Reconnecting Bangkok's Heritage Landscape: Urban Waterways and the Modern City

Montira Horayangura Unakul

In a city famed for being the Venice of the East, a strange urban phenomenon can be found: a housing development called the Grand Canal. Billboards advertising the residential community showcase an idyllic scene of European-inspired villas along a faux canal, bedecked with Venetian gondola hitching posts. The surreality of this situation came to a head during the Great Flood of 2011 which inundated over sixty provinces, with central Thailand bearing the brunt of the waters. The floods transformed this fantasy landscape into a nightmare of roiling water swirling about the houses and streets. A comment posted on a YouTube video of the flooding at the Grand Canal likened it to white water rapids. Whereas Bangkokians of a century ago would have sanguinely carried on with their daily lives from the dry comfort of their raised houses and paddled about on their boats, the residents of the ersatz modern-day Venice of the East were reduced to panic. The flooding at Grand Canal was a particularly ironic – but by no means isolated – illustration of the very fundamental changes that have been wrought to the urban landscape of Bangkok over the past century.

The 2011 flooding was a wake-up call for a country that had once experienced regular yearly floods as a matter of course, rather than as a cause for national crisis. The alarm was particularly magnified as Bangkok, often protected by government policy at the expense of other upstream provinces in previous years, could not be spared this time. Districts to the north, west and east of the city were engulfed in water. The periphery of the city, once rice paddies strung along irrigation canals which performed an important function in retaining, then draining flood water, had gradually been transformed into a hardscaped sea of built-up areas, leaving the water nowhere to go.

The collective soul-searching that ensued raised probing questions about the modern landscape of the city. Once a city vaunted for its intricate network of waterways, Bangkok had gradually turned its back on this fundamental infrastructure. For its citizens, water had become a menace to be battled and canals the dreaded

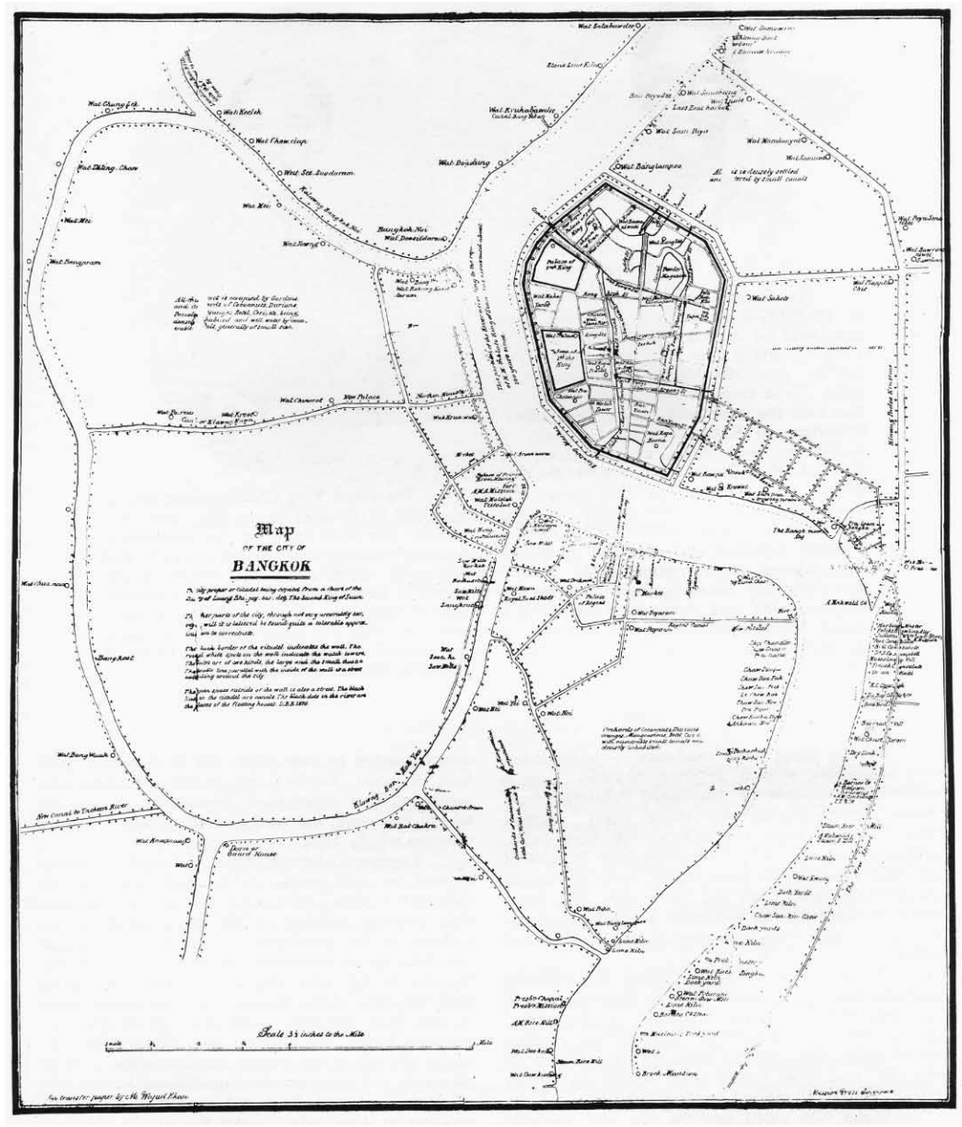

Figure 1. The urban formation of Bangkok in 1870 (from Sternstein, *Portrait of Bangkok*)

means for its conveyance. During the crisis, canals, long absent from public life, became a mainstay of daily government public service announcements and the object of obsessive analysis by news commentators and ordinary people. Modern-day houses, built right on the ground instead of teetering on stilts, became vulnerable targets; fortifications of sandbags and improvised water barriers proved defenseless against the relentless water. So absolute was the eradication of the vernacular logic of water-side building that even in designing an ersatz canal-side community like the Grand Canal, presumably to satisfy some lingering nostalgia among consumers for canals, a completely alien notion of living by the water was preferred rather than

more indigenous traditions that would have allowed for an easy co-existence with the inevitable annual rising of the waters. The tradition of living with water, in the context of the modern city, had all but disappeared.

This paper traces the historic evolution of Bangkok's waterways – which form the underlying anchor for its vernacular forms of urbanism and architecture – and examines the erosion of this traditional urban vernacular, which has had disastrous consequences on the function of the city. It goes on to make some policy recommendations on means of reintegrating the canal system, not merely as an aesthetic expression of a long-gone tradition, but as an alternative for revitalizing the ecological and socio-cultural sustainability of Bangkok today and in the future.

Historical development

The founding of Bangkok was predicated upon the replication of the geo-political template of Ayutthaya, whose urban configuration was an "island" protected on all sides by the Chao Phraya and Lopburi Rivers. The historic capital had a sophisticated system of water management. A series of parallel canals ran north-south across the width of the island, controlled by water gates at the junctions with the rivers. Localized water features like secondary canals, moats and ponds were connected to these primary canals, serving variously for retention and drainage.

