FILLING IN THE GAP

Opportunity Costs to be Regained

Flooding in Bidara Cina

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BACKGROUND: *Jakarta's detrimental climate conditions*

Jakarta, the Sinking City, faces many natural disruptions: floods, land subsidence and rising sea levels. Today, it is a city where housewives continue cooking in their houses with foul-smelling waist-deep waters. A city where residents struggle to find their way around and which is plagued with human-induced natural disruptions caused by urbanization and deforestation. Based on the "Mora Study", Jakarta will be one of the first few countries to experience the Climate Departure by 2028. Yet, with the current social conflicts and imperceptive measures taken to 'prepare' Jakarta for the ever changing climate and growing urban issues, it is evident that she is neither ready to adapt nor resilient enough to deal with the impending climate departure that is set to exacerbate the flooding issue in Jakarta.

Recurrent flooding in Jakarta is often the result of urbanization and human-induced disasters. With urbanization, Jakarta's population of 28 million has led to the increase in demand for infrastructure and deforestation; suburbanization has led to an overwhelming growth in illegal settlements along rivers. The raise in uncontrolled land demands has led to excessive extractions of groundwater. Environmental degradation along with the poor upgrading of deteriorating infrastructures are also adding additional stress on the water systems. As such, the sporadically changing climatic patterns has seen higher rainfall intensity, land subsidence and rising sea level, leading to an increase in flooding occurrences. Therefore, Jakarta faces the urgent need to become more resilient and adaptable to these shifting climate conditions. Yet interventions, such as the Ciliwung Canal Expansion project and the tunnel construction from Ciliwung to Cisadane River, do not target the root cause of the issue.

The project is located in Bidara Cina, part of a district in Kampung Melayu – a Kelurahan which has limited road access, poor sanitation infrastructures and outdated flood resilience systems. During floods, these settlements are often the first-line victims. Though an informal settlement, Bidara Cina has yet to be evicted due to their perseverance to protect their community and their resilience against flood through greening of spaces. With continuous site analysis (*Image 1)*, proper planning and design for Bidara Cina, the team believes it can serve as a potential pilot project to prove that on-site resettlement is possible alongside the building of resilience of the settlement against flood before the Climate Departure (by 2030). In particular, the area we will focus on is RW07 *(Figure 3*).

[1]

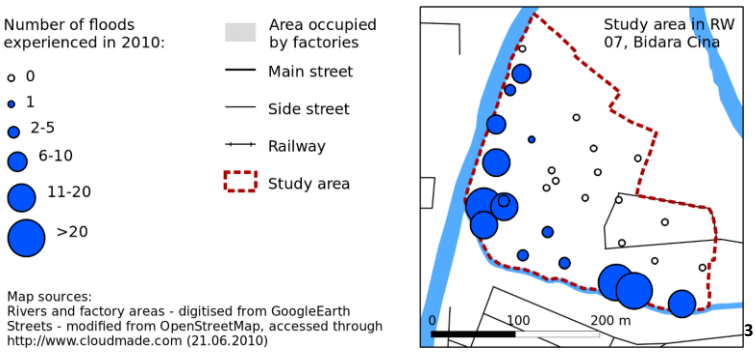
[2]

[1] Image 1: *Site Visits to have a first-hand understanding of the people's lifestyle and living conditions*

[2] Image 2: *Site Visits, Ruined landscape and poor sanitary conditions*

The selected site of 6.1 hectares *(excluding water bodies)* within RW07 is located east of the Ciliwung RIver and above a dead stream branch (Kali Mati). With an estimated population size of 4 per family, the official population is at 3800 with a density of 623 people while the unofficial population is at 4108 with a density of 675. Currently, the community is faced with cramped living conditions, communal space deficits, lack of infrastructure and flooding conditions *(Image 2)*.

