CHAPTER FIVE

Local Reservoirs and Chinese Aqueducts

The Politics of Water Security in Hong Kong

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Hong Kong is located on the southern coast of China, bordering the city of Shenzhen and Guangdong Province. The territory was a British colony from 1842 until 1997, when it became a special administrative region (SAR) under Chinese sovereignty (figure 5.1). Following the original occupation of Hong Kong Island, the colony grew with the acquisition of the Kowloon Peninsula in 1860, and again with a ninety-nine-year lease of the New Territories in 1898. As a British colony, Hong Kong maintained a high degree of autonomy due to a mandate for financial independence from the metropole, and it became an early exemplar of free-market rule (Tsang 2004; Peck, Bok, and Zhang 2020). After a series of bitter negotiations, Britain and China agreed that the New Territories would return to Chinese rule when their lease expired in 1997. The 1984 Sino-British Joint Declaration hinged on the concept of *one country, two systems*, which was meant to ensure Hong Kong's political autonomy and capitalist development for fifty years after it was handed over to China. However, its relative autonomy from China has eroded after large-scale pro-democracy protests in 2014 and 2019, culminating in the enactment by Beijing of the 2020 National Security Law, which limits civil liberties that existed in Hong Kong.

Against this political backdrop, the infrastructural rationale of Hong Kong's water supply has evolved from territorial self-sufficiency to regional integration. The colonial government prioritized early public investments in freshwater infrastructure over other forms of urban infrastructure due to Hong Kong's steep terrain and lack of perennial rivers. During the major period of population growth in the 1950s and 1960s, the quest for water security motivated significant technological innovation at various scales, from the use of seawater to flush toilets in private homes, to expansive freshwater reservoirs reclaimed from the sea.

However, severe water shortages in the 1960s made it necessary to import water from China despite political tensions, and Hong Kong's quest for resource self-sufficiency abruptly ended. Since then, the primary function of water supply infrastructure has shifted from local water collection to the storage of imported water, which is delivered through an eighty-kilometer aqueduct from Dongjiang

Figure 5.1. Hong Kong's territorial evolution. (Map by Dorothy Tang.)

(also known as the East River), a tributary of the Pearl River (figure 5.2). With increased dependence on Chinese water supply, Hong Kong's water demand has shaped an integrated infrastructural territory beyond its own administrative borders. Today, approximately three-quarters of Hong Kong's fresh water is purchased from Guangdong Province, across the border in Mainland China.

Over the past two centuries, Hong Kong's water supply infrastructure has also played a significant role in shaping the politics of land supply and development in the region. The land area of the Hong Kong SAR covers 1,111 square kilometers, and had a population of approximately 7.5 million people in 2019. The territory is known for its dense urban development, and it has some of the highest real estate prices in the world. Yet only 25 percent of Hong Kong's land is classified as urbanized, and approximately 40 percent of the land is classified as country parks for nature conservation and recreation (Planning Department 2020).[1] The boundaries of country parks largely coincide with the catchment areas of reservoirs and were a by-product of water production during the colonial era. However, as reliance on imported water from China increased, the political impetus for watershed protection has diminished. Since the 2010s, Beijing and the Hong Kong government have concluded that the housing shortage is at the heart of social discontent in the territory (Siu 2019), and they have stepped up their efforts to increase land supply. These strategies include converting colonial-era golf courses into development sites, building artificial islands, and a controversial proposal to rezone country parks for housing (Ng 2017). As a result, the utility of watershed protection has reentered the political sphere.

This chapter examines the development of post–World War II water supply systems at multiple spatial scales, as well as the discourse pertaining to self-sufficiency as Hong Kong transitioned from a British colony to an SAR of the People's Republic of China. Hong Kong's physical landscape is represented as the underlying reason for water scarcity, and it is continuously transformed by freshwater infrastructure