Bangkok, located at a strategic ox-bow-shaped bend of the Chao Phraya River, took on a similar form through the reshaping of the natural hydrological regime. The stretch of the river that now adjoins the Grand Palace was actually dug as a canal bridging the two ends of the bend. Over time, the canal became the principal waterway. With the addition of a ring canal to demarcate the eastern flank, the recreation of the Ayutthaya urban model was complete. The resulting Rattanakosin Island, eventually ringed by a triple layer of canals with fortifications, housed the royal palace, temples, and the elite. It was originally the only area of the city where buildings were erected on solid ground.

Most residential and commercial structures serving commoners were built along waterways – perched either on floating rafts or on stilts. The city retained its amphibious nature well into the late nineteenth century, with canals serving as the major circulation routes. Early "streets" were little more than rough footpaths, which bridged the numerous canals with simple planks. Early visitors to Bangkok waxed lyrical about the charm of the eastern "Venetian" city, while foreign residents decried its lack of firm ground, particularly streets.

Early canals served defensive, transportation and drainage functions. With Bangkok sitting in an alluvial plain, it was originally criss-crossed by natural watercourses. The later man-made canals augmented the natural system, creating a great network throughout the central plains which facilitated water distribution for

Figure 2. Early morphology of canal-side settlement

everyday use and water flow to the Gulf of Thailand in heavy rains. Approximately ten major man-made canals were dug to create short cuts along the river bends, and also to connect laterally from the Chao Phraya River to other north-south rivers.[1]

Modernization and the transition to roads

The shift in Thailand's economy from self-sufficient rice growing to export-oriented rice production after the signing of the Bowring Treaty of 1855 necessitated the construction of additional irrigation canals and the expansion of the agrarian land frontier. Newly-dug canals assumed a primary irrigation function, while

[1] Bunnag et al, *Canals in Bangkok,* 21.

continuing to serve as transportation routes. Royal financing for the excavation was supplemented by investment from aristocrats and wealthy Chinese, vastly expanding landholdings among the landed aristocracy and officials.[2] Not all tracts were immediately transformed into rice paddies.

While new canals expanded the city limits into new agricultural settlements, within the city proper, canal-building and then increasingly road-building were key mechanisms structuring urban growth. The first real road, New Road (also known as Charoenkrung Road), was built in 1861 upon royal decree, running southeastwards from the riverine old city, and paralleling the river. European accounts at the time report that the king was accommodating various foreign legations who petitioned for roads where they could engage in recreational activities for salubrious effects. Most of the foreign legations and trading houses located along the river, in close proximity to New Road. A new paradigm of land development arose – with roads opening up inhabitable areas, creating new typologies of inhabitation and circulation.

The modernization efforts during the reign of King Rama V saw the construction of twenty major irrigation canals outside the city core, creating the infrastructural backbone for Bangkok's current 1240 square kilometer total metropolitan area. Canals such as Mahasawasdi and Rachapimol on the western bank of the river, and Rangsit and Prakhanong on the eastern side created a regional transportation and irrigation network.[3] A new canal, Sawadpremprachakorn, provided a connection between the upstream former capital of Ayutthaya and Bangkok, which were historically linked primarily by the river itself, thus creating new inter-municipal linkages through the reclaimed agricultural land.[4]

In the city itself, the canal took on new forms and meanings as, increasingly, road-building and road-based development gained currency. Padung Krung Kasem Canal was dug as the third layer around Rattanakosin Island – doubling the urban area. Unlike in the past where the outer ring canal served as a moat, marking the de facto edge between formal settlement and extramural informal settlement, this last ring canal did not function as a hard edge, but rather as another circulation route in the expanding new urban landscape.

Both within the expanded city and outside the third ring canal, road-building grew rapidly. In addition to Charoenkrung Road, Fuang Nakhon Road and Bamrung Muang Roads were built. The northeast stretch of the original city wall was taken down, and the new royal compound at Dusit was constructed within a regularly gridded plan. Monumental boulevards, based on Baroque urban exemplars, were built as axes between new European-style government and royal complexes. At times the construction of roads and canals went hand-in-hand. In the case of Bangrak

[2] Denpaiboon, "Transformation by Modernization", 2–15.
[3] Bunnag et al, *Canals in Bangkok,* map 4.
[4] Ibid.

(Silom) Canal southeast of the ancient city, the excavated dirt for the canal provided the fill material for a parallel road running along the waterway.

In addition to constructing more roads, King Rama V encouraged the introduction of the first railway in 1891 and electrified tramways in 1894, and also subsidized a new bridge for each succeeding year of his reign. At the same time, the enactment of land ownership rights by the king encouraged residents to move from the water to newly-available plots of land by canals or new roads. The spread of water-borne diseases led to the introduction of new regulations for canal inhabitation and use. These included the Canal Fee Act (1870), which banned the discharge of human waste into the canals and introduced taxation on raft houses, and the Thai Territorial Waters Navigation Act (1903) which regulated the size and mooring locations of raft houses.[5]

By 1900, Bangkok's built-up area covered some thirteen square kilometers, with development spreading rapidly, but at low densities, beyond the old city wall. The first bridge across the river, Phra Buddha Yodfa Bridge, was not built until 1932, so growth was concentrated on the eastern side of the city. Furthermore, the Boat Mooring Control Act (1936) made illegal the mooring of any craft, including raft houses, for more than three days, spelling the end of canal dwelling in the capital city, leading to the transfer into stilt houses on land.

Post-War road-based boom

Urban growth began to pick up after World War II and exploded in the 1960s, with new development clustering densely along new road infrastructure corridors. As Thailand stepped into a new development paradigm emphasizing industrialization, Bangkok's role shifted from an administrative and cultural center surrounded by agricultural production, to a political and cultural center and locus of industrialized economic production, adding to its primacy. At the same time, the rise of private vehicular ownership began to supplant mass transit usage on trams or by boat, which had confined urban expansion in the past. These structural changes seemed to necessitate the corollary of road-based development, remaking Bangkok's urban identity again.

Furthermore, the shift to roads was absolute – rendering canals physically and notionally peripheral to the new mapping of Bangkok. As agricultural activity in the immediate area of the city declined, so did the importance of canals. As the economic structure shifted to industry and services, jobs moved away from the canal-structured agricultural land to factories and shops "in town". As real estate boomed, agricultural land was converted into new housing and commercial development which was accessed by streets. Canal traffic dwindled, canal communities grew physically and socially marginal, and canals themselves were paved over, blocked

[5] Denpaiboon, "Transformation by Modernization", 3-6.

