

BANGKOK REMADE
Design to Enhance Climate Resilience, Social Equity
and inspire the Nation's Imagination:
A Case Study of the Khlong Toei Port lands

Niall G Kirkwood
Harvard University Graduate School of Design

Abstract

This paper outlines alternative urban design futures for the capital city of Thailand and for all levels of communities and society living there. Recent academic research and graduate student design investigations engaged with environmental engineering, flood control and land dignity will be introduced as a source of pragmatic urban design ideas and site planning tools to understand and reimagine this large delta occupied by the global city of Bangkok, multiple stakeholders, industry, and dense settlements yet, in part, also polluted and in climate crisis. An ambition is also to inspire through these urban design works the nation's imagination about this contrary yet vibrant Thai city.

Bangkok forms a vast water holding and dispersion area which once served as a resource for military defense, supplies of fresh fish and a significant area of rice cultivation. A particular focus of this paper will be the long-time informal communities, daily visitors, and local organizations of the district of Khlong Toei - a large tract of city Port land and adjacent districts located alongside the main artery of the Chao Phraya River. This imposing water corridor is a central historic transportation system and natural urban organizer and a compelling visual and cultural image for the national capital.

A range of design approaches are presented using the tools of 'urban acupuncture' - the small scale insertion of landforms, vegetation, built infrastructure and civic elements that address flooding and drought mitigation, brownfield reclamation and the concerns of toxic soils, sediments and water, the disposal or reuse of municipal waste and the reconstruction or reinvention of urban infrastructure, the consolidation and protection of informal settlements and the creation of new and imaginative public space within the historic context and traditions of Bangkok's natural and built fabric.

Keywords: water urbanism, urban acupuncture, climate adaptation, public space, landscape engineering, brownfields equity

Introduction

BANGKOK REMADE ⁽¹⁾ as a design research initiative seeks to advance alternative futures for the capital city of Thailand and for all levels of society living there. The research engaged with environmental engineering, flood control and social dignity for its residents as a source of pragmatic landscape design ideas and tools to understand and reimagine this delta occupied by the City of Bangkok. In addition, the ambition was to also inspire through design the nation's imagination about this urban district as a vital and significant Thai cultural civic

landscape.

The study area is characterized as a flat low-lying plain which forms a vast water holding and dispersion area. This once served as a resource for military defense, with access to supplies of fresh fish and rice cultivation to serve the city's population. A particular focus of the research was the landscape of the long-time communities, daily inhabitants and local organizations of Khlong Toei (2) a large tract of land and adjacent districts along the main artery of the Chao Phraya. This ecologically enriched riverfront landscape as shown in Figure 2 is resplendent with busy public water taxis, barges and overhanging platforms and decks swarming with goods and people.



Figure 1. The main artery of the Chao Phraya

The broad area of the Lower Chao Phraya floodplain of 605 square miles (1,568 square kilometers) is located between the Bangkok City Core and its periphery to the north and the Gulf of Thailand to the south. This overall area comprises highly disturbed coastal forests, salt flats, former shrimp farms, networks of historic *khlongs* (canals) and *soi* (side-streets or service lanes), dense urban riverfront(s) in the capital city Bangkok and industrial and agricultural fringe districts. The initial geographic and social perimeter of the study consists of the Greater Bangkok area and its approximately 10.7 million population comprising a majority of Thai ethnicity but also communities of Myanmar, Khmer, Lao, Malay, and Chinese residents.

The research activities included shaping a landscape design language from schematic concepts to specific site details- for water detention and control that encompassed flooding and drought mitigation, brownfield reclamation and the concerns of toxic soils, sediments and water, the disposal or reuse of municipal waste and the reconstruction or reinvention of landscape infrastructure, the consolidation and protection of informal settlements and public space within the context and traditions of Bangkok's natural and built fabric. The research is ultimately concerned with the use of landscape design to embolden and advance creative projects for citizens and guest workers of all sectors of society. The research investigated the rights of all stakeholders on the site particularly those whose voices and histories have been often ignored

or rejected in the past. In this way, a range of alternative futures was advanced to allow informed decisions in the future to be made about the evolution of the Khlong Toei lands owned by the Port Authority of Thailand (PAT) and adjoining sites along the Chao Phraya River.