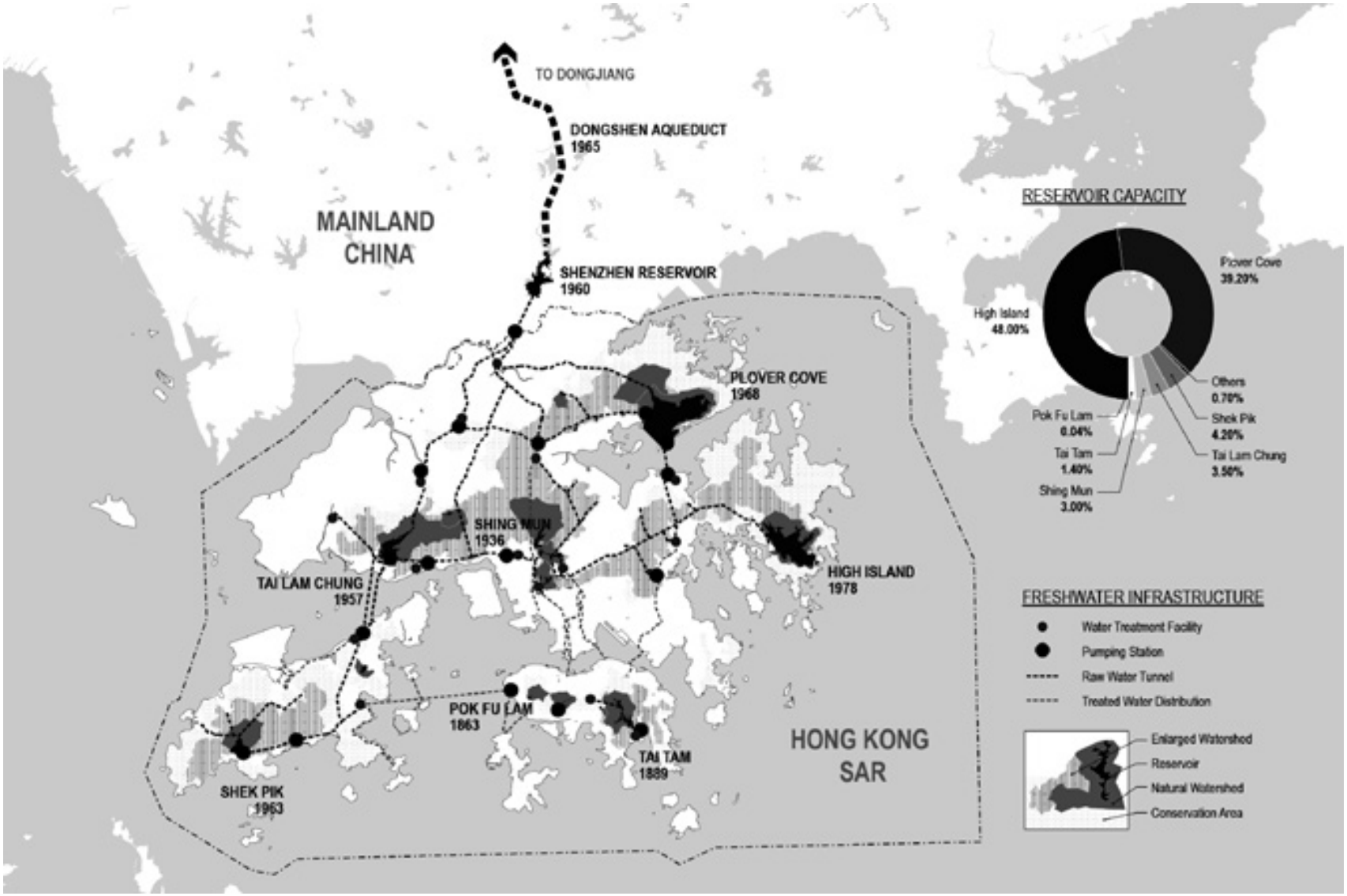

Figure 5.2. Hong Kong's freshwater infrastructure. (Map by Dorothy Tang. See WSD 1978.)

to meet the demands of a growing city. In particular, the response to water emergencies in the 1960s exemplified the fragile geopolitical negotiations between the British and the Chinese, which coincided with significant technological innovations and major landscape transformations within the territory. Over time, the Hong Kong government has maintained a delicate balance, maximizing local water production while depending on imported water from the mainland, and the scales of freshwater infrastructure are adjusted and reconfigured during times of political tension and conflict. Despite a period of stable supply as the British gradually ceded control of Hong Kong, renewed conflicts since the mid-2010s between Hong Kong's political autonomy and Chinese sovereignty have revived debates about water self-sufficiency versus reliance on the so-called motherland. Rather than signifying modernity and progress, the engineering achievements of Hong Kong's freshwater infrastructure reveal instead the multiple forms of political subjectivity in the territory's recent past.

My account of Hong Kong's water supply infrastructure questions the common assumption that modernization, capitalist development, and nationalism are the main drivers behind large-scale infrastructure development and its accompanying institutions. Modernity and infrastructure are often understood to be coproduced by mediating nature across multiple scales, times, and social organizations (Edwards 2003). The modernist impulse to stabilize environmental variability produces a new form of nature that in turn shapes infrastructure, and consequently the experience of modernity and its political institutions. This cyclical relationship between infrastructure and nature expands spatially and temporally as natural systems (such as forested watersheds) are absorbed to enhance infrastructural performance (such as reservoir capacity) (Carse 2012). By delving into political action observed at different scales during the water emergencies of the 1960s, I offer an alternative entry point into the hydropolitics of the region and how infrastructure shaped, and was in turn shaped by, the shifting relationship between Hong Kong and Mainland China, allowing us to better understand the technopolitics of key infrastructure projects completed between the late 1950s and 1982, as well as the coevolution of infrastructural territories on both sides of the border.

This is accomplished through a detailed analysis of the politics, infrastructure, and landscapes of water supply in Hong Kong. I first set the stage by showing how pre-war water supply infrastructure in colonial Hong Kong created a reciprocal relationship between urban growth and landscape resources. This is followed by an analysis of how Sino-British geopolitics during the water emergencies of 1963–1964 and 1967 shaped water supply infrastructure development until the Handover in 1997. Last, I turn to recent political debates over water security and their landscape implications. This chapter draws on archival sources available at Hong

Kong's Public Records Service, original consultancy reports at Hong Kong's Water Supplies Department, and publicly available reports and documents produced by various institutions and individuals.

Engineering the Barren Rock: Water Supply for Early Colonial Hong Kong

When Hong Kong Island was formally ceded to the British in 1842, after the First Opium War, the metropole's disapproval of the island's inhospitable landscape and poor strategic location was expressed with resounding derision by Foreign Secretary Lord Palmerston, who described the new colonial outpost as a "barren island with nary a house upon it" (quoted in Peck, Bock, and Zhang 2020, 1).

Indeed, although Hong Kong has abundant rainfall, seasonal variation reduces the reliability of perennial mountain streams. The mountainous terrain drains water quickly and lacks large natural bodies of water. The geology of Hong Kong mainly consists of volcanic and granite rock formations with shallow surface soil, little capacity for groundwater, and no natural aquifers (Ho 2001, 6). The same volcanic geology that formed Hong Kong's advantageous natural harbor also limits its freshwater resources. Therefore, official histories of Hong Kong's water supply typically begin with the double challenges of overcoming the territory's physical landscape and meeting the demands of population growth (see Ho 2001).

Before Hong Kong's first freshwater reservoir was built, the colony relied on seasonal streams and wells for fresh water. At the time of the British occupation in 1841, the population consisted of 7,450 people, including approximately 2,000 boat dwellers, and the available water resources were more than sufficient. The population increased dramatically following the establishment in 1842 of the City of Victoria as the colony's first urban settlement. Within ten years, the colonial government had dug the first publicly funded wells to serve a population that had more than quadrupled, to 32,983 people, and they began to devise plans for Hong Kong's first freshwater reservoir, Pok Fu Lam Reservoir, located in a valley in the northwestern part of the island. However, by 1861, before its completion, Hong Kong's population had grown to 119,321 people due to the expansion of the colony to the Kowloon Peninsula and an influx of migrants fleeing the Taiping Rebellion. When Pok Fu Lam Reservoir was finally completed in 1863, it was already insufficient for the needs of the city, and it was expanded in 1877. The next major water project was the completion of Tai Tam Reservoir on the south side of the island in 1889, which was expanded again between 1904 and 1908. By the early twentieth century, with the lease of the New Territories, Hong Kong's population had more

than tripled again to 386,159 people, with the vast majority living on Hong Kong Island (Ho 2001, 242–244; Swee-Hock and Kin 1975, 131).

