban continued. After all, adding additional pipes will not address the water shortage that the entire city faces. However, the program is not without a significant cost that the *delegación* shoulders in order to provide the systems to residents for free. Many people think that they are receiving a system in return for paying taxes. But not everyone pays taxes, Esteban told the crowd, so don't think that the program is a government obligation. If it was the government's obligation, then why didn't the *delegación*'s past administrations provide rainwater harvesting systems?²²⁰

The next day, I asked Ofelia, a participant in the program who had attended the presentation, what she thought about Esteban's comments over coffee at her home in the *colonia* of Santa Cruz de Guadalupe. "So then whose obligation is it?" she retorted. "Who is proposing it? Where does it come from?" She was skeptical of the *delegación*'s intentions with the program, and wondered whether it could be part of a scheme to embezzle funds. Despite her claims, however, she said that she was excited for the upcoming installation of her rainwater harvesting system.²²¹

Ofelia's distrust of the *delegación* helps explain why Esteban refused to characterize Xochimilco's rainwater harvesting program as a government obligation. As this chapter will show, Mexico City residents continue to understand water service as an obligation that the government must meet, often in exchange for taxation. Residents view the government's failure to provide adequate water as a rupture of this accord, which was one of several causes of public distrust of the state among those who I interviewed. By distancing the rainwater harvesting

²²⁰ Observation by the author at Xochimilco *Carpa Azul* event, August 5, 2018.

²²¹ Ofelia, interviewed by the author, August 6, 2018.

program from the nexus of government obligations, Esteban may have hoped to shield the program from public scrutiny that might foment greater distrust of the *delegación*'s work. In other words, if the rainwater harvesting program is not seen as a government obligation, residents will not hold the program's performance to the same critical standard as the piped water system. Instead, residents might view the program as a supplementary benefit provided by a benevolent municipal government, and their opinion of government might improve.

This chapter will attempt to unravel these issues further by exploring the municipal rainwater harvesting programs in Tlalpan and Xochimilco. I will show how officials from each *delegación* view rainwater harvesting as a way to supplement water-stressed communities in an ecologically sustainable manner, but also as a way to alleviate residents' distrust of government. Their efforts appear to have been successful, for the most part. Residents with whom I spoke, even harsh critics like Ofelia, were generally satisfied or enthusiastic about the program. Officials whom I spoke with heralded this enthusiasm as proof of an improving relationship with their constituents, and have used this enthusiasm to buoy the continuation and expansion of rainwater harvesting programs. Residents were more wary. Despite their satisfaction with the programs, rainwater harvesting did not entirely persuade residents to abandon their misgivings about the government. The systems can only partially meet residents' water needs for half the year, and do not directly address the problems with piped water service that are a source of public frustration. They continue to pay taxes and fees, and the government does not meet its perceived obligation to provide water.

Before diving into this central argument, it is first necessary to provide brief background about the *delegaciones* of Tlalpan and Xochimilco, and the water issues they face. I will then explain why the *delegaciones* chose to pursue rainwater harvesting and how their programs are

administered. Finally, I will introduce the residents of each *delegación* who served as participants in my research.

II. The origins of rainwater harvesting in Tlalpan and Xochimilco

As explained previously, Tlalpan and Xochimilco are two *delegaciones* located in the southern half of Mexico City. Both were once rural towns outside the city that were incorporated by rapid urbanization during the 20th century.²²² In terms of physical size, they rank among the largest *delegaciones* in Mexico City. Tlalpan is the largest—at 30,449 hectares, it accounts for 20.52% of Mexico City’s jurisdictional territory.²²³ Xochimilco is the fourth-largest *delegación*, with 12,517.8 hectares that makes up 8.4% of the capital territory.²²⁴ The vast majority of Tlalpan (83.5%) and Xochimilco’s (80%) territory falls within the conservation zone.²²⁵ Together, the two *delegaciones* account for nearly 40% of the city’s conservation zone.²²⁶ While development is largely restricted, each *delegación* divides their conservation territory among an array of land uses that create zones for strict ecological protection, agriculture, or rural habitation.²²⁷ Both *delegaciones* still contain rural towns within their conservation zones with historical roots in the pre-colonial period.²²⁸ These towns were clearly demarcated when the conservation zone was created during the 1980s.²²⁹

²²² Programa Delegacional [...] Tlalpan, p. 13; Programa Delegacional [...] Xochimilco, p. 14.

²²³ Secretaría de Desarrollo Agrario, Territorial y Urbano [SEDATU], Consejo Nacional de Población [CONAPO], and Instituto Nacional de Estadística y Geografía [INEGI], *Delimitación de Las Zonas Metropolitanas de México 2015* (Mexico City: SEDATU, CONAPO, INEGI, 2018), 108, accessed February 24, 2019, <https://www.gob.mx/conapo/documentos/delimitacion-de-las-zonas-metropolitanas-de-mexico-2015>; Programa Delegacional [...] Tlalpan, p. 8.

²²⁴ SEDATU, CONAPO, INEGI, *Delimitación de Las Zonas Metropolitanas de México 2015*, 108; Programa Delegacional [...] Xochimilco, 7.

²²⁵ Programa Delegacional [...] Tlalpan, p. 8; Programa Delegacional [...] Xochimilco, p. 7.

²²⁶ Programa Delegacional [...] Tlalpan, p. 8; Programa Delegacional [...] Xochimilco, p. 7; Wigle, “The ‘Graying’ of ‘Green’ Zones,” 573.

²²⁷ Programa Delegacional [...] Xochimilco, p. 84–85; Programa Delegacional [...] Tlalpan, p. 101.

²²⁸ Programa Delegacional [...] Xochimilco, p. 12; Programa Delegacional [...] Tlalpan, p. 13.

²²⁹ Ward, *Mexico City*, 174.

While Tlalpan and Xochimilco contain dense urban areas that adjoin Mexico City's metropolitan core, their vast tracts of rural and semi-rural terrain make them the third- and fourth-least densely populated *delegaciones*.²³⁰ Yet, each municipality struggles with poverty and living standards. One estimate showed that 57.51% of Tlalpan's population and 72.44% of Xochimilco's population live in "very high" to "high" levels of marginality.²³¹ In 2005, Xochimilco claimed that one-third of their population lived in some kind of informal settlement.²³² Xochimilco recognized 300 informal settlements, most of which were in the conservation zone.²³³ Tlalpan observed 191 informal settlements within their conservation zone in 2010.²³⁴

Access to water is a serious problem in Tlalpan and Xochimilco. According to one estimate by the federal government's National Institute of Statistics and Geography (INEGI), 79.8% of households in Tlalpan and 69.6% of households in Xochimilco had piped water within the home.²³⁵ Another INEGI study, however, revealed how infrequent water service can be. Only 52.7% of households with water in Tlalpan and 64.76% in Xochimilco receive water daily.²³⁶ In addition, Tlalpan estimated that only 41% of dwellings in its conservation zone are connected to piped water.²³⁷ It is unclear whether any of these statistics include informal settlements.

²³⁰ SEDATU, CONAPO, INEGI, *Delimitación de Las Zonas Metropolitanas de México 2015*, 108.

²³¹ Wigle, "The 'Xochimilco Model,'" 339.

²³² Programa Delegacional [...] Xochimilco, p. 42.

²³³ Ibid, 27, 42.

²³⁴ Programa Delegacional [...] Tlalpan, p. 53.

²³⁵ Instituto Nacional de Estadística y Geografía [INEGI], *Panorama Sociodemográfico de Ciudad de México 2015* (Mexico City: INEGI, 2016), 20, 22, accessed March 8, 2019, internet.contenidos.inegi.org.mx/.../panorama/702825082178.pdf

²³⁶ "Tabulados – Programas - Censos y conteos de población y vivienda - Cuestionario ampliado – Vivienda - Viviendas particulares habitadas con agua entubada y su distribución porcentual según dotación de agua para cada delegación," México en Cifras, Instituto Nacional de Estadística y Geografía [INEGI], accessed February 24, 2019, <https://www.inegi.org.mx/app/areasgeograficas/?ag=09>

²³⁷ Programa Delegacional [...] Tlalpan, p. 50.

Regardless, these numbers are striking when compared with *delegaciones* in the city center where upwards of 90% of homes have water provided on a daily basis.²³⁸

These issues with erratic water service sparked Tlalpan and Xochimilco's interest in rainwater harvesting. Officials from both municipalities whom I spoke to described Isla Urbana's systems as an easy and versatile way to expand residents' access to water.²³⁹ Sandra, who handles much of the administrative work for Tlalpan's rainwater harvesting program and serves as a primary interlocutor with Isla Urbana, said that Tlalpan's mountainous terrain and dispersed communities make the extension of water pipes financially and logistically impractical. Expanding piped water throughout the vast *delegación* also risks reduced water pressure throughout the network. Meanwhile, *pipa* trucks can be costly, inefficient, and susceptible to corruption because it is difficult for the *delegación* to oversee individual drivers and their routes. Rainwater harvesting does not require the transportation of water, making it a logical solution to Tlalpan's challenges.²⁴⁰

Roberta and Leo, who work alongside Esteban to run Xochimilco's rainwater harvesting program full-time, agreed that capturing rain can expand water access in their municipality more efficiently than installing pipes. Furthermore, many Xochimilco residents were badly affected by a 7.1-magnitude earthquake that struck central Mexico on September 19, 2017. Some went without water service for months because of pipe damage, and rainwater harvesting proved to be

²³⁸ INEGI, "Tabulados"; INEGI, *Panorama Sociodemográfico de Ciudad de México 2015*.

²³⁹ Roberta (Official, Xochimilco Rainwater Harvesting Program) and Leo (Official, Xochimilco Rainwater Harvesting Program), interviewed by the author, Xochimilco, CDMX, Mexico, August 13, 2018; Sandra (Official, Tlalpan Rainwater Harvesting Program), interviewed by the author, Tlalpan, CDMX, Mexico, August 27, 2018.

²⁴⁰ Sandra, interviewed by the author, August 27, 2018.

a viable way to provide water to affected communities. This realization redoubled officials' sense of urgency to expand the rainwater harvesting program.²⁴¹

Another reason harvesting rain is sensible in Tlalpan and Xochimilco is the fact that both *delegaciones* lie within the雨iest portions of the city. In high altitude regions of Tlalpan's conservation zone, between 900 and 1,500 millimeters of rain fall every year.²⁴² Xochimilco receives an estimated 946.3 millimeters per year.²⁴³ In comparison, the city center receives about 848 millimeters per year, while drier northern sections of the capital receive around 600.²⁴⁴ "We suffer from water, but we all have the good fortune that [rain] falls," Sandra told me, "So, we have to use [the rainwater harvesting systems]."²⁴⁵

Sandra acknowledged that Tlalpan remains focused on repairing and replacing leaky pipes, but disagreed with the idea that rainwater harvesting is only a temporary solution to municipal water problems. Repairs to the pipes take a long time to implement, she explained, and rainwater harvesting is a crucial way to reduce stress on both the water network and the city's water supply. Roberta added that changes to the city's pipes depend more on SACMEX than on the *delegación*, and Xochimilco's rainwater harvesting program is a way to proactively confront the problems that their population faces.²⁴⁶

The main differences between Tlalpan and Xochimilco's programs stem from their sources of funding. Tlalpan's funding comes from a federal program called the Social Infrastructure Contribution Fund (FAIS), which Mexico's Secretariat of Social Development administers. The FAIS fund provides funds to municipal or local governments to invest in

²⁴¹ Roberta and Leo, interviewed by the author, August 13, 2018.

²⁴² Programa Delegacional [...] Tlalpan, p. 9.

²⁴³ Programa Delegacional [...] Xochimilco, p. 10.

²⁴⁴ WMO, "Mexico"; Romero Lankao, "Water in Mexico City," 159.

²⁴⁵ Sandra, interviewed by the author, Tlalpan, August 27, 2018.

²⁴⁶ Roberta and Leo, interviewed by the author, August 13, 2018; Sandra, interviewed by the author, August 27, 2018.

programs or infrastructure to combat high levels of poverty or social marginalization.²⁴⁷ Sandra explained that FAIS uses geo-statistics to draw up a map of neighborhoods deemed “highly vulnerable” or “very highly vulnerable” to water scarcity. Tlalpan can only install rainwater harvesting systems within these established “polygons.” The project will not be able to move on to other areas of the *delegación* until all “highly vulnerable” zones have been covered, which Sandra estimates will take three more years.²⁴⁸ Xochimilco, meanwhile, receives funding from Mexico City’s Legislative Assembly for their rainwater harvesting program—initially 2.5 million *pesos* for a pilot project in 2016, and then 10 million *pesos* for their current project. It was unclear whether Xochimilco’s funding carries similar guidelines as FAIS, but the *delegación* has chosen to prioritize system installation in areas that were most affected by the 2017 earthquake.²⁴⁹

Critically, both programs prohibit the installation of systems in irregular settlements. Sandra told me that in Tlalpan, this restriction is part of the FAIS program’s guidelines. She may have been referring to a provision in the FAIS guidelines that requires municipalities receiving funding to comply with the most recent version of the General Law of Human Settlements (2016) which calls for municipalities to prevent and control the spread of irregular settlements.²⁵⁰ Similarly, Roberta indicated that Xochimilco’s program cannot provide systems to informal settlements because of the funding they receive from city government. Legal land tenure is a

²⁴⁷ Lineamientos Generales para la Operación del Fondo de Aportaciones para la Infraestructura Social [FAIS] [General Guidelines for the Operation of FAIS], Tit. 2.2, Diario Oficial de la Federación [DOF] 14-02-2014, 31-03-2016; “Fondo de Aportaciones para la Infraestructura Social (FAIS),” Secretaría de Bienestar, accessed February 25, 2019, <http://www.gob.mx/bienestar/documentos/fondo-de-aportaciones-para-la-infraestructura-social-fais>.

²⁴⁸ Sandra, interviewed by the author, August 27, 2018.

²⁴⁹ Roberta and Leo, interviewed by the author, August 13, 2018, Enrique Lomnitz, interviewed by the author, August 14, 2018.

²⁵⁰ Ley General de Asentamientos Humanos, Ordenamiento Territorial y Desarrollo Urbano [LGAHOTDU] [General Law of Human Settlements, Territorial Regulation, and Urban Development], Art. 11-XVI, Diario Oficial de la Federación [DOF] 28-11-2016; Lineamientos Generales de FAIS, Tit. 2.3-B.

requirement for beneficiaries of the program, she told me. It was unclear which statute or policy this restriction was grounded upon. Xochimilco's requirements for the program listed online simply say that legal land tenure is mandatory for participation, without giving a reason.²⁵¹ As mentioned in the previous chapter, the city's Water Law prohibits informal settlements in the conservation zone from receiving "water services that are the responsibility of the authorities."²⁵² The city's General Program for Ecological Planning calls for measures to "avoid the establishment of human settlements, as well as the introduction of [urban] services and infrastructure that will affect the ecological value of the [conservation] zone."²⁵³ Xochimilco's restrictions therefore seem to coincide with the city government's general attitude against providing infrastructure to informal settlements based on environmental concerns.

