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Nur Miladan

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DE L'UNIVERSITE DIPONEGORO**  
Programme de doctorat en Architecture et Urbanisme

## **Communities' Contributions to Urban Resilience Process: a Case Study of Semarang City (Indonesia) Toward Coastal Hydrological Risk**

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**I dedicate this doctoral thesis to my parents,  
Abil Huda & Elli Iriana**

## ABSTRACT

Semarang City is one of Indonesian coastal cities having high vulnerabilities of hydrological risks. This city has been threatened by floods for several centuries. This threat has been aggravated by *rob* (a local expression which means the occurrence of flood due to high tides in particular in coastal area since the late 1980s in conjunction with the industrialization process influencing the urban growth. The urban stakeholders, from the Dutch government era to the current government, have implemented many efforts to improve the capacities of urban system in order to reduce the hydrological risk, such as the developments of canalization and polder system. Nevertheless, in fact, the hydrological risk still remains a threat for this city. Moreover, the lack of urban system for the hydrological risk reduction entails an increasing vulnerability for the communities as regard the hydrological risk occurrences. In particular the coastal communities are often threatened by the *rob* risk in the daily life. Thus these conditions are an incentive for the coastal communities to implement their self-help efforts both individual and collective, in order to reduce the hydrological risk impacts in their territories (settlements). The communities implemented their local practices which are based on their perceptions and their initiatives. These efforts are carried out both routinely and temporarily. The communities use modest ways which depend on their economic capacities; these ways define an adaptation mode influencing the urban resilience process.

This research aims to understand the forms and influences of resilience at the local scale (communities and their neighbourhoods) and also the interactions between the local context and the urban context in the resilience process. The urban resilience reflects the capacities of urban system including technical and institutional system, and the capacities of communities to adapt to the urban disaster risk. The urban resilience is related to the stakeholders' initiatives to reduce the impacts of disaster risk in the periods of occurrences (before, during and after), to minimize the urban vulnerabilities, and also to learn from their experiences of disaster risk in order to develop urban sustainability.

The research approach is multidisciplinary. This study doesn't rely only on urban technical and spatial science, but also on sociological science. The understanding of urban flood resilience allows a comprehensive knowledge of the realities of the interactions between the efforts of urban institutions and communities to cope with urban flood risk. The result of this research reveals that the coastal communities of Semarang City have the capacities to develop the local resilience through their self-help efforts, in addition to the actions of others stakeholders. However, the urban system and its institutional system are necessary in order to develop a resilience process at the urban scale, and also to avoid communities' conflicts and urban inequalities related to the community self-help efforts as well as its adaptive capacities.

Key words: resilience, adaptive capacities, flood risk, coastal city.

## RESUME

La ville de Semarang est une des villes côtières indonésiennes vulnérables aux risques hydrologiques. Elle a été menacée par les inondations depuis plusieurs siècles. Cette menace a été aggravée par le phénomène de *rob* – expression locale qui désigne une inondation survenant lors d’une haute marée – en particulier dans la zone côtière, depuis la fin des années 1980, en liaison avec le processus d’industrialisation qui influe sur la croissance urbaine. Les acteurs urbains, de l’époque du gouvernement néerlandais à celle du gouvernement actuel, ont élaboré de nombreux projets pour améliorer les capacités du système urbain et réduire le risque hydrologique ; en témoigne le développement du réseau de canaux et du système du polder. Cependant, le risque hydrologique demeure une menace pour la ville. Les faiblesses du système urbain pour la réduction du risque hydrologique augmentent la vulnérabilité des communautés face aux risques hydrologiques. Ainsi les communautés côtières sont souvent menacées par le risque du *rob* dans la vie quotidienne. Cette situation les encourage à mettre en œuvre des efforts d’auto-assistance, individuelle et collective, basés sur leurs perceptions et leurs initiatives, afin de réduire l’impact des risques hydrologiques sur leurs territoires (habitats). Ces efforts sont effectués à la fois de manière routinière et temporaire. Les communautés utilisent des moyens modestes qui dépendent de leurs capacités économiques; ces façons déterminent un mode d’adaptation qui influence le processus de résilience urbaine.

Cette recherche a pour objet de comprendre les formes de la résilience à l’échelle locale (communautés et quartiers) ; elle vise également à appréhender les interactions entre les échelles du contexte local et celles du contexte urbain global qui interviennent dans le processus de résilience. Cette dernière reflète les capacités du système urbain qui comporte à la fois les systèmes technique et institutionnel, et les capacités des communautés à s’adapter aux risques. La résilience urbaine est liée aux initiatives des acteurs pour réduire les impacts des inondations durant les événements (avant, pendant et après), afin de minimiser la vulnérabilité urbaine, et aussi pour apprendre de leurs expériences acquises lors des inondations précédentes afin de développer la durabilité urbaine.

L’approche est pluridisciplinaire, à l’interface entre le génie urbain, la recherche architecturale et urbaine, et la sociologie. La compréhension de la résilience urbaine face aux inondations permet une connaissance globale des interactions entre les actions des institutions urbaines et celles des communautés. Le résultat de cette recherche révèle que les communautés côtières de la ville de Semarang ont la capacité de développer des formes de résilience grâce à leurs efforts d’auto-assistance, en liaison ou non avec les autres acteurs impliqués dans le processus. Cependant, le système urbain et le système institutionnel apparaissent comme nécessaires pour développer la résilience à l’échelle urbaine, et aussi la prévention des conflits communautaires et des inégalités urbaines relatives aux actions d’auto-assistance et d’adaptation.

Mots clés: résilience, capacités d’adaptation, risque d’inondation, ville côtière.

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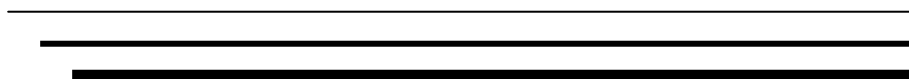
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# **GENERAL INTRODUCTION**



## A. Problematic

### *“Forms and effects of resilience at the community scale”*

#### **City and natural risk: between urban resilience and disaster management**

Our research aims to show how urban resilience process is closely linked to disaster management. The United Nations (2007) define disaster as a serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources.<sup>1</sup> However, disaster is not defined by fixed events or immutable relationships, but by social constructs, and these are liable to change.<sup>2</sup> Meanwhile, risk is the combination of the chance of a particular event and the impact that the event would cause if it occurs, therefore risk has two components – the chance (or probability) of an event occurring and the impact (or consequence) associated with that event.<sup>3</sup>

According to Magali Regezza (2006), cities and metropolises constitute indeed highly vulnerable spaces where the risk reduction becomes a fundamental issue in urban management policies.<sup>4</sup> The disaster management is an important element to support urban development. Resilience is a key term in disaster risk management (DRM).<sup>5</sup> In the context of a city, this concept designates urban capacities to absorb and to adapt to the urban risk.<sup>6</sup> Nevertheless, resilience remains difficult to measure but its analysis paves the way for new possibilities to manage social or natural risks.<sup>7</sup>

In fact, disaster management involves many urban stakeholders in the implementation of plans and projects to reduce risk: local and national governments, communities and also

<sup>1</sup> United Nations Office for Disaster Risk Reduction, “Disaster”, *Terminology* [Web], retrieved December 28<sup>th</sup>, 2015, from <http://www.unisdr.org/we/inform/terminology>.

<sup>2</sup> Alexander, D.E., 2005, “An Interpretation of Disaster in Terms of Changes in Culture, Society and International Relations”, In: Perry, R.W., Quarantelli, E.L. (eds.), *What is a Disaster? New Answers to Old Questions*, Philadelphia: XLibris Press, pp. 1-15.

<sup>3</sup> Sayers, P.B., Gouldby, B.P., Simm, J.D., Meadowcroft, I., Hall, J., 2006 (2003), *Risk, Performance and Uncertainty in Flood and Coastal Defence – A Review*, London: Defra.

<sup>4</sup> Reghezza, M., 2006, “*Réflexions autour de la vulnérabilité métropolitaine : la métropole parisienne face au risque de crue centennale*”, Doctorat en géographie, Université Paris X- Nanterre.

<sup>5</sup> MacAskill, K., Guthrie, P., “Multiple Interpretations of Resilience in Disaster Risk Management”, *Procedia Economics and Finance*, vol. 18, pp. 667 – 674.

<sup>6</sup> Resilience is a concept has diversified and come to have more than one meaning: it is the capacity of a system that incurs a brutal shock or continual pressure to sustain itself unchanged, and also it means a system is one that maintains its essential functions and structures by moving through different states of equilibrium (stable and unstable). Cf. Provitolo, D., “Resiliency Vulnerability Notion – Looking in Another Direction in order to Study Risks and Disasters”, in: Serre, D., Barroca, B., Laganier, R., *Resilience and Urban Risk Management*, London: Taylor & Francis Group. These definitions describe one part, resilience as a condition, and other part it as a process.

<sup>7</sup> Dauphiné, A., Provitolo, D., 2007, “La résilience : un concept pour la gestion des risques”, *Annales de géographie*, n° 654, pp. 115-125.

external participants such as foreign governments, NGOs, and academic partners. The disaster management is usually carried out by urban institutions. Nevertheless, the implementation of their policies is often incoherent. Risk management and risk reduction policies are not always integrated, and therefore the development of the urban projects, in order to support the risk management, can be inadequate. The idea of integration stresses the coherence between measures of protection, reduction of vulnerability, and management of disaster and recovery.<sup>8</sup> These criteria shows that the multi-aspects of risk management require related multi-stakeholders but their collaboration can be constrained during the implementation phase of urban projects. These situations certainly aggravate urban vulnerabilities, in particular for communities under the threat of disaster.

Communities also seek to reduce the urban risk impact through self-help actions.<sup>9</sup> These individual and collective efforts underlie the viability of life. Does the resilience process occur at the community scale (neighbourhoods)<sup>10</sup> because urban institutions inadequately manage the urban risk?

### **Indonesia as an archipelago country highly vulnerable to flooding**

Wisner et al. (2003) state that flood has been a very significant disaster around the world over the last decade. They assert also that some of the most extensive, damaging and costly floods have occurred in developed and wealthy countries.<sup>11</sup> In addition, the United Nations Office for Disaster Risk Reduction (UNISDR) states that flood was the most climate-related disaster around the world between 1980 and 2011.<sup>12</sup> Flood means an overflow or inundation that comes from a river or other body of water and often threatens lives and

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<sup>8</sup> Hubert, G., Deroubaix, J-F., Bruzzone, S., Rioust, E., 2015, *Projet TERIME Les territoires de l'eau et la gestion métropolitaine du risque d'inondation. Du bassin amont de la Seine au Grand Paris*, Paris: Ministère de l'écologie, développement durable et de l'énergie.

<sup>9</sup> Community is defined as the people living in one particular area or people who are considered as a unit because of their common interests, social group, or nationality. Cf. "community", *Cambridge Dictionaries* [Web], retrieved January 19<sup>th</sup>, 2016, from <http://dictionary.cambridge.org>. In Indonesian language, *komunitas* (community) means a group of organism (man and others) who live and interact with each other in certain area; society; association. Cf. "komunitas", *Kamus Besar Bahasa Indonesia (grand dictionary of Indonesian language)* [Web], retrieved January 19<sup>th</sup>, 2016, from <http://kbbi.web.id>.

<sup>10</sup> Neighbourhood means the area of a town that surrounds someone's home, or the people who live in this area. Cf. "neighbourhood", *Cambridge Dictionaries* [Web], retrieved January 19<sup>th</sup>, 2016, from <http://dictionary.cambridge.org>.

<sup>11</sup> Wisner, B., Blaikie, P. Cannon, T, Davis, I., 2003, *At risk: natural hazards, people's vulnerability and disasters*, London/ New York: Routledge.

<sup>12</sup> The number of climate-related disaster around the World (1980-2011) released by UNISDR, disaster occurrences includes 3455 Floods, 2689 Storms, 470 Droughts, and 395 Extreme temps. Sources: *Annual report 2011 UNISDR secretariat Work Programme 2010-2011*, 2011, Geneva: UNISDR, retrieved December 28<sup>th</sup>, 2015, from [http://www.preventionweb.net/files/27627\\_ar2011v2.pdf](http://www.preventionweb.net/files/27627_ar2011v2.pdf).

properties<sup>13</sup>. Floods are natural phenomena, they get affected by human intervention; for example, changing land use from farmland to housing developments can cause the runoff to increase and lead to an increase in the magnitude and frequency of flooding, and the speed of onset.<sup>14</sup> Furthermore, the World Bank stated that coastal cities and their poorest residents are among the most vulnerable; with rising sea levels, these cities long-term economic viability is at risk.<sup>15</sup>

Asian coastal cities are the most vulnerable cities to the flood risk.<sup>16</sup> More than half of global flood damages occur in Asia.<sup>17</sup> In Southeast Asia, coastal cities are particularly concerned by the flood risks. In this region, the hydrology of urban areas, just like in other urban areas of the developing world, is characterized by high coefficients of surface runoff, high drainage density, and the prominence of dual (natural and artificial) water-cycle.<sup>18</sup> According to Kinoshita (1993), big floods or big storms occasionally surge and induce casualty in this region.<sup>19</sup> These situations occur also in Indonesia. Two thirds of the Indonesian territories are surrounded by the sea and many Indonesian important cities are located on the coast. These cities emerged during the Middle Ages when international trade increased. During the Dutch colonial era, they were transformed for defensive purposes. As an archipelago with over 17.500 islands and over 81,000 kilometres of coastline, Indonesia and its coastal areas are very vulnerable to climate change.<sup>20</sup> Cities, such as Jakarta, Semarang, Surabaya, Medan, Makassar are threatened by flood. Flood is the dominant disaster in Indonesia. The flood risk is responsible for 75, 7 % of the disaster victims in Indonesia.<sup>21</sup> The Indonesian coastal cities vulnerabilities are linked to the increase of population, the decrease of forest land use, and the number of rivers in these places.<sup>22</sup>

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<sup>13</sup> Hong, Y, Adhikari, P., Gourley, J.J., 2013, "Flood Hazard and Disaster", in: Bobrowsky, P.T., *Encyclopedia of Natural Hazards*, Dordrecht: Springer Science+Business Media.

<sup>14</sup> Bureau of Meteorology of Australian Government, *Floods Warning Preparedness Safety*, June, 3<sup>th</sup> 2010, retrieved December 25<sup>th</sup> 2015, from <http://www.bom.gov.au>.

<sup>15</sup> World Bank, 2014, "Urban Resilience & Disaster Risk Management", World Bank Disaster Risk Management [Web], February 4, 2014, retrieved December 28<sup>th</sup>, 2015, from <http://www.worldbank.org/en/topic/urbandevelopment/brief/urban-resilience-disaster-risk-management>.

<sup>16</sup> Nicholls, R.J, Hanson, S., Herweijer, C., Patmore, N., Hallegatte, S., Jan Corfee-Morlot, Jean Chateau and Muir-Wood, R., 2007, "Ranking of the World's Cities Most Exposed to Coastal Flooding Today and in the Future: Executive Summary", Paris: OECD.

<sup>17</sup> Tingsanchali, T., 2011, "Urban Flood Disaster Management", *Procedia Engineering*, vol. 32, pp. 25-37.

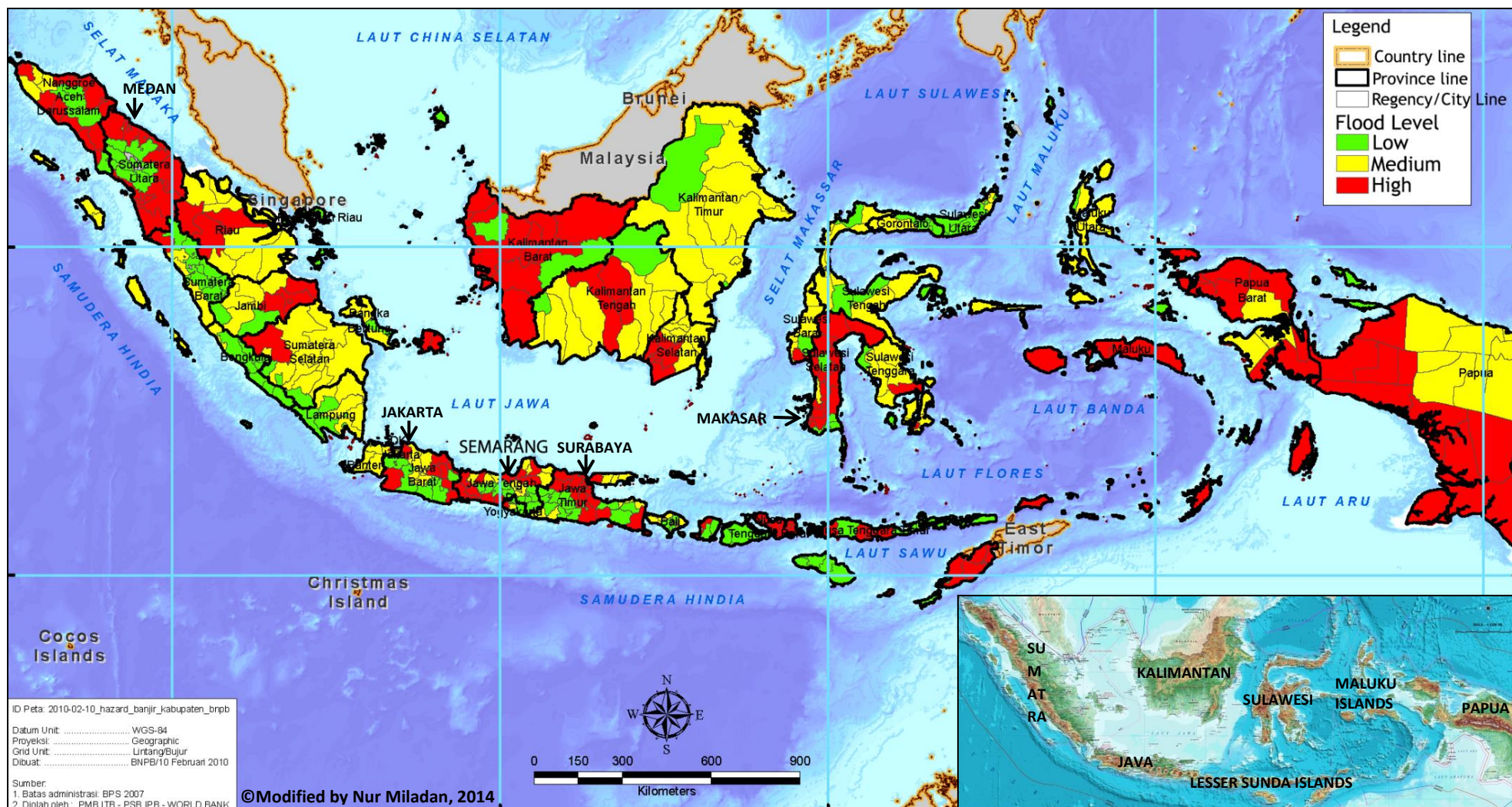
<sup>18</sup> Sim, L.K., Balamurungan, G., 1991, "Urbanization and Urban Water Problems in Southeast Asia. A Case of Unsustainable Development", *Journal of Environmental Management*, vol.32, pp. 195-209.

<sup>19</sup> Konosita, T., 1993, "Note for Flood Disaster Reduction in Southeast Asia", *Geo Journal* 31.4.

<sup>20</sup> Zikra, M., Suntoyo, Lukijanto, 2015, "Climate Change Impacts on Indonesian Coastal Areas", *Procedia Earth and Planetary Science*, vol. 14, pp. 57-63.

<sup>21</sup> United Nations Office for the Coordination of Humanitarian Affairs (OCHA), "Dampak bencana alam meningkat", *Buletin Kemanusiaan Indonesia*, January-March, 2014, retrieved December 25<sup>th</sup> 2015, from <http://reliefweb.int>.

<sup>22</sup> Wibowo, A. and Supriatna., 2011, "Coastal Environment Vulnerability on Coastal Cities in Indonesia", *Jurnal Ilmu dan Teknologi Kelautan Tropis*, vol. 3, no. 2.



**Figure 1. Flood hazard risk index in Indonesia**

Source: *Peta Indeks Ancaman Banjir di Indonesia*, [Map], 2010, Indonesian National Board for Disaster Management, Jakarta, retrieved December 25<sup>th</sup>, 2015, from [http://geospasial.bnpb.go.id/wp-content/uploads/2010/02/2010-02-10\\_hazard\\_banjir\\_kabupaten\\_bnpb.pdf](http://geospasial.bnpb.go.id/wp-content/uploads/2010/02/2010-02-10_hazard_banjir_kabupaten_bnpb.pdf); *Peta NKRI 2014* [Map], 2014, Geospatial Information Agency, Jakarta, Retrieved December 25<sup>th</sup>, 2015, from [http://www.bakosurtanal.go.id/assets/download/nkri/NKRI\\_2.5\\_jt.jpg](http://www.bakosurtanal.go.id/assets/download/nkri/NKRI_2.5_jt.jpg).

In Indonesia, the strengthening of disaster management has been developed since 2007. It was marked by the emergence of official rules.<sup>23</sup> Disaster management became a crucial issue in Indonesia in 2004 when a tsunami hit the country. Since then, the national government increasingly focuses on the mitigation (prevention) and management of natural risks, such as flood, tsunami, volcano, land slide... The law defines a disaster as an event or a set of events which threatens and disrupts the life and the community livelihoods, and it is caused by natural, non-natural, and/or human factors, and also its frequent consequences are human casualties, damages to the environment, loss of property, and psychological impact. Moreover, the national government formed the National Disaster Management Agency in 2008.<sup>24</sup> Each municipality and regency in Indonesia created Regional Disaster Management Agencies a year later. The disaster management has become an important issue in the urban development process ever since that time. However, flood is the disaster that occurs the most frequently in Indonesia<sup>25</sup> so it holds the particular attention of the national government.

### **Research case: Semarang City exemplifies Indonesian cities vulnerable to coastal hydrological risk**

Semarang City is one of coastal cities in Java Island which is most densely populated island in the world.<sup>26</sup> It is one of the biggest cities in Indonesia with a population of approximately 1, 584, 068 inhabitants in 2014.<sup>27</sup> As capital of the Central Java Province, this city plays a central role in the economic development of the region. Moreover, it was designated by the national government to be one of the economic centres on Java Island and to support the national development in particular industrialization and services provision between 2011 and 2025.<sup>28</sup> The existence of the Tanjung Mas Port in the north influences the urban growth and development of Semarang City. This nodal point for trade and industrialization strengthens the economic development of the Central Java and Yogyakarta Provinces.

<sup>23</sup> *Disaster Management*, Act n° 24/2007, Jakarta: Ministry of Law and Human Rights.

<sup>24</sup> *Guide of Determination of Regional Disaster Management Agency*, Regulation of Head of National Disaster Management Agency n° 3/2008, Jakarta: National Disaster Management Agency.

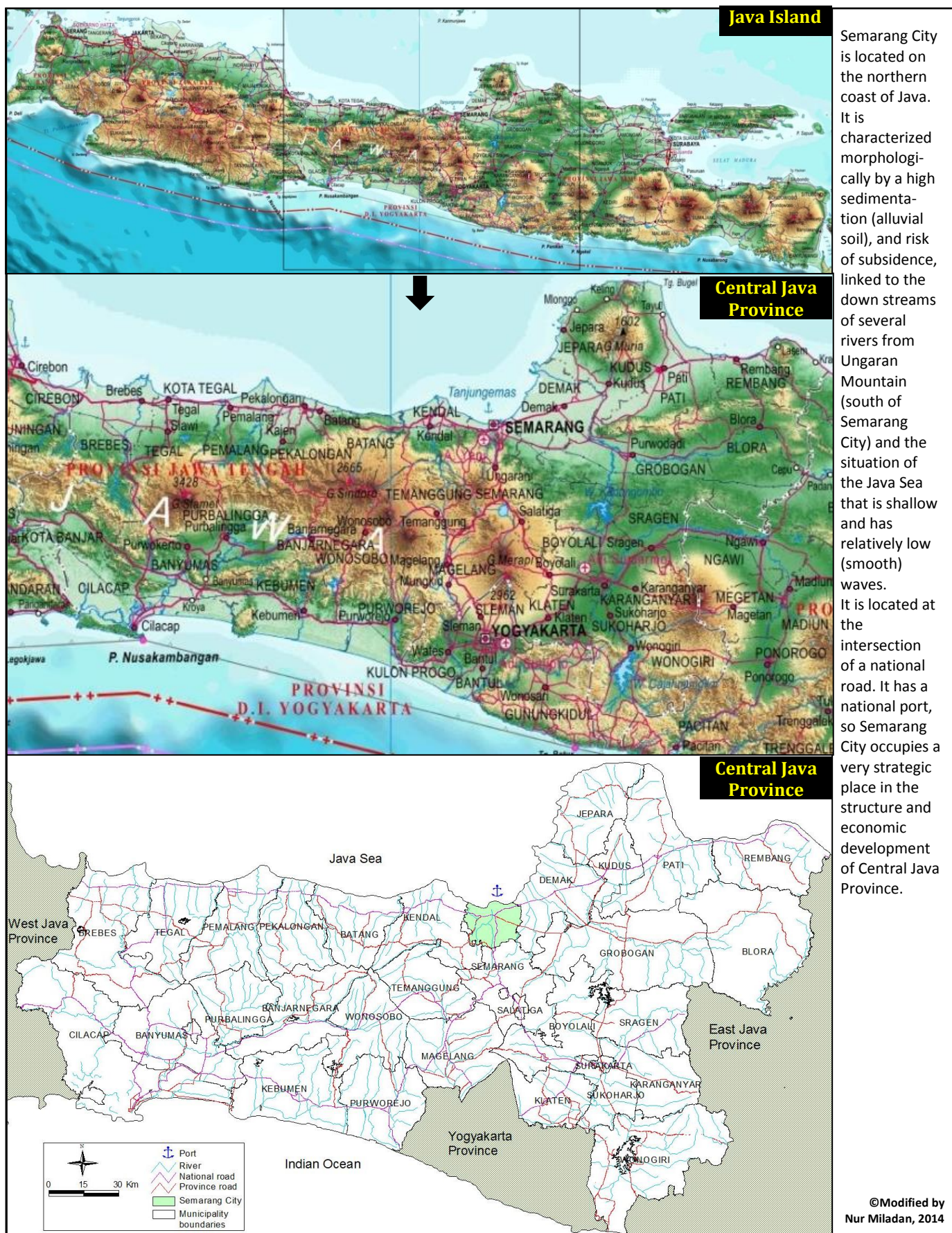
<sup>25</sup> It is based on the data of the distribution of disaster type and death victim from 1815 to 2015 released by National Disaster Management Agency. Cf. National Disaster Management Agency, "Sebaran Kejadian Bencana dan Korban Meninggal per Jenis Kejadian Bencana, 1815-2015 (Distribution of disaster occurrences and death victim per disaster occurrence type 1815-2015)", *Data & Informasi Bencana Indonesia* [Web], retrieved December 28<sup>th</sup>, 2015, from <http://dibi.bnpb.go.id>.

<sup>26</sup> Population number of Java Island in 2010 is about 136.610.590 inhabitants (57, 4 % of Indonesian population). Cf. Statistic Indonesia, *Population of Indonesia by Province 1971, 1980, 1990, 1995, 2000 and 2010* [Web], retrieved December 28<sup>th</sup>, 2015, from <http://www.bps.go.id/linkTabelStatistik/view/id/1267>.

<sup>27</sup> *Semarang in Figures 2015*, Semarang: Central Bureau of Statistics of Semarang City.

<sup>28</sup> *Masterplan Acceleration and Expansion of Indonesia Economic Development, 2011-2025*, 2011, Jakarta: Ministry for Economic Affairs.



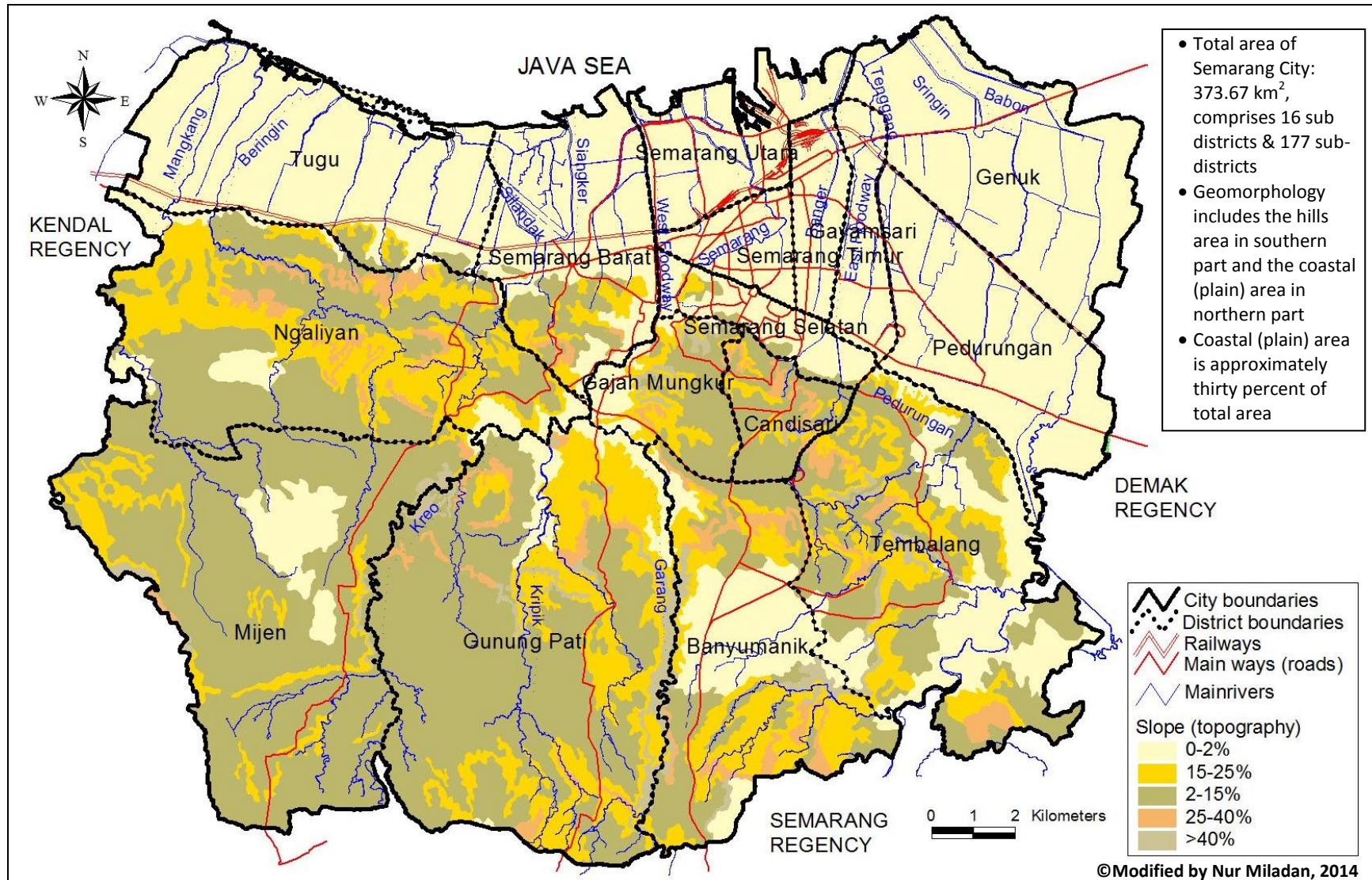


Semarang City is located on the northern coast of Java. It is characterized morphologically by a high sedimentation (alluvial soil), and risk of subsidence, linked to the down streams of several rivers from Ungaran Mountain (south of Semarang City) and the situation of the Java Sea that is shallow and has relatively low (smooth) waves. It is located at the intersection of a national road. It has a national port, so Semarang City occupies a very strategic place in the structure and economic development of Central Java Province.

**Figure 2. Semarang City orientation in Java Island**

Source: *Peta NKRI 2014* [Map], 2014, Geospatial Information Agency, Jakarta, Retrieved December 25<sup>th</sup>, 2015, from [http://www.bakosurtanal.go.id/assets/download/nkri/NKRI\\_2.5\\_jt.jpg](http://www.bakosurtanal.go.id/assets/download/nkri/NKRI_2.5_jt.jpg); *Peta Provinsi Jawa Tengah* [Map], Geospatial Information Agency, Jakarta, Retrieved December 25<sup>th</sup>, 2015, from <http://www.bakosurtanal.go.id/peta-provinsi/>





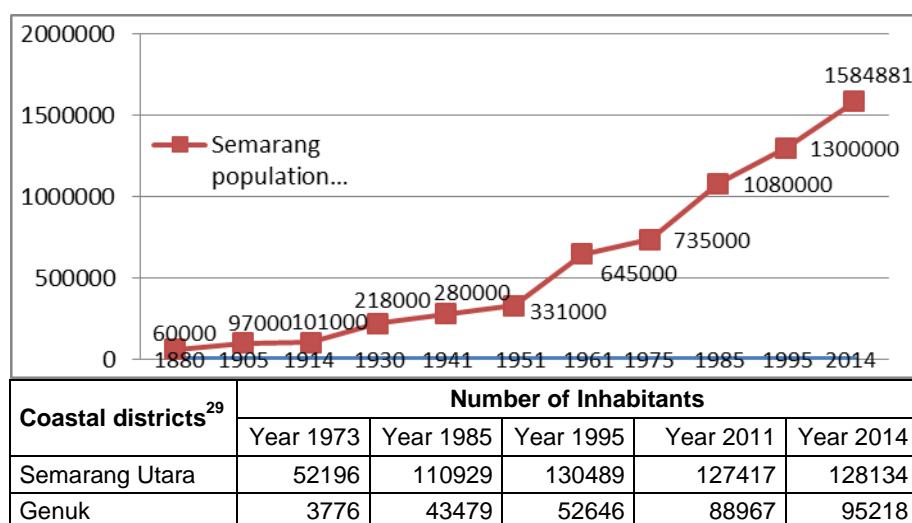
**Figure 3. Semarang City and its topography**

Source: *Urban Development Management Information System (UDMIS)*, 2001, Semarang: Regional Development Planning Agency (BAPPEDA).

The topography and the hydro-morphology of Semarang City account for the existence of hydrological risk, in particular on the coast (northern part of city) where the land has slipped between 0 and 2%. The southern part of city has various slopes up to more than 40%. Consequently, most of water discharge flows from the southern to the northern part. Furthermore, the high number of rivers increases the flood risk due to the overflow of water discharge. This situation is aggravated by urban geography: bordered by sea, the city is bordered by tidal flood.

The Central Java Province is divided into 35 municipalities including 6 cities (*kota*) and 29 regencies (*kabupaten*) (Annex 1). The territorial division between city and regency in Indonesia is linked to the history of urban development during the Dutch colonial era. At that time, the city designated urban areas which managed and designed by Dutch government. Meanwhile, the regency referred to non-urban areas which were dominated by villages and agricultural lands. This distinction underlies the development of municipalities in Indonesia until recently.

Located in the Central Java Province, Semarang City has been an important city in Indonesia since the Dutch government era. At that time, this city was developed by the Dutch authorities as a trade area (port) and a defensive site (ancient urban area). Semarang City has experienced a significant population growth since the 1960s. Semarang population almost doubled between the 1950s and the 1960s. But the 1960s population growth differed from the previous ones that occurred when Dutch municipality was still controlling the population growth of Semarang City. Inhabitants also left the city in times of war, thus influencing the population number of Semarang City at that time.



**Figure 4. Population growth in Semarang City**

Source: Cobban, J.L., 1992, "Exporting Planning: The work of Thomas Karsten in Colonial Indonesia", in: Dutt, A.K., Costa, F.J., Aggarwal, S., Noble, A.G. (eds), 1994, *The Asian City: Processes of Development, Characteristics and Planning*, Dordrecht / Boston: Kluwer Academic Publishers; Brommer, B., Budiharjo, E., Montens, A.B., Setiadi, S., Sidharta, A., Siswanto, A., Soewarno, Mr., Stevens, Th., 1995, *Semarang Beeld van Eenstad*, Purmerend: Asia Maior; *Statistical Year Book of Semarang City in 1973*, Semarang: Central Bureau of Statistics of Semarang City; *Semarang in Figures 1995*, Semarang: Central Bureau of Statistics of Semarang City; *Semarang in Figures 2011*, Semarang: Central Bureau of Statistics of Semarang City; *Semarang in Figures 2015*, Semarang: Central Bureau of Statistics of Semarang City; *Population of Semarang City in mid- Year 1985*, Semarang: Central Bureau of Statistics of Semarang City.

*Semarang is still experiencing a positive growth of population. This situation indicates that the urbanization process in Semarang City and the growth of regional economic in Central Java Province are still ongoing.*

<sup>29</sup> Industrial zones in Semarang coastal area are concentrated in both districts with high population density. In addition, the colonial town is located in the district of Semarang Utara. This district is one of the urban centres.

Since the establishment of the Central Java Province and of Semarang as its capital in 1950<sup>30</sup>, people have come from the hinterland areas of Central Java Province to Semarang City. They seek to improve their quality of life through work opportunities, accessibility to services, and better infrastructures. These conditions have become pull factors for migration since the 1950s. Migration has led to the growth of urban built-up spaces in Semarang City, particularly on the coast.

In 1960, Indonesia experienced a monetary crisis (high inflation up to 600 %)<sup>31</sup> that increased poverty. Moreover, in the 1960s, the Indonesian society experienced a massive change in its economy: from a traditional agricultural system to an industrial one, and also the national government centralized development in the big cities, therefore people massively left rural areas to come to these cities.<sup>32</sup>

Indonesian productions were very diverse during the rapid industrialization from the 1970s to end of the 1980s, and most of industrial enterprises were located on Java and also Sumatra.<sup>33</sup> Centralized industrialization policies in Indonesia have turned Semarang City into the development centre of Central Java Province since 1980s. This process accelerated the rural exodus in Semarang City with people concentrating in the coastal area. Consequently, this zone experienced a rapid population growth that extended the urban built-up space. However, although there had been urban economic growth and urbanization, the spirit of togetherness has always existed in urban communities.

Along with its important role in the Central Java Province, Semarang City is one of the most vulnerable areas to flood. Indeed, flood risk has recently affected several Indonesian coastal cities. But in our case, Semarang City has experienced flood risk for a long time. Generation after generation, it still threatens Semarang City. Since the Dutch government era (1800-1942), the municipality has sought to reduce the flood risk through the development of urban drainage system such as canalization and floodway. Nevertheless, this problem has not been solved and it certainly inhibits urban development.

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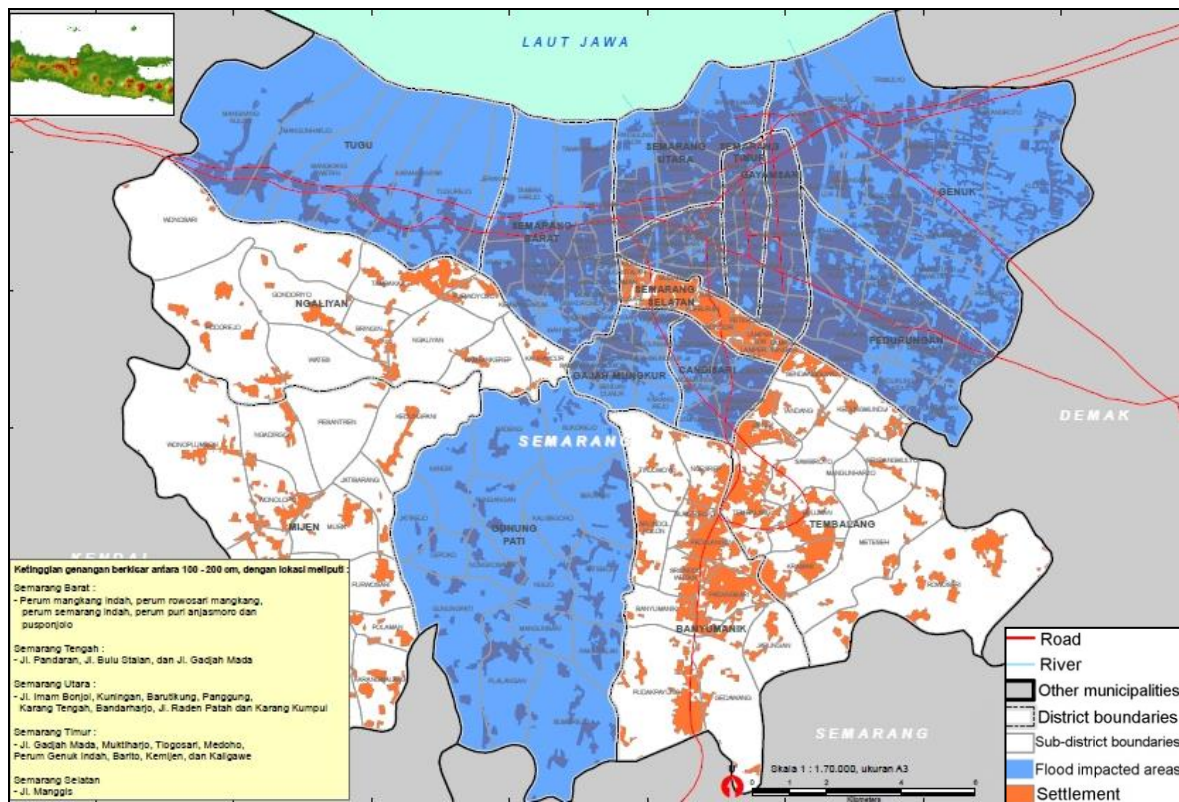
<sup>30</sup> *Determination of the Regencies in the Central Java Province*, Act n° 10/1950, Jogjakarta: Ministry of Justice.

<sup>31</sup> Kartasasmita, G., 2002, *Krisis ekonomi dan masa depan ekonomi Indonesia* [Papers], Bandung: Master of Management, Padjajaran University, retrieved December 28<sup>th</sup> 2015, from [https://www.academia.edu/7142696/KRISIS\\_EKONOMI\\_DAN\\_MASA\\_DEPAN\\_EKONOMI\\_INDONESIA\\_Oleh](https://www.academia.edu/7142696/KRISIS_EKONOMI_DAN_MASA_DEPAN_EKONOMI_INDONESIA_Oleh).

<sup>32</sup> Van Kooij, R.A. & Tsalatsa A, Y., 2007, *Bermain dengan api: relasi antara gereja-gereja mainstream dan kalangan Kharismatik dan Pentakosta*, Jakarta: Gunung Mulia.

<sup>33</sup> Franck, M., 1991, “*Deux processus d’urbanisation à Java-Est en Indonésie*”, *Cahiers de géographie du Québec*, vol. 35, n° 96, pp. 513-534.





**Figure 5. Flood-impacted areas in Semarang City on February, 7-8<sup>th</sup> 2009**

Source: Indonesian National Board for Disaster Management, 2009<sup>34</sup>

*Most of the flood-impacted areas are located in the northern part (coastal area) of the city. Furthermore, the central southern part of city was also threatened by flood due to the overflow of river water during the rainy season. As a consequence, Semarang City is highly vulnerable to flooding.*

Flood risk in Semarang City is caused not only by the lack of urban drainage system to accommodate water discharge in particular during the rainy season, but also by the effects of high sea tides in particular on the coast. *Rob*<sup>35</sup> often threatens this city since the mid-1980s because of industrialization and the rapid growth of population. The activities in the port and the industrial zones accelerate the urbanization in Semarang by increasing the number of settlements and extending the urban area. The construction of urban areas increases the water runoff by reducing the amount of ground able to absorb rainfall.<sup>36</sup> It also aggravates land subsidence occurs on the Semarang coast. Due to this process, part of the northern coast of Semarang city has experienced a growth of sea water inundation since almost the last three

<sup>34</sup> *Peta Bencana Banjir di Wilayah Kota Semarang 7-8 Februari 2009* [Map], 2009, Indonesian National Board for Disaster Management, Jakarta, Retrieved December 25th, 2015, from [http://geospasial.bnpb.go.id/wp-content/uploads/2009/05/2009-02-09\\_banjir\\_kota\\_semarang\\_BNPB.pdf](http://geospasial.bnpb.go.id/wp-content/uploads/2009/05/2009-02-09_banjir_kota_semarang_BNPB.pdf).

<sup>35</sup> *Rob* is a local expression for tidal flood

<sup>36</sup> Florida Division of Emergency Management, "Flooding Brochure", retrieved December 28<sup>th</sup>, 2015, from <http://floridadisaster.org/EMTOOLS/Severe/documents/Flood%20Brochure.pdf>.

decades.<sup>37</sup> Flood risk is increasing due to urban growth, which makes people more vulnerable and threatens economic assets, and due to factors that increase flood hazard, including reduced delta aggradation, subsidence through natural resource extraction, and climate change, including extreme weather events, such as typhoons, and sea level rise.<sup>38</sup> These phenomena also occur in Semarang City. Flood risk, the *rob* in particular, disturbs urban activities while communities and their environment are more and more vulnerable. The *rob* risk is aggravated by the monthly high tides, so it threatens the daily life of coastal communities. The *rob* phenomena can occur on the Semarang coast, even when there is no rain. It is worse during the rainy season.<sup>39</sup>



\* **TANJUNG MAS- Rob** becomes more malignant and threatens *kampung* of Asin River, in particular in RW (area) 4 of Kuningan Sub-district, Semarang Utara (District). *Rob* elevation reaches 75-100 cm. *Rob* inundation enters the houses of communities in Kemijen, Semarang Timur (District), Friday (31/5).

■ Rob Mengganans Terjang Kuningan

## Tanggul Kali Asin Jebol

**TANJUNG EMAS - Rob mengganans terjang**  
\* kampung Kali Asin, khususnya di RW 4 Kelurahan Kuningan, Semarang Utara. Ketinggian rob mencapai 75-100 sentimeter. Genangan air rob, juga memasuki rumah warga di Kemijen, Semarang Timur, Jumat (31/5).

Tidak hanya barang di rumah, warga juga khawatir tingginya rob membuat ikan lari dari tambak. Kondisi sama dialami Suroso warga Kampung Kaliasin RW 4 Kelurahan Kuningan, Semarang Utara, banjir rob terjadi akibat tanggul Kali Asin jebol. "Ketinggian di luar rumah bisa mencapai lebih dari 75-100 cm. Karena kampung dikepung air, maka warga kita tidak bisa apa-apa," akunya.

Genangan air juga terlihat di Jalan Ronggowarsito. Air rob melebihi hari biasanya. Ketinggian lebih dari 60 sentimeter membuat pengendara yang keluar dari pelabuhan memilih memutar lewat Jalan Kaligawe.

■ **Kemacetan**  
Akibat adanya pengalihan jalur, ruas Jalan Kaligawe mengalami kemacetan cukup panjang. "Daripada kena macet, kita pilih memutar lewat Tol Kaligawe. Sedikit lebih jauh tapi tidak macet," aku Sujono Koramil, Semarang Timur.

Karyono warga Kemijen mengungkapkan, rob mulai tampak naik ke darat sekitar pukul 12.00 WIB. Air, tambah dia, naik dengan cepat. Sekitar tiga jam kemudian, air sudah sangat tinggi. "Karena tidak seperti biasanya, maka warga harus mengevakuasi barang elektronik untuk ditaruh di sisi yang lebih atas," akunya.

Bersambung ke hal 21kol 5

**Figure 6. Rob occurrence in May, 2013**

Source: "Rob Mengganans Terjang Kuningan Tanggung Kali Asin Jebol", *Wawasan*, June, 1<sup>st</sup> 2013, retrieved December 25<sup>th</sup> 2015, from [http://issuu.com/koranpagiwawasan/docs/wawasan\\_20130601/17](http://issuu.com/koranpagiwawasan/docs/wawasan_20130601/17).

<sup>37</sup> Abidin, H.Z., Andreas, H., Gumilar, I., Sidiq, T.P., Gamal, M., Murdohardono, D., Supriyadi, Fukuda, Y., 2010, "Studying Land Subsidence in Semarang (Indonesia) Using Geodetic Methods", in: *FIG Congress Facing the Challenges-Building the Capacity*, Sydney.

<sup>38</sup> Chan, F.K.S., Mitchell, G., Adekola, O., McDonald, A., 2012, "Flood Risk in Asia's Urban Mega-Deltas Drivers, Impacts and Response", *Environment and Urbanization ASIA*, vol. 3, n° 1, pp. 41-61.

<sup>39</sup> Rainy season in Indonesia is between October and March.



## Rob Kian Parah Genangi Utara Kota Semarang

**KALIGAWE** - Rob kembali genangi beberapa kawasan di kota ini. Salah seorang kepala bidang di Dinas PSDA dan ESDM, Rosid Hudoyo, mengungkapkan genangan muncul di beberapa titik. Titik-titik itu, antara lain Kemijen, Kaligawe, Purwoyoso, dan Bugangan.

"Beberapa hari ini sebenarnya

Bersambung ke hal 21 kol 2

**LINTASI ROB:** Seorang penjual mie ayam keliling melintasi rob di Jalan Kaligawe kemarin. Jalan raya tersebut hingga kemarin sore tergenang rob sehingga menimbulkan kemacetan. **Foto: SM Network/Adhita A**



**Rob .....** (Sambungan hlm 17)

tak ada hujan yang besar, tapi genangan tetap muncul. Ini murni karena rob yang ditimbulkan akibat cuaca ekstrem karena pengaruh global," terangnya, Jumat (23/5).

Genangan mulai muncul beberapa hari lalu, tapi paling parah terlihat kemarin. Rosid mengungkapkan, dia memantau beberapa daerah yang tergenang dan memang bisa dipastikan air tersebut berasal

dari rob. Sumber genangan berasal dari Kali Tenggang dan Kali Banger.

### ■ Solusi

Rosid mengungkapkan, solusi untuk mengatasi bencana tersebut sebenarnya sudah direncanakan. Namun, rencana tersebut belum bisa berjalan lancar.

Untuk Kali Banger, pemerintah akan membangun sistem polder. Proyek tersebut terpaksa berhenti sementara di tengah

jalan karena ada beberapa kendala. Kemungkinan besar, pekerjaan tersebut baru akan dijalankan kembali tahun depan.

Sementara untuk Kali Tenggang, pemerintah sudah sejak beberapa tahun lalu merencanakan normalisasi.

"Normalisasi Kali Tenggang belum bisa dijalankan hingga kini. Terus terang, kami terkendala masalah sosial. Untuk persoalan teknis sebenarnya sudah kami kuasai," tambahnya.

Berdasar pantauan, rob tak

hanya menggenangi rumah warga tapi juga jalan raya. Salah satu yang tergenang yakni Jalan Raya Kaligawe. Puluhan meter ruas jalan itu tergenang dari beberapa centimeter hingga puluhan centimeter.

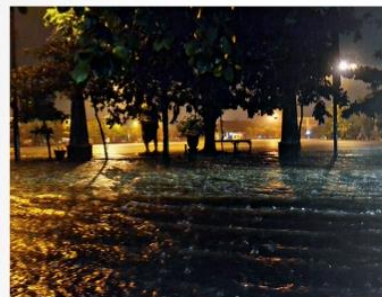
Hal itu mengakibatkan lalu lintas di jalan tersebut tersendat. Hingga sore kemarin, kendaraan yang melalui jalan itu terpaksa berjalan pelan sehingga menimbulkan kemacetan cukup panjang. **SM Network/H35,H71-die**

**\*ALIGAWE** - Rob inundates several areas in this city again. Rosid Hudoyo, a section head in the Department of Management of Water Resources and Energy and Mineral Resources, revealed the inundation hit several locations: Kemijen, Kaligawe, Purwoyoso and Bugangan. "In a couple of days, even though there is no heavy rain, inundation occurred. This is purely due to rob caused by the global extreme climate", Friday (23/5).

## Banjir Kepung Semarang

**SEMARANG** - Hujan deras yang mengguyur Kota Semarang sepanjang Kamis (12/2) hingga malam hari, mengakibatkan sejumlah kawasan dan ratusan rumah terendam banjir. Kondisi terparah terjadi di Simpanglima yang merupakan simpul dan pusat kota. Genangan setinggi 30-40cm di sekeliling kawasan ini menimbulkan kemacetan parah.

Banyak kendaraan yang harus antre melintas karena genangan menutup sebagian badan jalan. Laporan genangan air juga terjadi di Jalan Majapahit. Kendaraan yang ke arah timur terpaksa mengantre saat melintas Bangjo Kelinci. Genangan setinggi 30 cm berada di sisi kiri bahu jalan membuat penggu-



Bersambung ke hal 7 kol 1

**BANJIR** : Banjir yang melanda Kota Semarang, Kamis (12/2) mengakibatkan pertigaan Jalan Kelinci terendam. Polder Tatwang di depan Stasiun Tatwang juga meluap. (foto kanan). **Foto: Felek Wahyu-yan**

**SEMARANG** – Heavy rain flushes Semarang City the whole Thursday (12/2) until night. Some areas and hundreds of houses are inundated by flood. The worst situation happens in Simpanglima (node and city center). The inundation is as high as 30-40 cm around this area and produces a severe congestion.

### Figure 7. Local Newspaper Extract on the Rob Occurrence in May, 2014 & 2015

Source: "Rob Kian Parah Genangi Utara Kota Semarang", *Wawasan*, May, 24<sup>th</sup> 2014, retrieved December 25<sup>th</sup> 2015, from [http://issuu.com/koranpagiwawasan/docs/wawasan\\_20140524](http://issuu.com/koranpagiwawasan/docs/wawasan_20140524); "Banjir kepung Semarang", *Wawasan*, February, 13<sup>th</sup> 2015, retrieved December 25<sup>th</sup> 2015, from [http://issuu.com/koranpagiwawasan/docs/wawasan\\_20150213](http://issuu.com/koranpagiwawasan/docs/wawasan_20150213).

Most of the flood-impacted areas are located in the northern part (coast) of the city where population density is high. Although urban institutions have sought to solve the flood risk through urban hydrological projects and plans, it remains a threat to the city and its communities.

### **Is flood risk an unsolved urban problem in Semarang City?**

Since the 1980s, the acceleration of Semarang urban growth has not been supported by proper infrastructures. The characteristics of the coastal area were hardly taken into account in the urban development. Consequently, flood risk and in particular *rob* phenomena became the chronic problem of Semarang City. In the urban planning documents between 1975 and 2000, issues of *rob* risk were not considered. Consequently, the environment degradations and the infrastructure destructions have continued to occur in the Semarang coastal area. Moreover, the community life is always threatened by inundation risks. However, the recent spatial planning documents in Semarang City have made considerable progresses in addressing coastal disaster risk issues; the number of disaster related issues discussed in the spatial planning documents of 2010 to 2030 is much higher than those of 2000 to 2010.<sup>40</sup> This condition indicates that urban institutions are increasingly aware of coastal risks, as they develop urban risk management policies, including efforts to solve flood risks in Semarang City. Spatial planning in Indonesia<sup>41</sup> should also accommodate efforts for the reduction of urban risk.

Urban institutions have established several plans of urban drainage system in collaboration with international stakeholders to solve the flood risk in Semarang City since the 1990s such as the Master plan on Water Resource Development and Feasibility Study for Urgent Flood Control and Urban Drainage in Semarang City and Suburbs by Japan International Cooperation Agency/JICA (1993), Semarang Flood Control Project-Consolidated Preparation Study by Snowy Mountains Engineering Corporation/ SMEC (Australia) (1999), Semarang Urban Drainage Masterplan Project/SUMDP by the Ministry of Public Works (2000), Detailed Design of Flood Control, Urban Drainage and Water Resources Development in Semarang by CTI Engineering International Co., Ltd/ JICA (2000), and Master plan of urban drainages (2007). The last master plan consists of comprehensive hydrological plans composed by previous masterplans or feasibility studies of urban drainage system.

In fact, several hydrological projects based on these plans have been implemented to solve the flood risk in particular *rob* phenomena since the 1990s such as the normalization of

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<sup>40</sup> Sutanta, H., Rajabifard, A., Bishop, I., 2010, "Studying Spatial Plan in Coastal Urban Environment-Facing Global Threat and Adapting to Local Condition", in: *FIG Congress Facing the Challenges-Building the Capacity*, Sydney.

<sup>41</sup> *Spatial Planning (in Indonesia)*, Act n° 26/2007. The emergence of this law is in conjunction with the act no 24/2007 about disaster management. The previous act of spatial planning (n° 24/1992) was hardly taken into account the urban disaster management.

floodways and rivers, the development of the Tawang Polder<sup>42</sup> and several pump systems in the Semarang coastal area. But these projects were inefficient. Consequently, the flood risk continues to threaten Semarang City and coastal inhabitants are highly vulnerable to the flood risk. Although some improvements have been made, the current flood management system has generally failed to address a wide range of coastal inundation problems.<sup>43</sup> The local government believes that joint use of structural and non-structural measures is the best alternative of coping with flood; unfortunately, those efforts have not been sufficient to overcome problems caused by frequent floods in this city.<sup>44 45</sup>

Furthermore, urban institutions still seek to solve the flood risk through several plans and projects, such as the Jatibarang Dam Packet Project in collaboration with the Japanese government, the Banger Polder Pilot Project in cooperation with the Dutch government, and also the Resilient City Project in Asian Cities Climate Change Resilience Network (ACCCRN) initiated by Mercy Corps (an international NGO). Urban institutions have been supported by the central government (national and Central Java Province) in the implementation of these projects. Nevertheless, these projects are still underway, so their effectiveness in flood risk reduction can be questioned.

Urban institutions have sought to have sought to provide the maps of flood risks as the basic data for the flood risk reduction plans and strategies. In the 2000s, they have established several maps identifying flood-impacted areas. Nevertheless, these maps are not precise and need detailed verification. The lack of exhaustive maps supported by time series data of hydrological risks constrains the efforts to reduce urban flood risk.

Furthermore, the effectiveness of urban hydrological projects cannot be clearly measured. Flood becomes a coastal natural risk is not separated from urban growth and community life. Nevertheless, these situations disturb urban activities and economic growth.

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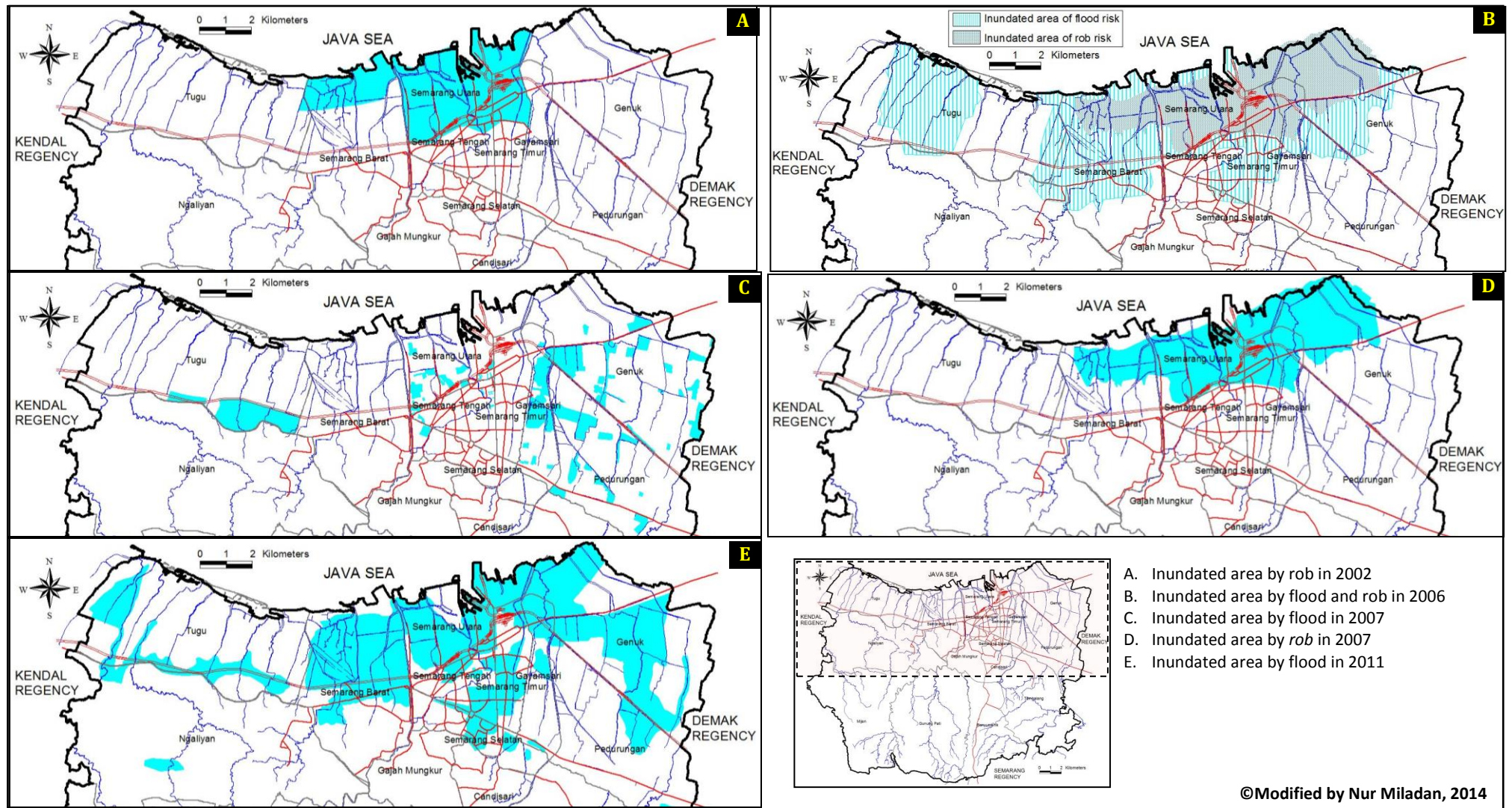
<sup>42</sup> The polder (retention basin) built in an area of approximately one hectare is located in Semarang Utara District.

<sup>43</sup> Marfai, M. A., King, L., 2008, "Coastal flood management in Semarang, Indonesia", *Environmental Geology*, Vol. 55, pp. 1507–1518

<sup>44</sup> Dewi, A., 2007, "Community-Based Analysis of Coping with Urban Flooding: a Case Study in Semarang, Indonesia", Master thesis in Geo-Information Science and Earth Observation, ITC-University of Twente.

<sup>45</sup> Structural measures: Any physical construction to reduce or avoid possible impacts of hazards, or application of engineering techniques to achieve hazard-resistance and resilience in structures or systems; Non-structural measures: Any measure not involving physical construction that uses knowledge, practice or agreement to reduce risks and impacts, in particular through policies and laws, public awareness raising, training and education. Cf. United Nations Office for Disaster Risk Reduction, "Structural and non-structural measures", *Terminology* [Web], retrieved January 19<sup>th</sup>, 2015, from <http://www.preventionweb.net/english/professional/terminology/v.php?id=505>.





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**Figure 8. The official maps of flood and rob risks in Semarang City (coastal area)**

Source: Sarbidi, 2002, “Pengaruh Rob pada Permukiman Pantai (Kasus Semarang)”, in: *Proceeding Kerugian pada Bangunan dan Kawasan Akibat Kenaikan Muka Air Laut pada Kota-Kota Pantai di Indonesia*, Jakarta; *Daerah Rawan Genangan Banjir (Flood Inundation Area)* [Map], 2006, Semarang: Department of Public Works; “Genangan Banjir (Inundation of flood)” [Map], and “Genangan Banjir Rob (Inundation of rob)” [Map], *Urban drainage masterplan of Semarang City*, 2007, Semarang: Regional Development Planning Agency; “Kawasan Banjir (Flood Area)” [Map], *Spatial planning of Semarang City for 2011-2031*, 2011, Semarang: Regional Development Planning Agency.

The different maps on the areas impacted by flood and rob indicate the inconsistency of existing data and information on inundation risk in Semarang City. However, these maps describe how the inundation risk still exists and is increasingly concentrated on the coastal (plain) area of Semarang City.

### **Community self-help efforts as local practices for adapting to the hydrological risk at the neighbourhood scale**

At the origin of our study, there are three observations. Firstly, flood risk has existed in Semarang City for several centuries but urban hydrological projects and plans have not yet solved this problem. Secondly, settlements endure and urban activities remain dynamic despite the flood risk. The Semarang coastal area continues to grow and the city centre still exists on the coast as in the past, surviving the floods and their impacts in the short and medium terms. As a result, communities seemingly reduce the hydrological risk impact through their self-help capacities. They have produced adaptive local forms through architectural transformations and practices. Communities have sought to limit the flood risks through the renovation of neighbourhood infrastructures such as the reconstruction and elevation of streets, the improvement of dikes around urban drainages and rivers, the cleaning of local drainages including the dredging of waste and sedimentation, and also the rehabilitation of local public spaces. Communities have carried out their collective efforts with the spirit of *gotong royong*. It is said to be derived from Javanese village traditions of communal work and responsibility where individuals owed certain moral obligations to wider society.<sup>46</sup> Furthermore, households of coastal communities seek to renovate their houses themselves (by elevation) every year to reduce the hydrological risk impact. However, these individual efforts depend on the economic capacities of each household. Some households totally renovate their houses, but others can renovate their houses only partially, with floor elevations for instance. Community efforts are temporary and modest practices. Nevertheless, the communities routinely carry out these initiatives since the emergence of *rob* risk.

These situations lead us to interrogate the resilience process at the community scale. In fact, urban institutions manage the hydrological risk with such difficulty that the effectiveness of the process of urban resilience has to be questioned. Communities carry out adaptive efforts based on the self-help capacities to keep their viability and quality of life. These situations show how risk has been incorporated into the communities' culture and practices. In hydrology, the inundation risk is the focus of prevention and management policies with the public awareness measures constitute a risk culture.<sup>47 48</sup> At the community scale, risk culture refers to prevention

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<sup>46</sup> Rigg, J., Allott, A., Harrison, R., Kratz, U., 1999, "Understanding Language of Modernization: A Southeast Asian View", *Modern Asian Studies*, vol. 33, Issue 3, pp. 581-602.

<sup>47</sup> Aubry, H., Marcondes, L. (eds.), 2014, *La culture du risque en question. Des inondations aux débordements nucléaires*, Paris : La Dispute.

<sup>48</sup> Risk culture means the stakeholder knowledge (elected officials, technicians, citoyens, etc.) concerning natural phenomena and understanding of vulnerability. Cf. Ministère de l'écologie du développement durable et de l'énergie, "culture du risque", *Glossaire* [Web], Retrieved January 19<sup>th</sup>, 2016, from <http://www.georisques.gouv.fr>.



and management policies initiated and organized by the self-help efforts of communities. These measures are certainly based on their awareness of flood risk in their territory. Furthermore, the risk culture is linked to the community perceptions of the risk existence. *Rob* phenomena often threaten the daily life of communities and influence their perceptions of and reactions to it. The existence of flood risk in Semarang City is not a new situation in coastal communities' life.



*Rob* occurrence (30 cm high) was inundating a settlement area in Semarang Utara District on May, 5<sup>th</sup> 2013.

©Modified by Nur Miladan, 2014

**Figure 9. *Rob* occurrence in the daily life of coastal communities in Semarang City**

Source: Sulistiyawan, W., "Semarang Utara Tergenang Rob" [Photo], *Tribun Jateng*, May, 5<sup>th</sup> 2013, <http://www.tribunnews.com/images/regional/view/559232/semarang-utara-tergenang-rob#img>.

*This image shows how the inhabitants are familiar with the hydrological risk existence in particular rob phenomena. They continue to socialize during the risk occurrences. It seems that the inhabitants have adapted to the hydrological risks in their territory.*

These situations can be explored to understand the resilience process at the community scale. The understanding of this development is linked to all the factors influencing the communities' life in areas impacted by hydrological risk. Furthermore, the hydrological risk management by communities will explain how the resilience process occurs at the community scale.

However, the community resilience (forms and effects, adequacy) can be analysed as an element of the urban resilience process. The influence of community resilience can be reflected in the resilience process at the city scale. How can the community resilience process contribute to urban risk management? These situations lead to understand the role and involvement of communities, their social dimensions and how they influence urban risk management and resilience in the face of hydrological risks in Semarang City.

## **B. Multidisciplinary perspectives to understand resilience as a key factor in the adaptation and management of urban risk**

Our research relates to urban risk management, domain that can be approached through many disciplines. Recently, the concept of resilience has become a key issue in urban risk management. This concept analyses how urban life can incorporate the urban risk. Some researchers sought to explain the concept of resilience through different perspectives and studies, including geography, physical engineering, architecture, ecological science, biological science, and psychology.

The term of resilience has been a focus of research and projects since the 2000s, but it has been discussed since the 1970s. André Dauphiné and Damienne Provitolo (2007), geographers who are experts in disaster management, state that the term of resilience comes from Latin *resilio*, meaning “to rebound”.<sup>49</sup> Meanwhile, Cutter et al. (2008), researchers in the domain of hazards & vulnerability (risk), state that C.S. Holling (1973) first used the term of resilience in ecological science.<sup>50</sup> C.S. Holling, Professor in Ecological Sciences, argued that resilience determines the persistence of relationships within a system. It measures the ability of these systems to absorb changes of state variables, driving variables, and parameters, and to still persist.<sup>51</sup> Recently, Mark Pelling (2003), Professor of Geography and expert in field of risk assessment, argues that resilience is the capacity to adjust to threats and to mitigate or avoid harm, and also it can be found in hazard-resistant buildings or adaptive social systems.<sup>52</sup> Meanwhile, Thomas J. Campanella and Lawrence J. Vale (2005), Professors of Urbanism, assert that urban resilience implies the physical capacity to bounce back from a significant obstacle, much like a rubber ball dropped on the pavement, but cities are not rubber balls, nor are disaster like an asphalt plane, from which a rebound can be definitively predicted by a set of mathematical equations.<sup>53</sup> In addition, Lisa Benton-Short and John Rennie Short, experts (professors) in the domain of urban environment assessment, argue in their book *Cities and Nature* that resilient cities express the power of hope and opportunity in the face of disaster. According to them, most of human inventions, cities also express the

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<sup>49</sup> Dauphiné, A., Provitolo, D., *ibid.*

<sup>50</sup> Cutter, S.L., Barnes, L., Berry, M., Burton, C., Evans, E., Tate, E., Webb, J., 2008, “A Place-Based Model for Understanding Community Resilience to Natural Disasters”, *Global Environmental Change*, vol. 18, Issue 4, pp. 598–606.

<sup>51</sup> Holling, C.S., 1973, “Resilience and Stability of Ecological Systems”, *Annual Review of Ecology and Systematics* 4, pp. 1-23.

<sup>52</sup> Pelling, M., 2003, *The Vulnerability of Cities: Natural Disaster and Social Resilience*, London: Earthscan Publications Ltd.

<sup>53</sup> Campanella, T.J., and Vale, L.J., 2005, *The Resilient City: How Modern Cities Recover from Disaster*, Oxford: Oxford University Press.

most human emotions, hope in the face of adversity. They also stated that resilient cities have both experienced environmental disasters and transcended them.<sup>54</sup>

At the intersection of these different perspectives, resilience becomes the capacity of a system to absorb and to adapt to disturbance (negative situation) during the risk occurrences and to recover in the post-risk occurrences, so that the system can anticipate and prevent future occurrences.

Furthermore, resilience in an urban context interweaves two dimensions: the capacity of an urban physical system and the capacity of a human system to absorb and to adapt to risk. David R. Godschalk (2003), Professor Emeritus in the domain of city and regional planning and also researcher at the Coastal Hazards Center of the United States, argues that the resilient city is a sustainable network of physical systems and human communities.<sup>55</sup> He asserts that physical systems are the constructed and natural environmental components of the city including built roads, buildings, infrastructure, communications, and energy facilities, as well as waterways, soils, topography, geology, and other natural systems. In addition, Chris Zevenbergen and Assela Pathirana, researchers (professors) at the Water Engineering Department of UNESCO-IHE, state that resilience in cities depends both on its physical form and characteristics as well as on the people capacity and social behaviour.<sup>56</sup>

In our research, these dimensions are taken into account to analyse the urban resilience process. Urban physical system (land use and infrastructures, and its management), and human system (communities) constitutes a unity of spatial dimensions, so that urban resilience is explored through both systems' capacities. These dimensions can be analysed as entities affecting each other. The optimum condition of urban resilience is when both systems function properly. Our case indicates that the lack of urban physical system capacities is such that the human system becomes the main focus in the assessment of resilience process in cities.

So far, urban resilience has been assessed only through one dimension, either urban physical system or human system. Most of the researchers in the field of urban engineering examine urban resilience through the lens of its infrastructures' capacities. Bruno Barroca and Damien Serre (2014) argue that resilience for technical systems is based on the identification of four complementary types of resilience: cognitive, functional, correlative, and organizational.<sup>57</sup> They argue that cognitive resilience refers to the culture that enables the development of

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<sup>54</sup> Benton, L., Short, J.R., 2008, *Cities and Nature*, London: Routledge.

<sup>55</sup> Godschalk, D.R., 2003, "Urban Hazard Mitigation: Creating Resilient Cities", *Journal of Natural Hazards Review*, vol. 4, Issue 3, pp. 136–143.

<sup>56</sup> Zevenbergen, C., Pathirana, A., 2013, "Managing Urban Flooding in the Face of Continuous Change" in: Serre, D., Barroca, B., Laganier, R., *Resilience and Urban Risk Management*, London: Taylor & Francis Group.

<sup>57</sup> Barroca, B., Serre, D., 2014, "Behind The Barriers: A Conceptual Model", *SAPIENS*, Vol. 6, n° 1, pp.1-10.

technical systems, likewise functional and correlative resilience designate the capacities (demand and supply) of technical systems, while organizational resilience focuses on the management of technical systems. Likewise, H el ene Beraud (2013) analyses the resilience of the waste infrastructures related to flood risk in her dissertation “*Initier la r esilience du service de gestion des d echets aux catastrophes naturelles, le cas des territoires urbains et de l’inondation*”.<sup>58</sup> In addition, Marie Toubin (2014) explains that urban resilience is linked to how infrastructures’ capacities and institutional management cope with the flood risk.<sup>59</sup>

Conversely, urban resilience has been sometimes assessed through the capacities of human system to cope with risk only. The adaptive capacities of communities constitute the essential focus of study. Prasad et al. (2009), researchers in Climate Change Practice at the World Bank Institute, state that a resilient society can withstand shocks and rebuild itself when it is necessary. They assert also that resilience in social systems has the added human capacity to anticipate and plan for the future, and also humans depend on resilience for survival.<sup>60</sup> Meanwhile, Peter Walters (2015), researcher in the field of urban sociology, argues that community resilience is a concept that has emerged in the social sciences from ecological literature as a way of assessing and measuring the ability of communities to respond and adapt following a disaster.<sup>61</sup>

Loy Rego and Arghya Sinha Roy (2009), researchers at the Asian Disaster Preparedness Center, state that the resilience of a community in respect to potential hazard events is determined by the degree to which the community has the necessary resources and is capable of organizing itself both prior to and during times of need.<sup>62</sup> Researchers of the Community and Regional Resilience Institute assume community resilience is the capability to anticipate risk, to limit impact, and to bounce back rapidly through survival, adaptability, evolution, and growth in the face of turbulent change.<sup>63</sup> Furthermore, according to Peter Eachus, researcher in psychology argues that the resilience of these individuals comes from

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<sup>58</sup> Beraud, H., 2013, *Initier la r esilience du service de gestion des d echets aux catastrophes naturelles, le cas des territoires urbains et de l’inondation*, Ph.D Dissertation in urban engineering, Universit e Paris-Est.

<sup>59</sup> Toubin, M., 2014, *Am eliorer la r esilience urbaine par un diagnostic collaboratif, l’exemple des services urbains parisiens face   l’inondation*, Th ese de doctorat en g eographie, Universit e Paris Diderot (Paris 7).

<sup>60</sup> Prasad, N., Raghieri, F., Trohanis, F.S.Z, Kessler, E., Sinha, R., 2009, *Climate Resilient Cities, A Primer on Reducing Vulnerabilities to Disasters*, Washington, DC: The International Bank for Reconstruction and Development (World Bank).

<sup>61</sup> Walters, P., 2015, “The Problem of Community Resilience in Two Flooded Cities: Dhaka 1998 and Brisbane 2011”, *Habitat International*, vol. 50, pp. 51-56.

<sup>62</sup> Rego, L., Roy, A.S., 2009, *Regional Training Manual on Disaster Risk Reduction for Coastal Zone Managers*, Bangkok: Asian Disaster Preparedness Center (ADPC).

<sup>63</sup> *Definitions of Community Resilience: an Analysis*, 2013, Washington, DC: Community and Regional Resilience Institute, retrieved December 25<sup>th</sup> 2015, from <http://www.resilientus.org/wp-content/uploads/2013/08/definitions-of-community-resilience.pdf>.

interacting with their environment through relevant institutions, for example local government or community groups, thus building community resilience.<sup>64</sup> These statements indicate how community resilience is linked to the capacities of human system and its institutions to cope with the urban risk.

Our research focuses on community resilience. However, we will analyse the development of community resilience in an urban context. Not only do we look at community resilience at the local scale, but we also seek to reveal how communities and their social aspects influence the process of urban resilience. So far, previous research on community resilience hardly took into account the context of urban resilience process as a scale to examine forms and effects of community resilience.

### **Communities' role in urban risk management and resilience development**

It is important to explore the relationships between environmental hazards, risks, and disasters in society more in depth, and whereby perspectives on environmental hazards and human development meet policy and practice.<sup>65</sup> Risk assessments should address the difficulties in implementing action plans and factor in community assets that can contribute to resilience under local conditions.<sup>66</sup> In our case, urban institutions have not yet solved the hydrological risk through their management policies, practices, and projects. This situation influences our perspective on hydrological risk management and resilience building at the community scale.

Furthermore, the extent to which action (flood risk management) is needed, however, depends on the objectives set by the responsible authorities.<sup>67</sup> This situation commonly occurs in flood risk management where urban institutions have the capacity to manage properly urban system and infrastructures, for instance in cities of developed countries. In Indonesia, local authorities experience such constraints when providing proper urban infrastructures that communities independently manage flood risk. So far, community social aspects are hardly taken into account in resilience analysis, particularly culture and risk

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<sup>64</sup> Eachus, P., 2014, "Community Resilience: Is it greater than the sum of the parts of individual resilience?", *Procedia Economics and Finance*, vol. 18, pp. 345-351.

<sup>65</sup> Collins, A. E., Manyena, B., Jayawickrama, J., Jones, S., 2014, "Introduction: Hazards, Risks, and Disasters in Society", in: Collins, A. E., Jones, S., Manyena, B., Jayawickrama, J., Shroder, J.F., *Hazards, Risks and Disasters in Society*, Oxford: Elsevier.

<sup>66</sup> Cavallo, A., Ireland, V., 2014, "Preparing for complex interdependent risks: A System of Systems Approach to Building Disaster Resilience", *International Journal of Disaster Risk Reduction*, vol. 9, pp. 181-193.

<sup>67</sup> *A Floods Working Group Floods (CIS) Resource Document Flood Risk Management, Economics and Decision Making Support*, 2012, Amsterdam: ARCADIS, retrieved December 25<sup>th</sup> 2015, from [http://ec.europa.eu/environment/water/flood\\_risk/pdf/WGF\\_Resource\\_doc.pdf](http://ec.europa.eu/environment/water/flood_risk/pdf/WGF_Resource_doc.pdf).

management. Communities are often considered only as passive receivers in the risk management. In our research, communities are not only the victims of risk existence. They take an active role in their protection from risk impact. They are also the subjects or stakeholders of the resilience process.

Mike Alexander (2013), expert in the domain of environmental management, states that a stakeholder is any individual, group or community living within the influence of the site or likely to be affected by a management decision or action, and any individual, group or community likely to influence the management of the site.<sup>68</sup> We consider communities as urban stakeholders in our study and assess their role to develop the resilience process at the local and urban scales.

The objective of this research is to understand the forms and influences of resilience at the local scale (communities and their neighbourhoods) and also the interactions between the resilience process in the local context and in the urban context. Dynamics of land development and resource uses and their ecological impacts depend on the spatial patterns of human activities and their interactions with biophysical processes at various scales.<sup>69</sup> The city as a unity of space is used to describe these interactions. In our analysis, urban hydrological risk management is also linked to the relations between communities and urban institutions when they develop urban resilience in the face of hydrological risk through spatial transformations, urban hydrological projects and local practices. They seek to create the infrastructures for the management of their environment and to establish adaptive capacities to flood risk.

The analysis of urban flood resilience produces knowledge on interactions between urban stakeholders (institutions and communities) and their responsiveness to urban flood risk. Their adaptive capacities become a key factor in the development of urban resilience. The reduction of vulnerability and enhancement of adaptive capacity: the policy and decision-making communities on the one hand and the broader public on the other.<sup>70</sup>

To fulfil our objectives, we develop a hypothesis about the ineffectiveness of urban hydrological risk management (plans and projects) and urban planning affects communities so much that they find solutions based on their own perceptions and initiatives to protect their

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<sup>68</sup> Alexander, M., 2013, *Management Planning for Nature Conservation - A Theoretical Basis and practical Guide*, Dordrecht: Springer Netherlands/ Springer Science & Business Media B. V.

<sup>69</sup> Alberti, M., 2008, *Advances in Urban Ecology Integrating Humans and Ecological Processes in Urban Ecosystems*, New York: Springer US.

<sup>70</sup> Vogel, C., Moser, S.C., Kasperson, R.E., Dabelko, G.D., 2007, "Linking Vulnerability, Adaptation, and Resilience Science to Practice: Pathways, Players and Partnerships", *Global Environmental Change*, vol. 17, Issues 3-4, pp. 349-364.



territories through local practices and spatial transformations as the adaptive forms for the hydrological risk. On the one hand, these conditions accelerate the territorial resilience process, but on the other it causes territorial (urban) inequalities. These situations indicate that hydrological risk resilience is missing at the urban scale but that it occurs at the local scale. However, urban flood resilience and flood risk reduction require the combination between community adaptive practices and an adequate system provided by urban institutions.

If urban hydrological risk management (plans and projects) and urban planning is ineffective, hydrological risk still threatens the city, although several urban (hydrological) projects have been carried out by urban institutions. Furthermore, the rapid growth of Semarang coastal area is aggravating hydrological risk and shows how ineffective urban planning is. Coastal communities have sought to reduce the hydrological risk impact in their territories for a long time ago. They implement local practices based on their knowledge of hydrological risk. They develop temporary and routine efforts to adapt. They principally try to prevent the inundation risk. They have limited ideas and plans to reduce hydrological risk. Nevertheless, they always carry out local practices to limit impact before (mitigation), during and after the occurrences (recovery). However, these conditions do not describe resistance process, but resilience. The resistance is the ability of a system to persist if disturbed without showing any reaction.<sup>71</sup>

Nevertheless, we assume that community practices to reduce flood risk can have negative consequences such as spatial inequality. This concept is discussed in terms of difference of accessibility to public goods among various population groups, and it exists in areas where population density is high compared to service availability.<sup>72</sup> Three main factors could have a bearing on the level of territorial cohesion or segregation in developing countries include the leading role of public/ local authorities combined with private companies strategies to promote social and territorial cohesion, the access inequalities can be due to insufficient funding, and the water access problem is partly due to uncontrolled urbanization and the strong development of outlying districts.<sup>73</sup>

In our context, we consider that territorial inequalities take place due to differentiated access to urban infrastructures and community management implementations of urban

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<sup>71</sup> Ashley, R., Garvin, S., Pasche, E., Vassilopoulos, A., Zevenbergen, C., 2007, *Advances in Urban Flood Management*, London: Taylor & Francis Group.

<sup>72</sup> Lee, G., Hong, I., 2013, "Measuring Spatial Accessibility in the Context of Spatial Disparity between Demand and Supply of Urban Park Service", *Landscape and Urban Planning*, vol. 119, pp. 85-90.

<sup>73</sup> Pflieger, G., Matthieussent, S., 2008, "Water and Power in Santiago de Chile: Socio-Spatial Segregation through Network Integration", *Geoforum*, vol. 39, n° 6, pp. 1907-1921.

hydrological risk. Appropriate urban drainage systems and risk management projects do not yet cover the entire city, particularly the coastal area. As a result, communities seek to anticipate these weaknesses through self-help efforts and depend on community economic capacities. Urban development practices such as land reclamation motorized by the private sectors aggravate the urban vulnerability to flood and territorial inequalities.

These situations weaken the adaptation and learning processes of urban stakeholders. Insufficient community involvement in hydrological risk management increases urban vulnerability to flood and hampers the resilience process.

### **Multidisciplinary perspectives on the Semarang hydrological risk**

Chronic hydrological risk has characterized Semarang for several centuries. Recently, the *rob* risk has always threatened coastal communities' life. Several researchers (physical geography, geology...) link the hydrological risk in Semarang City to geomorphological hazard such as land subsidence.<sup>74</sup> These studies analyse the causes of land subsidence, groundwater decrease and exploitation, intrusion of sea water, coastal line evolution and erosion process in Semarang. They state that land subsidence is the main problem causing flood risk, especially *rob* phenomena. Furthermore, several researchers in geodetics and marine science map past and future hydrological risk in Semarang City. They seek to facilitate the provision of flood mapping.<sup>75</sup> So far, the municipality has not yet provided detailed flood mapping. Flood maps are established by the municipality on a macro scale (1: 100.000) and need to be more specific. However, the flood maps provided by several (geodetics) researchers can help our research to describe the existing flood hazard in Semarang City.

Other researchers in human geography sciences focus on the assessment of urban flood vulnerability, especially to *rob* phenomena at the community scale. According to

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<sup>74</sup> Marsudi, 2001, *Prediksi Laju Amblesan Tanah di Dataran Aluvial Semarang Propinsi Jawa Tengah*, Ph.D dissertation in Hydrogeology-Mining Engineering, Bandung Institute of Technology; Abidin, H.Z., Andreas, H., Gumilar, I., Sidiq, T.P., Fukuda, Y., 2012 (2013), "Land Subsidence in Coastal City of Semarang (Indonesia): Characteristics, Impacts and Causes", *Geomatics, Natural Hazards and Risk*, vol. 4, Issue 3, pp. 226-240; Lubis, A.M., Sato, T., Tomiyama, N., Isezaki, N., Yamanokuchi, T., 2011, "Ground Subsidence in Semarang-Indonesia Investigated by ALOS-PALSAR Satellite SAR Interferometry", *Journal of Asian Earth Sciences*, vol. 40, Issue 5, pp. 1079-1088; Marfai, M. A., King, L., 2007, "Monitoring Land Subsidence in Semarang, Indonesia", *Environmental Geology*, vol. 53, pp. 651-659; Kuehn, F., Albiol, D., Cooksley, G., Duro, J., Granda, J., Haas, S., Hoffmann-Rothe, A., Murdohardono, D., 2010, "Detection of Land Subsidence in Semarang, Indonesia, Using Stable Points Network (SPN) Technique", *Environmental Earth Sciences*, vol. 60, Issue 5, pp. 909-921.

<sup>75</sup> Nugraha, A.L., 2013, *Penyusunan dan Penyajian Peta Online Risiko Banjir rob Kota Semarang*, Master thesis in Geomatics Engineering, Gadjahmada University; Wirasatria, A., Hartoko, A., Suripin, 2006, "Study of Sea Level Rise as a Base for *Rob* Problem Solving in Coastal Region of Semarang City", *Jurnal Pasir Laut*, vol. 1, n° 2, pp. 31-42.

Marfai, King, Sartohadi, Sudrajat, Budiani, and Yulianto (2008), the tidal flooding (*rob*) gives impact to community daily activities. Working and domestic activities cannot be done normally, and roads in the neighbourhood are blocked by inundation, and also public services to support domestic activities, such as water supply and electricity cannot be utilized during the rise of sea water.<sup>76</sup>

Moreover, several researchers focus on how economic perspectives are affected by flood risk, especially economic losses due to the hydrological risk existence. Rahmatullah (2010) states that the *rob* affects the fluidity of goods or humans transportation, and it may even reach a billion rupiah per day because so many businesses are disturbed.<sup>77</sup> Furthermore, Ali (2010) indicates that economic losses due to building destruction were about 16 Billion IDR (1 Million €) in the sub-district of Bandarharjo (Semarang Utara District).<sup>78</sup> The Semarang coast is quite vulnerable to sea level rise. The consequences of such a disaster can include physical building aspects, socioeconomic community aspects, social demography aspects, environmental aspects and regional economic.<sup>79</sup>

These researches can give preliminary information on the flood vulnerability of Semarang coastal area over the last years.

In our research, we will look at the history of flood risk in Semarang from the Dutch colonial era until today. How did hydrological risk emerge in Semarang City? How does it evolve? How have urban stakeholders coped with risk in the course of time? The comparison between different efforts to reduce flood risk at different periods will provide a comprehensive understanding of urban flood risk management and urban adaptive capacities and illustrate how the urban resilience process takes place.

Furthermore, several researchers focus on the assessment of community adaptive capacities. According to Marfai and Hizbaron (2011), the physical adaptation methods relied upon some technique, such as: put the house property on the higher place, increase the yard level in surrounding house, increase the floor level and making small dam to block the water from

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<sup>76</sup> Marfai, M.A., King, L., Sartohadi, J., Sudrajat, Budiani, S.R., Yulianto, F., 2008, "The Impact of Tidal Flooding on a Coastal Community in Semarang, Indonesia", *Environmentalist*, vol. 28, pp. 237-248.

<sup>77</sup> Rahmatullah, A.R., 2010, "Impact of *Rob* to Semarang Economy", *Proceeding of 1<sup>st</sup> International Conference on Regional Development*, Semarang.

<sup>78</sup> Ali, M., 2010, "*Kerugian bangunan perumahan akibat rob dan arah kebijakan penanganannya di Kelurahan Bandarharjo Kota Semarang*", Master thesis of urban and regional development, Diponegoro University.

<sup>79</sup> Miladan, Nur., 2009, "*Kajian kerentanan wilayah pesisir Kota Semarang terhadap perubahan iklim (Vulnerability assessment of Semarang City Coast toward Climate Change)*", Master thesis in Urban and Regional Development, Diponegoro University.

entering the house.<sup>80</sup> Meanwhile, Kobayashi (2004) states that in the remaining houses, inhabitants pay efforts to carry sand onto the ground floor by their expenditure, while some capable families demolish the damaged houses, reclaim the land and re-construct higher houses on the enhanced house-lot.<sup>81</sup> In addition, Harwitasari (2009) argues that the ability to adapt and cope with the future risk of tidal flood is assessed by economic resources, information and skills, infrastructures, technology and access to resources.<sup>82</sup> Likewise, some studies focus on the institutional adaptive capacities for the reduction of hydrological risk in Semarang City. Yunita (2010) assesses the adaptive capacity of the Banger Polder Pilot Project (BPPP) through the Adaptive Capacity Wheel.<sup>83</sup> She states that the adaptive capacities are insufficient in the BPPP being caused by there is no variety in problem frames and solutions; the learning is only one-direction (central/expert to community); the room for autonomous change is limited because of less information access, law enforcement, and high dependency; the central acts as entrepreneurial and collaborative leader, the advocacy leader is missing; the local contribution in financing and human resources is low; and also the fair governance is forced by donor institutions.<sup>84</sup>

These perspectives will be deepened in this research. We argue that there are different adaptive capacities among urban stakeholders. We will explore the adaptive capacities of each urban stakeholder and assess the relations between these different ways to adapt.

On the one hand, community adaptive capacities should be analysed through sociological approaches. Community efforts (structural and non-structural measures) are based on sociocultural aspects. The culture powerfully influences the residential behaviours of the different ethnic groups that make up these urban centres and it plays an important role in urban residential structure.<sup>85</sup> To thoroughly describe community adaptive capacities, we will not only look at the

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<sup>80</sup> Marfai, M.A, Hizbaron, D.R., 2011, "Community Adaptive Capacity Due to Coastal Flooding in Semarang Coastal city, Indonesia", *Analele Universităţii din Oradea – Seria Geografie*, Year XXI, n° 2, pp. 209-221.

<sup>81</sup> Kobayashi, H., 2004, "Impact Evaluation of Sea Level Rise on Indonesia Coastal Cities: Micro Approach through Field Survey and Macro Approach through Satellite Image Analysis", *Journal of Global Environment Engineering*, vol. 10, pp.77-91.

<sup>82</sup> Harwitasari, D., 2009, "Adaptation responses to tidal flooding in Semarang, Indonesia, Master thesis in urban management and development, HIS-Erasmus University Rotterdam.

<sup>83</sup> Gupta *et al.* stated there are six dimensions to assess the adaptive capacity of institution, such as variety, learning capacity, room for autonomous change, leadership, availability of resources and fair governance. Cf. Gupta, J., Termeer, C., Klostermann, J., Meijerink, S., Brink, M.V.D., Jong, P., Nooteboom, S., Bergsma, E., 2010, "The Adaptive Capacity Wheel: a Method to Assess the Inherent Characteristics of Institutions to Enable the Adaptive Capacity of Society", *Environmental Science & Policy*, vol. 13, Issue 6, pp. 459-471.

<sup>84</sup> Yunita, F.T., 2010, *A Developing Country Perspective on the Adaptive Capacity: Flood defence Institutions for Climate Change Adaptation in Indonesia*, Master thesis, Groningen University-Bandung Institute of Technology.

<sup>85</sup> Segun, O., 2012, "Behavioral Outcomes of Culture and Socio-Economic Status on Urban Residential Morphology. A Case Study of Lagos", *Procedia - Social and Behavioral Sciences*, vol. 50, pp. 294-306.

diverse forms of local practices to reduce hydrological risk, but also explain their rational backgrounds.

On the other hand, we will assess the entire urban hydrological risk management in Semarang City. So far, its institutions have not yet been explored in previous studies. Urban hydrological risk management can be examined through its urban hydrological projects, but this analysis should also entail the assessment of urban hydrological plans. Furthermore, this research will trace the historical evolution of urban hydrological risk management. We will study the urban hydrological risk management at different periods: during the Dutch colonial era, under the first Indonesian government, and in the last decade. We consider that institutional adaptive capacities should be described chronologically in order to better understand the flood resilience process.

There has been no research focusing on urban flood resilience in Semarang City. The concept of urban resilience in Semarang City began to be discussed by the municipality in 2009 and 2010 when the project of ACCCRN was first designed. This initiative aims to develop climate change risk resilience in Semarang City.<sup>86</sup> In the ACCCRN project, climate change impacts include flood and *rob*, coastal erosion, land slide and drought in Semarang City.<sup>87</sup> Furthermore, this project indicates that urban resilience to climate change means not only that the systems on which city residents depend must survive shocks and stresses, but that the people and social organizations who make day-to-day decisions are also capable of accommodating these stresses, and that the city's institutional structures serve to support, rather than undermine, the ability of people and organizations to achieve their objectives.<sup>88</sup>

We will analyse the ACCCRN project as the roles of external stakeholders. How do they support urban resilience in Semarang City? Do they favour practical approaches like the strengthening of urban institutional, the development of adaptive community skills (transfer of knowledge), and financial assistance to community adaptive actions? However, we will focus on urban flood resilience in Semarang City only, in particular its coastal area. We expect this research to be a complementary assessment (conceptual perspective) to the

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<sup>86</sup> In Indonesia, climate change issues started to be discussed in the mid-2000s. It was marked by the Presidential Regulation no 46/2008 about climate change. At that time, the national government focused on the green house effect or global warming. However, climate change issues have been discussed at the international level since the late 1980s. It was marked by the emergence of the Inter-Governmental Panel on Climate Change. Recently, climate change has been linked to natural risks including drought, fire, landslide, flood, sea level rise, and high temperatures.

<sup>87</sup> Brown, A.L., 2011, "Building climate change resilience in Semarang" [Presentation], in: *Asian Cities Climate Change Resilience Network (ACCCRN)*, 2<sup>nd</sup> World Congress on Cities and Adaptation, Bonn.

<sup>88</sup> *ACCCRN City Projects*, 2013, Bangkok: Asian Cities Climate Change Network (ACCCRN), The Rockefeller Foundation, Asia Office.

Semarang Climate Change Resilience Project, especially on issues of flood risk. Furthermore, this research will not only assess institutions, but also spatial transformations in order to give a comprehensive account of urban flood resilience.

### C. Methodology: Multidisciplinary Approach

This multidisciplinary approach is supported by the combination of qualitative and quantitative methods. It is time now, we believe, to review the various approaches offered by different disciplines and to start discussing in what way they can be regarded as complementary or can even be integrated in order to better understand complex urban systems.<sup>89</sup> This multidisciplinary analysis seeks to explain the resilience process in the context of urban studies including rational efforts to manage the city through the multi perspectives including geography, history, architecture, sociology and economy.<sup>90</sup> Furthermore, this research focuses on the city and disaster in uncertain situations, so it should be explored by empirical research. However, this research requires also a conceptual analysis of resilience as the basis of hypotheses that will be explored in the empirical situations.

The multidisciplinary approach is reflected in the three analytical steps of this research. The first analysis focuses on the evolution of urban risk. Understanding the risk existence is crucial to explore the resilience process. In this research context, this analysis will explain how flood risk emerged and has evolved in Semarang City, especially in its coastal area.

The risk existence is associated to hazard and vulnerability. In the first step of the analysis, we will analyse the flood hazard evolution and its impacts (vulnerabilities) on urban space (human activities, and environment). This analysis will be supported by the historical method. It is used to create the story, to scientifically determine the historical facts, and then those facts are incorporated into a scientific system.<sup>91</sup> The existence of flood risk has existed in Semarang City for several centuries, so historical methods are necessary to analyse the evolution of flood risk in the Semarang coastal area. So far, studies have only assessed flood

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<sup>89</sup> Gurr, J.M., Walloth, C., 2014, "Introduction: Towards a Transdisciplinary Understanding of Complex Urban Systems", in: Walloth, C., Gurr, J.M., Schmidt, J.A., *Understanding Complex Urban Systems: Multidisciplinary Approaches to Modelling*, Cham: Springer.

<sup>90</sup> Pierre Merlin argues that urbanism (urban studies) is a field of action, inherently multidisciplinary, which aims to create in time the orderly arrangement of space by searching the harmony, welfare, and economy. Cf. Merlin, P., 2009, *L'urbanisme*, Paris: Presses Universitaires de France; Meanwhile, Jacques Dreyfus states that urbanism is the willingness of rationality applied to space (cities). It arose from the chaos of industrial capitalist societies, and it aims to ensure human happiness through action. Cf. Dreyfus, J., 1976, *La ville disciplinaire*, Paris: Galilée.

<sup>91</sup> Seignobos, C., 1909, *La méthode historique appliquée aux sciences sociales*, Paris: Félix Alcan.

risk in Semarang City in the last decade. This research will not only focus on the current times, but also on the past periods. The flood risk existence in Semarang City should be explored chronologically in order to provide a comprehensive understanding of flood risks and of the resilience process.

The description of flood risk in Semarang City will be divided into four periods including the pre-Dutch colonial era (from the 15<sup>th</sup> century to the 16<sup>th</sup> century), the Dutch colonial era (from the 17<sup>th</sup> century to mid-19<sup>th</sup> century), the post-independence era (from the 1950s to the 1970s), the industrialization era (1980s), until today. These important periods account for the evolution of flood risk in Semarang City linked to urban geomorphology, urbanization, and the aggravation of hydrological risk.

Furthermore, the analysis of the flood risk evolution is based on a geographical approach. Geography as science has two dimensions: on the one hand, spatial distributions, and on the other, spatial organizations.<sup>92</sup> Geography is a science having objects about the space of society, the spatial dimension of social context.<sup>93</sup> These definitions lead us to use a spatial (geographical) approach to understand the emergence and evolution of hydrological risk in the urban space through the assessments of geomorphology and hydrology.

The second step of analysis will focus on hydrological risk management implemented by urban institutions. This analysis is related to the comprehension of urban system (infrastructures) capacities for the hydrological risk reduction and adaptation, and its management (institutional system). We will look at the strengths and weaknesses of urban infrastructures including floodgate infrastructures and the basic need infrastructures. The floodgate infrastructures include systems of urban drainage, reservoir and catchment area, and polder system. Meanwhile, basic infrastructures (waste, water supply, and sanitation) are associated to the consequences and causes of flood risk. These analyses will resort to descriptive methods supported by the quantitative and qualitative data. Descriptive researchers use most data-gathering techniques: surveys, field research, content analysis, and historical-comparative research.<sup>94</sup> The descriptive method will illustrate the conditions of urban infrastructures influencing the hydrological risk existence in Semarang City in past and recent times (from the Dutch colonial era onwards). However, this analysis does not focus on urban engineering approach, but it will look at urban morphology (architectural and urban

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<sup>92</sup> Brunet, R., Ferras, R., Théry, H., *Les mots de la géographie, dictionnaire critique*, Paris : La Documentation Française.

<sup>93</sup> Lévy, J., Lussault, M., 2003, *Dictionnaire de la géographie et de l'espace des sociétés*, Paris: Editions Belin.

<sup>94</sup> Neuman, L.W., 2007, *Basics of Social Research, Qualitative and quantitative Approaches*, New York: Pearson Education.

approach). The analysis of the urban forms dynamic, its determination/ transformations, its evolution mode (type), is the main object (purpose) of the urban morphology study (understanding).<sup>95</sup> In our research, the understanding of urban spatial transformations relate to the urban site (geomorphology, hydrology), and the urban infrastructures for hydrological risk reduction. This understanding will help to explain the process of urban flood resilience. Furthermore, the urban system adaptation to hydrological risk is reflected in the transformations of land use, urban infrastructures, and architectural forms. They all constitute forms of urban hydrological risk management. This work will explore the correlations between these transformations and the evolution of urban flood risk from the Dutch colonial era onwards.

Meanwhile, the institutional system of urban flood risk management influencing the adaptive capacity of urban system will be studied through a qualitative comparative analysis. It is a promising method for providing evidence in situations where interventions interact with contexts, enabling causal pathways to be discerned from how sets of conditions combine with particular outcomes; and it provides a basis for the qualitative consideration of complex policy problems based on like-with-like comparisons between cases, improving the robustness of case-study research by using a systematic approach.<sup>96</sup> A comparative case-based approach is the most suitable way to study the relationship between context and outcomes in projects.<sup>97</sup> In this research, this method will explain the complexity of urban management and institutional efforts for flood risk reduction in Semarang City, for instance the urban hydrological projects, the management of urban drainage system, etc. This situation must be explained by a qualitative comparative analysis in order to understand the complexity of urban flood management in past and recent times (Dutch colonial era, under the first Indonesian government). These understandings will explain why the hydrological management carried out by urban institutions has not yet solved the flood risk in Semarang City. Moreover, this analysis will clarify the roles of various urban stakeholders in this management.

The third step of analysis will demonstrate the existence of resilience processes at the local scales (communities or neighbourhoods). Community adaptive capacities to flood risk will be analysed with a descriptive phenomenological method. The main emphasis of

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<sup>95</sup> Lévy, A., 2005, "Formes urbaines et significations : revisiter la morphologie urbaine", *Espaces et sociétés*, n° 122, pp. 25-48.

<sup>96</sup> Blackman, T., Wistow, J., Byrne, D., 2013, "Using Qualitative Comparative Analysis to understand complex policy problems", *Evaluation*, vol. 19, n° 2, pp. 126-140.

<sup>97</sup> Verweij, S., Gerrits, L.M., 2013, "Understanding and Researching Complexity with Qualitative Comparative Analysis: Evaluating Transportation Infrastructure Projects", *Evaluation*, vol. 19, n° 1, pp. 40-55.



phenomenological research is to describe or to interpret human experience as lived by the experiencer in a way that can be used as a source of qualitative evidence.<sup>98</sup> In this analysis, the phenomenological method belongs to the qualitative paradigm (Creswell, 2009).<sup>99</sup> In our research, the understanding of community efforts to adapt the hydrological risk existence will be reflected in the interpretation of community behaviours and experiences of living in areas impacted by hydrological risk. Community perceptions of the flood risk will also be explored. It is useful to assess community culture and behaviours towards hydrological risk. The emotional components of risk perception, unlike cognitive ones, have a direct relation with the actions, behaviours and activities of people living in high environmental risk areas.<sup>100</sup> Cultures and behaviours influence individual and collective capacities and transform social spaces in the communities. Architectural objects and urban planning are assessed in their entirety: conception, production, and reception by society and its actors –habitants, users, and men of the art.<sup>101</sup> The conception, production, and reception of community self-help efforts (structural measures and non-structural measures/initiatives) for the hydrological risk reduction are the important aspects of this study. Structural efforts are linked to architectural and territorial structure transformations in the settlements including forms of houses and local infrastructures. Meanwhile, community initiatives will illustrate their knowledge of adaptive capacities for the hydrological risk existence.

Each analysis will enhance the understanding of the hydrological risk resilience process in Semarang City. The knowledge of the urban resilience process consists in a synthesis of all the analyses. These analyses will complement each other and their results will be described comparatively. The analysis of territorial resilience becomes the part of the understanding how the resilience process occurs at the urban scale. It will be analysed holistically from the territorial scale to the urban scale and vice versa. Territories result from the interactions between physical spaces and construction on the one hand, and social systems, economics, policies, and cultures on the other.<sup>102</sup> The comprehension of community resilience process is a way to look at the urban social system.

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<sup>98</sup> Mayoh, J., Onwuegbuzie, A.J., 2015, "Toward a Conceptualization of Mixed Methods Phenomenological Research", *Journal of Mixed Methods Research*, vol. 9, n° 1, pp. 91-107.

<sup>99</sup> Creswell, J.W., 2009, *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*, Thousand Oaks: SAGE Publications.

<sup>100</sup> Miceli, R., Sotgiu, I., Settanni, M., 2008, "Disaster Preparedness and Perception of Flood Risk: a Study in an Alpine Valley in Italy", *Journal of Environmental Psychology*, vol. 28, Issue 2, pp. 164-173.

<sup>101</sup> Lancret, N., Tiry-Ono, C. (eds.), 2015, "Introduction", *Architectures et villes de l'Asie contemporaine héritages et projets*, Bruxelles : Mardaga.

<sup>102</sup> Solinis, G., 2007, "Introduction", *Revue internationale des sciences sociales (Approches de la gouvernance urbaine)*, n° 193-194, p. 369-372.

### **Multiple data sources and its exploration**

The case studies how urban stakeholders interact with hydrological risk. According to Hardwick (2009), a case study can be approached by the triangulation method. Triangulation of multiple methods such as structured and unstructured interviews, participant observation, field observation, textual analysis, survey questionnaires, and spatial analysis are discussed and encouraged within the context of a few selected perspectives used by researchers.<sup>103</sup> It is most often used as a form of cross-checking to validate the results from different kinds of methods, such as interviewing and survey research, or the results from different observers of the same phenomenon.<sup>104</sup>

Our analyses need several data resources that will be triangulated. The analysis of the evolution of hydrological risk will be supported by many documents including manuscripts, memorial books, reports and magazines from the Dutch colonial era, as well as reports, records, and statistical documents of city in recent times. Furthermore, scientific articles and reports, and relevant articles in local newspapers will be collected also. Other sources will include institutional surveys from related government institutions. In addition, this analysis will be supported also by interviews with several urban stakeholders including government, researchers who focus on urban risk in Semarang, related NGOs, and communities. Photographs, maps, and videos are visual complementary data used to explore the flood risk in Semarang City in past and recent times. Maps provided by Geographic Information System (GIS) and aerial photos from open data sources like Google Earth will enrich this study. Furthermore, field observations have been carried out also to deepen the understanding of hydrological risks.

Meanwhile, the lack of data and information on flood risk, especially during the era of the first Indonesian government (from the 1940s to the 1970s), will be filled with interviews with related urban institutions. There is little information on hydrological risk in Semarang City from the 1980s. Nevertheless, the municipality began to establish documents in the mid-1990s. These data were provided also by the provincial and national governments.

To support the analysis of the urban system and its institutions, sources similar to previous analysis will be used. However, urban infrastructures and hydrological projects for the flood risk reduction will be the main focus. Data resources can be taken from reports on

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<sup>103</sup> Hardwick, S.W., 2009, "Case Study Approach", in: Kitchin, R., Thrift, N. (eds.), *International Encyclopedia of Human Geography*, Oxford: Elsevier.

<sup>104</sup> Nightingale, A., 2009, "Triangulation", *International Encyclopedia of Human Geography*, vol. 11, pp. 489-492.

urban infrastructures and hydrological projects: master plan of drainage system, detailed engineering design (DED) of urban hydrological projects, management policies and regulations, statistics on hydrological risk occurrences, documents on spatial planning, and related articles. These sources will be classified either as planning documents or project documents. Field observations of urban hydrological projects supported by photographs and records are also used to strengthen this analysis.

The complexity of the institutional system that manages hydrological risk will be highlighted in related institutional documents and interviews with urban stakeholders including government, NGOs, and academic partners. The interviews take place in several urban institutions that manage hydrological risk: Regional Development Planning Agency (*Badan Perencanaan Pembangunan Daerah*), Department of Urban Planning and Settlement (*Dinas Tata Kota dan Perumahan*), Department of Water Resources Management, and Energy and Mineral Resources Management (*Dinas Pengelolaan Sumberdaya Air dan Energi and Sumber Daya Mineral*), District offices (*kantor kecamatan*), Sub-district offices (*kantor kelurahan*) and Regional Disaster Management Agency (*Badan Penanggulangan Bencana Daerah*). Interviews with several NGOs such as Mercy Corps, BINTARI give also insights into the institutional management of hydrological risk in Semarang City. Interviews with NGOs mainly address the effectiveness of urban hydrological projects, urban drainage management, and community self-help efforts. Furthermore, interviews with industrial actors and private sectors illustrate the different forms of urban hydrological risk management privileged by diverse stakeholders. These interviews will be explored holistically and in depth. Snowball sampling is carried out during the interview. The idea of snowball sampling is that respondents are gradually accumulated by personal reference.<sup>105</sup>

The third step of analysis, the communities' adaptive capacities will be analysed by the questioners and interviews with communities. Communities tell different stories about how they adapt to hydrological risk and how they seek to reduce it. Their perceptions of their self-help community efforts and government and external stakeholders' efforts are explored in the primary surveys. Snowball sampling is also implemented in this survey. Interviews with key persons such as heads of communities, including cohesive group of households (*rukun tetangga/RT*), group of RT's (*rukun warga/RW*), and local associations, help

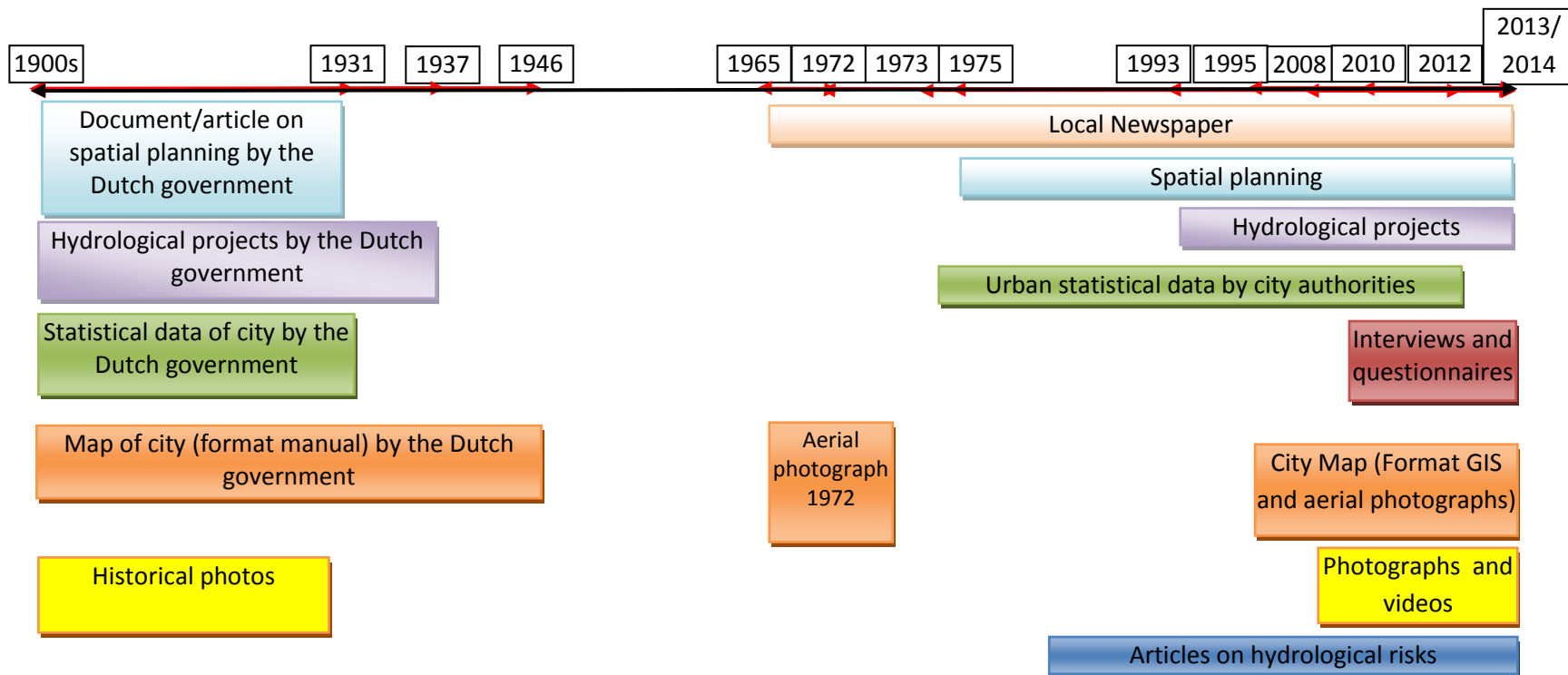
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<sup>105</sup> Olivier, P., 2010, *Understanding the Research Process*, London: SAGE Publications.

understand the situations of communities.<sup>106</sup> Usually, they are more aware of the issues in their territories. Interviews and open-ended questionnaires are proposed to them and to local inhabitants. They can suggest other key respondents who are competent to become informants. These data constitute the main sources for the interpretation of the adaptive community capacities. Furthermore, field observation is carried out to understand the actual situations of communities. These observations will be triangulated with information provided by community interviews and questionnaires. They will highlight the impact of hydrological risk in these territories and the adaptive forms of local infrastructures and houses. The lack of photographs and maps, especially for the past times, will be filled with questionnaires and interviews with heads of communities who know the growth and situation of their territories in detail. For instance, communities rarely have photographs of their houses from the past. So interviews with house owners can help describe the transformations that have occurred. Communities also tell stories about local infrastructures and land use changes due to flood risk in their territories. In addition, information from local newspapers and related articles on communities and their territories in the face of hydrological risk existence can complete data resources.

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<sup>106</sup> See Annex of the administrative division. A sub-district (*kelurahan*) is divided into several *Rukun Warga* (RWs), and each RW includes several *Rukun Tetangga* (RTs). Each RT consists of several households.



**DATA AVAILABILITY ON SEMARANG CITY**

**1678-1942 (Dutch government)** : some data available

**1942-1945 (Japanese occupation)**: lack of data during the war

**1945 – 1966 (Old Order government)**: lack of data due to war and transition

**1966-1998 (New Order government)**: data began to be collected, nevertheless lack of data occurred especially between 1966 and 1990

**1998-now (Reformation government era)**: the improvement of data availability

**Figure 10. Data sources**

Source: Miladan, 2013

**Table 1. Research Methodology**

<b>Analysis</b>	<b>Scope</b>	<b>Methods</b>	<b>Tools</b>	<b>Sources (data triangulation)</b>
Flood risk existence and evolution - Flood hazard - Urban flood vulnerabilities	Urban level (coastal area)	Historical method	<ul style="list-style-type: none"> <li>• Descriptive</li> <li>• Geographic Information System (GIS)</li> </ul>	<ul style="list-style-type: none"> <li>• Written sources:                             <ul style="list-style-type: none"> <li>- Manuscript document, memorial books, reports and magazines of city in Dutch government era</li> <li>- Reports and records of city, and urban statistical documents in recent situation.</li> <li>- Scientific articles on flood risk (article, thesis, journal, etc.)</li> <li>- local newspapers</li> </ul> </li> <li>• Interviews with urban stakeholders (government, researchers, academic partners, NGOs)</li> <li>• Photographs, maps and videos (records)</li> </ul>
Urban system adaptive capacities - Urban systems - Urban hydrological risk management and its institutional system	Urban level (coastal area)	<ul style="list-style-type: none"> <li>• Descriptive method</li> <li>• Cartographic method</li> </ul>	<ul style="list-style-type: none"> <li>• Quantitative</li> <li>• Qualitative comparative</li> </ul>	<ul style="list-style-type: none"> <li>• Spatial planning</li> <li>• Hydrological and flood risk reduction projects : master plan of drainage system, detailed engineering design (DED) of hydrological projects, statistical monographies of hydrological risk occurrences</li> <li>• Scientific articles on urban infrastructures.</li> <li>• Photographs, maps and videos (records)</li> <li>• Interviews of the urban stakeholders (government, NGOs, industrial (private) sectors)</li> </ul>
Community adaptive capacities - Hydrological risk existence in local territories: hazard and vulnerabilities - Cognitive perceptions and behaviours of communities - Community actions: structural (architectural and territorial forms transformations, local practices) and non-structural - Influence of urban hydrological projects and external stakeholders' efforts and community involvement	Local territories/ neighbourhoods (case studies)	Phenomenological method	<ul style="list-style-type: none"> <li>• Quantitative</li> <li>• Qualitative</li> </ul>	<ul style="list-style-type: none"> <li>• Questionnaires and interviews with communities</li> <li>• Photographs, maps, and videos (records)</li> <li>• Scientific articles, thesis, journals, etc. on communities, territories, and hydrological risk</li> <li>• local newspapers</li> </ul>

Source: Miladan, 2014

## D. Research sites

This research includes two scales of site analysis. The first scale is the coastal area of Semarang City and will feature in the general analysis on the urban flood risk management. The second scale is the coastal settlements in Semarang City and will feature in the case studies that assess the resilience process at the local scale.

### The coastal area of Semarang City

The 2008 document on coastal spatial planning in Semarang City indicates that there are six coastal districts in Semarang City: Tugu, Semarang Barat, Semarang Utara, Genuk, Semarang Timur and Gayamsari.<sup>107</sup> This research does not adopt directly the coastal delineation operated by the municipality. The division is firstly assessed by the literature on coastal boundary definition. The boundary between land and ocean is generally not a clearly defined line on a map. It occurs in a gradual transitional region. According to Ketchum<sup>108</sup>, the key element of coastal definition is the interaction between oceanic and terrestrial processes and uses: coastal areas contain land which interacts with the ocean in some way and ocean space which interacts with the land.<sup>109</sup> In this research, the phenomena of flood risk on the Semarang coastal, in particular the *rob* risk, is an important element to define the site of analysis. This risk is a flood caused by sea phenomenon. So it is reasonable to define the Semarang coastal area as site of analysis. The *rob*-impacted area in Semarang City consists of seven districts with an area of 3.915,16 Ha.

**Table 2. *Rob*-impacted area in Semarang City in 2012**

No	District	Width of district (Ha)	<i>Rob</i> -impacted area (Ha)
1	Gayamsari	618	164,85
2	Genuk	2739	568,70
3	Semarang Barat	2.174	530,93
4	Semarang Tengah	614	35,48
5	Semarang Timur	770	326,19
6	Semarang Utara	1.097	1.055,83
7	Tugu	3.178	1.233,17
<b>Total</b>		<b>11.190</b>	<b>3.915,16</b>

Source: Nugraha, 2013, Central Bureau of Statistics of Semarang City, 2011<sup>110</sup>

<sup>107</sup> *Rencana Tata Ruang Pesisir Kota Semarang (Coastal spatial planning of Semarang City)*, 2008, Semarang: Department of Marine and Fisheries of Semarang City.

<sup>108</sup> Dr. Bostwick H. Ketchum, Senior Scientist Emeritus, was associated with the Woods Hole Oceanographic Institution for more than four decades. Cf. Woods Hole Oceanographic Institution, "Ketchum (Bostwick H.) papers", retrieved December 25<sup>th</sup> 2015, from <http://archives.mblwhoilibrary.org/repositories/2/resources/18>.

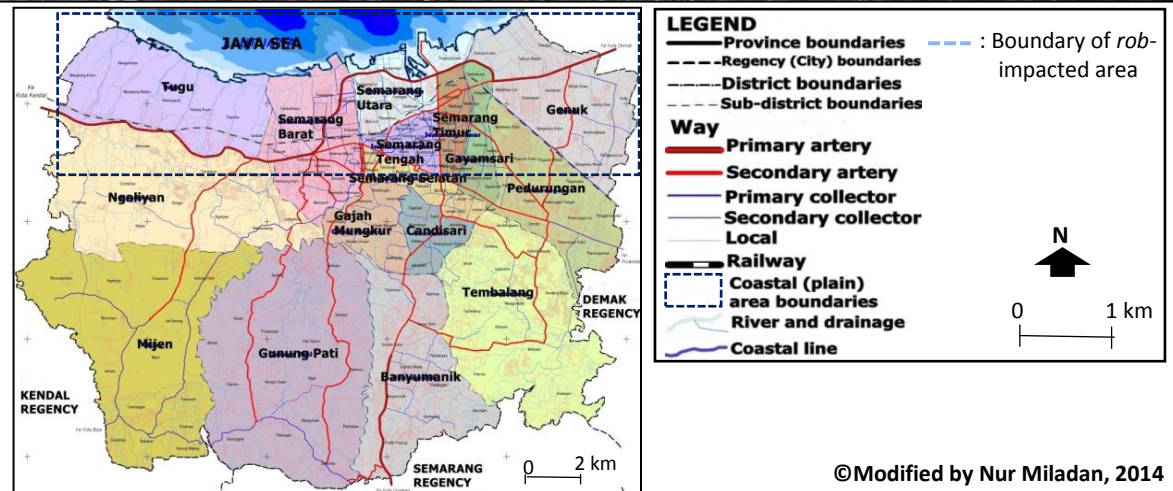
<sup>109</sup> Kay, R., Alder, J., 1999, *Coastal Planning and Management*, Routledge: London and New York. Ketchum definition is the coastal area definition by Ketchum in the article "The water's edge: critical problems of the coastal zone".

<sup>110</sup> Nugraha, *ibid.*; *Semarang in Figures 2011*, 2011, Semarang: Central Bureau of Statistics of Semarang City.





The high density of built-up area on the Semarang coast is located in the north and the east. These areas are dominated by settlements and urban facilities areas including commercial, business and industrial zones. Meanwhile, the western part is dominated by fishpond areas and open spaces. Nevertheless, several settlements and industrial zones are growing in the west southern part of the Semarang coastal area. Although rob risk occurs along the Semarang coast, the northern part and the eastern part are highly vulnerable due to the high density of built-up area. Furthermore, the rob-impacted area is about 12 percent of the total surface of Semarang City. It is also vulnerable to (flash) flood caused by the overflow of urban drainages from the upland areas during the rainy season.



©Modified by Nur Miladan, 2014

**Figure 11. Semarang Coastal (plain) Area**

Source: *Spatial planning of Semarang City for 2011-2031*, 2011, Semarang: Regional Development Planning Agency; Ikonos satellite image of Semarang in 2008; "Peta Ancaman (Hazard Map)"[Photo], *Peta online Risiko Banjir Rob Kota Semarang* [Web], retrieved December 28<sup>th</sup>, 2015, from <http://geodesi.undip.ac.id/gis/index.php#>



Several researchers in environmental science state that sea water intrusion has spread to the districts of Semarang Tengah and Gayamsari.<sup>111</sup> Furthermore, the Semarang coastal area has an altitude between 0 and 0.75 meter and the coastal line is 36.63 km long.<sup>112</sup> In addition, the topography of the Semarang coastal area is between 0 and 2 percent. These specificities show how Semarang City coastal morphology is vulnerable to inundation risk. Yet, urban centres including commercial, industrial and settlement zones are also situated in this area, thus making Semarang coastal area highly vulnerable to hydrological risk.

### **Coastal settlements as areas of case studies**

The site of coastal settlements is used to explore the resilience process in face of hydrological risk at the local scale. The resilience process is not only assessed through urban physic (infrastructures) dimensions, but also through social dimensions. It is about illustrating community and urban stakeholders' efforts to adapt to flood risk in local territories. These initiatives shape the territorial resilience and influence surrounding areas, even at the urban scale. The diversity of resilience processes is reflected in the multiple-case studies. A multiple or collective case study will allow the researcher to analyse within each setting and across settings.<sup>113</sup> The multiple-case will explore the similarities and differences between the cases in order to provide general perspectives on flood resilience processes in Semarang City. Each case must be carefully selected so that it either (a) predicts similar results (a literal replication) or (b) produces contrasting results but for predictable reasons (a theoretical replication).<sup>114</sup> Furthermore, a conceptual framework is needed to define the cases as representative. The sample selection is conceptually driven, either by the theoretical framework which underpins the research question from the outset, or by an evolving theory which is derived inductively from the data as the research proceeds.<sup>115</sup>

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<sup>111</sup> Suhartono, E., Purwanto, Suripin, 2013, "Kondisi intrusi air laut terhadap air tanah pada akuifer di Kota Semarang", *Prosiding Seminar Nasional Pengelolaan Sumberdaya Alam dan Lingkungan*, Semarang.

<sup>112</sup> *Rencana Tata Ruang Pesisir Kota Semarang (Coastal spatial planning of Semarang City)*, 2008, Semarang: Department of Marine and Fisheries of Semarang City; *Draft laporan akhir pemetaan potensi, kerusakan, dan model rehabilitasi kawasan pesisir Kota Semarang (Final report draft of the mapping of potencies, destructions, and rehabilitation model of Semarang City Coast)*, 2010, Semarang: Department of Marine and Fisheries of Semarang City.

<sup>113</sup> Baxter, P., Jack, S., 2008, "Qualitative Case Study Methodology: Study Design and Implementation for Novice Researchers", *The Qualitative Report*, vol. 13, n° 4, pp. 544-559.

<sup>114</sup> Yin, R.K., 2003, *Case Study Research: Design and Methods*, Thousand Oaks, CA: Sage.

<sup>115</sup> Curtis, S., Gesler, W., Smith, Glenn & Washburn, S., 2000, "Approaches to Sampling and Case Selection in Qualitative Research: Examples in the Geography of Health", *Social Science & Medicine*, vol. 50, Issues 7-8, pp. 1001-1014.

**Table 3. Conceptual framework for the case selection**

Step	Criteria (Parameters)				Justification	Supporting data & information	Selected case areas
	Geographic (environment)	Land use and territorial forms	Social and economic	Interventions of government			
I	High density of built-up area on the Semarang coast				It is linked to high vulnerabilities to hydrological risk	Pattern of built-up area in the city	Northern and eastern parts of the city
	Frequent occurrences of flood ( <i>rob</i> ) risk				Frequent occurrences linked to high vulnerabilities to hydrological risk	Delineation of flood risk, particular <i>rob</i> phenomena	Northern and eastern parts of the city threatened by flood ( <i>rob</i> ) risk
II		Domination of land use, architectural building forms and infrastructures patterns			Diversity of territorial forms influencing the different adaptive capacities	Field observation	Different coastal settlements including residential area and <i>kampung</i> in flood-impacted area ( <i>rob</i> )
III			Economic capacities and daily activities of communities		These criteria are predicted to be factors influencing community adaptive capacities	Statistical data of community economic capacities (poverty, livelihood resources), field observation	<ol style="list-style-type: none"> <li>1. <u>Tanah Mas Real estate</u> is a residential area where most of the inhabitants are middle and upper middle class (adequate community economic capacities). There is a local association that manages flood risk and the Jatibarang project-component C.</li> <li>2. <u>kampung Cilosari</u> and <u>kampung Tambak Lorok</u> represent the majority of coastal settlements where most of the inhabitants are poor. There is the Banger Polder Project around both <i>kampung</i></li> </ol>
			Local association for flood risk management		Local association can reduce the community vulnerabilities to hydrological risk	Field observation, Interviews	
				Existence of urban hydrological projects		Influences of urban hydrological projects, interactions between government and communities to reduce risk and development of territorial resilience	

Source: Miladan, 2014

The framework above describes the three steps characterizing the process of case selection. The first step concerns geographic (environment) criteria including the concentration of existing built-up area and the existence of hydrological risk. These steps account for the high vulnerability of these zones to hydrological risk. It links high density of built-up area to population density in the existing hydrological risk impacted area. The northern and eastern parts of the coastal area are the most vulnerable areas to hydrological risk because of the high density of built-up areas. The second step deals with the criteria of land use and territorial forms. The preliminary field observations in 2010 and 2011 and the master thesis project in 2009<sup>116</sup> indicate that settlements are the major form of land use in the northern and eastern parts of coastal area. Generally, settlement forms in Semarang coastal area, including architectural building forms and patterns of local infrastructures and open spaces, and also Indonesian cities, are divided in two types: *perumahan* (residential area) and *kampung*. A residential area is a settlement type that is commonly equipped with proper local infrastructures. It is built by private actors (housing developers) based on the master plan, so it tends to have regular architectural building forms. Conversely, *kampung* forms the majority of settlements in the Semarang coastal area. *Kampung*, as local expression designating a type of indigenous settlement in Southeast Asia, has many meanings. According to several researchers, it can be an informal settlement<sup>117,118,119,120</sup>, but also an urban village<sup>121,122</sup>.

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<sup>116</sup> Miladan, *ibid*.

<sup>117</sup> Bakti Setiawan defines *kampung* as physical phenomena that refers to various forms of urban settlements (ranging from new squatters to old established settlements), with various levels of physical quality (from very poor settlements to better quality settlements), located in various parts of an urban environment (from the center to the periphery), occupied by various socio-economic groups of people (although mostly by the poor) and always changing dynamically. Meanwhile *kampung* as urban communities, as sociopolitical units, mean that *kampung* are seen as organized group of people bound within a particular setting, in which people carry out initiatives and act collectively. Cf. Setiawan, B., 1998, *Local dynamics in informal settlement development: a case study of Yogyakarta, Indonesia*, PhD Dissertation in Community and Regional Planning, University of British Columbia.

<sup>118</sup> *Kampungs* have been recognized as traditional housing settlements in South East Asia for many centuries and the inhabitants are primarily from the lower income groups. Cf. Santosa, H.R., 2008, "Linking Open Building and Sustainable Livelihoods in the Kampung – Informal Settlement", *Proceedings of the Joint Conference of CIB W104 and W110*, Indiana.

<sup>119</sup> Raharjo, W., 2010, *Speculative Settlements: Built Form/Tenure Ambiguity in Kampung Development*, PhD Disertation in Architecture, Building and Planning, The University of Melbourne.

<sup>120</sup> Zhu, J., 2010, *Symmetric Development of Informal Settlements and Gated Communities: Capacity of the State. The Case of Jakarta, Indonesia (ARI Working Paper Series No. 135)*, Singapore: Asia Research Institute.

<sup>121</sup> Charles Goldblum states that urban villages reflect urban settlements with morphological or social references in rural universe. It imposes connections with village housing and it is signed by remanence effects. Cf. Goldblum, C., 1987, *Métropoles de l'Asie du sud-est, stratégies urbaines et politiques du logement*, Paris : L'Harmattan.

<sup>122</sup> *Kampung* is the traditional, spontaneous, fine-grain, and diverse form of indigenous urban settlement in Indonesia. It has grown locally, organically and incrementally over many years without planning guidance or regulations, building codes or centralized and coordinated provision of services. Cf. Sihombing, A., 2007, "Living in the Kampung: A Firsthand Account of Experiences in Jakarta's Kampung", *FORUM International Journal of Postgraduate Studies Architecture, Planning and Landscape University of Newcastle*, vol. 7, no 1, pp. 15-22; Sihombing, A., 2014, "Drawing *Kampung* through Cognitive Maps Case Study: Jakarta", *APCBEE Procedia*, vol. 9, pp. 347-353.

The definition of informal settlement is linked to the physical conditions of settlement: irregular and poor forms of buildings (houses and local infrastructures) and open spaces. Most of these forms are developed independently by community self-help (without intervention of housing developers). Community economic capacities are quite limited and also in certain cases, houses are built illegally. Furthermore, the majority of the inhabitants are poor or have limited livelihood resources. They work in informal urban sectors. Meanwhile, the definition of urban village is linked to a specific historical context of settlement and to community behaviour characteristics. Historically, *kampung* describes a settlement created by indigenous communities, and/or a traditional settlement where the municipality did not create a master plan of development during the Dutch colonial era. Community behaviour characteristics are linked to the influence of rural behaviours and values of *gotong royong* and fraternity in community activities. These *kampung* characteristics are featured in the settlements used for analysis.<sup>123</sup>

The third step of case selection concerns parameters of community socioeconomic capacities and the existence of urban hydrological projects. These parameters are simultaneously combined. Different community economic capacities already characterize the coastal settlement classification, especially the distinction between residential area and *kampung*. Meanwhile, social capacity (social capital) is linked to the existence of local associations focusing on hydrological risk management in local territories. Furthermore, the existence of urban hydrological projects can clarify their influences on settlements and the interactions between communities and urban stakeholders in these projects. Different conditions for these parameters might have significantly different consequences on the territorial resilience process.

In this research, at least two cases exemplify these situations. Diverse case method requires the selection of a set of cases—at minimum, two—which are intended to represent the full range of values characterizing *X*, *Y*, or some particular *X/Y* relationship.<sup>124</sup> This conceptual framework leads us to choose Tanah Mas Real Estate as the first case representing a residential area, and *kampung* Cilosari and *kampung* Tambak Lorok as the second case representing *kampung*. These territories are highly vulnerable to hydrological risk. These two cases represent different coastal settlement types, different community socioeconomic

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<sup>123</sup> In our research, we do not specifically define *kampung* as urban village or informal settlement. However, we used the socio-economic characteristics of its communities to describe our case study. Furthermore, *kampung* of our case describe the combination of territorial and architectural forms: traditional and contemporary types. The urbanization and modernization influences the evolution of physical forms of *kampung*.

<sup>124</sup> Seawright, J. & Gerring, J., 2008, “Case Selection Techniques in Case Study Research: A Menu of Qualitative and Quantitative Options”, *Political Research Quarterly*, vol. 61, n° 2, pp. 294-308.

capacities, and different urban hydrological projects. The *kampung* case is particular: two settlements are explored because they represent the majority of coastal settlements and the diversity of socioeconomic capacities among them. The community life in *kampung* Tambak Lorok is dominated by fishing activities (fishermen's settlement), while life in *kampung* Cilosari is dominated by the activities of industrial labour and informal urban sectors. Both settlements will complement the assessment of *kampung*.



**Figure 12. Different Housing Conditions in *Kampung* and Residential Area in Semarang City**

Source: Primary Data, 2011-2013.

*Different housing conditions characterize the kampung and the residential area in Semarang City. Commonly, buildings (houses and facilities) and local infrastructures in residential area, including local streets and drainages have better conditions than those of the kampung. Most of the housing forms in residential area are more regular than in kampung. These situations are linked to the different community economic capacities.*





**Figure 13. Sites of Case Studies**

Source: *Spatial Planning of Semarang City for 2011-2031*, 2011, Semarang: Regional Development Planning Agency; Ikonos Satellite Image of Semarang in 2008.



### **Residential area case: The Tanah Mas Real Estate**

The Tanah Mas Real Estate is the first residential area in Semarang City built during the first Indonesian government era. It has been constructed by the private sector (housing developers) in the coastal area in the 1970s. Before the existence of *rob* risk in this settlement, it was the most prestigious residential area in Semarang City. Recently, it has been often threatened by the *rob* risk through the Asin River and the Semarang River. Furthermore, it is vulnerable to (flash) flood occurrences due to the overflow of West Floodway during the rainy seasons and this risk has occurred several times in this settlement. It is situated approximately 500 m from the coastal line in the Semarang Utara District. Consequently, it experiences frequent occurrences of hydrological risk in particular *rob* risk.

This settlement was built according to the master plan. It has a structure of grid pattern. The building mass is adjusted to the street patterns, while the built-up coverage is about 70 %. Furthermore, it has open (green) spaces that are patterned scatter. It is also divided into several house types with land areas between 100 m<sup>2</sup> (small type) and 420 m<sup>2</sup> (large type). As a residential area, it has appropriate local infrastructures connected to the urban infrastructures (system).

Furthermore, the community of this settlement has a particular local association devoted to the management and reduction of hydrological risk in their local territory. This association is recognized by government institutions. Their members are often invited by urban institutions to participate in urban hydrological programs. In addition, it is the first settlement in the Semarang coastal area that implemented the pump system through community self-help efforts. Most of the inhabitants are middle and upper middle classes, thus allowing them to finance community projects of hydrological risk management.

This settlement is located around the urban hydrological project named the Packet of Jatibarang Dam, notably the Component C concerning the improvement of the Semarang River, the Asin River and the Baru River.<sup>125</sup> Therefore, this case can help assess the cooperation between urban institutions and community, the impact of urban projects on the management of hydrological risk.

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<sup>125</sup> The Packet of Jatibarang Dam Project includes three components, Component A (improvement of West Floodway and Garang River), Component B (development of Jatibarang Dam), Component C.

### **The *kampung* case: Cilosari and Tambak Lorok**

The community adaptive capacities to flood in the *kampung* are very different from the Tanah Mas residential area. The selection of Cilosari and Tambak Lorok is based on the fact that both *kampung* represent the majority of coastal settlements with high vulnerabilities to hydrological risk. These settlements are often threatened by *rob* occurrences through two urban drainages, the East Floodway and the Banger River. Furthermore, these *kampung* are also threatened by (flash) flood risk due to the overflow of both urban drainages during the rainy season. The *kampung* Tambak Lorok in particular is the most vulnerable to *rob* risk due to its location directly on sea.

Statistics on poverty in Semarang City from 2011 indicate that more than 40% of poor communities are settled in coastal districts: Semarang Barat, Semarang Utara, Semarang Timur, Genuk, Gayamsari and Tugu.<sup>126</sup> The majority of inhabitants in the settlements are lower middle class.<sup>127</sup> This situation is linked to the increase of community vulnerability in both *kampung*.

These two cases describe different characteristics of coastal *kampung* in Semarang City. Cilosari represents a *kampung* shaped by the growth of urban sectors since the 1980s. Conversely, Tambak Lorok represents the biggest traditional fishermen's *kampung* in Semarang City. Different behaviours and cultures distinguish both communities. The fishermen community is accustomed to sea phenomena, so different perspectives and self-help efforts might influence the resilience processes in the Tambak Lorok and Cilosari communities.

Furthermore, urban institutions are developing a hydrological project called the Banger Polder Project around both settlements. This project aims to solve the hydrological risk, especially *rob* risk in the area of both settlements. In addition, communities often receive financial aid and assistance from urban institutions and external stakeholders including NGOs, academic partners to improve the quality of life in their settlements. The analysis of this project will highlight the impact of these stakeholders' efforts on the development of community resilience in the face of hydrological risk.

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<sup>126</sup> *Kampung* Cilosari is located in the Semarang Timur District, while *kampung* Tambak Lorok is situated in the Semarang Utara District. Cf. Regional Development Planning Agency, "Rekapitulasi warga miskin Kota Semarang Tahun 2011 (Recapitulation of poor inhabitants in Semarang city in 2011)", *Sistem informasi manajemen warga miskin (SIMGAKIN)* [Web], retrieved December 28<sup>th</sup>, 2015, from [http://www.simgakin.semarangkota.go.id/2015/website/web/rekap\\_gakin/91](http://www.simgakin.semarangkota.go.id/2015/website/web/rekap_gakin/91).

<sup>127</sup> Monthly income can be the regional minimum wage or less. In Semarang City, it is 1.685.000 IDR ( $\approx$  105.31 €) in 2015, and it was 1.423.500 IDR ( $\approx$  88.96 €) in 2014. Usually, the regional minimum wage increases every year.

Territorial patterns in both *kampung* differ from the Tanah Mas Real Estate. They patterns are built by community self-help efforts, so they tend to be linear and organic. The linear patterns appear in the main streets of both settlements, while the organic patterns feature in the secondary (small) streets. The built-up coverage of both settlements is approximately 90 percent (high density), thus limiting the surface of open green spaces. Moreover, the conditions of houses vary a lot. For instance, some houses are made of wood walls and earthen floor, and other of brick wall and ceramic floor. Furthermore, there is no standard of house size in both settlements. Infrastructures including clean water supply, streets and drainages, waste and sanitary facilities are damaged. There is no local association managed by community self-help efforts and focused on hydrological risk management in both *kampung*. For all these reasons, these settlements have become highly vulnerable to hydrological risks. However, communities still seek to limit the impact of hydrological risk because of their limited limitations of economic capacities. The exploration of both *kampung* will show the wealth of their knowledge.

Varied territorial conditions, different community socioeconomic capacities, and the diversity of urban and external stakeholders' interventions in the management of the hydrological risk will account for the diversity of community resilience processes in the Semarang coastal area. These factors might influence community adaptive capacities. Furthermore, these cases describe adaptive capacities, both individually (households) and collectively. How can they live with hydrological risk over a long period? How do their initiatives cope with this risk in their territories? In addition, community perceptions of risk, urban hydrological plans and projects, and NGOs interventions in the management of risk in their territories will be examined through these cases. Moreover, the analyses will explain how the effects of urban and external stakeholders projects develop community resilience and how communities get involved in these projects.

## **E. Thesis plan**

The organization of this thesis relies on two questions: why do urban hydrological management become ineffective when this is the only one response? And consequently, how does resilience develop at the local scale? To answer these questions, the thesis is divided into two parts and a general conclusion. The first part focuses on the analysis of hydrological risk and its urban management. This part will be supported by two chapters. Chapter 1

explains the emergence of hydrological risk alongside urban development in Semarang City. This chapter will show how hydrological risk has existed for a long time and how the municipality has sought to anticipate this urban problem. Furthermore, Chapter 2 explores recent urban flood risk management practices and constraints that make this management inefficient.

The second part concerns the analysis of the resilience process at the local scale. Inefficient urban management for hydrological risk reduction leads to interrogate how communities live in spite of hydrological risk, how they adapt to this risk and what are the potencies and constraints of resilience at the local scale. This part will be supported by two chapters including Chapter 3 about the role of community association to develop the local resilience, while Chapter 4 deals with how the sociocultural system, urban and external stakeholders influence the local resilience process. Chapter 3 and Chapter 4 will both reveal how coastal communities of Semarang City seek to reduce the hydrological risk impact on their territories through their adaptive capacities.

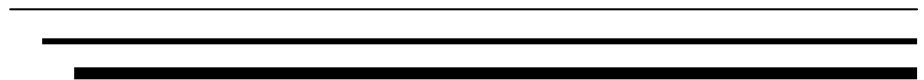
Lastly, reflections from these two parts will be synthesized in the general conclusion to reveal how the processes of territorial (neighbourhood) and urban resilience for hydrological risk take place in Semarang City. Furthermore, it will articulate two different scales of resilience processes to give a comprehensive understanding of the resilience process in the face of hydrological risk in Semarang City.

# **PART I**

## **HYDROLOGICAL RISKS: URBAN**

### **DEVELOPMENT COMPLEXITY AND RISK**

#### **MANAGEMENT DIVERSITY**



The objective of this part is to explain, according to a chronological viewpoint, the relation between the city and its hydrological risk, and also the flood risk management. The existences of flood hazard and urban vulnerabilities, and also the management risk diversity will be understood as the combination of urban elements in order to develop the urban flood resilience.

It includes two chapters; the first chapter will focus on understanding the relation between the urban development and the flood risk emergence relating to the urban resilience process. In our analysis, it will be associated with the urban space transformations as the adaptation forms toward the flood risk existence and the assessments of the flood hazard affecting the threats of urban life. To explain this situation, it will describe from the urban fabrication to the flood risk becoming the important element in the urban growth cycle. This chapter is based on an historical analysis to clarify the urban transformation and the urban hydrological risks evolution.

The second chapter will validate the diversities of the flood risk management including the urban flood vulnerabilities in recent times and the management for the flood adaptation and reduction through the municipality efforts being supported by the interventions of the national government and the external stakeholders such as international institutions and NGOs. Furthermore, the private sector's involvement must also be taken into account in so far as it is also one of the urban stakeholders influencing the urban flood management. On the one hand, this chapter will indicate the lack of urban metabolism process<sup>111</sup> causing the existence of hydrological risks. In the other hand, it explains the government approaches and efforts to cope with the hydrological risks as the institutional system influencing the process of urban flood resilience. Furthermore, the comprehensive analysis will explain the potentialities and constraints that determine the urban flood resilience process through the learning and adaptations process.

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<sup>111</sup> Urban metabolism is a multi-disciplinary and integrated platform that examines material and energy flows in cities as complex systems as they are shaped by various social, economic and environmental forces. Cf. Holmes, T., Pincetl, S. 2012, *Urban Metabolism Literature Review*. Center for Sustainable Urban Systems, UCLA Institute of the Environment. It is loosely based on an analogy with the metabolism of organisms, although in other respects parallels can also be made between cities and ecosystems; cities are similar to organisms in that they consume resources from their surroundings and excrete wastes. Cf. Kennedy, C., Pinceti, S., Bunje, P., 2012, "The study of urban metabolism and its applications to urban planning and design", *Environmental Pollution*, vol. 159, Issues 8-9, pp. 1965-1973.



*“While the Netherlands only has to cope with floods once every few years, many cities in Indonesia are flooded on a daily basis, causing havoc for the population.”<sup>112</sup>*

## **Chapter 1: The emergence of hydrological risk alongside urban development**

Disaster risk signifies the possibility of adverse effects in the future; it derives from the interaction of social and environmental processes, from the combination of physical hazards and the vulnerabilities of exposed elements.<sup>113</sup> In the case of Semarang City, the coastal area has been the subject of several interactions between social and environmental processes. It has gone through spatial transformations that turned the sea territory into a river port and then into a city. This took about two centuries, from the 17<sup>th</sup> century to the 19<sup>th</sup> century. In conjunction with urban growth, the city has also experienced flood risk. This risk has become an essential component of urban growth by influencing the daily life of communities. This chapter will explain how the hydrological risk has become a crucial urban problem and will identify which problem-solving has been found alongside the urban development.