The initial development of water resources in Hong Kong was concurrent with mid-nineteenth-century innovations in water supply systems in Britain and its colonies, where the assessment of water resources and their potential for expansion had become important components of town planning. These systems relied on the capacity of a natural landscape to collect and store water, and they used gravity-fed pipes to supply urban settlements. A typical gravitation scheme consisted of a large source of water that was collected and reserved, often in impoundment reservoirs, before being conveyed by gravity across a significant distance through some form of pipeline. Impoundment reservoirs were often located far from urban settlements, not only because of the technical considerations of location and size, but more importantly because engineers believed that reservoirs' considerable distances from polluted cities ensured higher water quality. The water catchment areas were legally protected from urban development through buffer zones or conservation areas to prevent further contamination and, in the colonies, often involved the forced relocation of people in existing settlements (Broich 2007, 358–359).

In Hong Kong, in addition to the space taken up by the new reservoirs, large tracts of land were required for a system of catchwaters to maximize water yields. Catchwater channels were carefully engineered to circle around the slope beyond the watershed ridges and drain into the lowest point of the reservoir, thus greatly expanding the natural catchment areas. Narrow footpaths adjacent to these lined channels enabled appropriate maintenance, and over time they have evolved into extensive hiking trail systems in Hong Kong's country parks. The catchwaters also demarcate the boundaries of conservation zones established to minimize the adverse impacts of human activity. These conservation zones were typically afforested to prevent soil erosion and protect the steep slopes, and Indigenous villagers were prohibited from using the timber for fuel (Ho 2001, 30; Peckham 2015). In contrast to typical colonial forestry practices, afforestation in Hong Kong was necessary for securing water supply, and it eventually laid the foundation for an ecologically driven conservation strategy after World War II (Corlett 1999).

Hong Kong's population continued to balloon, and occasional dry years and major droughts in 1902 and 1929 threatened the colony's economy and public health. With the acquisition of the New Territories in 1898, the colonial government had finally gained access to additional land and potential water resources. Shing Mun Reservoir, located near Shatin in the New Territories, was completed in 1936. At eighty-five meters tall, it included the highest dam in the British Empire at the time (Broich 2007). The innovative structure is a near-vertical reinforced

concrete diaphragm wall, with a wedge on the downstream side filled with sand and reinforced with rock to accommodate uneven settlement in the event of an earthquake. Construction was completed in fifteen months and under budget (Twort 1990, 19–20). However, although the reservoir more than doubled the territory's reservoir storage capacity, at the onset of Japanese occupation in 1941 the water resources of Hong Kong had already been exploited to full capacity.

As the British territory expanded, so did the water supply network and the accompanying landscape transformations from barren rock to lush subtropical forest. The first century of urbanization and water supply development set a foundation for subsequent water governance strategies ranging from the scale of the territory to the domestic sphere. Despite the liberal economy that was crucial to maintaining the colony's relative autonomy from the metropole (Tsang 2004), Hong Kong's water utility remained a public entity—in contrast to privatized utilities in Hong Kong such as electricity and, later, mass transit (Kwong 1997). The centralized and systematic planning required, and its mandate as a public good, necessitated this governance structure, which was solidified by complex geopolitics across the border with Mainland China after World War II.

Post-War Geopolitics and the Quest for Water Self-Sufficiency

In the wake of dramatic geopolitical shifts in East Asia immediately after World War II, the status of British sovereignty over Hong Kong was tenuous. Only after the Chinese Civil War concluded with the establishment of the People's Republic of China in 1949 would a tacit agreement emerge between China and Britain for Hong Kong to remain a British colony until an agreement about the New Territories lease could be achieved (Tsang 2004, 130–131). This political uncertainty not only shaped the colony's future governance, but it also produced a paradoxical relationship between engineering water independence from the mainland and needing to meet growing demand as a result of a massive influx of migrants and a burgeoning industrial sector. Nelson Lee (2014) describes this period of water supply development as a competition between the colonial government's desire for a local supply, and China's offer to provide water from Guangdong Province, while the media scholar Cheung Siu-Keung (2014) goes a step further and interprets these events as an overt effort by China to exert biopolitical control over Hong Kong. Both arguments suggest the inevitability of Chinese hegemony over Hong Kong. However, they overlook the fact that the crisis of colonial governance in the face of the dual emergencies of social unrest and water shortages during this period set the stage for local politics.

The following analysis examines how the relationship between Cold War geopolitics and water supply infrastructure ecology shaped late colonial governance in Hong Kong.

Post-War Recovery versus the Great Leap Forward

The planning and construction of Tai Lam Chung Reservoir in the western New Territories were interrupted by World War II, and due to other immediate recovery needs and a lack of financing, they did not resume until 1953. The forty-meter masonry-faced concrete gravity structure added almost twice the storage capacity of Shing Mun Reservoir (Twort 1990, 33). However, despite these impressive improvements, increased migration from China meant that Tai Lam Chung Reservoir barely made a dent in Hong Kong's water deficit.

At the same time, China was undergoing its own modernization drive, the Great Leap Forward,[2] and numerous primitive dams and reservoirs were constructed throughout the country—including Shenzhen Reservoir, located on the Chinese side of the Shenzhen River, which forms the border between Hong Kong and China. Work on the reservoir began in November 1959 and was completed in four months (Lee 2014, 915–916), just in time to play a major role in Hong Kong during a drought year. The Guangdong provincial authorities approached Hong Kong in January 1960 and offered water from Shenzhen Reservoir to alleviate Hong Kong's water burden. After several negotiations held in railway station waiting rooms in Shenzhen and Lo Wu, the Chinese authorities and their British counterparts reached an agreement for Hong Kong to import five billion gallons of water annually for an indefinite length of time. Hong Kong paid for the ten miles of steel pipes and appropriate pumping facilities needed to move water across the border, and this began the colony's importation of water from the mainland.[3]

Planning for Long-Term Water Security: Reservoirs in the Sea

Despite the temporary reprieve, Hong Kong continued to pursue other options, such as Shek Pik Reservoir, for water supply. After careful studies of Hong Kong's physical environment in search of new reservoir sites, the idea of reclaiming the sea for a freshwater reservoir had emerged in 1958 (Plover Cove 1970). In 1961, the Hong Kong government commissioned the British engineering firm Binnie & Partners (in collaboration with the Hong Kong-based Scott and Wilson, Kirkpatrick and Partners) to develop a masterplan for the scheme. The Plover Cove and Hebe Haven Scheme (Binnie et al. 1962) proposed the reclamation of a natural cove in Tolo Harbour, in addition to a network of catchwaters, tunnels, and pipelines

connected to a new water treatment facility in Shatin. The colonial government began the first phase of the scheme with the construction of Plover Cove, consisting of a 2.1-kilometer main dam connecting Tai Mei Tuk to Harbour Island and two subsidiary dams. When it was completed in 1968, Plover Cove more than doubled the total storage capacity of the existing reservoirs in the territory (figure 5.3).