Isla Urbana's role within each *delegación*'s program is mostly the same, with some mild differences. Isla Urbana serves both Tlalpan and Xochimilco as a contractor, and coordinates with each *delegación* to send teams and equipment to install a certain number of systems within designated areas. Prior to installation, Isla Urbana dispatches community relations teams to conduct "technical visits" at households that are eligible for the program and have expressed interest to the *delegación*. These teams inspect each roof to ensure that it is suitable for capturing rain, determine where the drainpipes and *tlaloque* might be placed, and take note of the storage capacity in each home's cistern or tank. Prior to installation, Delfín arranges a *Carpa Azul* presentation to teach new users about the system and promote water conservation. In Tlalpan, *Carpa Azul* presentations do not yet have the same level of structure and organization as Xochimilco. Enrique explained that Delfín's talks can often be impromptu speeches given on

²⁵¹ "Convocatoria Pública Para Participar En El Programa Social Cosecha de Agua En Xochimilco," Alcaldía Xochimilco, accessed February 25, 2019, http://xochimilco.gob.mx/xochimilco_trabaja/album-detalle/cosecha-de-agua-164.

²⁵² Aguilar and López, "Water Insecurity," 118.

²⁵³ Wigle, "The 'Graying' of 'Green' Zones," 579.

street corners in Tlalpan neighborhoods rather than methodical presentations with visual aids in a comfortable setting.²⁵⁴ Finally, Roberta and Sandra both stressed that their respective *delegación* maintains ultimate control over the project. Isla Urbana works for them, and problems or complaints about the system should be directed to the municipality rather than Isla Urbana.²⁵⁵ Nonetheless, Enrique maintained that effective coordination and communication between Isla Urbana and the *delegaciones* is essential for resolving issues and ensuring a successful program.²⁵⁶

Above all, the municipal officials I spoke with adamantly believed that their programs' successes had helped foster a stronger and more trusting relationship between the *delegación* and its residents. They echoed Esteban's narrative that the people's initial doubt and suspicion turned to acceptance and enthusiasm after the program was implemented. For example, Sandra explained to me:

"At first, they saw it as strange when we were making visits. No? I mean, really. I mean, from the time they started the program, right? And the people came to check it out because they noticed, 'What program are they offering me? I want to know.' When we returned to make these visits, yeah they received us differently. They said, 'Oh! I got a system installed. This one, it worked for me.' No? Now we have, like, more acceptance...I mean, it helps you have a better relationship."²⁵⁷

Roberta described how this enthusiasm spread like wildfire between neighbors, friends, and family members. "And these are the people who have helped us to have greater interest in the program," she said. "They are seeing that they are capturing rainwater, that their water is of good quality, and that other people also want to have these systems."²⁵⁸

²⁵⁴ Enrique Lomnitz, interviewed by the author, August 14, 2018.

²⁵⁵ Sandra, interviewed by the author, August 27, 2018; Roberta and Leo, interviewed by the author, August 13, 2018.

²⁵⁶ Enrique Lomnitz, interviewed by the author, August 14, 2018.

²⁵⁷ Sandra, interviewed by the author, August 27, 2018.

²⁵⁸ Roberta and Leo, interviewed by the author, Xochimilco, CDMX, Mexico, August 13, 2018.

I pressed Sandra to further explain where civilians' distrust of the *delegación* comes from and how the rainwater harvesting program has helped resolve this tension. In years prior, she told me, officials would ask for people's documents, claiming to want them for a government program. However, the officials instead used the documents for other purposes, and never provided the benefits that they had promised. "So, when we started with these systems," she continued, "they said, 'Are you really going to install them? Or are you just going to ask for my papers and leave it at that forever?' So yes, we do have that trust. Yes, the people hand over their documents more calmly, because they know that it is for a system."²⁵⁹

Sandra's description reveals how a certain transactional framework guides civilians' trust or distrust of government. Civic distrust stemmed from the government's failure to meet a perceived obligation to provide services in return for the handover of personal information. The rainwater harvesting program corrects this error by not only delivering the promised service, but delivering a service that works and yields visible benefits. This improved trust with residents and enthusiasm has helped the *delegación* expand the program. Sandra explained that officials have been able to work in new neighborhoods without meeting the kind of resistance that they once did.²⁶⁰

Sandra and Roberta's claims of improved civilian trust in government cannot be verified without hearing the perspective of residents who have benefitted from the rainwater harvesting program. The next section will introduce the beneficiaries with whom I spoke, the neighborhoods they come from, and their experiences with the program.

²⁵⁹ Sandra, interviewed by the author, August 27, 2018.

²⁶⁰ Ibid.

III. Introducing the residents and their *colonias*

Seeing that the rainwater harvesting programs only permit beneficiaries with legal land tenure, all of the nine residents discussed in this chapter live in *colonias* with some degree of regularization. Five of these respondents live in Tlalpan, and four live in Xochimilco. I met them through a variety of means. I met Jorge while observing the installation of his rainwater harvesting system, as described in the introduction. In the days that followed, I returned to Bosques del Pedregal and its adjacent *colonias* to look for other people to interview. I wandered through the streets looking for homes that appeared to have a rainwater harvesting system. When I saw a house with a bright blue *tlaloque* of Isla Urbana's system clearly visible, I would ring the doorbell and ask the resident if they were willing to participate in my project. In this manner, I found my other four Tlalpan respondents—Pedro, Alexis, Octavio, and Ezequiel. In Xochimilco, I met all four respondents—Ofelia, Alberto, Rodrigo, and Rosendo—when I accompanied Esteban and Martín Liedo, a community relations team member at Isla Urbana, on technical visits to their homes.

It is important to keep in mind that the respondents in this chapter did not have lengthy experience harvesting rain. Three residents—Alexis, Octavio, and Ezequiel—had had their system for about one year when I spoke to them. Jorge and Pedro had just had their system installed. The other four residents in Xochimilco were awaiting their installation in the coming weeks. Despite these limitations, I found residents' perception of the rainwater harvesting programs at any stage in the process a valuable gauge for their perception of government performance. As I will note below, dissatisfaction with the system may negatively impact a residents' perception of the program, and the *delegación* itself. For residents on the cusp of receiving their system, however, the near-certainty that they would receive a benefit from a

government program marked a significant departure from their previous experiences, where promises went unfulfilled. In other words, receiving technical visits or attending *Carpa Azul* events were already reshaping their views of the program and the municipal government.

I have already introduced Jorge and Bosques del Pedregal in preceding chapters. Today, the neighborhood is densely urbanized, with a population of 5,231.²⁶¹ About 78% of households in the *colonia* have piped water.²⁶² Bosques del Pedregal falls within the urban zone, and is designated as a “housing” area—meaning that human settlement is entirely permitted.²⁶³ Pedro is another resident of Bosques del Pedregal who has lived in the area for 38 years. He had just received his rainwater harvesting system a few days before I spoke with him at his home. As I rang his doorbell, I saw that he had a sticker on his front door from the Tlalpan *delegación* just like the one Jorge had, meaning that he had received his system as part of the municipal program as well.

The Tlalpan program has also installed rainwater harvesting systems in San Nicolás II, a *colonia* that borders Bosques del Pedregal just up the hill. Ezequiel, a lifelong neighborhood resident, explained that the area’s name refers to the *ejido* on which it was built, San Nicolás Totolapán—the same *ejido* from which Bosques del Pedregal has its origins. He said that his grandfather was an *ejidatario* and gave his parents the land on which the house is built in 1981. The parcel was 1200 square meters, and Ezequiel’s father eventually divided it into lots for each of his children. Ezequiel’s brothers and sisters are now his next-door neighbors.

²⁶¹ “Espacio y Datos de México,” Instituto Nacional de Estadística y Geografía [INEGI], accessed February 25, 2019, <https://inegi.org.mx/app/mapa/espacioydatos/?ll=24.078069,-102.293405&z=5&tem=0200000000000000&subt=0200001000000000&ssubt=0200001000100000&ind=6207020632&tm=2&ng=&mapabase=INEGI>; Calculated by the author using interactive data listed by INEGI above on the “Espacio y Datos de México” webpage.

²⁶² Ibid.

²⁶³ Programa Delegacional [...] Tlalpan, p. 99; SEDUVI, “Delegación Tlalpan – Plano de Divulgación”; Author determined Bosques del Pedregal’s zoning using the “Plano de Divulgación” listed above and available online.



Avenida Bosques, the street that forms the border between Bosques del Pedregal and San Nicolás II, as well as the urban and conservation zones. Photo by the author, 2018.

San Nicolás II's land tenure status is a bit complex. Its border with Bosques del Pedregal—a main thoroughfare known as Avenida Bosques—also marks the limit of the urban area. This means that San Nicolás II falls within the conservation zone.²⁶⁴ However, the neighborhood is now densely urbanized, and its removal seems improbable. It has paved streets,

²⁶⁴ SEDUVI, "Delegación Xochimilco – Plano de Divulgación."

houses built from lot-line to lot-line, and a population of about 3,827.²⁶⁵ Government officials appear to have recognized as much. Tlalpan's most recent urban plan from 2010 listed San Nicolás II as an “irregular human settlement subject to special regulation,” meaning that it must continue to undergo urban and environmental studies, but it is eligible for consideration for legal land tenure.²⁶⁶ The same 2010 plan also lists the neighborhood as a “rural housing” zone (the same designation given to Tlalpan’s rural towns), possibly indicating that it had made progress through the regularization process.²⁶⁷ By 2013, city and municipal officials had created a special commission to work toward the regularization of San Nicolás II and 26 other *colonias* with a similar status.²⁶⁸ However, residents whom I interviewed in 2018 made it clear that that regularization was still incomplete and that they did not yet have property titles.²⁶⁹

San Nicolás II also lacks piped water service, which its residents attributed to the lack of legal land tenure.²⁷⁰ Census data indicates that only about 10% of households in the colonia have running water in their home, although it is unclear where that service comes from.²⁷¹ The residents I spoke with attain most of their water from *pipa* trucks, which the *delegación* subsidizes.²⁷² When I spoke with him, Ezequiel reached into his wallet and showed me a card the *delegación* gave his wife with a photo of her on it. This card allows their family to purchase one 8000-liter *pipa* per month at a cost of 60 *pesos*.²⁷³ Despite their lack of land tenure, however, San

²⁶⁵ INEGI, “Espacio y Datos de México.”

²⁶⁶ Programa Delegacional [...] Tlalpan, p. 136; Wigle, “The ‘Xochimilco Model’,” 580.

²⁶⁷ Programa Delegacional [...] Tlalpan, p. 100, 135; SEDUVI, “Delegación Tlalpan – Plano de Divulgación.”

²⁶⁸ Jessica Castillejos, “Buscan ordenar asentamientos irregulares en Tlalpan,” *Excélsior* (Mexico City), July 16, 2013, <https://www.excelsior.com.mx/comunidad/2013/07/16/909167>.

²⁶⁹ Ezequiel, interviewed by the author, Tlalpan, CDMX, Mexico, July 28, 2018; Alexis, interviewed by the author, Tlalpan, CDMX, Mexico, August 2, 2018.

²⁷⁰ Ezequiel, interviewed by the author, July 28, 2018; Alexis, interviewed by the author, August 2, 2018.

²⁷¹ INEGI, “Espacio y Datos de México.”

²⁷² Ezequiel, interviewed by the author, July 28, 2018; Alexis, interviewed by the author, August 2, 2018; Octavio, interviewed by the author, Tlalpan, CDMX, Mexico, August 3, 2018.

²⁷³ Ezequiel, interviewed by the author, Tlalpan, CDMX, Mexico, July 28, 2018.

Nicolás II is eligible for Tlalpan’s rainwater harvesting program.²⁷⁴ “It’s in the process [of land regularization],” Sandra explained, “And it is part of a list of [*colonias*] that are going to be regularized.”²⁷⁵ Ezequiel, Alexis, and Octavio each claimed to have received their systems about one year before I spoke to them in the summer of 2018, meaning that the program had likely swept through San Nicolás II at some point during the previous year.²⁷⁶

All four of the Xochimilco residents I spoke with—Ofelia, Alberto, Rodrigo, Rosendo—reside in the adjoining *colonias* of Santa Cruz Chavarrieta and Santa Cruz Guadalupe. Both areas lie within the conservation zone, south of Xochimilco’s urban core, and resemble rural towns at first glance. Each resident was either elderly or late middle-aged and had lived in the area virtually all of their lives.²⁷⁷ Like Jorge, several residents described the history of the *colonias* as a transformation from a “natural” to an “urbanized” state. They talked about having to go fetch water from a nearby village as children or how *pipas* began to arrive once roads were paved.²⁷⁸ According to Alberto and Ofelia, the area underwent a period of community mobilization in the 1980s, during which piped water and other services were attained.²⁷⁹ It is unclear when the community received legal land tenure, but Xochimilco’s urban plan indicates that the *colonias* are designated as “rural housing” zones. Similar to Tlalpan’s “rural housing” designation, Xochimilco defines this category as intermediate urban zones between rural towns and protected

²⁷⁴ Sandra, interviewed by the author, August 27, 2018.

²⁷⁵ Ibid.

²⁷⁶ Ezequiel, interviewed by the author, July 28, 2018; Alexis, interviewed by the author, August 2, 2018; Octavio, interviewed by the author, August 3, 2018.

²⁷⁷ Alberto, interviewed by the author, Xochimilco, CDMX, Mexico, August 15, 2018; Rodrigo, interviewed by the author, Xochimilco, CDMX, Mexico, July 30, 2018; Rosendo, interviewed by the author, Xochimilco, CDMX, Mexico, August 6, 2018; Ofelia, interviewed by the author, August 6, 2018.

²⁷⁸ Alberto, interviewed by the author, August 15, 2018; Rodrigo, interviewed by the author, July 30, 2018; Rosendo, interviewed by the author, August 6, 2018.

²⁷⁹ Alberto, interviewed by the author, August 15, 2018; Ofelia, interviewed by the author, August 6, 2018.

areas where businesses and “basic services” are permitted.²⁸⁰ All four respondents had piped water of varying functionality, and were eligible to participate in Xochimilco’s rainwater harvesting program.²⁸¹

Despite their self-built origins, the four *colonias* I visited are now consolidated communities with legal land tenure and access to urban services. Yet, the quality of their servicing leaves much to be desired. This is particularly the case with water provision, which explains how rainwater harvesting arrived in these neighborhoods.

IV. “Yes, [the systems] work”

Residents of Tlalpan and Xochimilco were drawn to the rainwater harvesting programs by their need for improved access to water. When I visited Ofelia’s house, she had just regained water service for the first time in nearly three weeks.²⁸² Alberto had grown frustrated with the stress caused by the *tandeo* rationing system, which only delivers water for a few hours per day. “If in this time, in those two hours, you were not ready to capture the water,” he explained, “you wouldn’t have the water until another day or until they deliver it again.”²⁸³ Pedro receives water twice a week, and always has to be ready to fill his tanks when the water is running. He also said that service in Bosques del Pedregal has been hindered by leaks and burst pipes, which require technicians to shut off the water for long periods in order to fix.²⁸⁴ Rosendo claimed that poor water pressure is his main problem, and thought that rainwater harvesting would ensure that he

²⁸⁰ SEDUVI, “Delegación Xochimilco – Plano de Divulgación,” 85.

²⁸¹ Alberto, interviewed by the author, August 15, 2018; Rodrigo, interviewed by the author, July 30, 2018; Rosendo, interviewed by the author, August 6, 2018; Ofelia, interviewed by the author, August 6, 2018.

²⁸² Ofelia, interviewed by the author, August 6, 2018.

²⁸³ Alberto, interviewed by the author, August 15, 2018.