Semarang city has experienced a modernization process since the beginning 20<sup>th</sup> century. It has been characterized by the growth of urban infrastructures and the existence of urban plans that have included hydrological projects to solve the flood risk problem. The emergence of the canalization system indicates how the city has adapted to flood risk, besides the urban extension plans. The urban transformation has been influenced by the development of an urban drainage system as well as the space adaptation that has created urban flood resilience. The adaptation as resilience is a form that seeks to secure the continuation of desired system functions into the future in the face of changing context, through enabling alteration in institutions and organisational form.<sup>114</sup>

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<sup>112</sup> Zijlstra, S., 2011, “Indonesia it’s the Tone That Makes the Music”, *LOGO South programme*, “Water Politics”, VNG International, p. 27.

<sup>113</sup> Cardona, O.D., Van Aalst, M.K., Birkmann, J., Fordham, M., McGregor, G., Perez, R., Pulwarty, R.S., Schipper, E.L.F., Sinh, B.T., 2012, “Determinants of Risk: Exposure and Vulnerability”, in: Field, C.B., Barros, V., Stocker, T.F., Dahe, Q., Dokken, D.J., Ebi, K.L., Mastrandrea, M.D., Mach, K.J., Plattner, G.-K., Allen, S.K., Tignor, M., Midgley, P.M. (eds.), *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation*, Cambridge/New York: Cambridge University Press, pp. 65-108. This article is a special report of working groups I and II of the Intergovernmental Panel on Climate Change (IPCC).

<sup>114</sup> Pelling, M., 2011, *Adaptation to Climate Change from Resilience to Transformation*, London: Routledge.

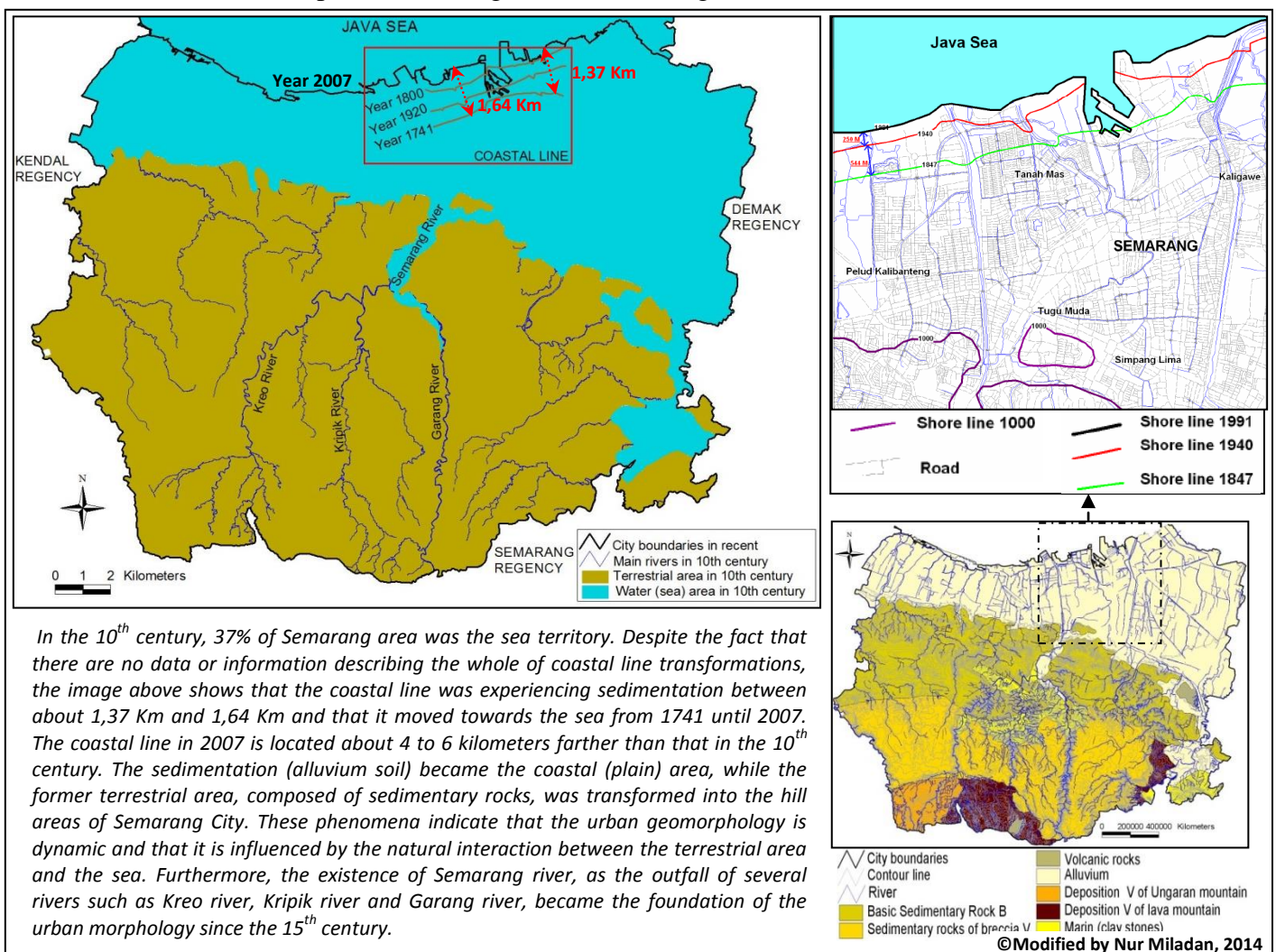
At the inception of the Indonesian government era, urban growth took place without proper urban plans. Flood risk remained an inevitable urban risk and kept threatening urban and community activities. The city started drafting urban plans in the 1970s, but some deviations from these urban plans actually took place. In the 1980s, the coastal area of Semarang City experienced a rapid development. It was characterized by the apparition of industrial zones and settlement areas. In conjunction with those phenomena, flood risk got worse and *rob* risk began to threaten the Semarang coast, thus becoming an unpredictable urban risk.

This chapter will follow a historical analysis approach. It will describe urban growth as well as the existence of flood risk chronologically in order to understand the interplay between the city and its water. This analysis will cover several periods, including the pre-Dutch government era (from the 15<sup>th</sup> century to the 16<sup>th</sup> century), the Dutch government era (from the 17<sup>th</sup> century to mid-19<sup>th</sup> century), the post-independence of the Republic of Indonesia era (from the 1950s to the 1970s), the industrialization era (1980s), until the present days. For each of these periods, this chapter will describe how urban growth and its plans were developed, the life of communities and flood risk. As far as the pre-Dutch government era is concerned, it will shed light on the coastal morphological characteristics that are a defining factor from which shed urban flood vulnerabilities. The Dutch government era is characterized by urban modernization and the emergence of flood risk prevention plans. During the post-independence of the Republic of Indonesia era, the city was growing without proper urban plans, in such a way that flood risk became an unsolved urban problem. Meanwhile, from the industrialization era until recently, the flood risk has worsened. This is due to the urban development process.

The findings of this chapter will be supported by urban historical data, such as records (memorial books), documents of urban plans and projects, city maps and satellite images, local newspapers and interviews with urban actors. These data will be triangulated and be described for each period of analysis. However, Semarang urban historic data provided by the government (municipality) are very limited, particularly data regarding the relationships between the city, its communities and its urban water management. The lack of testimonies of past inhabitants explains that historical photos and maps, and my own field observations are the primary sources supporting our historical analysis.

### 1.1. Semarang, a city whose urban history relates to the water

The geomorphological transformation of Semarang City is dynamic. The problems of hydrological risk in Semarang City relate to the transformations of its geomorphology. In Van Bemmelen's view, the coastal (plain) area of Semarang City was the sea.<sup>115</sup> He argued that the north coast of Java in the past was more advanced in the sea by a few kilometres than its current situation and that it was associated to the sedimentation phenomena (see Figure 14). During 144 years, from 1847 until 1991, the accretion of Semarang coastal area was about 884 meters to the sea.<sup>116</sup> It produced the significant Semarang coastline transformation.



**Figure 14. Terrestrial land transformation since the 10<sup>th</sup> century**

Source: Murdohardono, D., Hartanto, 2007, *Titik ketinggian (peil) stabil bedrock bench mark di area yang mengalami land subsidence di Kota Semarang* [PowerPoint], Semarang: Geology Agency, Ministry of Energy and Mineral resources; *Urban Development Management Information System (UDMIS)*, 2001, Semarang: Regional Development Planning Agency (BAPPEDA); Hartoko, A., Wirasatriya, A., Helmi, M., Rochaddi, B., Hariyadi, 2013, *Land Subsidence Spatial Model and Subsidence Vulnerability Index of Semarang Coastal City- Indonesia* [Presentation], Semarang: Marine Geomatic Center, Diponegoro University-BMKG.

<sup>115</sup> Van Bemmelen is a Dutch geologist whose interests were structural geology, economic geology and volcanology. He is known for his work on these subjects and the geology of Indonesia.

<sup>116</sup> *Ringkasan dan hasil lokakarya amblesan tanah Semarang (Executive Summary of Land Subsidence in Semarang)*, 2008, Bandung: German-Indonesian Technical Cooperation on Mitigation of Georisk (Bundesanstalt für Geowissenschaften und Rohstoffe (BGR) and Ministry of Energy and Mineral Resources).

The history of urban geomorphology shows that the Semarang coastal area is indeed vulnerable to inundations caused by the young alluvium soil characteristics.<sup>117</sup> Those (soils) are generally considered susceptible to liquefaction, and in some cases (when deposited in a loose state) they exhibit very low resistance to liquefaction.<sup>118</sup> This leads to natural land compression with limited capacities to support urban development. The foundation of urban morphology of Semarang began in the 15<sup>th</sup> century. Initially, the growth of urban morphology started around the Semarang River in the coastal area<sup>119</sup>. It was influenced by the emergence of the first port in Semarang. This port was located around the Semarang River and became a trade area between the indigenous inhabitants and traders from the surroundings of Java and other regions. It played an important role, as it was the first port in Semarang City before the apparition of Tanjung Mas Port in 1924<sup>120</sup> (see Figure 15).

Admiral Zheng He (Cheng Ho) arrived in Semarang River Port between 1406 and 1433 during his expedition undertaken in the course of trade relations between China and Afro-Asian countries (India, the Middle East and East Africa) in the Indian Ocean, and the increased circulation of foreign goods in the Chinese market<sup>121</sup> (see Figure 16). At that moment, many traditional sailboats came to this port. After the arrival of Chinese merchants, in the beginning of the 16<sup>th</sup> century, Portuguese and Dutch merchants started to arrive. Then Malay, Indian, Arab and Persian merchants came at the beginning of 17<sup>th</sup> century.<sup>122</sup> It became one of the most famous and important ports in Central Java besides Losari and Tegal.<sup>123</sup> The indigenous inhabitants traded agricultural products, especially rice from the inland regions of Central Java.

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<sup>117</sup> Alluvial soils are soils deposited by running water and are often located in existing floodplains. Cf. Iowa Department of natural resources, *Alluvial Soils and Floodplains*, Retrieved December 28<sup>th</sup>, 2015, from <http://www.iowadnr.gov/Environmental-Protection/Land-Quality/Animal-Feeding-Operations/Mapping/Alluvial-Soils-Floodplains>.

<sup>118</sup> Cubrinovski, M., McCahon, I., 2011, *Foundations on Deep Alluvial Soils*, Technical report prepared for the Canterbury Earthquakes Royal Commission, Christchurch: University of Canterbury.

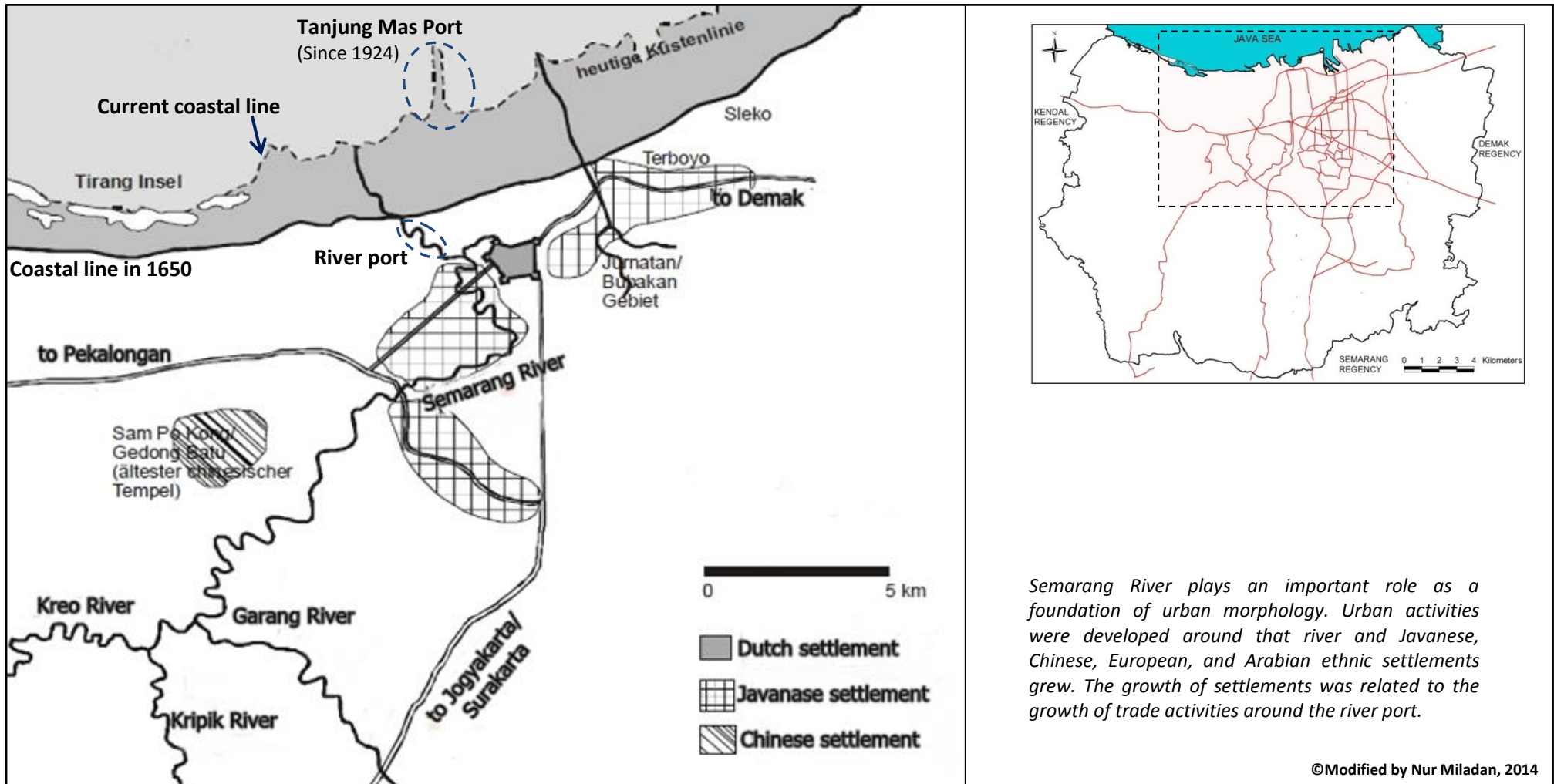
<sup>119</sup> The toponym of Semarang stems from “Asem” and “Arang”. Asem means vegetation of *Tamarindusindica*, while Arang means rare, so it means a territory which has several *Tamarindusindica* trees. That name was given by Kyai Ageng Pandanaran. He was given a mission by the Sultanate of Demak (the Muslim Kingdom between 1475 and 1518 in Java). He settled around the Semarang River and Bergota Island to promote the spread of an Islam territory in Java.

<sup>120</sup> Supriyono, A., 2001, “Hubungan antara pelabuhan dengan daerah-daerah hinterland: studi kasus di Pelabuhan Semarang pada masa Kolonial Belanda Abad XX”, in: Sedyawati, E., Zuhdi, S.(eds), *Arung Samudera*, Depok: Pusat Penelitian Kemasyarakatan dan Budaya Lembaga Penelitian, Universitas Indonesia, pp. 21-37

<sup>121</sup> Wijayakusuma, H., 2007, *Musim Tionghoa Cheng Ho: Misteri Perjalanan Muhibah di Nusantara*, Jakarta: Pustaka Populer Obor; T'ienJu-kang, 1981, “Chêng Ho's Voyages and the Distribution of Pepper in China”, *Journal of the Royal Asiatic Society of Great Britain and Ireland*, n° 2, pp. 186-197; Willetts, W., 1964, “The Maritime Adventures of Grand Eunuch Ho”, *Journal of Southeast Asian History*, vol. 5, n° 2, pp. 25-42.

<sup>122</sup> Purwanto, L.M.F., 2005, “Kota kolonial lama Semarang, tinjauan umum sejarah perkembangan arsitektur kota”, *Dimensi teknik arsitektur*, n° 1, July 2005, Surabaya, pp. 27-33.

<sup>123</sup> *Tanjung Emas sebagai central point port*, 2010, Semarang: PT. Pelabuhan Indonesia III Cabang Tanjung Emas.



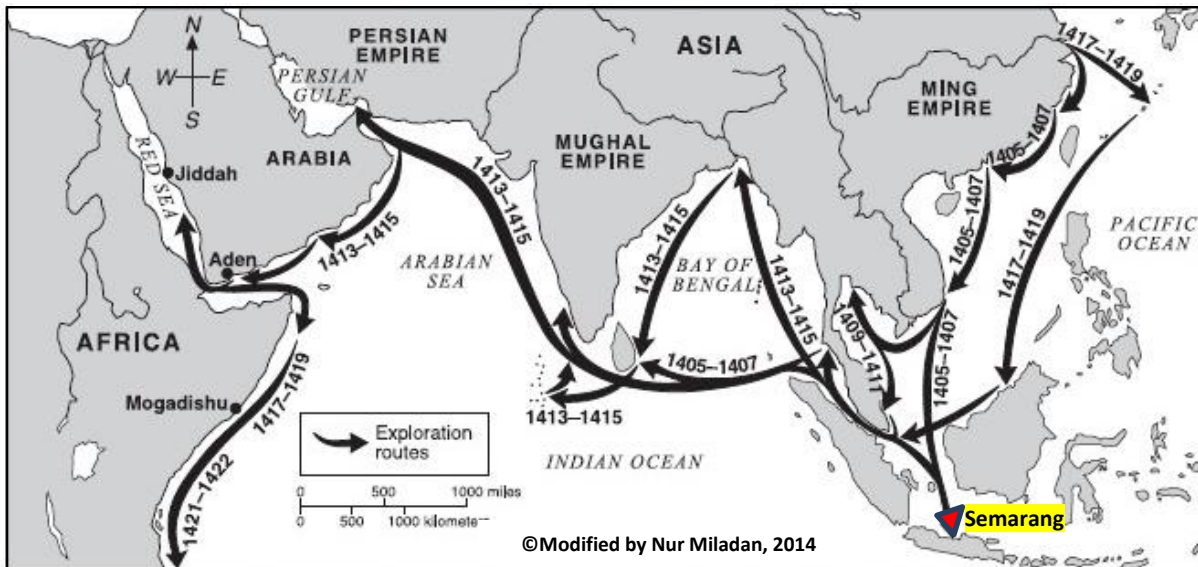
**Figure 15. Initial territorial morphology of Semarang in 1650 (17<sup>th</sup> century)**

Source: Purwanto, *Ibid.*, p. 29; *Urban Development Management Information System (UDMIS)*, *Urban Development Management Information System (UDMIS)*, 2001, Semarang: Regional Development Planning Agency (BAPPEDA).

*Semarang River plays an important role as a foundation of urban morphology. Urban activities were developed around that river and Javanese, Chinese, European, and Arabian ethnic settlements grew. The growth of settlements was related to the growth of trade activities around the river port.*

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**Figure 16. Cheng Ho (Zheng He) Expeditions**

Source: Ellis, E. G., Esler, A., 2001, *World History: Connections to Today*, New Jersey: Prentice Hall

*Semarang was one city (territory) that was passed by Cheng Ho during his expedition. This map shows that Semarang was visited by Cheng Ho between 1405 and 1407. This visit is explained by the growth of Chinese Settlements around the Semarang River.*

At the beginning of the 17<sup>th</sup> century, the region of Semarang was controlled by the Sultanate of Mataram.<sup>119</sup> The settlement kept on growing during this period. Based on the map of Semarang in 1650, three types of settlements may be identified, the Javanese settlement, the Chinese settlement and the Dutch settlement. The Javanese settlement was along the Semarang River and Terboyo River, the Dutch (European) settlement was situated in the estuary of Semarang River, while the Chinese settlement was located in the Southwest of the Javanese settlement and the Dutch Settlement. The growth of these settlements was related to the growth of trade activities in the river port and some migrants lived around the Semarang River. In 1678, Sultanate of Mataram gave VOC authority over the Semarang region.<sup>120</sup> This was due to the large debt and the military aid provided by VOC to face the rebellions that occurred at that time.<sup>121</sup> During the VOC government era, the river port of Semarang quickly developed because VOC moved the principal port from Juang Para (Jepara) to Semarang.<sup>122</sup> It then became the biggest port city in Central Java until the end of

<sup>119</sup> It was the last major independent Javanese Kingdom on Java before the island was colonized by the Dutch. It was the dominant political force in interior Central Java from the late 16th century until the beginning of the 18th century.

<sup>120</sup> VOC is acronym of *Vereenigde Oostindische Company* or Dutch East India Company. It was a chartered company established in 1602, when the States General of the Netherlands granted it a 21-year monopoly to carry out colonial activities in Asia.

<sup>121</sup> Ricklefs, M.C., Nugraha, M. S., 2008, *Sejarah Indonesia Modern 1200-2008*, Jakarta: PT Serambi Ilmu Semesta; Murtomo B. A., 2008, "Arsitektur kolonial Kota Lama Semarang", *Enclosure*, vol. 7, n° 2, pp. 69-79.

<sup>122</sup> Nowadays, Jepara is a regency (*kabupaten*) that is located about 73 km from the East of Semarang City.



the Dutch government era<sup>123</sup>. This resulted in the growth of international trade in Semarang, which became a trade city.

The urban geomorphology and the initial territorial morphology indicate that the growth of Semarang was associated to the existence of water spaces. The initial urban morphology of Semarang that started in the 15<sup>th</sup> century was situated in what was water space in the 10<sup>th</sup> century. The water area was turned into inhabited (urban) spaces involving urban activities. Furthermore, the initial territorial morphology that was situated around the Semarang River reveals the interplay between the water area and urban growth. The Semarang River became the primary element of urban morphology, the water space being a fundamental element of the city. As a result, Semarang City faces potential risks of inundations, due its geomorphology, its initial urban morphology and the urban activities around the river area.

## **1.2. Hydrological risk emergence and hydrological projects in the Dutch Government Era**

From the moment Semarang was controlled by VOC, it became the second center of the Dutch military in Java after Batavia (Jakarta). The VOC built the fortress of De Vilt Hoek to protect the Dutch settlement from rebellion actions, thus isolating Dutch settlement spaces from other areas. At that time, the VOC was extending the Dutch (European) settlement area, and controlled the growth of the Chinese settlement, the Javanese settlement and the Malay and Arabian settlements around the Dutch settlement (Figure 17). The Dutch settlement became a walled town, and, recently, it is described as the old town of Semarang City. The VOC implemented the model of Dutch architectural buildings to develop the Dutch settlement and also built the company buildings to support the VOC activities. Between the middle of the 18<sup>th</sup> century and the beginning of the 19<sup>th</sup> century, Semarang developed rapidly. The offices, the commercial buildings and urban facilities were built around the fortress. Furthermore, several villas were built outside of the fortress. They were located along Bodjong Street<sup>124</sup> and the Randusari area in 1758.<sup>125</sup> Nevertheless, during the VOC era (18<sup>th</sup> century)<sup>126</sup>, the budget was limited to develop Semarang City. The VOC had to support high war costs because of the rebellions. The development area only concerned the Dutch settlement (walled town), meanwhile the surrounding areas were still rice fields and swamp areas. The growth of the other settlements was very limited and it was strictly controlled by the VOC.

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<sup>123</sup> Supriyono, *Ibid.*

<sup>124</sup> Nowadays, this way is called Pemuda Street.

<sup>125</sup> Jessup, H., 1984, "The Dutch Colonial Villa, Indonesia", in Khan, H.(ed), *Mimar 13: Architecture in Development*, Singapore: Concept Media Ltd.

<sup>126</sup> Brommer, B., Budiharjo, E., Montens, A.B., Setiadi, S., Sidharta, A., Siswanto, A., Soewarno, Mr., Stevens, Th., 1995, *Semarang Beeld van eenstad*, Purmerend: Asia Maior.



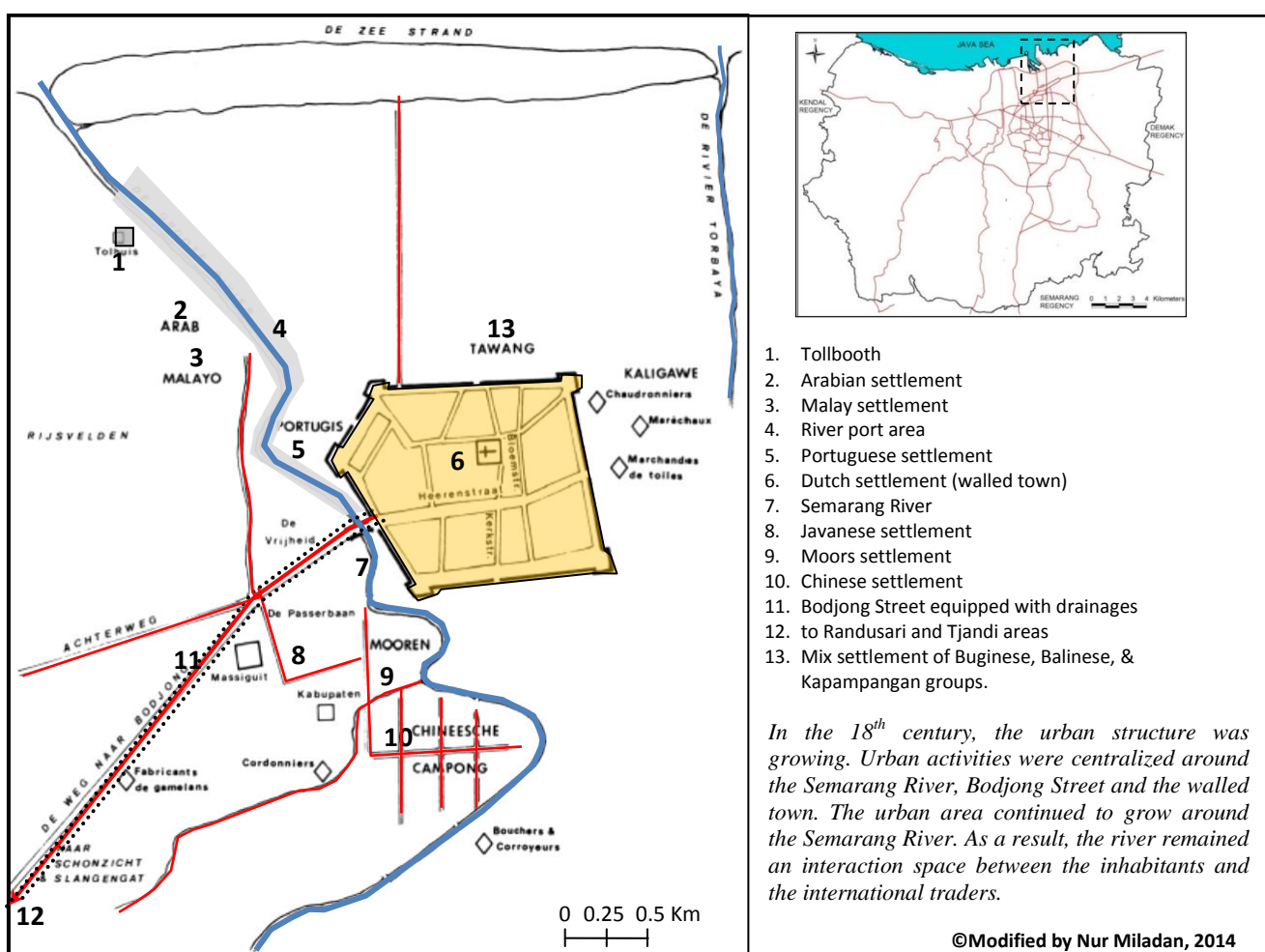
### Figure 17. Semarang and its surroundings in 1741

Source: *Kaart van Samarang en omstreken, Benevens aanwysing van 's Comp.s Leger en 's vyands vlugt. Gecommandeert en chef door commandant Gerrit Non. Anno 1741*[Map], Retrieved December 25<sup>th</sup>, 2015, from GahetNA, <http://www.gahetna.nl>.

Nevertheless, there is a lack of record of Semarang City during the 18<sup>th</sup> century, the Dutch settlement being just described as a small town or a village protected by a small fortress with five simple bastions, which were materialized by palisades and boards.<sup>127</sup> At the

<sup>127</sup> Lombard, D., 1989, "Une description de la ville de Semarang vers 1812", *Archipel*, vol. 37, pp. 263-277.

end of the 18<sup>th</sup> century, the VOC went bankrupt due to the high cost of wars and the corrupt officials of the VOC, the Dutch government subsequently took over the authority held by the VOC.<sup>128</sup> At that moment, Semarang started to be directly controlled by the Dutch government. This was a great impetus for the modernization process of Semarang City. In the beginning of the 19<sup>th</sup> century, the region of Semarang was divided into two parts, the walled town and the outskirts of the town. The former was populated by the Dutch inhabitants (3350 peoples) while the latter were *kampung* that were partitioned between various ethnic groups (17776 people) such as Bugis, Moors, Javanese, Chinese, Malay, and Portuguese groups.<sup>129</sup>



**Figure 18. Urban Morphology of Semarang in 1812**

Source: Lombard, D., 1989, "Une description de la ville de Semarang vers 1812", *Archipel*, vol. 37, pp. 263-277.

At that time, the walled town developed as the place where the government sat and as a trade centre, whereas the *kampung* around it were developing without government plans.

<sup>128</sup> Ricklefs, M.C., Nugraha, M. S., *Ibid.*

<sup>129</sup> Lombard, *Ibid.*

Consequently, this brought about a spatial disparity. Problems relating to infrastructures arose, such as bad roads, dirty drainages, and a lack of clean water. The drainages were built along Bodjong Street, which connected the walled town to the outskirts and the hinterlands. Nevertheless, the water could not be used by the inhabitants who were forced, as a result, to bring in water from the Tjandie area which was three or four miles away.<sup>130</sup> Despite the lack of clean water and the dirty drainages, there is no record referring to the existence of flood risk at that time.

Furthermore, the modernization of Semarang City in the 19<sup>th</sup> century concerned the transportation system and the development of urban infrastructures. The development of the Great Post Road of Daendels in Java Island (1808-1811)<sup>131</sup>, of a new (canal) port (1854)<sup>132</sup> and of the railway system (1864-1872) connecting Semarang to its hinterlands accelerated the modernization process.



**Figure 19. Existence of Canal Port of Kali Baru in 1920 (1927)**

Source: Rimestadt, E.A.H.G, *Gezichtvanaf de vuurtoren over de haven en Kalibaroe*, 1900-1940, retrieved December 25<sup>th</sup>, 2015, from Nationaal Museum van Wereldculturen, <http://collectie.wereldculturen.nl>

<sup>130</sup> Lombard, *Ibid.* Nowadays, it is called Candi, an area of the Semarang hills and it is located in the south of the walled town.

<sup>131</sup> The road connecting Anjer to Panaroekan along the northern coast of Java going from West to East was built between 1808 and 1811, following the initiative of Daendels, the Governor General of the Netherlands East Indies. Cf. Bakker RDPSA, A., 1991, ‘‘The Great Post Road of Daendels’’, *The Journal of the American Society for Netherlands Philately*, vol. 15, n<sup>o</sup> 3, pp. 42-45.

<sup>132</sup> Supriyono, *Ibid.*

Nevertheless, the development of transportation systems faced technical obstacles related to the geomorphology of Semarang. For instance, it was difficult to build the Great Post Road given the existence of swamps around Semarang City.<sup>133</sup> However, the apparition of that road had an effect on the urban functions that were formerly concentrated along the river, and then many functions moved to this road or to parallel and side roads.<sup>134</sup>

The development of *Groote Boom*<sup>135</sup> and the canal port were complemented by the development of a railway system. The railway system connected Semarang to Tanggung (1867), Surakarta (1870) and Yogyakarta (1872).<sup>136</sup> The trains carried agricultural products from the hinterlands to the port. These products were then sold to foreign merchants. The development of the canal port, which was larger than the old (river) port, was aimed to be more easily accessible to big boats.

The extension of Semarang urban area also took place after the demolition of the fortress in 1824.<sup>137</sup> This time, the urban extension reached the Southwestern and Southern parts of the walled town. Several offices were built by the Dutch Government in these areas, such as the post office (1862), the office of Malay newspapers (1876), the bank (1880), and the infrastructures such as a communication (telephone) network, urban drainages (canalization) and the important road connecting the Western part to the Eastern part of the city.<sup>138</sup> Furthermore, the Semarang population was still increasing. Trade activities were more significant than military activities. In the process of the penetration of the modern market structure in Central Java, a prominent role was played by Semarang.<sup>139</sup> Traditional markets were developing to support urban activities. Interactions between the urban areas and *kampung* were easier.

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<sup>133</sup> Toer, P. A., 2005, *Jalan Raya Pos, Jalan Daendels*, Jakarta: Lentera Dipantara.

<sup>134</sup> Colombijn, F, 2002, "Introduction. On the road", *Bijdragen tot de Taal-, Land-enVolkenkunde*, vol. 158, n° 4, pp. 595-617

<sup>135</sup> It was a checkpoint for boats that arriving and departing.

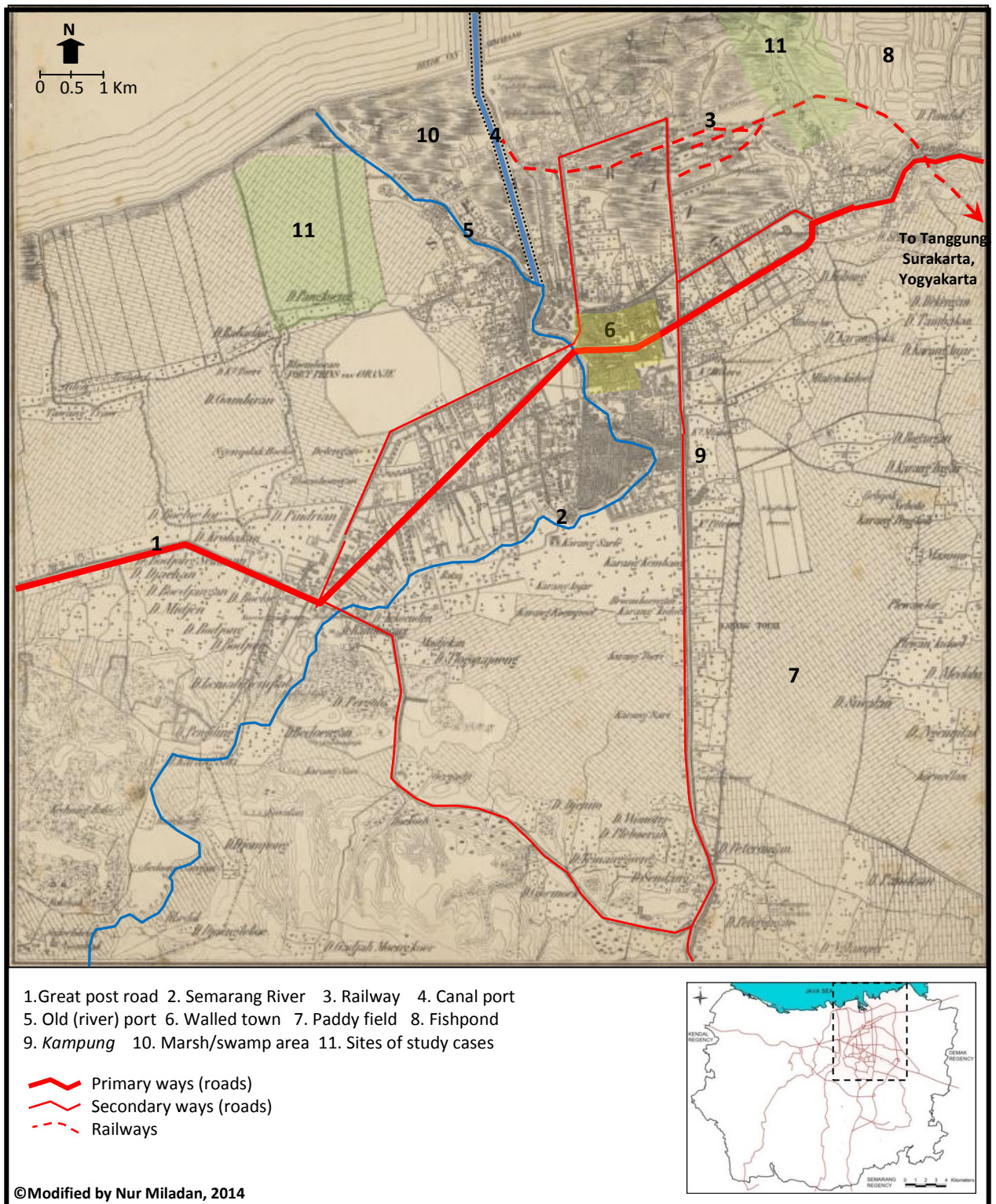
<sup>136</sup> Purwanto, E., 2008, "Kajian Arsitektural Stasiun NIS", *Enclosure*, vol. 7, n° 2, pp. 98-105.

<sup>137</sup> Murtomo, *ibid.*

<sup>138</sup> Wijayanti et al., 2004, "Green Map Kawasan Pecinan Upaya Pengembangan Pariwisata di Kota Semarang", *Proceedings Komputer dan Sistem Intelijen (KOMMIT 2004)*, Jakarta: Lembaga Penelitian Universitas Gunadarma.

<sup>139</sup> Stevens, T., 1986, "Semarang, Central Java and the world market 1870-1900", in Nas, P.J.M. (ed.), *The Indonesian City. Studies in Urban Development and Planning*, Dordrecht: Foris Publications.





**Figure 20. Urban structure of Semarang in the 19<sup>th</sup> century**

Source: Kaart van de Hoofdplaats Semarang en Omstreken/Topographisch Bureau [Map], 1875, KITLV, Leiden.

The development of transportation systems (road, railway and the new port) resulted in extending urban activities to the surroundings. Such activities were no longer exclusively centralized around the Semarang River. The Southern part of the walled town experienced a rapid growth of settlements. The urban structure was consolidated and it was marked by the development of street patterns. Nevertheless, open spaces, such as paddy fields, swamps and fishponds were still predominant with respect to the use of the land of the Semarang territory.



The modernization of Semarang City occurred in the 19<sup>th</sup> century, but it was not accompanied by the development of proper infrastructures, especially in the *kampung* areas. Urban facilities and infrastructures were concentrated in the walled town and its surroundings. Furthermore, the urban geomorphology revealed the vulnerability of the territory to the inundation risk. The Semarang coastal area is dominated by a land that is not suitable for urban development. The Dutch government exploited the vulnerable territory to support the urban development, such as the transportation system. This brought about urban problems many years later, such as the emergence of flood risk.

Alongside the urban development, urban problems occurred in the late 19<sup>th</sup> century, such as the flood risk. Semarang often experienced floods during the rainy season, notably the marshlands in the coastal area. These areas were turned into urban areas, which increased the urban vulnerabilities. Moreover, the Semarang River was often overflowed during the heavy rains. The activities of transportation route in that river led to the decrease of water capacity. As a result, the inundations were threatening the urban areas. The lack of slope sustained flooding of certain parts of the city during the rainy season so that at the end 19<sup>th</sup> century the Dutch built two flood canals one each to the west and east of the city to carry away the excess water.<sup>140</sup> The West canal (floodway) was first built in 1850,<sup>141</sup> as shown by the existence of Simongan Weir that was built in 1870. Before the construction of Simongan Weir, the water channelled from the Garang River to the Semarang River. After that, the water channelled from the Garang River to the West Floodway. It runs from the upper course of Semarang River that soon could not be sailed and lost its function as a primary element of the city.<sup>142</sup> This floodway was used to channel the water from the hills, but it was in fact not designed to channel the water from the urban areas.<sup>143</sup> Between 1894 and 1901, the Dutch government also built the East canal to manage the water discharge in the Eastern part of the city<sup>144</sup>. The canalization system in Semarang City was set up at this time. Urban drainages started developing along the main roads of the city, in addition to the drainage of Bodjong Street that was previously constructed.

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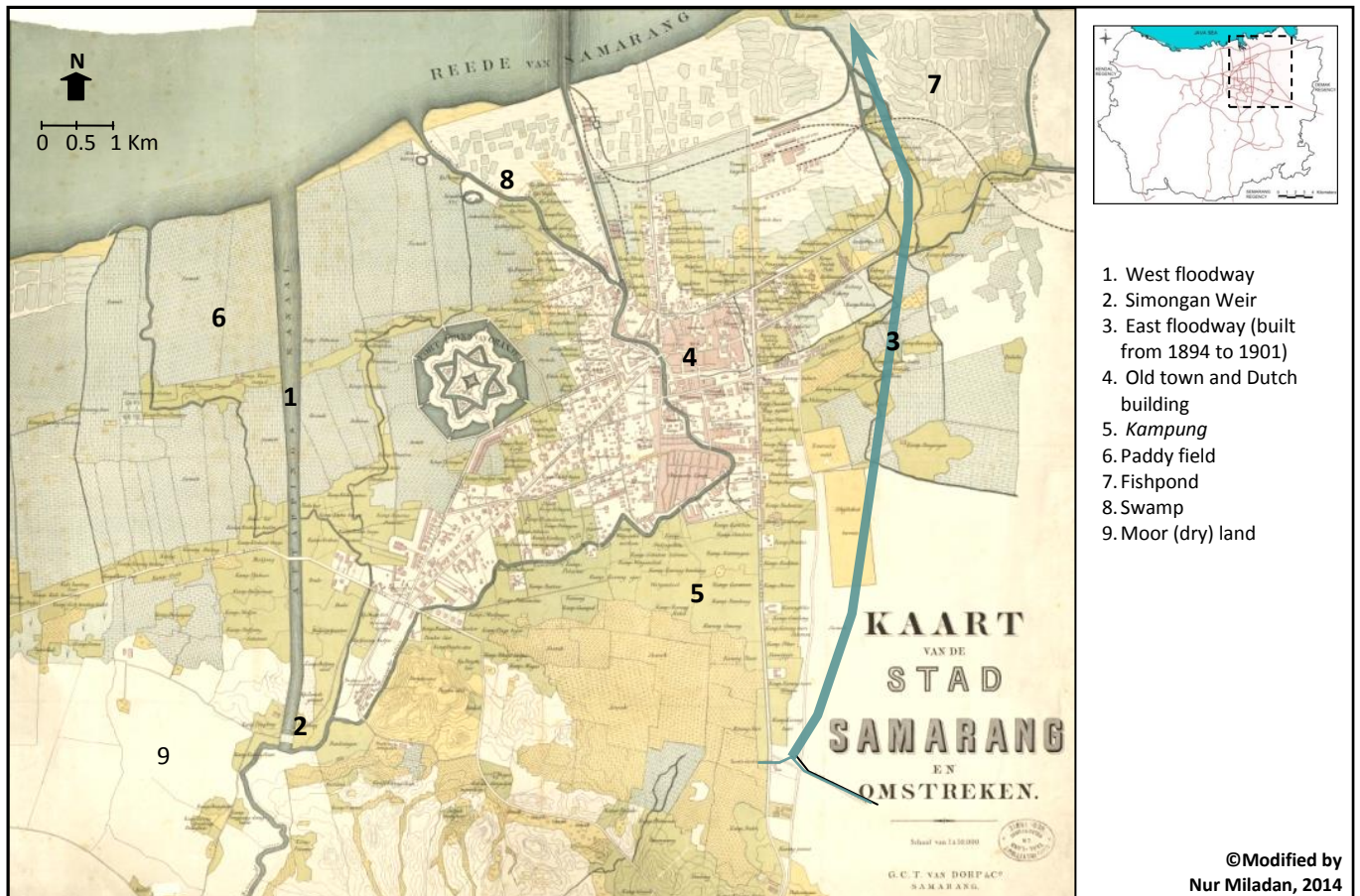
<sup>140</sup> Cobban, J.L., 1988, "Kampung and conflict in Colonial Semarang", *Journal of Southeast Asian Studies*, vol. XIX, n° 2, Singapore University Press.

<sup>141</sup> *Urban Drainage Masterplan of Semarang City*, 2007, Semarang: Regional Development Planning Agency.

<sup>142</sup> Pratiwo, 2004, "The City Planning of Semarang 1900-1970", 1<sup>st</sup> International Urban Conference, Surabaya.

<sup>143</sup> Permana, A.M., "Agar Banjir Kanal Tak Cuma Kanal Pengendali Banjir", *Suara Merdeka*, Augustus 29<sup>th</sup>, 2007, retrieved December 25<sup>th</sup> 2015, from [www.suaramerdeka.com](http://www.suaramerdeka.com)

<sup>144</sup> Cf. Ridder, D.C.C.M, 1974, *Inventaris van het archief van de Semarang-Joana Stoomtrammaschappij 1881-1947 (1952)*, Den Haag: Nationaal Archief, retrieved December 28<sup>th</sup>, 2015, from [http://www.gahetna.nl/collectie/archief/pdf/NL-HaNA\\_2.20.18.ead.pdf](http://www.gahetna.nl/collectie/archief/pdf/NL-HaNA_2.20.18.ead.pdf).



**Figure 21. Developments of Canals (Floodways) in the late 19<sup>th</sup> century**

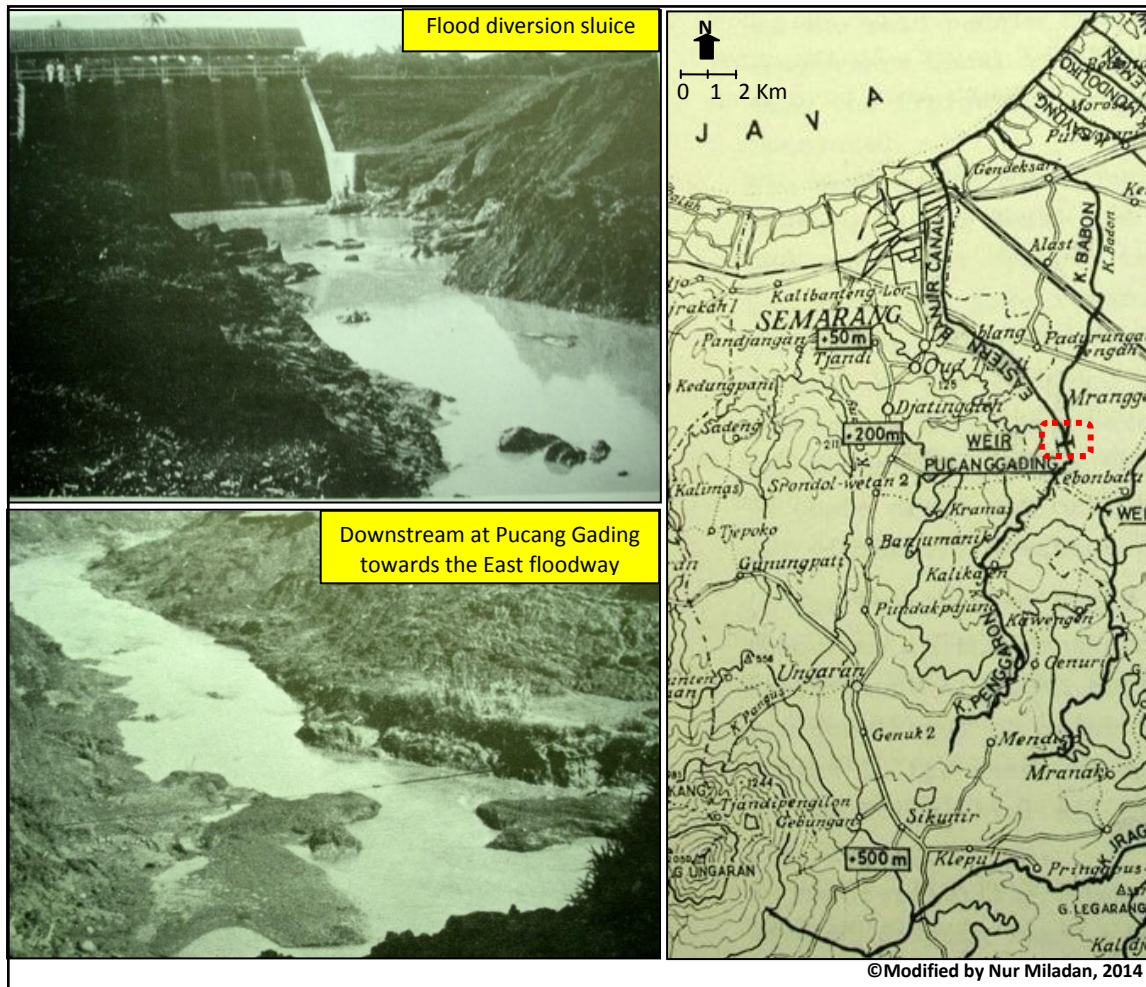
Source: *Kaart van de stad Samarang en Omstreken* [Map]. 1886. KITLV. Leiden.

The existence of the floodways shows that the city sought to solve the flood risk. The developments of these floodways also marked the modernization of water (drainage) infrastructures in the city. Furthermore, these floodways influenced the urban structure and the extension to Western and Eastern parts of the city.

The municipality also constructed Pucang Gading weir in 1893. This weir was designed to break up the water flow from the Penggaron River (Ungaran Mountain) and consists of a 19, 90 meter long sharp-crested weir.<sup>145</sup> Initially, the water channelled through the Babon River and then disposed to the Sea. Once Pucang Gading Weir started to operate, the water channelled from the Penggaron River to East Floodway. The optimum capacity of that floodway was 333 m<sup>3</sup>, while the optimum water from the Penggaron River was only 200 m<sup>3</sup>. This project was aimed to solve the flood risk from the hill areas and also to irrigate agricultural lands around East Floodway. Nevertheless, the existence of two floodways still not solved the flood risk at that time. The West canal (floodway) and the East canal (floodway) reduced only the water from Garang River in the Southwest and smaller rivers in the Southeast.<sup>146</sup>

<sup>145</sup> *Reconnaissance Survey Djratunseluna Area*, 1968, Ministry of Public Works and Power of Republic Indonesia and Ministry of Foreign Affairs of Kingdom of Netherlands, The Hague: NEDECO; *Jratunseluna Basin Development Project*, 1974, Ministry of Public Works and Power of Republic Indonesia and Ministry of Foreign Affairs of Kingdom of Netherlands, The Hague: NEDECO.

<sup>146</sup> Pratiwo, *Ibid.*; "De afwatering van Semarang", *I.B.T. Locale Techniek*, 1936, n° 5, September 1936.



**Figure 22. Location and Situation of Pucang Gading Weir in 1934**

Source: *Reconnaissance Survey Djratunseluna Area*, 1968, Ministry of Public Works and Power of Republic Indonesia and Ministry of Foreign Affairs of Kingdom of Netherlands, The Hague: NEDECO; *Jratunseluna Basin Development Project*, 1974, Ministry of Public Works and Power of Republic Indonesia and Ministry of Foreign Affairs of Kingdom of Netherlands, the Hague: NEDECO.

In the beginning of the 20<sup>th</sup> century, the modernization of Semarang City was still ongoing, especially in the Dutch settlement (old town) area, while *kampung* was of poor quality, caused by the lack of water supply infrastructures and sanitation facilities. *Kampung* had to deal with public hygiene problems: several diseases threatened its inhabitants, such as cholera and malaria. The poor quality of the settlement infrastructures was a crucial problem in the city besides the exposure of its inhabitants to flood risk. The poor urban and local drainages resulted in recurrent inundations of the settlements during the rainy season. The local drainages in the settlements were not only used to channel the water, but also with respect to the access of sanitation by the inhabitants.





*The length of the front side of houses is very short, only approximately 1.5 m. As a result, humidity spreads throughout the settlement. Roads are not paved, which causes a lack of drainage. This sheds light on the main features of kampung conditions during the Dutch government era.*



*The shapes of the houses are usually irregular and their wall is made of simple boards or bamboo. The floor is not paved - earthen floors were another feature of the houses. The absence of local drainages around the house caused potential risks of inundation during the rainy season for kampung.*

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**Figure 23. Kampung condition at the beginning of the 20<sup>th</sup> century**

Source: Tillema, H.F., 1913, *Van Wonen En Bewonen, Van Bouwen, Huis En Erf*, Semarang: Tandji.<sup>147</sup>

<sup>147</sup> Tillema was a Dutch pharmacist who came to Semarang in 1896 and who was a member of the Semarang municipal council.



*Poor drainages characterize the kampung. The dirty water is not evacuated and muddies. Moreover, the sanitation facility is mixed in that drainage. This reveals the untidiness.*

*Despite the absence of rain, inundations nonetheless occur around the house. It is a slum because of the mix of waste, mud, and dirty water in that area. This brings about potential diseases, such as malaria and cholera.*

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**Figure 24. Poor local drainages in *kampung* at the beginning of the 20<sup>th</sup> century**

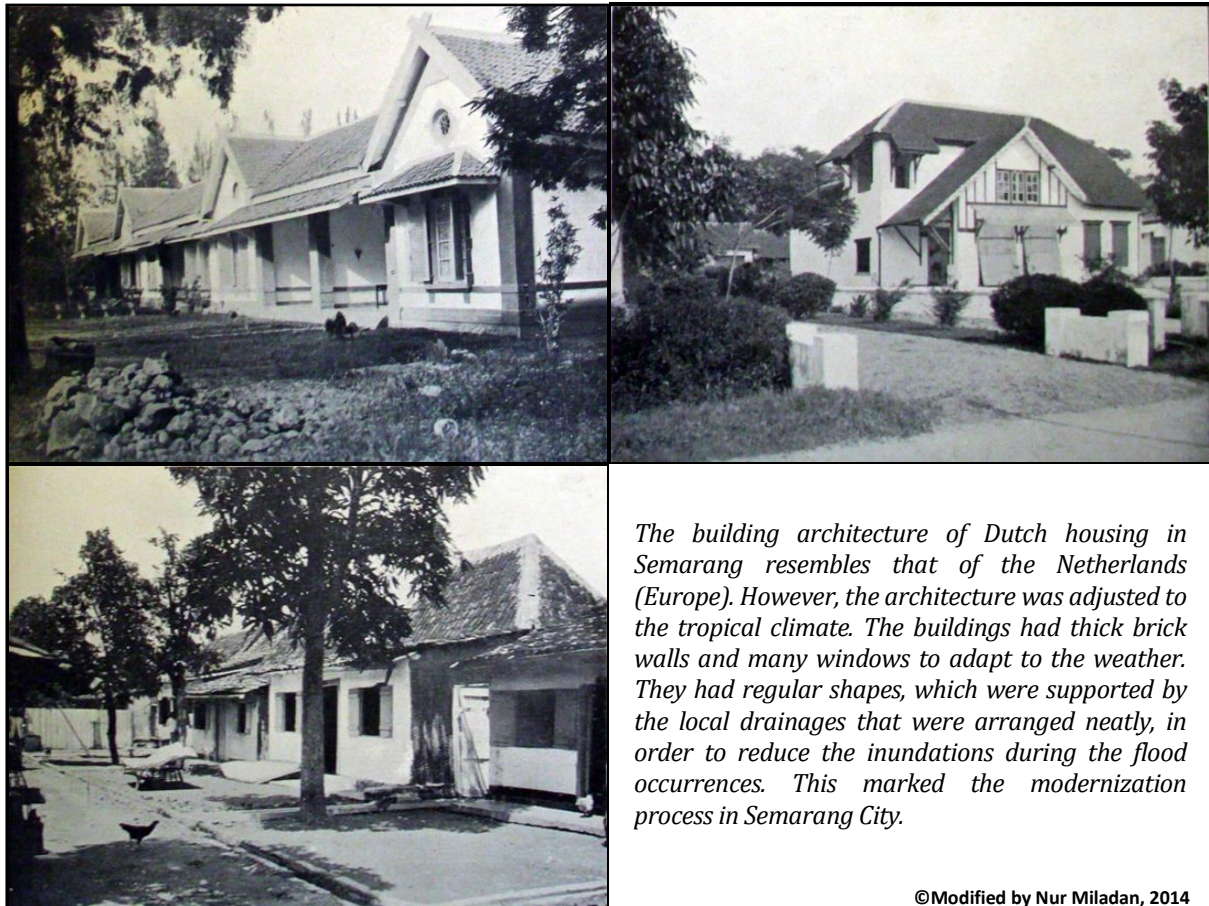
Source: Tillema, *Ibid.*

Tillema's study of the *kampung* reveals that communities were acquainted with inundations at that time, whereas they were less aware of the risks caused by the inundations. The existence of diseases, such as cholera and malaria, was related to inundation risks. This indicates how the communities' cultures adapted to inundation risks in their everyday life. They were not aware of healthcare problems, lived with the limited livelihood resources, very modestly.

The Dutch settlements were arranged and designed following the European architectural patterns. Most European people of Semarang had good houses along the high street, with a wide yard and complete facilities. By contrast, most houses of indigenous



people were located in muddy *kampung*, narrow and dirty streets, which were dusty during the dry season and turned into swamps during the rainy season.<sup>148</sup>



**Figure 25. Dutch settlement in the beginning of the 20<sup>th</sup> century**

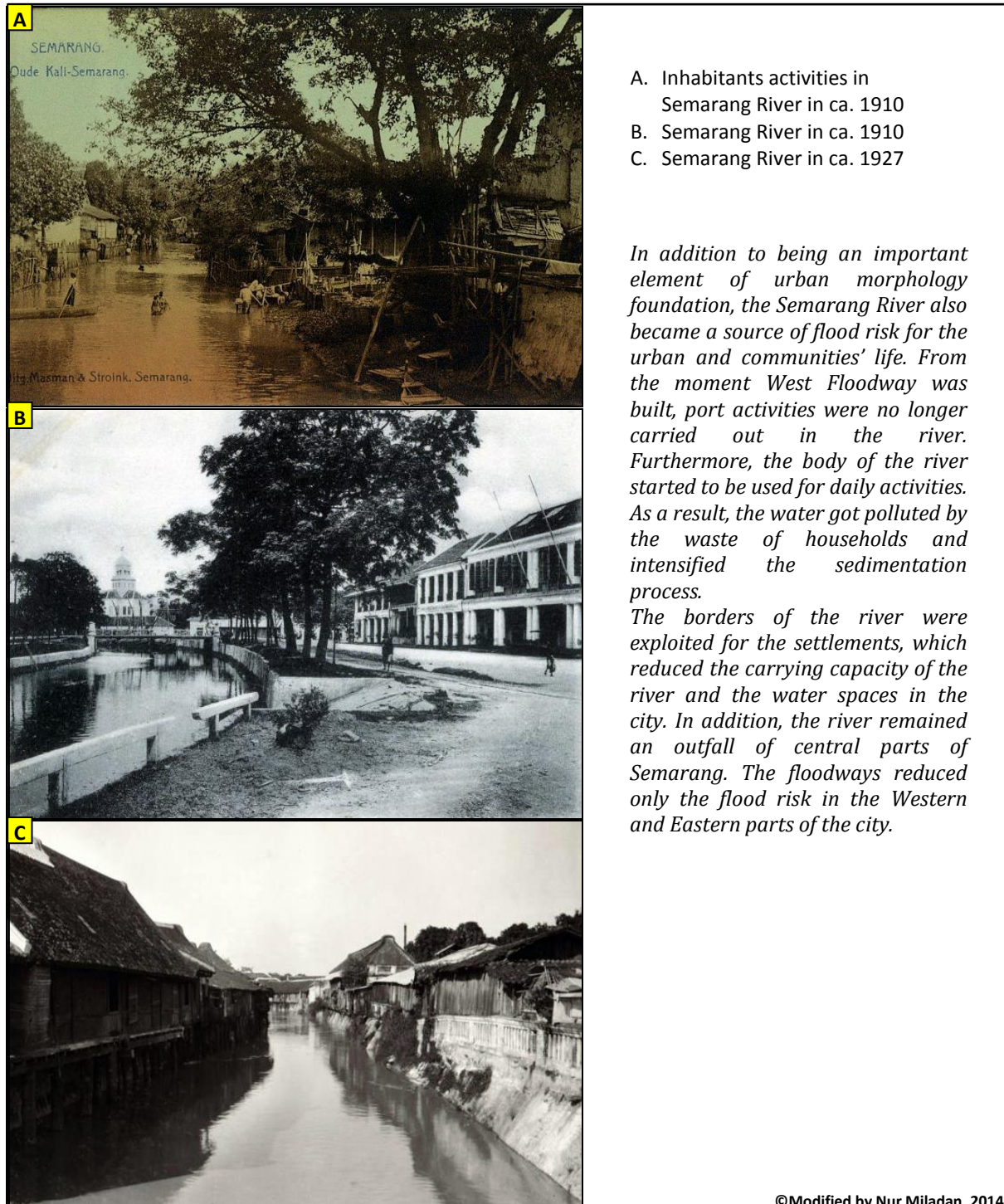
Source: Tillema, *Ibid.*

During the Dutch government era, most of Semarang areas experienced flood risk, especially those where the Semarang River runs. Flood risk was caused by the overflow of that river, in particular during the rainy season. Notwithstanding the existence of West Floodway, which reduced the amount of water running down to the Semarang River, flood risk continued to threaten the settlements around the river. Since the existence of West floodway, Semarang River experienced a sedimentation phenomenon, caused by the fact that the volume of water that ran into the river was smaller than that in the previous years. Furthermore, the inhabitants began to exploit the river for their daily activities, such as sanitation, bathing, washing. They moreover threw away trash in the body of river. As a result, the river became dirty and lost its function of being the important element of the city.

<sup>148</sup> Wijono, R.S., 2013, *Modernitas dalam kampung, Pengaruh Kompleks Perumahan Sompok Terhadap Permukiman Rakyat di Semarang Abad ke-20*, Jakarta: LIPI Press.



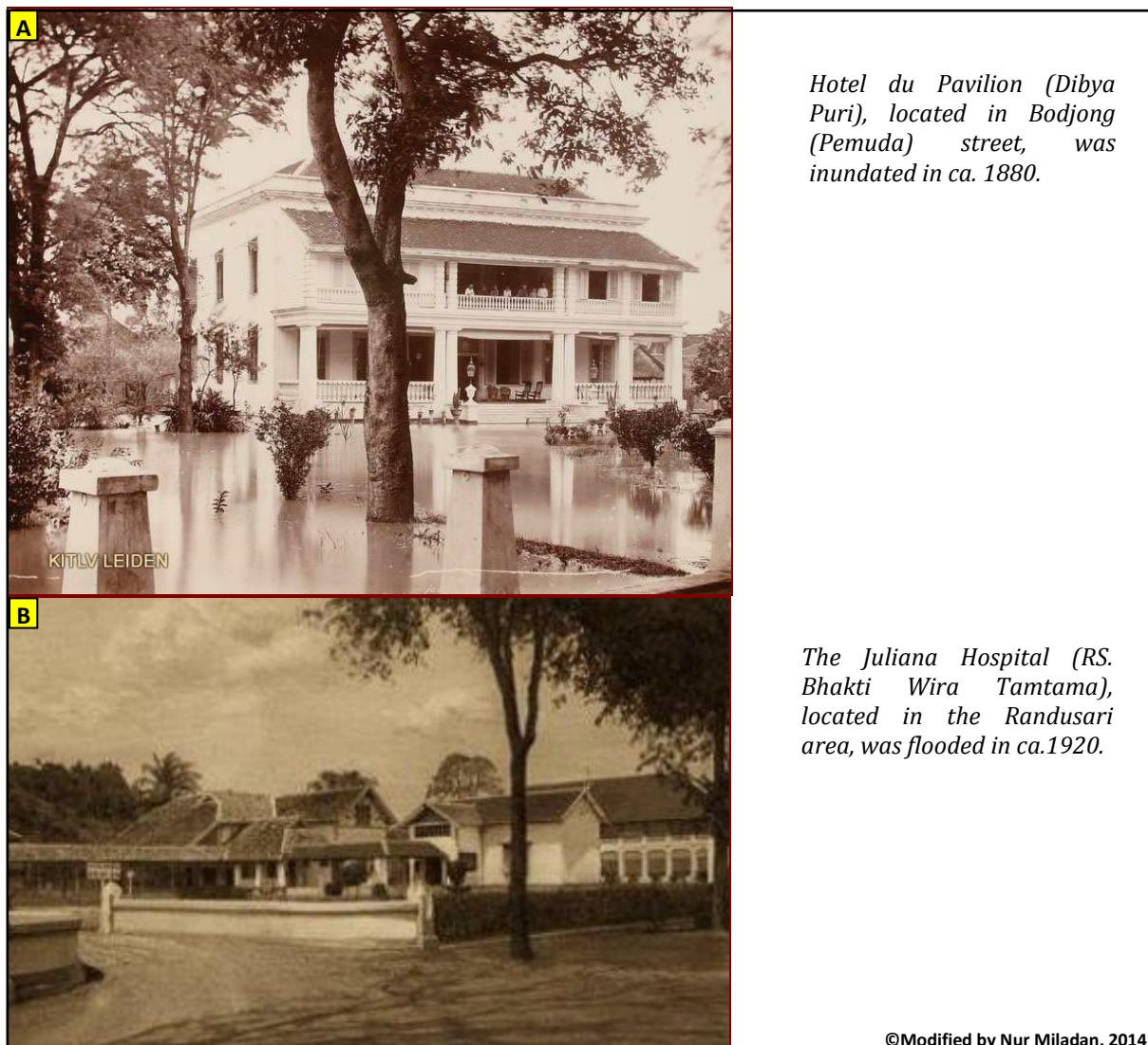
During several previous centuries, this river was an economic space for the various communities, but it then only became a disposal space for urban activities. These elements caused the potential flood risk of the river.



**Figure 26. Semarang River situation after the construction of West Floodway**

Source: Masman & Stroink, *De Oude Kali te Semarang* [Photo], 1910, retrieved December 28<sup>th</sup>, 2015, from Collections KITLV Digital Image Library, <http://media-kitlv.nl>; Van Dorp, G.C.T., *De Kali Semarang te Semarang* [Photo], 1910, retrieved December 28<sup>th</sup>, 2015, from Collections KITLV Digital Image Library, <http://media-kitlv.nl>; De Iongh Wzn, D., *De Kali Semarang te Semarang* [Photo], 1927, retrieved December 28<sup>th</sup>, 2015, from Collections KITLV Digital Image Library, <http://media-kitlv.nl>.

Floods occurred not only in the *kampung*, but also in the urban area. Pemuda Street and Randusari Street were the centres of urban growth at that time, often threatened by the flood risk. Urban facilities such as the hospital, offices, markets, and Dutch pavilions were situated in these areas. Although there is no detailed data related to the flood impacts to the city at that time, it may nonetheless be inferred that the flood risk did not only threaten the settlement areas, but also the territories which were supported by the urban drainage system. Nevertheless, settlements in particular *kampung* were obviously the most vulnerable territories to the recurring floods.



**Figure 27. Inundations of the Semarang urban area in the colonial government era**

Source: Woodbury, W.B., Page, J., *Hotel du Pavillon te Semarang tijdens een bandjir* [Photo], 1880, retrieved December 28<sup>th</sup>, 2015, from Collections KITLV Digital Image Library, <http://media-kitlv.nl>; Uitgeverij N.V. Semarang, *Het Juliana Ziekenhuis te Semarang* [Photo], 1920, retrieved December 28<sup>th</sup>, 2015, from Collections KITLV Digital Image Library, <http://media-kitlv.nl>.





- A. Flood occurrence in 1917
- B. Flood occurrence in the Chinese settlement in April 1917
- C. Flood occurrence in the Javanese settlement between 1906 and 1931 (without the exact date)

*The images show that, during several decades, the inhabitants lived with the flood risk. It seems that the inhabitants kept still carrying out their activities during flood occurrences.*

*The elevations of the level of the water caused by inundations amounted to approximately 60 to 80 cm. They threatened the communities around the Semarang River.*

© Modified by Nur Miladan, 2014

**Figure 28. Inundated *kampung* and inhabitants activities around the Semarang River during the Colonial government era**

Source: Lusken, J.H., Overstromingen te Semarang [Photo], 1917, Retrieved December 28<sup>th</sup>, 2015, from GahetNA, <http://www.gahetna.nl>; Lusken, J.H., Overstroming. Ingang van de Chinese kampong in Semarang [Photo], 1917, Retrieved December 28<sup>th</sup>, 2015, from GahetNA, <http://www.gahetna.nl/>; “Overstroomde kampoeng voor de verbetering” [Photo], Gedenkboek van der Gemeente Semarang 1906-1931, 1931, Semarang: N.V. Dagblad de Locomotief.

Although there is no record of the community efforts to anticipate the flood risk during this period, several historical images above nonetheless indicate that the communities continued to carry out their activities in public spaces despite the high flood risk. It seems that the communities were more resistant, and apparently that efforts of the communities to solve or to reduce the flood risk in their territories were inexistent. At that time, the municipality (*gemeente*)<sup>149</sup> played the important role of urban planning, including improvements of settlements. The urban development and improvement were carried out through top down planning, where inhabitants were only objects of urban development. The improvements of settlements were initiated by the municipality, while the communities tended to follow the municipality plans. As a result, the flood solving was very centralized in the municipality efforts.

H.F. Tillema is the initiator of the settlement improvement in Semarang City in the beginning of the 20<sup>th</sup> century. He strongly endorsed the foundation of Candi Baru, a new residential area located among the hills in the Southern part of Semarang City in 1915.<sup>150</sup> He successfully fostered the installation of a sewerage system in Semarang, and he made also people aware of the importance of hygiene, the necessity of *kampung* improvement and the need for adequate planned city extension.<sup>151</sup> The Tillema perspectives gave an incentive to the municipality to improve the housing and urban conditions. In 1916, the municipality appointed Thomas Karsten<sup>152</sup> as local authority council of Semarang urban planning.<sup>153</sup> He designed urban plans to improve the housing condition – which was inspired by the idea of Tillema and to extend the urban areas. The town expansion plans that Karsten drew up for Semarang date from his first years in the Dutch East Indies (1916-1919).<sup>154</sup>

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<sup>149</sup> Semarang officially became *gemeente* (Municipality) on 1 April 1906 based on Staatsblad (official gazette), n° 120/1906. Cf. Kakebeeke, H.C., 1931, “Geschiedenis der Gemeente”, *Gedenkboek van der Gemeente Semarang 1906-1931*, Semarang: N.V. Dagblad de Locomotief; *Master Plan of Semarang City for 1975-2000*, 1975, Semarang: Department of Urban Planning and Settlement of Semarang City.

<sup>150</sup> At that time, the idea of new residential areas in the hill area was also initiated by Dr. De Vogel, as health authority (medicine) in Semarang.

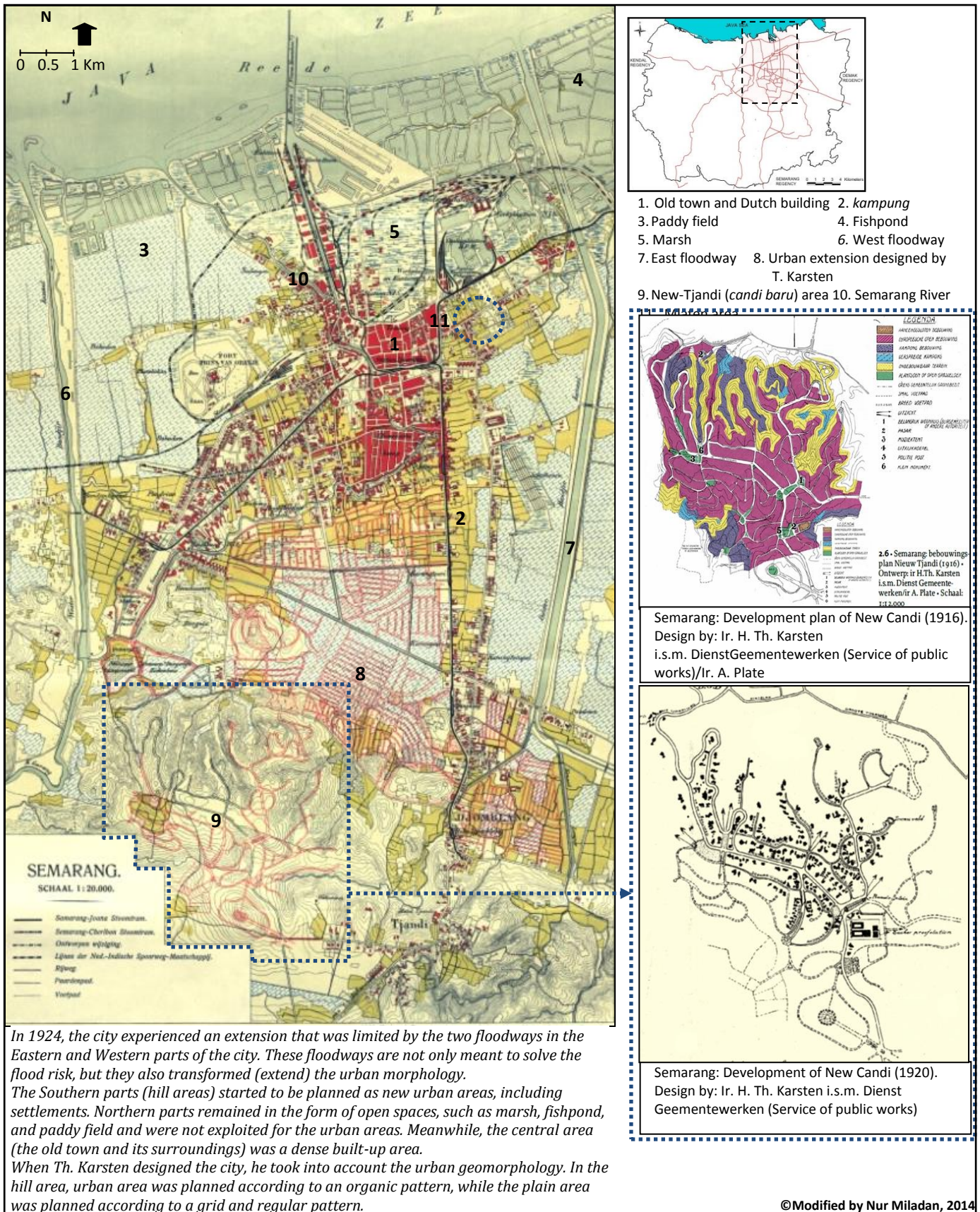
<sup>151</sup> Nas, P.J.M., Theuns, K., 2005, “Semarang: Was H.F. Tillema a director of urban change?”, in : Nas, Peter J.M. (ed.), *Director of Urban Change in Asia*, London / New York: Routledge.

<sup>152</sup> The Dutch architect and planner (1884-1945) championed in the former Dutch East Indies, present-day Indonesia, which in his publications he reflected European Planning thought and the extent to which European ideas accorded with the particular social and economic circumstances of colonial Indonesian cities. Cf. Cobban, J.L., 1992, “Exporting Planning: The work of Thomas karsten in Colonial Indonesia?”, in: Dutt, A.K., Costa, F.J., Aggarwal, S., Noble, A.G. (eds), 1994, *The Asian City: Processes of Development, Characteristics and Planning*, Dordrecht / Boston: Kluwer Academic Publishers.

<sup>153</sup> Wijono, *ibid.*

<sup>154</sup> Bogaers, E., De Ruijter, P., 1986, “Ir. Thomas Karsten and Indonesian Town Planning, 1915-1940”, in: Nas, P.J.M., *The Indonesian City. Studies in Urban Development and Planning*, Dordrecht / Cinnaminson: Foris Publications.



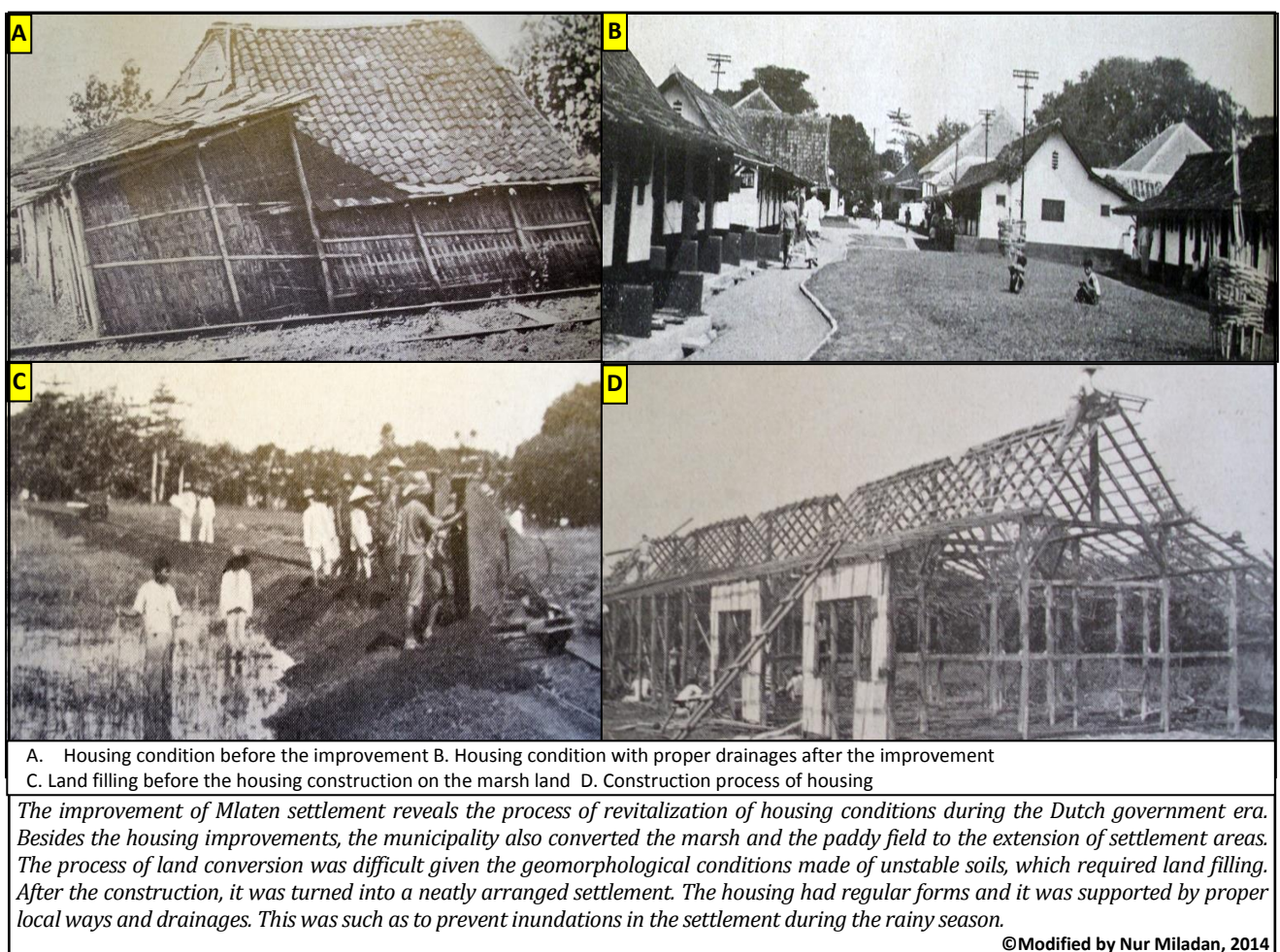


**Figure 29. Urban plans during the Dutch government era**

Source: N.V. Technisch-Reproductiebureau en Lichtdrukkerij Holland-Indië – ,s-Gravenhage, *Semarang* [Map], 1924, KITLV, Leiden; Roosmalen, P.K.M., 2008, *Ontwerpen aan de stad Stedenbouw in Nederlands-Indië en Indonesië (1905-1950)*, Ph.D. Dissertation in Architecture, Delft University of Technology.



Karsten planned the development of the Southern area of the city. He considered that the surrounding areas of the old town were not appropriate for the housing development areas. A Northern extension was not possible, because of the fishponds and the marsh. It has been stated that these surrounding areas were inappropriate and unhealthy settlement.<sup>155</sup> Furthermore, Karsten is the first who implemented Netherlands Indies urban plans not on the basis of the ethnic classification, but on the economic classification.<sup>156</sup> Besides the plan of the new settlement (New-Tjandi), the municipality also improved several settlements (*kampung*), such as Pekunden, Peterongan, Batan, Wonodri, Sompok, Semarang Timur and Mlaten<sup>157</sup> to increase the quality of life of inhabitants and to facilitate the housing needs of that time.



**Figure 30. Mlaten settlement improvement in the Dutch government era**

Source: "Exploitatie en bebouwing van het land Mlaten Semarang", *I.B.T. Locale Techniek*, n° 1-2, January-April 1932.

Karsten designed the settlements with proper infrastructures, such as drainage network, sanitation facilities, water supply and electricity network. Proper drainages could

<sup>155</sup> Thian Joe, L., 2004, *Riwayat Semarang*, Jakarta: Hasta Wahana.

<sup>156</sup> Muljadinata, S.A., 1993, *Karsten dan Penataan Kota Semarang*, Master thesis in Architecture, Bandung Institute of Technology.

<sup>157</sup> Muljadinata, *Ibid.*



reduce the flood risk in the settlements. Besides the New-Tjandi, settlements were provided for the middle class. The urban extension and the housing improvements by the Dutch municipality took place between the 1920s and the 1930s. The housing improvement programs were made concurrently with the providing of local drainages and sewerage facilities. After the improvements, the drainages and the sanitation facilities were no longer mixed. During the implementation of drainage and sanitation projects, there were several obstacles related to the financing and the technical aspects of the projects.<sup>158</sup> The municipality had a limited budget. The projects required two million gulden ( $\approx 907\,559,95$  Euro)<sup>159</sup>, only f 250.000 ( $\approx 113\,444,99$  Euro) were provided to finance them. In addition, corruption occurred in relation with these projects. Technical problems were caused by the fact that the urban geomorphology was not flat, characterized by hills and marsh, which made the construction of the water pipes much more difficult. The housing improvement programs, implemented by the Dutch municipality, obviously still did not solve the flood risk. It was still threatening the settlements, especially around the Semarang River. In 1936, the municipality planned several canals to support the functions of the West Floodway and the East Floodway. Those were designed to anticipate the water flow from the hills area, especially in the centre of Semarang City. These projects were financed by grants of the Dutch Government (Netherlands) about f 25 million ( $\approx 11\,344\,499,35$  €) destined to the Dutch East Indies.<sup>160</sup> They were other flood-handling projects stopped due to the lack of finance. The municipality designed new canals running to the East Floodway, supported by several floodgates. The land cutting from the constructions of the new canals was used to elevate several flood risks areas. The total cost of these projects was estimated at about f 270.000 ( $\approx 122\,520,59$  €). In 1937, the municipality implemented the new drainage, called Siranda Canal.<sup>161</sup> It was designed to evacuate the water during the rain, especially in the Eastern part of Tjandi hill area. This project was part of the city drainage programs and it was built at the foot of the Semarang hills. It divides the water running from the hills between two floodways. The cost of the Siranda Canal construction amounted to about f 260.000 ( $\approx 117\,982,79$  Euro). It was financed by the centre government (the Dutch government in Batavia) and the municipality. The centre government supported half of the total cost.

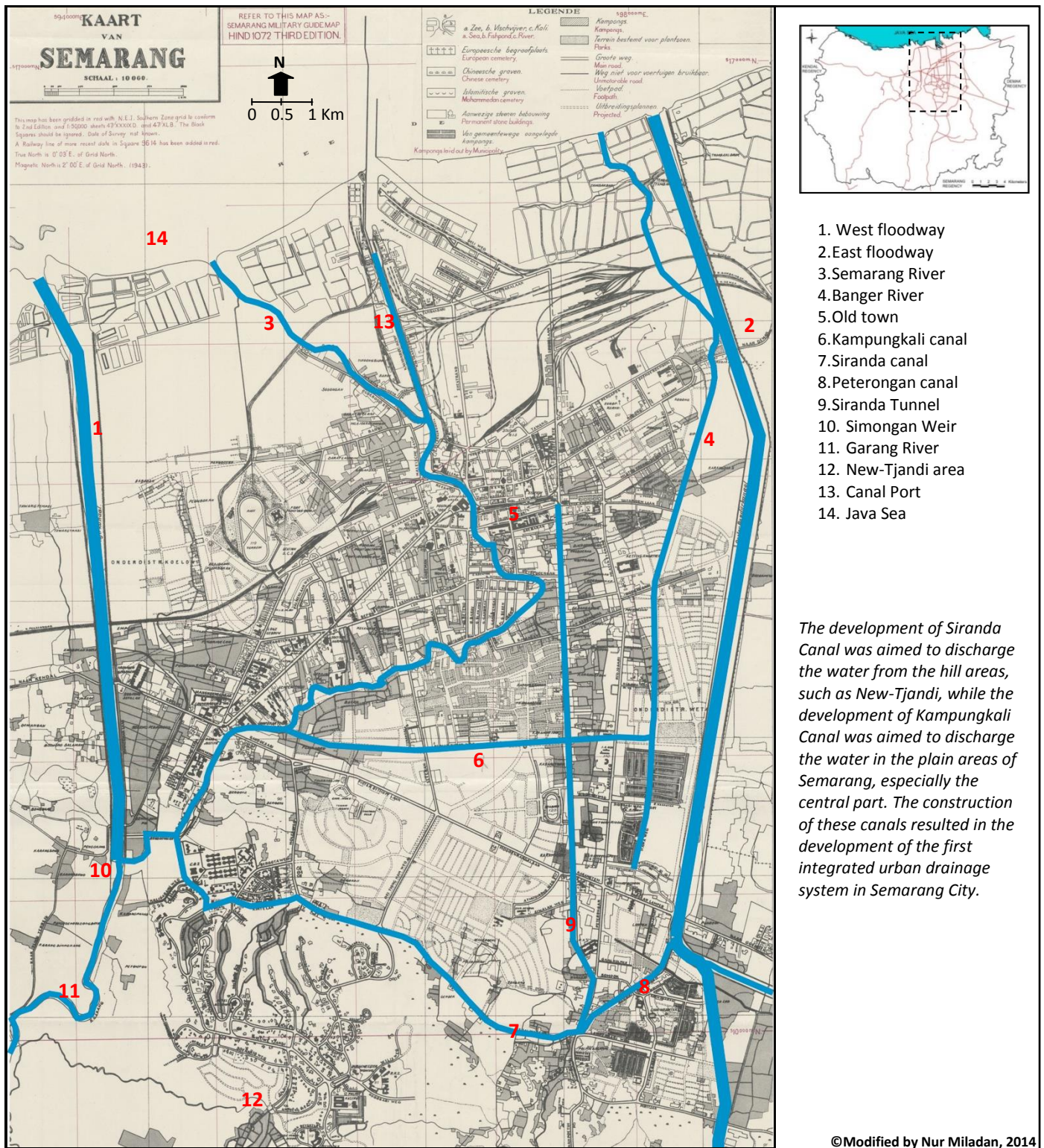
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<sup>158</sup> *Gedenkboek van der Gemeente Semarang 1906-1931*, 1931, Semarang: N.V. Dagblad de Locomotief.

<sup>159</sup> In year 2002, 1 €  $\approx$  2, 20371 Gulden. However, since that time Gulden has not been used.

<sup>160</sup> “De afwatering van Semarang”, *I.B.T. Locale Techniek*, 1936, n<sup>o</sup>. 5, September 1936.

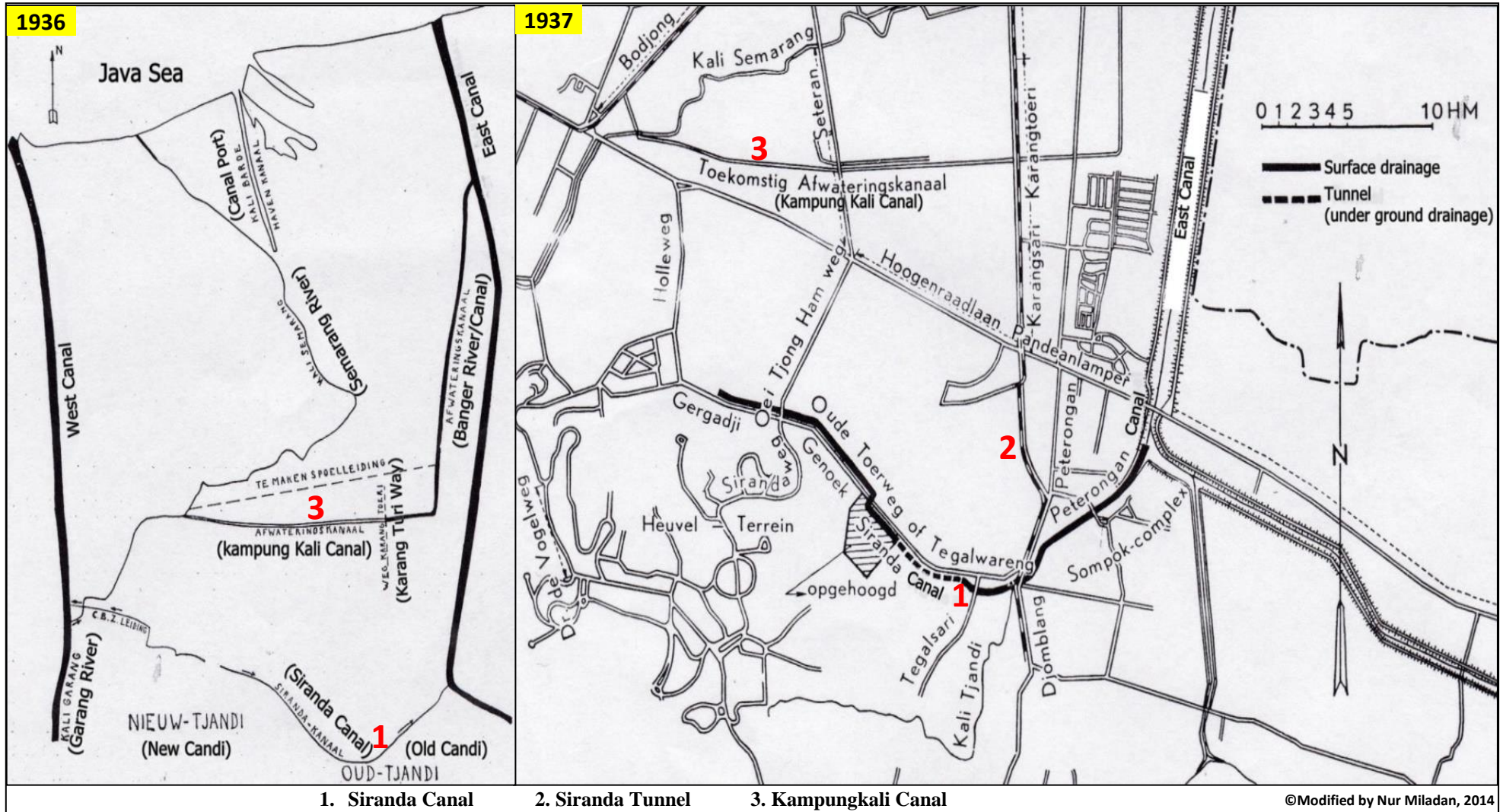
<sup>161</sup> “De aanleg van het sirandakanaal in de stadsgemeente Semarang”, *I.B.T. Locale Techniek*, n<sup>o</sup> 3, May/June 1937.



**Figure 31. Canal (urban drainage) system in the Dutch government era**

Source: Svy.Dte. AFNEI, *Semarang Military Guide Map Hind 1072 Third edition* [Map], 1946, KITLV, Leiden; "De afwatering van Semarang", *I.B.T. Locale Techniek*, 1936, n<sup>o</sup>. 5, September 1936; "De aanleg van het sirandakanaal in de stadsgemeente Semarang", *I.B.T. Locale Techniek*, n<sup>o</sup> 3, May/June 1937.

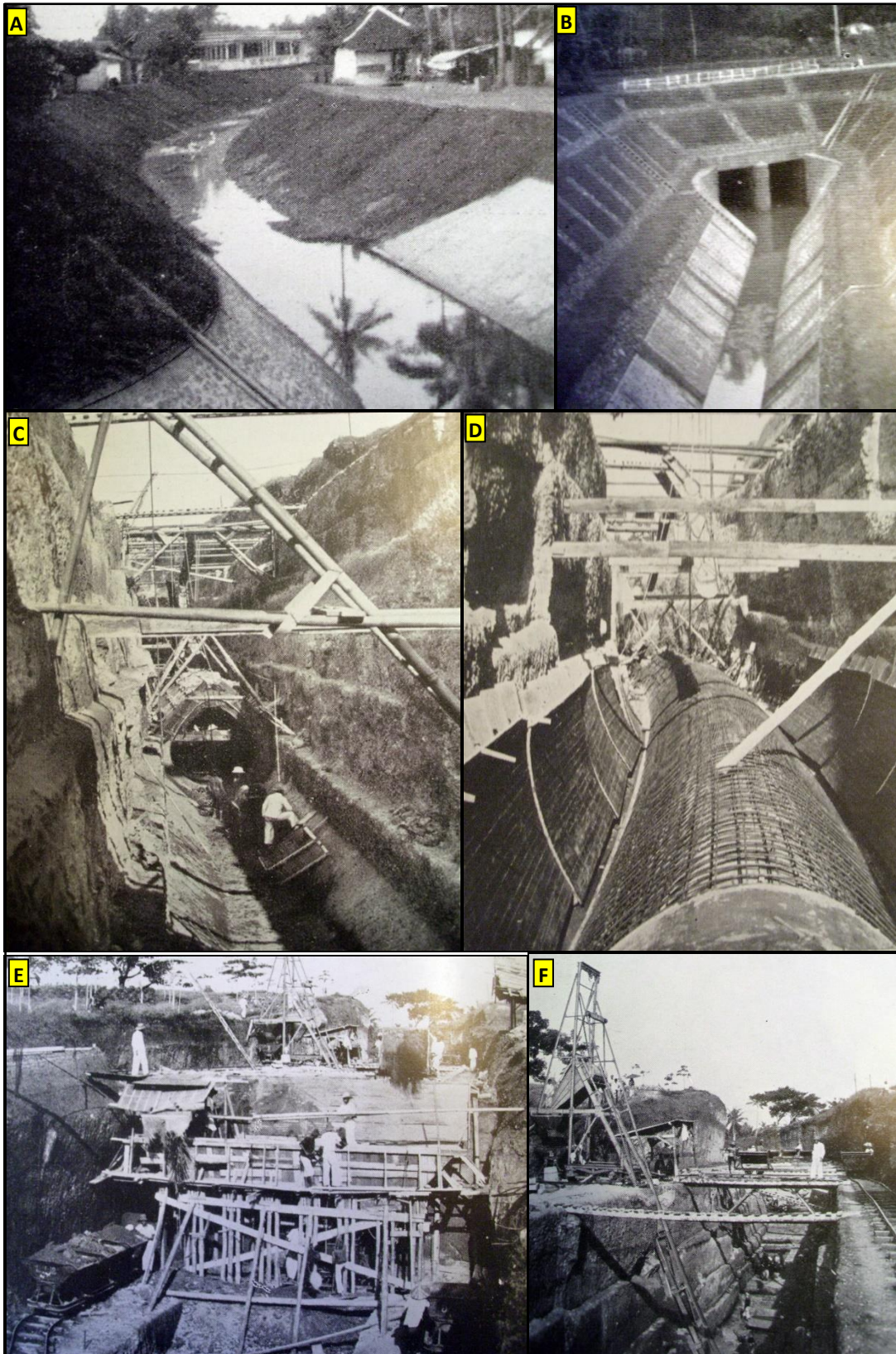




**Figure 32. Development plan of Siranda Canal**

Source: “De afwatering van Semarang”, *I.B.T. Locale Techniek*, 1936, n° 5, September 1936; “De aanleg van het sirandakanaal in de stadsgemeente Semarang”, *I.B.T. Locale Techniek*, n° 3, May/June 1937.





A and B: Siranda Canal  
 C and D: construction of  
 Siranda Tunnel  
 E and F: construction of  
 Siranda Canal

*The Siranda Canal was built on a distance of approximately three kilometers, and was included into the underground drainage (tunnel) and the surface drainage. The tunnel was located at 10 meters under the ground level and measured 2.85 meters X 2.50 meters. The design of the canal was adapted to the precipitation intensity and the urban geomorphology. This canal was connected to Kampungkali Canal (toekomstig afwateringskanaal) and Peterongan Canal connecting to East Canal. Peterongan Canal was built before the existence of Siranda Canal, while Kampungkali Canal was likely built after the Siranda Canal construction. Nevertheless, there were no detail records of the constructions of both canals.*

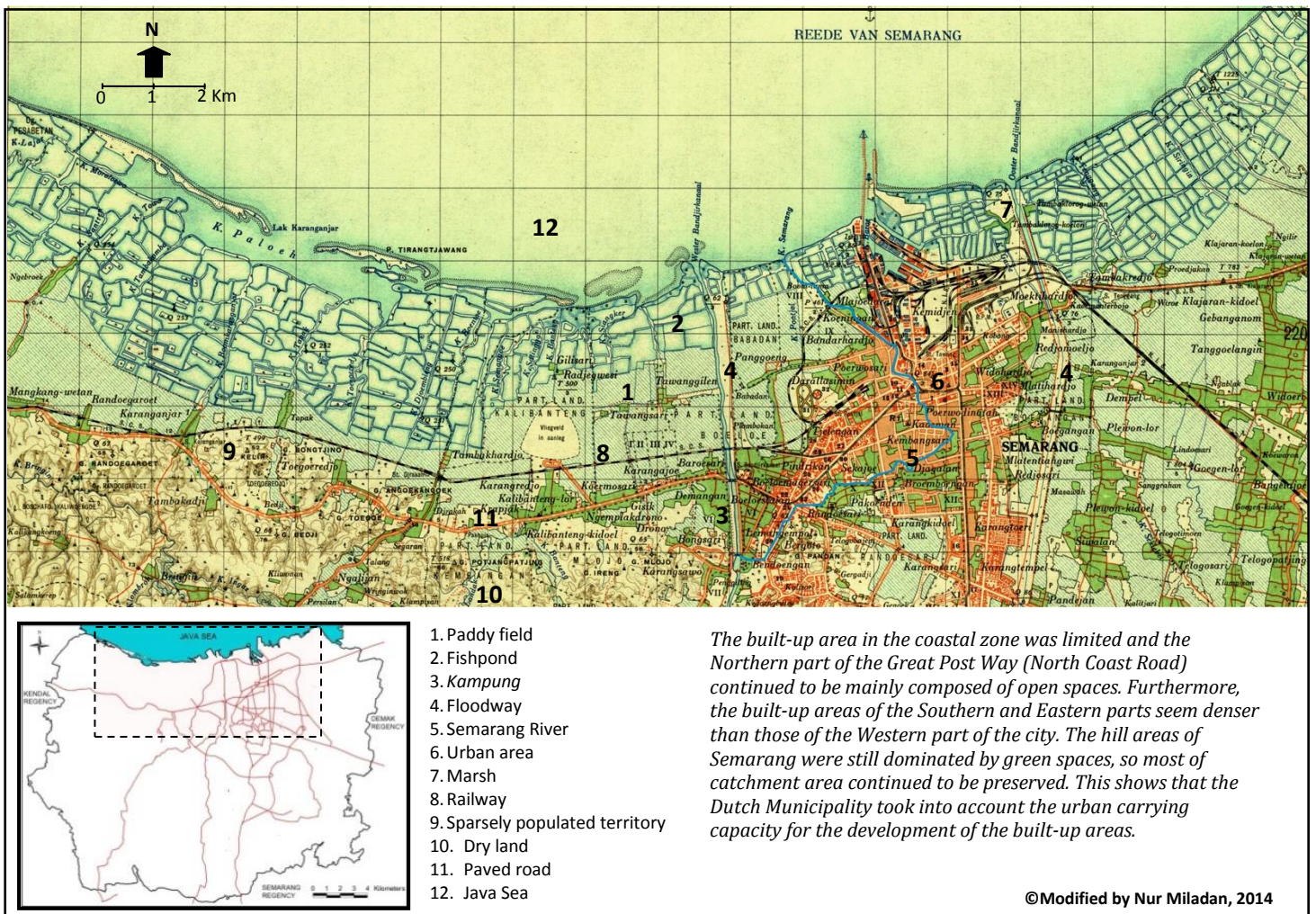
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**Figure 33. Siranda Canal and its construction process**

Source: "De aanleg van het sirandakanaal in de stadsgemeente Semarang", *I.B.T. Locale Techniek*, n° 3, May/June 1937.



Besides these canals, the municipality also constructed connecting local drainages from the settlements to the canals (main drainages). At that time, the canal constructions and the improvement of the settlements were the urban strategies were implemented by the municipality to solve the city problems including the flood risk and the unhygienic urban situations. On the other side, the existence of flood risk did not influence the urban growth and population. The migrants from the hinterlands were starting to settle in the areas between New-Tjandi (hill) and the old town. New-Tjandi was dominated by the Dutch inhabitants who moved from the old town. Meanwhile, the communities of *kampung* remained around the old town area. Moreover, the urban development was related to the development of several urban facilities, such as the new port – Tanjung Mas – Port in the Eastern part of the canal port (1924) and the airstrip for the military zone in the Western part of the city (1937).



**Figure 34. Urban land use in the end of the Dutch government era**

Source: Reproductiebedrijf Topografische dienst, *Semarang Herzien door den Topografischen dienst in 1937* [Map], 1938, KITLV, Leiden.

Until the end of the Dutch government era<sup>162</sup>, the urban area developed in the periphery of the old town and it created new centres of activities. This accelerated urban growth, which moved from a monocentric model to a polycentric one. However, the old town remained the main urban centre for trade and offices of Semarang City. Meanwhile, the urban periphery was still dominated by the Javanese *kampung*.

Urban growth was highly controlled by the municipality. The development of the coastal area was limited and only used for agricultural activities, such as fishponds and rice fields. Urban development was particularly carried out in the Southern and Eastern parts of the city. The Dutch municipality followed several appropriate strategies to improve the city conditions. The flood risk was finally reduced through the canalization projects and the housing rearrangement projects. Nevertheless, the whole of the urban plans could not be implemented as the Second World War took place. During the Japanese occupation, Semarang experienced destructions and un-development.<sup>163</sup> Many Dutch buildings were destroyed. Local inhabitants suffered from the occupation and the wars, while Dutch inhabitants were imprisoned by the Japanese military. The old town was used as the Japanese headquarters. As a result, urban plans, such as the canalization system, were no longer carried out and not fully achieved. From 1945 to 1949, two governments ran Indonesia: the Dutch and Indonesian governments. Therefore, Semarang city went through several wars between the Indonesian military and the Dutch military. There is accordingly no record (data and information) on the urban plans and flood risk occurrences. It is noteworthy that the urban growth of the city stagnated.

### **1.3. The interaction between the projects of both government and private sector which modified the relationship of the city towards water**

Since the mid-1950s, Semarang City became the capital of Central Java Province.<sup>164</sup> This resulted from an initiative of the Dutch government through the ordinance of the city formation in 1948. In the 1950s, the transition of government from the Dutch Government to the Indonesian government took place. At that time, Indonesian cities were experiencing stagnation and the society life was very much influenced by the political situation.

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<sup>162</sup> The Japanese Empire occupation took place between 1942 and 1945 (during the Second World War). The Indonesian government proclaimed the Independence on August 17, 1945, while the Dutch government recognized its independence on December 27, 1949.

<sup>163</sup> Murtomo, *ibid.*

<sup>164</sup> *The Determination of the Regencies in the Central Java Province*, Act n° 10/1950, Jogjakarta: Ministry of Justice.



Indonesian cities were growing without apparent direction. Coastal cities in Java such as Jakarta, Surabaya and Semarang were experiencing a significant increase of population. The city planning programs were centralized by the Central Bureau of Planning or *Centraal Planologisch Bureau* (CPB) of the national government. This bureau was established in 1946 as an institution depending on the department of public works and reconstruction. The main program of this bureau focused on urban reconstruction, while spatial plans had not yet been the focus of urban development. In fact, the implementation of these programs was difficult. It was caused by managerial problems, such as the absence of experts, the weakness of organization infrastructures and legal basis.<sup>165</sup> Furthermore, as a consequence of the scarcity of urban data, the CPB had difficulties to organize the spatial planning of the Indonesian cities.

The model of spatial planning in Indonesia that originally followed the Dutch approaches started to follow the American approaches in 1957. This was influenced by the war between the Indonesian and the Dutch about the seizure of power in the Papua Island. At that time, all of the Dutch inhabitants left the Indonesian territory. Many American experts of urban planning came to Indonesia and they helped to initiate urban planning in Indonesian cities. The first school of urban planning in Indonesia was established in the late 1950s, and remained the only school of this kind (Bandung Institute of Technology) until the beginning of the 1990s. In addition, the school of civil engineering was developing significantly. This reveals that urban planning did not become the focus of education and research in Indonesia, but that urban construction was the focus of development from the 1960s to the 1990s. The growth of Indonesian cities was oriented towards urban construction approaches, while the intervention of social development approaches with respect to urban planning was not considered.

The lack of urban planning in Indonesia from the independence until the beginning of the 1990s also influenced the situation of Semarang urban plans. The urban development of Semarang was also oriented towards urban construction. The wars resulted in urban destructions in Semarang, so the municipality concentrated on urban improvements until the 1970s.

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<sup>165</sup> Roosmalen, P., 2004, “Awal Penataan Ruang di Indonesia (the roots of spatial planning in Indonesia)”, *Sejarah Penataan Ruang Indonesia 1948-2000* (History of Indonesian Spatial Planning 1948-2000), Jakarta: Departemen Permukiman dan Prasarana Wilayah, pp. 9-42.

Semarang urban plans started to be paid attention to in the 1970s. The first document of urban planning of Semarang is the City Master Plan for 1972-1992.<sup>166</sup> Furthermore, in 1972, the Commander of Territorial Commando “IV – Diponegoro” stated “It’s time to implement the development based on the urban plans”.<sup>167</sup> At that time, the military played the important role of supporting the municipality for the urban development.<sup>168</sup>

From the 1970s, the urban activities, such as the industrial activities, the commercial activities and the amusement activities, grew. Moreover, settlements were still expanding, especially the Southern part of the city. Besides the extension of the settlements, industrial activities developed, particularly in the Srandol area. Meanwhile, the rapid growth of settlements took place in Krobokan, Seroja, Pleburan, Darat, Jangli and Mrican which were located in the Southern part of the city.<sup>169</sup> Similarly to the Dutch government era, the Northern part of Semarang was still dominated by marsh and fishponds areas and it was characterized by a low density of building coverage. The old town had the highest density of built-up area (see Figure 35). The quality of the settlement deteriorated. Squats and slums grew around the old town. In conjunction with urban growth, Semarang City started to expand in 1976. As the capital of Central Java Province, it needed that expansion to facilitate the growth of urban activities and population.<sup>170</sup>

In conjunction with the urban expansion, the municipality released the urban master plan revision that was designed for years 1975 to 2000. The municipality planned the coastal area as an industrial zone and a zone of settlements. This plan is different from the Dutch municipality plan. During the Dutch government era, the urban development was led towards the South, while the North was only used for agriculture and as an open (catchment) area. In the spatial plan for 1975-2000, the Northern part of city was planned as a place of urban extension and of exploitation of the water spaces there.

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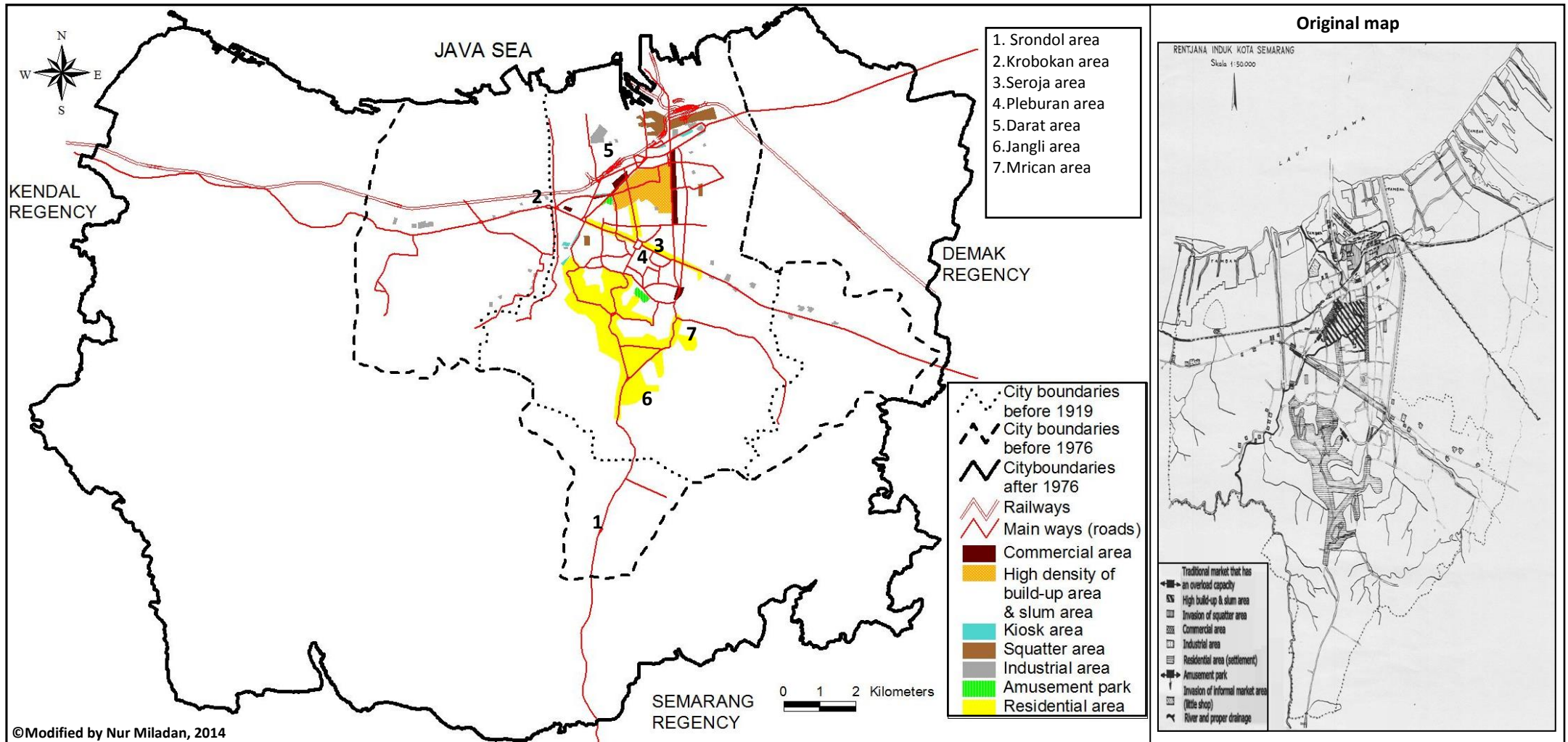
<sup>166</sup> It was made in 1971/1972 based on the regional regulation, n° 2/KEP/DPRD/’72 on April 4th, 1972, Semarang: Regional parliament.

<sup>167</sup> “Cita<sup>2</sup>semg.Kota Raya Jangan Hanya Impian”, *Suara Merdeka*, October, 10<sup>th</sup> 1972.

<sup>168</sup> In the New Order era, the military fulfilled the dual function of maintaining national security and order, and state authority and of managing the state.

<sup>169</sup> *Master Plan of Semarang City for 1975-2000*, 1975, Semarang: Department of Urban Planning and Settlement of Semarang City

<sup>170</sup> *Area Extension of Semarang City*, Government regulation n° 16/1976, Jakarta: Ministry of State Secretary.

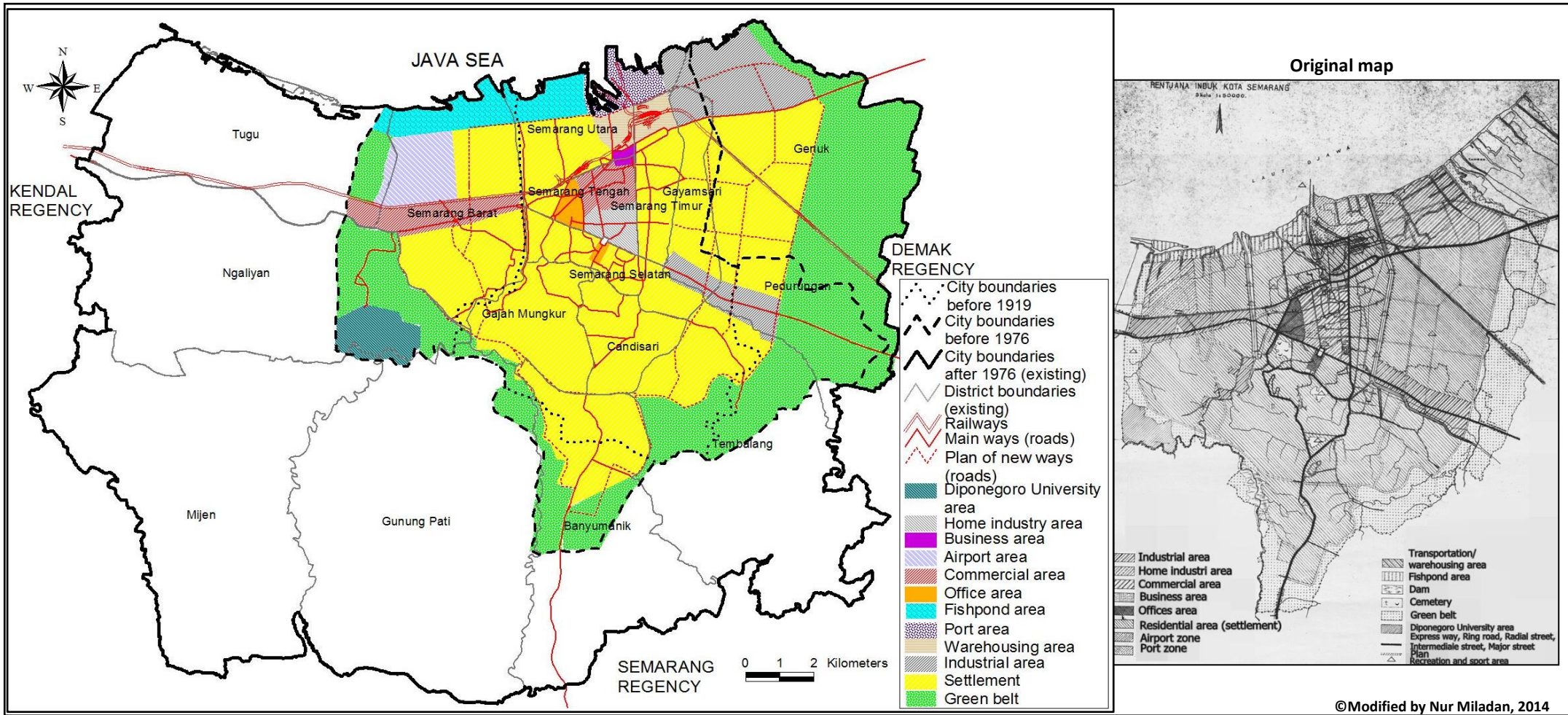


**Figure 35. Semarang urban area between 1967 and 1971 and its city extension**

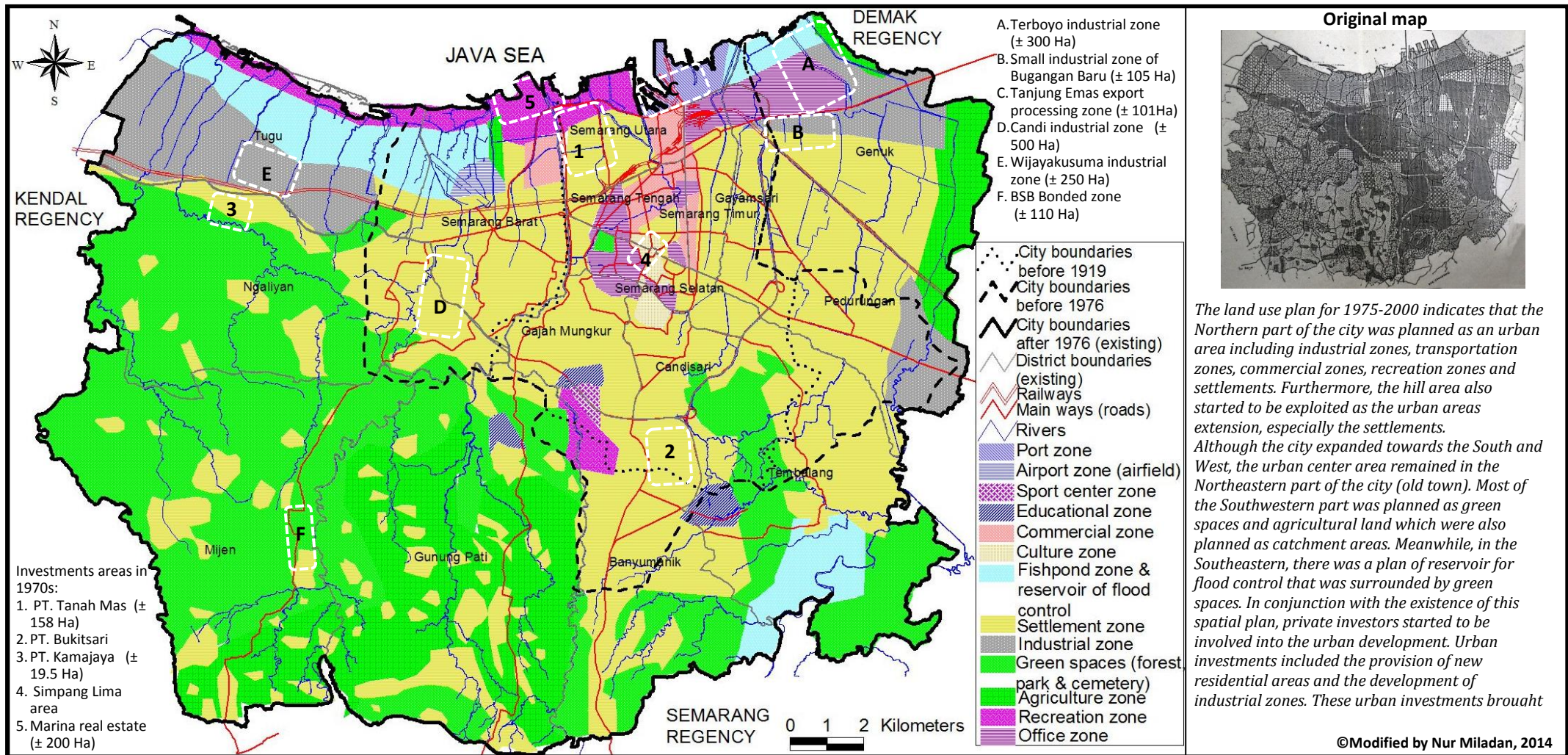
Source: “General analysis” [Map], *Master Plan of Semarang City for 1972-1992*, 1971/1972, Semarang: Department of Urban Planning and Settlement of Semarang City; *Urban Development Management Information System (UDMIS)*, 2001, Semarang: Regional Development Planning Agency (BAPPEDA).

*As the consequence of the inexistence of apparent direction of urban plans since 1950, the old town experienced a decrease of urban qualities. It became a zone with a high density of population. It was untidy. Meanwhile, the Northern part grew and turned into a squatter settlement which used the marsh area. Settlements grew in the Southern part. Furthermore, the New Candi area grew and turned into a residential area, as in the Dutch urban plan. Nevertheless, the urban area remained limited in the old city of Semarang (Dutch government era). On the other side, the extension of Semarang City, which went from 99,4 km<sup>2</sup> to 364,81 km<sup>2</sup>, influenced the extension of Semarang urban area in the next decades.*









**Figure 37. Land use planning of Semarang City in the mid-1970s and in the existing investment areas**

Source: "Land use plan" [Map], *Master Plan of Semarang City for 1975-2000*, 1975, Semarang: Department of Urban Planning and Settlement of Semarang City; *Urban Development Management Information System (UDMIS)*, 2001, Semarang: Regional Development Planning Agency (BAPPEDA); Indonesia Industrial Estate Directory, *Profil daerah Kota Semarang Kawasan Industri*, 2011-2012, retrieved December 28<sup>th</sup>, 2015, from Indonesia Investment Coordinating Board, <http://regionalinvestment.bkpm.go.id>.

In the mid-1970s, three large real estate's ventures built new housing estates in the coastal area and also in the hilly area. PT. Tanah Mas built the housing estate in the North, while PT. Bukit Sari developed the Southern part (Gombel Hill) and PT. Kamajaya built in the West (district of Ngaliyan).<sup>171</sup> The municipality started to give opportunities to the private sectors to be involved in urban investments. Furthermore, Simpang Lima zone became the new centre of Semarang city in the early 1970s (built in 1969). According to Sadono (1992), Soekarno designed it as an area for governmental, cultural, religious, and educational purposes that should be able to contain a million people and also exactly one year after being built, some modern retails were also developed in the area.<sup>172</sup> This reveals the various urban investments made at that time. Urban development relied on investments based on market ability or private sector. On the one hand, the role of the private sector substantially influenced urban development. But, on the other hand, the master plan of Semarang could not be optimally implemented, given the pressures of private sector investments. The private sector was indispensable to provide high investments, since the municipality had a limited budget for urban development.

From the mid-1980s, Semarang experienced a rapid growth of industrialization. The Department of Commerce of Semarang City<sup>173</sup> was established in 1977 to support the industrialization process and trade, while the national government has planned to implement industries in several big cities in Indonesia such as Semarang City since the 1980s. The industrialization process in Indonesia began in the 1970s.<sup>174</sup> However, Semarang industrial process occurred as soon as in the 19<sup>th</sup> century,<sup>175</sup> which was marked by the development of sugar factories under the Dutch government era. According to Solechedi<sup>176</sup>, industrial investment in Semarang City started in 1988, at the same time as the development of the industrial zone in the Semarang coastal area. The municipality set the industrial areas in the North-eastern part of the city for the investors to develop factories there.

The existence of the industrial zones in Semarang City was aimed to support the growth of the port activities. Initially, most of industrial development areas were in the

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<sup>171</sup> Pratiwo, *ibid.*; "BPN siap menata tanah PT. Kamajaya", *Suara Merdeka*, April 28<sup>th</sup>, 2004.

<sup>172</sup> Rukayah, Bharoto, 2012, "Bazaar in Urban Open Space as Contain and Container Case Study of Alun-alun lama and Simpang Lima Semarang, Central Java, Indonesia", *Elsevier: Procedia-Social and behavioral Sciences*, vol. 50, pp. 741-755.

<sup>173</sup> Nowadays, it's namely the Department of Industry and Commerce.

<sup>174</sup> Ishida, M., 2003, *Industrialization in Indonesia since the 1970s*, Chiba: Institute of Developing Economies.

<sup>175</sup> Hayati, C., 2004, *Partisipasi wanita dalam industrialisasi di Semarang, 1930-1970; Tenaga kerja wanita pada industri rokok dan jamu di Kota Semarang Tahun 1900-1965*, Semarang: Pusat studi wanita/gender, Diponegoro University.

<sup>176</sup> Head of Indonesian Chamber of Commerce and Industry of the Central Java Province at Period 2006-2011.



surroundings of Tanjung Mas Port. This became the principal factor explaining the high migration towards Semarang coastal area. The municipality and the national government decided to support the intensive labor industry and consequently, many people from the hinterlands of Central Java Province came to the Semarang coastal areas to get jobs. They worked as industrial labours and did informal jobs around these areas. Informal jobs included porters in the Johar market<sup>177</sup> and the industrial areas, stevedores in Tanjung Mas Port, hawkers in bus (Terboyo) and railway stations (Tawang and Poncol), and drivers of pedicabs, motorcycle taxis and mini buses.

At the same time, fishery from the Semarang coastal area was very productive and marine fish was also very abundant. As a result, fishermen and fish farmers from other parts of Java and other islands, such as Borneo, Sulawesi and Sumatera came to the area. From then on, the population of Semarang City grew rapidly, and the coastal area became a strategic place. The growth of urban activities in the Semarang coastal area produced a high demand of housing. At that time, land use changed enormously. Fishponds and marshes turned into urban areas, including industrial zones and settlements after private actors as well as the self-helps of communities requested them. On Semarang coast, the upper middle class preferred to stay in the planned settlements, such as Tanah Mas Real Estate, Puri Anjasmoro<sup>178</sup> (Marina Beach Real Estate) and Semarang Indah. Meanwhile, the lower middle class settled in the *kampung* areas. From that moment, *kampung* located in the Semarang coastal area developed rapidly without proper infrastructures. Consequently, this aggravated the poor condition of the settlements. In conjunction with urban growth, the national government launched the *Kampung* Improvement Program (KIP) project, which was carried out between the 1970s and the 1980s. This program was executed through the improvements, in the *kampung* areas, of the infrastructure systems, such as water supply, drainage, sanitation and waste. This project was implemented in several cities, such as Jakarta, Surabaya, Semarang, and Surakarta (Java Island); Ujung Pandang (Sulawesi Island); Banjarmasin, Pontianak, and Samarinda (Kalimantan Island); Denpasar (Bali Island); Padang and Palembang (Sumatera Island).<sup>179</sup> In Semarang City, the KIP Project was carried out in the *kampung* areas, which represented 85,9 Ha. The local drainages were improved, which was

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<sup>177</sup> Johar market is a traditional market center in Semarang. It was designed by Thomas Karsten during the colonial era.

<sup>178</sup> Puri Anjasmoro Real Estate was built in 1988.

<sup>179</sup> Manaf, A., 2005, *Ansätze zur Entwicklung von neuen Wohnvierteln mit Bewohnerbeteiligung für niedrige Einkommensgruppen in Indonesien, Modellprojekte in Semarang im Vergleich*, Ph.D. Dissertation in Landscape Planning, Kassel University.

seen as the problem solving of inundation risk.<sup>180</sup> This project was successful with respect to the quality of the constructions in the settlements, but it was less successful with respect to social conditions, such as poverty, community involvement, and convenience of residing.<sup>181</sup> Furthermore, this program was not fully development program carried out by the local government, while the role of society participation has not seemed yet in the practice of the program.<sup>182</sup> *Kampung* improvement and the conflicts it engendered remained a local but important urban issue at the end of the colonial time in Semarang, an unsolved problem which years later Indonesians themselves would attack.<sup>183</sup> Despite the fact that the KIP project had positive impacts on the settlement qualities in the early 1980s, the flood risk actually carried on and became the crucial problem of Semarang City. This program managed to reduce the inundation vulnerabilities of the *kampung* areas through the local drainage improvements, but only temporarily and, several years later, the flood risk increasingly threatened the city, together with the urban growth phenomenon.

In addition, in the 1970s and 1980s, the local governments (municipality and province) cooperated with several investors to develop certain urban areas, particularly around the Semarang coastal area, in order to implement the city master plan.<sup>184</sup> The local governments allowed the investors to expand the Semarang coastal area by converting the land and reclaiming the urban area developments, such as settlements, recreation areas, commercial and business areas and transportation areas, thereby anticipating urban growth. Planned settlements, such as Tanah Mas, Puri Anjasmoro and the recreation areas, were thus built in Semarang coastal area through land conversion and reclamation during the 1970s and the 1980s. Land reclamation in Semarang City was carried out, starting from 1985, to enhance luxury residential areas, the PRPP zone<sup>185</sup>, Maerokoco, Marina Park and Cinema 21 (recreation areas).<sup>186</sup> Moreover, Tanjung Mas Port area and industrial zones were also

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<sup>180</sup> *Pelaksanaan Repelita II (bidang perumahan rakyat dan permukiman)*, (1979, August 16), Jakarta: (Ministry of Information); *Pelaksanaan Tahun Pertama Repelita III (bidang perumahan rakyat dan air minum)*, (1980, August 16), Jakarta: (Ministry of Information), retrieved December 28<sup>th</sup> 2015, from <http://old.bappenas.go.id/>.

<sup>181</sup> Kismartini, 1993, *Peran program perbaikan kampung dalam peningkatan kualitas hidup masyarakat di Kotamadya Semarang* (the Role of *Kampung* improvement program in the improvement of the community quality of life in Semarang municipality), Master thesis in Assessment of Environmental Science, Indonesia University.

<sup>182</sup> Adiyanta, F.C. S, Warno, N.D., Triyono, 1999, *Kampung Improvement and Urban Renewal Program in Semarang Municipality as an Effort to Maintain Space Arrangement Quality that has been settled*, Faculty of Law, Diponegoro University.

<sup>183</sup> Cobban, J.L., 1988, “Kampung and conflict in Colonial Semarang”, *Journal of Southeast Asian Studies*, vol. XIX, n° 2, Singapore University Press.

<sup>184</sup> The Central Java Province has some property assets in Semarang City as capital of that province.

<sup>185</sup> PRPP is the abbreviation of *Pekan Raya dan Promosi Pembangunan/ Exhibition and Development Promotion*.

<sup>186</sup> Hadi, S.P., 2004, “*Reklamasi Marina mengapa diributkan ?*”, *Suara Merdeka*, September, 7<sup>th</sup> 2004, retrieved December 28<sup>th</sup> 2015, from [www.suaramerdeka.com](http://www.suaramerdeka.com).

extended through land reclamation from the 1980s. The municipality set limitations with respect to land availabilities, regarding especially the urban areas (settlement areas, commercial areas, and industrial areas), which caused the land reclamation decision in Semarang coastal area.<sup>187</sup> Nevertheless, it realized that they had several negative impacts, throughout the Semarang coastal area, such as abrasion, accretion, and the change of hydrodynamics. Land reclamation in the 1980s and the 1990s was not based on any environmental impact analysis. For instance, PT. IPU<sup>188</sup> implemented land reclamation representing approximately 20 Ha in the Western part of the Marina zone without being supported by an environmental assessment.<sup>189</sup> Environmental impact analyses of land reclamation were not taken into account in the context of urban development before 1996.<sup>190</sup> In Semarang City, the mechanism of land reclamation started to be regulated in 2004, in conjunction with the revision of spatial planning. Even then, it was only subject to a mayor decision that was issued in relation to the land use planning and it remained only the legal formality.<sup>191</sup> These elements shed light on the growth of flood risk, especially because the Semarang coast features were less taken into account while planning urban development at that time. Land reclamation, as a way of urban development eventually became a cause of flood risk growth. The lack of land use control by the municipality and the fact that market forces and communities' self-help drove urban development in the 1980s and the 1990s resulted in the existing land use and the spatial plan being inconsistent. There was also a lack of law enforcement in relation to urban planning violations.<sup>192</sup> The development of the settlements, commercial areas, recreation areas, warehousing areas, and industrial areas, particularly along the Semarang coast, did not comply with the city plan. The master plan of Semarang metropolitan fail to established urban fabrics, urban cohesion and urban coherence on a complex city.<sup>193</sup>

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<sup>187</sup> Regional Development Planning agency, 2006, *Reklamasi sebagai salah satu pilihan kebijakan pengelolaan wilayah pesisir Kota Semarang* [PowerPoint], Semarang.

<sup>188</sup> PT. IPU (Indo Perkasa Usahatama) is a company focusing on the urban land (properties) provision.

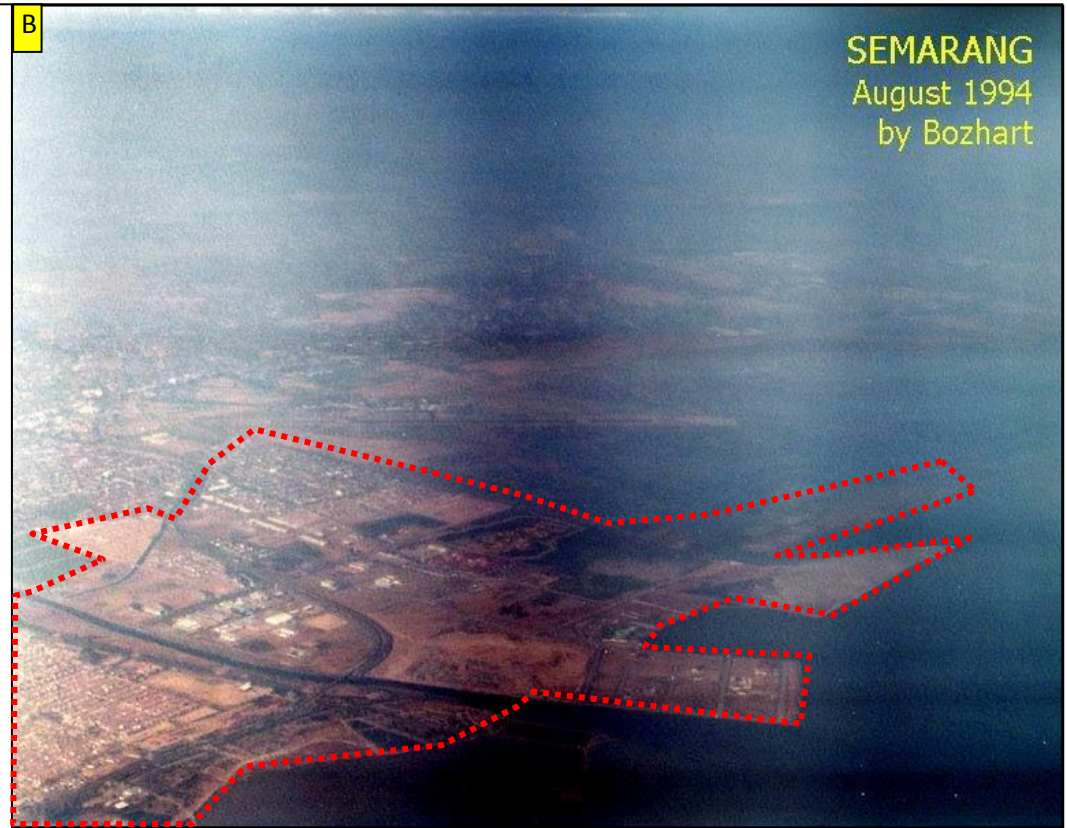
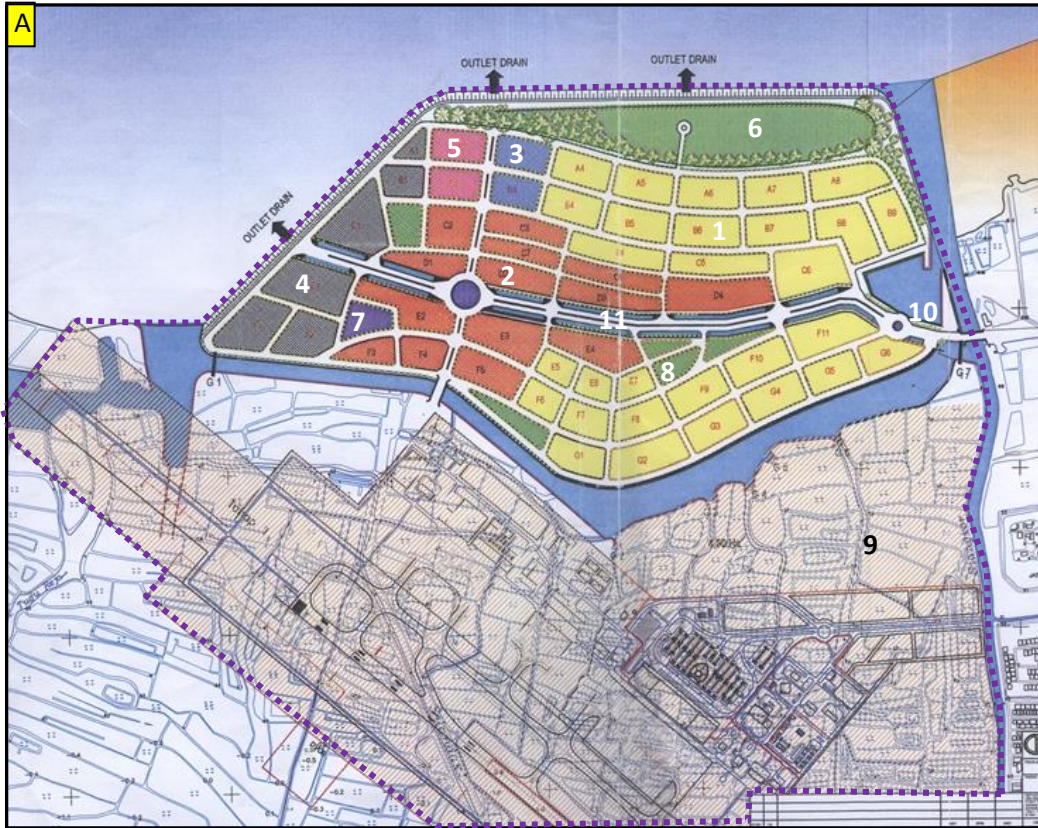
<sup>189</sup> Sasongko, D.P., "Marina dalam regulasi amdal", *Suara Merdeka*, June, 9<sup>th</sup> 2005, retrieved December 25<sup>th</sup> 2015, from [www.suaramerdeka.com](http://www.suaramerdeka.com).

<sup>190</sup> *Regulation of the status of the land arising out and the land reclamation*, Circular of Head of National Land Authority, n° 410-1293, May 9<sup>th</sup> 1996, Jakarta: Ministry of Agrarian Affairs/ National Land Agency.

<sup>191</sup> Maskur, A., 2008, *Rekonstruksi pengaturan hukum reklamasi pantai di Kota Semarang*, Master Thesis in Law Studies, Semarang: Diponegoro University.

<sup>192</sup> The first urban planning Act in Indonesia was enacted in 1992. Nevertheless, the enforcement of this Act in the 1990s and in the 2000s remained sketchy. In 2007, this Act was revised in order to enforce the practices of urban planning in Indonesia.

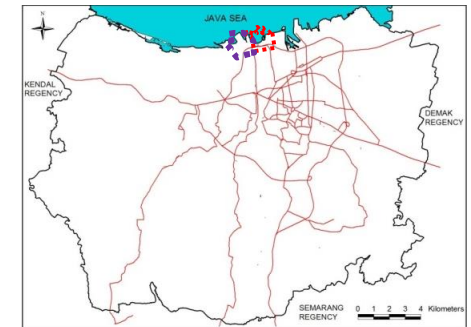
<sup>193</sup> Setioko, B., 2010, "The Methamorphosis of a Coastal City (Case study Semarang Metropolitan)", *Journal of Coastal Development*, vol. 13, n° 3, June 2010, pp. 148-159.



1. Residential area
2. CBD area
3. International education area
4. Light industrial zone
5. International hospital
6. Recreation area
7. Retention basin
8. Open space (park)
9. Airport area extension
10. Greenbelt of way
11. Open drainage

Figure B shows several areas of land reclamation (conversion) in Semarang Coastal area that were carried out from the 1970s to the 1990s (1994). These areas originated from the marsh and the sea which were converted into lands for urban development and which took forms such as settlements and recreation areas. These land reclamations were not based on the assessment of environment impact analysis including the estimation of flood risk impacts. In the East of these land reclamations are the port area and the industrial areas that were also developed through land reclamation (conversion). Besides the roles of private actors, the land conversions in Semarang coastal city were done by the inhabitants to develop the kampung areas as the result of urbanization in Semarang coastal area. In the 2000s, the Western part of these areas started to develop, also through land reclamation. Figure A shows the land reclamation plan (2004) in the fishpond area and the sea and until now, these activities have still been ongoing.

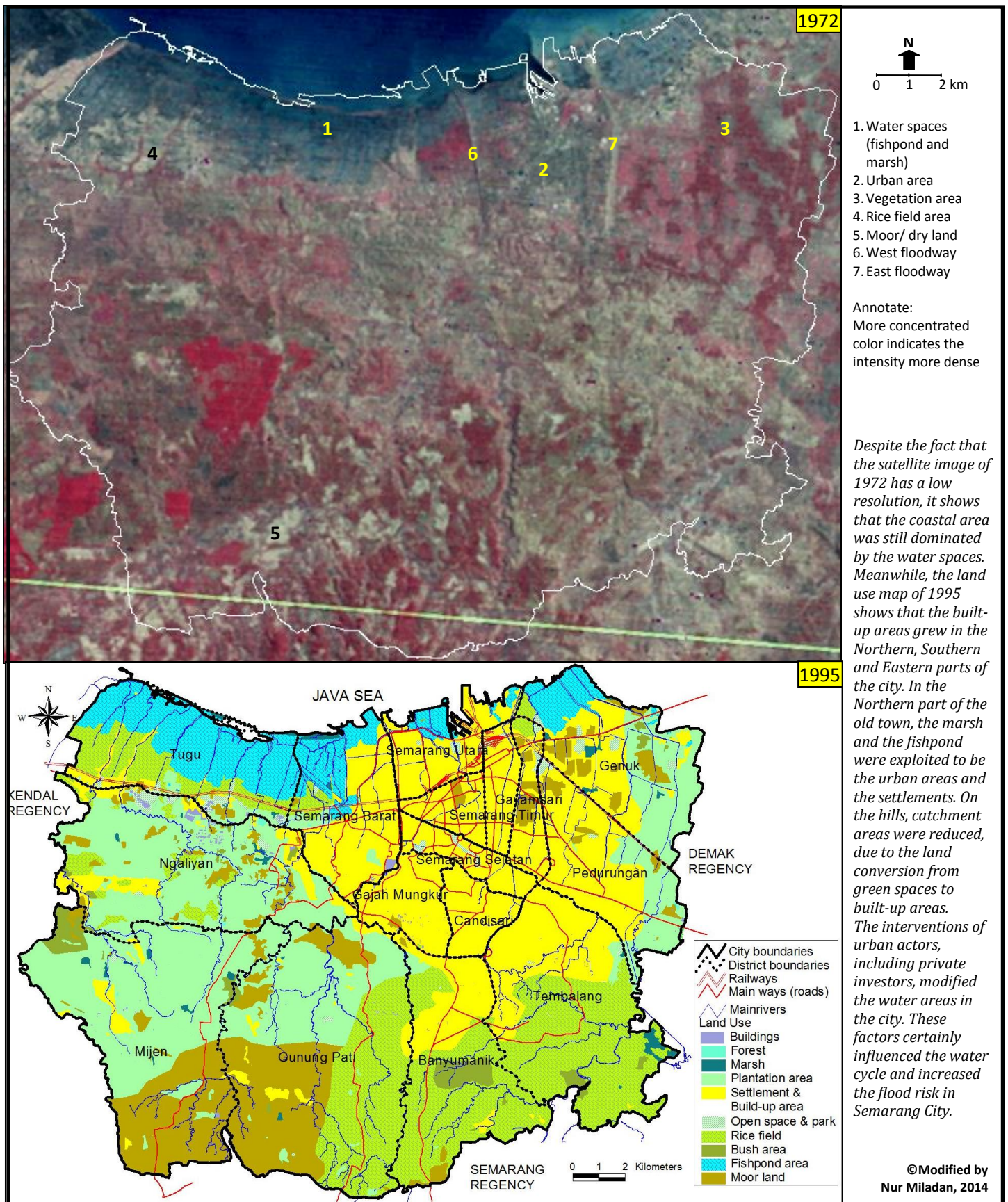
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**Figure 38. Land reclamation area (1994) and land reclamation plan of Marina zone (2004)**

Source: Bozhart, *Semarang August 1994*[Photo], May 31<sup>th</sup> 2008, retrieved December 28<sup>th</sup>, 2015, from <http://www.skyscrapercity.com/>; Reklamasi sebagai salah satu pilihan kebijakan pengelolaan wilayah pesisir Kota Semarang [PowerPoint], 2006, Semarang: Regional Development Planning Agency.





Despite the fact that the satellite image of 1972 has a low resolution, it shows that the coastal area was still dominated by the water spaces. Meanwhile, the land use map of 1995 shows that the built-up areas grew in the Northern, Southern and Eastern parts of the city. In the Northern part of the old town, the marsh and the fishpond were exploited to be the urban areas and the settlements. On the hills, catchment areas were reduced, due to the land conversion from green spaces to built-up areas. The interventions of urban actors, including private investors, modified the water areas in the city. These factors certainly influenced the water cycle and increased the flood risk in Semarang City.

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**Figure 39. High urban growth in the centre of Semarang coastal area between the 1980s and the 1990s**

Source: Landsat Satellite Image in 1972; UDMIS, *Ibid.*

Over the years, the built-up areas have continuously expanded without suitable urban plans. This indicates that the growth of urban constructions has been given more weight than urban planning. The built-up area in the urban centre of Semarang coast has grown dense, while the hilly area has been expanding through new housing developments. The Semarang coast has been unplanned, which has resulted in the emergence of slum settlements. This will certainly increase the flood risk, which also relates to water space changes in the coastal and hill areas. The unpredictable urban flood risk caused by massive urban constructions has become an important factor of flood vulnerabilities in Semarang City. However, the urban risk assessment is an important element of urban plans in order to avoid urban problems. Urban growth in the areas at risk will threaten urban sustainability.

#### **1.4. *Rob*, a natural phenomenon which takes part in the aggravation of the hydrological risk**

The cities and towns of Java also experience disasters in the form of floods, the basic causes of which lie in the rapid and unplanned growth of the urban areas themselves.<sup>194</sup> In the case of Semarang City, the conservation spaces were turned into built-up areas; consequently, a degradation of the environment, such as floods and land subsidence, occurred. The unsuitability of urban growth and urban plans has resulted in disaster risks.

The lack of Semarang urban planning in the 1950s and the 1960s caused inundation risks. These risks occurred in most of urban zones that were developed on the marsh areas. Moreover, most of water spaces, including the rivers and the canals in Semarang City, experienced a phenomenon of high sedimentation, caused by erosion and urban waste.<sup>195</sup> This sheds light on the poor management of the urban drainage system of that time. Nevertheless, only a few records concern flood risk occurrences in Semarang City at that time. But the existence of the Javanese folk song *jangkrik genggong* shows that the communities remained aware of the flood risk threatening urban activities at that time.