Meeting the technical challenges of converting a saltwater cove into a freshwater reservoir required a great level of innovation. The total height of the dam is 44 meters, but its base is 28 meters below sea level (figure 5.4). The main dam required dredging a 200-meter-wide foundation trench along its length, at depths of as much as 17 meters (Elliot, Ford, and Oules 1972). However, the greatest challenge was removing salinity from the reservoir bed (Ford and Elliott 1965). The engineers devised a process in which the majority of the seawater would be pumped out during the dry season, leaving just enough water to avoid disturbing the sea mud, and then diluting the remainder by pumping out the first flush of rainwater until the salinity levels met certain standards. Then the remainder of the wet-season inflow would be allowed to accumulate. Depending on rainfall, this process could take up to a year before normal impoundment could commence, and the engineers speculated that salinity levels would continue to drop over time.

In converting a marine ecology into a freshwater ecosystem, engineers worried that the initial decline of marine benthic species and an increase in invasive species could threaten the water quality of the reservoir and breed mosquitoes (La Touche, Smith, and Townsend 1972). Thus, a full-time marine biologist was hired to survey the conditions and propose a reasonable transition. Carefully selected fish species—commonly referred to as fry fish in Hong Kong—were stocked in the reservoir to control algae growth and insects, and by 1969, additional predatory species were introduced to manage the populations of black mussels and other invasive species (Water Authority 1979; La Touche, Smith, and Townsend 1972).

The 1963–1964 Water Emergency and Importing Water from China

During the early stages of planning for Plover Cove Reservoir, Hong Kong experienced one of its most harrowing water shortages in history. The government struggled to provide constant and universal water supply for the population of over 3.5 million, even during times of typical rainfall. An unusually dry wet season in 1963 almost drove the city to its brink. Water rationing was the norm for a year and a half in 1963 and 1964, including especially stringent periods when water was supplied for only four hours every four days. Shenzhen Reservoir also suffered from the drought and could not supply additional water to Hong Kong.

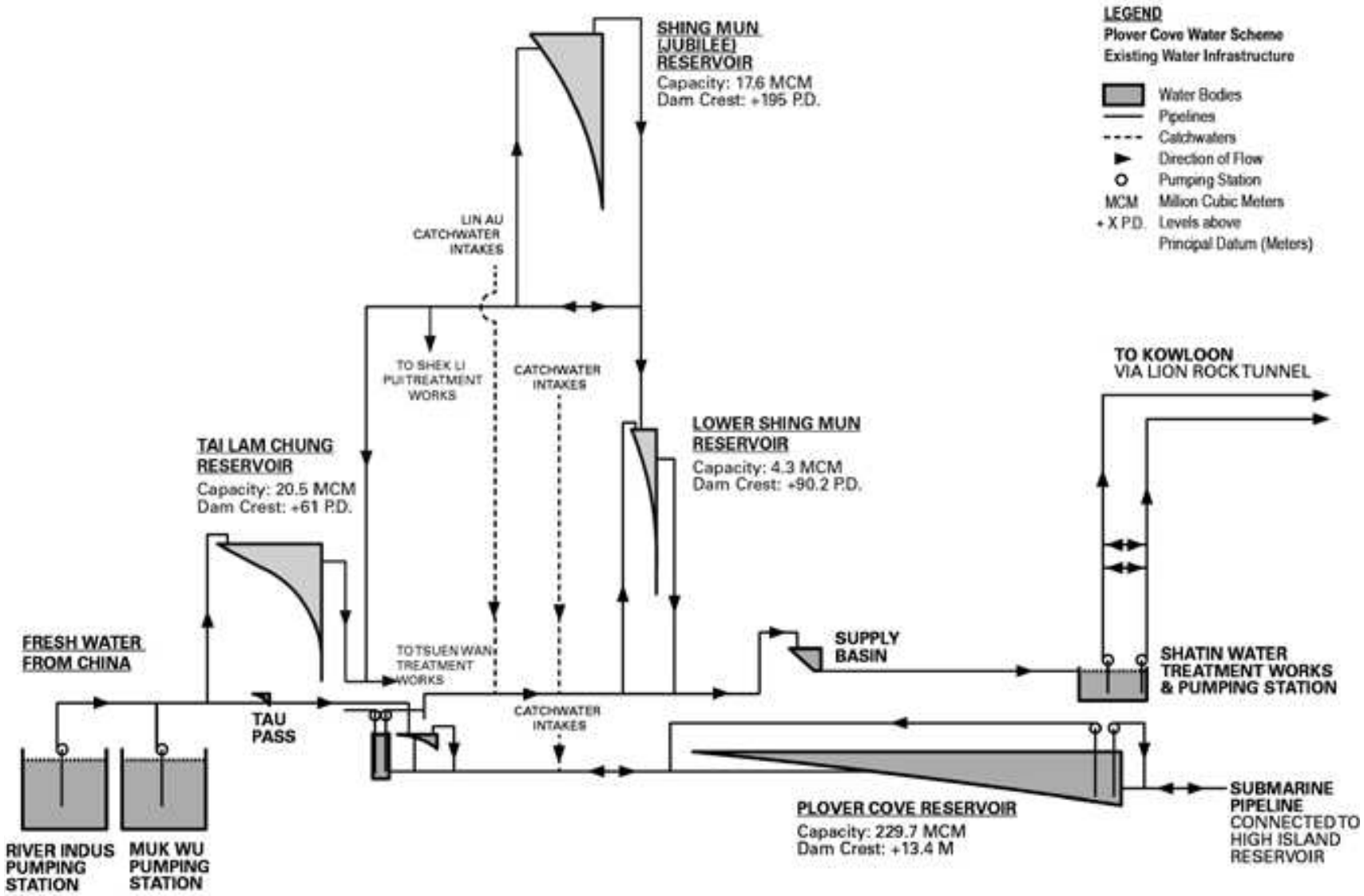

Figure 5.3. Plover Cove Water Scheme diagrammatic layout. (Illustration by Dorothy Tang. See Binnie et al. 1962.)

Figure 5.4. Aerial view of Plover Cove Reservoir. (Photograph by Dorothy Tang.)