FLOOD COPING MECHANISM



[3]

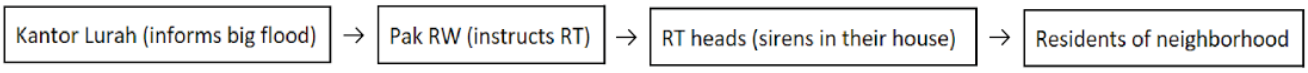
Year	Water Level (mm)
2002	1500 - 3000
2007	>2000
2009	500 - 1800
2010	200 - 500
2012	< 1200
2014	500- 2000
2013	1000-2000
2016	200-500

[4]

During flooding, many are displaced resulting in much inconvenience and disruptions to their daily livelihood for approximately. In the 2007 flood, most houses faced flood levels >2 meters *(Figure 4)*. As a result, 85% of the household had to evacuate for approximately 3 weeks. Many sought residence in Kantor Lurah, schools and religious institutes within the Kelurahan while others found shelter in their friend's houses.

As many reside in the area for a decade and are familiar with the floods, they have made attempts to adapt to it through changes in their lifestyle or making physical improvements to their current residence. However, residents tend to avoid evacuation as long as their daily activities are not affected as their income will be disrupted. Houses faced with significant damages are subsequently fixed with the help of government grants. Prompt access to health treatment were sufficient to tackle the diseases acquired.

The area is equipped with well-functioning emergency structures. With the help of their neighbors, volunteers, and CBAT trained personals in emergency tasks, the majority could evacuate their dwellings successfully and smoothly. The implementation of early flood warning system aided their swift and timely evacuation. They are mainly communicated hierarchically along the local government and RW/RT structures:



[5]

With a direct radio contact with officials monitoring the water level at a major floodgate of the Ciliwung near Bogor, the floods in BC are generally preempted 8-10 hours in advance before the water reaches BC. Hence, there is sufficient time for the residents to secure important household items and evacuate their neighbourhood. However, as only major floods are announced, those residing along the rivers have to remain alert permanently as they are constantly exposed to small, moderate floods in which no warnings are provided.

Despite the fact that the residents show great ability to cope with flooding events, they cannot be regarded as

[3] Figure 3 *: Site Map: Selected Site*
[4] Figure 4 : *Bidara Cina Yearly Flooding Levels*
[5] Figure 5 : *Current Hierarchy for Flood Emergencies*

resilient to flooding due to their reliance on third party aid provision. Therefore, a change in circumstances is required such that despite the consistent flooding in their daily lives, they are able to mitigate the issue with much certainty and independence because the infrastructural development supports it. This would hence create a self-responsible and self-supporting community that is resilient and able to make quick adaptations to their drastically transforming environment over the years.

OUR DESIGN APPROACH

DESIGN CONCEPT

Currently, the site has a multitude of lost opportunity costs. The design attempts to tap on the potential of the underutilised Kali Mati for the resettlement of flood victims while having the new development reconnect the two areas through the growth of commercial spots. This project believes in minimum intrusion and maximum benefit - utilizing the existing parameters to our design advantage which targets four key areas: on - site resettlement, reestablishing the buffer space between the river and built area, maximizing social spaces through multifunctional water retention features and improving infrastructure.

OPPORTUNITY COST FORGONE

1. Resettlement/Social Housing: Repopulating the Gap	Using an underutilized site and revitalizing it into a new hub of resettlement for flood victims and providing opportunity for green living
2. Landscape: Cultivating the Gap	Creating space for greenery after resettlement of riverbank dwellers and the external benefit derived from public green space
3. Amenities and Infrastructure: Bridging the Gap	Potentially improving their quality of living by improving amenity networks and road infrastructure for future development
4. Water Squares: Utilizing the Gap	The social gap that could be reformed and the changing of mindsets by utilizing the physical gap meant for flood intervention as social spaces

DESIGN PHASES[6]

