

Readdressing Dhaka's Public Water Bodies: A Design Research


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ABSTRACT

 In Dhaka, the capital of Bangladesh, rampant expansion and commercial development are brutally transforming the urban tissue. As a consequence, Dhaka's water network, which was once integrated into the city's fabric and is of major importance for its drainage capacity, is rapidly disappearing. This article critically investigates the layered meanings of water in the city through focusing on the case study of Hatirjheel Lake, Dhaka's largest inner-city water body. A number of interpretative maps dissect the rich history of the city and its water, while contemporary cartographies reveal a new set of issues as advancing urbanization fills in water bodies. Beyond mere descriptive urbanism, the paper is also projective and proposes design as research by way of a conclusion. The tools of urban and architectural design are utilized for a project on Hatirjheel Lake that could restore and enlarge land/water and culture/nature relationships.

Keywords: *water urbanisms, Dhaka, Hatirjheel Lake, design research*

THE HYDROLOGY OF DHAKA

Bangladesh is situated within the world's largest delta at the confluence of the low-lying flood plains of the Ganges (Padma), Brahmaputra (Jamuna) and Meghna Rivers. Its territory is interlaced with an intricate system of waterways and tidal channels. Most parts of the poor, over-populated

and inefficiently-governed country are less than 12 meters above sea level and it is estimated that approximately 50% of the land would be flooded if the sea level were to rise by 1 meter. Bangladesh is near-universally regarded as one of the most stressed environments in the world—frequented by vicious tropical cyclones, tornados, tidal bores and life-threatening monsoon floods (Novak, 1993).

¹ This article was developed from a 5th year master thesis studio 'water urbanisms' by students I. Havermans, P. de Groeve, I. Naesens, S. Peeters, L. Van Reeth, S. Verrewaere and E. Wellens, guided by professors Kelly Shannon, Bruno De Meulder and Guido Geenen. The collective framing of the water problematic was then individually developed as a design research thesis. Sanne Peeters' work was co-guided by Kelly Shannon and Bruno De Meulder.

Dhaka, Bangladesh's mega-city capital is no exception to the general perception of the nation. The city is on the higher ground at the southern edge of an alluvial old terrace in a low-lying region. At a strategic position regarding the water-routes of the country, the city is bounded by the Balu River on the east, Turag River on the west, the Buriganga River on the west and south and the Tongi Khal on the north. (Figure 1) Stretches of high land are flanked by marshes and old riverbeds. Expansion of the city is extremely difficult, and the hazards of flooding and inundation haunt city dwellers. Dhaka is dependent upon and inseparable from water—it is a city rising from the surface of the water. Its profits and perils are linked to what once was an extensive system of rivers, canals, lakes, ponds and lowland marshy areas. Water resource management should arguably be at the core of the city's planning and development, but everyday realities and the ineffectiveness of development controls has resulted in widespread illegal encroachment, land filling and severe environmental degradation of water bodies.



Figure 1: *Shrinking Waters.* Over the course of the past decades, Dhaka's once abundant waters have been dramatically disappearing. [Drawn by authors. Sources: Detailed Area Plans of RAJUK (2009), Google Earth Images, 2009].

From the contentious misuse of the Buriganga River from untreated sewage and chemical waste discharges from a number of industries, including tanneries in the west, to the land-grabbing and indiscriminate filling of the absorptive lowlands of the eastern periphery, water problems are guaranteed to exponentially increase. Illegal appropriation of waterways and the subsequent watercourse loss exacerbates flooding. In an effort to reduce flooding, the rivers are often dredged. Ironically, this results in the branching rivers and canals drying up, which are subjected to further land-grabbing. The ultimate result is that Dhaka's water bodies are under threat of extinction.

Inside the city, there is a system of *khas* (often translated as 'canals'), ponds, lakes and reservoirs, which serves as a natural drainage system. A great problem in Dhaka is the fact that its soil is clay, which does not absorb water and its climate humid, which does not allow water to evaporate. The city's network of canals and drainage channels is the only means by which to evacuate the city's storm water to the flood plains and low-lying lands at the periphery of the city. On the other hand, in the rainy season all the rivers surrounding Dhaka start to swell, fed by the rivers coming all the way from the Himalayas. The low-lying areas in between the rivers and the city are inevitably inundated. The eastern fringe and the banks of the Buriganga River on the west form particularly vague borders between the city and water.

Besides being an important system for the city's drainage, Dhaka's inter-connected water system has also been a great transportation network. Water links the rural hinterlands to the capital city and areas of the city to one another, making Dhaka a flourishing centre of commerce, trade and industry. Over time, however, natural siltation of smaller waterways and the filling in of many of them has unfortunately made water transportation inside the city impossible, resulting in the fact that today, it merely occurs along the larger rivers. Another important aspect of water in Dhaka, is its symbolic meaning for the Hindu founders of the city. In the past, and even in today's rural Bangladesh, ponds accompanied houses, not only for its life supportive properties, but also for daily rituals. Since the water coming from the Himalayas holds a sacred meaning, many Hindu temples and rich palaces were built along the rivers. (Figure 3)

However, Dhaka's fortune based on its water riches didn't last. By the 1830s, the city was already described as a ruin, "full of stagnant pools, ditches and marshes, [...]" while the Dulai Khal which pierced

almost through the heart of the city had degenerated into a pestilential channel" (Ahmed, 1986, p. 148). Because of the unhealthiness of the Old City and the introduction of wheeled carriages, tap water etc., the meaning of water completely changed (Ahmed 1986). In the Town Planning Report Dacca of the famous British town planner Patrick Geddes, khals were important open spaces (Geddes, 1917). He was no doubt influenced by the English picturesque gardens, but nevertheless, this point of view corresponds to the idea of Bangladesh being the 'Venice of the Orient', an often-heard comparison for old Bangladesh (Taylor, 1840, as cited by Nilufar, 2000, p. 6). Not long after Geddes' proposal in 1917, khals once again returned to becoming important merely for pragmatic purposes—first as transport conduits and later as drainage channels (De Groeve et al, 2010, pp. 19-23).

After the independence of Bangladesh in 1947, the population of Dhaka, which had become the capital city, started to explode. Large amounts of swamps and wetlands, previously outside the city, became part of the urban core and were subsequently filled-in, in order to develop them as areas of residential, commercial, administrative or for business importance (Shahadat, 2010). The remaining khals and ponds quickly transformed into black and smelly waters, choked at places by the filth and garbage discarded from houses (Dani, 2009, p. 4).

Water inside the city became nothing more than a burden. In the 1990s, many of the khals in the Old City were converted into underground drainage and sewerage box culverts; hidden underneath a number of the city's main highways. In a way, people preferred roads instead of the smelly khals because it reduced flooding around the former khal and it was a solution for the traffic congestion (Khatun, 2009). It is no wonder that Dhaka's citizens forgot about the existence of most of the inner-city waters or at least avoided visiting them. Today, few people seem to care about water issues, even if the lack of water bodies causes more and more problems during the rainy season. However, the ecology and environment are well on their way to becoming endangered to a point where health and safety issues will inevitably require a change in attitude.

PRESSURE ON DHAKA'S WATER SYSTEM

In merely 35 years, the urban agglomeration of Dhaka has grown from 2.2 million inhabitants

(1975) to 14.65 million (2010). Today, Dhaka is the ninth largest city in the world and according to UN projections, it will become the world's 5th largest city by 2025 with a population of 20.94 million (UN 2008, UN Population Division 2010). The city grew from a reasonably organized town to a seemingly unstructured mega-city, bursting at the seams and limited in its growth by rivers and low-lying land. Until recently, the expansion of Dhaka has always been influenced and limited by its water bodies and lowlands. On the combined maps of the topography and the urban growth of Dhaka, it is clear that the few higher grounds in Dhaka were first to become urbanized. Dhaka originated along the Buriganga River, where once rich and wealthy palaces were built in the 17th century. Until the 1850s, expansion mainly took place along the river, on the natural levee formed by the river. In the 20th century, expansion shifted inland, bounded by the floodplains of the Turag and Balu Rivers, on an elongated stretch from south to north. After the independence of Bangladesh in 1971, massive urbanization and migration towards Dhaka caused densification and a shift towards the lowlands east- and westwards. Until 1980, most of the urbanized area was situated on land higher than 6 meters above sea level. The land between 6 and 9 meters is flooded every year for a short period of time (Islam, 2009). Today, even the low-lying flood plains (2-5 meters above mean sea level) are urbanized. (Figure 2)

Besides the forgotten streams and disappearing water bodies, there are still a few reminders of the vivacious water culture of the past. The development of four big khals into artificial lakes—Dhanmondi Lake, Gulshan Lake, Banani Lake and Mirpur Lake—are efforts to give the water back to the city (Bertuzzo et al, 2008, p. 20). These lakes are still used for boating, fishing and as storm water and drainage outfalls, but are mainly situated in the planned higher income residential areas. In middle class areas, on the other hand, the unplanned, seemingly chaotic development has taken over most of the water bodies: not only khals, but also ponds and wetlands have been filled up for building purposes. The remaining water bodies are mostly used by lower income people for their daily needs. Here, women gather and talk while collecting water or washing, representing a last trace of the traditional relation between Dhaka and its water.