The source of the Chao Phraya River is in the north of Thailand where the Ping, Wang, Yom and Nan rivers merge to form an estuary at Paknam Pho District in Nakorn Sawan Province. It flows southwards through Uthai Thani, Chai Nat, Sing Buri, Ang Thong, Ayutthaya, Pathum Thani, Nonthaburi and Bangkok before reaching the Gulf of Thailand in the Samut Prakarn province. Bangkok over the last centuries was directly tied to the landscape qualities of this large and legible river rivaling the Nile. Early maps referred to it first as 'Me Nam', meaning 'Mother of Water'. In the Thai language, 'Mae Nam' with the addition of an 'a' is a generic term for river with 'Mae' signifying mother and 'Nam' water. The Thai royal and noble title Chao Phraya may be translated as 'Grand Duke'.

Although humans have inhabited what is modern day Thailand for around 40,000 years, it wasn't until the 13th century that the first Buddhist Kingdom was founded in Sukhothai. A new kingdom was established in the mid-14th century on the banks of the Chao Phraya River (just to the north of where Bangkok now lies), expanding to become the capital of Siam at Ayutthaya. Bangkok traces its origins back to the 15th century when it began as a small village under the rule of the capital Ayutthaya. Early settlers chose the original site because of the land's fertility and the abundance of fresh water and food. Due to its strategic location near the river's mouth, the settlement soon grew in importance by serving as a customs outpost. During the years 1534-1546 Somdet Phrachai Rachathirat, the King of Ayutthaya, instructed that a canal be dug to create a short-cut in the narrowest neck of land, starting from the mouth of Bangkok Noi canal to the mouth of Bangkok Yai canal. He named it Khlong Lat Bangkok ⁽³⁾. After the 18th century sacking of Ayutthaya in the Burmese-Siamese war, the capital was relocated to a safer stretch of the 372km-long Chao Phraya river -- initially in Thonburi, to the west, then across to the eastern bank in what became Bangkok. In 1782 King Rama I, finding the eastern banks more favorable, founded what is now modern Bangkok and celebrated the occasion by building some of the world's most beguiling structures and landmarks such as the Grand Palace and the Wat Phra Kaew ⁽⁴⁾. Canals or 'khlongs', natural formed or manmade, began to weave themselves into the city bounded by informal and formal housing settlements and small-scale industry and contributed significantly to the cityscape and the inhabitants' lifestyle. While most of the countries surrounding Thailand such as Laos and Cambodia (under the French) and Burma and Malaysia (under the British) were colonized by European countries, Thailand's rulers were able to exploit the rivalry between French Indochina and the British Empire to their advantage and thus were never colonized. A revolution in 1932 resulted in the first constitution being established by King Prajadhipok, and seven years later in 1939 the country's name, Siam, was officially changed to Thailand.

Bangkok residents then traveled by the Chao Phraya, canals and waterways and often met at floating food and goods markets some of which still serve that same purpose. The city has today expanded far beyond the river's banks. However, locals still live, work, and play along the Chao Phraya. More than 50,000 people still use its ferries every day. Long strings of barges bearing cargo move slowly upstream hourly. The riverbank landscape and way of life has also grown vertically. Hotels and condominiums hem in traditional temples, churches, and civic buildings. It is this juxtaposition of calm and chaos, modern and traditional, religious, and secular, ugly and sublime, foreign and indigenous that makes the Chao Phraya so evocative and

challenging as an area of landscape and design research. Following a series of crippling events that included severe nationwide floods in 2011 that killed 815 people (5) and affected millions of citizens and the political turmoil in Thai national leadership with overt corruption at all levels of society and a coup d'état in 2014, the banks of the Chao Phraya River have experienced a recent renaissance with intense development in the Silom and Sukhumvit districts.

Background to Khlong Toei

Khlong Toei is a district in central Bangkok of 5 square miles (13 square kilometers) related to the City Port shown in Figure 2 and long known for the large number of communities of informal settlements of workers who came there initially from the north of Thailand to find employment in the urban core.



Figure 2. Aerial Image of Khlong Toei District, Bangkok

The population is approximately 103,000 with a density of 20,500 people/square mile. However, the industrial marine development of the site by the City and growing number of unregistered residents and their shifting status as permanent or illegal communities over time has led to a tense and controversial set of negotiations over land sharing, displacement of certain communities and financial buyouts and removals. All set within a landscape of declining quality

and poor environmental conditions in water, air and sanitation. On one hand, the owners of the land, the Port Authority of Bangkok see opportunities for overseas investment and development, while the informal communities of over seventy years without land tenure see this as their permanent home and a place for their family's present livelihood within their community and future growth.