Current Zoning Breakdown	Area (m^2)	Percentage (%)
Housings (to-be-retained)	8311.84	9.3
Targeted Phase I Housing (over Kali Mati)	16 875	18.8
Targeted Phase II Housing (along to-be-widen roads)	12 500	13.9
Gross Landscape	**1 532.356**	**1.7**
Services (Roads)	18 376.029	30.7
Services (Drainage)	3405.123	3.8
Ciliwung Gross Area	20 598.343	23.0
Kali Mati Gross Area	7941.410	8.9
Proposed Zoning Breakdown	**Area (m^2)**	**Percentage (%)**
Housings (retained)	8311.847	9.3
Phase I Housing (over Kali Mati)	5752.231	6.4
Phase II Housing (along widen roads)	3834.776	4.3
Services (Roads)	20 376.029	22.8
Services (Concrete (storm) Drainages)	950.385	1.1
Landscape (water squares)	235	.3
Gross Landscape (wetlands/ natural drainages) **overlaps with water squares*	**21 540.087**	**24.1**
Ciliwung Gross Area (added wetland slope beside without expanding)	20 598.343	23.0
Kali Mati Gross Area (added wetland slope beside without expanding)	7941.410	8.7
Proposed Runoff surface area Breakdown	**Area (m^2)**	**Percentage (%)**
Impermeable surface	39460.269	44.1
Urban Greenspaces	21540.097	24.1
Water Bodies	28539.753	31.8

The design process can be divided into two phases: on-site resettlement and the preparation for future development. The estimated time frame for completion of both phases are approximately 5 years.

In the first phase, it attempted to address the issue of on-site resettlement through the environmental, physical and social aspects. The environmental aspect first lays the foundation of the site and scheme by filling part of the Kali Mati with soil for the development of new infrastructures on it and the re-connection between the divided BC areas. Subsequently, the normalization and cleaning of the river can be continued upon the resettlement of the residents into alternative temporary housing. The physical aspect focuses on the development of retention basins and water squares which serve as multifunctional spaces according to the water level.

[6] Figure 6: *Breakdown of Current Site Analysis and Proposed Zoning*

They act as the fundamental adaptation of the consistent flooding from the Ciliwung River. Lastly, the social aspects redevelops the system of networks by utilizing the water pockets scattered across the site. Green spaces are added for maximal groundwater recharge. Amenities and businesses can then be set up for the economical and social vitality of the community.

In the second phase likewise, the environmental, physical and economical aspects are continuously improved to meet the growing needs of the increasing population and the ever-changing landscape. The environmental aspect continues the development and enhancement of the Ciliwung River with the construction of a boardwalk along it. Its construction act as a buffer from the river banks while providing necessary conditions for the development of the wetlands. This allows the absorption rate of water into the ground to be higher, thus reducing rate of runoffs while retaining rainwater. Simultaneously, it creates new public spaces for people to congregate. In terms of economic prosperity, amenities and addition of programs to the site will occur along with population growth. Hence, to generate the necessary foot traffic for the economical sustainability of the site and its people, road networks are improved to bridge the divided BC to create greater accessibility to residents from the periphery of the site. Lastly, while taking into consideration the current growth rate, blocks are built along the newly expanded road network. It will be developed according to the needs of the site and orientated to the direction which maximizes daylight and wind flow and reduces glare, based on the simulation.

WATER MANAGEMENT DESIGN[7]

Current site capacity	Volume (m^3)	Percentage (%)
Drainage	24.21791	0.58532
Ciliwung River 92692.54351 (4.5m depth)	92692.54351	76.48096
Kali Mati (3.5m depth)	27 794.936	22.9337
Total	120 511.69721	100
Estimated Capacity to Consider (excluding greywater)	**Volume (m^3)**	**Percentage (%)**
Daily Water Usage	77.6/ pax 35 690.45721	-
Rainwater Volume (highest)	217017mm in height 32 8660.24012	-
Rainwater Volume (lowest)	79.26mm in height 12 002.4101	-
Inundation volume (max)	4000mm in height 104 629.32152	-
Inundation volume (min)	1000mm in height 26 157.33251	-
Total (minimum)	73 850.1975	-
Total (maximum)	173206.018	-
Proposed Capacity	**Volume (m^3)**	**Percentage (%)**
Ciliwung River	152564.944 **depth - raise to 4.673**	57.9 **~79 without considering greywater*
Kali Mati Basin	23 347.7688 **depth - raise to 4.2**	9.8
Water Square (Large) - 3 Qty	1875	1.9
Water Square (Medium) - 12 Qty	2160	
Water Square (Small) - 8 Qty	480	
Rain Water Absorption Tank	11520	4.8
Landscape (Wetlands/ Bioswales/ Moat)	4308.017	1.8
Storm Drainage	20 690.457	8.7
Subsurface Drainage	85.184 in length 19.616 m^3	0.008
Sanitary sewer pipe	35 690.457 (greywater)	15.1
Total	202 963.943 35 690.4572 (greywater)	100