In the past few years, the low-lying areas (2-5 meters)—which had previously served as necessary sponges for Dhaka—are also being recklessly urbanized. It is interesting to note that encroachment was first mentioned in the Masterplan For Dhaka in

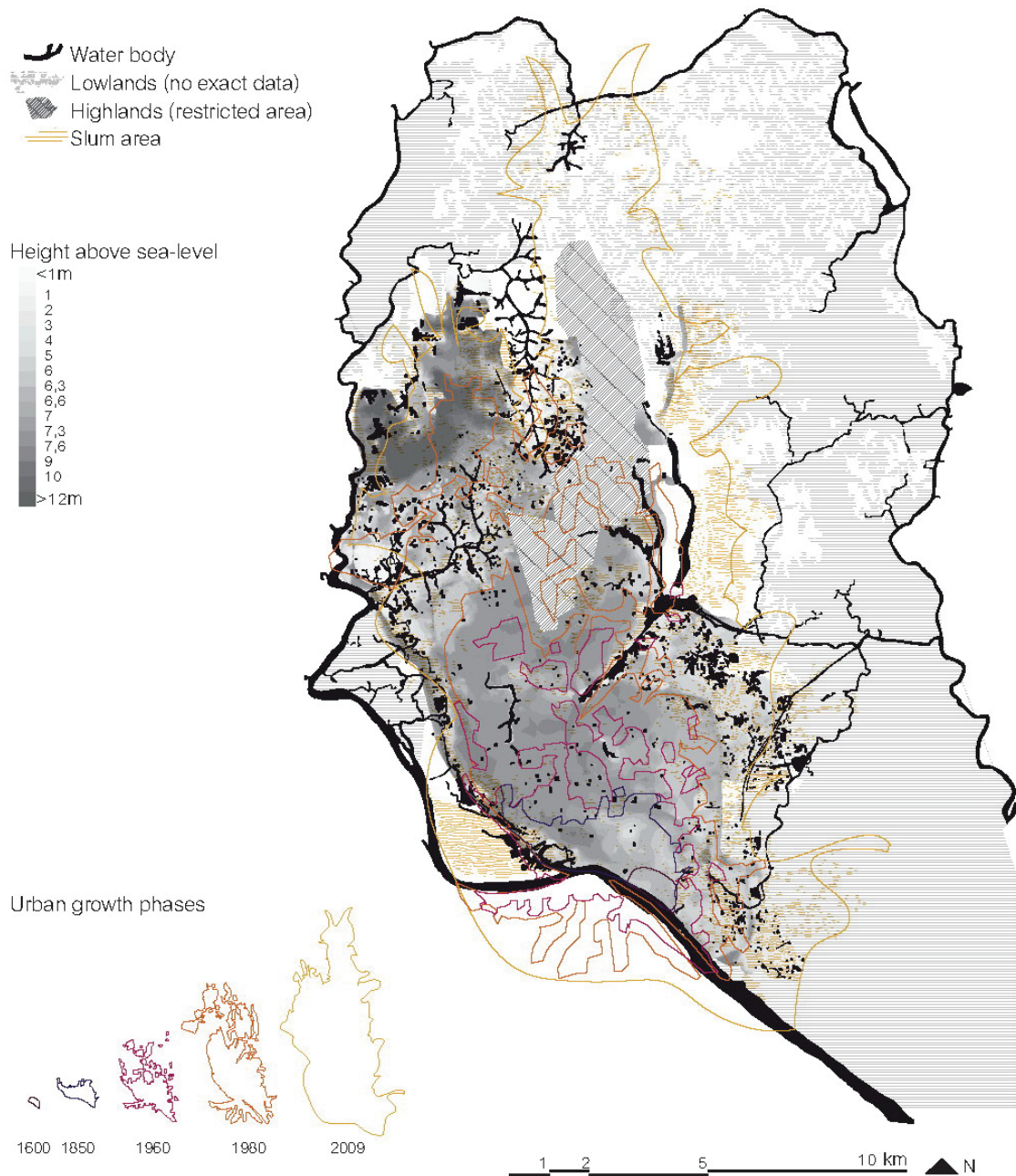


Figure 2:
Evolution of Urbanization & Topography. Urbanization has only recently been inhabiting the dangerous lowlands, due primarily to a lack of other options for expansion. [Drawn by authors. Sources: Detailed Area Plans of DMDP by Ganibangla Ltd (2006), Dhaka City Corporation. Google Earth Images, 2009-2010. Dhaka's Centre for Urban Studies (2005), adapted by UN-HABITAT Global Urban Observatory, 2008 (UN Habitat, 2008)]



Figure 3:
Rich Land/Water Thresholds. Historically, the Buriganga River was used for both daily life activities and rituals, as shown here in its association to the Hindu Darrassari Temple in Dhaka, with a ghat (public stair/ ramp) linking land and water. [Source: F. Kapp photo, 1904, Curzon Collection, Online Gallery of the British Library]

1959 (Minoprio et al. 1959, p. 6). Year after year, poor migrants from Bangladeshi villages, threatened by floods or droughts (depending on the season) come to the capital in search of a better future. However, housing in Dhaka is scarce, and the rural newcomers are left to settle on cheap vulnerable lands to build their often illegal shelters (Dogan and Kasarda, 1988). In Dhaka, this means that sides of canals, banks of rivers and low-lying catchment areas around the city are rapidly being encroached. Most of the current slums and squatters of Dhaka are located in the lowlands in the east of the city, and around water bodies inside the city. A large slum is located near the Buriganga River, indicating the shift in prestige of the once wealthy riverfront. In addition to the disappearance of lowlands due to unchecked urbanization by the urban poor, powerful developers are also building on the little remaining vacant

land in the city and expanding their multi-storied apartment complexes to large parts of the low-lying catchment areas. In order to erect buildings in such landscapes, they have to significantly raise the land above the normal flood level through landfilling. This is often done with sand and is an expensive process, significantly raising the costs of investment. The area where this is most occurring is in the city's eastern periphery. Overall, the permeability of the city's soil and the amount of catchment surface is largely reduced. Adding fuel to the fire is corruption, and a number government organizations are known to work hand-in-glove with the developers, giving them permission against their own rules, or turning a blind eye to developments that simply should not occur.

In recent history the water network of Dhaka has repeatedly been unable to avoid major floods caused

by the swelling of the rivers around the city. There were major floods recorded in 1954, 1955, 1970, 1974, 1980, 1987, 1988, 1989, 1998, 2004 and 2007. The floods of 1988 and 1998 were particularly catastrophic, with 85% and 56% respectively of the city inundated. In 1988, about 60% of Dhaka's residents were affected and daily life was completely disrupted (Huq and Alam, 2003). During the flood in 1988, the water level of Hatirjheel Lake reached 6.5m, which is significantly higher than the normal flood-level of 4.6m (Barua, 2008; MacDonald and Culpin, 1995).

According to Dhaka's Water and Sewerage Authority (DWASA), there were once 43 canals in Dhaka. Seventeen of them have disappeared completely. The remaining 26 are in bad condition, while DWASA is presently recovering 15 of them. Eight of the disappeared canals have been replaced by box culverts—a hollow concrete box section under the ground—and consequently covered by important roads. Other canals exist but are rarely seen, because of the encroachment and filling-in either by developers, squatters or the government itself (Alam et Rabbani, 2007, p. 95). (Figure 4)

Although the transformation of polluted khals into box culverts solved odor and traffic issues, it increased the city's general risk of flooding. (Figure 5) The drainage sections are mostly inadequate, with too little capacity and not enough slope. On top of that, they are often clogged due to solid waste blockage, as there is an insufficient sewer system and waste collection in some neighborhoods which results in a mixture of storm water and wastewater. The municipal agencies that are responsible for the maintenance of the drainage system lack proper equipment and resources, which makes the cleaning of the box culverts a difficult task. Furthermore, it is estimated that in a city that is only served by storm drains (as opposed to a natural drainage system) and where 60% of the land surface is covered by roads and buildings (such as Dhaka City), floods are almost six times more numerous than before the levels of present-day urbanization (Pipkin and Cummings 1983 in Khalequzzaman 2000).

One should note, however that there has been a relatively long history of formal water resource management in Dhaka. A first measure to protect the city from seasonal flooding caused by the spilling over of the Buriganga River—and to revalue the riverbanks—was launched in 1864 by C T Buckland, the then commissioner of Dhaka (Alam and Rabbani, 2007). The “Buckland Bund” was finished in the 1880s and was meant to “protect the riverbank from

flooding and erosion and to give a facelift to the riverside” (Huq and Alam, 2003, p. 130). But it was only after the devastating floods in 1987 and 1988 that an urgent flood protection and drainage plan of Greater Dhaka was developed. The first phase of the Flood Action Plan was completed and protects the west of Dhaka. It is complemented by a partly earthen embankment along Buriganga and Turag Rivers and the Tongi Canal, with 11 regulators at the connection of the rivers and the inner-city khals and supplemented by two pumping stations.

In a second phase, a rail/road embankment is proposed to run along the Balu River, protecting the eastern edge of Dhaka. This would mean that the ecologically vulnerable wetlands of the Eastern fringe will no doubt fall victim to developers as the area is made accessible by infrastructure and, paradoxically, the flood plain area and catchment zones would become even further reduced. In the mean time, a raised DIT Road, traversing north to south in the middle of Dhaka, acts as a temporary embankment, safeguarding the most urbanized parts of Dhaka from being inundated. The combination of the disappearing inner-city water network and the construction of embankments around the city, are turning Dhaka into what one may call “an upside down umbrella”, where storm water can no longer escape from the city (De Groeve et al, 2010).