²⁸⁴ Pedro, interviewed by the author, Tlalpan, CDMX, Mexico, August 3, 2018.

has an extra supply when pressure is low in the pipes.²⁸⁵ Rodrigo, meanwhile, wanted to reduce his spending on water, and was excited about the money that rainwater harvesting would save.²⁸⁶

In San Nicolás II, relying entirely on *pipa* deliveries can be fraught with anxiety. Alexis, a 23 year-old who helps his parents run an auto repair shop at their house, described how after ordering a *pipa*, you are told that it will be delivered between 1 and 15-to-20 days. Frequent delays further complicate this ambiguous timeframe. When I spoke with him, his family had been without water for 20 days because they were still waiting for their next delivery. Sometimes, the *pipa* truck may only deliver half the expected amount, forcing his family to file a complaint and hope the problem can be resolved. Usually there is a response from the *delegación*, but if not, they have to wait helplessly for their next *pipa* to arrive.²⁸⁷ For Octavio, who lives a few blocks from Alexis above the small bodega that he runs, worries about *pipa* delays and how his family will have water in the interim have caused him “physical wear.” He envied those who have piped water, claiming that they do not have to ration and worry as much as those who rely on *pipas*. “I mean, you have to conserve it,” he said, “but not to that extreme.”²⁸⁸

“The assurance of having water, that is everything,” as Pedro succinctly put it. “If you have water, the problem is fixed.”²⁸⁹ Yet, it is obvious that the problem is far from resolved, and residents blamed the government. Their frustrations stemmed from a sense that the government is obligated to provide water. Several residents I spoke to framed this obligation as part of a

²⁸⁵ Rosendo, interviewed by the author, August 6, 2018.

²⁸⁶ Rodrigo, interviewed by the author, July 30, 2018.

²⁸⁷ Alexis, interviewed by the author, August 2, 2018.

²⁸⁸ Octavio, interviewed by the author, August 3, 2018.

²⁸⁹ Pedro, interviewed by the author, August 3, 2018.

package of services that the government owes them in return for paying taxes. Pedro was among them:

“They are charging us, that’s why we say, ‘Well, they are charging us and the water doesn’t arrive.’ For example, I went to pay. I told them, ‘You’re not giving me water.’ But they kept ignoring me! I go and I pay and I don’t have water. I don’t have water. I have to pay anyway.”²⁹⁰

For Ofelia, similar frustrations have built up over the course of a lifetime. This was her response when I asked her why she deserves water service:

“Because simply, I pay my taxes. I pay the services, they’re not gifting them to me. I worked 28 years and in those 28 years they deducted taxes. It’s obvious that if I have retired [she is retired] they have to give what is appropriate for me. Why? Because of the years of service. And for the taxes that I was charged. The *delegación* is charging you taxes for light. They’re charging you taxes for water. They’re charging you property taxes...I think it’s just that in turn they give us services.”²⁹¹

Jorge agreed that it is the government’s responsibility to bring tax money to life through service provision, even though it often requires public pressure:

“When the government gives you a service, really the service isn’t free, right? All of this [points around] is from our taxes...don’t believe that the government is so generous that they say, ‘Oh no! Poor people, no? We’re going to do some programs of this and that, no?’ No, because all that is a result of us. I mean, it’s what we accumulate in taxes and they give us. So what is there to do there? We have to make sure the government puts our money to work. Uh huh. That they work it and invest it in the necessities that we have.”²⁹²

However, applying pressure and demands on the government can grow tiring, especially when water already consumes so much of a resident’s time and energy. Alberto claimed that if he goes to Xochimilco’s water office, he is unlikely to find anyone there to help him.²⁹³ Octavio said that he has “constantly” gone to Tlalpan’s offices to ask for improved *pipa* service, but he is almost always ignored. “They always give you a good response, right?” he told me. “But they

²⁹⁰ Ibid.

²⁹¹ Ofelia, interviewed by the author, August 6, 2018.

²⁹² Jorge, interviewed by the author, July 28, 2018.

²⁹³ Alberto, interviewed by the author, August 15, 2018.

don't follow through. I mean, they're pure promises that they don't keep.”²⁹⁴ Jorge said he had become overwhelmed by these never-ending demands on government. “There are many necessities,” he told me. “You will always be asking for things. For one thing or another. You have to be on top of them, right? All these issues, I say they never end.”²⁹⁵

Some residents had other opinions about the government’s obligation to provide water or the reasons for it. Alberto argued that the government’s obligation to provide services did not stem from taxes, but is simply an inherent requirement of any governing authority.²⁹⁶ Ofelia tempered her demands of the government by stressing that residents have an equal responsibility to conserve water and other resources that they are provided.²⁹⁷ Rosendo felt that responsibility falls upon residents to go to the *delegación* and inquire about social benefits. “They are giving us a lot of help in the *delegación*,” he told me. “It’s the people who take the blame if they don’t go.”²⁹⁸

Rosendo’s comments were virtually anomalous amongst my respondents, who largely felt that the government had reneged on its duty to provide water services. There was some room for circumspection amidst the criticism. Pedro credited government officials for improving Bosques del Pedregal over the course of his lifetime by introducing services and providing land tenure.²⁹⁹ Jorge agreed that Tlalpan’s responsiveness to water issues has improved. Water arrives more regularly and he can call a hotline to report leaks. However, these changes have made things 50% better, he said, not 100%.³⁰⁰ “You have to fight for yourself,” Alberto said. “The

²⁹⁴ Octavio, interviewed by the author, August 3, 2018.

²⁹⁵ Jorge, interviewed by the author, July 28, 2018.

²⁹⁶ Alberto, interviewed by the author, August 15, 2018.

²⁹⁷ Ofelia, interviewed by the author, August 6, 2018.

²⁹⁸ Rosendo, interviewed by the author, August 6, 2018.

²⁹⁹ Pedro, interviewed by the author, August 3, 2018.

³⁰⁰ Jorge, interviewed by the author, July 28, 2018.

authorities by themselves give you nothing. Here there has to be something special for a politician, a *delegado*, to have an obligation to travel around his municipal surroundings. He doesn't do it.”³⁰¹

Despite this dissatisfaction with government performance, the rainwater harvesting programs caught residents' attention. Three residents claimed to have learned about the program through *delegación* census workers who visited their house.³⁰² Five others learned about the program through friends, neighbors, or mutual acquaintances, some of whom had already obtained a system.³⁰³ Seeing the systems installed in other houses offered residents tangible proof that the program was not a sham. Jorge described seeing the systems for the first time when he was walking through San Nicolás II, and then agreeing to participate in the program when *delegación* workers knocked on his door.³⁰⁴ Alberto resolved to keep inquiring about his eligibility for the program because he had seen others receive a rainwater harvesting system.³⁰⁵

For nearly all respondents, the fact that the program provided a system free of charge was a deciding factor as well.³⁰⁶ When I asked Ezequiel why he decided to get a rainwater harvesting system, the first words out of his mouth were “Because it was free.”³⁰⁷ Meanwhile, several residents said that the cost of a system would have prevented them from seeking on

³⁰¹ Alberto, interviewed by the author, August 15, 2018.

³⁰² Octavio, interviewed by the author, August 3, 2018; Ezequiel, interviewed by the author, July 28, 2018; Pedro, interviewed by the author, August 3, 2018.

³⁰³ Alberto, interviewed by the author, August 15, 2018; Ofelia, interviewed by the author, August 6, 2018; Jorge, interviewed by the author, July 28, 2018; Rosendo, interviewed by the author, August 6, 2018; Rodrigo, interviewed by the author, July 30, 2018.

³⁰⁴ Jorge, interviewed by the author, July 28, 2018.

³⁰⁵ Alberto, interviewed by the author, August 15, 2018.

³⁰⁶ Ofelia, interviewed by the author, August 6, 2018; Alberto, interviewed by the author, August 15, 2018; Ezequiel, interviewed by the author, July 28, 2018; Octavio, interviewed by the author, August 3, 2018; Alexis, interviewed by the author, August 2, 2018; Pedro, interviewed by the author, August 3, 2018.

³⁰⁷ Ezequiel, interviewed by the author, July 28, 2018.

independently of the rainwater harvesting program.³⁰⁸ Enrique told me that the full cost of Isla Urbana's systems range between \$300 or \$400 US dollars to \$3,000 to \$4,000 US dollars.³⁰⁹

For some residents, the free provision of systems not only made them affordable, but may have lessened the perceived risk that the government would not deliver what it had promised. For example, Ofelia said she has been suspicious of government assistance programs for a long time and has doubted that they offer any real benefits. When she first heard about the rainwater harvesting program, she remained wary and thought that the systems were simply available for purchase from the *delegación*. Then when she found out the systems were free, she began to change her mind. Yet, she said that she has maintained a degree of caution throughout her participation in the program, worried about the *delegación* "taking advantage" of her. She proudly insisted that she "was not going to pay a cent" for the system aside from providing the platform on which it would sit. If she had had to pay for the system, she would not have participated in the program.³¹⁰ Alberto also said that the free provision made the system "worth it." However, he remained skeptical of the program and doubted that workers would even show up for the installation. "They told us, 'We're coming that day,'" he remembered. "I said, 'Well then, I'm going to wait and see if it's true.'"³¹¹

Alberto would not be disappointed. When a team of workers arrived to install his system, his faith in the program was restored. "And yes, when I saw that they had arrived with the team, how good. It's true isn't it? It is true that they are going to give it to us."³¹² Likewise, Ofelia

³⁰⁸ Ofelia, interviewed by the author, August 6, 2018; Octavio, interviewed by the author, August 3, 2018; Alexis, interviewed by the author, August 2, 2018.

³⁰⁹ Enrique Lomnitz (General Director, Isla Urbana), interviewed by the author, Coyoacán, CDMX, Mexico, August 24, 2018.

³¹⁰ Ofelia, interviewed by the author, August 6, 2018.

³¹¹ Alberto, interviewed by the author, August 15, 2018.

³¹² Ibid.

found her skepticism dampened by the “real” results of the rainwater harvesting program. When I spoke to her, she said that she felt happy and calm about her system arriving the next month:

“It is the first time that I am participating and I am seeing that yes, it is real. Because there are a lot of neighbors here who tell me, ‘I’m not going because it is not true. It won’t happen. The *delegación* is just making their rounds.’ But I’m a person who says, ‘Well, I don’t get carried away by people. It has to be me.’ And right now that is what I’m seeing. I’m seeing all affirmative. And so, what should I do in return? Well, respond affirmatively.”³¹³

Ofelia continued to say that the program had led her to enjoy “citizen participation” and indicated that she would continue her involvement in *delegación* activities.³¹⁴ Despite Pedro’s criticisms of government performance, he too felt that the system would make his home life “easier” and was grateful to the *delegación* for providing it. “Yes, I did have confidence that the government is going to support us,” he said of the program. “Yes, trust, yes.”³¹⁵

Several respondents who have been using the system for months were pleased with its performance and ability to supplement their water supply. “Yes, [the systems] work,” Alexis said. “Yes, yes they are very good because when there is no water and it is the rainy season, it captures a lot of water...it fills the cistern.” Overall, he said that rainwater harvesting has made his family’s life easier. “It has helped us a lot in this aspect [of making life easier]. When we don’t have water, we know that it will be there.”³¹⁶ Ezequiel has had a positive experience as well. “It helps our consumption of water,” he said. “Well, it isn’t potable, but yes it is for domestic uses.” He wondered why no one had thought of implementing rainwater harvesting systems before, and suggested that they would be beneficial infrastructure in areas of the city where water access is “worse” than San Nicolás II.³¹⁷

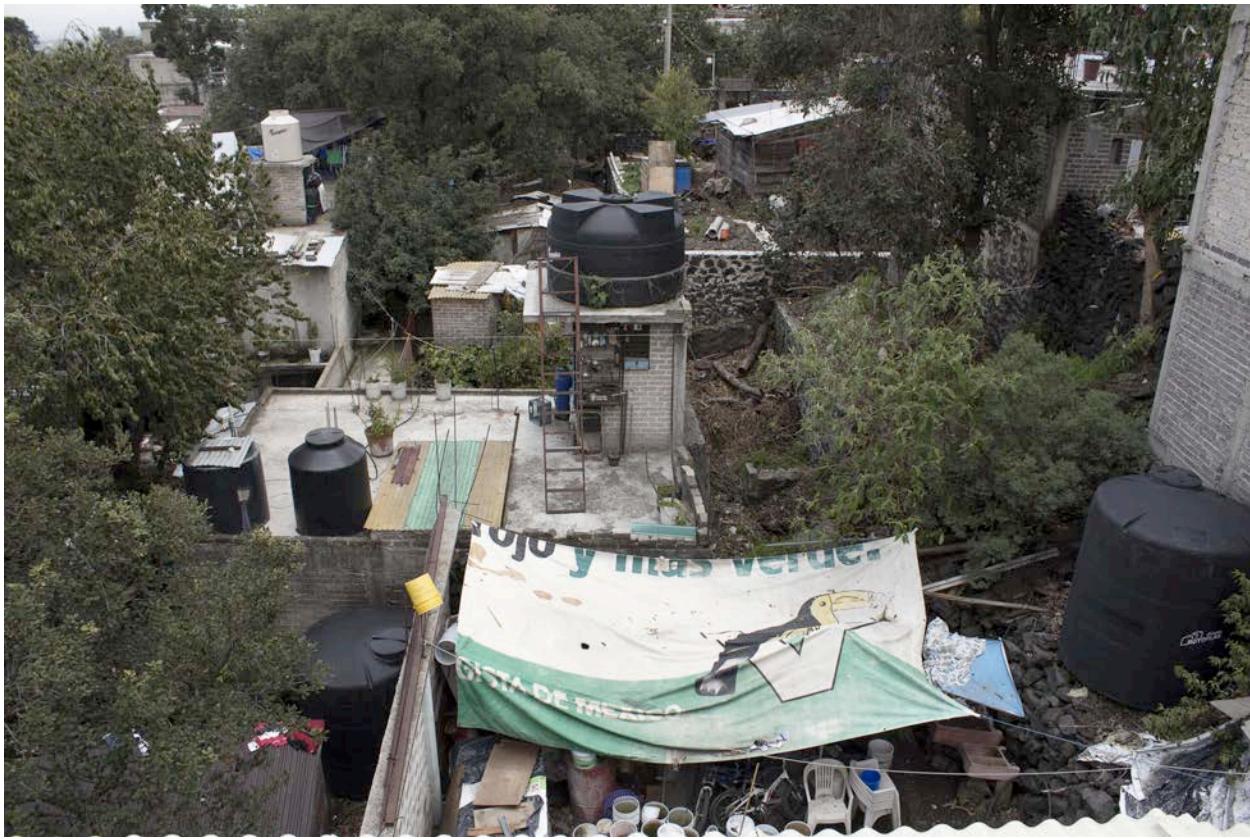
³¹³ Ofelia, interviewed by the author, August 6, 2018.

³¹⁴ Ibid.

³¹⁵ Pedro, interviewed by the author, August 3, 2018.

³¹⁶ Alexis, interviewed by the author, August 2, 2018.

³¹⁷ Ezequiel, interviewed by the author, July 28, 2018.



Rooftops in Bosques del Pedregal. Note the abundance of tanks for water storage, many of which are placed on roofs in order to create water pressure. Photo by the author, 2018.

These experiences seem to confirm the narrative that officials from Tlalpan and Xochimilco conveyed to me. The rainwater harvesting programs provide tangible benefits to users' water consumption, and these successes have restored faith in government among lapsed constituents. Unfortunately, as the next section will show, this narrative is riddled with exceptions. Because rainwater harvesting is only viable for half the year, residents do not see it as a permanent solution to their water problems. Instead, residents feel that the programs are a helpful, but incomplete way for the government to fulfill its obligation to provide water service, and by no means a panacea for resolving their distrust of authorities.