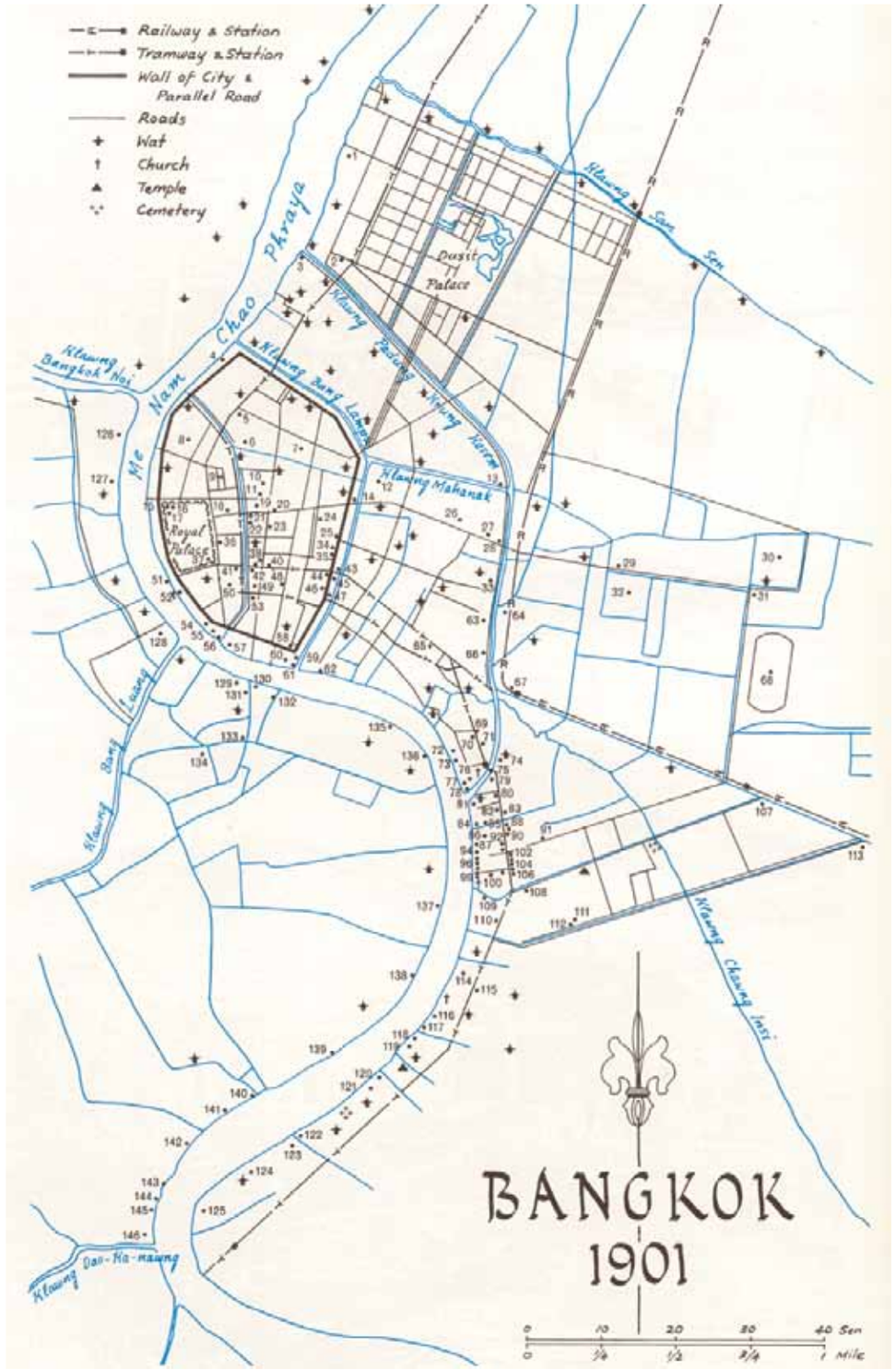

Figure 3. The expansion of the waterway network: Bangkok in 1901 (from Sternstein, *Portrait of Bangkok*)

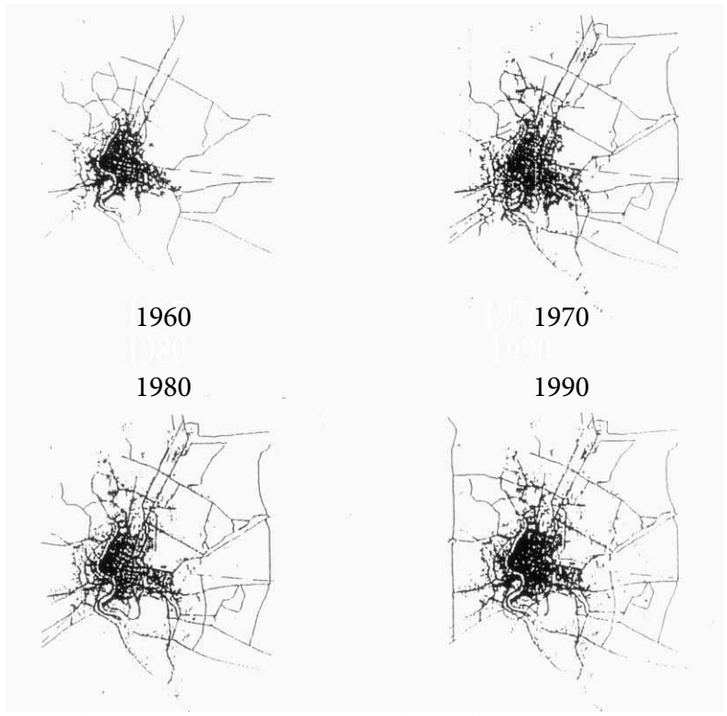

Figure 4. Bangkok's rapid post-war growth (from *Bangkok Plan*)

by gates, or left as conduits for sewage and stormwater drainage. As the network was locally eradicated one area at a time, the functioning of the entire system of water movement was destroyed, creating stretches of stagnant water that only exacerbated the decline and abandonment of canals. If canals were not physically erased from the planning map, they were otherwise treated as practically invisible. New major roads loosely paralleled major canals to some extent, but outside of the historic city center, no effort was made to cut roads immediately adjacent to canals or to find a way for the two systems to meet or intersect in a bivalent way.

Heavy government spending to upgrade the Bangkok metropolitan area, private investment responding to the expanding metropolitan market, better road networks, and technological advances that allowed for the erection of mid- and high-rise buildings all contributed to the rapid economic and physical growth of the city.[6] With rapid expansion, and no longer anchored around the historic core, Bangkok grew into a city with multiple nuclei, linked primarily by roads, while maintaining its historic pattern of undifferentiated land use. In the 1960s, new high-density residential areas located along five major roadways: Sathorn/Nang Linchee, Ploenchit/Sukhumvit, Patiphat, Lat Phrao, and Din Daeng. Likewise, commercial development, primarily in mixed-use shophouse form, lined every new street. At

[6] Vichit-Vadakan et al, *Urbanization in the Bangkok Central Region*, 31.

many points in the city the linear commercial strips intersected to form nodes.[7]

The southeastern and northern corridors from the city were increasingly densely occupied, with a high concentration of subdivisions as well as industrial estates. The Eastern Seaboard industrial development zone, which took off in the late 1980s, triggered both residential and commercial development to the east. Of the 16 million square meters of residential development for which permits were issued between 1991 and 1993, over two-thirds were located on the eastern edge of the city. Commercial development was split evenly between the inner city and the eastern suburbs, following residential growth and new consumer markets.[8] At the same time, the northern corridor was opened up with the expansion of Don Muang International Airport and the upgrade of north-south arterials and expressways. The construction of more bridges across the Chao Phraya River to Thonburi also encouraged growth on the western side of the city. By the mid-1990s, up to 3 million people were estimated to commute to the eastern side each day.[9]

The MIT-proposed Bangkok Plan (1992) pointed out that major arterial roads and expressways have had such an important impact on physical development in part because the local streets do not follow a clear pattern, lack capacity and connectivity. Roads in Bangkok account for only 8 percent of total land area, in comparison to the more typical 20–25 percent found in other cities. Road length per capita is also low – 0.6 meters, well under ten times lower than in American cities, and lower than other Asian cities too.