E. P. Wilmot-Morgan, the deputy director of the colony's Public Works Department, led a delegation to meet with Guangdong provincial authorities in Guangzhou in early June 1963, to discuss various options of importing water (including both raw water and treated tap water) from Dongjiang to Hong Kong by ship. Throughout the negotiations, Guangdong authorities emphasized that they were willing to offer water (including tap water) at no charge because the water shortage in Hong Kong was at the level of a "national calamity," and they feared that importing water might increase water charges for Hong Kong customers. While Wilmot-Morgan accepted the offer of free raw water, he declined to receive tap water for free, insisting instead on paying the same rate that Hong Kong was charged for its annual allowance of water from Shenzhen Reservoir. In late July 1963, the colonial government launched Operation Water, in which a fleet of ten tankers would travel up the Pearl River Estuary and ship water from Dongjiang to supplement Hong Kong's water supply.[4]

The delegation also explored additional possibilities for increasing the water supply, such as constructing a temporary barrage across the Shenzhen River to divert more river water into the Hong Kong system, and installing a pipeline from Dongjiang to Shenzhen Reservoir.

The Guangdong representatives were taken aback by the suggestion of the pipeline and suggested that for a project such as this, the Hong Kong government would need to approach the central government in Beijing directly. In a telegram to the British secretary of state of the colonies, Governor David Trench of Hong Kong explained the necessity for the project: "I am bound to consider the possibility that grave weather conditions will continue . . . [T]his would undoubtedly have a serious effect on industry in particular, and on public confidence in Government generally."[5] In the meantime, it was essential to pursue the pipeline as an emergency reserve option until Plover Cove Reservoir was scheduled to start operation in 1968. Trench concluded that the pipeline infrastructure could be made available to the Chinese for irrigation after Hong Kong met its water supply challenges. Beijing agreed to the proposal and subsequently instructed the Guangdong authorities to proceed in assisting Hong Kong with the pipeline. Premier Zhou Enlai himself made a visit to the construction site in 1963 to demonstrate the importance of the project (*Wen Wei Po* 2015).

The Hong Kong government was aware of the potential pitfalls in collaborating with a politically volatile regime, particularly "the possibility that on the orders of a single individual, over whom the Hong Kong government has no control, all supplies could be cut off without warning."[6] Nonetheless the project proceeded, but on Chinese terms. Rather than building a closed pipeline as proposed by the Hong Kong Public Works Department, the Guangdong authorities constructed an eighty-kilometer-long open canal from Dongjiang to Shenzhen Reservoir. The canal reversed the flow of an existing tributary, Shima River, through six large regulating dams and nine pumping stations that ultimately connected to Shenzhen Reservoir, where the water flows through an artificial channel into Hong Kong's water supply network (figure 5.5). Journalists marveled over the Chinese project, which was completed mostly with manual labor and employed over nineteen thousand workers at the height of operations. All of the machinery used and equipment installed were made in China, and the massive project was completed in eight months (*Financial Times* 1965; *Times* 1964). Another new water agreement was signed for fifteen billion gallons of water annually, three times the amount allocated in the 1960 agreement. And on March 1, 1965, the waters from China flowed.

The 1967 Riots and Saline Drinking Water

July 1967 was a difficult month in Hong Kong. In April, riots had begun after the Hong Kong Artificial Flower Works fired 650 workers. The mass firing instigated a labor movement with tacit Chinese support, while across the border, Mao's Cultural Revolution was well under way. In Hong Kong, anti-British sentiment converged with communist sympathies in the most violent political unrest in the

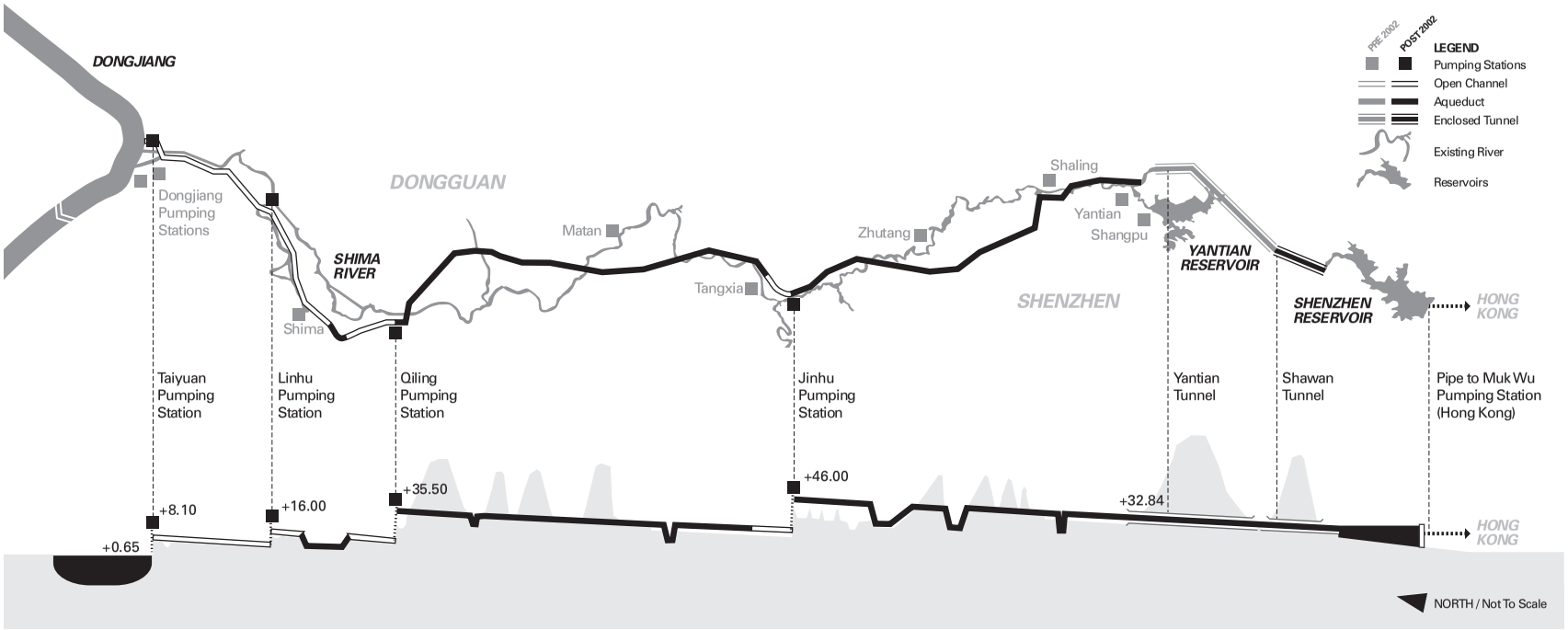

Figure 5.5. Dongjiang aqueduct alignment and pumping stations. (Illustration by Dorothy Tang. See WSD 2015.)

colony's history, resulting in six months of riots and fifty-one deaths. By the end of June, Hong Kong had experienced a general strike, which halted food imports from the mainland and coincided with the end of the annual water supply period determined by the new water agreement with China. On July 8, a bloody border dispute with mainland militia rocked colonial Hong Kong. And on July 13, the government again enforced water restrictions by limiting supply to four hours every fourth day. The situation was so dire that the British colonial government contemplated the possibility of leaving Hong Kong (G. Cheung 2009).