Other residents of the City, see access to the Chao Phraya River edge and the amenities of the site as both providing more public landscape space as well as offering opportunities to address climate equity, flooding, and drought adaptation as well as other current environmental issues. The land lies opposite Bang Kra Chao which is popularly known as the 'Green Lung of Bangkok'. This last complete remnant of floodplain ecology and vegetation provides a significant section of open land with little or no buildings with elevated walkways, bikeways, and access for Bangkok's citizens to natural and highly vegetated landscapes.

Bangkok Port, popularly known as Khlong Toei Port, contains major shipping and container facilities located on the Chao Phraya River. It was Thailand's main international port from its opening in 1947 until it was superseded by the deep-sea Laem Chabang Port in 1991. It is primarily a cargo port, though its inland location limits access to ships of 12,000 deadweight tons or less.

Purpose of Study

Bangkok is a rich area to carry out landscape design research as well as to build core knowledge about working productively in a shifting floodplain and with a growing population at all levels of society (extreme wealth to abject poverty and everything in between). In short, it offered researchers an opportunity to explore the creative and projective aspects of landscape design and construction to address specific current concerns.

The research team conceived and pursued a range of design proposals at differing scales of operation culminating in overall detail design proposals for Khlong Toei and everyday Bangkok and in turn form a design project at the scale of 'acupuncture' for the remaking of Bangkok that is culturally, socially, spatially, economically and aesthetically inventive, rigorous and pragmatic. Finally, the ability to convey ideas and projects to a public, non-professional audience in Thailand and the City of Bangkok was addressed and a range of methods for recording and presenting the research work outside of the conventions of normal design and planning publications will be advanced especially in the venues of public exhibition displays for the citizens of Bangkok across the city and in community spaces of Khlong Toei.

The research study was structured in four parts. The initial work was carried out in teams which enabled the early part of the project to advance in a more collaborative manner prior to the field testing. The research project was divided into these main periods as follows: Portraits and Features- The Delta, Greater Bangkok and Chao Phraya. This collected information to carry out a broad ecological study and allow an understanding of the nature of this delta landscape including the main elements of land, water, vegetation, agriculture, topography, microclimate, civic development and infrastructure.



Figure 3 Khlong Toei detail and everyday urban space

Fieldwork- Site Testing in Bangkok. The results of Part A were tested by the research team on-site. Working together they carried out an inventory and critique of local traditional and emerging landscape technology site techniques in Thailand using handsketches, video and photography. Proposals- the required the development of conceptual urban design ideas and building towards an urban landscape Language. The research team advanced a repertoire of outdoor test plots and a method to disperse them in the landscape. Those addressed water and land remediation, stabilization and management within individual design hypothesis related to environment, economy, energy, governance, living, and mobility.

Bangkok Remade- Design Development and Landscape Detail

Landscape plots were strategically applied within Khlong Toei and surrounding districts and its existing and emerging fabric to test out the creation of a visible practical design language, expression and site dispersal using 'urban acupuncture' within an existing infrastructure of energy, settlements, land movement and drainage.

Final documentation of research projects were assembled as a foldable set of poster documents and collected together in a 'blue box' as a portable exhibition to be sent to and displayed in Bangkok for the general public in the study site shopping malls, art centers, community venues, design offices and government centers.

Site Analysis and Alternative Proposals

The major urban design approach is that of ‘acupuncture’ a means by which human small-scale spaces and urban elements, technologies, and materials are inserted into the fabric of the buildings, streets, natural green land, infrastructure of roads and canals to give local citizens more access to amenities or to solve spatial and solve environmental problems. Overall issues that are addressed as part of the ‘acupuncture’ design approach are the concerns of local climate adaptation through the medium of landscape elements of water, soils, and vegetation. A further theme is the need for social equity in city making and to address the needs of all levels of society in Bangkok particularly in areas of public space, community health, heat islands, flooding, and waste management. What unites all the project work is a concern for bottom-up design focusing on the people themselves at all levels of society, the day-to-day activities and material fabric that makes up their lives and its relationship to the natural world and the ecological processes in place.