“[...] Semarang kaline banjir, jo semelang rak dipikir, jangkrik upo sobo ning tonggo, melumpat ning tengah jogan [...]”<sup>196</sup> ([...] Semarang, its river is flooded, don't be lulled thoughtless, cricket comes to the stairs, and jump into the middle of floor [...]).

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<sup>194</sup> Hardjono, J., 1986, “Environmental Crisis in Java”, *Prisma*, Environmental Degradation. A Call for Action (n° 39), Jakarta: Institute for Economic and Social Research, Education, and Information (LP3ES), pp. 3-13.

<sup>195</sup> *Master Plan of Semarang City for 1975-2000*, 1975, Semarang: Department of Urban Planning and Settlement of Semarang City.

<sup>196</sup> Some lyrics of *Jangkrik genggong*.

These lyrics demonstrate that the flood risk in Semarang City was caused by the river overflows. The rivers often inundated the urban areas in the previous years; as a result, this risk was not a new urban problem in that period. Furthermore, the local newspaper *Suara Merdeka* of 14 and 15 January 1965 indicates that the heavy rains, which lasted several days, caused the floods that occurred in Semarang City.

“Since Monday evening, Semarang City has been moistened by the small rain, while, on Tuesday, the heavy rain and the high wind lasted all day long. It kept raining until Wednesday noon. In several chronic flood areas, during the rainy season, the water could not flow such as the crossroads of Depok Street, Gadjahmada Street and Dr. Djawa-Regang Street. Moreover, Semarang River has overflowed, and it has inundated *kampung* in the surrounding area.”<sup>197</sup>

“According to the report of the municipality, the rain has been pouring in Semarang City for three days. In Semarang Barat District, the flood has inundated half of Karangaju sub-district and Krobokan sub-district. The flood elevation is of about 75 centimetres in Karangaju sub-district and of about 30 centimetres in Krobokan sub-district.”<sup>198</sup>

In the 1960s and the 1970s, the municipality sought to prevent flood risks through the normalization of the urban drainages. It often dredged the sedimentation on the drainage surfaces, and often cooperated with other institutions, such as the military, to implement those efforts.

“The working groups of Semarang City, which will be formed in the sub-districts and the departments by the end of next month, will dredge the sedimentation on the drainages and will reconstruct the roads destructed by the rain (flood). According to the explicated centurion of military district 0733 Semarang City, Peltu Sudharno, the planning of the working groups has been formed at the meeting [...]”<sup>199</sup>

At that time, the normalization of urban drainages was the main solution taken by the municipality. There was no particular urban spatial plan to solve the flood risks and the municipality only implemented the existing urban drainage improvement plans without spatial organization plans. In the first urban master plan in 1971, the municipality mapped the existing drainage system that existed since the Dutch government era. Furthermore, it also drew the map of inundated urban areas. This plan could be used as the evaluation assessment of flood risk and also as the basic data necessary to flood risk reduction efforts in that era. Moreover, the municipality sought to reduce the flood risk through flood prevention projects.

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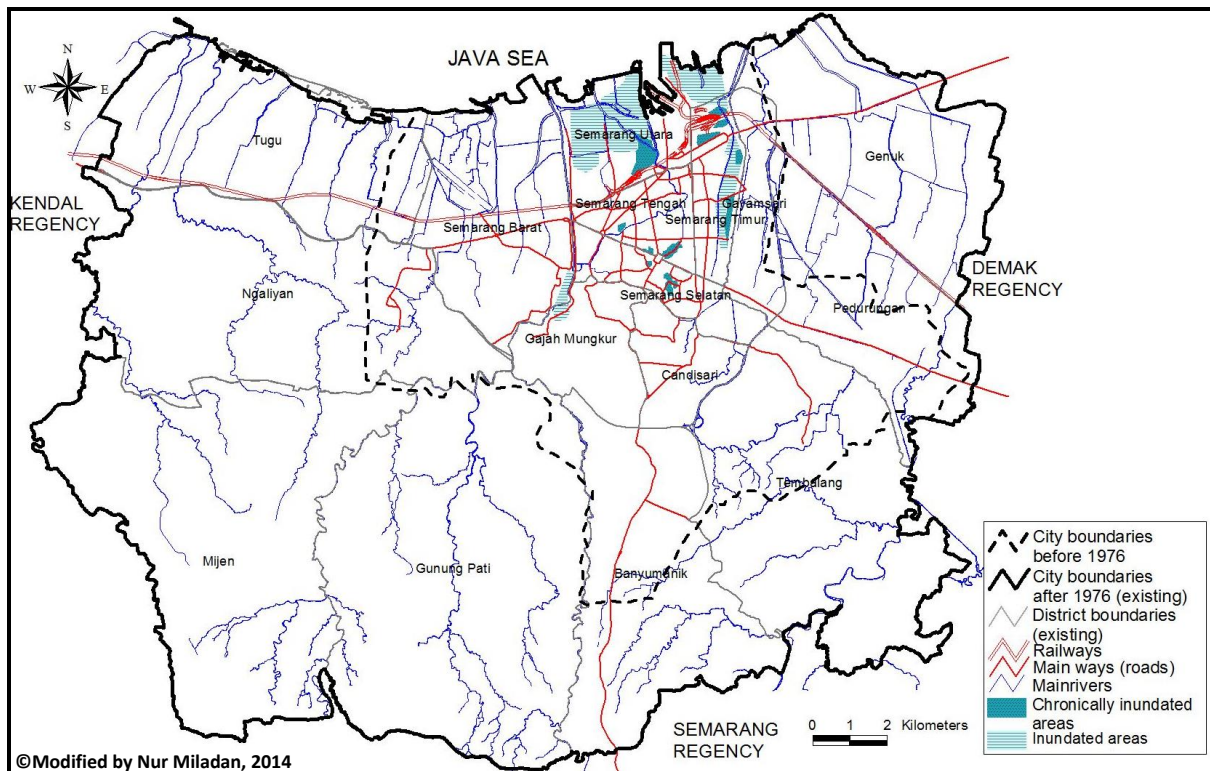
<sup>197</sup> “Semarang Dlm Genangan Hudjan Jg Tiada Hentinja”, *Suara Merdeka*, January, 14<sup>th</sup> 1965.

<sup>198</sup> “150 Rumah Penduduk Karangaju Tergenang Air”, *Suara Merdeka*, January, 15<sup>th</sup> 1965.

<sup>199</sup> “Regu<sup>2</sup> Kerdja Akan Bantu Wujudkan, Smg By Pass”, *Suara Merdeka*, January, 18<sup>th</sup> 1965.



For instance, in 1972, it carried out the normalization of the Semarang River. “Semarang River had been dug but the big drainage of Ki Mangunsarkoro Street did not let enough water flow, consequently the water level is the same with the level of the river banks”.<sup>200</sup>



**Figure 40. Inundated areas of Semarang City between the 1960s and the 1970s**

Source: “Irrigation and inundated areas” [Map], *Master Plan of Semarang City for 1972-1992, 1971/1972*, Semarang: Department of Urban Planning and Settlement of Semarang City; UDMIS, *Ibid*.

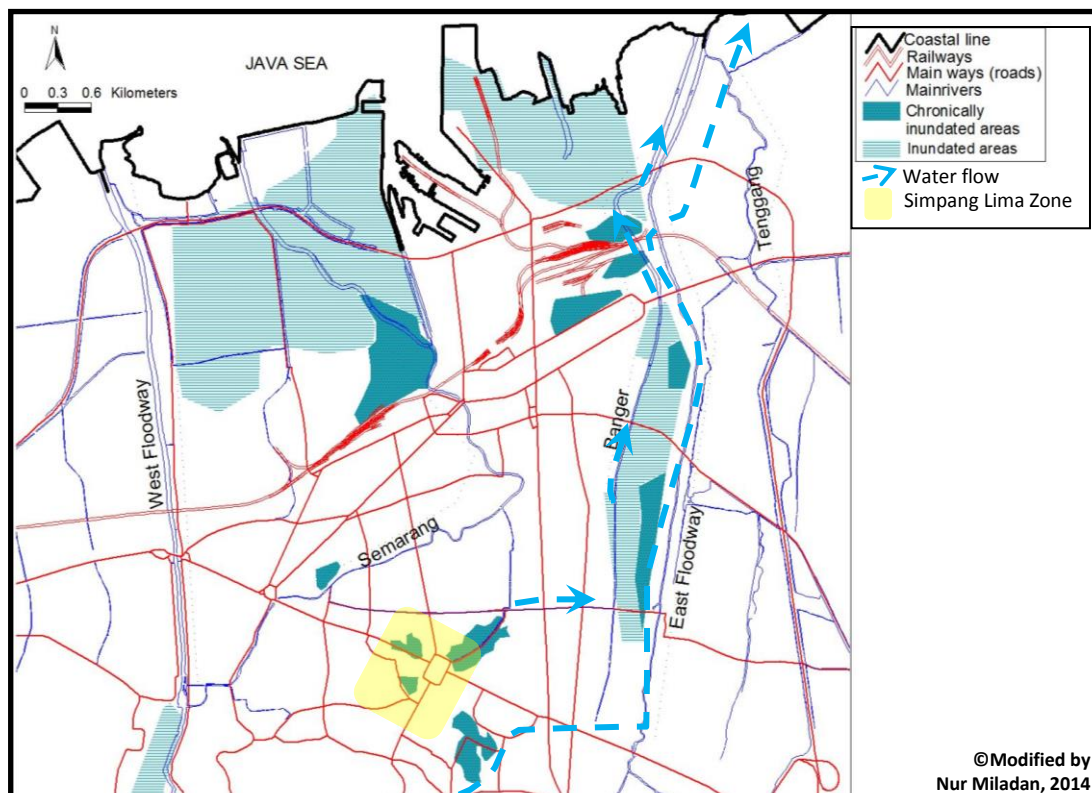
*The old town area was known as the chronically inundated area, while the area surrounding Semarang River was the inundated area. It seems that the urban center of Semarang City, particularly its Northern part, was highly vulnerable to floods. Nevertheless, during the urban developments that took place several years later, they became urban growth areas, and experienced massive land conversion and reclamation necessary to support urban growth and extension. Furthermore, most of inundated areas also remained around the urban drainage areas, such as rivers and canals.*

The municipality planned to solve the flood risk through infrastructure approaches, such as the improvement of the urban drainage system. Based on the urban master plan for 1975-2000, several strategies were planned to solve the flood risks, including the construction of reservoirs on several big rivers, such as Kreo River, Garang River, Kripik River and Babon River, the normalization of the existing reservoir and the existing dams, the normalization of the rivers and the canals through the dredging of sedimentation, the widening of the riverbed, the strengthening of the river dikes, the building arrangement around main rivers and canals,

<sup>200</sup> “Semg. Banjir”, *Suara Merdeka*, December, 15<sup>th</sup> 1972.



the building arrangement such as the fishpond and the settlements around the outfalls, the development of the urban drainage system including 8 sub-systems such as Semarang River, the East coast of the old town, the East canal and Babon river, the West Canal and Garang River, the West coast of the old town, Beringin River, Bosole River, and Blorong River, and also the mall reservoir surrounding Sriwijaya area. In conjunction with the urban drainage system plans, the municipality normalized the Banger River in 1975. It foresaw that this project could solve the floods in Semarang City, especially in the surrounding area of Simpang Lima. The water flow from Simpang Lima area was pumped and then it was channelled to the Banger River. This river was dredged as deep as one meter, along seven kilometres.<sup>201</sup> It was funded to the amount of IDR 20 million (1250 €) by the regional budget for the years 1974-1975 and it was done by 500 workers.



**Figure 41. Banger River improvement project in 1975**

Source: Master plan of Semarang City for 1972-1992 and UDMIS, *Ibid.*

*Simpang Lima zone, as a new urban centre, has been subject to the inundation risk since the 1970s, because of its poor drainage system. The Banger River, as an important urban drainage, is used for channelling the drain water from the urban area, including Simpang Lima zone. Several years later, this drainage system experienced sedimentation again. This was caused by natural sedimentation and waste from urban activities related to poor waste and sanitation infrastructures. Recently, in the Simpang Lima zone, flooding oftentimes took place, particularly during the rainy season.*

<sup>201</sup> “KalibangerSemg. MulaiDikeruk”, *Suara Merdeka*, December, 17<sup>th</sup> 1975.

During the same period, the national government, through the Department of Public Works (national government), drafted the Stormwater Drainage Master Plan for Semarang City. This document was designed by the American consultancy firm Burn & Mc Donnell together with Trans-Asia Engineering Associates, Inc. Several conclusions were drawn about the problems of Semarang urban drainage, including the lack of rainfall data, which complicated the urban drainages programs, and the effect of urban drainages affected by the sedimentation and the waste. The widening of several urban drainages was needed, and a low water flow had to be paved on the urban drainages in order to overcome high water flows. Waste had to be avoided on the drainages; only rainwater could flow on them. Rearrangement of the hills (upstream) areas was also necessary to reduce erosion. The consultants suggested three steps of urban drainage development to solve these problems.

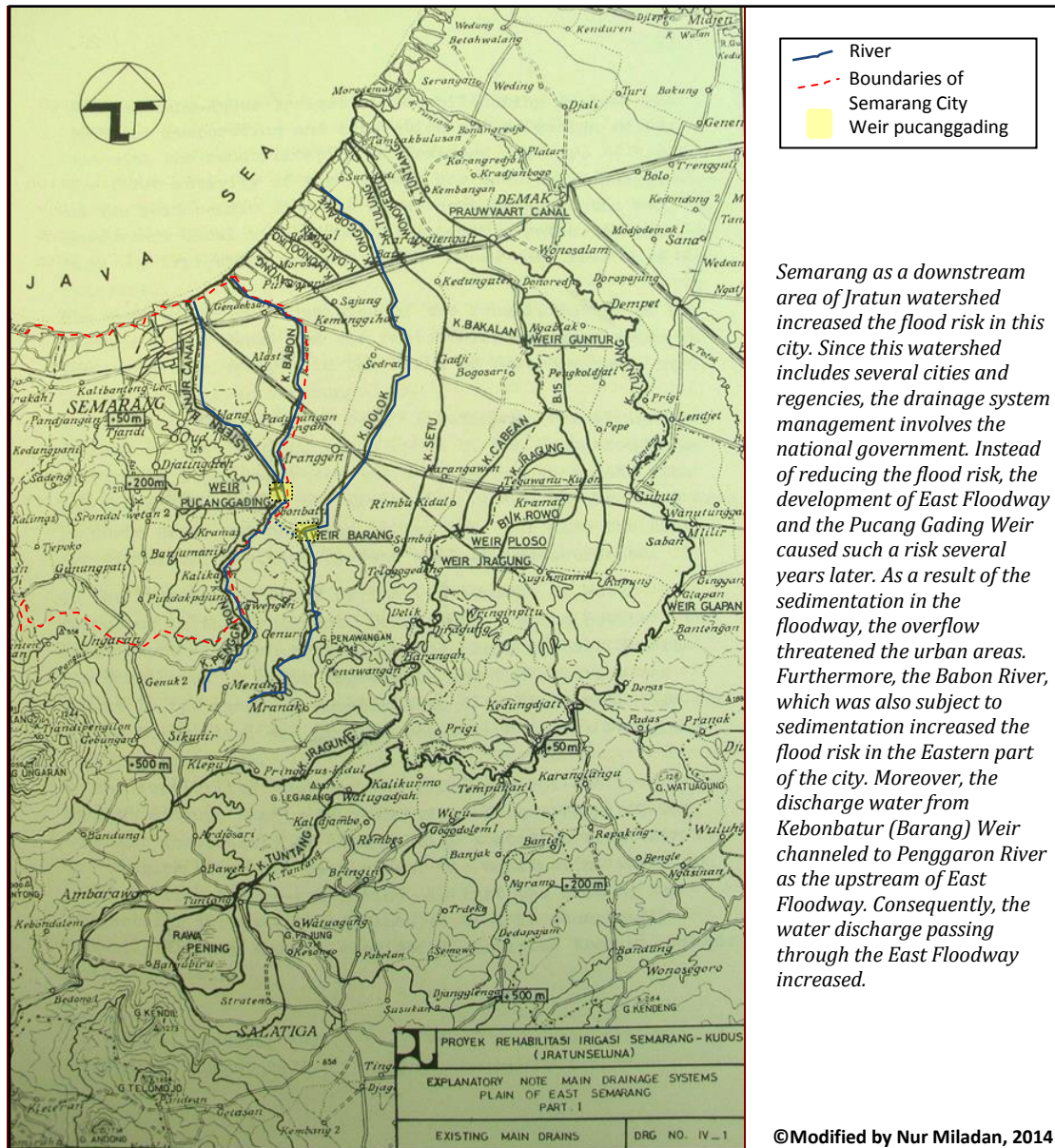
- Step 1 (until year 1980): development of the institution (organization) of urban drainage management and rehabilitation of the existing urban drainage, such as the rehabilitation and improvement of the local drainages, the improvement of Semarang River, the development of new local drainages, the development of the floodgate of the tidal, and the development of side outlet weir.
- Step 2 (1990): Planning and development of the drainage system of Simpang Lima area (urban centre), including wells and pump station development.
- Step 3 (until 2000): Planning and development of the urban drainage system for the urban development, including the drainage development along the new roads, the management of flood risk areas, and the development of new urban drainages.

Furthermore, the hydrological system of Semarang City is located in the Jratun Watershed and it is related to the region of Jratunseluna Basin.<sup>202</sup> Between 1968 and 1974, the Ministry of Public Works and Electric Power (Directorate General of Water Resources Development) cooperated with the Ministry of Foreign Affairs (Directorate of International Technical Assistance) for the Project of Jratunseluna Basin development. This project was divided into three steps. The first step was the reconnaissance Survey for East Semarang and Demak (1968), the second step was the first development project water resources of the Plain of East Semarang (1971) and the third step was the explanatory note on the rehabilitation of the main drainage in the plain of East Semarang (1974).

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<sup>202</sup> Cf. *Proyek Induk Pengembangan Wilayah Sungai Jratunseluna*, 2004, Jakarta: Department of settlement and regional infrastructure. Jratunseluna Basin is included into the Jratun River (Jragung River and Tuntang River) and Seluna river basins (Serang River, Lusi River and Juana River). This basin has been designed in the Project of Master plan of the river region development (PIPWS) of Jratunseluna since 1969.

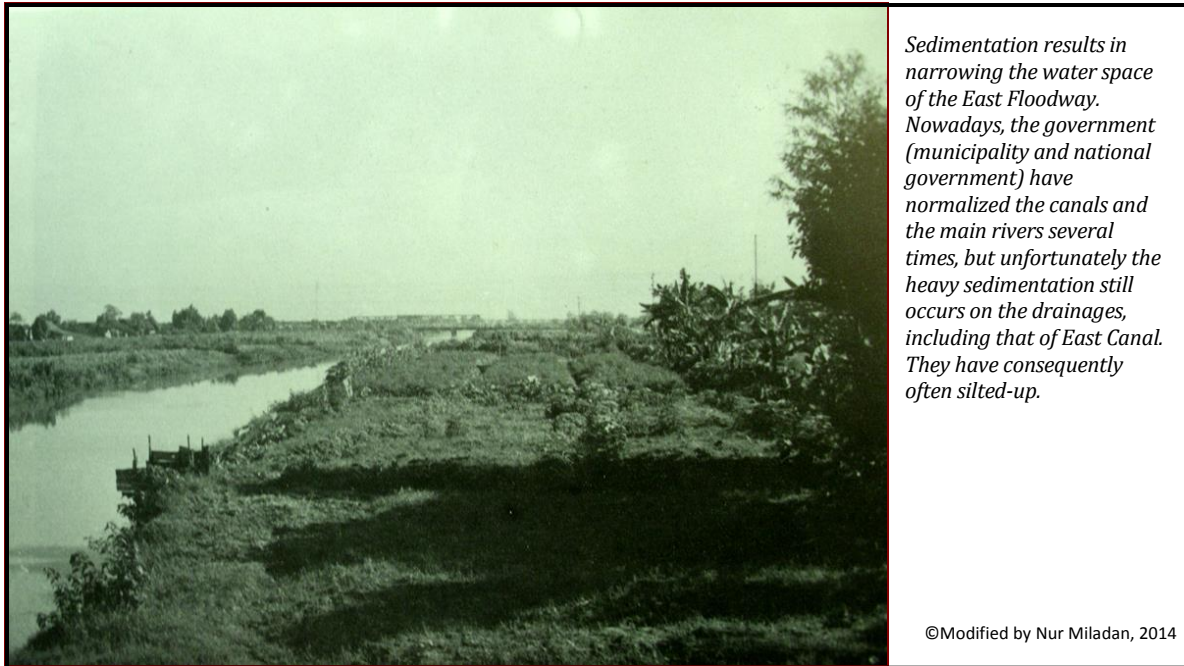
The existence of East Floodway and Babon River as the parts of Jratun Watershed deeply influenced the flood risk in the Eastern part of Semarang City. At that time, both drainages silted up. The East Floodway was subject to a heavy sedimentation phenomenon since the development of the Pucanggading Weir and also the sediment of the Penggaron River was moreover transported to that floodway as the outlet formed a right angle with the river.



**Figure 42. Semarang City as the downstream area of Jratun River Basin**

Source: *Jratunseluna Basin Development Project*, 1974, Ministry of Public Works and Power of Republic Indonesia and Ministry of Foreign Affairs of Kingdom of Netherlands, The Hague: NEDECO.





**Figure 43. The East Flood Way seen from the bridge in the road from Semarang to Demak looking towards the sea. Note siltation and vegetation on foreland, 1968**

Source: *Reconnaissance Survey Djratunseluna Area*, 1968, Ministry of Public Works and Power of Republic Indonesia and Ministry of Foreign Affairs of Kingdom of Netherlands, The Hague: NEDECO.

In the document of “Jratunseluna Basin Development Project”, there were several solutions to improve the situations of the Babon River and the East Floodway. As far as the Babon River is concerned, there were two possibilities, such as enlarging its capacity and the construction of a reservoir in the Penggaron River. Meanwhile, the improvement of East Floodway was planned through the normalization and the widening of its dimensions. In fact, in 1978, the Kebonbatur Weir was built in the upstream of the Dolok River and it was aimed to lead the water discharge from the Dolok River to the Penggaron River.<sup>203</sup> After that construction, the water discharge increase of East Floodway resulted in increasing flood vulnerabilities in the Eastern part of Semarang coastal. Normally the East Floodway would have to be renewed every three years.<sup>204</sup> Nevertheless, the high cost of this program became an obstacle for drainage maintenance, and, consequently, the dredging was implemented more than every three years.

Furthermore, the municipality sought to implement reforestation projects with respect to the river barriers, especially in the hilly areas, such as the catchment areas. For instance, in 1980, the municipality drafted a reforestation plan around the Kaligarang Watershed at the upstream of Semarang River and West Floodway. Nevertheless, these projects encountered many difficulties,

<sup>203</sup> *Urban Drainage Masterplan of Semarang City*, 2007, Semarang: Regional Development Planning Agency.

<sup>204</sup> *Jratunseluna Basin Development Project*, *Ibid.*



caused by the lack of funding. Several articles of a local newspaper *Suara Merdeka*, during the 1980s, deal with these issues.

“[...] presumably, it is not easy to have this (reforestation in Kaligarang Watershed) done by the municipality without the financial help of the upper institutions. Such funding has not been provided yet to the regional budget of the city. However, the municipality of Semarang has not accepted the financial help offered by the presidential instruction of the reforestation [...]”<sup>205</sup>

“[...] that is the first step of the Semarang River dredging getting funds of about IDR 50 million from the Directorate of Health Engineering of the Directorate General of Human Settlement. There is still need for additional assistance funds of about IDR 350 million from the Directorate General of Human Settlement [...]”<sup>206</sup>

The various elements above indicate that Semarang City needed an additional budget from the upper institutions (Central Java Province and National Government) to realize these projects. Besides the financial problems, the municipality was subject to technical constraints, such as the need to erect barriers around of the rivers. For instance, in 1985, along Semarang River and Banger River the settlements had sprawled around, although the municipality had designed boundaries along the riverbanks which should have been at least five meters large.<sup>207</sup> These constraints caused the hydrological projects not to be fully completed.

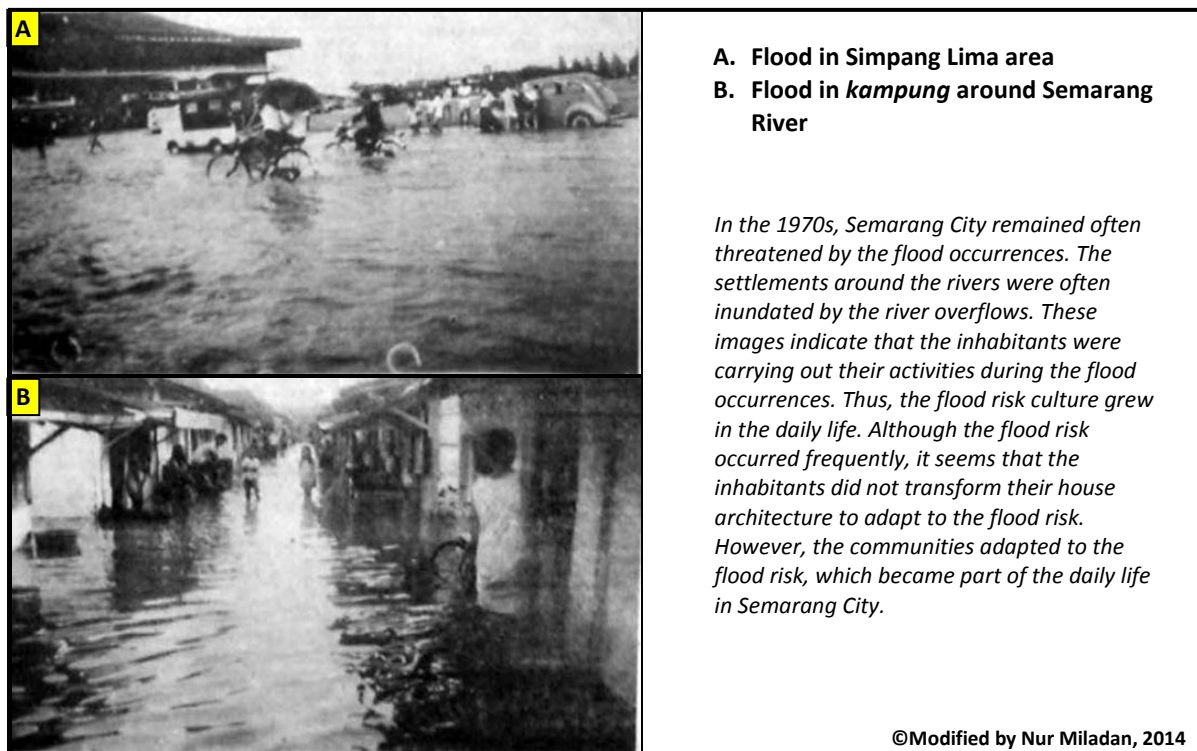
The flood risk problem-solving through infrastructure improvements was not supported by spatial plans during the 1975-2000 periods. In fact, spatial plans did not accommodate the flood risk. Despite the fact that the Semarang coast was vulnerable to the flood risk, urban areas nonetheless developed. This shed light on a contradicting planning. One the one hand, the improvements of the infrastructures was subject to many constraints. On the other hand, the urban spatial plan was a factor influencing the flood risk increase. This impacted the flood risks, which kept threatening Semarang City during the 1980s, and it was getting worse in the following years.

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<sup>205</sup> “Hijaukan DAS Kaligarang perlu bantuan propinsi”, *Suara Merdeka*, February, 2<sup>th</sup> 1980.

<sup>206</sup> “Pengerukan Kali Semg Tahap I segera mulai”, *Suara Merdeka*, February, 2<sup>th</sup> 1980.

<sup>207</sup> “Ganti rugi bangunan yang terkena proyek harus sesuai”, *Suara Merdeka*, February, 11<sup>th</sup> 1985.



**Figure 44. Flood occurrences and settlement along Semarang River**

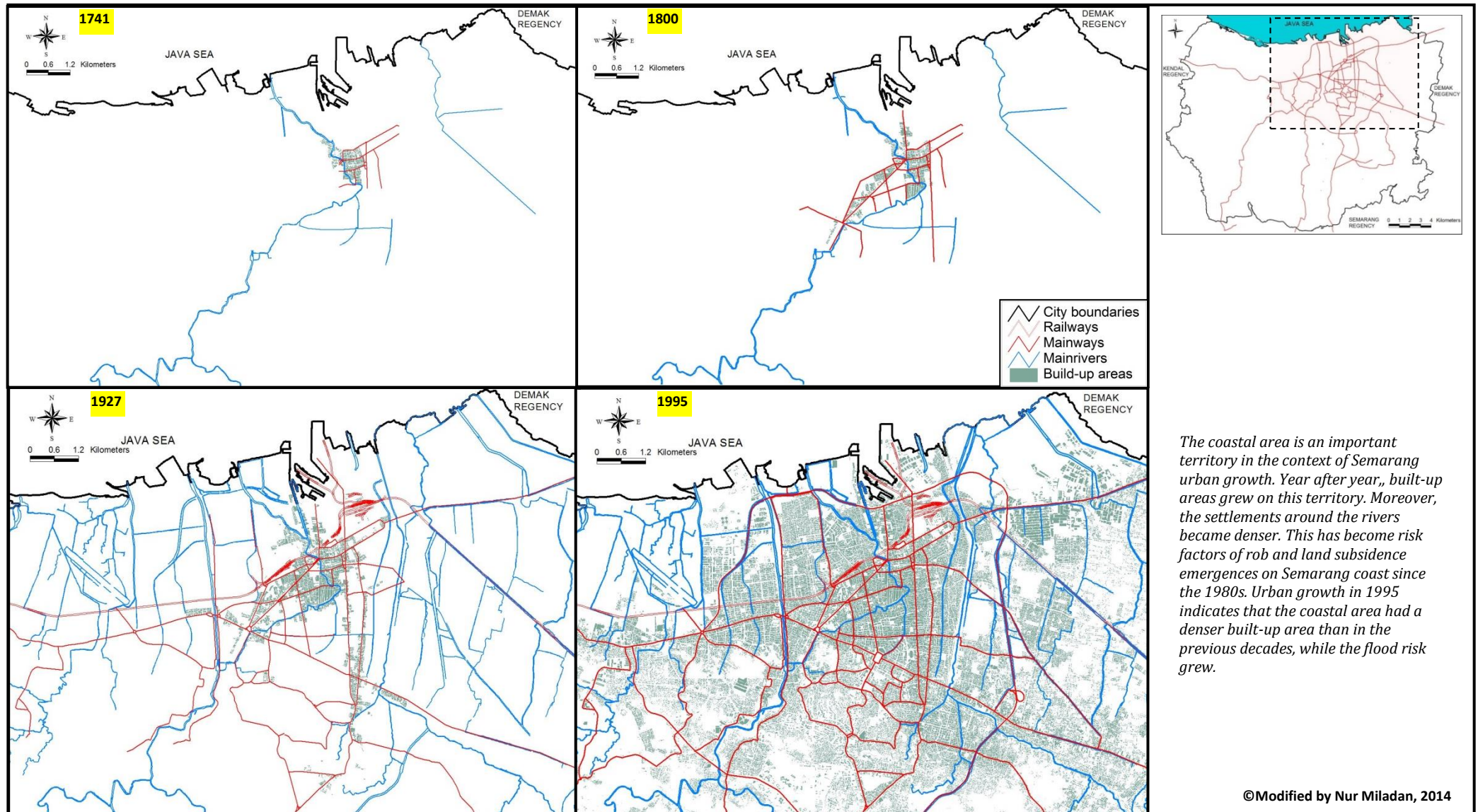
Source: *Suara Merdeka*, May, 27<sup>th</sup> 1975.<sup>208</sup>

Urban growth could not be circumvented, and the urban development on Semarang coast was a response to this phenomenon. As a result of the inadaptability of the urban plans and the ineffectiveness of the urban infrastructures projects regarding the flood risk, the communities adapted to that risk. Year after year, the built-up areas grew and the number of inhabitants on the Semarang coast increased, although the flood risk remained a threat to the communities' life. Oftentimes the flood occurred, caused by the high sea tide that took place since the late 1980s. The urban area on Semarang coast was threatened by that flood, although it was not during the rainy season. Since that period, the local inhabitants have described the flood caused by the high tides as *rob*. This word comes from the Javanese language "*rwab (rob)*". It means high tide, high water; to be at the flood, be at high tide, or overflowing.<sup>209</sup> Because of the Javanese expression, it can be considered that the use of *rob* expression originates from Semarang City.<sup>210</sup> The emergence of *rob* correlates with the urban growth on the Semarang coast area.

<sup>208</sup> "SemgBanjir; Simpang 5 jadi "Rawa """, *Suara Merdeka*, May, 27<sup>th</sup> 1975.

<sup>209</sup> Zoetmulder, P.J., Robson, S.O., Koninklijk Instituut voor Taal-, Land- en Volkenkunde, 1982, *Old Javanese-English Dictionary*, 's-Gravenhage: M. Nijhoff. It is available also on *Old Javanese-English Dictionary* [Web], <http://sealang.net/ojed/>.

<sup>210</sup> Several coastal cities in Indonesia are experiencing the *rob* phenomena. The other Javanese coastal cities, such as Jakarta and Surabaya, have experienced the *rob* phenomena since the 1990s. The Javanese language is still used frequently in everyday life in Central Java Province (Semarang) and East Java Province (Surabaya).



*The coastal area is an important territory in the context of Semarang urban growth. Year after year, built-up areas grew on this territory. Moreover, the settlements around the rivers became denser. This has become risk factors of rob and land subsidence emergences on Semarang coast since the 1980s. Urban growth in 1995 indicates that the coastal area had a denser built-up area than in the previous decades, while the flood risk grew.*

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**Figure 45. Urban area growth of Semarang**

Source: Hartoko et al., Ibid. ; Kaart van Samarang en omstreken, Benevens aanwysing van's Comp.s Leger en's vyands vlugt. Gecommandeert en chef door commandant Gerrit Non. Anno 1741 [Map], Retrieved December 25<sup>th</sup>, 2015, from GahetNA, <http://www.gahetna.nl>; Busscher, K.F., Plan of plattegrond van Semarang, met dies environs [Map], early nineteenth century (1800), Retrieved December 25<sup>th</sup> 2015, from GahetNA, <http://www.gahetna.nl>; N.V. Technisch-Reproductiebureau en Lichtdrukkerij Holland-Indie – ,s-Gravenhage, Semarang [Map], 1924, KITLV, Leiden; UDMIS, Ibid.

In conjunction with the implementation of spatial plans for 1975-2000, the developments of industrial zones and formal settlements in fact took into account the flood risk. For instance, the industrial zones were built one meter above the level of high tide. But this was inappropriate. Moreover, because of the urban development, the coastal area became subject to high risks of land subsidence.<sup>211</sup> At that time, urban actors expected that the land reclamation could reduce the inundation risk. But, on the contrary, it increased that risk. The land reclamation only moved the inundation risk from the upper areas to the lower areas.

Furthermore, the growth of the settlements and the industrial zones was not supported by the proper infrastructures, especially clean water infrastructures. The limitation of the clean water resources of Semarang City combined with the lack of the production management of PDAM<sup>212</sup> resulted in the deficiency of clean water supply for Semarang inhabitants.<sup>213</sup> In fact, several rivers passed by Semarang City, the latter had clean water problems. This caused the communities and the industrial sectors to exploit the ground waters through the artesian wells for their daily activities. The local newspaper *Suara Merdeka*, in November 1985, and the interviews with industrial actors, give an account of these phenomena at that period.

“Most of illegal artesian wells were made by the big companies (industries) and several settlements. There are many ground water extractions and those were very deep”.<sup>214</sup>

“If we want use the water from PDAM, we must make the pipes by ourselves to connect to the PDAM pipes. They didn’t pick the ball (proactive) and didn’t make good marketing. They asked us to provide the distributed pipes. So, it was not supported by the good infrastructures from the government (municipality)”.<sup>215</sup>

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<sup>211</sup> Land subsidence occurs when large amounts of groundwater have been excessively withdrawn from an aquifer. The clay layers within the aquifer compact and settle, resulting in lowering the ground surface in the area from which the groundwater is being pumped. Cf. San Jacinto River Authority (SJRA), *What is Land Subsidence?*, Retrieved December 28<sup>th</sup> 2015, from <http://www.sjra.net/about/facts/what-is-land-subsidence/> Land subsidence resulting from inelastic compaction of aquifer systems has generally gone unnoticed until substantial infrastructure disruption occurs. Cf. Borchers, J.W., Carpenter, M., 2014, *Land Subsidence from Groundwater Use in California*, California: Luhdorff & Scalmanini Consulting Engineers.

<sup>212</sup> Local Water Company. It’s one of the companies which are owned by the municipality and it works in the distribution of clean water to the communities.

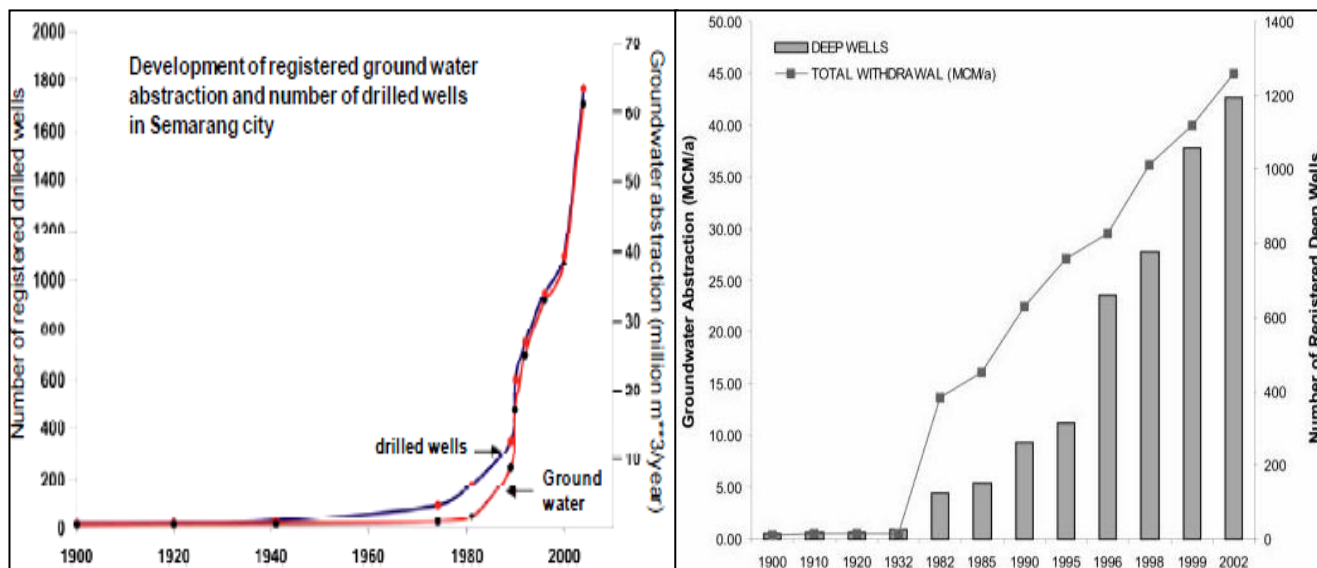
<sup>213</sup> Hartono, D., 2005, *Alternatif Pemenuhan Air Bersih oleh PDAM di Kota Semarang*, Master thesis, Semarang: Diponegoro University.

<sup>214</sup> “Banyak Sumur Artesis Tak Punya Izin”, *Suara Merdeka*, November, 8<sup>th</sup> 1985.

<sup>215</sup> The interview with M. Solechedi (Head of Indonesian Chamber of Commerce and Industry of the Central Java Province at period 2006-2011) in 2013.



The groundwater exploitation on Semarang coast is a crucial problem and is due to the lack of urban water supply management and the inexistence of water exploitation regulations during this era. From 1982 until 1985, there was a significant increase of registered deep (artesian) wells (see Figure 46). This indicates that the urban development was followed by the growth of the groundwater extraction, thereby accelerating the emergence of land subsidence on Semarang coast. These phenomena have been increasing up to now.



**Figure 46. The Development of registered deep wells and groundwater abstraction**

Source: Murdohardono, D., Tobing, T.M.H.L., Sayekti, A., 2007, "Over pumping of ground water as one of causes of sea water inundation in Semarang city", in : *The International Symposium and Workshop on Current Problems in Groundwater Management and Related Water Resources Issues*, Bali, December, 3<sup>rd</sup>-8<sup>th</sup> 2007; Putranto, T.T., Rüde T.R., 2011, "Groundwater Problems in Semarang Demak Urban Area, Java/Indonesia", in: Baier, K., Fernandez-Steegeer, T., Heinrichs, K., Neukum, C., Post, C. (eds.), *Festschrift zum 60. Geburtstag von Univ.-Prof. Dr. Dr. h.c. Rafiq Azzam / Lehrstuhl Ingenieurgeologie und Hydrogeologie*, Aachen: Lehrstuhl für Ingenieurgeologie und Hydrogeologie (LIH), RWTH Aachen University.

The land subsidence was accelerating the growth of *rob* risk on Semarang coast. During the high tide period, the *rob* risk threatened the urban areas through the urban drainages such as the rivers and the canals (floodways). The lack of an urban drainage system also accelerated the increase of *rob* risk on Semarang coast in the 1980s and the 1990s. The city experienced failures of the urban drainages development, thus causing the degradation of the quality of the urban drainage system. The urban drainage programs that were designed by the Dutch Government were abandoned during the Indonesian government era, because of technical and management problems. Furthermore, this sheds light on the fact that the demand and supply of the city growth were not balanced. Consequently, the flood risk was not solved and got even worse.

## Chapter conclusion

Semarang is a city characterized by a dynamic space transformation. From the river port to the coast, a process of urban growth took place for four centuries. The growth of Semarang flood risk is related to the coastal morphological characteristics, which have influenced the carrying capacities of the urban development and the lack of urban plans and their implementation. During the Dutch government era, the urban plans and projects accommodated to the coastal characteristics and reflected the urban adaptation to the flood risk, such as the development of a canalization system including canals, floodways and dams. The urban development was limited on Semarang coast. Furthermore, the urban extension plan sheds light on the urban stakeholders' efforts to reduce the flood risk through the arrangements of coastal and hilly areas and the emergence of an integrated urban spatial system. The Dutch government sought to accommodate the water spaces in the context of the urban development in order to anticipate potential urban problems. The urban planning and the infrastructures development became integrated efforts to manage the city and its water. Even though there are no records stating that the flood risk was solved in that era, the urban hydrological projects at least transformed the city in order to adapt it to the flood risk. On the other hand, the strong authority of the Dutch municipality to implement the urban plans and various projects influenced the flood risk solving, which it centralized. While, community self-help did not play a role and it has tended to be resistant to the flood risk since that era.

Under the Indonesian government era, the unsustainability of Dutch plans in relation to the urban development, including hydrological projects, was revealed. Semarang coast began to be developed as an urban area through land conversion and reclamation. The morphological characteristics of the coast were not the important elements taken into account in the urban plans. Semarang coast experienced a high urban growth, and suffered from the discontinuity of the Dutch urban plans, especially the urban hydrological projects. Moreover, the government transition, the limitation of the hydrological and planning experts, and the lack of funding to provide proper urban infrastructures resulted in urban problems, including the growth of flood risk. The incompatibility of the urban plans and their implementation has also aggravated the flood risk since the 1980s. Indeed, urban actors have sought to reduce the urban flood vulnerabilities since the 1970s. Nevertheless, the lack of comprehensive urban hydrological plans and projects left the flood as an unsolved urban problem. A *rob* risk emerged as a consequence of urban growth, influencing the urban transformation and the risk culture of coastal communities. As a result, the problem of recent urban flood is more complex and, consequently, it also relates to the diversity of flood risk management.

*“Cities can also be the most dangerous place on earth for those who live in an urban environment where the authorities have little presence and where the will and the resources are lacking to ensure basic social services, food security, running water, sewerage and respect for building codes.” (Bekele Geleta, Secretary General, IFRC)<sup>248</sup>*

## **Chapter 2**

# **Flood risk management in recent times: concepts and projects**

The discussion on the history of urban flood risk set out in the previous chapter provided us with explanatory material regarding the flood risk which has still been threatening the urban coastal areas of Semarang in the recent times. The flood risk, as well as the urban problem that has not been solved yet until now, entail key questions about how the municipality manages the urban flood risk and the involvement of other stakeholders such as national government (province and central), NGOs, private sector, practitioners/academic partners and international governments in their respective efforts of urban flood risk reduction. The development of collaborative approaches by these different urban stakeholders is necessary in order to allow urban resilience.<sup>249</sup> Nevertheless, sometimes, these collaborations have faced several constraints in the implementation process. This chapter will identify who is involved in the efforts of flood risk management in Semarang City and their roles in that management in the recent era.

In the 1990s, the municipality has carried out studies and planned hydrological projects to support the flood risk management of Semarang City. Several projects are routine actions to reduce flood risk, including urban drainage rehabilitations and maintenance of pump systems, particularly in the Semarang coastal area. Nevertheless, the implementation of these projects is often constrained by the high maintenance cost of the urban drainage system, and the municipality is limited by the annual regional budget allocated to these projects.

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<sup>248</sup> Geleta, B., “Urban Dangers”, International Federation of Red Cross and Red Crescent Societies [Web], retrieved December 28<sup>th</sup>, 2015, from <http://www.ifrc.org/en/what-we-do/disaster-management/preparing-for-disaster/risk-reduction/urban-disaster-risk-reduction/>

<sup>249</sup> Toubin, M., 2014, *Améliorer la résilience urbaine par un diagnostic collaboratif, l'exemple des services urbains parisiens face à l'inondation*, Ph.D Dissertation in Geography/ Urban Engineering, université Paris-Diderot (Paris 7).

Furthermore, the municipality has made several studies relating to flood risk reduction in order to carry out the master plan of urban drainage system and the planning documents of hydrological projects. Nevertheless, these documents have encountered difficulties as regards collaboration projects and financing issues. Consequently, the hydrological projects have not yet been implemented or have been only partially implemented.

The collaborations of flood risk management of Semarang City involve not only the local (urban) institutions such as the Regional Development Planning Agency, the Department of Water Resources, and the Regional Disaster Management Agency, but also the national government. Semarang City, as capital of Central Java Province, plays an important role of support of the national economic growth and development, so the urban sustainability of Semarang becomes also the concern of national government. This is evidenced by the national policies of flood risk management and several urban hydrological projects, such as the Banger Polder Project and the packet of Jatibarang Dam project, which are supported by the national government both in terms of financing and technical initiations. Against this background, the collaboration actions between the municipality and the national government often involve the participation of international governments, such as the Japanese, Dutch, and Australian governments, and also that of the local and international NGOs. Furthermore, the roles played by the national government also include the management of regional watershed, Semarang City as the integrated part of the region of Jratunseluna Basin including also the other surrounding regencies (cities). Semarang flood risk is related to the role of this city as the downstream area of Jratunseluna Basin, so the involvement of national governments including the Central Java Province and the Large River Basin Organization Pemali Juana, the Directorate General of Water Resources – Ministry of Public Works is strongly needed to manage the water cycle of that basin and to ultimately reduce flood risk in Semarang City. From this perspective, understanding the comprehensive flood risk management, including policies and projects, is necessary to explain diversity, contradictions and coherence of the flood risk management in Semarang City.

Furthermore, the flood risk management of Semarang City is also linked to the NGOs. Recently, Mercy Corps (International NGO) has played a key-role, focusing on the program of Asian Cities Climate Change Resilience Network (ACCCRN) in Semarang City, which involves the local NGOs and local academic partners.<sup>250 251</sup> ACCCRN is a 7-year old

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<sup>250</sup> Mercy Corps is an international NGO, helping people around the world to turn the crises of natural disaster, poverty and conflict into opportunities for progress; the program in Indonesia addresses the root causes of poverty, thereby improving the quality of life for disaster and conflict affected urban and coastal communities.



initiative (2008-2014) supported by the Rockefeller Foundation; it aims to draw attention, funding and action to strengthen cities' resilience to climate change impacts, and it has been working in 10 cities in 4 Asian countries (India (Gorakhpur, Indore and Surat), Indonesia (Semarang and Bandar Lampung), Thailand (Chiang Rai and Hat Yai), Vietnam (Can Tho, Da Nang, Quy Nhon) to develop effective processes and practices addressing urban climate vulnerabilities, using multi-stakeholder planning as well as implementing targeted intervention projects. The Urban Resilience Framework, which guides the resilience planning approach utilized in ACCCRN and has been refined through demonstrations in ACCCRN, has been jointly developed by Arup and ISET.<sup>252 253</sup> The project background is the climate change vulnerability of Asian Cities. In this respect, UN-Habitat estimates that 70% of the world's population will live in urban areas by 2050, and approximately 60% of growth is expected to take place in Asia.<sup>254</sup> Through the actions of the Asian Cities Climate Change Resilience Network, it is expected that by 2012, a network of cities in Asia will have developed robust plans to prepare, withstand, and recover from climate change impacts.<sup>255</sup>

The ACCCRN program in Semarang City and the involved stakeholders assess flood risk reduction as an integrated factor to create urban resilience to climate change. This program does not only focus on flood risk reduction, but also on other disasters and issues relating to climate change such as drought, land slide, and health problems. Finally, it describes the roles of the external stakeholders (NGOs) to support the flood risk management of Semarang City

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Cf. *Introduction to ACCCRN, 2010*, The Asian Cities Climate Change Resilience Network (ACCCRN), retrieved December 28th, 2015, from <http://accrn.net/resources/introduction-accrn-prepared-bellagio-donors-meeting>.

<sup>251</sup> Semarang (Indonesia) became a part of the Asian Cities Climate Change Resilience Network (ACCCRN) programme, funded by Rockefeller Foundation, in 2009. Cf. Sutarto, R., Jarvie, J., 2012, *Integrating Climate Resilience Strategy into City Planning in Semarang, Indonesia (Climate Resilience Working Paper, n° 2)*, Hanoi: Institute for Social and Environmental Transition-International.

<sup>252</sup> *ACCCRN City Projects*, 2013, Bangkok: Asian Cities Climate Change Network (ACCCRN), The Rockefeller Foundation, Asia Office.

<sup>253</sup> Rockefeller Foundation pursue this mission through dual goals: advancing inclusive economies that expand opportunities for more broadly shared prosperity, and building resilience by helping people, communities and institutions prepare for, withstand, and emerge stronger from acute shocks and chronic stresses. Rockefeller Foundation, *Intern, Program Related Investment Fund*, [Web], September 2014, retrieved December 28<sup>th</sup>, 2015, from [https://www.rockefellerfoundation.org/career\\_post/intern-program-related-investments-pris/](https://www.rockefellerfoundation.org/career_post/intern-program-related-investments-pris/); ISET is a NGO which concerns to improve understanding and elevate the level of dialog and practice as society responds to natural resource, environmental and social challenges. Cf. Friend, R., MacClune, K., *Climate Resilience Framework Putting Resilience into Practice*, 2013, Colorado: Institute for Social and Environmental Transition-International, retrieved December 28<sup>th</sup>, 2015, from <http://i-s-e-t.org/resources/working-papers/resilience-into-practice.html>; Arup is an independent firm of planners, designers, engineers and consultants working across the built environment. Cf. Arup, *We shape a better world*, [Web], 2015, retrieved December 28<sup>th</sup>, 2015, from <http://www.arup.com/>.

<sup>254</sup> *Asian Cities Climate Change Resilience Network (ACCCRN): Responding to the Urban Climate Challenge*, 2009, Colorado: Institute for Social and Environmental Transition (ISET), 60 p.

<sup>255</sup> Rockefeller Foundation, *White Paper Building Climate Change Resilience*, August 4 2009, retrieved December 25<sup>th</sup> 2015, from [http://accrn.net/sites/default/files/publication/attach/10\\_RF\\_WhitePaper\\_Resilience.pdf](http://accrn.net/sites/default/files/publication/attach/10_RF_WhitePaper_Resilience.pdf).

and state that they are an element of comprehensive management of flood risk. In other side, the roles of private actors are very visible with respect to the transformation of space, in particular the land use on Semarang coast, which comprises the most vulnerable areas of flood risk. The conflicts of interests and practices of coastal land use also shed light on the complexity of the flood risk management. Prior to explaining the flood risk management, the hazard (flood) and urban vulnerabilities must be explored specifically. The existence of these elements determinates the logical thinking of the flood risk management process implemented by the relevant stakeholders. The understanding of urban stakeholders concerning the existence of hydrological risk certainly influences the approaches of hydrological risk management. These conditions lead to analyze the risk factors as the integrated and important elements necessary for the understanding of urban flood management risk and its complexity.

The analysis of flood risk management in Semarang City will be supported by the documents of hydrological projects and also by interviews of the relevant stakeholders. This will allow us to understand the concepts of hydrological planning and the implementation of hydrological projects that have been carried out to manage the flood risks in Semarang City. Furthermore, the understanding of the comprehensive management of flood risk will explain the coherence, discrepancies, and discordances of these approaches (planning concepts and projects implementations) with respect to flood risk management in Semarang City. Likewise, the interviews concerning the interpretations and perceptions of the relevant stakeholders about the existence of urban hydrological risk and relating to the definition, history, and causes will clarify the reasons of the current hydrological risk management.

### **2.1. Plurality of flood risk existence: causes and consequences**

Flood risk in Semarang City is not a recent threat, and this risk has even been aggravated in the past few decades. Flood risk in Semarang City is related to several different issues, including urban geomorphological characteristics and urban infrastructures. The evolution of Semarang urban geomorphology influences the vulnerabilities of flood risk, in particular in Semarang coastal area. The coastal area is a former sea area, and it is composed of alluvium (sedimentation) soil, which influences the probabilities of hydrological risk in Semarang City. Furthermore, the various urban topographies and the existence of many rivers also produce a hydrological risk in Semarang coastal area, due to the natural water cycle that goes from the hills to the coast. These situations indicate that the evolution of water space in Semarang City is much correlated to the existence of urban hydrological risk. In addition, the urban growth that did not take place within appropriate urban infrastructures, especially drainage networks and

water supply networks, increased the hydrological risk in Semarang City. The existence of urban drainage systems and water supply systems are important urban elements arranging the water cycle and access to the city. The absence of such systems certainly increases the existence of urban hydrological risk. These systems are certainly correlated to the urban infrastructure management and also to the urban flood risk management.

### **2.1.1. Water scarcity and ground water extraction: impacts of poor water infrastructure and weak water regulation**

In Semarang City, water scarcity problems have occurred since the Dutch government era. Between 1911 and 1932, the municipality built six water resources in the hill areas to support the water supply in Semarang City.<sup>256</sup> In conjunction with the growth of population and build-up area, Local Water Company (PDAM) was continuing to provide the water supply in Semarang City. They have built several new water resources from 1952 to 2002, such as water treatment installations and several artesian wells. Water supply from PDAM, in Semarang City, covered about 61,58 % of the total population in 2010.<sup>257</sup> This indicates that the supply and the demand of water in Semarang are not balanced yet, and that some areas have still no access to urban water supply. This situation brings about water scarcity in these areas. However, urban water access has increased in the past few years. The lack of access to water also occurs in several settlements and industrial zones in Semarang coastal area. Moreover, most of Semarang coastal area experiences a gap between demand and supply of water. It is related to the high density of population, but it has not been supported yet by a proper urban water access. Local communities and factories that did not get water services preferred to extract ground water through artesian wells. This resulted in an over use of ground water to support the urban activities and daily life of communities. According to Hadipuro and Indriyanti (2009), the ground water in sub-district of Tanjung Mas is exploited widely for private and industrial uses; each *RW* in that sub-district has at least one well to exploit the ground water.<sup>258</sup> This example indicates that the communities and industries have used the groundwater as an alternative to the lack of urban water service. They have argued that purchasing wells is cheaper than PDAM services.

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<sup>256</sup> PDAM Tirta Moedal of Semarang City, *Sejarah PDAM Tirta Moedal Kota Semarang*, retrieved December 25<sup>th</sup>, 2015, from <http://www.pdamkotasmg.co.id>.

<sup>257</sup> Indonesia Urban Water, Sanitation and Hygiene, *Mendukung Semarang Setara dalam Akses Air Minum dan Sanitasi*, Augustus 2013, retrieved December 28<sup>th</sup> 2015, from <http://iuwash.or.id>.

<sup>258</sup> Hadipuro, W., Indriyanti, N.Y. 2009, "A Typical Urban Water Supply Provision in Developing Countries: A Case Study of Semarang City, Indonesia", *Water Policy*, vol. 11, issue 1, pp. 55-66; Hadipuro, 2010, "Indonesia's Water Supply Regulatory Framework: Between Commercialization and Public Service?", *Water alternatives*, vol. 3, Issue 3, pp. 475-491.

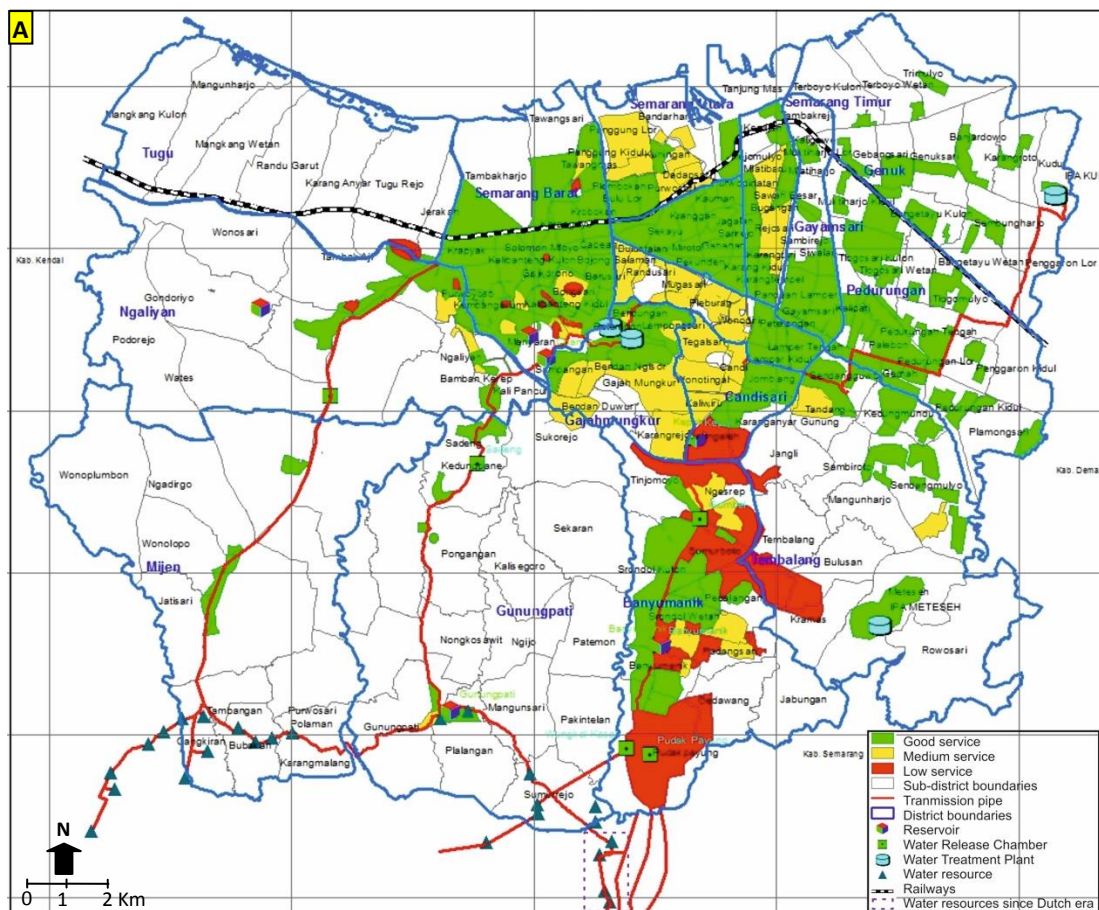


Figure A shows that most of the areas with access to urban water service had good services in 2013. However, some areas in Semarang coastal areas have not been covered by the urban water service.

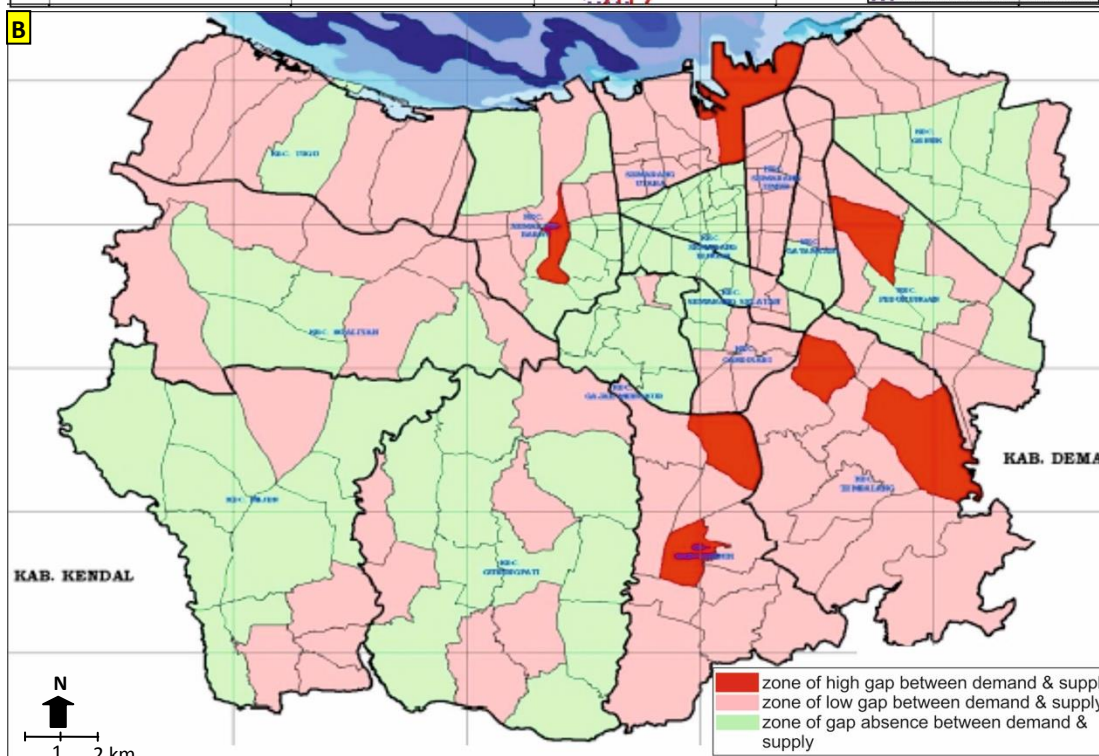


Figure B indicates that Semarang coastal area is dominated by zones of low gap between demand and supply of water. This water brought about an augmentation of ground water extraction in Semarang coastal area.

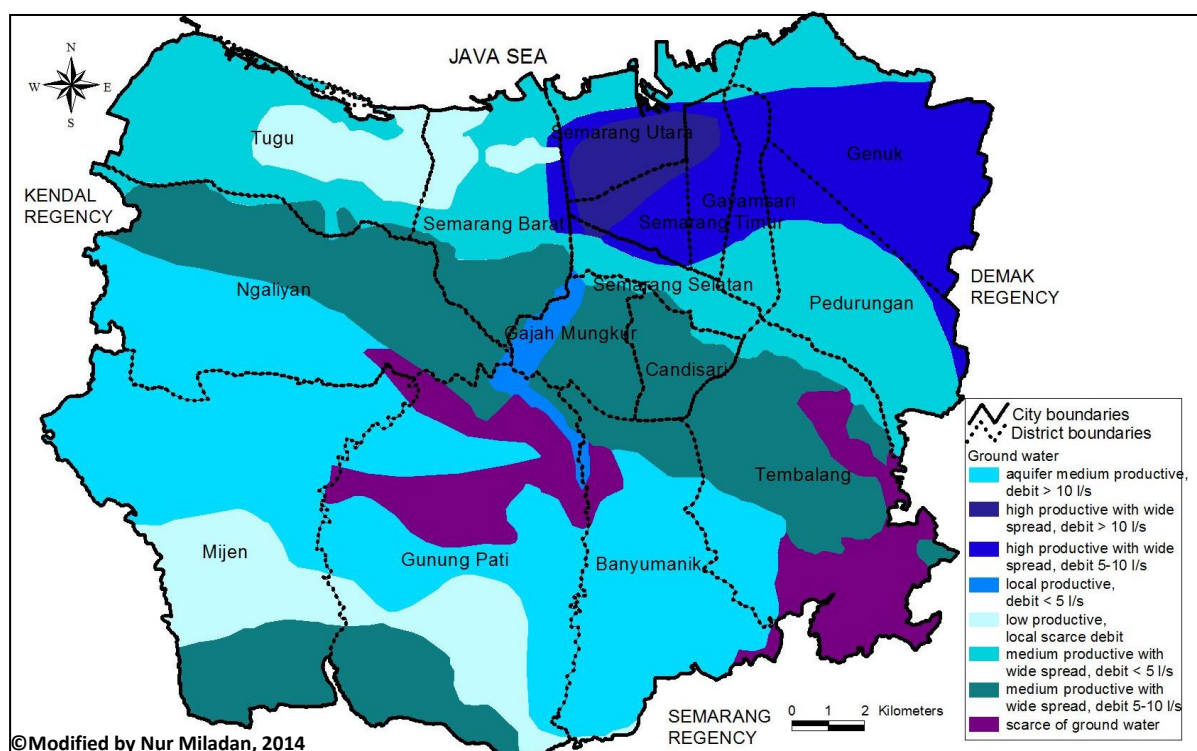
©Modified by Nur Miladan, 2014

**Figure 47. Water supply-demand and water coverage (service) of PDAM**

Source: Brown, A.L., 2011, "Building Climate Change Resilience in Semarang" [Presentation], in *Asian Cities Climate Change Resilience Network (ACCCRN), 2<sup>nd</sup> World Congress on Cities and Adaptation*, Bonn; *Kondisi aliran PDAM Tirta Moedal Kota Semarang* [Map], 2013, PDAM Tirta Moedal of Semarang City, Semarang.



Groundwater abstraction in Semarang city is increasing sharply since early 1990s, especially in industrial area.<sup>259</sup> Moreover, the Tanjung Mas Port also uses groundwater to supply water providing to the arriving boats. According to Schmidt (2002), the volume of groundwater abstracted increased from 0.5 million m<sup>3</sup>/year during the period of 1901–1910 to 53 million m<sup>3</sup>/year in 2000, and a significant amount of this increase took place in the 1980s when the abstraction rate nearly doubled from 12.7 to 23.7 million m<sup>3</sup>/year as well as in the 1990s when the rate increased to 40.4 million m<sup>3</sup>/year.<sup>260</sup>



**Figure 48. Hydrogeology of Semarang City**

Source: *Urban Development Management Information System (UDMIS)*, 2001, Semarang: Regional Development Planning Agency (BAPPEDA); *Spatial planning of Semarang City for 2011-2031*, Semarang: Regional Development Planning Agency

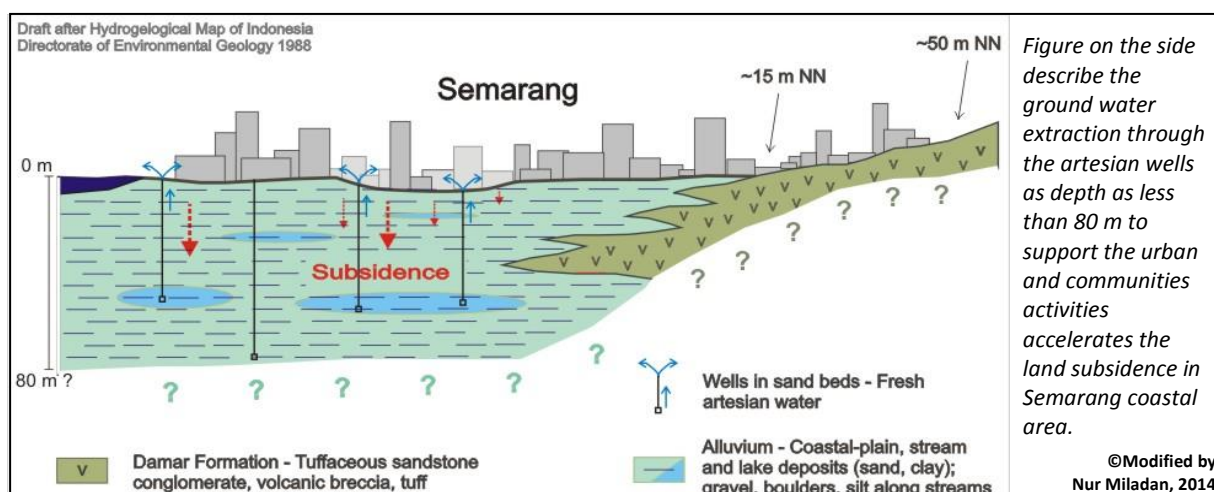
*The exploitation of groundwater by communities and industries on Semarang coast is related to its accessibilities. Semarang coast, particularly in its Northern and Western parts, has potential resources of groundwater.*

The above conditions show that the activities of groundwater extraction are influenced by the lack of urban water services and the potential groundwater resources on Semarang coast. On the other hand, municipality has advised the communities to reduce groundwater

<sup>259</sup> Abidin, H.Z., Andreas, H., Gumilar, I., Sidiq, T.P., Gamal, M., Murdohardono, D., Supriyadi, Fukuda, Y., 2010, "Studying Land Subsidence in Semarang (Indonesia) Using Geodetic Methods", in: *FIG Congress Facing the Challenges-Building the Capacity*, Sydney.

<sup>260</sup> Kuehn, F., Albiol, D., Cooksley, G., Duro, J., Granda, J., Haas, S., Hoffmann-Rothe, A., Murdohardono, D., 2010, "Detection of Land Subsidence in Semarang, Indonesia, Using Stable Points Network (SPN) Technique", *Environmental Earth Sciences*, vol. 60, Issue 5, pp. 909–921.

extraction since the 2000s, but nevertheless municipality just restricted the regulation of groundwater management in 2013.<sup>261</sup> The municipality and the geological researchers believe that groundwater extraction is one of the main causes of land subsidence in Semarang City, and, therefore, that these activities should be reduced. According to Marsudi, this phenomenon is due to the consolidation of the land filling (load of building) and the decreasing of groundwater.<sup>262</sup> The land subsidence pattern is moreover in line with the spreading of groundwater decrease.



**Figure 49. Schema of land subsidence in Semarang City**

Source: Murdohardono, D., Hartanto, 2007, *Titik ketinggian (peil) stabil bedrock bench mark di area yang mengalami land subsidence di Kota Semarang* [PowerPoint], Semarang: Geology Agency, Ministry of Energy and Mineral resources.

In the Semarang coastal area, it is aimed to limit groundwater extraction. It sets out the sanctions faced by natural or legal persons carrying out illegal groundwater extraction.

“The control of the damaged capacity of groundwater is aimed to prevent, to cope with the intrusion of salt water and to rehabilitate groundwater conditions deteriorated by the intrusion of salt water, and also to prevent, to avoid, or to reduce the occurrence of land subsidence.”<sup>263</sup>

“To avoid the occurrence of (sea) salt water intrusion, paragraph 39, clause 1 limits groundwater extraction in the coastal area which causes the disturbance of the equilibrium between the surface of fresh groundwater and that of salt groundwater.”<sup>264</sup>

<sup>261</sup> *Management of Groundwater*, Regional Regulation of Semarang City, n° 2/ 2013, Semarang: Municipality of Semarang City.

<sup>262</sup> Marsudi, 2001, *Prediksi Laju Amblesan Tanah di Dataran Aluvial Semarang Propinsi Jawa Tengah*, Ph.D dissertation in Hydrogeology-Mining engineering, Bandung Institute of Technology.

<sup>263</sup> *Management of Groundwater*, Regional Regulation of Semarang City, n° 2/ 2013, *ibid.*, Paragraph 39, clause 1.

<sup>264</sup> *Management of Groundwater*, Regional Regulation of Semarang City, n° 2/ 2013, *ibid.*, Paragraph 40, clause 1.

“To cope with the occurrence of the (sea) salt water intrusion, paragraph 39, clause 1 prohibits the extraction of groundwater in the coastal area.”<sup>265</sup>

“[...] the person in charge of business and (or) activity which does not comply with the obligation (the cessation of groundwater extraction) is liable to an administrative sanction (written warning by the municipality) and to imprisonment of up to six months or a fine of up to IDR 50 million (≈ 3125 €).”<sup>266</sup>

This Regulation shows that the municipality is aware of the significance of groundwater management. It stresses that land subsidence is a crucial urban problem that can be mitigated by the reduction of groundwater extraction. However, in fact, the municipality (urban institutions) has the difficulties for the prevention of the groundwater extraction by communities. This is also clarified by the interview with Rosyid Hudoyo, Head section of Water Resources, Energy and Geology of the Department of Water Resources Management and Energy and Mineral Resources (PSDA-ESDM) of Semarang City in 2011.

“[...] in Semarang coastal area, land subsidence has aggravated the *rob* (risk) because of groundwater extraction. That (groundwater extraction) should be the last alternative of water resources. Nevertheless, this is difficult to be avoided. We have a limited capacity to control and monitor groundwater extraction related to human resources and monitoring tools. On the other hand, it is difficult to prohibit groundwater extraction because of the limitation of access from the Local Water Company. If we forbid it, we must find a solution for water use because it is an important element of urban activities and community daily life [...]”

Previously, the permits of groundwater use were under the control of the Central Java Province, which caused a lack of control over groundwater extraction several years ago. This situation was due to the fact that the province had a large area management, including 35 regencies or cities. Before the enactment of the Regional Autonomy Act,<sup>267</sup> the province had significant resources to manage the lands in cities. It has resulted from regional autonomy that municipality authorities had to manage their own lands, including the groundwater. However, the municipality must still request a recommendation from the province in order to issue permits for groundwater extraction, because groundwater management involves several cities and regencies.

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<sup>265</sup> *Management of Groundwater*, Regional Regulation of Semarang City, n° 2/ 2013, *ibid.*, Paragraph 40, clause 2.

<sup>266</sup> *Management of Groundwater*, Regional Regulation of Semarang City, n° 2/ 2013, *ibid.*, Paragraph 68, clause 1.

<sup>267</sup> Regional autonomy is the right, authority, and duty to regulate autonomous regions and manage their own affairs and interests of communities in accordance with the laws and regulations. Cf. *Government Affairs Division between (National) Government, Provincial Government and Municipality*, Government Regulation of Indonesia, n° 38 /2007, Jakarta: Ministry of State Secretary.

Nevertheless, today, the implementation of this Regulation is still ongoing. In fact, our field observation in 2013 indicates that many illegal groundwater wells are still used by inhabitants and industrial actors in the Semarang coastal area. Besides the reduction of groundwater extraction, the municipality seeks to increase the accessibility and productivity of urban water services through the construction of Jatibarang Reservoir in the Southwestern part of the city. The government expects that it will be able to supply the water needs of the city, so that the number of artesian wells, especially in Semarang coastal area, will drop and that the Local Water Company will be able to supply water resources for the whole city<sup>268</sup>. In sum, this sheds light on the progress of the municipality efforts to reduce land subsidence in Semarang coastal area through the institutional enforcement of water resources management and water infrastructures improvements.

### **2.1.2. Land subsidence, between natural phenomena and urbanization effects**

The Northern region of Semarang along the coast exhibits higher rates of subsidence compared to its Southern region, and this subsidence is believed to be caused by the combination of natural consolidation of young alluvium soil, groundwater extraction and loads of buildings and constructions.<sup>269</sup> However, land subsidence does not only take place in Semarang City, but also in several Indonesian coastal cities and many coastal cities in the world. Despite the fact that the land subsidence issue was already observed in the 1980s<sup>270</sup>, in the case of Semarang City, it was not taken into account in the urban planning and projects. However, this risk has existed in Semarang City since more than a hundred years.<sup>271</sup> The high growth of land subsidence resulted in putting some territories of Semarang coastal area under the sea level. An increasing number of territories is impacted each year. These territories are located in the Northeastern part of the city, where the urban centers and the productive groundwater areas are. Thus, part of the growth of land subsidence is due to the urban growth effects, while this also produces an increase of urban flood vulnerabilities, especially *rob* risk.

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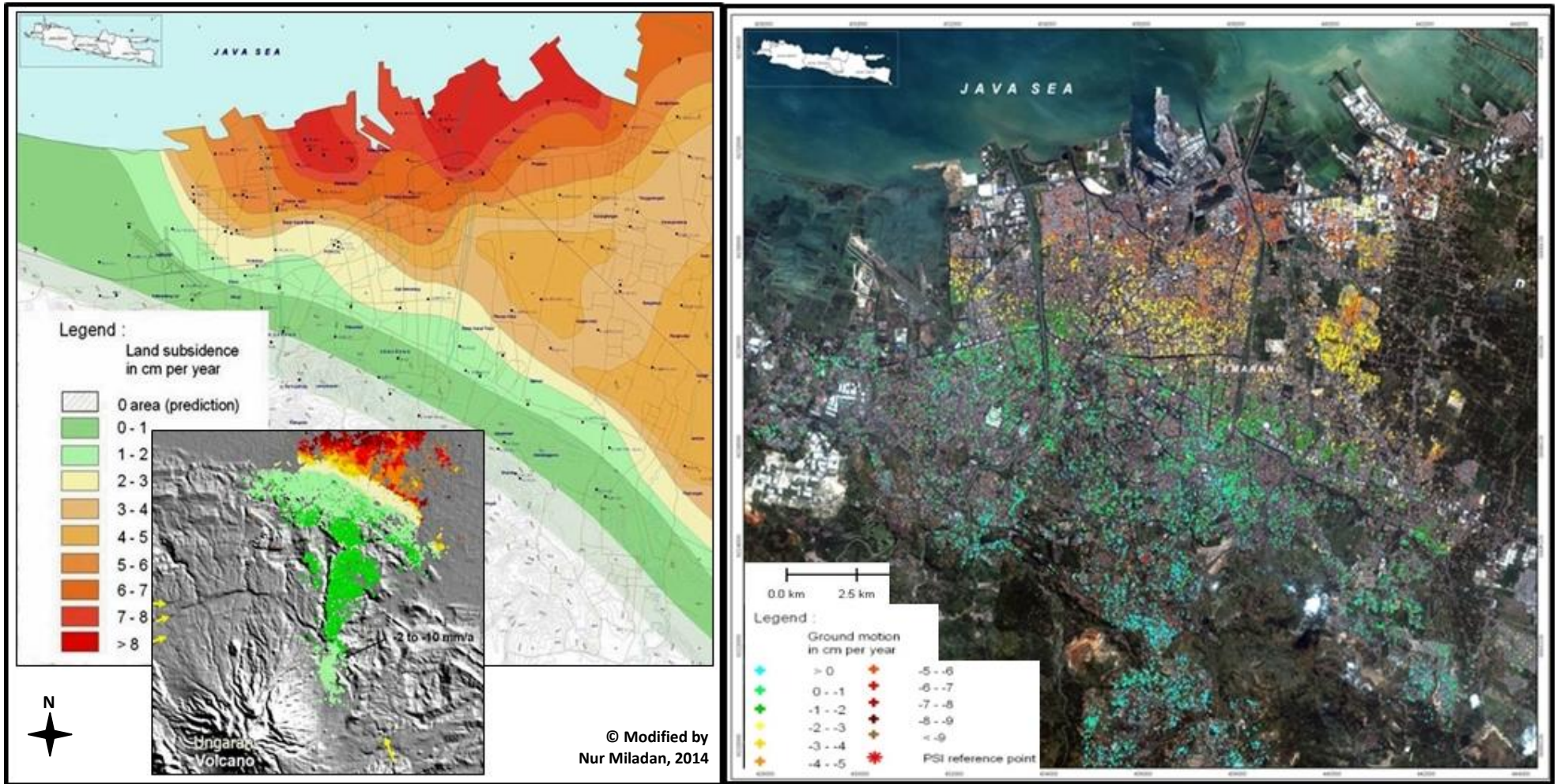
<sup>268</sup> Ringkasan dan hasil lokakarya amblesan tanah Semarang (*executive summary of land subsidence in Semarang*), 2008, Bandung: German-Indonesian Technical Cooperation on Mitigation of Georisk (Bundesanstalt für Geowissenschaften und Rohstoffe (BGR) and Ministry of Energy and Mineral Resources).

<sup>269</sup> Abidin, H.Z., Andreas, H., Gumilar, I., Sidiq, T.P., Fukuda, Y., 2012, "Land Subsidence in Coastal City of Semarang (Indonesia): Characteristics, Impacts and Causes", *Geomatics, Natural Hazards and Risk*, vol. 4, Issue 3, pp. 226-240.

<sup>270</sup> Holzer, T.L., Johnson, A.I., 1985, "Land Subsidence Caused by Ground Water Withdrawal in Urban Areas", *Geo Journal*, vol.11, n° 3, pp. 245-255; Nutalaya, P., 1989, "Flooding and land subsidence in Asia", *Episodes*, vol.12, n° 4, pp. 239-248.

<sup>271</sup> Abidin, H.Z. et al, *ibid*.



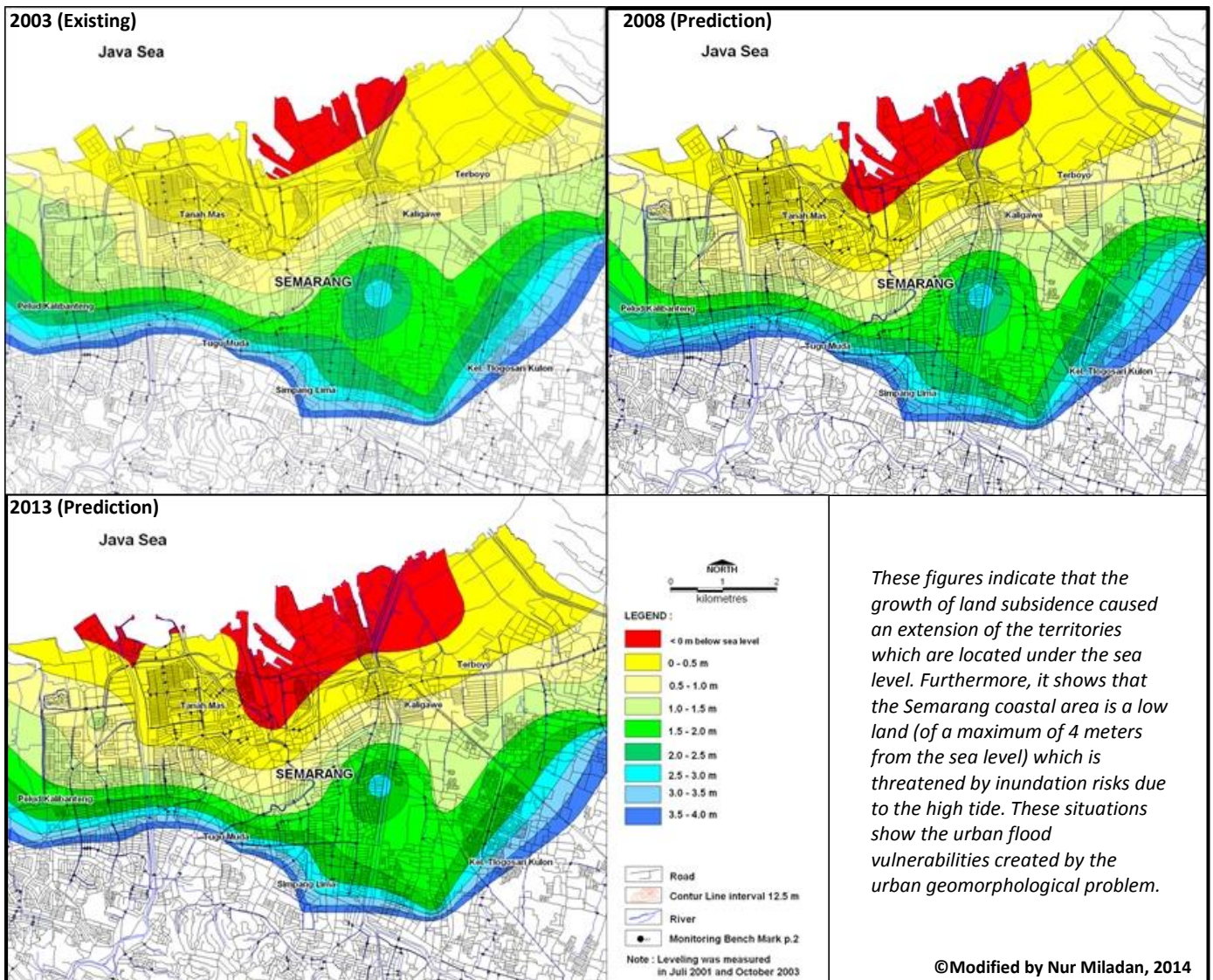


**Figure 50. Land subsidence of Semarang City**

Source: Ringkasan dan hasil lokakarya amblesan tanah Semarang (executive summary of land subsidence in Semarang), 2008, Bandung: German-Indonesian Technical Cooperation on Mitigation of Georisk (Bundesanstalt für Geowissenschaften und Rohstoffe (BGR) and Ministry of Energy and Mineral Resources); Kuehn, F., Albiol, D., Cooksley, G., Duro, J., Granda, J., Haas, S., Hoffmann-Rothe, A., Murdohardono, D., 2010, "Detection of Land Subsidence in Semarang, Indonesia, Using Stable Points Network (SPN) Technique", *Environmental Earth Sciences*, vol. 60, Issue 5, pp. 909–921.

The aggravated land subsidence in Semarang City is situated in the Northeastern part of Semarang coastal area. These territories are potential groundwater areas where a massive extraction of groundwater has occurred. Meanwhile, the hill areas have not experienced land subsidence and they are not high productive groundwater areas.





**Figure 51. Land Elevation of Semarang City**

Source: Murdohardono, D., 2006, *Amblesan Tanah Semarang* [PowerPoint], Semarang: Geology Agency, Ministry of Energy and Mineral resources.

Land subsidence is also influenced by natural phenomena, such as young alluvium soil consolidation (compression), linked to the coastal land history. These phenomena consist of the dynamic transformation of the Semarang coastal space and the hydrological cycle. The Geological Agency Survey measured the young alluvium area in Semarang City: the land depth is 79 meters and is composed by the clay, sand and gravel. This composition presents high risks of land consolidation.

Depth(m)	Symbol	Litologi	Sample Depth (m)	Unit Weight (gr/cm <sup>3</sup> )	Angka Por	Cc	Cv	Pc
0.00 – 1.35		Fill		1,540				
			2.00 - 2.55	1,785	0,99	0,268	0,00026	0,70
1.35 – 19.90		Clay	6.00 - 6.55	1,811	0,91	0,214	0,00075	1,50
19.90 – 23.00		Sand						
23.00 – 25.00		Claystone	23.00 - 23.40	1,682	1,15	0,339	0,00065	1,50
25.00 – 28.00		Sand						
28.00 - 35.50		Sandy Clay	31.45 - 31.80	1,682	1,24	0,33	0,00020	1,25
35.50 – 47.00		Sand		1,682	1,15	0,339	0,00065	1,50
47.00 – 57.50		Clay - Sandy Clay	51.65 - 52.00	1,731	1,170	0,242	0,00018	1,30
57.50 – 62.00		Sand	58.50 - 58.90	1,750	1,12	0,249	0,00045	0,85
62.00 – 63.00		Gravelly Clay		1,731	1,17	0,242	0,00018	
63.00 – 66.00		Silty Sand - Sand	63.40 - 63.75	1,567	1,5	0,772	0,00045	1,00
66.00 – 68.00		Gravel		1,750	1,23	0,251	0,00075	
68.00 – 79.00		Gravelly Clay	69.80 - 70.00	1,703	1,23	0,251	0,00075	1,50
79.00 – 100.00		Conglomerate	85.70 - 86.00	1,644	1,55	0,342	0,00065	0,65

**Figure 52. Land depth condition of Semarang coastal area**

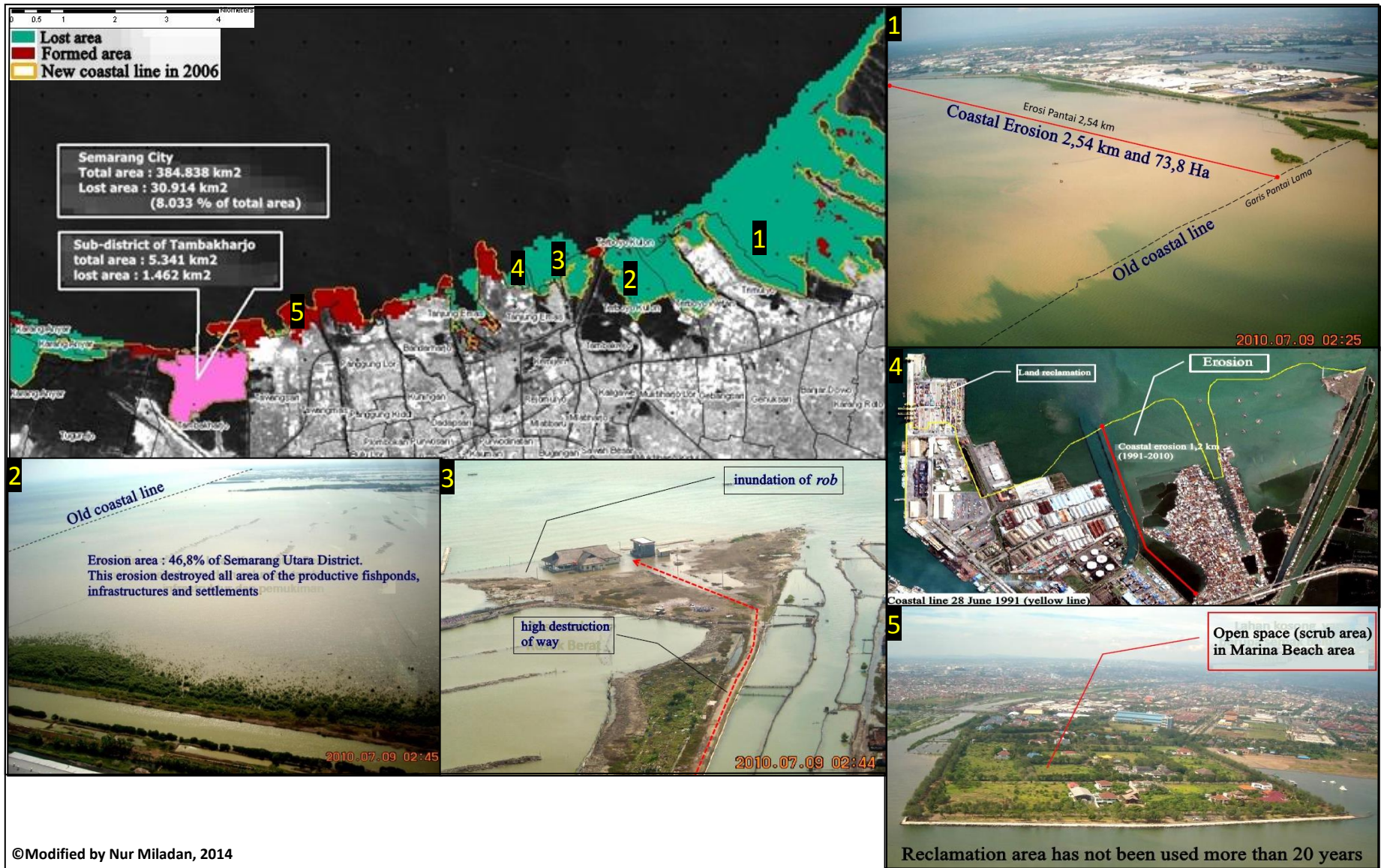
©Modified by Nur Miladan, 2014

Source: Murdohardono, D., Hartanto, 2007, *Titik ketinggian (peil) stabil bedrock bench mark di area yang mengalami land subsidence di Kota Semarang* [PowerPoint], Semarang: Geology Agency, Ministry of Energy and Mineral resources.

*Clay, sand and gravel are soils presenting a high erosion risk and are very vulnerable to inundation risk. Furthermore, these soils can underpin the growth of build-up area on top only to a limited extent.*

What has been described above is the result of urban growth that is at odds with the urban geomorphology. The spatial planning for 1975-2000 did not indicate the mitigation of land subsidence risks. In this document, indeed, the Northern part and the Eastern part of city were planned as settlement, transportation zone and industrial zone. Nevertheless, the land subsidence phenomena were not predicted, although the flood risk already existed at that time. Likewise, the high abrasion risks, due to the soil characteristics, were not been taken into account in that period. Several areas in Semarang coast have disappeared since the 1970s and it has recently been inundated by the seawater. On the one hand, the municipality has developed the extension area through land reclamation, but, on the other hand, Semarang City has experienced a loss of areas.





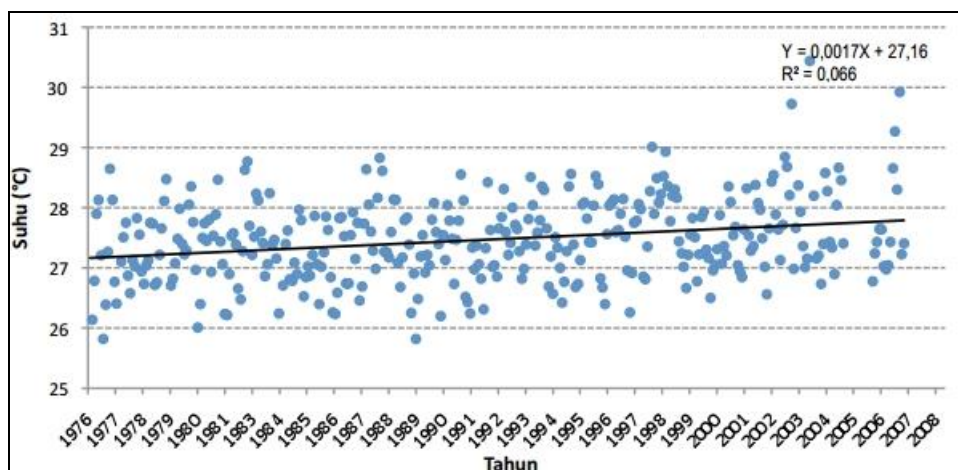
**Figure 53. Transformation space in Semarang coastal area from 1972 to 2006**

Source: Ringkasan dan hasil lokakarya amblesan tanah Semarang (executive summary of land subsidence in Semarang), 2008, Bandung: German-Indonesian Technical Cooperation on Mitigation of Georisk (Bundesanstalt für Geowissenschaften und Rohstoffe (BGR) and Ministry of Energy and Mineral Resources); Draft laporan akhir pemetaan potensi, kerusakan, dan model rehabilitasi kawasan pesisir Kota Semarang (Final report draft of the mapping of potencies, destructions, and rehabilitation model of Semarang City Coast), 2010, Semarang: Department of Marine and Fisheries of Semarang City.



The areas lost on Semarang coast are also linked to the risk of a rise in sea level. According to Wirasatria, Hartoko, and Suripin (2006), the value of the rise in sea level in Semarang water due to global warming amounted to 2,65 mm per year, but this phenomenon is not the dominant factor influencing the rise in sea level in Semarang City.<sup>272</sup> Indeed, there is an increase of temperature in Semarang City, and it is considered as a form of global warning in the local context.

However, the land subsidence is considered as the dominant factor influencing the *rob* risk in Semarang City. As a result, the municipality has recently begun to mitigate this risk as well as other risks of disasters caused by global warning, such as drought and erosion hazards on the basis of the project of Asian Cities Climate Change Resilience Network (ACCCRN).

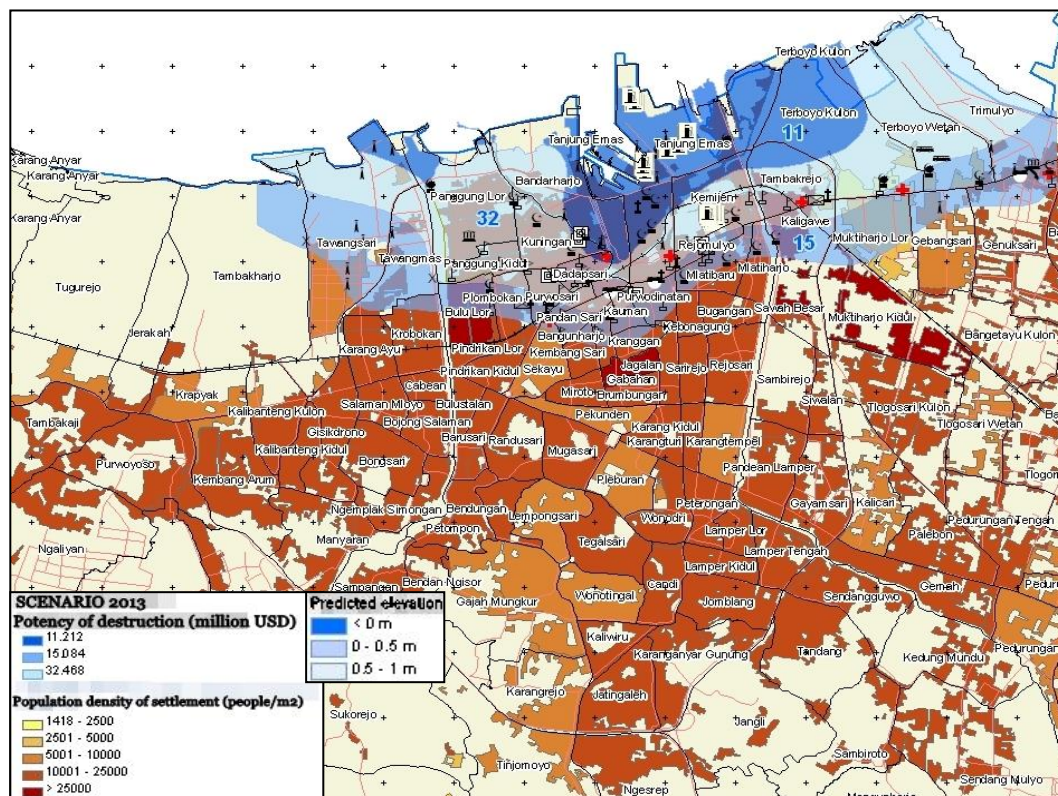


**Figure 54. Increasing trend of temperature in Semarang City**

Source: *City resilience strategy Semarang's adaptation plan in responding to climate change*, 2010, Semarang: Asian Cities Climate Change Resilience Network (ACCCRN)/ Institute for Social and Environmental Transition (ISET).

The municipality has begun to implement the mitigation of land subsidence since 2008. This project is the result of the cooperation between the municipality and several stakeholders, such as the Central Java Province, the Geology Agency under the Ministry for Energy and Natural Resources and the German Federal Institute for Geosciences and Natural Resources (BGR). These entities have assessed the vulnerabilities of the coastal area, starting with the land subsidence risk, and they have identified which institutions were involved in order to manage that risk. The vulnerability assessment of land subsidence in the coastal area indicates that Semarang City is experiencing economic losses, the amount of which has been estimated in 2013 to about 58.764 Million USD.

<sup>272</sup> Wirasatria, A., Hartoko, A., Suripin, 2006, "Study of Sea Level Rise as a Base for *Rob* Problem Solving in Coastal Region of Semarang City", *Jurnal Pasir Laut*, vol. 1, n° 2, pp. 31-42.



**Figure 55. Land subsidence scenario map for 2013 in Semarang**

Source: *Ringkasan dan hasil lokakarya amblesan tanah Semarang (executive summary of land subsidence in Semarang)*, 2008, Bandung: German-Indonesian Technical Cooperation on Mitigation of Georisk (Bundesanstalt für Geowissenschaften und Rohstoffe (BGR) and Ministry of Energy and Mineral Resources)

Furthermore, the causes of land subsidence in Semarang City were established: natural consolidation (79%), massive groundwater extraction (6%) and other factors (rise in sea level or tectonically occurrences 5%).<sup>273</sup> Based on these assessments, the government (municipality and province), through a forum discussion group, put forward several mitigation strategies and also the institution management of land subsidence risk.<sup>274</sup> They include strict law enforcement, handling of ground water extraction, detailed identification of land subsidence risks (natural and anthropogenic), environmental impact assessment, a regulation for the development in the land subsidence risk areas, reassessment of spatial planning and land use including relocation,

<sup>273</sup> *Ringkasan dan hasil lokakarya amblesan tanah Semarang, ibid.*

<sup>274</sup> Forum discussion group (FGD) involved the municipality (including Regional Development Planning Agency, Drinking Water Regional Agency, Red cross, Office of National Unity and Community Protection, Community Empowerment Agency, Department of Public Works, Department of Agriculture, Department of Industry), the Province Government (including Regional Development Planning Agency, legislature, Department of energy and mineral resources, Department of Human Settlement and Spatial Planning, Environment Agency, Department of Water Resources, Department of Health, Department of transportation and communication, Department of Social Welfare, Department of Highways, Administration Bureau, Regional Development Bureau, Regional Secretary), academic partners (Diponegoro University, Semarang State University and Gadjah Mada University), PT. Angkasa Pura I, and USAID. This FGD was facilitated by NGO of Good Local Governance-GTZ.

controlling and development of building codes, assessment or cessation of land reclamation development.

Despite the fact that several strategies of land subsidence mitigation have been planned since 2008, in fact, the land subsidence risk nowadays remains to be a crucial problem on Semarang coast. The implementation of these mitigation strategies face many constraints relating to the obscurity of management and the di-synchronization of urban plans. The obscurity of management relates to the obscurity of the roles of institutions. Despite the existence of FGD, the monitoring of the land subsidence phenomenon must be done every two years with the municipality as the responsible institution for the monitoring. The coordinator of land subsidence mitigation is the Central Java Province through the Regional Development Planning Agency and the Department of Energy and Mineral Resources. The roles of the province government are expected to support the limitation of municipality authority to manage the coastal land. Semarang City as capital of Central Java has several regional infrastructures such as airport, port and power plants which are located on Semarang coast, but the municipality has the authority limitations for management of these facilities and groundwater.<sup>275</sup> Nevertheless, the existing collaboration for the implementation of these mitigation strategies is not reflected in the urban plans, and these strategies have recently not been well known to the local authorities, such as sub-districts (*kelurahan*) and districts (*kecamatan*), which have the responsibility to inform inhabitants of government plans and projects.

“[...] we have informed the government (municipality) projects, such as the pile-up of soil for the streets, and the communities can propose the projects (of local street elevations) to get the help (of financing) by the municipality. But we have not heard yet about the mitigation plans of land subsidence by the municipality and we have certainly not informed yet the inhabitants. But, clearly, the government (municipality) and the inhabitants encounter difficulties to cope with these disasters [...]”<sup>276</sup>

“[...] we have not heard yet about the municipality plans to anticipate the land subsidence, but we indeed know that the land subsidence takes place in our sub-district by the information given by the municipality [...]”<sup>277</sup>

The recent spatial plan of Semarang City (for 2011-2031) which has been released by the municipality does not indicate the strategies (plans) of land subsidence mitigation. The

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<sup>275</sup> *Ringkasan dan hasil lokakarya amblesan tanah Semarang, ibid.*

<sup>276</sup> The interviews with Didik Dwi Hartono, as a secretary of District Office of Semarang Utara in 2011.

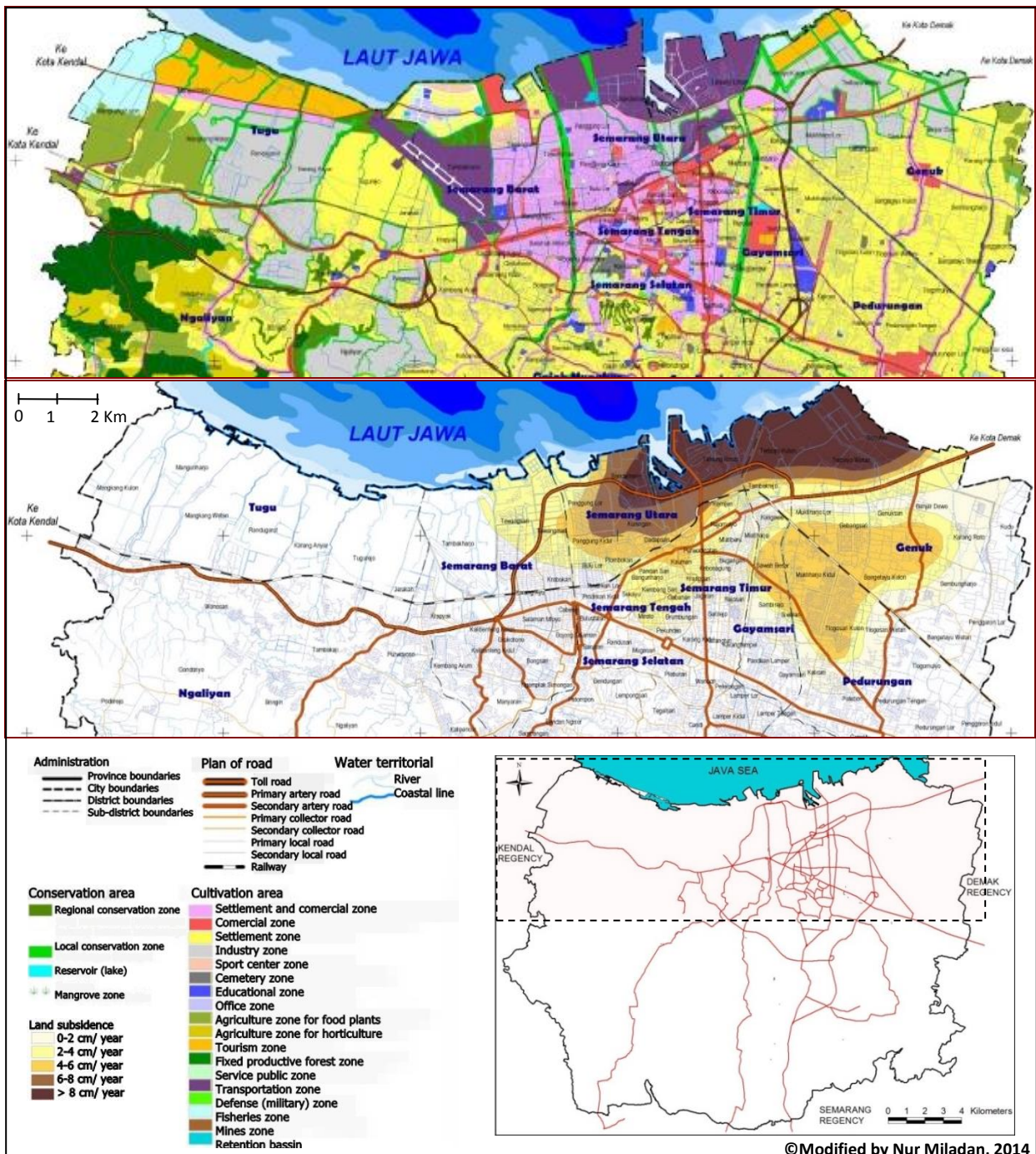
<sup>277</sup> The interviews with Sumardi, as a head of Sub-district office of Panggung Lor in 2011.

inconsistency between the recent spatial plan and land subsidence mitigation lies in the fact that the municipality has not planned yet how the coastal area can adapt to the land subsidence risk. This plan remains to be oriented towards the urban and economic development, but the environmental factors have not yet become the priority to develop urban sustainability. The land subsidence area remains to be planned for the urban areas (high build-up zones). Despite the fact that the municipality has sought to mitigate the land subsidence through the regulation of groundwater extraction, it is not supported by the recent spatial plan.

These situations certainly produce an increase of urban flood vulnerabilities, particularly on Semarang coast. Likewise, it seems that the institution management for land subsidence mitigation has not yet implemented these strategies. The land subsidence process is only monitored, and it actually remains develop to spread on Semarang coast. These elements highlight the failures of Semarang spatial plans, and the fact that the latter did not accommodate the geomorphological risks, and the land subsidence phenomenon in particular.

It seems that it is difficult to implement land subsidence mitigation in the Semarang coastal area. The province government, as coordinator of land subsidence mitigation, could not intervene in the Semarang land use plan which was planned by the municipality. In addition, the land use plan was adjusted to the recent processes by which the land subsidence areas have become urban centers. Meanwhile, the province government, through the Regional Development Planning Agency and the Department of Energy and Mineral Resources, mitigate land subsidence only through technical approaches and law enforcement of groundwater extraction reduction without a spatial organization. This is due to the existence of authorities that are limited for Semarang land use plan. Moreover, the broad authority of the province government results in a lack of focus by Semarang city on land subsidence mitigation. This leads to the inexistence of spatial organization plans for land subsidence mitigation in Semarang City.





**Figure 56. Comparison between Spatial Plan for 2011-2031 and land subsidence risk**

Source: *Spatial planning of Semarang City for 2011-2031, ibid.*

Despite both maps are stated in the document of spatial plan for 2011-2031, it seems clear that between the land use plan and the land subsidence phenomena are contradictory situation. The land subsidence areas were planned as the urban centers such as industrial zones, transportation zones, tourism zones, and also commercial zones and settlements. Furthermore, it seems that the water spaces in those areas will be reduced, whereas the land subsidence will produce the extension of the territories which are situated under the sea level and have the high vulnerabilities of hydrological risk. The municipality realized that the load of building and construction as land subsidence cause accelerating the natural soil consolidation in Semarang coastal, but contrary, the land use plan will produce those territories as the build-up areas with high density.

### 2.1.3. Urban drainage problems: design and maintenance

The existence of problems relating to the drainage system is one cause of flood risk in Semarang City. This system has existed since the Dutch government era and, it's only recently, that the municipality has started to rehabilitate and develop extensive networks. Indeed, this system is functions poorly, and, consequently Semarang coast is always threatened by *rob* phenomena and inundations during the rainy season.

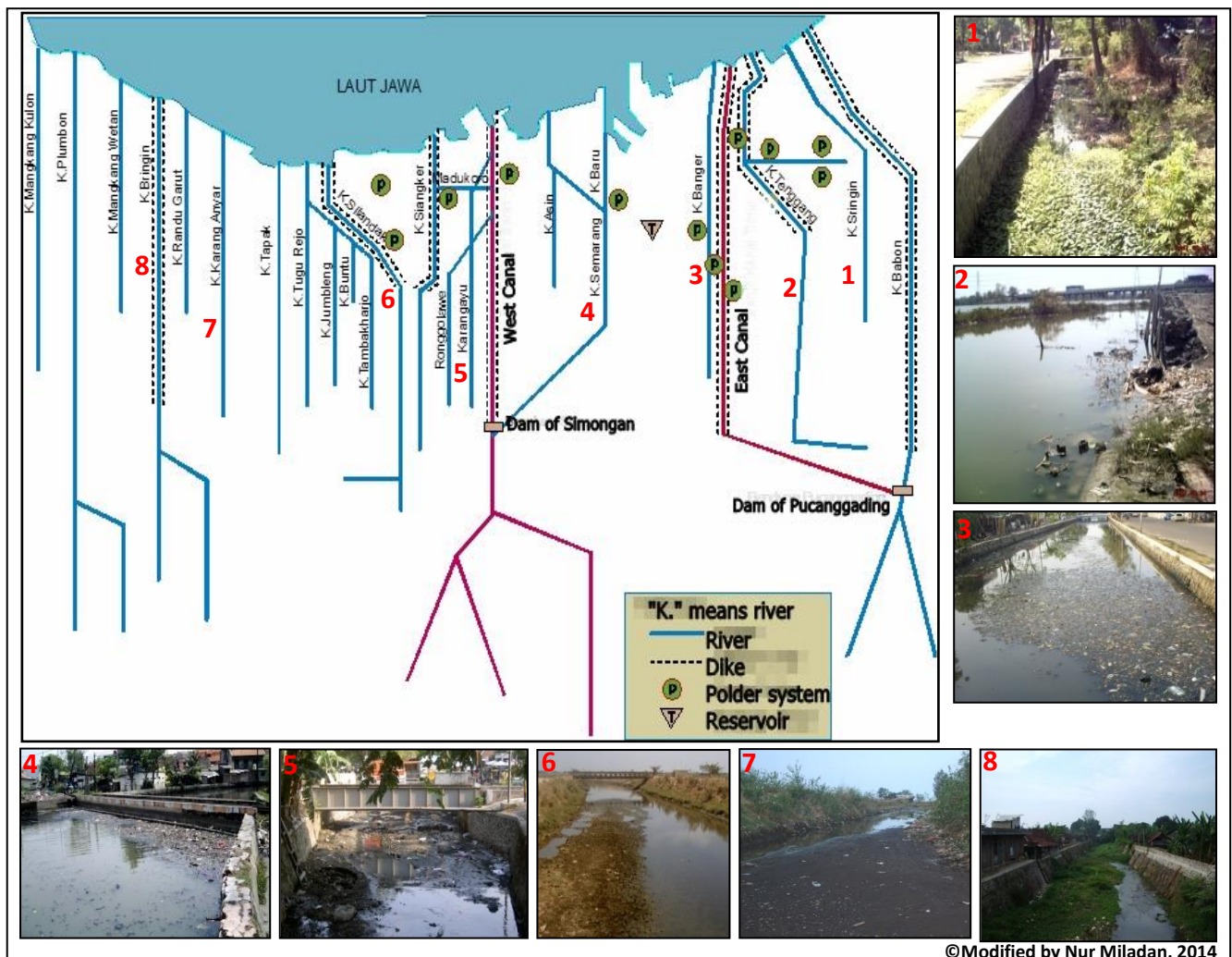
The smart book of water resources management of Semarang City which was released by the Department of Water Resources of Semarang City in 2010 stated that urban drainage problems of Semarang City are related to the topographical situation, growth of population, land conversion, exploitation of minerals, land subsidence, waste, squatter area, maintenance and climate change.<sup>278</sup> The urban topography characterizing the hill and plain (coastal) areas produces technical difficulties to develop a urban drainage system. The hill areas experience high water discharge, while the coastal areas encounter troubles to channel water to the sea. Likewise, the growth of population, the land conversion and the exploitation of minerals are regarded as causes of water spaces reduction influencing the work performance of the urban drainage system. Furthermore, waste produces sedimentation, while the squatter areas along the rivers and canals cause the decrease of urban drainage capacities. Moreover, the municipality has a limited budget for urban drainage maintenance, and, consequently, the rivers and canals normalizations are rarely implemented. The climate change issue relating to the rise in sea level and land subsidence are also considered as factors causing the lack of a drainage system, in particular on the coastal areas. However, urban drainages problems are the result of technical and managerial problems. The technical problem relates to the poor qualities of urban drainages, which in turn relate to the inefficiency of water discharge. Meanwhile, the managerial problems are caused by the complexity of the institutions in charge of the drainage management, including its funding.

The discharge of urban drainages is not optimum. This is due to the sedimentations and the limitations of the catchment areas in the downstream area. Most of the main urban drainages are silted, such as floodways, Tenggang River, Sringin River, Banger River, Semarang River, Karangayu River, Silandak River, Karang Anyar River and Bringin River. The sedimentations originate from the Ungaran mountain area and the sea. The water discharge from Ungaran Mountain has high level of sedimentation, while the water from the sea relates to the abrasion of the drainage outfalls. These situations certainly halt the water

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<sup>278</sup> *Buku pintar pengelolaan sumber daya air Kota Semarang (Smart book of water resources management of Semarang City)*, 2010, Semarang: Department of Water Resources, Energy and Mineral Resources of Semarang City.

channeling from the upstream to the downstream areas, and, consequently, the inundations occur on the Semarang (plain) coastal area. Furthermore, this is aggravated by the lack of catchment area in the foothills of Semarang City. Besides sedimentation, urban drainages experience the destructions being caused by the land subsidence. Several dikes around the main drainages in the Eastern part of Semarang City such as East Canal, Tenggang River and Sringin River experience damages and a decrease of the height of dike. In addition, the elevations of several urban drainages are higher than that of the urban areas or the settlements. Consequently, the drain water from the local drainages of settlements to the urban drainages cannot to be channeled naturally. These drain waters must be pulled by a pump system before being channeled to the urban drainages. These situations shed light on the dependency on the pump system to support the urban drainage system, particularly on the Semarang coastal area.

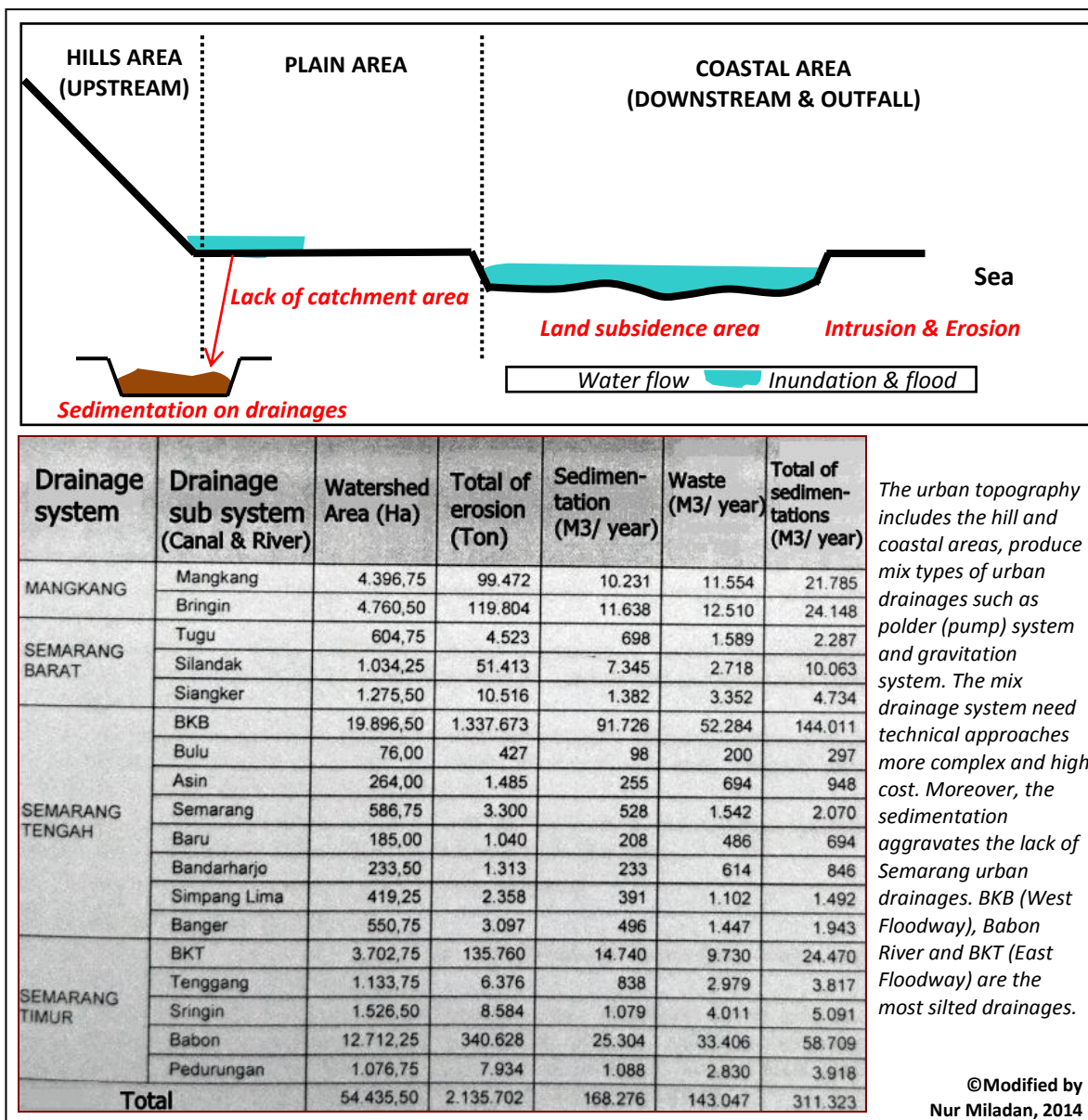


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**Figure 57. Existing urban drainage of Semarang City**

Source: *Buku pintar pengelolaan sumber daya air Kota Semarang (Smart book of water resources management of Semarang City)*, 2010, Semarang: Department of Water Resources, Energy and Mineral Resources of Semarang City.





**Figure 58. Schema of flood risk problems in Semarang City and its prediction of urban drainage sedimentations**

Source: *Urban Drainage Masterplan of Semarang City, 2007*, Semarang: Regional Development Planning Agency.

The technical problems of urban drainages are linked to their poor management. They relate to the financial problems, the lack of urban infrastructures and the land use change handling (controlling), especially in the watershed areas. The municipality stated that the maintenance of the urban drainage incurs high costs. Since 2007, the municipality has had the Master plan of urban drainages, but it is actually under the financial constraints to realize the hydrological projects and urban drainages maintenance. The municipality has implemented the dredging of sedimentations on urban drainages as routine projects since the 1970s. But, in reality, as a result of the high sedimentation from the Ungaran Mountain, the urban drainages



are often silted again. The urban drainages must be renewed at least every three years. However, the dredges were implemented on the urban drainages for more than three years because to the lack of funding. In the document of urban drainage master plan (2007), this problem is mentioned as a crucial problem of the operation and maintenance of urban drainages.

“[...] For several decades, the operation and the maintenance of the hydrological projects, particularly the drainage projects, were not taken seriously. This situation does not stem from the ignorance of the operation and maintenance, but it is caused by financial difficulties. If there is a funding, there is no guarantee that it is used for the operation and maintenance (of urban drainages) because it is used for urgent (unpredictable) projects [...]”<sup>279</sup>

The municipality has calculated the initial investment cost of the urban drainage development to anticipate flood risk amounted to about 8.310.124.521.000 IDR (519.382.782, 6 Euro), including the costs of construction, consultation, administration, socialization, land availabilities, and the unpredictable costs. Meanwhile, the operation and maintenance cost of the urban drainage system was estimated to about 115.736.907.000 IDR (7.233.556, 688 Euro) each year. Nevertheless, the average budget availability for the yearly urban drainage development and maintenance is of about 118.402.409.500 IDR (7.400.150, 59 Euro)<sup>280</sup>. This budget is part of the annual municipality budget. The national government also contributes to the funding of several hydrological urban projects, despite the fact that these aids cannot be guaranteed, due to the capacity of the annual state budget. This situation points to the imbalance between the demand and supply of the development and maintenance of urban drainages. It moreover has negative consequences for the flood reduction programs in Semarang City.

In the post-Dutch government era, the urban drainages system faced the stagnation of innovation. Until 2009, there was only a little change in the urban drainage system. The municipality only carried out standardization of the existing urban drainages and provided the pump system. The development of several urban drainages was carried out in conjunction with the constructions of new urban roads. These elements indicate that urban growth was not followed by the supply of a urban drainage system.

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<sup>279</sup> *Urban Drainage Masterplan of Semarang City*, 2007, Semarang: Regional Development Planning Agency.

<sup>280</sup> It is estimated by the budget of urban drainage development and maintenance by Department of Water Resources in 2014.

Likewise, the waste on bodies of drainages results in the ineffectiveness of the urban drainage system. The inhabitants' behaviors still consist in disposing wastes on the drainages, which have become a crucial urban problem, similar to that of the other big cities in Indonesia. Nevertheless, this problem is not only caused by Semarang City inhabitants, but also by other regencies located in the upstream areas of the rivers in Semarang City. The municipality has sought to control these behaviors through inspections and law enforcement. But it is actually still struggling to handle this problem. Furthermore, the waste problem in Semarang City is not only caused by the behavior of the inhabitants, but also to the poor waste management in this city. The waste public service does not cover the whole city; consequently, many settlements do not have access to the waste network services. The public service only covers 67 % of the sub-districts of Semarang City and it only handles 64, 57 % of the total waste (4.757, 10 m<sup>3</sup>/ day) from 1.574.366 inhabitants.<sup>281</sup>



**Figure 59. Waste on the urban drainages of Semarang City**

Source: *Urban Drainage Masterplan of Semarang City*, 2007, Semarang: Regional Development Planning Agency; Handaka, H., Buwono, B., *Pemkot akan pasang paving di Kuningan Semarang Utara*''[Photo], *Tribun Jateng*, July, 10<sup>th</sup> 2014, retrieved December 25<sup>th</sup> 2015, from <http://jateng.tribunnews.com>.

*The high quantities of waste occur in the majority of coastal urban drainages producing the water discharge is overflowed during the rainy seasons or the tidal seasons.*

To conclude this section, it may be argued that the crucial causes of flood risk in Semarang city include the unpreparedness of urban infrastructures and the massive growth of built-up areas. The lack of water supply, drainage, waste and sanitation infrastructures urges inhabitants to seek access to and to provide infrastructures by themselves. The problems of massive groundwater extraction, poor local drainages and sanitation and also the limitation of waste disposal areas are the consequences of the lack of urban infrastructures. Furthermore,

<sup>281</sup> Ernawati, D., Budiastuti, S., Masykuri, M., 2012, "Analisis komposisi, jumlah dan pengembangan strategi pengelolaan sampah di wilayah Pemerintah Kota Semarang berbasis Analisis SWOT", *Ekosains*, vol 4, n<sup>o</sup> 2, pp. 13-22.

this brings about urban environmental problems, such as flood risk. The failures of the urban infrastructure system are involved in the growth of the hydrological risk.

Additionally, Semarang coastal city needs many water spaces to adapt to the hydrological risks. The many buildings and constructions that did not take into account the coastal characteristic adaptations have given rise to environmental problems, such as land subsidence, erosion and intrusion of sea water into Semarang coast. According to several studies<sup>282</sup>, Semarang coast experiences a high risk of water sea intrusion, thus aggravating land subsidence stemming from the soil erosion process. The massive growth of built-up areas gave rise to lost urban water spaces.

In the two situations above describe have shed light on the imbalance between supply and demand of urban metabolism system. This takes place within the concurring context of two emerging worries: first, the capacity of the planet to feed and maintain a growing population and, second, the destructive power of man, given the Earth's finite, limited and unique characteristics.<sup>283</sup> On the one hand, the city needs an increase of urban infrastructure supplies (access) in line with the demand of urban growth. On the other hand, the failures of urban infrastructure development have brought about a lack of an urban metabolism system producing the existence of urban disaster risks. Likewise, the natural environment system, such as the hydrological cycle, also influences the existence of Semarang as a coastal city. Natural consolidation of alluvium soil, sedimentations on urban drainages from the mountain and the sea are inevitable natural environment phenomena. In this city, it seems that the adaptations of natural characteristics are not the integrated elements for urban development as the preventive efforts for flood risk.

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<sup>282</sup> Suhartono, E., Purwanto, Suripin, 2012, "Model intrusi air laut terhadap air tanah pada akuifer di Kota Semarang", *Prosiding Seminar Nasional Pengelolaan Sumberdaya Alam dan Lingkungan*, Semarang; Nurwidyanto, M.I., Achmad, R.T., Widodo, S., 2006, "Pemetaan sebaran air tanah asin pada akuifer dalam di wilayah Semarang bawah", *Berkala Fisika*, vol. 9, n° 3, pp.137-143; Sriyono, Qudus, N., Setyowati, D.L., 2010, "Model spasial ketersediaan air tanah dan intrusi air laut untuk penentuan zona konservasi air tanah", *Saintekno*, vol. 8, n° 2, pp. 87-94.

<sup>283</sup> Barles, S., 2010, "Society, Energy and Materials: the Contribution of Urban Metabolism Studies to Sustainable Urban Development Issues", *Journal of Environmental Planning and Management*, vol. 53, n° 4, pp. 439-455.



**Figure 60. The emergence of flood risk in Semarang City**

*The Semarang flood risk is the accumulation of the coastal natural phenomena, and the imbalance between supply and demand of urban metabolism system. These situations have more aggravated since the rapid urbanization process in Semarang coastal area.*

The complexity of the flood risk phenomenon in Semarang City relates to urban management, including urban concepts and projects. Admittedly, urban management effectiveness reduces the rise of urban risk. Nevertheless, quite the reverse may also occur. The recent rise of urban risk correlates the lack of adaptation of urban management to urban risk in the past, which was oriented towards partial projects, such as urban drainage standardization. In fact, those projects were not the solutions for the existence of flood risk, which has recently increasingly aggravated. Nowadays, the comprehensive urban plans, such



as the spatial organization between the upstream and the downstream areas, and the coastal area management are being developed by the municipality as a response to the previous lack of hydrological urban management. Nevertheless, these approaches require collective efforts to be made by related institutions. Their implementation is actually often subject to many constraints, such as project funding and project management, as well as coordination among them. These elements should be analyzed as components of the flood resilience process in Semarang City.

## **2.2. From partial to comprehensive hydrological projects: concepts and urban space transformations**

### **2.2.1. Hydrological projects, discrepancies between plans and their implementation**

Comprehensible projects to reduce flood risk have been initiated in the 1990s. They comprise the project of the Master plan on water resources development and a feasibility study for urgent flood control and urban drainage in Semarang City and suburbs carried out in 1993. It was a cooperation project between the municipality and the Japan International Cooperation Agency (JICA) which was facilitated by the Ministry of Public Works.<sup>284</sup> This project was seen as a response to the flash flood occurrence in 1990. This flood caused the death of 47 people and an economic loss of about 8,5 milliards IDR ( $\approx$  531.250 Euro).<sup>285</sup> It occurred around of the Garang Watershed and overflowed through the West Floodway.

In addition, the land use of the Garang Watershed between 1980 and 2005 was affected up to more than 30 %.<sup>286</sup> The land use change did not have any significant impact on the flash flood; nevertheless, the depth, the distribution, and the hazard level of the flood were related to the distribution and the morpho-arrangement of the detailed landform unit (the narrow valley between anticlinal hills in the downstream of the Garang River Basin).<sup>287</sup>

The determination of the Master plan on water resources development and the feasibility study for urgent flood control and urban drainage in Semarang City and suburbs were expected to anticipate the frequent flood risks in Semarang City. Since that period, the municipality has sought to reduce flood risks through the planning approaches of the

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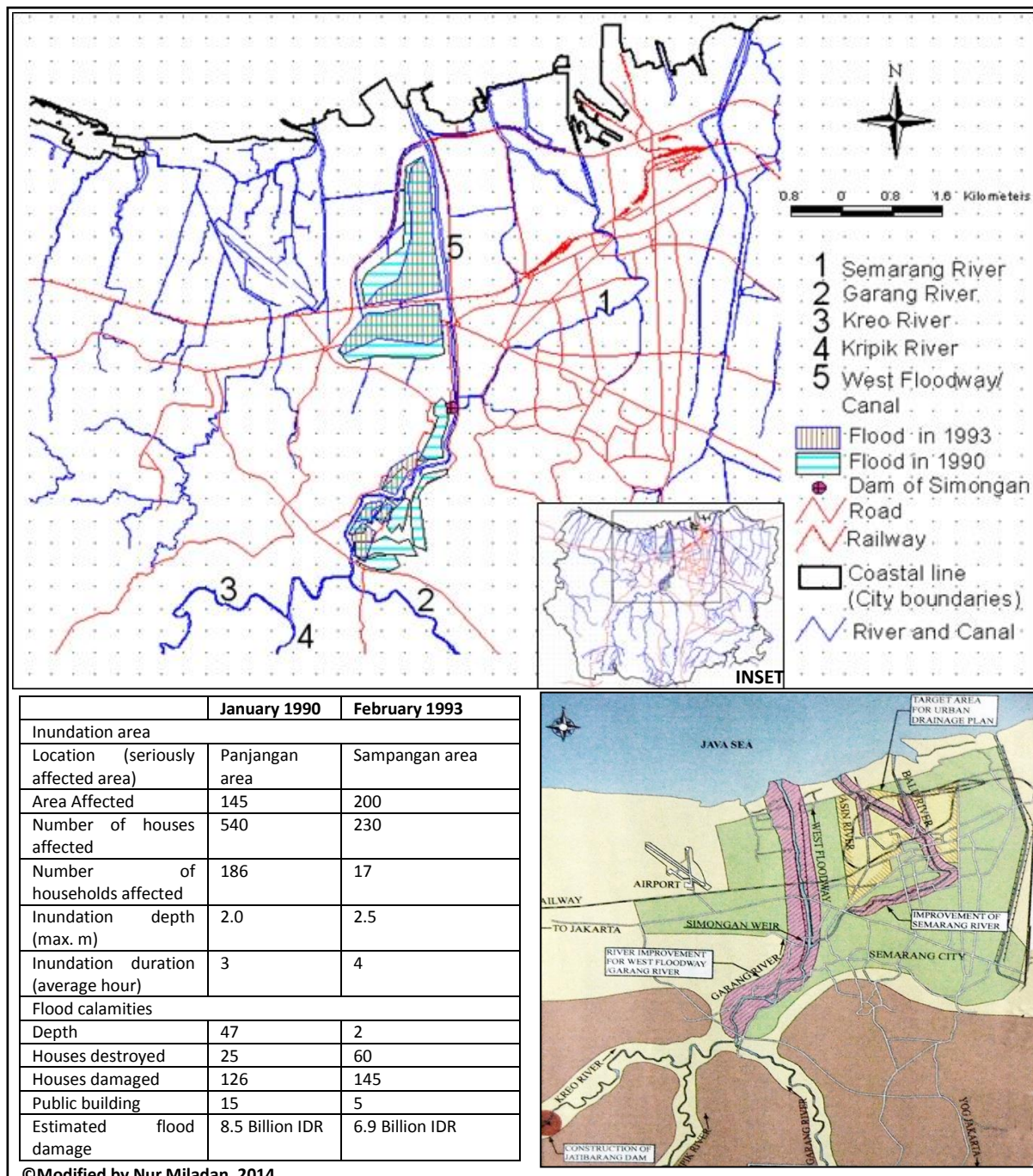
<sup>284</sup> The Japan International Cooperation Agency (JICA), established in 1974 is the primary Japanese governmental agency responsible for technical cooperation component of Japan's bilateral ODA (Japan's Official Development Assistance) program. Cf. "JICA Japan International Cooperation Agency", *Massachusetts Institute of Technology* [Web], retrieved December 28th, 2015, from <http://web.mit.edu/urbanupgrading/upgrading/resources/organizations/JICA.html>.

<sup>285</sup> *Urban Drainage Masterplan of Semarang City*, *ibid.*

<sup>286</sup> Suhandini, P., 2008, "Perilaku masyarakat terhadap penggunaan dan pelestarian air di lingkungannya (studi kasus di Daerah Aliran Sungai Garang, Semarang)", *Forum ilmu sosial*, vol. 35, n° 1.

<sup>287</sup> Suhandini, P., 2012, *Banjir bandang di DAS Garang Jawa Tengah (Penyebab, dan implikasi)*, Ph.D Dissertation in Geography, Gadjah Mada University.

downstream and upstream areas. On the basis of this document, it planned to implement three priority hydrological projects, including the improvements of West Floodway, Garang River and Simongan Dam, the development of Jatibarang reservoir around Kreo River, and the improvement of the local drainage system. Most of these plans were not implemented until the mid-2000s. However, they are currently being developed.



**Figure 61. The Flash flood occurrence in 1990 and in 1993 and flood control plan of Garang Watershed**

Source: “Flood Inundation Map 1990”, “Flood Inundation Map 1993”, “Location of Project Site”, *The Detail Design of Flood Control, Urban Drainage and Water Resources Development in Semarang in the Republic of Indonesia*, 2000, Semarang: Japan International Cooperation Agency (JICA).

*The flood control plan of Garang Watershed is to reduce and to manage the water discharge, in particular along Garang River, West Floodway and Semarang River.*

However, flood risks got worse during the 1990s and the 2000s. The flood aggravated the damages caused to urban infrastructures. For instance, *Suara Merdeka* (local newspaper) in 1997 mentioned these issues:

“This flood is not only disturbing inhabitants’ activities, but it also causes damage to the roads. The Department of Public Works (of Semarang City) has become the busiest department. It is requested to conduct emergency efforts with respect to the damaged roads and the clogged drains.”<sup>288</sup>

From 1997 to 2000, the municipality developed the project of the Detail design of flood control, urban drainage and water resources development. This project is the continuation of the flood control master plan carried out in 1993. This project was aimed to detail the design of the improvement of Garang watershed located in the central part of Semarang City. Furthermore, the municipality also sought to anticipate the flood risks in the Western and Eastern parts of the city. During 3 years (1997-1999), the municipality also cooperated with Snowy Mountains Engineering Corporation (SMEC) to support the flood risk reduction in Semarang City through the project of Semarang Flood Control Project-Consolidated Preparation Study.<sup>289</sup> The recommendations of that project are the standardization (rehabilitation) of Bringin River and Silandak River in the Western part of the city, and of Babon River (Dolak-Penggaron River system) in the Eastern part of the city. These rivers are subject to sedimentation and there are several squatter settlements that grew along them. These elements limited the water discharge capacities, implicating in turn flood occurrences in the surrounding areas.

In 2000, the municipality composed the new urban drainage master plan. This plan is the compilation of the previous hydrological projects and plans. It comprises the comprehensive plans that have been notified through the development of urban drainages integrated system. The Semarang urban drainage master plan project put forward several strategies on flood risks reduction, including the division of the drainage system between the upstream and the downstream areas, the development of polder and pump system in the coastal area, the plans of drainage region system, and law enforcement to support the

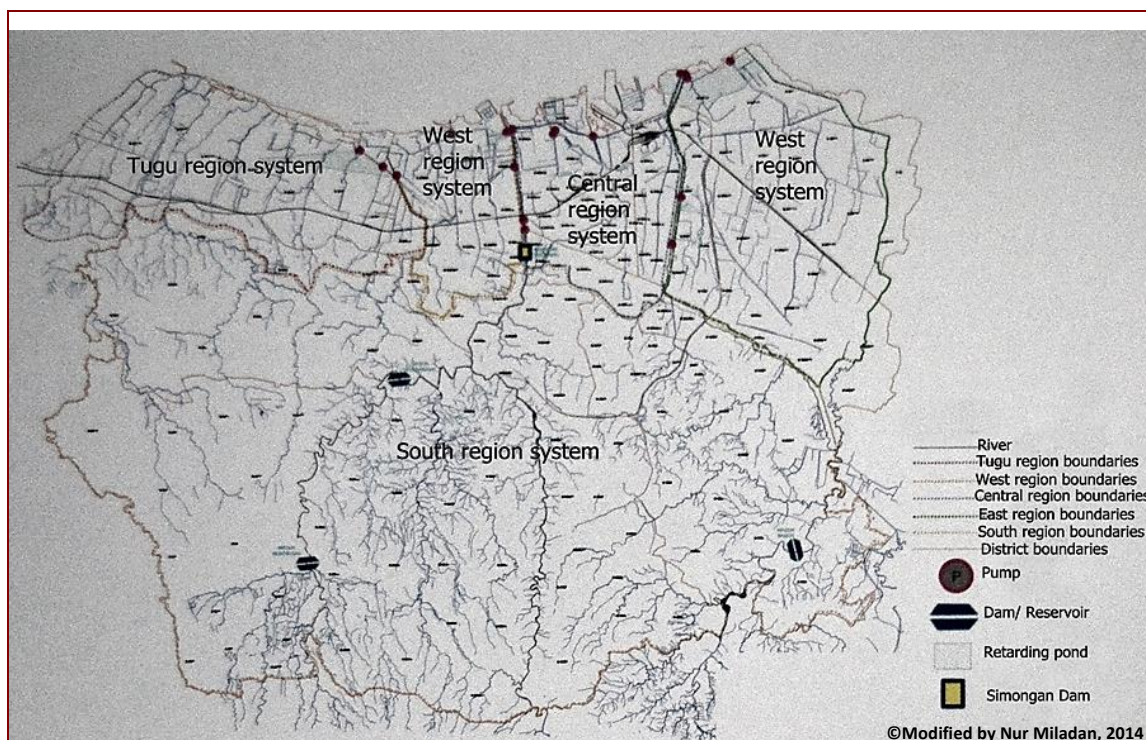
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<sup>288</sup> “Tambal sulam agar tak makin parah”, *Suara Merdeka*, February, 1<sup>st</sup> 1997.

<sup>289</sup> SMEC is a professional services firm with Australian origins and a global footprint that provides high-quality consultancy services on major infrastructure projects. Cf. “Company Overview”, *SMEC* [Web], retrieved December 25<sup>th</sup> 2015, from <http://www.smec.com/about-smec/company-overview>.



development of an urban drainage system and flood risk reduction. However, most of these plans were not implemented between the 2000-2007 period.



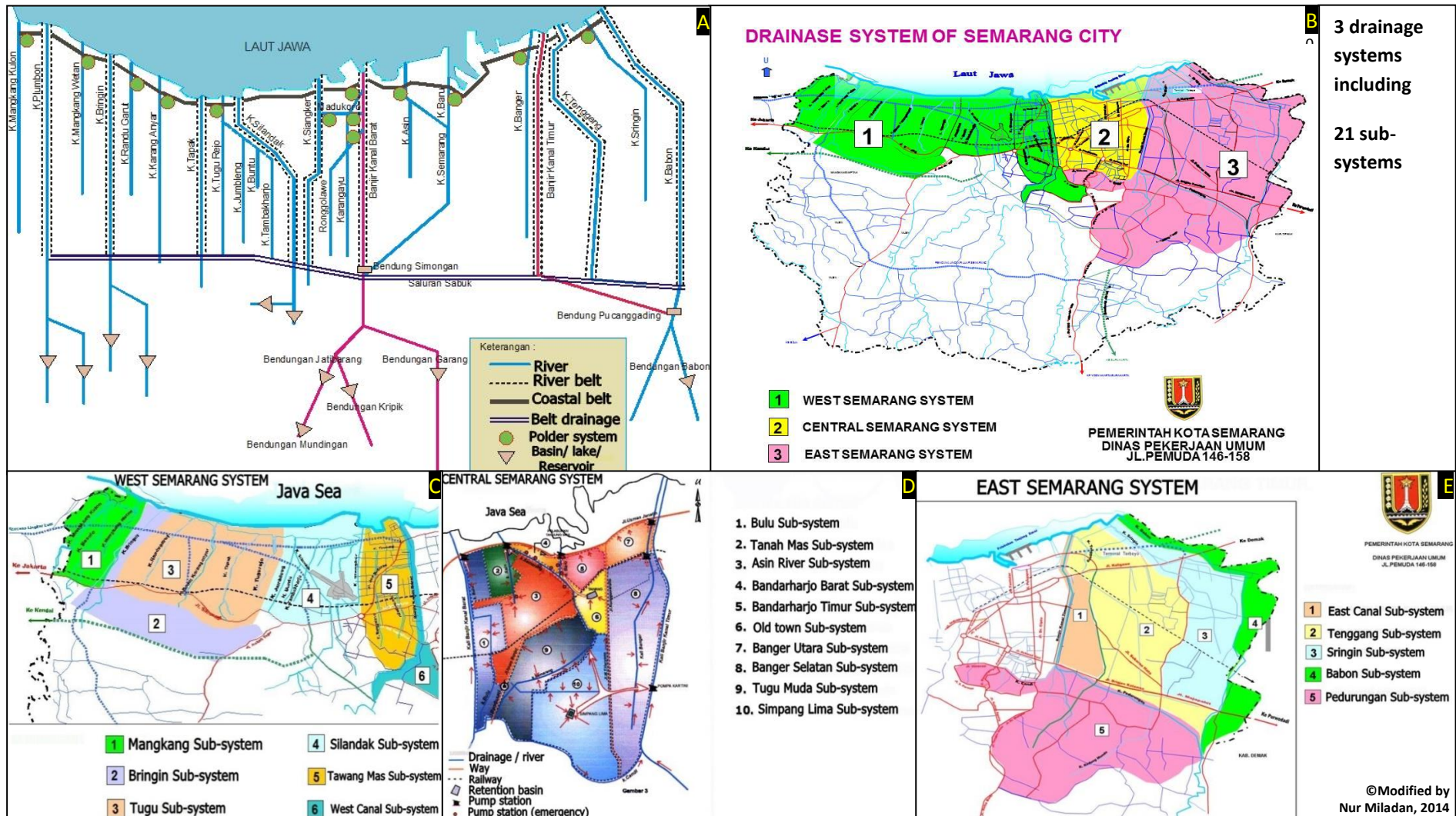
**Figure 62. Urban drainage system master plan in 2000**

Source: *Semarang urban drainage master plan project*, 2000, Semarang: Department of Public Works of Semarang City. The urban drainage system includes five region systems such as Tugu region system, West region system, Central region system, East region system and South region system.

In 2007, the municipality, through the Regional development planning agency and the Department of water resources, revised the urban drainage master plan. This project completed the previous 2000 urban drainage master plan and updated the existing urban drainage condition. The nub of this master plan involves technical and non-technical approaches<sup>290</sup>. Technical approaches include the planning of the upstream and the downstream areas. Firstly, as regards the upstream area, what is at stake is the rainwater harvesting, including the development of lakes (reservoirs) and the rehabilitation of the river green belts. Secondly, as regards the downstream area, the municipality planned the polder system, the rainwater harvesting, such as basins, and also the rehabilitation of river green belts. Meanwhile, non-technical approaches include the public education for the urban drainage system, the improvement of the public participation and empowerment, the cooperation between Semarang City and the surrounding regencies, the law enforcement of the urban drainage system.

<sup>290</sup> *Buku pintar pengelolaan sumber daya air Kota Semarang (Smart book of water resources management of Semarang City)*, *ibid.*





**Figure 63. Concept of the urban drainage system of Semarang City**

Source: *Urban Drainage Masterplan of Semarang City*, *ibid.*; Municipality of Semarang City, 2010, *Pengelolaan sumber daya air dan konsep penanganan banjir Kota Semarang* [PowerPoint], Semarang: Seminar Polder untuk Kota-Kota Dataran Rendah di Indonesia.

Generally, the schema of urban drainage system was divided into the downstream area which supported by polder system, and the upstream area was designed through the reservoir system, and also among those areas was planned a belt drainage to discharge the water from the upstream area (see Figure A). Furthermore, the urban drainage system also divided into three systems (Figure B) such as West Semarang System including 6 sub-systems (Figure C), Central Semarang System including 10 sub-systems (Figure D) and East Semarang System including 5 sub-systems (Figure E).