PROTECTION OF WATER BODIES AND AWARENESS

Dhaka's recent growth pattern severely compromises its flood resilience and thus the city's livability. Studies have proven that more retention areas are needed (Nazem, 2009) since “the city has lost hundreds of hectares of wetland in last ten years” (Islam, 2009, p. 136). The introduction of new links and reservoirs are clearly necessary, as well as effective protection of Dhaka's remaining water bodies. A number of laws to legally protect water bodies do exist. However, according to Ishrat Islam (Islam, 2009, p. 151), they are largely ignored by developers, since prosecution if they are violated is extremely rare. There is, as well, the lack of a clear definition of which water bodies are protected by law. A precise mapping of Dhaka's seasonal water bodies, together with strict law enforcement is necessary to effectively initiate a protection strategy.

Another potential protection tool is the 1995 Master Plan for Dhaka, which is named the DMDP (Dhaka

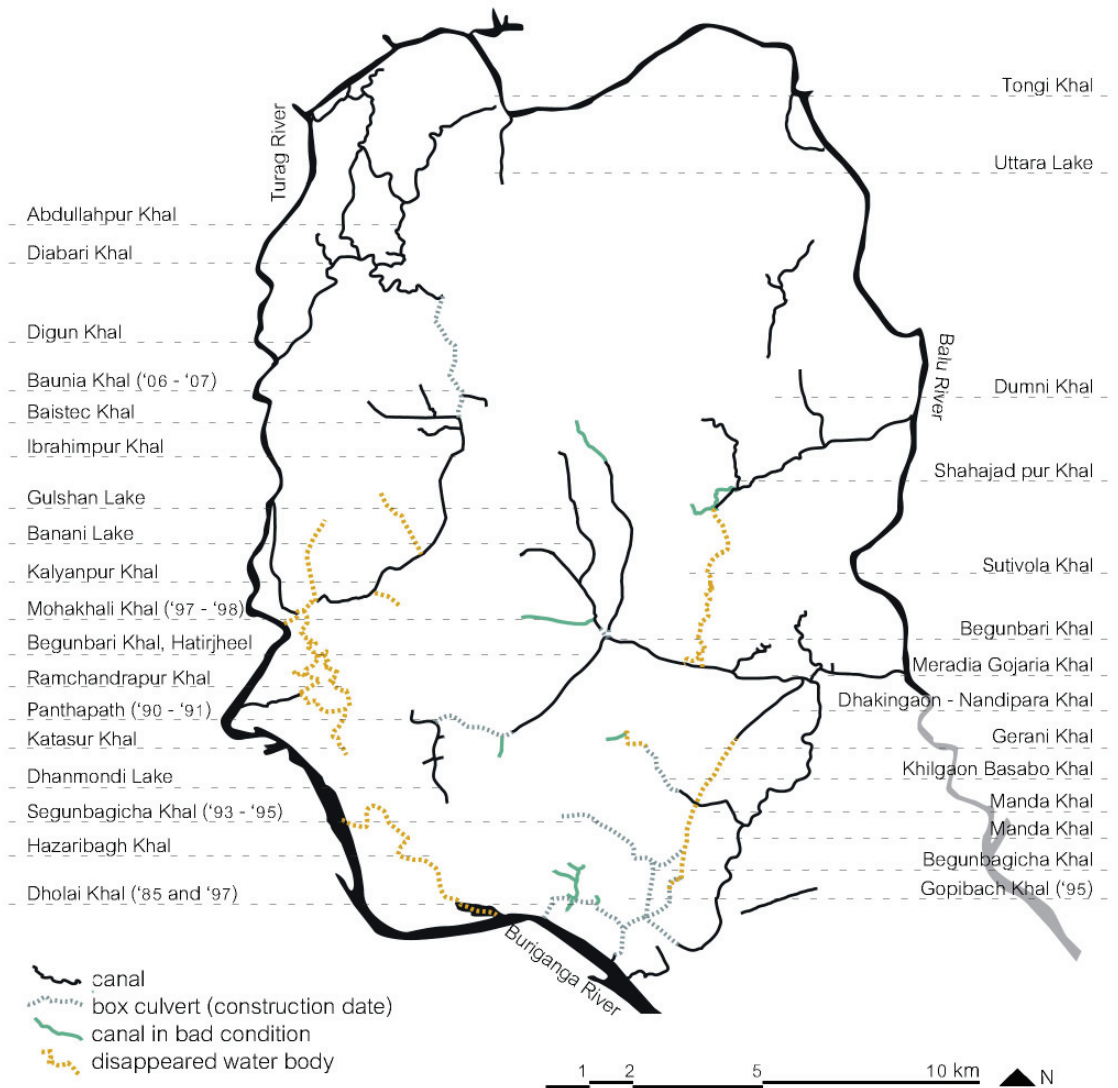


Figure 4:
Dhaka's Khals 1955 to 2009. Khals, often translated as canals, were an essential part of the city's natural drainage system. In the past, they also served as transport corridors; as time passes, they are disappearing from the urban fabric. [Drawn by authors. Sources: drainage map by IWM, geological report by United Nations (based on survey in 1955) (United Nations, 1999) and interview at DWASA drainage circle (Wakiullah, 2009). The khals have been drawn schematically, since there is not specific information available on their width.]

Metropolitan Development Plan 1995-2015). The structure plan, one of the three phases of DMDP, recognizes that rivers and flood plains are important for both the ecology and economy of the capital region (RAJUK, 1995a). The Master Plan also foresees retention reservoirs for storm water. However, according to specialists, there is evidently

a deficit of such reservoirs (Nazem, 2009). Plans obviously lag far behind the actual situation on the ground. The plot-to-plot recommendations for the entire DMDP-area that was approved in the 1995 plan has virtually no correspondence with the as-built condition, thus leaving the proposals glaringly outdated long before they can be implemented.

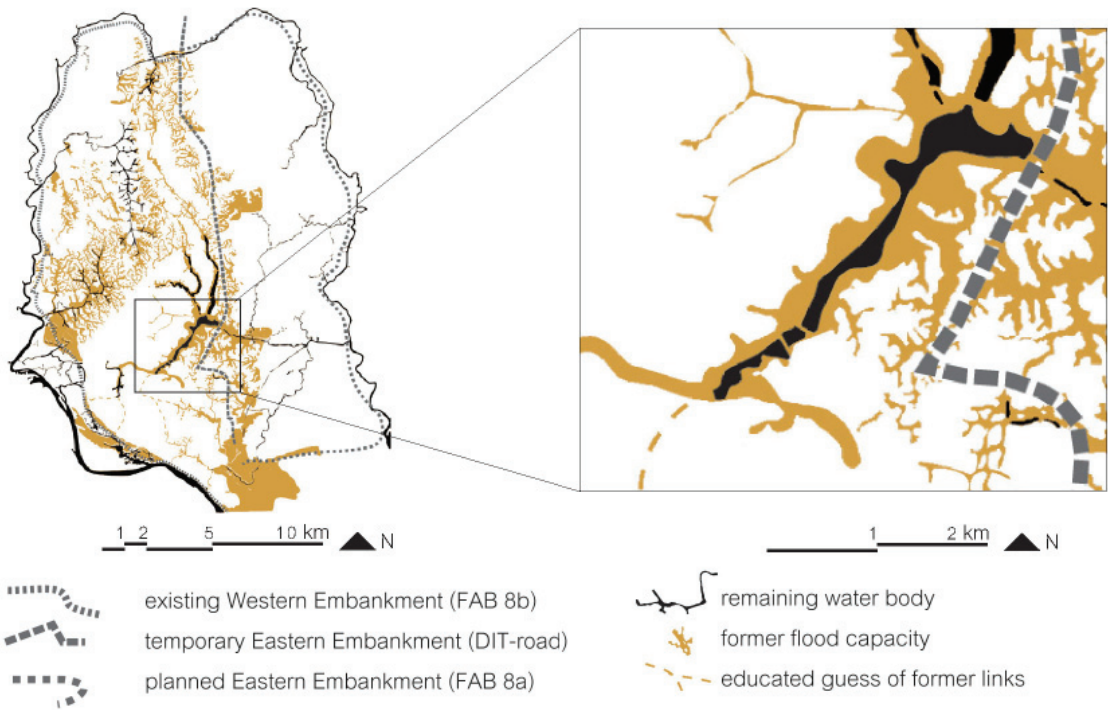


Figure 5:

Encroached Edges / Reduced Flood Capacity. The existing water bodies in Dhaka have lost a great deal of their capacity to mitigate flooding due to the fact that their edges have become encroached by informal settlements.

[Drawn by authors. Sources: geological report by United Nations (based on survey in 1955) (United Nations, 1999). Embankments as proposed by FAB 8A and 8B (IWM, 2005).]

However, the pressure of urban growth coupled with political pressure as well, a certain degree of political corruption has led to the planned and unplanned expansion of the city towards the east in tandem with the erection of the Eastern Embankment. Such a development is extremely unfortunate, whereas today the area, as a vast lowland, acts as a necessary counterbalance—a sponge—for the impermeable landmass of the city to the west. In such a scenario, almost all the eastern lowlands will be filled with 2-5 meters of earth and transformed into a mixed-use and residential area, since the lowlands will be much more attractive after completion of the Eastern Embankment.

Dhaka's planning authority, RAJUK, is also maintaining individual inner-city water bodies. A widely used strategy to protect water bodies from illegal encroachment is the demarcation of borders by either green areas or pathways (RAJUK, 1995a). Pavements edge a number of the lakes and there are plans for several lakeside promenades to be

implemented in the near future. This approach seems intended to protect the water bodies from further reduction. However, this could compromise the relation with the water as the water body often stays on the backside of houses, with pollution and negligence as a consequence.