For further definition, ‘acupuncture’ is an urban design method used in city repair and renovation, that supports the idea that interventions in public space don’t need to be expensive or complex to have a transformative impact. An alternative to conventional development processes, urban acupuncture represents an approach for Bangkok to address its complex physical environment. Named from the small-scale needle insertion techniques to the human body to stimulate the bodies nerves and ultimately overall health, ‘acupuncture’ refers to the improvement of social and urban issues through precise interventions that revitalize areas of the city and consolidate urban planning strategies. The approach has the advantage of being a bottom-up fast-tracked design method, that can be implemented swiftly and often with modest resources.

Climate Adaptation- the concern for cities and population centers to address climate adaptation is of urgent need by design and planning professionals. While the case for adaptation is clear, some communities most vulnerable to climate change are the least able to adapt because they have fewer resources or are in countries struggling to come up with enough access for citizens to basics like clean water and air, fresh food, employment, and children’s education.

Social Equity- focuses on justice and fairness across all members of society irrespective of status. It accepts that each person is exposed to differing conditions of environment whether clean water, air and access to public space and natural landscapes. This can be due to race, gender, education, financial circumstances, or even religious background.

To understand the Thai Peninsula and the Chao Phraya Lower Flood-plain as a working delta and a container of rich biodiversity and extensive cultural urban communities, initial research assembled and reviewed the data and change of this landscape over time.

The history and physical manifestation of the river ecology and canal systems, which drove the formation of modern Bangkok and shaped its current form and elements can be traced back to a series of initial Royal settlements, trading cities and capital locations. Fluvial sediments, hydrology (watersheds, rivers, ponds, and canals) with the generally flat topographical conditions was mapped along with the diverse river ecology including indigenous river settlements, wildlife alongside infrastructure and river settlements. Agriculture and city infrastructure within the floodplain was also studied in relation to their spatial implications. The events of the infamous 2011 floods ⁽⁵⁾ in Bangkok which crippled most of the city and hinterlands northwards of the city were examined as an example of extreme

climatic conditions and introduces temporary widespread disruption to the entire built fabric, transportation and to local communities as well as longer term devastation to agriculture and manufacturing.

Team research made comprehensive documentation and study of the regional context of the Lower Chao Phraya Flood-plain over time and the broad geographical and cultural land use features and landscape elements. A data base was built to serve as an understanding of the dynamics of the Greater Bangkok area and the responses of periods of change through water control and movement and urbanization within a dynamic natural landscape.

Site analysis and design study proposals are presented in the next part with a short description addressing general approaches and methods used in the initial overall research and five individual projects that address aspects of urban design, city repair and reconstruction and the addition of public resources and amenities for the city.

Liberating the Khlongs (6)

“The shift away from khlongs (canals) towards a network of new vehicular and pedestrian streets and sois [alleys] marks a distancing from a lifeline and cherished part of Thai culture - it’s deep civic connection to water. Water’s importance is still present culturally, however, physically, waterfront space is a commodity typically only afforded in sites off limits to the public or one that projects a negative image due to present issues of water pollution, flooding, and inconvenience in a car-centric city.

Celebrating Thailand’s aquatic DNA by liberating the khlongs physically, visually, and symbolically, ignites a new era for the health of water, the city, and the Khlong Toei community. In the face of the decline of the Khlong Toei Port and shifting industry patterns, the vision for liberating the khlongs calls for future micro re-development of industrial Port lands for example through floating markets and public gathering spaces. A toolkit of ‘acupunctural approaches’ within this greater vision leverages the power of water for phytoremediation (remediation of water and soils by plants), spiritual/cultural venues, cleansing of air and infrastructure and a stronger human connection and relationship with water itself”.