From the 1990s until the mid-2000s, the municipality only implemented routine projects to reduce the flood risk, including pump maintenance and river dredges. Although the flood control plans have existed since 1993, their implementation has been hampered by the lack of the funding and the detailed design plans. Moreover, technical problems affecting the urban drainage system have often occurred. For instance, the pumps did not work properly, and, consequently, the coastal area has gotten inundated by *rob*.

The central Northern part of the city comprises the territories that are the most vulnerable to flood risk. Therefore, the municipality decided to implement priority programs to reduce flood risks thereto. The priority territories are identified on the basis of several urban elements, such as population density, inundation area, project economic feasibility, and environmental impacts.<sup>291</sup> In order to carry out these priority programs, the municipality designed several projects relating to the Central Semarang Drainage System, such as the Packet of the Jatibarang Dam and Banger Polder. The Packet of Jatibarang Dam includes the improvement works of Garang River and West Floodway (Component A), the construction of Jatibarang reservoir (Component B), and the improvement of Semarang River, Asin River and Baru River/Canal (Component C). This project packet follows on from the master plans relating to integrated water resources and flood management project drafted in 1993 and in 2000. It is the result of the cooperation program between the municipality, the Central Java government, the national government (Ministry of Public Works), and the Japanese government. It was aimed to reduce the flash floods around the Garang Watershed and the *rob* phenomenon in the central Northern part of the city. The implementation of this project has begun in 2009. It was then financed by a loan granted by the Japanese government (Loan IP-534), which amounted to about 16,302 million Yen ( $\approx$  113.999.184, 49 €). Initially, this project was supposed to last from April 2006 to December 2013 (93 months).<sup>292</sup> But, instead, the project was carried out until 2014. The construction of Jatibarang Reservoir, for instance, was not completed before May 2014. The delay was due to the design review process and the construction process.<sup>293</sup> Component C is aimed to reduce the *rob* risk. It includes retarding pond, pumping station, revetment improvement (lower Semarang and Asin River) and river dredging. However, the pumping station, and retarding pond is the core of this project. It is supposed to drift the water flow from Semarang River to the sea.

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<sup>291</sup> *Urban Drainage Masterplan of Semarang City, ibid*

<sup>292</sup> *Ex-ante evaluation Integrated Water Resources and Flood Management Project for Semarang, 2006*, Semarang: Japan International Cooperation Agency (JICA).

<sup>293</sup> “Pembangunan Waduk Jatibarang molor setahun”, *Suara Merdeka*, September 29<sup>th</sup> 2009, retrieved December 25<sup>th</sup> 2015, from <http://suaramerdeka.com>; “Penggenangan Jatibarang molor lagi”, *Koran Sindo*, April, 25<sup>th</sup> 2014.





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**Figure 64. Flood control in the Central Drainage System and improvement of Semarang River, Asin River and Baru River (Component C)**

Source: River Basin Development Agency of Pemali Juana (Directorate General of Water Resources, Ministry of Public Works), 2009, *Integrated water resources and flood management project for Semarang* [Presentation], Semarang; Reinaldo, A and Kusumastuty, Y., 2012, "Tantangan Kota Semarang bagian tengah dalam mengatasi banjir", *Buletin Cipta Karya*, Edition 01/year X/January 2012; *Kolam retensi Kali Semarang diujicoba* [Television broadcast], (2014, March 11), Semarang: Cakra TV; Purbono, A, *BPK temukan kelebihan Rp. 2, 7 M* [Photo], July, 29<sup>th</sup>2010, retrieved December 28<sup>th</sup>, 2015, from <http://aripurbono.blogspot.fr/2010/07/bpk-temukan-kelebihan-rp-27-m-lahan.html#more>; Sulistiyawan, W., "Normalisasi Kali Asin Semarang" [Photo], *Tribun Jateng*, September, 13<sup>th</sup> 2013, retrieved December 25<sup>th</sup> 2015, from <http://www.tribunnews.com/images/>; Sulistiyawan, W., Buwono, B., "Camat Semarang Tengah Bambang Minta Kali Semarang Dikeruk" [Photo], *Tribun Jateng*, August, 8<sup>th</sup> 2014, retrieved December 25<sup>th</sup> 2015, from <http://jateng.tribunnews.com>.

The flood control in central drainage system indicates the arrangement of hydrological cycle between upstream area and downstream. Particular the component C project is to manage the water cycle in urban coastal (downstream) areas).

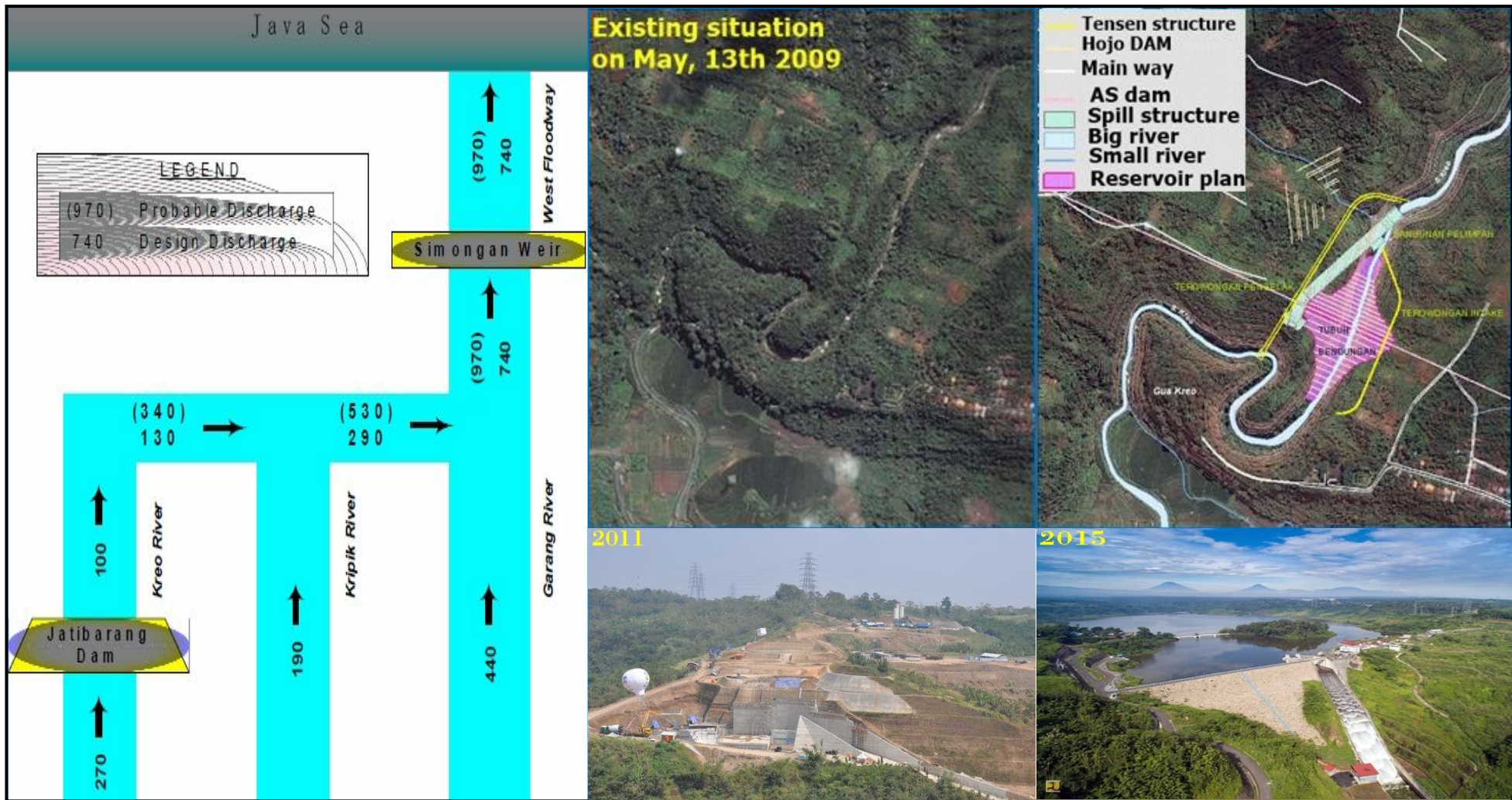
Semarang River is the “source” of the *rob* phenomenon threatening the communities. Therefore, the spatial arrangement of this river has become a significant program of the project of Component C. The revetment improvement and the dredge of Semarang River, Asin River and Baru River are to support the system of pumping and retarding pond, in such a way as to channel the water discharge smoothly from the upstream surrounding urban areas. Component B is aimed to control the water discharge from the upstream area, especially the flash flood risk caused by the over capacities of the Garang River and West Floodway during the rainy season. It has the capacity of 2.6 million m<sup>3</sup> per second and it can reduce the flood risk to about 170 m<sup>3</sup> per second.<sup>294</sup> Project of Component A aims to rehabilitate the existence of West Floodway and Garang River, and also to improve Simongan Dam. The design of that project takes into account the maximal water discharge from the upstream area. Banger Polder is another project that aims to support the flood risk prevention in the central Northern part of Semarang coast. It uses the pump system as a way to control the drainage system. Component C of JatiBarang Dam packet covers the Western part of the central drainage system, while Banger Polder is to handle the Eastern part. It is the first polder project (pilot) in Indonesia dealing with flood risk reduction, especially the *rob* risk. It is a twinning project in which Indonesia and the Dutch authorities work together to carry out the polder systems and set up organization plans to operate and maintain the system in the Banger River.<sup>295</sup> It involves several stakeholders, such as municipality, Central Java province, national government and Dutch government. The funding was also jointly provided by the Indonesian government and the Dutch government in 2010. The total amount is of about 84 billion Rupiah ( $\approx$  5.250.000 €) that were divided between Semarang municipality (32%), Central Java Province Government (32.5%), the national Government and the Dutch Government through ORIO grants (35%). Although it was supposed to start in 2002, it was only launched technically in the 2009, while its construction began in 2010. It is aimed to solve the flood problem in the Semarang Timur District, which comprises about 84 thousand inhabitants.<sup>296</sup> Furthermore, municipality has planned the rehabilitation of Tenggang Watershed in East Drainage System and the standardization of all urban drainages as comprehensive projects for flood risk reduction. However, this requires a lot of time and money, so this will be implemented step by step according to the priority scale of the urban drainage master plan.

<sup>294</sup> Ministry of Public Works, *Waduk Jatibarang upaya penanganan banjir Semarang*, February, 6<sup>th</sup> 2012, retrieved December 25<sup>th</sup>, 2015, from [http://www.pu.go.id/main/view\\_pdf/160](http://www.pu.go.id/main/view_pdf/160).

<sup>295</sup> SIMA Banger, *The Banger Polder pilot* [Web], retrieved December 25<sup>th</sup> 2015, from [http://jhelmer.wix.com/sima#!\\_english](http://jhelmer.wix.com/sima#!_english).

<sup>296</sup> Istibsaroh, N., “Masyarakat diajak jaga kebersihan Polder Banger”, *Antara Jateng*, October, 1<sup>th</sup> 2013, retrieved December 28<sup>th</sup> 2015, from <http://www.antarajateng.com/>.





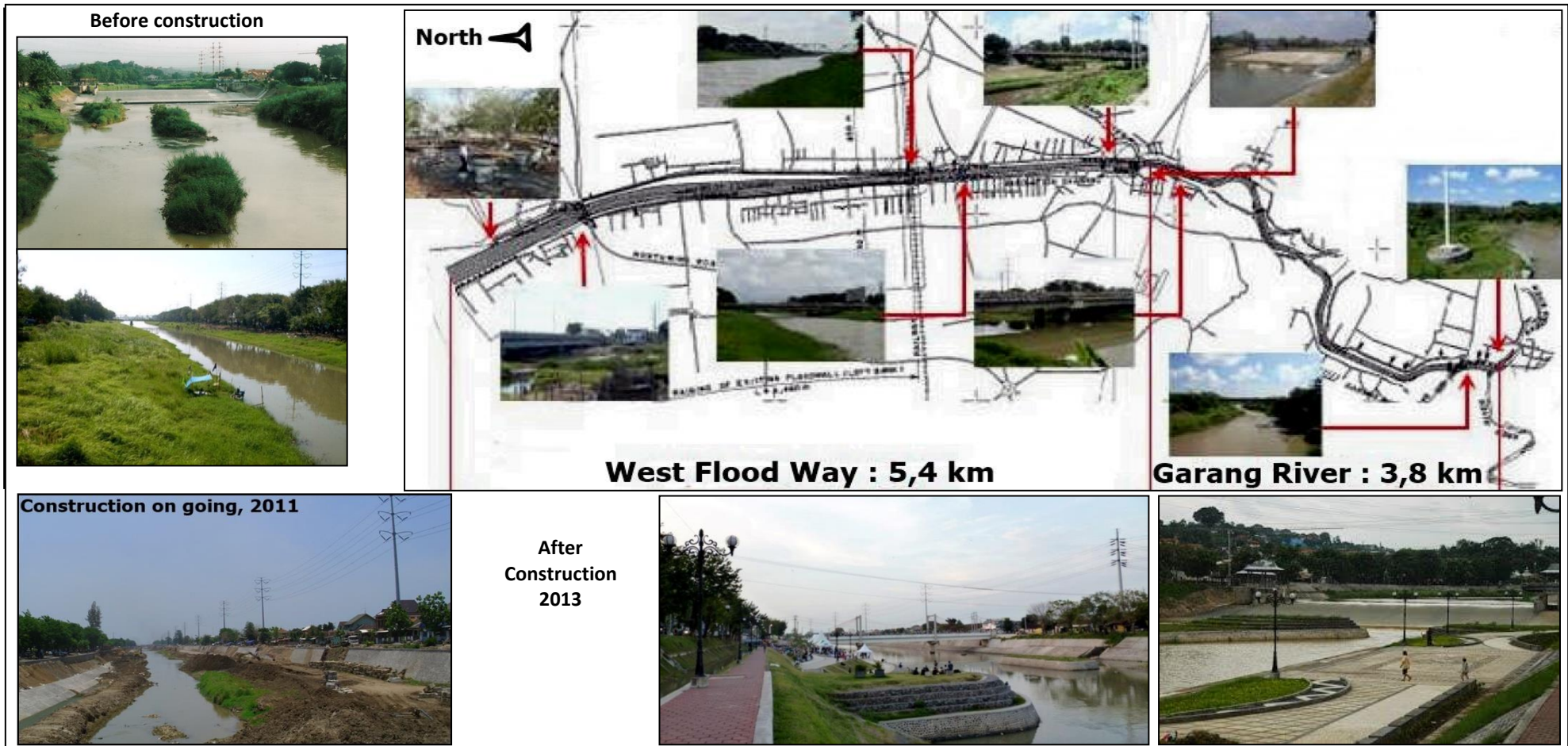
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### Figure 65. Component B- Jatibarang Reservoir

Source: *Waduk Jatibarang (1:2.500)* [Map], *Waduk Jatibarang Rencana Detil Citra (1:5.000)* [Map], 2009, Retrieved December 25<sup>th</sup>, 2015, from Locket Pelayanan Informasi Peta Kementerian Pekerjaan Umum dan Perumahan Rakyat Republik Indonesia, <http://loketpeta.pu.go.id/>; River Basin Development Agency of Pemali Juana (Directorate General of Water Resources, Ministry of Public Works), 2009, *Integrated water resources and flood management project for Semarang* [Presentation], Semarang; “Galeri Photo Bendungan Jatibarang”, *PU-net* [Web], November, 24<sup>th</sup> 2011, retrieved December 28<sup>th</sup>, 2015, from <http://pu.go.id/galeri/photo/3/Bendungan-Jatibarang>; “Waduk Jatibarang Semarang Di Operasionalkan”, *PU-net* [Web], May, 11<sup>th</sup> 2015, retrieved December 28<sup>th</sup>, 2015, from <http://pu.go.id/berita/10190/Waduk-Jatibarang-Semarang-Di-Operasionalkan>.

The Jatibarang Dam controlled the water channelling through Kreo River in order to reduce the water discharge to Garang River and West Floodway and so it can decrease the flood vulnerabilities in Semarang coastal



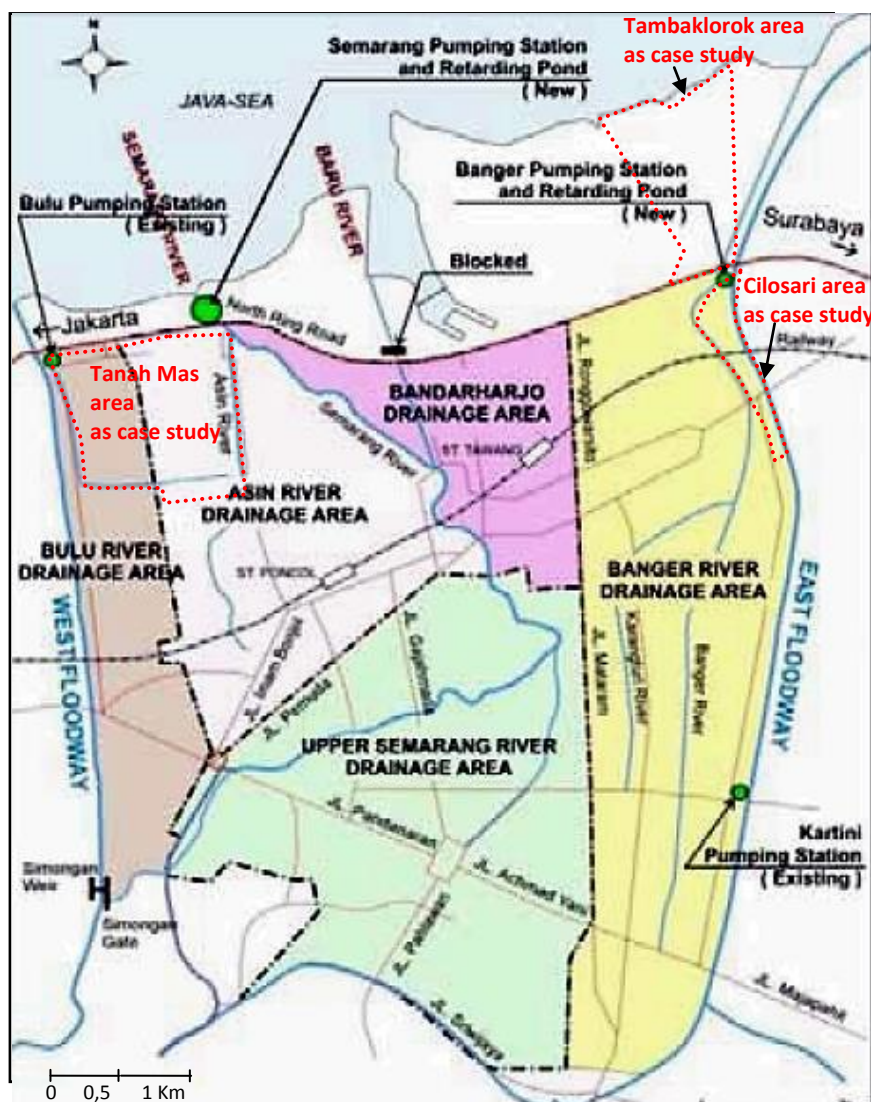


**Figure 66. Component A- Improvement works of Garang River and West Floodway**

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Source: Miladan, 2011; River Basin Development Agency of Pemali Juana (Directorate General of Water Resources, Ministry of Public Works), 2009, *Integrated water resources and flood management project for Semarang* [Presentation], Semarang; Cahyaningtyas, D., *Banjir Kanal Barat Semarang* [Photo], September 2014, retrieved December 28th, 2015, from <http://outsidewalls.blogspot.com/2014/09/banjir-kanal-barat-semarang.html>; Ma'arif, Y.I., *Banjir Kanal Barat Semarang, Dulu dan Kini* [Photo], July 16<sup>th</sup> 2013, retrieved December 25<sup>th</sup>, 2015, from <http://www.kompasiana.com/imammaarif/banjir-kanal-barat-semarang-dulu-dan-kini>; Chris, H., *Pulau di Tengah Sungai BanjirKanal Barat Semarang* [Photo], March, 12<sup>th</sup> 2011, retrieved December 28<sup>th</sup>, 2015, from <http://rubik.okezone.com/view/4680/pulau-di-tengah-sungai-banjir-kanal-barat-semarang>; Goenoeng, *Banjir kanal barat* [Photo], September, 3<sup>rd</sup> 2008, retrieved December 28<sup>th</sup> 2015, from <http://semarangonthespot.blogspot.com/2008/09/banjir-kanal-barat.html>.

*This project transformed the bodies of West Floodway and Garang River. Initially, both drainages experienced a high sedimentation caused by the lack of a maintenance process. But, recently, beside the fact that the sedimentations have been dredged, the bodies of drainages have been extended. The embankment (dike) was built along these drainages in order to smooth the water discharge and reduce the sedimentation risk.*



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**Figure 67. The flood control in Central Drainage System of Semarang City**

Source: Reinaldo, A and Kusumastuty, Y, *ibid*.

The development of two systems of pumping station and retarding pond and the blockage of Baru River are the urban drainages plans that are implemented by the Jatibarang-Component C Project and the Banger Polder Project.

The Banger Project is part of a comprehensive urban drainage project. Its design engineering was created by Witteveen+Bos,<sup>50</sup> and it is funded by Partners for Water.<sup>51</sup> Meanwhile, the institution model of management of Banger Polder was initiated by Water Board Schielanden de Krimpenerwaard.<sup>52</sup> These institutions are the delegated by the Dutch Government. Technically, the Banger Polder Pilot Project is composed of several elements,

<sup>50</sup> An internationally operating Dutch consulting and engineering firm, cf. "Witteveen+Bos Indonesia", *Witteveen+Bos* [Web], retrieved December 28<sup>th</sup>, 2015, from <http://www.witteveenbos.co.id/>.

<sup>51</sup> It provides support to Dutch water sector organizations, profit and non-profit, that work together to realize their international objectives in the field of water, and it has been commissioned by the Dutch Ministries of Economic Affairs, Infrastructure & the Environment and Foreign Affairs. cf. "Partners for Water Programme Springboard for international ambitions", *Partnes voor water* [Web], retrieved December 28<sup>th</sup>, 2015, from [http://www.partnersvoorwater.nl/?page\\_id=74](http://www.partnersvoorwater.nl/?page_id=74).

<sup>52</sup> Dutch regional water authority and it focuses to water management in particular flood prevention in Netherlands.



such as the pumping station and dam (reservoir) in Banger River, the fishing ponds in the retention area, the dredging and deepening of Banger River, the construction of the Northern dike (sea side), the elevation of East Canal embankment, the East Canal water inlet and the development of several dams. Overall, the Banger Polder Project is developed in an area of 527 hectares, with approximately 84,000 inhabitants and it includes ten sub-districts, Kemijen, Rejomulyo, Mlatiharjo, Mlatibaru, Bugangan, KebunAgung, Sarirejo, Rejosari, Karangturi, and Karangtempel. There is no official settlement use in this area.<sup>53</sup>



**Figure 68. Design of Banger Polder Pilot Project**

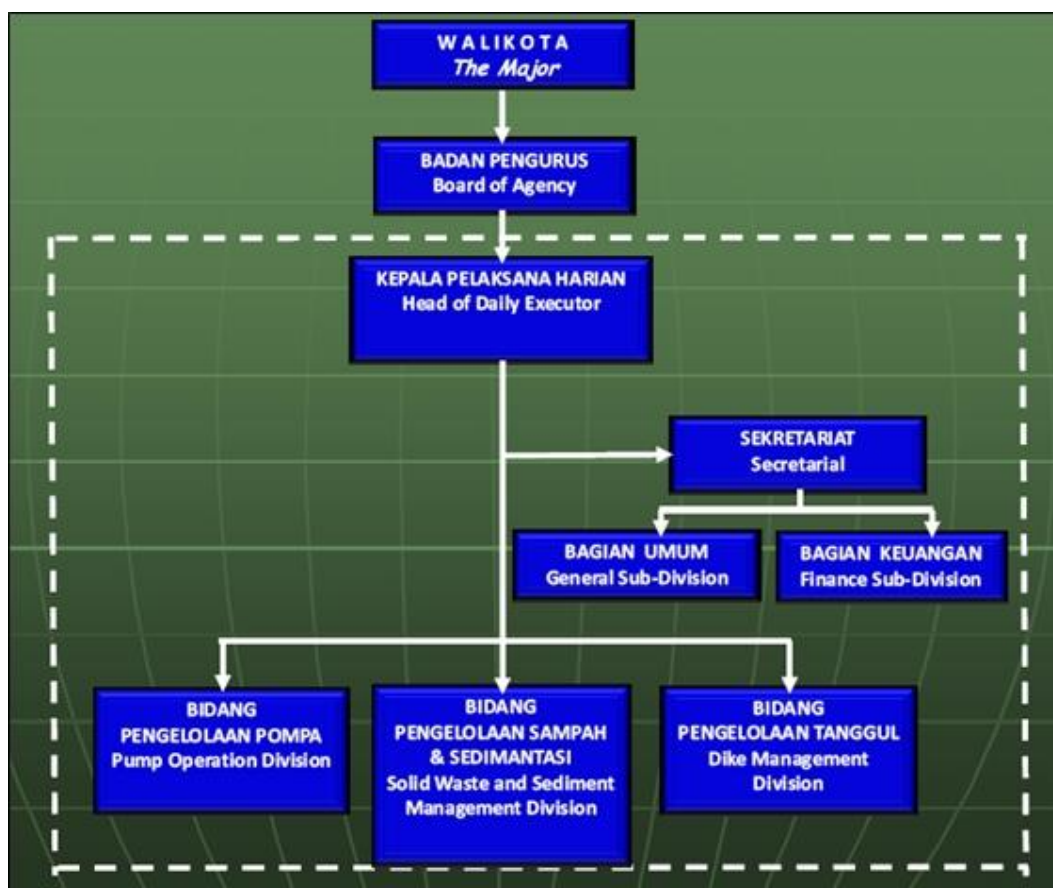
©Modified by Nur Miladan, 2014

Source: SIMA Banger, *Poster of Banger Polder* [Pdf], retrieved December 25<sup>th</sup> 2015, from <http://jhelmer.wix.com>.

<sup>53</sup> “Volume 4: Case Study Banger Polder, Semarang”, *Urban Polder Guidelines*, 2009, Jakarta: Indonesian Ministries of Public Works, and of Environment and the Netherlands Ministries of Transport, Public Works and Water Management, and of Spatial Planning, Housing and Environment.



Polder Banger Water Board (*Badan Pengelola Polder Banger* “SIMA”) is in charge of the management of Banger Polder. This agency was based on the Semarang Mayor Act in 2010. The main task of Polder Banger Water Board is to operate and to maintain all infrastructures of the “Polder Banger” environment.<sup>54</sup>



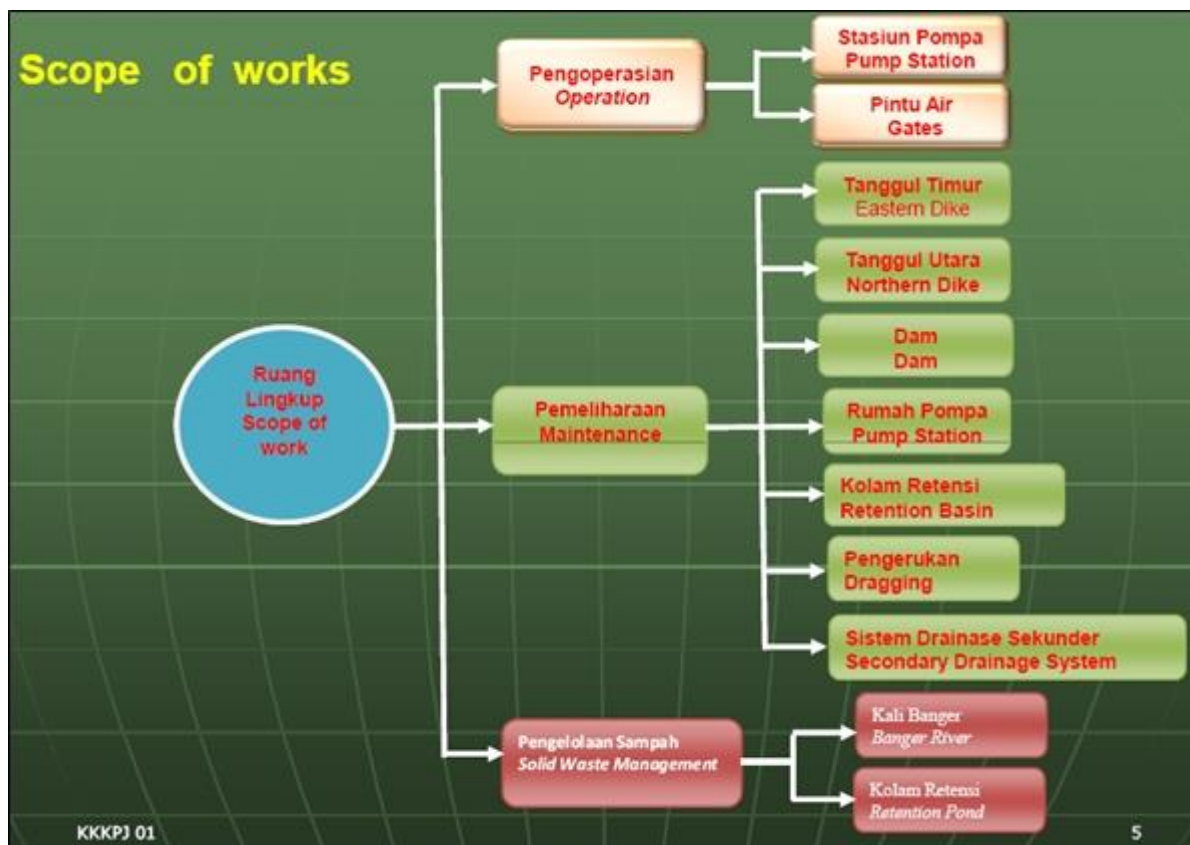
**Figure 69. Organizational Structure of Polder Banger Water Board**

Source: Darsono, S., *BPP Banger SIMA* [Presentation], Semarang: BPP SIMA, retrieved December 28<sup>th</sup> 2015, from Website of BPP Banger Sima, [http://jhelmer.wix.com/sima#!\\_\\_download-page](http://jhelmer.wix.com/sima#!__download-page).

The organizational structure of Polder Banger is composed mayor of Semarang City, board of agency, and daily executor. The board of agency controls and informs the Polder Banger Water Board. Its members are academics, and urban institutions (municipality), and community. The municipality, through the Regional Development Planning Agency, has involved academics to support the implementation of Polder Banger project, and, in particular, the monitoring of constructions and the mediation between the city government and the community. Meanwhile, the representatives of the community are appointed by the

<sup>54</sup> Darsono, S., *BPP Banger SIMA* [Presentation], Semarang: BPP SIMA, retrieved December 28<sup>th</sup> 2015, from Website of BPP Banger Sima, [http://jhelmer.wix.com/sima#!\\_\\_download-page](http://jhelmer.wix.com/sima#!__download-page).

*lembaga pemberdayaan masyarakat kelurahan* (LPMK/ Community Empowerment Board of Sub-district).<sup>55</sup> The daily executor manages the daily activities of Banger Polder. Lately, the daily executor has not been active, because the construction of Banger Polder is still not finished. It is expected that the participation of local inhabitants will be sought to support the Banger Polder system. The municipality expects that the community will contribute to the funding of the polder system, and that it will also be aware that the polder system will require maintenance once the construction process of the polder is completed.



**Figure 70. Scope of works of Polder Banger Water Board**

Source: Darsono, S., *ibid*.

The tasks of Polder Banger Water Board include the operation of the polder system, the maintenance of the polder components and solid waste management. This work plan will cover the whole area of Banger Polder. However, the solid waste management strongly depends on the awareness of the community to reduce the existence of solid waste in the polder system area.

<sup>55</sup> LPMK is functioned for mediator between the community and the municipality. That is the national policy and it is expected as a form of bottom-up development paradigm in Indonesia. The determination of this institution based on the Government Regulation of Indonesia n° 38 /2007 concerning Government affairs division between (National) Government, Provincial Government, and Municipality. Each sub-district has LPMK. The projects of municipality are socialized through LPMK to communities and also the aspirations of communities are transferred through LPMK to municipality. Members of community empowerment board are elected directly by the meeting of sub-district being attended by the heads or the delegations of RW's communities.

The management of the polder system will require a yearly investment of about 1.5 Billion Rupiah ( $\approx$  93.750 €) that will be provided by the municipality and the community.<sup>56</sup> Nevertheless, up to now, this funding scheme has still not been agreed upon in the propositions of funding made by the municipality and the community.

There are indeed several problems relating to the implementation of the Banger Polder Project. It was planned that the construction of Banger Polder would be carried out between 2010 and 2013. However, the construction has not been completed yet. The first problem is the delay of the polder construction. A technical error was made with respect to the sheet piles pegging of the construction of the pumping station in the area of *kampung Cilosari*. As a result, the construction was interrupted for several months (from November 2010 through May 2011).<sup>57</sup> Furthermore, there is also a problem of land acquisition. It is planned that the retention basin will be located in the squatter settlement.<sup>58</sup> At the moment, the Indonesian Railway Company owns this land, which the municipality has agreed to rent out for five years for the Banger Polder development. Under land law, the municipality cannot directly manage this land. The Indonesian Railway Company must instead relocate the squatter settlement. This situation points out the long bureaucratic procedure, and it certainly causes the absence of implementation of the Banger Polder construction.

The second problem is the lack of funding. The Dutch government canceled the ORIO grant for this project. According to the Political Representative *Hoogheemraadschap Schielanden van de Krimpenerwaard* (HSK)<sup>59</sup>, Roy Kraft Ermel, ORIO<sup>60</sup> canceled the grant of the engineering unobstructed agreement because the terms proposed by the Indonesian Government are considered too stringent, not transparent, and because the (construction) process is too long.<sup>61</sup> The municipality attempted to negotiate with the Dutch Government to prolong the grant, but the negotiations did not succeed. As a result, 35 % of the funding must be covered by the national government. The funding issue also affected the implementation

<sup>56</sup> "Proyek Polder Banger Molor", *Suara Merdeka*, December, 13<sup>th</sup> 2013, retrieved December 25<sup>th</sup> 2015, from <http://psda.jatengprov.go.id/berita/2013/12des/131213-01.htm>.

<sup>57</sup> Municipality of Semarang City, 2011, *Pembangunan Polder Banger Kota Semarang*, [PowerPoint], Semarang: Regional Development Planning Agency.

<sup>58</sup> Central Java Province, *Pemprov pantau pembangunan Polder Banger*, May, 19<sup>th</sup> 2014, retrieved December 28<sup>th</sup> 2015, from <http://jatengprov.go.id/id/berita-utama/pemprov-pantau-pembangunan-polder-banger>.

<sup>59</sup> HSK dan Witteveen + Bos is the institution of Dutch Government delegation in Banger Polder Project.

<sup>60</sup> ORIO is a facility to help develop infrastructure in developing countries which is provided and funded by Dutch Ministry of Foreign Affairs and implemented by the Netherlands Enterprise Agency. Cf. "ORIO background information", Netherlands Enterprise Agency (*Rijksdienst voor Ondernemend Nederland*) [Web], retrieved December 28<sup>th</sup>, 2015, from <http://english.rvo.nl/subsidies-programmes/orio-background-information>.

<sup>61</sup> Wibisono, L., "Belanda batal danai pembangunan Polder Banger", *Suara Merdeka*, May, 18<sup>th</sup> 2013, retrieved December 25<sup>th</sup> 2015, from <http://www.suaramerdeka.com/v1/index.php/read/news/2013/05/18/157336/Belanda-Batal-Danai-Pembangunan-Polder-Banger>.

of the polder construction, which was interrupted again from 2012 to 2013. According to P. Iswari (representative of HHSK), in January 2013, the construction process was half completed, and its completion was planned for the first quarter of 2014. 50% of the remaining work had become the responsibility of the national government. Meanwhile, the respective roles of the municipality and the province government in the construction process had been implemented.<sup>62</sup> The following parts of the Banger Polder project had been implemented: the pumping station by the municipality, the dredge of Banger River, and the construction of the Northern dike by the province government. But the pumping station was not completed with the pumps, and it was still not clear which entities were to fund the providing of the main pumps since the budgeting scheme relating to the polder project implementation had changed. Certain aspects of the project had still not been implemented, including the constructions of the retention area, the dams, and the Eastern dike. Those constructions had to be performed by the national government, but, until mid-2014, it had still not clarified the carrying on of the polder construction. This situation was mentioned in the local newspaper in Semarang City.

“The completion of Polder Banger that was due this year (2014) must after all be delayed and postponed to next year. The development of the pump system, the retention basin and the other supporting systems will be carried out in early 2015”.<sup>63</sup>

The constraints affecting the Banger Polder Projects have many negative consequences for the process of flood risk reduction in Semarang City. The partial implementation of the Banger Polder Project means that this system has not operated yet. As a result, the communities are still threatened by flood risk, especially the *rob* phenomenon. There is no significant reduction of flood risk around the Banger Polder Project.

In addition, this situation brings about uncertainty with respect to the Banger Polder Project sustainability. The ineffectiveness of this project creates skepticism within the community. Furthermore, the Banger Polder Project, as an institutional collaboration program, results in the fact that the municipality cannot overcome independently and rapidly the constraints characterizing the project. It moreover very much depends on the decisions of

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<sup>62</sup> Yulianto, A., Er Maya, Susiana (Producers), (2013, Jan. 30), “Pembangunan Polder Kalibanger Capai 50 Persen”, [Television broadcast], in *Berita*, Semarang: Suara Merdeka TV/Network, retrieved December 25<sup>th</sup> 2015, from <http://www.suaramerdeka.tv/>

<sup>63</sup> Pengoperasian Polder Banger mundur”, *Suara Merdeka*, May, 21<sup>th</sup> 2014, retrieved December 25<sup>th</sup> 2015, from <http://www.suaramerdeka.com/v1/index.php/read/cetak/2014/05/21/262120/Pengoperasian-Polder-Banger-Mundur>.



other institutions (national government and Dutch government). Likewise, the problem of construction affects the lack of the implementation for the Banger Polder management. This situation sheds light on the miscommunication between the municipality and the community.



**Figure 71. Construction of the pump station area of Banger Polder Project has not been completed**

Source: Sulistyawan, W., Buwono, B., "Hendi Menggesa Selesaikan Masalah Administrasi Polder Banger" [Photo], *Tribun Jateng*, May, 19<sup>th</sup> 2014, retrieved December 25<sup>th</sup> 2015, from <http://jateng.tribunnews.com/2014/05/19/hendi-menggesa-selesaikan-masalah->

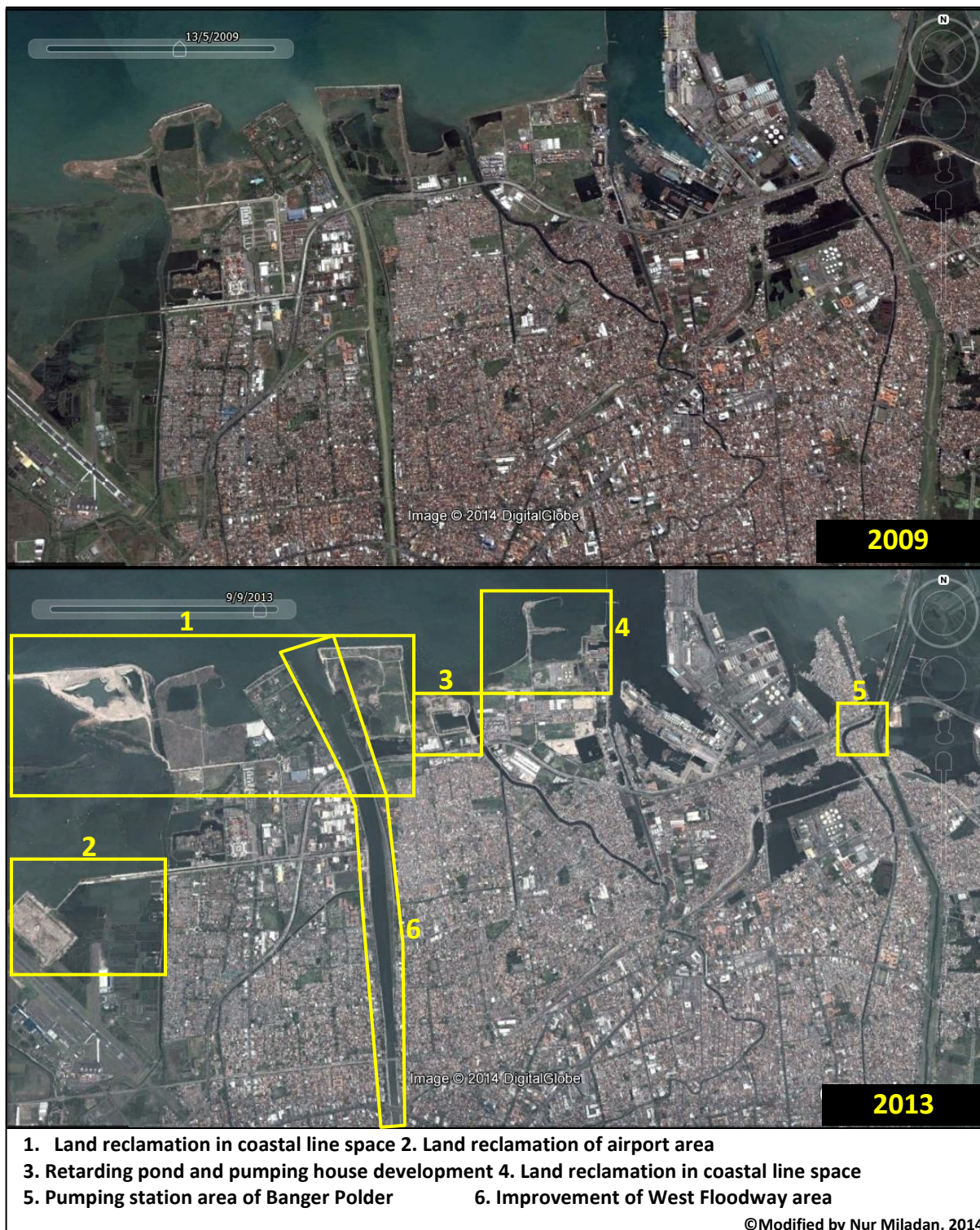
The lack of implementations of the urban hydrological projects is not only due to the financial and management problems, but also to the lack of the community's involvement in these projects. Such involvement only corresponds to a top down approach, not to a community-based approach. The initial plans and the implementation of the Banger Polder Project are the responsibility of public actors, including the municipality, the national government and the Dutch government. Meanwhile, the communities are not involved in the procedures, although the municipality seeks to get their involvement in the project socialization and in the implementation, with respect, in particular, to the post-construction of the polder process. Nevertheless, it seems that the communities have a small decision-making power in this project, and that the decisions taken very much depend on the government stakeholders. Even though the communities have a high interest in this project, they nevertheless do not have funding capacities or the power to take initiatives in order to accelerate the implementation process of the project. As a result, they tend to observe the carrying-on of municipality actions without a clear understanding of the urban hydrological projects around their territories. There is thus a lack of communities' responsibilities to

underpin the achievement of these projects. These conditions highlight a lack of management of urban hydrological projects resorbing the ineffectiveness of flood risk reduction in Semarang City.

### **2.2.2. Urban hydrological projects and land reclamation projects as spatial organization forms adapting to flood risk**

Urban institutions have undertaken several actions in order to reduce flood risk, such as infrastructures improvements and spatial organizations. In case of Semarang City, the municipality seeks to reduce flood risk through these two options. The existence of comprehensive hydrological projects, including the Jatibarang packet project, the Banger project and the standardizations (rehabilitations) of urban drainages, brings about a process of spatial transformations that adapt to flood risk in Semarang City, in particular the coastal area. These projects redevelop the water spaces, and limit the development of built-up spaces in the city. For instance, the development of the retention basin of Semarang River (Jatibarang project – component C) of approximately 6 Ha has the effect of changing land use from built-up and open spaces to the water spaces on Semarang coastal area. Furthermore, the development of Banger Polder will also increase water spaces on Semarang coast. Semarang, as a coastal city, needs water spaces to accommodate the urban water cycle and the coastal disaster risk. Accordingly, the municipality seeks to create and rehabilitate the water spaces in the city. These projects are new forms of space adaptation to the existence of urban flood risk.

On the other hand, land reclamation, as spatial engineering, is a factor influencing space transformation and organization on Semarang coastal area. The land reclamation process was based on the elevation of high tide as the mitigations efforts for the flood risk. This development seeks to create new adaptive urban areas to flood risk. Such areas are planned as new urban centers in Semarang coastal area, such as formal residential areas, commercial and business areas, and also industrial and warehousing areas. This indicates that the coastal area is still considered as the strategic area for the urban future. Nevertheless, it is not guaranteed that it will be free from flood risk. It seems that little attention is paid to the land subsidence phenomena in Semarang coastal area with respect to the urban development relating to land reclamation. These phenomena are still ongoing in Semarang coastal area. On the one hand, land reclamation is a spatial transformation way to adapt to flood risk, but, on the other hand, it is contrary to the land subsidence risk, which accelerates the increase of flood risk around these areas and their surroundings. These situations threaten the flood resilience process of Semarang City.



**Figure 72. Coastal spatial transformation in 2009 and 2013**

Source: Google Earth, 2014

*It seems that the Semarang coastal area was experiencing fast space transformations through the urban hydrological projects, and the recent land reclamations. The urban hydrological projects sought to provide the extension of water spaces in the city, while the land reclamations are aimed to provide the new urban areas adapting to the anticipation of flood risk, especially the rob phenomenon. Although both strategies are not integrated, they nonetheless shed light on the fact that urban adaptation to flood risk is carried out through both strategies.*



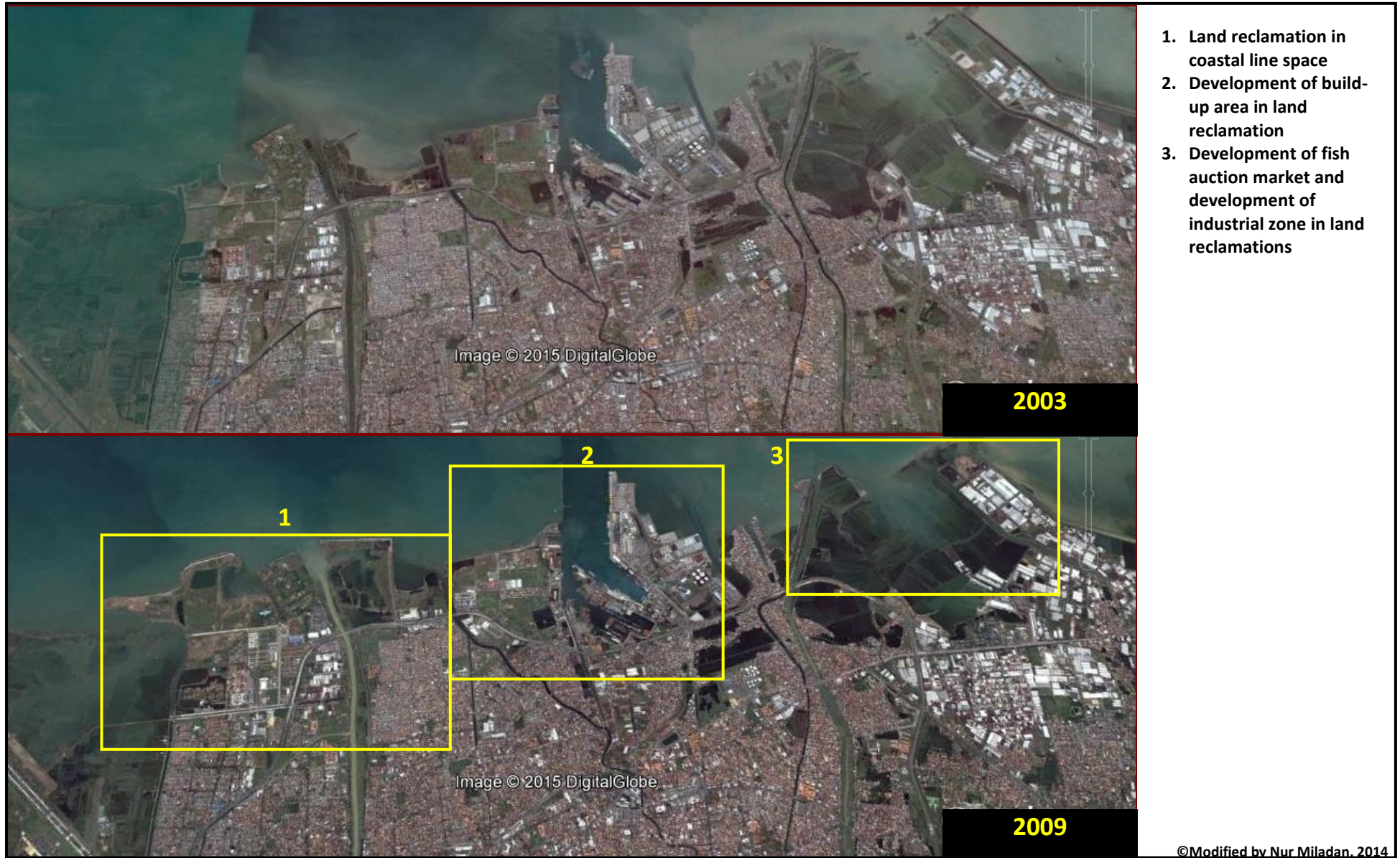


**Figure 73. Detail of coastal spatial transformation between 2009 and 2013**

Source: Google Earth, 2014

Figures 1, 2 and 4 describe urban extension through land reclamations. Figure 1 and Figure 4 represent land reclamations in the coastline areas which changed from the sea to the terrestrial areas. Meanwhile Figure 2 depicts the extension of the airport area through land reclamation from the swamp area. Figures 3, 5 and 6 represent the implementations of hydrological projects to reduce the flood risk in Semarang coastal area. Figure 3 illustrates the development of the retention basin for Jatibarang Project-component C, while Figure 6 pictures the improvement of West Floodway as Jatibarang Project-Component A. Figure 5 shows the space transformation from the settlement to the open space for the pump system area of Banger Project.





1. Land reclamation in coastal line space
2. Development of build-up area in land reclamation
3. Development of fish auction market and development of industrial zone in land reclamations

©Modified by Nur Miladan, 2014

**Figure 74. Coastal spatial transformation between 2003 and 2009**

Source: Google Earth, 2014

Although land reclamation dates from the 1970s, its development has started to accelerate in the 2000s. This occurred alongside the 2004 land reclamation policy for Semarang coast. The growth of Semarang coastal area in the 2000s was very dynamic. On the one hand, land reclamation became the choice of urban extension in Semarang coastal area, but, on the other hand, several parts of Semarang coastal area experienced abrasion and some fishponds were inundated by the sea water (the urban vulnerabilities of coastal risk), which was caused by the fact that the land reclamation process influenced the flow change of water sea in Semarang coastal area.





Each figure (from figure 1 to figure 3) shows the upside is situation in 2003 and the downside is that in 2009.

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### Figure 75. Detail of coastal spatial transformation between 2003 and 2009

Source: Google Earth, 2015

Figure 1 shows that land reclamation in Puri Marina Real Estate in the 2000s produced the spatial transformation in Semarang coastal area. Despite the fact that this area is vulnerable to flood risk, it was nonetheless expanded. This situation highlights the resilience process through spatial transformation, although that land reclamation actually aims to urban extension. Nevertheless, this situation is contrary to the urban geomorphology which comprises a risk of land subsidence. The port zones (Figure 2) and the industrial zones (Figure 3) have increasingly become built-up area. Indeed, urban investors see to expand the urban built-up area, whereas the municipality seeks to reduce the flood risk through the providing of water spaces such as the retention area. The municipality has still not implemented a strict building regulation in Semarang coastal area characterized by a high risk of flooding.

Most of the built-up areas in the land reclamation of Semarang coast was designed by the concept of neo-traditional development which has been developed in Indonesia since the 1980s. This concept emphasizes the sustainable transportation dimension, diversity (e.g. of housing types), compactness, mixed land uses, and greening. It also has a lot to do with style and design coding.<sup>64</sup> Furthermore, these territories are developed as the new urban areas or real estate having a mixed land use function, such as commercial/business and residential areas. These areas are built by private investors (developers) and are planned through a master plan. The underlying concept of this master plan is different from the one that existed with respect to the urban extension process that took place in the hilly area under the Dutch government era. It was designed by reference to the grid morphological pattern in order to achieve space efficiency by integrating the built-up areas and the green areas in the territories. As a result, these territories have organized and regular morphological forms.

The form of the town is established in relation to the outdoor spaces and buildings, which exist in a given landscape/soil<sup>65</sup>. In the case of land reclamation in Semarang coastal area, it seems that the mitigation of flood risk has been less taken into account in the recent urban form. The land reclamation areas have a small proportion of open spaces, and are characterized by a high density of built-up areas. These situations are at odds with the natural landscape of the areas, which are very vulnerable to land subsidence affecting the high risk of flooding. Meanwhile, the forms of the buildings in the land reclamation areas are not adjusted as the adaptive buildings against flood risk. These buildings have been developed since the 1980s in the same manner as the common buildings in urban areas. The houses (buildings) on stilts, which are commonly developed in the flood areas, were not built by developers in Semarang coastal areas. The municipality established the urban spatial planning, while the development of built-up areas by private investors in the Semarang coastal areas does not support the mitigation of flood risk.

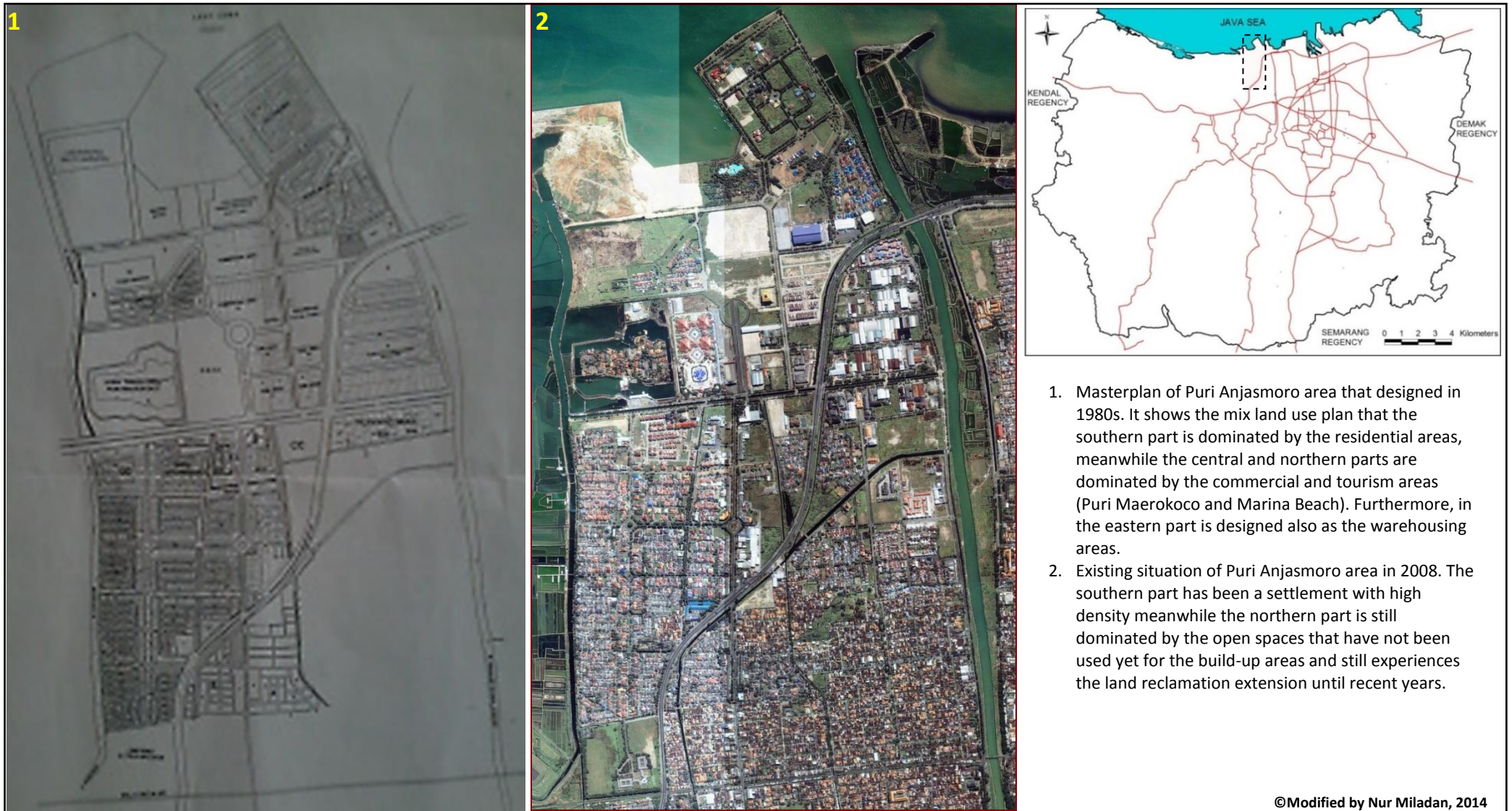
The existence of Puri Marina area is an example of the development of land reclamation area in Semarang City. It was built in the late 1980s as a modern real estate venture, designed through a grid pattern and mixed land use, with a high density of built-up areas. The buildings were built through a maximum building coverage, and there were few water spaces. The master plan of this area did not take into account the need to mitigate flood risk, and it also accelerated the land subsidence process in Semarang coastal area.

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<sup>64</sup> Jabareen, Y.R., 2006, "Sustainable Urban Forms Their Typologies, Models, and Concepts", *Journal of Planning Education and Research*, vol. 26, n° 1, pp. 38-52.

<sup>65</sup> Valente-Pereira, L., 2014, *Urban Form Definition in Urban Planning*, Porto Alegre: Revolução eBook.





1. Masterplan of Puri Anjasmoro area that designed in 1980s. It shows the mix land use plan that the southern part is dominated by the residential areas, meanwhile the central and northern parts are dominated by the commercial and tourism areas (Puri Maerokoco and Marina Beach). Furthermore, in the eastern part is designed also as the warehousing areas.
2. Existing situation of Puri Anjasmoro area in 2008. The southern part has been a settlement with high density meanwhile the northern part is still dominated by the open spaces that have not been used yet for the build-up areas and still experiences the land reclamation extension until recent years.

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**Figure 76. Comparison between Existing Situation of Puri Marina Area in 2008 and its Master Plan**

Source: PT. Indo Perkasa Usahatama, without the exact date; Iconos Satellite Image, 2008

*Puri Marina area is one land reclamation territory in Semarang coastal area and it has become one urban center of Semarang City. Although its master plan is not very clear, it nonetheless shows that the territory was planned according to a grid morphological pattern. The buildings and the local drainage system followed the pattern of the grid ways. Furthermore, it seems that most of Puri Marina Area was built in conjunction with its master plan. Although this area is organized, it is subject to a high risk of flooding, caused by a lack of mitigation plans such as a high proportion of water and green spaces. Furthermore, this area does not have a particular design of drainage system, despite the fact that it is a plain area which is adjacent to the sea subject to the rob phenomenon.*





A. Aerial photo of Puri Marina Area B. Paving as primary street C. Street reconstruction D. Inundated local drainages E. local canal (drainage) F. Commercial and Business buildings

©Modified by Nur Miladan, 2014

### Figure 77. Existing situation of Puri Marina Area

Source: Primary survey, 2013; Sulistiyawan, W., “BPN Pastikan Tanah di Marina Semarang Tak Bisa Jadi Hak Milik” [Photo], *Tribun Jateng*, December, 10<sup>th</sup> 2014, retrieved December 25<sup>th</sup> 2015, from <http://www.tribunnews.com/regional/2014/12/10/bpn-pastikan-tanah-di-marina-semarang-tak-bisa-jadi-hak-milik>.

Figure A depicts Puri Marina Area and its grid spatial pattern and its high density of built-up areas. Although this area is close to the sea, it does not have a specific urban drainage system such as a polder system. As a result, the risk of flooding strongly threatens the existence of this territory. Figure B, Figure C and Figure D represent the way structures in Puri Marina area which are not supported by proper drainages and which should be facilitated by a proper canalization system. Meanwhile, Figure E shows that the main drainage of this area is in the central part of the territory, but that it is not sufficient to support the canalization system. Figure F indicates that the area is built according to a European architectural style, but that it does not comprise buildings with adaptive forms to flood risk.

The absence of flood mitigation plans in the Puri Marina Area indicates that the flood risk was not taken into account for the development of that area. However, land reclamation sheds light on the fact that the process of urban flood adaptation is a defining part of the city. The development of the local canal in the central part of this area marks the flood adaptation process through the providing of water space inside the site. Furthermore, the spatial adaptation efforts are carried out in this area through the development of a pump system and the rehabilitation of local streets thanks to the community recent self-help efforts. Likewise, the inhabitants seek to elevate their houses to adapt to flood risk. The interviews of the local inhabitants living in the residential area of Puri Anjasmoro<sup>313</sup> detail these community actions.

“[...] here, the efforts of flood reduction are carried out by the community. The government (municipality) doesn't give anything. We pay the costs every month to clean up the settlement including the (local) drainages, the waste and the pump system. Each household was required to pay the costs with respect to street elevations. For example, each household recently had to give 10.000.000 IDR (625 €) to pay for the elevation of a local street. The asphalt was replaced by 70-centimeter high paving blocks. But the house renovation (elevation) depends on each household [...]”<sup>314</sup>

The pump system is used to channel the water from the local drainages of the settlements to the urban drainages. There is a high reliance on the pump system, in particular during the high tide season and the rainy season. Nevertheless, this system only reduces in the local territory, while the surrounding territories, which are not integrated into the pump system, are experiencing an increase of flood risk during the “flood season”.

Likewise, the street elevations did not change the territorial (urban) pattern, but they point to the adaptive transformation of the territorial (urban) form. These transformations highly depend on the capacity of the communities to contribute financially. They are carried out locally in the city. Nevertheless, there has not been an integrated transformation of urban form at the city scale, which produces inequalities in the urban form transformation given that there is no comprehensive transformation of the urban form that should be implemented by the municipality.

Besides land reclamation, a spatial transformation induced by flood risk adaptation also occurred in the urban drainages, such as, for instance, the improvement of West Floodway and Garang River (Jatibarang project-component A) in Semarang coastal area. The

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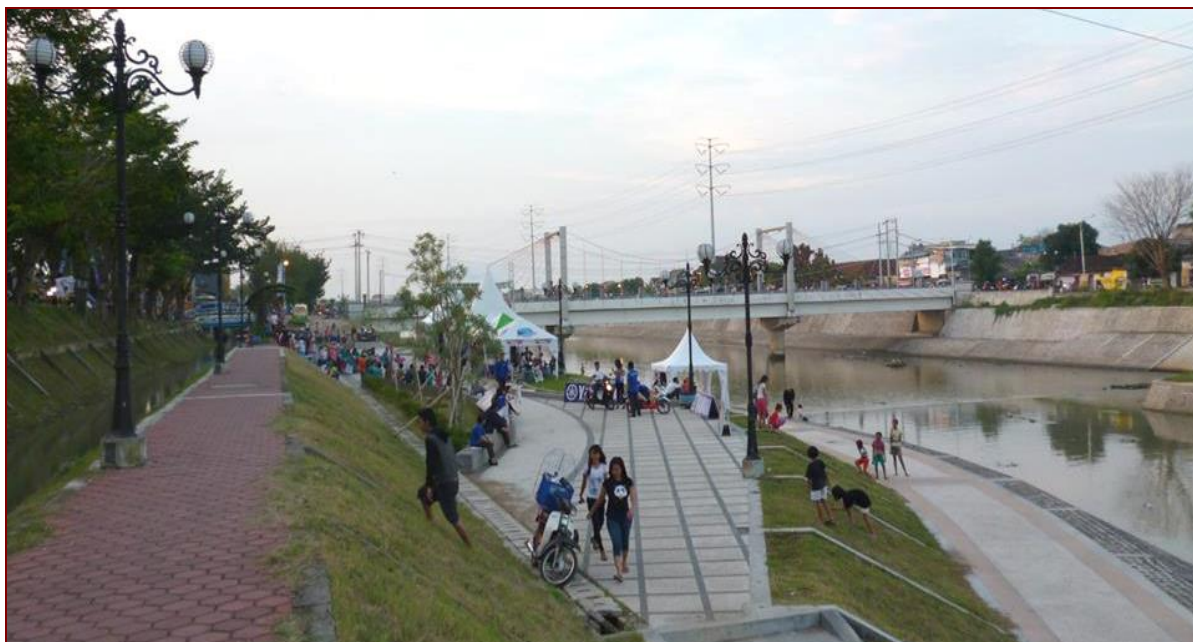
<sup>313</sup> Puri Anjasmoro is one residential area which located in the Puri Marina Area.

<sup>314</sup> Interviews with Okky Yuliawan (29 years old) and his father (± 60 years old) who have been lived in Puri Anjasmoro since 1988

dike was improved through the design of the staircase steps, which point out the learning process of flood occurrences. Furthermore, the pedestrian ways, as wide as approximately 2 m and 3,5 m, are characterized by the paving and the green belt (dike) that aim to absorb the water inundations occur. Besides the function of flood risk reduction, several parts (spots) of these drainages were developed, such as open spaces for recreation areas. The river amenity was also taken into account in the design of the drainages. Therefore, urban drainage has a dual function in Semarang City: it functions as the water discharge, and as a public space. Thus, the spatial transformation is not only meant to adapt to the urban flood risk, but also to influence the inhabitants' behaviors to the urban water spaces.

The development of public spaces around West Floodway is the first project of waterfront development in Semarang City. The urban drainages include rivers, canals and floodways in Semarang City. They are not only used for the water discharge, but also as urban public spaces. Most of urban drainages in Semarang City have not been maintained properly, and have been polluted by the waste. The inhabitants settled along the urban drainages are accustomed to throw their wastes in the urban drainages. The municipality seeks to raise the awareness among the inhabitants with respect to the need for keeping the urban drainages clean. In addition, most of urban drainages in Semarang city are located behind the settlements (houses). The urban drainages are only used to throw waste and for the inhabitants' sanitation. However, the waterfront development of West Floodway shows that the urban drainages are integrated and important elements for the flood risk reduction. As such, they should be preserved not only by the municipality, but also by its inhabitants. The municipality urges community behaviors to preserve the water spaces in order to reduce the flood risk in Semarang City. Flood risk has been part of urban life. As a result, it is of utmost importance that inhabitants become aware of the situation and aggregate their efforts to create urban flood resilience.





**Figure 78. The staircase-steps design of West Floodway**

©Modified by Nur Miladan, 2014

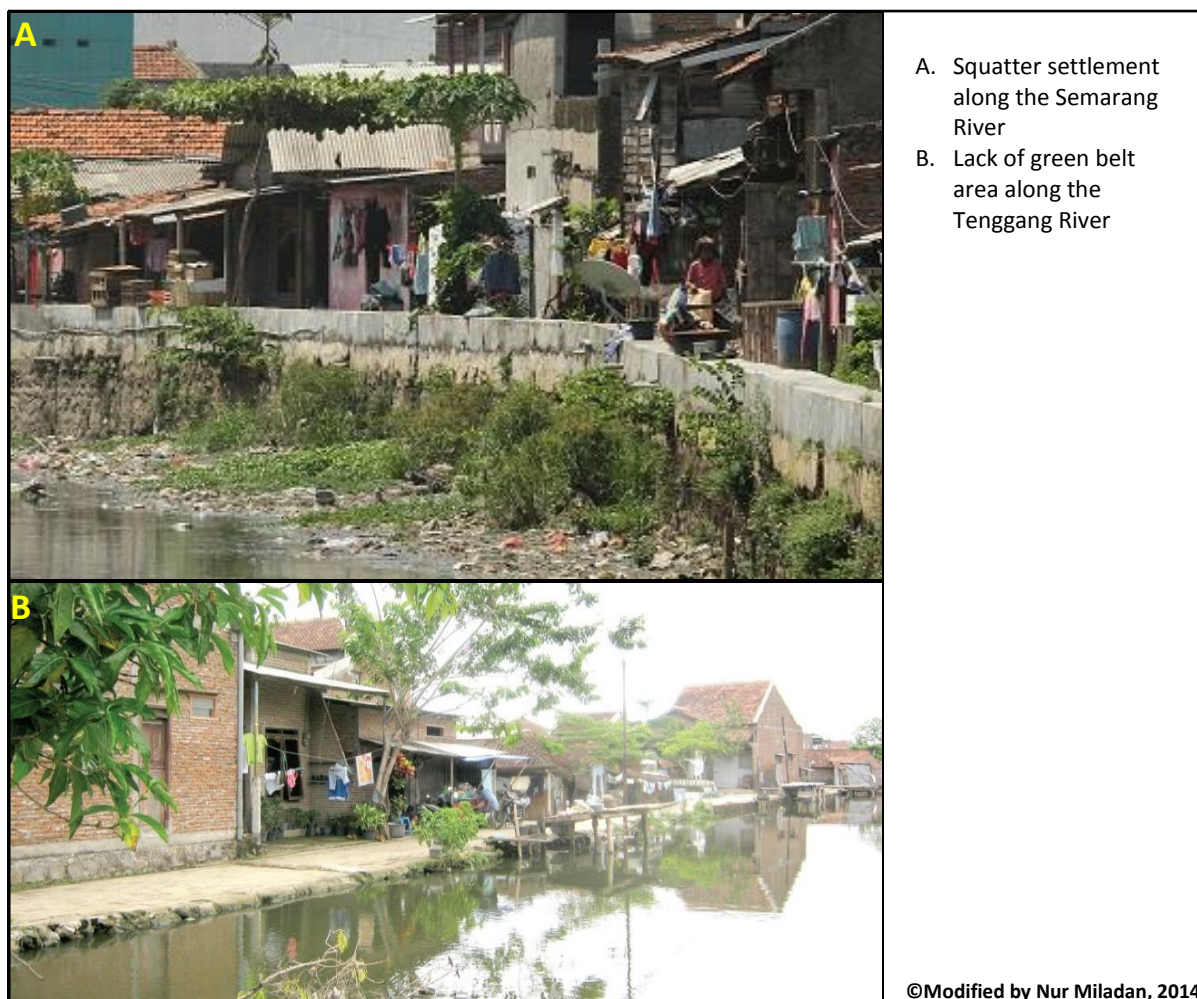
Source: Ma'arif, Y.I., *Banjir Kanal Barat Semarang, Dulu dan Kini* [Photo], July 16<sup>th</sup> 2013, retrieved December 25<sup>th</sup>, 2015, from <http://www.kompasiana.com/imammaarif/banjir-kanal-barat-semarang-dulu-dan-kini>.

*The design of West Floodway was aimed to anticipate several levels of inundation elevation and also to be used for the inhabitants' activities, such as jogging track, parks and also as a commercial area. During the maximum water discharge or the rainy season, this area can serve as a water spaces to reduce the risk of inundation caused by the water overflow of that floodway. The width of these drainages amounts to around 100 m in the upstream area and to 300m in the downstream area. Meanwhile, their depth is of approximately 2 to 3 m. This improvement was aimed to increase the water discharge from 300-400 m<sup>3</sup> to 730 m<sup>3</sup>.*<sup>315</sup>

The spatial transformation of urban drainage did not only occur in the West Floodway, but also in the other rivers. The municipality seeks to improve the quality of urban drainages through the arrangement of green belts around them. Most of these areas have been changed as the built-up areas, such as squatter areas and commercial areas. So far, the lack of green belt areas around the drainages has caused inundations since there is an overflow of these drainages which are threatened directly by the settlements. This relates to the lack of watershed area management by the municipality several decades ago. The inhabitants have occupied the open areas around the urban drainages (rivers and canals) and have turned them, for instance, into squatter settlements. This resulted in the narrowing of water spaces.

<sup>315</sup> Widyanti, P., Kismartini, Maesaroh, 2014, "Implementasi Kebijakan Penanggulangan Banjir (Studi Kasus Proyek Normalisasi Banjir Kanal Barat dan Kali Garang Kota Semarang)", *Journal of Public Policy and Management Review*, vol. 3, n° 3.





- A. Squatter settlement along the Semarang River
- B. Lack of green belt area along the Tenggang River

©Modified by Nur Miladan, 2014

### Figure 79. Lack of the green belt areas of urban drainages in Semarang City

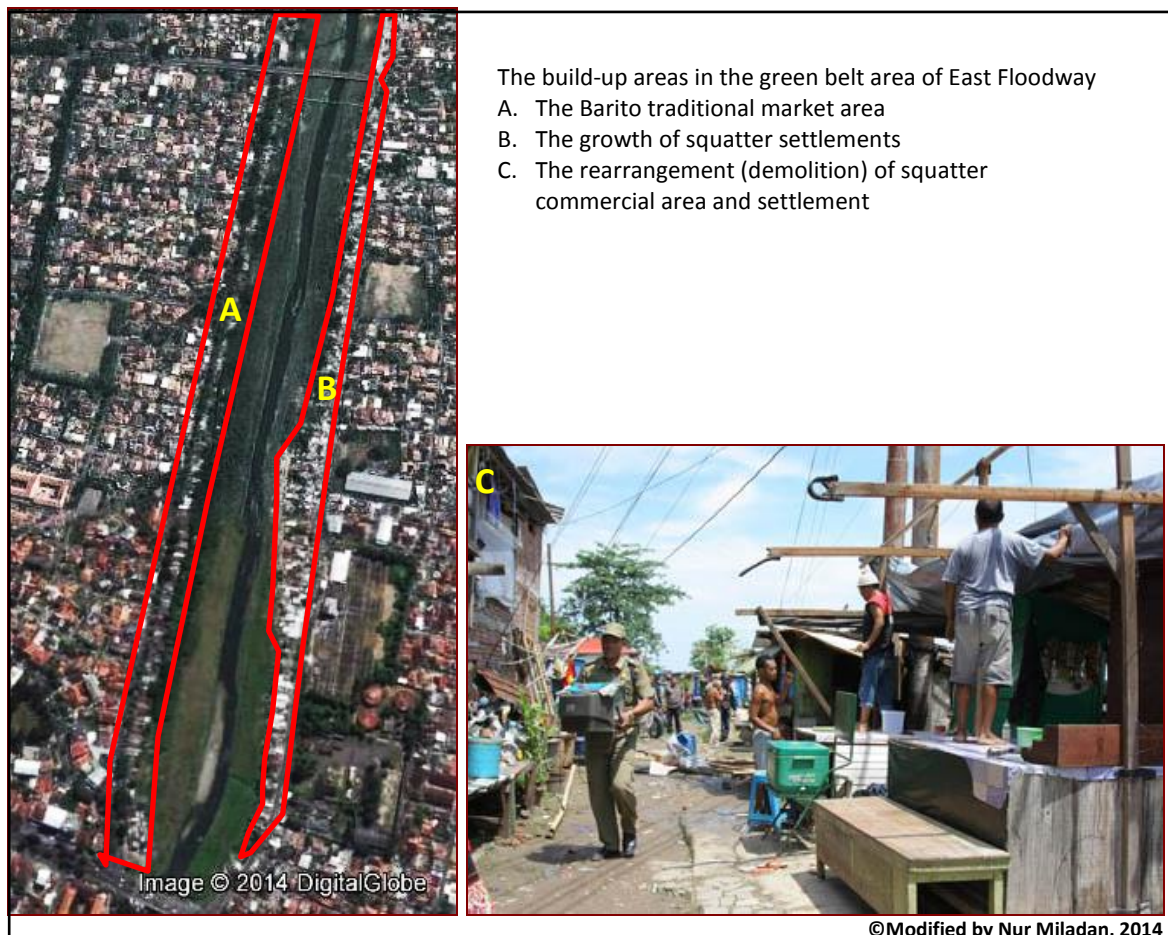
Source: “Warga Minta Realisasi Kali Tenggang”, *Harian Semarang*, June, 9<sup>th</sup> 2010, retrieved December 25<sup>th</sup> 2015, from <http://hariansemarangbanget.blogspot.com>.; “Digusur 39 Warga Sleko Gigit Jari”, *Radars Semarang*, November, 26<sup>th</sup> 2014, retrieved December 25<sup>th</sup> 2015, from <http://www.radarsemarang.com>.

*The lack of green belts areas around most of urban drainages, especially in Semarang coastal area, brought about the urban flood vulnerabilities. Recently, the municipality has sought to rearrange these areas in such a way as to reduce urban flood, but its actions are not easy to be implemented given the high cost for the land acquisitions and the difficulties of settlements relocations.*

However, the municipality has implemented the green belt improvements around several urban drainages in order to rehabilitate the urban water spaces. For instance, it has improved the green belt areas of East Floodway, West Floodway and Semarang River through the demolitions of squatter areas.<sup>316</sup> Furthermore, the municipality has planned to set up traditional markets around the urban drainages. For instance, it has implemented the arrangement plan of the four-kilometer long Barito Market along the East floodway. This market has existed since the 1980s, and was indeed planned by municipality as a commercial

<sup>316</sup> Fahmi, M.M., “11 Bangunan kumuh di bantaran Banjir Kanal Timur dibongkar”, *Suara Merdeka*, January, 6<sup>th</sup> 2011”, retrieved December 25<sup>th</sup> 2015, from <http://suaramerdeka.com>; Prabowo, A., “Satpol PP bongkar gubuk tempat tinggal di BKB Semarang”, *Sindonews.com*, October, 29<sup>th</sup> 2013, retrieved December 25<sup>th</sup> 2015, from <http://daerah.sindonews.com>; Syukron, M., “Bangunan Liar di Bantaran Kali Semarang ditertibkan”, *Suara Merdeka*, October, 26<sup>th</sup> 2011, retrieved December 25<sup>th</sup> 2015, from <http://suaramerdeka.com>.

area at that time. Nevertheless, the Barito Market extended year after year, and the municipality was overwhelmed to arrange this extension, thus giving rise to a growth of the market in the green belt area of East Floodway. It was thus a failure in the green belt management of urban drainages several years ago. Consequently the municipality now faces difficulties to rehabilitate this green belt area.



**Figure 80. The growth of build-up area in the green belt area of East Floodway**

Source: Google Earth, 2014; Fahmi, M.M., “11 Bangunan kumuh di bantaran Banjir Kanal Timur dibongkar”, Suara Merdeka, January, 6<sup>th</sup> 2011”, retrieved December 25<sup>th</sup> 2015, from <http://suamemerdeka.com>.

*The rehabilitations of the green belt areas of the urban drainages are spatial organization forms to adapt to the urban flood risk. Indeed, the municipality is subject to many technical constraints to implement these actions. However, it seems that it has recently decided to focus them.*

That being said, the municipality seeks to create urban spaces that adapt to flood risk through urban spatial transformation (system), including land reclamation and the improvements of urban water spaces to build urban flood resilience. The spatial planning of Semarang City for 2011-2031 and the interviews with urban stakeholders indicate that these

actions will be continued and integrated to reach a sustainable development of Semarang City.

“[...] Controlling (reduction) plans of *rob* and flooding including the development of a retention basin in the Semarang Utara District, the development of coastal belts (dikes) in the Tugu District, Semarang Barat District, Semarang Utara District, and Genuk District, the standardization (rehabilitation) of watershed in the whole of Semarang City, the controlling of the built-up areas in the Gunungpati District, Mijen District, Ngaliyan District, and the improvement of urban drainage network (system) in the whole of Semarang City [...]”<sup>317</sup>

“[...] The municipality seeks to reduce the problems of flooding and *rob* through the Banger Polder development, the mega projects of Jatibarang Reservoir, and the standardization of rivers such as Asin River, Baru River and Semarang River. Nonetheless, these efforts only reduce flood risk (which includes *rob* risk), it is not possible to solve (eliminate) the existence of flood risk in Semarang City [...]”<sup>318</sup>

“[...] We (the municipality) seek to implement the development of the urban drainage system, like its master plan, including the arrangements of the upstream and downstream areas. We implement the polders (system) in the downstream of Semarang such as Banger Polder, the development of Jatibarang Reservoir, the standardization of West Floodway. These efforts aim to arrange the water spaces in the city [...]”<sup>319</sup>

“[...] it (West Floodway) is not only the drainage system for the flood control in city, but this river can also be a recreational and sports area. If, in the past, the river was considered as a dirty area and was used to throw waste, (now) the existence of standardization and arrangement (of West Floodway) is expected to change the perception of the community [...]”<sup>320</sup>

Despite the fact that land reclamation is considered by the municipality as the solution of urban development to reduce the flood risk in order to achieve environmental sustainability, it actually presents potential risks for urban sustainability. So far, the land reclamation area has experienced land subsidence and it is subject to a high risk of flooding and *rob* phenomenon. In addition, the municipality seeks to improve the urban water spaces in the upstream and downstream areas. The development of a reservoir corresponds to a spatial transformation aimed to improve the water spaces in the upstream area. Meanwhile, the urban drainage improvements, in particular the territories with a high density of built-up area in the coastal area, also shows a process of spatial transformation in the downstream

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<sup>317</sup> *Spatial planning of Semarang City for 2011-2031*, 2011, Semarang: Regional Development Planning Agency.

<sup>318</sup> The interview with Nik Sutiyan, Head of Research and Development of Spatial Planning and Regional Infrastructure, Regional Planning Agency of Semarang City in 2011.

<sup>319</sup> The interview with Rosyid Husodo, Head of Water Resources, Energy and Geology, Department of water resources management.

<sup>320</sup> The statement of Anang Mukhlis (Head of working unit of Jatibarang Reservoir, Large River Basin Organization Pemali Juana in local newspaper. Cf. “Normalisasi selesai, PKL perlu ditata”, *Suara Merdeka*, January 7<sup>th</sup> 2013, retrieved December 25<sup>th</sup> 2015, from <http://www.suaramerdeka.com/v1/index.php/read/cetak/2013/01/07/211010/Normalisasi-Selesai-PKL-Perlu-Ditata>.

area. These elements attest the water dynamics influencing the transformations of urban spaces.

Nevertheless, these transformations are linked to the implementations of urban projects, the interventions of private sectors (investors), and the community's financial capacity. The constraints imposed on the urban projects caused by management problems, including funding, delay of technical construction, and the coordination of the institutional and private sectors, and also the limited financial capacity of the community, give rise to a lack of urban spatial transformation and adaptation to flood risk. Consequently, they hinder the process of urban flood resilience.

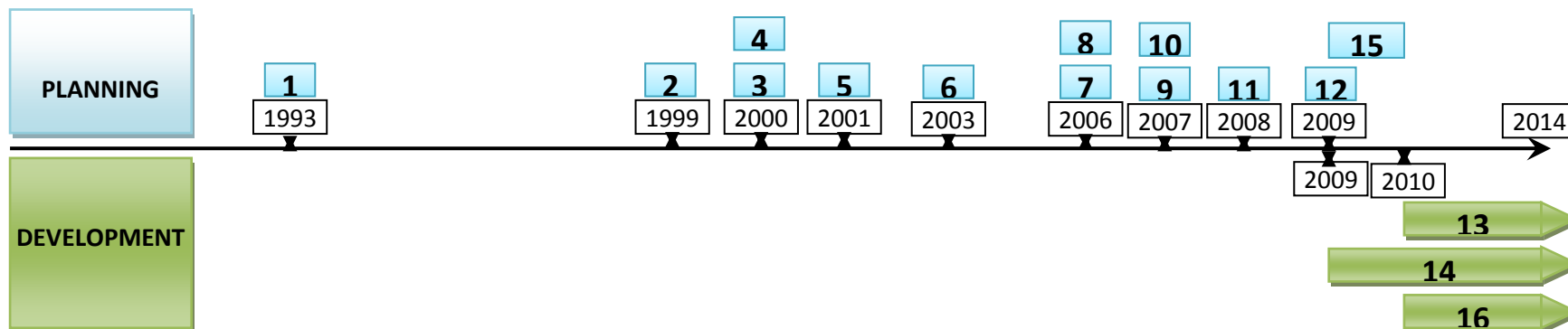
### **2.3. Constraints imposed on the risk management and the hydrological projects**

#### **2.3.1. Complexity of the institutional framework relating to the urban flood risk management**

The management of urban flood risk is related to the management of the urban drainage system and the management of the hydrological projects in Semarang City. These processes involve several stakeholders, such as the municipality, Central Java Province, and the national government. This institutional arrangement is linked to the important role of Semarang City as the capital of Central Java Province and one big city in Indonesia. The existence of hydrological projects in Semarang City has systematically involved the cooperation between these institutional actors. This has existed for several decades. According to the municipality, the funding of hydrological projects for the reduction of flood risk requires high costs and must thus be done through the cooperation between the Central Java government and the national government. Furthermore, Semarang City is located in the downstream of the other regencies in Central Java. Consequently, the urban drainage system of Semarang City is connected to the other regencies in the upstream areas, such as Semarang Regency, Demak Regency, and Kendal Regency. During the last 20 years, several projects of urban flood risk reduction have been conducted through the cooperation between the municipality of Semarang City, the province government and the national government (see Figure 81).



**Figure 81. Urban projects related to the hydrological risks reduction since 1990s**



No	Project Title	Institution
1	Master plan on water resources development and feasibility study for urgent flood control and urban drainage in Semarang City and suburbs (1993)	- Municipality - General Directorate of Irrigation (water resources), Ministry of Public Works - Japan government (JICA)
2	Semarang Flood Control Project-Consolidated Preparation Study (1999)	- Municipality - Ministry of Public Works - SMEC (Australia)
3	Detail design of flood control, urban drainage and water resources development (2000)	- Municipality - General Directorate of Irrigation (water resources), Ministry of Public Works - Japan government (JICA)
4	Semarang urban drainage master plan project (2000)	- Municipality - World Bank
5-6	Technical agreement (planning) for Banger polder Project (2001, 2003)	- Ministry of Public Works - Ministry of Environment - Netherlands government - Municipality (Regional development planning agency and Department of water resources)
7	Master plan and Detail Engineering Design of Ahmad Yani Airport drainage system (2006)	- Department of Human Settlement and Spatial Planning of Central Java Province
8	Detail Engineering Design of Tenggang River (2006)	- Department of Public Works of Semarang City (Municipality)
9	Drainage master plan of Semarang City (2007)	- Municipality (Regional development planning agency and Department of water resources)

No	Project Title	Institution
		resources)
10	Detail Engineering Design of Banger Polder (2007)	<ul style="list-style-type: none"> <li>- Netherlands government (HHSK and Witteveen + Bos)</li> <li>- Municipality (Regional development planning agency and Department of water resources)</li> </ul>
11	Detail Engineering Design of Bringin River (2008)	<ul style="list-style-type: none"> <li>- Department of Water Resources Management of Central Java Province</li> </ul>
12	Financial agreement of Banger Polder Pilot Project (2009)	<ul style="list-style-type: none"> <li>- Municipality (Regional development planning agency and Department of water resources)</li> </ul>
13	Implementation of Banger Polder Pilot Project (2010-on going)	<ul style="list-style-type: none"> <li>- Central Java Province (Department of Human Settlement and Spatial Planning of Central Java Province and Regional development planning agency)</li> <li>- National government (Directorate of Human Settlement and Large River Basin Organization Pemali Juana, Directorate General of Water Resources- Ministry of Public Works)</li> <li>- Netherlands government</li> </ul>
14	Packet of the Jatibarang Dam (2009-on going) <ul style="list-style-type: none"> <li>- Component A : Improvement works of Garang River and West Flood Way</li> <li>- Component B : construction of Jatibarang reservoir</li> <li>- Component C : Improvement of Semarang River, Asin River and Baru River/Canal</li> </ul>	<ul style="list-style-type: none"> <li>- Municipality</li> <li>- General Directorate of water resources (Ministry of Public Works)</li> <li>- General Directorate of Human Settlement/ Cipta Karya (Ministry of Public Works)</li> <li>- Work Unit of Environment Sanitation Development (Department of Human Settlement and Spatial Planning of Central Java Province)</li> <li>- Japan government (JICA)</li> </ul>
15	Initiation and planning of Asian Cities Climate Change Resilience Network (ACCCRN) (2009-2010) <ul style="list-style-type: none"> <li>- City resilience strategy</li> </ul>	<ul style="list-style-type: none"> <li>- Municipality. Regional development planning agency as the coordinator of city working group</li> <li>- Mercy Corps ( Project holder)</li> <li>- Rockefeller Foundation ( Initiator and funding of ACCCRN)</li> </ul>
16	ACCCRN project implementation (2010-on going) <ul style="list-style-type: none"> <li>- Pre-feasibility Study For Expanding Rainwater Harvesting Systems</li> <li>- Flood Forecasting and Warning System</li> <li>- Enhancing Coastal Community Resilience through Strengthened Mangrove Ecosystem Services and Alternative Livelihoods (in Tugurejo Sub-district)</li> <li>- Community Based Micro Finance Program for Sanitation (in Kemijen Sub-district)</li> </ul>	<ul style="list-style-type: none"> <li>- Contributor Team               <ul style="list-style-type: none"> <li>- Universities: Diponegoro University, Semarang State University, Semarang University, Soegijapranata Catholic University</li> <li>- Local NGOs : BINTARI, LEPAAS, PERDIKAN</li> <li>- International NGO : ARUP</li> <li>- Indonesian Meteorology Climatology and Geophysics Agency</li> </ul> </li> </ul>

Based on the above figure, it seems that since the 1990s, there have been many urban projects related to the planning of flood risk reduction. But around three development projects only have been carried out since 2009. This situation indicates the inconsistency between the planning and the development projects. Although the planning projects have involved many stakeholders, including the municipality, the province government, the national government, international actors (Netherlands, Japan, Australia, and the World Bank), their developments have been subject to many constraints. Likewise, there have been many delays. More than a decade has separated the planning and the development projects.

Indeed, the collaboration between the multi stakeholders has led to various initiatives for the planning of flood risk reduction in Semarang City, but it has also given rise to a complexity in the development of hydrological projects. Oftentimes, the hydrological projects have been inhibited due to the lack of collaboration between the stakeholders and legal constraints.

For instance, the Banger Polder Project started in 2002, but, in 2014, it was still not completed. This project faced several obstacles relating to project management for ten years, such as the co-financing and the responsibility collaboration. Furthermore, the Jatibarang packet project experienced the constraints. This project was initiated in 1993, and about 20 years were needed to implement it. The involvement of many stakeholders led to an overlap of the hydrological projects management. Allegedly, the stakeholders stated that the collaboration between the municipality, the province government and the national government worked effectively, and that there was a clear job division among the institutions.<sup>321</sup> In fact, the management of the collaboration was difficult, as evidenced by the statement of the Governor of Central Java Province about the constraints of the Banger Polder Project, mentioned on the official website on 19 May 2014:

“Anyway, if there is an obstacle, we must solve it. If an amendment, an addendum or a revision of the agreement contract is needed, this can be discussed. There may be bilateral meetings between the municipality and the Indonesian Railway Company on the squatter settlement. Technically, action plans may be prepared. The Pertamina Company is invited to discuss the technical pipes in the Polder (Banger) location, whether they (the pipes) must be covered or the solution. My expectation is that there will be, by this end of the month, a clear road map”<sup>322</sup>

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<sup>321</sup> Interviews with several stakeholders from the Regional Development Planning Agency of Semarang City, the Department of Water Resources Management of Semarang City, and the Department of Human Settlement and Spatial Planning of Central Java Province during 2011 and 2013

<sup>322</sup> Central Java Province, *Pemprov pantau pembangunan Polder Banger*, May, 19<sup>th</sup> 2014, retrieved December 28<sup>th</sup> 2015, from <http://jatengprov.go.id/id/berita-utama/pemprov-pantau-pembangunan-polder-banger>.

That statement points to the difficulties of the Banger Polder Project management among several stakeholders involved. Although they have agreed on a job division, each of them faces the constraints for the implementation of that project. For example, the development of the retention basin is supposed to be carried out by the Directorate of Human Settlement (Ministry of Public Works). However, it is necessary to await the land acquisition by the municipality, which depends on the Indonesian Railway Company, the owner of the land. Likewise, the improvement of East Floodway falls under responsibility of Large River Basin Organization Pemali Juana, the Directorate General of Water Resources (Ministry of Public Works), but it has still not been implemented. As a result, this prolongs the delay of the implementation of the project.

The stakeholders involved in the hydrological projects in Semarang City, such as the local government (municipality) and the (national and province) central government, have conducted the processes of consultation necessary to support the implementations of hydrological projects. Nevertheless, oftentimes, these processes have faced the ambiguities of the management of the hydrological projects relating to their financing, the coordination of the authorities, and the timing of the implementation of the projects. For example, the projects of maintenance of the floodways involve the municipality, the province government and the central government. The task division is so obscure that the floodways have not been maintained properly.

Furthermore, the inconsistencies in the management of the hydrological projects also prevented the implementation of the latter. Several related institutions planned the hydrological projects, but, due to the lack of their integration, they could not be carried out. The existence of the Banger Polder Project points to the problem of the existence of inconsistencies in the management among the related institutions. This is evidenced by the decreasing trust of international assistance (Netherlands) when requested to participate in the funding of the Banger Polder Project. The management of the hydrological projects, involving many institutions, presents risks of inconsistency caused by the long procedure of the administration and the regulation of the project. The problem of the rehabilitation (standardization) of the urban drainage system sheds light on the inconsistencies of the implementation of the hydrological project in Semarang City. The task divisions influence the delay or the ineffectiveness of the urban hydrological projects. The case of Tenggang River rehabilitation is a good illustration. On the official website of Central Java Province, the Head of Water Resources, Energy and Geology, Department of water resources management makes the following statement:



“[...] The flooding in Kaligawe (situated in the Semarang coastal area) is caused by the fact that the drainage of Tenggang River has not functioned properly. It falls within the responsibility of the municipality. The provincial government has assisted and consulted the central (national) government to help (the implementation of the project), but however, the land acquisition must be first completed by the municipality. And it still not has been finished. Consequently, the central (national) government has still not helped the implementation (of this project) [...]”<sup>323</sup>

“[...] We expected that the standardization of Tenggang River would be completed as soon as possible, because if the estuary (of the river) cannot be managed, the flooding keeps on occurring. Meanwhile, the standardization of East Floodway falls within the responsibility of the Department of Water Resources Management of Central Java Province and Large River Basin Organization (of Pemali Juana, Directorate General of Water Resources-Ministry of Public Works).”<sup>324</sup>

These statements point to the fact that the task division between the institutions involved produces inconsistencies in the urban hydrological projects in Semarang City. The success of collaboration in a project management very much depends on the effectiveness of the implementation of the project by each institution involved. The interruption of the implementation by an institution will influence the effectiveness of other institutions. This will give rise to disharmony among the institutions involved in the implementation of the hydrological projects.

Furthermore, despite the fact that the urban hydrological projects are supposed to be comprehensive, these projects have nonetheless not encompassed the whole of the areas in Semarang City impacted by the flood. The hydrological projects were carried out only in some parts (areas) of the city. However, they have not been integrated yet. The various collaborations between institutions result in a lack of comprehensiveness of the projects. For instance, the institutions involved in the Banger Polder Project are different from those of the Jatibarang Packet Project. This gives rise to a lack of priority programs for reduction of flood risk in Semarang City. The hydrological projects are implemented separately, which means that there is no linkage among them. Consequently, despite the fact that the municipality is the owner of the master plan of the urban drainage system, the implementation of the hydrological projects highly depend on the external stakeholders (institutions), including the national (central and provincial) government and international governments, such as the Netherlands and Japan. The lack of clarity of the priority programs relating to the

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<sup>323</sup> Central Java Province, “Badan Penanggulangan Bencana Daerah (BPBD)”, *Lapor Gub..!* [Web], August, 6<sup>th</sup> 2014, retrieved December 28<sup>th</sup> 2015, from <http://laporgub.jatengprov.go.id/main/detail/537.html#>.

<sup>324</sup> Abduh, M., “Kali Tenggang mendesak dikeruk”, *Koran SINDO*, February, 16<sup>th</sup> 2015, retrieved December 25<sup>th</sup> 2015, from <http://daerah.sindonews.com/read/964866/151/kali-tenggang-mendesak-dikeruk-1424055987>.

hydrological projects leads to a lack of effectiveness of the reduction of flood risk in Semarang City.

Likewise, a deviation planning has recently occurred between the urban drainage master plan and the city master plan. According to the urban drainage master plan, Semarang coastal area is to have a polder system supported by water spaces, such as retention basins, reservoirs and also green spaces for the catchment areas. This is at odds with the city master plan, according to which the Semarang coastal area is to be exploited as an urban zone comprising residential areas, industrial areas, tourism areas, commercial areas and land reclamation areas. These planning documents were established by the municipality, particularly by the Regional Development Planning Agency. Their contradictory character seems to stem from the lack of collaboration between the stakeholders involved. This will certainly influence the effectiveness of urban hydrological projects in future situations.

However, the projects collaborations point to the comprehensive planning and initiatives taken by the institutions concerned to reduce Semarang flood risk. The interventions of international actors, including JICA (Japan), Witteveen + Bos and Water Board Schielanden de Krimpenerwaard (Netherlands), SMEC (Australia), and Mercy Corps (international NGO), evidence a transfer of knowledge and a learning process by the local institutions, in particular the municipality. JICA, Witteveen + Bos and Water Board Schielanden de Krimpenerwaard and SMEC have provided knowledge with respect to the improvements of the urban hydrological system aimed to reduce flood risk and the development of urban flood resilience.

Moreover, Mercy Corps has recently initiated the program of Asian Cities Climate Change Resilience Network in Semarang City. Two Indonesian cities (Semarang and Lampung) were elected for that program. Semarang, as case study relating to it, is already facing significant environmental and climate pressures, including storms, coastal erosion, and drought, with resulting problems of flooding, coastal inundation and depleted water supplies.<sup>325</sup> The aim of the program is to create the Semarang urban resilience towards climate change. The flood risk is considered as being an effect of climate change in Semarang City, which must be anticipated. Mercy corps and municipality released the document of Semarang Resilience Strategy matching the Long Term Development Plan of Semarang City for 2010-2015. Several projects are implemented for the reduction of flood vulnerabilities and coastal community adaptation, such as a Pre-feasibility Study For Expanding Rainwater

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<sup>325</sup> *Asian Cities Climate Change Resilience Network (ACCCRN): Responding to the Urban Climate Challenge*, 2009, Colorado: Institute for Social and Environmental Transition (ISET).

Harvesting Systems (2010-2011), Flood Forecasting and Warning System (2012-2014), Enhancing Coastal Community Resilience through Strengthened Mangrove Ecosystem Services and Alternative Livelihoods (in Tugurejo Sub-district) (2013-2016), and Community Based Micro Finance Program for Sanitation (in Kemijen Sub-district) (2010). These collaborative projects seek to involve the communities, local NGOs and academic partners (universities).

The ideas behind these projects are the increasing adaptation process of Semarang communities towards climate change through actions of risk and vulnerability reductions. These projects seek to enhance the awareness of the communities concerning the risk and reductions efforts of climate change on their territories. They focus on the coastal communities because the stakeholders concerned consider them as the most vulnerable communities to climate change effects, such as drought, flooding, inundation, abrasion, land slide and diseases in Semarang City. The stakeholders also took the view that, if climate change is a complex natural disaster, solving this risk must be anticipated in a comprehensive manner by the urban institutions. For instance, Semarang City needs a long term and significant funding to reduce flood risk through the implementation of urban hydrological projects. It is therefore expected that the projects can be implemented on the short and medium terms. Furthermore, the objectives of these projects are to prepare the capacity of the communities to adapt to climate change. It is also expected that the government (municipality) can overcome the climate change impacts through comprehensive urban projects. The concepts of Asian Cities Climate Change Resilience Network (ACCCRN) in Semarang City have been used in several areas of the city as pilot projects. It was expected that the municipality could replicate the projects independently in other areas of the city in the future, and this concept must certainly be supported by the capacities of urban institutions to cope with climate change impacts. These projects were instigated by the city working group, which comprises the municipality (Regional Development Planning Agency), Mercy Corps, BINTARI (local NGO), the Environment Agency, and the academic partners (Diponegoro University). This team designed the concept and action plans for the development of ACCCRN Program in Semarang City. The selected action plans (projects) revolved around the issues of climate change impacts on Semarang City.

The Pre-feasibility Study for Expanding Rainwater Harvesting Systems aims to provide means to the community to adapt to the drought risk. The project of Enhancing Coastal Community Resilience through Strengthened Mangrove Ecosystem Services and Alternative Livelihoods focuses on the need to strengthen the capacity of the community to

reduce coastal abrasion threatening their livelihood, notably the inland fisheries. Meanwhile, the project of Community Based Micro Finance Program for Sanitation aims to increase the capacity of the community to reduce the impacts of flooding, particularly the *rob* phenomenon, which gives rise to bad conditions of sanitation of poor households. However, these various projects do not have the desired effects. Feri Prihantoro, a member of the city's working group, has stressed that these projects will only slightly reduce the flood risk chances of happening:

“[...] the project of rainwater harvesting system aims to increase the availability of water resources, but it also has the little effect on flood reduction because the rainwater is stored in several containers. The project of mangrove cultivations focuses on reducing coastal abrasion. However, it will influence the reduction of rob risk because it has become a barrier in the coastal area. Meanwhile, the micro finance program for sanitation certainly reduces the vulnerability of the poor communities to flood risk. The rehabilitation of sanitation will have a positive impact on the health on inhabitants [...]”<sup>326</sup>

Meanwhile, according to Aniessa Delima Sari, an ACCCRN Semarang Project Officer, the project of Flood Forecasting and Warning System is a specific project relating to the building of flood resilience in Semarang City. The aim of this project is to enhance the capacity of the community with respect to flood risk in Beringin Watershed. It relates to the knowledge of the community on the existence of flood risk on the territory and on its preparedness to minimize flood impacts. This project is elaborated by structural and non-structural measures. The structural measures relate to the installations of simple flood forecasting tools around the Beringin River. The non-structural measures relate to the capacity of the community to manage these tools and also to understand the action steps of flood vulnerability reduction on their territory, in particular during the occurrences. Likewise, this project seeks to improve the management of flood risk by the municipality through an information system of early warning which is coordinated by the Department of Water Resources and the Regional Disaster Management Agency. This system is used to connect the department and the community together with respect to flood risk information.

“[...] this project does not solve the flood, it seeks to provide a proper information for the community about the *rob* (risk) and the flash flood, so that it can prepare and have enough time to evacuate before the flood occurrences and during the time when the Regional Disaster Management Agency (of Semarang City) has not arrived yet... so far, the municipality has focused on major projects, including floodway improvements, Jatibarang

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<sup>326</sup> Interview with Feri Prihantoro, Executive Director of BINTARI (local NGO) in 2012.



Dam and Banger Polder, which require a co-funding (high cost), land acquisition. However, the community has not been handled yet [...]"<sup>327</sup>

These efforts point to the interventions of external stakeholders, such as NGOs, which have a supporting role within the flood resilience process in Semarang City. The lack of efforts made by the municipality to develop the community resilience is anticipated by the intervention and the initiatives of external stakeholders. Furthermore, urban institutions are strengthened through the transfer of knowledge on urban resilience by the external stakeholders. The municipality and the Semarang communities go through a learning and adaptation process with respect to climate change that includes flood risk.

Nevertheless, so far this project has suffered from several weaknesses caused by the broad scope of the ACCCRN project. Flood risk reduction is only a part of comprehensive efforts for climate change resilience in Semarang City. The other risks affecting Semarang City, such as drought, diseases, and storms, are also considered as urban disasters that must be anticipated to create climate change resilience. Furthermore, these actions only take place in specific locations of Semarang City. Direct impacts on the whole of city have not yet been identified. Moreover, this project has been launched recently, whereas its sustainability is still to be evidenced.

The ACCCRN project in Semarang City did not take into account the urban and architectural transformations. Because this project only focuses on the increasing capacity of the community, and because it only resorts to simple tools, it does not give rise to significant urban and architectural transformations. It solely changes some of the practices of the community in order to cope with climate change vulnerabilities at local level. However, the existence of the project of mangrove cultivation will bring about a small transformation of green spaces to reduce the abrasion in Semarang coastal area. But this is only carried out in selected areas of the project.

Besides the complexity of the implementation of the urban projects aiming to reduce flood risk, the management of the urban drainage system in Semarang City involves several other institutions, from municipality to the national levels. This is another sign of the complexity of the institutions in the management of the urban drainage system.

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<sup>327</sup> Interviews with Aniessa Delima Sari, as ACCCRN Semarang Project Officer and Mercy corps staff.

**Table 4. The institutions involved in Semarang Urban Drainage Management**

No	Institution	Administrative level	Technical task for the flood risk reduction in Semarang City <sup>328</sup>
1	Department of Water Resources and Mineral Resources Management	Municipality	- Maintenance and operation of urban drainage system in Semarang City - Planning and design for urban drainage and flood risk reduction
2	Regional Development Planning Agency	Municipality	- Planning and Budgeting of urban drainage program and projects - Coordinating of urban drainage projects with other actors, such as National Government, Province, foreign governments and NGOs
3	Department of Urban Planning and Settlement	Municipality	Rehabilitation and improvement of settlement qualities, such as sanitation improvement, roads elevation and financial support for poor households that are impacted by flood risks
4	Regional Disaster Management Agency <sup>329</sup>	Municipality	Providing of flood mitigation and prevention and evacuation of the community during flood occurrences in Semarang City
5	Department of Human Settlement and Spatial Planning, through Work Unit of Environment Sanitation Development	Province within the Directorate General of Human Settlement, Ministry of Public Works (National)	- Planning and implementation of the integrated urban drainage system for Semarang City - The work unit of Directorate General of Human Settlement, Ministry of Public Works for the drainage infrastructure development in Semarang City
6	Water Resources Management Agency of Jragung Tuntang Department of Water Resources Management	Province	- Planning and implementation of project for the irrigation area of Jragung Tuntang including the irrigation system and flood risk reduction. (Semarang City is part of Jragung Tuntang River Basin)
7	Large River Basin Organization Pemali Juana, within Directorate General of Water Resources Management	National (Ministry of Public Works)	- The delegation of Directorate General of Water Resources Management for flood risk reduction and water resources management in Semarang City such as management of Jatibarang Dam and Flood Ways (Semarang City is part of Jragung Tuntang River Basin)

At least seven institutions are involved in the urban drainage management in Semarang City. As a result, these institutions must collaborate. The complexity of the

<sup>328</sup> Based on the interviews with several related stakeholders in 2012-2013.

<sup>329</sup> Regional Disaster Management Agency (*Badan Penanggulangan Bencana Daerah*) is regional institution formed to handle of disaster problem in region. This agency is associated with National Disaster Management Agency.

institutional framework prevents a fast implementation of Semarang urban drainage projects. For example, the management of East Floodway implies collaborative actions between the municipality, the Large River Basin Organization Pemali Juana, the Agency of Water Resources Management of Jragung Tuntang and the Department of Human Settlement and Spatial Planning of Central Java Province. Nevertheless, East Floodway has actually been experiencing high sedimentation for several years, which has still not been solved. This relates by the chaotic management of East Floodway. This also occurs with respect to the other main urban drainages in Semarang City.

The complex character of the management of the hydrological projects and the urban drainage system relate to the lack of a comprehensive management system of the hydrological risk. The involvement of many institutions gives rise to difficulties to achieve coordinated actions. On the one hand, the municipality has a limited capacity to manage the hydrological risk autonomously. On the other hand, the involvement of other government institutions, including the national and province governments, blur the respective contours of the tasks of each institution. In 2014, the municipality legalized a regional regulation relating to the urban drainage master plan for 2011-2031, explaining that it had the authorization to divide the tasks of the national government, the province government, and/or the other municipalities with respect to the development, management and rehabilitation of the drainage system.

**Table 5. Hydrological risk management of Semarang City in recent times**

AUTORITY	INSTITUTION	PLANNING AND POLICY RELATED URBAN HYDROLOGICAL RISKS						DISASTER RISK REDUCTION						
		Disaster Risk Reduction Policy	Urban strategic development planning	Urban spatial planning	Urban drainage system plan	Risks assessment and forecasting	Budgeting for hydrological projects	Protection (hydrological project)	Preparedness (Early Warning System and Organizational)	Prevention		Response (during crisis)	Recovery	
										Physical mitigation	Social mitigation (community awareness)		Urban Physics (building, way...)	Urban Social
LOCAL (MUNICIPALITY)	Regional Development Planning Agency	√√	√√	√√	√√	√√	√√		√		√			
	Department of Water Resources and Mineral Resources Management				√	√	√	√√	√√	√				
	Department of Urban Planning and Settlement			√									√√	
	Regional Disaster Management Agency	√				√			√		√	√		
	Department of Marine and Fisheries			√		√				√				
	Department of Healthy										√			√
	Agency of Environment	√				√								
	Department of Social, Youth and Sports										√			√√
	District Office								√		√	√		
	Sub-district Office								√		√	√		
	Local Parliaments						√							
Agency for Meteorological, Climatological and Geophysics in Semarang City					√			√						
NATIONAL <sup>330</sup>	Department of Human Settlement and Spatial Planning of Central Java Province • Work Unit of Environment Sanitation Development (within Directorate General of Human Settlement (Ministry of Public Works)						√	√						
	Water Resources Management				√		√	√			√			

<sup>330</sup> Provincial Government is a delegation of National Government which works based on the principle of deconcentration, Cf. *Local government*, Act n° 32/2004, Jakarta: Ministry of State Secretary.



AUTHORITY	INSTITUTION	PLANNING AND POLICY RELATED URBAN HYDROLOGICAL RISKS						DISASTER RISK REDUCTION						
		Disaster Risk Reduction Policy	Urban strategic development planning	Urban spatial planning	Urban drainage system plan	Risks assessment and forecasting	Budgeting for hydrological projects	Protection (hydrological project)	Preparedness (Early Warning System and Organizational)	Prevention		Response (during crisis)	Recovery	
										Physical mitigation	Social mitigation (community awareness)		Urban Physics (building, way...)	Urban Social
	Agency of Jragung Tuntang, Department of Water resources Management of Central Java Province													
	Large River Basin Organization Pemali Juana, within Directorate General of Water resources Management (Ministry of Public Works)				√		√	√						
	Directorate of Spatial Planning (Ministry of Public Works)	√		√										
	National Development Planning Agency	√												
	National Disaster Management Agency	√												
	Geological Agency					√				√				
	Department of Energy and Mineral Resources of Central Java Province					√				√				
Internati-onal Govern-ment	Japan				√		√							
	Netherlands				√		√	√						
	Australia				√									
NGO	Internal NGO: Mercy Corps (funded by Rockefeller Foundation)		√			√	√		√		√			
	Internal NGOs: Bintari, Perdikan,....		√			√			√		√			√
Academic Partners	Local universities : UNDIP, UNIKA, UNNES, UNISSULA,....		√			√			√		√			

Remarks: √√ : involved and coordinator (pilot) stakeholder √ : involved stakeholder

The table above shows that the hydrological risk management in Semarang City relies on urban planning and policy and the implementation of disaster risk reduction. Conceptually, Semarang City has had a comprehensive management for the hydrological risk. There are many elements (approaches) that are taken into account to support the hydrological risk management. This comprehensive management implies the involvement of many institutions at the local government (municipality) and the national government (province and state) levels. Actually, this situation points to the appropriate management of the hydrological risk in Semarang City. The limited capacity of the municipality will be offset by the national government and external stakeholders, including NGOs and academic partners.

At the local authority level, the Regional Development Planning Agency of Semarang, as the coordinator of urban institutions, plays a significant role to develop the planning and policies and the disaster risk reduction relating to the hydrological risk management in Semarang City. This institution is charge of many tasks, including urban planning and strategic development, urban disaster policy, urban drainage system plan, risks assessment and forecasting, projects budgeting, preparation and prevention of disaster reduction. Furthermore, the other institutions that play important risk management roles are the Department of Water Resources and the Regional Disaster Management Agency. These institutions are involved in technical tasks related to the hydrological risk management. Meanwhile, the other local institutions only play supporting roles for the urban risk management.

At the national government level, several institutions are also involved in the hydrological risk in Semarang through policies and their supporting roles with respect to the implementation of hydrological projects. The national government, through the Directorate of Spatial Planning (Ministry of Public Works), the National Development Planning Agency and the National Disaster Management Agency, has set out several regulations and guidelines on hydrological risk management, such as guidelines on the spatial use of flood risk area, and guidelines and rules on flood disaster handling, and also on the collaborative management of the urban drainage system and watershed.

The joint involvement of the local government and the national government points to their collaborative efforts to support the administrative system of the regional autonomy. Multiple stakeholders are involved in the strategic projects, and policies. Conceptually, the governance procedures are good, since they involve all the governmental administrative levels. On the one hand, their collaboration improves the accessibility of the hydrological

projects and the hydrological risk reduction, including the budgeting and policies. Nevertheless, in practice, the implementation of the hydrological projects and policies are often obscure. For instance, urban drainage improvements, as element of the hydrological projects, face a lack of financing by the municipality due to the restriction of the regional (urban) budget each year. As a result, the viability of the projects depends on the funds provided by the national government, including the Central Java Province, and the state. The National Government also has to carry out other priority programs, so, sometimes the funds originally allocated to the hydrological projects in Semarang City are called off. Furthermore, the complexity of hydrological risk management is related to the institutional decisions involving the collaboration between the local (municipality) and national (province and state) governments. Frequently, these collaborations require a long time for the decisions of hydrological risk management to be taken and the hydrological projects to be implemented.

Moreover, it is difficult to implement hydrological risk management policies in Semarang City. For instance, the directorate of spatial planning (ministry of public works) has issued the guideline on spatial use of the flood risk area, but, in fact, the urban planning of Semarang does not comply with the guideline. The Semarang coastal area is subject to a high risk of flooding, but the spatial plan for 2011-2031 indicates that most of this area was planned to be an urban area. This is contrary to the guideline, which recommends the development of preservation areas. However, the municipality stated that the recent spatial plan of Semarang City referred to the guideline and rules of spatial planning issued by the national government. Nevertheless, the adjustment of the urban existing condition is an important element for the urban spatial plans.

“[...] We seek to refer to the guideline of the national government with respect to Semarang spatial plans. However, the urban existing situation and urban developments are taken into account. We must use the prudential principles to implement the spatial plans. Recently, the legalization of urban spatial plan had to be agreed by the central government through the Department of Public Works. So if they don't agree, it will be revised, and the regional rule of urban spatial plan will not be legalized. This is part of the cooperation between the municipality, the central government and also the province government for the spatial plan [...]”<sup>84</sup>

“[...] As technical agency, we implement the use and the control of the spatial plan. The construction permits will refer to the document of spatial plan that is to be implemented in accordance with the national guideline [...]”<sup>85</sup>

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<sup>84</sup> Interview with Budi Prakosa, Head of Spatial and Environment Division, Regional Development Planning Agency in 2011.

<sup>85</sup> Interview with Moch. Agus, Head of Housing and Settlement Division, Department of Urban Planning and Settlement in 2011.

These statements reveal that the management of the flood risk area has constraints related to the discrepancy between the national policy and the municipality level. The urban stakeholders seek to adjust the national rules of the flood risk area, although in fact it is not easy to synchronize this policy at the urban level, due to the fact that they are also taken into the urban development trend. The national flood management is not elaborated together with the urban flood management. In addition, the legalization of the spatial plan of Semarang City was carried out by the central government (national and province), which reveals that there is a lack of supervision with respect to the national flood policy at the municipality level, and, consequently, failures of urban flood management occur.

Another example, land subsidence prevention, as an effort of flood risk reduction, reveals the obscure character of the implementation of the project, although this involves the collaboration between the municipality and the province government. The collaborative actions among the institutions do not pursue the objectives of the projects, and their efforts to reduce urban flood risk are ineffective.

The problem of the hydrological risk management related to the fact that the renewal (rotations) of the public servants in the local (municipality) and the national (province and national government) institutions is recurrent. Furthermore, urban policies, the hydrological projects and the cooperation with the other stakeholders, such as NGOs have not always been sustainable, given the absence of transfer of responsibilities among the public servants. Oftentimes, the urban projects are affected by the renewal processes that take place in the institutions. This was mentioned by Wiwandari Handayani, an academic partner of the ACCCRN project in Semarang City.

“[...] The rotations (of public servants) within the government (municipality) institutions are very frequent, for instance, before we had Mr. Hardjono, formerly he was head section in the Regional Disaster Management Agency. But now, he works in the Department of Water Resources, and the other head section, I forget his name, was replaced by Mr. Murjoko, before he worked in the Regional Development Planning Agency, so these rotations made the projects difficult: as soon as we have trained a person (civil servant), suddenly, he moves to another institution [...]”<sup>86</sup>

From that statement, it stems that the difficulties of collaboration among the institutions are caused by a bad rotation management of civil servants in the municipality. On the one hand, the hydrological projects need the civil servants to focus on the implementation

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<sup>86</sup> Interview with Dr. Wiwandari Handayani, Lecturer in Department of Urban and Regional Planning, Diponegoro University.



of the projects, but, on the other side, the bad management the rotation of public servant positions is common in the local and national institutions in Indonesia. Furthermore, the hydrological projects and the risk management highly depend on the skills of the people (public servants), but there has not been yet an integrated system. The institutional management is thus lacking and complex and affects the performances of urban (hydrological) projects and risk management in Semarang City.

### 2.3.2. Conflict of interest in Semarang coastal area

Besides the problem of the institutional complexity, the municipality also faces a problem of the availability and acquisition of the land in order to support the risk management for the flood reduction in Semarang City. Most of the land in the coastal line area of Semarang City, about 60 percent, is not owned by public actors (communities/municipality), but by private investors.<sup>87</sup> Furthermore, the map of land ownership in Semarang coastal area, which was established by the municipality, reveals that most of the land is owned by the private sector.



**Figure 82. Land ownership in Semarang Coastal area**

Source: Sasongko, P. D., (2013, Oct. 21), *Kebijakan Penanganan Banjir dan Rob di Kota Semarang* [Presentation], Semarang: Coastal Inundation Forecasting Demonstration Project Indonesia-BMKG/ Regional Development Planning Agency.

*Based on that map, it seems there are 14 companies having the sites in Semarang coastal, nevertheless several areas being owned by the inhabitants.*

The private sector in this area involves the developments of an industrial and warehousing zone, a transportation zone (port and airport), a housing area, commercial and business, and also a tourism area. Most of these zones were built in the reclamation land. In conjunction with the process of urban development in the 1980s, they were flood-free zones.

<sup>87</sup> Wibisono, L., Armitrianto, A., “Reklamasi dan kerusakan pesisir”, *Suara Merdeka*, December 18<sup>th</sup> 2014, retrieved December 25<sup>th</sup> 2015, from <http://epaper.suaramerdeka.com/read/2014/12/18/27SM18L14SMT.pdf>.

Considering the increasing of flood risk, private investors often rehabilitated their respective zones in order to reduce the flood risk.

In the industrial zones, no other strategy has been implemented by the private actors to reduce the flood risk besides the re-elevation of zones. This is at odds with the land subsidence phenomenon. On the one hand, the municipality seeks to reduce the land subsidence effects, and on the other hand, the municipality cannot stop the re-elevation of these areas by the industrial actors because of the lack of urban hydrological projects in the coastal area. Furthermore, these areas are characterized by a high building coverage and less green spaces which contributes to increase the flood risk. These situations reveal the discrepancy (disintegration) between the efforts of the municipality and the actions of private investors with respect to flood risk reduction.



**Figure 83. The area of Industrial Zone of Terboyo Megah Partners in 2013**

Source: Google Earth, 2015.

*Based on that aerial photo, it seems the private sector built the industrial zone with maximal building coverage approximately 90% and the high mass building. These situations indicate the inadaptable zone for the existence of land subsidence and the rob phenomena.*





**Figure 84. The condition of the Industrial Zone of Terboyo Megah in 2013**

Source: Primary Survey, 2013.

*Industrial activities in Semarang coastal area experience the stagnation of growth, due to the impacts of the rob phenomenon. The high cost of industrial zone maintenance pushed some investors to move their industries to other industrial zones. Consequently, several areas (fabrics) in this zone have not been used. Nevertheless, the investors face difficulties to sell their properties, which is due to the fact that the other investors avoid the rob risk. On the one hand, this industrial area is very prosperous because it is very close to the port area, but, on the other hand, there is a degradation of the environment, which means that investors must take into account the additional costs necessary to rehabilitate the zone.*

The strategies of land re-elevation are also implemented by real estate investors in the residential zone, the commercial and business zone, and the tourism zone. However, the impacts of flood risk in these areas are less significant than in the industrial zones because the efficiency of green (open) space and the appropriate building coverage approximate 70 %. Although the Semarang coastal area is vulnerable to flood risk, it remains interesting for some developers to invest in this area, because some inhabitants are attracted to its accessibility. The role of real estate developers certainly increases the land value of Semarang coastal area. On another note, solving the flood risk is one of seven priority programs of Semarang City<sup>88</sup>, so the municipality focuses on the urban hydrological projects that certainly involve acquisition of land. On the basis of the master plan of the urban drainage system, the municipality planned to provide the zones with floodgate infrastructures, including a polder, a retention basin and a coastal belt, especially in Semarang coastal area. It is difficult to implement these plans, given the fact that the lands owned by the municipality (government) are very limited in Semarang coastal area.

As a result of the failure of the municipality to control the built-up areas in Semarang coastal is municipality seeks to prompt private actors to acquire lands during the 1980s and the 1990s. Often, this is subject to many constraints related to the rules and the land prices. Furthermore, most of the lands owned by private actors in Semarang coastal area in particular areas of land reclamation correspond to situations where the actors only own building rights on land and rights to manage the land.<sup>89 90</sup> Actually, these conditions should facilitate the municipality (government) to acquire those lands for the urban hydrological projects. Nevertheless, the long duration of these rights has the effect to prevent the municipality from implementing the projects on the short and medium terms, and certainly, to limit the flood risk reduction of Semarang City. Under Act no. 1/ 2014 concerning the management of the coastal territory and of small islands in Indonesia, the coastal territory is a strategic area which requires the authorization of the government. Thus, the autonomy of the private actors

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<sup>88</sup> *Medium Term Development Plan (RPJMD) of Semarang City for 2010-2015*, 2010, Semarang: Regional Development Planning Agency.

<sup>89</sup> Several rights types of land ownership in Indonesia include right of ownership (*hak milik*), building rights on land (*hak guna bangunan*), cultivation rights on land (*hak guna usaha*), right of use (*hak pakai*), right of lease of building (*hak sewa untuk bangunan*), right of land clearing and right of forestry (*hak membuka tanah dan hak memungut hasil hutan*), rights of water use and fisheries (*hak guna air, pemeliharaan dan penangkapan ikan*), right of airspace use (*hak guna ruang angkasa*), right of land for religious and social purposes (*hak-hak tanah untuk keperluan suci and sosial*). The building rights on land are given during 30 years and it can be extended during 20 years. Cf. *Basic Regulation of the Agrarian Dicta*, Act n° 5/1960, Jakarta: Ministry of State Secretary.

<sup>90</sup> The right to manage land is the right is owned by the state which some authority is given to its holder. Cf. *Procedure of the granting and cancellation of the state land right and its management*, Regulation of Agrarian Minister/ Head of National Land Authority n° 9/1999, Jakarta: Ministry of Agrarian Affairs/ National Land Agency.



is limited. This Act revised Act no.27/ 2007 defining the rights of coastal management (exploitation) of the private actors. Act no 1/2014 seeks to reduce the rights of the private actors, and it increases the role of the government in the management of the coastal area seeking to achieve a sustainable environment, including the implementation of flood risk reduction programs. This reveals that the government is more aware of the vulnerability of the coastal territories to the disaster risks. In the case of Semarang City, this Act allows the municipality to authorize the land of coastal areas for the support of urban hydrological projects, which enhances the flood resilience process in Semarang City. Nevertheless, the spatial plan for 2011-2031 indicates that the municipality seeks to increase the role of the private actors in the development of urban zones, such as the coastal areas. Economic interests are therefore more taken into account than the need to preserve the environment and the process of flood risk reduction. There is also a discrepancy between urban planning and Act no 1/2014. The national policy has not been integrated into the municipality policies.

Furthermore, the problem of land ownership in Semarang coastal area occurred in the *kampung* areas. For instance, the existence of *kampung* Tambaklorok is seen as part of the extension area of Tanjung Mas Port by Indonesian Port Corporation (PT. PELINDO). Yet, since 2002, the municipality has given the official ownership rights of that area to the community of Tambaklorok. Consequently, it is no longer a squatter settlement. On the one hand, the municipality facilitated the existence of this settlement, but, on the other hand, it produced a vulnerable settlement to flood risk, in particular the *rob* phenomenon. Giving land ownership to the community in the flood-impacted areas is at odds with the efforts aiming to reduce urban vulnerability. Furthermore, it complicates the process of land acquisition within the framework of the urban hydrological projects. There are therefore conflicts of the interests with respect to land use in Semarang coastal area which constrain the urban flood resilience process. The urban spatial policies have a small impact on flood risk reduction in Semarang coastal area. Furthermore, the urban activities and practices by the communities and the private actors have not been articulated with the efforts of flood risk reduction by the municipality. The implementation of the urban hydrological projects has not been followed by adaptable land use planning by municipality or the practice of the communities and private actors in urban life and development for the flood risk reduction. However, the land use planning by the municipality and the practices for the urban flood adaptation by the communities and private actors are important elements for the urban flood resilience process. Whenever conflicts of interest and land use practices occur in Semarang coastal area, follows a high risk of failure for the urban flood resilience.

## Chapter Conclusion

Flood risk in Semarang City is not only a natural disaster, but it also impacts the inefficiencies of the urban metabolism and the measures of prevention and risk management. Flood occurrences have destroyed the coastal space. The communities are very vulnerable, in particular in the Semarang coastal area where the *rob* phenomenon occurs frequently.

According to Jha *et al* (2013), the tools for building urban resilience include risk assessment; risk-based land use planning; urban ecosystem management; urban upgrading; community and stakeholder participation; disaster management systems; data gathering, analysis, and application; and risk financing and transfer approaches.<sup>91</sup> In the context of Semarang City, the urban stakeholders have at least implemented these tools. The municipality has sought to carry out a risk assessment, including the identification of the hazard, exposure, and vulnerability to urban flooding. Nevertheless, the risk assessment has not been supported by the accuracy of hazard identification. The municipality has established several maps of flood hazard, which lack data accuracy and times series, so, consequently, they do not have detailed basic information on the flood (including *rob*) risk existence in the city. Several researchers involved (geologists, geodesists, marine and coastal scientists) have sought to identify the existence of flood risk in Semarang City. Nonetheless, these identifications are not exactly the same as the flood identification established by the municipality, and they have not become the reference data for the urban hydrological projects. These situations are related to the lack of data gathering and analysis. The municipality has not implemented a detailed methodology to provide accurate data on flood risk. For instance, the data gathering has not been followed by a proper sampling of the communities' interviews. The inhabitants certainly understand the situations of flood risk in their territories (at the local level). Proper interviews of the communities will increase the accuracy of flood risk data. Furthermore, the data gathering of times series have not been implemented by the municipality, so the monitoring and evaluation of flood risk have been incidental. Certainly, this will influence the lack of flood risk analyses. Likewise, the municipality has not used complex applications (technologies) to design basic data of flood risk in Semarang City. Despite the fact that the Geographic Information System has been developed for the spatial planning project and the master plan of the urban drainage project, it has not been developed to produce accurate data of flood risk. In addition, the municipality has not launched a particular project for flood risk assessment. So far, it has provided flood

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<sup>91</sup> Jha, A.K., Miner, T.W., Stanton-Geddes, Z., 2013, *Building Urban Resilience: Principles, Tools, and Practice*, Washington, DC: World Bank.

risk data, which has been only the element used in the spatial planning projects or the master plan of urban drainage. The deviations of urban flood data certainly influence the problems of accuracy of urban flood exposure and vulnerability. Likewise, the effectiveness of the urban hydrological projects recently carried out by the municipality is questioned. Moreover, the information of flood risk existence provided is not conveyed to the communities. The interviews with the communities of Semarang coastal area indicate that most inhabitants do not know the flood risk data provided by the municipality.<sup>92</sup> The communities tend to understand the flood risk in their territories through their own experience of flood occurrences.

In other side, the flood risk assessment as effort of resilience process development is less taken account in the land use planning. So far, the recent and previous spatial plans of Semarang City, even the master plan of urban drainage, have not been integrated into the urban hydrological projects. Although the recent spatial plan includes the evacuation plans of flood occurrences, it does not comprise the adaptive land use planning with respect to the existence of flood risk. Moreover, these evacuation plans are not articulated with the evacuation plans established by the Regional Disaster Management Agency of Semarang City. Furthermore, the development plans of urban flood risk reduction, which were designed in the master plan of urban drainage, are not indicated in the recent land use planning. The comprehensive urban hydrological projects and plans are not integrated into the recent spatial planning. The same holds true for the Banger Polder. Likewise, the recent land use plans do not implement the detailed regulations and the incentives mechanisms aiming at prompting the communities and private actors to support the efforts of urban flood risk reduction. Private actors and communities have thus unclear roles to play in the urban flood resilience process. The recent spatial plan is very oriented towards the economic development in the coastal areas, but there is a lack of taking into account of flood risk growth and predictions. The high concentration of population and urban economic assets will be followed by an increase of urban flood vulnerabilities if the municipality does not change the recent spatial plans. It seems that the existing flood risk is less taken into account for the spatial planning project.

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<sup>92</sup> The interviews of communities were carried out in the areas of case studies including Real Estate of Tanah Mas (Semarang Utara District), *kampung* of Cilosari (Semarang Timur District), and *kampung* of Tambaklorok (Semarang Utara District). Furthermore, we interviewed several inhabitants of other coastal districts including Semarang Barat District, Genuk District and Gayamsari District. These interviews were carried out in 2012-2013.

Yet, the lack of urban flood resilience process in Semarang City is related to the lack of urban ecosystem management. For instance, the projects of land reclamation in Semarang coastal area substantially affect the process of abrasion in the surrounding areas, thus disturbing also the livelihood of the coastal communities, in particular the fishery activities. In addition, the practices of the communities and private actors consisting in providing the fishpond areas through the deforestation of mangrove reveal a lack of urban ecosystem conservation. There is a lack of monitoring and evaluation by the municipality about the changes of coastal land use. Moreover, the greenbelts of most of the rivers and urban drainages are occupied by the squatter communities. Therefore, the urban ecosystem management is subject to constraints relating to plans and implementation. It certainly leads to the high cost of urban infrastructure investments while the municipality has a limited budget for flood risk reduction projects.

The urban flood resilience process is also influenced by the practice of urban upgrading, which only focuses on avoiding the flood risk, but not on reducing urban flood vulnerabilities. These situations tend to characterize the sustainable urban projects, not the sustainable urban development. The projects of urban upgrading, including roads and houses elevation and sanitation improvement, are only regular and continued projects of urban institutions. However, recently, the communities depend much on these projects so that the municipality seeks to provide (to finance) these projects every year. So far, municipality focuses on the improvements of the poor coastal settlements (communities). This reveals the awareness of urban institutions concerning the poor communities who are very vulnerable to the *rob* risk. Furthermore, urban upgrading is supported by the role of the private (industrial) actors in Semarang coastal area, such as the efforts made with respect to road elevations. Nevertheless, these efforts have not been integrated yet into the urban upgrading carried out by the municipality. Often, the private actors implement urban upgrading without coordinating with the municipality, because this corresponds to corporate social responsibilities. This turns into constraints that are imposed on the comprehensive projects of the urban upgrading in Semarang coastal area. The disintegration of urban upgrading by the municipality and the private actors slows down the process of urban flood resilience in Semarang City. However, the urban upgrading in Semarang coastal area deeply influences the urban and community adaptation process to the flood risk.

The other tool for urban resilience development lies in the urban disaster management systems. So far, the municipality has delegated its technical responsibilities of urban flood management, including the efforts of mitigation, crisis occurrences, and post-crisis into the



Regional Disaster Management Agency. This institution has the responsibility to coordinate the roles of urban institutions with respect to urban flood management. For instance, this agency coordinates with the Water Resources Management Agency to develop the early warning system of urban flood risk. Furthermore, it fulfills a task of socialization of flood prevention efforts in order to reduce urban and communities' vulnerability to flood risk. Meanwhile, the plans and policies of urban flood management are delegated to the Regional Development Planning Agency, the coordinator of urban projects and plans. Institutionally, the existence of these urban institutions is needed to develop urban flood resilience, but implementing problems still often occur. The limited human resources and tools held by the Regional Disaster Management Agency and the widely flood impacted areas lead to a lack of implementation of the technical urban flood management. For instance, the coastal communities stated that the municipality is often late to help the communities during the flood occurrences.<sup>93</sup> Meanwhile, the Regional Development Planning Agency seeks to develop urban flood policies and plans. The existence of the urban drainage master plan and the related urban policies and plans of flood risk reduction, such as the policy on the limitation of ground water exploitation and the policy of land reclamation development shed light on the development of urban flood management through the institutional system. Furthermore, the act of management of coastal territory and small islands has become the form of national policy influencing the reinforcement of urban policies. Likewise, the flood management tools involve hydrological concepts and projects that are being recently developed. Flood management concepts and projects have moved from partial approaches to comprehensive approaches since the 2000s. However, the flood management concepts of the Dutch government era are still adopted and improved, such as the rehabilitation of the urban floodways. The hydrological concepts and projects related to the arrangement of water cycle between the upstream and downstream areas, including the development of the packet of Jatibarang Dam projects and the Banger Polder Project, follow comprehensive technical approaches. These projects also influence the transformation of urban spaces beyond the roles of private actors affecting the transformations of land use which adapt also to the existence of flood risk such as the development of land reclamations, especially in Semarang coastal area. The adaptations are considered as responses to risks associated with the interaction of

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<sup>93</sup> The interviews of communities were carried out in the areas of case studies including Real Estate of Tanah Mas (Semarang Utara District), *kampung* of Cilosari (Semarang Timur District), and *kampung* of Tambaklorok (Semarang Utara District). Furthermore, we interviewed several inhabitants of other coastal districts including Semarang Barat District, Genuk District and Gayamsari District. These interviews were carried out in 2012-2013.

environmental hazards and human vulnerability or adaptive capacity.<sup>94</sup> The space transformations for flood risk adaptation in Semarang coastal area are spatial forms producing the urban flood resilience process.

The effectiveness of urban flood management is related to the participation of the community and the stakeholders. The role of external stakeholders, such as international governments and NGOs, substantially support the development of risk communication and perception for the urban institutions and the communities. The risk communication for the urban institutions is related to the collaboration on flood risk management between the local institutions (municipality) and the national government, such as, for instance, the collaboration on hydrological projects. In other side, the urban institutions experience the increase of flood risk understanding because of the roles of external stakeholders. The adoption of the ACCCRN Program by Mercy Corps improves the institutional capacity with respect to urban resilience, including the flood adaptation process. Mercy Corps shared with the urban institutions the knowledge of urban resilience in both contexts of concepts and practices, although, in reality, the effectiveness of the implementation of the project remains to be proved, since the program is still ongoing and its sustainability is still questioned. Meanwhile, the communication with the communities and their perception of risk relates to the implementation of the ACCCRN project in several areas of Semarang City, such as the Flood Forecasting and Warning System. This project seeks to improve the community awareness of flood risk. However, the replications of ACCCRN project for other communities depend much on the capacities of urban institutions, and this situation still becomes a question.

Furthermore, the collaboration between the institutions, the municipality, the national government, and external stakeholders such as international governments and NGOs, sheds light on a recent process of comprehensive project management for the flood risk. External stakeholders play important roles to support the flood risk management, in particular technical approaches on flood risk reduction and adaptation, and also a role of funding support. International governments, such as Japan, Netherlands, and Australia, have helped the municipality to improve the understanding of the technical approaches on flood risk reduction. The international NGO Mercy Corps has tried to transfer the knowledge of community adaptation and the local institutional improvements for the development of flood resilience process. The efforts of external stakeholders are complementary to support the

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<sup>94</sup> Smit, B., Wandel, J., 2006, "Adaptation, adaptive capacity and vulnerability", *Global Environmental Change*, vol. 16, Issue 3, pp. 282-292.

flood resilience process of Semarang City, and these actions have existed since the 2000s. The limited initiatives for a comprehensive hydrological management taken in the past period by the urban stakeholders (institutions of the municipality) influencing the high vulnerability of the city to flood risk can be minimized by the roles played by the external stakeholders.

Nevertheless, there is a lack of involvement of the communities in the plans and projects of urban flood reduction. So far, the involvement of the communities has been defined by the initiatives of urban institutions and external stakeholders. The communities were only involved in the urban hydrological projects which have been planned by the urban institutions and the external stakeholders. The communities' initiatives have not become yet important elements within the context of urban flood risk reduction. The communities have pursued their own actions without the interventions of urban institutions. These situations describe a lack of a community-driven program into the comprehensive urban flood management, and, consequently, there is a disintegration of the efforts of flood risk reduction between the urban institutions and the municipality. These situations have a detrimental impact on the urban flood resilience process of Semarang City.

In addition, the process of urban flood resilience also depends on financial capacities. The municipality has recently drafted an estimation of the costs induced by the urban drainage development and the hydrological projects on the basis of the urban drainage master plan. It requires a very high budget. The annual budget of the municipality could not fund these projects. However, the financial support of the national government is limited since it is involved in other priority programs on flood risk reduction at the national level. Likewise, the grants and loans provided by the external stakeholders, such as international governments and NGOs, are also unpredictable. The limited financial resources available are another barrier in the urban flood resilience process.

## Conclusion of Part I

This part demonstrates the water spaces and cycle is the important element in the urban growth and also otherwise it becomes the urban element threatening the urban development and activities. The exploration historically of the flood existence and its growth leads to understand the lack of urban development process causing the flood risk becomes the evitable risk throughout the urban history. The different era from Dutch government to recent government indicates the different conditions of flood risk existence and its risk management. However, the urban planning and strategies for flood reduction very influences the growth of flood risk in the city. However, Semarang City is a case indicating the existence of the process of urban and communities' adaptations influencing the flood resilience process. In fact, this city had many constraints to develop the urban flood resilience due to the diversity of risk management relating the lack of urban plans and projects in several government periods. Furthermore, the roles of private sectors in recent, one side, those can support the process of urban flood resilience in local scales (territories) and otherwise, those influence also the growth of flood risk in urban scales. The process of urban flood adaptation only occurs in several parts of urban spaces, not the whole of city.

The lack of flood resilience process in the urban scale produces the different situations of communities' adaptations. It implicates the community resilience can be questioned. However, at least, it seems the process of community resistance in the past time has been changed into the community resilience in recent. In this case, the community is an integrated element for the development of urban flood resilience process. How the community (local) resilience is formed, despite the lack of urban resilience take place. However, at least the existence of the community resilience will implicate the urban resilience besides the comprehensive approaches remaining to be the responsibilities of urban stakeholders. The urban resilience assessment is not only the analyses of urban infrastructures and the institutional system, but also those of community resilience being explained as the integrity of urban resilience.

Those situations invite to understand the community resilience process. How the local practices by the communities to adapt and to manage the flood risk in their territories. Furthermore, how the local actions are integrated into the urban projects and strategies to develop the urban resilience. Those will be answered through the understanding of community resilience in the next part of our research.



*“Cultural constraints determine the challenges and the limitations of hybridization; those lead to the potential of the inhabitants’ creativities.”<sup>1</sup>*

## **PART II**

# **LOCAL RESILIENCE PROCESS: COMMUNITY ADAPTIVE CAPACITIES FROM COGNITION TO IMPLEMENTATION**

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<sup>1</sup> Lancret, N. 2005. “Contacts de structures spatiales lors de la formation d’une rue marchande à Denpasar (Bali)” in *le métissage interculturel créativité dans les relations*, in : Villanova, R., Vermes, G. (eds), *Le métissage interculturel. Créativité dans les relations inégalitaires*, L’Harmattan, coll. « Espaces interculturels », Paris, pp. 147-176.

## INTRODUCTION

In the first part, we have discussed about the existence of hydrological risks in Semarang City and the efforts, from the Dutch government era to the current government's era, of urban institutions to cope with hydrological risks. Although they have sought to reduce hydrological risks, these ones are still threatening the city, especially in coastal area. However, the growth of urban activities is still taking place, and most communities continue to settle in Semarang coastal area. Meanwhile, their life is still threatened and they remain highly vulnerable.

In this part, we will explore the adaptive capacities of coastal communities. We will study how the communities take initiatives and step up their efforts, both individually and collectively to reduce hydrological risks in their settlements (neighbourhoods). These communities' efforts are implemented according to their perceptions of hydrological risk existence which are correlated to their cultures. These situations result in creativity and initiatives of communities in order to adapt to the hydrological risk existence. We suppose these creativities influence local practices and spatial transformations as the adaptive forms which are the elements of resilience process.

To explain the resilience process at local scales (communities), firstly the hydrological risk evolution in local territories must be understood. This understanding will explain how the hydrological risks affect the community life. Secondly, we will clarify why the communities are still settling in areas which are still impacted by hydrological risk and what are the communities' efforts in order to keep up their settling in these territories. We supposed these situations are related to the cultures of communities. Thirdly, we will explain the efforts of urban institutions and external stakeholders to support the community adaptive capacities and we will analyse to what extent the urban risk management influence the local resilience process.

These understandings will be described through several cases of coastal communities. These cases present complementary aspects. The similarities and differences among these cases will clarify the comprehensive understanding of resilience process occurring in coastal communities of Semarang City. The diversity of communities' adaptive capacities will also explain the typologies of local resilience process. We suppose that the diversity of communities' cultures and socio-economic conditions influence also the diversity of local resilience process towards hydrological risks in Semarang City.

To achieve the objectives of the case studies, the inductive approach is supported by the collection of data through field observations and interactions with inhabitants (such as interviews and questionnaires). This approach is used to explore the rational backgrounds of communities when they manage their territory through community self-help organization. Their explanations cannot be described with a deductive approach. The data retrieval was carried out between 2011 and 2013 and it was implemented complementary and triangularly.

The first phase of data collection involved interviews with related stakeholders, such as Regional Development Planning Agency, Department of Water Resources, Department of Urban Planning and Settlement, Office of Semarang Utara District, and several offices of sub-districts in the Semarang Utara District through the snowball method. The main focus was on the community self-help efforts and their adaptive capacities to the hydrological risks. The interview results led to study the Tanah Mas community and its local association of *Paguyuban Pengendali dan Penanganan Air Pasang Panggung Lor / P5L* (Association of Controlling and Handling of *Rob* Risk in Panggung Lor Sub-district). Meanwhile other case focuses on the understanding of the adaptive capacities of *kampung* communities. The interview results led to *kampung* which are located around Banger Polder Project. This project will clarify the interactions between *kampung* communities and urban institutions in hydrological risk management at local scales. Cilosari and Tambak Lorok areas are determined as the case study of *kampung* because the community characteristics (cultures and socio-economics) represent communities of coastal *kampung* in Semarang City.

The second phase examined community efforts to manage their territory in the face of hydrological risk through interviews and questionnaires. Some of the questions asked to the community related to their social activities such as profession, age and original place, their reasons for staying in the settlement, their understanding and involvement in the collective efforts, their individual efforts to reduce risk and also the histories and perceptions of their settlement and the flood risk growth. These primary data focused on the heads of community (*RTs* and *RWs*) because they are the most able to understand the phenomena in their territory. Usually, heads of community are chosen by the inhabitants because they have resided in the settlement the longest and also they are classified as the key persons in the area (*RTs* or *RWs*). Due to the community's large size, a random sampling was used to collect data from the heads of community. The questionnaires were evenly distributed based on the administrative division inside the settlement (*RTs* and *RWs*). When constraints of questioners' distribution due to the limited time of several community heads (bustle of work) emerged, we solved

these problems by asking other community heads who were more available, although it took several weeks to collect data.

Initially, we planned to organize a forum discussion group with the community to deepen the understanding of questionnaires. But this plan was not realized due to the unavailability of community heads of *RTs* and *RWs*, and budget issues. However, the data exploration evolved after community meetings which were often attended by several heads of community and inhabitants, and also in-depth interviews with several heads of community. A purposive sampling was used during the data collection process. During the data collection, in particular the in-depth interviews, community members easily communicated their ideas and their visions. They were friendly and open-minded, so it facilitated the brainstorming.

Furthermore, limitations of historical evidences such as manuscripts and photos relating to the growth of the settlement and flood risk become constraints for data analysis. Most of the key persons understand these issues and have the limited documents related to our research. Although they are an open-minded community, a detailed exploration of housing condition was not possible due to the respect of inhabitants' privacy. Therefore, the lack of data will be covered by data reconstruction from the interviews and questionnaires filled by the inhabitants. Furthermore, several analyses will be supported by secondary data and information, such as city manuscripts and media (local newspapers, etc.). It will be useful to comprehensively examine the socioeconomic activities relating to the flood risk impact and the structural adaptations created by the community (housing and environment). Related primary data and information can be completed with secondary data.

Likewise, interviews with other communities and other local institutions (sub-districts) also become our data sources through the purposive sampling. They help develop comprehensive analyses on flood risk management in the areas of case studies and its influence on the surrounding areas. Additionally, field observations were carried out to understand the geographic situation and forms relating to flood vulnerability along with the spatial organization created by the community to reduce flood risk in their territories. Observations were based on the exploration of interviews and questionnaires collected during the data collection period.