Aligning our design with the Ciliwung River Expansion Plan, river normalization and clean-up will be followed through. 80% of the floodwater will be contained by the river (*Fig. 6)*, the normalization of the river can allow for the subsequent widening and deepening of the river upon the relocation of the residents to the newly-built mid-rise social housing developed on the Kali Mati. 17% of the flood volume will be contained within the retention basin located along the Kali Mati beside the newly built blocks. The remaining 3% are allocated in water pockets distributed on empty and underutilized or abandoned plots on the site. As the plot sizes differ, the allocated water pocket sizes differs accordingly - small, medium, big with different projects injected into them such that their functions changes according to the water level. The steps along the water squares also serve as indicators of floodwater level.

The water squares, basins and bio-swales allocated across the site serve to retain as much as possible during flooding with the use of valves, which can then be subsequently released back into Ciliwung River after the flood. Not only does this provide a flexible and systematic flood water management, it avoids the contamination of clean water supply while purifying water before they are being discharged back into Ciliwung River. With a boardwalk located beside the normalized and purified Ciliwung River, diversity of fauna and greenery are able to flourish, allowing visitors to enjoy the

[7] Figure 7: *Breakdown of Current Site Water Capacity compared to Proposed*

environment visually while acting as a setback from the riverbank.

Also, the allocation of rainwater harvesting tanks within each block of apartments allows rainwater to be collected and distributed to all apartments. The green roof comprises cleansing biotopes which also help to filter the rainwater before they are transferred into the harvesting tanks.

BUILDING DESIGN

The unit is designed to maximize the amount of space without compromising its comfort. Mezzanine floor is added to allow the living space to expand inwards. Meanwhile, the gap in between units can be utilized as a private spillover space for each family while allowing daylight to enter the unit. This gives flexibility in terms of spatial arrangement depending on the needs of each family

By taking the advantage of the self-healing nature of bio-concrete walls, the reduction of constant maintenance and the consideration of a sustainable building system is well taken care of. The two north - south facing walls of the unit are formed with a steel frame supporting wire mesh. Also, in an attempt to heighten the work of the local craftsmen and the provision of jobs during the process of construction, local recycled woods chips are used and cladded as the facade. These materials can be easily acquired from the previous site or collected from the waste of the furniture industry. Furthermore, the use of a wood chip facade allows for greater porosity of the units for ventilation without compromising the need of privacy within them. Their porosity is alternated according to the level privacy required of that particular space directly behind the wall.

On the other hand, the living green wall and the green parapet provides residents to “greenify” their neighborhood, creating a sense of ownership. The roof that is covered with solar panels is slanted at 5.4 degrees, which is the optimal degree for maximum sun exposure in Indonesia’s latitude, and directs water to the water catchment funnel which drains to the water catchment tank at the bottom of the block. This is later reused for greywater purposes by the residents. The green roof further increases the efficiency of the solar panels by bringing the ambient temperature down.

CONCLUSION

The team hopes that the development of a resilient community will transcend all disciplines, and not just solely the role of the architects or designers. In the schemes proposed, the residents, government institutions and various stakeholders are responsible and have an important role to play in the development. The term “resilient” should not only refer to the pliancy of the building or simply being cautious to our energy and water usage, but also the versatility of the network of systems, the residents along with its economic prosperity for the community to be a sustainable one. Though the project strives to develop lower-cost housing alternatives (rusun), the solutions proposed in the scheme are beneficial to the community in the long run - the creation of long-lasting design solutions that are constantly able to shift according to the ever-changing needs of the environment and the community.