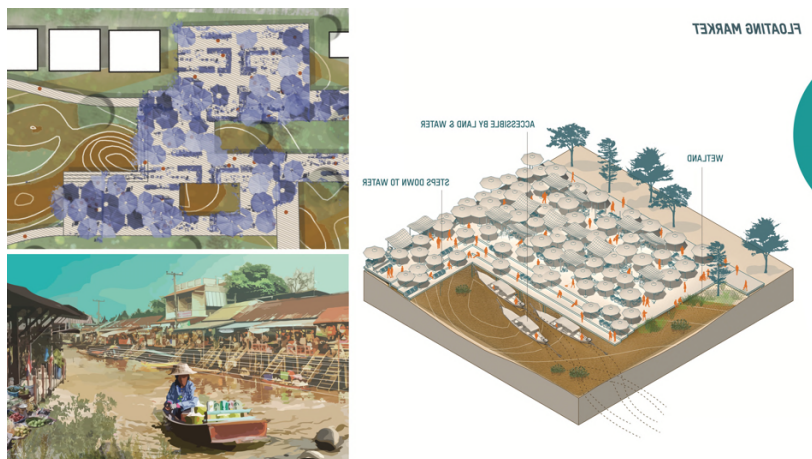


Figure 4 Floating Market inserted into Khlong Toei

This approach serves as a catalyst for significant progress in preserving Thai culture’s vibrant connection to water and furthering the city’s mission for environmental resiliency, and inspiring the Khlong Toei community to reclaiming cultural and economic opportunities afforded by public space on the water.

Vacancies as Filter (7)

“ Rapid urbanization and stagnant dwelling qualities in Bangkok have resulted in vacant lands related to existing urban infrastructure, including privatized spaces beneath elevated sky train railways and the expansion of trash in the khlongs around human settlements. The Khlong Toei Slum, as the largest complex of Bangkok vacant lands, is facing issues such as high population density, limited accessibility to clean drinking water and insecurity of land tenure. Instead of massive relocation, a system is introduced that improves water supply and self-help food production and propels “in-depth tourism” that preserves local culture and right to stay with mutual benefits between the landowners and residents.

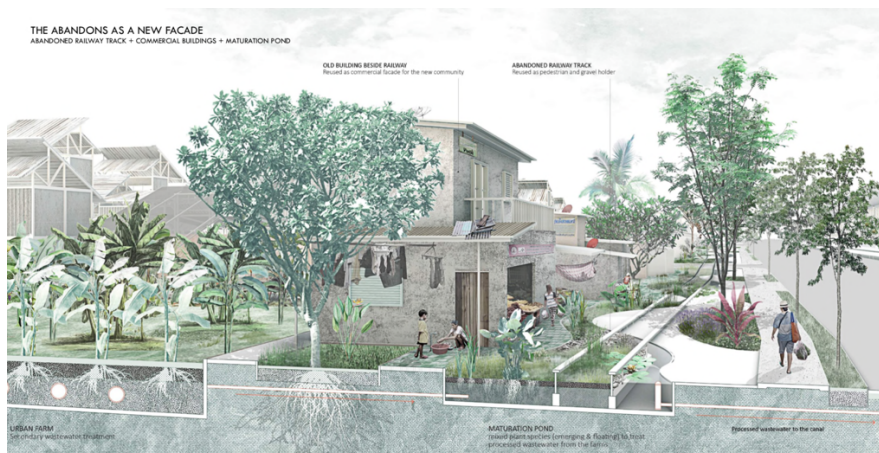


Figure 5 The Abandons as a New Facade

Twenty two percent of Bangkok residential communities are categorized as informal settlements. In Khlong Toei, the communities and families live in three main kinds of sites: abandoned waterway encroachments, disused railway tracks, and vacant land found under highway infrastructures. They share a similar linear narrow form that cannot be easily repaired and developed. By cooperating with National Housing Authority (NHA) and local NGOs, these spaces are revitalized with water infrastructure that is adaptive, poly-functional, and publicly accessible. This opens the enclosed community to more public awareness that could assist in preventing their site becoming gentrified by new port development or expansion”.

Human-Oriented Green Infrastructure Design (8)

“On the premise of maintaining local living habits and customs, and minimizing damage to the environment, this project advances the maximum benefits that can be obtained from small scale insertions to the urban fabric. Based on the dynamic ecological status of the existing greater Bangkok area, the project introduces elements of Green Infrastructure design, including series of river corridors and natural wetland parks at the lower basin of Chao Phraya River.