**Table 6. Respondents from the case study of Tanah Mas Community**

<b>Characteristics</b>	<b>Total</b>
Population in case study (number of inhabitants)	± 14.000
Households that are members of P5L association	4320
Vulnerable and poor inhabitants <sup>2</sup>	180 (± 1% of population)
RWs communities that are members of P5L association	15
In-depth interviews	7
Interviews and Questionnaires	27
<u>Length of residence</u>	
> 30 years	15
20-30 years	8
10-20 years	4
<10 years	-
<u>Age</u>	
< 30 years	-
30-50 years	10
> 50 years	17
<u>Profession</u>	
Entrepreneur	10
Worker in private company	8
Academic (Teacher, Lecturer)	1
Public servant and staff of Indonesian state-owned enterprises	4
Pensioner	4
<u>Household income per month</u>	
< 2.000.000 IDR (≈ < 125 €)	-
2.000.000 IDR –5.000.000 IDR (≈125 – 312,5 €)	15
5.000.000 IDR –10.000.000 IDR (≈ 312,5 – 625 €)	10
> 10.000.000 IDR ( > 625 €)	2
Annotate : regional minimum wage in Semarang City in 2015 is 1685000 IDR (≈ 105,3 €), against 1423500 IDR (≈ 88,9 €) in 2014	
<u>Education</u>	
University	20
Senior high school	7
Junior high & elementary school	-
No formal education	-
<u>Origin of respondents</u>	
Semarang City	11
Other Cities and Regencies in Central Java Province	12
Other Cities and Regencies in Java Island	3
Other Islands (Sumatera, Sulawesi, Kalimantan, etc.)	1
<u>House type</u>	
Type A (land large of 420 m <sup>2</sup> )	4
Type B (land large of 240 m <sup>2</sup> )	8
Type C (land large of 100 m <sup>2</sup> )	7
Type CM (land large of 120 m <sup>2</sup> )	8

Source: Questionnaires and Interviews in 2011-2013

<sup>2</sup> Based on statistical data of management information system on the poor inhabitants in Semarang City released by the municipality in 2015

**Table 7. Respondents from the case study of Cilosari and Tambak Lorok Communities**

Characteristics	Total	
	Cilosari	Tambak Lorok
Population in case study (number of inhabitants)	± 4.000	± 13.000
Poor inhabitants <sup>3</sup>	40-60 %	
RWs communities	4	5
In-depth interviews	7	5
Interviews and Questioners	30	23
<u>Length of residence</u>		
> 30 years	24	16
20-30 years	6	6
10-20 years		1
<10 years		
<u>Age</u>		
< 30 years		
30-50 years	21	14
> 50 years	9	9
<u>Profession</u>		
Industrial labour	6	5
Driver (bus, pedicab, motorcycle taxi, share taxi)	1	
Underemployed worker	13	5
Public servant, staff of Indonesian state owned enterprises	3	3
Small/medium entrepreneur/trader	5	
Pensioner	2	
Fisherman		10
<u>average monthly salary of household</u>		
< 800.000 IDR (≈ < 50 €)	8	5
800.000 IDR- 2.000.000 IDR (≈ 50 € - 125 €)	20	15
> 2.000.000 IDR (≈ >125 €)	2	3
Annotate : regional minimum wage in Semarang City in 2015 is 1685000 IDR (≈ 105,3 €), while that in 2014 is 1423500 IDR (≈ 88,9 €)		
<u>Education</u>		
University	3	
Senior high school	20	10
Junior high & elementary school	7	8
No formal education		5
<u>Origin of respondents</u>		
Semarang City	7	5
Other Cities and Regencies in Central Java Province	20	10
Other Cities and Regencies in Java Island	3	4
Other Islands (Sumatera, Sulawesi, Kalimantan, etc.)		4

Source: Questioners and Interviews in 2011-2013

<sup>3</sup> Result from the interviews with heads of communities in 2013 and it is strengthened by the statistical data of management information system of the poor inhabitants in Semarang City released by the municipality in 2015.

« *Habiter les zones inondables suppose de connaître le risque et d'adapter ses comportements en conséquence* »<sup>296</sup>

(Living in flood areas requires to know the risk and consequently, to adapt behaviours)

## Chapter 3

### Role of community association to develop the local resilience

This chapter aims to present community capacities to reduce the hydrological risk in their settlement. Due to the lack of urban hydrological projects, communities seek to protect their settlement from hydrological risks through self-help efforts. Local initiatives influence structural efforts implemented by communities such as the development of pump system in their territory. The risk existence stimulates self-help efforts and adaptive behaviours in the communities. Each disaster risk type certainly produces different adaptive behaviours. Communities adapt differently to flood risk, to volcano risk or to nuclear risk. So, the understanding of community behaviours and related risk plays an important element in the exploration of urban resilience process.

The Tanah Mas Real Estate (residential area) is settled by socio-economically diverse community. Its members include entrepreneurs, workers at private companies, academics, public servants and staffs of Indonesian state-owned enterprises, and also pensioners. As a result, they are mostly middle class and upper middle class. The economic situation differs from *kampung* in the Semarang coastal area with predominantly poor communities. Moreover, this community is also dominated by Javanese and Chinese inhabitants. These community structures influence their behaviours towards hydrological risk in their settlement. Despite the diverse community, they develop a self-help association to reduce hydrological risk in their territory. Since they share the same fate, they have carried out collective efforts for more than a decade: funding, initiatives, and also structural measures. However, this case describes a process of local resilience built by community initiatives but also by local change agents.

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<sup>296</sup> Reghezza-Zitt, Magali, 2013, "Paris inondé: des risques négociés" in: Aubry, H., Marcondes, L., *La culture du risque en question, des inondations aux débordements nucléaires*", Paris: La Dispute/ Snédit.

The analysis of hydrological risks in this territory will first help determine local and community vulnerabilities, and also the related space transformations. Secondly, the community perceptions and cognitive aspects will be assessed to understand what influences community adaptive capacities. Thirdly, we will explore the forms of community adaptive capacities to reduce hydrological risk. Furthermore, we will analyse the impacts of urban plans and hydrological projects on this territory and also the forms of cooperation between community and urban institutions. Did these efforts influence the community resilience process? What are the positive and negatives influences? Does the lack of collaboration hinder the transition into urban flood resilience process? These questions will conduct the explanation of the local resilience process in the Tanah Mas Real Estate.

### **3.1 Territorial development and hydrological risk influence social transformations**

Hydrological risks and land use transformations affect each other in Semarang coastal area. These phenomena will be explored in the case of Tanah Mas Real Estate. Furthermore, it will describe the hydrological risk influences the population dynamic and vulnerability. On the one hand, the population growth increases urban vulnerability, but on the other, it encourages the resilience process.

#### **3.1.1 Land use transformation: swamp and agriculture areas to “Golden Land”**

Tanah Mas is the first planned settlement in Semarang City after the end of Dutch colonial era. The municipality gave a building permit to the Tanah Mas Company (PT. Tanah Mas) to develop a residential area in the Semarang coastal area in 1975. The interviews with the representatives of the Tanah Mas Company and the Tanah Mas community reveal that this company, which was developed by Mr. Djamin Ceha, was the first real estate developer in Semarang City. This pioneer company sold houses on credit (periods between 5 and 20 years) all over Indonesia.<sup>297</sup> The Tanah Mas Real Estate was built in 1976 and it has been inhabited since 1977.

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<sup>297</sup> Setyautama, S., 2008, *Tokoh-tokoh Etnis Tionghoa di Indonesia*, Jakarta: Kepustakaan Populer Gramedia.





**Figure 85. Geographical site of the Tanah Mas Real Estate**

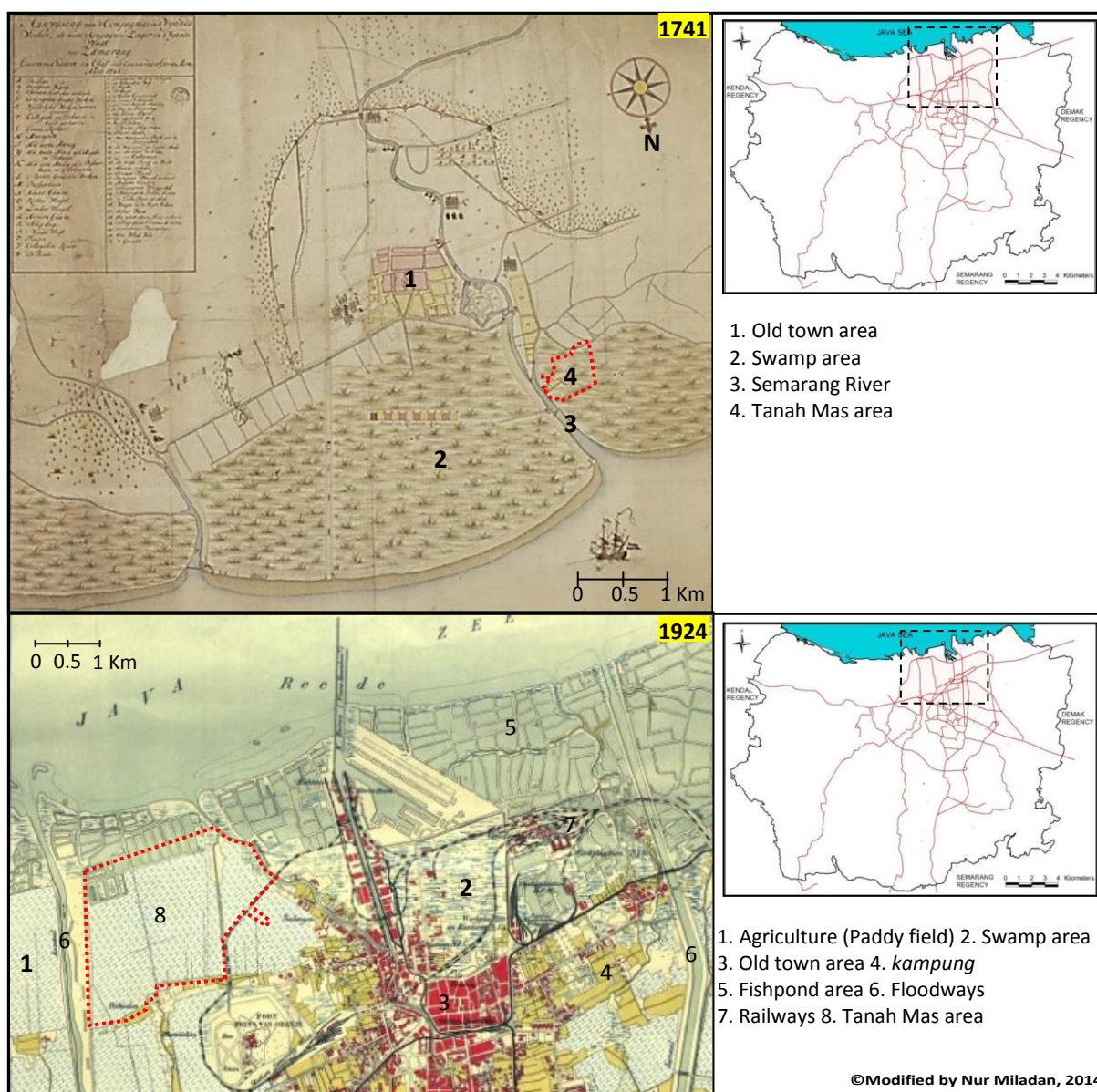
Source: Ikonos Satellite Image of Semarang in 2008.

This settlement is located between West Flood Way, Bulu Drain, Asin River and Semarang River. It is situated approximately 500 meters away from the sea, thus in the coastal district vulnerable to hydrological risk. It includes three sub-districts: Panggung Lor, Panggung Kidul and Kuningan which are parts of the Semarang Utara District. It has an area of 162 Ha. Currently, the settlement population is approximately 17.000 inhabitants.

The research focuses on Panggung Lor: it is the only sub-district with a community self-help association to reduce hydrological risk. Furthermore, most of the Tanah Mas Real Estate area is located in this sub-district (14 RW communities). However, one RW of Panggung Kidul Sub-district is involved in the association management. The land use



transformations of that area can be traced through historical maps. In the Dutch colonial era, it was covered by dry land, swamps, and fishponds.



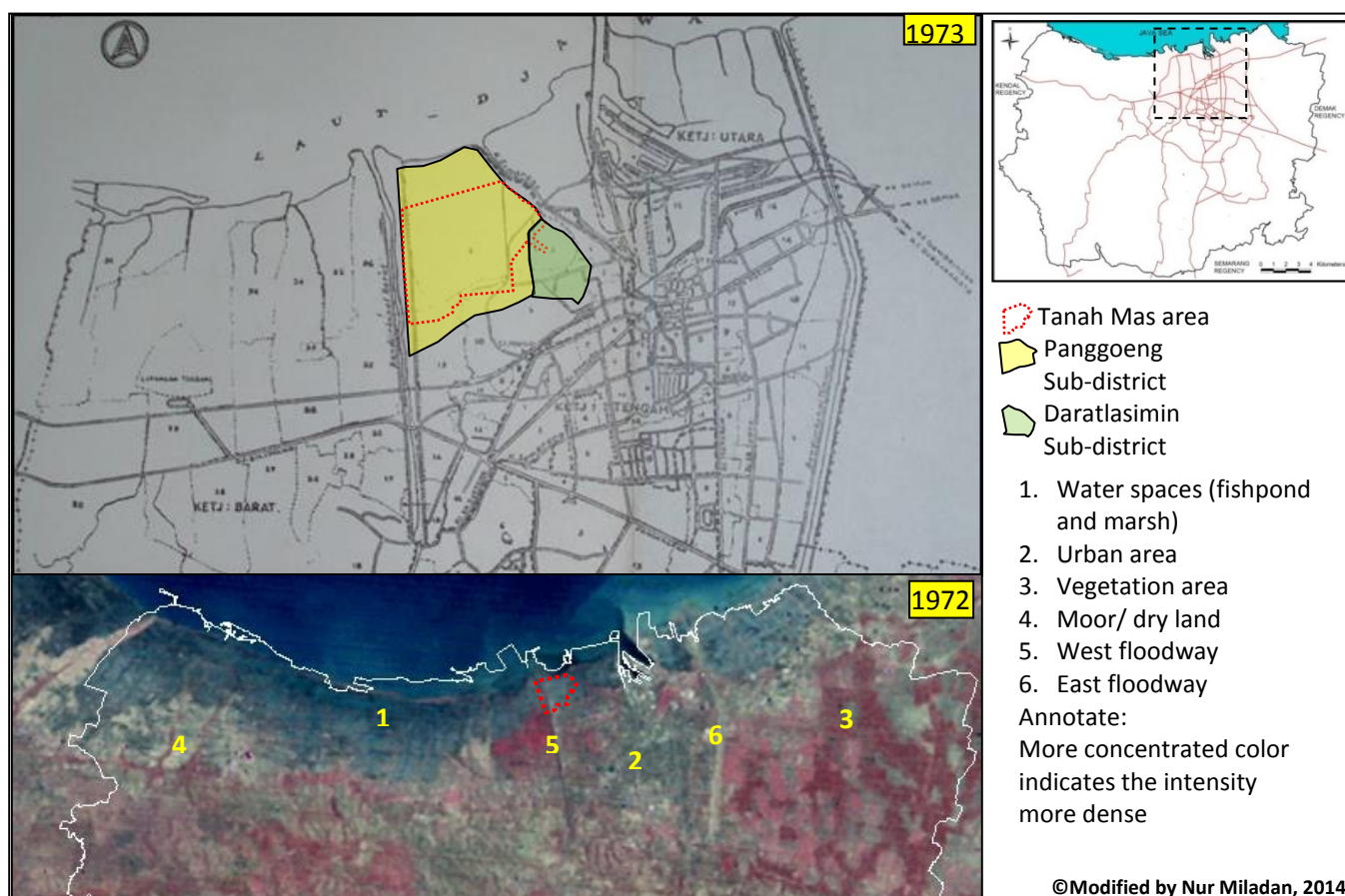
**Figure 86. Land use in the Tanah Mas area in 1741 and 1924<sup>298</sup>**

Source: Kaart van Samarang en omstreken, Benevens aanwysing van's Comp.s Leger en's vyands vlugt. Gecommandeert en chef door commandant Gerrit Non. Anno 1741[Map], Retrieved December 25<sup>th</sup>, 2015, from [http://www.gahetna.nl.](http://www.gahetna.nl;); N.V. Technisch-Reproductiebureau en Lichtdrukkerij Holland-Indie – ,s-Gravenhage, Semarang [Map], 1924, KITLV, Leiden.

*According to the maps of Semarang in 1741 and in 1924, there was no significant change of land use during this period. This area was only water and green spaces. Furthermore, the Dutch government did not include this territory in the urban development plans. However, the green area in the east was transformed into a built-up area (the port area).*

<sup>298</sup> The north position in Dutch old maps indicates the south in the reality. The Dutch designed these maps from the perspective of a boat at sea in the 18<sup>th</sup> century.

The development of West Floodway called for land use transformations in the west of the Tanah Mas area between 1901 and 1904. The Semarang River and the West Floodway increased sedimentation process, so the territory could be used as an agricultural area by the inhabitants. The Tanah Mas area was originally part of the Babadan Village. “Babadan” means a clearing or cut down.<sup>299</sup> The name refers to the change of land use, i.e. from the swamp to an agricultural area. However, it became Panggoeng Village during the Dutch colonial period. “Panggoeng” means the stage or the tower. At that period, the Dutch military built a tower to watch the city from this village, so that the inhabitants renamed it the Panggoeng village. Just after independence, a new administrative division was set up in Semarang City. The Tanah Mas area became part of the Semarang Barat District and it consists of the Panggung (Panggoeng) Village and Ralin (Daratlasimin) Village.<sup>300</sup> The Tanah Mas area remained dominated by swamps and rice fields until 1975.



**Figure 87. Land use (1972) and administrative division (1973) in Semarang City**

Source: Landsat satellite image in 1972<sup>301</sup>; “Kotamadya Semarang (Semarang City)” [Map], *Statistical Year Book of Semarang City in 1973, 1973*, Semarang: Central Bureau of Statistics of Semarang City. On the satellite map of 1972, the Tanah Mas area in Panggoeng Sub-district and Daratlasimin Sub-district consisted of water spaces.

<sup>299</sup> Zoetmulder, P.J., Robson, S.O., Koninklijk Instituut voor Taal-, Land- en Volkenkunde, “Babadan”, *Old Javanese-English Dictionary* [Web], retrieved December 28<sup>th</sup>, 2015, from <http://sealang.net/ojed/>

<sup>300</sup> According to interviews with several local inhabitants and the historical map of Semarang City in 1973.

<sup>301</sup> Landsat 1 satellite image has a low resolution: 80 meter-ground.

In 1976, the Tanah Mas Company developed the Tanah Mas Real Estate through land reclamation. From swamps, rice fields and dry lands, it became a built-up area. Community heads and representatives of the Tanah Mas Company stated in their interviews that the soil for filling up came from the Tugu District.

Tanah Mas derives from the words “Tanah” and “Mas”. “Tanah” means land and “Mas” means gold, so Tanah Mas means “golden land”. After the transformation from swamp and agricultural area to residential area, the land value increased. The developer expected it to become the most prestigious settlement in Semarang City. According to Heriyanto, senior member of the Tanah Mas Company who has lived in Tanah Mas Real Estate since 1977, the Tanah Mas Real Estate was beautiful and very comfortable settlement in the 1980s.

“[...] at that time, it was a beautiful and nice settlement in Central Java (Province), and also secure at the beginning of the Tanah Mas development...thieves were afraid here, we had 120 employees. Every day there was 40 for the morning shift, 40 for the night shift while 40 had a day off. Before the development of the Tanah Mas Real Estate, it was a black zone, but afterwards it became a prestigious settlement. Many government officials such as the head of special commands for capital city districts and cities together with government officials of Semarang City and the Central Java Province were living here... recent developers study us because our settlement was the first residential area in the capital of the Central Java Province [...]”

Meanwhile, A. Bakar, head of community who has lived in the settlement since 1978, explained that the Tanah Mas Real Estate was very comfortable to stay and offered an organized settlement which could be bought on credit in the 1980s.

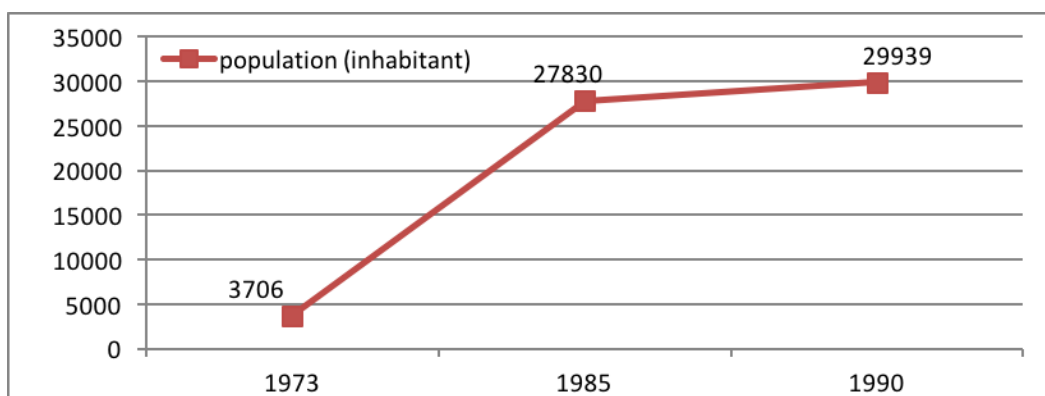
“[...] the possibility to buy the house in Tanah Mas, we could buy on credit and the environment was organized, this is why we bought and stayed in this settlement. Many ethnic groups, such as the Chinese, the Javanese, etc. live here [...]”

At that period, the first planned settlement was located near the city centre. Geographically, the settlement had a strategic location: close to urban facilities such as modern and traditional markets, transportation facilities (port, station and airport) and central business districts. The settlement became the favorite residential area of Semarang City. The role of Semarang City as capital of the Central Java Province also increases the land price in the Semarang urban area including the Tanah Mas Real Estate. Furthermore, the municipality



supported the development of Tanah Mas Real Estate because it became the housing supply program designed to accelerate the Semarang urbanization. More importantly, *Bank Tabungan Negara* (BTN)<sup>302</sup> offered loans to buy houses in the Tanah Mas Real Estate and encouraged the settlement development.

During the development of the Tanah Mas Real Estate, the inhabitants called the territory “Panggung Baru (New-Panggung) area” which means that part of Panggung Sub-district was occupied by a new community whose members came mainly from other areas of Semarang City and Central Java Province. According to the Government Regulation no. 50/1992<sup>303</sup> and the interview with the head of Panggung Lor Sub-district in 2011, the Panggung Sub-district was divided into two sub-districts in 1993. The north part (Panggung Baru) became the Panggung Lor Sub-district while the south became the Panggung Kidul Sub-district. The majority of the Panggung Lor Sub-district is dominated by the Tanah Mas Real Estate, while the Panggung Kidul Sub-district is dominated by settlements (*kampung*) of indigenous inhabitants. The evolution of the Tanah Mas Real Estate exemplifies the urban migration process: many people came to live in Semarang City, thus significantly increasing the Semarang population in the 1980s.



**Figure 88. Population in the Panggung Sub-district between 1973 and 1990**

Source: Statistical Year Book of Semarang City in 1973; Population of Semarang City in mid- Year 1985; Semarang in Figures 1990, Semarang: Central Bureau of Statistics of Semarang City.

According to the figure above, the Panggung Sub-district population rapidly grew in the 1980s. This situation is linked to the emergence of the Tanah Mas Real Estate in this sub-district in the mid-1970s along with urbanization and industrialization on the Semarang coast in the 1980s. The population growth also indicates land use transformations that became important pull factors of migration to the Panggung Sub-district and the Semarang coast in general.

<sup>302</sup> It is one of the national banks in Indonesia.

<sup>303</sup> Formation of the districts in regencies of Purbalingga, Cilacap, Wonogiri, Jepara, and Kendal, and also the arrangement of districts in Semarang City under the Central Java Province, Government Regulation n° 50/1992, Jakarta: Ministry of State Secretary.

The Tanah Mas Real Estate dominated the Panggung Lor Sub-district area. The population density of this sub-district was about twenty inhabitants per hectare only in 1973.<sup>304</sup> According to its inhabitants, just a few houses had been built in the early 1970s. But when the settlement was developed, population massively increased, especially in the 1980s. In 1985, it was about 27.830 people and during twelve years (1973-1985), population experienced a 7.5-fold increase. Consequently, the population density increased about 148 inhabitants per hectare. This situation lasted until the end of the 1980s. On the one hand, it illustrates the urbanization process on the Semarang coast, but on the other, it describes the exploitation of coastal spaces for built-up areas, thus fostering the emergence of hydrological risk.

### 3.1.2 Settlement development versus hydrological risk

Since the emergence of the Tanah Mas Real Estate in 1976, the land use changed significantly. The housing developer built this settlement gradually: the last of the fourteen development steps happened in 2006.<sup>305</sup> However, interviews with community heads indicate that this settlement is generally developed in four steps. The first stage occurred in the central-eastern parts and the second in the central-western parts. Then, the north was developed and the final development was in the east.

The massive development took place between the mid-1970s and the mid-1980s when 5000 houses were built. Firstly, the soil of the swamps, fishponds and paddy field areas was filled up about 50 centimetres high. Then, it was situated around one meter above the water level of the Semarang River. During the high tide period, the sea water flowed naturally in the urban drainages only, so there was no hydrological risk yet. According to the community heads and representatives of the Tanah Mas Company, the settlement was a restful and comfortable settlement and 90 % of the buildings were sold out at that period. During the settlement's first decade of existence, the community felt comfortable to live there and the master plan of settlement was implemented properly.

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<sup>304</sup> The population was 3706 persons in 1973 and the width of area is about 188.75 Ha.

<sup>305</sup> Octaviani, D.W., 2007, *Motivasi masyarakat bertempat tinggal di Kawasan Rawan Banjir dan Rob Perumahan Tanah Mas Kota Semarang*, Bachelor thesis in Urban and Regional Planning, Diponegoro University.





**Figure 89. Form of the territory**

Source: *Urban Development Management Information System (UDMIS)*, 2001, Semarang: Regional Development Planning Agency (BAPPEDA); Iconos Satellite Image, 2008

The Tanah Mas Real Estate has a grid pattern and the housing site is arranged accordingly. The building coverage is approximately 80-90 %, so the settlement has a high density of build-up area. The green spaces in the settlement are formed clusters. They are primarily located in the northwestern part. Furthermore, three urban drainages are located east (Semarang River and Asin River) and west of the area (West Floodway). The area is indeed vulnerable to hydrological risk due to the site structure.





In the case study area, there are 73 houses of type A, 657 houses of type B, 1.496 houses of type CM type, and 1.499 houses of type C.

© Modified by Nur Miladan, 2014

**Figure 90. House types in the Tanah Mas Real Estate**

Source: Primary survey, 2013; www.urbanindo.com, 2013-2014; www.tokobagus.com, 2014

*Houses were built with the same design parameters in the 1970s and 1980s but recently, most of the houses have been renovated by their owners to reduce hydrological risk. These renovations produced the building transformations of original houses took place.*



The Tanah Mas Real Estate has four standard types of housing. The classification is based on land size. Type A has a land surface of 420 m<sup>2</sup>, a built-up area of 300 m<sup>2</sup> and it is situated around the primary streets of the settlement (5-6 m long). Meanwhile, Type B has a land surface of 240 m<sup>2</sup>, a built-up area of 200 m<sup>2</sup> and it is also situated around the primary streets. The Type C is located in the secondary streets of the settlement (3-4 m long) and it has a land surface of 100 m<sup>2</sup> and a built-up area of 98/100 m<sup>2</sup>. Type CM is also situated in the secondary streets and it has a land surface of 120 m<sup>2</sup> and a built-up area of 100 m<sup>2</sup>. These house types have been built since 1976 and each step of settlement development has always integrated these house types. At the beginning, the buildings of the Tanah Mas Real Estate were developed according to a contemporary architectural concept. This concept emerged in Indonesia after the independence and it was booming in the 1970s and 1980s along with the massive growth of residential area in Indonesia. It was made of bricks and it privileged a minimalist design.



*These images describe the original houses in the Tanah Mas Real Estate. However, these houses have been renovated partially (fences and floors). These houses are included in the type of C (or CM) which has the minimalist architecture. Doors, windows and roofs are simply shaped and modestly built. However, these houses have a low building height due to these partial renovations, the land subsidence and the elevations of local streets. However, because of the lack of historical photos it is difficult to describe the original forms of housing in the Tanah Mas Real Estate.*

**Figure 91. Original houses in the Tanah Mas Real Estate**

Source: Primary survey, 2012-2013

Due to the house renovations operated by each household, the forms of housing are more and more diverse, so the regular forms of the settlement become irregular. Some houses have been totally renovated, but some transformations involved floor improvements only and no roof renovation. On the one hand, the owners' desires influence the forms of house renovations and on the other hand, there are no development rules issued by the municipality regarding house renovations in this settlement. The government rule only limits the maximal height of buildings (45 m) located around the airport area.<sup>306</sup>



**Figure 92. Recent housing conditions**

Source: Primary Survey, 2012-2013.

*Initially, the developer built houses with one floor, but recently some houses have been renovated to have two or three floors, depending on the economic capacities and desires of the owners. Furthermore, because of the flood risk, the houses often experience the destructions, so the inhabitants must often renovate their houses. Therefore, the building mass and coverage increase in the settlement. This situation is certainly at odds with the efforts to reduce land subsidence.*

<sup>306</sup> *Flight Operation Safety Area around the Airport of Ahmad Yani in Semarang City, Central Java Province, Regulation of Transportation Minister n° 35/2008, Jakarta: Ministry of Transportation. This airport is located approximately 2,5 km away from the Tanah Mas Real Estate.*



The Tanah Mas Real Estate is one of settlements in Semarang City equipped with several public facilities such as places of worship, commercial areas and educational facilities.



**Figure 93. Places of worship in the Tanah Mas Real Estate**

©Modified by Nur Miladan, 2014

Source: Reports of the identification of the morphology of Semarang coastal area, 2012, Semarang: Department of Urban and Regional Planning, Diponegoro University<sup>307</sup>

*The facilities not only fulfill public needs, but they are also landmarks of the settlement. They indicate the ethnic and religious diversity of the community members. This situation rarely occurs in other Indonesian settlements and it is quite rare in Semarang City. Furthermore, they also hinted at the diversity of architectural forms. The temples illustrate Chinese architecture, while the church has a European style. The mosque was built in the Javanese architectural style.*

<sup>307</sup> Reports created by Bachelor students of the Department of Urban and Regional Planning, Diponegoro University in the framework of the course on urban and architecture morphology. They were realized under my supervision when I was an assistant lecturer in 2012.





**Figure 94. Educational and commercial facilities in the case study area<sup>308</sup>**

Source: UDMIS, *ibid*; Iconos Satellite Image, 2008

*In the case study area, there are several educational facilities including preschools, elementary school, junior high school, and senior high schools. Furthermore, commercial areas also exist in the settlement. Therefore, the community has an easy access to educational facilities and commercial facilities in their settlement. Nevertheless, educational and commercial activities are very disturbed during flood occurrences.*

Besides built-up areas, the territorial form is shaped by green spaces. According to the interviews and questionnaires in the community, green spaces were only affected when the settlement was developed. In the 1980s, the northern part of settlement was still an open space, although some land use transformations had already occurred: from swamps and paddy fields into filling-up areas. Since the 1990s, these areas were developed as an extension to the settlement area. Therefore, the settlement area has a more dense built-up area and consequently, green spaces became more limited. Moreover, green spaces inside the settlement have not been transformed since the 1980s. Only the vegetation has been changed in order to improve the landscape: from scrub plants to bamboo, acacia, and palms. Most of these changes were financed by community dues.

<sup>308</sup> Cf. *Monography of Pangung Lor Sub-district Semester I in 2011*, Semarang: Sub-district Office of Pangung Lor. Statistical data from the monography on Pangung Lor Sub-district indicates that there are 8 preschools, 3 elementary schools, 1 junior high school, and 1 senior high school in 2011. These figures do not indicate all of the educational schools in the case study area, but they show how accessible educational facilities are in this settlement.





**Figure 95. Territorial morphological transformations in the Tanah Mas Real Estate**

Source: UDMIS, *ibid.*; Interviews with community heads, 2012<sup>309</sup>

The territorial structure of the case study area has significantly changed since the end of the 1970s. In the 1980s, only the southern part had been built and it became the initial structure of settlement. Since the 1990s, the territory structure has developed in the northern part. This territory structure has not changed since the 2000s. However, some change occurred in the central eastern part the open space was transformed into a mini polder that functions as a water storage for the local drainages before the channeling of drain water to the Asin River.

<sup>309</sup> The developer of the Tanah Mas Real Estate could not indicate the development steps, so the reconstruction of historic morphological plans is based on interviews with community heads and several city maps.





**Figure 96. Green spaces in the case study area**

Source: Iconos Satellite Image, 2008; Field observations, 2011-2013

*Green spaces are limited in our case study area and they do not spread across the entire settlement. Therefore, the catchment area is also limited in the settlement, thus increasing the vulnerability to inundation. Furthermore, the limited green belt also aggravates the flood risk. However, the community seeks to grow vegetation in the local streets and around their houses in order to reduce the inundation risk and also to anticipate the hot temperatures due to its location close to the sea.*



The territorial form of the Tanah Mas Real Estate is based on a master plan designed in 1975/1976. The master plan privileged a neotraditional style, very common in residential areas (patterned grid structures). This trend emerged in Indonesia in the 1970s-1980s and most of the housing developers in Indonesia still use it to design new residential areas. The grid pattern is used for reasons of efficiency and practicality in subdivision; the obtained square shape of the lot is conformed to the market condition in Indonesia.<sup>310</sup>



**Figure 97. Master plan of the Tanah Mas Real Estate**

Source: P5L Association, 2012

*The master plan of the Tanah Mas Real Estate took into account the site topography. The grid pattern can be implemented in the plain area. This pattern has a regular structure in order to ameliorate the efficiency of the built-up area, the proper internal circulation, and the accessibility and the organization of building mass blocks. Furthermore, the master plan can easily be implemented in the development process. These factors are certainly linked to the cost-benefit analysis in housing development business.*

Although the master plan of the Tanah Mas Real Estate took into account the site topography, it did not accommodate the growth of hydrological risk. The settlement was developed one meter above the normal level of sea tide of the Semarang River. Nevertheless, the

<sup>310</sup> Kwanda, T., 2000, "Penerapan konsep perencanaan dan pola jalan dalam perencanaan real estate di Surabaya", *Dimensi Teknik Arsitektur*, vol. 28, n° 2, pp. 106-113.

developer and the community did not predict the emergence of flood risk, especially the *rob* phenomena in the settlement. Community heads who have lived there since the end of the 1970s and the beginning of the 1980s stated that they did not imagine their settlement would become vulnerable to flood risk in the late 1980s. The statements of Soesbijanto, Mudiyono, and Heriyanto perfectly illustrate their unawareness.

“As far as we know, at the beginning, our house was situated around 1,5 meters above the sea level, and we didn’t think about the flood risk in our settlement...”<sup>311</sup>

“We have been lived in this settlement since January, 1<sup>th</sup> 1981 and at that time, there was no flood occurrence. This settlement was the first residential area in Semarang and it was very comfortable.”<sup>312</sup>

Moreover, Heriyanto and Henky H, representatives of the Tanah Mas Company, also stated that the growth of flood risk had not been predicted during the settlement development.

“Sea tide phenomena have existed since the days of our forefathers because they are natural manifestations, but at that time, in (19)75, (19)76, (19)77, at the beginning of real estate development, the normal level of sea tide is lower one meter than our land...we never thought that disaster would hit. Actually, this risk had been considered in our calculations. 5000 houses were built, but nature is not friendly to us”.<sup>313</sup>

“Initially, we did not think about the growth of flood risk, but we designed the settlement to be safe from flood risk because the surface level of settlement was more than one meter above the sea level...at that time, the settlement became the favorite residential area and the houses were sold out very fast... the land subsidence phenomena did not exist at that time, but now, due to the effects of global warming and climate change, the *rob* phenomena have emerged. Nevertheless, the problem has been solved because the community created an association of P5L to anticipate flood risk, especially the *rob* occurrences”.<sup>314</sup>

These statements explain how the mitigation of flood risk was not an important element in the development of Tanah Mas Real Estate. The coastal morphology was not taken into account into the master plan of settlement. On the one hand, the coastal settlement was built through land reclamation, but on the other, it increased the high density of built-up area. The area has a high risk of land subsidence. Moreover, these circumstances aggravate the land subsidence process and consequently, influence the growth of *rob* phenomena in the settlement. They also

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<sup>311</sup> Interview with Soesbijanto (63 years), community head who has lived there since 1976.

<sup>312</sup> Interview with Mudiyono (61 years), community head who has lived there since 1981.

<sup>313</sup> Interview with Heriyanto (59 years), community head.

<sup>314</sup> Interview with Henky H, representative of the Tanah Mas Company. He just started to work in the company and he was a student when the Tanah Mas Real Estate was built in the 1980s, so he has less information on the history of the settlement.



illustrate contradictions between the urban development design and process and urban morphology.

In the report on land subsidence phenomena in Semarang City<sup>315</sup>, it is known that land subsidence on the Tanah Mas Real Estate is between 4 to 9 centimetres on average each year. The causes for land subsidence in Semarang City exist also in the Tanah Mas Real Estate. The density of built-up area is linked to the land use transformations and consequently, the natural soil consolidation has become the main cause for land subsidence in Semarang City.

Furthermore, the development of the Tanah Mas Real Estate is followed by the exploitation of groundwater within the settlement. According to the questionnaires and interviews with the community, groundwater has been routinely exploited through private (artesian) wells since the 1980s. The community can exploit easily groundwater because it is located only one meter under the surface of settlement. The community considered artesian wells as an alternative water supply during the PDAM (local water company) water supplies do not work. It is also more accessible and cheaper. Most of the interviews with community heads described these phenomena:

“[...] this community uses groundwater because it is accessible, we can find the water only one meter under the surface... two sources of water are owned by the PDAM (municipal water resource) but the artesian wells are used since the beginning...here, the PDAM water and the artesian wells run smoothly, maybe because it is the downstream area, if the southern part of city (hill area) has difficulty accessing water resources [...]”<sup>316</sup>

“[...] land subsidence is caused by the exploitation of groundwater that has been going on here for a long time, many artesian wells which are not authorized (by the municipality) [...]”<sup>317</sup>

Nowadays, most of the inhabitants actually know that groundwater exploitation accelerates the land subsidence process in their settlement. Nevertheless, the community still uses groundwater to carry out their activities. On the one hand, groundwater has been used by the community for usual activities for several decades. On the other, due to the lack of government regulation of groundwater exploitation, the community is not aware of these issues, although some rules have been implemented several years ago. However, recent municipality regulation focuses on reducing groundwater use by the communities and industrial sectors and on increasing community awareness about the consequences.

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<sup>315</sup> *Ringkasan dan hasil lokakarya amblesan tanah Semarang (executive summary of land subsidence in Semarang)*, 2008, Bandung: German-Indonesian Technical Cooperation on Mitigation of Georisk (Bundesanstalt für Geowissenschaften und Rohstoffe (BGR) and Ministry of Energy and Mineral Resources).

<sup>316</sup> For reasons of confidentiality, the person's name will not be mentioned.

<sup>317</sup> Idem.

Today, the municipality and the province government stated that the Tanah Mas Real Estate area is a part of the critical zone of groundwater in Semarang City. The local newspaper *Suara Merdeka* published statements of the head section of water resources and geothermal, Department of Energy and Mineral Resources of Central Java Province and of the head of Department of Water Resources and Energy Mineral Resources of Semarang City about the difficulties of controlling groundwater exploitation.

“[...] critical zone (of groundwater exploitation) includes the Tanah Mas area, the port, Bandarharjo, until Kaligawe (from the central to the eastern parts of the Semarang coastal area)...the Department of Water Resources and Energy Mineral Resources of Semarang City could not yet explain the monitoring and controlling of groundwater use...There is no measuring tool or parameter, so the monitoring (of groundwater using) is difficult to be implemented [...]”<sup>318</sup>

Groundwater exploitation is linked to the intrusion of sea water. This situation also occurs in the Tanah Mas Real Estate. Community heads also explained that the groundwater of their settlement is salted so they do not use it as drinking water. These circumstances indicate how complex environmental problems are in Semarang coastal area.

Along with land subsidence and other related phenomena, the case study area is increasingly vulnerable to flood risk. Due to land subsidence, the water level of the Asin River (sea water) seems to rise. During the high tide, some parts of the settlement were inundated. According to the interviews and questionnaires with the community, *rob* phenomena have threatened the settlement since the end of the 1980s or the beginning of the 1990s. Several statements of community describe this situation:

“[...] in 1990, *rob* began to enter (the settlement), but it only threatened the RWs territories located in the low part (of settlement) [...]”<sup>319</sup>

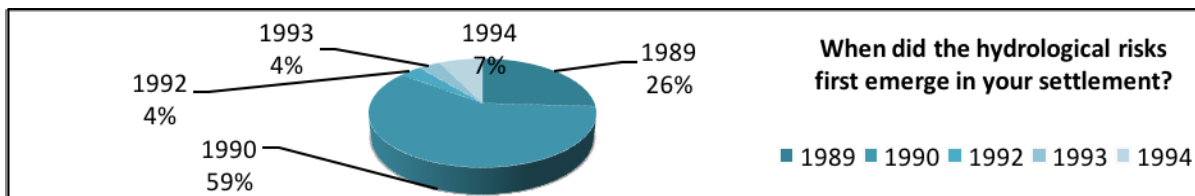
“[...] since the end of the 1980s or the beginning of the 1990s, *rob* has attacked our settlement, but at that period, only one part of the area (settlement) was inundated by *rob*, year after year, the *rob* risk remained until we solved it with the P5L (association)...we have lived here since the beginning of 1989, initially we rented the house, at that time there was no flood occurrence, but when we bought the house in 1993, our recent house, the *rob* had attacked most of Tanah Mas area [...]”<sup>320</sup>

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<sup>318</sup> Sudibyo, A., Handriana, E., “Tanah Terus Turun, Air Tanah Tak Terpantau”, *Suara Merdeka*, April 29<sup>th</sup>, 2014, retrieved December 25<sup>th</sup>, 2015, from <http://www.suaramerdeka.com/v1/index.php/read/layar/2014/04/29/1144/Tanah-Terus-Turun-Air-Tanah-Tak-Terpantau>.

<sup>319</sup> Interview with A. Ibnu Soebroto (60-year-old), community head which has lived there since 1982.

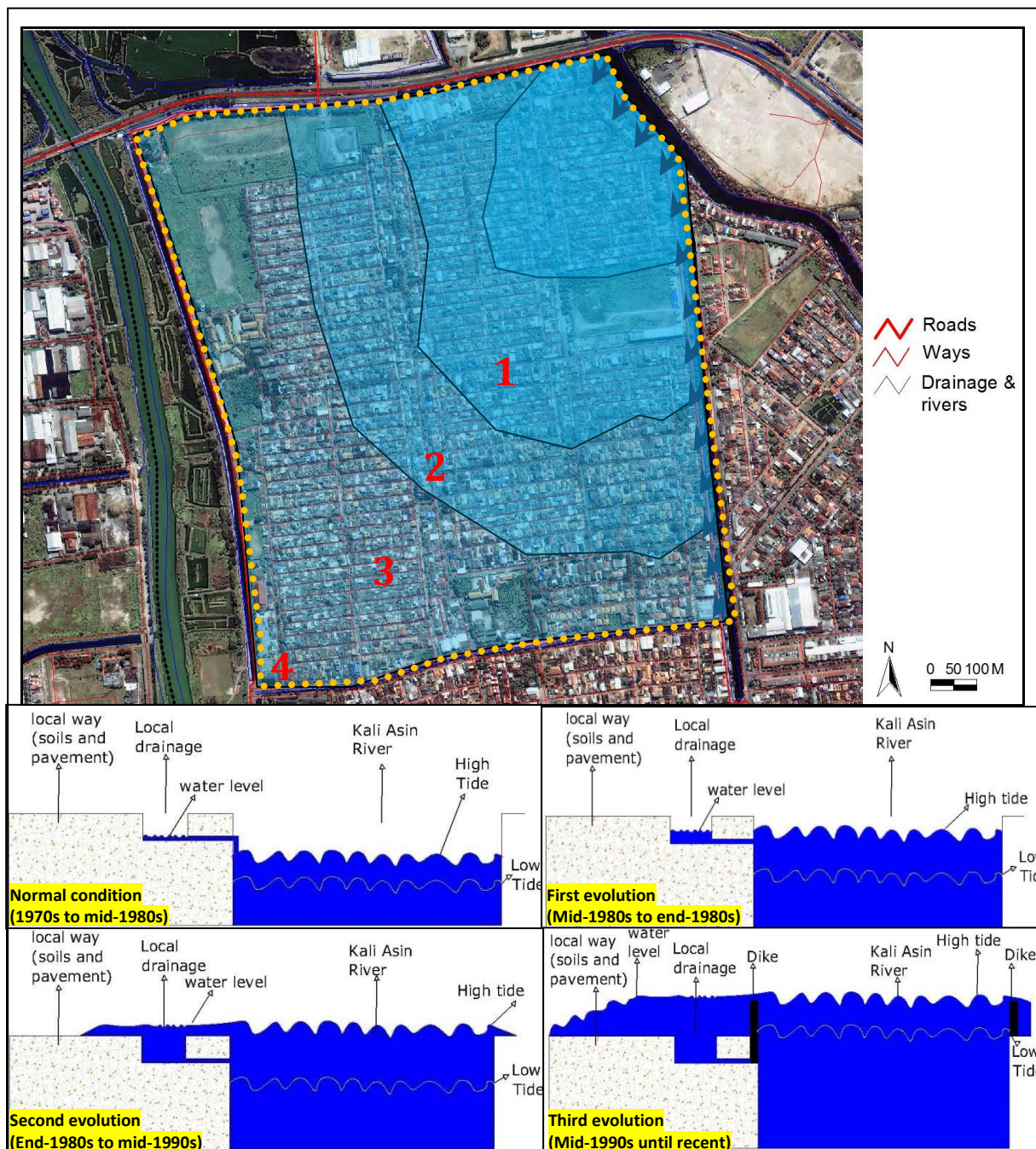
<sup>320</sup> Interview with Surjanto (55-year-old), community head which has lived there since 1989.



**Figure 98. The emergence of hydrological risk in the Tanah Mas Real Estate**

Source: questioners, 2012-2013.

The first signs of hydrological risk appeared in various areas of the settlement between the end of the 1980s and the mid-1990s. This situation depends on the distance between impacted areas and urban drainages (Semarang River and Asin River). However, most of the inhabitants stated that hydrological risk emerged in 1990.



**Figure 99. Rob risk evolution in the Tanah Mas Real Estate**

© Modified by Nur Miladan, 2014

Source: Interviews with community heads; Iconos Satellite Image, 2008

The case study area is located on the Semarang coast which has the elevation between 0 and 0,75 m from the sea level. Due to the land subsidence phenomena, some areas of settlement are located under the sea level, so during the high tide, the flood risk always threatens the case study area. The number of impacted areas increased gradually from the northeast to the south of the settlement (from step 1 to step 4).

The evolution of *rob* risks in the Tanah Mas Real Estate can be explained in three steps. First, the local drainages were inundated by sea water during the high tide period in the mid-1980s and it came back to normal during the low tide period.

During the first period of the evolution of hydrological risk, the community did not consider the high tide in their local drainages as a sign of flood risk. At that period, the community thought it was normal because their settlement is close to the sea. Some inhabitants imagined that they could benefit from these phenomena: for instance, gathering fishes in their local drainages after the high tide. They also enjoyed the life in a coastal settlement.

“[...] at that time, the community could easily get the sea fishes in their local drainages, they felt lucky thanks to the phenomena. They did not see it as the emergence of *rob* [...]”<sup>321</sup>

“[...] I remember that in the mid-1980s, *rob* did not exist, it was just about the elevation of water level in the local drainages...at that time, this settlement was comfortable, sometimes, we felt the sea wind around the settlement, the weather was not too hot like today [...]”<sup>322</sup>

“[...] In the 1980s, the *rob* risk was only as high as the water level of river, at that time, our settlement was safe, houses and streets were not destructed [...]”<sup>323</sup>

The second phase of the risk evolution started in late 1980s. Several *RWs* areas were inundated by the *rob* risk, especially the north-eastern parts of settlement which are the most vulnerable territories to flood risk. The *rob* first occurred in these areas and they were inundated more often than the other territories within the settlement. They are the closest to the Semarang River and Asin River. According to the inhabitants, north-eastern parts of the settlement are located lower than the other parts, while the highest area is located in the southern parts. This is why the north-eastern parts are highly vulnerable to flood risk. However, field observation and municipal data indicate that the different topographies in the settlement are not so visible because the site is a relatively plain area. At the end of the 1980s, most of the local drainages often overflowed.

Until the mid-1990s, the *rob* risk was more and more acute. The impact was spreading and soon, most of the case study area was threatened by the *rob* risk. However, during this period, the water level of local drainages remained higher than the water level of the Kali Asin River and Semarang River, so the inundation could easily to go out from the settlement after the *rob* occurrences.

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<sup>321</sup> Interview with A. Ibnu S, (*RW*) community head and director of P5L association.

<sup>322</sup> Interview with Heriyanto, community head.

<sup>323</sup> Interview with Susilowati, inhabitant since 1979.



“[...] Since the mid- or late 1994, the rob risk began to preoccupy, threaten most of the settlement areas. However, the elevation of local drainages was higher than the level of the Asin River, so after the high tide, the water could to easily flow (to rivers). But two years later, the situation was reversed: the water level of the Asin River was higher than the local drainages. Consequently, during the *rob* attack, the water could again go out rapidly. Since then, the entire settlement is often threatened by the *rob* phenomena for several days [...]”<sup>324</sup>

The third phase occurred in the mid-1990s when the water level of the Asin River was higher than the land level. The *rob* risk was threatening the whole settlement. The local streets were inundated for several days and the inundation could not go out easily from the settlement so the *rob* phenomena occurred almost every week. At that period, the level of inundation could reach more than one meter above the surface during the high tide and the rainy season.

“[...] the *rob* risk was very acute from 1993 to 1996, it was threatening our settlement almost every day, I have never noted these months, but after we created P5L (association) in 1996, could be solved these problems [...]”<sup>325</sup>

“[...] since the beginning of 1995, I have lived in this settlement. Since then, the *rob* risk has always increased and we have been overwhelmed, but since 1996 the establishment of P5L which was based on community self-help, that problem could be solved and the risk did not inundate our settlement [...]”<sup>326</sup>

Nowadays the settlement surface is located 40 to 60 centimetres under the water level of urban drainages and the land subsidence process is still occurring until now. Meanwhile, the high tide can reach approximately 1.5 meters and consequently, the inundation risk is as high as one meter in the settlement. These circumstances certainly increase community vulnerability.

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<sup>324</sup> Interview with Eko Indriyanto, 42-year-old, head of community and his parents and grandparents who have lived there since the emergence of the Tanah Mas Real Estate in the 1970s.

<sup>325</sup> Interview with A. Ibnu S, head of community (*RW*) and director of P5L association.

<sup>326</sup> Interview with Yudho Sapto Edy, community head.



*This image describes the elevation of Asin River water was higher than that of local way surface. During the high tide, it certainly overflows to the settlements around that river including Tanah Mas Real Estate. The lack of urban drainage system produces those settlements have the high vulnerabilities of flood risk.*

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### **Figure 100. Comparison between the street level and the water level of the Asin River**

Source: “Tanah Mas Semarang bekas perumahan elite yg hamper ditelan air” [Photo], June 2<sup>nd</sup>, 2013, retrieved December 28<sup>th</sup>, 2015, from <http://www.kaskus.co.id>.

*This image describes how the elevation of the Asin River was higher than the street level. During the high tide, it overflows to the settlements around the river including the Tanah Mas Real Estate. Due to the lack of urban drainage system, these settlements are highly vulnerable to flood risk.*

Besides the *rob* risk, the case study area is also vulnerable to flash floods. This flood risk is due to the fact that the Tanah Mas Real Estate is located near the West Floodway that channels the drain water from the Semarang upland areas. The overflow of West Flood Way caused the inundation of the case study area several times. The last flood occurred in 2010. The height of inundation was approximately one meter above the settlement surface. According to the community heads, it occurs sometimes when dikes are destroyed or when the pump system of Bulu Drain (controlled by the municipality) do not work because of technical problems (pump damage or fuel shortage) and human errors during the improvement works of the West Floodway.



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**Figure 101. Bulu Drain System and West Floodway around the Tanah Mas Real Estate**

Source: Primary survey, 2011; Iconos Satellite Image, 2008

*The Bulu drain system is one of the devices to control floods on the Semarang coast. It is managed by the municipality. Sometimes, this system does not function due to technical problems such as fuel shortage and burning pumps. The street level of the Tanah Mas settlement is lower than the Bulu Drain level. Therefore, when this system dysfunctions, the Tanah Mas Real Estate is highly vulnerable to flash flooding coming from the Semarang upstream area flowing through the Bulu Drain and West Floodway.*





Figure A and Figure B indicate that during the flood occurrence, the inundation level was between 0.5 m and 1 m within the settlement. Meanwhile, Figure C and Figure D describe the settlement situation after the inundation: street destruction, waste and mud dirty everything.

©Modified by Nur Miladan, 2014

### Figure 102. Flood occurrence in the case study area in 2010

Source: Komunitas Warga Perumahan Tanah Mas, “Petaka Banjir di Akhir Tahun 2010” [Photo], February, 24<sup>th</sup> 2012, retrieved December 28<sup>th</sup>, 2015, from <http://kuala-mas-rw14.blogspot.com>.

*A flood occurred at the end of 2010 after the destruction of the West Floodway’s dikes due to technical problems and human errors during improvement works. This situation shows the settlement vulnerability to hydrological risk due to its location close to the main urban drainages.*

According to Ujang Sutrisna, technician of the Bulu Drain system, the pump system sometimes experienced technical problems, so the *rob* risk was difficult to solve.

“[...] the Bulu Drain system covers the areas of three sub-districts including Panggung Lor, Panggung Kidul and Bulu Lor...the *rob* risks occur at different times, sometimes it takes place during the day, but sometimes at night...for instance it occurs from 6 pm to 5 am, or from 6 am to 4 pm and it flows through the West Floodway...the pump system operates during 6 hours, and it turns off for 1 hour, and then it turns on again...but during the high *rob* occurrences, we always seek to turn it on ...when the machine burns down due to the waste or when the municipality delivers fuel too late, consequently the *rob* phenomena threatens the settlements, such as Tanah Mas...nevertheless, the Tanah Mas



community has its own pump system, they have more than 20 pumps, so Tanah Mas was safe (from the *rob* risk)...the problem of waste disturbs the pump system. The waste could be collected by one truck, sometimes it was big size, such as beds and house equipment, and moreover the buffaloes that were carried away by the river flow...indeed, it is difficult to improve the inhabitants' awareness of waste problems [...]"<sup>327</sup>

"[...] we don't benefit from the Bulu Drain. Its stock (drain water) is not connected to us (local drainages), the elevation of the Bulu Drain is higher than our settlement, so the drain water is channeled to the Asin River. Nevertheless, we have the stock (local drainage) to channel to the Bulu Drain...moreover, the Bulu Drain causes flood occurrences in our settlement. The Bulu Drain water often overflows to our settlement...The Bulu Drain is often trouble. I even contacted the mayor to ask for the delivery of fuel to operate the Bulu Drain during flood occurrences. He finally delivered it [...]"<sup>328</sup>

According to these statements, the Bulu Drain aggravates the flood risk in the case study area. Although the community has its self-help pump system, in fact, the municipal pump system still needs to be efficient in order to reduce the flood risk in the case study area. It seems that the lack of urban drainage system increases the vulnerability of the Tanah Mas Real Estate but also of other settlements.

### **3.1.3 Challenges of living with hydrological risk**

For several decades, the community has lived with hydrological risks in their settlement. It complicates the community life, notably the economic and social aspects. Properties experience value fluctuations, while community dynamics change in the face of hydrological risk. These situations are inevitable elements of community life in the case study area.

#### **3.1.3.1 Property value fluctuations: the settlement destruction burdens the community economically**

Frequently hydrological risk occurrences destroy streets and buildings of the Tanah Mas Real Estate. Yet, these occurrences do not affect directly the destructions of infrastructures during the crisis, but they cause the weathering for these infrastructures. Three impacts of inundation can be distinguished: physical, mechanical, and chemical.<sup>329</sup> Building materials such as wood, iron, brick and cement wither and corrode, and consequently it reduces the building strength, aesthetic and comfort.

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<sup>327</sup> He has operated the Bulu Drain system since 2001 and he lives near the pump house of the Bulu Drain.

<sup>328</sup> Interview with A. Ibnu S, (RW) community head and director of P5L association.

<sup>329</sup> Lasino, 2002, "Pengaruh genangan terhadap bangunan", in *Proceeding Kerugian pada bangunan dan kawasan akibat kenaikan muka air laut pada kota pantai di Indonesia*, Badan Litbang Departemen Permukiman dan Prasarana Wilayah, Jakarta.



**Figure 103. Lichens and corrosion on houses**

Source: Primary survey, 2013

*Although the house buildings seem proper and regular, esthetics values of settlement decrease due to corrosion and lichens caused by frequent inundations.*

In addition, sanitation facilities become environmental problems due to the impact of hydrological risk. During the crisis, septic tanks in each house do not function and are inundated. Therefore, living conditions are unhygienic, the settlement becomes dirty, and also the environment smells bad. These situations certainly decrease the quality of life in the settlement. Several statements by community heads describe this destruction:

“[...] when the *rob* phenomena came to our settlement, it inundated our settlement for several days, consequently the streets and walls became mossy and then ruined. Furthermore, the septic tanks were inundated and very disgusting...at that time, the toilet service business just boomed. At least, we spent about 150.000 IDR. ( $\approx$  9, 37 €) for this service [...]”<sup>330</sup>

“[...] *rob* destroys our house equipment, such as cupboards, tables, vehicles. It disturbs our life very much, we must always clean our house after *rob* occurrences, it certainly takes us a lot of time [...]”<sup>331</sup>

Besides the infrastructure destruction, the community also experiences the loss of house equipment and vehicles. The damaged house equipment and corroded vehicles result from frequent inundations. It represents a huge economic loss because the community members spend a lot to replace and rehabilitate house equipment and vehicles. Although most of the households did not calculate their losses in detail, the hydrological risk burdens the community life economically. Furthermore, they anticipate the hydrological risk through house renovation and street rehabilitation (elevations).

The household of A. Ibnu Soebroto<sup>332</sup> can illustrate how the community renovated their houses to reduce inundation risks. He had the house renovated four times (1987, 1992, 1994, and 2007) with a total cost of three hundred millions IDR ( $\approx$  18750 €)<sup>333</sup>. However, they could not detail the cost of house renovations. The inflation has lasted for more than 30 years and as a result, it is difficult to exactly calculate. In 1987, the home was converted into a *two-story* house. According to him, the house was initially extended to anticipate the needs of their two children. However, since the flood risk often threatened their settlement, the second floor was used as an evacuation room during flood occurrences. The second and third renovations were carried out in 1992 and in 1994 and involved floor elevations. At that time, the renovation was implemented in order to prevent inundation from entering the house. Meanwhile, the last renovation took place in 2007 and entailed floor re-elevation, so the interior of house has a low elevation because the distance between floor and roof is only approximately 2.6 meters against 4 meters at the beginning.

<sup>330</sup> Interview with Agus Setyawan (56-year-old), community head who has lived there since 1992.

<sup>331</sup> Interview with Poerwanto (70-year-old), inhabitant since 1980.

<sup>332</sup> He is 60-year-old and an entrepreneur. He has been a municipal councilor and also a journalist. He comes from Klaten Regency, Central Java Province. We selected him as our case because he is one of the key persons who knows about the settlement evolution.

<sup>333</sup> Their house includes two houses of CM type. Today, a CM type house costs about 120 million IDR ( $\approx$  7500 €).

“[...] In 1992, I elevated the house. At that time, my house was the highest (house) in our area, the elevation was carried out after the street elevation in front of my house [...] most of the households implemented house renovation after street elevations, if they had not elevated (the house floor), inundation would have entered their houses [...] as a result, all households were vying for house elevation [...] in 1994, I re-elevated my house, at that time I would be an example in the community, I had elevated the house and my house was higher, but I remained concerned with the development of the pump system [...] for 2 years, I elevated my house, but the inundation level continued to rise [...] again, it was a sign for the community [...] sometimes, the inhabitants thought that their houses were higher (than the other houses), so their houses would not be inundated [...] In 2007, the floor elevation was at its maximum, I could not elevate (the floor) again, in recent the distance to the was only 2.6 meters, when it was about 4 meters at the beginning [...] later if the children will move away, I will destruct the second floor, so my house (and the distance to the roof) will be high again [...]”<sup>334</sup>

The house renovation is a common effort carried out by the community to reduce the inundation risk inside their houses. Usually, each household renovates the house after the streets in front of their house have been renovated. These actions were implemented by most of the households in order to prevent water from flowing into their houses because the street level is higher than the house level. These efforts cannot solve the flood problem in their settlement. They are temporary solutions repeated over several years that certainly burden the community economically.

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<sup>334</sup> Interview with A. Ibnu Subroto, 2013.





Figure A and B describe the house sample situated near a street (4-5 meters long). The house is higher than the surrounding houses. Figure C indicates the distance between the roof and the floor inside the house is only 2.6 meters. It was initially 4 meters. Figure D and Figure E show the front faces of the first and second floors. Figure F features the fence made of cement and ceramic. Figure G describes the terraced wall in the front face. Figure H represents the inundated drainage around the house.

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### Figure 104. House sample in the case study area

Source: Primary survey, 2013

*This house illustrates the house renovations often carried out by the community. Most of the inhabitants elevated their houses, especially the first floor three or four times since the end of the 1980s. These house transformations are meant to reduce flood risk inside the houses but they represent economic losses.*

According to the questionnaires answered by the community, house renovations cost to the community between 10.000.000 IDR ( $\approx$  625 €) and 300.000.000 IDR ( $\approx$  18750 €) for each house renovation. They depend on the economic capacities of each household and the chosen type of house renovation. Most of the households reconstructed their houses step by step in accordance with the availability of renovation budgets. When their savings are exhausted, they suspend the house renovations until they save enough. Each household cannot calculate in detail the costs spent for the house renovation and how much they saved. This situation is described by several statements from community members:

“[...] We carry out house renovations step by step in accordance with our capacity (economic). If we reconstruct totally and directly, the budget is heavy limited. It costs at least 20 million IDR ( $\approx$  1250 €). We wait until we have sufficient savings for the house renovation [...]”<sup>335</sup>

“[...] we have renovated our house due to *rob*. In 1994, we elevated the floor about 60 cm and it cost approximately 10 million IDR ( $\approx$  625 €) and then in 1997, we re-elevated the floor about 2 meters and it cost approximately 40 million IDR ( $\approx$  2500 €) [...]”<sup>336</sup>

“[...] because of budget difficulties, we renovated our house step by step...it depends on subsistence. If we have more subsistence, we elevate the house. It can be carried out when the daily needs have been fulfilled [...]”<sup>337</sup>

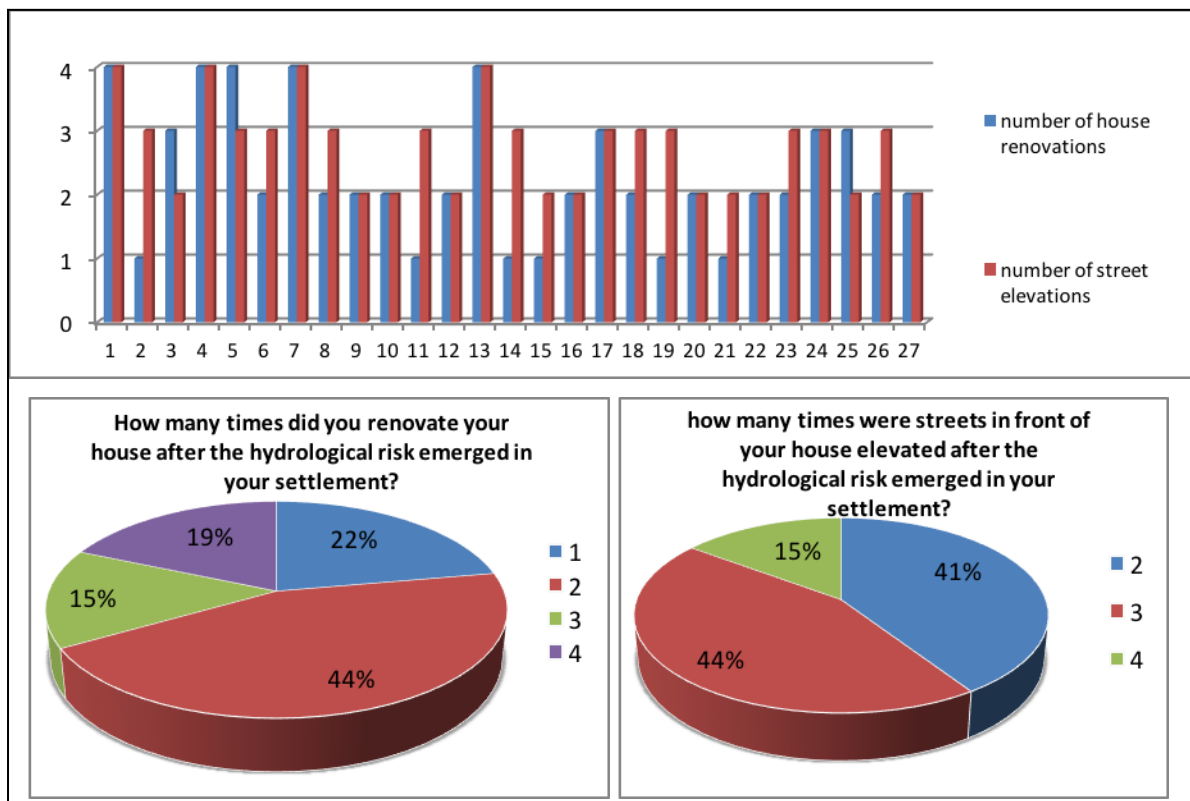
Furthermore, the community also bears the economic burden of the rehabilitation of settlement infrastructures such as streets and public facilities including security posts and local green areas. Frequent inundations destroy these infrastructures. The community often collects dues for the rehabilitation costs and these dues were demanded from all households in each *RT*. According to interviews with community heads, the average cost of street elevation is tens of millions IDR ( $\approx$  from 625 € to 6250 €). Several community heads stated that the community spent up to 150.000.000 IDR ( $\approx$  9375 €) for these projects. These costs vary and depend on the economic capacities of community, especially *RTs* and also the degree of street destruction. Furthermore, questionnaires mention community efforts to renovate houses and streets since the hydrological risk emerged in their settlement.

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<sup>335</sup> Interview with Mudiyono (61-year-old), community head who has lived there since 1981, former worker of a national enterprise.

<sup>336</sup> Interview with Koespradianto (69-year-old) who has lived there since 1979, former civil servant.

<sup>337</sup> Interview with Agus Setyawan (56-year-old), community head who has lived there since 1992, former civil servant.



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**Figure 105. Comparison between house renovations and street elevations after the emergence of hydrological risk in the case study area**

Source: Questionnaires in the community, 2013

According to these diagrams, house renovations and street elevations are common efforts carried out by the community to reduce flood risk in the settlement. The number of house renovations and street elevations vary a lot. Most of the households have renovated their house and it involved only floor elevations. Meanwhile, the community has reconstructed their local streets at least two times. The houses and local streets that have been rarely reconstructed are the most vulnerable to inundation risk.

The revenues of households influence the type of house renovations. According to questionnaires and interviews with the community, most of them are middle-class and upper middle class. Their revenues are between ± 2.000.000 IDR (± 125 €) and ± 15.000.000 IDR (± 937.5 €) each month. They are workers in private enterprises, public servants, and entrepreneurs. They evaluate the costs of the house renovations between 10 to 25 % of their incomes on a period of approximately five to eight years. Several inhabitants prefer to renovate their houses before they retire and the fixed incomes become limited. Furthermore, some households can obtain loans for house renovation from their companies or banks only before they retire. Moreover, several households sell their other properties or ask the financial help from their families. Certainly, these situations illustrate the economic burden of the community.

“..[...] we renovated our house before retirement and we borrowed some money from BRI (one of national bank) and until today, our home is protected from the inundation risk, one of the reasons is the existence of the P5L (association) [...]”<sup>338</sup>

“[...] we have been renovated our house with an elevation of approximately 60 cm in 1993, and in 2005, we renovated the walls. At that time, the budgets for house renovation came from our savings and family donation [...]”<sup>339</sup>

“[...] for the house renovation, we must save about 10 % of our revenue at least...that is a standard and minimal renovation. Several inhabitants around our area could not elevate their houses again because they have already retired [...]”<sup>340</sup>

“[...] usually, we save 20 % of our revenue each month, but it has been spent on house renovations every 5 years [...]”<sup>341</sup>

“[...] We must save about 25 % of our monthly revenue in order to prepare the budget for these renovations. We have been reconstructed our house four times since we have lived in the residential area of Tanah Mas [...]”<sup>342</sup>

The hydrological risk and the related destruction led to a significant decrease of land price in the Tanah Mas Real Estate. The community stated that this decline took place after the emergence of hydrological risk and continued until the beginning of the 2000s. Initially, the land price in the Tanah Mas Real Estate was higher than the price of other settlements in Semarang City. According to the community heads, the land price in Tanah Mas was about 60.000 IDR ( $\approx$  3.75 €) per m<sup>2</sup> in the early 1980s, while other areas in the city centre cost almost same prices about 50.000 to 60.000 IDR ( $\approx$  3.13 to 3.75 €) per m<sup>2</sup>. But in the 1990s, when the hydrological risk often threatens the settlement, the land value decreases. During this period, the land price was 500.000 IDR ( $\approx$  31.3 €) per m<sup>2</sup> maximum and these lands were very difficult to sell, so few people were interested in purchasing properties in the Tanah Mas Real Estate. Investors were rare. Meanwhile, other areas around the city centre, free from the *rob* risk, cost more than 2.500.000 IDR ( $\approx$  156, 25 €) per m<sup>2</sup>. This situation also affected house prices and moreover, the banks did not accept houses in this settlement as loan guarantees. As a result, the community suffered investment losses because of their properties in the Tanah Mas Real Estate.

However, according to community heads, since the 2000s the property rights can be used again as guarantee for loans. At that time, the community had started to carry out collective efforts to reduce the *rob* risk in their settlement. The community regained the trust of banks

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<sup>338</sup> Interview with Koespradianto (69-year-old), inhabitant since 1979 and former civil servant.

<sup>339</sup> Interview with Untung Budi Subagio (55-year-old), works for a private enterprise, inhabitant since 1993.

<sup>340</sup> Interview with Rendra Purwadhiguna (39-year-old), community head who has lived there since 1980, works for a private enterprise.

<sup>341</sup> Interview with Yudho Sapto Edy, community head who has lived there since 1995, works for a private enterprise.

<sup>342</sup> Interview with Mudiyono (61-year-old), community head who has lived since 1981, formerly worked for a national enterprise.



regarding property values in the Tanah Mas Real Estate. Several statements of community evoke this evolution.

“[...] I was a broker, I got the sustenance (from the fluctuation of properties prices), at that time (1990s), I bought several houses that were abandoned by their owners, thus cheaper, but since the 2000s I have started to sell again, the prices were more expensive. I bought several proper houses that owners gave me between 60 million IDR and 80 million IDR ( $\approx$  3750 to 5000 €). These are CM type of houses, but since the 2000s, I have sold them between 120 million and 150 million, depending on the house condition. This economic impact would have been disastrous, if the P5L association had not existed. The *rob* risk still remains. SO these prices could stagnate and maybe decrease due to house destructions [...]”<sup>343</sup>

“[...] previously (1990s), our houses could not be used as a guarantee for loans from the banks, but now, the certificate for CM house type enables to borrow 200 million IDR ( $\approx$  12500 €). A few days ago (in 2013), my neighbors had already got a loan from the banks[...]”<sup>344</sup>

The fluctuation of property values are also indicated by the land prices. The land prices have increased since the 2000s. In 2001/2002, the land price was still less than 500.000 IDR ( $\approx$  31.25 €) per m<sup>2</sup>, but in 2012/2013 the land price reached 1.000.000 to 1.500.000 IDR ( $\approx$  62.5 to 93.75 €) per m<sup>2</sup>. Nevertheless, these prices are now cheaper than the land prices of other areas which are un-impacted by hydrological risk. For instance, the land price of the settlements in the Semarang upland area (close to the urban centers) is more than 3 million IDR ( $\approx$  187.5 €) per m<sup>2</sup>. The fluctuation of property values is linked to the existence of hydrological risk with very detrimental consequences for the community.

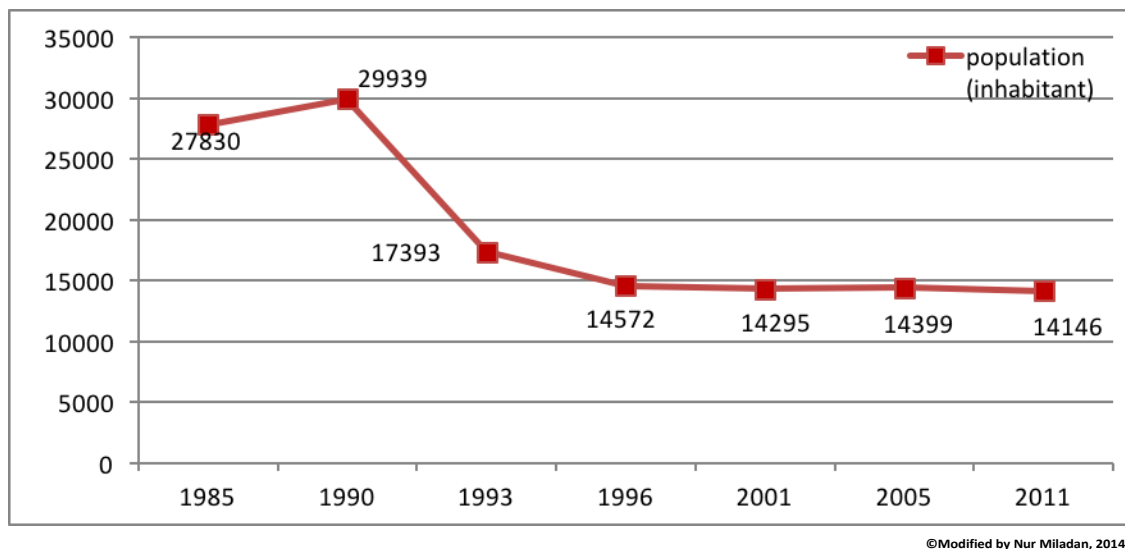
### 3.1.3.2 Deviation of population growth between life choices and cultures

The existence of hydrological risk in the case study area does not only produce the fluctuation of properties values, but also the deviation of population growth and related social problems. Since the construction of Tanah Mas Real Estate, its population was increasing rapidly. Conversely, since the emergence of hydrological risk, the population is decreasing.

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<sup>343</sup> Interview with Heriyanto (59-year-old), community head who has lived there since 1977, senior worker of the Tanah Mas Company.

<sup>344</sup> Interview with A. Ibnu Soebroto, community head which has lived there since 1982.



**Figure 106. Population decrease in the 1990s and population stagnation in the 2000s**

Source: Time series data on *Semarang in Figures*, Semarang: Central Bureau of Statistics of Semarang City. According to the statistical data, population increased between 1985 and 1990 to reach approximately two thousand inhabitants. In 1993, the population data does not indicate a decrease, but it is only linked to the administration division between Panggung Lor Sub-district and Panggung Kidul Sub-district. From 1993 to 1996, the population decreased and reached to three thousand inhabitants. This situation has the linear correlation with the aggravated hydrological risk in the case study area at that period. Meanwhile, from 1996 to 2011, the population was relatively stable (about fourteen thousand inhabitants).

Since the 1990s, the density of built-up area in the Tanah Mas Real Estate has not really changed. Most of the houses have been occupied by inhabitants and in 1993, the population density reached about 141 inhabitants/Ha. Population significantly decreased between 1993 and 1996 produced also the decrease of population density in that settlement about approximately 118 inhabitants/ Ha. The interviews with community heads explained that some inhabitants preferred to relocate due to the hydrological risks at that period. According to them, many inhabitants left their houses and migrated to other areas, such as the hill area of Semarang City. However, they could not sell their houses and also could not use them as guarantee for bank loans. Thirty to fifty percent of the house numbers have been left by the owners. Although some inhabitants migrated, the property rights still belong to them. According to community heads, the number of relocations was higher than the population decrease mentioned in the municipal statistical data.

Some inhabitants moved from the Tanah Mas Real Estate because they could not cope with the hydrological risk in their daily life. Some houses were abandoned by their inhabitants and owners had difficulty selling their houses. Consequently, some houses withered because the owners did not maintain their houses due to high costs. Although the detailed number of houses abandoned by owners is unknown, several interviews with the community perfectly describe these situations.

“We preferred to leave Tanah Mas because we felt uncomfortable because of the *rob*. It was not calm to live there, we were anxious. The *rob* arrived suddenly, disturbed our activities, the vehicles corroded and the hot climate”. Here (Banyumanik District in the Semarang hill area), we are calm, comfortable. We are not flooded, although my office is now more distant. My office is in Puri Anjasmoro (Marina Beach area), only two kilometers from Tanah Mas (settlement)”<sup>345</sup>

“[...] at that time (1993-1996), I became a RW community head. Almost every day, I signed moving letters for my community and the average (of moving letters every day) was two letters at least. I thought if this situation lasted, there would be no inhabitant to solve the flood problems. Consequently, I would be a RW community head without the inhabitants. Thus, friends (other inhabitants) and I were forced to solve these problems through self-help efforts. If they had not been carried out, we would have experienced *bedol deso* (massive relocation). But since 2002, people have returned and rebuilt their houses in the Tanah Mas settlement. Now, the number of households is 4320. The settlement is almost full and we calculated that only approximately 10% of the house total number is uninhabited. Between 1994 and 2001, there were many uninhabited houses, it was almost about fifty percent (of house total number) [...]”<sup>346</sup>

“[...] population significantly decreased between the end of 1993 or the beginning of 1994 and the beginning of the 2000s. Many inhabitants moved to Gombel (Semarang hill area), when their houses were threatened by landslide. Nevertheless, we stayed here because we considered that Tanah Mas has the most strategic location (compared to other settlements), it is close to the city center, and we can go anywhere quickly, such as the airport, the port, the stations, and the malls, so we could survive until now [...]”<sup>347</sup>

“[...] indeed in 1994, 1995, 1996, some households move from our settlement, but I cannot mention the detailed number of inhabitants who relocated...but clearly, they felt uncomfortable because of *rob* (risk). But other inhabitants and I have survived here, we considered it to be a strategic location. If we also moved from here and sold our houses, we could not have houses near the city center and distant from the coast (free from hydrological risk) because the house prices were expensive. So we are more comfortable here, we can go anywhere, it is close (strategic location) [...]”<sup>348</sup>

These statements indicate that some inhabitants migrated to other settlements, but other households survived in the case study area during the 1990s. Although there are no reliable data on migration, statistical data on population show that more inhabitants choose to stay rather than leave. For instance, between 1993 and 1996, only 16% of population moved from the settlement. These situations illustrate how the social capital influences the community resilience process. Community resistance is needed to develop local resilience. Community resistance is influenced by various factors such as livability, affordability, and location. The livability pertains to the psychological aspects of living in the face of

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<sup>345</sup> Interview with Harry, lawyer and entrepreneur, inhabitant who preferred to move from Tanah Mas settlement.

<sup>346</sup> Interview with A. Ibnu Soebroto (60-year-old), community head which has lived there since 1982.

<sup>347</sup> Interview with Heriyanto (59-year-old), community head who has lived there since 1977.

<sup>348</sup> Interview with Soesbijanto (63-year-old), community head who has lived there since 1976.

hydrological risk and the affordability relates to the economic capacities of households to buy houses in other settlements and to renovate the houses. The location is the most important factor that influences the resistance of the Tanah Mas Community against hydrological risk.

Surviving inhabitants are the motor of the community resilience process. Their self-help efforts enabled their settlement to subsist until today. After they succeeded to reduce the hydrological risk in their settlement through the development of local association, other inhabitants began to settle or resettle. Several statements of new and returning inhabitants between the mid-1990s and the 2000s underline this aspect.

“[...] many inhabitants have settled since the construction of the pump system and the creation of the P5L association focusing on the *rob* risk reduction. Finally, the inhabitants recognized the achievement of the P5L association when the *rob* risk could not enter again in the settlement. Furthermore, Tanah Mas has a strategic location [...]”<sup>349</sup>

“[...] since the 1980s, there were many newcomers. Most of them are Chinese people. In the 1990s when the *rob* risk was more acute, many Chinese people bought houses here. In 1995, I rent the house here, but in 1999, I bought it. I consider the strategic location, the sturdy building because it is categorized as real estate (high quality of building). Despite the *rob* risk, I believe that the municipality is aware of this settlement. Moreover, the inhabitants have communality, we are together to solve the problems of *rob* or flood with the installation of pumps [...]”<sup>350</sup>

“[...] in 1996, the Tanah Mas settlement was categorized as a residential area with a very cheap price. It is close to city center. In 1997, I began to settle in the residential area of Tanah Mas...at that time, some inhabitants began to settle here. Besides, this settlement is close to the city center, the community is adaptable and friendly. Furthermore, we could get very cheap houses in 1997 [...]”<sup>351</sup>

The statements above indicate that although some inhabitants preferred to move from the settlement, but some inhabitants began to settle in 1996/1997 because they trusted the P5L association with reducing the hydrological risk in the settlement. Furthermore, they considered the Tanah Mas as a real estate with several advantages such as the good quality of housing construction and the municipality concerns with the condition of the settlement. Furthermore, the low price of housing also convinced people to buy houses there at that period. These factors influence community and local resilience process.

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<sup>349</sup> Interview with Yoseph Salim (52-year-old), community head who settled there in 2002.

<sup>350</sup> Interview with Yudho Sapto Edy, community head who has lived there since 1995.

<sup>351</sup> Interview with Udi Maryuwanto (43-year-old), inhabitant or community head who has lived there since 1997.



In 1997, the Chinese people dominated the number of population about 70 % of total population in the Tanah Mas Real Estate (approximately 10.000 peoples).<sup>352</sup> This situation differed from the 1980s. In 1985, the Chinese only accounted for approximately 1.5 % of the total population. Initially, the population was dominated by the Javanese and most of them were civil servants and entrepreneurs. Until the beginning of the 1990s, the Javanese still dominated in the settlement and only a small proportion was Chinese and most of them were traders.

However, Chinese represented about 60 % of the total population in 1993.<sup>353</sup> At that period, many Javanese preferred to sell their houses and moved from the settlement because the *rob* risk made it unlivable. Furthermore, several civil servants moved to other cities (work mutations). The Chinese preferred to settle in the settlement because its location is close to commercial areas (Johar Market and Pekojan Market) where they work as traders. They appreciated the low price housing around the city centres. These factors increased the growth of Chinese in the case study area in the 1990s. According to Lee Kuen Yew (senior minister of Singapore), the success of Chinese overseas in ASEAN territories (Southeast Asia) is explained by Chinese cultural values. Chinese are economical, they work hard, prioritize education and ethnic unity, and they help each other.<sup>354</sup> These Chinese values are present in the Tanah Mas Real Estate. In spite of the flood risk, the Chinese preferred to settle due to economic factors, job orientation and community unity. Furthermore, these cultures foster community resistance.

However, the Chinese have cooperated with other ethnic groups, especially the Javanese majority. Indeed, the community self-help association was established by the Javanese, but in fact the Chinese have been involved in the management since the 1990s. They perform the same efforts for hydrological risk reduction, both individual and collective. The different ethnic groups in the community have cooperated to reduce the hydrological risk in their settlement. Ethnicity does not constraint the community resilience process, but it accelerates it. The Javanese played a role in developing collective efforts, while the Chinese accelerated the community resilience process through their resistance against hydrological risk in the 1990s.

Although inhabited houses account for approximately 90 % of total buildings in the settlement, the number of population has been relative stable over the last thirteen years,

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<sup>352</sup> “Semarang Kaline Banjir, Semarang Laute Banjir”, *Kompas*, May 4<sup>th</sup>, 1997.

<sup>353</sup> Noor, D and Mulyono, 1997, *Terbentuknya Pacinan Baru: Kasus Tanah Mas Semarang*, Semarang: Diponegoro, University.

<sup>354</sup> Zein, A.B., 2000, *Etnis Cina dalam potret pembauran di Indonesia*, Jakarta: Prestasi Insan Indonesia.

about  $\pm$  14.000 people. Population grows like in other settlements. Inhabitants could sell again their properties, albeit at a low price. Furthermore, the banks accepted this property as loan guarantee once again. In the 2000s, the uninhabited houses began to be occupied by new households. Most of them are young Javanese inhabitants. They took into account the low prices housing around the city centres where their livelihoods are located. Furthermore, the success story of the community self-help association for the *rob* risk reduction incited trustful new inhabitants to settle there. The Javanese population increased in the settlement in the 2000s. According to the statistical data of Panggung Lor Sub-district, the Chinese represented only 39 % from the total population (5534 inhabitants) in 2011. The Javanese dominated again in the settlement. Several community statements explain this situation.

“[...] this settlement is close to the city centers and work office. Public facilities are all here, we settle here because it is comfortable thanks to the P5L (association) [...]”<sup>355</sup>

“[...] after the success of the P5L, some young households bought and settled in the uninhabited houses in the 2000s. Since that period, the land and house prices have been stable [...]”<sup>356</sup>

The situations above illustrate how the population growth and the property investments in the Tanah Mas Real Estate were relatively returning to previous situations. The Chinese but also the returning Javanese proved to be a resistant community when they choose to settle there. These situations also evidence the community (local) resilience process where the community remains. They perform both individual and collective efforts to reduce the hydrological risk in their settlement.

### 3.1.3.3 Social problems: constraints in the community resilience process

The hydrological risk disturbs the community daily life completely. It destroys the settlement and creates social problems relating to physiological and health conditions in the community. The community often suffers from diseases due to frequent hydrological risk occurrences in their settlement. Interviews and questionnaires indicate that inundation impacts often threaten the community with two types of illness: skin (foot) and respiratory diseases. Skin diseases usually caused itchiness, especially around the foot. The inhabitants do not use footwear during the inundations because they are uncomfortable. Moreover, the inundations carry dirty and salted water. The community stated that the respiratory diseases

<sup>355</sup> Interview with M. Syafri (43-year-old), inhabitant who has lived there since 2002.

<sup>356</sup> Interview with Agus Setyawan (56-year-old), community head who has lived since 1992, former civil servant.

affect children especially. Humidity is everywhere because house walls are often wet. Nevertheless, frequent inundations force the community to adapt to these diseases. Statements of community heads mention the diseases affecting the settlement.

“[...] because the walls (of houses) are always wet, upper respiratory tract infections often threaten us, and also we suffer from foot diseases, especially the housewives [...]”<sup>357</sup>

“[...] cough, influenza, itchiness or skin diseases, sometimes diarrhea, we are familiar with these diseases. Furthermore, dengue fever sometimes threatens our community [...]”<sup>358</sup>

Furthermore, the majority of community feel ashamed and anxious because of the hydrological risk. The *rob* risk can occur anytime: night, morning, and noon. So, it became a daily phenomenon in their life. During the rainy season (from October to March), the community is particularly worried because they think the risk of flooding is very high in their settlement. Although they can predict when the *rob* phenomena will arrive, sometimes they feel defeated when the *rob* risks took place at night when they sleep soundly. As a consequence, they store their precious things and equipment (letters, electronic goods, etc.) in preparation. If they are negligent, their valuables will be damaged or will disappear. These situations are described in several community statements.

“[...] it makes us very anxious, moreover, when it (*rob* risk) occurs at night, suddenly in the morning we see the inundation inside the house and our environment is inundated, we feel defeated and this situation repeats itself [...]”<sup>359</sup>

“[...] it (hydrological risk) is very troublesome, death and marriage ceremonies, community meetings, and other social activities take place when there are flood occurrences. You can imagine, we have planned the marriage ceremony, and we feel anxious because the flood (*rob*) can also occur in that day. And if that day, the flood occurs, the guests have difficulty coming to the wedding, maybe they cancel, etc. We are deeply ashamed in front of the guests. Moreover, our workshop is deserted because most of the people are too lazy to go out from their houses [...]”<sup>360</sup>

“[...] when we are enjoying the night with our wives. Suddenly the *rob* occur and we don't have any choice. We must arrange our house equipment at night in order to reduce the flood impact. Of course, we feel uncomfortable in those situations. Moreover, we accept guests in our house during the inundation occurrences. When they ask to go to the toilet (inside the house), we are ashamed of the septic tanks. With the inundation, it is disgusting and smells bad[...]”<sup>361</sup>

<sup>357</sup> Interview with Susilowati, inhabitant who has lived since 1979.

<sup>358</sup> Interview with Soekrisno Hadi (47-year-old), community head who has lived since 1987, entrepreneur.

<sup>359</sup> Interview with Harry Budiono (41-year-old), community head who has lived there since 1988.

<sup>360</sup> Interview with Eko Indriyanto (42-year-old), community head who has lived there since 1977, entrepreneur.

<sup>361</sup> Interview with A. Ibnu Soebroto, community head who has lived there since 1982.

“[...] in the 1990s, there were frictions between neighbours, *RTs*, and *RWs*. It was linked to the problems of different house elevations. The flood inundated the low houses. *RTs* and *RWs* generally had problems of street elevation. The flood threatened *RTs*' streets. *RWs*' streets are lower than other streets. So they competed to do elevations [...]"<sup>362</sup>

The statements above indicate psychological problems in the community. The anxiety results from the disturbance of their social and economic activities. They had difficulty organizing social ceremonies (marriage, death, etc.) in their settlement because the hydrological risk always threatens their daily life. Sometimes, they preferred to stay in their houses and not work because they must secure their house equipment during the hydrological risk occurrence.

Furthermore, they feel ashamed not only in front of their guests when they cannot accommodate them well, but also in front of their neighbours. Since the emergence of hydrological risk in their settlement, most of the community have carried out house renovations. Nevertheless, the type of house renovations depends on the economic capacities of each household. It involves different models of house renovations including height and material. Moreover, several households could not renovate their house due to their limited economic capacities. Feelings of envy and shame often exist between neighbours. Some inhabitants are envious when the houses of their neighbours are higher than theirs because during inundation occurrences, the water flows to their houses due to the low height. Each household wants to renovate its house to be higher than the neighbours'. Furthermore, the households that cannot renovate their houses feel ashamed in front of their neighbours and have a low self-esteem because their houses were always inundated while the neighbours' houses are free from inundation during the flood occurrences.

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<sup>362</sup> Interview with Heriyanto (59-year-old), community head who has lived there since 1977.





**Figure 107. Comparison of house renovations in the case study area**

Source: Primary Survey, 2013

*Different house elevations produce social problems among the neighbors. These frictions affect the quality of life in the settlement.*

However, after the creation of community self-help association for the hydrological risk reduction in their settlement, the community stated that this association has positive consequences on the social conditions of community. Several statements of community heads describe these situations.

“[...] before the P5L association, the community often experienced conflicts between *RTs* and *RWs* due to street elevations. After the creation of P5L, the community experienced positive change, we have become *saiyeg saeko projo*. It means “we are solid because we have the same fates [...]”<sup>363</sup>

“[...] P5L creates a feeling of togetherness in our efforts to solve *rob* and flood through community self-help without financial help from the municipality...thanks to P5L, there is hospitality for the community, so the members can meet one other. Initially, most of

<sup>363</sup> Interview with A. Bakar (66-year-old), community head who has lived there since 1978, entrepreneur.

the upper middle households were selfish, but thanks to P5L, we can all come together. This is a miniature of Indonesia, with different ethnic groups, Javanese, Chinese. But we can implement the communality”<sup>364</sup>

“[...] P5L helps the community think positively, so we have communality to reduce flood risk in our settlement [...]”<sup>365</sup>

Initially, the community had social problems such as apathy and individualism. They did not care about the condition of neighbourhoods. Each household only sought to reduce the inundation risk in their own houses. The community self-help association was initiated by several heads of community in order to reduce hydrological risk. They could unite all the inhabitants and they can avoid frictions because they carry out collective efforts in their settlement. A resistant community needs a feeling of togetherness to develop collective efforts against risk and become a resilient community.

### **3.2 Community perceptions influence local initiatives as elements of community resilience process**

Community behaviors and efforts for flood risk reduction, both individual and collective, are linked to their social cultures. The sociocultural environment (i.e., ecologically and motivationally significant ideas, practices, social structures, among many others) is likely to shape perceptual processing and give rise to culturally specific behavioral and neural responses.<sup>366</sup> Moreover, the disaster risk also depends fundamentally on how social systems and their associated power relations impact on different social groups (through their class, gender, ethnicity, etc.)<sup>367</sup>. Exploring community culture and perceptions is important to understand community initiatives and efforts for the hydrological risk reduction in their territory.

In the case study, Javanese and Chinese cultures influence their initiatives and efforts to live with the hydrological risk. The number of Chinese people increased during the period of aggravated risk in the 1990s while the Javanese people tended to move out from the settlement. Furthermore, culture affects perception and subsequently cognition at both the

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<sup>364</sup> Interview with Soesbijanto (63-year-old), community head who has lived there since 1976.

<sup>365</sup> Interview with Rendra Purwadhiguna (39-year-old), community head who has lived there since 1980, works for a private enterprise.

<sup>366</sup> Freeman, J.B., Rule, N.O., Ambady, N., 2009, “The Cultural Neuroscience of Person Perception”, *Progress in Brain Research*, vol. 178, pp. 191-201.

<sup>367</sup> Wisner, B., Blaikie, P. Cannon, T, Davis, I., 2003, *At risk: Natural Hazards, People's Vulnerability and Disasters*, London/ New York: Routledge.

society and individual level.<sup>368</sup> Perception is a complex process that involves structural factors, or influences from physical stimuli, and functional factors, or psychological influences from the perceiving organism; among these psychological influences are the perceiver's needs, wants, moods, attitudes, and assumptions.<sup>369</sup> Community perceptions and cognitions of the hydrological risk explain their choices. Community definitions and causes of the hydrological risk, and choices of residence are important elements to understand the community resilience process. Although their settlement remains vulnerable to hydrological risk, the majority of houses is still occupied by the inhabitants. These situations are linked to their perceptions of the hydrological risk. Although community perceptions can diverge, there is a rational background to the community relation with the hydrological risk.

However, interviews with community heads and field observations indicate that there is no settlement partition between ethnic groups. But the perceptions of different ethnic groups are considered as factors of community resilience process. Each ethnic group has common and different characteristics. They can either strengthen or constraint the community resilience process.

### 3.2.1 Hydrological risk is not an absolute disaster

The community definition of hydrological risk is an important element to explore the community relation to hydrological risk in their settlement. Interviews and questionnaires indicate that the community distinguishes two types of hydrological risk in their settlement: flash flood and *rob*. All the members have the same definition of hydrological risk in their settlement. Flood is an inundation which originates from the upstream area and occurs when the water overflows from the drainages (river and canal), particularly during the heavy rainy seasons. They consider that their settlement is vulnerable to flood risk because it is situated in the downstream area. Meanwhile, *rob* is an inundation caused by the tidal phenomena which are natural manifestations in coastal areas. The moon rotation influences the apparition of *rob* risks. During the high tide period, the sea water overflows through the drainages and water infiltrates soils in the settlement. The *rob* risks can occur anytime, even when there is no rain and it can also occur in any other zones of the Semarang Coast. Furthermore, they also state that the worst occurrences of hydrological risks in their settlement took place when *rob* occurred in parallel with flood caused by the overflow of urban drainages, in particular the

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<sup>368</sup> Kastanakis, M.N., Voyer, B.G., 2014, "The Effect of Culture on Perception and Cognition: A Conceptual Framework", *Journal of Business Research*, vol. 67, pp. 425-433.

<sup>369</sup> Severin, W. J., Tankard, J.W., 2001, *Communication Theories: Origins, Methods, and Uses in the Mass Media*, 5<sup>th</sup> edition, New York: Addison Wesley Longman.

West Floodway during the heavy rains. Some inhabitants' statements describe these community perceptions of the hydrological risk in their settlement.

"[...] here, there is flood and *rob*. The flood is caused by the overflow of the West Floodway. The water originates from the hill areas of Semarang. The *rob* comes from the sea. The sea water overflows into the land. Initially, the *rob* occurred any time, any month, but now we have reduced it. But if there is flood, it takes place in other settlements. As far as I remember, the last flood was in 2010 and the water entered rapidly to the settlement. It's different with *rob*. Usually, it originated from the Kali Asin and the inundation gradually increased [...]"<sup>370</sup>

"[...] the flood risk might have existed for a long time. But the *rob* emerged in the 1990s. Indeed, these are the same problems and both have inundated our settlement. *Rob* was a frequent phenomenon, but flood was rare and depended on the season. The dikes of West Floodway were always destroyed, consequently the water entered our settlement [...]"<sup>371</sup>

"[...] *rob* occurred because of the land subsidence and sea level rise. These are global phenomena, according to experts. Clearly, in this settlement, *rob* occurred when sea water entered our settlement. The water was salty and caused the corrosion, the vehicles were rapidly damaged. There have been several flood occurrences. The P5L association focuses on *rob* (risk) reduction, because these phenomena threaten daily life. We cannot predict the emergence of flood, but for the *rob*, we can observe the increase of river water level [...]"<sup>372</sup>

"[...] *rob* is a natural phenomenon. The sea level rise inundated our settlement frequently. But flood is due to the overflow from the West Floodway and commonly occurs during the heavy rain seasons, sometimes it is caused by human errors [...]"<sup>373</sup>

Those statements indicate that the community understanding of the hydrological risk types in their settlement is based on their experiences. The hydrological risk occurs so frequently that the community can distinguish the types of hydrological risk. They recognize their characteristics. These conditions certainly become the basic elements of community resilience process.

Furthermore, different ethnicities do not produce different perceptions of the hydrological risk impacts. There are Chinese and Javanese inhabitants who see the hydrological risk as a disaster, but also several Chinese and Javanese inhabitants who consider the hydrological risk as a disturbance only. So, community perceptions of hydrological risk impacts underline the community unity.

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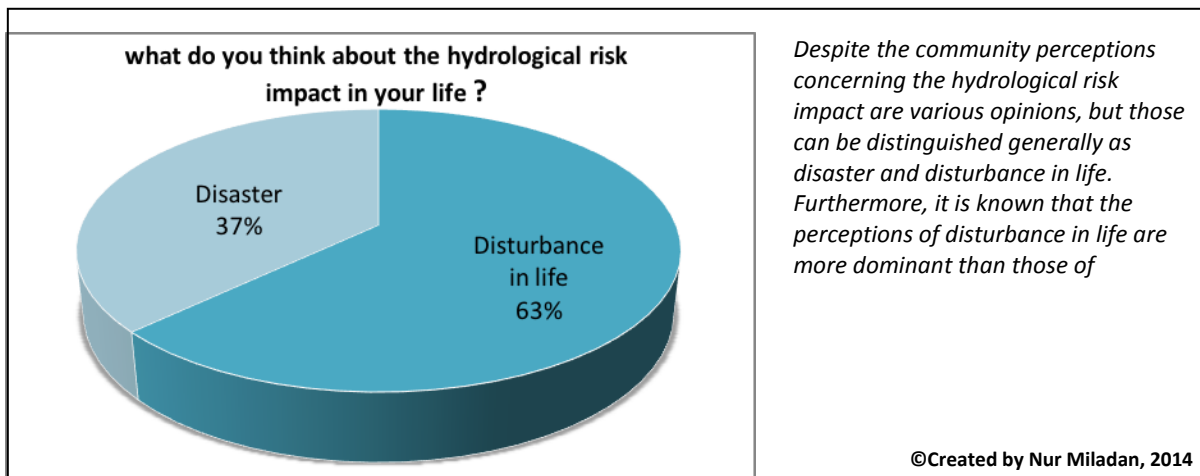
<sup>370</sup> Interview with a Chinese inhabitant who has lived there since 2002, works for a private enterprise.

<sup>371</sup> Interview with a Chinese inhabitant who has lived there since 1988, entrepreneur.

<sup>372</sup> Interview with a Javanese inhabitant who has lived there since 1982, entrepreneur.

<sup>373</sup> Interview with a Javanese inhabitant who has lived there since 1975, entrepreneur.





**Figure 108. Perception of hydrological risk impacts in the Tanah Mas Community**

Source: Questionnaires and interviews, 2013

*Although community perceptions of the hydrological risk impact vary, they generally consider either as disaster or disturbance. Furthermore, the perception of disturbance is dominant.*

Several reasons underlie the community perception of a disturbance. The occurrences did not cause any death, they are natural phenomena in the coastal areas and thus, part of the daily life. They think that only disasters cause the death of inhabitants, but that the hydrological risk only disturbs activities and economics. It only damages infrastructures and vehicles, and bring diseases. They consider that the hydrological risk can be anticipated through many efforts, both individual and collective. But disasters cannot be handled. The other reason for this community perception is that the hydrological risk can occur anytime. The community says that the disaster occurs only at certain periods and cannot be predicted. They consider that the hydrological risk, especially *rob* risk, can be predicted. They cause frequent inundations in their settlement. Furthermore, they also state that the hydrological risk is a natural phenomenon in coastal areas. They can appear and disappear naturally. Their settlement is close to the sea, and consequently coastal oceanic phenomena usually affect coastal settlements. Several inhabitants' statements describe the perceptions of hydrological risk as disturbance.

“[...] it (hydrological risk) disturbs our social economic activities, but we are capable to handle it, we have P5L [...]”<sup>374</sup>

“[...] the impact of inundation, especially *rob*, is very detrimental to us. It causes diseases, damages buildings, the streets, the vehicles and also the house equipment. But it

<sup>374</sup> Interview with a Javanese inhabitant who has lived there since 1979, former civil servant.

(hydrological risk) is not a disaster because it does not cause death. Disaster occurs suddenly, but flood or *rob* do not. We can predict *rob* phenomena [...]"<sup>375</sup>

"[...] it disturbs our life, the inundation and *rob* risks did not disappear with time. Sometimes, it occurs morning, noon, and moreover mid-night [...]"<sup>376</sup>

"[...] I think it (hydrological risk) disturbs the inhabitants' activities. If it is not solved, it will become a disaster. It will submerge our settlement[...]"<sup>377</sup>

Other inhabitants argue that the hydrological risk is a disaster because it brings suffering and catastrophes in their life. They feel that the hydrological risk threatens their life system. They cannot perform their activities normally due to frequent hydrological risks. Several inhabitants also argue that the hydrological risk is a rebuke without forgiveness from God because humans destroyed the environment instead of preserving it. They believe God will forgive them if they can maintain and rehabilitate their environment. They considered it to be a natural law. When people destroy the nature, they have to face the consequences before God. These beliefs are linked to the religious diversity in the community: Muslim (37,2%), Christian Catholic (27,2%), Christian Protestant (27,2%), Hinduism (0,1%), Buddhism (8,2%), and Cults (0,1%).<sup>378</sup> Several inhabitants' statements illustrate these perceptions.

"[...] flood and *rob* (risk) are parts of a natural law. A plain (area) is indeed vulnerable to inundation and if a settlement is built on it, it is a human mistake [...]"<sup>379</sup>

"[...] inundation (*rob* and flood) in our settlement is a disaster which threatens our life system. We have experienced many losses in our life. We cannot perform activities normally. Humans destroy the environment. Consequently, we must feel the consequences of environmental destructions [...]"<sup>380</sup>

The community perception of the hydrological risks impacts as a disturbance indicate a resistant community. Although the impact of hydrological risk threatens their daily life, they still consider it as a disturbance only. Theoretically, the disaster is a serious disruption of the functioning of a community or system in a given spatial area causing widespread losses which exceed the ability of the affected system or community to cope with it, using its own

<sup>375</sup> Interview with a Javanese inhabitant who has lived there since 1977, works for a private enterprise.

<sup>376</sup> Interview with a Chinese inhabitant who has lived there since 1988, entrepreneur.

<sup>377</sup> Interview with a Chinese inhabitant who has lived there since 1980, entrepreneur.

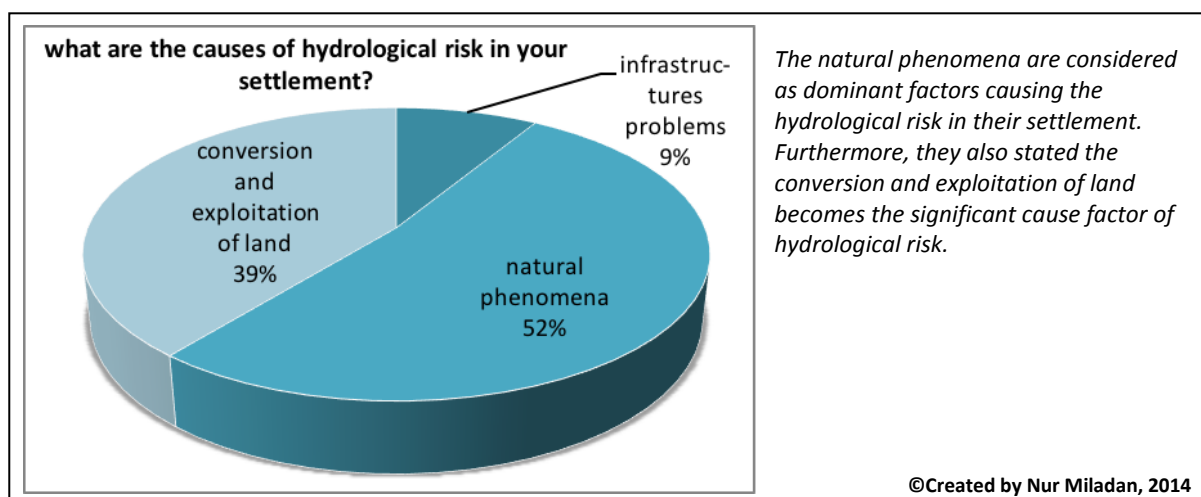
<sup>378</sup> *Monography of Panggung Lor Sub-district in 2013*, Semarang: Sub-district Office of Panggung Lor.

<sup>379</sup> Interview with a Javanese inhabitant who has lived there since 1981, entrepreneur.

<sup>380</sup> Interview with a Chinese inhabitant who has lived there since 1979, entrepreneur.

resources.<sup>381</sup> In this case, it seems that the community considered the hydrological risk, especially the *rob* risk, as a natural phenomenon only. It can be solved by their efforts and their socioeconomic capacities. Although *rob* disturbs their life when they occur, they continue to perform their daily activities. The cognitive resilience indicates the foundation of the community resilience process. These perceptions influence their adaptive efforts. They will always seek to reduce the hydrological risk in their local territory because they believe they can handle it through their adaptive efforts. The existence of a community self-help association for the hydrological risk reduction reveals the links between their perceptions and their behaviors to adapt to the hydrological risk in their territory.

Furthermore, community perceptions of hydrological risk causes foster mitigation efforts, such as house and street elevations. Although the inhabitants' statements on hydrological risk causes are diverse, three causes of hydrological risk are generally considered: natural phenomenon, conversion and exploitation of land, and also infrastructure problems. Furthermore, they state that the accumulation of these factors aggravates hydrological risks in their settlement.



**Figure 109. Perceptions of hydrological risk causes in the Tanah Mas Community**

Source: Questionnaires and interviews, 2013.

*The natural phenomena are considered as the dominant factor causing the hydrological risk in their settlement. Furthermore, they also state that the conversion and exploitation of land have become a significant cause of hydrological risk.*

By natural phenomena, the inhabitants refer to sea tides, the sea level rise caused by global warming and also the low elevation of the settlement. They consider the influence of

<sup>381</sup> Miniati, R., 2013, "Hospital Response and Natural Disasters", in Alexander, D., Masini, E, Mugnai, L. (eds), *Integrated Emergency Management for Mass Casualty Emergencies*, Amsterdam: IOS Press.

sea tides to be natural because they live near the sea, so *rob* risk always threatens their settlement. They state that the nature cannot be challenged but the risks can be reduced. Furthermore, polar ice is melting due to global warming and climate change. As a consequence, the sea level rises and threatens the settlement with inundation. Moreover, the sea water can enter easily because the settlement is on a plain area. The community sees the hydrological risk as preventable. They seek to reduce hydrological risk through community adaptive efforts.

The community also states that the conversion and exploitation of land aggravate hydrological risk in their settlement. The massive exploitation of groundwater causes land subsidence and thus, hydrological risk. The community use of water and artesian wells increases sea water infiltration. They use it to perform their activities but it impacts negatively their settlement. Nevertheless, they have difficulty avoiding groundwater use for their daily needs. The inhabitants also argue that the former fishponds and swamps influence the emergence of hydrological risk in their settlement. According to them, these lands are instable and consequently very vulnerability to inundation. In addition, the inhabitants assert that problematic urban infrastructures also cause hydrological risk in their settlement. They argue that the dike level of the Asin River is lower than the high tides, so their settlement is vulnerable to flood. Furthermore, they also state that the small proportion of green space (catchment area) increases the risk of inundation in their settlement. Inhabitants' statements describe these perceptions.

“[...] *rob* (risk) in our settlement is a natural effect, our settlement is close to the sea, so it is logical that our settlement is under the threat of flood [...]”<sup>382</sup>

“[...] it (flood and *rob*) is due to global warming, it is a natural phenomenon. Furthermore, the massive exploitation of groundwater causes land subsidence, so our settlement has been often inundated [...]”<sup>383</sup>

“[...] flood, especially *rob* (risk), is a natural cycle in Semarang City. Initially, this settlement was marsh and fishponds and then, it was built as residential area. We must accept that our settlement is vulnerable to flood because of this exploitation. But, initially, I did not think this settlement would be inundated. Now, I understand that this is a natural phenomenon caused by the melting of polar ice, so the sea water volume increases[...]”<sup>384</sup>

“[...] the causes for flood risk in our settlement are the bad condition of the drainage system, the lack of vegetation areas and our settlement is lower than the sea water surface [...]”<sup>385</sup>

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<sup>382</sup> Interview with a Javanese inhabitant who has lived there since 1996, worker for a private enterprise.

<sup>383</sup> Interview with a Chinese inhabitant who has lived there since 1988, entrepreneur.

<sup>384</sup> Interview with a Javanese inhabitant who has lived there since 1976, entrepreneur.

<sup>385</sup> Interview with a Chinese inhabitant who has lived there since 1982, formerly worked for a private enterprise.



Community definitions of the causes for hydrological risk demonstrate that the community understands the existence of hydrological risk in their settlement. According to Cutter et al (2008), the local understanding of risk is a part of community competence that influences the community resilience.<sup>386</sup> This case study demonstrates that community is able to understand the risk in their territory. Community definitions of flood and *rob* are based on their experiences. Because of the frequent occurrences, the community recognizes the characteristics of hydrological risk. They can distinguish the different types of hydrological risk, both flood and *rob*, although they do not perform different efforts to reduce them.

Nevertheless, community perceptions are similar to the argumentation of the municipality and researchers. The municipality has played a role in the community understanding of hydrological risk causes. Initially, the community did not know about land subsidence and how it furthered hydrological risk. They had only noticed the increase of inundation levels in their settlement. Furthermore, the community knowledge of the sea level rise caused by global warming also indicates that external factors such as socialization with the municipality and mass media have become sources for the community understanding of hydrological causes. Community heads have also influenced the perceptions of the other members.

“[...] I remember being invited by the (Department of) Environment, when the projects of development plan of Tanjung Mas Port were unfolding...I said that the dredging of the Asin River must be installed initially on the river belt (dike) to prevent the land from slipping down. After the dredging of the Asin River, the depth of land was about one meter, it was a black soil, indicating that the soils had slipped down. I’m not an expert, but I have seen it [...] a professor from Diponegoro University said that land subsidence eroded several centimetres in our area each year and I informed our community about this situation during P5L meetings. We are laypeople, we don’t know about land subsidence in detail, but we seek to do something for hydrological risk reduction based on what we experienced [...]”<sup>387</sup>

The community understanding of hydrological risk is produced by the combination of community experiences and interventions of urban stakeholders (municipality and experts). Community heads have played an important role through the creation of the local association. They are needed to mediate and circulate knowledge between the urban stakeholders and the community. The community understanding of hydrological risk is still limited and needs the intervention of urban stakeholders to build resilience.

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<sup>386</sup> Cutter, S.L., Barnes, L., Berry, M., Burton, C., Evans, E., Tate, E., Webb, J., 2008, “A Place-based Model for Understanding Community Resilience to Natural Disasters”, *Global Environmental Change*, vol. 18, Issue 4, pp. 598-606.

<sup>387</sup> Interview with A. Ibnu Soebroto, community head which has lived there since 1982, entrepreneur, chief executive of the P5L association.

### 3.2.2 Diverse reasons of the life in hydrological risk-impacted areas

The literature on 'place', especially the literature which sees 'home' as a particularly significant type of place, provides insight into the relationship between places and people's identities and psychological well-being; the dynamics of conflicts surrounding home-places; and the political-economy of home places.<sup>388</sup> In the case study, the community chooses to live in an area vulnerable to flood risk for specific reasons.

The reasons to settle in the case study area will be divided into three periods: before the emergence of hydrological risk (mid-1970s-end of the 1980s), aggravation of hydrological risk (1990s), and the creation of local association for the hydrological risk reduction (1996-recent). Before the emergence of hydrological risk, the community privileged the settlement accessibility, the location and financial factors. They considered the accessibility to urban centers and livelihoods areas, such as offices, markets, industrial areas and transportation areas. The distance between the settlement and these areas is approximately between one and four kilometers only. Furthermore, the access to loan also incited people to buy houses in residential areas at that time. Several community interviews evoke these situations.

“[...] This settlement is near the airport, station, and (centre) city. This settlement is also the first residential area in Semarang City since 1975. So, in 1987 we moved in here[...]<sup>389</sup>

“[...] 30 years ago, we decided to settle in Tanah Mas (residential area) because of its strategic location. It is near the centre city and also not far from my office [...]<sup>390</sup>

“[...] my wife worked in BCA (Bank Central Asia). At that time, we got a loan from *Bank Tabungan Negara* to buy a house.<sup>391</sup> We can ask a 15-year credit in 1981. We settled in 1982. And the Tanah Mas residential area was the first residential area in Semarang City and also maybe the first in Central Java (Province) since 1975[...]<sup>392</sup>

Likewise, family togetherness also became a reason to settle in the area. The massive and new housing development of the Tanah Mas Real Estate enabled big families to live in the same area in the 1970s and 1980s. Several inhabitants state that their families bought several houses in the settlement in order to keep fraternity among them and set up future houses for their children.

<sup>388</sup> Easthope, H., 2004, “A Place Called Home”, *Housing, Theory and Society*, vol. 21, Issue 3, pp. 128-138.

<sup>389</sup> Interview with Soekrisno Hadi (47-year-old), community head who has lived there since 1987, entrepreneur.

<sup>390</sup> Interview with Toto Subroto (60-year-old), inhabitant who settled in 1983.

<sup>391</sup> One of the national state banks in Indonesia which first offered loans for house ownership.

<sup>392</sup> Interview with R. Sri Widjatkiko (59-year-old), community head and entrepreneur.

“[...] Our grandparents have lived in Tanah Mas. They bought each child one housing unit so that their children do not spread [...]”<sup>393</sup>

Community perceptions illustrate the common criteria for housing preferences. The hydrological risk factor did not influence the choice to settle. Furthermore, it indicates that the Tanah Mas Real Estate is the valuable residential area in Semarang City at that period.

Nevertheless, the factors for settling there have varied a lot since the emergence of hydrological risk in the 1990s. They were not the only reasons for settling. The decline of property values at that period incited peoples (especially the Chinese) to take advantage from the situation. They thought it was a strategic location. This factor was more important than the existence of risk. The Chinese preferred to settle there because the settlement is close to the city markets which are sources of livelihood. Furthermore, the Chinese moved to the settlement because of historical factors. The Chinese dominated the population in the 1990s. Historical factors influenced the migration of Chinese people from the late 1980s to the mid-1990s. Safety was a factor due to the traumatic previous century. There had been many killing of Chinese people in the days prior to the Java War (1825-1830), they fled on boats at that period.<sup>394</sup> As a result, Chinese people preferred to settle close to the sea and it became part of the Chinese hereditary values in Semarang and Java. Furthermore, Chinese people are one of the ethnic minorities in Semarang City and gathered in one territory. Nevertheless, the Javanese people preferred to leave because of hydrological risk in the 1990s. Ethnicity was one of the factors for living with risk. Several community statements describe these situations.

“[...] In 1996, the Tanah Mas residential area was classified as the cheapest residential area. It is an affordable location near the city centre, and then I lived here. Moreover, inhabitants are open (togetherness) [...]”<sup>395</sup>

“[...] In the 1990s, houses of the Tanah Mas residential area were cheap. We settled here in 1993. Our family adapted to the environment and the community, so we feel comfortable here [...]”<sup>396</sup>

After the creation of the local association for the flood risk reduction, especially in the 2000s, people had several reasons for settling such as strategic location, the association for the flood risk reduction, fraternity, hockey places, good housing, government attention, hereditary properties, and limited resources.

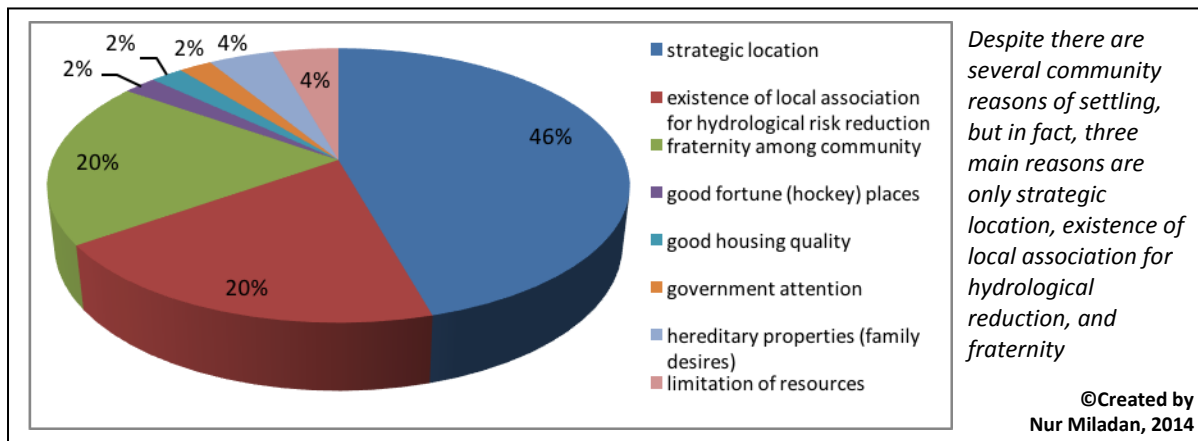
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<sup>393</sup> Interview with Eko Indriyanto (42-year-old), inhabitant who has always lived there.

<sup>394</sup> Noor, D., Mulyono, 1997, *Terbentuknya Pacinan Baru : Kasus Tanah Mas Semarang*, Semarang: Diponegoro University.

<sup>395</sup> Interview with a Chinese inhabitant (43-year-old) who has lived there since 1996-1997, entrepreneur.

<sup>396</sup> Interview with a Chinese inhabitant (55 years old) who has lived there since 1993, entrepreneur.



**Figure 110. Community perception of the reasons for settling in recent times**

Source: Questionnaires and interviews, 2013.

*Although there are several reasons for settling, the three main reasons are strategic location, the local association for hydrological reduction, and fraternity*

The strategic location is still the main reason for living in the settlement. It is more important than hydrological risk. They consider that the hydrological risk can be reduced by the collective efforts of community through the local association. Fraternity is also a factor. Community self-help efforts need the spirit of fraternity but they also increase it. This is one of the reasons why the location is considered so strategic. The risk factor is still taken into account in the community perceptions when they choose to settle in the case study area.

In addition, family desires are part of the inhabitants' reasons. Some of them mention the hereditary property rights as a reason to settle. They inherited houses from their parents or their parents gave it to them. So they seek to preserve it. The children's desires also influence the community choice. The children have to feel comfortable with their environment (schools and friends), so the parents respect their desires. Furthermore, several inhabitants also state that these are their first houses. So they want to keep their memories.

"[...] I have lived here since 1980 because I followed my parents. This house comes from my parents, I will preserve it. The other reason is the accessibility; it is easy to go to the city centre and office [...]"<sup>397</sup>

"[...] formerly, I actually wanted to move, the house would have been sold, and I will have moved upward (the hills of Semarang City) because of the flooding. I would develop my lands located outside the Tanah Mas settlement. But my children did not want to move, my wife also didn't want to move. Should I have moved alone? I was already comfortable. My children are girls, they are hanging out near the centre city. It is close and it is no

<sup>397</sup> Interview with Rendra Purwadhiguna (39-year-old), community head who has lived there since 1980, works for a private enterprise.



dangerous. For example, Mijen (one area of the Semarang hills) is dangerous for my family[...]"<sup>398</sup>

"[...] By coincidence, I am part of the Tanah Mas Company staff, this is my first house. I do not want to move out from the Tanah Mas settlement. During the period of high flooding (1990s), I did not move. Moreover, the recent *rob* (risk) has been solved by the P5L [...]"<sup>399</sup>

However, limited resources also influence community perceptions of why they live in the settlement. Because of their limited resources, they cannot buy houses in other settlements. They look for houses in other settlements that have the same conditions than their houses. But the price of these houses is higher. They cannot relocate and they have to remain in the case study area.

"[...] This area is quite strategic and also there is the P5L association. Initially, I would like to move out from the settlement, but the cost of relocation is beyond my means [...]"<sup>400</sup>

"[...] I have lived here for 31 years. I always thought I would go out from Tanah Mas but my revenue is limited. Today, *rob* threatens Tanah Mas, but I feel more comfortable thanks to the pump system managed by P5L. In fact, it has successfully solved *rob* (risk) [...]"<sup>401</sup>

The Chinese inhabitants also think that the settlement brings good fortune (hockey) in their life. They believe their business can gain the maximal profits thanks to their houses. Some inhabitants state that the profits of their business have increased since they settled in case study area. Although the correlation between business and houses is difficult to prove, they believe these situations. The Chinese nation believes the fortune of people is influenced by the trilogy "sky fortune, earth fortune, and human fortune"; the earth fortune defines luck accepted by the humans and comes from the earth through the house and the workplace.<sup>402</sup>

"[...] This place brings fortune, our business has been well established and the relationship with the neighbors has improved. Since our arrival in Tanah Mas, we pioneered the business and now, it is well established. We don't have the desire to move out, because if later we have more sustenance, we will use it for the house reconstruction. Moreover, we can elevate the floor and the roof to avoid the flooding [...]"<sup>403</sup>

"I don't have the desire to move from Tanah Mas. Here, I'm comfortable. My business, my home industry run well. I fit with my house, it gives luck [...]"<sup>404</sup>

<sup>398</sup> Interview with A. Ibnu Soebroto (60-year-old), community head who has lived there since 1982.

<sup>399</sup> Interview with Heriyanto (59-year-old), community head who settled in 1977.

<sup>400</sup> Interview with Poerwanto (70-year-old), who has lived there since 1980.

<sup>401</sup> Interview with Aryanto Soesilo (65-year-old), who has lived there since 1982.

<sup>402</sup> Chandramulyana, S., 2010, "*Pilih Rumah Kejar Hoki*", Jakarta: Elex media komputindo.

<sup>403</sup> Interview with a Chinese inhabitant (42-year-old) who has lived there since 1976, entrepreneur.

<sup>404</sup> Interview with a Chinese inhabitant (43-year-old) who has lived there since 1997, entrepreneur.

Additionally, the good quality of house also shapes the inhabitants' perceptions. The community considered their settlement as the first residential area where houses were constructed with good materials. They differ from the recent residential areas in Semarang City. Moreover, the inhabitants trust the government because it pays a particular attention to the hydrological risk reduction in the Semarang coastal area. The community expects a lot from the West Floodway rehabilitation and the retention basin development of Semarang River, government projects developed to reduce hydrological risk around their settlement. These initiatives can help the inhabitants return to their previous life. Several community statements describe these situations.

“[...] maybe, the retention basin will be effective. It will be a water catchment during the high tide. If it happens, our life will be quieter [...]”<sup>405</sup>

“[...] we expect the government project to be effective. The water elevation of the Asin River will recede, so our settlement will be protected from the flood and I will not think about moving out from the Tanah Mas settlement”<sup>406</sup>

Compulsion is not a main factor for settling in Tanah Mas because the community thinks they can overcome the hydrological risk in their life. Most of the inhabitants consider the hydrological risk as a disturbance and natural phenomena only. When they choose to settle, they think about the strategic location and the local association for the hydrological risk reduction. It indicates that the community believes that they can reduce and cope with the hydrological risk through their collective initiatives and efforts. This will be the basis for the community resilience process. The hydrological risk is considered as an element of community life that must be anticipated through collective efforts like the local association for the hydrological risk reduction.

### **3.3 Hydrological risk reduction models : community initiatives from partial to collective efforts and territorial problems**

Community perceptions underlie individual and collective initiatives for hydrological risk reduction in their settlement. These efforts become the adaptive efforts in the face of hydrological risk. Since the emergence of hydrological risk in the late 1980s, the community has implemented several mitigation efforts to reduce the hydrological risk, especially the *rob*

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<sup>405</sup> Interview with A. Bakar (66-year-old), community head who has lived there since 1978, entrepreneur.

<sup>406</sup> Interview with Surjanto (55-year-old), community head who has lived there since 1989.

phenomena in their territory. The community was always seeking to rehabilitate their settlement through house and street elevations like other communities in the Semarang coastal area. Furthermore, each individual household constructed modest barriers around their houses, notably doors surrounding the houses. Nevertheless, these efforts were only temporary solutions and in fact, their settlement continued to be inundated during the hydrological risk occurrences. These situations are confirmed by several community statements.

“[...] In the past, I often elevated my house. I renovated the house four times to avoid flood. Meanwhile, the community often elevated the local streets approximately 40 cm through self-help efforts. During the flood, we sought to save the valuables (house equipment) by placing them in higher zones in order to reduce the risk of damage. But today, it is different. The P5L association can solve the flood. We gave 22500 IDR (1,4 €) each month for the management of the P5L”<sup>407</sup>

“[...] we created small barriers in front of the entrance door to prevent inundation from entering the house and we also closed the channel (pipe) of household sewage water. But these are temporary (actions) [...]”<sup>408</sup>

“For the floor elevation, during the flood we traced a line on the wall and we gave distance 10 or 20 cm (from that sign). After a new flood, we traced a line again. This effort has become a manner to measure and determinate the floor elevation level in each household [...]”<sup>409</sup>

The community states that during the crisis, they always sought to do mitigation efforts, such as the placement of the house equipment and valuables in the safe space inside the houses (higher place). For them, the maximum level of inundation risk was always increasing and they sought to measure these levels during the crisis. The measuring of the inundation levels were used for the next house and street elevations and the reorganization of safe spaces inside the houses. These repetitive efforts are part of community customs.

Initially, the community, in particular each *RT*, always seeks to elevate their local roads. These actions depend on the consent of each *RT* during regular meetings of households.<sup>410</sup> In this case, they often discuss community projects of road elevation. They take collective decisions about the budgeting and development plans. The project is financed by the dues collected from households by the *RT* board members. The households stipulate that the amount of dues is based on discussions among them during regular meetings.

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<sup>407</sup> Interview with Poerwanto (70-year-old), who has lived there since 1980, pensioner of an Indonesian state-owned enterprise.

<sup>408</sup> Interview with Heru Tri Haryanto (46-year-old), community head who settled in 1986.

<sup>409</sup> Interview with A. Ibnu Soebroto (60-year-old), community head who settled in 1982.

<sup>410</sup> Regular meetings are part of the common community activities carried out every several weeks or months. They depend on agreements among the households. These meetings aim to discuss the issues, problems and development plans in their territory and also to take collective decisions.

Usually, they distribute the same amounts of dues among them. Sometimes, frictions among them occur when they disagreed on the amount. For instance, some households expect different dues because they have different economic resources. However, they find solutions through deliberation or vote.

Most of the *RTs* reconstruct local roads and change material. They switch from asphalt to paving and also proceed to street elevation. The community considers that the material changes could absorb the inundations more than before. However, several primary roads are still made of asphalt to signal the settlement entrance. After the frequent occurrences of inundations especially in the 1990s, each *RT* often re-elevated their local roads due to the frequent damages.

For instance, the Muara Mas road, one local street in case study area, was rehabilitated three times in 1987, 1997 and 2006. According to community heads, it was elevated about 40 to 50 centimeters each rehabilitation, thus a total of 1.5 meters approximately over the last three decades. Each project of road elevation also included the reconstruction of local drainages on the roadsides: the change of material (from non-paved into stone and cement) smoothed the water flow. However, non-paved drainages increased the sedimentation rate during the crisis.

Usually, these projects were given to elected contractors or building porters during the regular meetings. During these deliberations, the community created and chose the simple design of local road rehabilitations (determination of level elevation and materials). Sometimes, the elected contractors were themselves members of the community or colleagues. However, the *RT* board members could select designs and contractors, and then communicate these decisions to the community.

An executive team, which included selected inhabitants, supervised and evaluated the implementation of the *RT* projects. Usually, the members worked as voluntaries. At the end of the community projects, the executive team reported on the construction and budgeting and publicized them during the community meetings.





**Figure 111. Rehabilitation of local streets in the case study area**

Source: Primary survey, 2013; Komunitas Warga Perumahan Tanah Mas, “Pembangunan Portal dan Peninggian Jalan Kuala Mas RW XIV” [Photo], April, 29<sup>th</sup> 2012, retrieved December 28<sup>th</sup>, 2015, from <http://kuala-mas-rw14.blogspot.com>.

Nevertheless, the elevation of local roads produced problems among the *RTs* communities, and also among the households within the *RTs* communities. Because of the different elevations of local roads among the *RTs* areas, the lower areas were more vulnerable to the inundation than the other areas. These situations caused frictions among *RTs* communities. During the meetings of *RWs* communities, the delegations of *RTs* communities often experienced disagreements due to the different levels of local streets in their settlement. These situations produced social tensions among *RTs* communities.

“[...] indeed the efforts of some inhabitants in each RT/RW seemed successful, but actually they were carried out partially and only moved the problem. It means that the territories (RT/RW areas), which are less able to do house and street elevations or have no unity (little togetherness), become “victims” of the overflow of flood from other RT/RW areas [...]”<sup>411</sup>

After local road elevations in each *RT* community, households usually renovated their houses. The surface of non-renovated houses was lower than the reconstructed local roads, and consequently these houses were more vulnerable to inundation during the crisis. The non-renovated houses experienced higher inundation levels than the renovated houses. Furthermore, the types of house renovations depended on the economic affordability of each household, so consequently the house renovation models vary a lot. Households usually elevated the ground floors but they did not renovate roofs and walls. However, most of the upper middle class households could reconstruct their houses totally. The different forms of houses reflected individualistic behaviors and aroused envy among the households in *RTs* communities. They only sought to avoid inundations in their own houses and did not think about the conditions of their neighbors' houses. These situations produced social problems among the households in *RTs* communities. It certainly disturbed for the community daily life.

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<sup>411</sup> *Lintas sejarah P5L 1996-2010* (History of P5L 1996-2010), 2010, Semarang: P5L association.



Figure A:

There were no wall and roof renovations in this house. Meanwhile, the local road in front of the house had been elevated three times and reached 1.5 meters. Consequently, the distance between the local road and the road center is approximately 2 meters only. Although the owner constructed a fence to reduce the inundation impact, the house remained vulnerable to flood occurrences.



Figure B:

The house was renovated partially: floor elevation but no roof elevation. The floor elevation was carried out after the elevation of the local road in front of the house. Although this house is highly vulnerable to inundation, the floor elevation at least reduces the inundation level in the house during flood occurrences. Nevertheless, this renovation decreases the house quality because the sunlight cannot enter.



Figure C:

The house has been totally renovated. The surface of house and yard is higher than the local road. Furthermore, it is equipped with the high fence in order to reduce the inundation inside the house. Moreover, the local drainage is also covered in order to limit inundation in this drainage during the flood occurrences, in particular the rob risk.

©Modified by Nur Miladan, 2014

### Figure 112. The different conditions of house renovations to reduce the impact of flooding in the Tanah Mas Real Estate

Source: Primary survey, 2013

*Different conditions of houses renovations indicate different ways of households to reduce the flood impact in their houses. The various conditions of houses reflect the different economic resources of each household in the settlement. As a result, there are different impacts of inundation to the houses. It also produces social frictions in the community daily life.*





Figure A:  
A house is surrounded by a solid fence to reduce the inundation risk. However, the house has not a proper air circulation and also the sunshine cannot enter.



Figure B:  
Most of the houses have solid fences around, although the fences' conditions are diverse because of the economic resources and the desires of each household. However, most of the households have similar aims. They build fences to reduce the inundation impact in their houses. Furthermore, most of the house entrances are higher than the local road.

©Created by Nur Miladan, 2014

### Figure 113. Solid fence are built around houses to reduce the inundation risk

Source: Primary survey, 2013

*The building of solid fences is the common form of house adaptation to flood risk in this settlement. During the flood occurrences, these fences can reduce the inundation inside the houses. Nevertheless, the bad air cannot circulate and the sunlight cannot enter the houses. Consequently, humidity spurs the apparition of diseases.*



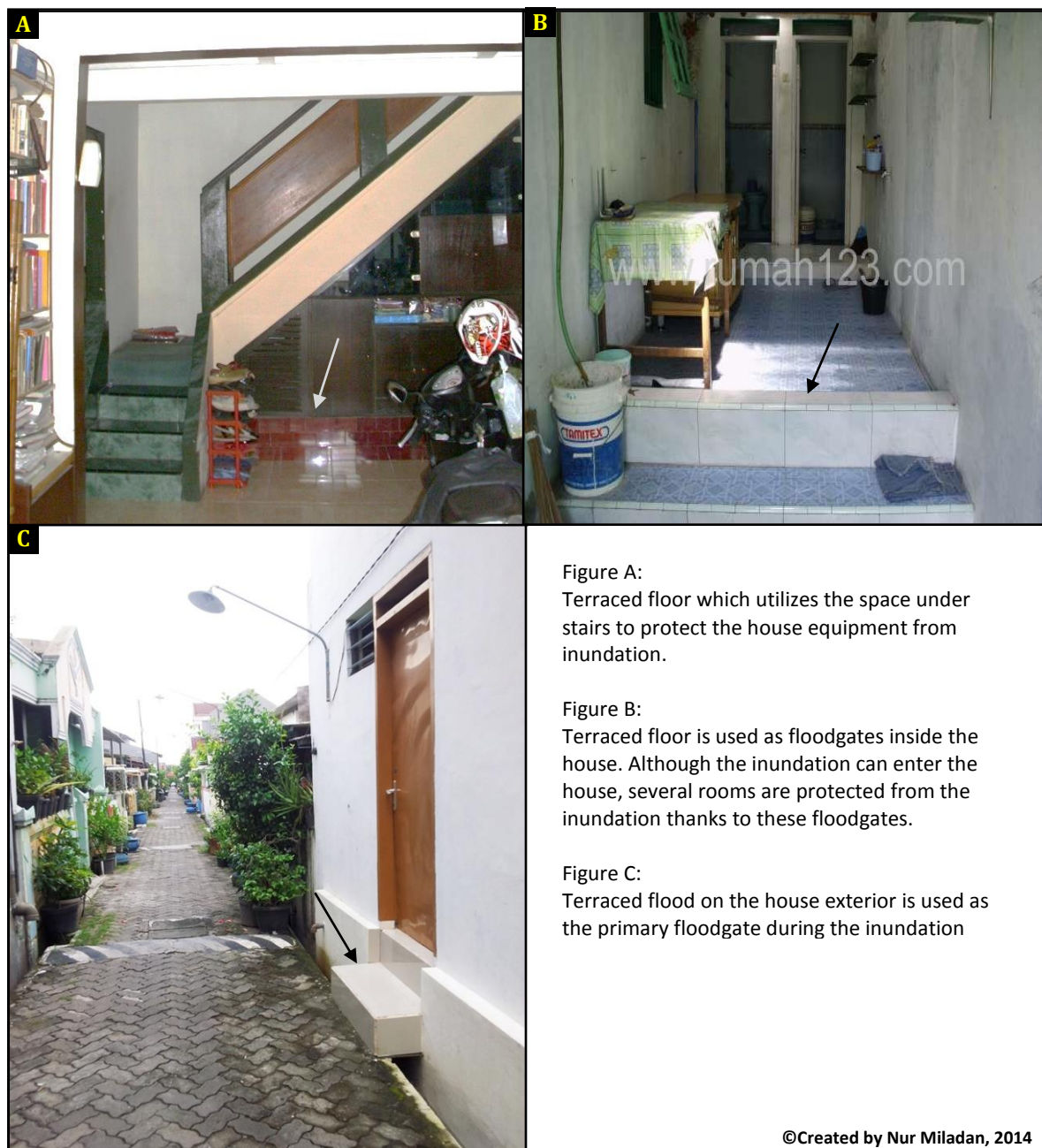


Figures A, B, and C feature the story houses of the Tanah Mas settlement. In the past, the houses were built uniformly. Households (owners with economic resources) developed story houses to reduce flood risk impact. The first floors (or second floors) can be used as a safe place for the house members, valuables and house equipment during flooding events.

**Figure 114. Story houses as a household effort to reduce the flood risk impact**

Source: Primary survey, 2013

After renovating house exteriors, most of the households also modified the house interiors. The terraced floors in the first floors were the most common modification inside the house to reduce the inundation risk. It prevented the inundation from entering several rooms that could be used as evacuation rooms during the flood occurrences. The dimensions of the terraced floors were based on the household experiences of previous inundation. Terraced floors were also developed around the house exteriors.



**Figure 115. The common modifications of floors in the Tanah Mas Real Estate**

Source: Primary data, 2013 and [www.rumah123.com](http://www.rumah123.com).

*Terraced floors show how community initiatives and practices are based on their experiences of previous flood occurrences. Nevertheless, inundation can still enter the house because the levels are unpredictable.*



Furthermore, most of the households sought to mitigate their house equipment with simple wood boards in the upper spaces inside the houses. Usually, this practice was implemented by households who do not have story houses (minimum two floors). They placed their house equipment above these simple boards in order to avoid the inundation risk. Likewise, households sought to place switches and socket vectors on the upper side of the walls. They anticipated electricity problems that could harm them during the flood occurrences. Moreover, they implemented the simple faucet system (open-close) on the water outlets in order to reduce the inundation risk inside the house.



**Figure 116. Wood boards and switches-sockets on the upper side of the walls**

Source: Primary survey, 2013; [www.rumah123.com](http://www.rumah123.com)<sup>412</sup>

*The use of wood boards illustrates how the community implements simple tools to reduce the inundation impact inside the houses. However, these community practices indicate adaptive forms to flood risk based on their economic resources and their knowledge.*

<sup>412</sup> A house for rent situated in the Tanah Mas Real Estate. It was advertised on a property website in 2012.

Besides the efforts of each household, the community also sought to implement social work (*kerja bakti*)<sup>413</sup> to reduce flood risk in their territory. Since the emergence of *rob* phenomena in their settlement, the community sought to implement social work every 2 to 3 months.<sup>414</sup> These activities focused on cleaning the sedimentation and waste on the local drainages. The community sought to clean up the waste and sedimentation after each occurrence of *rob* (flood) in order to minimize the impact of the next inundation. Nevertheless, the implementation of these activities, in particular in the 1990s, was constrained by the lack of community participation. Several community heads argued that they had difficulty involving upper middle class members (the majority) in the social work.

“[...] the positive impact is that the community can be harmonious (relationship) and there is togetherness to solve the problem of *rob* risk through the P5L (association). In the past, it was difficult to involve inhabitants in the collective efforts such as social work. They preferred to elevate their own houses because they thought this is more effective and they did not think about their neighbors and the environment. Initially, it was also difficult to demand dues for pump system [...]”<sup>415</sup>

“[...] Initially, Tanah Mas was the “warehouse” of the rich inhabitants. They were able to elevate optimally their houses to avoid flooding. At that time (1990s), it was difficult to involve the community in social work. *Rob* events occurred again and again, so the community was too “lazy” to do social work. The most important was that the house was not inundated [...]”<sup>416</sup>

Furthermore, social work (*kerja bakti*) belongs to Javanese culture and was accepted with difficulty by other ethnic groups (especially the Chinese inhabitants) in the 1990s. The different cultures and the individualist behaviors made social work inefficient at that period. Likewise, because of the frequent occurrences of flooding in the 1990s, households only focused on cleaning up their houses after the crisis because this is not easy and require a couple of days. However, some middle-class households preferred to use the services of underemployed people (three to five) to clean up their houses because of their bustle of work. Other households preferred to leave their houses and stay at other places such as hotels and family houses when the inundation level is high. They spent routinely additional costs for the house maintenance, rehabilitations and other efforts to avoid flood occurrences.

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<sup>413</sup> In the Indonesian grand dictionary, *kerja bakti* is defined as activities to do collectively through the spirit of *gotong royong* for collective purposes. Cf. “*kerja bakti*”, *Kamus Besar Bahasa Indonesia (grand dictionary of Indonesian language)* [Web], retrieved December 28<sup>th</sup>, 2015, from <http://kbbi.web.id/kerja>. Usually, the community carries out this activity regularly based on agreements made during community meetings.

<sup>414</sup> Interview with community heads in 2013.

<sup>415</sup> Interview with Agus Setyawan (56-year-old), community head who has lived there since 1992.

<sup>416</sup> Interview with Heriyanto (59 years), a head of community who has lived there since 1977.



Along with the growth of flood risk in their settlement in the 1990s, the Tanah Mas Real Estate community realized that the elevations of local roads and houses are only temporary efforts. They felt they would always have to contend with the increase of hydrological risk. These elevations could only reduce the flood impact on the short term (one to two years). Then, they had similar problems in the following years. They understood that the elevations of house surfaces could only be done three or four times maximum. Afterwards, they must do total houses renovations because the distance between the roof (plasterboard) and floor was too low. They also realized that these elevations produced social and territorial problems among them. However, the community was seeking to discuss solutions to these problems during their routine meetings of *RTs* or *RWs* communities.<sup>417</sup> Debates and differences on the collective efforts for flood risk reduction in their settlement occurred among them and often they found themselves in deadlocks. Each *RT* community continued to elevate their area without the cooperation of other *RTs* or *RWs* communities.

“[...] on June, 5<sup>th</sup> 1996, the heads of communities RW.03, RW.04, RW.05, and RW.06 carried out the meeting in the house of the RW.02 community head to state their rejection of the plan because the RW.02 community blocks the local drainages in their territory. Nevertheless, the head of RW.02 community is convinced that the pump system is a more appropriate solution than “the competition” for the road or house elevations [...]”<sup>418</sup>

In 1996, the Tanah Mas Community agreed on community collective efforts to reduce hydrological risk, in particular *rob* phenomena, and created a local association in their settlement. The local association was named *Panitia Pelaksana Proyek Pompanisasi Panggung Lor/ P5L* (Executive Committee of Pump System Project of Panggung Lor Sub-district). The community considered that the pump system project was an appropriate solution because the water surface of the Asin River had been higher than the surface of settlement, so the inundation discharge could be pumped. Furthermore, they also realized that the elevations of local roads and houses caused social and territorial problems, so they sought to implement another endeavor, the pump system.

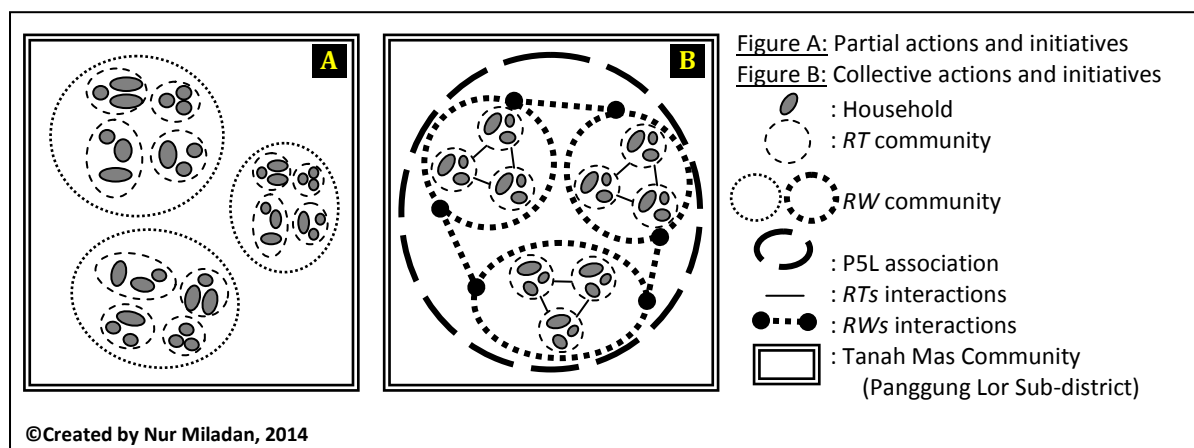
However, these situations indicate the changes in community initiatives and practices regarding the flood risk reduction in their settlement. Local initiatives are needed to develop collective efforts to counter the inefficiency of repetitive and partial efforts. Furthermore,

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<sup>417</sup> The routine meetings of *RT* community are attended by the households, while the *RW* community meetings can be attended by households or only representatives (heads) of *RTs* communities depending on agreements between *RTs* communities.

<sup>418</sup> *Lintas sejarah P5L 1996-2010* (History of P5L 1996-2010), *ibid.*

these situations indicate the development of community resilience process rooted in local initiatives and practices without the intervention of top-down planning by the municipality.