V. “It is a very good support. But does it change my perception?”

Octavio was the lone resident who expressed dissatisfaction with his rainwater harvesting system. The water it produces is “not healthy,” he claimed, because of the city’s bad air and smog, which the system’s filters are unable to clean sufficiently. The *delegación* gave him chlorine pills for disinfection, but the water in his cistern can easily become over-chlorinated when it mixes with water delivered by *pipas*. This water would irritate his skin when he used it to bathe. Because of these issues, Octavio’s family only uses the rainwater they collect for watering plants, flushing toilets, or laundry. Rainwater harvesting is a “bad idea,” he said, because it does not rain all year, and he needs water most during the dry season. It would be better to have a permanent solution to water scarcity that works year-round. I asked Octavio if rainwater harvesting helped him feel more independent at all, despite these challenges. “Well, nothing has changed,” he replied, “because we keep buying water.”³¹⁸

Octavio’s criticisms are a reminder that rainwater harvesting’s benefits have limits. Mexico City only receives rain for half the year, and rainwater harvesting systems are unusable during the dry season. Furthermore, water collected from rain is usually not potable, and users will likely have to continue purchasing *garrafones* for their drinking water. As Octavio said, these issues may complicate rainwater harvesting’s effectiveness at reducing residents’ dependence on current infrastructure and services.

While other respondents’ experiences with rainwater harvesting did not support the notion that it is a “bad idea,” several seemed to agree that the systems are not a permanent solution to water shortages and might not necessarily offer infrastructural “independence.” Jorge

³¹⁸ Octavio, interviewed by the author, August 3, 2018.

expected his system to be very helpful during the heavy rains of summer, but anticipated that the bounty will wear off as the dry season approaches:

“It will be for a time. It is not permanent...I mean, during the rainy season...But it isn’t permanent. So, on the upside, yes it will help us. And outside of that, I mean, in the dry season, well, we know that the water...it runs out, no? So we’re going to have to, well, begin to think about saving water, to not spend a lot on *pipas* as well.”³¹⁹

Alberto did not expect to feel more independent from his erratic piped water service, perhaps only during the summer when his system can harvest rainwater.³²⁰ Pedro described the rainwater harvesting program as a helpful, but incomplete solution. “I mean, half of the problem will still be there,” he said. “Half because the water grid is not complete, and rainwater harvesting is not complete. Because when it doesn’t rain, what are we going to do?”³²¹

Other residents disagreed, and felt that rainwater harvesting had provided or would provide independence from dysfunctional service. Alexis claimed that rainwater harvesting had helped his family feel less reliant on the chaotic service of *pipa* trucks:

“Yes we feel a little more independent, also because, well, we use [the system]. We use it. It is a service that over time will keep helping us. It will keep helping us a lot. If we don’t get [public services] here and all that...we’ll keep having it, for that reason we have to take care of it as well. So that it helps us and provides for us in the future.”³²²

Ofelia expected her system to leave her with similar feelings. “Like, now I’m not going to depend so much on public water,” she said. “Because now I’m going to have rainwater harvesting. It’s going to be a benefit for me. I’m not going to have to leave and go ask [neighbors], ‘Do you have water?’ Why? Because now I will have it.”³²³

However, Ofelia’s positive expectations of rainwater harvesting did not necessarily imply renewed trust in the *delegación*. She remained suspicious that Xochimilco had ulterior motives to

³¹⁹ Jorge, interviewed by the author, July 28, 2018.

³²⁰ Alberto, interviewed by the author, August 15, 2018.

³²¹ Pedro, interviewed by the author, August 3, 2018.

³²² Alexis, interviewed by the author, August 2, 2018.

³²³ Ofelia, interviewed by the author, August 6, 2018.

siphon funds from the program, as I mentioned at the beginning of this chapter. “You saw the way the talks were,” she said. “But while they were talking, I was reflecting on everything they were saying. And I said, ‘There isn’t an easier way for the *delegación* to delude us...to conceal some money.’ And us like donkeys believing it is true.”³²⁴ I pressed her to explain why she kept participating in the program despite these suspicions. “If I participate, it’s because I want a benefit for me. Not for the *delegación*,” she replied. Thus far, she felt that she would benefit from the program, and so she has continued to participate. However, she explained that if she received no benefit or perceived the *delegación* to be taking advantage of her, she would reconsider her involvement:

“If in September they put in the service and I see that it is beneficial FOR ME, what I’m going to do—I’m going to invite my neighbors to come and see the service that I got. Give them the tools to say to them, ‘Go to the *delegación* and ask for it.’ So that they enjoy the same benefit that I’m enjoying. And that’s what is going to happen, it will be affirmative. But if I see that they installed it and I didn’t receive a single benefit, do you think that I’m going to go out and recommend it? Obviously not. It should always be affirmative.”³²⁵

Ofelia’s participation in the program is contingent on the rainwater harvesting system meeting her needs. Just as *defeños* in Wayne Cornelius’ time were willing to tolerate corrupt *caciques* for the sake of receiving services, Ofelia was willing to play along with Xochimilco’s program, despite her suspicions of it, as long as she felt that she was not being duped. I saw no evidence that her claims about the *delegación* were true, nor did I see any suggestion that the rainwater harvesting programs in either municipality functioned according to a clientelist logic. Nonetheless, it was clear that the *delegaciones* used residents’ participation to drum up further support for the programs. Ofelia had attended the *Carpa Azul* event in Xochimilco, where she signed documents and wore a hat and t-shirt that signified her participation in the rainwater

³²⁴ Ibid.

³²⁵ Ibid.

harvesting program. Jorge pointed to the sticker that the *delegación* had placed on his door following his installation. “Yes, they make us political ends and all that,” he said.³²⁶ Yet, it appears that for the time being, accepting hats and stickers from the *delegación* are worthwhile compromises for residents in exchange for the possibility of an augmented water supply.

Still, others shared Ofelia’s continued caution toward the *delegación* despite their satisfaction with the program. Alberto was adamant that his perception of government was unchanged:

“The thing is that I never waited, from my own experience. All our lives we have waited for something from the government and we never get it. I mean, I was skeptical toward the whole government program, right? That everything is achieved by means of gifts or leaders. I mean, of being hard, hard, hard and against the government. I say, it was a knowledge that we already had, rainwater harvesting.³²⁷ I mean, yes this...it is a support. I mean, I don’t deny it. It’s a very good support. But does it change my perception? [Laughs] Of course not. I mean, what? Do you think that the authority is going to change for this? That they’ll say, ‘Oh, I gave you this. Now, you have to change...’ No.”³²⁸

Other residents agreed that the rainwater harvesting program alone was not sufficient to change their opinions of local government. “Well, I feel like a lot of things are missing,” Jorge said with a sigh. “On the upside, yes, these are programs that help you, no? Yes, they help you, but many things from the *delegación* are still missing.” In addition to better piped water and less leaks, Jorge would like to see improvements in neighborhood security and streetlights.³²⁹ Pedro would like to have more reliable piped water as well—to “have water all the time,” as he said. But he feels that he is ignored by the *delegación* whenever he goes to voice a concern or complaint individually. Curiously, he doubted that rainwater harvesting would improve government accountability for water provision. “[When it does not rain] who are we going to make demands

³²⁶ Jorge, interviewed by the author, July 28, 2018.

³²⁷ Alberto, interviewed by the author, August 15, 2018; Alberto explained that he and his family had been harvesting rain since he was a child to cope with their water deficit. Although, he said that Isla Urbana’s system will make the practice much easier.

³²⁸ Ibid.

³²⁹ Jorge, interviewed by the author, July 28, 2018.

of?” he asked. “Of no one. But what we are paying for, we can make demands of. To say, ‘Why aren’t you giving me water? But you are charging me!’”³³⁰

San Nicolás II might not achieve improvements until the community completes the regularization process. Yet, residents’ desire for a more responsive municipal government was palpable. “What we would like to see is that they involve themselves more with the people, no?” Alexis told me. “That they ask. That they don’t only do what they [pause]...that they have the opinion of the people, no?” Making constant demands of the *delegación* can grow tiring, he added, even if projects are eventually completed. Furthermore, Alexis sees piped water as a crucial improvement. “Yes, we need it,” he said, “To have water daily...and pay for it, no? But then it would be more accessible than waiting 15 or 20 days to have it.”³³¹ Octavio was also eager to see pipes arrive in the *colonia*. However, he was doubtful that city or municipal government would ever get around to the project, and wondered whether the *delegación* pursued rainwater harvesting so that “the people will not complain so much about the lack of water.”³³² As noted previously, San Nicolás II will likely have to complete its land regularization process in order to receive piped water. It is unclear which stage in that process the *colonia* is currently in. While Alexis seemed to think that piped water would arrive before land tenure, he described both as important milestones that would bring the community more benefits:

“Well, I feel that [piped water] would give us, like, more priority. Because, I’d say that since we are a *colonia* that just started [about 25 years ago], not many years ago, it will be a little more important to have it and have more accessibility...to other things. Like that’s important. I feel that it is important to have drainage. Because the government would take you into account. Papers would come in. Then we would be...we would be a *colonia* where...where several things, several services would enter.”³³³

³³⁰ Pedro, interviewed by the author, August 3, 2018.

³³¹ Alexis, interviewed by the author, August 2, 2018.

³³² Octavio, interviewed by the author, August 3, 2018.

³³³ Alexis, interviewed by the author, August 2, 2018.

Quite obviously, rainwater harvesting cannot fully meet all of the needs and demands that respondents mention. Despite their satisfaction with Tlalpan and Xochimilco's programs, and a few successes using the systems, residents did not feel that rainwater harvesting was a cure-all solution to their ongoing struggle with water service and their misgivings with government that have resulted. Respondents mainly pointed to the fact that rainwater harvesting is only viable for half the year, and they were aware that it might not cover all of their needs—like drinking water. Overall, residents described the systems as supplements to the water service that they already have—"helpful" devices that come in handy when they lack water—rather than primary sources of water. While some residents felt less dependent on pipes and *pipa* trucks on account of rainwater harvesting, or expected to feel this way, they still maintained that the government had an obligation to improve conventional water infrastructure.

As Enrique said previously, Isla Urbana's systems are not intended to supplant state water infrastructure, but provide a buttress against erratic water service.³³⁴ Nonetheless, residents' perspectives and experiences with rainwater harvesting presented in this chapter offer substantial caution to the narrative conveyed by municipal officials from Tlalpan and Xochimilco that their programs have helped create a more trusting relationship between constituents and the government. The programs have certainly fostered improvement on this front, but not enough to make up for a deficit of trust created by years of lagging water service. Meanwhile, the enthusiasm and "trust" that municipal officials observe may simply be performances by their constituents in order to acquire perceived benefits, as Ofelia's testimony indicates. It seems clear that in order for city and municipal governments to genuinely earn residents' trust, they will have to provide a higher standard of water service that residents expect

³³⁴ Enrique explained Isla Urbana's goal of creating "alternative infrastructure" in a conversation with the author on July 16, 2018; Enrique Lomnitz, interviewed by the author, August 14, 2018; Enrique Lomnitz, interviewed by the author, August 24, 2018.

in return for paying taxes and bills. Despite rainwater harvesting's advantages, it is unclear that the systems can meet that standard.

VI. Conclusion—Persisting needs

In the year 2000, Octavio moved back to Mexico City after spending 14 years in the United States. He had been living in Chicago, where he worked at a restaurant and bar. He was undocumented in the US, but spoke fondly of his time there and said that his decision to return to Mexico was difficult. He had made money and enjoyed the “way of life” in the United States. Unlike Mexico, he said, there was plenty of work, children were never denied a space in school, and the justice system punished criminals instead of letting them go. Octavio recalled having reliable water service as well. “In the United States,” he said, “you pay water, you pay light, you pay gas. But you know that you have it. And you don’t have to wait like here...during the time I lived in the United States I never had this problem...because I paid, the bill arrived, and I paid it, and they never cut my water off. I never had to wait 15, 20 days for water to arrive.”³³⁵

Sensing irony, I reminded Octavio that he also had no legal rights in the United States, and was liable to be deported at any time. I asked him whether this reality still made life in the US preferable to Mexico. The threat of deportation is greater today than it was back then, he responded, and when you try the food at two restaurants and you prefer the food at the second, why would you go back to eat at the first?³³⁶

Octavio's expectations of government have remarkable similarity to those of *defeños* during the 20th century discussed in chapter 1. He expects to receive services in return for what he pays. As long as the services function, he is not only content, but willing to overlook government behavior he might consider to be exploitative, unfair, or corrupt—all of which may

³³⁵ Octavio, interviewed by the author, August 3, 2018.

³³⁶ Octavio, interviewed by the author, August 3, 2018.

marginalize him further. During the 20th century, city residents tolerated political and social control by the PRI. In Octavio's scenario, he seemed willing to tolerate an "alien" status as long as the government meets his needs.

The viewpoints of residents described in this chapter demonstrate that water service is still understood as a need that government actors are obligated to fulfill. The rainwater harvesting programs are best understood within this arrangement—they provide systems that help meet these needs, but not to the full extent that residents expect of government water service. Yet, the municipal programs are not the only way in which *defeños* can acquire rainwater harvesting systems. The next chapter will explore how rainwater harvesting impacts unserviced informal communities who acquire systems independently of the government.

Chapter 3: Harvesting Autonomy in Informal Settlements

I. *A glimpse of autonomy*

“This is the water!” Elena exclaimed. She scurried back to the living room from the kitchen and excitedly set the glass down on the table in front of me.

“Wow, it looks pretty clean,” I responded. I was not exaggerating. Specks of distant sunlight shimmered in the translucent liquid, whose unblemished appearance belied the fact that it had been collected from rainfall in a city notorious for its air pollution. For the past few years, Elena and her husband, Antonio, have relied on Isla Urbana’s rainwater harvesting system to meet a substantial portion of their family’s water needs. In their kitchen, another set of filters that they recently obtained purifies the rainwater to a quality suitable for drinking. They’ve done tests, Elena told me, and the quality is consistently excellent.³³⁷

In truth, the clean water contained in the glass offers Elena and Antonio much more than just good health. It affords them some sense of security in a home that lacks legal land tenure and access to piped water service, while saving valuable time and money. The family’s home is in Santa Rosa, a small settlement within Xochimilco’s conservation zone that sits in a rolling mountain valley alongside a rural highway. Elena, Antonio, and their young children settled their land in the early 2010s without any kind of purchase.³³⁸ The growing family had become too big for their small house in San Gregorio Atlapulco, an urbanized town several miles down the valley from their new parcel. They had to build a home from scratch on the mountainside and buy all the materials themselves, but they found relief from the cramped conditions in which they had been living. Yet, accessing water was a major challenge for the family. They were ineligible

³³⁷ Elena and Antonio, interviewed by the author, Xochimilco, CDMX, Mexico, August 24, 2018.

³³⁸ Ibid.

for piped water service because they lacked legal land tenure.³³⁹ They narrowly missed an opportunity to register in the census, which they claim would have given them access to subsidized *pipa* service from the Xochimilco *delegación*.³⁴⁰ The full cost of purchasing *pipas* from the *delegación*, they said, would have been unaffordable.³⁴¹ So, they would make trips down to a pump in San Gregorio, fill up a half-dozen or so 19-liter jugs with water, and either hire a taxi to bring them home or haul the jugs back uphill themselves in a cart. It was tiresome work, but they had few other avenues to meet their household needs.