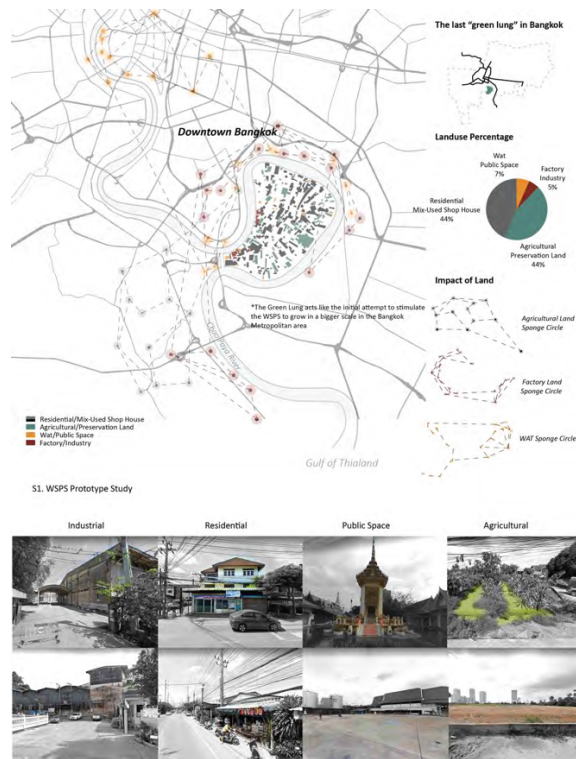


Figure 6 Analysis of the last green lung in Bangkok

The goal is to re-navigate the water channel, to remediate and slow down the water, to cleanse the surrounding air, to improve the polluted soil environment, and to increase the green coverage percentage of the area. The idea of rationing, cleaning, replenishing, and managing water is a key urban approach that small amounts of effort and resources can yield larger results that can impact the lives of residents”.

Contemporary Urban Space in Bangkok (9)

“The goal in this project is not just to preserve or replicate forms of traditional urban spaces such as alleyways (sois) and canal streets (khlong-ways), but to reimagine Bangkok’s contemporary civic spaces through the preservation of the unique ‘ways-of-life’ within them by the residents. A user-centered analysis of the contemporary street spaces was carried out to discern the needs and desires of the users and how these can be physically manifested within urban space.

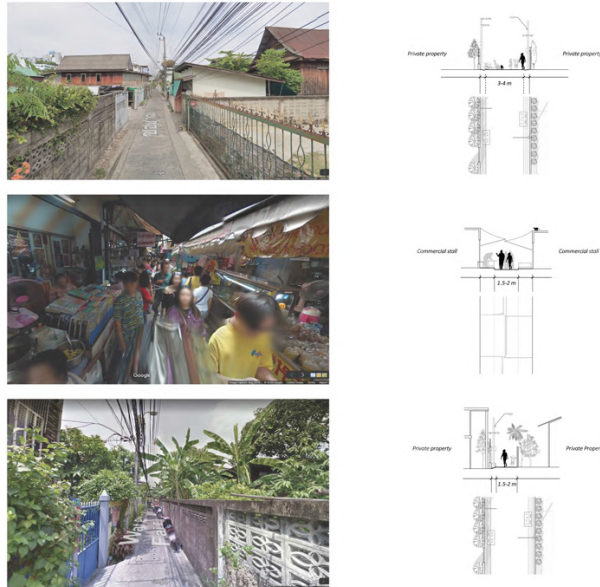


Figure 7. Acupuncture Details in Khlong Toei Urban Fabric

The form of the initial design is the concept of a *notch*: the dent on the edge, the change of rhythm, the place among space. Parallel to developing the physical form of this framework, spatial patterns of such space were also studied. The expectation will be the reimagination of a city language (words, grammar, structure) that serves local needs, while the exuberant energy from Bangkok’s urban life is preserved”.

Towards a New Entanglement: Pacemaker, Place maker and Peacemaker (10)

“Khlong Toei is one of Thailand’s oldest informal settlements, hidden behind the flourishing modern city of Bangkok. Over its history it has been plagued by many issues that have further deteriorated the quality of the daily living environment for the residents. These include contaminated emissions from the nearby Port and oil refineries, untreated city sewage, polluted industrial soils, untreated household waste, and flooding actions that affected the whole city. In addition to these problems, the lack of good and varied employment opportunities further contributes to the challenging living conditions for most of its residents.

Poverty emerges as a key factor that has shaped Khlong Toei. This has led to economic vulnerability, food insecurity, the migration of younger people, poor educational opportunities, and lack of land tenure for residents. The residents are trapped in a negative cycle: the more they live in poverty, the worse their environment becomes, the more dangerous the atmosphere, and the more they are separated from society. However, residents

are optimistic and hardworking and want to improve their income and quality of life while remaining in Khlong Toei and becoming better integrated into city life.