Major roads (arterials, distributors, secondary roads) account for 980 kilometers, while small local access roads, which are typically no more than two lanes wide and do not connect, account for 2800 kilometers.[10] Major roads are constructed by the state, while the secondary street network is often built by private land developers. This prevents a pre-planned fabric with a clear hierarchy of interconnected streets. The secondary street network serves only local circulation functions – moving people from the main arterial road into the depths of the secondary streets. There is rarely connection through to another main street at the back, resulting in secondary streets which dead-end – surprisingly often, at a canal edge.

The disconnected network has resulted in "ribbon development" and concentrated traffic volume along major transportation corridors extending radially out from the city center. Dense commercial activity that serves a city-wide catchment area lines the main street. Moving into the flanking fabric, localized pockets of development (scattered residential, retail, and slums) typically extend either along dead-end streets or in a loose network behind the main arterial. This pattern leaves wide swathes of land in between main streets undeveloped, and the secondary street

[7] Sternstein, *Portrait of Bangkok*, 124.
[8] EEC-BMA Urban Planning Team, *Trends in Office Building Construction*.
[9] *Bangkok Plan*, 7.
[10] Poboon, *Bangkok: Anatomy of a Traffic Disaster*, 14.

Figure 5. Modern urban morphology with new developments concentrated along roadways instead of waterways

network underused for through traffic.

The undeveloped land hemmed in by road-based development is often traversed by canals. In some cases, the access into such areas remains water-based. In other cases, access is limited to pedestrian paths off the road network. Rarely is this in-between fabric accessible by roads.

Canals today: challenges and opportunities

In spite of all the changes outlined above, the residual canal network of Bangkok still remains extensive, a testament to how deeply it is embedded in the city's

DNA. Some 864 canals are still left, constituting an infrastructural filigree totaling some 1890 kilometers in length.[11] However, for the reasons described earlier, many of these canals no longer serve the full range of their original functions. Today, they mostly serve as part of the surface drainage system, sewerage and wastewater drainage, and to a lesser extent, as part of the transportation system. In the outlying areas of Bangkok, the canals also continue to provide irrigation functions.

Incompatible modern infrastructure has hampered the drainage capacity of canals as originally designed. Moreover, the new pattern of road-based building has turned its back on the canals, resulting in socio-spatial marginalization from outside (through the lack of purposive engagement), and from within (through the ensuing decline of canal-side settlements themselves). The result is a whole network of low-density green belts lining the canals, often housing pockets of historic settlements that have deteriorated into slums.

However, their seeming abandonment belies their continuing importance in structuring the city. The morphological development of infrastructure and settlement in Bangkok arose through the conversion of agricultural land, which was organized precisely around the canals. Present-day land holding patterns, roadways, drainage routes, and even political boundaries are more often than not informed by a historic waterway. When the underlying geographical and morphological structure is not respected, then problems, such as prolonged flooding, will follow. This underlying waterway logic that governs the city, albeit silently, coupled with the sheer amount of open space along the canals, present a tremendous opportunity for strategic engagement with a view towards sustainable urban growth.

A revitalization of the partially defunct canal system could provide a means to address several of Bangkok's municipal needs, namely by:

- Improving environmental quality and resilience to flooding
- Increasing green areas and open space network
- Easing urban transit congestion with supplementary canal-based transport
- Creating alternative opportunities for infill development served by canal transit
- Promoting the viability of historic canal communities

Improving environmental quality and resilience to flooding

The drainage regime of Bangkok is inextricably tied to the underlying canal system, which historically discharged both wastewater as well as surface storm water. The debilitation of these dual functions, particularly the latter one, became

[11] Denpaiboon, "Transformation by Modernization", 2–23.

painfully apparent during the Great Flood of 2011.

The majority of Bangkok's canals run east-west, draining into the Chao Phraya River in the heart of Bangkok, into the Tha Chin River on the Thonburi side, and into the Bangpakong River on the eastern side. Later canals excavated to irrigate new agricultural land on the eastern side of the city run north-south, draining into the Gulf of Thailand. In the past, when the annual rainy season or occasional flood resulted in inundation throughout the delta, the water was gradually absorbed by the permeable ground surface and slowly discharged through the canal network into the rivers or the Gulf. As houses were elevated on stilts and transportation was largely

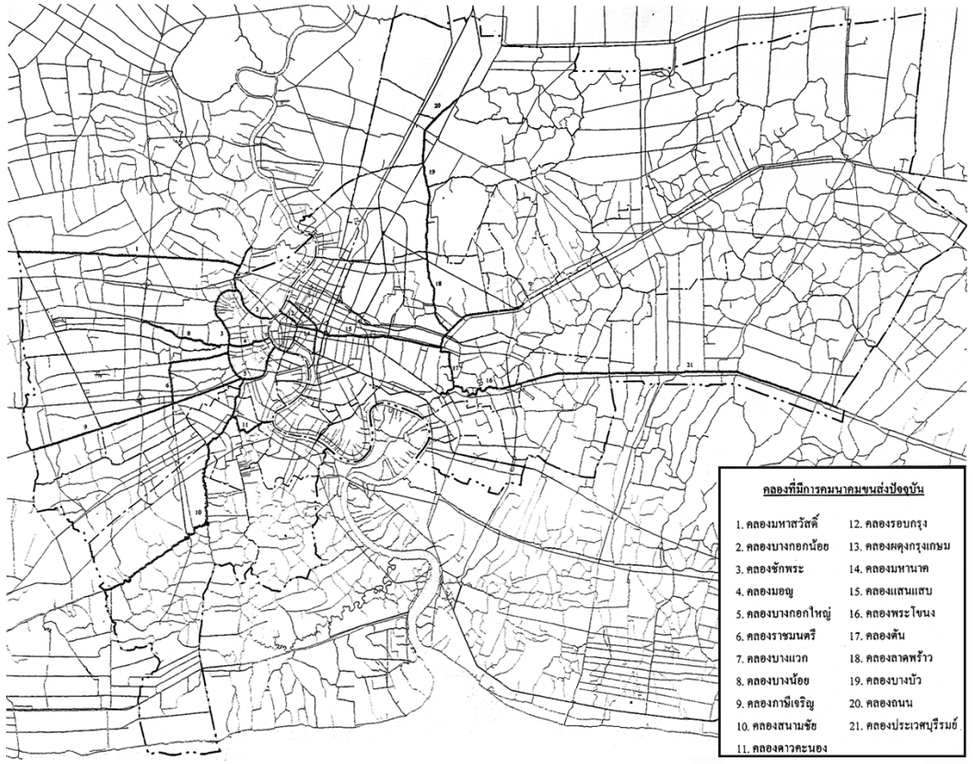

Figure 6. The canal network today. The canals in bold are served by water transit

by boat, such periodic inundations were accommodated as part of daily life, and indeed served a vital role in rice-growing. Even after the gradual transformation of the city starting at the turn of the last century, the canals still continued to perform their drainage functions relatively efficiently using a natural system of gravity flow and tidal changes.

In the modern context of Bangkok, hydrological control is no longer left to natural forces but is actively regulated, with water levels, tidal flow, and water exchange (particularly with saline water) in the canal network being monitored and controlled by municipal authorities. The control is accomplished through a system

of water gates, locks and pumping stations. Water gates located at the canal outlets, in particular, mechanize the water exchange, replacing the natural system of tides, flooding and gradual subsidence. The heavy intervention, requiring a technology- and capital- intensive approach, has fundamentally altered the function of the canal system as originally designed.