In the midst of the fraught political situation, representatives of the colonial government approached their Guangdong counterparts to request additional water throughout the summer, but they were met with silence. Although the main construction of the Plover Cove system was complete, the desalination process still required another year before the system would be fully in service. There was one heavy rain event at Plover Cove on July 13 and 14, and the colonial government started exploring the possibility of using some of that rainfall.[7] The Water Authority immediately began to discuss acceptable levels of salinity in drinking water, referring to a World Health Organization recommendation of nine hundred parts per million as an upper limit with regard to taste, but ultimately deciding that fifteen hundred parts per million was an acceptable level that would not endanger public health. It also began a survey of water consumption habits in the colony, and noted that water consumption in affluent parts of the city was very high and should be the principal target for a water-saving campaign. Finally, in mid-August the government announced that it had to supplement its water supply by increasing salinity levels, which included saline water from Plover Cove.

In a memo that Trench sent to the secretary of state of the colonies on July 25, he lamented that, even with normal rainfall and the completion of Plover Cove, Hong Kong would still require assistance from China to maintain a constant supply of water, and he suggested the exploration of additional reservoirs or water sources.[8] As the colony proceeded with its water emergency measures, the Water Authority began to consider the possibility that, given the anti-British rhetoric of the riots and the unstable political situation in China, water from Dongjiang might not come through, even with a stipulated annual supply period from October to June. The colony was relieved when water from Shenzhen was resumed with "an hour's notice" on October 1, and that things seemed to be back to normal. However, the Chinese failure to respond to Hong Kong's request earlier that summer prompted the colony's Executive Council to seriously consider the possibility that the water supply could be discontinued without notice for political reasons.[9]

One direct outcome of addressing the uncertainty of the water supply from across the border was the strengthening of the local water supply. This was

accomplished first by increasing the height of Plover Cove Reservoir by four meters and expanding its catchment; second by abandoning the next phase of the planned Plover Cove and Hebe Haven Scheme, in favor of exploring another site for an even larger reservoir; and third by the government's revisiting options for desalination.

Despite the recommencement of sorely needed water supply from Dongjiang, the amount of water stored by the colony remained unusually low. Water restrictions were lessened, but the Water Authority continued to mix saline water in the water supply until February 1968. This strategy to increase water supply was not without controversy. Industries, especially the dyeing industry, could not tolerate increased salinity levels, and Hong Kong's electrical companies needed fresh water for their generators. Most importantly, tea drinkers were unhappy with the saline content in their water. At a press conference in December 1967, implications that saline water was unequally distributed resulted in an exasperated response from the Water Authority, which stated, "We have modified our water distribution to distribute saline water as widely and fairly as we can," and concluded, "People on the Peak get the same sort of water as anyone in Wan Chai or Yau Ma Tei."[10]

These complaints were more than just petty concerns. Due to the riots, the British colonial government in Hong Kong had suffered a blow to its credibility and ability to govern, and while the colony would see extensive social reforms in the upcoming decade, 1967 was still a very delicate time. The deputy colonial secretary was concerned about how discontent with saline water was being "exploited by the communists," and he believed that fresh water from China was offered as a propaganda measure.[11] Indeed, between 1967 and 1969, the leftist Chinese newspaper *Ta Kung Bao* (1967) published articles with sensational claims such as "British Hong Kong supplies saline water and uses safety as an excuse," and further claiming that the British "are lying about the health impacts in revenge for our countrymen's actions in May. The reservoir has rotting biomass and sea water, how is it not poisoned or dirty?" An unintended consequence of bringing Plover Cove into operation before desalination was complete was the increased politicization of Hong Kong's water sources.

Localized Resources: High Island Reservoir and Lok On Pai Desalter

It is important to note that while Dongjiang was an important source of water for Hong Kong in the 1970s, it accounted for only 22–26 percent of the colony's water consumption (Lee 2014, 914). Although Hong Kong's freshwater infrastructure had not yet caught up with the growing water demand, the colonial government was optimistic that a solution to water security could eventually be engineered. The proposed High Island Reservoir and Lok On Pai Desalter would be Hong

Kong's most ambitious attempts yet for water autonomy, both in terms of scale and of technological innovation.

The High Island Reservoir is located in the northeast New Territories on the Sai Kung Peninsula. It replicated the engineering strategy of Plover Cove by constructing a freshwater reservoir out of a marine environment. After its completion in 1978, it had a storage capacity of 273 million cubic meters of water, which is approximately 22 percent more than Plover Cove—effectively more than doubling Hong Kong's existing water storage capacity. Together, High Island and Plover Cove Reservoirs have the capacity to store over 85 percent of Hong Kong's water reserves. The reservoir itself has a smaller footprint than Plover Cove, but has an overall height of 107 meters, and its engineered water catchment area covers virtually the entirety of the Sai Kung Peninsula. Despite the serious design and engineering challenges of the project, the colonial government spared no efforts in creating this last and largest reservoir.

Simultaneously, serious efforts were put into developing alternatives for desalination, and after years of piloting, the colonial government decided to use newly developed multistage flash distillation technology as the basis for a desalination plant. Construction began in 1973, and Lok On Pai Desalter, the world's largest desalination plant, was completed in 1975. At its peak, the plant produced 12 percent of the water consumed daily in Hong Kong. However, the energy costs of the process were staggering, and after one year of unusually abundant rainfall, the desalter was temporarily closed at the end of 1978. It was temporarily revived during an exceptionally dry year in 1981, but decommissioned again in 1982, and it was completely dismantled in 1992 (Ho 2001, 202–206). Lee (2014) explains that, given the exceptional capital and operational costs for localized supply, the colonial government was increasingly criticized for not using the much cheaper water from Dongjiang.