The Khlong Toei ‘Pacemaker’ is created. It creates attractive spaces for outside visitors and potential investors and provides work opportunities and life quality improvement for the Khlong Toei community. The ‘Pacemaker’ as a spatial element is inserted into Khlong Toei by transforming existing underutilized open spaces, especially parking lots.

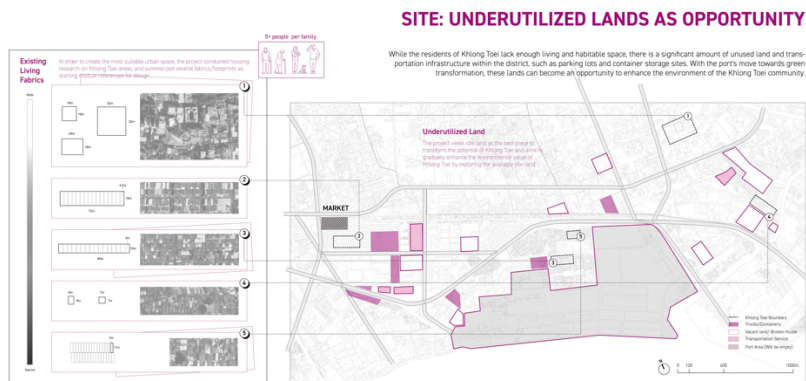


Figure 8. Analysis: Underutilized Lands as Opportunity

These sites can be changed into active spaces for nearby residents without requiring them to be removed from their homes built on Port Authority land. The ‘Pacemaker’ is a pilot project, an experimental landscape that will be simple, powerful, and a highly visible public space. It is also a multi-layered space, which can be varied functional, including "waste treatment education," "sewage treatment agriculture," and "soil purification recreation." Meanwhile, landscape corridors extending from the existing urban fabric are inserted and will serve as the ‘Place maker,’ a method to link the ‘Pacemakers’ together. This network system will connect the various community ‘Pacemakers’ and ensure their activity at a larger scale, activating more communities. Finally, by transforming the existing industrial port into a series of micro urban parks, the entire Khlong Toei area will be activated, allowing residents of both Khlong Toei and Bangkok to rediscover the riverfront and enjoy its space. New commercial and subsequent recreation, tourism, and cultural development can also be inserted in time to the new riverfront park, the ‘Peacemaker.’

Through the ‘Pacemakers’ improvement of residents’ lives, the ‘Place makers’ connection of community activities, and the ‘Peacemakers’ harmonious coexistence with urban waterfront development, the Khlong Toei port can become a new model for transforming low-income communities in Bangkok.

Discussion

The contemporary urban environments of large dense South-east Asian deltaic cities bring a complex set of planning and design requirements, tools, and approaches, several of which have been found in the research projects in the last section. I would like to return to a topic

that is of significance to Bangkok, Khlong Toei and other landscapes in the future- the sources of design ideas as they relate to individual small scale and larger district sites. There is a persistent moral strain, which has continued to inform design practice in present times. The medium of the landscape is considered by many to be 'natural', and therefore lays claim to a moral status of 'truth' that places it in an oppositional relationship to the 'cultural artifice' and the true condition of these sites and districts. Even the most cursory analysis of these sites reveals industrial and artificially manipulated surfaces. In fact, the site with which the urban designer works becomes a rhetorical product - a fiction. Here the moral superiority assigned to landscape design-by appeal to the 'natural' needs to be questioned. By looking observantly, without trite moralizing at the natural world as well as the disposable world, the urban designer builds at the great overlap between the two. This suggests a challenging model for how we ought to work within the urban Thai environment, a new quality of attention through the acupuncture approach to the intricate organic and artificial systems of reality. Looking beyond nostalgia for the impossibly pristine, (for example, the riverways, khlongs and mangroves green spaces cannot be recovered completely) and clear sighted beyond disgust for the actual present site conditions.