In general, the awareness of the importance of water bodies is quite low amongst the inhabitants of Dhaka. Most of the people that occupy the wetlands are poor, illiterate migrants from the countryside who are often not aware of the effects of their activities on the larger environment. Day-to-day survival is their only concern. The necessity of natural drainage is not a priority and there are effectively no restraints to using waterways as receptacles for liquid and solid waste. However, there are several organizations, mostly non-governmental, which are attempting to raise the level of environmental awareness in Dhaka and attempting to make people more conscious of their actions. They try to make people understand that throwing waste in the sewage system is the root

cause of many problems. Judging from the many articles in newspapers during rainy season (Daily Star August 2009, Daily Star July 2011), it seems that the general level of awareness is no doubt increasing, at least among Dhaka's more educated inhabitants.

Dhaka's contemporary failure to conserve its water bodies raises the fundamental question whether Dhaka's current method of planning corresponds to its urban challenges. Many scholars are convinced that the method of all-encompassing master planning and static land-use planning are not able to deal with the complexity of the contemporary city (De Meulder et al. 2004, p. 187; Watson, 2008, p. 2261-2262, Ansari, 2004, p. 53). Especially in the case of fast growing cities, master plans appear to be too rigid and "outdated and inappropriate" (Watson, 2008, p. 2262). The planning methods are also said to still be based on the ideologies originating from Europe and the US from the beginning of the 20th century, and in the particular case of India and Bangladesh, mainly from the UK (Ansari, 2004, p. 71 and Watson, 2008, p. 2261). However, the assumptions concerning the nature, aesthetics and growth-rates of cities, from which these type of master plans were conceived, are fundamentally different than the South Asian mega-cities of today.

De Meulder and his colleagues argue for an approach that concentrates on strategic actions and projects. Design research can reveal the capacity existing territories offer, taking into account all the complexities of the contemporary city on various scales, from structuring armatures to urban fabrics, and employing a variety of fields of knowledge (De Meulder et al. 2004, p. 193). The research of Ansari (2004, p. 76) shows that a more flexible planning approach is needed, where institutional support is less essential, and where participation plays a more important role. This would require wide reforms on different levels. He also mentions a project initiated by the Indian government, JNUURUM, where projects are formulated and prioritized through plans, set up through a participatory process, much like the projects De Meulder et al describe in 'A project for projects' (De Meulder et al. 2004).

HATIRJHEEL LAKE: A DESIGN RESEARCH CASE STUDY

Hatirjheel Lake, the case study of this paper, is the city's largest reservoir. It is located in the center of Dhaka and is a crucial element in the city's drainage

system. It used to be connected to a string of other lakes, the Banani, Dhanmondi and Gulshan Lakes, and to the Begunbari Khal at the Rampura Bridge (Figure 5). The Begunbari Khal used to be a very important waterway during the Mughal period (1608-1764) and functioned as the entry to the city (Ferdous and Nilufar, 2007, p. 55). However, in 1991, the canal was turned into a box culvert with an arterial road on top of it, named Pantha Path, following the demand for better accessibility through the very dense urban tissue and the unattractive condition of the water. At Rampura Bridge, which is part of a temporary embankment, there is a pumping station with a sluice. This prevents backflow from the Balu River in the east in case it bursts its banks.

Today, Hatirjheel Lake is the reservoir of one third of the catchment area of the city (MacDonald and Culpin, 1995) and there is a high variation in its water level between the dry and wet seasons (from May to October), with a normal flood-level of 4.6 meters and a water level at 6 meters or more during extreme rainfall (MacDonald and Culpin, 1995). In recent years, the natural system has been interrupted, causing ever-larger problems of flooding and water logging. In the rainy season, a large amount of storm water and excess water from the rivers is retained in the city and cannot be drained. Conversely, in dry season, it is hard to find any water at all. The pressures on the water system are manifold and create a number of challenges for the immediate future.

The physical environment of the lake itself is quite poor since squatters have illegally appropriated it and there are no municipal services. Over the past decade, Hatirjheel Lake has been a typical example of encroachment due to Dhaka's population growth. A large part of Hatirjheel's Lake edge is covered with bamboo houses on stilts, and a larger percentage of it with more permanent illegal structures. The lake is not considered an amenity, but rather as a backside. Domestic waste, as well as polluted industrial water from the factories next to Hatirjheel, and both the storm and wastewater from neighborhoods further away empty into the lake since it is topographically a low area in the surroundings. However, there is a large on-going project of urban renewal by the government. A new, 60-foot wide ring road encircling the water body is being constructed and large parts of the illegal structures have been removed. The main objective is to develop the low-lying areas as a storm water retention basin, in order to minimize the risks of floods into the nearby areas and to protect them from further encroachment. The road is to become a very important east-west traffic connection

through the city, effectively connecting the rapidly transforming commercial and business center at Kawran Bazar to the new eastward expansion of the city. This will drastically increase the importance of the area and attract substantial new development.

In these changing development conditions, the Hatirjheel Lake was investigated as a design research case study. The main hypothesis was that the potential role of the lake as a structuring element, across multiple scale levels, can address a number of essential issues in the city. Water as an element has the potential to enrich areas by creating interplays between infrastructure, landscape and urbanism. Inner-city water can be strengthened as an element of transportation and the every-day public realm (for bathing, washing, and recreations purposes). The flooding issue and notion of maintaining water retention basins in Dhaka is a clear motivation for the precise articulation of the strengthened borders and further articulation of the lake's borders—to deter encroachment, while, at the same time, provide differentiation through programming and the creation of landscape typologies. The redefinition of the water border can generate new water use and the border can re-claim the water.

INTERPRETATIVE MAPPING AND LOCAL LOGICS

The design research began with fieldwork, followed by interpretative mapping and projective cartographies in order to (re)read and (re)write the potentials of Dhaka's water urbanism. Fieldwork specifically focused upon the city's relationship to water as a precursor to proposing an alternative to present-day urbanism, which offers possible scenarios for developing the city in tandem with the dynamics of its rich liquid landscape. Interpretative mapping has long been a part the University of Leuven's methodology, since "It must be stressed that the requalification of space from contested territory to a supportive frame requires new design tools in order to maximize its potential. What is required is a series of operative methods which develop understandings of existing spatial realities and structuring potentials. Suggesting strategic interventions and outlining project scenarios can then be developed. These new methods are built on the vast knowledge base of descriptive urbanism: employing methods such as reading the city as a complex text, with multiple, layered narratives; graphically analyzing cities to discover the syntax and vocabulary of the urban text; creating morphological syntheses of cities;

establishing taxonomies of urban fabrics; naming new urban patterns and understanding the logics and ecologies of landscapes. Intensive fieldwork forms the base of interpretative mapping and critical questioning which, in turn, frames the projective cartographies in the form of visions for the (regional) territory and strategic urban projects which follow" (Shannon, 2011, p. 82).

The major structuring elements of cities and landscapes are relatively easy to identify whereas understanding the major built volume of all territories, the urban fabric—the often uncelebrated, predominantly residential, infill is more complex. However, it can be argued that the anonymous fabric is at least as significant in defining the character and culture of any given territory as are the larger structures. To further understand the territories of Dhaka, a 1969 method of fabric analysis by Caminos, Turner and Steffian of Massachusetts Institute of Technology (Caminos et al. 1969) was revisited. The systematic representation of 400x400 meter sample tissues revealed the correlation between various settlements, their geographic and cultural contexts. The making of the squares often literally included the mapping of elements unrecognized, not officially mapped or documented. The compilation of an urban tissue atlas of sorts facilitates comparative analysis and remains a useful testament to the variety and richness of settlement morphologies. Admittedly, the danger of such analysis lies in the ease to which it can become highly mechanistic. However, if well balanced, it can reveal the inner-workings and provide a materiality to cities and their neighborhoods (Shannon, 2008, p. 113).

The first sample tissue chosen was at Hatirjheel Lake, near the Tejgaon industrial area and the residential neighborhood of Nayatola (Figure 6). The British planned Tejgaon as an industrial area outside the city, but as the city has expanded, it now lies in the center of an urbanized area. Hatirjheel Lake was severely threatened by encroachment during the time of the fieldwork. Most of the buildings in the sample tissue were built illegally on stilts in the water. The water was used as a waste dump by the slum dwellers, as well as by industry. The construction of two 7.5 meters-wide roads, one for through- traffic, the other for local traffic, had begun construction, so that a part of the slums and other illegal structures had been cleared.