When Elena and Antonio connected with Isla Urbana through mutual acquaintances, their fortunes began to change. Rainwater harvesting quickly became a way to alleviate the cost and anxiety they had to endure in order to access water. Today, the family relies entirely on rainwater during the rainy season—including for drinking—and only purchases their water during the dry season. They developed a friendship with Isla Urbana team members, and have helped spread word about rainwater harvesting among their neighbors. Furthermore, both Elena and Antonio expressed a desire to expand the storage capacity in their homes so that they can use rainwater harvesting year-round. Not only is rainwater harvesting a great help to them, the couple said, but an environmentally friendly practice that will reduce stress on the city’s aquifer and will be important to continue in the future.³⁴²

Other residents of informal communities in the conservation zone whom I spoke to had similar experiences with Isla Urbana’s rainwater harvesting system. I found their stories striking and intriguing. Until I began actively working in informal settlements, San Nicolás II had been the only community I had visited that lacked legal land tenure. There, as described in the

³³⁹ LADF, Art. 50.

³⁴⁰ Elena and Antonio, interviewed by the author, August 24, 2018..

³⁴¹ Ibid.

³⁴² Ibid.

previous chapter, residents were eager for the regularization process to be completed and piped water to be installed. They appreciated rainwater harvesting, for the most part, but did not regard it as a primary source of water.³⁴³ As I began to visit three other informal settlements in Tlalpan and Xochimilco, however, I was surprised by how differently their residents described the role of rainwater harvesting in their lives. For many, rainwater harvesting had become their main source of water, even into the dry season. They were enthusiastic about the time and money they saved, as well as the stress they relieved. They spoke passionately about the importance of conserving water, and praised Isla Urbana's work. Most interesting of all, they seemed relatively content to continue relying on rainwater harvesting, instead of seeking other sources.

This chapter will show how rainwater harvesting has a pronounced effect on the lives of informal residents within Mexico City's conservation zone. Unlike San Nicolás II, the informal areas discussed in this chapter are generally less densely urbanized and more recently settled. Regularization is likely a distant prospect, meaning that piped water service cannot be expected for quite some time. These areas are ineligible for rainwater harvesting programs run by the *delegaciones* on account of their land tenure status as well. However, Isla Urbana has installed rainwater harvesting systems in informal settlements independently of the *delegaciones* through privately funded projects. The success of these projects has lifted the burden of water access in these communities, as indicated above. Yet residents' satisfaction has meant that they do not see an urgent need to demand water service from government authorities. They still depend on the government for some services, and hope that one day they can receive legal land tenure and even piped water. However, rainwater harvesting has introduced residents to the possibility that they do not have to rely on government authorities for water. The long-term effects of residents'

³⁴³ Octavio, interviewed by the author, August 3, 2018; Alexis, interviewed by the author, August 2, 2018; Ezequiel, interviewed by the author, July 28, 2018.

newfound autonomy, and whether it impacts the expectation of water service as a government obligation that has shaped state-society relations for over a century, are yet to be seen.

II. The informal communities of Tlalpan and Xochimilco

As discussed in the previous chapter, communities that lack legal land tenure are ineligible to participate in Tlalpan and Xochimilco's rainwater harvesting programs. Isla Urbana, however, can install systems in informal areas independently of the *delegaciones*. Funding for these projects comes from other sources, often corporate donors like HSBC or Shell.³⁴⁴ Unlike the *delegaciones*' programs, beneficiaries of private projects have to pay some part of the cost themselves, but not the full amount. Elena and Antonio paid 3050 *pesos* (about \$150 US dollars) for a 5000-liter cistern, a *tlaloque*, a pump, and two filters. If they had paid the full cost, they said that the cistern alone would have cost them 8000 *pesos*.³⁴⁵ Jesús, a resident of Huacahuasco, another informal community in Xochimilco, said that he also paid 3050 *pesos* for the same kit.³⁴⁶ Participation in these projects is voluntary, but Isla Urbana typically needs a certain number of neighbors to agree to take part. For instance, Elena and Antonio had to find four other people to participate in their community project.³⁴⁷ For some residents, however, the cost of a system may be more than they are willing to pay. I spoke to one woman in Huacahuasco who collects rainwater in buckets for her household needs, but said that she decided not to acquire one of Isla Urbana's systems because she thought they were too expensive.³⁴⁸

I visited a total of three informal settlements while researching this chapter—Huacahuasco, Ahuayoto, and Santa Rosa. These communities generally have a more rural

³⁴⁴ Enrique Lomnitz, interviewed by the author, August 14, 2018; "Isla Urbana - Diagrama de Colaboraciones," Isla Urbana, accessed March 1, 2019, <http://islaurbana.org/isla-urbana/>.

³⁴⁵ Elena and Antonio, interviewed by the author, August 24, 2018.

³⁴⁶ Jesús, interviewed by the author, Xochimilco, CDMX, Mexico, August 15, 2018.

³⁴⁷ Elena and Antonio, interviewed by the author, Xochimilco, CDMX, Mexico, August 24, 2018.

³⁴⁸ The woman told this to the author in a conversation during a research visit to Huacahuasco on August 20, 2018.

character than consolidated neighborhoods like San Nicolás II, in the sense that they are surrounded by green space and sit at a distance from other settlements. At least one of these settlements—Ahuayoto—was being monitored by the Tlalpan *delegación* as of their most recent urban plan in 2010.³⁴⁹ The other two settlements’ legal statuses were much more ambiguous—only part of Huacahuasco seems to be monitored, while Santa Rosa does not appear on Xochimilco’s plan at all.³⁵⁰ Regularization seems unlikely in the immediate future, and all three communities lack piped water.³⁵¹ Yet, as I noted in chapter 1, the legal ambiguity surrounding *pipa* service means that tanker trucks from the *delegaciones* deliver water to at least some of these communities.³⁵² If residents cannot access or afford *pipas*, like Elena and Antonio, they will have to look to other sources for their water.

Huacahuasco was the first informal settlement that I visited outside of San Nicolás II. It is located in a mountain pass south of Xochimilco’s urban area, alongside a highway that leads to the rural town of San Miguel Topilejo. During the height of the rainy season, the surrounding vista is quite verdant—a mix of scrubby vegetation and agricultural fields immediately surround the settlement, and some forested areas can be seen in the distance. The settlement’s gated core is neatly laid out and orderly. Streets are partially paved, vegetation is largely trimmed and manicured, and houses and lots are evenly spaced. This is likely one of the older parts of the settlement. While exploring this consolidated area, I met Tania, who runs a school supply store in front of her house, after I saw that she had a rainwater harvesting system and decided to introduce myself. She has lived on her property since her parents purchased the land over 30

³⁴⁹ Programa Delegacional [...] Tlalpan, p. 57; SEDUVI, “Delegación Tlalpan – Plano de Divulgación.”

³⁵⁰ Programa Delegacional [...] Xochimilco, p. 154; Secretaría de Desarrollo Urbano y Vivienda, “Delegación Xochimilco – Plano de Divulgación.”

³⁵¹ LADF, Art. 50.

³⁵² Enrique Lomnitz, interviewed by the author, August 14, 2018; Sandra, interviewed by the author, August 27, 2018; Roberta and Leo, interviewed by the author, August 13, 2018; Programa Delegacional [...] Tlalpan, p. 162.



A mural painted by Isla Urbana in Huacahuasco as part of the *Carpa Azul* program. Photo by the author, 2018.

years ago and moved the family there from the center of Mexico City. Initially, they carried water from a distant well one hour away using a cart or donkey. For the past 8 years or so, they have purchased water from private vendors who cruise the neighborhood in pickup trucks. She said that *pipas* from the *delegación* generally do not service Huacahuasco, but they do provide water to another nearby *colonia*.³⁵³ Huacahuasco's consolidated core appears on Xochimilco's 2005 urban plan as a "rural and agricultural production area" with "very low-density rural habitation."³⁵⁴ The plan explains this classification to mean a "rural area where their predominant activity is impacted by the use of housing" that will be subject to a "specific study" and other

³⁵³ Tania, interviewed by the author, August 15, 2018.

³⁵⁴ Programa Delegacional [...] Xochimilco, p. 85; SEDUVI, "Delegación Xochimilco – Plano de Divulgación."

urban and environmental studies.³⁵⁵ In other words, regularization and the consequent provision of services are a possibility pending the result of these studies, but the process will take longer than in a “special regulation” settlement like San Nicolás II.³⁵⁶ It was unclear whether this status has changed since the plan was published in 2005, but Tania said that she still had not received legal land tenure.³⁵⁷

Settlement in Huacahuasco appears to have spread beyond the area that Xochimilco designated for a “specific study” in 2005. Jesús moved to the settlement in February 2015 after building a small home on a piece of land he acquired next to the highway, outside of Huacahuasco’s core.³⁵⁸ I met him almost immediately after I arrived in the *colonia*. He was landscaping in his front yard and I saw that he had one of Isla Urbana’s systems, so we struck up a conversation that quickly became an interview. Until he obtained a rainwater harvesting system, Jesús said, he relied mainly on the same private water vendors that Tania described.³⁵⁹ He insisted that the area was undergoing a “process” to see whether it could be regularized, which may have referred to the “specific study” mentioned above.³⁶⁰ Yet, unless the 2005 plan has been updated, it is unclear whether Jesús’ property would be included in the study. The polygon indicated as a “specific study” area does not seem to include the place where his house is located. Instead, his property appears to sit on land designated for “ecological protection” where human settlement is prohibited.³⁶¹ Furthermore, “specific studies” can elect to ultimately exclude certain areas of the polygon from regularization, and the *delegaciones* generally favor

³⁵⁵ Programa Delegacional [...] Xochimilco, p. 85.

³⁵⁶ Wigle, “The ‘Graying’ of ‘Green’ Zones,” 580–81; Wigle, “The ‘Xochimilco Model’,” 343-44.

³⁵⁷ Tania, interviewed by the author, August 15, 2018.

³⁵⁸ Jesús, interviewed by the author, August 15, 2018.

³⁵⁹ Ibid.

³⁶⁰ Ibid.

³⁶¹ Programa Delegacional [...] Xochimilco, p. 85; SEDUVI, “Delegación Xochimilco – Plano de Divulgación.”

older settlements.³⁶² In sum, it is unclear whether Huachucasco's peripheral properties, like Jesús' home, are currently eligible for regularization, nor is it definitely clear which sections of Huacahuasco would be given land tenure should regularization arrive. For homes that fall outside of the "specific study" area, however, the path to legal land tenure and government services would be far more uncertain.³⁶³

I have already described Santa Rosa, where Elena and Antonio live, but it is worthwhile to add a few more details. I was introduced to the couple through Jennifer White, Isla Urbana's Community Relations Coordinator, and arranged a date to meet them at their home. Santa Rosa is small—perhaps 15 or 20 other households. It is not densely settled either, and there is ample green space surrounding their home. Xochimilco's 2005 plan indicates that Santa Rosa is built in an area designated for "rural and agricultural production," meaning that the land is supposed to be for agricultural use and not for housing.³⁶⁴

The final informal settlement that I visited was Ahuayoto, located within Tlalpan's conservation zone. Ahuayoto's legal status is somewhat complex. The settlement is located just outside of the town of Santo Tomás Ajusco, a *pueblo originario* ("original town"). The capital territory has about 150 *pueblos*, which trace their origins back to the pre-Colombian era.³⁶⁵ These villages are not necessarily indigenous communities—Nahuatl (the language of the Aztecs) is hardly spoken and traditional farming practices have been abandoned—but natives (*nativos*) honor their indigenous origins through festivals, religious ceremonies, and other cultural

³⁶² Wigle, "The 'Xochimilco Model,'" 343–44; Wigle, "The 'Graying' of 'Green' Zones," 580; Connolly and Wigle, "(Re)Constructing Informality," 191–93.

³⁶³ Wigle, "The 'Xochimilco Model,'" 343–44; Wigle, "The 'Graying' of 'Green' Zones," 580; Connolly and Wigle, "(Re)Constructing Informality," 191–93.

³⁶⁴ Programa Delegacional [...] Xochimilco, p. 84–85; SEDUVI, "Delegación Xochimilco – Plano de Divulgación."

³⁶⁵ Hagene, "Everyday Political Practices," 211.

practices.³⁶⁶ The right to communal property, which the *pueblos* had traditionally practiced, was lost in 1856, but restored under Mexico's 1917 constitution following the Mexican Revolution.³⁶⁷ In general, there are two forms of communal land: *ejidos*, which have been discussed previously, and *bienes comunales*. Ahuayoto is built on land purchased from *comuneros* (holders of the *bienes comunales*).³⁶⁸ Most of its residents are not natives of Santo Tomás, but outsiders, referred to as *avecindados*, looking for an affordable place to live.³⁶⁹

Miguel was the first Ahuayoto resident I met, again through an introduction from Jennifer White. He moved to the settlement with his family in 2013. Miguel and his wife are biologists—Miguel works for the federal government—and in part they wanted to leave the city in order to live closer to nature. Yet needs also drove their relocation. The city was expensive, and the family lived in a small, 60 square meter home owned by Miguel's parents. Ahuayoto offered them an affordable place to buy property with more space.³⁷⁰ Miguel also introduced me to his next-door neighbor, Yesenia, who moved to the settlement around 2009. She had been living in an urban neighborhood of north-central Mexico City, near the border with the State of Mexico. She separated from her husband and sought a divorce, but the judge said that he could not process the request until she moved out of the house. She considered moving to Pachuca, the capital of the state of Hidalgo, northeast of Mexico City. However, Ahuayoto's affordable property allowed her to stay within Mexico City proper. This was important, she told me,

³⁶⁶ Ibid, 211; Mario Ortega Olivares, "Pueblos originarios, autoridades locales y autonomía al sur del Distrito Federal," *Nueva Antropología: Revista de Ciencias Sociales* 23, no. 73 (December 2010): 88.

³⁶⁷ Hagene, "Everyday Political Practices," 212.

³⁶⁸ Miguel, interviewed by the author, Tlalpan, CDMX, Mexico, August 17, 2018; Yesenia, interviewed by the author, Tlalpan, CDMX, Mexico, August 22, 2018.

³⁶⁹ Ibid, 211; Miguel, interviewed by the author, Tlalpan, CDMX, Mexico, August 17, 2018.

³⁷⁰ Miguel, interviewed by the author, August 17, 2018.

because she thought the school choices for her three young children would be far better in Mexico City than in the provinces.³⁷¹

Both Yesenia and Miguel purchased their property from a local *comunero*.³⁷²

Technically, these sales were illegal—reforms in 1992 permitted the private sale of *ejidal* lands but not *bienes comunales*. Still, illegal sales to outsiders are common in *pueblos originarios* as a way for individual *comuneros* to profit.³⁷³ But village natives as a whole tend to frown upon *avecindados*, whose presence they view as a threat to the local way of life.³⁷⁴ The two groups generally experience a tense coexistence, and *avecindados* are usually excluded from social and political functions in the villages.³⁷⁵

Yesenia and Miguel have experienced difficulty with water access, and they blame natives in Santo Tomás Ajusco for it. Both said that the village will not provide them with piped water because they are *avecindados*, and water service is only for native families. Miguel claimed that natives withhold water because they do not want the village to expand, even though their argument contradicts the fact that *comuneros* are the ones selling properties to outsiders.³⁷⁶ He is angered by the fact that the natives decline him services, and said that he feels like a “second-class citizen.”³⁷⁷ Yesenia had similar sentiments. “But I am Mexican!” she said with a laugh. “By virtue of being Mexican we belong to the whole republic. But no. [The natives say] ‘You’re not from here. I won’t give you water.’”³⁷⁸

³⁷¹ Yesenia, interviewed by the author, Tlalpan, CDMX, Mexico, August 22, 2018.