The drainage function of the remaining canal system has been greatly compromised by a decrease in the canals' capacity, coupled with an increase in surface run-off. Many inner-city canals have been filled in to accommodate new road lanes, with open channels being replaced by piped drainage. The remaining canals have essentially not been improved or expanded from their early urbanized


Figure 7. Canals are relegated to the backs of buildings, unlike in the past

condition, while maintenance in the form of routine dredging is spotty, unlike in the Netherlands where canal and dike upkeep is of utmost priority. The habit of constructing roads in the path of canals has further blocked drainage flows. Together, these factors have decreased the system's capacity for dealing with surface run-off water. At the same time, the rapid urbanization of the city has led to a concomitant increase in impervious surfaces, creating heavier volumes of surface run-off, which then overtax the drainage system, resulting in flooding.

To address this problem of inadequate drainage, the capacity of the canals could be increased, through an improved regime of periodic dredging or expansion where appropriate. Careful planning of new infrastructure to ensure that existing drainage gradients and waterways are not blocked would maximize the flow of water through

historic conduits. Increasing permeable ground cover could help. After the 2011 floods, architects proposed designing contemporary buildings which would provide open space at the ground level for water to be retained or else absorbed. Combined with a system of retention ponds, these measures could help to deal with flooding in a manner which is more effective and more attuned to the underlying topographical and morphological reality of Bangkok.

The other function of canals as conduits for wastewater dates back to the very first urban settlements. Today, much of the city's wastewater comes from domestic sources, with industrial wastewater accounting for a quarter of the total discharge volume. While this use has given rise to the unsavory appearance and foul smell of many canals today, in fact, the public health problem was even more acute in the past since the canals also served at that time as the main source of domestic water for drinking, bathing and washing. Various regulations passed in the late 1800s tried to control direct discharge into the water, with limited success. In the ensuing century, the infrastructure for wastewater collection has not improved much, though a separate water supply system now exists. A large volume of wastewater continues to be discharged directly without treatment into the canals and the Chao Phraya River. Bangkok now has only seven sewage treatment plants, treating a combined total volume of 992,000 cubic meters per day serving 12 percent of the total area and 40 percent of the total population,[12] up from 420,000 cubic meters per day a decade ago when the system was only capable of serving a mere 42 square kilometers and 1,320,000 people.[13] The plants mostly serve the heavily populated districts that line the eastern flank of the river, leaving the majority of the western districts and the rapidly growing suburbs under-serviced. The Bangkok Metropolitan Administration's Department of Drainage and Sewerage has also been working on a system of interceptor pipes running along canals and surface drains to collect wastewater in already developed areas. This strategy for separating wastewater is the cheapest and easiest to implement, although occasional contamination may be a problem.

The discharge of sewage and effluents, coupled with the disposal of trash, has led to high pollution levels in most of the canals. A UNEP study of canal water quality demonstrated, on the basis of 661 sampling points around the city, that most canals fell within the Category 5 standard which indicates that canal water can be used for transportation purposes only. Dissolved Oxygen (DO) levels were less than 2mg/l, falling short of minimum Biological Oxygen Demand (BOD) levels of 4 mg/l.[14] The resulting odor, murky water and lack of oxygen kills aquatic life and degrades the overall canal environment. Pollution abatement is primarily contingent on the comprehensive implementation of infrastructure for sewage collection and treatment.

[12] Visvanathan, *Present Status of Sewage Dissemination*, 10.
[13] *Bangkok Plan*, 89.
[14] http://www.gpa.unep.org/igr/Reports/THAILAND.htm.

In part, the decline in canal conditions is due to their lack of use. Reviving water traffic and other daily functions would help to aerate the water, reducing the growth of anaerobic bacteria. Experiments show that after water shuttles were re-introduced along certain canals, with water movement and constant agitation from the outboard motors, the concentration of bacteria dropped by up to 30 percent.

Finally, community stewardship can be mobilized to ameliorate the canals. The limited interaction of most Bangkok residents with the canals has led to waning concern with the downstream effects of careless actions such as improper trash disposal. This attitude only hastens the deterioration of canal conditions, which becomes a self-reinforcing vicious cycle. In order to combat lack of public awareness, there is an urgent need for education and outreach efforts. In addition to general public relations efforts, a more effective strategy would be to create expanded usage of the waterways so people would have more opportunities to interact with the canals on a more regular basis, with the hope that greater public awareness could then lead to a stronger stewardship ethic. Such programs include an open space network, transit, housing and other urban uses.

Increasing green areas and open space network

Bangkok has the dubious distinction of being among the megacities with the least amount of park land (0.21 percent of total urbanized land area) and the lowest amount of park space per person (an average of 0.46 square meters for each of its 9 million registered inhabitants).[15] Even cities with seemingly similar levels of congestion out-perform Bangkok – New York has 19.2 square meters of park per resident, and even Tokyo has 3.7 square meters of park per resident.

The net area of park space alone is not the only problem. Bangkok's recreational open space tends to be concentrated in a few large parks, with no even distribution throughout the city by a system of district or neighborhood parks. Moreover, the existing large parks are located either in the city core or on the outskirts of town, limiting convenient access given the traffic congestion. The quality of air in Bangkok, the terrible condition of its sidewalks, and the paucity of community centers (other than temples or schools) mean that most recreational activity, especially exercising, is almost entirely limited to the parks, making the need for them even more pressing.

In addition to the larger parks such as Lumpini Park, Chatuchak Park and Rama IX Park, several smaller urban parks have been inaugurated in the past twenty years, including Benjasiri Park (converted from the old national meteorology center) and Rangnam Park, which occupy less than five hectares and are located in dense commercial or residential areas. Sited near major roads, they are also easily

[15] *Bangkok Plan*, 105.

accessible by public transit and by foot, but not so accessible by car, given their lack of parking. These welcome additions reflect the on-going efforts of the Bangkok Metropolitan Authority to increase the city's green recreational space, at least at the regional and district levels.

However, neighborhood parks still remain under-provided in the city. Moreover, the current park system is mainly aimed at meeting recreational needs. It does not yet utilize the city's existing green infrastructure to provide enhanced ecological connectivity or functions. For instance, parks could be deployed as part of a flood control mechanism which employs the city's open spaces to direct and retain water as part of the overall hydrological regime. The connections which would be necessary for such a system to function would require the creation of a series of linked parks and parkways. Planning parks as part of an integrated recreational and ecological management system can leverage existing parks and shape future green space development, with greater benefits to the entire city.

The difficulty in acquiring land, given the intense competition for more remunerative urbanized uses, is one of the main limitations in creating new green spaces. Admittedly, choice parcels of an adequate size, in the desired under-served location, and with adequate transportation and infrastructure linkages, are increasingly rare. With occasional exceptions, even land held by the government is not readily made available for such public uses.

The proposal here is to consider the natural green network in the city – the waterways and their attached lands. Making neighborhood pocket parks by selective conversion of the agricultural parcels and vacant lots which line the city's canals would create an amenity literally in the back yards of many residents. The underutilization of these sites makes them more affordable for park land than road-side sites. By channeling surface run-off or other greywater through the parks into the canals, and encouraging a regular maintenance program through on-going use, the functioning of the canals as the drainage vessels for the city would be re-established. The waterways would become the green arteries that anchor nodes of park space, which might be programmed with complementary and different functions as dictated by the circumstances of each neighborhood. The connection along the waterways could be relatively easily enhanced through improved pedestrian or bicycle paths and canal transportation. Such non-vehicular modes of transit could help ease Bangkok's gridlock to some extent.