**Figure 117. Social interactions change to reduce hydrological risk**

Source: Miladan, 2014

*Indeed, the hydrological risk impacted negatively the community and settlement, but it changed social interactions and fostered collective community efforts. Positive interactions emerged among them such as the spirit of community togetherness for flood risk reduction in their settlement. Community efforts have emerged at the scale of RTs communities but they have different economic resources. It also increased the role of RWs communities in the social system, particularly the RWs heads as mediators. They mediate the collective efforts for hydrological risk reduction in the framework of the P5L association.*

### 3.4 The role of community adaptive capacities in the transition of urban resilience process

The community is a part of vulnerability relating to the urban risk. The community is an object that must be preserved by urban institutions during disaster occurrences, but the community is a subject able to develop adaptive capacities to reduce urban vulnerability. The urban resilience process involves urban institutions that implement plans and projects to reduce the disaster risk and the community also seeks to develop adaptive capacity to anticipate the lack of institutional initiatives, and urban system. Community adaptive capacities can be determined by the role of urban institutions and external stakeholders (such as NGOs), although these capacities are based also on community experience and knowledge. However, community adaptive capacities can be analyzed as part of the urban resilience process. On the one hand, these capacities can accelerate the urban resilience process, but on the other, community adaptive capacities and the improvement of urban infrastructures are integrated efforts to develop urban resilience process. Nevertheless, community practices to reduce disaster risk are often not integrated in the development of urban resilience fostered by urban institutions. Consequently, urban problems such as social frictions and territorial inequalities can occur.

### 3.4.1 The community association is a key element of the local resilience process

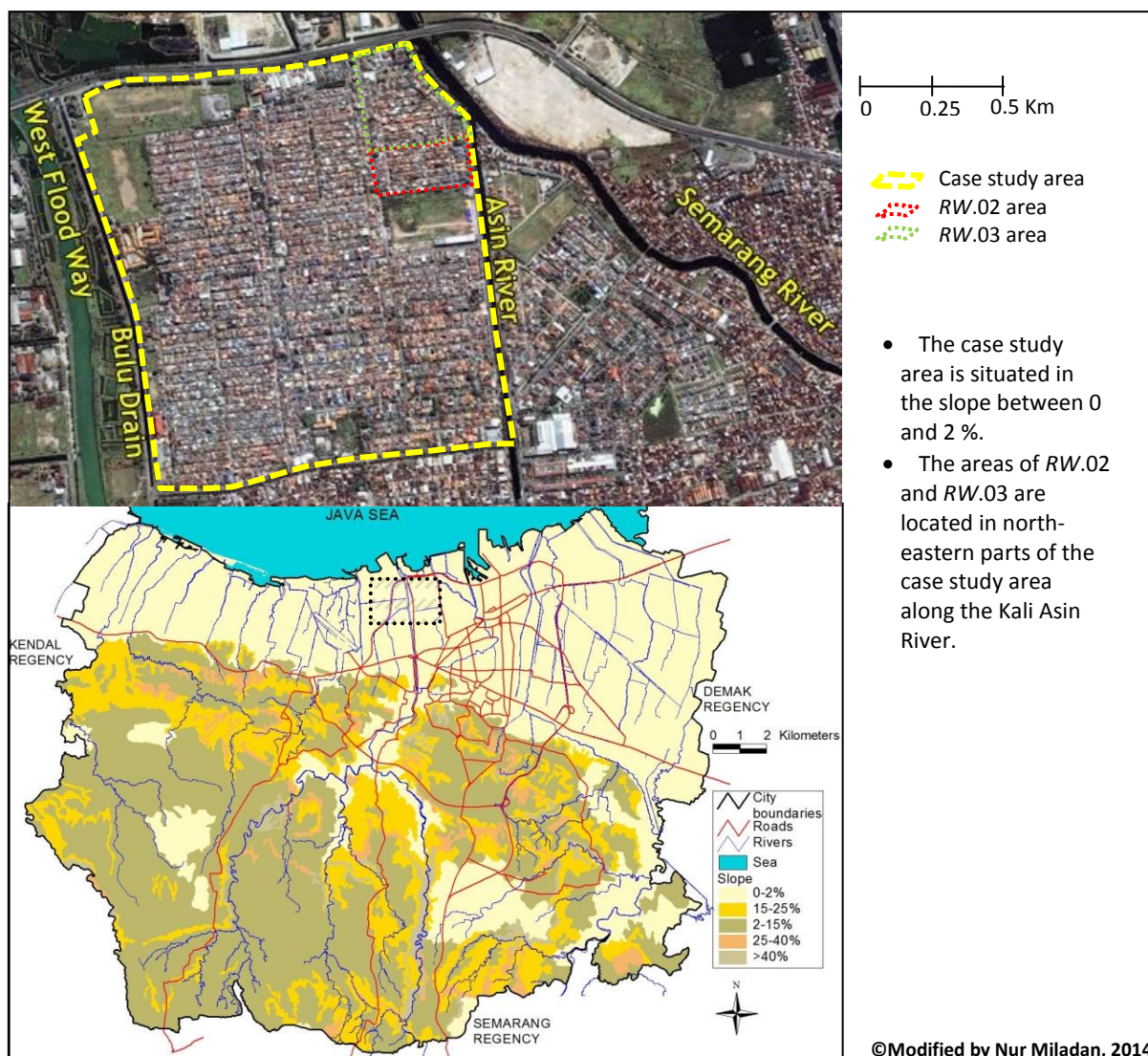
The creation of P5L signals the emergence of community initiatives to reduce the hydrological risk impact through collective efforts based on self-help. These efforts appeared when the hydrological risk, especially *rob* phenomena, increasingly threatened their settlement between 1994 and 1995.<sup>419</sup> Nevertheless, collective efforts were difficult to implement because the *RWs* and *RTs* communities have the different solutions to reduce hydrological risk. Initially, most of them thought the elevation of settlement with fill soil was the best solution they could implement. Nevertheless, these efforts could not be implemented by the communities due to the high cost of construction. As a result, comprehensive collective efforts could not be carried out because there was no community consensus. Only the elevation of local streets could be implemented in each *RT* community and it depended on the economic resources of its members. However, the community succeeded in finding a new way to develop collective efforts for risk reduction in their settlement. The transformation of collective efforts was engineered by change agents of community. A change agent is anyone who has the skill and power to stimulate, facilitate, and coordinate the change effort, and also they may be either external or internal.<sup>420</sup> In this case, the change agents were the local inhabitants who wanted a new kind of collective efforts because they thought that the existing collective efforts were not efficient enough to eradicate the hydrological risk in their territory.

The primary change agent in this case was the head of *RW.02* community in Sub-district of Panggung Lor (A. Ibnu Soebroto). He is an activist in several social organizations such as the political party, People's Representative Council of Semarang City in 1999-2004. He even became a journalist for a local newspaper in Semarang City. He became head of *RW.02* community in the 1980s, because the community placed a great trust in him. His experience as a journalist and also senator led him to participate actively in social activities. He is one of the initial inhabitants in the settlement, so he knows about the evolution of settlement. This is why the community has repeatedly chosen him as community head until recently. The idea of a local association was inspired by A. Ibnu Soebroto who was trying to build a pump system in the *RW.02* area. He succeeded in convincing the *RTs* communities, members of *RW.02*, that the pump system is the best solution for flood risk reduction in their settlement.

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<sup>419</sup> Interviews with several board members of P5L and several heads of community in 2012-2013.

<sup>420</sup> Lunenburg, F.C., 2010, "Managing Change: the Role of the Change Agent", *International journal of management, business, and administration*, vol. 13, n° 1, pp. 1-6.



**Figure 118. Topographic situation of the case study area**

Source: UDMIS, *ibid.*; Ikonos satellite image of Semarang, 2008

Although the municipal map cannot describe the topography of the case study area in detail, the interviews of community heads explained that the northeastern parts are the lowest areas of the settlement. The RW.02 and RW.03 territories became the most vulnerable parts of the settlement to hydrological risk, in particular *rob* phenomena.

A. Ibnu Soebroto argued that only the pump system can eradicate the hydrological risk in their territory because the settlement surface is lower than the Asin River level which is the “source” of the hydrological risk, in particular *rob* phenomena in their settlement. He convinced the RW.02 community that only the pump system can protect their local drainages from inundation and reduce the elevation of inundations during flood occurrences. He also contended that the duration of inundation can be minimized if they use the pump system. In 1994-1996, the inundations were difficult to discharge from their territory into the urban drainage (Asin River) after flood occurrences. As a result, inundations lasted a long time in



this settlement and destroyed infrastructures such as local streets. He stated that the elevation of houses and roads cannot reduce the inundation risk, although their houses and local roads are not inundated for temporary periods, but the risk of inundation is very high because the local drainages are always inundated. Furthermore, A. Ibnu Soebroto warned his community that the *RW.02* is one of *RWs* areas with the worst risk of inundation due to its area topography. So the pump system had to be used to reduce the inundation levels and duration.

Initially, the *RW.02* community wanted to implement a pump system supported by the blockages of the local drainages in their area. The *RW.02* community discussed the plan with the surrounding *RWs* communities (*RW.03*, *RW.04*, *RW.05*, and *RW.6*). Surrounding *RWs* communities disagreed with the *RW.02* community. Nevertheless, the *RW.02* community convinced the surrounding *RWs* communities to develop the pump system in these *RWs* areas.

However, this community plan could not be carried out because the head of the Pangung Lor Sub-district and the developer of the Tanah Mas Real Estate disagreed. They considered that the pump system in 5 *RWs* areas could create conflicts between these *RWs* communities and 9 other *RWs* communities including *RW.01*, *RW.07*, *RW.08*, *RW.09*, *RW.10*, *RW.11*, *RW.12*, *RW.13*, and *RW.14*. However, the head of the Pangung Lor Sub-district and the developer of Tanah Mas Real Estate decided to facilitate meetings to anticipate possible conflicts. They considered that the pump system would not be efficient. It would also necessitate high costs and burden households economically. They argued that the most effective effort was to fill soil (land reclamation) through collective efforts of the *RWs* communities. Different argumentations and opinions about the best way to reduce risk are explained by the diversity of educational, professional, and economic backgrounds in the community. Most of the inhabitants went to university and were part of the upper middle class. Finally, communities built consensus to delegate the decision to the heads of *RWs* communities. As a result, 12 *RWs* communities voted in favor of the pump system and 2 *RWs* communities against.<sup>421</sup> So, the pump system would be implemented in the settlement.

“[...] elevations of houses and roads are only displacing the problem (inundation), not solving it. It means that the inundation is only transferred to surrounding *RTs*. If the surrounding *RTs* are not able to elevate roads and houses (limited economic resources), that is really a pity. But because you have elevated your house, my territory is inundated. This is why there is friction and conflict in our territory. And then there was a problem. Initially, when *rob* receded, our settlement was not inundated. But in 1995 it was not the case anymore. So, when *rob* receded, our settlement was still inundated, for three days at least

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<sup>421</sup> *Lintas sejarah P5L 1996-2010* (History of P5L 1996-2010), *ibid.*

after the occurrences [...] so, because of that, in 1996, we tested the pump system. I remember that at the beginning, there were several people who said I was crazy. But actually, the result of pump system surprised the community. When the inundated drainages dry, many inhabitants found a lot of sea fishes after the drainage water receded. Based on that, the community realized that the only solution to the problem was the pump system. We installed only a few pumps. Finally, in August 1996, when we celebrated the Independence Day, we officially created the P5L association [...]"<sup>422</sup>

The pump system in the Tanah Mas Real Estate is not only implemented in the Pangung Lor Sub-district area, but also in one RW of the Pangung Kidul Sub-district (RW.05). The Pangung Lor Community decided to make this RW community participate in the P5L programs. This RW area is close to the Pangung Lor area and also it is part of the Tanah Mas Real Estate.



Nonetheless, the Panggung Lor Community did not invite others *RWs* communities of the Kuningan Sub-district, also parts of that real estate. The Panggung Lor Community heads argued that the drainage system of the Panggung Lor Sub-district and the Kuningan Sub-district one are not integrated. They asserted that the P5L service area is only limited by the Asin River in the east and the Brotojoyo River (drainage) in the south. Their settlement is located on the west side of the Asin River, while the Kuningan area is on the east side of the Asin River. Moreover, the Kuningan area is equipped with the pump station that the municipality provided in 2001.

P5L was formed officially by the community agreement of Panggung Lor District which was ratified by the head of that sub-district on July, 29th 1996. The *RWs* communities chose A. Ibnu Soebroto as the chief of the executive committee of P5L because he initiated the pump system in their settlement. Furthermore, the executive committee of P5L sought to involve *RWs* community heads and also leading figures in order to increase the trust and participation of communities in P5L programs. However, the initial management of P5L was operated by the Tanah Mas Company. The community reckoned that the company had an experience of financial management and could assume the operation and maintenance of the pump system. They considered that the company, as developer, has also the responsibility to maintain the sustainability of the settlement. Nevertheless, the implementation of P5L actions experienced many constraints in the initial years of the P5L existence. Although P5L committee members included many delegations of *RWs* communities, committee members rarely participated in the management.<sup>423</sup> The lack of the community dues proved to be the main reason for the inefficiency of P5L programs. It limited the pump system development. Initially, the community was reluctant to give dues because they did not know whether the pump system was effective. The Tanah Mas Company was responsible for the financial management and had difficulty collecting community dues. Due to the community financial constraints, the pumping houses were built with the financial help from the Tanah Mas Company, while the pumps' installation was financed by a bank loan. The P5L executive committee decided to borrow about 35.000.000 IDR ( $\approx$  2187.5 €) to pay for the pumps and electrical network. Despite the installation of the pump system, the lack of community dues made the pump system maintenance impossible. Furthermore, the Tanah Mas Company decided to withdraw from the financial operational management of P5L. They stated that the collection of community dues was too difficult and they could not finance P5L programs with

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<sup>423</sup> *Lintas sejarah P5L 1996-2010* (History of P5L 1996-2010), *ibid.*

the company budget. They preferred to hand over the management to the community in the meeting of P5L committee executive at the beginning of 2004. Due to the lack of pump system maintenance, the settlement continued to be inundated during *rob* occurrences. At that period, some inhabitants preferred to move to other areas because the inundation risk was not solved.

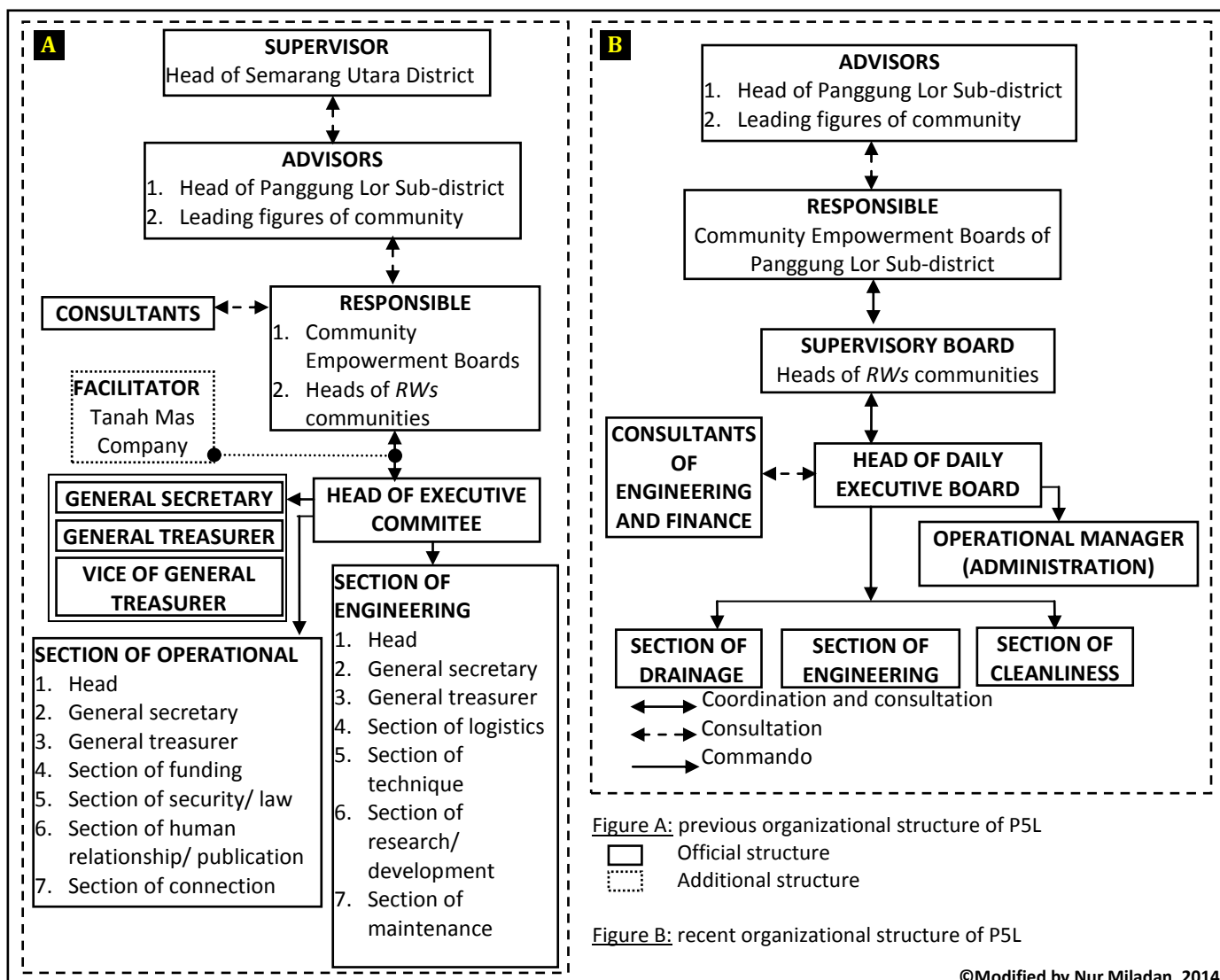
Since then, the management of P5L has been independently assumed by the community who proceeded to significant changes. They decided to change the structure of P5L organization. They developed a daily executive board to handle the pump system maintenance and the community financial management. This feature has become an important element of the P5L association. The daily executive board increased the community trust and awareness of its actions. Indeed, the P5L management has sought to involve the *RWs* communities to support the collective efforts. However, the daily executive board was very needed to ensure the effectiveness of the pump system management in the daily life. They realized that the daily executive board was more effective than the previous management of P5L. Likewise, the community has changed the acronym of P5L from *Panitia Pelaksana Proyek Pompanisasi Panggung Lor* (Executive Committee of Pump System Project of Panggung Lor Sub-district) to *Paguyuban Pengendali dan Penanganan Air Pasang Panggung Lor* (Association of Controlling and Handling of *Rob* Risk in Panggung Lor Sub-district) since 2001. They expected the change of acronym to increase community awareness of P5L actions. The transfer from the executive committee to the association was supposed to increase the community sense of belonging. Community heads argued that the meaning of the association would emphasize that the P5L organization was owned by the entire community and independently managed by community self-help efforts. The executive committee emphasized that the P5L management was implemented by several leading figures and Tanah Mas Company only.

“[...] Equally, the name of association is P5L. Initially, the executive community was changed association. This change is supposed to give the impression of community togetherness. And recently, P5L has been recognized nationally. The proof is that I have been invited 2 times by the Ministry of Public Works to present P5L in November 2011 and December 2012. Actually, the community participates easily because we have the same fate and a feeling of empathy emerged. After empathy came sympathy. In the past, it was only empathy. The evidence is that the dues used to be collected door to door, but now the community is aware and they give independently. We don't need to collect door to door again.”<sup>424</sup>

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<sup>424</sup> Interview with A. Ibnu S, community head (*RW*) and director of P5L.





**Figure 120. The organizational structure of P5L**

Source: Informasi seputar P5L dan kinerja P5L (Information and performance of P5L), 2010, Semarang: P5L Association.

The recent organizational structure of P5L indicates streamlining measures of organization to support the effectiveness of the association. Indeed, the previous organization structure had many members and sections of executive committee which involved many heads and leading figures of communities. It was aimed to encourage the active participation of the community. In fact, most of the sections of executive committee did not function. In fact, the sections of operational and engineering were carried out by the facilitator (Tanah Mas Company) due to the lack of active participation of executive committee members. Nonetheless, the streamlining of association members aimed to ensure the good performance of the association, including the financial and maintenance aspects of the pump system. Furthermore, the community participation is clearer when the heads of RTs communities are the supervisory board which is a delegation of the communities. The supervisory board monitors and evaluates the performance of the executive board. It ensures that the pump system management is effective every day. These situations illustrate how the community learns by doing and develops efforts for flood risk reduction based on self-help.



**Figure 121. P5L association and members of the daily executive board**

Source: Primary survey, 2013.

Furthermore, the acronym change reaffirmed the objective of P5L association to reduce the hydrological risk, in particular *rob* phenomena. The community emphasized the *rob* risk reduction because the risk threatens in the community daily life, but they could predict the impact of that risk in their settlement. Indeed, the pump system could reduce also the impact of flash flood, but it could not function optimally due to the limitation of pumps capacities and numbers. The investment for additional pumps was certainly expensive, but the community has limited economic resources. The P5L association had financial problems due to these high costs covered by community dues. Likewise, the community also argued that the flash flood rarely occurred in their settlement, so the development of an efficient pump system was not an urgent necessity for them.

Since the creation of the daily executive board, the P5L association has been managed professionally. The daily executive board has managed the administration and the pump system management. The administration aspects relate to the financial management and the community relationship. Meanwhile, the pump system management aspects include drainage maintenance, the engineering of the pump system, and the cleanliness of the settlement. These managerial aspects are controlled by the head of daily executive board.

The supervisory board functions to monitor and to evaluate the management of P5L association which is implemented by the daily executive board. The decisions of the daily executive board are conveyed to the supervisory board which represents the communities.

The members of the supervisory board (heads of *RWs* communities) have facilitated the communication between the communities and the daily executive board regarding the activities and management of P5L. The supervisory board has also the responsibility to convey the communities' aspirations, initiatives and complaints regarding the management of P5L. Furthermore, the P5L association is also endorsed by the head of Panggung Lor Sub-district and the community empowerment board (*Lembaga Pemberdayaan Masyarakat Kelurahan/ LPMK*) as advisory and responsible board members. The existence of P5L was recognized by the sub-district authorities as a community self-help organization (*badan keswadayaan masyarakat*) in 2008.<sup>425</sup>

“[...] at the beginning, the association had no status or legal basis. The policies and the management of organization are based on the consensus among *RWs* and *RTs* community heads. However, on June, 11<sup>th</sup> 2008 in the limited plenary meeting of P5L facilitated by the community empowerment board, it was attended by three delegations of each *RW* community and also leading figures of the community. Therefore, P5L is under the legal umbrella of the community empowerment board of Panggung Lor (sub-district)...Nevertheless, as head of sub-district, the community empowerment board does not have the direct authority to supervise the operational management of P5L [...]”<sup>426</sup>

This condition clarified the legal positioning of P5L in the organizational structure of the society. Furthermore, it ensured the sustainability of P5L as a community self-help organization. However, since 1996, P5L has been recognized by the Head of Panggung Lor Sub-district indicating the municipal awareness of the organization. In addition, the community empowerment board has only been responsible for the organization so that the community has used self-reliance to implement the P5L programs. This evolution shows how the community drive has been taken into account in the collective efforts for hydrological risk reduction in their territory.

However, the self-reliance of P5L means that the financial management (the pump system maintenance, the administration, and the monthly salaries for the daily executive board) depends on monthly community dues. The dues amount was decided by the

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<sup>425</sup> *Badan keswadayaan masyarakat (BKM)* is an institution of collective leaderships in a community at the level of sub-district. It has the role of board decision-making through a participative approach. Cf. Directorate General of Human Settlements (Ministry of Public Works), 2012, “*Petunjuk teknis: pengembangan badan keswadayaan masyarakat (BKM)/ lembaga keswadayaan masyarakat (LKM)*”, PNPMP Kota: Jakarta. In Indonesia, the concept of community self-help organization (*BKM*) has been developed since the 2000s along with the development of the project *Proyek Penanggulangan Kemiskinan di Perkotaan (P2KP)*. The national government implemented this project to minimize the impact of the 1998/1999 monetary crisis in urban communities.

<sup>426</sup> *Informasi seputar P5L dan kinerja P5L (Information and performance of P5L)*, 2010, Semarang: P5L association.

community with the consent of the supervisory board. According to the head of the daily executive board, the total operational management cost of P5L is about 25.000.000 IDR per month. The principal cost is the pump functioning, especially the electrical cost.

**Table 8. Example of annual balance of P5L association (2009)**

Description	Note	Amount
Beginning balance in January, 1 <sup>th</sup> 2009	3.1.	36414529, 68 IDR (2275,90 €)
Revenues until November 2009	3.2.	
- Regular dues (of community)	3.3.	283963925, 00 IDR (17747,7453 €)
- Others		511223, 22 IDR (31,95 €)
<b>Total of revenues</b>		284475148, 22 IDR (17779, 70 €)
		320889677, 90 IDR (20055,60 €)
Expenditures until November 2009		
- Cost of administration (office)	3.4	24118322, 00 IDR (1507,39 €)
- Cost of pump functioning (operational)	3.5	168836728, 00 IDR (10552,29 €)
- Cost of employees (of daily executive board)	3.6	82489721, 00 IDR (5155,60 €)
<b>Total of expenditures</b>		275444771, 00 IDR (17215,30 €)
Balance in November, 30th 2009	3.7	45444906, 90 IDR (2840,30 €)
<b>Annotate:</b>		
- Regular dues include dues contributions from all households (in 15 RWs communities)		
- Others include bank interests (451223, 22 IDR/ 28, 20 €) and the financial help from the Pangung Lor Sub-district (60000 IDR/ 3,75 €)		
- Each annual balance of P5L association was audited by a public accounting firm		

Source: Laporan pertanggungjawaban kinerja pengurus P5L 2007-2010 (responsibility report of executive board performance of P5L 2007-2010), 2010, Semarang: P5L association.

*This accounting indicates that the P5L association is professionally managed by the executive daily board, like a company. Furthermore, it shows that regular community dues are the principal resource of P5L financing. The transparency in financial matters is to maintain the community trust of P5L management.*

To increase the community awareness of collective efforts and thus, community dues, P5L stakeholders, in particular the daily executive board and the supervisory board, often publicized the importance of the P5L association to the communities. They considered that the pump system has given several benefits to the communities in terms of social, economic and psychological aspects. Social aspects related to the meaning of fraternity or social interaction in the communities. The common fate empowers the community to implement collective efforts by the self-help community. The economic aspects related to the effectiveness of pump system that increased property, reduced diseases and health costs, and limited the damages to house equipment and vehicles. Likewise, the psychological aspect related to the elimination of anxiety and shame in the community.

P5L stakeholders publicized pump system benefits during meetings attended by the heads of RTs communities and facilitated by each RW community. They sought to convince



*RTs* communities that the pump system was managed by P5L and was the best solution for the hydrological reduction in their settlement.

“[...] Indeed, initially, we were experiencing difficulty publicizing the benefits of the pump system to *RTs* communities. However, we continued to enjoy them. Thanks to the *RWs* meetings, they understood these benefits. Furthermore, the active commitment of the *RWs* heads convinced the community that the pump system was the best solution for our settlement. Moreover, this pump system finally succeeded in solving *rob* in the settlement, so they felt the direct benefits [...]”<sup>427</sup>

However, the effectiveness of the pump system for the hydrological risk strengthened the P5L management, the community trust and thus, the existence of P5L. During the *rob* occurrences, their settlement was not inundated unlike the surrounding settlements in the Semarang coastal area. This situation increased the community trust to support P5L. Since that time, the community has a great trust in P5L as the best community self-help effort for hydrological risk reduction in their settlement. The increase of community trust and awareness was revealed by the amount of community dues. Communities have the same vision of the collective efforts for the hydrological risk reduction in their territory. The community believed that the pump system can serve all the *RWs* areas without negative impacts on *RWs* communities. Several interviews with community heads describe these conditions.

“[...] P5L (association), which we established on September, 2<sup>th</sup> 1996, is very effective. Recently, local drainages around the houses of communities can be dry. This association is purely community self-help efforts without the aid of other stakeholders. Its management is well organized and there is a daily maintenance of the pump system. What must be improved is the community awareness of how to dispose of waste in the local drainages and the payment of community dues on time [...]”<sup>428</sup>

“[...] P5L is very effective. It is proven, our territory was not inundated during *rob* events, our community becomes unified (togetherness), and also our practices are recognized in Indonesia (P5L was presented in the meetings of Ministry of Public Works) [...]”<sup>429</sup>

Furthermore, the increase of community trust in P5L related to the transparency of P5L management. The daily executive board has been in charge of the pump system functioning and maintenance in the daily life. The supervisory board, which includes the

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<sup>427</sup> Interview with Soesbijanto (63-year-old), community head who has lived there since 1976 and member of P5L supervisory board.

<sup>428</sup> Interview with Susilowati, who has lived there since 1979.

<sup>429</sup> Interview with M. Syafri (43-year-old), who has lived there since 2002.

heads of *RWs* communities, controlled and monitored the daily executive board. The community believed that the association is managed professionally through community self-help efforts. This condition strengthened the sense of community belonging.

Likewise, the self-reliance of P5L association related to the role of community in the management of the association. Indeed, the control and evaluation of the organization is carried out by the supervisory board. However, members of the supervisory board (heads of *RWs* communities) represent delegations of each *RW* community. Heads of *RWs* communities have an important role in the management of P5L. They are the mediators between the community and the daily executive board. Each decision of the supervisory board regarding the P5L management is first examined during the meetings of each *RW* community which are attended by the heads of *RTs* communities. In addition, they have the responsibility to convey the aspirations of the households for the management of P5L association.

Although there is a hierarchal structure, the community is involved in the decision-making and the collective efforts for the hydrological risk reduction in their territory. This community structure underlines the important role of the heads of *RWs* and *RTs* communities in the management of P5L. The effectiveness of the community heads can influence how good or bad P5L performs. In addition, the role of the community heads (15 *RWs* and 124 *RTs*) is reflected in the public deliberation which is carried out every three years and facilitated by the Community empowerment board. It aims to evaluate the performance of P5L association and also to select new P5L stakeholders, in particular for the daily executive board. The decisions of the community heads reflected the aspirations of community. However, A. Ibnu Soebroto is still trusted by the community as the chief of daily executive board. The community believed that he consistently managed the P5L association and initiated the pump system in their settlement. Several inhabitants' statements explained the reasons for renewing A. Ibnu Soebroto as the chief of daily executive board.

“Purwanto (head section of financing of P5L) (said): [...] his attitude (A. Ibnu Soebroto) is responsive and spontaneous, especially for decision-making. For instance, once, there were floods or *rob* (events). He was so responsive, directly contacted all friends in P5L and invited to work on the field. Furthermore, his leadership in the organization is very good. He knows a lot about flood and *rob* problems in this territory [...] Soesbiyanto (head of *RW*. 01) (said): In the environment of Pangung Lor Sub-district, Ibnu Soebroto is known as familiar and open-minded with the community. In the organization leadership, he always uses the principle of transparency. However, he is not authoritarian and dominant. Furthermore, he has never intervened in the duties carried out by his friends because he believes in the capacities of others [...]”<sup>430</sup>

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<sup>430</sup> “Rintis pompanisasi atasi kepungan banjir”, *Harian Seputar Indonesia*, December 30<sup>th</sup>, 2012.

Besides the public deliberations, P5L has used other mechanisms to take collective decisions: the daily meeting (can be attended any time by the daily executive board only), the limited plenary meeting (can be attended any time by the daily executive board, supervisory board, community empowerment board), the expanded plenary meeting (can be attended in emergency situations by daily executive board, supervisory board, head of sub-district, community empowerment board, leading figures, representatives of family welfare movements<sup>431</sup>), working meeting (can be attended by daily executive board, supervisory board and leading figures to discuss the additional programs), and extraordinary working meeting (can be attended by daily executive board, supervisory board, head of sub-district, community empowerment board, leading figures, representatives of organization of empowerment of family welfare for discussing extraordinary issues that need a rapid solution without public deliberation).

These mechanisms demonstrate that the P5L clear management actively involves the community in the initiatives and decision-making of collective efforts for the hydrological risk reduction in their territory. These mechanisms also indicate that the community awareness of the hydrological risk is strengthened by local initiatives. The community has implemented approaches of learning by doing in their collective efforts. Moreover, these mechanisms also prevented social friction because in community deliberation, each *RT* (or *RW*) community has the same rights to participate in the development of the collective efforts for the hydrological risk reduction in their territory.

Furthermore, the P5L management seeks to increase the community participation through the development of motto and vision of organization, indicating that P5L is a community collective effort. The motto of “P5L exists, because of you” and the vision “To create a community and environment in Tanah Mas that are not threatened by flood, an environment that is clean, beautiful, and secure” describe P5L as the result of community initiatives. Its purpose is to serve the community. A vision statement is an articulation not of

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<sup>431</sup> The family welfare movement (*Pembinaan Kesejahteraan Keluarga/PKK*) is a national movement which has its roots in the community, and in which women are the prime motivators. The formation of PKK cadres at all levels is based on Ministerial Decree No. 27/1961. It then became a passive regime institution, whereby every Indonesian woman automatically becomes a member as soon as they get married and gain the status of housewife. Cf. Imelda, J.D., 2011, *Mobilizing Motherhood: Case Study of Two Women's Organizations Advocating HIV Prevention Programs in Indonesia*, PhD Dissertation in FMG: Amsterdam Institute for Social Science Research (AISSR), University of Amsterdam.

purpose, but of a preferred future for the organization.<sup>432</sup> This vision of P5L encouraged the community expectation of a settlement situation not threatened by flood.

The community involvement is not limited to the P5L management and development. They also participated in P5L programs such as the cleaning of local drainages in order to support the performances of the pump system. The heads of *RTs* communities invited the households to actively participate in social work. These activities had a positive impact on the community, fostering fraternity, the spirit of *gotong royong* among them to support P5L programs. The diversity of backgrounds in the community can be unified by the feeling of fraternity in the collective efforts.

“[...] if we want to ponder on the flood events, we can see that the “invasion” of *rob* risk occurred in our settlement every day. It brought a wisdom that increased the spirit of *gotong-royong* and the fraternity among our heterogeneous community [...]”<sup>433</sup>

Likewise, the community participation to the monthly dues has been very important for the management of P5L. The fares of dues depend on the house size. The fare for the house type A is 35.000 IDR (2.19 €) per month, while it is 22.500 IDR (1.40 €) per month for the house type B. For the type house C and CM, the fares are about 10.500 IDR (0.66 €) and 6.500 IDR (0.40 €) per month. The shop house in Telaga Mas street and in Kuala Mas street are about 30.000 IDR (1.87 €) and 15.000 IDR (0.94 €) per month. In addition, the house which is also used for business purposes is also charged about 10.000 IDR (0.62 €) for each small enterprise, 20.000 IDR (1.25 €) for each medium enterprise per month. These fares have been agreed by the community since 2011. These dues have been known several folds of adjustments. For instance, before the 1st April 2011, the fare of type house A was only 22.500 IDR (1.40 €) per month. Meanwhile, community dues were about only 1000 to 1500 IDR (0.06 to 0.09 €) per month in 1997.

The fares of community dues are determined through the deliberation of the heads of *RWs* communities. However, the heads of *RWs* communities took into account the aspirations of the *RTs* communities before taking decisions regarding the community dues. The amount of these dues was adjusted with the calculation of the total cost of P5L


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<sup>432</sup> Gurley, D.K, Peters, G.B., Collins, L., Fifolt, M., 2015, “Mission, Vision, Values, and Goals: An Exploration of Key Organizational Statements and Daily Practice in Schools”, *Educational Change*, vol. 16, Issue 2, pp. 217-242.

<sup>433</sup> Speech of the chief of daily executive board (A. Ibnu Soebroto) which conveyed in the public deliberation of P5L in January, 10<sup>th</sup> 2010.



management (pump maintenance including machine, electricity, and administration including office equipment and employee salaries) for each year and then divided by the numbers of house types in the P5L service area. However, the cost of pump system maintenance (such as the increase of electricity costs) is in fact the principal factor that increases community dues over the last years. They considered that the house types represent the economic resources of each household. The house types are proportional to the cost of house maintenance. In addition, they took into account the economic benefits enjoyed by community thanks to the pump system. The owners of shop houses and house-enterprises are charged different fares after consideration of the principle of economic benefits. The efficiency of the pump system helps these owners perform their economic activities normally. They believed these are measurable and easy criteria that take into account equitable principles for the community. In fact, there are less spacious houses (type A and type B) than small houses (type CM and type C). Consequently, the consensus of liberation was siding with the households in small houses who expected to have different dues.

TRANSLATION OF ARCHIVE		ORIGINAL ARCHIVE	
<b>ADJUSTMENT OF THE FARE OF MONTHLY DUES OF P5L FOR COMMUNITY/ MEMBERS</b> IMPLEMENTED EFFECTIVELY (SINCE) APRIL 1 <sup>ST</sup> 2011			
3. FARE OF MONTHLY REGULAR DUES			
HOUSE TYPE	FARE (IDR)		
A	22.500	35.000	
B	15.000	22.500	
CM	7.500	10.500	
C	4.500	6.500	
RUKO TELAGA MAS	10.000	30.000	
RUKO KUALA MAS		15.000	
4. HOUSE/ RESIDENCE WHICH IS ALSO USED FOR THE ACTIVITIES OF ECONOMIC (ENTERPRISE) HAS ADDITIONAL MONTHLY DUES BASED ON CRITERIA: MEDIUM ENTERPRISE: 20.000 IDR SMALL ENTERPRISE: 10.000 IDR			
VISION: TO CREATE THE COMMUNITY AND THE ENVIRONMENT OF TANAH MAS (SETTLEMENT) THAT ARE NOT THREATENED BY THE FLOOD, THE ENVIRONMENT THAT IS CLEAN, BEAUTIFUL, AND SECURE			
			
©Modified by Nur Miladan, 2014			

**Figure 122. The bulletin of fare adjustment for community dues in 2011**

Source: P5L archive, 2011

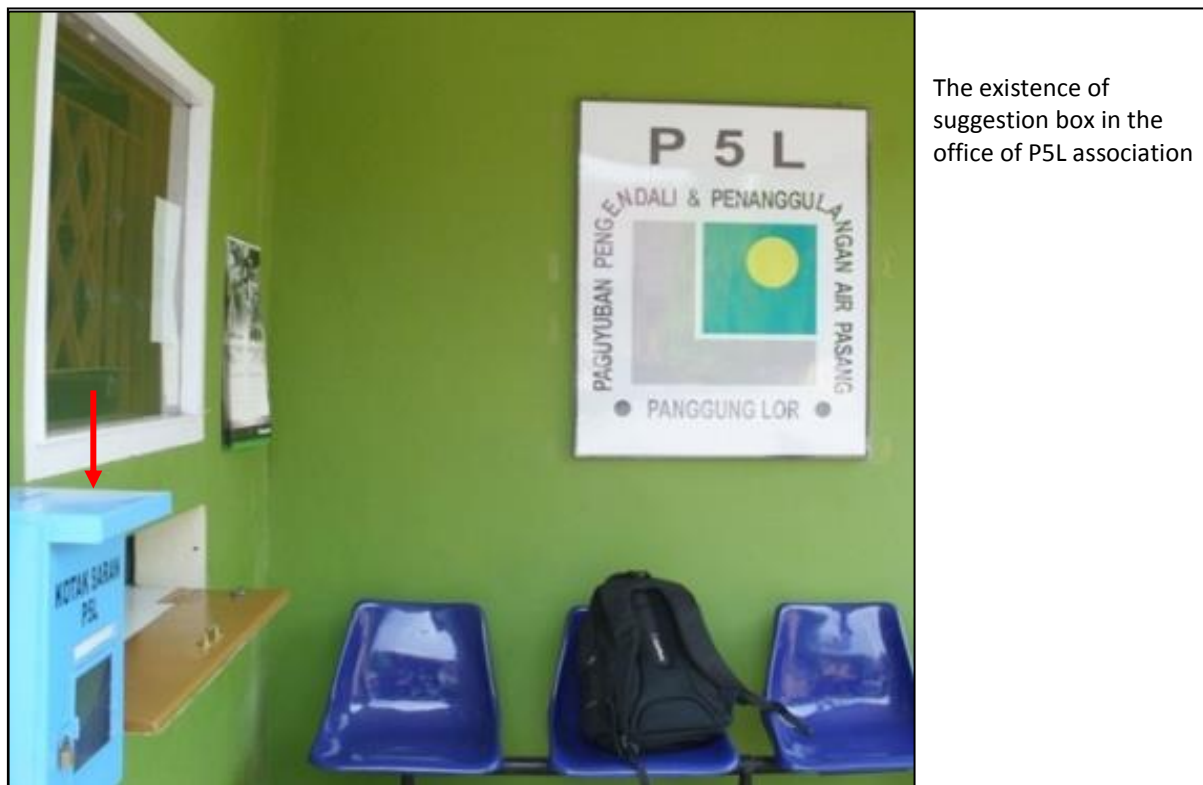
The collection of community dues is organized by the heads of *RTs* and *RWs* communities. Each head of *RTs* community organizes the collection of household dues and then they give these dues to the *RW* community head. Afterwards, *RWs* community heads transfer the dues to the P5L management (financial accounting). This mechanism is carried out every month and then the P5L management must report on community dues every three months. The report is evaluated by the supervisory board. In order to facilitate the collection of community dues, the community, through the supervisory board, decided to use the provision of wages for the collection of community dues. Each collector in *RT* community gets a fee about 3.5% of the total amount of *RT* monthly community dues, while each collector in *RW* community gets a fee about 1.5% of the total amount of *RW* monthly community dues. This fee calculation is based on the work load of the collectors. They considered that the work load of the collectors in *RTs* communities is heavier than for the collectors in *RWs* communities. The collectors in *RTs* communities must provide direct service to collect households' dues.

Considering the importance of community trust in the management of P5L, the stakeholders, in particular the daily executive board, must conduct a transparent financial management. They must release quarterly and annual reports on financial management. In addition, the association activities and administration must be transparent. These reports must be conveyed to the supervisory board every three months and then the supervisory board transfers the P5L reports to the community through the *RTs* community heads. Moreover, every household has the right to have its complaints and suggestions directly conveyed to P5L stakeholders and also to check the reports on financial management anytime.

“[...] “disease” of organization is suspicious. (For example), perhaps the money is used by me, if there is the seed of suspicion, the organization will disintegrate. So we are very careful in how we manage the association and the community money. We, including me, must take seriously the community mandate, that's the key. The community trust was not easy to gain, so now we must keep it seriously [...]”<sup>434</sup>

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<sup>434</sup> Interview with A. Ibnu Soebroto, as chief of daily executive board in 2013.



The existence of suggestion box in the office of P5L association

**Figure 123. The suggestion box for P5L association**

Source: Primary survey, 2013

*The suggestion box is a modest manner for P5L stakeholders to receive community complaints and suggestions. It indicates how the transparency principle is carried out by the P5L association to maintain the community involvement and trust.*

These facts explain how the association is developed through local initiatives and collective efforts in order to reduce the hydrological risk in the territory. However, the community trust is a key element in this process. Furthermore, the existence of change agents in the community accelerates the implementation of collective efforts that foster local resilience.

### **3.4.2 The pump system: a modest local infrastructure for the hydrological risk reduction based on local initiatives**

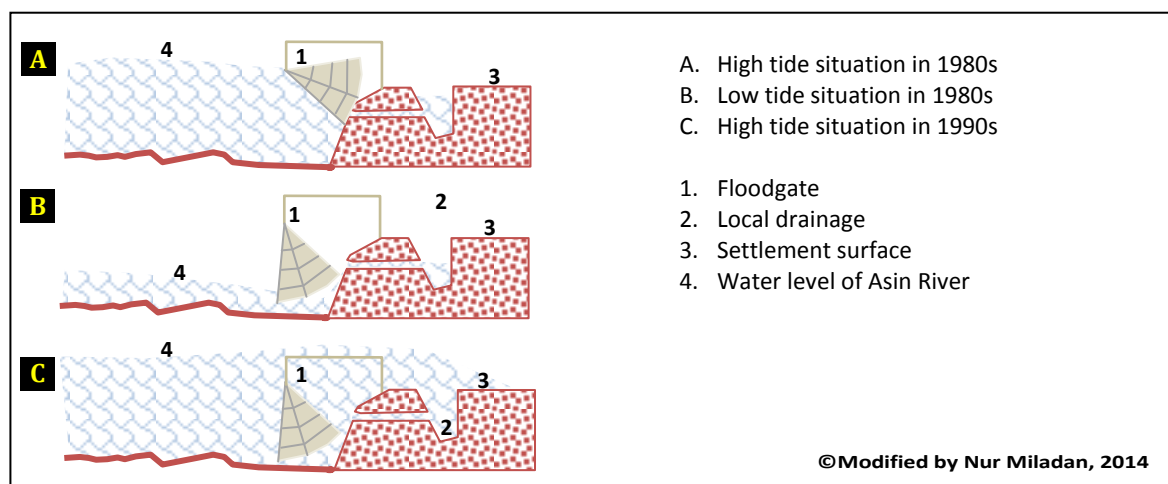
The P5L association is the first community self-help association focusing on the development of pump system for the hydrological risk reduction in Semarang City. The community claimed that they initiated the pump system development for the hydrological risk reduction in Semarang City. The surface of the settlement is lower than the Asin River level. This is why they developed the pump system. The community stated that their experiences of

street and house elevations produced social problems and also that they were only temporary and repetitive solutions.

The development of the pump system in the Tanah Mas settlement was carried out by the community without the intervention of government and NGOs. The community stated that the initiative of the pump system development is based on community experiences and decisions, in particular the role of change agents in the community.

However, the floodgate existence has been built by the developer since the apparition of *rob* risk at the end of the 1980s. At that time, the developer used simple automatic floodgates without electricity. During the tidal sea situation, floodgates could close automatically and conversely, they opened automatically during the low tide. The developer realized that the coastal settlement should have a flood security system.

Nonetheless, the growth of hydrological risk made these floodgates ineffective. These infrastructures depend on the water level and in fact, these were influenced by the water level rise of the Asin River. In fact, in the 1990s the water level of this river was higher than the settlement surface, and consequently the floodgates did not work properly.



**Figure 124. Illustration of the floodgates created by the developer**

Source: Interviews with several community heads, 2013

*Although the floodgates could reduce the hydrological risk impacts during the rob events in the 1980s, the system could not anticipate these impacts in the 1990s because the water level of the Asin River was higher than the settlement surface (including the level of floodgates). Land subsidence aggravates the frequency of rob events in the settlement. Furthermore, in the 1980s, the developer did not suspect the rapid growth of hydrological risk.*

Due to the failure of the floodgate system, the settlement was often inundated during the *rob* events in the 1990s. These situations forced the community to develop the pump



system. The community continued to utilize the existing floodgate system, but they upgraded it with the providing of submersible pumps<sup>435</sup> around these floodgates. The operating of these pumps is connected to electricity and automatically depends on the water level. It will switch on automatically when the water level increases (hydrological risk events), and switch off automatically when the water level goes back to normal.

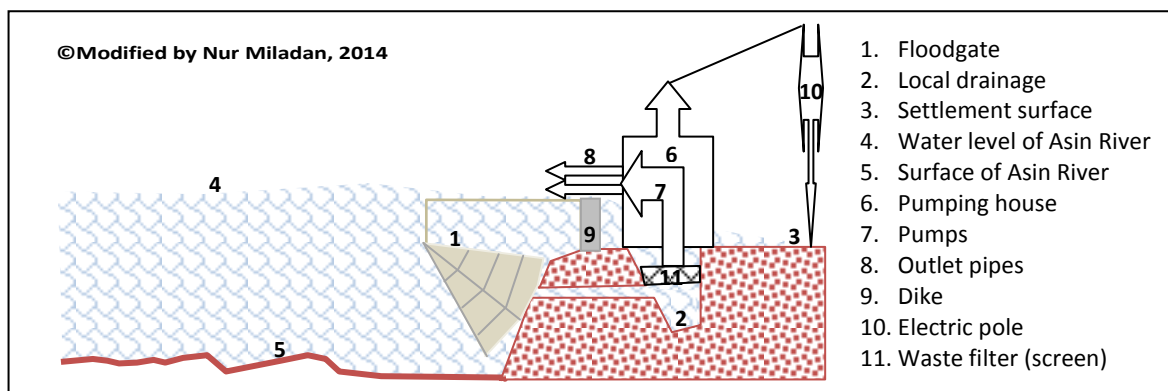


**Figure 125. The pump system of P5L association**

Source: Primary survey, 2013

*The simply equipped pump system shows how the community implemented their initiatives based on the community experiences. The waste filter and outlet pipes indicate that the community does not use high-technology tools and operate a simple pump system.*

<sup>435</sup> Submersible pumps are used for the removal or transfer of sewage, waste water or storm water. It is designed to operate with the complete pump and motor submerged in the water they are pumping. Cf. Grundfos Ecademy, *Basic pump principles pump types* [Pdf], retrieved December 28<sup>th</sup>, 2015, from <http://au.grundfos.com>.



**Figure 126. The illustration of the pump system mechanism created by the community**

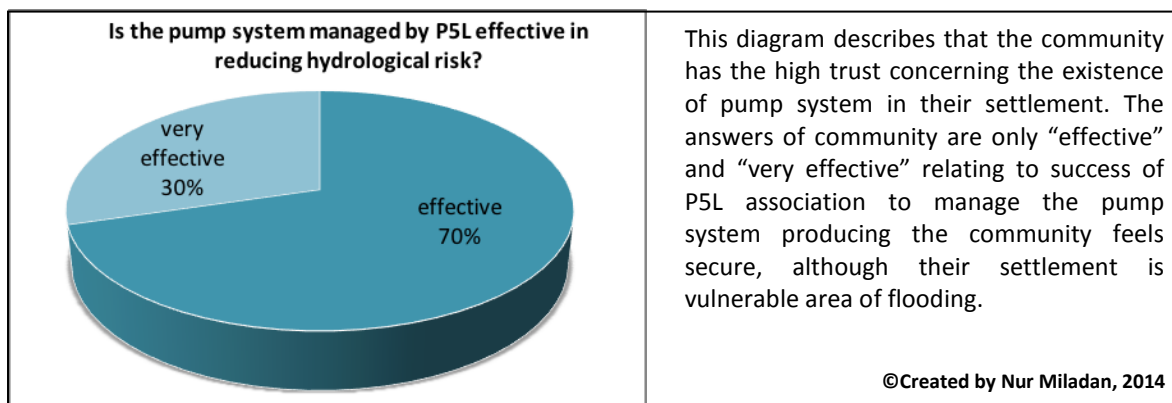
Source: Interviews with several community heads, 2013

*This system can reduce the hydrological risk impact in the settlement. Nevertheless, it is very dependent on electricity. During the heavy rain occurrences, the state electricity company (perusahaan listrik negara) often switches off the urban electric network instead of the system maintenance. Consequently, the pump system depends on a genset (diesel generator). The genset has limited capacities, so during the events, the pump system does not function properly and the hydrological risk impact cannot be avoided by the community. In addition, this pump system is very vulnerable to damage because the pumps are burned by waste. Therefore, they are supported by a waste filter designed with three layers including big, medium, and small screens in order to avoid waste on pumps.*

Initially, P5L bought six second-hand pumps from fishing entrepreneurs whose business collapsed in Kendal Regency.<sup>436</sup> These pumps were installed along the Asin River and the operating of these pumps needed specific electrical networks 3 KVA because each pump needs approximately 30.000 Watt. However, because of the effectiveness of the pump system, the community was willing to give dues for the development and operating. At that time, dues were about 20.000 to 87.500 IDR (1.25 to 5.47 €) per household.<sup>437</sup> The community stated that the pump system in their settlement can solve the *rob* risk, but it is not designed for the high flooding due to the heavy rain that lasts more than three hours and the flash flood coming from the Semarang upland areas. Most of them believe that the system is effective to reduce the *rob* risk and can also minimize the impact of flash flood events in their settlement. The high *rob* events could be reduced through the pump system in three to four hours only. Before the installation of the pump system, the settlement was often inundated during several days.

<sup>436</sup> Regency located on the western side of Semarang City.

<sup>437</sup> "Semarang Kaline Banjir, Semarang Laute Banjir", *Kompas*, May 4<sup>th</sup>, 1997.



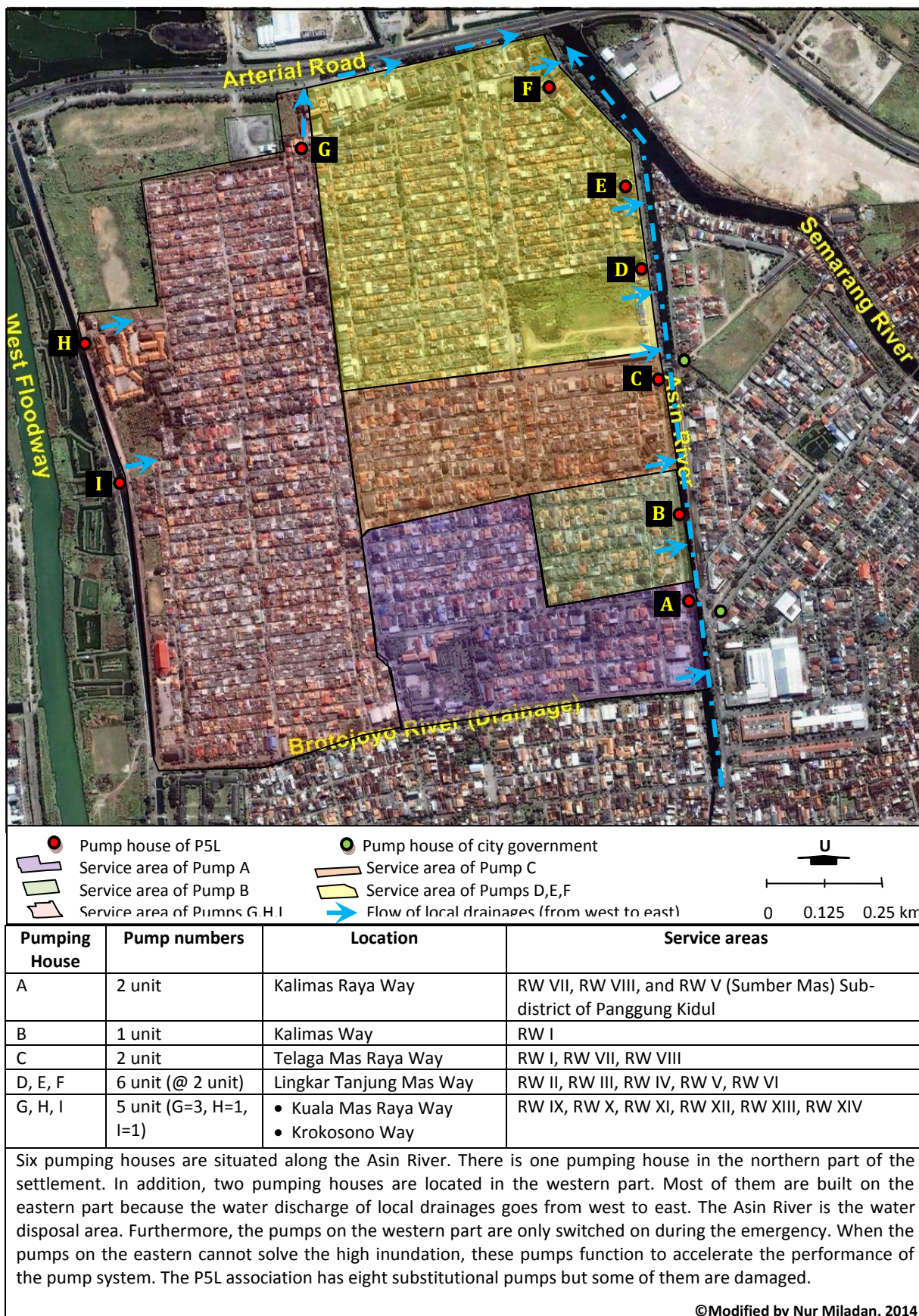
**Figure 127. Community perception of the pump system effectiveness in their settlement**

Source: Questionnaires to the community, 2013

This diagram indicates that the community has a great trust in the pump system of their settlement. The community answers are only “effective” and “very effective” because the P5L association is considered very successful in its management of the pump system. As a result, the community feels secure, although their settlement is vulnerable to flooding.

Nowadays, 24 pumps were installed in 9 pumping houses placed along the nodes of the drainage system in their settlement. Each pumping house covers different areas. There is one pumping house serving only one *RW* area, but otherwise the other pumping house serves six *RWs* areas. Each pump measures 10 inches and can aspirate the inundation about 60 liters per second. Each pumping house includes one to three pumps aspirating the inundation from the local drainages and then transferring it to the urban drainages, particularly the Asin River. However, the P5L association stated that the pump numbers are not enough to anticipate the high flooding (flash flood from the Semarang uplands). This pump system needs additional pumps.





**Figure 128. Existing pumps installations and pump system mechanism**

Source: Ikonos satellite image of Semarang, 2008; *Informasi seputar P5L dan kinerja P5L* (Information and performance of P5L), *ibid.*; *Lintas sejarah P5L 1996-2010* (History of P5L 1996-2010), *ibid.*



According to P5L, the high flooding can be solved with the pump system supported by 40 pumps at least. But consequently, the addition of pump numbers will certainly increase community dues. Furthermore, the pump system operates optimally (all pumps function at full time) in order to accelerate the water discharge process during the high inundation risk. This system certainly helps the community keep its composure in the daily life.

“[...] actually, the existing pumps are ideal to solve the high tide (*rob* risk). However, if the community wants to avoid the high flooding due to the heavy rain and flash flood, our pump system must ideally be supported by 40 pumps at least or each pumping house must have four pumps. 40 pumps will discharge the inundation at the minimum speed of 2400 liter/second. This is why the elevation of dikes is still needed in order to prevent the overflowing of the West Floodway or the Bulu Drainage (western side of the settlement) and the drainages are adjusted to the Panggung Kidul Sub-district (south side of settlement). Furthermore, the local drainages inside the settlement must be normalized (expanded size).”<sup>438</sup>

The pumping house also functions as a floodgate to manage the water discharge coming from and going in the settlement. All local drainages are dammed and the water discharge is managed by the pump system every day. During the hydrological risk events, the floodgates are blocked and at the same time, the pumps aspirate the inundation from local drainages, and then transfer it to the Asin River. The topography of the Bulu Drainage and the West Floodway is higher than the settlement surface. Consequently, local drainages cannot flow naturally to these urban drainages. The water discharge of the settlement depends on the existence of the Asin River. During the heavy flood events, the inundation arrives from all urban drainages such as the Asin River, the West Floodway and the Bulu Drainage. This settlement has experienced several heavy flood events over the last decade (2002, 2004, 2006, 2009 and 2010).<sup>439</sup> The pump system has worked very hard to discharge the inundation and needed a long recovery process.

The operating of the pump system is carried out by six field officers every day. They work from 8 am to 4 pm to maintain the pumps and local drainages. However, during the flood crisis, they work overtime to ensure the pump system functions properly. They maintain the cleanliness of local drainages regularly which is very important to ensure the effectiveness of the pump system. The waste filters installed on local drainages and pumping houses areas facilitate waste collection before they put the waste into the temporary landfill site of the Panggung Lor Sub-district.

<sup>438</sup> *Lintas sejarah P5L 1996-2010* (History of P5L 1996-2010), *ibid.*

<sup>439</sup> *Informasi seputar P5L dan kinerja P5L* (Information and performance of P5L), *ibid.*



**Figure 129. Waste filters on local drainages and mini-tractors of P5L**

Source: Primary Survey, 2013

*The waste filters on local drainages are made of wire nets and bamboo. The community utilizes simple tools to reduce hydrological risk in the settlement. Two mini-tractors are very useful to support the activities of field officers such as waste collection. Furthermore, the loan of a mini-tractor by the municipality indicates that the association is recognized and supported by urban institutions. Urban stakeholders are aware of the community self-help efforts for hydrological reduction*

In addition, field officers always monitor the dikes around the settlement. When they find leakages in the dikes, they always rehabilitate them. These efforts are carried out immediately to mitigate the high inundation risk. The leakages of dikes prevent the pump system from working optimally during the hydrological risk occurrences.

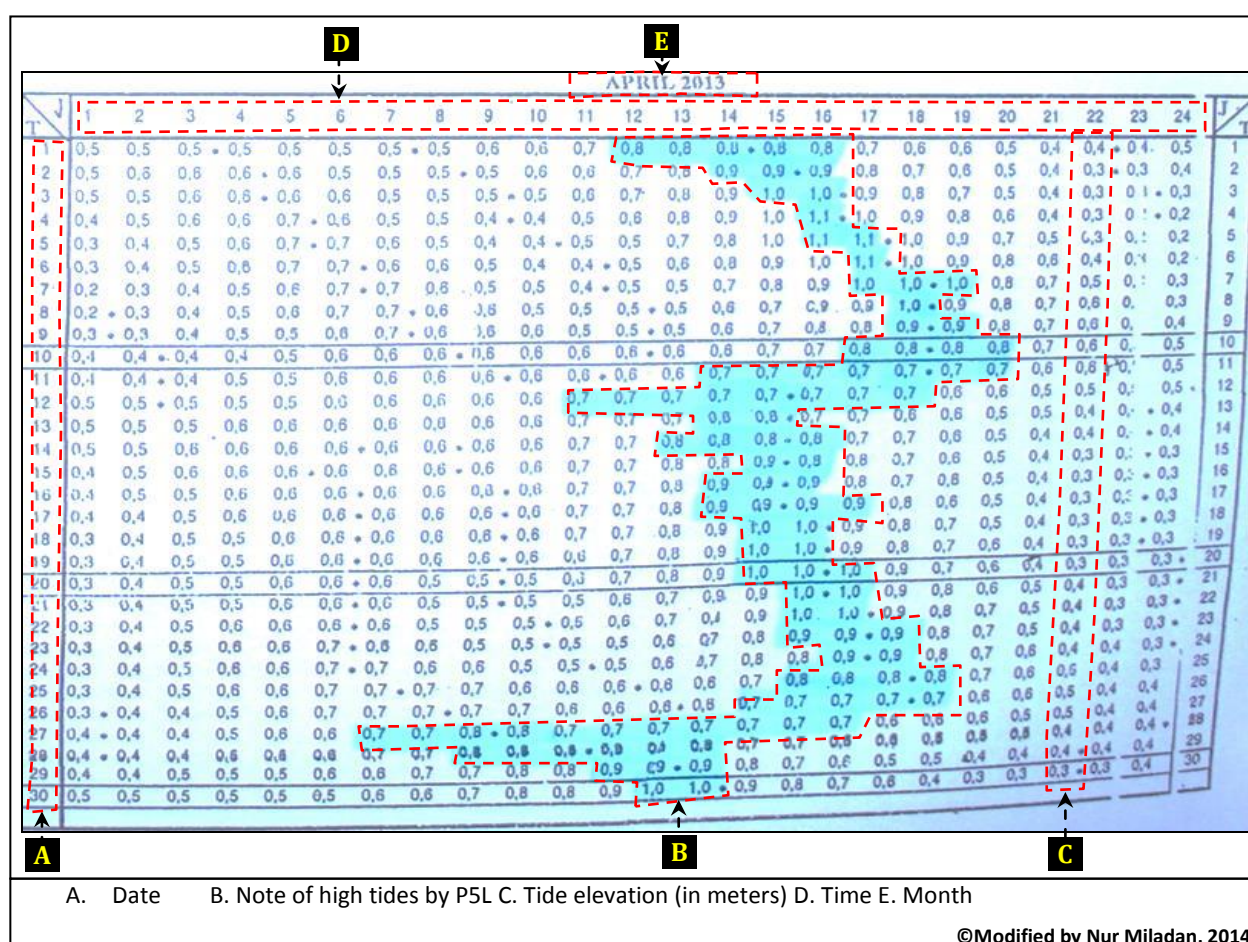
Furthermore, technical problems in the pump system occur sometimes: the pumps are damaged due to waste problems or the machine is no longer working. The P5L association, in particular the section of engineering, repaired immediately these pumps in order to ensure the pump system works during the events of hydrological risk. They implement the cannibalization<sup>440</sup> of pump spare parts to economize the reparation costs and streamline the reparation time. So far, the pump system can anticipate the hydrological risk in the settlement. However, P5L stakeholders always monitor it. They considered whether the growth of hydrological risk should be solved through the addition of the pump numbers.

“[...] we (P5L association) have a balance in bank account, it is about 120.000.000 IDR (7500 €). This balance is the surplus of community dues and also bank interests. It can be used to pay for the pump maintenance and reparation, and also the rehabilitation of dikes.

<sup>440</sup> The situation often occurs when one machine is inoperative due to the (perhaps only temporary) lack of a component at the same time that one or more other machines are inoperative due to the lack of different component(s). If the restoration of machines is important enough, maintenance personal may “cannibalize” operative components from one or more machines to repair the other(s). Cf. Fisher, W.W., 1990, “Markov Process Modelling of a Maintenance System with Spares, Repair, Cannibalization and Manpower Constraints”, *Mathematical and Computer Modelling*, vol.13, Issue 7, pp. 119-125.

In addition, if it is needed, it can be used to buy additional pumps to reinforce the pump system and to anticipate the growth of *rob* (risk) [...]”<sup>441</sup>

Besides the regular maintenance of pump system, the P5L association observes the tide phenomena influencing the *rob* occurrences in their settlement. They always have prediction data on the sea tide level for every month. They utilize the prediction data established by the harbor master of the Tanjung Mas Port. The P5L association publicizes them to the community through the heads of *RWs* and *RWs* communities or the information board in the P5L office. So households can mitigate the inundation risk in their houses during the high tide periods.



**Figure 130. The prediction of daily tide elevations in April 2013**

Source: P5L Archive, 2013.

This prediction indicates that P5L stakeholders and the community understand the existence of hydrological risk in their settlement. Furthermore, this document shows that the community is aware of hydrological risk impact in the daily life.

<sup>441</sup> Interviews with Purwanto, head of the financing section of P5L in 2013.



Besides its management of the pump system, P5L has a positive social impact on the community by fostering the spirit of togetherness to anticipate the hydrological risk impact. The social work through *gotong royong* is routinely carried out by each *RT* community every two or three months. It involves the cleaning of their area, especially the conditions of streets, drainages, and open spaces. Community members believed social work can influence the effectiveness of the pump system during the flood events. The community awareness of P5L and the pump system as a self-help effort motivates volunteers to participate in social work and maintain the pump system mechanism in their settlement.



- A. Soil filling (mud) as temporary dike reinforcement along the Asin River for the prevention of *rob* risk in June 2012.  
 B. Sandbags as temporary effort to solve the leakage of a dike along the Asin River in January 2012  
 C. and D. Settlement recovery process after the flood event in November 2010 such as the dredging of mud on the local drainages and the street cleaning

Annotate:

Sometimes, the community uses the service of underemployed people for cleaning the local drainages and streets after the occurrences of high and flash flooding. Underemployed people receive wages allocated by the community dues and coordinated by the *RWs* or *RTs* community heads.

©Modified by Nur Miladan, 2014

### Figure 131. The P5L association and community self-help efforts for the prevention and recovery process from hydrological risk events

Source: “Kali Asin Rawan Meluap”, *Harian Semarang*, January, 25<sup>th</sup>, 2012, retrieved December 25<sup>th</sup>, 2015, from <http://hariansemarangbanget.blogspot.com>; “Jalan Sumber Mas diuruk Swadaya”, *Harian Semarang*, June 8<sup>th</sup>, 2012, retrieved December 25<sup>th</sup>, 2015, from <http://hariansemarangbanget.blogspot.com>; Komunitas Warga Perumahan Tanah Mas, “Petaka Banjir di Akhir Tahun 2010” [Photo], February, 24<sup>th</sup> 2012, retrieved December 28<sup>th</sup>, 2015, from <http://kuala-mas-rw14.blogspot.com>.



Furthermore, P5L also facilitates community meetings regarding the reconstruction of local drainages and streets in their settlement. Before the implementation of these projects, the community always discusses about their plans during P5L meetings. These assemblies aim to avoid social frictions and to extend benefits to all the *RWs (RTs)* communities through these constructions. These projects are developed gradually based on agreements made during P5L meetings. Nevertheless, these reconstructions are still financed by each *RW* community. However, according to several community heads, because of the efficiency of the pump system local streets are rarely reconstructed.

The effectiveness of P5L as a community self-help efforts for the hydrological risk reduction is recognized by the municipality and other communities. It is considered as a best practice. P5L is often invited by the government institutions and visited by international stakeholders. For instance, the Ministry of Public Works has invited P5L delegations to share their experiences with government institutions and other communities in Indonesia. Furthermore, several international governments, from the Netherlands and South Korea for instance, have visited the P5L association. They wanted to know how the pump system is managed by self-help community efforts. Several information sources mentioned these conditions.

“Wim Klaassen, representative of Netherlands polder management, visited the Pangung Lor District, Semarang Utara (District). He came to study the pump system which is implemented in the residential area of Tanah Mas [...]”<sup>442</sup>

“[...] we do not use high technology. The Korean delegation came here, they said the situation in Korea is similar to Tanah Mas. They took photos of our pumps to apply it in Korea. The Dutch delegation came here, they laughed because we only use modest technology, but they admire us because this association work is based on community self-help. In the Netherlands, they have to oblige people, it is like coercion. The management of the pump system in Netherlands is tax-financed and is included in other taxes (managed by the national government), so the inhabitants do not feel that they pay dues, even though they do. In the Netherlands, dike also broke ...there it is located about tens of meters under the sea level, while we are only at 80 centimeters. We believed the pump system can solve the hydrological risk.”<sup>443</sup>

Besides the sharing of their knowledge on flood risk management and community self-help with other stakeholders, P5L stakeholders also learn from other territories, in particular the practice of pump system development in Netherlands. They know about the

<sup>442</sup> “Tim Polder Belanda Pelajari Sistem Pompa di Tanah Mas”, *Suara Merdeka*, May 4<sup>th</sup>, 2007, retrieved December 25<sup>th</sup>, 2015, from <http://www.suaramerdeka.com>.

<sup>443</sup> Interview with A. Ibnu S, community head (*RW*) and director of P5L association.

municipal collaboration project of Banger Polder. However, P5L stakeholders are more interested in the comparison of their pump system management with the Dutch pump system. They are inspired by the Dutch drainage system because they know that it is located tens of meters under the sea level and the government can anticipate properly the flood risk. This situation convinces them that the existing pump system management is the best and the realistic solution for their settlement.

These situations above explain that the community carries out efforts for hydrological risk reduction in their territory using modest technologies and community knowledge. Furthermore, external stakeholders give them the occasion to learn other practices of pump management. Community knowledge about the flood risk reduction increased thanks to external stakeholders, although it is only sharing of knowledge. However, it fosters logical thinking in the community. Furthermore, the recognition of P5L by external stakeholders strengthens community trust. However, the community empowerment is an important element to develop collective efforts and to build community resilience.

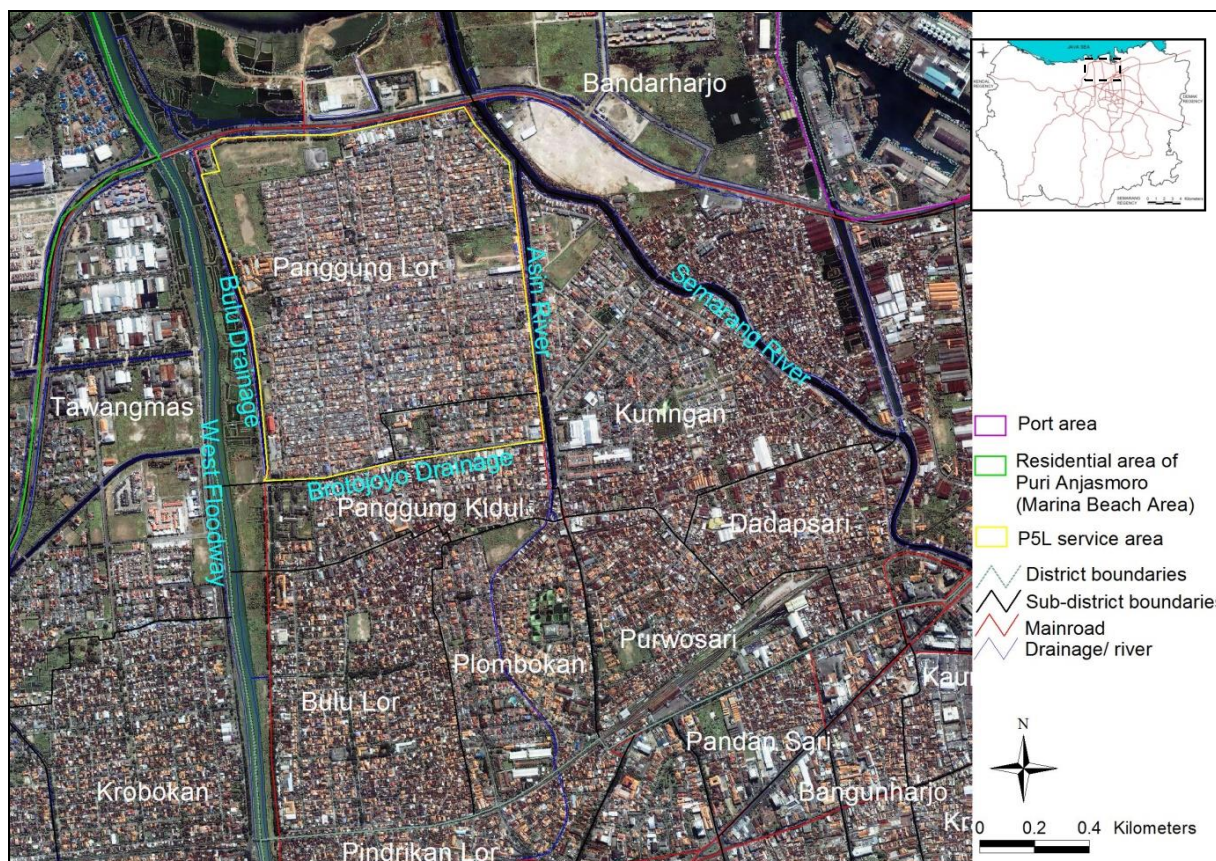
### **3.4.3 Community self-help efforts between local resilience and territorial inequality**

The pump system reduces the hydrological risk impact in the Tanah Mas Community. Social and environment problems due to the hydrological risk existence can be minimized thanks to P5L. The settlement is “secure” during the hydrological risk, in particular when *rob* phenomena threatens the Semarang coastal area. These collective efforts and community self-help build community resilience at the local scale. The community has the capacity to develop collective efforts for hydrological risk reduction because there is no urban system to solve risk, especially in the Semarang coastal area. The community self-sufficiency is the social capital that contributes to the process of urban resilience independent of urban system capacities.

Nevertheless, the efficacy of pump system in the Tanah Mas settlement negatively impacts the surrounding areas. The pump system managed by P5L only protects this settlement, but increases the flood vulnerability of other settlements, in particular *kampung* located around the Tanah Mas settlement.

The Tanah Mas settlement and surrounding zones are located on a plain area, so inundation can easily threaten these territories. The Asin River, the water disposal area of the P5L pump system, increases the hydrological risk in other settlements located along the Asin River. This river is the primary drainage for several sub-districts including Plombokan,

Panggung Kidul, Panggung Lor, Purwosari, and Pindrikan Lor.<sup>444</sup> In addition, this river passes also through the sub-district of Kuningan located on the eastern side of the P5L pump system area.



**Figure 132. P5L service area and surrounding areas**

Source: UDMIS, 2001 ; Iconos Satellite Image, 2008.

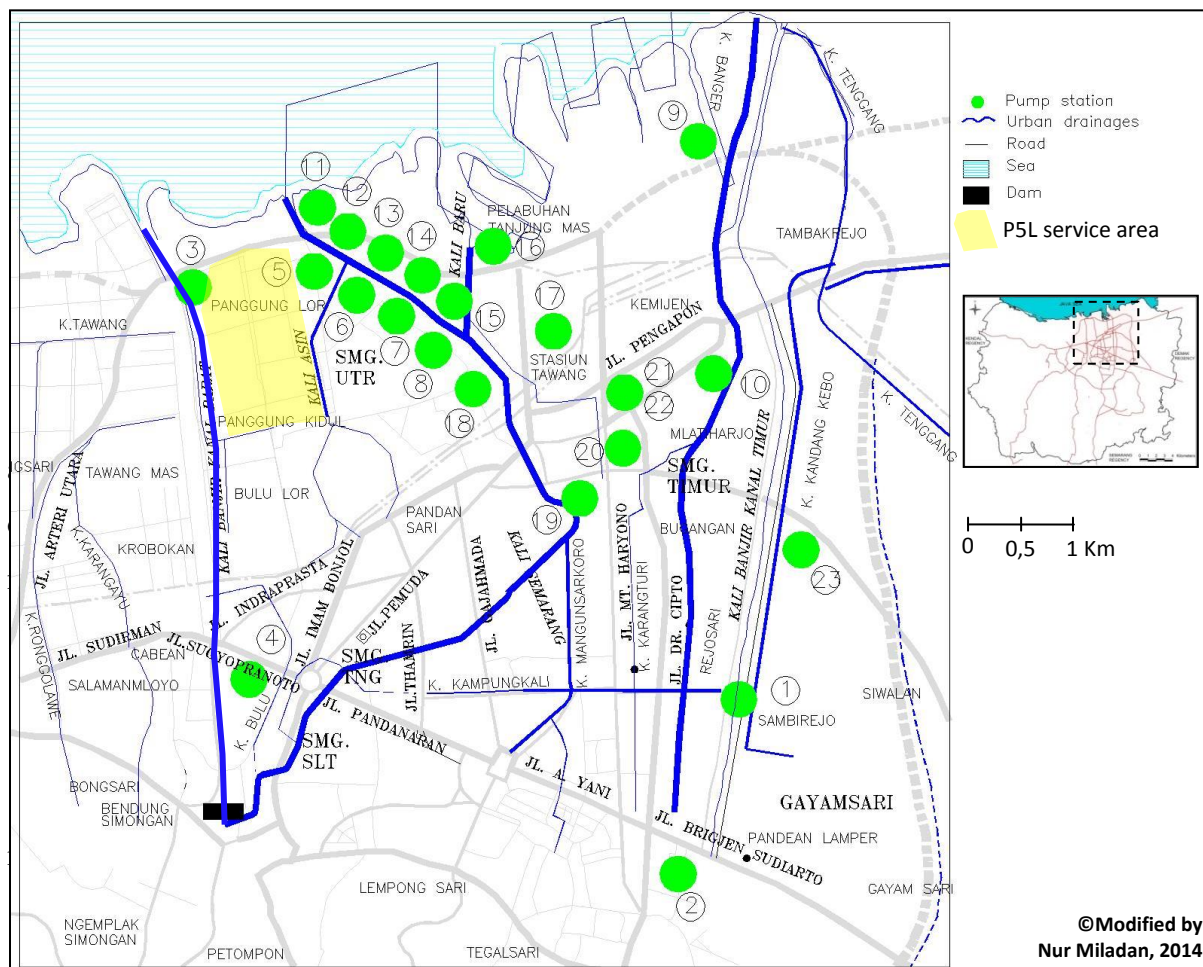
On the eastern and southern side of P5L service area, the settlements have a high density. These settlements are also highly vulnerable to flood because they are close to sea and urban drainages. There are not enough green belts around these settlements. Furthermore, the existence of the West floodway also increases the vulnerability of these settlements to flood.

The neighboring areas of the Tanah Mas Real Estate are dominated by *kampung* and generally inhabited by poor communities. These settlements are not equipped with a pump system managed by community self-help like in the Tanah Mas settlement. The communities of these settlements entirely depend on pumps owned by the municipality for the hydrological risk reduction.

In fact, these pumps often cause technical problems and the service area is limited. Consequently, it does not work optimally to reduce the *rob* risks there. The communities of these *kampung* are not involved in the management of these pumps. The pumps' maintenance

<sup>444</sup> *Urban Drainage Masterplan of Semarang City*, 2007, Semarang: Regional Development Planning Agency.

depends entirely on the municipality. The nature of the water which flows from the high to low levels explains the spatial interaction between the Tanah Mas Real Estate and the other settlements.



**Figure 133. Municipal pump stations in 2005 (2008)**

Source: Buku pintar pengelolaan sumber daya air Kota Semarang (Smart book of water resources management of Semarang City), 2010, Semarang: Department of Water Resources, Energy and Mineral Resources of Semarang City.

*Municipality pump stations are unevenly distributed across the Semarang coastal area. The pump stations are concentrated along the Semarang River. Meanwhile, the other rivers including the Asin River, are less monitored by municipal pump stations. These territories are highly vulnerable to flood because they are not served by these pump stations. The existing pump stations often have technical problems and consequently, the Semarang coastal area often experienced flood occurrences.*

During the hydrological risk events, the pump system of P5L association discharges the inundation into the Asin River and increases the river water volume. Moreover, the sedimentation on drainage surface limits the drainage capacity. Consequently, the inundation flows to the settlements that have no pump system, especially the ones around the Tanah Mas



settlement. There is no drainage system to anticipate *rob* risk, so other territories will accept the overflow of water (inundation). In other words, the flood of *rob* only moved to other territories.<sup>445</sup>

The interviews with the inhabitants and the representatives of sub-districts located in the areas surrounding the Tanah Mas settlement indicate that the P5L pump system negatively impacts them. Most of them considered that the system increases the inundation risk in their territories. They stated indeed that the elevation of *rob* phenomena always increases year after year. According to them, the *rob* events often occur in their areas, but not occur in the Tanah Mas settlement because of the pump system. These argumentations are related to the water cycle flowing from the high-pressure to the low pressure. Furthermore, the Tanah Mas Real Estate is considered by the surrounding communities as the cause of *rob* risks in their settlements. The development of the Tanah Mas settlement through land reclamation has decreased water spaces around their territories, influencing the growth of *rob* risk in their settlements.

“P5L is good. This association exists because it has its roots in the community. It is a concept of mutual service of environment. How the community manages itself and the environment through self-help...but the areas surrounding the Tanah Mas settlement experience worst flood, that’s for sure! The water does not recognize administrative territory, or family. It is the nature of water [...]”<sup>446</sup>

“[...] indeed, RW.05 (community located on the Sumber Mas Street) is involved in the P5L association, because it is limited by the Brotojoyo drainage (on the southern side). Meanwhile, the other RWs communities (of the Panggung Kidul Sub-district) are not involved. Because of the P5L pumps, the Brotojoyo drainage is dry (not inundated), the water is disposed of in the Asin River. Of course, the other areas, which are not covered by the pumps, experience worst floods. But the municipality through the department of water resources has improved the dike of Brotojoyo drainage [...]”<sup>447</sup>

“[...] After the construction of Marina (Puri Anjasmoro residential zone/ Marina Beach area) and Tanah Mas, the flood worsened. The fishponds that were sea water containers disappeared. The flood is worse today, it can occur every day, the inundation level is about one meter” said Sugiyanti (45-year-old), inhabitant of RT. 10/ RW. 4 (Kuningan Sub-district) [...]”<sup>448</sup>

“[...] the community (of Plombokan Sub-district) also seeks to clean the waste on the (Asin) river through self-help efforts. Nevertheless, the arrival of *rob* still passes through this river. Of course, the pump system disposes of the inundation in the Asin River and increases the inundation volume, threatening Plombokan (Sub-district). Plombokan is not close to sea,

<sup>445</sup> Muhrozi, 1997, “Penurunan sebagai salah satu factor penyebab terjadinya banjir air laut pasang (rob) di Semarang bawah”, *Pilar*, vol. 5, n° 7, pp. 65-71.

<sup>446</sup> Interview with Bambang S. Dahlan, head of the community empowerment board in the Tanjung Mas Sub-district and also coordinator of community empowerment boards in the Semarang Utara District, in 2013.

<sup>447</sup> Interview with Nguncardiyo, head of the Panggung Kidul Sub-district in 2012.

<sup>448</sup> “Pompa dan Polder di Kali Asin”, *Kompas*, April 16<sup>th</sup>, 2008, retrieved December 25<sup>th</sup>, 2015, from <http://nasional.kompas.com>.

but *rob* occurs due to the overflow of the Asin River passing also through the sub-districts of Panggung Lor, Panggung Kidul, Purwosari [...]”<sup>449</sup>

“[...] flood due to *rob* in Purwosari (Sub-district) occurs when the Asin River overflows. The river must absolutely be normalized. The problem is that we don’t have pumps to reduce the inundation. Here, there is no disposal area for the inundation, so the water inundates the territory of Purwosari Sub-district. Our territory “looses” against the territory with the pumps, because the source of flood is the Asin River. So the high elevation of inundation occurs in Purwosari (Sub-district) [...]”<sup>450</sup>

Otherwise, several inhabitants of the Tanah Mas community considered that the growth of *rob* risk in their territory was caused also by the land reclamations for the development of the Puri Anjasmoro residential zone (Marina Beach area) and the extension of the Tanjung Mas Port area since the late 1980s.

“[...] *rob* has occurred since the (re)development of the Tanjung Mas port and the Marina residential area. There were many catchments of water but they have disappeared. In addition, it is due to the massive exploitation of groundwater and also the increasing burden of housing development, so there is land subsidence [...]”<sup>451</sup>

“...[...] locations were formerly fishpond areas and became settlements, such as Puri Anjasmoro (residential area). So, there is an area of water infiltration that causes the flooding [...]”<sup>452</sup>

“[...] if there is a high tide, the tidal area is filled with water. During the low tide, the water disappears. This area has been occupied by settlements and fabrics through a reclamation process. Today, there is the Tanah Mas settlement, formerly it was fishponds (areas) [...]”<sup>453</sup>

In addition, local newspapers published similar statements on the growth of *rob* risk in the Semarang coastal area. They mentioned the *rob* risk is not caused by land subsidence, but by the land reclamations in the Semarang coastal area. Moreover, the failures of municipal urban drainage management were also mentioned in the local newspapers. These statements can influence the opinions of coastal communities on hydrological risk in their territories.

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<sup>449</sup> Interview with Indriyati, head of the Plombokan Sub-district in 2012.

<sup>450</sup> Interview with Djoko Santoso, head of the Purwosari Sub-district in 2012.


<sup>451</sup> Interview with Susilowati who has lived there since 1979.

<sup>452</sup> Interview with M. Syafri (43-year-old) who has lived there since 2002.

<sup>453</sup> Interview with A. Bakar (66-year-old) who has lived there since 1978.

**LAPORAN UTAMA**

## Ketika Kawasan Mlayudarat Menjadi Cekungan



**KAMPUNG** Darat merupakan cikal bakal permukiman di kawasan pantai Semarang. Adapun Kampung Melayu hanyalah sebutan bagi kawasan baru di sebelah timur Kampung Darat yang pada awal terbentuk dihuni penduduk berbahasa Melayu.

Bukan hanya itu, Kampung Darat juga dikenal melalui sosok ulama besar KH Muhammad Saleh bin Umar As-Samarani atau yang lebih dikenal sebagai Kiai Sholeh Darat.

Kampung Darat dan Kampung Melayu pernah menyatu menjadi nama Kelurahan Mlayudarat. Namun sejak 1992 kelurahan itu dihapus dari peta Kota Semarang dan bekas wilayahnya menjadi Kelurahan Dadapsari. Kampung Darat telah berdiri sejak abad ke-17 dan merupakan daratan terakhir dekat pantai yang terbentuk secara alami. Jadi kawasan itu bukanlah hasil reklamasi atau pengurukan.

Pada 1890, Belanda membangun Banjir Kanal Barat untuk meluruskan aliran Kali Garang menuju laut. Sejak saat itu pula sedimentasi Kali Garang, Kali Kreo, dan Kali Kripik melalui Kali Semarang yang membentuk daratan kota bawah terhenti, dan Kampung Darat menjadi wilayah paling tinggi di kawasan pantai.

Adapun daerah di sekitarnya, yakni Baratiking, Kuningan, Perbalan, Plombokan, dan Panggung, masih berupa tambak, sawah, dan rawa-rawa.

Namun kawasan Mlayudarat kini tak lagi kering. Secara perlahan, sejak 1980-an, air asin merambah. Lomba meninggikan jalan kampung dan lantai rumah pun dimulai, namun kawasan itu justru makin tergenang.

Rumah-rumah tingkat kehilangan lantai bawah. Bahkan tak sedikit rumah dibiarkan terpendam. Banyak warga pindah ke tempat lain, namun tak sedikit yang bertahan di tengah genangan air.

Orang boleh bilang, rob makin tinggi akibat pemanasan global dan penurunan tanah. Barangkali memang itulah yang terjadi di kawasan Mlayudarat.

Namun yang pasti, kawasan itu kini telah berubah menjadi cekungan. Bukan karena penurunan tanah, melainkan akibat wilayah sekitarnya yang semula merupakan daerah tambak, sawah, dan rawa telah mengalami pengurukan besar-besaran.

Kegiatan *mbongkar gunung, nguruk segara* yang dimulai akhir 1970-an itu dilakukan hingga kawasan lepas pantai yang kini menjadi Perumahan Tanah Mas. Dan, seperti biasa, dengan pengurukan besar-besaran, daerah yang dibangun belakangan selalu dibuat menjadi lebih tinggi.

Namun alam rupanya memiliki jalan sendiri dan meminta kembali wilayah yang dulu digenangi. Kini hampir seluruh wilayah Kecamatan Semarang Utara dilanda rob, tak terkecuali Tanah Mas yang dibangun paling akhir. (51)

**Hartono**

“People can say that *rob* (risk) is higher due to global warming and land subsidence. Maybe, these indeed occur in Mlayudarat. However, this area has changed into a basin. It was not due to land subsidence, but to the conversion of the surrounding areas that formerly were fishponds, paddy fields, and swamps with massive soil-filling.

The activities of unloading hills and soil filling in sea began at the end of the 1970s. They were carried out in the offshore area that recently became the residential area of Tanah Mas. And usually, the territories were built each time higher than other territories through the soil filling.”

**Figure 134. Opinions on flood causes in local newspapers**

Source: Hartono, “Ketika kawasan Mlayudarat menjadi cekungan”, *Suara Merdeka*, February 16<sup>th</sup>, 2014, retrieved December 25<sup>th</sup>, 2015, from <http://epaper.suaramerdeka.com>.

“Only a third of the pumps function (31 pumps out of the 94 built by the municipality) so the rain water enters the settlements of communities. Because of the massive addition of rain water, the water cannot be dammed again” Said Hendi, familiar name of the major of Semarang City, Saturday (14/02/2015).<sup>454</sup>

The pump system, on the one hand, is very important for the flood risk reduction in coastal settlements, but on the other, the conditions of the different pump system among the settlements produce urban equality. It means an approach that describes differences in housing conditions, access to services and/or health outcomes as an unequal state between one social group and another in the population of a city or town or between different districts/spatial areas.<sup>455</sup> In this case, the different access to pump system for the hydrological risk reduction produces unequal conditions among the coastal settlements during flood events.

<sup>454</sup> Prianggono, A., “60 mesin pompa air macet diduga sebagai penyebab banjir di Semarang”, *Tribun Jateng*, February, 14<sup>th</sup> 2015, retrieved December 25<sup>th</sup> 2015, from <http://www.tribunnews.com>.

<sup>455</sup> Stephens, C., 2011, “Revisiting Urban Health and Social Inequalities: the Devil is in the Detail and the Solution is in all of us”, *Environment and Urbanization*, vol. 23, n° 1, pp. 29-40.

Semarang Utara is the district with the highest level of poverty in Semarang City.<sup>456</sup> This situation is linked to the community resources for the efforts of flood risk reduction such as house and street reconstructions. Most of the settlements in the Semarang Utara District are *kampung* inhabited largely by the lower middle-class or poor inhabitants. They rely on the effectiveness of the municipal pump system for the flood risk reduction. But unfortunately, this pump system has often many technical problems, so these *kampung* experienced high inundations during the hydrological risk events. The communities of *kampung* considered that the growth of inundation levels in their territories was due to the P5L pump system that disposes of the water in the Asin River during the flood occurrences. These situations produce social frictions among the neighboring communities in the Semarang coastal area. These conditions absolutely constraint urban flood resilience in Semarang City. Although the pump system produces territorial problems among the communities, this system is also implemented by coastal communities in Semarang City. They adopted the P5L pump system to protect their settlements. Several other communities discussed sharing the pump system practice with P5L.

“[...] so, in Semarang City, we are the first community to install the pump system, it's not bragging, we started it. The communities of Pondok Hasanudin, Semarang Indah, Puri Anjasmoro studied us. So we become the example because we are “the bravest”. Usually, the first to be recognized, while the “followers” were recognized later. To imitate, it's easy, but to initiate, to have the idea first is difficult. In 2010, if I'm not mistaken, the working units (of provincial governments) of Eastern, Central and Western Java came here [...]”<sup>457</sup>

“[...] to solve the flooding, the community of Puri Anjasmoro residential area, through community self-help, bought two units of pumps with each pump having the capacity to aspirate 1 m<sup>3</sup> of flood water per second. Furthermore, the community also cooperated with PT.IPU to develop a pumping house for these pumps (6x6 m<sup>2</sup>) [...]”<sup>458</sup>

The pump system has become a model of hydrological risks reduction initiative in the Semarang coastal area since the beginning of the 2000s. This system is developed as a community self-help effort to response to the lack of urban system for hydrological risk reduction. Although these efforts also produce social and territorial problems among the communities, it is still the preferable strategy of community to reduce hydrological risk reduction in their territories (local scales). Nevertheless, it depends entirely to the community

<sup>456</sup> According to the statistics of Management information system on poor inhabitants in Semarang City in 2015, there are 12 percent of poor inhabitants settled in the Semarang Utara District.

<sup>457</sup> Interview with A. Ibnu S, RW community head and director of P5L association.

<sup>458</sup> Ayudea, F., “Bangun rumah pompa atasi banjir, warga swadaya Rp. 1 Miliar”, November, 6<sup>th</sup>, 2009, *Suara Merdeka*, January 25<sup>th</sup>, 2012, retrieved December 25<sup>th</sup>, 2015, from <http://suaramerdeka.com>.



economic resources. When these are limited, it is a principal barrier in the implementation of collective efforts including the pump system. It also constraints the resilience process which is based on community empowerment.

#### **3.4.4 Lack of integrated system for flood risk reduction between urban projects and community self-help efforts**

Although the community developed self-help efforts in the face of hydrological risks, they realized they needed the municipality as a partner. The effective management of the P5L association increased the trust in municipality. Interviews with the secretary of district office of Semarang Utara describe this intention.

“[...] P5L (association) originated from community self-help. This association is good. They have 14 pumps in 10 locations (pumping houses) to solve the flood. We appreciate these community efforts that are aware of their environment. The Asin River, “source” of *rob* connected to the sea, passes through the Panggung Lor Sub-district. So, the pump system developed by the community can reduce the risk of flood there [...]”<sup>459</sup>

Furthermore, the P5L association stated that the municipality has recognized the drainage system in the Tanah Mas Real Estate as one of 21 drainage sub-systems in Semarang City. The division of drainage system of Semarang City is linked to the alternative management for the drainage sub-systems. The municipality used the concept of “one watershed, one plan, one management” for the urban drainage management.<sup>460</sup> Each drainage sub-system is developed with different plan alternatives.

“[...] in conjunction with the decree of major of Semarang City (regarding the establishment of *Tim 10* in 2006), the drainage (sub-) system developed and managed by P5L was set down as one of 21 drainage sub-system of Semarang City [...]”<sup>461</sup>

In addition, the municipality has involved the Tanah Mas community in the planning and management of the drainage sub-system since 2006 through the establishment of *Tim 10*. It is a team that includes 10 inhabitants of the Tanah Mas settlement. Besides *Tim 10* for the Tanah Mas community, the municipality also formed 9 other teams for the communities of Bandarharjo Barat, Bandarharjo Timur, Banger Utara, Kali Asin, Kota Lama, Banger Selatan,

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<sup>459</sup> Interview with Didik Dwi Hartono, secretary of district office of Semarang Utara in 2012. The district government is the delegation of major (municipality) to carry out some affairs of regional autonomy.

<sup>460</sup> *Urban Drainage Masterplan of Semarang City*, *ibid.*

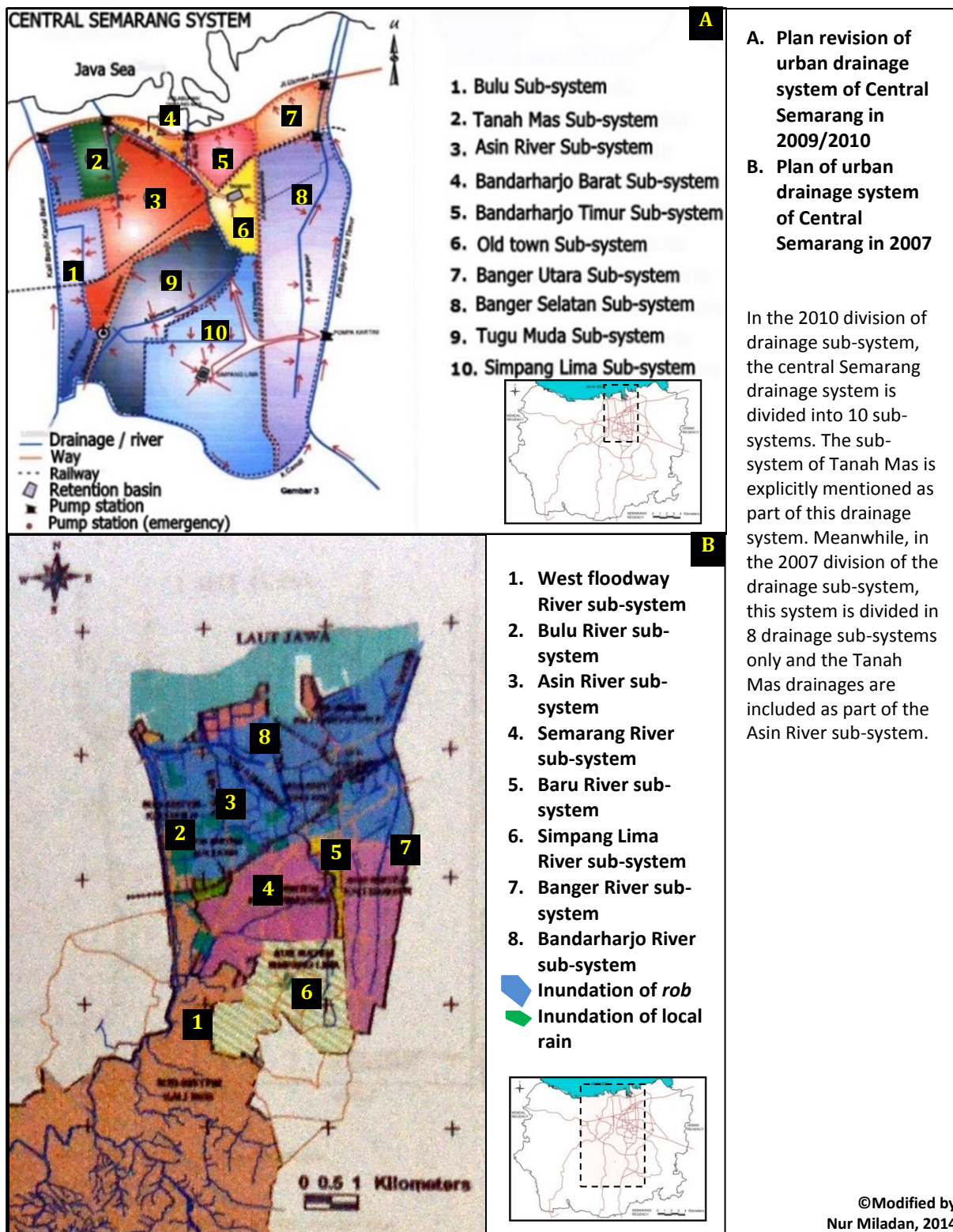
<sup>461</sup> *Lintas Sejarah P5L 1996-2010 (History of P5L 1996-2010)*, *ibid.*

Bulu, Tugu Muda, dan Simpanglima.<sup>462</sup> Each team has the role to identify problems and solutions for each drainage sub-system which will become the input in the making of urban drainage master plan document.

In the case of the Tanah Mas community, community delegations (10 inhabitants) are selecting during deliberations that involve the supervisory board of P5L, the community empowerment board, and leading figures of the Tanah Mas settlement. So, in other words, *Tim 10* represents P5L. In fact, it was just an official legalization but it did not clarify the management collaboration of the drainage sub-system between the municipality and the community. However, it still indicates that P5L is recognized as a stakeholder for one drainage sub-system in Semarang City. The Asin River is the primary drainage for the sub-system managed by P5L. Nevertheless, the document on urban drainage master plan (2007) did not indicate explicitly the Tanah Mas drainage sub-system but it mentioned the drainage sub-system of the Asin River. This master plan has become the basis for regional regulation of Semarang City No. 7/2014 on urban drainage master plan for 2011-2031. There are 4 drainage systems (Mangkang, West Semarang, Central Semarang, and East Semarang) and 19 drainage sub-systems. In this document, the drainage system of Central Semarang is divided into 8 sub-systems including the West Floodway River, the Bulu River, the Asin River, the Semarang River, the Baru River, the Bandarharjo River, the Simpang Lima River, and the Banger River. The municipality planned the management of drainage sub-system of the Asin River through several programs including the dredging of sedimentation and waste on the primary drainage, the development of a 1125 m long sea embankment between the West Floodway and the Semarang River to prevent the *rob* risk from entering terrestrial areas, the development of a 1,12 km long storage on the Asin River with a water capacity of 75.100 m<sup>3</sup> and the community participation to the drainage management and the development of rain harvesting infrastructure. Nevertheless, so far, these plans have not been implemented due to the lack of regional regulation for the implementation of these plans. The regional regulation of Semarang City No. 7/2014 aims to support the implementation of these project plans. At least, this situation indicates the long administrative procedure to implement hydrological projects in Semarang City.

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<sup>462</sup> “Atasi banjir dan rob, 10 subsistem drainase ditangani tim khusus”, *Suara Merdeka*, February 23<sup>rd</sup>, 2006, retrieved December 25<sup>th</sup>, 2015, from <http://www.suaramerdeka.com>.



**Figure 135. Tanah Mas sub-system as part of Central Semarang drainage system**

Source: *Urban Drainage Masterplan of Semarang City*, 2007, Semarang: Regional Development Planning Agency; Municipality of Semarang City, 2010, *Pengelolaan sumber daya air dan konsep penanganan banjir Kota Semarang* [PowerPoint], Semarang: Seminar Polder untuk Kota-Kota Dataran Rendah di Indonesia.

*Despite the management plan of drainage sub-system, the hydrological risk is in fact not recognized in the administrative division. So, the urban drainage plan is still the unity of system. The division of drainage sub-system is based on the existence of urban drainages and produces differences of scope areas in these sub-systems and consequently, the effectiveness of these sub-systems depends on the scope areas.*

Furthermore, in 2010, the municipality revised the division of urban drainage system including 3 drainage systems and 21 drainage sub-systems.<sup>463</sup> Nevertheless, this revision was not used as a basic assessment for the regional regulation of Semarang City No. 7/2014. The municipality still uses the division of drainage system indicated in the document of urban drainage master plan separating the drainage system based on the watershed areas in Semarang City. Meanwhile, the 2010 plan of drainage system takes into account territorial boundaries rather than the watershed areas. These conditions indicate that at that time, there is a desynchronization of urban plans and policies in the drainage sub-system management. However, today, these urban policies do not affect directly the pump management of P5L association. The community focuses on carrying out the pump system development without regard to the different divisions of drainage sub-system in their area.

Tanah Mas is a large settlement whose drainage management is based on community self-help and recognized by the municipality thanks to the efficient P5L management of the Asin drainage sub-system. These conditions influence the partnership between the community and the municipality. The dike reconstructions on the Asin River and the tractor loan from the municipality to support the P5L activities, as well as the cooperation in social work are the partnership forms privileged by the municipality and the community for the hydrological risk reduction.

Furthermore, the municipality also often involved the P5L in discussions and reports on government projects to reduce the hydrological risks, such as the Jati Barang Dam packet project or the arrangement of the Asin River and the Semarang River. Then, P5L association publicized government projects during P5L meetings attended by the supervisory board (heads of *RWs* communities). They transferred this information to the heads of *RTs* communities that convey it to the inhabitants. As a result, the majority of the Tanah Mas community knows about the urban hydrological projects and plans carried out by the urban institutions. In addition, the municipality also publicized their projects and plans through the community empowerment board of the Panggung Lor Sub-District. This organization has the active role to organize the annual meeting of development programs (*musrenbang*).<sup>464</sup> It seeks to collect the priority programs from the communities to be conveyed to the related urban institutions. So far, the community has a great trust in the community empowerment board as their representatives.

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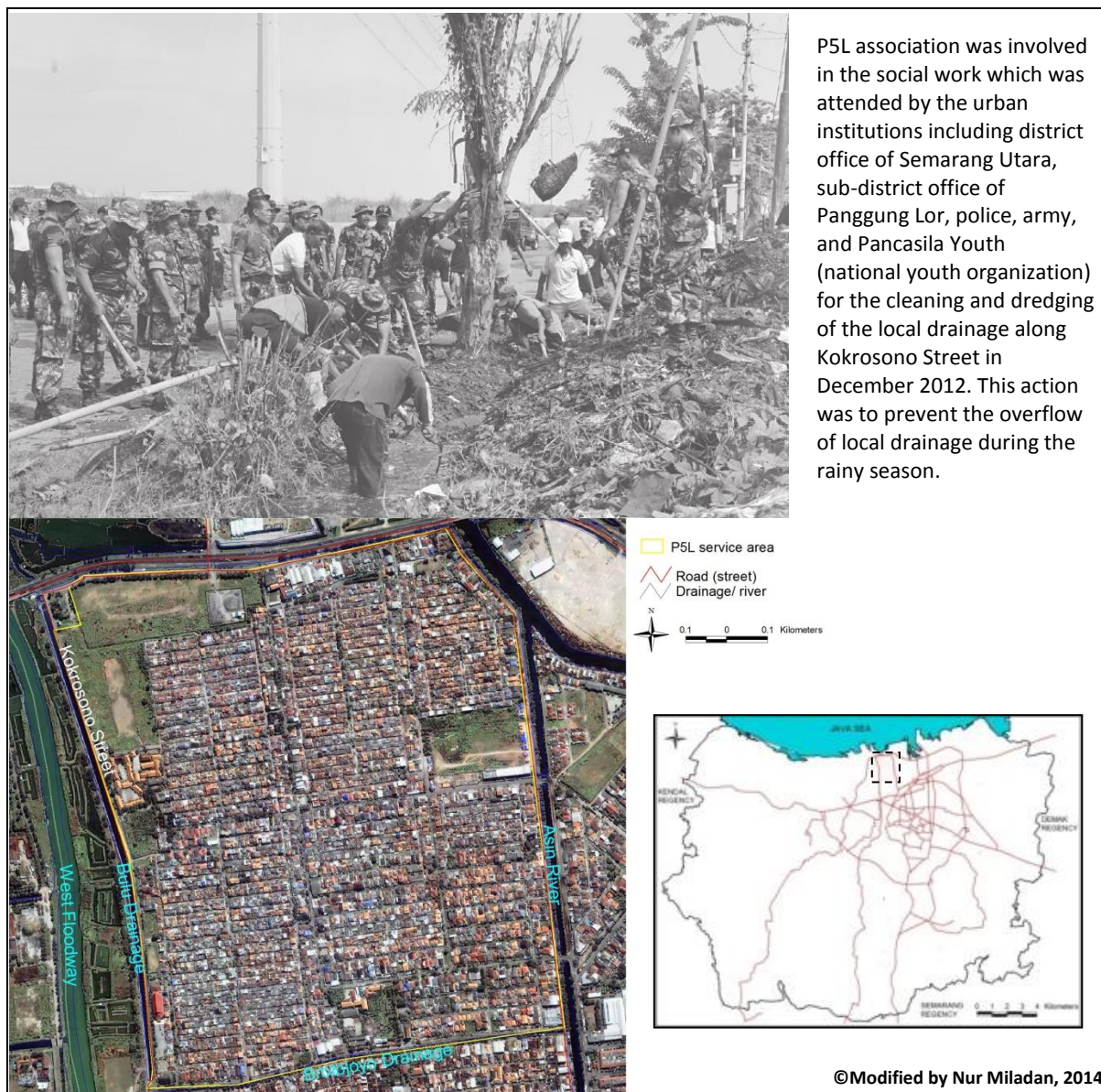
<sup>463</sup> Municipality of Semarang City, 2010, *Pengelolaan sumber daya air dan konsep penanganan banjir Kota Semarang* [PowerPoint], Semarang: Seminar Polder untuk Kota-Kota Dataran Rendah di Indonesia.

<sup>464</sup> *Musyawarah Perencanaan Pembangunan (Musrenbang)* is the national policy to realize bottom-up planning in Indonesia and has been implemented since 2010. Each sub-district holds *Musrebang* every year. The results of *Musrenbang* of sub-district are conveyed to District *Musrenbang* and then to Municipality *Musrenbang* to decide the priority programs of municipality every year.



“In general, the community empowerment board conveys the government projects related to the problem-solving of flood [...]”<sup>465</sup>

“[...] the community empowerment board is responsible for P5L and actively conveys the community problems and aspirations to government levels (sub-district, district, and municipality) [...]”<sup>466</sup>



**Figure 136. P5L association involvement in social work by urban institutions**

Source: “Saluran Krokosono dibersihkan manual”, *Harian Semarang*, December 27<sup>th</sup>, 2012; UDMIS, *ibid.*; Iconos Satellite Image, 2008.

The Tanah Mas community, through P5L annual meetings on development programs, often proposed structural efforts to reduce *rob* risk in their territory such as the rehabilitation

<sup>465</sup> Interview with Yudho Sapto Edy (47-year-old), community head who has lived there since 1995 and member of *Tim 10* of P5L.

<sup>466</sup> Interview with Udi Maryuwanto (43-year-old), inhabitant or community head who has lived there since 1997.

of the Asin River (dike enforcement and sedimentation dredging). But in fact, the municipality did not approve all community programs because the regional budget was limited. The municipality must share the regional budget for all sub-districts in Semarang City, so they financed only several community projects in each sub-district every year.

According to the community, over the last three years, the municipality often gave aid to reduce *rob* risks in the Tanah Mas settlement through the Department of Water Resources Management. This institution manages the rehabilitation of urban drainages around their settlement, such as the Asin River, the Bulu Drain and the West Floodway. So far, the municipality implemented urban hydrological programs based on the master plan of flood risk reductions established by the municipality since 2000.

Moreover, the municipality has given a direct aid during the inundations in the Tanah Mas settlement such as the providing of hundreds of sand bags to strengthen the dikes around the settlement. During several flood events, the municipality also provided water pumps and genset (diesel generator) to reduce the inundation impact. They also gave financial aid for the mini-polder development in RW.03 area (eastern part of settlement). This mini-polder was initiated by P5L to create a temporary water storage connected to local drainages and then, the water is discharged to the Asin River. Furthermore, the municipality through the Department of City Planning and Housing has supported the reforestation to increase the surface of infiltration areas in the Tanah Mas settlement by giving trees seedlings.

“[...] the head of the Panggung Lor Sub-district, Sumardi said that P5L has prepared everything to anticipate the overflow of the Asin River to the street. Hundreds of sand bags have been prepared by the Department of Water Resources (of Semarang City) some time ago and these bags are used for the emergency dike [...]”<sup>467</sup>

“[...] the aid of water pump and genset was carried out by the municipality through the Department of Water Resources during the overflow of the West Floodway in 2010 [...]”<sup>468</sup>

“[...] the building of the retention basin and pump system with floodgates, but (it) is processing. Furthermore, the aid of 8 pumps and 2 gensets from River Basin Organization (Ministry of Public Work), the aid of hundreds of sand bags from Department of Water Resources (of Semarang City). And also the aid of trees for the water catchment from the Department of Cleanliness and Landscaping (of Semarang City) [...]”<sup>469</sup>

“[...] there are several ways to obtain the aid of the Semarang Municipality, such as the building of a 1.320 m long dike on the west side of the Asin River, the building of a mini-polder in RW.03 Muara Mas. The immediate response of the municipality was to fulfil the

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<sup>467</sup> “Kali Asin Rawan Meluap”, *Harian Semarang*, January, 25<sup>th</sup>, 2012, retrieved December 25<sup>th</sup>, 2015, from <http://hariansemarangbanget.blogspot.com>.

<sup>468</sup> Interview with Mudiyo (61-year-old), community head who has lived there since 1981, formerly worked for a national enterprise.

<sup>469</sup> Interview with Susilowati, who has lived there since 1979.

community demand by providing fuel for the operating of the pumping house of the Bulu Drain and a mini tractor to support drainage and pump maintenance during the inundation of our territory...thanks to the Department of Public Work of Semarang City which has lent a backhoe to dredge the mud during two months and also to the Tanah Mas Company which loaned a dump truck to dispose of the mud [...]"<sup>470</sup>

Moreover, P5L is negotiating with the River Basin Organization of Pemali Juwana<sup>471</sup> to obtain gensets (diesel generators) to support the pump system in the P5L service area. According to the head of P5L, this institution will donate two generators (with a power 250 KVA and 100 KVA). Nevertheless, until recently, these generators have not yet been installed in the Tanah Mas settlement due to administrative procedural problems. The P5L wanted to use these generators in the eastern part of the settlement (Genset 250 KVA) and the western part (Genset 100 KVA). These generators will bring electricity to switch on the pump systems, in particular in the emergency situations.

Furthermore, the community also proposed the drainage rehabilitation to the Ministry of Public Works through the program of the acceleration and the extension of settlement infrastructure development/P4IP.<sup>472</sup> This project would have been financed with a national budget about 258.333.000 IDR (16.145, 81 €) and community dues about 20.833.000 IDR (1302, 06 €). The community expected this project to improve the quality of local drainages through the use of box culvert for the surfaces of drainages and thus to support the effectiveness of the pump system in their settlement. Currently, the community is awaiting the decision from the Ministry of Public Works about this project.

Over the last three years, the municipality is implementing several urban hydrological projects for the hydrological risk reduction. Today, the Tanah Mas Community expects the reconstruction of the West Floodway and the construction of a retention basin in the delta of the Semarang River (Jati Barang Packet Project) to solve the hydrological risk in the Semarang coastal area including their settlement.

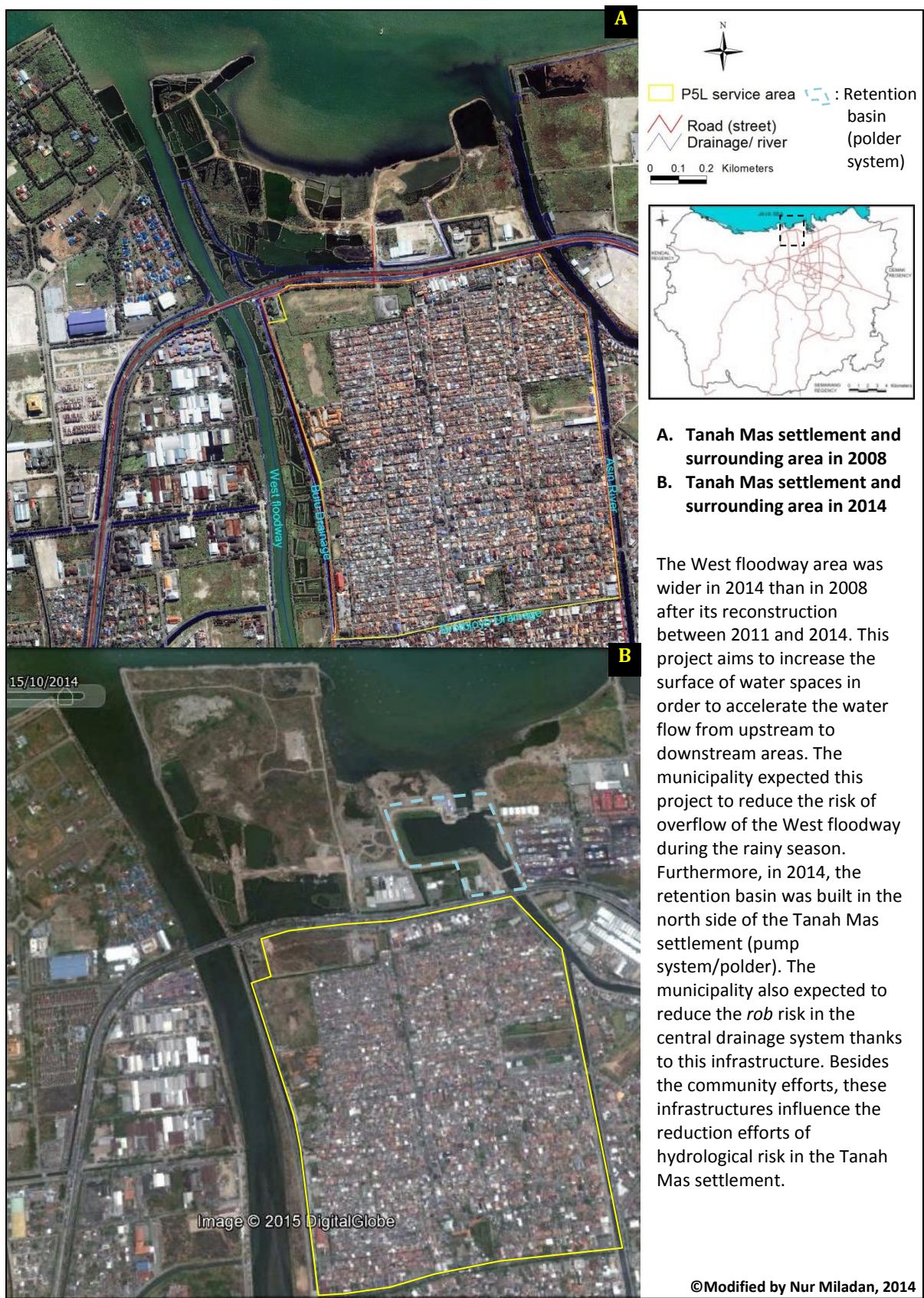
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<sup>470</sup> *Laporan pertanggungjawaban kinerja pengurus P5L 2007-2010 (responsibility report of executive board performance of P5L 2007-2010)*, 2010, Semarang: P5L association.

<sup>471</sup> Institution that is a part of the Ministry of Public Works and manages the river areas of Pemali Juwana in the Central Java Province.

<sup>472</sup> P4IP is the abbreviation of *Program Percepatan dan Perluasan Pembangunan Infrastruktur Permukiman* (program of acceleration and extension of settlement infrastructure development). This program began in 2013 and aimed to accelerate the infrastructure development of settlement in Indonesia.





**Figure 137. The West Floodway and the retention basin around the Tanah Mas settlement**

Source: UDMIS, *ibid.*, Iconos Satellite Image, 2008; Google Earth, 2015.



# Air Kali Semarang dan Asin Turun

1

**SEMARANG** - Seiring dengan dioperasikannya sistem kolam retensi, permukaan air Kali Asin dan Semarang turun.

Kemarin, terlihat permukaan sungai tersebut turun sekitar satu meter dari biasanya. Hal itu terlihat dari bekas batas permukaan air yang masih menempel di dinding tanggul dibanding permukaan air

sekarang. 2

Yang tampak sekarang justru sedimentasi di beberapa titik badan sungai itu. Penurunan permukaan air tersebut disambut warga. Beberapa orang yang tinggal di

sekitar sungai itu merasa senang. Salah seorang warga Dadapsari, Ningrum, mengungkapkan saat ini pihaknya tak perlu lagi cemas akan rob.

"Sekarang lingkungan kami bisa kering. Rob tak lagi datang. Kami berharap kondisi ini bertahan terus hingga musim hujan nanti," ujarnya.

Dikatakan, saat ini yang harus diperhatikan adalah saluran di ling-

kungan sekitar. Saluran-saluran yang ada menurutnya masih dalam kondisi memprihatinkan karena dipenuhi sampah. Dia berharap saluran itu segera dibersihkan.

Sedimentasi

Hal serupa juga diutarakan salah seorang warga Tanah Mas, Wahyu. Dia berharap normalisasi Kali Asin dan Semarang diikuti dengan perbaikan infrastruktur di lingkungan sekitar. Selain saluran, jalan juga

seharusnya mendapat perhatian. Sebagian jalan di sekitar kedua sungai itu dalam kondisi parah.

Terpisah, Kepala Satuan Kerja PPLP Jateng, Subarsono, mengungkapkan, Kali Asin dan Semarang menjadi salah satu sistem drainase yang penting dalam penanggulangan banjir karena rob dan hujan di wilayah Semarang bagian tengah dan utara. Muara kedua sungai tersebut saat ini sudah ditutup. Selanjutnya, pengaliran ke laut akan dilakukan oleh pompa-pompa yang ada di kolam retensi.

"Pompa-pompa di kolam retensi akan bekerja secara otomatis bila ketinggian air terdeteksi cukup untuk dialirkan ke laut," katanya.

Program berikutnya adalah pengerukan sedimentasi kedua kali tersebut.

Selain itu, menurut Subarsono, saat ini pihaknya juga tengah melaksanakan penutupan Kali Baru. Jika proyek tersebut sudah selesai, dia yakin, genangan bisa berkurang.

Meski demikian, satu lagi proyek yang harus dijalankan adalah Polder Banger agar penanganan banjir bisa lebih total. (H35,H71-87)



**1** Water of the Semarang River and the Asin River decreased

**2** Yesterday, it seems that the river level decreased approximately one meter below usual according to the water level sign on the dike wall..

**3** LEVEL (OF WATER) DECREASED:

Water level of the Semarang River and the Asin River decreased along with the implementation of test runs on the retention basin at the outfall of these rivers.

**PERMUKAAN TURUN:**  
Permukaan air Kali Semarang dan Asin turun seiring pelaksanaan uji coba kolam retensi di muara kedua sungai itu. (87)

3

**Figure 138. Excerpt of retention basin effectiveness built by government**

Source: "Air Kali Semarang dan Asin turun", *Suara Merdeka*, April, 15<sup>th</sup>, 2014, retrieved December 25<sup>th</sup>, 2015, from <http://www.suaramerdeka.com>.

*This urban infrastructure certainly reduces the hydrological risk in the case study area. Nevertheless, it does not ensure that the community can be free from hydrological risks. Today, the management sustainability of the infrastructure is in question because the infrastructure maintenance (operating of pump system and also the regular dredging of drainages) is very expensive.*

So far, in fact, the municipality has a limited budget for urban hydrological projects but the community involvement in the management of these infrastructures is not clear yet. There is a lack of community participation in the development of urban hydrological projects. These initiatives are carried out through top-down planning, so that the community is not involved in the development of urban hydrological projects. The community awareness of urban hydrological

infrastructures is certainly needed to ensure the sustainability of a urban system for the hydrological risk reduction.

“[...] we were only involved when urban hydrological projects are publicized, it seems that they are effective for the hydrological risk reduction, but until recently, the operating of pump system and the retention basin has not begun yet [...]”<sup>473</sup>

“Based on the technical explanation given during the publication of municipal results, the retention basin seems very effective. But until recently, it does not function yet [...]”<sup>474</sup>

However, the municipality publicized these projects to coastal communities including the Tanah Mas community through government channels and even statements in local newspapers. In fact, miscommunications and frictions around urban hydrological projects often occur between the Tanah Mas community and the municipality. The rehabilitation of the Asin River as part of the retention basin design is a case of miscommunication among them. Initially, the contractor was dredging the sedimentation on the Asin River and then the community sought to stop these actions. The community asked the municipality and the contractor to first construct sheet piles (river belts) before dredging the sedimentation. The community argued that the sheet piles could reduce the landslide risk in their settlement caused by the dredging of sedimentation. However, the municipality agreed with the community to construct the sheet piles as part of the project.

“[...] there are negative elements in government efforts to solve the risk of *rob*, but sometimes, their impacts are not analyzed. The feasibility study of the retention basin and pump system has not been researched. I asked to the consultants on this project but they could not answer. Have you measured the level of sedimentation in the Asin River? They said it will be dredging 3 meters deep. How many years before it is full again (high sedimentation)? I insisted on developing sheet piles. Initially, they were not planned. There were 2 backhoes already dredging the sedimentation of the Asin River, I stopped it. How do you dare to take the risk to dredge the Asin River 3 meters deep? What if the streets of settlement are damaged afterwards? They did not dare so they stopped. Why didn't they ask permission from the Tanah Mas community? So, finally, there is a program of sheet piles [...]”<sup>475</sup>

The other technical problem was the closure of local drainages in the Tanah Mas settlement on the Semarang and Asin Rivers carried out by the municipality. The government recommended the water to be discharged from local drainages into the Bulu Drain because

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<sup>473</sup> Interview with Yudho Sapto Edy (47-year-old), community head who has lived there since 1995 and member of *Tim 10* of P5L.

<sup>474</sup> Interview with Soesbijanto (63-year-old), community head who has lived there since 1976 and member of *Tim 10* of P5L.

<sup>475</sup> Interview with A. Ibnu S, *RW* community head and director of P5L association.

the Semarang River was an element of the retention basin project. But in fact, the government has not yet built the canal drainage to discharge the water from the Tanah Mas settlement into Bulu Drain. According to the community, the Bulu Drain is not useful to the P5L pump system because the Bulu Drain water level is higher than the local drainages in the settlement.

“[...] complaint of Panggung Lor (Tanah Mas) community and Tanah Mas Company about the closure of drainage has not found a solution yet. Some time ago, Ibnu Soebroto (head of P5L daily executive board) complained that the local drainages of Panggung Lor (in the Tanah Mas community) towards the Semarang River were closed unilaterally by the government [...]”<sup>476</sup>

“We benefited from several government projects such as the normalization of the West Floodway. But the Bulu Drainage is not useful to us. The stock drainage from there is not connected to our local drainages. It is not possible to channel the water there because the Bulu Drainage level is higher than the local drainages of settlement. So our water is channeled to the Asin River. But some local drainages are connected to the Bulu Drainage. During heavy rain, the Bulu Drainage pump system is the only one pump which works. The arterial road (north side of settlement) is not equipped with drainages, so the water inundation flows to our settlement. The municipality is not consistent. They built the arterial road without drainages. In addition, the Bulu Drainage has the immense pump. When our settlement was flooded, we checked it and the fuel was empty. Mr. Ibnu (head of P5L daily executive board) called the mayor. So the mayor sent 30 liters of fuel, and then the mayor was contacted again because 30 liters of fuel only last 10 minutes. He responded by asking how large was the pump. Finally, he sent 300 liters of fuel.”<sup>477</sup>

In addition, the community often complained about the pump system of Bulu Drainage managed by the municipality through P5L. Sometimes, the malfunction of the Bulu Drain pump system during heavy rain caused the overflow of this drainage and thus, the flood events in the Tanah Mas settlement. The community asked the municipality to provide fuel supply to operate the Bulu Drain pump system during the inundation and the municipality responded. Nevertheless, sometimes they must remind (complain first) the municipality about the Bulu Drainage management. In addition, the community complained about waste in urban drainages including the Asin River and the Bulu Drainage. According to them, the waste is also “source” of hydrological risk and the municipality must be held responsible for the existence of waste on urban drainages. The community considered that the municipality was less aware of the management of urban drainages, and thus increased hydrological risk in their settlement.

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<sup>476</sup> Buwono, B., “Drainase Warga Panggung Lor Semarang Masih Tertutup”, *Tribun Jateng*, April 30<sup>th</sup>, 2014, retrieved December 25<sup>th</sup>, 2015, from <http://jateng.tribunnews.com>.

<sup>477</sup> Interview with Heriyanto (59-year-old), community head who has lived there since 1977.

Moreover, several community heads explained that the land ownership of the Tanah Mas settlement limits the municipal aid to the community. They felt that the municipality is not responsible for settlement infrastructures because the land is owned by the Tanah Mas Company, the developer. The providing of infrastructures and their maintenance must be carried out by the developer. But the developer considered that the settlement management had been handed over to the community. These situations occur due to the high cost of infrastructure management and hydrological risk reduction in this settlement. The community expected the land ownership of their settlement to be handed over to the municipality, so that the community can ask for the help of the municipality to improve infrastructure and reduce the hydrological risk impact in their settlement.

“[...] we are constrained by the difficulty to obtain government aids because the land of the settlement is still owned by the Tanah Mas Company. We also want a positive response from the municipality about the suggestions developed by the community [...]”<sup>478</sup>

“[...] The land ownership of the Tanah Mas residential area has not been handed over to the municipality. That is our constraint. If it is handed over to the municipality, maybe we can propose the subsidization of the pump operating costs (electricity) to the municipality [...]”<sup>479</sup>

“[...] after many years of waiting, the Tanah Mas company, developer of the Tanah Mas residential area, gave some part of land to the municipality of Semarang City for the development of facilities in the settlement ...these lands (infrastructures), which were given, are included in the infrastructure of 48 km long street in an area of approximately 349462 m<sup>2</sup>, 3.1 km long drainage infrastructure in an area of 37562m<sup>2</sup>, and also public facilities including office of the sub-district, worship facilities, green space (park), land for educational and sport areas about 27223 m<sup>2</sup>”<sup>480</sup>

The change of infrastructures management encourages municipal authorities to manage urban infrastructures in the Tanah Mas settlement. As a result, the municipality can strengthen the community self-help efforts for hydrological risk reduction. However, the community expects urban institutions to take an active role in facilitating community efforts and also in realizing urban hydrological projects around their settlement. So far, the community needs the municipality to give them a financial help (subsidies) for the expensive operating of the pump system electricity. However, the municipality can fulfil these demands only with difficulty because of their limited authority on settlement infrastructures and problems of urban policy.

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<sup>478</sup> Interview with Rendra Purwadhiguna (39-year-old), community head who has lived there since 1980, works for a private enterprise.

<sup>479</sup> Interview with Yoseph Salim (52-year-old), community head who settled in 2002.

<sup>480</sup> Prianggoro, A., “Akhirnya, perumahan Tanah Mas diserahkan kepada pemkot”, *Tribun Jateng*, July 15<sup>th</sup>, 2015, retrieved December 25<sup>th</sup>, 2015, from <http://jateng.tribunnews.com/2015/07/15/akhirnya-perumahan-tanah-mas-diserahkan-kepada-pemkot>.



However, the community still expects the effectiveness of urban projects to solve the hydrological risk. The community realized that their efforts only reduce the impact of hydrological risk in their settlement. But the efforts for flood risk reduction in the Semarang coastal area remain to be carried out by the municipality. Yet, the community is not really sure that government efforts can solve the hydrological risk. The community considers that their self-help efforts are still needed to anticipate the probable lack of urban system. However, community self-help efforts are an important element to develop urban resilience.

“[...] recently, the retention basin has been built. So, if the retention basin is really functioning, how will its operational cost financed? With the annual regional budget or by us (community)? This project includes some communities of the Semarang Utara District. Anyway, communities agreed or not if there are dues? I’m sure that the municipality has difficulty to publicize these community dues, whereas the pump of retention basin must function 24 hours [...]”<sup>481</sup>

Since P5L chose self-reliance, NGOs are not interested in participating in efforts for hydrological risk reduction in this settlement. For one decade, P5L has worked with community self-help without the assistance of NGOs. In the case of Semarang coastal communities, NGOs usually focus on helping poor communities in *kampung* areas in the face of hydrological risk impact. This objective is not in line with the economic resources of the majority of Tanah Mas inhabitants.

These situations above describe how the community and municipality efforts of urban hydrological risk reduction are not integrated. Collaboration efforts only occur in partial actions such as the involvement of community in the flood prevention efforts developed by municipality. Urban hydrological projects are created by government initiatives without the intervention of community. The involvement of community is limited to public hearings only, but it is not reflected in urban hydrological projects and plans. On the one hand, urban hydrological projects and plans often experienced constraints in the implementation due to community disagreements. On the other, the system of hydrological risk reduction built by community self-help efforts is not integrated into urban hydrological projects and plans. The lack of urban hydrological management by the municipality influences the inefficiency of community collective efforts. Nonetheless, the community resilience process depends on the urban resilience process. In fact, the down planning approaches dominate the processes of urban hydrological reduction in Semarang City. It absolutely inhibits the processes of urban flood resilience.

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<sup>481</sup> Interview with A. Ibnu S, RW community head and director of P5L association.

## Chapter conclusion

The Tanah Mas residential area is a planned territory in the Semarang coastal area that is highly vulnerable to hydrological risks. Its development was the result of urban investors that supported the Semarang urbanization with providing much needed urban settlements. Nevertheless, this case indicates that urban plans and projects were inattentive to urban geographical characteristics, in particular the development of urban zones on the Semarang coastal territory. The land reclamation consisted in urban development engineering that changed water and green spaces into built-up spaces. It was a form of urban planning and project without the element of urban risk mitigation. The urban development was oriented towards urban economic approaches. Recently, it engendered urban economic losses for both municipality and the communities. However, the planning and existence of water spaces in the city are important elements in terms of urban development.

Furthermore, this case indicates urban transformations, in particular architectural forms due to the risk existence. Although the settlement pattern has not experienced significant change, the architectural pattern experienced a transformation process in the development of the adaptive forms in the face of risk. Initially, this settlement was built with regular and uniform architectural patterns, including the types of houses and streets. Nonetheless, the risk existence led to the emergence of irregular architectural patterns in the settlement. The transformations of house forms (types) are also influenced by the economic resources and desires of each household for the reduction of hydrological risk impact. Moreover, community self-help influences the architectural form of local streets in the settlement. The esthetic values of architectural forms are not the principal elements for the settlement transformation. Community perceptions and behaviors of the flood risk become the main elements in the process of settlement transformation and urban rehabilitation. Furthermore, the hydrological risk existence changes the settlement values. Initially, this settlement was a prestigious residential area in Semarang City, but it has recently experienced a decrease in property value.

Moreover, the risk existence produces territorial and social problems. The community carried out self-help efforts that unfortunately negatively impacts the neighbors' areas from small to large scale in the city. These efforts produce social frictions which certainly inhibit the urban resilience process. The process needs the collaboration between communities and urban institutions. Although the community understands the causes of hydrological risk, they have in fact great difficulty discontinuing the practices that influence the risk existence. For instance, the community still uses artesian wells as water resources, even though they know

this action produces land subsidence, and thus flood risk in their territory. So far urban institutions developed positive efforts to reduce groundwater extraction, although these efforts remain at the level of regulation enforcement and have not been implemented yet.

The awareness of local change agents influence community initiatives and forms of collective efforts for the hydrological risk reduction at the local scale. The local change agents include leader figures and community heads. They become the motor of the community resilience process. The lack of awareness and initiatives of local change agents constrains the urban resilience process. In the case of the Tanah Mas community, the pump system managed by the P5L association is the “fruit” of community initiatives that were influenced by local change agents. The community considered this system as the best practice for flood risk reduction in their territory. Furthermore, the role of change agents in the development of the local association positively affected the Tanah Mas community. It fostered togetherness that enables the community to anticipate the hydrological risk. The transformation from individual (household) efforts to collective (community) efforts indicates a positive social process that is needed for the development of community and urban resilience. In addition, the resilience process does not only depend on structural efforts, but also the community trust in collective efforts.

Although the community self-help efforts are temporary, the community felt their actions were effective. The community trust in their collective actions is important to develop resilience because there is no zero risk. The community trust, is developed through local initiatives and actions of local change agents for risk reduction efforts, which needs a long process of social transformation. Sharing the same fate strengthens the community willingness to participate in collective self-help efforts.

Furthermore, the community trust and perception of the P5L association as “solution” for risk existence is a social capital that helps developing local resilience. They considered that the hydrological risk is always increasing, but they also believed in their self-help collective efforts. Moreover, the official recognition of P5L by the government and other communities increases the community trust in their collective efforts.

The lack of government efforts is described in this case. The creation of P5L and its management of the local pump system result from the lack of urban system and influence the urban equality. Indeed, the pump system can be effective for the hydrological risk reduction at the local scale, but it can increase hydrological risks in the other areas in city. So far, the partnership between the urban institutions and the community only focuses on the socializations of urban hydrological plans and projects which are initiated through the top-

down planning approaches. The lack of government intervention to develop collaboration between communities also occurs in Semarang City. The disintegration of community self-help efforts certainly inhibits the process of urban flood resilience. Community self-help efforts are still limited by administrative divisions (including district, sub-districts, and also settlement boundaries) and geographic situations. These efforts are focused only on the local scale.

The explanations above demonstrate that the lack of urban flood resilience process is due to the disintegration of collaborative efforts between communities and the urban institutions and to the inadequacy of urban system. However, the P5L management of the local pump system is the best practice for hydrological risk reduction in Semarang City. Other communities seek to emulate the P5L efforts in their territories. This demonstrates a knowledge transfer of the local initiatives among the communities in the Semarang coastal area. The community learning process is still an indicator of urban flood resilience process. Nevertheless, communities have different capacities to implement community learning and adaptive efforts for the hydrological risk reduction.

The Semarang coastal area is dominated by *kampung* communities where the socio-economic conditions differ from the Tanah Mas community. Different economic resources produce different adaptive capacities between the Tanah Mas community and *kampung* communities in Semarang City. However, the analysis of *kampung* communities is an integrated perspective for assessing the process of urban flood resilience in Semarang City.



*“Urban space becomes a social learning space, which allows the passage from the rural urban to the urban life. It occurs through the wide range of activities forming the informal sector; those in space of urban centre is significantly related to the migrants”<sup>348</sup>*

## Chapter 4

# How the sociocultural system, urban and external stakeholders influence the local resilience process

This chapter aims to describe the efforts of *kampung* communities - majority of communities in the Semarang coastal area – to manage hydrological risks in their neighbourhoods. The consequences of communities’ efforts as responses to the hydrological risk will be assessed in terms of spatial transformations including territorial and architectural forms, and their social meanings.

In this chapter, *kampung* Cilosari and *kampung* Tambak Lorok will represent the *kampung* in the Semarang coastal area. Although both neighbourhoods are often inundated by *rob* phenomena, population statistics indicate that only a small proportion moves away from those areas. This situation leads us to question the resilience process occurring in those neighbourhoods. How can communities adapt their *kampung* to the *rob* risk? How do interactions between communities and urban institutions support initiatives (projects) to reduce the hydrological risk in these areas? To answer these questions, we will analyse the Banger Polder Pilot Project as an example of urban hydrological project that describes the real interactions between government, urban institutions and communities and their efforts to reduce hydrological risks. As described in the previous chapter, we will use a phenomenological method supported by qualitative and quantitative data.

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<sup>348</sup> Soetomo, S., 1988, *Le Secteur informel dans la structure spatiale de la ville de Semarang (Indonésie) : une étude de quelques petites activités présentes dans différents espaces, de l'urbain au rural*, thèse de doctorat, Institut Français d'Urbanisme, Université de Paris 8.

#### 4.1. The *kampung* expansion results from the growth of the urban informal sector

This sub-chapter deals with the spatial transformations caused by the growth of the urban informal sector in the Semarang coastal area. *Kampung* grew during the Dutch colonial era and have continued to expand after the Indonesian independence. However, since the 1980s, the industrialization process, urban economic growth and high migration rates have caused their dramatic expansion. These conditions influence the urbanization process of Semarang City. The development of the Tanjung Mas Port and the Samarang Nederlands-Indische Spoorweg (NIS) Station account for the growth of Cilosari and Tambak Lorok *kampung*. These specific conditions have influenced hydrological risks in the coastal area of Semarang City.

##### 4.1.1. Transportation zones as strategic areas for international trade and industrialization during the Dutch colonial era

The growth of *kampung* in the Semarang coastal area initially occurred in the old town. At that time, these *kampung* were located in the zone around the first station of Semarang City: *Samarang Nederlands-Indische Spoorweg (NIS) Station* or Tambaksari Station built by the Dutch government in 1864. Tambaksari is the area located around the old town. The toponymy denotes an area being dominated by aquaculture. *Tambak* means fishpond area while *sari* means bustling or essence.

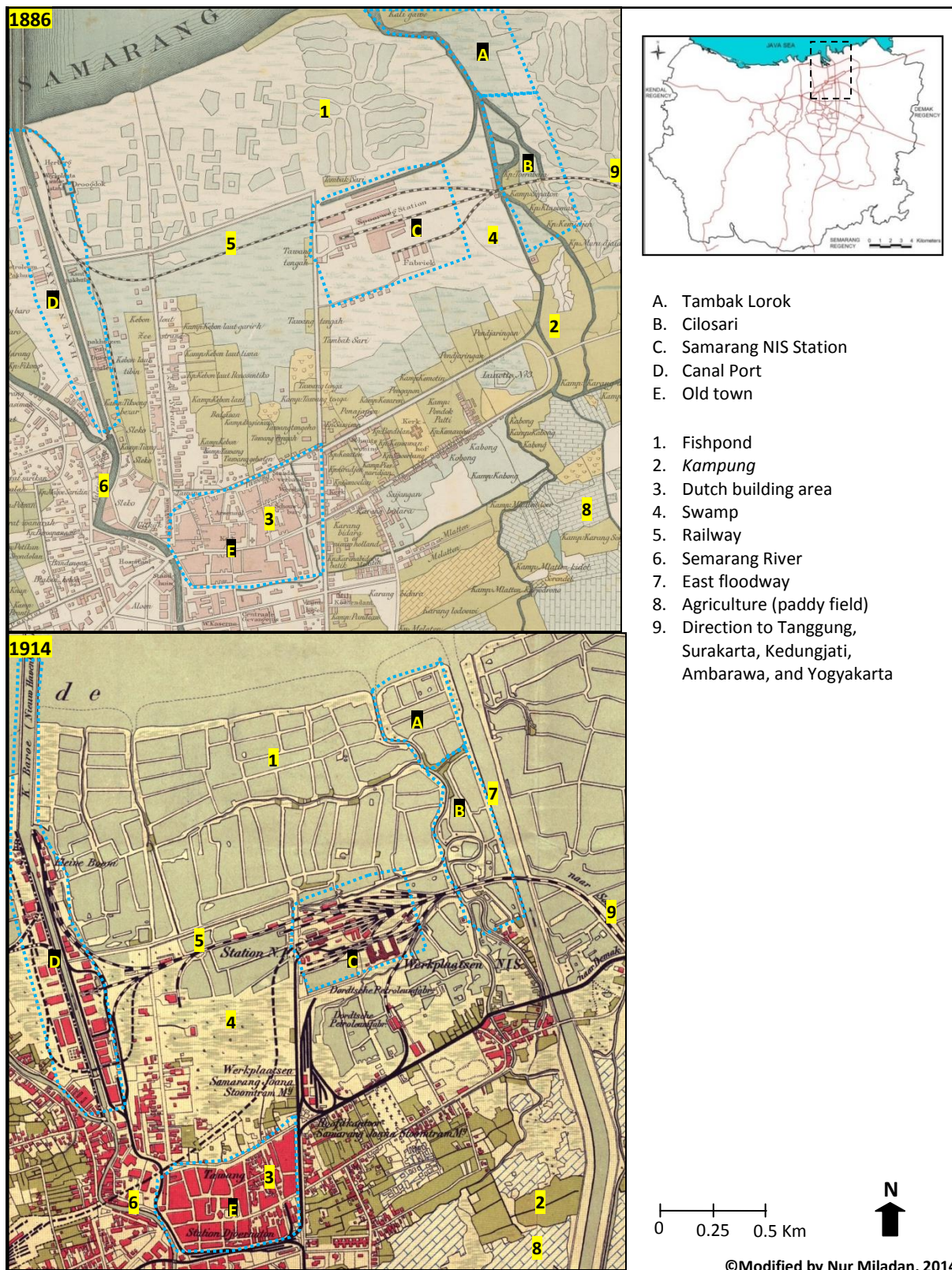
Java started early to build railways. On 17th June 1864, a first section of 26-kilometre opened between Kemijen and Tanggung, a few years later it became the first and main public line connecting Semarang to Solo and Yogyakarta.<sup>349 350</sup> This railway line operated between 1867 and 1872 to serve economic (transport of agricultural commodities and mining products from hinterland to the harbour) and military purposes (pacification).<sup>351</sup> This station provided both freight and passenger service. The railway system accelerated the urban economic growth. The development of agriculture and forest commodities transformed Semarang into a trading city. At the beginning of the 20<sup>th</sup> century, Cilosari and Tambak Lorok were low-density zones dominated by areas of aquaculture.

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<sup>349</sup> Lee, R., 2003, *Potential Railway World Heritage Sites in Asia and the Pacific*, York: Institute of Railway Studies, University of York.

<sup>350</sup> Today, *kampung* Cilosari is located in Kemijen Sub-district (Semarang Timur Sub-district). Tanggung is a district in Grobogan Regency located approximately 67 km in the east of Semarang City.

<sup>351</sup> Vries, B., Graaf, G., Schild, R., 2014 (2015), *Identification Mission Historical Rolling Stock Indonesia*, Amersfoort: Cultural Heritage Agency- Ministry of Education, Culture and Science of Netherlands.