³⁷² Miguel, interviewed by the author, August 17, 2018; Yesenia, interviewed by the author, August 22, 2018.

³⁷³ Hagene, “Everyday Political Practices,” 213, 216.

³⁷⁴ Ortega Olivares, “Pueblos originarios,” 102.

³⁷⁵ Ibid, 102. Hagene, “Everyday Political Practices,” 211–15.

³⁷⁶ Miguel, interviewed by the author, August 17, 2018

³⁷⁷ Ibid.

³⁷⁸ Yesenia, interviewed by the author, August 22, 2018.

In truth, village natives' authority over water service in *avencidado* settlements, as well as land tenure, likely has more of a political basis than a legal one. The *pueblos* elect local authorities, but they have not had a strong legal standing since the creation of the Federal District in 1928 and are subordinated to the *delegación*.³⁷⁹ The most recent version of the Human Settlements Law (2016) clearly establishes that *ejidal* and communal property must comply with state planning norms, in part to prevent the spread of irregular settlements.³⁸⁰ Over the past few decades, PRD politicians have tormented some villages by encouraging *avencidados* to purchase communal land and promising to regularize their property in exchange for votes.³⁸¹ Research indicates that village authorities have some authority under the auspices of Agrarian Law to prosecute *comuneros* who sell land illegally.³⁸² Buyers of illegal land are subject to prosecution through normal civic institutions, even though substantial penalties may never result.³⁸³ Meanwhile, SACMEX provides water to Santo Tomás Ajusco on the *tandeo* rationing system.³⁸⁴ Yet, an incident from the spring of 2017 illustrates how natives of the village may assert control over water service. After villagers spotted workers and equipment from the Tlalpan *delegación* who appeared to be installing new water pipes, they became enraged and demanded to know why the project was taking place and where the new pipes would be going.³⁸⁵ Protests escalated and some reports indicated that angry villagers kidnapped water workers.³⁸⁶ After weeks of lengthy

³⁷⁹ Ortega Olivares, "Pueblos originarios."

³⁸⁰ LGAHOTDU, Art. 61-63.

³⁸¹ Hagene, "Everyday Political Practices," 213.

³⁸² Ibid, 212.

³⁸³ Ibid, 212.

³⁸⁴ Resolución de las Zonas que Reciben el Servicio de Agua por Tandeo [Resolution of the Areas that Receive Water Service through Tandeo], Gaceta Oficial de la Ciudad de México [GOCDMX] 23-03-2018.

³⁸⁵ Tenorio, "La guerra por el agua inicia en Santo Tomás Ajusco en Tlalpan," *Periódico LEO* (Mexico City), March 31, 2017, <http://periodicoleo.com/alcaldias/2017/03/31/la-guerra-por-el-agua-inicia-en-santo-toma-ajusco-en-tlalpan/>; Laura Gómez Flores, "Llegan a acuerdos pobladores del Ajusco y delegada," *La Jornada* (Mexico City), April 4, 2017, <https://www.jornada.com.mx/2017/04/04/capital/031n3cap#>.

³⁸⁶ Tenorio, "La guerra por el agua inicia"; Gómez Flores, "Llegan a acuerdos."

dialogue and negotiation with communal officials, the *delegación* was allowed to continue the project, having convinced the village that the secondary lines installed would improve water service.³⁸⁷ Reports did not suggest that this conflict raised legal questions, indicating instead that it was simply a matter of the *delegación* assuring the *pueblo* that they were not “taking the water elsewhere.”³⁸⁸ Thus, the *pueblo*’s authority over water service that Miguel and Yesenia perceive likely reflects villagers’ political sway and sensitivity to new infrastructural development. The *delegación* and SACMEX clearly administer water, but villagers can influence where it goes.

Regardless of Santo Tomás’ political realities, Ahuayoto is legally ineligible for piped water because it is an informal settlement.³⁸⁹ The community appears on Tlalpan’s 2010 urban plan as a settlement “subject to diagnosis,” meaning that the regularization committee will decide if they will be approved for a “specific study” or if the settlers will have to be relocated.³⁹⁰ As with other informal communities I visited, it was unclear whether this status had changed, but regularization is likely a long way off.³⁹¹

Until they discovered rainwater harvesting, Miguel and Yesenia both relied on *pipas* as their primary source of water. Miguel was able to obtain a card from the *delegación* for subsidized service after presenting an array of documents—his voter register card, a map of his home’s location, and his sales contract from the purchase of his property.³⁹² The subsidy provides him with one 8000-liter *pipa* per month at a cost of 100 *pesos*. Yesenia has not been

³⁸⁷ Eduardo Hernández, “Tlalpan reinicia obras de distribución de agua en Santo Tomás y San Miguel Ajusco,” *El Universal* (Mexico City), May 19, 2017,

<https://www.eluniversal.com.mx/articulo/metropoli/cdmx/2017/05/19/tlalpan-reinicia-obra-de-distribucion-de-agua-en-santo-tomas-y>; Flores, “Llegan a acuerdos.”

³⁸⁸ Gómez Flores, “Llegan a acuerdos”; Hernández, “Tlalpan reinicia obras de distribución.”

³⁸⁹ LADF, Art. 50.

³⁹⁰ Programa Delegacional [...] Tlalpan, p. 56, 136; SEDUVI, “Delegación Tlalpan – Plano de Divulgación.”

³⁹¹ Connolly and Wigle, “(Re)Constructing Informality,” 192–95; Wigle, “The ‘Graying’ of ‘Green’ Zones,” 580–81.

³⁹² Miguel, interviewed by the author, August 17, 2018; Miguel received a sales contract from his purchase, but he did not receive a property title.

able to receive the subsidy. “[The Tlalpan delegación] always said, ‘No it can’t be given. It’s *this*. It’s *that*,’” she explained. “So they always put up obstacles for one thing or another.” She has to pay the full cost of a *pipa* delivery, about 800 *pesos*. Both Miguel and Yesenia also said that they practiced rudimentary rainwater harvesting during their initial years in Ahuayoto. They would each collect rainfall from their roofs using buckets in order to supplement their supply.³⁹³ “Buckets, tins, everything we could to collect some rainwater,” Yesenia said. “For the bathroom and everything.”³⁹⁴

In sum, residents of the three informal settlements I visited face difficult access to water and an uncertain path to legal land tenure. The reasons for this are diverse depending on the settlement. The next section will explore the factors that have made Isla Urbana’s systems attractive to these residents, and what the consequences of harvesting rain have been.

III. *Half a year of plenty*

All six informal residents with whom I spoke obtained their rainwater harvesting system within the past few years through an Isla Urbana program. Miguel became acquainted with Isla Urbana after his young son befriended Enrique’s niece in kindergarten. When Isla Urbana received funding from HSBC in 2015, Miguel helped organize an installation project in Ahuayoto.³⁹⁵ Yesenia was among the neighbors to benefit from this project and received her system around the same time.³⁹⁶ Elena and Antonio acquired their system around 2015 as well, after about 2 years of obtaining water from other sources.³⁹⁷ In Huacahuasco, Jesús had the good fortune to stumble into a community-wide project with Isla Urbana only one month after he

³⁹³ Miguel, interviewed by the author, August 17, 2018; Yesenia, interviewed by the author, August 22, 2018.

³⁹⁴ Yesenia, interviewed by the author, August 22, 2018.

³⁹⁵ Miguel, interviewed by the author, August 17, 2018; Yesenia, interviewed by the author, August 22, 2018.

³⁹⁶ Yesenia, interviewed by the author, August 22, 2018.

³⁹⁷ Elena and Antonio, interviewed by the author, August 24, 2018.

began living there in February 2015.³⁹⁸ Tania, meanwhile, received her system around 2017 after hearing about the project from a neighbor.³⁹⁹

Despite the upfront costs of purchasing a system, all six residents said that, in hindsight, the system pays off economically. All residents have relied on rainwater harvesting as their primary source of water for at least half of the year, meaning that their spending on *pipas* or other sources has drastically reduced. “It is worth it because it isn’t expensive in comparison to what it would really cost,” Antonio said of the systems. His family still has to buy 3 or 4 *pipas* during the dry season, but said that overall they have saved time and money from rainwater harvesting. “Thanks to God we don’t suffer from water,” he added.⁴⁰⁰

The other residents have had similar experiences to Antonio, finding rainwater harvesting to be easy and free of cost. Yesenia relies on rainwater entirely until the rainy season passes. She went from buying 7 *pipas* per year to buying only 3 during the dry season. “I mean, yes really, as I said, we have decreased our spending,” Yesenia explained. “The system has worked very well.”⁴⁰¹ Miguel’s family uses rainwater for everything besides drinking, and only begins to buy *pipas* in November when the dry season is in full swing.⁴⁰² In Huacahuasco, Tania explained that rainwater harvesting has made her life “very easy.” She too said that her need to purchase water has greatly diminished. “I don’t buy water anymore,” she explained. “Basically we provide for ourselves from [the system]...you can invest [the money] in something else.”⁴⁰³ By the time that the rainy season began in June 2015, Jesús was fully dependent on rainwater harvesting. “All

³⁹⁸ Jesús, interviewed by the author, August 15, 2018.

³⁹⁹ Tania, interviewed by the author, August 15, 2018.

⁴⁰⁰ Elena and Antonio, interviewed by the author, August 24, 2018.

⁴⁰¹ Yesenia, interviewed by the author, August 22, 2018.

⁴⁰² Miguel, interviewed by the author, August 17, 2018.

⁴⁰³ Tania, interviewed by the author, August 15, 2018.

those hours of rain, I don't buy water," he said. "I save on that issue of water. Of water expense."⁴⁰⁴

The fact that residents can rely on rainwater for at least half a year is certainly a testament to the efficacy of Isla Urbana's systems. However, it is also a consequence of benevolent rainfall patterns and meticulous rationing by each individual household. As I mentioned in the previous chapter, Tlalpan and Xochimilco fall within the雨iest sections of Mexico City, especially areas that are at high elevations within the mountains.⁴⁰⁵ Ahuayoto is one of those areas. "Here, the truth is that it rains between 50 to 70 percent all year round," Yesenia said, "Here really, it doesn't need to be the rainy season for it to rain. Here, if it wants to rain, it rains." When it rains regularly, she continued, her cistern is always full. Miguel has 3 cisterns in his home with a total capacity of 20,000 liters to catch as much of Ahuayoto's summer deluge as possible.⁴⁰⁶ Elena and Antonio also described how powerful rains fill their tanks and cisterns up with water that lasts them into the dry season. "And then when the rainy season ends and the dry season arrives, well, we have everything filled up," Antonio explained. "And then when a few months pass and it runs out, then we buy a *pipa*. And, well, that has made it easier for us. Yeah, now we don't run around looking for water and all that." Yet, they also said that they have to ration their usage carefully during the dry season, in order to reduce the amount they will spend on purchasing water. "I have to take care of [water] because if it runs out, it affects my wallet," Antonio continued, "because I would have to buy more water."⁴⁰⁷

⁴⁰⁴ Jesús, interviewed by the author, August 15, 2018.

⁴⁰⁵ Instituto Nacional de Estadística y Geografía [INEGI], *Anuario Estadístico y Geográfico de La Ciudad de México 2017* (Mexico City: INEGI, 2017), 22–23, 34, <https://www.inegi.org.mx/app/biblioteca/ficha.html?upc=702825094683>.

⁴⁰⁶ Miguel, interviewed by the author, August 17, 2018.

⁴⁰⁷ Elena and Antonio, interviewed by the author, August 24, 2018.



Ahuayoto during a heavy rainstorm. The peak on the left is Ajusco Peak, the highest point in the city's territory at over 12,000 feet. Photo by the author, 2018

In Huacahuasco, Jesús said that he carefully rations and recycles his water by using greywater from his washing machine to flush toilets, among other things. He tries to make his water last as long as possible, and said that usually he does not need to buy water again until mid-February, several months into the dry season. He admitted that he is aided by the fact that he lives alone, and that there would be more stress on his water supply if he lived with others. Nonetheless, he said, his approach to water consumption is entirely different than it was in his

previous residence—a rental property in the urban *delegación* of Coyoacán near Azteca Stadium that had access to running tap water. He is now far more conscious of how much water he is using, and seeking ways to reduce his consumption.⁴⁰⁸ For Tania, however, rainwater harvesting’s success has made her less worried about her water supply, because she has a reliable source to bring water right to her home. “Now you’re not watching to see when it will run out, right?” Tania told me, “Or if there’s water or not. You use it. You take advantage of it. You do everything you have to do having water right there.”⁴⁰⁹

Informal residents’ experiences with rainwater harvesting contrast sharply with those of the participants in the *delegaciones*’ rainwater harvesting programs discussed in the last chapter. Informal residents do not see rainwater harvesting systems as a supplemental water source, but a primary water source for at least half the year. The next section will further reveal how the systems’ success at meeting informal household water needs has sparked a wholesale embrace of rainwater harvesting among residents I spoke to. Having met these needs, residents see less of a reason for recourse to government officials for service improvements.

IV. “*The truth is that I’m fine*”

Despite the fact that regularization is likely not an immediate possibility in Ahuayoto, Huacahuasco, and Santa Rosa, residents expressed a desire to see their communities attain legal land tenure. In January 2017, Jesús and other Huacahuasco residents participated in the rally in the center of Mexico City I described in chapter 1, in which political leaders from Xochimilco demanded that the city’s forthcoming constitution include measures for property regularization.⁴¹⁰ For Jesús, possessing legal land tenure is a matter of security and stability. “I

⁴⁰⁸ Jesús, interviewed by the author, August 15, 2018.

⁴⁰⁹ Tania, interviewed by the author, August 15, 2018.

⁴¹⁰ Stettin, “Piden a Constituyentes Regular Asentamientos En Xochimilco.”

mean, I would just like to feel a bit more relaxed that no one will come to take away what has cost you so much to make,” he explained. “If you regularize the *colonia*, then, well, it leaves me alone and I will have my property title. I will have all the benefits we need here, which is a lot that we lack. All of this logically benefits me.”⁴¹¹

Tania, whose mother participated in the same 2017 demonstration, felt that regularization would bring improved services to the community:

“Well I think that everyone’s looking for that improvement in the *colonia*. It’s that with...the change of land use we’d have more help. More government help, right? For example, we have made all these streets. I mean, we have to work. Put in the material and work so that our streets are there. So if we had a change in the land use, the government would have to come and pave the streets. Or give us services for light, water, telephone, everything.”⁴¹²

Elena and Antonio also felt that regularization would bring improved services. Specifically, they would like to see piped water service, or at least more *pipas*. “We all have rights to these things,” Elena declared. “Just as we have a right to light, we have a right to water. We have rights to urban services. And just because we live up here doesn’t mean we have no rights. We have the same rights as those who live down there [in the city].”⁴¹³

For the time being, however, rainwater harvesting’s ability to meet residents’ water needs has diluted their sense of urgency to realize improved water services. Tania admitted as much when I spoke with her:

“I mean, we do want to keep improving, but [rainwater harvesting] changes your perspective, right? You’re no longer waiting for the government to give you a solution. Basically, everyone is looking for a way to get better. Yes, it changes because, now that I have [rainwater harvesting], now we look for a temporary solution or a solution, now you don’t have that urgency, right? Or that...that necessity to go and demand something of the government. Yes, yes it changes.”⁴¹⁴

⁴¹¹ Jesús, interviewed by the author, August 15, 2018.