The Sino-British Declaration and the End of Water Rationing

At the dawn of the reform era in China, there was once again optimism for the future, and border tensions eased significantly. In addition, Britain began negotiations with China over Hong Kong's future. Although initial negotiations between the British and China were contentious, it was widely acknowledged that Hong Kong's future was with China, and thus there was no strong political reason for Hong Kong to insist on water autonomy. By 1980, even with the completion of High Island Reservoir, the proportion of the colony's water coming from Dongjiang had increased to approximately 40 percent.

New water agreements with Shenzhen required infrastructural upgrades on the Hong Kong side. These upgrades were implemented over twelve years and spread across many distributed projects, but taken as a whole, they represented

one of the largest freshwater infrastructure investments that Hong Kong had made to date.[12] The purpose of these infrastructural upgrades was to convert the existing water supply system from a collection system to a storage system for Dongjiang water. By 1982, water rationing had formally ended, and in 1984, the year that the Sino-British Declaration was signed, Dongjiang provided 50 percent of the water consumed in Hong Kong. This reliance on Dongjiang water has dramatically increased (accounting for approximately 75 percent of Hong Kong's water in 2019), which signals the culmination of an enormous shift in the hydropolitics of Hong Kong, from a condition of relative autonomy to one of systematic integration with the mainland (figure 5.6).

Post-Handover Infrastructure and New Politics of Water Security

In 2019, Hong Kong experienced more than half a year of violent protests in one of the greatest political crises in its history. After protestors successfully disrupted operations at Hong Kong International Airport, the overseas edition of *China Daily* published an interview with a Chinese expert based at the National University of Singapore, who joked about the possibility of ending the protests by cutting off Hong Kong's water supply (Zhang 2019). Controversy among both Hong Kong and Mainland Chinese commentators immediately ensued, and the scholar quickly issued a clarification condemning the use of his comments out of context. Despite this correction, Chinese state media maintained that Hong Kong "separatists" should consider the reality that Hong Kong's daily necessities, such as "water, electricity, meat, vegetable and fruits," rely on mainland resources (Yang and Wang 2019). Cheung Siu-Keung has argued that China's increased contribution to Hong Kong's water and food supply since the 1960s was a deliberate political maneuver to weaken British negotiations (2014, 1016–1018) and a demonstration to Hong Kong residents of benevolent rule (2014, 1024).

Indeed, water security has played an important role in postcolonial discussions of the future and autonomy of Hong Kong. In 2017, environmental policy think tanks Civic Exchange and ADMCF co-published a scathing report titled *The Illusion of Plenty*, which criticized Hong Kong's water security strategy with regard to increased competition in the Dongjiang watershed and the territory's wasteful water provision policies. The analysis implied that the Hong Kong government's water strategy had been "uninspired" (2017, 5) because of an overreliance on water from Dongjiang and poor water pricing structures. This false sense of security, the report argued, is based on the exorbitantly high price that Hong Kong pays to guarantee a fixed quantity of supply compared to other cities in the

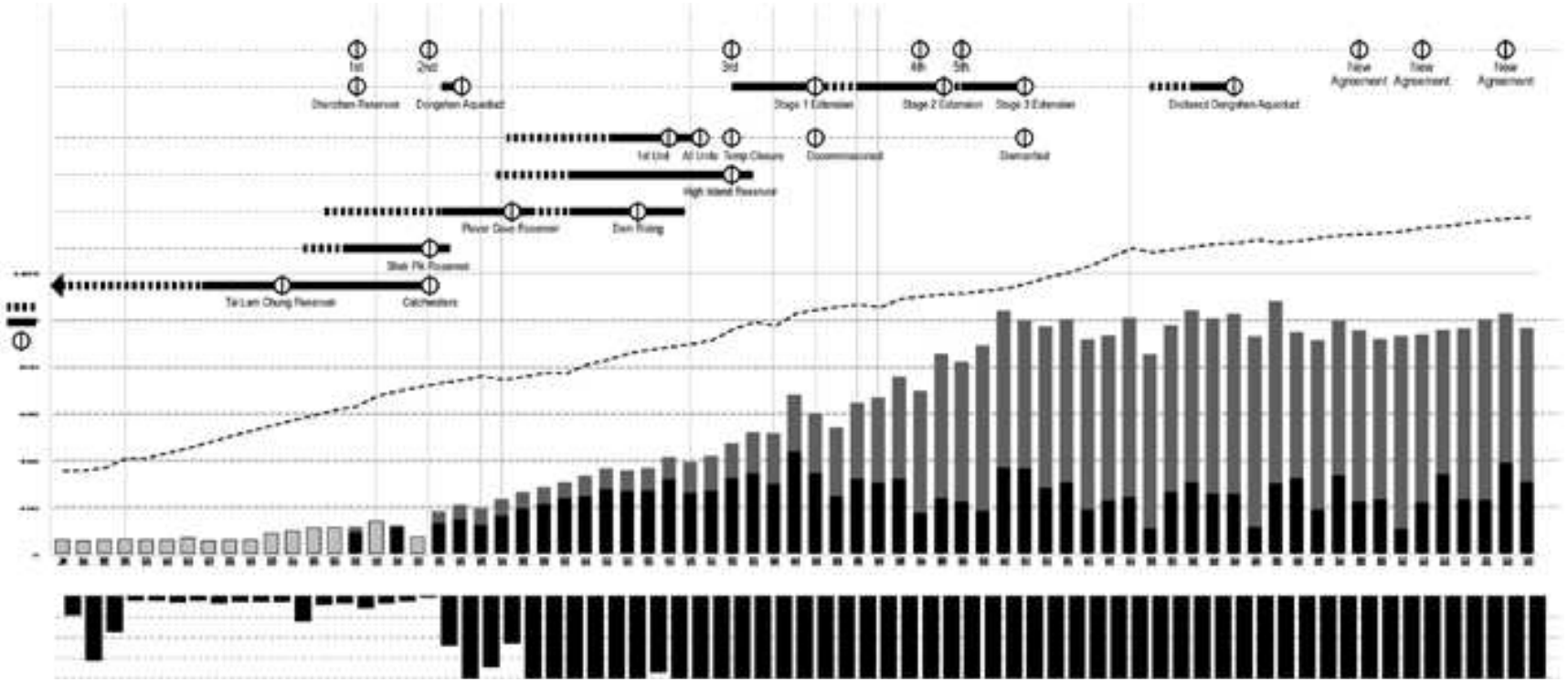

Figure 5.6. Evolution of Hong Kong's post-war water supply. (Illustration by Dorothy Tang. See WSD 1978, 2011; Lee 2014; Liu 2013.)