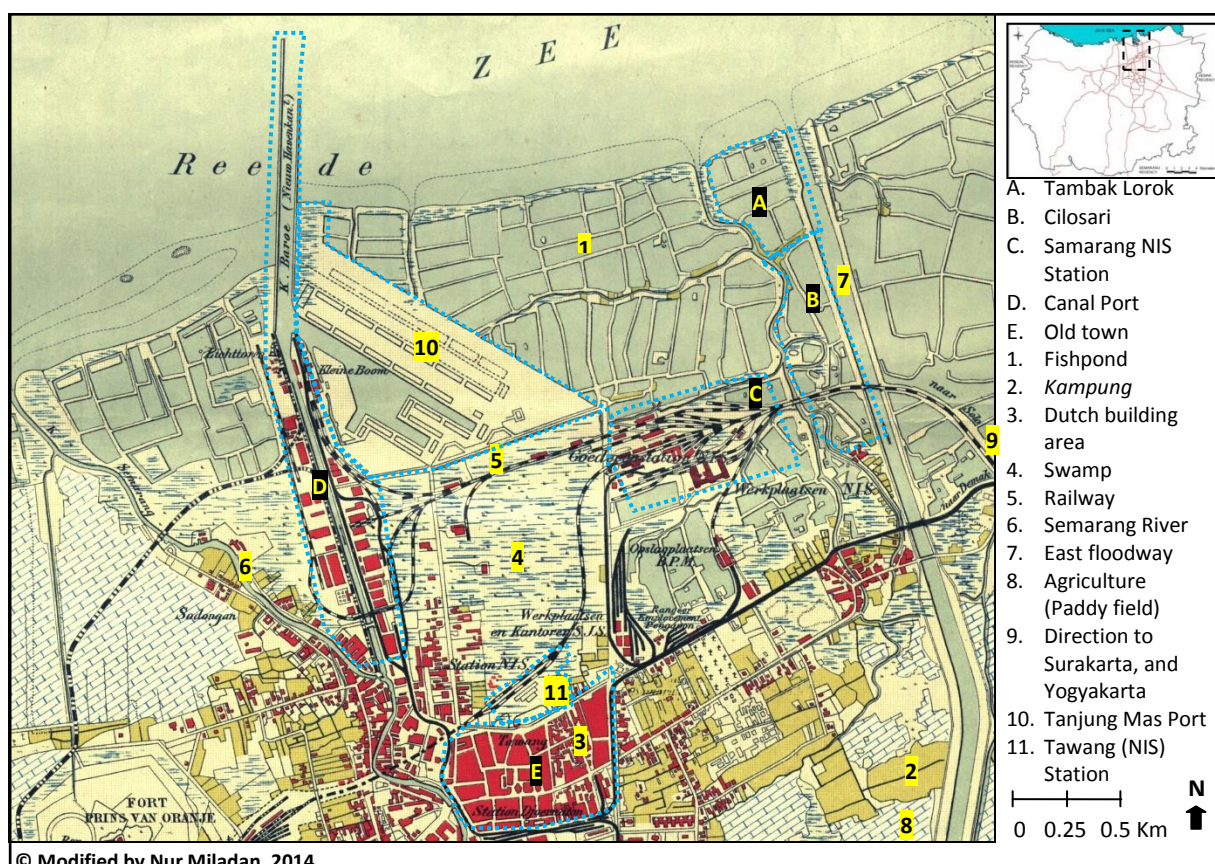
**Figure 139. Cilosari, Tambak Lorok and their surroundings in 1886 and in 1914**

Source: *Kaart van de stad Samarang en Omstreken* [Map], 1886, KITLV, Leiden; Technisch Reproductiebureau Broek en van Gheel Gildemeester, Rijsmijk Z.H, *Samarang* [Map], 1914, KITLV, Leiden.

The maps of Samarang City in 1886 and in 1914 show how Cilosari and Tambak Lorok were still open spaces dominated by the fishpond and swamp area. At that time, the development of the Samarang NIS Station and the canal port furthered the growth of surrounding areas including Cilosari and Tambak Lorok. In addition, the map of Samarang City in 1914 indicates the emergence of East floodway East of Cilosari and Tambak Lorok. Today, the East floodway and the Banger River (West of both settlements) increase the vulnerability of these settlements to flood risk.



The Semarang NIS station expansion considerably affected Cilosari. The Dutch government built several buildings around the station to intensify station activities such as warehousing for the agriculture and forest commodities waiting to be sold at the Semarang port. Furthermore, a railway connected the Semarang NIS Station and the Canal Port to facilitate the freight unloading activities. The passenger service was moved to Tawang Station in 1914.<sup>352 353</sup> The appearance of the Tanjung Mas Port in 1924 also stimulated the growth of Cilosari and Tambak Lorok. It became the site of international commerce where traders came from Europe, China, Arab, and India to acquire the commodities of plantations and forests from the Javanese inland.



**Figure 140. Cilosari, Tambak Lorok and their surroundings in 1924**

Source: N.V. Technisch-Reproductiebureau en Lichtdrukkerij Holland-Indie – s-Gravenhage, *Semarang* [Map], 1924, KITLV, Leiden.

*Maps of Semarang City show how Cilosari and Tambak Lorok were still dominated by the open (water) spaces in 1924. However, the emergence of the Tanjung Mas Port increased commercial activities on Semarang coastal area. These activities attracted many migrant workers. They settled in areas surrounding the port, including Cilosari and Tambak Lorok.*

<sup>352</sup> New station in area of Semarang old town.

<sup>353</sup> Unit Station Maintenance, Preservation & Architecture, Indonesian Railway Company, 2014, *Stasiun Semarang Tawang*, retrieved December 28<sup>th</sup>, 2015, from <http://heritage.kereta-api.co.id/>.



Migrants came from other coastal regions (Jebara, Demak, Kudus, Pekalongan, Kendal) and inland regions (Ungaran, Surakarta, Ambarawa, Grobogan) around Semarang City. Most of them were indigenous (Javanese) peoples. They worked in the Tanjung Mas port and stations as porters and traders. At that time, the area around Cilosari began to be built as an extension area to the warehousing and station zones and several workers of Dutch Railway Company (*Nederlands-Indische Spoorweg*) came to settle there. These urban facilities accelerated the urbanization process, notably in the Semarang coastal area.

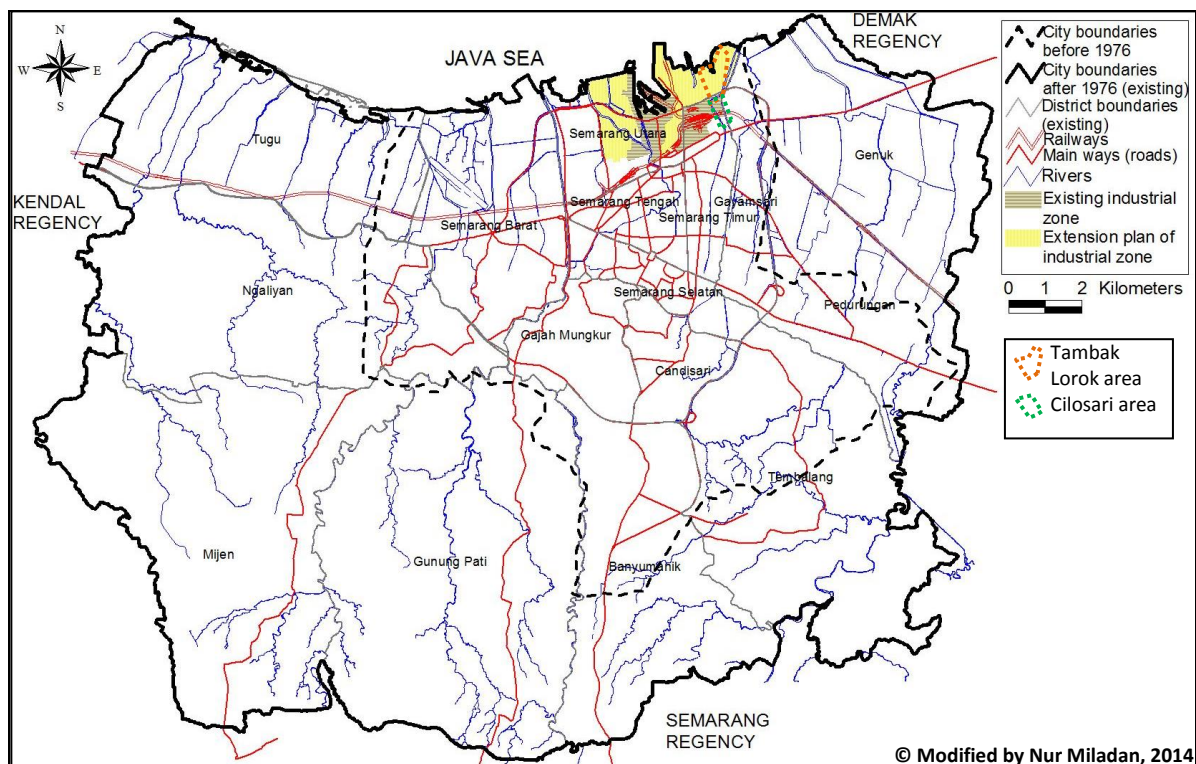
Meanwhile, the Semarang coastal aquaculture was very productive because marine fish was abundant. These opportune circumstances attracted fishermen from Central Java who settled around Tanjung Mas Port. According to the heads of Tambak Lorok communities, their ancestors started to settle there in the 1920s and 1930s and created *kampung* Tambak Lorok. These settlers further developed aquaculture activities. The land use was still dominated by the aquaculture (water spaces), so the phenomena of high tide were typical in this coastal area. The existence of fishermen's *kampung* over several decades indicates a culture and behaviours familiar with sea phenomena.

In 1937, the Dutch government planned the development of industrial areas close to the Tanjung Mas Port. Cilosari and Tambak Lorok were designed to be industrial and warehousing areas. In fact, this plan was not well implemented because of the instability of government created by the Second World War. However, several industrial factories were constructed by the Dutch government such as the building of Oil Company (*opslagplaatsen BPM/ PERTAMINA*).<sup>354</sup> Furthermore, several wars occurred during the transition era (1940s to 1950s). This chaotic situation hindered urban planning. In the case of Cilosari and Tambak Lorok, these areas were not properly maintained. At that time, the Cilosari area remained a zone devoted to station activities and owned by *PT. kereta api Indonesia* (Indonesian Railway Company)<sup>355</sup>, although the Samarang NIS station went out of service around that time. Cilosari and Tambak Lorok did not experience significant changes of land use from the 1950s to the 1970s. These areas were still dominated by aquaculture. Urban settlements in the Semarang coastal area, notably the *kampung*, have expanded since the mid-1970s with the emergence of industrialization process and the increase in migrants.

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<sup>354</sup> *Perusahaan Pertambangan Minyak dan Gas Bumi Negara* (National Company of Oil and Natural Gas Mining).

<sup>355</sup> Formerly, it was *Nederlands-Indische Spoorweg (NIS)*/State Railway Company during the period of Dutch government. With the advent of the Indonesian government, all state companies, including the railway company, were managed independently by the Indonesian government.



**Figure 141. Industrial zone in Semarang City in 1938**

Source: Baldinger, H.TH., "Semarang als industrie-stad", *Locale Techniek Indish Bouwkundig Tijdschrift*, March-April 1938; *Urban Development Management Information System (UDMIS)*, 2001, Semarang: Regional Development Planning Agency (BAPPEDA).

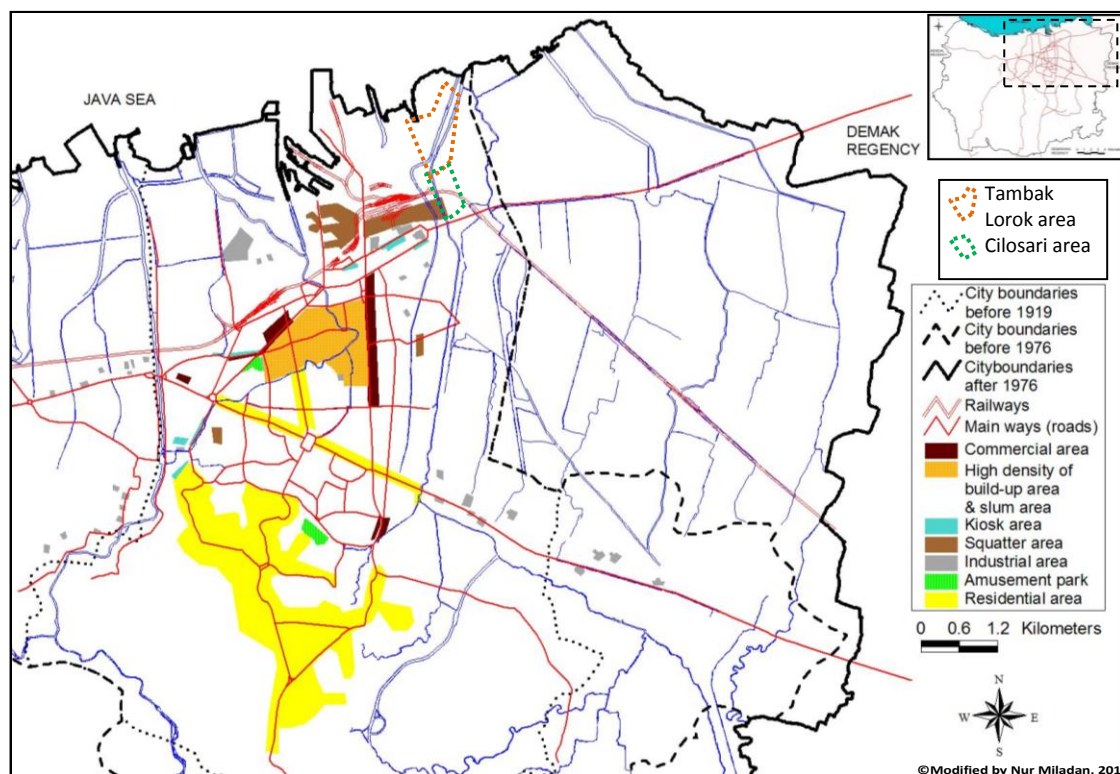
*This plan shows how Cilosari and Tambak Lorok were designed to be industrial zones and not settlement zones during the era of Dutch government. The plan was never implemented and these areas grew without adequate planning and followed the patterns of population settlement in these areas from the 1970s onwards.*

#### 4.1.2. Industrialization and natural resources as pull factors of high migration in coastal *kampung*

New industrial zones emerged with the industrialization process in Semarang City and thus attracted many migrants to the Semarang coast, particularly around Tanjung Mas Port. The rapid growth of population in *kampung* Cilosari and *kampung* Tambak Lorok occurred in the 1980s. The development of the Tanjung Mas Port significantly accelerated the Semarang urbanization. The migrants from other Indonesian islands such as Sumatera, Sulawesi and Borneo came to Semarang City through the Tanjung Mas Port. The former Semarang NIS Station was inhabited by some workers of Indonesian Railway Company. The inhabitants converted the station buildings into houses. The municipality classified the territory as a squatter area because it was situated on a government land. Cilosari was a part of *kampung* Tambak Lorok that was located in the Rejomulyo Sub-district until 1985.<sup>356</sup> At that time, *kampung* Tambak Lorok was

<sup>356</sup> Rejomulyo was a part of Semarang Utara District until it became the Tanjung Mas Sub-district in 1985.

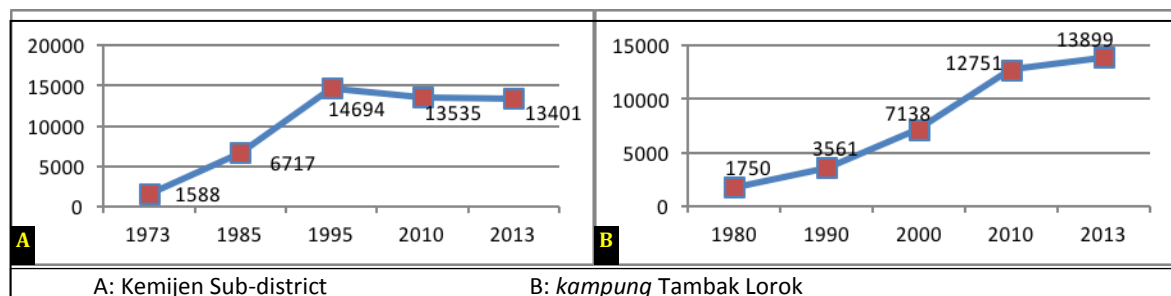
split in two parts: the Southern side was known as *kampung* Cilosari and belonged to the Kemijen Sub-district<sup>357</sup>, while the Northern side kept the name of *kampung* Tambak Lorok.



**Figure 142. Situation of Semarang City in 1972**

Source: “Analisis Umum (General analysis)” [Map], *Master Plan of Semarang City for 1972-1992*, 1971/1972, Semarang: Department of Urban Planning and Settlement of Semarang City; *Urban Development Management Information System (UDMIS)*, *ibid*.

This map shows how Cilosari and Tambak Lorok were still dominated by the open spaces at the beginning of the 1970s. However, migrants began to live in squatter settlements of the Southern part of Cilosari.



**Figure 143. Population growth of Kemijen Sub-district<sup>358</sup> and kampung Tambak Lorok**

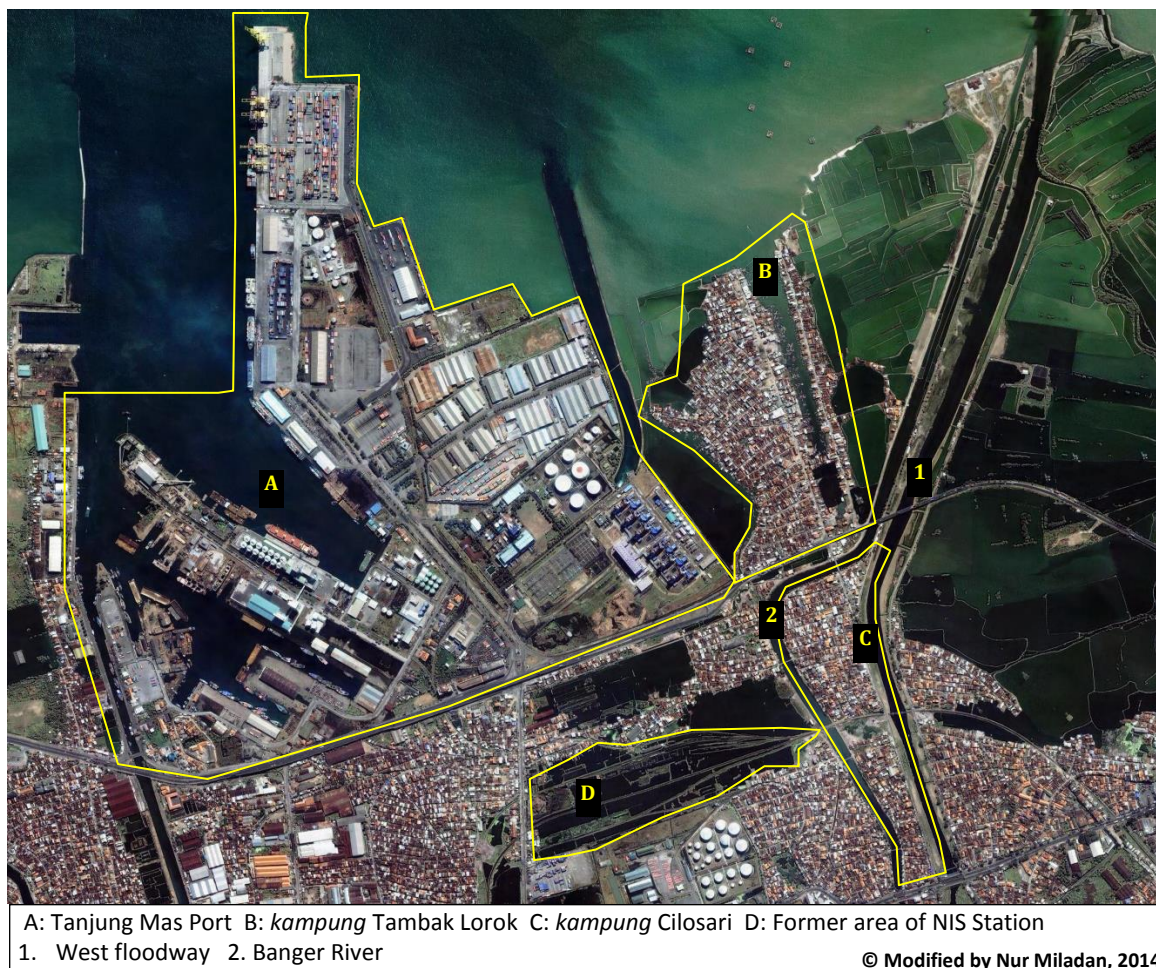
Source: Statistical Year Book of Semarang City in 1973, Population of Semarang City in mid- Year 1985, Semarang in Figures 1995, Semarang in Figures 2010, Semarang in Figures 2013, Semarang: Central Bureau of Statistics of Semarang City; Statistical data from communities, 2013.

These graphics describe how population has rapidly grown in the last three decades. Population continued to increase in spite of the hydrological risks. Statistics indicate a slight decrease in the Kemijen population between 1995 and 2013. *suaaest* that only a small propoortion of the community relocated.

<sup>357</sup> Government regulation no. 55/ 1992 regarding the composition of districts in several municipalities in Central Java Province. It establishes the administrative move of Kemijen Sub-district from the Semarang Utara District to the Semarang Timur District.

<sup>358</sup> Official statistical data of population published by the municipality only indicate the population in scales of city, district, and sub-district. There is no official data from the municipality about the *kampung* population . However, the population growth in the Kemijen Sub-district gives an estimation of the *kampung* Cilosari.





**Figure 144. Boundaries between kampung Cilosari and kampung Tambak Lorok**

Source: Ikonos Satellite Image of Semarang in 2008 and primary data, 2013

*Kampung Tambak Lorok and kampung Cilosari are located less than 1 km away from the Tanjung Mas Port. This urban facility becomes the livelihood resources for the communities of Cilosari and Tambak Lorok.*

At that time, *kampung Cilosari* consisted of one *RW* only and was inhabited by dozens of inhabitants. *Cilosari* comes from the Javanese words *cilo* (river) and *sari* (bustling or essence) and designates a bustling area around of the river,<sup>359</sup> whereas *Tambak Lorok* originates from *tambak* (fishpond) and *lorok* (slipped down) and refers to the fishpond areas that slipped down.<sup>360</sup> These names are to be found where the inhabitants created the fishponds and reflected it in the name of the *kampung*. Some inhabitants even asserted that *lorok* means “to come”. They argued that some fishermen came and settled in that area and that eventually it became a *kampung*. However, the name of *Tambak Lorok* was changed to *Tambakmulyo* by the head of the sub-district and the community to give a more positive connotation to the place. *Mulyo* means indeed prosperous and the change was supposed to increase the

<sup>359</sup> Interviews with several heads of the Cilosari community, 2013.

<sup>360</sup> Interviews with several heads of the Tambak Lorok community, 2013.



community welfare. The community divided their *kampung* in two parts separated by a river. The Western part is Tambakmulyo and the Eastern part is Tambakrejo. Actually, the community preferred to call their settlement *kampung* Tambak Lorok because other communities have used this denomination for several decades.

Interviews with several heads of communities explore the evolution of these *kampung*. Since the 1970s, many migrants came to live in these *kampung*. Most of them are indigenous (Javanese) peoples but other ethnic minorities are to be found: Chinese, Celebes (Ambon and Bugis), Borneo and Sumatera (Malay). These different origins influence the migrants' choice of settlement between *kampung* Cilosari and *kampung* Tambak Lorok.

*Kampung* Cilosari evolved as an industrial labour settlement. The Cilosari community chose to locate close to the Tanjung Mas Port, less than one kilometre away from the industrial zones. They reckoned that this large territory was a quiet open space outside the supervision of the Indonesian Railway Company. They converted these swamp areas into housing areas without a building permit delivered by the municipality. Urban industrialization did not involve housing construction for industrial workers. Masses of migrants came to get the jobs in the industrial zones and thus *kampung* Cilosari became a high density settlement during the 1980s. Several statements illustrate this evolution.

“I followed my parents who moved from Demak (Regency) to (kampung) Cilosari in 1975. At that time, (this kampung) was part of kampung Tambakmulyo (Tambak Lorok), while the Rejomulyo Sub-district was only inhabited by tens of families. In 1980, there was a territorial enlargement that enabled one *RW* (community) to separate from Tambak Lorok and to become *kampung* Cilosari...Masses of migrants arrived in the 1980s. They were from Demak, Grobogan, Solo, Yogyakarta, Salatiga, and other regions in Indonesia such as Ambon (Maluku). Most of them worked in the fabric industry [...]”<sup>361</sup>

“I was born at (*kampung*) Cilosari in 1964. My parents used to live here and now, I continue to live with my family in the house of my parents. At the beginning, this *kampung* was quiet and it was still a swamp. In the 1970s and the 1980s, there were many migrants who came and settled in Cilosari. They were industrial workers [...]”<sup>362</sup>

“I was born in 1970 and I have always lived in this *kampung*. According to older inhabitants, this *kampung* appeared in the 1970s. But, the houses were not close to each other. In the 1980s, many migrants came to this *kampung* because of the development of the Tanjung Mas Port [...]”<sup>363</sup>

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<sup>361</sup> Interview with H.M. Jamhari (54-year-old), head of the Cilosari community, entrepreneur/ small trader. He settled with their parents in 1975.

<sup>362</sup> Interview with Kunardi (48-year-old), head of the Cilosari community, labour.

<sup>363</sup> Interview with Wahyuni (44-year-old), Cilosari inhabitant, labour.

In contrast, the *kampung* Tambak Lorok evolved as a fishermen's settlement. It has attracted many migrants since the 1970s. According to the heads of the Tambak Lorok community, the marine resources and the fishery productivity in the Semarang coastal area were better than in other coastal regions at that time. Many fishermen came to live near the Tanjung Mas Port (Tambak Lorok area). The following statements aptly describe these trajectories.

“I was a fisherman on a fishing vessel that came from Bagan Siapi-api, Sumatra. I entered Semarang in the port of fishery (Tanjung Mas Port area) in 1973. At that time, it was in Ujung Sari but now it is the area of the BBPI<sup>364</sup> office (around Tanjung Mas Port). In 1974, I relocated to Tambak Lorok and until recently, I was a fisherman, although I'm rarely at sea due to my advanced age...According to the stories of older people, the ancestors of our community came in the 1930s. My father-in-law was born in 1933 and now, he is already dead... In the 1960s and 1970s, our coast had abundant marine resources so many fisherman from other regions settled in (*kampung*) Tambak Lorok. They came from Bugis, Makasar (Sulawesi Island); Cirebon, Demak (other regions in Java Island), and even Sumatra (Island)”<sup>365</sup>

“I was born in (*kampung*) Tambak Lorok in 1964. At that time, there were still dirt roads and no electricity. From 1985, more homes began to have electricity, streets were paved with asphalt in Tambak Lorok [...] In the 1970s, many fishermen migrated from other (regions in) North Coast of Java. Because of the wave season, our fishermen could sail more safely than those of other regions such as Kendal, Demak, Jepara (other coastal regencies in Central Java Province). But there were also migrants from the inland (of Central Java Province) such as Solo, Purwodadi, Blora [...]”<sup>366</sup>

“In 1966, I moved from Jepara to (*kampung*) Tambak Lorok. At that time, I needed to go to school (better accessibility to education facilities in Semarang City than in other municipalities in Central Java Province), so I followed my family who settled in (*kampung*) Tambak Lorok. I have been a fisherman since 1972 [...] In the 1970s, during each stormy season, the area of Tambak Lorok was used to shelter fishermen from other regions. Some of them preferred to remain in (*kampung*) Tambak Lorok and became the inhabitants of (*kampung*) Tambak Lorok. In the 1970s or 1980s, because of the extension of Tanjung Mas Port, the community of Ujung Sari (around Tanjung Mas Port area) relocated to Tambak Lorok. In the 1990s, the area of Dargo Market was extended<sup>367</sup> and some inhabitants relocated to Tambak Lorok.”<sup>368</sup>

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<sup>364</sup> *Balai besar penangkapan ikan* (BBPI) Semarang (Fishing technology center of Semarang) was developed by the national government in 1975.

<sup>365</sup> Interview with Sunarto (60-year-old), head of the Tambak Lorok community, fisherman.

<sup>366</sup> Interview with Jumron (49-year-old), head of the Tambak Lorok community, fisherman.

<sup>367</sup> The traditional market is located south of *kampung* Tambak Lorok.

<sup>368</sup> Interview with Panjang Mas Hadi (59-year-old), head of Tambak Lorok community, fisherman.

These statements also suggest that the high population growth of *kampung* Tambak Lorok was influenced by natural growth (high birth rate in Indonesia<sup>369</sup>), marriages of fishermen with indigenous inhabitants, and also relocations of inhabitants from surrounding areas since the 1970s. The growth of industrial zones in Tanjung Mas Port also induced the growth of *kampung* Tambak Lorok in the 1990s. Although it was dominated by fishermen, some inhabitants became industrial labours, and underemployed workers in the surrounding area of the Tanjung Mas Port. This *kampung* has an area of  $\pm 26$  Ha and in 2013, a population of  $\pm 13,000$  inhabitants. It is divided into 5 *RWs* communities. Its most populous habitation is in the Tanjung Mas Sub-district where there are approximately 4,600 households ( $\pm 60\%$  of total number of households in that sub-district).

Meanwhile, *kampung* Cilosari's most populous habitation is in the Kemijen Sub-district. It is divided into 4 *RWs* communities and 36 *RWs* communities. *Kampung* Cilosari has an area of  $\pm 17$  Ha and a population of  $\pm 4,000$  inhabitants in 2013. *Kampung* Cilosari and *kampung* Tambak Lorok have high population densities that are estimated at 236 inhabitants/ Ha and 500 inhabitants/ Ha respectively.<sup>370</sup> In the 1970s, these *kampung* had a low population density. These *kampung* were located in the Rejomulyo District which had a population density of approximately 52 inhabitants/ Ha. These data describe the rapid growth of population in 30 years. In the 1990s, when the high hydrological risk threatened Semarang coastal area, the population densities of both *kampung* were still increasing. Indigenous inhabitants remained and masses of migrants settled in both *kampung*. These communities' choices show how economic factors matter more than the hydrological risk. The growth of economic activities in Semarang coastal area was followed by the growth of population, but this evolution increased the growth of hydrological risks.

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<sup>369</sup> Average annual population growth rate in 1971-1980 (2, 31), in 1980-1990 (1, 98), in recent time (2010-2014) is about 1, 40. Central Bureau of Statistics of Indonesia, *Population Growth by Province* [Web], retrieved December 28th, 2015, from <http://www.bps.go.id/linkTabelStatis/view/id/1268>.

<sup>370</sup> In 2013, the population density average of Semarang City is only about 42 inhabitants/ Ha. Furthermore, the rule of national standard for settlement (neighbourhood) mentions that the population density in urban area is very high (about 201 to 400 inhabitants/ Ha). Source: *Semarang in Figures 2013, 2014*, Semarang: Central Bureau of Statistics of Semarang City; *Tata cara perencanaan lingkungan perumahan di perkotaan*, 2004, Jakarta: National Standardization Agency of Indonesia.

## 4.2. The urbanization process affects neighbourhoods' hydrological vulnerabilities

This part explains the correlation between urban transformations and hydrological risks. It describes how urban areas grew alongside hydrological risks.

### 4.2.1. High built-up densities versus land subsidence

The high population growth is linked to the built-up area growth in coastal *kampung* including Cilosari and Tambak Lorok. Since the 1980s, the inhabitants have converted open spaces (including the fishpond and swamp areas) to the built-up spaces for settlements. Urban stakeholders also built infrastructures such as transportation (port, station, and airport), industrial and commercial zones in coastal area to reinforce the Semarang urban development. These developments certainly decreased the surface of urban open spaces. At that time, migrants purchased lands from indigenous peoples and even utilized the urban spaces that were not properly maintained by urban institutions, such as foreshores and river banks, colonial buildings as settlements. These changes took place also in *kampung* Cilosari and *kampung* Tambak Lorok. In the case of *kampung* Cilosari, migrants built houses next to the former station, the Banger River Bank, and the East floodway since the 1980s. As a result, the municipality classified some parts of the settlement as squatter areas. These transformations also took place in *kampung* Tambak Lorok where inhabitants built houses near the Banger River Bank and the Tanjung Mas Port. The municipality prohibited built-up areas along the Banger River, but in fact the situation was difficult to handle. The built-up areas in both *kampung* were massively increasing in the 1980s and 1990s. The ownership of Tambak Lorok lands was contested between the community and the *PT. Pelabuhan Indonesia* (Indonesia Port Corporation).<sup>371</sup> This company stated that the land belonged to the Tanjung Mas Port and would be used to launch an extension project for the international port. However, the municipality has given land ownership certificates to Tambak Lorok community since 2002. On the one hand, this municipal recognition benefits the community, but inhibits the Semarang national urbanization project on the other.

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<sup>371</sup> National company managing the ports in Indonesia.





**Figure 145. Building densities in kampung Cilosari and kampung Tambak Lorok**

Source: Ikonos Satellite Image of Semarang in 2008; Google Earth, 2015.

*These aerial photos taken in 2008 and in 2015 indicate there is no significant change of built-up areas in both kampung over the last few years. The change of land use (from built-up area to open area) only occurred in the area of the Banger Polder Project that aims to reduce hydrological risk around kampung Cilosari. The building densities in both kampung are very dense. The building coverage is more than 90 percent of the total areas. Small proportion of the vegetation spaces influences the less of catchment area there. These situations certainly increase the vulnerability of these kampung to inundation risks.*

In the 2000s, most of the fishpond and swamp areas in both *kampung* have been changed in housing areas. In the last decades, coastal *kampung* grew without building permits or any municipal control of changes in land use. Consequently, *kampung* were built by the community self-help efforts only. At that time, there were no municipal rules to supervise the



forms of settlement. The forms of houses in *the kampung* very much depended on the inhabitants' abilities, often determined by economic and socio-culture conditions. As a result, building forms in the *kampung* are very irregular.



**Figure 146. Housing condition in *kampung* Tambak Lorok**

Source: Primary Survey, 2011-2013.

*The building forms in kampung Tambak Lorok are very diverse due to the different economic capacities of the community. Irregular building forms are linked to slum conditions. Waste and inundation inside the settlement indicate that this kampung is very vulnerable to hydrological risk. Although its location is adjusted to sea levels, the house on stilts is not a common building form in this kampung.*

According to several heads of the Tambak Lorok community, houses on stilts were the common housing form built by their ancestors. However, with the urbanization process on the Semarang coast since the 1980s, these housing forms were rarely used by the community because of their disadvantages. Several statements of the heads of community reflect this evolution.

“Houses on stilts actually existed a long time ago. At first, most of them (ancestors) built the foundations and the pillars (wood) with *umpak*<sup>372</sup> [...]”<sup>373</sup>

“Since the 1980s, we stopped building houses on stilts. The community preferred ordinary housing (built on the ground) because it is easier to manage the house equipment and vehicles. Besides, it does not produce mosquito nests. Usually, capable persons (not poor) preferred ordinary houses. However, poor inhabitants recently built houses on stilts because they are practical. They take a long time and many efforts to re-elevate.”<sup>374</sup>

These situations show how housing forms are influenced by socio-cultural factors. The community considers the house on stilts to be an adaptable housing form in case of inundation, but it is not principal choice for living in a hydrological risk impacted area. The Tambak Lorok community is dominated by Javanese people who are familiar with the house built on ground.<sup>375</sup> In the 1980s, houses built on the ground were constructed in mass when the phenomena of land subsidence and *rob* had not yet become crucial environmental issues in Semarang City and threatened *kampung* Tambak Lorok. The community saw the house built on the ground as more hygienic than the house on stilts because it prevents diseases such as malaria and skin diseases caused by mosquito and waste that often occur in coastal settlements. Moreover, the community considered that the construction of houses on wooden stilts cost less and thus, reflected poverty. Poor inhabitants prefer houses on wooden stilts only because of their limited economic resources. These community perceptions of explain why houses on stilts are rarely used by the Tambak Lorok community.

<sup>372</sup> Local expression referring to the foundation of foot plate.

<sup>373</sup> Sunarto (60-year-old), head of community who settled in *kampung* Tambak Lorok in 1974, a fisherman.

<sup>374</sup> Jumani, head of community who has always lived in *kampung* Tambak Lorok (birth in 1965), civil servant.

<sup>375</sup> There are four Javanese traditional house types based on their roof shape: *joglo*, *limasan*, *kampung*, and *panggang pe*. Cf. Unakul, M.H., Gurung, H., Sapardan, W.O., 2007, *Homeowner's conservation manual, Kotagede Heritage District, Yogyakarta, Indonesia*, Jakarta: UNESCO. One indicator of the strong impact of *indianisasi* (Indian form) influencing Central Java and East Java is the existence of building forms that do not have the space under them (house on stilts). This form is different in other neighbouring regions such as West Java, Sumatra, Sulawesi, Kalimantan, and East Indonesian region: there is space under the building. Source: Kartono, J.L., 2005, “Konsep ruang tradisional jawa dalam konteks budaya”, *Dimensi Interior*, vol. 3, n° 2, pp. 124 – 136.



**Figure 147. House on stilts in *kampung* Tambak Lorok**

Source: Primary Survey, 2011-2013.

*Today, the choice of house on stilts development is primarily explained by community economic resources rather than community culture. However, in fact, the elevations of houses on stilts are lower than those of neighbours' houses so that these houses are very vulnerable to inundation during the rob phenomena.*



In contrast, *kampung* Cilosari has massively built houses on the ground since the 1980s. The Javanese culture is not familiar with the residential flat form. Javanese people like to socialize in community and value kinship. Their leisure time is used to socialize with the neighbours. For them, life in flat jeopardizes kinship values. Moreover, most of the Javanese argue that a real house is built on the ground. Land ownership is very important to the Javanese. A house can be part of the resources and livelihood of a household. They can utilize parts of the house like the living room or family room as *Warung* (kiosk) for the daily needs of the community such as consumption goods, house equipment, writing and communication equipment, and even the monthly payment of electricity and water bills. The creative initiatives of a household influence which goods they sell to the community.



**Figure 148. Kiosk in *kampung* Cilosari**

Source: Saenong, I.B. (Producers), “Kemijen Bergerak” [Video], Jakarta/Semarang: Transparency International Indonesia, retrieved December 28<sup>th</sup>, 2015, from [www.youtube.com](http://www.youtube.com).<sup>376</sup>

Domestic animals (chicken, duck, bird/pigeon, goats, cat and dog) are raised within houses of the *kampung* for food, entertainment or as an investment. For the Javanese, a flat is ill-suited for this purpose: limited space, no courtyard. Besides, it would be difficult to receive many guests for the community meetings. Several interviews with the heads of communities stress this view.

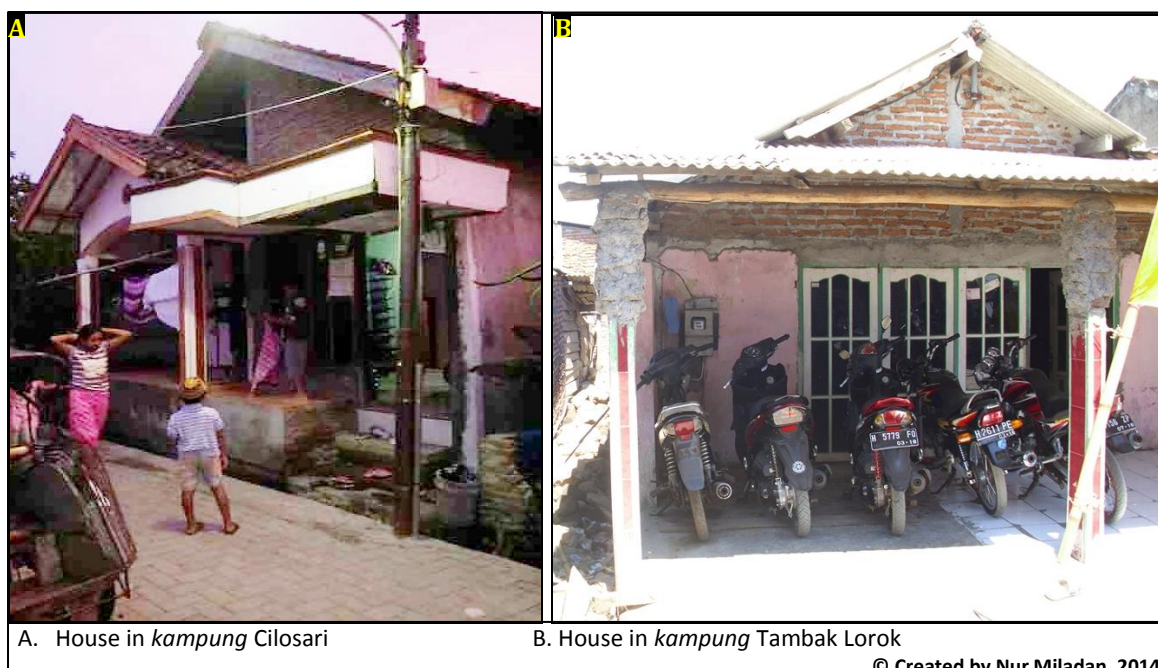
<sup>376</sup> Transparency International Indonesia (an NGO focusing on anti-corruption programs).

“Our community thought that life in an ordinary house (house built on the ground) is better than life in a flat. But it depends on the taste of inhabitants. To us, land ownership status is very important. If it is the flat, then the land is jointly owned.”<sup>377</sup>

“[...] we preferred ordinary housing because we own the property (*hak milik*). A flat is narrow, complicated, not practical, and it is not comfortable. It is difficult to invite guests. For instance, the meetings of *RTs* communities.”<sup>378</sup>

“[...] life in an ordinary house is better for the socialization (with community) than the flat. We can build our house the way we want and we can utilize for commerce, plantation, animal raising [...]”<sup>379</sup>

This community culture produces horizontal houses and considerably decreases the surface of open spaces in *kampung*. Until the 1980s, most of the houses had only one floor and were very modest. These houses were built using timber for the walls and had earthen floors. Since the beginning of the 1990s, most of the households have used other materials including bricks and cements of wall and ceramic of floor. The house size varies but most of the houses measure about 90 m<sup>2</sup>. The majority of these houses have the maximal building coverage (small proportion of open space). These constructions characterize the general modern architecture of housing forms in Indonesia.



A. House in *kampung* Cilosari

B. House in *kampung* Tambak Lorok

© Created by Nur Miladan, 2014

**Figure 149. Recent housing condition in *kampung* Cilosari and *kampung* Tambak Lorok**

Source: Primary data, 2013

Although both *kampung* have experienced architectural modernization of housing forms, limited economic resources of the communities produce intermediate and inadequate housing forms.

<sup>377</sup> Interview with RY. Soegondo (61-year-old), head of the Cilosari community who settled in 1975, pensioner.

<sup>378</sup> Interview with Suharto (40-year-old), head of the Cilosari community who has always lived there, private sector.

<sup>379</sup> Suratni (60-year-old), inhabitant who settled in 1976, underemployed worker.

Due to the lack of municipal data<sup>380</sup>, interviews with several heads of communities and field observations are the main way to obtain information on land use transformations in the *kampung*. The heads of communities do not have detailed statistical data but they really remember how changes occurred in the area. They have often lived in their *kampung* for a long time. They explained that the massive growth of built-up areas in their *kampung* started in the 1980s.

“I settled in 1965. At first, *kampung* Cilosari was a swamp and a basin. But since the 1980s, these areas were filled with soil in order to build houses.”<sup>381</sup>

“[...] initially, this *kampung* was an area of fishponds, swamps and then we filled it with soil to build houses. The inhabitants’ numbers of this *kampung* were always increasing. I was born here, I have always lived here and it (the situation) has always been like this [...]”<sup>382</sup>

In contrast, the data on land subsidence released by the municipality indicate that *kampung* Tambak Lorok and *kampung* Cilosari experience high land subsidence, about 8 to 9 centimetres each year.<sup>383</sup> The highest rate percentage of the impacted areas of land subsidence in Semarang City is settlement.<sup>384</sup> The burden of built-up areas accelerates land subsidence in both *kampung*. Furthermore, several researchers have argued that the dominant factor causing land subsidence process is ground water exploitation and that this process is spreading around the Tanjung Mas Port area.<sup>385</sup> The interviews with several heads of communities confirm that these situations indeed happen in both *kampung*.

<sup>380</sup> No official data or manuscript on land use transformations in the sub-district until 2006. Since then, these data figures in the annual reports of the Central Bureau of Statistics of Semarang City (*Semarang dalam Angka*).

<sup>381</sup> Interview with Sudiyono (70-year-old), head of the Cilosari community.

<sup>382</sup> Interview with M. Shodiqin (43-year-old), head of the Tambak Lorok community, fisherman.

<sup>383</sup> *Ringkasan dan hasil lokakarya amblesan tanah Semarang (Executive Summary of Land Subsidence in Semarang)*, 2008, Bandung: German-Indonesian Technical Cooperation on Mitigation of Georisk (Bundesanstalt für Geowissenschaften und Rohstoffe (BGR) and Ministry of Energy and Mineral Resources).

<sup>384</sup> Ismanto, A., Wirasatriya, A., Helmi, M., Hartoko, A., Prayogi, 2009, “Model sebaran penurunan tanah di wilayah pesisir Semarang”, *Ilmu kelautan*, vol. 14, n° 4, pp. 189-196.

<sup>385</sup> Raharjo, P., Sianipar, A.H., Yosi, M., 2010, *Perkembangan kota muka laut Semarang dan bukti penurunan (land subsidence) kasus Pelabuhan Tanjung Emas*, retrieved December 25<sup>th</sup> 2015, from <http://www.mgi.esdm.go.id.>; Sarah, D., Syahbana, A.J., Lubis, R.F., Mulyono, A., 2011, “Modelling of land subsidence along Tanah Mas-Pelabuhan section Semarang City using finite element method”, *Riset Geologi dan Pertambangan*, vol. 21, n° 2, pp. 105-119; Wirasatria, A., Hartoko, A., Suripin, 2006, “Study of Sea Level Rise as a Base for Rob Problem Solving in Coastal Region of Semarang City”, *Jurnal Pasir Laut*, vol. 1, n° 2, pp. 31-42; Wahyono, H.L., 2007, “Studi penurunan tanah pada Kawasan Pelabuhan Tanjung Mas Semarang”, *Wahana Teknik Sipil*, vol. 12, n° 2, pp. 125-132.

“Actually, the highest groundwater exploitation occurs in the Tanjung Mas Port. There are 8 resources (of artesian wells). These resources are used to provide water to the big anchored ships. The ships use water resources for sailing logistics.”<sup>386</sup>

“[...] resource of clean water in our *kampung* comes collective artesian wells. The number of artesian water resources in each *RT* community is not the same. Sometimes, there is one well in one *RT* community, and other *RT* communities have two wells. Each household looks for the water resource closest to his house. Our entire community uses artesian water. Actually, PDAM<sup>387</sup> has offered the water supply network to our community, but we have read that the PDAM water network is disorganised in the city centre. But we use artesian water that is evenly distributed in the community. The payment of artesian water used by each household is made once a week. One cubic costs 3000 to 3500 IDR (0.19 to 0.22 €). Artesian water is indeed more expensive (than PDAM water) but they are satisfied [...]”<sup>388</sup>

“[...] in our *kampung*, many inhabitants (households) who use the artesian wells, so that the land subsidence (process) takes place [...]”<sup>389</sup>

To cover their daily needs, communities resort to water (artesian) wells due to the lack of urban clean water network. Kemijen Sub-district’s residents who cannot access PDAM network buy water from private vendors who extract it from private wells and sell it.<sup>390</sup> The heads of the Cilosari community indicate that approximately 70 to 80 percent of households use water wells and other households use PDAM water for their daily needs. Meanwhile in *kampung* Tambak Lorok, all households use water (artesian) wells. The massive use of artesian wells causes a big decrease in groundwater and hastens land subsidence process in both *kampung*. Groundwater extraction results from the increasing number of houses. Therefore, the land subsidence process in the *kampung* is not only a consequence of the land subsidence process in the Tanjung Mas Port area. It is aggravated by the communities’ groundwater use.

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<sup>386</sup> Interview with Bambang S. Dahlan, head of the Tambak Lorok community and head of the community empowerment board of Tanjung Mas Sub-district.

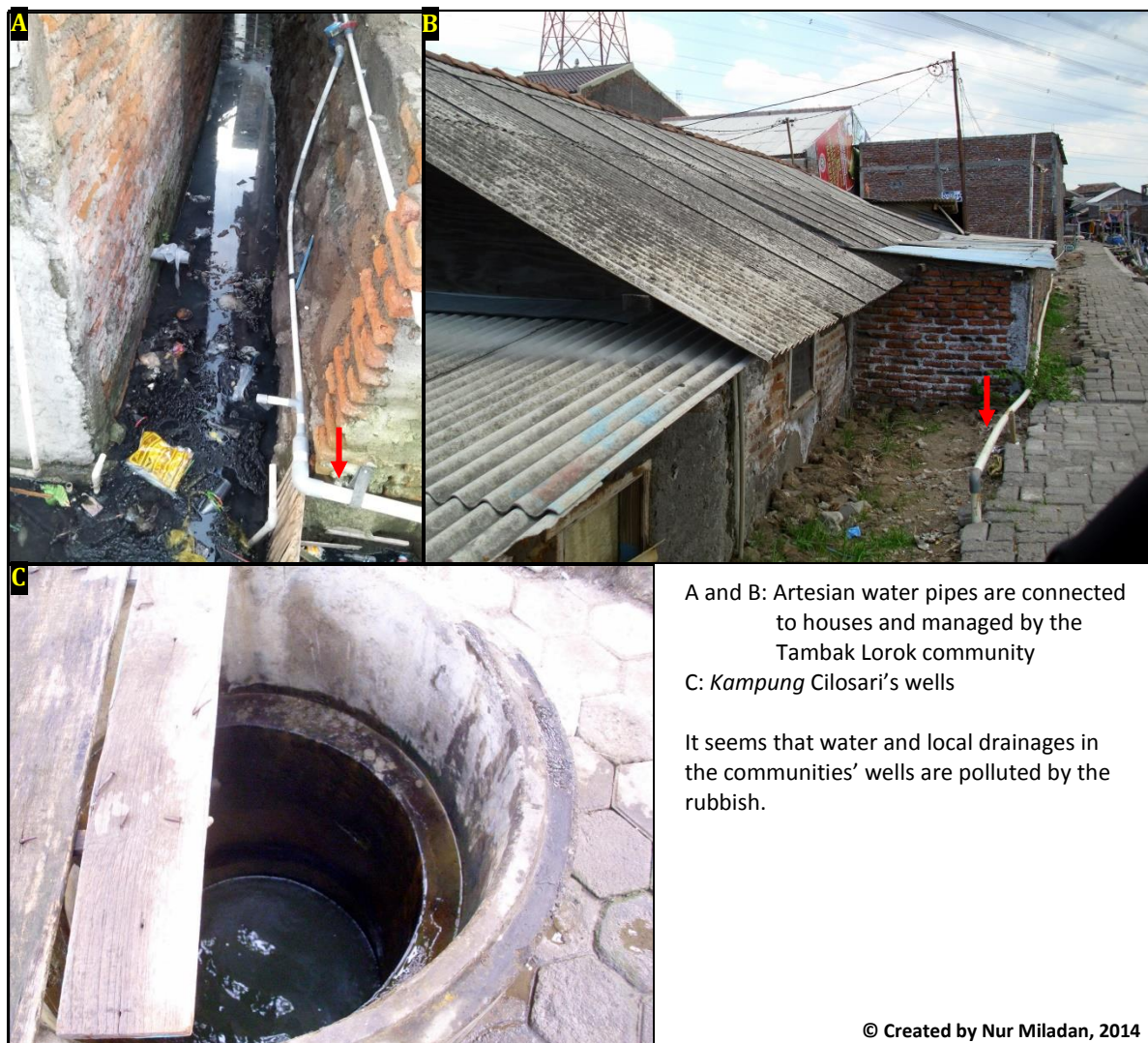
<sup>387</sup> Regional Drinking Water Company.

<sup>388</sup> Interview with Rowi (± 40 years old), inhabitant of Tambak Lorok community who has always lived there and works in a filling station for fishermen.

<sup>389</sup> Interview with Yamin Riyanto (60 years old), head of Cilosari community who settled in 1983, underemployed.

<sup>390</sup> Taylor, J., 2010, “*Community based vulnerability assessment Semarang and Bandar Lampung, Indonesia*”, Jakarta: ACCCRN Indonesia/Mercy Corps.





**Figure 150. Condition of water resources in *kampung Cilosari* and *kampung Tambak Lorok***

Source: Primary Data, 2013.

*Communities exploit groundwater resources themselves due to the lack of urban water supply infrastructures. This extraction thwarts the efforts to reduce land subsidence and the related hydrological risk. The low quality of water resources indicates poor hygiene in coastal kampung.*

These water conditions show how the Semarang urbanization, especially in coastal *kampung*, was not supported by the proper infrastructures, and the lack of land use control by municipality. Furthermore, the massive growth of built-up area and the architectural modernization of housing exacerbate land subsidence and increase hydrological risks in the *kampung*.

#### 4.2.2. Factors aggravating hydrological risk

According to the heads of *kampung* Tambak Lorok and *kampung* Cilosari, streets in their settlement started to be paved in the 1980s. At that time, the urban electricity network began to equip both *kampung*. But other urban infrastructures including clean water, sanitation, waste, and drainage remain problematic in the coastal *kampung* that continued to grow until recently. Due to the lack of urban waste network, coastal *kampung* produce piles of rubbish that end up in the open spaces of *kampung* such as river banks and public spaces. This habit of many inhabitants to dispose of their rubbish in those spaces creates unhygienic conditions in the *kampung*.



**Figure 151. Rubbish piles in *kampung* Cilosari and *kampung* Tambak Lorok**

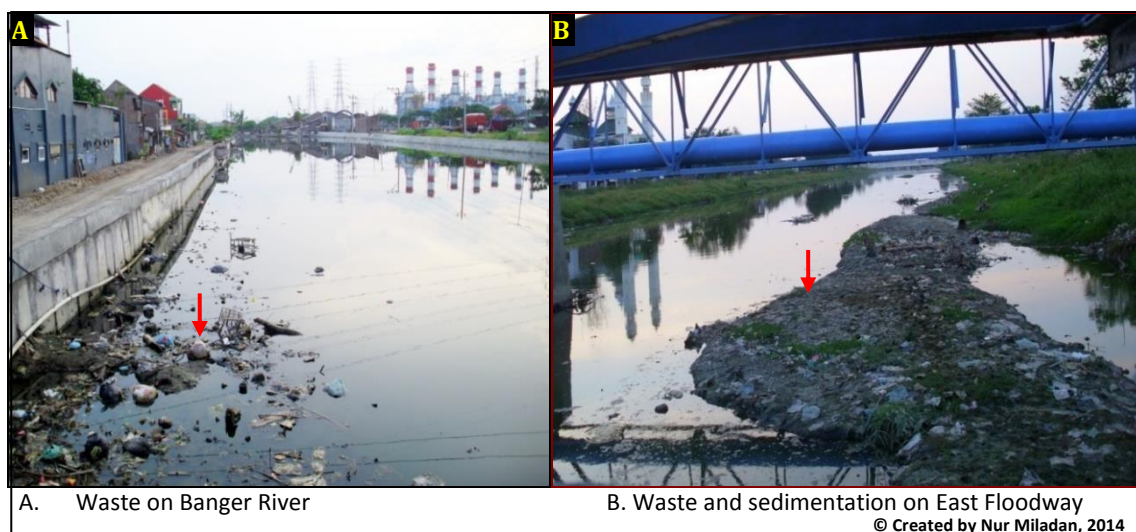
Source: Primary Data, 2013.

*Due to the absence of waste disposal sites and urban waste network, rubbish piles are left around open spaces in both kampung. These rubbish piles aggravate hydrological risks and hamper the water discharge of local drainages, river and floodway around kampung. Although the Cilosari community manages its waste (monthly RT/RW dues to pay workers to collect waste from houses), the rubbish piles remain around open spaces, the river banks in particular. Meanwhile in Tambak Lorok, due the absence of collective waste management, inhabitants dispose their waste in the open spaces, especially the river banks.*

Rubbish piles in both *kampung* are not only produced by these communities, but also by the communities of Semarang upland areas. The waste from upland areas ends up in the Banger River and West Floodway, while the lack of drainage system in both *kampung* exacerbates the problem. The drainage system in *kampung* Cilosari consists of local drainages and urban drainages (Banger River and East Floodway). The urban drainages are



silting up because of waste and sedimentation. Furthermore, the water in these urban drainages is polluted and dirty.



**Figure 152. Condition of Banger River and East Floodway**

Source: Primary Data, 2013.

The Banger River appeared with the evolution of Semarang lowland area and stems from the canal of Kampung Kali.<sup>391</sup> This river has a least depth of 5 meters and its width is approximately 30 meters. It flows along 7.8 kilometers of Semarang upland area. This river carries sedimentation of approximately 1.5 meters and its water is very turbid. Thus, the river capacity is not optimum. The municipality has carried out sedimentation dredging several times. Yet, sea and waste caused the river siltation. The sedimentation process in this river has been occurring since year 1982.<sup>392</sup> Meanwhile, the East Floodway is one of the artificial drainages constructed during the colonial era. It was built in 1858 before the construction of West floodway in 1901.<sup>393</sup> The aim of these constructions was to control the flood risk coming from upland (hills) area to lowland (coast) area. The East Floodway's width is about 30 to 40 meters, and its depth is more than 5 m. But because of the high sedimentation, its depth is only about 0.5 to 2 m. It flows along 17.8 km of the upland areas (Dam of Pucanggading located in the Tembalang Sub-

<sup>391</sup> It flows from West to East of the Semarang urban centre (zones with high population densities), so this canal discharges the dirty water and waste from these zones.

<sup>392</sup> "Normalisasi Banger diteruskan", *Suara Merdeka*, May, 26<sup>th</sup> 2004, retrieved December 25<sup>th</sup> 2015, from <http://www.suaramerdeka.com/harian/0405/26/kot11.htm>.

<sup>393</sup> Rukardi, "Mengurangi banjir Semarang (1) abai pada system drainase kolonial", *Suara Merdeka*, November, 27<sup>th</sup> 2004, retrieved December 25<sup>th</sup> 2015, from <http://www.suaramerdeka.com/harian/0411/27/kot09.htm>; Permana, A.M., "Agar Banjirkanal Tak Cuma Kanal Pengendali Banjir", *Suara Merdeka*, August 29<sup>th</sup> 2007, retrieved December 25<sup>th</sup> 2015, from [www.suaramerdeka.com](http://www.suaramerdeka.com).

district).<sup>394</sup> The outfall of this floodway is located approximately one kilometer away from *kampung* Cilosari. Urban institutions have carried out some dredging in several parts of this floodway at high costs. In fact, due to the high sedimentation, this floodway experiences siltation every 2 to 3 years after a dredging.<sup>395</sup> Lately, the municipality and the provincial government have planned to reconstruct this floodway. However, they argued that the reconstruction cost is very expensive (up to 1 trillion IDR - about 62.500.000 € - for the rehabilitation of 1.2 km) and that this project should be financed by the national government.<sup>396</sup> Initially, the East Floodway and the Banger River were also dividing *kampung* Tambak Lorok. But the municipality deflected the direction of these drainages to the East of *kampung* Tambak Lorok in the 1990s while an arterial road was constructed in the Semarang coastal area. However, the drainage problems are not only related to the urban drainages, but also to the bad condition of local drainages in the *kampung*. The local drainage network has small dimensions and its state is damaged by waste, sea water and the resulting sedimentation. The small dimensions of local drainages are explained by the relatively small size of local streets (approximately 1.5 m wide).



**Figure 153. Local drainages in *kampung* Cilosari and in *kampung* Tambak Lorok**

Source: Primary data, 2013

The local drainages have a width of approximately 30 centimeters only and their depth is less than 50 centimeters. Most of local drainages are always inundated by the dirty water that cannot be discharged naturally to the urban drainages. These complications occur because of the surface levels of urban drainages: they are higher than the local drainages.

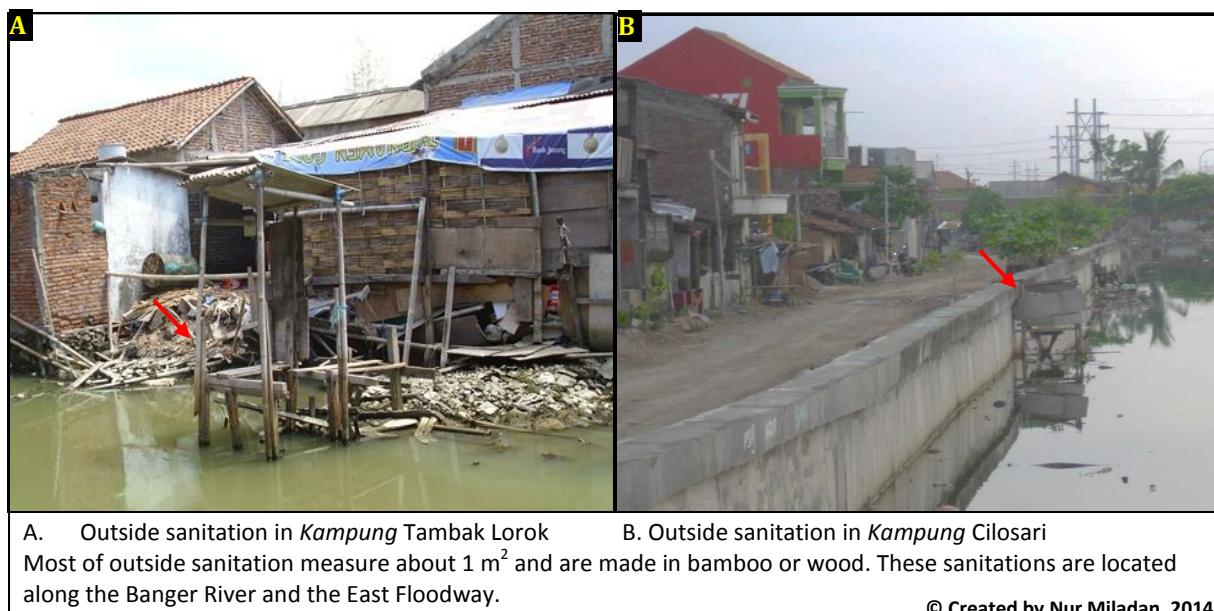
<sup>394</sup> Susilo, H., Dewanto, H. "Potret Buram Pengendali Banjir", *Kompas*, June, 15<sup>th</sup> 2009, retrieved December 25<sup>th</sup> 2015, from <http://www.ampl.or.id/digilib/read/potret-buram-pengendali-banjir/20724>.

<sup>395</sup> "Sungai Banjir Kanal Timur diperlebar", *Suara Merdeka*, June, 11<sup>th</sup> 2011, retrieved December 25<sup>th</sup> 2015, from <http://suaramerdeka.com/v1/index.php/read/cetak/2011/06/11/149247/Sungai-Banjir-Kanal-Timur-Diperlebar>.

<sup>396</sup> Suyono, "Kanal banjir barat sukses, Jateng rencanakan kanal banjir timur", *Lensa Indonesia*, August, 19<sup>th</sup> 2013, retrieved December 25<sup>th</sup> 2015, from <http://www.lensa-indonesia.com>.



The problem of drainage system is aggravated by the sanitary problems in both *kampung*. Most of households do not have sanitary facilities inside houses. According to them, the construction of proper sanitary facilities inside house is very expensive because of the difficulties of septic tank provision and the related constant risk of inundation. Many inhabitants utilize the public sanitary facilities provided by the municipality inside the *kampung*. However, some inhabitants are accustomed to using the modest sanitation on the river (outside sanitation).



**Figure 154. Outside sanitation**

Source: Primary Data, 2013.

*The unhygienic conditions of the river sanitation increase sewage (sedimentation) in the river and render the urban drainage system ineffective, thus intensifying the hydrological risk in the kampung.*

Outside sanitations dirty the water on urban drainages (river and floodway). Nevertheless, this situation is not significantly correlated to poor health in the communities because they do not use the river water for the daily needs. According to them, the communities are familiar with this situation, but they realized that during the flood, the dirty water carries many diseases to the communities, such as leptospirosis and digestive diseases. Yet, they have great difficulties abandoning outside sanitation because they have used it for such a long time.

Beyond the problems of infrastructure, there are natural problems threatening Semarang coastal *kampung*. The process of abrasion occurs in *kampung Tambak Lorok*. According to the heads of Tambak Lorok community, this phenomenon started in the 1980s.

At first, this *kampung* had a coast of approximately 700 meters on the north side. Nevertheless, the abrasion process reached this settlement located directly on the sea.



**Figure 155. Abrasion around *kampung* Tambak Lorok**

Source: Department of marine affairs and fisheries of Semarang City, 2010.<sup>397</sup>

The 2010 map of the Semarang coastal abrasion indicates that the fishpond areas and the parts of *kampung* Tambak Lorok have been disappearing (they changed into sea) due to abrasion. Over the last 20 years, *kampung* Tambak Lorok was experiencing an abrasion loss of 1.2 km. The absence of coast and fishpond areas means that *kampung* Tambak Lorok does not have sea barriers. Therefore, the high tide effects (*rob* phenomena) are worsening and threatening the *kampung*.

The growth of built-up areas, the infrastructure problems, and the abrasion risk have many consequences on *kampung* Tambak Lorok and *kampung* Cilosari: catchment areas decrease, land subsidence, sea water intrusion, and inefficiency of drainage system. These situations caused the emergence of *rob* risk in both *kampung*. However, the land subsidence is the dominant factor that causes the emergence. The land surface of these *kampung* is lower than the sea surface, especially during the period of high tide. Consequently, the water in the

<sup>397</sup> *Draft laporan akhir pemetaan potensi, kerusakan, dan model rehabilitasi kawasan pesisir Kota Semarang (Final report draft of the mapping of potencies, destructions, and rehabilitation model of Semarang City Coast)*, 2010, Semarang: Department of Marine and Fisheries of Semarang City.

drainages overflows, and *rob* phenomena inundate these settlements. It threatens *kampung* Cilosari via the Banger River and the East Floodway. According to the Cilosari community, *rob* risk initially happen in the northern part of *kampung*. Year after year, it came nearer to the southern part of *kampung*. Meanwhile, the *rob* risk is worse in *kampung* Tambak Lorok because it is situated north of *kampung* Cilosari. During the period of high tide, urban drainages flow from sea to terrestrial areas while sea water brings sedimentation causing the siltation of the drainages. These circumstances provoke the water drainage overflow around both *kampung*.

#### **4.2.3. The quality of life decreases because of the hydrological risk impact**

Over the last decades, the constant hydrological risk has produced several socio-economic problems for the communities in both *kampung*. The settlements have become slum areas with unhygienic conditions: poor state of the houses, local streets drainages, and open spaces. Houses are damaged by long-term corrosion and weathering in both *kampung*. The deterioration is worse than in residential areas, such as Tanah Mas Real Estate, probably because of the communities' limited economic resources.

Most of local drainages are always inundated by dirty water and waste, while frequent inundation leads to more sedimentation. This situation causes the bad smell and attracts of mosquitoes. However, as the communities explained, the situation has been going on for a long time, so they became familiar with this situation, albeit uncomfortable. Moreover, local streets are crumbling, thus reducing the communities' accessibilities. They have difficulties to go through the local streets because of the puddles.

The impression of slum is also strengthened by the existence of water resources. The main groundwater resource for communities' life is poor and turbid because it is polluted by sea water intrusion. In *kampung* Cilosari, the community knows about the low quality of groundwater, so most of the households prefer to buy their drinking water from private vendors. Conversely, most of the households in *kampung* Tambak Lorok drink groundwater (artesian wells) in spite of its salinity.





A. *Kampung Cilosari*

1. Building corrosion and weathering
2. Significantly different heights of buildings (houses)
3. Local street in the settlement

B. *Kampung Tambak Lorok*

1. Low height of house
2. Permanently inundated house
3. Local street in the settlement

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Nur Miladan, 2014

**Figure 156. Conditions of buildings and local streets in *kampung* Cilosari and in *kampung* Tambak Lorok**

Source: Primary Data, 2013.



Other social problems appear because of the hydrological risk. Some inhabitants cannot go to work when there is an inundation. Many inhabitants earn their incomes while working in industrial zones, fishing or being underemployed workers. They must keep their house equipment and prevent the inundation from entering their house. Consequently, community livelihood resources decrease. Based on interviews with communities' heads in 2013, approximately 40 to 60 % of both communities experience poverty.

Furthermore, the hydrological risk existence changes community behaviours. The inhabitants become more individualistic: while they constantly seek to renovate their houses to protect themselves from the inundation risk, they become less aware of their neighbours' housing conditions. Some households have great difficulties to interact with each other. It weakens the fraternity spirit which characterizes Javanese culture. In addition, some households, especially poorer inhabitants, do not have enough self-confidence to socialize within their community. They feel ashamed compared to others households' houses. Usually, community meetings take place in different houses of the community members every 1 to 3 months. However, these meetings never take place in low quality houses. Moreover, poor households do not want to speak during community meetings because they feel different from the others. In addition, when a family member marries or dies, they cannot welcome guests in their houses. Because of these circumstances, the deceased is transported to the mosque before its burial.<sup>398</sup> Such situations can engender psychological disorders in the community.

Finally, the hydrological risk aggravates health conditions in the communities of Tambak Lorok and Cilosari. Frequent diseases include skin pathologies, diarrhoea and vomiting, typhoid, leptospirosis, and respiratory tract infections. These diseases are caused by the dirty water that inundates their settlements. However, most of the inhabitants stated that they were familiar with these diseases. Even though they suffered from these diseases, they considered them benign. Poor inhabitants often tolerate the pain because they do not the means to seek medical treatment. Sometimes, they prefer to use traditional medications to spare money. However, because of the frequent diseases, they have the capacity to adapt to health problems (good immune system).

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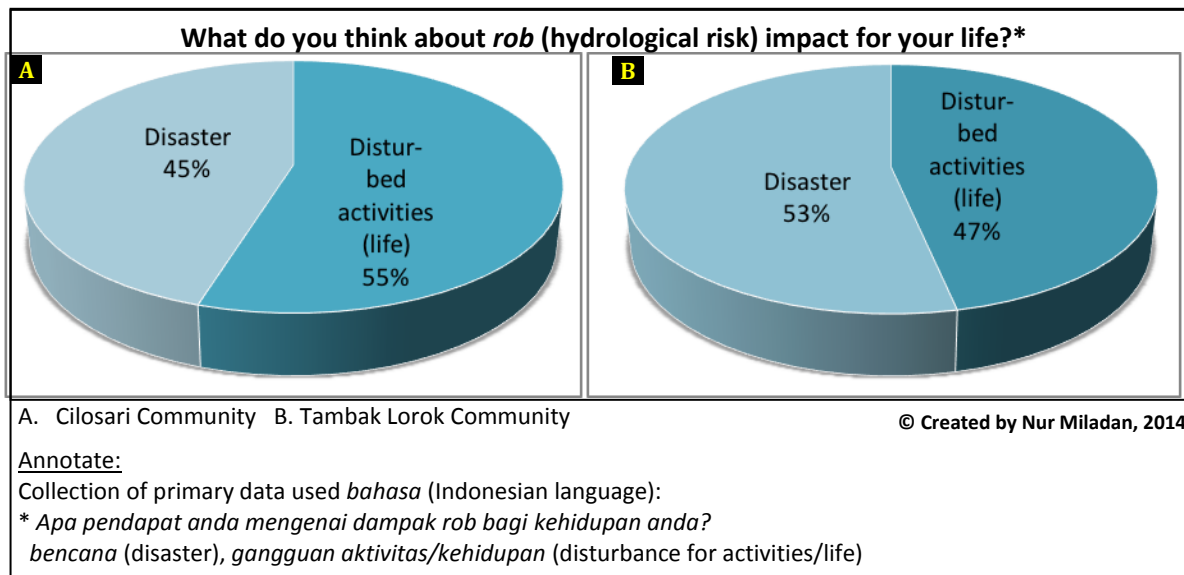
<sup>398</sup> Most of the inhabitants are practising Muslims.

### 4.3. Socio-cultural efforts to reduce hydrological risk

The interviews with the community heads of Cilosari and Tambak Lorok reveal that *rob* risks have threatened their settlements since the late 1980s.<sup>399</sup> Each year, *rob* phenomena were getting worse in both *kampung*. Furthermore, since the 2000s, *rob* phenomena have frequently occurred and entirely inundated both *kampung*. The average height of *rob* occurrences was about 20 to 80 cm from the settlements. However, it fluctuates according to the season.<sup>400</sup> Sometimes it could be approximately 1.5 m, especially in *kampung* Tambak Lorok. This situation certainly influences community life and its socio-cultural aspects. The community understanding of the hydrological risk shapes their efforts to adapt and transform the space, thus defining the resilience process.

#### 4.3.1. Risk mindset and human resilience

Tambak Lorok and Cilosari perceptions of the hydrological risk influence how they survive to this predicament. Interviews with both communities reveal that there are two general perceptions about how hydrological risks impact their settlements.



**Figure 157. Community perceptions of *rob* (hydrological risk) impact**

Source: Primary Data, 2013.

Tambak Lorok and Cilosari communities have almost the same perceptions of the *rob* impact. Some inhabitants argue that it disturbs their daily life. They frequently mention how

<sup>399</sup> The question was “How was the chronology / history of *rob* (flood) in your settlement? Since when did it occur?”

<sup>400</sup> January and February are usually the peak of *rob* height which coincides with the rainy season.

*rob* impacts their economic activities and jeopardizes livelihood resources. For them, this risk destroys infrastructures but they are familiar with this threat. Some inhabitants considered that they are “accustomed” to *rob* risk because it has frequently occurred for a long time. Furthermore, they reckon that their *kampung* are situated in a coastal area, so that this risk is indeed a coastal natural phenomenon, thus part of coastal communities’ life. They also see *rob* as a source of disease, but not a cause of death. In contrast, they argued that a disaster has engendered death. Although *rob* phenomena have frequently occurred in their settlements, they argued that the disaster occurred during the massive flood that took place in the Semarang upland areas. Moreover, the *rob* is not a frightening situation to them. *Rob* risk can be predicted thanks to the lunar cycle and the observation of water levels in the urban drainages. They recognize the signs of *rob* emergence, so they can anticipate *rob* occurrences. Conversely, they think that a disaster comes suddenly. In addition, most of the fishermen considered that *rob* phenomena benefited their fisheries: fish seeds can spread in their areas (fishponds), even though the *rob* causes abrasion in their areas. Several statements of communities describe these perceptions.

“[...] *rob* (risk) is a disturbance. Because of the *rob*, our environment becomes an unhygienic slum and smells bad. In addition, it causes the diseases [...]”<sup>401</sup>

“[...] *rob* (risk) is a natural phenomenon. According to the media, it is caused by the global warming or the greenhouse effect. Consequently, glaciers and polar ice are melting. It is clearly due to human behaviour [...]”<sup>402</sup>

“[...] *rob* (risk) is a disturbance for coastal communities, this occurrence has existed for a long time [...]”<sup>403</sup>

Other inhabitants mention how *rob* amounts to a disaster. They argue that it is a source of misfortune, misery and sorrow. They feel that their life stagnates and deteriorates because of it. Their incomes are always used to reduce the hydrological risk and it is very difficult to save money for other purposes. Poverty is impossible to solve due to the hydrological risk impact. Poor households cannot get out from the poverty and become even poorer. Furthermore, this risk increases anxiety because it can occur any time. Some inhabitants see *rob* as “scourge”, “monster”, a “cancer” because they cannot escape from it, and also because it has occurred for a long time in their settlements. They feel anxious during the *rob* occurrences. Some inhabitants believe *rob* to be a rebuke from God because they do

<sup>401</sup> Interview with Sri Rejeki (45-year-old), a housewife, a Cilosari inhabitant who settled with her parents in 1964. She still lives in the same house.

<sup>402</sup> Interview with Bambang Handayana (58 years old), Head of Tambak Lorok community who settled in 1978.

<sup>403</sup> Jumani, head of community who has always lived in *kampung* Tambak Lorok (birth in 1965), civil servant.

not protect the environment. This perception shows how religion is an important element in the communities' life. In addition, the communities state that *rob* does not only destroy infrastructures, but also negative externalities, such as the constraints of educational and working activities, thus producing social problems and poverty.

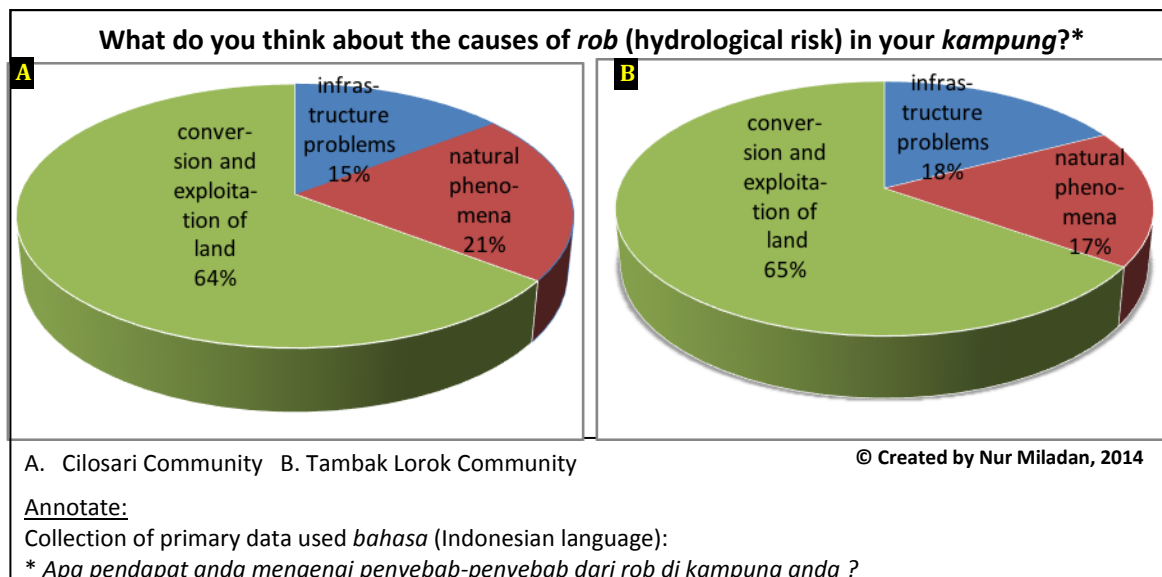
“[...] *rob* is a rebuke from God Almighty to tell humans to carefully preserve [...]”<sup>404</sup>

“[...] it (*rob* risk) is a disaster. All property is destructed. It causes problems of safety, disrupts the economy, education, and destroys infrastructures [...]”<sup>405</sup>

“[...] *rob* is a disaster due to the low-height houses in (*kampung*) Tambak Lorok, *rob* can certainly enter the houses...it will come any time, sometimes when we are asleep, suddenly. Moreover, when we wake up, we are soaking wet[...]”<sup>406</sup>

“[...] *rob* is a calamity because all houses in (*kampung*) Tambak Lorok are inundated by this high tide, and children suffer from many diseases [...]”<sup>407</sup>

Furthermore, most of the inhabitants argue that the conversion and exploitation of land is the main cause of hydrological risk. They assert that the massive land conversion, from water spaces (swamps and fishponds) to built-up areas, has significantly increased the hydrological risk in their settlements.



**Figure 158. Communities perceptions concerning *rob* (hydrological risk) causes**

Source: Primary Data, 2013.

The inhabitants of Cilosari and Tambak Lorok know about the land use changes around their settlements. Most of them state water areas were converted into industrial areas. They also

<sup>404</sup> Interview with H.M. Jamhari (54-year-old), head of Cilosari community who settled with his parents in 1975, entrepreneur/ small trader.

<sup>405</sup> Interview with Sukatno (42-year-old), head of Cilosari community who has always lived there.

<sup>406</sup> Interview with Sholihin (47-year-old), head of Tambak Lorok community who settled in 1990, fisherman.

<sup>407</sup> Interview with Bambang Sukoco, (54-year-old), head of Tambak Lorok community who has always lived there.



argue that the extension of the Tanjung Mas port increased the rob risk in their settlements in the 1980s. Because of the land reclamation, the surface level of the Tanjung Mas Port area is higher than in the surrounding areas including *kampung* Cilosari and *kampung* Tambak Lorok. Consequently, sea water flows to the lower areas during rob occurrences. In addition, they argue that the growing number of houses has caused the decrease of water and open spaces, thus intensifying the hydrological risk. Moreover, the massive reduction of mangrove zones wiped out the barrier areas that could reduce the effects of tide.

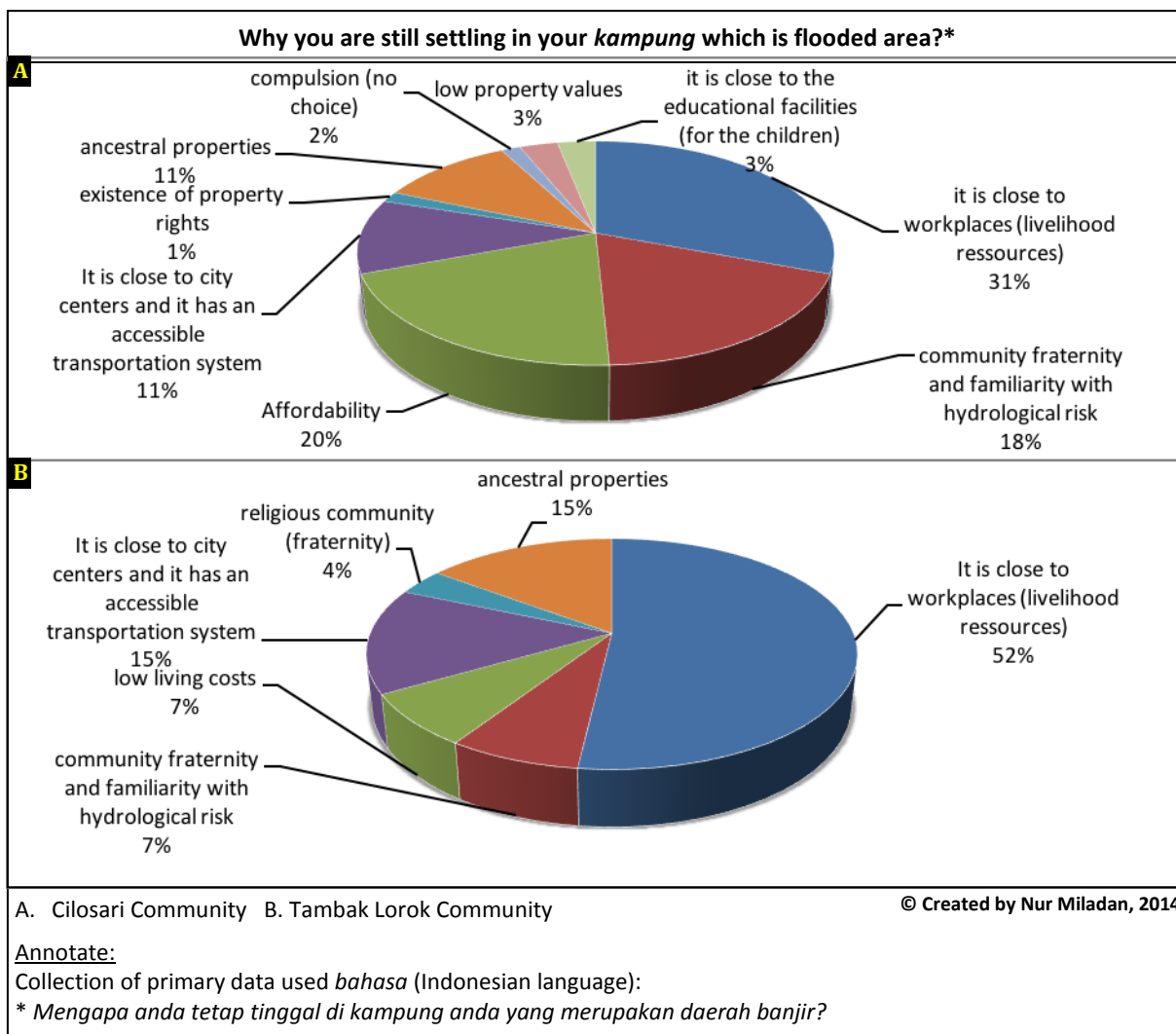
Communities also affirm that the exploitation of land including massive groundwater extraction has produced the land subsidence that aggravated hydrological risks. They acknowledge that many illegal groundwater extractions take place in their settlements. Nevertheless, they could hardly avoid it because it is the main water resource in their settlements. Furthermore, communities mention the existence of an electric power plant<sup>408</sup> in the Tanjung Mas Port that affects them negatively. The mechanical vibrations of the power plant produce land instability and accelerate land subsidence. Although communities do not know exactly how the land subsidence process occurs in their settlements, they can still observe the decline of their housing surface.

Some inhabitants state that this hydrological risk is a natural phenomenon. They believe that sea levels rise because of global warming and threaten their settlements. They do not know exactly what are the consequences, but they constantly have to re-elevate their houses. Furthermore, they realized that the drainage system is in a particularly bad condition and does not protect from hydrological risk. They seek to improve the quality of local drainages through self-help efforts, but the local drainages are always inundated because its surface is lower than for urban drainages. Consequently, the local drainages are not properly working, while dikes are often destroyed alongside the urban drainages, so that inundation always threatens their settlements during the period of high tide. The communities' perceptions of hydrological risk existence are influenced by their experiences. However, media and urban institutions also affect the knowledge of hydrological risk.

The communities' perceptions of hydrological risk explain why people are still settling even though the hydrological risk always threatens their life. These reasons include economic motives (work), community fraternity, religious community, location accessibility, ownership rights, ancestral properties, low property values, and also compulsion.

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<sup>408</sup> The electric power plant was established in 1983 and it is managed by PT. Indonesian Power (a subsidiary of the state electricity company).



**Figure 159. Reasons for settling in the *kampung***

Source: Primary Data, 2013.

The main reason is economic resources. Most of the Cilosari inhabitants are industrial labours, and underemployed workers. Industrial labours work in the industrial areas of Tanjung Mas Port, Terboyo, and Genuk which are located approximately 1 to 3 km away from their *kampung*. Their low incomes force them to settle near their workplace. They argue that settling in other areas would increase the distance from the workplace, transportation costs and the commuting time. Industrial labour is based on time. Shifts can be in the morning but sometimes in the night. These circumstances require them to live near their workplace.

Meanwhile, the Tambak Lorok community consists mainly of fishermen who depend on their access to the sea. They consider Semarang coastal area to be a productive place for fishing activities, so that their revenues can cover their daily needs including the cost of the efforts to reduce hydrological risk. Furthermore, underemployed workers that have no fixed incomes, depend very much on the activities of industrial areas, transportation areas (terminal and stations, port), and traditional markets areas that are close to their settlements. They work in informal sectors: for instance, as porters at the Johar market<sup>409</sup> and industrial areas, stevedores at the Tanjung Mas Port, hawkers at the bus terminal of Terboyo and the railway stations (Tawang and Poncol), and also drivers of pedicab, motorcycle taxi and minibus.

Questioners and interviews with Tambak Lorok and Cilosari communities reveal that the households' revenues vary a lot. Inhabitants with minimum revenues earn less than 800.000 IDR ( $\approx$  50 €) per month. Usually, they have no fixed incomes and the majority of them are underemployed workers or work as hawkers (smaller traders) and drivers of pedicab. Meanwhile, industrial labours, builders and traders at the traditional markets earn incomes between 800.000 IDR ( $\approx$  50 €) and 2.000.000 ( $\approx$  125 €) per month. Likewise, the average revenue of industrial labours is between 1.200.000 ( $\approx$  75 €) and 1.500.000 (93.75 €) every month. In addition, fishermen have no fixed incomes because it depends on the season. Nevertheless, some fishermen state that their average revenues are about 1.500.000 ( $\approx$  93.75 €) every month. Several inhabitants work as civil servants, entrepreneurs, and owners of boats and fishponds. Their incomes amount to more than 2.000.000 ( $\approx$  125 euro) every month. However, each household income depends very much on the productivity of the family members. To understand the household economic capacities in both *kampung*, we will look at three representative households.<sup>410</sup>

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<sup>409</sup> The Johar market is a traditional market in Semarang centre and it was designed by the Dutch architect Thomas Karsten during the colonial era.

<sup>410</sup> Primary data was carried out in 2013.

### Suratno Family

Mr. Suratno (48 years old) is born in *kampung* Cilosari and has always lived there. He has lived with his wife, their two children, and his mother. His first son settled in Demak Regency after his marriage. Mr. Suratno is an underemployed worker in the Terboyo Terminal area. Mrs Suratno is a housewife, so that their livelihood depends very much on the income of Mr. Suratno. However, they have a small video rental business. Although he has no fixed income, his total revenue is about 1.500.000 IDR (93.75 €) every month. He states that this revenue can meet their daily needs, but he is not able to save money every month. Every month, he spends his revenue to pay for food 900.000 IDR (56.25 €), electricity 150.000 IDR (9.4 €), water 36.000 IDR (2.25€), and also for other expenses including children' education, community dues, and unpredictable costs about 400.000 IDR (25 €).

Furthermore, he asserts that his house has never been reconstructed, although it is always inundated during flood occurrences. However, they have no desire to relocate because they want to keep ancestral property and stay on their native land. They are waiting for surplus revenue to protect their house from hydrological risks.

### Parno Family

Mr. Parno is a fisherman who settled in *kampung* Tambak Lorok in 1968. He lives with his family including his wife and their three children. He has no fixed income, but he states that his average revenue is about 1.500.000 IDR (93.75 €). Every month, he spends about 1.400.000 IDR (87.5 €) to cover the household daily needs including food 750.000 IDR (47 €), electricity and water 250.000 IDR (15.6 €), and also other expenses such as children's education, community dues, and unpredictable costs about 400.000 IDR (25 €). However, his first son works at the filling station for fishermen and earns an income of 1.400.000 (87.5 €), so that he can contribute to the family livelihood.

Mr. Parno states that their house has been renovated every six years to reduce the hydrological risk impact. Each house renovation requires about 25.000.000 IDR (1562.5 Euro). He has always used loans from creditors to finance the renovation work and they must use their incomes to reimburse the credit. They are unable to make savings.

### Ahmad Riyadi Family

Mr. Ahmad Riyadi (49-year-old) drives a shared taxi (minibus) who settled in *kampung* Cilosari 25 years ago. He has a big family: he lived with six family members including wife, three children, son-in-law, and little son. Their livelihood resources are based on the incomes of Mr. Ahmad Riyadi and of his son-in-law. He has no fixed income, but every month he gets about 1.500.000 IDR (93.75 €) from his job. Meanwhile, his son-in-law is an industrial worker with a fixed income of 1.250.000 IDR (78.12 €) every month. This family spends their incomes to cover their daily needs about 1.650.000 IDR (103.12 €) every month: food 750.000 IDR (46.87€), electricity and water 125.000 IDR (7.81 €), community dues 75.000 IDR (4.69 €), bank debt payment 600.000 IDR (37.5 €), and other expenses such as children's education and sudden needs 100.000 IDR (6.25 €).

Moreover, their house has been renovated 6 times. According to Mr. Ahmad Riyadi, each house renovation cost 10.000.000 IDR (625 €) which was paid by their incomes and bank loan. In addition, Mr. Ahmad Riyadi also states that he does not have any savings due to the necessity of house renovations and hydrological risk reduction. However, he also asserts that their family will not (move) from *kampung* Cilosari because they owned the property (house and land), and *the kampung* is close to their workplace.

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## Figure 160. Representatives of communities' economic capacities

Source: Primary Data, 2013.



The representative households above reveal the poor quality of life in the communities of Tambaklorok and Cilosari. Furthermore, the workplace location influences the communities' livelihood. However, because of the limited economic resources, people are still settling in these *kampung*. The properties (land and house) are more affordable than in other areas and fit the communities' limited economic resources. Moreover, they can obtain property rights. Nevertheless, poorer households are subjected to the compulsion factor influencing their choice to settle in their *kampung*. They surrender to any conditions that can improve their life.

People prefer to settle in these *kampung* because they share a sense of fraternity. They argue that their common experience of poverty leads them to help each other. Some inhabitants, particularly in *kampung* Tambak Lorok, see religion as an important factor in the development of fraternity bonds. Moreover, they state that their communities are familiar with the hydrological risk. Because of this habit, some inhabitants feel it is a normal situation, comparable to other settlements.

Furthermore, these fraternity values are linked to the community perception of ancestral properties. They consider ancestral lands and houses as very important to their life. Historical values and emotional feeling are attached to their native land. Communities have lived in these settlements for generations and have known each other for a long time.

In addition, they state that their settlements are close to the city centres and also have an accessible transportation system. These settlements are situated approximately 5 km away from the city centres only. They are located near urban facilities such as markets (traditional and modern), schools, hospitals, and also transportation (stations, port, and terminals). Some inhabitants also stress the importance of educational facilities for children around their settlements. They can feel relieved during their daily working hours because their children study in schools close to their houses.

These reasons illustrate the human resilience process. They continue their daily life in spite of the hydrological risk. They have adapted their way of life to these circumstances. This Javanese attitude is called *nerimo ing pandum*<sup>411</sup> and introspective are a way of life.<sup>412</sup> In our context, this Javanese way of life influences the mindset of communities and how they live in spite of low economic resources and the threat of hydrological risk. They accept these

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<sup>411</sup> This Javanese expression means to accept God's gift without complaining.

<sup>412</sup> Supriyadi, B., Sudarwanto, B., Werdiningsih, H., 2012, "In Search of the Power of Javanese Culture against the Cultural Urbanization in Kotagede, Yogyakarta-Indonesia", *Procedia, Social and Behavioral Sciences*, vol. 68, pp. 676-686.

situations as their life without complaining and they always seek to improve their quality of life by reducing the impact of hydrological risk individually or collectively. The community perceptions show how much they are familiar with the hydrological risk and able to adapt. Although their efforts to reduce the hydrological risk impact are economically limited, they did not capitulate.

#### 4.3.2. Repetitive efforts to reduce hydrological risk: habits, experiences, and adoptions

The mindset of these communities shapes their efforts to reduce the hydrological risk in their territories. Most of the inhabitants in *kampung* Cilosari and *kampung* Tambak Lorok are Javanese people who perpetuate the tradition of *gotong royong*, fraternal community. This spirit underlies the community self-help efforts to reduce hydrological risk through the activities of *kerja bakti*<sup>413</sup>, or social work. These activities are regularly carried out (every week or month) or by common agreement. Furthermore, these activities aim to improve the quality of settlement. They can involve men and even women who are members of community. The heads of (RT/RW) communities have the important task to coordinate the social work in their settlements. Meanwhile, the social work is financed by community dues which are managed by the executive boards of RT/RW communities.<sup>414</sup> These activities are carried out on a voluntary basis. People can help each other based on this inherited community system.

In our context, the social work functions as a collective effort to reduce the hydrological risk in their *kampung*. The social work is carried out as a preventive effort and includes the cleaning of waste and sedimentation, the rehabilitation of local drainages and dikes, the reconstruction of local streets, and also the maintenance of pump system. Furthermore, volunteers often help to the reconstruction of household houses.<sup>415</sup> Nevertheless, the effectiveness of social work can be sometimes limited due to the lack of community awareness. The frequent episodes of hydrological risk burden the community with considerable social work in their *kampung*.

However, the community self-help efforts focus on the reconstruction of local streets only and are carried out every three to five years. Communities deem these efforts effective,

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<sup>413</sup> This Javanese expression means to work through the spirit of *gotong-royong* without remuneration for the common interest. Cf. “kerja bakti”, *Kamus Besar Bahasa Indonesia (grand dictionary of Indonesian language)* [Web], retrieved December 28<sup>th</sup>, 2015, from <http://kbbi.web.id/kerja>.

<sup>414</sup> Generally, the executive board of RT/RW community includes a head, a secretary, a treasurer, and also sections.

<sup>415</sup> Usually, the house owner only provides snacks for the volunteers.

although they realize that these efforts are temporary and last several years only. The reconstruction of local streets is mostly financed by the communities' dues. For instance, each household gave about 300.000 IDR of dues ( $\approx$  18.75 Euro) to renovate the streets in *kampung* Cilosari in 2012.

This reconstruction work is aimed for elevating the level of local streets. Communities use simple materials (stone, soil, sand, cement, and paving) for the renovation. They pile up these materials on the local streets (between 1.5 m and 3 m wide) in order to add 30 to 50 cm approximately. At first, communities built most of their local streets with stone and cement. However, after surviving many hydrological risk occurrences, they switched to paving. They argue that paving is more porous than cement, so the inundation is more quickly absorbed. Therefore, it reduces the crumbling of local streets after risk occurrences.



A. Cilosari community B. Tambak Lorok community ©Modified by Nur Miladan, 2014  
**Figure 161. Social work to reconstruct local streets in *kampung* Cilosari and *kampung* Tambak Lorok**

Source: “Tiap Lima Tahun Warga Tinggikan Jalan - Polder Penampung Belum Berfungsi, Bertahun-tahun Hidup dengan rob”, *Koran Sindo*, November, 9<sup>th</sup> 2013; Tambak Lorok Semarang, *Test* [Photo], December, 26<sup>th</sup> 2010, retrieved December 28<sup>th</sup>, 2015, from Tambak Lorok community social media, <https://www.facebook.com/tambaklorok.tambakmulyo.tanjungmas.semarang/photos/a.187826494567885.55206.121345074549361/187826517901216/?type=3&theater>.

*The practice of social work can involve all members of community such as women and children. These initiatives show that the spirit of gotong royong remains deeply rooted in the community. These actions have been carried out by the communities since the 1990s when the hydrological risk started to threaten their settlements. However, the reconstruction of local streets is a part of the spatial transformation process, although it does not change the spatial structure of kampung.*

Usually, communities reconstruct the local drainages alongside the renovation of local streets. However, they seek to regularly maintain local drainages through social work in order

to reduce the inundation impact during the flood occurrences. In addition, they seek to implement a modest manner to manage local drainages. They call it a system of “*knock down*”. They use simple materials such as zinc, wood, roof-tile for the floodgates of the local drainages. During the hydrological risk occurrences, they block these floodgates in order to prevent the inundation from entering the houses. Otherwise, they open these floodgates in order to channel the dirty water from houses to local drainages and flow them to the river (urban drainages).



**Figure 162. Simple floodgates between local drainages and houses' water outlets**

Source: Primary Data, 2013.

Volunteers also help rehabilitate river dikes along their settlements (urban drainages). Communities only reconstruct parts of the dikes that are damaged. They use modest materials (cement, soil, stone...) in order to minimize the reconstruction cost. Furthermore, communities also modify the pump system to reduce the inundation during flood occurrences. This system is managed by each *RT* community and does not cover the whole *kampung* area, so the pump system has different capacities in places. This system reflects the socio-economic capacities of each *RT* community (households' number and amount of dues). At first, the system was developed by some *RT* communities in the early 2000s. Then, most of the other *RT* communities adopted this system.

The Tanah Mas community manages the pump system better than in the *kampung*. Because of their limited economic capacities, the *kampung*' communities can gather only a



small amount of dues and operate the pump system at minimum cost. For instance, each Cilosari household gives about 2.000 IDR ( $\approx 0.125$  €) every month. They also donate additional dues when the pumps are damaged. Other financial problems constraint the communities. Their pump systems need a lot of fuel and thus, cost a lot. The pump systems should function at all times because it regulates the water level in the local drainages and limits the inundation during flood occurrences. However, Tambak Lorok *RT* communities have not used their pump systems. They argued that the pump system is a useless effort due to its location in their settlement. River pumps and dikes deteriorate too often.



Communities implement a modest pump system. It consists only of pumps and pipes connecting local drainages to the rivers (urban drainages).

© Modified by Nur Miladan, 2014

**Figure 163. The Central Java Province governor observes the pump system in *kampung Cilosari***

Source: Utami, P., Assifa, F., “Pagi dilantik, sore Ganjar blusukan ke kawasan rob” [Photo], *Kompas*, August, 23<sup>th</sup> 2013, retrieved December 25<sup>th</sup> 2015, from <http://regional.kompas.com>.

In addition to these collective efforts, each household individually protects their houses from inundation risks. They use modest floodgates using wood boards in front of the house doors. According to them, it is sufficient to prevent the inundation from entering their houses. In addition, they put the house equipment in upper rooms and protect it with wood boards. They record the maximum height of previous inundations to determine the height of protection materials. However, the height of inundation is sometimes higher than determined, and consequently the house equipment ends up drenched. In addition, some households build the cot with cement and bricks. They argue that this way is safer than the ordinary cots and prevents the inundation from entering the house.



**Figure 164. Protection materials and post-occurrence recovery activities**

© Modified by Nur Miladan, 2014

Source: Primary data, 2013; Pamungkas, S., Ashari.F. (Producers), (2012, Oct.18), "Kampung rob di jantung kota" [Television broadcast], in *Indonesia Tangguh 8<sup>th</sup> Eagle Awards*, Jakarta: Metro TV.

After flooding occurrences, some households often use small pumps<sup>416</sup> to aspirate the inundation that made it to the house through the local drainages. They utilize pumps to simplify the house cleaning process that takes several hours or days.

However, the communities realize that their initiatives, collective and individual, are less effective. They argue that these repetitive actions only reduce the impacts but also these efforts produce new problems for the communities, such as poverty and social problems. These endeavours dilapidate the community economic resources. Furthermore, social problems emerge due to the different household capacities to contribute to these efforts. However, communities continue to carry them out because alternative efforts to reduce impact are limited.

#### **4.3.3. House transformations and communal spaces: between community socioeconomic losses and local adaptations**

In addition to the collective efforts, each household seeks to transform their house to adapt to the hydrological risk. Communities often reconstruct their houses to reduce the impact of inundation and they consider it to be more effective than any other community efforts, although they know it is only temporary. Several inhabitants' statements describe these perceptions.

“The house elevation is the best alternative to the reduction of flood impact, although its effectiveness is very temporary because the *rob* does not have patterns. For instance, this year, it reached a height of 40 cm, but it will be higher in the next years. *Rob* heights vary a lot. Sometimes it is low, sometimes it is very high [...]”<sup>417</sup>

“[...] today, the only way is to elevate houses. Every 5 years, we reconstruct them about 50 m higher.”<sup>418</sup>

“[...] the community elevates the house foundations every 5 years. Indeed, this way is not effective because of land subsidence, but it is the best solution.”<sup>419</sup>

“[...] we are filling the local streets and houses with soil every 5 years. Actually, it is less effective, but indeed it is the only way [...]”<sup>420</sup>

Usually, they elevate their houses every five years approximately or reconstruct their local streets. These situations certainly cause serious economic losses to the communities. For

<sup>416</sup> Usually, these pumps are used for the aquarium.

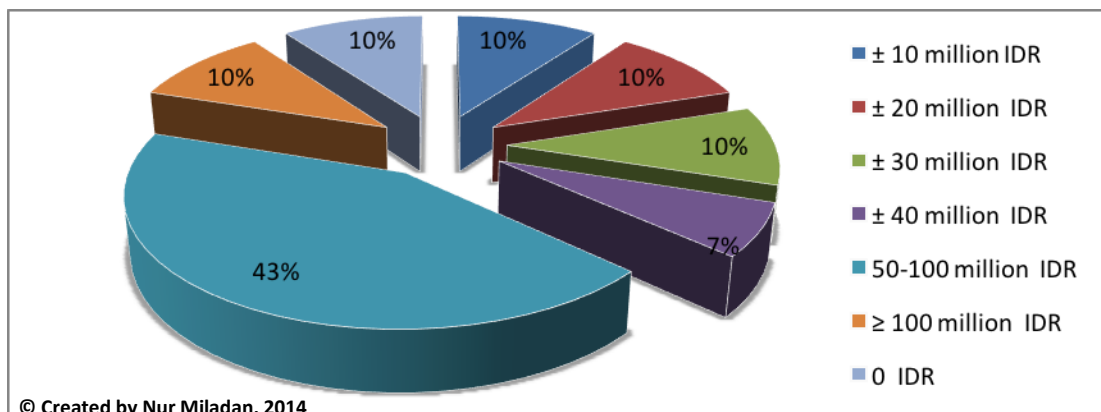
<sup>417</sup> Interview with Joko Nugroho (48-year-old), head of Cilosari community, worker in the private sector.

<sup>418</sup> Interview with Wahyuni (44-year-old), Cilosari inhabitant, labour.

<sup>419</sup> Interview with Azari (47-year-old), head of Tambak Lorok community who has always lived there, fisherman.

<sup>420</sup> Interview with Zamroni (43-year-old), head of Tambak Lorok community who has always lived there, fisherman.

instance, the interviews in the Cilosari community indicate that house renovation varies a lot and costs between tens of millions and hundreds of millions.<sup>421</sup> The poorest households could not reconstruct their houses due to their limited resources.



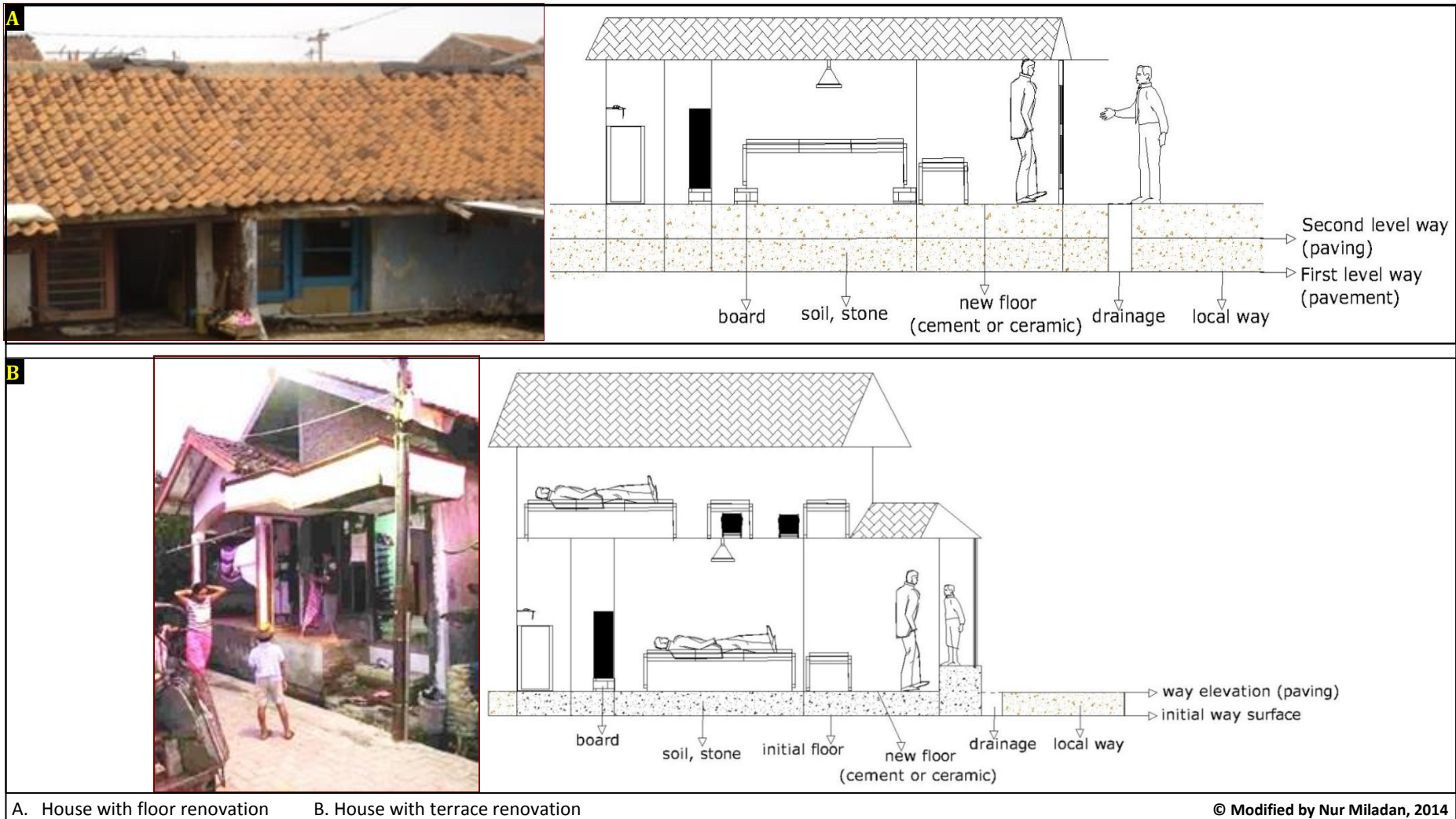
**Figure 165. House renovation costs by household**

Source: Primary Data of Cilosari Community, 2013.

The house renovation cost depends much on each household economic capacities and their choice of reconstruction type. In our case, there are three common types of house renovation carried out by households: one includes partial renovation, the second is a yard renovation, and the last type is the total renovation. The partial renovation has two alternatives. The first possibility is to reconstruct only the floor with piles of sand and soil or cement. It elevates the floors and adjusts them to the street level. It does not change the house structure, but the height between floor and roof is getting closer, so it looks like the house is lower than before. Piles of sand and soil are a preventive effort to prevent inundation from entering the house less easily during flood occurrences. In this alternative, ventilations and windows are lacking and increasing humidity. In certain cases, the owners have to bend to penetrate. The sun cannot properly enter the house due to its low height. This reconstruction type costs between 10.000.000 IDR ( $\approx 625$  €) and 20.000.000 IDR ( $\approx 1250$  €) approximately. It depends on the amount of soil used to match the house size. The soil costs about 120.000 IDR ( $\approx 7.5$  €), each mini truck having a tub volume of 1.2 m<sup>3</sup> approximately. This is the simplest solution to renovate a house.

<sup>421</sup> 10.000.000 IDR  $\approx 625$  €.





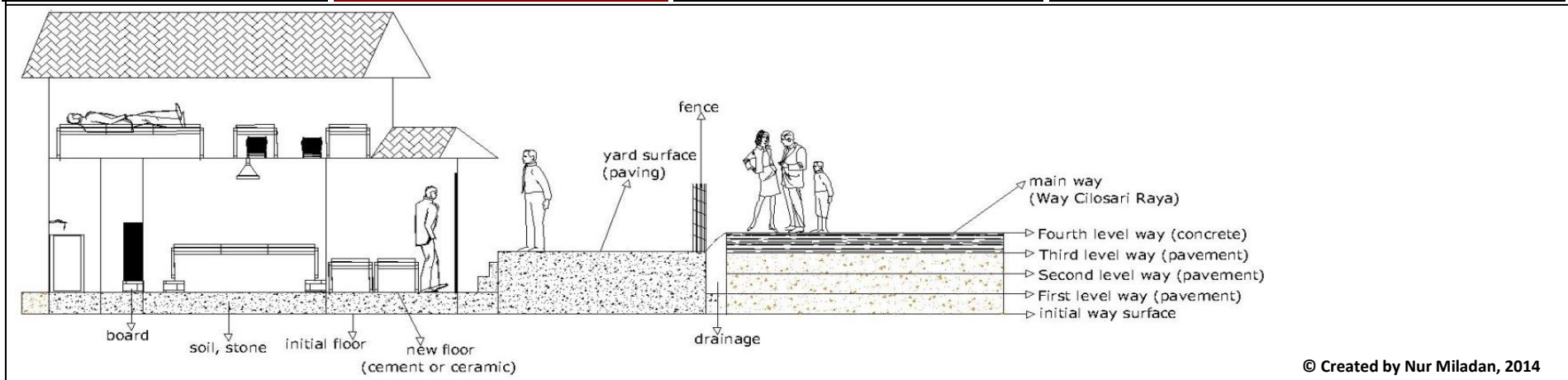
**Figure 166. Partial house renovation**

Source: “Memprihatinkan rumah warga terendam”, *Harian Semarang*, January, 11<sup>th</sup> 2012, retrieved December 25<sup>th</sup> 2015, from <http://hariansemarangbanget.blogspot.com/2012/01/memprihatinkan-rumah-warga-terendam.html>; primary survey, 2013

The second method is the terrace renovation. The terrace and its roof are elevated of approximately 50 cm above its previous level. However, there is no significant change of the house partition. In certain cases, this house renovation was not finished due to budget limitations. The house terrace functions as a barrier to prevent the inundation from entering the house during flood occurrences.

The second type of house renovation is the yard elevation. Usually, the house is located around the main streets, and it is wider than the other houses of the *kampung*. The yard is renovated to function as a barrier to limit the inundation. Generally, the yard is renovated with a more permeable paving to let the inundation infiltrate more easily. The surface of yard is built higher than the street, while the house floor is lower than the yard. On the one hand, this renovation can prevent the inundation from entering the house during flood occurrences, but on the other part, the water flows to the house during heavy rains. Usually, the owners elevate the house floor to adjust it to the yard when they have additional funds. The second and third types cost approximately 30.000.000 IDR ( $\approx$  1875 €) to 40.000.000 IDR ( $\approx$  2500 €).

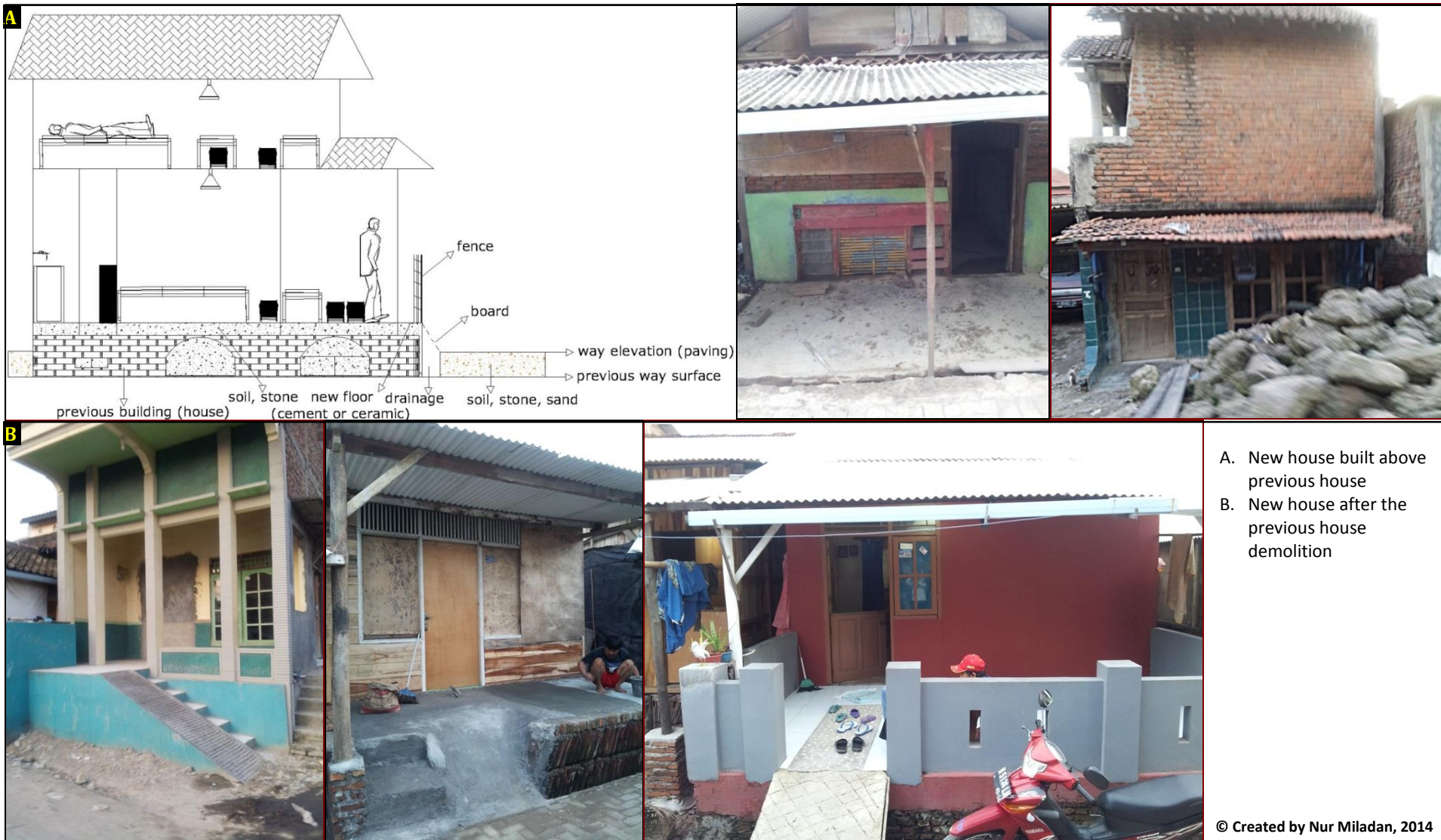
The third type of house renovation is the total house renovation. It looks like a new house. This type has two variations. The first change consists in building above the previous house, so that the new house is significantly higher than the local streets. The second way is to demolish the previous house and construct a new one. In certain cases, this house renovation type involves a fence in order to limit the inundation. Usually, this type is implemented in a house that has been renovated several times because it has a low height: the distance between roof and floor is short. Owners can make a new house partition, but the time for this reconstruction type is longer than for the others. Communities consider it to be the best type of renovation for their settlements. It costs between 50.000.000 IDR ( $\approx$  3125 €) and 100.000.000 IDR ( $\approx$  6250 €) approximately. However, some owners built a storey house costing more than 100.000.000 IDR ( $\approx$  6250 €). The first floor is used as a shelter when the inundation reaches the ground floor. The owners can move the house equipment to the first floor during these occurrences. They can perform the daily activities on the first floor during the flood occurrences.



**Figure 167. House with yard reconstruction**

Source: Primary Data, 2013.



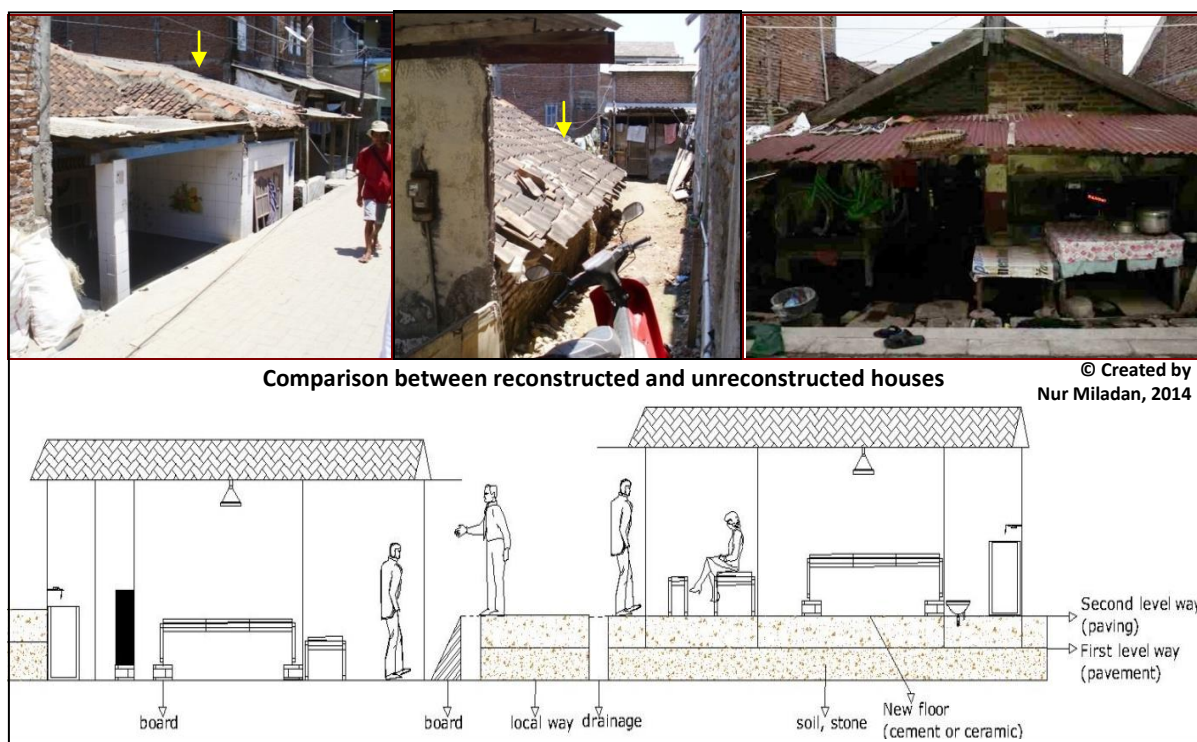


**Figure 168. Total house renovation**

Source: Primary Data, 2013.



However, some households cannot renovate their houses. These houses look squalid and messy. Usually, these houses use simple materials: zinc for the roof, soil and stone for the floor, and wood boards for the walls. Most of these houses have damaged walls. Furthermore, the house floor surface is lower than the local streets. Hence, these houses are more vulnerable to inundation than the other houses. Because of space limitations, the house equipment is irregularly placed on the highest spaces in the house in order to reduce the inundation impact.



**Figure 169. Unreconstructed house**

Source: Primary Data, 2013.

Most of house renovations have been carried out two to three times over the last 25 years. Moreover, some households have enough resources to reconstruct their houses four to five times. However, other households often borrow money from banks or moneylenders to finance their house renovations. The community interviews estimate house renovation costs to 25 to 30 % of their revenues in the last five years. Nevertheless, this estimation is not entirely accurate. For the comparison, the majority of the Cilosari community are industrial workers earning a monthly income between 800.000 IDR ( $\approx$  50 €) and 2.000.000 IDR ( $\approx$  125 €). It can be estimated around 240.000.000 IDR ( $\approx$  15.000 €) to 600.000.000 IDR ( $\approx$  37.500 €) in the last 25 years. Most of the households spend an average of at least 150.000.000 IDR ( $\approx$  9.375 €) to renovate their houses three times over the last 25

years. This calculation indicates that the cost of house renovation is between 25 % and 62.5 % of their revenues. They do not know exactly how much they have spent for the house renovations.

The different economic capacities produce different forms of house renovations, thus irregular forms of housing in the settlement. Consequently, Architecture is not valued as much as it used to. Before, traditional Javanese settlements had regular housing forms. But nuances in Javanese traditional settlements have disappeared from both *kampung*. Furthermore, the property loss of communities also decrease land value. Interviews with several heads of the Cilosari community suggest that this decrease started with the emergence of hydrological risk in their *kampung*. In the 1980s, this *kampung* was one of the settlements attracted migrants. At that time, the land price of this *kampung* was adjusted to the prevailing standard price of Semarang peripheral urban areas. It was approximately 5.500 IDR ( $\approx$  0.34 €) per m<sup>2</sup>. In 2013, according to the land procurement committee, the official land price of this *kampung* is approximately 533.000 IDR ( $\approx$  33.31 €).<sup>422</sup> Meanwhile, the minimum price of other Semarang low land areas (non-impacted territories by the flood risk) is approximately 1.500.000 IDR (93.75 €). These situations reveal that land value decreases in this *kampung*.

Although the spatial structure is not radically transformed, local practices towards public spaces change in both *kampung*. Communities utilize public facilities to minimize the social segregation caused by the hydrological risk. When public spaces are saturated, *mushola* (musallah)<sup>423</sup> usually accommodates community activities such as meetings, death ceremonies but it is transformed into a shelter during the flood occurrences. Communities use these worship places to welcome poor households that are very vulnerable to the inundation risk because of their sordid housing conditions. The poor households can resort to these worship place for community meetings, death ceremonies, and their own evacuation during flood occurrences. Because of the importance of musallah in their settlements, communities earnestly seek to maintain its existence. The renovation of the musallah is prioritized over other damaged houses. The musallah and the mosque must be always reconstructed for protection against hydrological risk. Several interviews underline this preoccupation.

“If his house has a low height, the brave man feels defeated. For instance, you will go to his house, he will answer “no”. You only wish to visit him, and you don’t have any

<sup>422</sup> Ayudea, F., “Warga belum sepakati harga ganti rugi rel ganda”, *Suara Merdeka*, September, 3<sup>th</sup> 2013, retrieved December 25<sup>th</sup> 2015, from <http://suaramerdeka.com>.

<sup>423</sup> A small worship place used by Muslims. The difference between *mushola* (musallah) and *masjid* (mosque) is the worship use. The mosque welcomes the daily prayers and Islamic ceremonies, but musallah can only be used for special circumstances.

specific intentions. He cannot put you in a decent place. Imagine, if you were him, you would feel defeated in front of your neighbours. Moreover, he does not come to the *RT* community meetings. When he is invited to participate in the community dues, he does not want to. Therefore, we built a place which is also used for musallah. Every *RT* community (in *kampung* Tambak Lorok) certainly has musallah to anticipate this, to welcome poor households.”<sup>424</sup>



**Figure 170. Musallah in *kampung* Tambak Lorok**

Source: Primary Data, 2013.

Although the community has limited economic capacities and most of its members live in poor housing, they still seek to maintain the quality of its worship places. They elevate the surfaces of these facilities in order to protect them from the inundation risk. The musallah is of the utmost importance because it can be used as evacuation space and accommodate poor households during flood occurrences.

<sup>424</sup> Interview with Bambang S. Dahlan, head of the Tambak Lorok community, and head of the Tanjung Mas Sub-district community empowerment board.

Communities always finance the reconstructions of musallahs with community dues. Usually, the surface of these worship places is higher than the houses in the *kampung*. This situation is linked to religion. They believe that the musallah and the mosque represent their belief in God, so that they seek avoid damages to the musallahs.

Community transformation of the Musalla functions is one of the adaptive practices implemented because of the hydrological risk in their settlements. It is a local practice designed for mutual help and to reduce the hydrological risk impact. These transformations are more visible in *kampung* Tambak Lorok than in *kampung* Cilosari. In *kampung* Tambak Lorok, most of *RT* communities have a musallah because of their stronger religious attitudes.

#### **4.3.4. Local actions to reduce hydrological risk impact: limited community initiatives and role of external stakeholders**

The collective efforts for the hydrological risk reduction are devised during the routine meetings of *RT* and *RW* communities. The reconstructions of local streets, local drainages, and river dikes, and the development of pumps system are decided and agreed to during these meetings. However, the community self-help efforts focus on reducing the hydrological risk impact only, not on finding sustainable solutions to the hydrological risk.

Because of the poverty and these limited initiatives, external stakeholders seek to assist coastal communities in the improvement of their quality of life. Heads of the Cilosari community mention several NGOs involved in this endeavour: PATTIRO<sup>425</sup>, Perdikan<sup>426</sup> and Mercy Corps, LBH APIK<sup>427</sup>, and SETARA<sup>428</sup>. These NGOs have different purposes: economic capacity building, human rights, and environment rehabilitation. Although these NGOs do not focus directly on the solving of hydrological risk existence, their roles complement the community efforts to reduce hydrological risk impact.

Most of NGOs use social approaches to improve the quality of community life. They seek to improve the communities' socio-economic capacities, thus their ability to implement

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<sup>425</sup> PATTIRO is an abbreviation for *Pusat Telaah dan Informasi Regional* (Centre of study and regional Information). Established on 17 April 1999, this non-governmental organization (NGO) concentrates on good governance and public participation in Indonesia, particularly for local government. Cf. "Sejarah" *Pattiro Semarang* [Web], retrieved December 28<sup>th</sup>, 2015, from <http://pattirosemarang.org/pattiro-semarang/>

<sup>426</sup> Perdikan is a local NGO envisioning the empowerment of marginalized people in order to obtain the respect of the European Convention on human rights.

<sup>427</sup> LBH APIK is an abbreviation for *Lembaga Bantuan Hukum Asosiasi Perempuan Indonesia untuk Keadilan* (Legal Aid Institute of Indonesian Women's Association for Justice). It aims to create an equal society on a non-discriminatory basis, both in regard to relationships between women and men and other aspects of life. Cf. International Labour Organization, "Unit 6: Staff and agencies working on gender issues"[Web], retrieved December 28<sup>th</sup>, 2015, from <http://www.ilo.org/public/english/region/asro/mdtmanila/training/unit6/agenindo.htm>.

<sup>428</sup> SETARA is a local NGO focusing on the issue of children's rights.



initiatives to reduce hydrological risk impact. They also want to minimize their dependency on governmental projects.

LBH APIK targets on violence towards women and divorce issues that accentuate their vulnerability to poverty in kampung Cilosari.<sup>429</sup> Furthermore, Perdikan is working in collaboration with Mercy Corps that focuses on building human capacity to cope with climate change and its consequences. They have designed a pilot project that seeks to reduce the vulnerability of female-headed households on the lower coast of East Semarang City that is often affected by sea inundation and flooding.<sup>430</sup> They state that female-headed households are more vulnerable to flood risk. Female-headed households have limited economic resources, so that they have to resort to credit. 26 female-headed households receive loans to renovate sanitary facilities and clean water installations in their houses.<sup>431</sup> These credits were coordinated by the Community Self-Reliance Agency (Badan Keswadayaan Masyarakat) and given for 20 months. This project is expected to accrue the community ability to spare money, and thus their economic resources. Started in 2010, this project was a part of the Asian Cities Climate Change Resilience Network (ACCCRN). Furthermore, Mercy Corps has analysed the potencies and constraints of Kemijen Community (including Cilosari Community) facing climate change.

PATTIRO has encouraged the establishment of the Kemijen Community. This NGO assumes that this community lacks building capacity. They state that urban projects have not increased community welfare, and frauds occurred within the poverty alleviation projects. The community is an object of, not a subject in the urban projects implemented in their settlement.<sup>432</sup> This NGO is associated with TII-Danida<sup>433</sup> and operates in the Kemijen Sub-district where many urban projects have been implemented. This NGO seeks to develop the active role of the community in the supervision of urban projects in their area. They state that frauds occurred within the financing of urban projects in Semarang City so that community awareness of regional budget use is important for the effectiveness of urban projects. To this end, the community established an association called Kemijen Community (KOMJEN) in 2009. Before that, there was no community association devoted to the evaluation and monitoring of urban projects

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<sup>429</sup> In the Javanese society, the household livelihood depends on the husband.

<sup>430</sup> Lassa, J., Setyono S., 2014, "Micro-finance for community based sanitation as a tool for climate adaptation and risk management tools: A case study from Semarang City, Indonesia", *IRGSC Working Paper*, n° 10, retrieved December 25<sup>th</sup> 2015, from <http://irgsc.org/pubs/wp/IRGSCwp010-adaptation-sanitation.pdf>.

<sup>431</sup> ACCCRN Indonesia, "Integrasi Perubahan Iklim dalam Rencana Pembangunan Kota", *ACCCRN Newsletter*, second edition, December, 14<sup>th</sup> 2011, retrieved December 25<sup>th</sup> 2015, from [https://accrnindonesia.files.wordpress.com/2011/12/2nd-newsletter-accrn\\_final.pdf](https://accrnindonesia.files.wordpress.com/2011/12/2nd-newsletter-accrn_final.pdf).

<sup>432</sup> Nugroho, J. A., *Meretas Jalan Keterbukaan dari Kampung Kusam*, September, 5<sup>th</sup> 2013, retrieved December 25<sup>th</sup>, 2015, from <http://pattirosemarang.org>.

<sup>433</sup> Transparency International Indonesia - Danish International Development Agency ((TII-Danida). TII is an NGO focusing on the anticipation of corruption in the government. It cooperates with a Danish international NGO.

including hydrological initiatives in their area. Although the Kemijen community is not officially recognized by the municipality, but this association is expected to become the community self-reliance and improve their quality of life. Several inhabitants of the Cilosari community are actively involved in this association.

The community know about frauds affecting the urban projects in their area. Sometimes, the implementation of urban projects is not in accordance with the Engineering Detail Design (DED) and its budget. Most of urban projects in kampung Cilosari are supposed to reduce hydrological risks impact. With the emergence of the Kemijen community, urban projects in kampung Cilosari are monitored by them. In 2011, the community discovered a fraud within the water and sanitary facilities project which was coordinated by the Department of Urban Planning and Settlement. They assert that the construction of sanitary facilities is not similar to the Engineering Detail Design.<sup>434</sup> Because of this fraud, the community protested against the municipality. Several universities seek to assist the community efforts to improve their quality of life via community service programs. In 2011, Diponegoro University built a communal sanitary installation that produces biogas for kampung Cilosari. However, the community stated that this equipment has limitations and can be utilized by some households only, not the whole community.

In addition, the community seeks to reduce the hydrological risk impact through the waste management in their settlement. They created an association called Creative House in 2008. They realize that the urban drainages (Banger River and East Floodway) around their settlement are very polluted by rubbish. They collect waste from the rivers and environment, and then they transform it into handicrafts. They expect this association to improve their economic capacity thanks to the selling of handicrafts. It is a form of home industry and a community effort to reduce hydrological risk.<sup>435</sup> Recognizing the efficiency of Creative House, several organizations - governmental and private – have assisted this community effort. The Budi Santoso Foundation helped improve the handicrafts' quality. It was part of a House Network Enterprises project in cooperation with Bank Indonesia<sup>436</sup> and it aims to ameliorate economic capacity and social welfare for middle-class and poor people. This organization gave also the training in product management and marketing to Creative House members.

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<sup>434</sup> Based on interviews with several heads of community; Saenong, I.B. (Producers), "Kemijen Bergerak" [Video], Jakarta/Semarang: Transparency International Indonesia, retrieved December 28<sup>th</sup>, 2015, from [www.youtube.com](http://www.youtube.com); "MCK Plus Kemijen Minim Sosialisasi", *Suara Merdeka*, September, 27<sup>th</sup> 2011, retrieved December 25<sup>th</sup> 2015, from <http://suaramerdeka.com/v1/index.php/read/cetak/2011/09/27/160585/MCK-Plus-Kemijen-Minim-Sosialisasi>.

<sup>435</sup> Interview in 2013 with Umiyati Narsan, a Cilosari inhabitant who coordinates Creative House activities.

<sup>436</sup> Central bank of the Republic of Indonesia.



**Figure 171. Association of Creative House**

Source: Primary data, 2013; Yulianto, A., Vallen, Susiana (Producers), (2012, Oct. 13), “Limbah Plastik Jadi Kerajinan Cantik”, [Television broadcast], in Feature, Semarang: Suara Merdeka TV/Network, retrieved December 25<sup>th</sup> 2015, from <http://www.suaramerdeka.tv/>

Most of the Cilosari inhabitants declare that KOMJEN and Creative House support their struggle against the hydrological risk impact. KOMJEN helps the development of their settlement. Nevertheless, some inhabitants also argued that KOMJEN has not directly contributed to the hydrological risk reduction, but they consider it as a means of communication: they use it to consult the community, to advertise and accommodate their aspirations. It also strengthens the community awareness of urban projects in their area. They believe that the urban projects, including hydrological projects, should always be monitored by them. However, they realize that KOMJEN’s lack of funding and facilities constraint the management. Furthermore, the majority of them agree that Creative House is useful for the hydrological risk reduction in their *kampung*. This association carries out direct efforts, such as the cleaning of their environment that reduces the causes of hydrological risk. Nevertheless, several inhabitants think that this association has financially benefited certain inhabitants only, not the whole community.

The initiative to create a local association in the Tambak Lorok community is less successful than in the Cilosari community. Until recently, this community did not have a local association to reduce the hydrological risk impact. They only have a local association devoted to increase the fishermen’s economic capacities: Tambak Manunggal. This

association helps the community obtaining property rights in 2002. Furthermore, the Tambak Lorok community states that there is no NGO to assist their efforts to reduce hydrological risk. However, there are several universities aiding the Tambak Lorok community: Diponegoro University, State University of Semarang, and Sultan Agung University.<sup>437</sup> These universities have the ambition to ameliorate the quality of life through the strengthening of economic and social capacities, and the improvement of their settlement. For instance, in cooperation with PT. PERTAMINA in the framework of the program of Corporate Social Responsibility, the State University of Semarang created a village coaching for *kampung* Tambak Lorok in 2010. This program includes the establishment of early childhood education, library (*rumah pintar* PATRA SUTERA), free medical check-up, supervision of small enterprise development<sup>438</sup>, and also the implantation of mangrove on the *kampung* Tambak Lorok coast.

Furthermore, the Indonesia Port Corporation and the Indonesian Power Corporation also created several programs of corporate social responsibility for the improvement of the settlements. The Indonesia Port Corporation built communal sanitary facilities and gave financial aid for street reconstruction in 2011.<sup>439</sup> Meanwhile, the Indonesian Power Corporation set up programs to strengthen socio-economic conditions including the provision of the industrial equipment for fish treatment in order to enhance the fishery quality, increase the fishermen's revenues, and decrease community poverty.<sup>440</sup> The Indonesian Power Corporation also carries out free medical check-up for the community as a form of corporate social responsibility.<sup>441</sup> In addition, the Tambak Lorok community has discussed with several NGOs in order to assist them in the realization of hydrological projects in their *kampung* including breakwater and dikes reconstructions.

Likewise, the Cilosari Community has asked the *Forum Komunikasi Lembaga Swadaya Masyarakat Jawa Tengah* (Communication forum of non-government organization of Central Java) to convey their requests to the government.<sup>442</sup> The community expects the

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<sup>437</sup> Three universities in Semarang City.

<sup>438</sup> Small industries of salted egg and shrimp paste.

<sup>439</sup> PT Pelabuhan Indonesia III, *Press Release: Pelindo III Tanjung Emas Berikan Hibah Dana Untuk Desa Miskin*, December, 13<sup>th</sup> 2011, retrieved December 25<sup>th</sup>, 2015, from <https://www.pelindo.co.id/media/berita-pers/q/press-release-pelindo-iii-tanjung-emas-berikan-hibah-dana-untuk-desa-miskin>.

<sup>440</sup> PT. Indonesian Power, 2012, "PT Indonesia Power UBP Semarang entaskan kemiskinan melalui peningkatan produktivitas dan kualitas bandeng presto", *Media Komunikasi Perusahaan Magazine*, Edition V.

<sup>441</sup> PT. Indonesian Power, *Sehat bersama Indonesian Power di Tambakmulyo Semarang*, May, 22<sup>th</sup> 2014, retrieved December 25<sup>th</sup>, 2015, from <http://www.indonesiapower.co.id>.

<sup>442</sup> Budiyanto, E.W., "Nelayan keluhkan kondisi dam Tambak Lorok", *Suara Merdeka*, December, 30<sup>th</sup> 2013, retrieved December 25<sup>th</sup> 2015, from [http://suaramerdeka.com/v1/index.php/ramadan/ramadan\\_news/2013/12/30/185263/Nelayan-Keluhkan-Kondisi-Dam-Tambaklorok](http://suaramerdeka.com/v1/index.php/ramadan/ramadan_news/2013/12/30/185263/Nelayan-Keluhkan-Kondisi-Dam-Tambaklorok).



realization of these projects to protect their settlement from the flood risk. In addition, Cilosari and Tambak Lorok communities explain that they often receive financial aid from several political parties. Most of the subventions have been used for street reconstruction and the development of water and sanitary facilities.



**Figure 172. Cilosari community thanksgiving**

Source: Primasiwi, A., "Warga Kemijen syukuran jalan baru bersama PKS", *Suara Merdeka*, July, 22<sup>th</sup> 2013, retrieved December 25<sup>th</sup> 2015, from <http://www.suaramerdeka.com>.

However, Cilosari and Tambak Lorok communities state that external stakeholders' projects are only incidental, and question the sustainability of these projects. Furthermore, these projects have not significantly helped communities' problems including poverty and flood risk impact. However, the efforts of external stakeholders (financing, and even knowledge transfer) largely influence the communities' perceptions and their initiatives to reduce hydrological risk impact. The communities expect the help of external stakeholders, even though they do not have the same expectations. However, these situations describe the community resilience process is influenced also by the roles of external stakeholders. The limitation of community initiatives renders their efforts highly repetitive. However, the renewal of community initiatives is needed for the process of community self-help efforts. The existence of local associations for the reduction of hydrological risk impact indicates the renewal of community initiatives. Although these efforts have not been optimal, they indicate that the community is aware of the need to improve community resilience and the quality of life. Conversely, the absence of community renewal mindset increases vulnerability to the hydrological risk existence.

#### **4.4. The process of local resilience depends on urban hydrological projects**

Urban institutions have many projects in *kampung* Cilosari and *kampung* Tambak Lorok because of the hydrological risk and the low quality in the settlements. They have carried out various projects to improve the community life and its environment such as financial aid to poor inhabitants, construction and rehabilitation of local infrastructures including streets, drainages, sanitary system, and educative programs for the improvement of economic capacities and health conditions. Most of these projects focus on solving poverty in the communities and reducing hydrological risk impact. Interviews indicate that urban institutions have dispensed financial aid for settlement improvement since the late 1990s. However, dozens of government projects have been carried out in *kampung* Cilosari over the last five years.

**Table 9. Implementation of development projects in *kampung Cilosari* over the last five years**

INSTITUTION		YEARS				
		2010	2011	2012	2013	2014
Municipality	Department of Urban Planning and Settlement		Sanitary facilities project “MCK Plus” at Cilosari Dalam RT IV/RW IX	Financial aid for the house reconstruction of poor households	Sanitary facilities project at Cilosari Dalam, RT I/RW VII	
	Department of Water Resources	Construction of Banger Polder Cooperation with Dutch Government, Ministry of Public Works through Directorate of General of Human Settlement and Office of Pemali-Juwana River Area (National Government) and Office of General of Human Settlement and Spatial Planning (Central Java Province) Pumps systems: 7 pumps, floodgate and local drainages. This project is cooperated and funded by Central Java Province (2011)				
	Office of Semarang Timur District			Reconstruction of streets, drainages and bridges	Streets elevations : RW.VII and RW.VIII Cilosari Barat, 900 m <sup>2</sup> Cilosari Raya street and drainage, RT. VIII, 300 m <sup>2</sup> Cilosari Raya street, RT III / RW VI, 400 m <sup>2</sup>	Streets elevations : RT 04/RW 6 RT 03/RW 6, 200 m <sup>2</sup> Cilosari Raya Street, RT VI. RW II, 200 m <sup>2</sup> Cilosari Raya Street, RT VI. RWI, 200 m <sup>2</sup>
National Government	Directorate of General of Human Settlement and Directorate of Spatial Planning, Ministry of Public Works	Settlement rehabilitation project in RW V , include: <ul style="list-style-type: none"> <li>• rearrangement of housing (re-blocking)</li> <li>• structuring and elevation of streets,</li> <li>• construction of waste storage facilities</li> <li>• structuring local drainage</li> <li>• provision of clean water</li> <li>• construction of communal sanitary facilities as economic community empowerment effort.</li> </ul>				

Source: *Regional Development Working Plan 2014, Regional Development Working Plan 2013, Regional Development Working Plan 2012*, Semarang: Municipal Secretary of Semarang City, “MCK Plus Kemijen Minim Sosialisasi”, *Suara Merdeka*, September, 27<sup>th</sup> 2011, retrieved December 25<sup>th</sup> 2015, from <http://suaramerdeka.com/v1/index.php/read/cetak/2011/09/27/160585/MCK-Plus-Kemijen-Minim-Sosialisasi>.; SIMA Banger, *Proyek – Proyek Tambahan yang Kian Melengkapi Banger Pilot Polder*, 2011, retrieved December 25<sup>th</sup> 2015, from <http://jhelmer.wix.com/sima#!services>; Interviews with heads of community, 2013

The Department of Urban Planning and Settlement, Department of Water Resources, and Office of Semarang Timur District Several carried out urban projects in *kampung* Cilosari over the last five years. The Department of Urban Planning and Settlement focused on the development of local infrastructures, sanitary facilities in particular. They constructed communal sanitary facilities in 2011 and 2013 in order to solve the low sanitary quality due to the frequent flood occurrences. They considered that communal sanitary facilities are the best solution for Kemijen sub-district where the high density built-up areas are often threatened by *rob* risk. Furthermore, they expected these facilities to strengthen community economic capacities through the management of biogas residues resulting sanitary treatment. Fuel can be used to support households' activities so that households' expenses decrease. Furthermore, this institution often gave financial aids to poor households. For instance, it helped 35 households in the Kemijen sub-district including *kampung* Cilosari in 2012. Interviews with the Cilosari community indicate that each household was given 5.000.000 IDR (312.5 €) to reconstruct their houses. This financial aid was allocated to three households in each RW, so nine households of Cilosari community received it. However, this financial aid was limited, compared to the numbers of poor households in the Cilosari community.

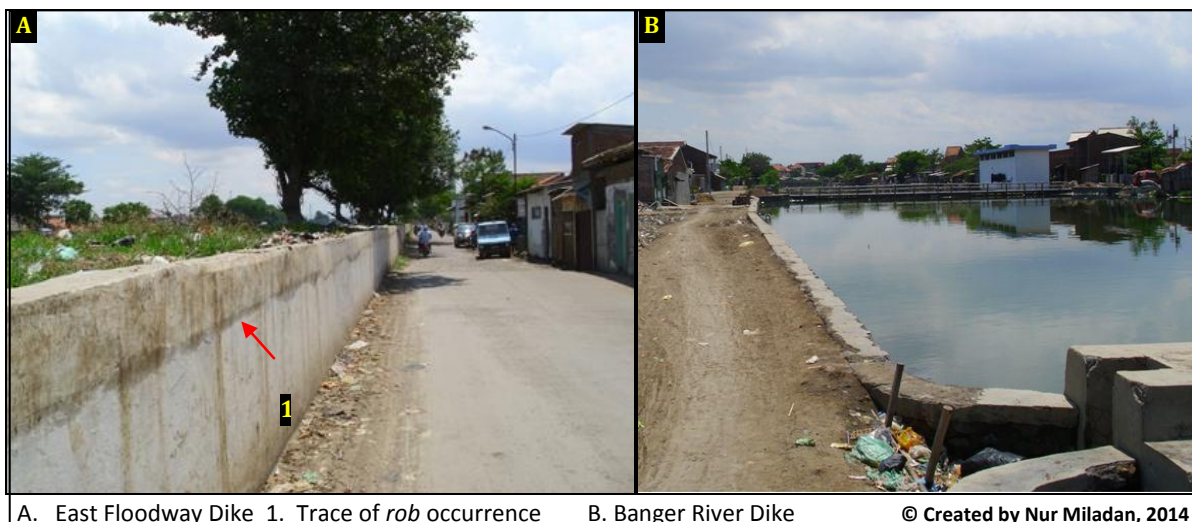
The Office of Semarang Timur District implemented several projects in *kampung* Cilosari. Most of their projects consisted in the reconstructions of local streets and drainages to reduce the hydrological risk impact. For instance, they carried out these projects between 2012 and 2014. Each local street reconstruction costs about 25.000.000 IDR (1562.5 €).

Moreover, the government also gave several pumps to the Cilosari community. In 2011, the municipality gave seven additional pumps while the sluice gates of Banger River were funded by the provincial government, and its implementation was carried out by the Department of Water Resources of Semarang City (municipality) and Department of Human Settlement and Spatial Planning of Central Java (provincial government).<sup>443</sup> They expected this pump system to be managed by the community self-help. The government was the reconstruction of dikes along urban drainages (East Floodway and Banger River) in the Cilosari area. The Department of Water Resources of Semarang City elevated this dike several times since the 1990s. The municipality often cooperated with the provincial government to implement projects around East Floodway dredging. Nevertheless, these efforts are only temporary due to the high sedimentation. So far, the height of *rob* occurrences were always higher than the East Floodway dike. Recently, the height of East Floodway dike was about one meter.

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<sup>443</sup> "Belum Serah Terima Pompanisasi Kemijen Sudah Bermasalah", in *Edunews*, November, 17<sup>th</sup> 2012, Semarang: TVKU.