⁴¹² Tania, interviewed by the author, August 15, 2018.

⁴¹³ Elena and Antonio, interviewed by the author, August 24, 2018.

⁴¹⁴ Tania, interviewed by the author, August 15, 2018.

Miguel agreed, claiming that rainwater harvesting reveals the possibility that residents do not have to look to the government for their water. “When you know that you’re going to need something and you can get it in a different way,” he said, “you begin to change your way of life to provide for yourself through those means.”⁴¹⁵

Jesús felt that rainwater harvesting lowered the stakes of the 2017 protest. “Either way we would still be protesting on the issue that they know to pay attention to us,” he said, “But it will cost us much more, no? Because if I didn’t have rainwater harvesting, well it would be more costly than what it is these days.”⁴¹⁶

Yesenia doubted that village natives in Santo Tomás Ajusco would ever allow piped water to be installed in Ahuayoto, or legal land tenure to be granted. She said that she would like the Tlalpan *delegación* to improve *pipa* delivery, but is reluctant to make “face-to-face” contact with officials because she feels that they have ignored her in the past. When I spoke to her, she said that rainwater harvesting has left her feeling satisfied. “I think for the moment I am content,” she said. “I mean, we really aren’t low on water anymore.”⁴¹⁷ Later on, she reiterated that she does not feel a need to make demands of any authority:

“No. I believe at this point, no. I don’t think so. I am doing very well with rainwater harvesting. I’d neither ask nor demand much else. I mean, as I said to you, if they come to tell us, ‘Guess what? They’re going to install pipes.’ Well I’d say, ‘Well, that’s fine. That’s good, isn’t it?’ But if not, then no. Because if...with the rainwater harvesting system, well, the truth is that I’m fine.”⁴¹⁸

Rainwater harvesting’s success at meeting household needs was not the only reason for residents’ ambivalence toward seeking improved water service from the government. Many residents I spoke to cited environmental concerns, and said that rainwater harvesting was a vital

⁴¹⁵ Miguel, interviewed by the author, August 17, 2018.

⁴¹⁶ Jesús, interviewed by the author, August 15, 2018.

⁴¹⁷ Yesenia, interviewed by the author, August 22, 2018.

⁴¹⁸ Ibid.

practice for the survival of the city's water supply. Miguel is a dedicated environmentalist, and in his spare time runs a community center out of his garage that provides environmental education programs for local children. He said that he would not like to have piped water, and instead he is focused on trying to increase his storage capacity so that he can capture enough rainwater to last a whole year. He would still like to see Ahuayoto receive legal land tenure so that other services may be improved and he can get a property title. However, he said that there is too much economic and environmental cost incurred to bring water up to a high-altitude community like his, and he thinks that more effort should go in to pursuing rainwater harvesting and other sustainable practices.⁴¹⁹

Other residents similarly felt that if regularization and improved services ever arrived, it would not weaken their resolve to continue harvesting rain and rationing water usage. “We have [rainwater harvesting], it has helped us a ton,” Elena explained. “But yes, if piped water came, then that too. But also...as we said before we have to be conscious, right? Although we would have piped water, save it, right? Take care of it.” Jesús stubbornly insisted that community improvements would not change his current practices either. “Sure, I would like to see [Huacahuasco] regularized,” he said, “but I will keep collecting rainwater. Yes, I would keep doing it. Why? Because this way I am helping out the environment a bit, I’d say. Because sometimes you talk and you don’t do much...”⁴²⁰ Yesenia agreed that she would not stop harvesting rain if pipes were installed, and said that she would like to see others embrace water conservation as well.⁴²¹ “I lived the necessity of having to take care of water,” she said. “So I

⁴¹⁹ Miguel, interviewed by the author, August 17, 2018.

⁴²⁰ Jesús, interviewed by the author, August 15, 2018.

⁴²¹ Yesenia, interviewed by the author, August 22, 2018.

think if everyone from a young age teaches us to care for it, we're not going to have that need at some point. To learn to care for it.”⁴²²

The respondents' emphasis on water conservation was yet another aspect that set them apart from the formal residents discussed in chapter 2. The informal residents whom I spoke to seemed to embrace rainwater harvesting beyond its utilitarian value. Harvesting rain is not simply a useful thing to do, they said, but the right thing to do for the environment. There may be reasons behind this that are fascinating, but perhaps beyond the scope of this chapter.⁴²³ Regardless, residents' environmental concerns only strengthen their affinity for a system that has effectively met their needs for water. As I have demonstrated in this section, residents' satisfaction with rainwater harvesting has left them less in need to look to government officials for improvement. Virtually all residents desire the security and services that legal land tenure would bring, and I do not intend to argue that rainwater harvesting's success renders land regularization unnecessary in any way. Rather, rainwater harvesting appears to have complicated the expectation of water as a state service. The long-term effects of this observation remain to be seen.

V. Conclusion

On the day that I travelled to the center of Tlalpan to speak with Sandra, I arrived to find the *delegación*'s office building blockaded by protestors. Hundreds of people had encamped themselves in dozens of tents that lay scattered across the shady plaza in front of the building. It was clear that they had no intention of leaving anytime soon. The smell of taco meat and *elotes* filled the air, while protestors sat about eating and talking amongst themselves. Posters had been

⁴²² Ibid.

⁴²³ I have considered whether I observed something similar to Pezzoli (1998), who claimed that activists in Bosques del Pedregal in the 1980s promoted sustainable community development plans to try to counter the state's idea that settlers were an environmental threat.

hung around the tents, most of which contained messages specifically directed at Claudia Sheinbaum, the incoming mayor of Mexico City who had served as Tlalpan's *delegado* before her mayoral campaign in 2018. "406 families of scarce resources harmed by Sheinbaum's incompetence," said one poster, "Claudia Sheinbaum does not comply with what she signs," said another.⁴²⁴

Sandra arrived, and explained that the building had been occupied and that the *delegación* was working in a nearby museum for the time being. She said that the protest had occurred because a community had invaded land, and the Tlalpan *delegación* had agreed to grant property rights to a certain number of settlers. However, they had exceeded this established limit, and so a judge ruled that some of these new houses had to be torn down. This decision upset many settlers, and the plaza had now been occupied for 15 days.⁴²⁵

This demonstration serves as a sobering reminder of the legal risks that informal settlements in Mexico City face. It is unclear if or when the residents discussed in this chapter will receive their desired change in land tenure status, and the prospect of forced eviction is a nightmarish possibility for some. The apparent autonomy that rainwater harvesting offers informal residents does not mean that they are more ambivalent towards legal land tenure, that they do not need access to government services, or that they abandon all expectations of government. The city and *delegaciones* have sole authority to resolve land tenure status, and regularization will require continued engagement with the state. Residents discussed in the chapter also enjoy a limited range of state services. The *delegaciones* provide *pipa* deliveries and garbage collection.⁴²⁶ They also have access to electricity provided by the *Federal Electricity*

⁴²⁴ Observations by the author, August 27, 2018.

⁴²⁵ Sandra told this to the author in a conversation on August 27, 2018.

⁴²⁶ Miguel, interviewed by the author, August 17, 2018.; Jesús, interviewed by the author, August 15, 2018; Yesenia, interviewed by the author, August 22, 2018.

Commission—although it was unclear whether they had formal metered service or an illegal hookup.⁴²⁷ Residents hope to improve their access to these services, and feel that regularization would be an important step toward that end.⁴²⁸ Finally, residents I spoke to maintained expectations of the government to provide services, including water. Miguel and Yesenia expected services in return for taxes and fees they pay.⁴²⁹ Elena, Antonio, and Jesús claimed that services were “human rights.”⁴³⁰ Tania said that the government should help needy communities like Huacahuasco.⁴³¹ Success with rainwater harvesting does not seem to have altered any of these beliefs.

Instead, the apparent autonomy that residents have experienced from rainwater harvesting has shown them the possibility that water does not *have* to be a state service. As this chapter has shown, Isla Urbana’s systems offer informal residents an effective means to obtain water independently of government infrastructure and actors. Having found an easier path to meet their needs, residents feel less urgency to demand improved water service from the state. It is too soon to say whether this means that residents no longer *expect* the government to provide water—at the moment, this does not seem to be the case. Nonetheless, residents’ reliance on rainwater harvesting for at least half of each year offers a glimpse of an alternative arrangement to the nexus of needs and obligations that has governed water service in Mexico City for over a

⁴²⁷ Some residents implied that because electricity was provided by a federal agency, and not a local one, it was a service accessible to informal communities. It is not clear whether that is true; Miguel, interviewed by the author, August 17, 2018; Jesús, interviewed by the author, August 15, 2018; Elena and Antonio, interviewed by the author, August 24, 2018; Yesenia, interviewed by the author, August 22, 2018; “Información Al Cliente Para Contratar,” Comisión Federal de Electricidad, accessed March 3, 2019, <https://www.cfe.mx/Casa/InformacionCliente/Pages/ParaContratar.aspx>.

⁴²⁸ Miguel, interviewed by the author, August 17, 2018; Tania, interviewed by the author, August 15, 2018; Jesús, interviewed by the author, August 15, 2018; Elena and Antonio, interviewed by the author, August 24, 2018; Yesenia, interviewed by the author, August 22, 2018.

⁴²⁹ Miguel, interviewed by the author, August 17, 2018; Yesenia, interviewed by the author, August 22, 2018.

⁴³⁰ Elena and Antonio, interviewed by the author, August 24, 2018; Jesús, interviewed by the author, August 15, 2018.

⁴³¹ Tania, interviewed by the author, August 15, 2018.

century. Time will tell whether residents decreasingly look to the government for water or reframe their expectations. As I conclude my exploration of rainwater harvesting, it is important to consider whether Mexico City government is changing its approach to water service, largely due to the needs imposed by the city's water crisis and a changing climate.

Conclusion: Every Last Drop

It was my penultimate day in Mexico City when I saw the protesters gathered in Tlalpan's main plaza. After I finished my interview with Sandra, I returned to find the square doubly crowded. A street market taking place a block away from the demonstration had attracted even more visitors. Seeking a more accessible place to call for an Uber, I wandered aimlessly through Tlalpan's center, away from the hum of noise and activity. The cobblestone sidewalks underneath my feet and painted colonial stucco that grazed my shoulders were relics of what Tlalpan was as recently as a century ago—a town ten miles south of Mexico's capital surrounded by rural hinterland.

The rideshare drove me through the city that Mexico had become. We roared down the tree-lined freeway of Insurgentes Sur, past the Olympic Stadium and the colossal Diego Rivera mural that adorns it—a reminder of the troubled 1968 summer games. We meandered through the hilly campus of the *Universidad Nacional Autónoma de México* (UNAM), Mexico's most prestigious university. We stopped at a traffic light next to the Copilco metro station, where vendors sold *tortas* and tacos to commuters across the street from a Burger King and a 7-Eleven. Finally, we arrived at Isla Urbana's office, a modern, three-story residential building that had been converted to office space in a quiet *colonia* in the *delegación* of Coyoacán.

I had used Isla Urbana's office as a workspace during my fieldwork, and I returned to say my last goodbyes to its staff whom I had gotten to know. I also wanted to interview Enrique one last time. I found him on Isla Urbana's rooftop patio, comfortably at work on his laptop in the shade and sipping a cup of coffee.

In the course of our conversation, the question of a human right to water came up. As I have mentioned throughout this thesis, statutes like Mexico City's Water Law define access to

water as a “right.”⁴³² This idea has been present in Mexican law for some time. Mexico’s 1917 constitution famously declared water to be the property of “the Nation,” which can transmit title to Mexican nationals and communities, and regulate its use “to achieve a more equitable distribution of public wealth.”⁴³³ Article 4 of the constitution now states, “Every person has a right to the access, provision, and drainage of water for personal and domestic consumption in a sufficient, healthy, acceptable, and affordable manner.”⁴³⁴

I asked Enrique whether the idea of a human right to water plays a role in Isla Urbana’s work.

“It doesn’t. Why would it?” he responded. The human right to water could be a useful *ex post facto* argument to justify Isla Urbana’s work providing water to those who lack it, he clarified, but it is not centrally important to rainwater harvesting. “It’s not so much about the right to water, it’s just the fact that if people don’t have water they really do go nuts. As soon as people [stop] getting water, you start having serious, serious crises.”⁴³⁵

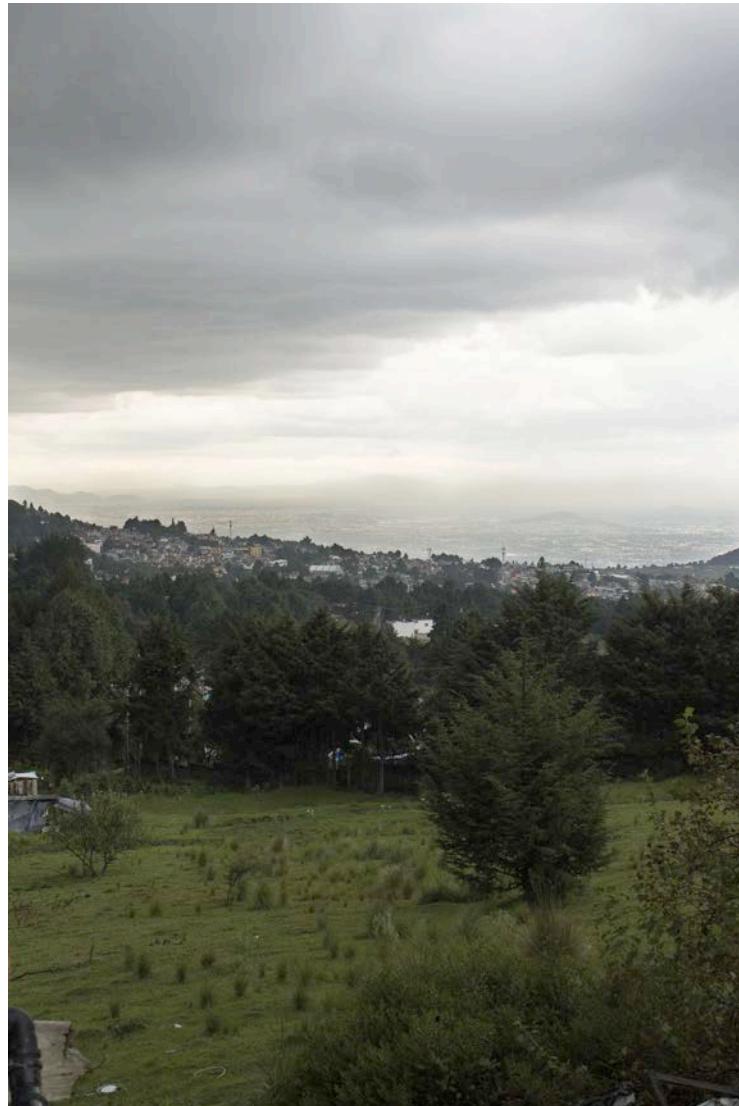
There is plenty of evidence in this thesis to prove Enrique right. Moreover, when water crises have occurred in Mexico City, the public has tended to direct their animosity toward the government, which they perceive as obligated to provide water service. The water protests of the 1920s and 1980s are notable historical examples. Today, chronically deficient service in large swaths of the city is among the factors that have provoked public distrust of government.