Dongjiang watershed, and on a refusal to acknowledge the uncertainties introduced by climate change, the geographical shift upstream of polluting industries, and the urban region's growth, with a population of over forty million people (Civic Exchange and ADMCF 2017, 12–14).

In a rebuttal, an official from the Water Supplies Department stated that "unlike Singapore, where water is imported from another country and drastic actions are required to enhance the water security, Hong Kong imports water from her motherland, which provides a higher level of water security" (Chau 2017, 1). He argued that the department does not take imported water for granted, and that it seeks to bolster water security through its multipronged flagship policy. Furthermore, he contended that the 2008 "Total Water Management Strategy" proposed water conservation, infrastructure upgrades, and increasing use of alternative water resources, such as a planned desalination plant in Tseung Kwan O, as well as the use of reclaimed water in the New Territories to meet Hong Kong's needs (Chau 2017, 3). This paradoxical representation of water security relies on an assumed benevolent sovereign Chinese state protecting Hong Kong against the ills of unchecked urbanization in the mainland by enhancing its own infrastructural capacity.

This paradox is also evident in other planning projects in Hong Kong. In 2008, a team of real estate researchers at the University of Hong Kong released a study on reviving large-scale reclamation projects to increase land supply. The team reviewed land policies and land reclamation trends since the nineteenth century, and argued that the only viable solution to land shortage in Hong Kong was continued reclamation. As an example, they suggested the reclamation of Plover Cove Reservoir to provide up to twelve thousand hectares of land (HKU 2017).

This scheme was originally proposed by Frederick Lai, an alumnus of the real estate program at the university and the facility manager for the Bank of East Asia. The underlying assumption was that, with imported water from the mainland, Plover Cove was no longer a critical component for localized water collection, and as an engineered reservoir, it had no inherent ecological value. Reclaiming land at Plover Cove for a new town would not endanger Hong Kong's water security or threaten the marine environment, unlike other proposed reclamation projects in the territory (Hong Kong Development Bureau 2018).

Lai's proposed Plover Cove New Town would house 0.8–1.2 million people on only six hundred hectares of land, and would consist of 300,000 residential units and over 6 million square meters of retail, commercial, institutional, and public space. The total land value generated would be sufficient to fund public infrastructure for mass transit and vehicular access, as well as site preparation. The proposal included a cost-benefit analysis related to water production and storage, as well as

environmental impact. Lai argued that removing the water storage capacity at Plover Cove would not impact water supply quantity or environmental value. However, he estimated that if the water quality of imported Dongjiang water went below a certain threshold, Hong Kong water reserves without Plover Cove would not be sufficient to dilute the pollution. Therefore, the reclamation of Plover Cove would need to occur in tandem with two large-scale desalination projects as a precaution against that contingency (Lai 2018). While Lai's proposal was ultimately rejected in a public consultation process, it illustrates how the contemporary politics of land supply are weighed against the politics of water security in Hong Kong.

Hong Kong's Water Futures

Since 1976, Hong Kong has designated approximately 40 percent of its land as country parks for nature conservation and recreation. The Country Park Ordinance, which took effect shortly before the completion of High Island Reservoir, was originally intended to protect the colony's water gathering grounds, and it covers all the water catchment areas of the territory's impounding reservoirs (Stimpson 1985). The recreational and ecological functions of these landscapes were a secondary concern at the time, but they have evolved into an important resource for Hong Kong's urban residents. However, the value of water gathering grounds within the territory persists in the collective consciousness of the public, despite both perennial land supply shortages and assurances that Mainland China will offset any shortfall in Hong Kong's water supply. Watershed protection remains an important justification for proponents of country parks against encroaching urban development, even though the function of these landscapes long ago shifted from water production to water storage.

The perceived merits of Hong Kong's local water supply infrastructure were borne out of a long period of dissent and controversy, in stark contrast to projects such as Chek Lap Kok Airport or the Mass Transit Railway system that have become de facto symbols of Hong Kong's infrastructural modernity. The colonial government committed significant resources and political capital to localizing water supply infrastructure, yet despite remarkable engineering achievements and technological innovation, it still failed to gain legitimacy. Throughout the post-war period, the government was undermined by the very weather patterns and natural processes that it sought to overcome. Ironically, the public's acceptance of this colonial infrastructure system shifted with changes in sovereignty, and continues after the original infrastructural function of this landscape became obsolete.

Narratives of water scarcity since 1842 have provided technocratic cover to suppress local resistance amid ongoing geopolitical negotiations between Main-

land China and Hong Kong. The water emergencies of the 1960s shaped and solidified opposing narratives of water scarcity with regard to political affinity—one is limited by the political boundaries of Hong Kong and its landscape, while the other extends into the Dongjiang watershed in the People's Republic of China. Each political shift or crisis determines the geographical extent that Hong Kong is entitled to rely upon in order to meet its water demand. The dramatic transformation of Hong Kong from barren rock into a territory of lush, afforested hillsides more than fulfilled the British colonial fantasy of a civilized landscape, as Robert Peckham (2015, 1180) has argued, but it is an infrastructural landscape carefully configured and reconfigured in response to political conflict at various scales. The 2019–2020 pro-democracy protests once again amplified the politics of infrastructural integration and economic reliance between Hong Kong and the mainland, and it remains to be seen what new infrastructural rationales will emerge.

Notes

1. By contrast, New York City is approximately 1,200 square kilometers with a population of 8.4 million people, and only 21 percent of its land is used for parks and recreation (TPL 2020).
2. The Great Leap Forward occurred between 1958 and 1962. In addition to the reorganization of the population into rural communes, the program used labor-intensive and low-tech strategies to increase China's economic output and help it rival the modern nations of the West. The Great Leap Forward was terminated due to a nationwide famine that resulted from the diversion of labor from agriculture to industry and numerous floods and droughts during this period.
3. See Water Supply from China 1960–1986.
4. See Water Supply from China 1960–1986 and Water Emergency 1964–1965.
5. Quoted in Water Emergency 1964–1965.
6. See ibid.
7. See Water Supplies 1965–1968.
8. See ibid.
9. See Water Supply from China 1960–1986.
10. Quoted in ibid.
11. Quoted in ibid.
12. See ibid.

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