Easing urban transit congestion with supplementary canal-based transport

Bangkok's notorious traffic results from too many cars squeezed onto a road network which is inadequate and disconnected. On the demand side, free and easily available parking, subsidized fuel, and the relative ease of obtaining car financing

create distorted incentives for car ownership. Meanwhile, the inconvenience, slow traffic speed, and poor maintenance of the bus network, the major and most extensive public transportation system, hastens the desire to "trade up" towards car ownership. Moreover, the prestige of car ownership creates a self-reinforcing situation in which transportation modes become segregated along class lines, and car ownership becomes an important indicator of perceived upward mobility. As a result, car ownership rates in Bangkok are the highest in Asia and 51 percent of trips are made by private vehicle.[16]

On the supply side, Bangkok has fewer roads per capita than other cities in Asia or in the world. At the regional level, the completion of new bridges across the river in recent years, the final stages of the expressway network, and new tollways and motorways heading north and east have eased longer-distance commuting and bypass movement around the city. However, within the city core, the road supply still falls short of ever-increasing demand.

As critical as the total road length is the configuration of the road network. The main highways and arterials are planned and constructed by the public sector, with some coordination with future growth patterns. However, there is no planning or public financing for the local access road network. This has resulted in a web of dead-end narrow secondary streets (typically no more than two lanes wide) which do not connect with each other. Unlike in a gridded road network, where traffic volume is distributed along alternative routes, in Bangkok the primary roadways are constantly overloaded, resulting in heavy congestion. This morphological problem of the disconnected road network is endemic throughout the city. Better coordination and planning could help avoid this situation in future development areas. However, in already built up areas, the cost and logistics make the task of introducing secondary streets impossible.

The intractable headache of surface transportation makes a strong case for distributing the commuting load through alternative modes of transportation, especially those that are not road-based. The success of various other forms of transportation depends on the level of coordination with each other and with road-based transportation, which will still remain the primary mode of circulation in the foreseeable future. The Seventh and Eighth National Plans (1992–96 and 1997–2001) placed a priority on shifting away from road and expressway projects in favor of investing in comprehensive mass rapid transit systems for Bangkok. The recent experiment with dedicated bus lanes along Rama III Road has had some success in improving bus speed, but at the expense of the other lanes of traffic. Other forms of mass transit include the elevated train, which came online in 1999, the subway which started operations in 2004, and various forms of water-based transit on the Chao Phraya River and canals.

[16] *Bangkok Plan*, 59.

The viability of water-based transport is most obviously seen with the express Chao Phraya River shuttle, which arguably provides the most rapid form of north-south transportation in the city. Large ferries that can seat about 200 passengers run from Yannawa, below the Sathorn Bridge in Bangkok, upstream to Nonthaburi, stopping on both the east and west banks of the river en route. The shuttle is supplemented by local ferries that cross the river at certain heavily populated points. On the Thonburi side, it also connects with canal shuttle boats that ply local routes further inland. However, on the Bangkok side, there are no river-to-canal connections. Once they disembark, boat riders typically connect to the bus, taxis, motorcycle shuttles or the elevated train.

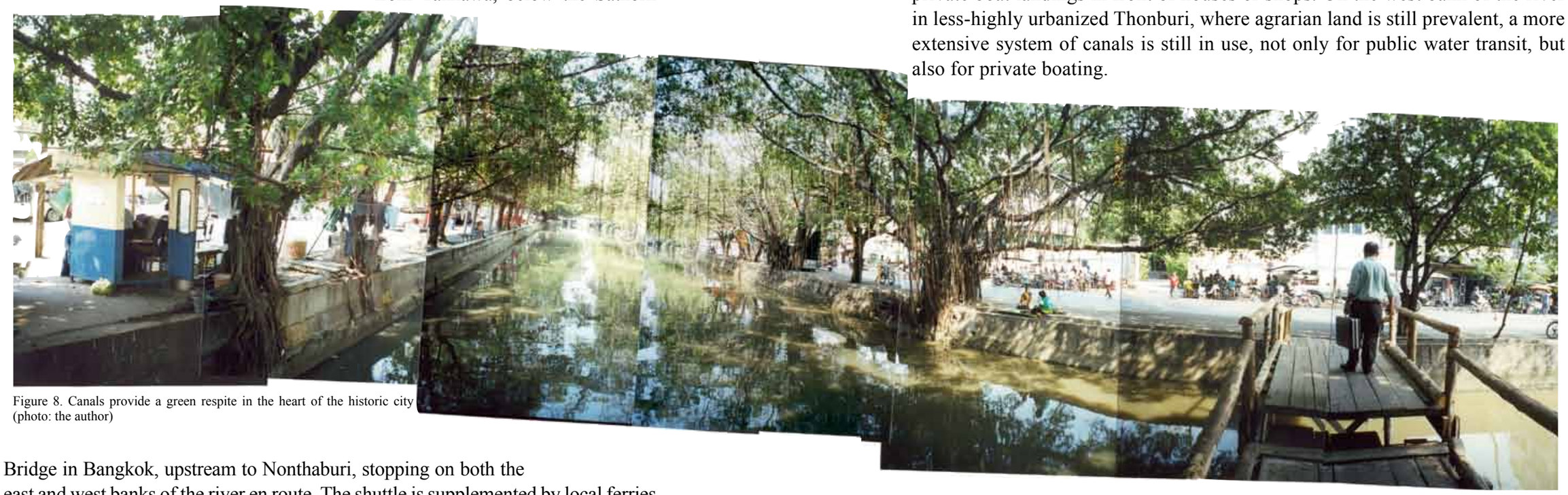

Figure 8. Canals provide a green respite in the heart of the historic city (photo: the author)

The current use of canals as transport routes falls well below the potential of the existing physical network which is quite extensive. Shuttle boats operate only in 21 major canals, providing skeletal coverage of the city and lacking secondary routes for more local circulation. On the east bank, one main route runs east-west (mostly on Saensaeb Canal), connecting to two other lines going north towards the old airport (along Ladprao Canal) and east towards the new airport (Prawet Buriram Canal). Along these main trunk lines, the boats are run by private concessionaires, and only stop at designated landings maintained by the Port Authority. These larger canals snake through highly dense urbanized areas, where much of the earlier canal-facing settlement has been replaced by office or residential towers and other intensive uses. On smaller canals with less through traffic, independent shuttles operate on a more local basis, providing short-distance trips from a transit

multi-modal point (i.e., where a boat stop meets a bus stop) or between nearby destinations (i.e., school to home). In such canals, some water-side pattern of life may be maintained, with local residents owning private boats and maintaining private boat landings in front of houses or shops. On the west bank of the river in less-highly urbanized Thonburi, where agrarian land is still prevalent, a more extensive system of canals is still in use, not only for public water transit, but also for private boating.