In contrast with the neglected Hatirjheel Lake tissue, the other sample tissue was taken at Dhanmondi Lake (Figure 6). This lake used to be a natural water body, connected to Hatirjheel Lake through

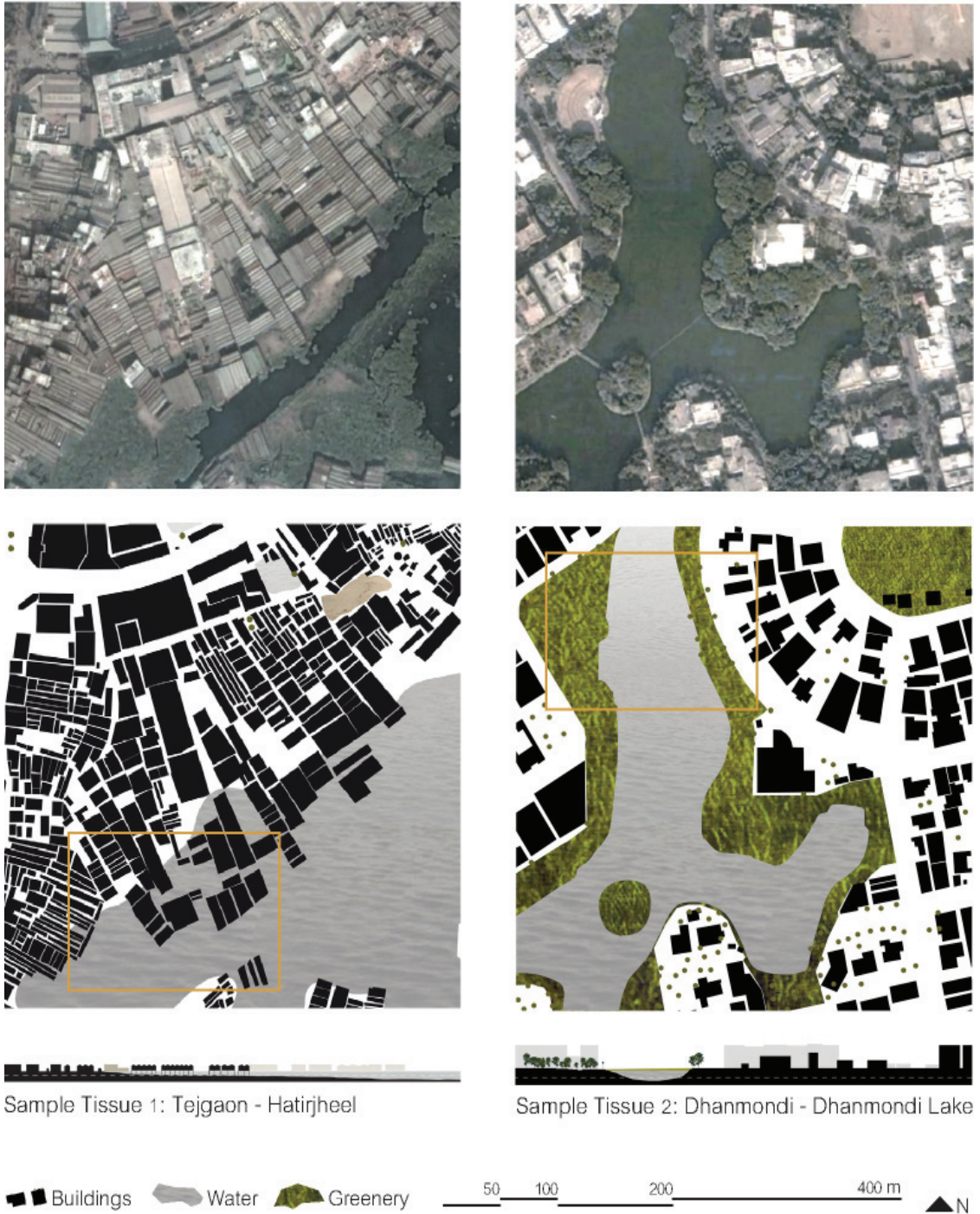


Figure 6:
Hatirjheel Lake/ Dhanmondi Lake: Figure/ Ground. Urban tissue samples of 400 x 400m in Hatirjheel Lake and Dhanmondi Lake reveal striking differences in the density, built/open relationship and greenery of the two areas. At the time of the fieldwork in 2009, Hatirjheel was severely encroached and neglected, while Dhanmondi Lake was a very popular recreational place. [Drawn by authors. Sources: Google Earth Images, 2009-2010 and fieldwork]

the former khal that is now underneath Pantha Path, and which was once a part of the natural drainage network of the city. In 1998, the Dhaka City Corporation (DCC), appointed the architectural firm Vitti Sthapati Brinda to redesign the banks of Dhanmondi Lake and to reprogram the lake with recreational uses (Shannon and Nilufar, 2008). The 37-hectare lake was cleaned and cut off from the larger water network to prevent sewerage water from the box culvert underneath Pantha Path and Hatirjheel to pollute it again. The lake has become a very popular meeting and relaxing place amongst all ages and classes of Dhaka's inhabitants.

In both tissue samples, the edge treatment of the water has a strong influence on its use (Figure 7a). At Dhanmondi Lake, the redevelopment uses clever design strategies to protect the large water body from encroachment and expands the much desirable and needed public realm in a very dense city. However, there are some lessons that can be learned from this project. "The overwhelming success of the neighborhood lake into a city-scaled recreational area has brought new problems including renewed park (evidenced by an insufficient number of entry points and too narrow pathways) and access road congestion, overuse for which maintenance cannot keep up and further environmental degradation. As well, the safety and security of the park is far from ideal—which could perhaps be improved via inclusion of more activities in the park. Finally, Dhanmondi residents are not involved in the management and a sense of ownership is missing. Nonetheless, the Dhanmondi Lake redevelopment is a canonical project in contemporary Dhaka where it courageously sought to become an interface between urban planning, architecture, and landscape ecology, mediating among various scales and conflicting interests" (Shannon and Nilufar, 2008, p. 80-81). The edges of Hatirjheel Lake were completely different at the time of the fieldwork (August 2009). The edge between water and land was very ambiguous and construction did not clearly stop at the lake's edge. Illegally built stilt houses with small bamboo walkways, as well as illegal concrete buildings, encroached the lake and excluded recreational uses as a possibility. Hatirjheel Lake was merely used as a solid waste receptacle, a place for ferry boats and for everyday needs, such as washing—despite the filth of the water—and as a toilet.

Visibility from the street is another aspect that highly determines the state of the water in Dhaka (Figure 7b). When a pond or water body is completely hidden

from the street, and thus from the eye of the public, it can easily be misused and neglected. Public activities along the water and community awareness are also important determinants of water use and perception. Dhanmondi is a planned middle-to upper-class neighborhood. It has the advantage of lying on highland and the sample tissue is situated between 6 to 8 meters above sea level and rarely suffers from flooding (Figure 8a). The lake is clean and well-maintained and, in case of heavy rainfall, drainage lines bring water from the surrounding streets to the water body, thus preventing the streets from getting water logged. Conversely, in Hatirjheel, the houses are with their foundations in the water during the rainy season. Most of them stand only 2 to 6 meters above sea level. It is obvious that the poor have to live in the low-lying area because the land is cheaper and more available because of its risk-prone character. The lake is polluted with solid waste and overgrown with hyacinths. In case of heavy rain, the surroundings of Hatirjheel are inundated and the existing concrete columns are often not high enough to prevent the houses from flooding (Figure 8b).

A PUNCTUAL DESIGN FOR A PUBLIC WATERFRONT

The research led to a design proposal for the south-eastern side of Hatirjheel. In this area, three low- to middle-class residential areas—Mogh Bazaar, Nayatola and Madhubag—have informally grown into a very densely packed neighborhood, accessed by a labyrinth-like series of narrow roads with only a few small open spaces. An estimated 130,000 people per km² are projected to inhabit the area by the end of 2011 (based on RAJUK 2008). The area is enclosed in the east by the DIT Road and in the south by the railway and the only possible area of expansion is towards the northwest and into the low-lying retention area. In dry season, inhabitants walk over pipelines which jut out over the water. There used to be an informal ferry service to bring people to and from their work on the both sides of the lake. As well, in the past, some parts of Hatirjheel Lake were used to cultivate rice when the water level was low. In fact, the residents intensively used the water and even lived on top of it, despite is awful stench.

The new 60-foot roads along the perimeter of the Hatirjheel Lake, as planned by the government for better accessibility to the east and with better connection to the lands eventually opened up the Eastern Embankment, has led to the clearing of