Conclusion

The Capital of Thailand- Bangkok, is an Aquatic City and it is also a home to a diversity of urban form from small scale lanes and dense close-knit low-rise neighborhoods with street markets to contemporary linked adjacent shopping malls, apartment high-rises, luxury stores and restaurants yet always close to its origins in the delta to remind all its citizens, guest residents, and short-term visitors. Its connection to water in many forms is also a design, cultural, ecological and spiritual inspiration to all. For its inhabitants and especially those who grew up there living with water it is the vernacular way. Residents originally had their homes on stilts and accessed the structures by small flat-bottomed boats, water taxis and canal or khlong boats. They were fed from the floating food markets that persist today although many have become commercial tourist destinations. Communities in Bangkok are used to living on water and flooding and inundation originally meant defense from neighboring countries and food (particularly an abundance of fresh fish, crabs, and productive rice fields). Sediment was part of seasonal change; flooding was transformational and vital. The Chao Phraya River was, and is, the lifeblood of Bangkok and to the origins and evolution of this city as a landscape. The river still flows in exaggerated loops through historic neighborhoods where traders settled along its banks to trade in cloth, gems, and spices and past Buddhist temples, gilded palaces, and humble teak bungalows teetering on the water's edge. Kids still frolic in the russet-brown water. As a landscape it is a juxtaposition of the calm and chaotic, modern, and traditional, religious, and secular, ugly and sublime. Yet since the 2011 flood in the Watershed of the Chao Phraya, submerging Bangkok and its hinterlands, this relationship with water has changed in a negative way.

This has been recently documented by the author Pitchaya Sudbanthad in his 2019 complex novel infused with menace, heartbreak, climate disaster and humor titled- 'Bangkok Wakes to Rain'. In this set of short stories that finally fold into a novel about the lives of inhabitants of a building in Bangkok he paints "a twin portrait of an Megacity of over 11 million that many call home and of a world where sanctuary is increasingly hard to come by".

To assist Bangkok in addressing rising sea levels and still preserve its amphibian identity, the research project eight alternative works establish a network of ideas to create a porous city, a series of working landscapes to solve environmental problems and increase the resilience of Bangkok across Thailand. The site works aid, engage, and educate these climate-vulnerable communities about productive urban landscape design as well as providing a model for the rest of Thailand about the resourcefulness, practicality, and beauty of their capital city.

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Notes

1. 'Bangkok Remade' was run as an academic research project in Spring 2020 and Spring 2023 at the Harvard University Graduate School of Design, Cambridge, Massachusetts, USA. Graduate Participants were as follows: (2020) Ahmed Mena, Chen Xinyi, Clingen Kira, Du, Gilbert Samuel, Grosman Shira Li Xiuzheng, Liu Nguyen Hanh, Song Yayun, Tsai Yun-Ting, Turrini Michele, Valentine Sam, Zhou Xinyi (2023) Bai Xue, Boyce Jonathan, Chen Chen, Gao Shengfeng, Guo, Kai, Lang, Yingchen, Liu Janet, Liu Rongqing, Umana Cristian, Wang Shuo, Yang Chunfeng, Zhou Zhuohan, Zhu Jingyuan.
2. Toei meaning 'padan leaf a fragrant local leaf used to flavor local candy and the air and Khlong meaning canal'

3. Translated from the Thai language it means 'Bangkok short-cut canal'.
4. Translated from the Thai language it means 'Temple of the Emerald Buddha'.
5. In 2011 an unprecedented flood occurred in the City of Bangkok resulting in over 800 deaths overall and over 13 million people affected. The flooding began at the end of July triggered by Tropical Storm Nock-ten. These floods soon spread through the provinces of northern, northeastern, and central Thailand along the Mekong and Chao Phraya River basins through Bangkok. Of equal significance it became a measure or point of reference in time by governmental and environmental and planning agencies in addressing the remaking or rebuilding of water control barriers and defenses in the city.
6. Project – 'Liberating the Khlongs' authored and copyrighted by Christian Umana (2023)
7. Project- 'Vacancies as Filter' authored and copyrighted by Tina Yun Ting Tsai. (2020) This project was the top winner of the 2020 American Society of Landscape Architects (ASLA) National Student Award of Excellence for Residential Design
8. Project- 'Human-Oriented Green Infrastructure Design Channel and Water Improvement, Air Remediation and Surface Vegetation Restoration' authored by Lucy Du (2020)
9. Project- Contemporary Urban Space in Bangkok authored by Jason Liu (2020)
10. Project- Towards a New Entanglement: Pacemaker, Place maker and Peacemaker authored by Kai Guo (2023)

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