These localized water transit services point the way forward for more extensive mobilization of canal transport as feeder routes and for short-distance commuting trips that supplement main public transit such as buses. Given that the canal system is not fully interconnected at the scale of the entire city, the use of canals for long-haul cross-town connections has limitations. Furthermore, due to the operation of water gates, not all canals are passable, limiting the possibility of cross-town connections to a small handful of routes. However, since many inner-city Bangkok neighborhoods are located between a road at one end and a canal at the other, accessibility to canal transit is possible to a certain degree. Instead of competing with the other forms of private and public transportation, canal transport would be most effectively deployed as a supplementary system of para-transit. In terms of shorter-distance routes, canal transit should build on its strengths, in particular the rapid travel speeds possible by its unimpeded right of way, verdant open spaces, and access to historic structures. This framework suggests creating additional canal routes to serve local neighborhood commuting needs, to provide district-level recreational and historic trails, and to link to other city-wide forms of transit.

Creating alternative opportunities for infill development served by canal transit

Since the development boom of the 1960s, heavy government spending in infrastructure, better road networks, speculative private investment, and construction advances that allowed for the erection of mid- and high-rise buildings have contributed to densification of the city center and tremendous expansion of the periphery.[17] As large-scale developers became more active from the 1970s onwards, housing production densified in two locations, specifically: the inner core and the outer suburbs (11–20 kilometers outside the city).[18]

Housing in the inner core has been dominated by high-rises, mostly aimed at the middle- to high-end market. Between 1986 and 1990 alone, over 500 condominium towers were constructed, located mainly in major urban corridors like Sukhumvit Road. In the same time period, the percentage of high-rise condominiums as a share of the total housing market jumped from two percent to 43 percent of new units, while single-family houses dropped to 30 percent and townhouses fell to 20 percent.[19] Building dense up-market high-rises allows the acquisition and development of expensive city-center parcels to be profitable. The real estate boom in the early 1990s (which went spectacularly bust in the 1997 crisis), led to high-rise towers mushrooming all over the city, so that opportunities for such dense city-center developments have become increasingly more difficult. Readily developable vacant parcels with suitable vehicular access and infrastructure are rare and prohibitively expensive, leading Bangkok to follow the footsteps of Hong Kong in the redevelopment of already dense parcels into even "higher and better" uses. Moreover, with scores of half-built towers haunting Bangkok's skyline, access to financing for such projects has become much more stringent. However, there are some encouraging signs of continued demand – real estate statistics show that the downtown residential market has continued to grow steadily. With the hiatus of construction projects post-1997, this demand indicates an under-served and pent-up market for urban housing.

Meanwhile, the city's periphery has been transformed even more dramatically. From 1974 to 1988, agricultural land was rapidly converted to urban uses, with about half of new urban development ending up for residential purposes, pointing to the important impact of housing development on the form of urban growth. New development has clustered densely along highway and arterial corridors. The early suburbs took the form of detached or semi-detached housing. As land prices rose, developers turned to building more intensively, constructing smaller detached units, townhouses and condominiums. The more modestly sized and priced units then became affordable to a burgeoning middle class.

[17] Vichit-Vadakan et al, *Urbanization in the Bangkok Central Region*, 31.
[18] Dowall, *A Second Look at the Bangkok Land and Housing Market*, 15.
[19] Ibid., 35.

Figure 9. Existing transportation networks in Bangkok

Changes in family structure and the rise of the middle class have led to sustained demand for new housing. In the 1970s the tradition of extended family living gave way to a new pattern of newly-married couples moving away from parental homes in the inner urban core out to new subdivisions. In the boom of the 1980s and 1990s, an estimated 30,000 to 50,000 new dwelling units were needed each year to meet the demand of 150,000 to 200,000 new residents.[20] Until 1997, the growing middle class enjoyed strong purchasing power and high mobility, which translated into a ready market, mostly for suburban housing. In the aftermath of the crisis, housing demand has continued to surge as Bangkok's population grows from a combination of migration and internal growth.

Development continues to move further afield, to peripheral areas with easier road access and opportunities to acquire large-scale land plots.[21] In the absence of metropolitan planning, unrestrained private development has led to a haphazard pattern of land conversion, assembly and development. The result is non-contiguous and leapfrog development, which makes it more expensive and more difficult to provide infrastructure, precisely when higher-densities make such services more critical than ever. Most suburbs are not well-served by public transit, exacerbating the rise in car ownership and consequently congestion.

Bangkok is not unlike other metropolitan areas that face the complicated problems of sprawl, with its relentless conversion of agricultural land, steadfast

[20] Ibid., 2.
[21] Ibid., 42.

reliance on automobility, and patently unsustainable growth patterns and resource consumption. Unlike in North America where many downtown areas have hollowed out, there is still strong demand for living in downtown Bangkok. In this case, the option of urban infill development seems a logical alternative. However, redeveloping existing road-side buildings is wasteful of resources in the form of the physical building stock and the accumulation of social capital and meaning, and also destroys the historic continuity of the city. Meanwhile, struggling to find and develop vacant plots is equally problematic since they are mostly small, if available at all.

However, a ready source of available land continues to exist, if a different urban development paradigm is considered: the canal sides. As discussed above, there are vacant parcels along the lengths of Bangkok's canals – some quite deep and wide, and others more shallow and linear along the waterways. Thus far, they have been little developed in modern times since road access has not been constructed to access

Figure 10. Canal-side living (photo: the author)

such blind spots. Some of these sites could be connected as part of a green open space network. In other cases, they could be developed for housing and other uses. If vehicular access is made possible, or alternative modes of transport are provided, then the option of developing these sites becomes a very real and tempting one.

In particular, making the connection between future land use and transit would create a new model for urban infill development in lieu of privileging only sites with road access. As part of a holistic strategy, reviving water transit while encouraging canal-side property development would maximize the chances of success of both. On the one hand, a ready commuter market is created by locating housing or commercial activity next to the canals. On the other hand, the new development also becomes viable and attractive, with both in-town locations as well as alternative forms of transport that would allow commuters to by-pass the traffic-clogged roads.

Moreover, the new canal-side developments will stand a better chance of flourishing if they respect Bangkok's dominant pattern of mixed land uses. By developing canal sites around existing amenities, and adding needed local services

such as elementary schools and grocery stores, it becomes possible to reduce cumbersome outside commutes, while creating a sense of community, not unlike the nature of earlier canal-side settlements.

Since the canal-side sites are still not in much demand, they are relatively affordable in comparison to similar road-side sites. As a result, it will be possible to develop a range of housing and commercial building types, instead of constructing just mid- to high-end high-rises, which is increasingly the development norm in the city center where land prices necessitate maximizing the built-up space. With lower financial pressure at the canal-sides, having a diverse mix of housing and retail options will allow for social adjacencies to occur in a way which is not possible by the spatial separation of different demographic groups into dispersed areas of the city. In this way, a more diverse range of residents will be able to share the amenities of the proposed canal-side developments.

Figure 11. A neighborhood hub along the Prakhanong canal (photo: the author)

Promoting the viability of historic canal communities

The physical isolation of canals has consequently led to their social and economic decline as well. Many canal-side settlements today are low-income informal communities. Their provenance varies. Some are vestigial remnants of the original agricultural settlements which were located when the land was first claimed for rice or fruit farming. Some are home to rural emigrants who have come to Bangkok in search of jobs and now squat on municipal or private land. Other areas have a history as distinct communities that were granted rights to settle a certain area, either with or without formal land titles. For instance, the contested Ban Khrua community is a Muslim community whose roots along the Saen Saeb Canal date back around two hundred years when they were settled by royal land grant.