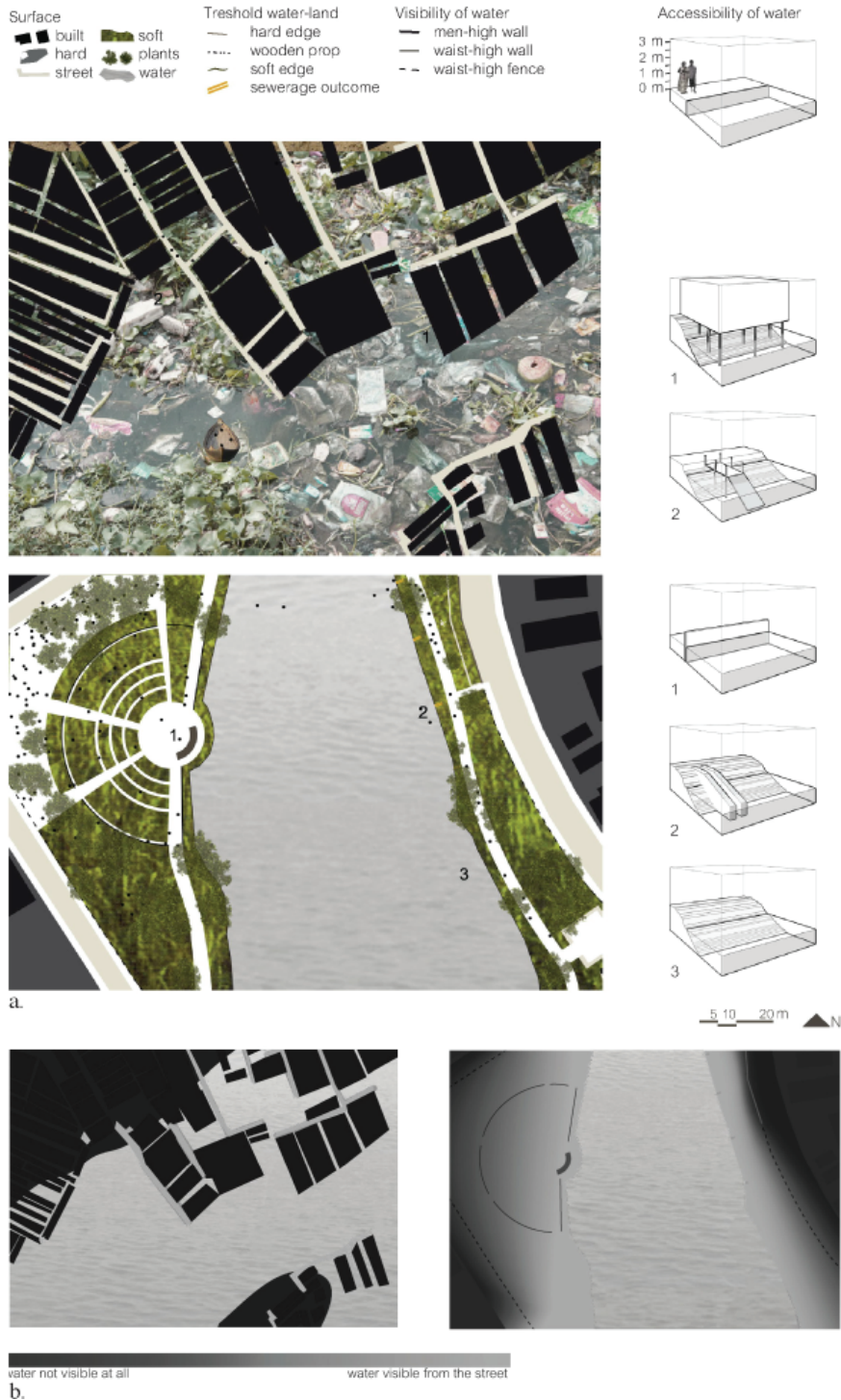
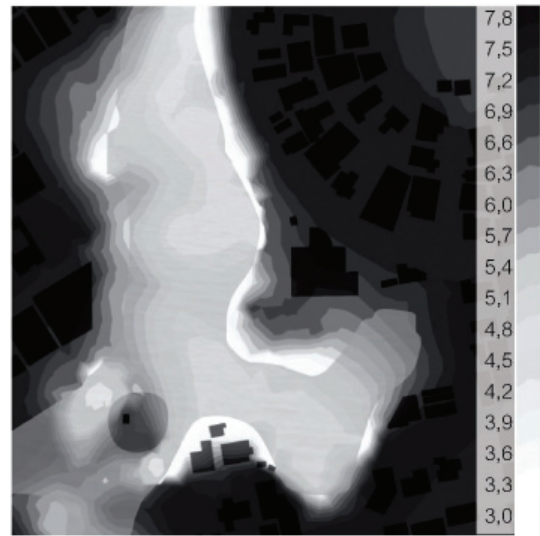
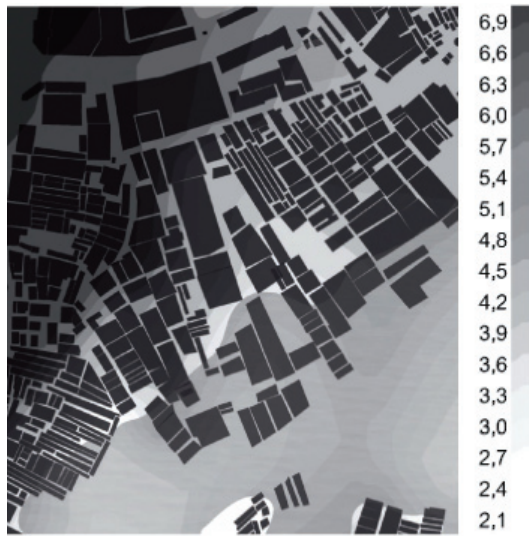
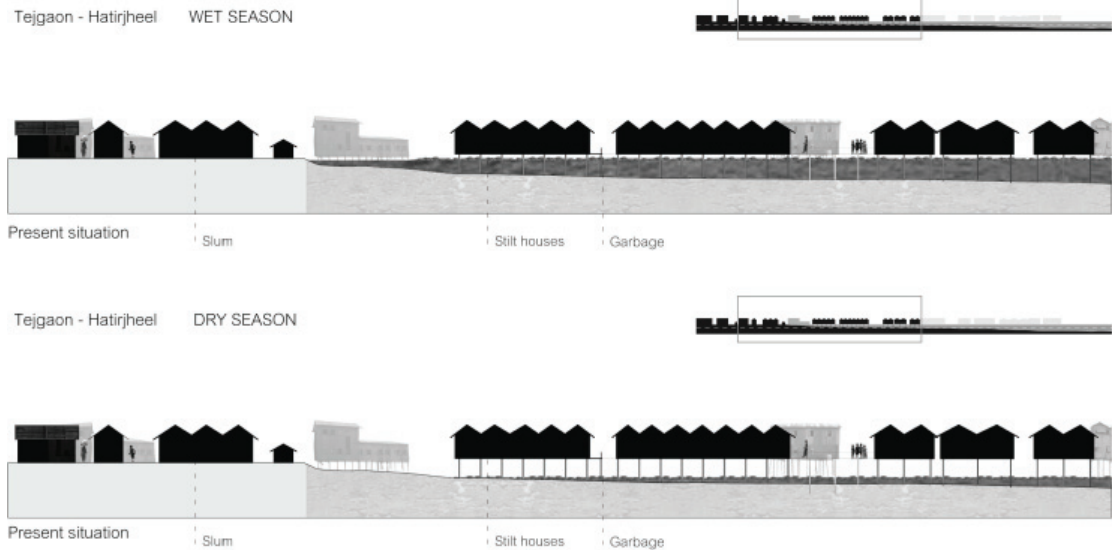


Figure 7:
Hatirjheel Lake/ Dhanmondi Lake: Water's Edges, Use & Visibility. Details within the tissues of the lakes confirm the radically different atmospheres perceived at the previous scale. Hatirjheel is highly polluted while Dhanmondi is a manicured and highly programmed landscape. [Drawn by authors. Sources: Google Earth Images, 2009-2010 and fieldwork].



Sample Tissue 1: Tejgaon - Hatirjheel
a.

Sample Tissue 2: Dhanmondi - Dhanmondi Lake



b.

Figure 8:
Hatirjheel Lake/ Dhanmondi Lake: Topography & Built. The area of Hatirjheel Lake is situated much lower than Dhanmondi Lake, which reflects in the adjacent dwelling environment (as clearly revealed in the Hatirjheel sections in wet and dry season). [Drawn by authors. Sources: Google Earth Images, 2009-2010 and fieldwork].

slums along the edges of the lake. Since the start of the construction works in the summer of 2009, all slums within the perimeter of the new roads have been removed (fieldwork August-November 2009 and Google Earth Images February 2010). In contrast to the previously blurred border between the water's edge and the inhabitants' living quarters and their daily use of the water, the new road system forms a very hard edge and creates clear borders. The new road is designed with three explicit components: a pedestrian zone, closest to the water; an express road, two lanes wide, which encircles the lake as a one-way traffic system; and a local road, which connects to the existing road network and the urban tissue. As well, there are plans for the existing road network to be improved by widening the most important access roads and completing missing links (Figure 9).

The entire Hatirjheel area and its adjacent neighborhoods are witnessing major transformations. The new ring road will drastically change the importance of the area and attract significant new development once it is finished. As the most important east-west traffic connection through the city, from the upcoming commercial and business centre at Kawran Bazaar to the new eastward expansion of the city, the new road will surely undergo a process of Bangladeshi gentrification.

On the lake's western bank, in the Tejgaon area, the tissue will no doubt evolve towards one of more commercial high-rise buildings in the future. The footprint of buildings on that side of the lake is relatively small, while the plots are quiet large and surrounded by wide planned roads, acting as axes towards the water. On the eastern bank however, 4-to 5-story houses occupy most of the small plots since a major geo-physical fault line in the area restricts further vertical expansion. In a reading of the trace of the new roads, one can distinguish pockets of water that are disconnected from the water network. The present-day situation foreshadows what will happen when land becomes freed. The free market will reign, commercial development will prevail, building to a maximum height, and commercial development will seize its opportunity. The site will become further and further disconnected from the water. The distinctive organic morphology of the tissue will no doubt disappear quickly as new development proceeds.

Due to the ambiguous border between land and water in the past years, it is hard to establish criteria whether a certain piece of land should be protected from the water or be protected from encroachment.

Should the express road work as the definitive edge between water and land, or should pockets of water between the engineering work and the lake's edge be maintained? Different maps and satellite images show different traces of the water line. However, based on the analysis of the water system and the history of Dhaka, it is obvious that the lost pockets of water are important for drainage and important for the image of the city. "Saving" such pockets by integrating them into dense neighborhoods would not only be beneficial for the resilience of the area, but also be important for the relationship between the people and the water, which is so essential in the lives of the local inhabitants.

In defining the structuring principles of the design intervention, the larger connections of the area in relation to Dhaka were a primary consideration. The east-west connectivity through the area is pivotal for the city and, in spite of the fact that a large percentage of the overall surface area of water from Hatirjheel will disappear and the inhabitants will be further detached from the water, the expressway is a crucial infrastructural element in the structuring and mobility plan of the city. The local road that connects to the existing network, on the other hand, doesn't seem necessary, if only the most important connections from the main roads (DIT-road, Shaheed Tajuddin Road and their new connection along the railway) towards the water are widened. Moreover, it seems even unwanted, as it is this road that would trigger too much new development, choking the fragile urban tissue behind it.