⁴³² LADF, Art. 5.

⁴³³ Constitución Política de los Estados Unidos Mexicanos [CPEUM], Art. 27, Diario Oficial de la Federación [DOF] 05-02-1917, últimas reformas DOF 27-08-2018.

⁴³⁴ Ibid, Art. 4.

⁴³⁵ Enrique Lomnitz (General Director, Isla Urbana), interviewed by the author, Coyoacán, CDMX, Mexico, August 24, 2018.



A passing rainstorm, Ahuayoto. Photo by the author, 2018.

Rainwater harvesting is simply a way for residents to meet these lagging needs. “It’s just a way for individual houses to have more water,” Enrique clarified. “[It’s] a way of reducing demand from outside sources.”⁴³⁶

The social consequences of rainwater harvesting that I have explored throughout this thesis depend upon the systems’ ability to meet household needs for water. For the most part, they have successfully achieved this goal, though to varying degrees. Some *defensores* appreciate Isla Urbana’s systems as a helpful supplement to their fickle or costly water service. Others,

⁴³⁶ Ibid.

especially in informal communities, rely on rainwater harvesting more heavily for lengthy periods of time, which has revealed the possibility that they may not have to look to the government for reliable water. Meanwhile, local governments provide the systems through programs that partially aim to assuage popular distrust by helping residents meet their water needs. The extent to which the programs actually restore public confidence hinges on whether its beneficiaries perceive the systems as useful.

The future of rainwater harvesting will be shaped not only by the needs of individual households, but also by the city's collective need for a sustainable water supply. It is too soon to tell whether rainwater harvesting will be a temporary or permanent fixture in the urban landscape. "I think in Mexico City it will all depend on what happens," Enrique said, "The way things are going, [rainwater harvesting is] probably going to become the only way that we can have water."⁴³⁷

According to Mexico City's "Resilience Strategy," a report released in 2016 to outline potential measures to adapt to climate change, the aquifer beneath the city will no longer be viable as the capital's main source of water in 30 to 40 years if current rates of extraction keep up.⁴³⁸ Changing rainfall patterns will exacerbate fallout. Droughts may become more prolonged, and precipitation will increasingly occur in extreme events.⁴³⁹ The report estimates that Mexico City will see a 10% reduction in precipitation during the rainy season by 2050.⁴⁴⁰ This means that less water will recharge the aquifer, as well as the provincial sources that the city's aqueducts draw from.⁴⁴¹

⁴³⁷ Ibid.

⁴³⁸ CDMX Resilience Office, *CDMX Resilience Strategy: Adaptive, Inclusive, and Equitable Transformation* (Mexico City: Secretaría del Medio Ambiente [SEDEMA], 100 Resilient Cities, 2016), 40.

⁴³⁹ Ibid, 38-40.

⁴⁴⁰ Ibid, 36.

⁴⁴¹ Ibid, 37.

The environmental threats posed to the city have been taken into account in recent political changes. In January 2016, the capital territory ceased to be known as the *Federal District* (DF) and was officially renamed *Ciudad de México* (CDMX), which simply means “Mexico City.”⁴⁴² The changes did not make Mexico City a state, but granted it greater administrative autonomy from the federal government.⁴⁴³ The city received its own constitution for the first time, drafted in February 2017 and put into effect in September 2018.⁴⁴⁴ The constitution rebranded the *delegaciones* as *alcaldías* (mayoralties), and granted them greater administrative controls.⁴⁴⁵ Observers also noted the array of progressive rights that the charter offered, including assisted suicide, medical marijuana, and abortion.⁴⁴⁶ Among numerous environmental provisions, the constitution called for sustainable water consumption, including “the promotion of rainwater harvesting, the treatment and reuse of water for consumption and to reverse the overexploitation of the aquifers.”⁴⁴⁷

The city’s proposed replacement for the 2003 Water Law—referred to as the Water Sustainability Law and enacted by the Legislative Assembly in 2017—contains a more detailed

⁴⁴² “Federal District Is Now Officially Mexico City,” *Mexico News Daily (Mexico City)*, January 30, 2016, <https://mexiconewsdaily.com/news/federal-district-is-now-officially-mexico-city/>; David Agren, “Mexico City Officially Changes Its Name to – Mexico City,” *The Guardian (US Edition)*, January 29, 2016, sec. World news, <https://www.theguardian.com/world/2016/jan/29/mexico-city-name-change-federal-district-df>.

⁴⁴³ “Federal District Is Now Officially Mexico City,” *Mexico News Daily*; Eugene Zapata, “Resilience in the New Constitution for Mexico City,” 100 Resilient Cities, February 15, 2017, <http://www.100resilientcities.org/resilience-in-the-new-constitution-for-mexico-city/>.

⁴⁴⁴ Constitución Política de la Ciudad de México [CPCDMX], Gaceta Oficial de la Ciudad de México [GOCDMX] 05-02-2017; “15 puntos para conocer la Constitución de la CDMX,” *El Financiero* (Mexico City), September 17, 2018, <https://elfinanciero.com.mx/nacional/esto-es-lo-que-debes-saber-sobre-la-constitucion-de-la-cdmx>.

⁴⁴⁵ “15 puntos para conocer la Constitución de la CDMX,” *El Financiero* (Mexico City); Diego Badillo, “¿En Qué Consiste La Nueva Constitución de La Ciudad de México?” *El Economista* (Mexico City), September 9, 2018, <https://www.eleconomista.com.mx/politica/En-que-consiste-la-nueva-Constitucion-de-la-Ciudad-de-Mexico--20180909-0011.html>.

⁴⁴⁶ “15 puntos para conocer la Constitución de la CDMX,” *El Financiero* (Mexico City); Badillo, “¿En Qué Consiste La Nueva Constitución de La Ciudad de México?”

⁴⁴⁷ CPCDMX, Art. 16-B-3f.

mandate for rainwater harvesting.⁴⁴⁸ It dedicates an entire section to measures for promoting and incentivizing the practice in order to help create a sustainable “culture of water” in the city.⁴⁴⁹ It obligates new buildings to install equipment for capturing rainfall and, in some cases, ensure that they preserve green space for aquifer recharge.⁴⁵⁰ It also calls for a variety of programs at the city and municipal levels to expand rainwater harvesting in individual households, new buildings, rural towns and *ejidos*.⁴⁵¹ However, the law was effectively vetoed (“sent back with observations” to the Legislative Assembly) by city officials in 2018 over concerns about its language surrounding tariffs, and it is unclear whether the statute will ever be put into effect.⁴⁵²

In practice, the city’s pursuit of rainwater harvesting may take a variety of forms. The Resilience Strategy calls for the “temporary” establishment of rainwater harvesting systems in water-stressed households while the piped water network is repaired and expanded in a sustainable manner.⁴⁵³ It also recommends measures to preserve and develop areas for aquifer recharge, or even reservoirs for retaining rainwater for future use.⁴⁵⁴ In January 2019, the city’s *Secretariat of the Environment* (SEDEMA) announced that it would pursue a major rainwater harvesting program that aims to install 10,000 household systems in neighborhoods that lack sufficient water access, and hopefully install 100,000 systems over the next six years.⁴⁵⁵

⁴⁴⁸ Suárez, “Asamblea aprueba Ley de Sustentabilidad Hídrica,” *El Universal* (Mexico City), November 24, 2017, <https://www.eluniversal.com.mx/metropoli/cdmx/asamblea-aprueba-ley-de-sustentabilidad-hidrica>

⁴⁴⁹ Sistema de Aguas de la Ciudad de México [SACMEX], *Proyecto Final de Ley de Agua y Sustentabilidad Hídrica*, 58–71, accessed January 29, 2019, <https://www.sacmex.cdmx.gob.mx/storage/app/media/index/LeySustentabilidad.pdf>.

⁴⁵⁰ *Ibid.*, 58–62.

⁴⁵¹ *Ibid.*, 58–71.

⁴⁵² Gabriela Romero Sánchez, “Cedió el gobierno a demandas y devolvió a la ALDF la ley hídrica,” *La Jornada* (Mexico City), February 12, 2018, <https://www.jornada.com.mx/2018/02/12/capital/032n1cap#>; “Atora GCDMX la Ley de Sustentabilidad Hídrica, se niega a fijar tarifas,” *Diario Basta!* (Mexico City), April 29, 2018, <http://diariobasta.com/2018/04/29/atora-gcdmx-la-ley-de-sustentabilidad-hidrica-se-niega-a-fijar-tarifas/>.

⁴⁵³ CDMX Resilience Office, *CDMX Resilience Strategy*, 81–85.

⁴⁵⁴ *Ibid.*, 86–91.

⁴⁵⁵ “Mexico City Announces Water Catchment Program for Homeowners,” *Mexico News Daily* (Mexico City), January 18, 2019, <https://mexiconewsdaily.com/news/mexico-city-announces-water-catchment-program/>; “Gobierno

SEDEMA will invest \$10.5 million US dollars in the program.⁴⁵⁶ Isla Urbana might be among the organizations awarded a contract for the project, which will begin work in April 2019.⁴⁵⁷

Rainwater harvesting can also be pursued beyond the household scale. The Resilience Strategy not only recommends measures to preserve and develop areas for aquifer recharge, but to create reservoirs for retaining rainwater for future use.⁴⁵⁸ Enrique mentioned that Isla Urbana has installed systems on larger commercial buildings, although this is not their main focus and they usually defer such projects to other companies that produce large-scale systems.⁴⁵⁹ On a gargantuan scale, the federal government announced a plan in 2014 to build a new international airport, whose buildings would serve as enormous rainwater catchment spaces.⁴⁶⁰ A concurrent agenda aimed to convert the old airport into a vast reserve for capturing rainwater.⁴⁶¹ However, the airport project was scrapped in 2018 by Mexico's newly elected president, Andres Manuel López Obrador, who cited concerns about excessive spending, corruption, and environmental damage resulting from the new facility.⁴⁶²

The collapse of the airport project demonstrates how the realization of ideals and plans to combat the water crisis may be complicated not only by the magnitude and scale of Mexico

de La CDMX Presenta Programa Para Captar Agua Pluvial En Viviendas," *El Economista* (Mexico City), January 18, 2019, <https://www.eleconomista.com.mx/politica/Gobierno-de-la-CDMX-presenta-programa-para-captar-agua-pluvial-en-viviendas--20190118-0051.html>.

⁴⁵⁶ Ibid.

⁴⁵⁷ In a text message exchange with the author on March 7, 2019, Enrique Lomnitz said that Isla Urbana would "definitely" be participating in the project; "Mexico City Announces Water Catchment Program for Homeowners," *Mexico News Daily* (Mexico City).

⁴⁵⁸ CDMX Resilience Office, *CDMX Resilience Strategy*, 86-91.

⁴⁵⁹ Enrique Lomnitz, interviewed by the author, August 24, 2018.

⁴⁶⁰ Alissa Walker, "Mexico City's New Mega-Airport Will Collect Its Own Energy and Water," *Gizmodo*, September 3, 2014, <https://gizmodo.com/mexico-citys-new-mega-airport-will-collect-its-own-ener-1630253952>.

⁴⁶¹ Angeles Rodriguez, "Retiring Mexico City Airport May Move on to Greener Pastures," *BNamericas* (Santiago de Chile), September 4, 2017, <https://www.bnamericas.com/en/news/waterandwaste/retiring-mexico-city-airport-may-move-on-to-greener-pastures>; Kimmelman, "Mexico City, Parched and Sinking, Faces a Water Crisis."

⁴⁶² Eleanor Gibson, "Foster's \$13 Billion Mexico City Airport Nixed after Public Vote," *Dezeen*, October 30, 2018, <https://www.dezeen.com/2018/10/30/foster-partners-fernando-romero-mexico-city-airport-nixed-public-vote/>; "Mexico President-Elect Halts New Airport," *BBC*, October 29, 2018, sec. Latin America & Caribbean, <https://www.bbc.com/news/world-latin-america-46026860>.

City's environmental threats, but by the social and political realities of the megalopolis. Isla Urbana is fortunate to have found conducive partnerships with Tlalpan and Xochimilco's municipal governments, as well as corporate donors to fund their projects in informal areas. However, working in other water-stressed regions of the city, such as Iztapalapa or the conurban municipalities of the State of Mexico, has been difficult due to messy politics or complicated logistics.⁴⁶³ Moreover, rainwater harvesting is impractical in multi-unit apartment buildings that compose a large fraction of the city. Enrique explained that the roofs of apartment buildings do not have enough catchment area per occupant to make the practice worthwhile.⁴⁶⁴ Indeed, the implementation of rainwater harvesting projects in the future may be determined at least as much by political or practical constraints as by the city's pressing need for water.

Mexico City's new laws, plans, and charter also provide reasons to be skeptical that the capital can feasibly navigate its water crisis. I have already described how the 2003 Water Law paints an uncertain picture of who is eligible to receive certain kinds of water service from the state, despite claiming to adhere to a belief that water is a universal right. The proposed 2017 Water Law replicates the exact same contradictory language as its predecessor.⁴⁶⁵ The city's new constitution similarly guarantees "universal water coverage," but also calls for the prevention of "irregular" settlement of the conservation zone.⁴⁶⁶ The Resilience Plan declares the reduction of water scarcity and access inequality to be its primary goal toward achieving sustainable water usage, but presents maps that show how many of the city's most water-stressed areas straddle the conservation zone, where most of the city's irregular settlements are also located.⁴⁶⁷ The challenge of preserving ecology and green space will be vital if the city's aquifer is to survive.

⁴⁶³ Enrique Lomnitz, interviewed by the author, August 24, 2018.

⁴⁶⁴ Ibid.

⁴⁶⁵ LADF, Arts. 5-6, 50; SACMEX, *Proyecto Final de Ley de Agua y Sustentabilidad Hídrica*, 10-11, 37.

⁴⁶⁶ CPCDMX, Art. 9-F, Art. 16-C-5a.

⁴⁶⁷ CDMX Resilience Office, "CDMX Resilience Strategy," 27, 80–81.

Yet, the fleeting hope of realizing this goal may require taking a different approach to “informality” in the conservation zone than has been taken over the past few decades—one that can accommodate urgent environmental concerns without pushing poor communities outside the law and excluding them from access to urban services. The language currently employed in state documents indicates that further reckoning with the idea of informality (and the idea that it poses an inherent threat to “nature”) will be needed. Otherwise, declaring water to be a universal right is a rather futile endeavor that is relatively aloof from the realities of Mexico City.

It is also too soon to tell whether city residents will continue to expect water as a government service. In the end, it will likely depend on if and how residents can meet their needs amidst changing environmental and socio-political circumstances. Actions that the government takes in order to manage and administrate public water supplies will have an enormous impact as well. Perhaps my research has presented a glimpse of an answer, but more likely I have just offered fodder for speculation. After all, Mexico City is enormous and diverse, and the snapshot I have captured in this thesis is just a small sliver of the whole.

By the time I had finished my interview with Enrique, the brilliant afternoon sun had begun to cloud over. I said my goodbyes, and meandered downstairs and out Isla Urbana’s door for the last time. The streets were quiet. A few waning birdsongs warbled in the distance. The steady tremble of air traffic overhead had ceased. To the west, final shafts of sunlight punctured the encircling clouds. To the east, the coming rainstorm.

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