Likewise, there is no one generalizable pattern of canal-side settlements in physical terms. The buildings range in typology and condition, with wooden sheds located adjacent to elaborate teakwood houses or modern reinforced concrete

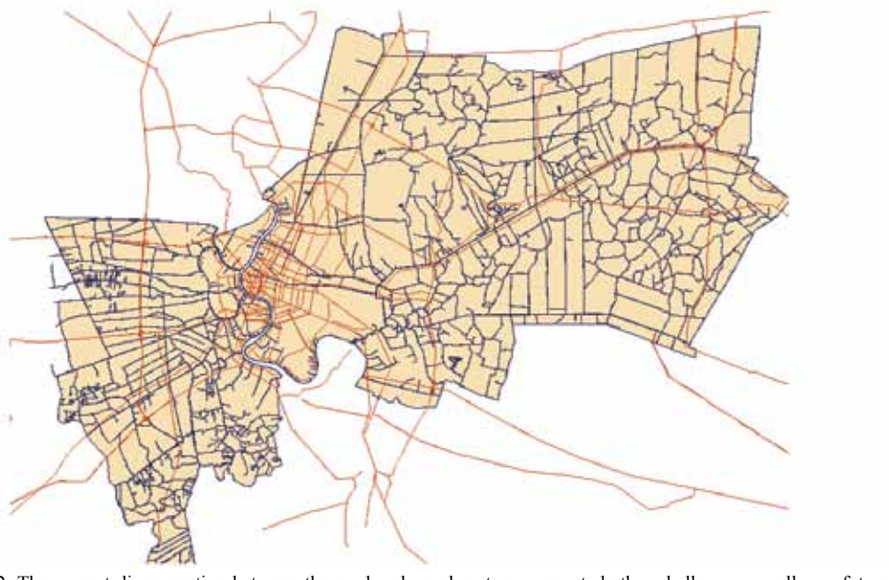

Figure 12. The current disconnection between the road and canal systems presents both a challenge as well as a future opportunity

buildings with generous front lawns. Many settlements retain a collection of vernacular architecture which is today rare to find. These include wooden shophouses with wide frontages and walkways, the occasional traditional raised house of the Central Plains style, and later gabled houses with wooden fretwork fascia boards. As these kinds of buildings are mostly unlisted on national registers of archaeological heritage, they are subject to being demolished or treated in ways that diminish their authenticity.

Like many other informal communities, the canal settlements often lack a full complement of urban amenities, in addition to being physically segregated from the rest of the city. Water, garbage collection, street lighting, electricity, sewage, phone booths, and mail delivery may not be available, along with the absence of roads, sidewalks, public transit, and parking. If they do exist, they may have been provided in an ad hoc way, and are often not as complete or at the same scale as in more formally developed areas of the city. Yet these downscaled amenities provide a critical level of service which allows the communities to continue to function. Moreover, the maintenance of local institutions such as schools, temples, local retail and para-transit has given these communities a vibrancy and level of interaction which are often missing in other areas of the city.

Encouraging modern canal-side infill development in a manner that is sensitive to the pre-existing historic communities would provide a means not only for re-connecting them physically, but also for rewiring them back into Bangkok's social and economic networks, thus providing these communities the possibility to be sustained in the future. By providing needed amenities like green spaces to

serve the city at large, these once-neglected communities would become more livable, accessible and attractive as destinations. By providing better transportation connections and improved local urban amenities like connected pedestrian paths along the canal edges and improved sewerage systems, the living conditions for existing communities will be improved. Moreover, promoting mixed use development will increase local economic development opportunities, which will allow existing local residents access to a wider range of livelihood options even in their immediate neighborhood. The retention and integration of the existing communities and their houses and community institutions into new development projects allow them to escape the constant threat of whole-sale removal, displacement and replacement. Historic houses, stores, schools, gardens, religious institutions and infrastructure like public boat landings should be retained alongside new developments. This would allow the maintenance of distinctive forms of vernacular water-side townscapes and buildings, nowadays no longer being constructed, along with the attendant social networks and traditions which sustained these communities. Hopefully this strategy would help bring new life to the canals, by respecting and harnessing the energy of the existing communities, and creating continuity with the historical physical and social fabric of the canals.

Future possibilities

The lessons from the 2011 floods underscored the folly of urban development that fails to adequately take into account the underlying ecological and morphological context, in particular, the backbone of urban waterways which have played a key role in the past for drainage, transport and communication and thus constitute the fundamental basis for the city's heritage landscape. With a generation of urban dwellers more interested in fake canals and canal heritage theme parks rather than the real thing, valorizing Bangkok's urban waterways has become more of a challenge than ever. Yet, as this paper proposes, the canal system, if properly reinvigorated, has rich potential in many ways – as an important part of the urban water management system which is well-attuned to the environmental rhythms of the Chao Phraya delta, as a potential site of green spaces, as an alternative means of urban transport, as a location for urban infill, and as a repository of the city's vernacular built heritage and associated traditions in the form of historic communities.

That said, the strategy proposed in this paper is not appropriate along all of the city's canals. Certainly, only a subset will have the necessary ingredients to augur success: relatively sound environmental conditions; remaining social and physical landmarks and hubs; navigability by water and the possibility to connect to other existing forms of transport; and proximity to job centers, schools, retail, and recreational areas. Even if the strategy proves successful, it would not be a panacea for all of Bangkok's urban ills. What the proposal does do, however, is to raise

the possibility of working within the logic and vocabulary of the neglected historic urban landscape of the city in a way that leaves the canals renewed and Bangkok's waterside traditions revitalized in a manner appropriate to the complexities of the contemporary city.

References

Bangkok Plan: A Vision for the Bangkok Metropolitan Administration Area, 1995-2005. Discussion Draft. Cambridge, MA: MIT, January 1996.

Bunnag, Piyanant, Duangporn Nopkum and Suwattana Thadaniti. *Canals in Bangkok: History, Changes and their Impact (1782 AD-1982 AD)*. Bangkok: Chulalongkorn University, 1982. (in Thai)

Denpaiboon, Chaweewan. "Transformation by Modernization of the Traditional Waterfront Settlements in the Context of their Coexistence with the Aquatic Environment: A Case Study of Raft Houses and Pillar Houses in Thailand." Kyoto University. Dissertation. 2001.

Dowall, David. *A Second Look at the Bangkok Land and Housing Market.* Berkeley: IURD, November 1990.

EEC-BMA Urban Planning Team. *Trends in Office Building Construction: 1991-1993*. (Report). 15 May 1995.

Poboon, Chamlong et al. *Bangkok: Anatomy of a Traffic Disaster*. Perth: Murdoch University, 1995.

Sternstein, Larry. *Portrait of Bangkok*. Bangkok: Bangkok Metropolitan Administration, 1982.

Vichit-Vadakan, Vinyu et al. *Urbanization in the Bangkok Central Region.* Bangkok: University Research Associates, 1976.

Visvanathan, C. *Present Status of Sewage Dissemination in Thailand and the Applicability of UASB-DHS to Thailand*. 2011. Retrieved January 2013. http://www.faculty.ait.ac.th/visu/pdfs/AIT-TOHOKU.pdf