In the design research, the space between the expressway and the existing border of the tissue has been designed as a public open space. All the dead ends of the access roads have been seized as an opportunity to provide urban activators that reclaim the waterfront for the neighborhood. At the same time, the new threshold has not been over-designed, since informality and spontaneity are so typical in Dhaka. The ambition is to integrate the water and demarcate a clear border for new development. This new edge is not a hard one like the roads; instead it choreographs the dynamic condition of the water, allowing it to rise and recede and to hide or reveal open spaces. As well, the expressway is slightly re-engineered, in that it is lifted from the land in order that it no longer forms a border to the urban tissue, but conversely divides the water into a metropolitan side and a local side (Figure 10).

At the urban design scale, one of the local water pockets is detailed at the end of the widened access



Figure 9:
Hatirjheel Lake: Infrastructure Impact. The new east-west infrastructure will have a radical impact on the lake. As new ring roads encircle the lake, hundreds of illegally built houses will be demolished and the entire relation of land/ water will fundamentally be redefined. [Drawn by S. Peeters. Sources: Google Earth Images, 2009-2010 and fieldwork].

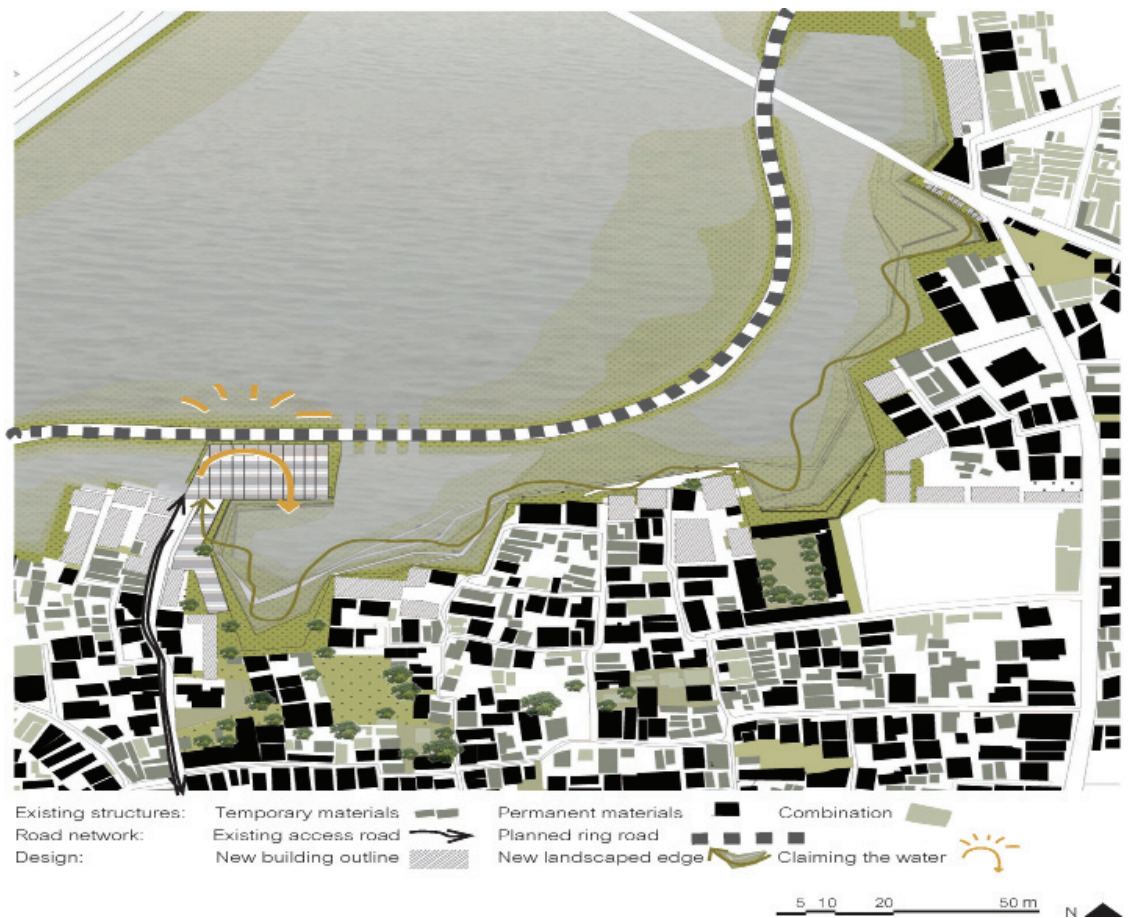


Figure 10:
A Strategic Urban Project. A new landscaped edge and the existing main access road come together in a new public building, reclaiming the water body for the neighborhood. The new express ring road is no longer a strict border between land and water, but addresses local and metropolitan scales.
[by S. Peeters]

road. The area—between the lake's edge and the back of the house of the urban tissue—is presently occupied by temporary structures. These structures are removed, a new urban façade aligning a park edge. The edge is designed as a vibrant public landscape, accessible to all, and highlighted with a public building as an icon/balcony overlooking both the new landscape, the lake, and “the other side” where metropolitan Dhaka is booming. The lost pocket of water is poetically reclaimed for the neighborhood in a modestly spectacular way. The new building, a cultural center, is located where the access road ends, perpendicular to the expressway (Figure 11). It is a node where the world of rickshaws and cars ends and where the transition from the

motor world, with parking buried underneath, meets a landscaped pedestrian world of pathways, terraced platforms, vegetated areas and water basins. The new edge consists of different plateaus, integrated with the cultural center and continues over the length of the site. A datum line of a “safe level” of 7 meters above sea level is established, above which the water should never rise. The datum line is a continuous public path, surrounded by higher and lower, wider and narrower, harder or softer levels. Along this “safe level”, five distinct functional areas are created and establish a series of different atmospheres. At certain places, terraces cascade down from the datum line to allow closer contact to the water or the neighborhood, while in other

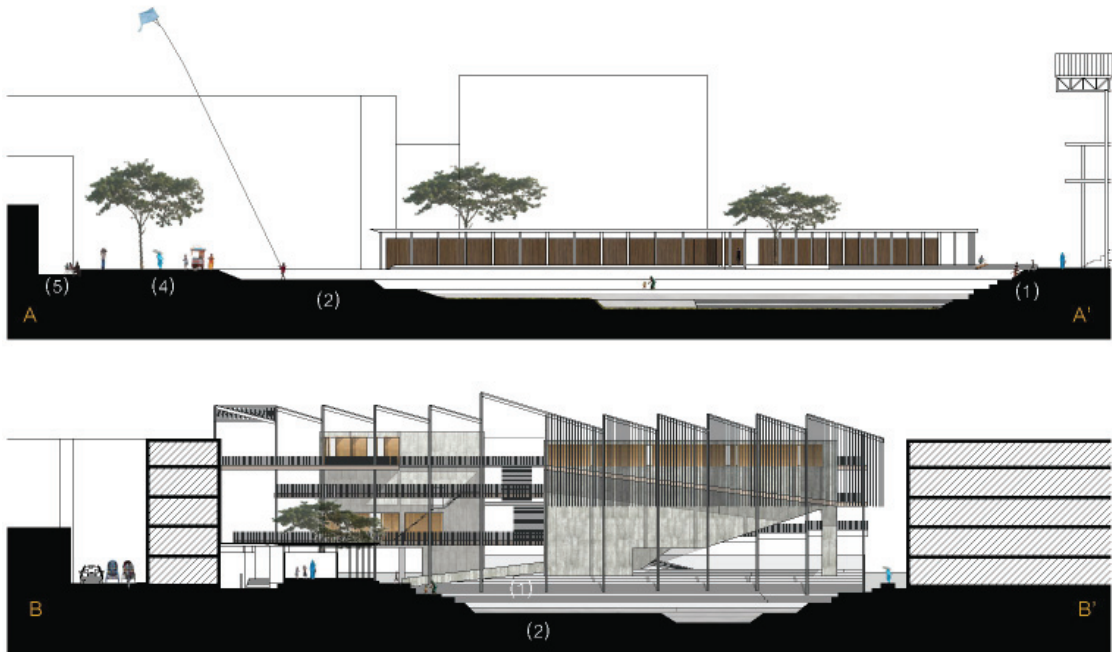


Figure 11:

Civic Presence. Longitudinal and transverse section through the plateaus and paths along the cultural center and the educational pavilion. (1) ghats near cultural center (2) wide plateaus (3) educational pavilion (4) continuous path above flood level (5) lower level of the existing tissue. [S. Peeters].

locations the public path rises as high as 9.5 meters to offer breathtaking views over the expressway towards the larger metropolitan Hatirjheel Lake. In places where the architectural promenade is relatively narrow, merely strolling and/or sitting along its edge is possible, whereas wider platforms allow for all kinds of spontaneous activities. The levels of the terraces/plateaus connected to the main promenade establish their use. Materials are also a determining factor and there is a gradient from hard to soft that makes the link between the urban and natural. The plateaus that are often inundated have more porous ground cover to allow water to drain into the ground more quickly, while also having harder elements, to make them passable even during heavy monsoon rains. Ramps, stairs, paths and surfaces of various sizes create a landscape mosaic that gives relief to the congested urban tissue and act as an animated filter between the city and the lake.

The new cultural center itself is landmark for the site and is located in a pivotal space between the newly

created public landscape and road. The building literally draws both cars, via its underground parking, and pedestrians, via its plateaus, into the belly of its being. The building appears to float over the landscape—with terraced steps (an interpretation of the region's traditional ghats) leading to the lake, and wide plateaus, (sometimes inundated, sometimes dry and available for all kinds of spontaneous activities), on the city side (Figure 12). The building is structured, similar to the park, as a wonderful architectural promenade, with views over the city and the lake. It houses a series of small, medium and large halls that can host various cultural, social and educational programs, from small classes to large weddings. In terms of formal programs, it includes a large auditorium and an open-air cafeteria. All is brought together in three construction systems: one of concrete with large spans for the fixed programs, one of bamboo for the more climatic responsive and flexible needs in the building and finally a large steel roof, uniting everything and providing shade and protection from the heavy monsoon rains (Figure 13).

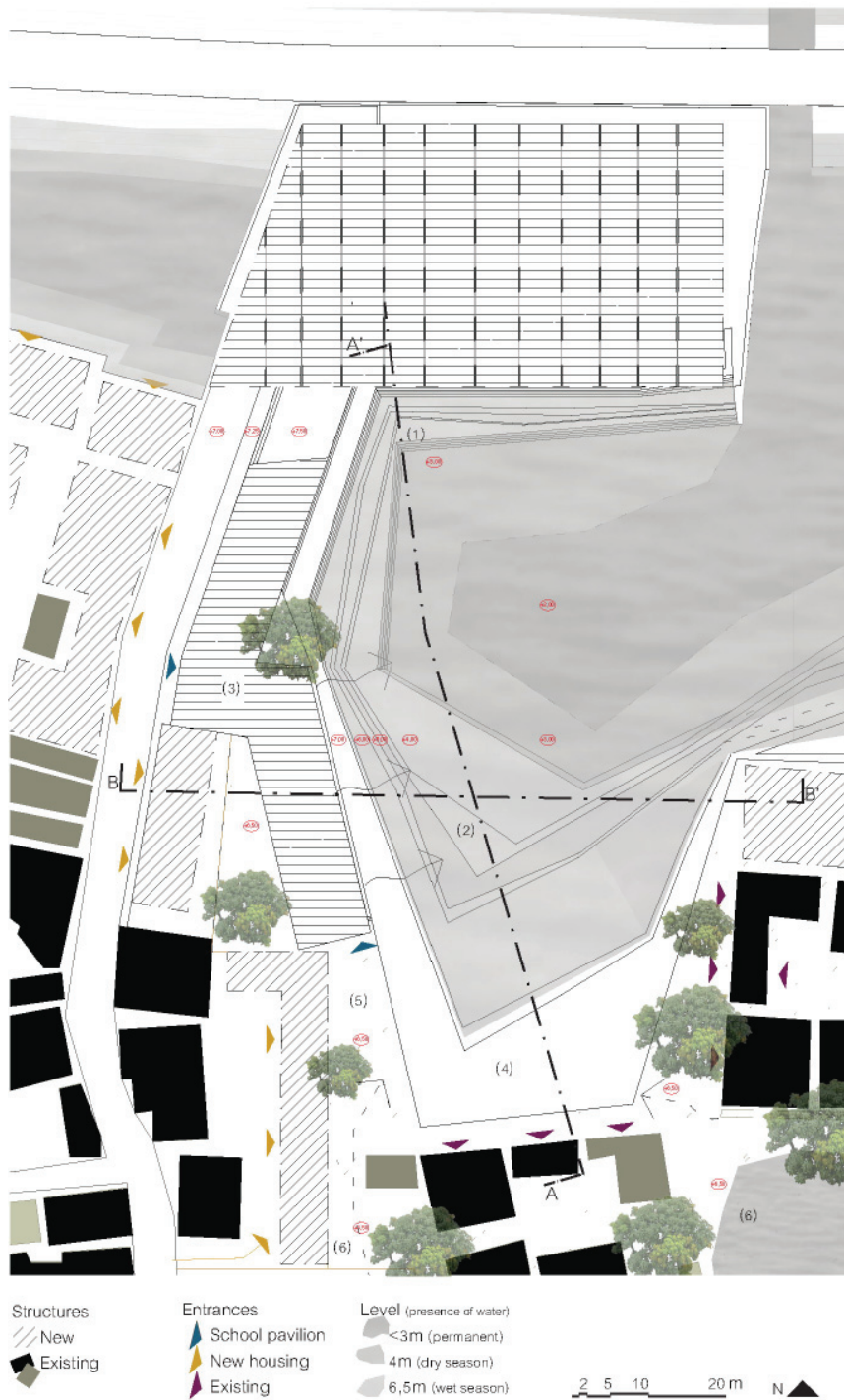


Figure 12:
Cultural Center as Component of New Landscape. The building melds into the landscape and acts as a hinge between an existing access road and a new hybrid landscape. (1) ghats near cultural center (2) wide plateaus (3) educational pavilion (4) continuous path above flood level (5) lower level of the existing tissue. (6) Connection to existing voids and ponds. [S. Peeters].

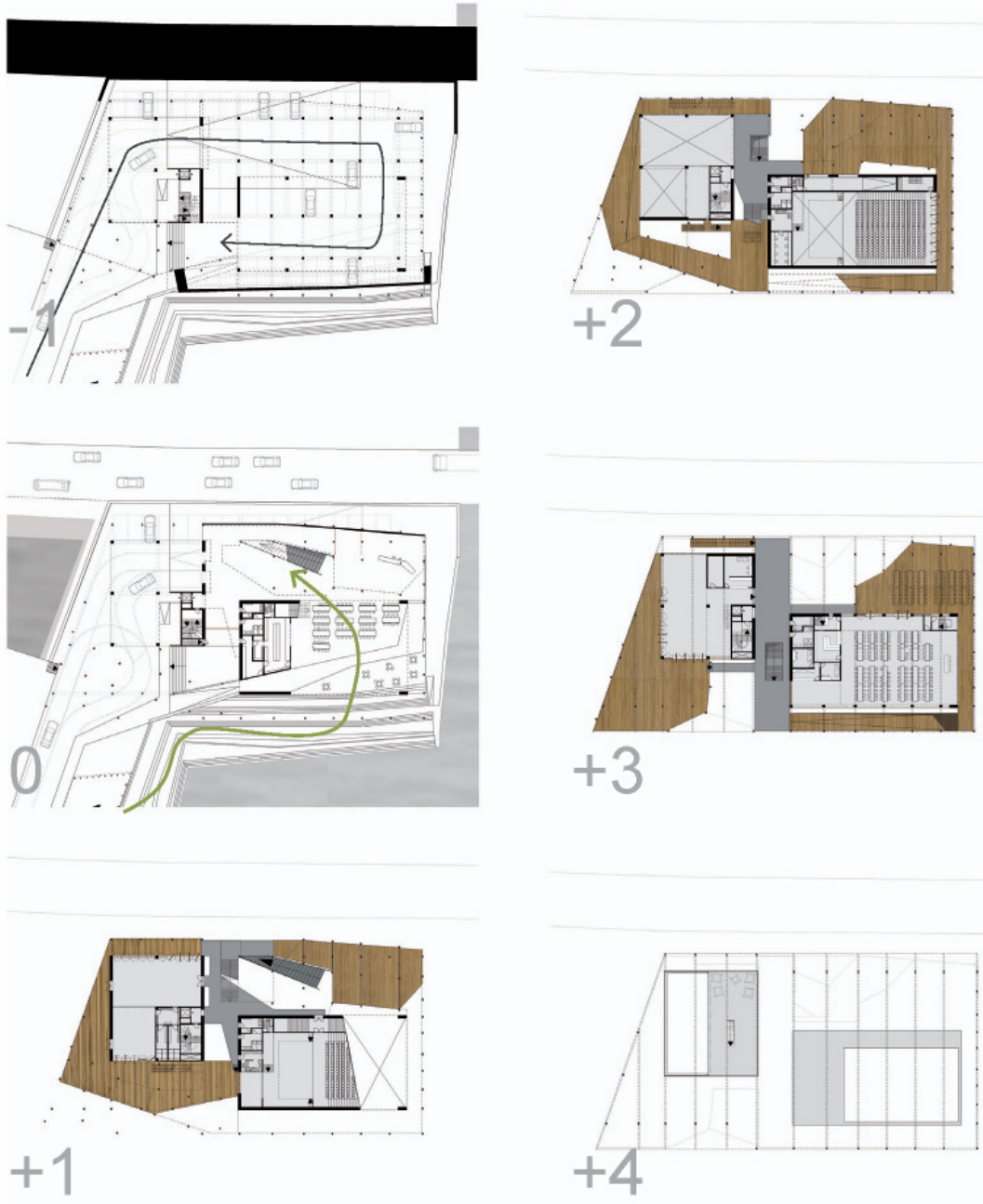


Figure 13:
Cultural Centre as a Terraced Promenade. The existing road and the new steps and terraces of the landscape enter the building, drawing both pedestrians (level 0) and cars (level -1) inside. The building is structured similar to the park—as an architectural promenade, with views over the city and the lake. [S. Peeters].

DESIGN RESEARCH AS PROBLEM FORMULATION

Design research in water urbanism for Dhaka, with the case of Hatirjheel Lake, was clearly not an exercise to find the solution for such a socially, culturally, politically and hydraulically complex problem. Of course, the answers to such broad questions are not easily discovered in the process of a year-long undergraduate design thesis. Instead the entire project was framed not as problem solving per se, but as questioning; reformulating problems, forming insights, staging scenarios and spatially intervening to simultaneously accept global forces while producing local values. The strategy abandoned the traditional tools of urban design and planning, top-down master planning and static land use planning that seem to have proven inadequate in dealing with the complexities and uncertainties of contemporary urbanism. Instead it developed a cross-scalar 'strategic' project, which sought to build upon the existing logics and act as a support for future urban development.

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