**Figure 173. East Floodway and Banger River dikes in *kampung* Cilosari**

Source: Primary data, 2013

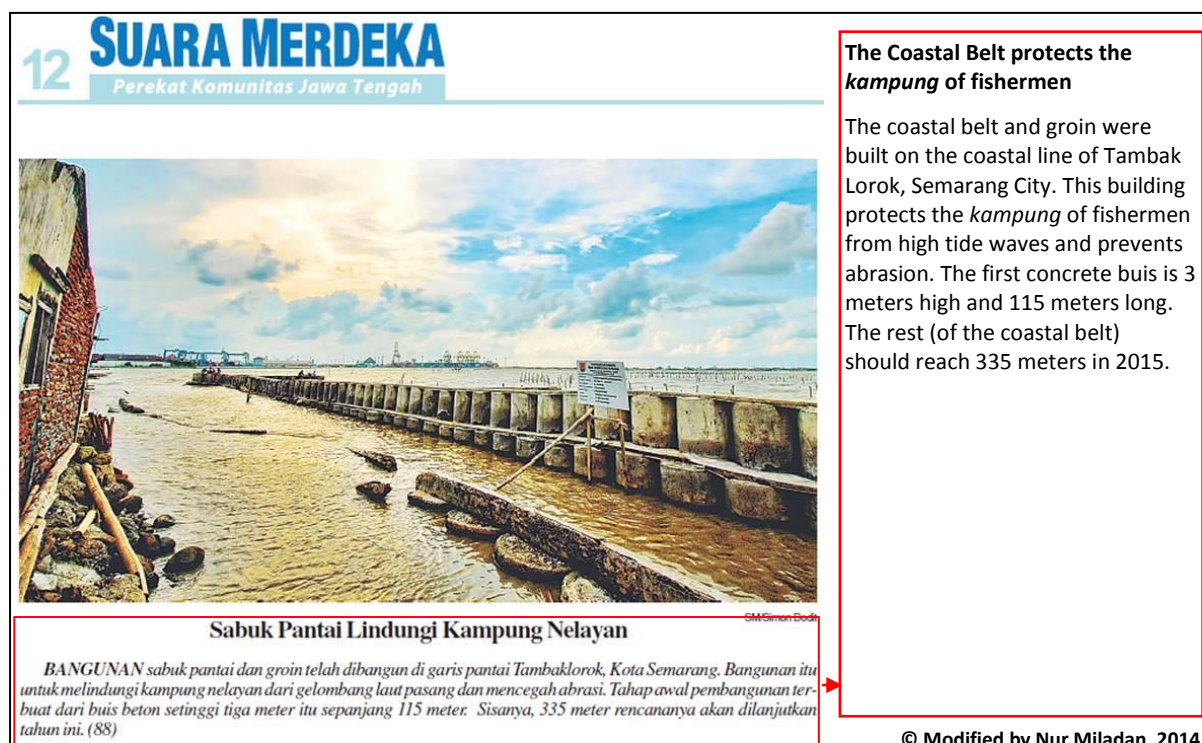
*Recently, the dike has a low height which is in line with the settlement surface. This situation increases the inundation risk in kampung Cilosari during the flood occurrences. Its rehabilitation unintentionally influences spatial transformation to adapt to hydrological risk in kampung Cilosari.*

Moreover, the municipality built the Banger River dike in the 1990s. In the early 1990s, a flash flood hit Semarang, so the municipality built several dikes, including the Banger River Dike, in the coastal area as a preventive effort against the hydrological risk. Furthermore, the municipality renovated this dike several times. However, the land subsidence and the elevation of *the kampung* surface decrease the dike height.

Meanwhile, in *kampung* Tambak Lorok, the municipality often gave financial aid for the reconstruction of streets and drainages and helped poor households. One after the other, RT communities have received financial aid to reconstruct local streets every year since the 2000s. For instance, financial aid for the local street reconstruction was about 52.500.000 IDR ( $\approx$  3281.25 €) in the RT.4 (RW.14) community.<sup>444</sup> Furthermore, the municipality often gave financial aid to poor household for the reconstruction of their houses. For instance, the municipality gave about 1.000.000 IDR ( $\approx$  62.5 €) by household in 2012. In addition, the municipality built a breakwater on the coast along *kampung* Tambak Lorok, but the

<sup>444</sup> *Prioritas dan plafon anggaran sementara- perubahan anggaran pendapatan dan belanja daerah tahun anggaran 2014 (Priority and ceiling of temporary budget- change of annual regional budget in 2014)*, 2014, Semarang: Regional Development Planning Agency.

breakwater was destroyed in 2009.<sup>445</sup> The community has repeatedly asked the municipality to construct a coastal belt since 2003.<sup>446</sup>



**Figure 174. Redevelopment of the coastal belt in *kampung* Tambak Lorok**

Source: Dodit, S., “Sabuk pantai lindungi kampung nelayan” [Photo], *Suara Merdeka*, February, 2<sup>nd</sup> 2015

Finally, the municipality through the Department of Marine and Fisheries has acted on the community will of a coastal belt redevelopment in their *kampung*. The endeavour is implemented through several steps due to the limited annual regional budget of municipality.

The reconstruction of local streets in *kampung* Tambak Lorok was principally financed by the municipality through the Department of Urban Planning and Settlement, the Department of Water Resources, the Department of Marine and fisheries, and the Office of Semarang Utara District. In 2014, the Department of Water Resources budgeted a subvention

<sup>445</sup> “Warga Tambak Lorok Tolak Relokasi Permukiman”, *Kompas*, January, 25<sup>th</sup> 2012, retrieved December 25<sup>th</sup> 2015, from <http://regional.kompas.com>; Utomo, B.B., Wibowo, D.P., 2008, *Perencanaan bangunan pelindung pantai Tambak Mulyo, Semarang (Design of the shore protection for Tambak Mulyo, Semarang)*, Undergraduate thesis, Faculty of Civil Engineering, Diponegoro University.

<sup>446</sup> “Warga Tambak Lorok minta dibuatkan Dam”, *Suara Merdeka*, July, 10<sup>th</sup> 2003, retrieved December 25<sup>th</sup> 2015, from <http://www.suaramerdeka.com>; “Gelombang Pasang Hantam Pantai Semarang”, *Kompas*, December, 27<sup>th</sup> 2007; Yulianto, “Warga Tambak Lorok desak Plt Walikota realisasi sabuk pantai”, *Suara Merdeka*, October, 10<sup>th</sup> 2013, retrieved December 25<sup>th</sup> 2015, from <http://suaramerdeka.com>.

for the rehabilitation of local drainages in this *kampung*, RT 5/RW 14 and RT 7/ RW 15 in particular.<sup>447</sup>

Furthermore, the municipality also implemented non-structural projects. The regional Disaster Management Agency of Semarang City directly gave funding to the communities of Tambak Lorok and Cilosari during the flood occurrences, especially when the inundation lasted several days. They distributed foods, medication and also flood prevention equipment. But when the inundation was too low or only lasted for a few hours, this institution did not intervene. Furthermore, this institution has also proposed training in disaster prevention to the communities. Meanwhile, The Department of Health often organised the prevention of flood diseases and offered free medical check-up.



**Figure 175. Flood preventive equipment provided by the Regional Disaster Management Agency to the Cilosari community**

Source: Primary Data, 2013.

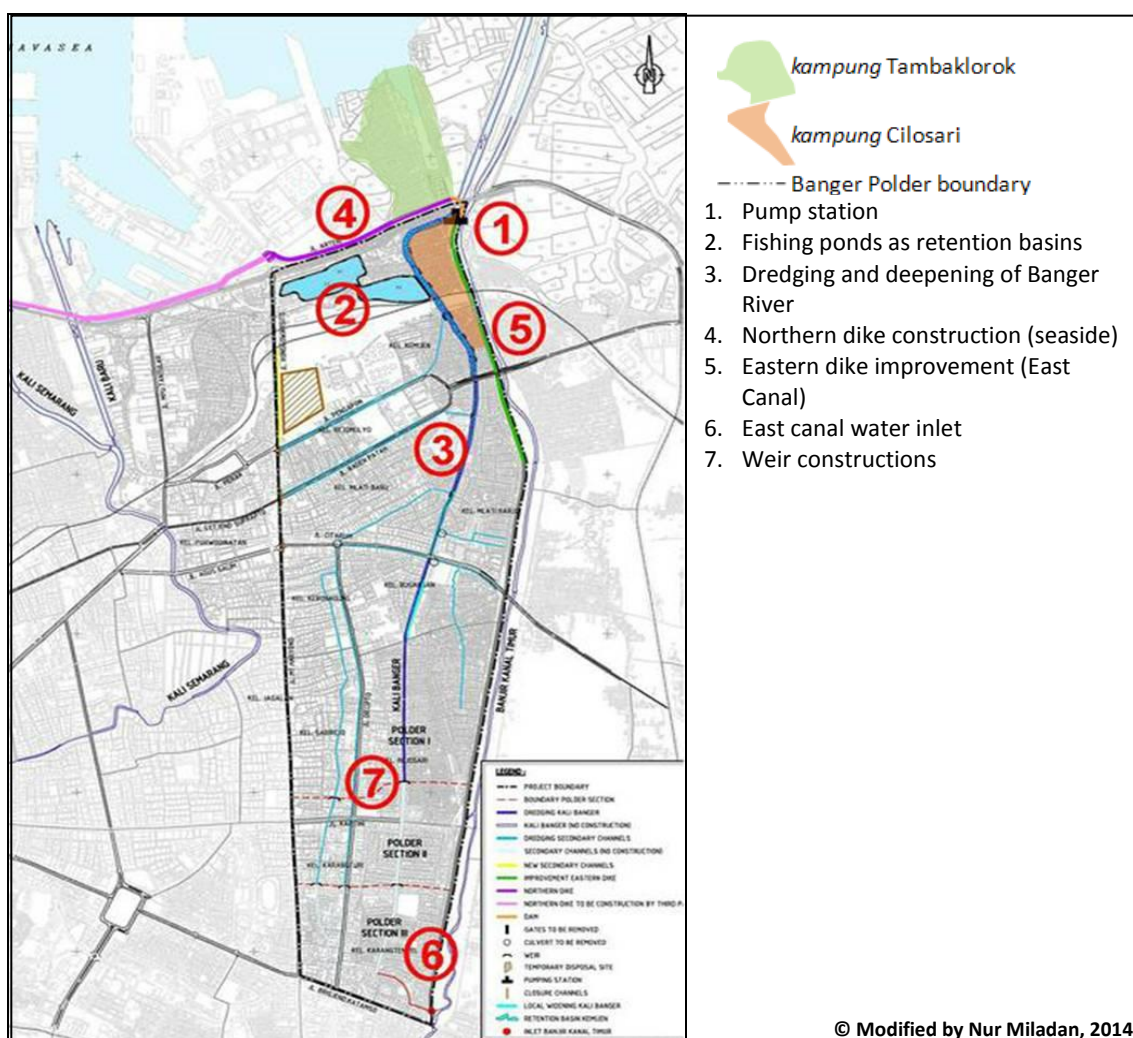
In addition, the municipality carried out several programs to minimize the causes of hydrological risk such as *gerakan bersih pantai dan laut* (movement for the cleaning of coast and sea) in *kampung* Tambak Lorok. The municipality hopes it could change community attitudes about sea waste management.<sup>448</sup>

<sup>447</sup> Rencana umum pengadaan barang/jasa Dinas PSDA & ESDM Kota Semarang Tahun Anggaran 2014/Perubahan Anggaran (General Plan for the Procurement of Goods / Services of Department of Water Resources Management & Energy and Mineral Resources of Semarang City in 2014/ Budget change, September, 9<sup>th</sup> 2014, retrieved December 28<sup>th</sup> 2015, from <http://www.lpse.semarangkota.go.id>.

<sup>448</sup> "Hendi: laut bukan keranjang sampah", *Suara Merdeka*, November, 24<sup>th</sup> 2012, retrieved December 25<sup>th</sup> 2015, from <http://suaramerdeka.com/v1/index.php/read/cetak/2012/11/24/206454/Hendi-Laut-Bukan-Keranjang-Sampah>.



The projects above are partial projects for temporary terms. They are implemented incrementally over a few years. These projects constantly burden the limited annual regional budget of Semarang City. The hydrological risk and the related poverty continue to plague community life. Furthermore, these projects are the “sustainable efforts” of the municipality only. The capacity building of community is not empowered yet by these projects. Although community capacity building is not a priority in the eradication of hydrological risk, it can reduce the community vulnerability. However, the municipality also seeks to implement comprehensive hydrological projects to reduce hydrological risks. The Banger Polder Pilot Project around Cilosari and Tambak Lorok *kampung* is one of them.



**Figure 176. Banger Polder location**

Source: Detailed design report development pilot polder Semarang and guideline polder development, 2009, Deventer: Witteveen+Bos.

*Kampung Cilosari* has an important role in this project because the main pumps of Banger Polder are located in that *kampung*. Meanwhile *kampung Tambak Lorok* is adjacent to the north dyke of Banger Polder.



To support the development of Banger Polder area, the municipality relocated one *RT* community of *kampung* Cilosari to put a pumping house and also a retention basin. At first, the municipality offered them to move to the public flat of Kaligawe situated approximately 3 km away from *kampung* Cilosari. However, this *RT* community rejected the proposal. Then, the municipality increased the compensation from 40.000.000 IDR ( $\approx$  2500 €) to 90.000.000 IDR ( $\approx$  5625 €) for each household.<sup>449</sup> This community rejected because this public flat is located far from their children's schools.<sup>450</sup> The compensation differences are explained by the conditions of the houses. However, in fact, several inhabitants of that *RT* community relocated only around *kampung* Cilosari. They argued that the compensation is not comparable to the property prices in other areas of Semarang City, so they preferred to settle there.



**Figure 177. Land use transformation in *kampung* Cilosari: Pumping house area**

Source: Ikonos Satellite Image of Semarang in 2008; Google Earth, 2014.

*The pumping house area indicates the growing necessity of open spaces to reduce the hydrological risk. But the East Floodway seems to silt up, thus increasing the hydrological risk in kampung Cilosari.*

<sup>449</sup> Interviews with several heads of Cilosari community carried out in 2013.

<sup>450</sup> Badan Pengelola Polder (BPP) SIMA, (2011, August 6), *Pengembangan kapasitas SIMA dalam hal drainase perkotaan yang ramah lingkungan* [Minutes of meeting], Semarang.

Likewise, the provincial government built the north dike to protect the settlements and had the Banger River dredged to smoothen the water flow in the framework of the Banger Polder project.



**Figure 178. Construction of the north dike around *kampung* Cilosari in 2010**

Source: Tamzil, M., Department of Human Settlement and Spatial Planning of Central Java Province, (2011, May 25), *Peningkatan Kinerja Sub-sistem Drainase Kali Banger* [Presentation], Semarang, retrieved December 28<sup>th</sup> 2015, from Website of BPP Banger Sima, <http://jhelmer.wix.com>.

Furthermore, the Cilosari community demanded the reconstruction of the crumbling Cilosari Raya Street.<sup>451</sup> Frequent inundation and also the burden of trucks transporting the materials for Banger Polder Project and the railway project seriously damaged the road.<sup>452</sup> The municipality acted on the community desire in late 2013. They changed the street material from asphalt to concrete because of its strength. It can minimize the risk of bumps and holes. This street is equipped with new local drainages adjacent to the East Floodway (dimension about 0.25 m<sup>2</sup>). It functions to reduce the inundation that overflows the East Floodway.

<sup>451</sup>Main street located near *kampung* Cilosari connecting two urban roads, an arterial road and the Kaligawe road.

<sup>452</sup>The Railway Company projects to build a double-tracked railway passing through *kampung* Cilosari.





**Figure 179. Situation of Cilosari Raya Street in 2012 and in 2013**

Source: Primary Data, 2013; *Harian Semarang*, 2012.<sup>453</sup>

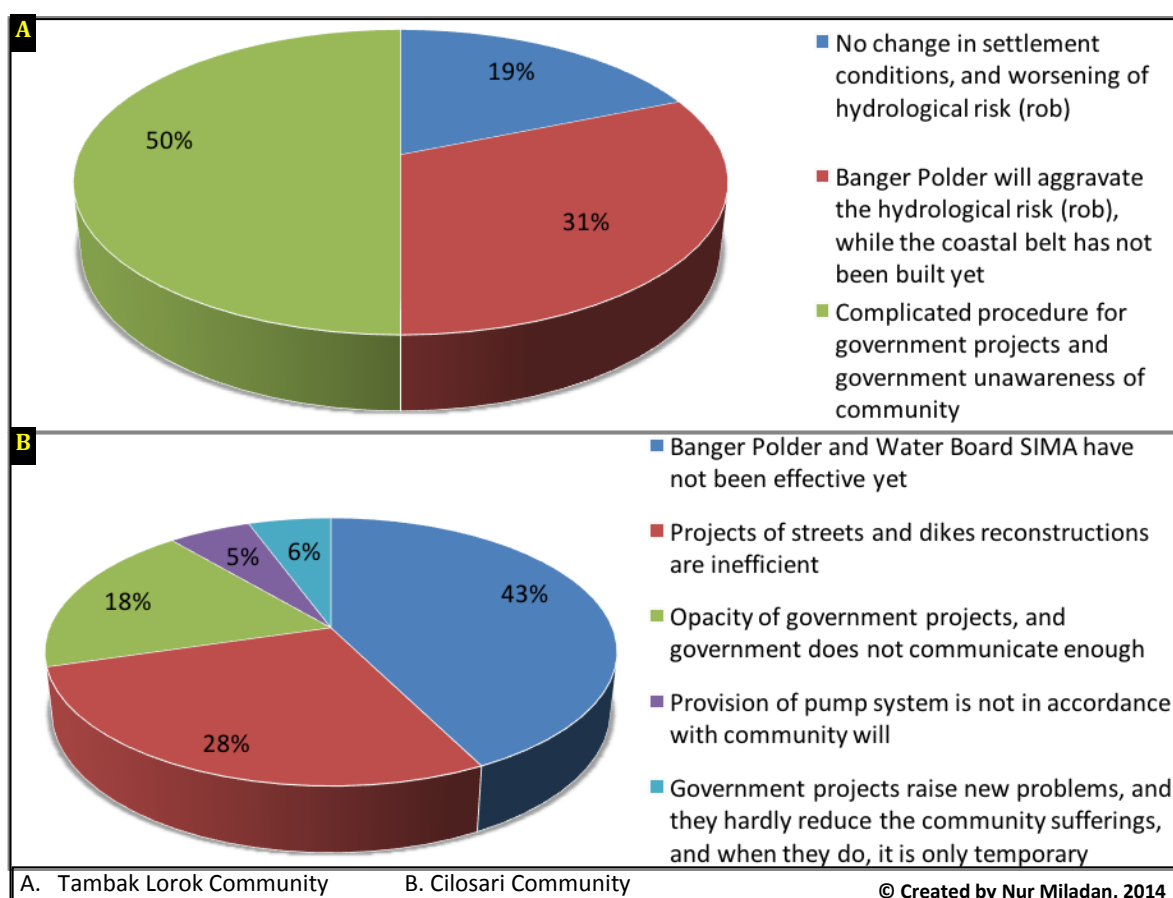
*This street has a width of approximately 5 m and an elevation of approximately 30 cm. Furthermore, it is equipped with wire fence (2 m high approximately) to protect the East Floodway barrier from the squatter area, and to avoid the community practice of disposing rubbish on urban drainages (East Floodway). These efforts aim at supporting the Banger Polder project. This street has experienced several transformations over the last 25 years. It was paved with asphalt since the 1990s. Nevertheless, it was often re-elevated due to frequent inundation.*

In addition, the government also seeks to involve the community in the Banger Polder project management. Several Cilosari representatives are participating. They have the responsibility to develop community participation to support the Banger Polder project. But

<sup>453</sup> “‘Jalan Cilosari Barat Rusak Parah’”, *Harian Semarang*, January, 10<sup>th</sup> 2012, retrieved December 25<sup>th</sup> 2015, from <http://hariansemarangbanget.blogspot.com/2012/01/jalan-cilosari-barat-rusak-parah.html>.

over the last few years, the construction of Banger Polder has experienced many constraints. Consequently, this management has not been effective yet.

Although *kampung* Tambak Lorok is directly adjacent to the Banger Polder Project area, the municipality does not involve its community in the project. The detail engineering design of Banger Polder indicates that the arterial road is the north dike of Banger Polder area, so *kampung* Tambak Lorok is not protected by the Banger Polder system. As a result, Tambak Lorok community does not consent to this project. They feel it will aggravate the hydrological risk in their *kampung*. Similarly, the Cilosari community also deems this project inefficient due to its construction constraints.



**Figure 180. Communities' Perceptions of Government Projects**

Source: Primary Data, 2013.

Communities deemed government projects inefficient for several reasons. Most of the Cilosari community mention the constraints the Banger Polder project experienced during its implementation. They know that the Banger Polder construction should have finished in 2013, but it has been left in neglect. They consider that the government is not serious about



finishing this project. In addition, they think that *Badan Pengelola Polder SIMA* (Polder Banger Water Board) has not been effective due to the delay of Banger Polder construction. This institution only gives advice on the Banger Polder plan, and the community feels that it is not useful. They expect a real reduction of the hydrological risk impact in their settlement. Meanwhile, the Tambak Lorok community assert that the Banger Polder project will aggravate the hydrological risk in their settlement because the Banger River and East Floodway will be dammed, and consequently their *kampung* will be more vulnerable to inundation during the flood occurrences. This condition will be aggravated by the absence of coastal belt on the coast of Tambak Lorok. They assumed that the coastal belt will protect their *kampung*, although the Banger River and East Floodway are dammed. In addition, they assume that the hydrological risk has increased in their settlement due to the implementation of retention basin system around Tanah Mas Real Estate.<sup>454</sup> They argue that the disposal area of this retention basin will worsen the overflow of sea water in their settlement during *rob* (flood) occurrences. For the community, the coastal belt project should be implemented beforehand. As a result, in the eyes of the community, the government does not take their opinion into account. Furthermore, the procedure of government projects is too complicated for them and delays the projects. According to the Tambak Lorok community, the municipality has promised the coastal belt since 2009. Likewise, this community feels that the port extension plan has been devised by the municipality and Indonesian Port Corporation only, so consequently their wills are overlooked by the municipality.

Moreover, the Cilosari community states that although the municipality financially aided to the street reconstruction, their projects are not effective. But they do not have alternative demands to the municipality. So these projects consist of municipal efforts only, and their *kampung* remains highly vulnerable to inundation during flood occurrences. Furthermore, they mention the lack of government communication and the opacity of their projects. The municipality often makes minor and incomplete projects. For instance, they argued construction of communal sanitary facilities is hardly effective, unsustainable, and unpublicised.<sup>455</sup>

Moreover, the Cilosari community links the inefficiency of government efforts to the provision of pumps systems. According to them, the pump system in their settlement is not in

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<sup>454</sup> Yulianto, A., "Rob datang, warga Tambak Mulyo Resah", *Suara Merdeka*, Semarang, June, 26<sup>th</sup> 2013, retrieved December 25<sup>th</sup> 2015, from <http://www.suaramerdeka.com/v1/index.php/read/news/2013/06/26/162299/Rob-Datang-Warga-Tambak-Mulyo-Resah>.

<sup>455</sup> "Kualitas Bangunan MCK Plus Disoal", *Suara Merdeka*, October, 6<sup>th</sup> 2011, retrieved December 25<sup>th</sup> 2015, from <http://suaramerdeka.com>.

accordance with the community will. Three of seven pumps and most of the floodgates have been damaged. As a result, the pump system cannot flow optimally the water out of the settlement or prevent the high inundation in their *kampung* during flood occurrences.<sup>456</sup> In addition, they also complain about the electricity bills for the pump system about 12.000.000 IDR ( $\approx$  750 €) which burdens the community. In 2012, they try to discuss the issue with the legislators and the municipality in order to solve this problem. But it has not been solved yet.

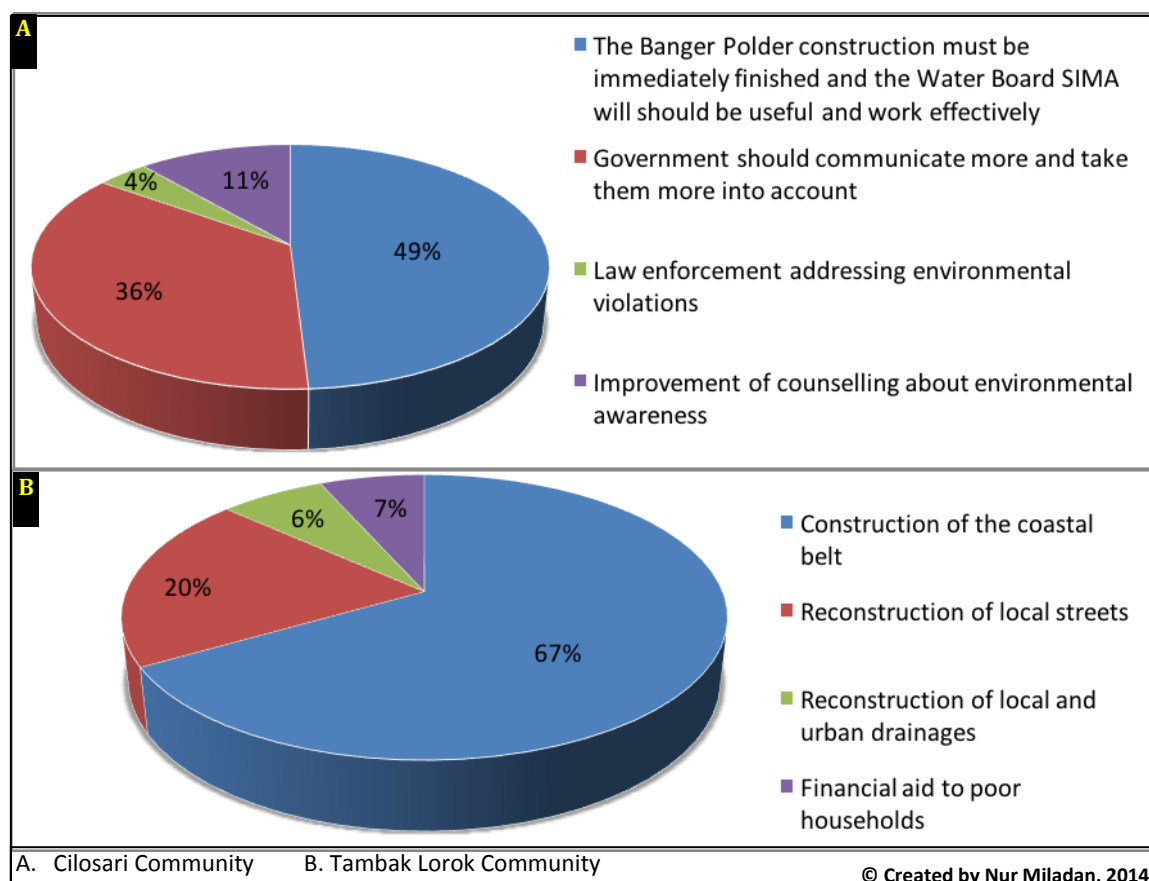
Cilosari and Tambak Lorok communities also consider that government projects often produce new problems and hardly reduce the community sufferings. The financial aid to the street reconstruction has negatively impacted poor houses, whose surface is lower than the streets. Thus, they are highly vulnerable to inundation. However, the financial aid to poor households is not sufficient to construct proper houses. For instance, every poor household received a financial aid about 5.000.000 IDR ( $\approx$  312.5 €), but in fact, the cost of a proper house is more than 10.000.000 IDR ( $\approx$  625 €). As a result, poor households have difficulties to get additional funds to finance the house reconstruction. They also argue that the government efforts are effective only for a few moments due to the flood recurrence. However, because of their limited economic resources, these financial aids are very important for the improvement of the settlement quality.

However, Tambak Lorok and Cilosari communities really expected the government projects to overcome or reduce the hydrological risk impact in their settlements. Most of the Cilosari community wanted the Banger Polder construction to be immediately finished and well managed. The publicity around the Polder Banger Water Board SIMA engendered high expectations for the Banger Polder project. They have no alternative about what they can do to eradicate the hydrological risk in their settlement. In addition, the Cilosari community wants transparency in the Polder Banger Water Board SIMA management, a clear division of stakeholders' roles in particular. They expected this board would empower them to enhance the effectiveness of Banger Polder through tangible actions. Furthermore, they hoped that the municipality could communicate more and take them more into account. But, according to them, the administrative procedure of government projects is too complicated, too long time and delays the implementation of projects. They need quick decision-making because the community has suffered for so long. According to them, the municipality is often late to implement initiatives reducing hydrological risk impact, and therefore, this risk is getting worse in their *kampung*. They also want the municipality to provide counselling and law

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<sup>456</sup> “Belum Serah Terima Pompanisasi Kemijen Sudah Bermasalah”, in *Edunews*, November, 17<sup>th</sup> 2012, Semarang: TVKU.

enforcement addressing violations that cause the environmental problems, such as massive illegal groundwater exploitations, waste management, and squatter areas around urban drainages in their *kampung*. Some inhabitants reckon that the lack of community awareness of environmental issue aggravates the hydrological risk.



**Figure 181. Community wills for government efforts**

Source: Primary Data, 2013.

Meanwhile, the Tambak Lorok community expected the coastal belt to be built immediately. They would have agreed on the implementation of Banger Polder project, if the coastal belt had been implemented beforehand. They believed that the coastal belt is the best way to reduce hydrological risk impact in their settlement. They argue that other solutions like financial and logistic aids, the development of other infrastructures are useless efforts, and do not solve the problem.<sup>457</sup> However, they realize that the community still need these projects, because these projects can temporarily alleviate their suffering. Furthermore, the municipality began to build the coastal belt in 2014 and in 2015, a partial dike was built on the Tambak Lorok coast.

<sup>457</sup> “Gelombang Tinggi 13 Rumah di Tambak Lorok Rusak”, *Harian Semarang*, January, 26<sup>th</sup> 2012, retrieved December 25<sup>th</sup> 2015, from [http://issuu.com/hariansemarang/docs/harian\\_semarang\\_26-01-12](http://issuu.com/hariansemarang/docs/harian_semarang_26-01-12)

The municipality has the important role to improve the *kampung* quality of life because the community self-help efforts are limited. So far, the government projects ameliorated the *kampung* quality of life only temporarily. However, the municipality seeks to transform their partial projects to comprehensive projects. The Banger Polder Project indicates the change of the government mindset, and actions for the reduction of hydrological risk existence. This project also influences the community attitudes towards floodgate infrastructures. Before the implementation of Banger Polder Project, communities considered that partial projects, such as the settlement elevations and the local pumps system, were the best they could do. However, the creation of Banger Polder as comprehensive project becomes a new way to reduce the hydrological risk impact. Furthermore, it requires the collaboration between community and government to manage the Water Board SIMA. Meanwhile, the coastal belt project in *kampung* Tambak Lorok indicates also that the community mindset is moving from partial effort to comprehensive effort. It also suggests that there is a process of knowledge transfer from government to community.

Through these efforts, urban institutions seek to develop community resilience through its empowerment and infrastructure improvement. The developments of this resilience rely on government efforts. Conversely, the inefficiency of government efforts constrains community resilience. However, communities have the lack of trust for the government efforts due to the lack of implementations. The progression of comprehensive government projects will strengthen the communities' trust that fosters territorial resilience. Otherwise, the stagnation of comprehensive government projects and the unsustainability of the partial government projects will continue to limit community empowerment and territorial resilience of coastal *kampung*.



## Chapter conclusion

*Kampung* Cilosari and *kampung* Tambak Lorok are examples of coastal settlements that grew because of industrialization and urbanization in Semarang City. The phenomena of hydrological risk, *rob* in particular, are the cause and consequences of space transformations in these *kampung*. The causes of hydrological risk are linked to poor infrastructures and coastal natural phenomena. The growth of *kampung* was not supported by the provision of urban infrastructures. Consequently, communities sought to build local infrastructures themselves. However, these infrastructures created environmental problems such as land subsidence, land and water pollutions. because of these circumstances, these settlements have irregular built-up areas. Furthermore, coastal natural phenomena, including high tide and sea level rise, aggravate the vulnerability of coastal *kampung* to the hydrological risk. Year after year, the hydrological risk in both *kampung* is worsening. Indeed, the *rob* risk started in the late 1980s, but the massive land use change, from water and open spaces to built-up spaces, has increased the hydrological risk in both *kampung*.

The hydrological risk negatively impacts coastal *kampung*: slum conditions, destruction of houses and infrastructures, social problems caused by increasing poverty, economic disparities among different households, limited hydrological risk impact, and also poor health conditions. All these conditions deteriorate the communities' quality of life.

Moreover, because of the constraints of urban hydrological projects, communities seek to anticipate the hydrological risk impact through their self-help efforts. The spirit of community fraternity, through social work, is capital to their initiatives to reduce hydrological risks. Furthermore, communities seek to implement their self-help efforts based on their experiences, perceptions and knowledge of the hydrological risk. Communities' perceptions of hydrological risks influence how they react and how they survive. Although community perceptions vary a bit, they all aim to reduce hydrological risks in their settlements.

Even though community self-help efforts are temporary solutions only, but they are deemed to the best solutions. Their adaptive efforts are spontaneous and often repeated. Furthermore, other communities adopted these practices, such as the pump system. However, communities have limited economic resources and consequently, their efforts are also constrained. The pump system management is very expensive and requires proper management.

However, urban and external stakeholders play an important role in the development of community resilience. Urban institutions focus more on the improvement of settlement

infrastructures. They have carried out partial approaches to improve the quality of life, such as financial aid for the reconstruction of local streets, drainages and poor houses, the provision of sanitary facilities. However, in fact, these efforts have not substantially increased the community quality of life. Urban institutions also seek to implement new approaches to reduce hydrological risk impact. They develop comprehensive hydrological projects involving community empowerment, although their implementation is constrained by managerial and financial problems. On the one hand, these initiatives transform community attitudes towards hydrological risk, but on the other hand, the lack of urban hydrological project implementation weakens community trust in these efforts.

Meanwhile, external stakeholders including NGOs, academic partners (universities), and private sectors focus more on changing community mindset. They seek to empower communities in order to increase their capacity to fight hydrological risk in their settlements. These actions influence community (local) resilience. Consistency, effectiveness and sustainability are key elements in this process. However, local resilience depends a lot on urban and external stakeholders' efforts. When these initiatives often stagnate, communities become all the more vulnerable to hydrological risks, essentially because their capacities are limited.

## CONCLUSION

Since the early 1980s, urbanization and industrialization in Semarang City have dire consequences in the coastal areas: high population growth, high transformations in land use, from water and open spaces to build-up spaces. This process was not supported by proper urban infrastructures, so the growth of coastal settlements was shaped by community self-help efforts and the private sector.

Since the late 1980s, hydrological risks are threatening coastal settlements of Semarang City. The cases of Tanah Mas real estate, of the Cilosari and Tambak Lorok *kampung* suggest that the hydrological risk emerged in relatively similar circumstances. The problems of land conversion, infrastructure provision, land subsidence, and coastal natural phenomena have engendered hydrological risks in these settlements. Nevertheless, the *kampung*' vulnerability to hydrological risk is higher than in the real estate (planned settlement) due to the lack of local infrastructures. For instance, due to the lack of water infrastructures, groundwater is more massively exploited in the *kampung*, thus aggravating land subsidence and hydrological risks.

Furthermore, the lack of government efforts pushed communities to create solutions by themselves. Community efforts are influenced by their own perceptions, experiences, and knowledge of hydrological risk. Indeed, perceptions among communities are quite similar. Most of the inhabitants state that the hydrological risk disturbs their life because to them, the main cause of hydrological risk is coastal natural phenomena which cannot be opposed. Meanwhile, they also mention that land conversion, exploitation, human behaviours deteriorate the environment and transform hydrological risks into a disaster. However, these different perceptions are also shaped by community knowledge, education and their limited economic capacities.

Furthermore, the perception of hydrological risk impacts is linked to the reasons for settlement in the flood impacted areas. Most of the inhabitants who see the hydrological risk as disturbing their life, they chose to settle there because it is a strategic location, and because community self-help efforts to reduce risk already exist. These statements indicate that they have the choice of settling or leaving, although most of them decided to settle there. They feel they can anticipate the impact by their efforts. The location is strategic because it is near the urban centre and livelihood resources.

For the majority of inhabitants who state that the hydrological risk impact is a disaster, the most important factor is the proximity to livelihood resources. Most of the

*kampung* members work in informal sectors and in the fishing industry. They do not have fixed incomes or very small fixed ones. They have limited economic capacities and thus, few relocation choices away from their most recent settlements. These circumstances create a compulsion factor for them. It forces them to settle in the flood impacted areas and to become familiar with the hydrological risk. These conditions also shape their resilience. Because they settle in flood impacted areas, they have to carry out these adaptive efforts, individual and collective.

Communities share a similar logic. They improve the quality of life in their settlements through the reconstruction of houses, local streets, drainages, floodgates, and also the development of pump system. They have been threatened by the constant hydrological risk for a long time, so they understand its characteristics. However, because of the limited community knowledge, they implement modest solutions to anticipate these problems without proper technologies. However, they realize that their efforts are temporary solutions and do not solve the problem. But they still implement these efforts because they have limited economic capacities.

Although communities carry out similar efforts, they have different capacities to implement them. Different community economic resources produce different ways to reduce hydrological risk. Furthermore, the effectiveness of community self-help efforts depends much on the role of local change agents such as heads of communities in the case of the Tanah Mas community. They conducted community self-help efforts. They can trigger the brainstorming process and encourage independent decision-making in their communities. Furthermore, the community management of the pump system becomes a best practice recognized by the government, and also adopted by other communities. Meanwhile, the case of *kampung* communities indicates the learning process is also influenced by external stakeholders including NGOs, academic partners, and the private sector. They play the role of mediators for community empowerment in order to develop community self-help efforts to reduce hydrological risks. The roles of external stakeholders are explained by the limitations of local initiatives. Communities focus more on household efforts, while the collective efforts are less taken into account. *Kampung* communities have a strong fraternity among them, but they also depend a lot on their heads of communities because of their limited knowledge and economic capacities.

Community self-help efforts produce social and territorial inequalities. In the *kampung*, these situations produce the negative neighbours' relationships. The different housing conditions influence the social inequality among the neighbours. Meanwhile, the



territorial inequality occurs among *RTs* communities. The inundations flow to the areas of poor *RTs* communities that cannot rehabilitate their areas through the reconstruction of local streets and drainages. It causes frictions among them and aggravates other social issues (envy, self-consciousness, and apathy). Meanwhile, social and territorial inequalities do not really affect the Tanah Mas community but its relationships with the surrounding communities. The local pump system is managed through community self-help efforts and strengthens their fraternity bonds. It changes the community behaviours from individualistic to communal which is a positive effect for them. Nevertheless, this system produces territorial inequalities among the surrounding communities due to the natural characteristics of water (inundation) flowing from high level to low level. So far, coastal communities do not collaborate together to reduce hydrological risk. Each community focuses on its self-help efforts, while the lack of urban stakeholders' hinders the development of comprehensive hydrological projects.

In terms of spatial transformations, physical changes happen faster in the *kampung* than in the planned settlement (real estate). *Kampung* communities cannot freely develop collective self-help efforts such as a proper pump system and its management. Consequently, the reconstruction of local streets, drainages, houses, and facilities is more frequent in the *kampung* than in planned settlement (real estate). The spatial transformation in *kampung* Tambak Lorok is the quickest due to its higher vulnerability to hydrological risk because it is located close to the sea. Furthermore, local practices towards public spaces are changing in coastal settlements, *kampung* in particular. The high density of built-up area and the limited economic capacities lead to the use of public spaces for evacuative zones. Musallah as a worship place, functions as a community shelter, notably to welcome poor households during flood occurrences. These situations show that the local initiatives change the utilization of space to reduce hydrological risk.

The situations above show that there is process of community resilience in the Semarang coastal area. According to Cohen et al (2013), the conjoint community resiliency assessment measure (CCRAM) includes leadership, collective efficacy, preparedness, place-attachment, social trust, and social relationship.<sup>458</sup> These factors are reflected in our cases. However, there are different levels of community resilience process in the Semarang coastal area. The degree of community resilience in Tanah Mas community is higher than in the

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<sup>458</sup> Cohen, O., Leykin, D., Lahad, M., Goldberg, A., Aharonson-Daniel, L., 2013, "The conjoint community resiliency assessment measure as a baseline for profiling and predicting community resilience for emergencies", *Technological Forecasting and Social Change*, vol. 80, Issue 9, pp. 1732–1741.

Cilosari and Tambaklorok communities. The Tanah Mas community trust their self-help efforts. Conversely Cilosari and Tambaklorok communities have the lack of trust for their self-help efforts.

However, the urban government efforts, comprehensive hydrological projects and their management in particular, are necessary for the improvement of community resilience. The community resilience is limited because each coastal settlement, *kampung* communities in particular, still needs the comprehensive intervention of urban institutions. The government efforts are necessary to support community empowerment to reduce hydrological risks and to develop resilient urban infrastructures.

**Table 10. Schema of similarities and differences between Tanah Mas community, and Cilosari and Tambak Lorok communities in the process of local resilience**

Type of settlement		Real Estate (planned settlement): Tanah Mas	Kampung: Cilosari and Tambak Lorok
<b>Similarities</b>	Hydrological risk existence: causes, evolution, and impacts	<ul style="list-style-type: none"> <li>• Causes : land subsidence, land conversion and exploitation, infrastructure problems, coastal natural phenomena</li> <li>• Evolution and impact during the past several decades. Nevertheless, <i>kampung</i> are more vulnerable than real estate (planned settlement) due to the lack of infrastructure</li> </ul>	
	Community roles	<ul style="list-style-type: none"> <li>• Heads of communities (leadership) influence the effectiveness of community self-help efforts (initiatives and actions), and they are the local change agents</li> </ul>	
	Logic behind the initiatives	Community self-help efforts are produced by community perceptions about the hydrological risk existence <ul style="list-style-type: none"> <li>• Settlement rehabilitation through the reconstruction of houses, local streets and drainages</li> <li>• Pump system and floodgates at a local scale</li> <li>• Modest solutions to protect the house such as simple materials for floodgates including wood, roof-tile</li> </ul>	
<b>Differences</b>	Reasons for settlement	<ul style="list-style-type: none"> <li>• Strategic location : accessibility to urban centres and workplaces</li> <li>• Self-help community association</li> </ul>	<ul style="list-style-type: none"> <li>• Livelihood resources : informal and industrial sectors</li> <li>• Compulsion (no choice)</li> </ul>
	Perceptions of the hydrological risk	<ul style="list-style-type: none"> <li>• The hydrological risk impact as disturbance more dominant than as disaster</li> <li>• Main cause : coastal natural phenomena</li> </ul>	<ul style="list-style-type: none"> <li>• The hydrological risk impact as disturbance and as disaster are relatively the same</li> <li>• Main cause : land conversion</li> </ul>
		These perceptions are related to knowledge (education) and community economic capacity	
	Local initiatives	<ul style="list-style-type: none"> <li>• Autonomous, focus, structured and organized, collective efforts</li> <li>• Learning process and brainstorming</li> <li>• Presence of local change agents</li> <li>• Replication initiatives (efforts)/ knowledge transfer between other communities.</li> </ul>	<ul style="list-style-type: none"> <li>• Most of the learning process takes place in the interactions with external stakeholders, government (urban institutions), and also in the transfer of knowledge between other communities</li> <li>• Lack of local change agents influencing the lack of the management of community initiatives and self-help efforts</li> <li>• High dependency on heads of communities that limit initiatives to reduce hydrological risk</li> </ul>
	Perceptions and effectiveness of community self-help efforts	<ul style="list-style-type: none"> <li>• High trust for the community self-help (collective) efforts.</li> <li>• Pump system is considered as the best practice, although it causes inequality problems between communities (settlements)</li> </ul>	<ul style="list-style-type: none"> <li>• Low trust for the community self-help efforts due to the repetition of efforts, and the problems of self-help efforts such as management of pump system</li> </ul>
Perceptions of government	<ul style="list-style-type: none"> <li>• Low trust in government efforts and</li> </ul>	<ul style="list-style-type: none"> <li>• High trust in government efforts and external stakeholders</li> </ul>	

Type of settlement		Real Estate (planned settlement): Tanah Mas	<i>Kampung: Cilosari and Tambak Lorok</i>
	and external stakeholders roles and efforts	external stakeholders roles and efforts	roles and efforts, although sometimes they have different perceptions from the stakeholders
	Social and territorial inequality	<ul style="list-style-type: none"> <li>• It does not really emerge within the settlement (community)</li> <li>• Change of community behaviours from individualistic to communality as a positive effect</li> <li>• Social and territorial inequalities occur in the relationships with the surrounding settlements (communities)</li> </ul>	<ul style="list-style-type: none"> <li>• It emerges within the settlement (community)</li> <li>• Social problems are linked to the feelings of envy, self-consciousness, and apathy in community</li> <li>• Territorial inequalities occur within the settlement among the <i>RTs</i> communities</li> </ul>
	Transformation (change) of local practices for communal (public) spaces	<ul style="list-style-type: none"> <li>• It does not really happen</li> </ul>	<ul style="list-style-type: none"> <li>• It transforms public spaces, such as musallah that becomes an evacuation space</li> </ul>
	Process of spatial transformation	<ul style="list-style-type: none"> <li>• Slow transformation</li> </ul>	<ul style="list-style-type: none"> <li>• Rapid transformation</li> </ul>
	Resilience form	<ul style="list-style-type: none"> <li>• Process of community resilience dominated by community self-help (independent)</li> </ul>	<ul style="list-style-type: none"> <li>• Process of community resilience dominated by human capacity (resilience) and supported by urban and external stakeholders roles</li> </ul>

Source: Miladan, 2014.



# **GENERAL CONCLUSION**

**Reflections on the coastal hydrological risk in Semarang City: the urban resilience challenge from cognition to implementation**

## **A. Urban resilience requires integrated approaches between urban physical and human systems**

Understanding urban resilience is about analysing the capacities of urban physical system: infrastructures, natural environment, institutions that manage the urban risk. But it is also evaluating the community capacity to acclimate to the undesirable conditions of a city. It is necessary to look at the urban stakeholders' ability (institutions and communities) to anticipate disaster before, during, and after the crisis: learning process, adaptive efforts to reduce risk such as urban system development and community self-help actions. These abilities help the urban environment "leap back" or return to its previous state. However, where urban system and/or communities failed to cope with the disaster risk, urban resilience has engendered urban sustainability. It is a new type of urban gentrification because the theme of environment is integrated into urban competitiveness strategies.<sup>1</sup>

Urban resilience emerges through the development of an urban physical system, often supported by institutions and community (territorial) resilience. When physical urban systems are missing, territorial resilience plays the important role to back up the urban resilience process. Nevertheless, territorial resilience cannot initiate a process of urban resilience due to the inadequacies between space and community capacities. The different temporal and spatial scales in resilience strategies are required<sup>2</sup>, and also the links between regenerative design and resilience at the three scales of building, neighbourhood, and city focusing on the process of the design approach and impacts on resilience, regeneration and on collective action.<sup>3</sup> The process of urban resilience is optimal when urban physical resilience and territorial resilience are combined.

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<sup>1</sup> Levy, A., Emelianoff, C., 2011, "Editorial", *Quelle ville durable? (Espaces et sociétés)*, n° 147, pp. 7-23.

<sup>2</sup> Bach, C., Bouchon, S, Fekete, A., Birkmann, J., Serre, D, 2013, "Adding Value to Critical Infrastructure Research and Disaster Risk Management: the Resilience Concept", *SAPIENS*, vol. 6, n° 1.

<sup>3</sup> Oliver, A. Thomas, I and Thompson, M.M., 2013, "Resilient and Regenerative Design in New Orleans: the Case of the Make it Right Project", *SAPIENS*, vol. 6, n° 1, pp. 1-13.

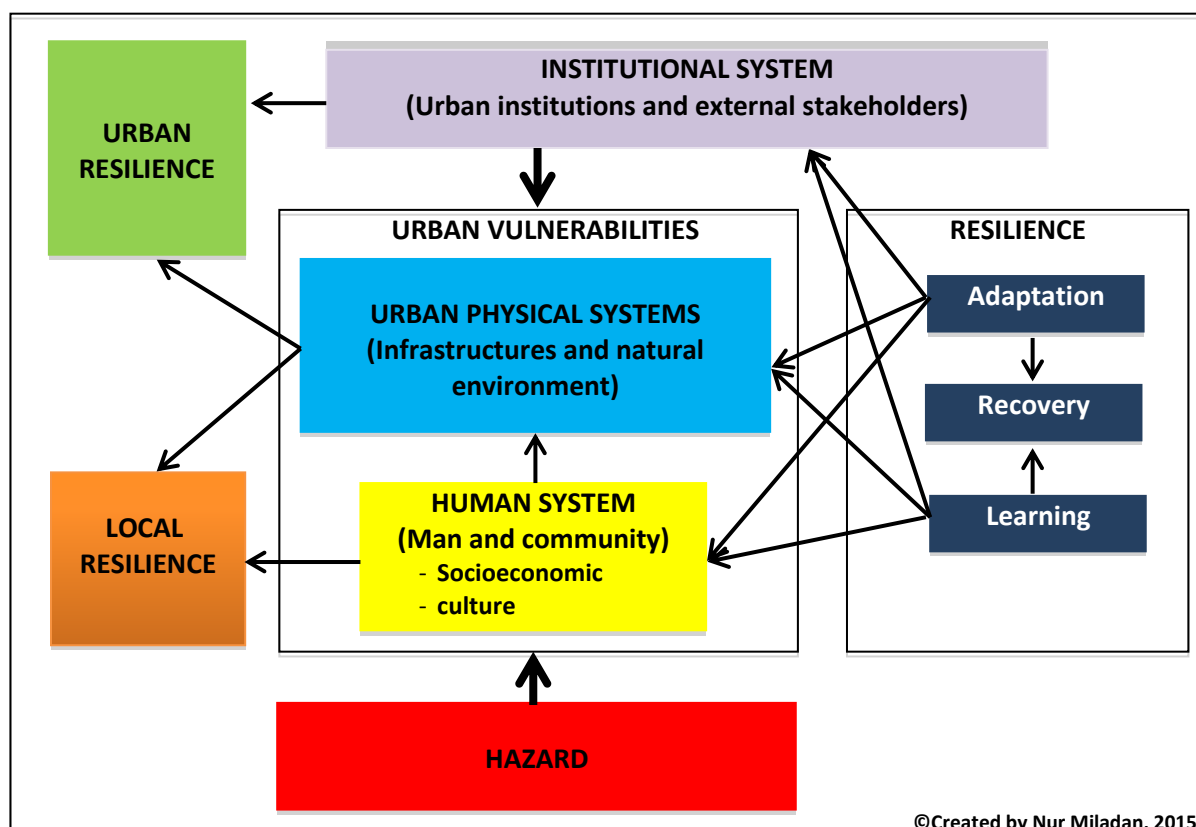


Figure 182. Building Urban Resilience from Risk

Urban physical and human systems complement one another in the development of the urban resilience. The lack or dysfunction of urban physical system when coping with the risk will inhibit the urban resilience process. Moreover, the lack of human system in the creation of “local protection” rapidly constrains the urban resilience process. Consequently, in these circumstances, the city is highly vulnerable to disaster.

The institutional system plays an important role in the urban resilience. The initiatives of urban institutions hasten the development of adaptive capacities in an urban physical system. When these initiatives are lacking, the urban physical system becomes inefficient. Furthermore, the human system will be stifling the resilience process due to the lack of institutional support.

However, external stakeholders such as national government, NGOs, international entities, and academic partners can help strengthen or develop an institutional system to reduce urban risks: transfer and sharing of urban resilience knowledge and initiatives, funding and technical approaches to develop the urban physical system. Moreover, in several cases, the territorial (neighbourhood) resilience process depends on the collaboration of urban institutions and external stakeholders. Because of the important role of external stakeholders,

understanding the urban resilience competency becomes an absolute requirement to ensure effective interventions in the urban resilience process. When the external stakeholders do not succeed in transferring their urban resilience knowledge (global vision and adaptive efforts) to urban institutions and communities, the urban resilience improvement is limited.

Moreover, the self-help abilities of the human system (individual and collective efforts to learn about and to adapt to the disaster risk) are key elements in the determination of territorial resilience and thus, the urban resilience process. The human system seeks to reduce the disaster risk impact based on their cultures and experiences along with the constraints of urban physical system. The human system creates adaptive measures against disaster risk impact. Nevertheless, the disaster risk reduction has to be supported by the urban physical system to guarantee effective urban resilience.

In fact, urban communities have diverse capacities that influence the territorial resilience process. They develop local infrastructures and manage the disaster risk reduction in their territory through diverse socioeconomic, cultural capacities. As a result, territorial inequalities emerge in the city. The human system and comprehensive approaches of the urban physical system provided by the institutional system are absolutely necessary in order to anticipate differences in the territorial resilience and to strengthen urban resilience.

## **B. Community culture as social capital contributes to urban resilience process**

Our research illustrates the urban resilience process relating to the existence of hydrological risk in Semarang City. Like other Indonesian coastal cities (especially on Java island such as Jakarta, Surabaya, Pekalongan, Tegal), Semarang City is vulnerable to flooding that caused by marine submersion and river overflow. Nevertheless, it has a long experience of flooding compared to other coastal cities. The management of flood risk in Semarang City can help develop larger projects of urban flood resilience in Indonesia.

The case of Semarang City shows that the flood resilience process depends on the adaptive capacities of communities and the capacities of the urban physical system provided by the institutional system. Unfortunately, the lack of urban physical system becomes a crucial problem for the development of flood resilience process in Semarang City.

Indonesia is a vast archipelago country threatened by many natural disaster risks, such as flooding, volcano, tsunami, land slide, drought... leaving Indonesian cities very



vulnerable. Due to limited regional and national budgets, there are no proper urban physical infrastructures to reduce disaster risk. So far, international stakeholders tend to provide financial and technical assistances to solve these problems.

Dependent urban physical system relating to urban flood resilience also appears in other countries. For instance, in France (Europe), urban resilience usually involves an urban physical system able to absorb the disaster risks.<sup>4</sup> The urban physical system functions properly, so cities are more resilient. These situations commonly take place in cities and countries with proper urban infrastructures and sophisticated technologies to anticipate the flood risks. Furthermore, the urban physical system is always tied to an institutional system that supports the urban physical system resilience.

In the case of Paris, one of the European metropolises with flood risk, the concept of urban resilience is developed on a practical level. To develop flood resilience, the municipality carries out three approaches: action plans (removable system protection, activity continuation plan of municipal services/infrastructures), regulations (Plans for Flood Risk Prevention/PPRI replacing Risk Prevention Plans/ PPR (a state regulation/policy) through the land use planning control in flood areas, and public awareness) and cooperation with related actors (flood prevention action program of Seine and Marne Franciliennes/PAPI, partnership with network operators...<sup>5</sup>).

Moreover, urban resilience depends on the anticipation and improvement of the resilience of network infrastructures and urban services but on prevention policies through

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<sup>4</sup> Recently, several dissertations and researches explain the urban resilience through the capacities of urban infrastructures to absorb the disaster risks: Giangola-Murzyn, A., 2013, *Modélisation et paramétrisation hydrologique de la ville, résilience aux inondations*, Thèse de doctorat en Sciences et Techniques de l'Environnement, Université Paris-Est; Beraud, H., 2013, *Initier la résilience du service de gestion des déchets aux catastrophes naturelles, le cas des territoires urbains et de l'inondation*, Thèse de doctorat, Université Paris-Est; Rioust, E., 2012, *Gouverner l'incertain : adaptation, résilience et évolutions dans la gestion du risque d'inondation urbaine : les services d'assainissement de la Seine-Saint-Denis et du Val-de-Marne face au changement climatique*, Thèse de doctorat en Aménagement de l'espace, Urbanisme, Université Paris-Est; Toubin, M., 2014, *Améliorer la résilience urbaine par un diagnostic collaboratif, l'exemple des services urbains parisiens face à l'inondation*, Thèse de doctorat en Géographie, Université Paris Diderot (Paris 7); Beucher, S., 2008, *Risque d'inondation et dynamiques territoriales des espaces de renouvellement urbain : les cas de Seine-Amont et de l'Est londonien*, Thèse de doctorat en Géographie, Université Paris X-Nanterre; Lhomme, S., Serre, D., Diab, Y., Laganier, R., 2010, "Les réseaux techniques face aux inondations ou comment définir des indicateurs de performance de ces réseaux pour évaluer la résilience urbaine", *Bulletin de l'Association de géographes français. Géographies*, pp. 487-502; Lhomme, S., Serre, D., Diab, Y., Laganier, R., 2013, "Analyzing Resilience of Urban Networks: a Preliminary Step towards more Flood Resilient Cities", *Natural Hazards Earth System Science*, vol. 13, pp. 221-230; Jébrak, Y., 2010, *La reconstruction et la résilience urbaine: l'évolution du paysage urbain*, PhD Dissertation in Urban Studies, Université du Québec à Montréal (UQAM).

<sup>5</sup> Defretin, E., (Municipality of Paris), (2014, Sept.9), *Réduire la vulnérabilité du territoire parisien face à une crue centennale de la Seine : les démarches de la ville de Paris* [Presentation], Paris: Petit-déjeuner de l'IAU îdF, retrieved December 25<sup>th</sup> 2015, from <http://www.iau-idf.fr/fileadmin/DataStorage/Recherche/PetitDej/2014/MetropResiliente/IAU-MetropResiliente-EricDefretin.pdf>.

governance capacities.<sup>6</sup> Other European cities are also implementing these strategies and policies.<sup>7</sup> All of these efforts indicate that the process of urban flood resilience through the improvement of urban physical system very much depends on the institutional system (risk management and policies/ governance).

Because of these dependencies, urban physical systems are fragile. Modern cities where the urban activities rely on urban infrastructures, such as public transportation system, electrical network and public water system, are very vulnerable to disaster risks when the lack of urban communities' adaptive capacities takes place. The community can be a subject and an object of the urban resilience process. The urban physical system resilience grows alongside the human system resilience influenced by socioeconomic and cultural aspects.

In the case of Semarang City, the community abilities are key elements in the flood risk reduction due to the lack of urban physical system. Hydrological risks evolve in conjunction with the community self-help efforts to adapt. Therefore, the community capacities to develop territorial resilience can be questioned. Because of the lack of urban physical system, the city is more vulnerable to hydrological risks. Settlement as majority of land use in Semarang coastal area has the highest vulnerabilities than other land uses because of its function as main space of life. It is the principal space being protected by the communities from the hydrological risks. Communities have to rely on their own self-help efforts to adapt these risks in their settlements because of the inadequate institutions and infrastructures. Their initiatives are influenced by the community culture and perceptions. The spirit of *gotong royong*, principle of the Indonesian philosophy<sup>8</sup>, expresses a sociocultural form of togetherness, community collectivity confronting the hydrological risk.

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<sup>6</sup> Faytre, L., (2014, Sept. 9), "*Enjeux de la diminution de la vulnérabilité aux inondations en Ile-de-France*" [Presentation], Paris : IAU IdF/DEUR; *OECD Reviews of Risk Management Policies: Seine Basin, Ile-de-France, Resilience to Major Floods*, 2014, Paris: OECD; Hegger, D.L.T., Driessen, P.P.J., Dieperink, C., Wiering, M., Tom Raadgever, G..T., Van Rijswick, H.F.M.W., "Assessing Stability and Dynamics in Flood Risk Governance, An Empirically Illustrated Research Approach", *Water Resources Management*, vol. 28, Issue 12, pp. 4127-4142; Gersonius, B., Ashley, R., Zevenbergen, C., 2012, "The Identity Approach for Assessing Socio-Technical Resilience to Climate Change: Example of Flood Risk Management for the Island of Dordrecht", *Natural Hazards and Earth System Sciences*, vol. 12, pp. 2139-2146; Toubin, M., Diab, Y, Laganier, R., Serre, D., 2013, "Les conditions de la résilience des services urbains parisiens par l'apprentissage collectif autour des interdépendances", *Vertigo*, vol. 13, n° 3; Brun, A., Gache, F., 2013, "Risque inondation dans le Grand Paris : la résilience est-elle un concept opératoire ?", *Vertigo*, Regards / Terrain.

<sup>7</sup> Recent related projects in Europe: Flood Resilient City (FRC) which involves several cities: Paris and Orleans (France), Bradford (England), Brussels and Leuven (Belgium), Dublin (Ireland), Mainz (Germany), Nijmegen (Netherlands); STAR-FLOOD (Strengthening and redesigning European Flood risk practices: towards appropriate and resilient flood risk governance arrangements) involving Netherlands, Belgium, France, England, Poland, Sweden; SMARTeST involves England, Germany, France, Greece, Netherlands, Spain.

<sup>8</sup> Gotong royong is a very familiar social concept in many parts of Indonesia and forms one of the core tenets of Indonesian philosophy. Cf. Fahrudin, A., 2013, "Social welfare and social work in Indonesia", in: Furuto, H.B.C.L., *Social Welfare in East Asia and the Pacific*, New York: Columbia university press.

Community self-help efforts to reduce risks (local association for instance) are mobilized by heads of communities and local change agents. They rely on social structure and community culture. It indicates that social capital is necessary for risk reduction. Although communities have realized their self-help efforts are not problem-solving, they emphasize collectivity to reduce risk. In spite of the constant risk and the lack of urban physical system, communities still seek to eradicate these risks through their limited resources.

Furthermore, community culture and constant flood risks made community resilience. Their community culture influences their perception of flood impact: it is not only an absolute disaster, but also a life disturbance. As a consequence, communities seek to survive the daily uncertainty. Our case study of *kampung* areas shows how the Javanese attitude called “*nerimo ing pandum*” / to accept (whole of) giving (of God/ fate) without complaints becomes the fundamental element of culture helping these communities to accept the risk in their daily life. They accept that their fate depends on flood risk, but they also seek to improve their quality of life with their limited economic resources. Despite the growing flood risks, they still settle in their territory and seek to reduce flood risk impacts. These conditions illustrate how the process of flood resilience occurs in the community life.

The community culture also influences inhabitants’ initiatives and perceptions in their efforts to adapt to the risk impact. The inhabitants have different capacities to develop their resilience, but these manners can be explained by a similar logic. For instance, house elevation is a frequent community effort to reduce risks. However, the forms of house renovation depend on the initiatives of each household. It also reflects individual abilities to sustain their livelihood and social activities in flood-impacted territories. The number of livelihood sources provided in risk territory determinates individual resilience.

### **From economic space to resilience: livelihood resources and disaster risk**

In our research, the livelihood resources of communities are linked to functions of urban space. The Semarang coastal area was the center of urban growth until the 1990s, in particular northern and eastern parts as strategic urban zones. This area has been the core of urbanization and industrialization in Semarang since the 1970s. Nevertheless, the existence of coastal hydrological risk causes the stagnation of urban growth in this area. Recently, the orientation of Semarang urban growth has reached areas non-impacted by the hydrological risks such as the Semarang hill areas (southern part of city).

However, recent urban activities in the Semarang coastal area have influenced the process of territorial flood resilience. The existence of strategic zones in the Semarang coastal area, such as transportation areas (port, station, and airport), industrial areas, commercial areas (traditional and modern markets), office areas and marine and fisheries areas, provide livelihood resources to the communities whose very existence depend on it.

The urban area of Semarang coastal is dominated by the existence of *kampung* areas whose livelihood depend on these urban sectors. The majority of inhabitants work in informal sectors<sup>9</sup> related to formal sectors such as industry, commerce, transportation, and fishery. Because of their limited skills, they work in informal sectors and earn uncertain income. Economic compulsion pushes these communities to settle in risk-impacted areas of hydrological risk. They settle near economic centres to ensure their livelihood. Due to poverty, communities carry out illegal practices to exploit natural resources such as groundwater and cover their basic needs. Access to urban infrastructures massively increases the resort to these practices. These circumstances aggravate environmental risks (land subsidence and flood risk) and thus, the community vulnerability. In the face of the daily threats like poverty and expulsion, water-related threats appear secondary; the population becomes more resilient, elastic in the face of rare phenomena related to water than in the face of other dangers of daily life, such as fire or expulsion.<sup>10</sup>

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<sup>9</sup> The informal sector covers a wide range of labor market activities that combine two groups of different nature. On the one hand, the informal sector is formed by the coping behavior of individuals and families in economic environment where earning opportunities are scarce. On the other hand, the informal sector is a product of rational behavior of entrepreneurs that desire to escape state regulations. Cf. World Bank, "Concept of Informal Sector", *The World Bank* [Web], retrieved December 28<sup>th</sup>, 2015, from <http://lnweb90.worldbank.org>.

<sup>10</sup> Texier, P., 2009, *Vulnérabilité et réduction des risques liés à l'eau dans les quartiers informels de Jakarta*, Thèse de doctorat en Géographie, université Paris-Diderot (Paris 7).



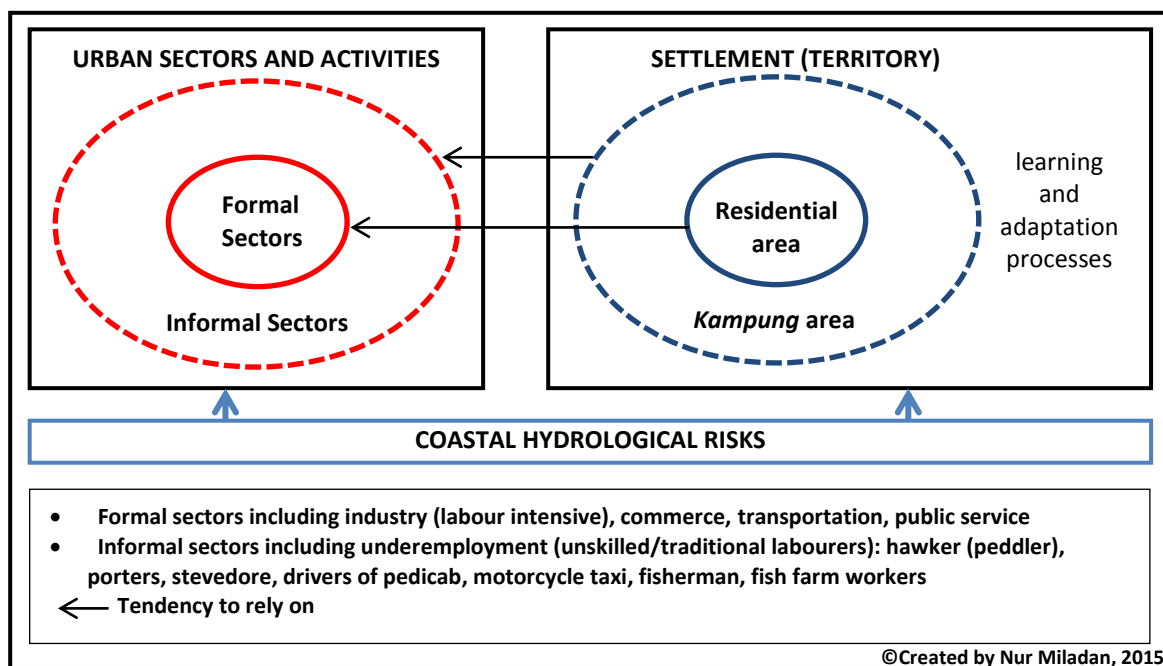


Figure 183. Economic space and local resilience in Semarang coastal area

The economic spatial organization influences territorial resilience. Economic spaces and livelihood resources affect adaptive community capacities. Although communities develop similar structural measures to reduce the risk in their territories, but different livelihood resources produce different levels of adaptation and learning.

However, economic spaces are also influenced by community culture. Cultural background plays a role in important economic choices.<sup>11</sup> Tolerance, accepting fate and striving for harmony constitute Javanese main characteristics.<sup>12</sup> In the unity with God, the Javanese also believe in acceptance of destiny or *nrimo* (acceptance).<sup>13</sup> Our case of *kampung* areas describes how Javanese culture influences communities to accept their limited economic resources and the daily risk in their lives. The existing economic spaces become the community foundations helping them to “sustain” their life in risk territories. This case reflects how community economic resources and community cultures are interdependent social elements that support the territorial (neighbourhood) resilience process.

These facts above illuminate how urban resilience is not only characterized by the capacities of the urban physical system, but also the sociocultural system. Community

<sup>11</sup> Guiso, L., Sapienza, P., Zingales, L., 2006, “Does Culture Affect Economic Outcomes?”, *Journal of Economic Perspectives*, vol. 20, n° 2, pp. 23-48.

<sup>12</sup> Permana, I., 2015, *Surrender: the Influence of Religion, Culture and Access to Health Care on Diabetes Self-Care for Javanese Muslim in Yogyakarta*, PhD Dissertation in Health and Social Care, University of Salford.

<sup>13</sup> Sunaryo, L., 2005, *Managing a Complex Environment-Social Cultural Perspectives. The Case of Indonesia*, Master of Commerce, University of Otago.

capacities play an important role in the process of urban resilience, particularly when the lack of urban system occurs due to institutional inadequacy. However, the empowerment of communities as agent of their development is very necessary to develop urban resilience. If the communities do not take an active part in their own development, they can remain highly vulnerable, and consequently the urban resilience process should also be questioned.

### **C. Inadequate urban comprehensive approaches to learning and adaptation processes develop local resilience in the face of hydrological risk**

The resilience process in Semarang City depends on the evolution of risk and government approaches. The flood risk was not as high during the Dutch government era as it is now. Therefore, the Dutch centralized governance made processes of risk reduction and adaptation depend on urban infrastructure system developed by municipality. At that time, community adaptation was not the main factor in the urban resilience process. The discontinuity in urban planning between the Dutch era and the initial phase of Indonesian government increased hydrological risks in Semarang City. It indicates that there has been a lack of learning process by the initial urban institutions. As a result, urban drainages were not rehabilitated at that time.

Recently, the increase of hydrological risks conjugated to the lack of urban infrastructure system and urban comprehensive approaches have accentuated the importance of territorial resilience in the urban resilience process. These situations occur in coastal communities seeking to reduce hydrological risks through their self-help efforts. Nevertheless, these communities contribute differently to these initiatives, sometimes causing inequalities among them. These self-help efforts are isolated. There is an absence of consensus and cooperation in the development of community endeavours.

Furthermore, these efforts reduce hydrological risks only in each territory. The municipality is not yet involved in community self-help efforts, nor in the implementation of comprehensive hydrological risk management system. Although they installed pump systems in several flood impacted territories, these initiatives have not yet produced equal access to urban infrastructure between communities due to constrained urban infrastructures, in particular pump system capacities. In addition, the municipality has not yet initiated comprehensive plans and projects integrating community self-help efforts to reduce risk. So far, the Regional Disaster Management Agency of Semarang City has organized flood

prevention and recovery efforts in coastal communities. Comprehensive plans and projects do not stem from community-based approaches. These municipality programs constitute routine efforts and top-down approaches. In the top down context, decisions are made by government agencies, with little or no information provided to the public; alternative expressions used in the literature for this context are cooperative or normative.<sup>14</sup> The urban hydrological projects have not yet reflected community initiatives, and consequently the government efforts and the communities' self-help efforts are not combined. However, the involvement of communities and even private sectors is needed to develop integrated approaches.

The learning processes are different and unconnected for the municipality and the communities. Recently, external stakeholders including NGOs and international entities influence municipal understanding of hydrological risks and eradication efforts. The municipality tends to develop hydrological risk resilience through infrastructure improvement because they learned it from external stakeholders. Nonetheless, several factors inhibit the implementation and sustainability of urban hydrological projects, and thus, so the resilience process.

Moreover, the knowledge transfers from municipality to communities experience many constraints. The low community understanding of government projects is one of them. The learning process of urban institutions does not take place in communities.

The community learning processes are based on their experiences and initiatives. Because of their limited economic resources and technology knowledge, community self-help efforts are modest. In addition, several NGOs and academic partners seek to develop community empowerment, especially in poor coastal communities. Nevertheless, their efforts lack initiatives and programs to reduce risk. They focus on strengthening community empowerment through the increase of economic capacities, thus enhancing community capacities for the development of self-help efforts to reduce hydrological risk impact. However, these efforts may not significantly enhance community resilience.

The situations above demonstrate the inadequacy of urban comprehensive approaches to improve territorial resilience. Both the municipality and communities have implemented initiatives, even though these efforts are carried out separately. Urban comprehensive approaches require transparency between municipality and communities to build collective efforts. The development of urban comprehensive approaches still needs urban institutions to

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<sup>14</sup> In the community-based context, coastal management is controlled by local stakeholders, with government delegates defining limits and guidelines; alternative expressions used in the literature for this context are coordinated or bottom-up. Cf. Zagonari, F., 2008, "Integrated Coastal Management: Top-down vs. Community-Based Approaches", *Journal of Environmental Management*, vol. 88, Issue 4, pp. 796-804.

organize and to integrate communities. However, the sustainability of community self-help efforts has to be developed in conjunction with urban comprehensive approaches in order to fight urban inequalities in the efforts for hydrological risk reduction.

Recently, the Asian Cities Climate Change Resilience Network (ACCCRN) project is a pilot project for the development of hydrological risk resilience through the combination of community empowerment and government efforts. The project has not yet affected coastal community resilience. The ACCCRN is a macro project that aims to create urban resilience in Semarang hit by several disasters caused by climate change. However, urban comprehensive approaches to develop hydrological risk resilience should be a priority focus of Semarang resilience program, because flooding is the dominant risk in Semarang City. The focus of this priority program will significantly influence Semarang urban resilience in face of climate change issues.

#### **D. Key issues in the development of urban resilience**

The gradual move from a logic of protection towards one of prevention took place in parallel with the emergence of the concept of vulnerability in the 1980s, followed by that of resilience in the 2000s<sup>15</sup>; the latter of these concepts, which is being increasingly applied, incorporates risk management as part of a proactive approach that promotes coordination between the various aspects of public policy.<sup>16</sup> Perhaps resilience offers new routes into framing these deeper, more structural issues, and bringing them into a planning agenda.<sup>17</sup> The statements above indicate that the practices of urban resilience are related to the urban planning process and need the involvement of various urban stakeholders. In general, the urban institutions and communities are the two urban stakeholders directly involved in the urban resilience process. The efforts of urban institutions and communities are not combined to function simultaneously and to develop an integrated urban resilience process. Furthermore, external stakeholders including academic partners, NGOs and international entities are not completely integrated into the decision process. They cannot check the development steps of urban resilience such as technical assistance, knowledge transfer and

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<sup>15</sup> In Europe, we have witnessed the emergence of resilience in the same time of the capacity reduction of public authorities, and the idea that individuals are responsible of their own.

<sup>16</sup> Hubert, G., 2014, "Ville et inondation: une cohabitation délicate" in : Terrin, J., *Villes inondables. Prévention, adaptation, résilience*, Marseille: Editions Parenthèses/GIP AIGP.

<sup>17</sup> Wilkinson, C., 2012, "Urban Resilience: What Does it Mean in Planning Practice?", in: Davoudi, S., Porter, L., *Applying the Resilience Perspective to Planning: Critical Thoughts from Theory and Practice*, Planning Theory & Practice, vol. 13, n° 2, pp. 319-324.



possibilities of funding for urban projects. In this issue, collaborative efforts become important elements in the planning process. The coordination of governmental institutes at all scales is essential for an effective flood risk management in general and flood resilience in particular.<sup>18</sup>

Planning tools are necessary to evaluate criteria of urban resilience process. To build the urban resilience to natural hazard and climate change, it should be supported by the urban risk assessment and the integrating risk into urban development strategies.<sup>19</sup> To assess the vulnerability of inundated territories and to propose development projects integrating the knowledge of local vulnerabilities, it can promote the construction of local resilience and the integration of risk in urban development as an essential factor of sustainability.<sup>20</sup>

Integrated and collaborative approaches and planning tools are complementary instruments for the governance of urban resilience process. These instruments are adjusted to the context of risk existence. Multi-dimensional risk produces different collaborative approaches and planning tools. However, a community-based approach can constitute a proper alternative for urban resilience development, although top-down approaches also occur.

**Autonomous organization of hydrological risk management is taken into account in top-down and bottom-up approaches between community and urban levels in order to ensure the governance of urban resilience**

In the case of Semarang City, the involvement of many institutions creates collaborative efforts for the hydrological risk management. On the one hand, collective responsibilities can support the projects and plans for hydrological risk reduction. Collaborative efforts between institutions positively impact the sharing and transfer of initiatives and knowledge, funding and responsibilities. On the other, they still indicate several weaknesses in the project implementation, such as funding complexity, coordination and responsibility among the institutions.

For instance, the Banger Polder Project has taken more than ten years to unfold. It was initiated in 2002 and it is still in construction because of many constraints. The lack of

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<sup>18</sup> Schelfaut, K., PAnnemans, B., Van der Craats, I., Krywkow, J., Mysiak, J., Cools, J., 2011, "Bringing Flood Resilience into practice: the FREEMAN project", *Environmental Science and Policy*, vol. 14, Issue 7, pp. 825-833.

<sup>19</sup> Asian Development Bank, 2013, *Moving from Risk to Resilience: Sustainable Urban Development in the Pacific*, Mandaluyong City.

<sup>20</sup> Barroca, B., Hubert, G., 2008, "Urbaniser les zones inondables, est-ce concevable ?", *Développement durable et territoires*, Dossier 11.

coordination among institutions affects the repartition of project responsibilities. On the one hand, it indicates a spirit of collaboration between local, national and international institutions. On the other, it creates a complicated procedure of project management, institutional interdependency and the lack of coordination. These circumstances cause delays in project implementation. Moreover, funding for very expensive construction and sustainability remains a crucial problem. The municipality has a limited budget, while the community is hardly involved in project maintenance. This situation also occurs in other urban hydrological projects around the retention basin of Semarang River and Jatibarang.

The development of urban resilience through infrastructures depends on budget capacities. On the one hand, it burdens the regional budget of the municipality. On the other, the high percentage of poor communities in the Semarang coastal area constrains community involvement in the maintenance of urban hydrological infrastructures.

According to Lu and Stead (2013), there are six characteristics of urban resilience: attention to the current situation, attention to trends and future threats, ability to learn from previous experience, ability to set goals, ability to initiate actions, and ability to involve the public.<sup>21</sup> In the case of Semarang resilience process for hydrological risks, the existence of urban hydrological projects and plans indicates urban institutions' attention to the current situation and to trends and future threats. They also set the goal of hydrological risk reduction through the learning processes of the previous hydrological risk experience and also the sharing of resilience knowledge with external stakeholders. They have also initiated several policies with the goals of hydrological risk reduction and adaptation. Nevertheless, the ability to involve the public is lacking. The urban hydrological risk management in Semarang City demonstrates that communities are not involved in policy decision and project implementation in the framework of top-down approaches.

So far, the municipality focuses more on developing urban flood resilience through the urban infrastructure improvement. However, several government programs, such as the BPP Banger SIMA, concentrate on the empowerment of coastal communities. They constitute top-down approaches to build community resilience. Furthermore, urban institutions still give financial aid and assistance to coastal communities in order to develop community empowerment and reduce hydrological risk impact. Nevertheless, these efforts

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<sup>21</sup> Lu, P., Stead, D., 2013, "Understanding the Notion of Resilience in Spatial Planning: A Case Study of Rotterdam, The Netherlands", *Cities*, vol. 35, pp. 200-212.

have not yet resorted to comprehensive approaches for community resilience building due to time and space limitations.

The bottom-up (community based) approaches are not yet used in the urban hydrological risk management. Hydrological projects and plans are based on the initiatives of policy makers. However, community initiatives can be adapted to integrate urban hydrological risk management. For instance, the P5L association exists in the Tanah Mas Community only.

The case of P5L association reflects the concept of Dutch water management board, which is recognized as a best practice. However, it is a form of water management board entirely initiated by the community, not the government and serves a small area. Elements of structure in the Dutch water management regime include culture, infrastructure, and institutions.<sup>22</sup> These elements are present in the P5L association.

The need for an autonomous organization focusing on the management of water system and risk can be an alternative to solve urban inequalities in efforts for the reduction of hydrological risk in Semarang coastal communities. It involves urban institutions and coastal communities. This organization aims to manage the water system including flood control and reduction system and also planning urban comprehensive approaches for hydrological risk reduction and adaptation. It is emphasized through the bottom-up approach and works in conjunction with top-down approaches. Both approaches are still used in order to integrate collaborative efforts. Bottom-up approaches could facilitate community initiatives and involvement in the coastal water system management to reduce urban inequalities. Meanwhile, top-down approaches are still regarded as the unique solution for multi-tasking responsibilities. For the time being, this organization is based upon the two approaches but the municipality has not yet guaranteed the legality of the organization.

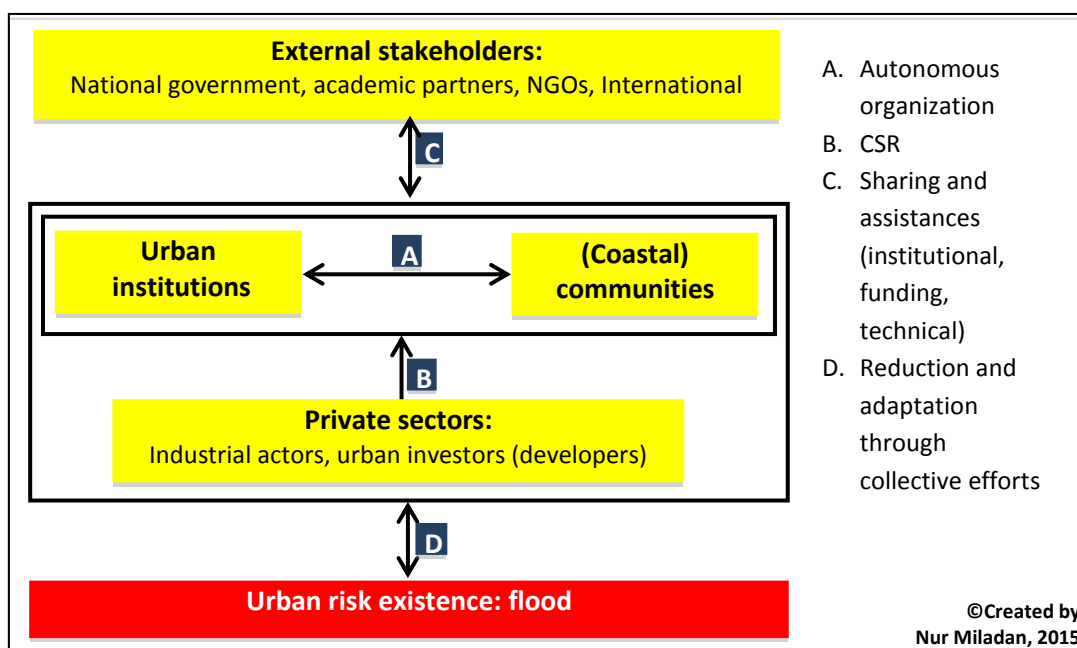
Furthermore, the involvement of the private sectors, such as industrial actors located in the Semarang coastal area, is currently very low to support autonomous organization. The involvement of private actors in government programs will provide added value and can reduce the governments' financial restriction to deliver better services to community.<sup>23</sup> Partnerships must reach the poorer customer base, encourage informal small entrepreneurs, and boost financial mechanisms (e.g. micro-insurance, micro-finance) to support the most

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<sup>22</sup> Van der Brugge, R., 2009, *Transition Dynamics in Social-Ecological Systems the Case of Dutch Water Management*, PhD Dissertation, Erasmus University Rotterdam.

<sup>23</sup> Auzzir, Z.A., Haigh, R.P., Amaratunga, D., 2014, "Public-Private Partnerships (PPP) in Disaster Management in Developing Countries. A Conceptual Framework", *Procedia Economics and Finance*, vol. 18, pp. 807- 814.

vulnerable in the society.<sup>24</sup> The adaptation is only successful when the private sector is invited to participate at an early stage of the process; to involve the private sector, we must learn how to identify the business development potential that exists in adaptation measures.<sup>25</sup> Private sectors are stakeholders that have interests in urban investments and need the adaptive spaces of risk existence to support their activities. The private sectors do not currently play an important role to develop economic spaces supporting the urban resilience process. In our case, the involvement of private sectors can focus on Corporate Social Responsibilities (CSR) opportunities. So far, CSR for coastal communities is less integrated into the government and community efforts for risk reduction and adaption. It remains a concern for the development of socioeconomic programs in the communities including empowerment of small medium enterprises and educational facilities. Autonomous organization can manage CSR for urban and community projects. The CSR strategies, which have been adopted from an organization, is not just a Public Relationship matter, but infiltrates in the basic construction and initiates changes that affect the culture and the functionality of the organization.<sup>26</sup>



**Figure 184. Public private partnership for urban resilience**

<sup>24</sup> Johannessen, Å., Rosemarin, A., Thomalla, F., Swartling, Å.G., Stenström, T.A., Vulturius, G., 2014, "Strategies for Building Resilience to Hazards in Water, Sanitation and Hygiene (WASH) Systems: The role of Public Private Partnerships", *International Journal of Disaster Risk Reduction*, vol. 10, Part A, pp. 102–115.

<sup>25</sup> Veelen, P.V., 2014, "Rotterdam, un modèle d'adaptation au climat" in Terrin, J., "Villes inondables. Prévention, adaptation, résilience", Marseille: Editions Parenthèses/GIP AIGP.

<sup>26</sup> Mousiolis, D.T., Zaridis, A.D, 2014, "The Effects in the Structure of an Organization through the Implementation of Policies from Corporate Social Responsibility (CSR)", *Procedia - Social and Behavioral Sciences*, vol. 148, pp. 634-638.



So far, our research indicates that the urban risk management is concentrated on urban institutions, so the regional budget of municipality is very much burdened by the high cost of hydrological risk management. The collaboration between urban institutions, communities and private sectors is possible because of the strategic interests in the Semarang coastal area.

The absence of autonomous organization engenders a lack of efficiency in the design process (proper prioritized plans and projects involving the private sectors for funding and implementations). CSR programs should look for inconsistencies and unsustainability of CSR programs through integrated management. These conditions will strengthen the institutional system and thus, the urban resilience process.

Furthermore, external stakeholders such as national government, academic partners, NGOs, international entities, are kept away from the planning process for there is no autonomous organization. Creating opportunities for resilience scientists to share experiences concerning the risks and benefits of (not) engaging in policy and institutional change processes can help inform the choices they frequently have to make concerning their own role at the science–policy interface.<sup>27</sup> Academic partners or related NGOs are not yet consulted to facilitate collaborative approaches between communities, urban institutions and private sectors. They are not associated to the process of planning, monitoring and evaluating the efforts of autonomous organization. The concept of Triple Helix<sup>28 29</sup> is not implemented in this case. The existence of ACCCRN project of Semarang City involving urban institution, NGOs, and academic partners is not yet developed as an initiation for the development of autonomous organization. Indeed, involving coastal communities and private sectors in a collaboration process is not a current priority in the urban hydrological management.

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<sup>27</sup> Milkoreit, M., Moore, M., Schoon, M., Meek, C.L., 2015, “Resilience Scientists as Change-Makers—Growing the Middle Ground between Science and Advocacy?”, *Environmental Science & Policy*, vol. 53, Part B, pp. 87-95.

<sup>28</sup> The concept of the Triple Helix of university-industry-government relationships was initiated in the 1990s by Etzkowitz (1993) and Etzkowitz and Leydesdorff (1995), encompassing elements of precursor works by Lowe (1982) and Sábato and Mackenzi (1982), interprets the shift from a dominating industry-government dyad in the Industrial Society to a growing triadic relationship between university-industry-government in the Knowledge Society. Cf. Triple Helix Research Group-Stanford University, “The Triple Helix Concept”, *Triple Helix Research Group* [Web], retrieved December 28<sup>th</sup>, 2015, from [http://triplehelix.stanford.edu/3helix\\_concept](http://triplehelix.stanford.edu/3helix_concept).

<sup>29</sup> National and local governments play a key role in it, especially in the disaster risk reduction by establishing the policies, plans and programs. Universities and research institutions supports the effort by providing expertise in the tools and methodology as well as providing education and training for the government’s personals. Businesses, in form of private consultancies, get involved in the project level by processing and analyzing the data using the appropriate methods. Cf. Prasetyo, E.A., Arifianti, Y., Hardjakaprabon, B., Agustin, F., 2012, “Triple Helix in Disaster Management: Case Study of Strategic Environmental Assessment (SEA) for Government Office Relocation Planning of Padang City, Indonesia”, *Procedia - Social and Behavioral Sciences*, vol. 52, pp. 150 – 159.

In addition, the existence of autonomous organization can adopt the community initiatives accommodating cultures. For instance, the concept of *jogo tirta* for the improvement of urban drainage system can be developed.<sup>30</sup> *Jogo tirta* (*ulu-ulu/raksabumi/uceng/ili-ili*) is central figure has a responsibility to manage and to distribute water from a drainage (irrigation) or a water resource into paddy fields being owned by the farmers.<sup>31</sup> This concept has been existed since the ancient Javanese Kingdom era and it is local culture for irrigation management, but in recent it is only used for traditional irrigation system in villages. Despite the basic concept of *jogo tirta* is used for the agriculture irrigation system, but it can be implemented for management of urban drainage system as efforts of hydrological risk reduction. Besides for water management, this concept can be an alternative of problem solving of waste in urban drainages causing flood risks. This initiation indicates local wisdom (culture) can be accommodated through the bottom up (community based) approaches. The understanding of community culture becomes an absolute requirement in the community based approaches. In addition, these approaches are not currently taken into account though they take part into the funding process regarding the communities self-helps for urban risk management because the enhancement of communities awareness and kinship among them.

### **Spatial functional transformation and urban carrying capacity as planning tools of urban vulnerability assessment for the development of urban physical resilience**

Hydrological risks occur in Semarang City due to the imbalance between urban development and urban carrying capacity. Documents of spatial plan in 1975/1976 indeed indicated programs of urban flood risk reduction, but the assessment of urban carrying capacity was hardly taken into account. Furthermore, not all programs of urban flood risk reduction could be implemented due to the lack of project management and financing. These factors worsened the flood risk while *rob* phenomena started to threaten the Semarang Coastal area. This situation illustrates the lack of urban risk assessment at that time. However, urban institutions have sought to assess the existing hydrological risks since the mid-1990s when the hydrological risk became a crucial problem for Semarang City.

In 2007, the document of urban drainage master plan indeed indicated urban hydrological risk assessment. Nonetheless, it still needs to be assessed in more details,

<sup>30</sup> Interviews with heads of Tanah Mas Community in 2013.

<sup>31</sup> Agustina, D.A., Subari, 2011, "Potency of Local Wisdom on Irrigation Management Institution in Java", *Jurnal Irigasi*, vol. 6, n° 2, pp. 104-113.

especially in the Semarang coastal area where the hydrological risk is very high. Detailed assessments of hydrological risk can illuminate hazards, vulnerabilities and help planning reduction and adaptation process in the territorial scales.

Urban vulnerability is not yet evaluated in detail for risk assessment. It is a key element for the analysis of inundation risks.<sup>32</sup> There are various methods to evaluate the weakness, or vulnerability of an area, but since the last ten years the qualitative approach of vulnerability in flood risks became more important.<sup>33</sup> Our research describes urban institutions that have quantitatively assessed Semarang coastal vulnerabilities to hydrological risks. They have also analyzed urban vulnerabilities to land subsidence and climate change and their links with the vulnerability to hydrological risks. However, the urban hydrological risk assessment is not yet deep enough qualitatively, in particular the vulnerability assessments, learning and adaptation process to enhance urban resilience. It is important in order to choose priorities in the adaptive plans of communities and even of urban systems.

So far, the hazard assessments of Semarang City are hardly detailed and updated. Several geodetic and geographic researchers have sought to provide detailed hazard maps. Nevertheless, it should be officially established by the municipality and these maps should be updated regularly. The Geographic Information System (GIS) can be a tool to provide assessments of detailed hydrological hazards in Semarang City. The Geographic Information System (GIS) tools are adequate to represent risk at the regional or local scale.<sup>34</sup> It can analyze hydrological risks through aerial images and then use primary (qualitative) data to confirm, such as interviews in the communities on a local scale (at the level of district or sub-district).

Furthermore, hydrological risks in Semarang City are linked to the transformations of space functions. Built-up area has grown alongside hydrological risks, especially in the Semarang coastal area. In this perspective, the assessment of space function transformations is not currently taken into account. The importance of taking land-use dynamics into account when assessing potential flood hazard impacts in coastal areas characterized by a strong

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<sup>32</sup> Barroca, B., Hubert, G., Diab, Y., 2006, "Vulnérabilité : une clé de lecture du risqué inondation" in : Thevenot, D.R., *Journées Scientifiques de l'Environnement*, Créteil.

<sup>33</sup> Barroca, B., Bernardara, P., Mouchel, J., Hubert, G., 2006, "Indicators for Identification of Urban Flooding Vulnerability", *Natural Hazards and Earth System Science*, vol. 6, n° 4, pp. 553-561.

<sup>34</sup> Mebarki, A., Valencia, N., Salagnac, J.L., Barroca, B., 2012, "Flood Hazards and Masonry Constructions: a Probabilistic Framework for Damage, Risk and Resilience at Urban Scale", *Natural Hazards Earth System Sciences*, vol.12, pp. 1799–1809.

pressure on land resources.<sup>35</sup> Among all the measures, land use management is regarded as the most potential nonstructural disaster mitigation way.<sup>36</sup>

So far, the hydrological risk assessment has hardly taken the existing land use and its plan for 2011-2031 into consideration. The land use engineering adapts to hydrological risk, but it is not yet a way to reduce hydrological risks, especially in the Semarang coastal area. The assessment of space function changes is supported by the analysis of urban carrying capacity. For city managers, careful assessments on the present carrying capability provide indications on the sectorial and spatial distributions of population and urban services towards their capacity improvement, for maintaining the living quality, and for meeting the growing demand on the urban areas.<sup>37</sup> The growth of built-up area on the Semarang coast is not sufficiently assessed in order to determine the adaptive spaces to coastal hydrological risks. Water spaces in land use plans are not currently taken into account. The different modes of accepting water into the urban area that have resulted are encouraging innovation in an effort to improve resource management, optimize functional and temporal strategies in land use planning, justify architectural approaches and specialized techniques and build a positive vision of redesigning landscapes with water.<sup>38</sup> The Semarang coastal urban area does not integrate enough water and green zones to provide adaptive urban spaces to hydrological risk. In addition, land reclamation plans are not currently integrated into adaptive and comprehensive coastal spatial plans including the assessments of urban density and land capacities. It is important to promote the development of coastal zones with a complete understanding of the effects of reclamation on coastal ecosystems.<sup>39</sup> The designs of coastal land reclamation do not use the concepts of polder system and water landscape to reduce the growth of hydrological risk. Likewise, coastal land reclamation is not yet influenced by the principle of “building with nature”. It is applied in order to integrate land in sea and water in land in such a way that future generations will be able to use coastal resources in a sustainable way, including a minimal effort to maintain the coastline and the promotion of a

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<sup>35</sup> Canters, F., Vanderhaegen, S., Khan, A.Z, Engelen, G., Uljee, I., 2014, “Land-use Simulation as a Supporting Tool for Flood Risk Assessment and Coastal Safety Planning: The Case of the Belgian coast”, *Ocean & Coastal Management*, vol. 101, Part B, pp. 102-113.

<sup>36</sup> Chang, Hsueh-Sheng, Hsieh, Hsin-Ying, 2013, “An Exploratory Study on Land Use Planning of Disaster Prevention. A Case Study of Kaohsiung New Town”, *Procedia Environmental Sciences*, vol. 17, pp. 382-391.

<sup>37</sup> Wei, Y., Huang, C., Lam, P.T.I., Yuan, Z., 2015, “Sustainable Urban Development: A Review on Urban Carrying Capacity Assessment”, *Habitat International*, vol. 46, pp. 64-71.

<sup>38</sup> Terrin, J.-J., 2014, “Renouvellement des approches urbaines face aux inondations” in “*Villes inondables. Prévention, adaptation, résilience*”, Marseille: Editions Parenthèses/GIP AIGP.

<sup>39</sup> Li, J., Pu, L., Zhu, M., Zhang, J., Li, P., Dai, X., Xu, Y., Liu, L., “Evolution of Soil Properties Following Reclamation in Coastal Areas: A Review”, *Geoderma*, vol. 226–227, pp. 130-139.



multiple-use system.<sup>40</sup> These concepts emphasize the provision of water spaces in urban coastal development.

Recently, the municipality documented urban carrying capacities through geological approaches.<sup>41</sup> However, the carrying capacity assessment of coastal urban area has not been explored comprehensively. This assessment does not yet refer to coastal land use plans and policies. In practice, it does not take ecological footprint analysis and tools into account. It is an indicator of synthesis which can describe and estimate the pressures that the human activities exert on natural environment and the capacity of ecosystem regeneration; it is applicable to all scales of the human society.<sup>42</sup> Several environmental researchers have stated that the ecological footprint calculation of Semarang industrial zone in Genuk District has exceeded its environmental carrying capacity (overshoot).<sup>43</sup> For the time being, the assessment of the ecological footprint is not yet applied to policies of adaptive land use management in the Semarang coastal urban areas. However, the lack of community awareness, and law enforcement have to be addressed by these policies. The space function changes take into account the coastal carrying capacity and the urban physical resilience. This effort is not yet integrated to urban hydrological plans and projects. However, the space function changes are bound to be the primary element to support the adaptation to and reduction of hydrological risks, and also to anticipate the lack of urban hydrological projects in the urban resilience process.

Semarang City is a case study that provides the opportunity to analyse the role of local communities for their own protection against floods. In this case, the inhabitants' participation (involvement) should be taken into account in the weakness of public policy. This research has underlined the merits and limits of the community involvement which is only a contribution to the resilience capacity development of urban system. Finally, the resilience to the natural risks results from an overall policy combining structural and non-structural measures at different scales.

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<sup>40</sup> Waterman, R.E., Misdorp, R., Mol, A., 1998, "Interactions Between Water and Land in The Netherlands", *Journal of Coastal Conservation*, vol. 4, pp. 115-126.

<sup>41</sup> It refers to *Atlas informasi geologi lingkungan kota Semarang, Jawa Tengah (Atlas of environmental geological information of Semarang City)*. It was established in 2009.

<sup>42</sup> Cordeau, E., Nascimento, I., 2005, *L'empreinte écologique des habitants de la région Ile-de-France*, Paris: Institut d'aménagement et d'urbanisme de la région d'Ile-de-France-IAURIF/ Conseil Regional d'Ile-de-France, retrieved December 25<sup>th</sup> 2015, from [http://trolldegrognon.free.fr/NiCo/M2DUD/projet\\_SDRIF/fiches/empreinte\\_ecologique.pdf](http://trolldegrognon.free.fr/NiCo/M2DUD/projet_SDRIF/fiches/empreinte_ecologique.pdf).

<sup>43</sup> Cf. Budihardjo, S, Hadi, S.P., Sutikno, Purwanto, 2013, "The Ecological Footprint Analysis for Assessing Carrying Capacity of Industrial Zone in Semarang", *Journal of Human Resource and Sustainability Studies*, vol. 1, n° 2, pp. 14-20.

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# **ANNEXES**

## I. Administrative division of Central Java Province in 2014/2015

No	Municipality	Area of municipality (Km <sup>2</sup> )	Kecamatan (District)	Sub-district		Total of sub-districts
	Kabupaten (kab.)/Kota (Regency/ City)			Desa (Village)	Kelurahan (Urban village)	
1.	Kab. Cilacap	2138,51	24	269	15	284
2.	Kab. Banyumas	1327,59	27	301	30	331
3.	Kab. Purbalingga	777,65	18	224	15	239
4.	Kab. Banjarnegara	1069,74	20	266	12	278
5.	Kab. Kebumen	1282,74	26	449	11	460
6.	Kab. Purworejo	1034,82	16	469	25	494
7.	Kab. Wonosobo	984,68	15	236	29	265
8.	Kab. Magelang	1085,73	21	367	5	372
9.	Kab. Boyolali	1015,07	19	261	6	267
10.	Kab. Klaten	655,56	26	391	10	401
11.	Kab. Sukoharjo	466,66	12	150	17	167
12.	Kab. Wonogiri	1822,37	25	251	43	294
13.	Kab. Karanganyar	772,2	17	162	15	177
14.	Kab. Sragen	946,49	20	196	12	208
15.	Kab. Grobogan	1975,85	19	273	7	280
16.	Kab. Blora	1794,4	16	271	24	295
17.	Kab. Rembang	1014,1	14	287	7	294
18.	Kab. Pati	1491,2	21	401	5	406
19.	Kab. Kudus	425,17	9	123	9	132
20.	Kab. Jepara	1004,16	16	184	11	195
21.	Kab. Demak	897,43	14	243	6	249
22.	Kab. Semarang	946,86	19	208	27	235
23.	Kab. Temanggung	870,23	20	266	23	289
24.	Kab. Kendal	1002,27	20	266	20	286
25.	Kab. Batang	788,95	15	239	9	248
26.	Kab. Pekalongan	836,13	19	272	13	285
27.	Kab. Pemalang	1011,9	14	211	11	222
28.	Kab. Tegal	879,7	18	281	6	287
29.	Kab. Brebes	1657,73	17	292	5	297
30.	Kota Magelang	18,12	3	0	17	17
31.	Kota Surakarta	44,03	5	0	51	51
32.	Kota Salatiga	52,96	4	0	23	23
33.	Kota Semarang	373,67	16	0	177	177
34.	Kota Pekalongan	44,96	4	0	27	27
35.	Kota Tegal	34,49	4	0	27	27
<b>Total</b>		<b>32544,12</b>	<b>573</b>	<b>7809</b>	<b>750</b>	<b>8559</b>

Annotate:

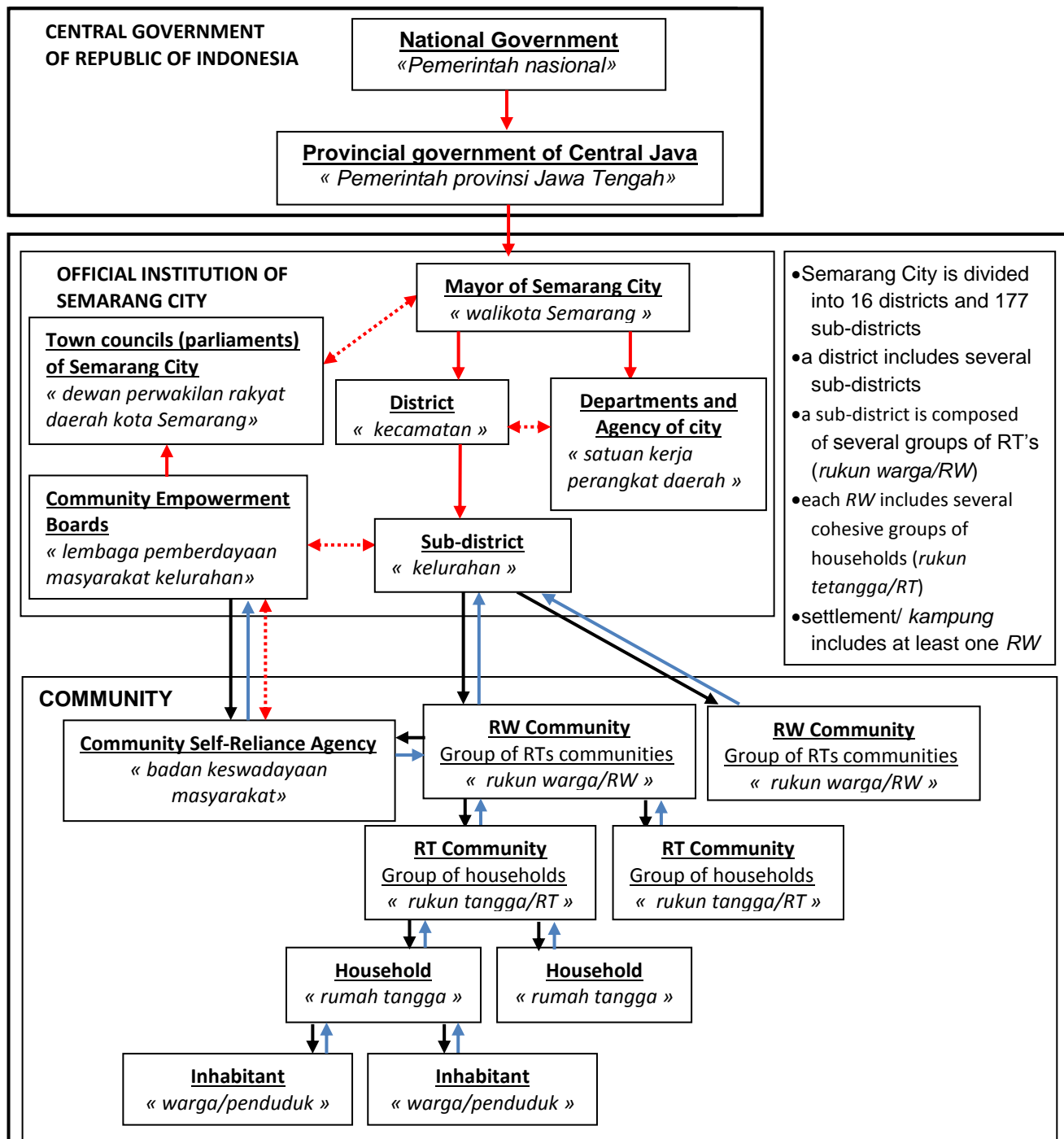
- Municipalities in Indonesia include *kota* (city) and *kabupaten* (regency). *Kota* describes a region which is dominated by urban area characteristics, while *kabupaten* is a region which is dominated by non-urban area characteristics including agricultural lands and villages. Generally, the area of regency is wider than that of city, and each regency has *ibu kota* (a capital/centre) which is dominated by urban area characteristics.
- Sub-districts in Indonesia include *desa* (village), and *kelurahan* (urban village). *Desa* is dominated by non-urban area characteristics, while *kelurahan* is dominated by urban area characteristics. City (*kota*) only has *kelurahan* (urban village), while *kabupaten* has *kelurahan* (urban village), and *desa* (village).

Created by Nur Miladan, 2015

Source: Central Bureau of Statistics of Central Java Province, 2015, "Statistik daerah Provinsi Jawa Tengah 2015 (Regional statistic of Central Java Province 2015); Central Bureau of Statistics of Central Java Province, Government Bureau of Central Java Province, "Administration Area by Regency/City in Jawa Tengah (Central Java) June 2015"



## II. Administrative division ( institutional access and social information)



—> Institutional information (socialization)      <---> Coordination  
 —> Aspiration of community                              <---> Delegation

- RW community is part of job of sub-district head; it is an institution which is formed through the liberation of RT executive board in their coverage area being determined by the authority of sub-district or head of sub-district.
- RT community is an institution which is formed through the liberation of local community in order to provide the service of government and society being determined by the government of sub-district or head of sub-district.
- The functions of RT/ RW community are:
  - The data collection of inhabitants and the other service of governmental administration.
  - The maintenance of security, orderliness, and life harmony among inhabitants.
  - The creation of idea in the implementation of development accommodating the aspiration and the community self-help
  - The mover of self-help (spirit) of *gotong royong* and participation of community in their area.

Source: Regulation of the Minister of Home Affairs no.5/2007 concerning the guidance of social institution management

### III. Primary data

#### 1. Respondents

<i>Kampung Cilosari</i>	<i>Kampung Tambak Lorok</i>	<i>Tanah Mas Real estate</i>	<i>Coastal sub-districts in Semarang Utara District</i>	<i>Government</i>	<i>NGOs, Private sector, academic partners</i>
<p><b>30 respondents</b> (interviews &amp; questioners): 3 heads of RWs communities, 22 heads of RTs communities, 2 heads of local associations, and 3 local inhabitants</p> <p>In depth interview : 7 respondents</p>	<p><b>23 respondents</b> (interviews &amp; questioners): 5 heads of RWs communities, 11 heads of RTs communities, 2 heads of associations, and 5 local inhabitants</p> <p>In depth interview : 5 respondents</p>	<p><b>27 respondents</b> (interviews &amp; questioners): 15 heads of RWs communities, 5 heads of RTs communities, 1 heads of associations, 1 staff of association, and 5 local inhabitants</p> <p>In depth interview : 7 respondents</p>	<p><b>21 respondents</b> (interviews &amp; questioners):</p> <ul style="list-style-type: none"> <li>- Bandarharjo: 2 heads of RWs communities</li> <li>- Tanjung Mas: 7 heads of RWs communities</li> <li>- Kuningan: 2 heads of RWs communities</li> <li>- Panggung Kidul: 2 heads of RWs communities</li> <li>- Bulu Lor: 2 heads of RWs communities</li> <li>- Plombokan: 2 heads of RWs communities</li> <li>- Purwosari: 2 heads of RWs communities</li> <li>- Dadapsari: 2 heads of RWs communities</li> </ul>	<p><b>24 respondents</b> (interview) :</p> <p>4 staffs of Department of water resources management (<i>PSDA</i>), 2 staffs of Regional Planning Agency (<i>BAPPEDA</i>), 1 staff of Department of Urban Planning and Settlement (<i>DTKP</i>), 1 staff of Regional Disaster Management Agency (<i>BPBD</i>), 5 staffs of office of districts (<i>kantor kecamatan</i>), 10 staffs of office of sub-districts (<i>kantor kelurahan</i>), 1 staff of Department of Human Settlement and Spatial Planning of Central Java Province (Cipkataru Provinsi Jawa Tengah)</p>	<p><b>8 respondents</b> (interview) : 1 staff of NGO BINTARI, 1 Staff of NGO Mercy Corps, 1 industrial actor, 1 staff of Indonesia Port Corporation, 1 developer staff of real estate, 3 academics partners</p>

#### Institutional interviews

<b>Actor</b>	<b>Institution</b>	<b>Position</b>
Budi Prakosa	Regional Planning Agency	Head of spatial and environment division
Nik Sutyani		Head of research and development of spatial planning and regional infrastructure
Moch. Agus	Department of City Planning and Housing	Head of housing and settlement
Suhardjono	Regional Disaster Management Agency	Head of institution
Rosyid Hudoyo	Department of water resources management	Head of Water Resources, Energy and Geology
Kumbino		Head section of operation and maintenance of water management
Widjanarko		Head section of pump system
Ujang Sutrisna		Operator of pump system of Bulu Drain
M Tamzil	Department of Human Settlement and Spatial Planning of Central Java Province	Head of institution
Didik Dwi Hartono	District of Semarang Utara	Secretary of district office
Eko Yuniarto	District of Semarang Barat	Head section of development
Purwoko	District of Tugu	Head section of development
Gatot	District of Genuk	Secretary of district office

Actor	Institution	Position
Sutedjo	District of Gayamsari	Head section of development
Margo Haryadi	Sub-district of Bandarharjo	Head of institution
Sri Setyanto	Sub-district of Bulu Lor	Head of institution
Sogol Warsito	Sub-district of Dadapsari	Secretary of sub-district office
Y. Widodo	Sub-district of Kuningan	Head of institution
Nguncardiyo	Sub-district of Panggung Kidul	Head of institution
Sumardi	Sub-district of Panggung Lor	Head of institution
Indriyati, SH	Sub-district of Plombokan	Head of institution
Djoko Santoso	Sub-district of Purwosari	Head of institution
Mardiono	Sub-district of Tanjung Mas	Head of institution
Endang Walujati	Sub-district of Kemijen	Head of institution
Feri Prihantoro, ST	NGO BINTARI	Executive director
Aniessa Delima Sari	NGO Mercy Corps	ACCCRN Semarang Project Officer
Dr. Ir. Robert J. Kodoatie M. Eng	Department of Civil Engineering, Diponegoro University	Lecturer/ Expert in water resources management, hydraulics and sedimentation. Concern with the flood risks of Semarang City
Ir. Muhrozi, MS	Department of Civil Engineering, Diponegoro University	Lecturer/ Expert in geotechnical science. Concern with land subsidence of Semarang City
Dr. -Ing. Wiwandari Handayani, ST, MT, MPS	Department of Urban and Regional Planning, Diponegoro University	Lecturer/ Expert in regional planning. Involved in ACCCRN project of Semarang City.
Solichedi	Chambers of Commerce and Industry of Central Java Province	Head of institution for 2006-2011
Heriyanto	Tanah Mas Company (Corporation)	Staff of developer
Agus Budi Irianto	Indonesia Port Corporation III-branch of Tanjung Mas Port, Semarang	Head (manager) section of engineering

## 2. List of questions

### A. Government

- **The existence of coastal hydrological risk, and its evolution and impacts on Semarang City**
  1. Since when do the coastal hydrological risks (land subsidence, flooding and *rob*) exist in Semarang City? To what extent is there an evolution of the coastal risk from 1980 to 2010 (or until recently)?
  2. What are the factors causing these risks?
  3. Can you describe the emergence processes of the coastal risks in Semarang City?
  4. How far are the impacted areas by the coastal hydrological risk? Which area is the worst affected by the coastal hydrological risk? And is there any monthly or yearly measurement for the coastal hydrological risk impacted areas?
  5. What are the losses incurred by coastal hydrological risks in Semarang City? Please mention and show their locations.
  6. What are the urban sectors being affected by coastal risks? And where is the most impacted area of each urban sector?
- **Efforts of government (urban institutions), and communities to anticipate the coastal hydrological risk**
  7. What are the urban projects that have been carried out for the reduction (anticipation) of coastal hydrological risk problems in Semarang City? Could you explain chronologically

these urban projects since 1970s/1980s until recently? And how was the effectiveness of each urban project?

8. What are the communities' self-efforts for the reduction (anticipation) of coastal hydrological risk? Could you explain chronologically these efforts?
9. How is the effectiveness of the whole urban projects for the coastal hydrological risk anticipation? And also how is the effectiveness of community self-help efforts for the coastal hydrological risk anticipation?
10. To what extent is there an interaction between government and communities in the implementations of efforts of hydrological risk reduction? Could you explain chronologically?
11. How is the effectiveness of these efforts? Could you compare between the effectiveness of government efforts and that of communities' self-help efforts?
12. Which steps or efforts are needed to improve the collaboration between government and communities for the hydrological risk reduction (anticipation)?
13. What are the obstacles (constraints) to develop the partnerships (collaboration) between government and communities in the implementations of hydrological risk reduction efforts?
14. What are the key points (factors) for the partnerships (collaboration) between government and communities in the implementations of hydrological risk reduction efforts?
- **Influences (impacts) of hydrological risk for urban sectors (activities) and communities**
15. Where are the central areas of urban sectors development (industry, housing, commerce and business...) in Semarang City (coastal area)?
16. How is the growth of urban sectors (activities) in Semarang coastal area (hydrological risk impacted area)? Could you explain chronologically?
17. How are the correlations (influences) between the urban sectors (activities) with the hydrological risk existence? Is hydrological risk taken as a very serious constraint by the various stakeholders in urban development?
18. Why the urban sectors in Semarang coastal area continue to survive and thrive?
19. Which factors are affecting the sustainability of urban activities (sectors) in Semarang coastal area?
20. How about the urban sustainability relating to the hydrological risk existence in urban centres?
21. Which one(s) is/are urban sector(s) / activity (s) that can survive in the hydrological risk impacted area?
22. Why can community survive in hydrological risk impacted area?
23. What are the changes of social condition and settlements conditions?
- **Urban and architectural transformations in Semarang coastal area are correlated to the hydrological risk existence**
24. Was there any change of land use in Semarang coastal area due to the existence of hydrological risk?
25. Was there any change of open spaces (green and water areas) in Semarang coastal area due to the existence of hydrological risk?
26. Was there any change (development or improvement) of urban infrastructures (roads, drainages, ...) in Semarang coastal area due to the existence of hydrological risk?
27. Was there any change of architectural forms of buildings in Semarang coastal area due to the existence of hydrological risk?
28. Was there any coastal line change of Semarang City due to the existence of hydrological risk?

29. Was there any change regarding the urban structure in Semarang coastal area? To what extent the coastal risk has been influencing these changes?
30. Where are the areas which have experienced significantly the urban structure changes?
31. Can you indicate whether the supporting factors which produced the urban centres are still located in Semarang coastal area though they are concerned by hydrological risk?

## **B. Private sectors**

### • **Industrial or private actors (sectors)**

1. Since when did the industrialization process occur in Semarang coastal area? At that time, had the hydrological risks already been threatening the industrial (enterprise) area? Could you explain chronologically?
2. At that time, did the industrial (private) actors know about the existence of hydrological risk in the industrial (company) area? Why did the industrial (private) stakeholders develop the industries (companies) there?
3. Was there any correlation between the development of industrial (enterprise) area and the coastal hydrological risk emergence?
4. Do the hydrological risk and coastal destructions disturb the industrial (enterprise) activities? How many economic losses have been caused by the existence of hydrological risk?
5. Which reasons are assessed to explain why the industries (enterprises) carried on their implementation in Semarang coastal area having hydrological risk?
6. Is there any will of industrial (private) actors to move their industries (enterprises) from Semarang coastal area? Please explain their reasons.
7. Is there any effort from the government (urban institutions) to improve the conditions of industrial (enterprise) area due to the hydrological risk existence?
8. Is there any self-effort of industrial (private) actors to overcome the coastal hydrological risk? And is there any collective effort between the industrial (private) actors, and government and/or communities to overcome this risk?
9. What is the purpose (will) of industrial private actors in persevering in their implementation in Semarang coastal area? And what are the efforts that will be carried out to support the sustainability of the industrial (enterprise) area in Semarang coastal area?

### • **Housing developer**

1. Since when did your residential area exist in Semarang coastal area? At that time, had the hydrological risks already been threatening your residential area? Could you explain chronologically?
2. At that time, did your company know if the existence of hydrological risk in the residential area? Why did your company develop the residential area there?
3. Was there any correlation between the development of residential area and the coastal hydrological risk emergence?
4. Do the hydrological risk and coastal destructions disturb your residential area? How many economic losses have been caused by the existence of hydrological risk?
5. Which were the supporting factors of producing the development of residential area in Semarang coastal area having hydrological risk?
6. Is there any will of inhabitants to move from your residential area since the emergence of hydrological risk? Please explain their reasons.
7. Is there any effort from the government (urban institutions) to improve the conditions of your residential area due to the hydrological risk existence?



8. Is there any self-effort of your company to overcome the coastal hydrological risk in particular in your residential area? And is there any collective effort between your company, and government and/or communities to overcome this risk?
9. What is the will of your company in order to carry out the sustainability of residential area in Semarang coastal area? And what efforts that will be carried out to support the sustainability of residential area?

### **C. NGOs and academics partners**

1. What is the involvement (programs and their purposes) of your organization to support the efforts of hydrological risk reduction or to provide the community assistance for the improvement of life quality due to the existence of hydrological risk?
2. Since when were these programs (projects) implemented?
3. How is the effectiveness of these programs (projects)?
4. What are the potentials of these programs (projects) in processes of implementations and management (institutional and financing)?
5. What are the constraints of these programs (projects) in processes of implementations and management (institutional and financing)?
6. How is the sustainability of these programs (projects)? Will your organization implement long-term projects in order to support the efforts of hydrological risk reduction or the provision of the community assistance for the improvement of life quality due to the existence of hydrological risk?
7. Does your organization have the collaboration (cooperation) with the government (urban institutions), or other urban stakeholders (communities, private sectors)? And what are the potentials and constraints for these collaborations?

## D. Communities


Respondent	Questions	Residential area of Tanah Mas	Kampung Cilosari	Kampung Tambak Lorok	Coastal sub-districts in Semarang Utara District
Head (leader) of community	<u>Personal information</u>				
	1. Information of name, age, education, address, job, and contact?	√	√	√	√
	2. What was the chronology (history) of your presence in this settlement? Since when did you live in this settlement?	√	√	√	√
	<u>History of settlement</u>				
	3. What was the history of presence (origin) of your settlement? Since when? What is the origin of toponym and the meaning of the name of your settlement?	√	√	√	
	4. Since when did people inhabit in your settlement? Please tell us about the population growth in your settlement in 1970s, 1980s, 1990s, 2000s, and nowadays. Did the population always increase? When did the population increase rapidly or otherwise?	√	√	√	√
	5. Approximately how many inhabitants are there in your settlement?	√	√	√	
	6. Since when did migrants settle in your settlement? What are the reasons they assess for their settling in this settlement? And where are the origins of the migrants? And what are their ethnic origins?	√	√	√	
	<u>Socio-economic condition of community</u>				
	7. What are the jobs or the livelihood resources of the inhabitants? Which job or livelihood resource is the most usual?	√	√	√	√
	8. Related to no 7, please tell us about average revenue of the inhabitants (monthly or daily) for each job or livelihood resource?	√	√	√	√
	9. Are there any poor inhabitants (households) in your settlement? If it is the case, what is the approximate percentage of poor inhabitants (households) in your settlement?	√	√	√	
	10. Where are the workplaces of inhabitants? Please explain it for each job or livelihood resource.	√	√	√	√
	<u>Situation of <i>rob</i> (flood) risk and land subsidence</u>				
	11. How was the chronology / history of <i>rob</i> (flood) in your settlement? Since when did it occur?	√	√	√	√
	12. What is the average height of <i>rob</i> (flood) in your settlement?	√	√	√	√
13. Could you tell me about the occurrences of <i>rob</i> (flood) in the 1980s, the 1990s, the 2000s and nowadays? Did it more often threaten your settlement recently?	√	√	√	√	
14. When was the worst time of <i>rob</i> (flood) occurrences? Which year was it? Or every which month? Could you explain chronologically?	√	√	√	√	
15. What is the height of land subsidence that occurs in your settlement each year?	√	√	√	√	
<u>Perception about <i>rob</i> (flood) risk and land subsidence</u>					
16. Please explain about the definition of <i>rob</i> (flood) based on your own understanding. And how is the	√	√	√	√	



Respondent	Questions	Residential area of Tanah Mas	Kampung Cilosari	Kampung Tambak Lorok	Coastal sub-districts in Semarang Utara District										
	community perception about this risk?														
	17. Did you know the origin or the meaning of the word "Rob"? Since when did the word of "Rob" appear?	√	√	√	√										
	18. What do you think about <i>rob</i> (hydrological risk/flood) impact for your life? If you use several terms, please explain it.	√	√	√	√										
	19. What do you think about the causes of <i>rob</i> (hydrological risk) in your settlement? If you use several terms, please explain it.	√	√	√	√										
	20. According to you and to your community, what are the causes of land subsidence? Please tell us as accurately as possible (If you use several terms, please explain it)	√	√	√	√										
	21. According to you and to your community, is there any correlation between the land subsidence and the <i>rob</i> (flood)? Please explain it.	√	√	√	√										
	22. According to you and to your community, what are the reasons that led you, and or community to persist in living in this settlement while it is exposed to <i>rob</i> (flood)?	√	√	√	√										
	23. About the reasons mentioned in no. 22, please explain which ones are the basic reasons to stay living in this settlement?	√	√	√	√										
	24. According to you and to your community, is there any will of leaving the settlement? If it is the case, why? If no, why? Explain the reasons.	√	√	√	√										
	25. According to you and to your community, relating to the existence of <i>rob</i> (flood) risk, which one is preferred, living in common house (above the land), or in flat (apartment), or in house on stilts? Please explain the reason you choose it.	√	√	√											
	<u>Perception about community self-help efforts (both individually, and collectively)</u>														
	26. What are current efforts (as individual or household) to overcome <i>rob</i> (flood) risk? If it is possible, tell us the time to carry out these efforts. And are these efforts done regularly?	√	√	√	√										
	27. What are existing efforts (as community or collectively) to overcome <i>rob</i> (flood) risk? If it is possible, tell us the time to do these efforts. And are these efforts done regularly?	√	√	√	√										
	28. Related to question no. 26, are these efforts effective to overcome <i>rob</i> (flood) risk? Tell us also the reasons.	√	√	√	√										
	29. Related to question no. 27, are these efforts effective to overcome <i>rob</i> (flood) risk? Tell us also the reasons.	√	√	√	√										
	30. Is there any local association (organization) that was established by the community self-help efforts in order to anticipate <i>rob</i> (flood) risk in your settlement? If yes, mention the approximate time of its creation and is that effective?	√	√	√	√										
	<table border="1"> <thead> <tr> <th>Activity (social institution)</th> <th>Notes (how many time implemented and when was it implement? Which year? How many times a year?)</th> <th>Activeness (Effectiveness)</th> <th>Success</th> <th>Location</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>	Activity (social institution)	Notes (how many time implemented and when was it implement? Which year? How many times a year?)	Activeness (Effectiveness)	Success	Location									
Activity (social institution)	Notes (how many time implemented and when was it implement? Which year? How many times a year?)	Activeness (Effectiveness)	Success	Location											

Respondent	Questions	Residential area of Tanah Mas	Kampung Cilosari	Kampung Tambak Lorok	Coastal sub-districts in Semarang Utara District
	31. According to you, and or community, is P5L effective as an effort to anticipate <i>rob</i> (flood) risk? What is the strengths and the weaknesses of that association? And what aspect needs to be improved for sustainability of P5L?	√			
	32. According to you, and or community, is <i>Komunitas Kemijen</i> (KOMJEN) effective as an effort to anticipate <i>rob</i> (flood) risk? What is the strength and weakness of that association? And what aspect needs to be improved for the sustainability of KOMJEN? And what about the other associations such as Creative House, etc.?		√		
	33. Which social conditions changed due to <i>rob</i> (flood) in your settlement? Are the positive or negative changes for your community? Please explain.	√	√	√	√
	<u>Perception about government efforts</u>				
	34. What are the efforts that have been carried out by the government (urban institutions) to solve the risk of <i>rob</i> (flood) in your settlement? If possible, At what time it was done and through what office / department it was done. And are these efforts always done regularly / routine?	√	√	√	√
	35. Related to question no. 34, are these government efforts effective and did they successfully overcome the <i>rob</i> (flood)? Give us also the reasons.	√	√	√	√
	36. Is there any association (organization) made by government in order to anticipate <i>rob</i> (flood) in your settlement? If yes, mention the date of its creation and is that effective and successfully done?	√	√	√	√
	37. According to you, and or community, is the existence of retention basin of Semarang River effective to overcome <i>rob</i> (flood) in your settlement? Can you, please, base your explanation on the recent situation and your prediction in the future (year 2014 and so on)?	√			
	38. According to you, and or community, is the existence of Banger Polder and its management BPP SIMA effective to overcome <i>rob</i> (flood) in your settlement? Please explain based on recent situation and prediction in the future (year 2014 and so on).		√	√	
	39. What are the constraints faced by community in having relationship (collaboration) with government to overcome <i>rob</i> (flood) in your settlement?	√	√	√	√
	40. What is the will the community address the government for the efforts to be carried out in order to overcome <i>rob</i> (flood) in your settlement? Is this will fulfilled by the government?	√	√	√	√
	41. Which one is more effective between government efforts or community self-help efforts to overcome risk of <i>rob</i> (flood)?	√	√	√	√
	42. According to you, and or community, what aspects need to be improved in order to overcome <i>rob</i> (flood) in your settlement, regarding both government efforts and community self-help efforts?	√	√	√	√
	<u>Perception about external stakeholders (NGO, academics partners,...)</u>				
	43. Please mention some external stakeholders that act in order to overcome <i>rob</i> (flood) or to provide	√	√	√	√

Respondent	Questions	Residential area of Tanah Mas	<i>Kampung Cilosari</i>	<i>Kampung Tambak Lorok</i>	Coastal sub-districts in Semarang Utara District
	<p>community assistance for the reduction of hydrological risk impacts in your settlement. Please explain their roles.</p> <p>44. What are the efforts that have been carried out by external stakeholders? Mention the efforts of each external stakeholder and have these efforts always been done regularly / routine? When were these efforts implemented?</p> <p>45. Related to question no. 44, are these efforts effective and successful in overcoming <i>rob</i> (flood)? Give us also the reasons.</p> <p>46. What is external stakeholder that is most important in overcoming <i>rob</i> (flood) or on provision of community assistance for the reduction of hydrological risk impacts in your settlement? Please explain why.</p> <p>47. How is the relationship between the external stakeholders and the government? Are they in line or opposite?</p> <p>48. What are the constraints faced by the community in collaboration with external stakeholders to overcome <i>rob</i> (flood) or in providing community assistance for the reduction of hydrological risk impacts in your settlement?</p> <p>49. What is the will of the community regarding the interventions of the external stakeholders in order to overcome <i>rob</i> (flood) or to provide community assistance for the reduction of hydrological risk impacts in your settlement? Is this will fulfilled by them?</p>	<p>✓</p> <p>✓</p> <p>✓</p> <p>✓</p> <p>✓</p> <p>✓</p>	<p>✓</p> <p>✓</p> <p>✓</p> <p>✓</p> <p>✓</p> <p>✓</p>	<p>✓</p> <p>✓</p> <p>✓</p> <p>✓</p> <p>✓</p> <p>✓</p>	<p>✓</p> <p>✓</p> <p>✓</p> <p>✓</p> <p>✓</p> <p>✓</p>



Respondent	Questions	Residential area of Tanah Mas	<i>Kampung Cilosari</i>	<i>Kampung Tambak Lorok</i>	Coastal sub-districts in Semarang Utara District
	<p><u>Transformations (changes) of settlement relating to hydrological risk existence</u></p> <p>50. Please tell us the approximate limits of inundation in your settlement in year 1980s, 1990s, 2000s and nowadays.</p> <p>a. the approximate limits of inundation in residential area of Tanah Mas (please tell and describe settlement boundaries and limits of inundation in your settlement chronologically)</p> 	√	√	√	
		√			

Respondent	Questions	Residential area of Tanah Mas	<i>Kampung</i> Cilosari	<i>Kampung</i> Tambak Lorok	Coastal sub-districts in Semarang Utara District
	<p>b. the approximate limits of inundation in <i>kampung</i> Cilosari (please tell and describe settlement boundaries and limits of inundation in your settlement chronologically)</p>  <p>c. the approximate limits of inundation in <i>kampung</i> Tambak Lorok (please tell and describe settlement boundaries and limits of inundation in your settlement chronologically)</p> 		√	√	

Respondent	Questions	Residential area of Tanah Mas	Kampung Cilosari	Kampung Tambak Lorok	Coastal sub-districts in Semarang Utara District																																										
	<p>51. Which transformations did occur in your settlement due to the existence of <i>rob</i> (flood) risk from the 1980s? Please explain it, taking into account the different periods: the 1980s, the 1990s, the 2000s, and nowadays. As far as the conditions of your environment are concerned, if there are some pictures and if allowed we want to copy the photo archives owned by you.</p> <table border="1" data-bbox="280 456 1451 826"> <thead> <tr> <th data-bbox="280 456 595 576">Transformation(renovation/reconstruction)</th> <th data-bbox="595 456 734 576">Basic materials before renovation</th> <th data-bbox="734 456 873 576">Basic materials after renovation</th> <th data-bbox="873 456 1182 576">Notes (how many times did community reconstruct it? when was it implement? Which year?)</th> <th data-bbox="1182 456 1339 576">Cost of Construction</th> <th data-bbox="1339 456 1451 576">Location</th> </tr> </thead> <tbody> <tr> <td data-bbox="280 576 595 608">Streets</td> <td data-bbox="595 576 734 608"></td> <td data-bbox="734 576 873 608"></td> <td data-bbox="873 576 1182 608"></td> <td data-bbox="1182 576 1339 608"></td> <td data-bbox="1339 576 1451 608"></td> </tr> <tr> <td data-bbox="280 608 595 639">Drainages</td> <td data-bbox="595 608 734 639"></td> <td data-bbox="734 608 873 639"></td> <td data-bbox="873 608 1182 639"></td> <td data-bbox="1182 608 1339 639"></td> <td data-bbox="1339 608 1451 639"></td> </tr> <tr> <td data-bbox="280 639 595 727">Open spaces including water area: basin, pond, green area : plantation</td> <td data-bbox="595 639 734 727"></td> <td data-bbox="734 639 873 727"></td> <td data-bbox="873 639 1182 727"></td> <td data-bbox="1182 639 1339 727"></td> <td data-bbox="1339 639 1451 727"></td> </tr> <tr> <td data-bbox="280 727 595 759">Embankment</td> <td data-bbox="595 727 734 759"></td> <td data-bbox="734 727 873 759"></td> <td data-bbox="873 727 1182 759"></td> <td data-bbox="1182 727 1339 759"></td> <td data-bbox="1339 727 1451 759"></td> </tr> <tr> <td data-bbox="280 759 595 791">Public infrastructures</td> <td data-bbox="595 759 734 791"></td> <td data-bbox="734 759 873 791"></td> <td data-bbox="873 759 1182 791"></td> <td data-bbox="1182 759 1339 791"></td> <td data-bbox="1339 759 1451 791"></td> </tr> <tr> <td data-bbox="280 791 595 826">Etc., please mention.....</td> <td data-bbox="595 791 734 826"></td> <td data-bbox="734 791 873 826"></td> <td data-bbox="873 791 1182 826"></td> <td data-bbox="1182 791 1339 826"></td> <td data-bbox="1339 791 1451 826"></td> </tr> </tbody> </table> <p>52. What are the changes of your house (building) to avoid (reduce) the <i>rob</i> (flood) impacts? Please explain (tell us): models (types) of renovations, years of renovations, costs of renovations (if you have some photos of it, please permit us to copy them)</p> <p>53. How long did you wait for the implementation of house renovation? Were there any constraints you had to face in order to renovate your house? What is the approximate percentage of your income that is used for the costs of house renovation?</p> <p>54. Are there any inhabitants (households) around you who cannot renovate their houses, entailing therefore that their house is always inundated during the <i>rob</i> (flood) occurrences? If yes, please explain several of them. Who are they? And what are their jobs, and why do they not renovate their houses?</p>	Transformation(renovation/reconstruction)	Basic materials before renovation	Basic materials after renovation	Notes (how many times did community reconstruct it? when was it implement? Which year?)	Cost of Construction	Location	Streets						Drainages						Open spaces including water area: basin, pond, green area : plantation						Embankment						Public infrastructures						Etc., please mention.....						√	√	√	
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Etc., please mention.....																																															
Local inhabitant (household)	<p><u>Personal information</u></p> <p>1. Information of name, age, education, address, job, and contact?</p> <p><u>Household condition</u></p> <p>2. How many members are in your house? please specify in detail which ones are parents, and children</p> <p>3. How many heads of households are in your house? Have your children already married? Please explain.</p> <p>4. What is the job status of the household head?</p> <p><input type="checkbox"/> Civil servant</p> <p><input type="checkbox"/> Private employee</p>	√	√	√																																											

Respondent	Questions	Residential area of Tanah Mas	Kampung Cilosari	Kampung Tambak Lorok	Coastal sub-districts in Semarang Utara District
	<input type="checkbox"/> Industrial labour <input type="checkbox"/> Fisherman <input type="checkbox"/> Labour/farmers of fish <input type="checkbox"/> Owner of fishponds <input type="checkbox"/> Owner of small medium enterprise <input type="checkbox"/> Owner of big enterprise <input type="checkbox"/> Owner / skipper of fishing boat <input type="checkbox"/> Businessman / wholesaler/retailer <input type="checkbox"/> Retired / pensioner <input type="checkbox"/> Etc., please mention				
	5. How much is the income of the household head per month?	√	√	√	
	6. How long have you been living in your settlement?	√	√	√	
	7. Is your wife working? If yes, what is her job? How much is her income per month?	√	√	√	
	8. Do your children work? If yes, what is the job for each child? How much is his/her income each month?	√	√	√	
	9. Do you have any children who are still in school? If yes, in which school and what is his/her grade (level)?	√	√	√	
	10. Do your children who have married still remain in your house? What is the reason to stay at parents' house? Please explain.	√	√	√	
	11. What is the average expense of your household for one month? Is that expenditure can that expenditure be all covered by your household income? Please explain in detail, what kind of spending do you do regularly every month.	√	√	√	
	12. Do you save money? What is the average of your savings each year? or please explain your conditions.	√	√	√	
	<u>Understanding of hydrological risk</u>				
	13. What do you think about the existence of <i>rob</i> (flood) risk in your settlement? Please explain.	√	√	√	
	14. What do you think about the causes of <i>rob</i> (flood) risk in your settlement? Please explain.	√	√	√	
	15. Why do you stay in this settlement? Is there any will to move to another settlement which would be in a non-impacted area regarding the hydrological risk? Please explain.	√	√	√	
	<u>Household efforts for the reduction of hydrological risk impacts</u>				
	16. Did you renovate your house due to the existence of <i>rob</i> (flood)? How many times have you renovated? When were these renovations carried out? Which budget is required for each house renovation?	√	√	√	
	17. Where do you get the budget for the house renovation? What is the frequency of the renovations you had to carry out for your house in order to reduce the hydrological risk impacts?	√	√	√	
	18. Is there any regular financial contribution of the community of your settlement for the efforts of	√	√	√	

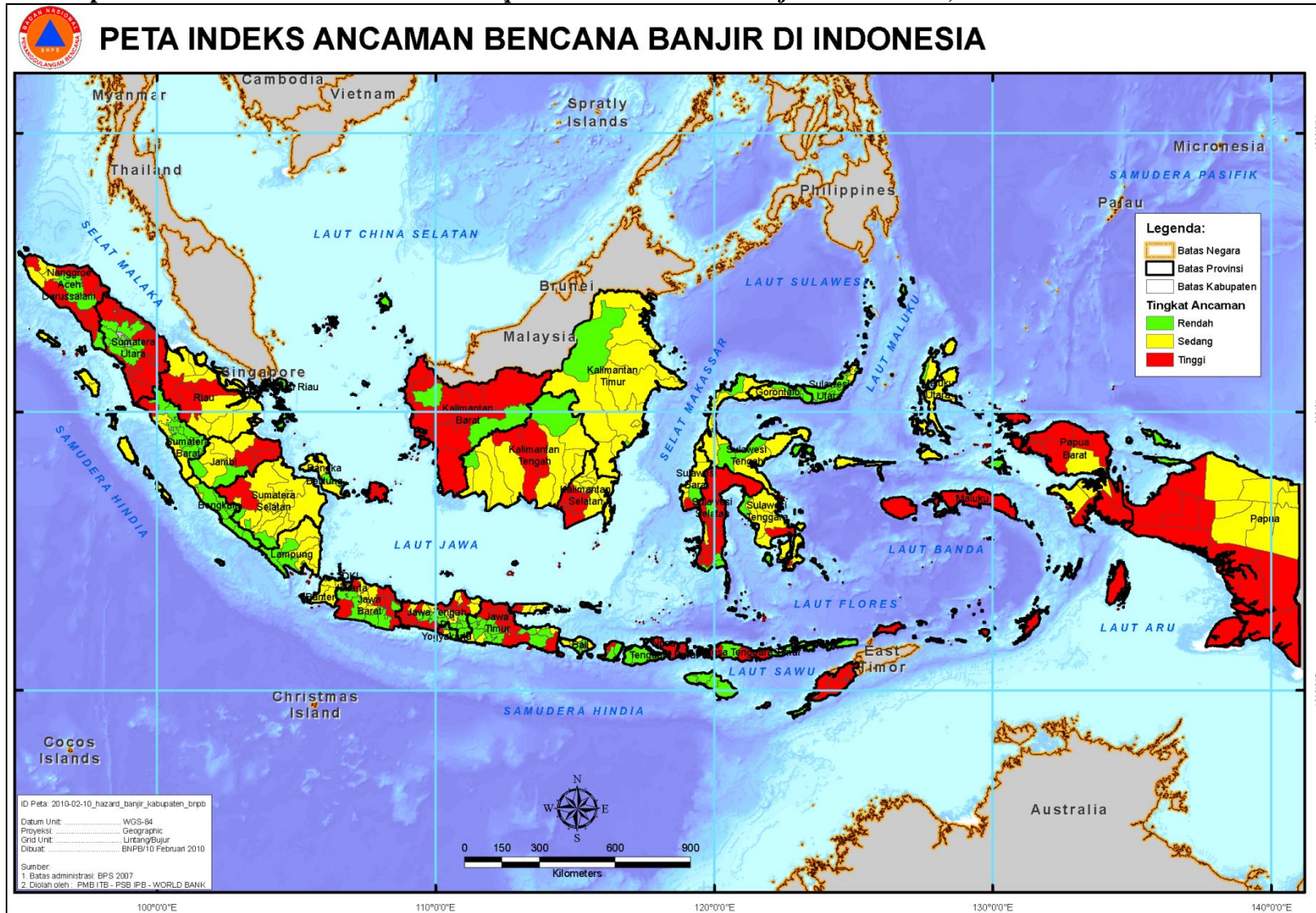
Respondent	Questions	Residential area of Tanah Mas	Kampung Cilosari	Kampung Tambak Lorok	Coastal sub-districts in Semarang Utara District																									
	<p>hydrological risk reduction? How much is the amount of each contribution? Can you indicate the frequency of this contribution?</p> <p>19. Are there any social activities to overcome <i>rob</i> (flood) in your settlement? Are they carried out regularly? Can you indicate the frequency of these activities?</p> <p>20. What did your household do before the occurrences of flood in particular <i>rob</i>?</p> <p>21. What did your household do when the occurrences of flood in particular <i>rob</i>?</p> <p>22. What did your household do after the occurrences of flood in particular <i>rob</i>?</p> <p>23. What did you try to do for long term (more than 1 year) for the <i>rob</i> (flood) risk anticipation in your house?</p> <p>24. Did you do the house renovations with the purpose of anticipating <i>rob</i> (flood) risk? If yes, please specify the renovations that have been carried out, and also when and how many times these renovations were implemented since the first settling in your house? (There are some photos of your house, if it is allowed, we would like to copy them or take photos of it)</p> <table border="1" data-bbox="297 719 1364 1018"> <thead> <tr> <th data-bbox="297 719 412 884">House part</th> <th data-bbox="412 719 654 884">Basic materials before renovation</th> <th data-bbox="654 719 878 884">Basic materials after renovation</th> <th data-bbox="878 719 1160 884">Notes (how many times did you renovate your house or extend it? Which year?)</th> <th data-bbox="1160 719 1364 884">Cost of Construction</th> </tr> </thead> <tbody> <tr> <td data-bbox="297 884 412 919">Wall</td> <td data-bbox="412 884 654 919"></td> <td data-bbox="654 884 878 919"></td> <td data-bbox="878 884 1160 919"></td> <td data-bbox="1160 884 1364 919"></td> </tr> <tr> <td data-bbox="297 919 412 954">Roof</td> <td data-bbox="412 919 654 954"></td> <td data-bbox="654 919 878 954"></td> <td data-bbox="878 919 1160 954"></td> <td data-bbox="1160 919 1364 954"></td> </tr> <tr> <td data-bbox="297 954 412 989">Floor</td> <td data-bbox="412 954 654 989"></td> <td data-bbox="654 954 878 989"></td> <td data-bbox="878 954 1160 989"></td> <td data-bbox="1160 954 1364 989"></td> </tr> <tr> <td data-bbox="297 989 412 1018">Yard</td> <td data-bbox="412 989 654 1018"></td> <td data-bbox="654 989 878 1018"></td> <td data-bbox="878 989 1160 1018"></td> <td data-bbox="1160 989 1364 1018"></td> </tr> </tbody> </table>	House part	Basic materials before renovation	Basic materials after renovation	Notes (how many times did you renovate your house or extend it? Which year?)	Cost of Construction	Wall					Roof					Floor					Yard					√	√	√	
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Roof																														
Floor																														
Yard																														



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- i. Map of flood hazard index in Indonesia (*peta indeks ancaman banjir di Indonesia*)
- ii. Map of Administration of Republic of Indonesia (*peta negara kesatuan Republik Indonesia*)
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- iv. Map of inundation risk of *flood and rob* in Semarang City (*peta potensi genangan rob & banjir Kota Semarang*) in 2006
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i. Map of flood hazard index in Indonesia (*peta indeks ancaman banjir di Indonesia*)



Source: *Peta indeks ancaman banjir di Indonesia*, [Map], 2010, Indonesian National Board for Disaster Management, Jakarta, retrieved December 25<sup>th</sup>, 2015, from [http://geospasial.bnpb.go.id/wp-content/uploads/2010/02/2010-02\\_10\\_hazard\\_banjir\\_kabupaten\\_bnpb.pdf](http://geospasial.bnpb.go.id/wp-content/uploads/2010/02/2010-02_10_hazard_banjir_kabupaten_bnpb.pdf)

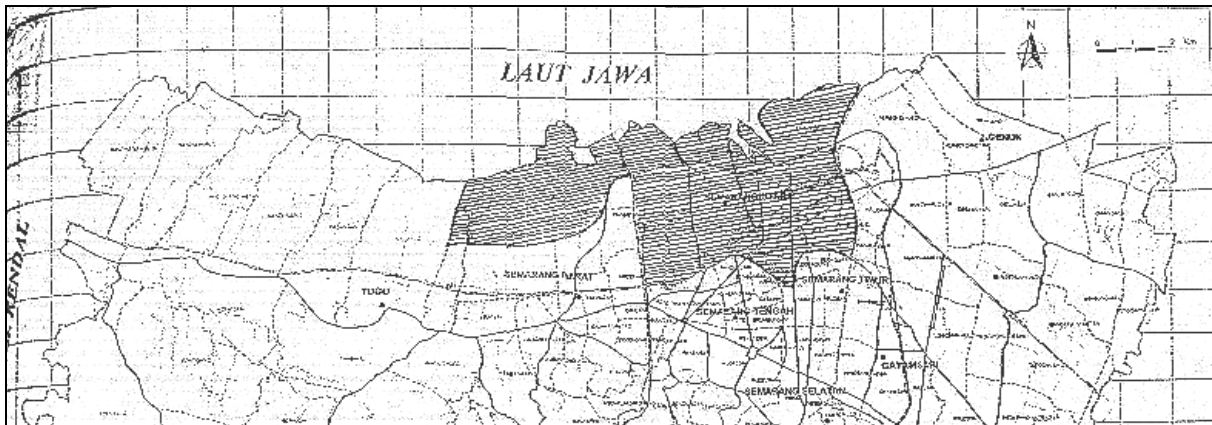


ii. Map of Administration of Republic of Indonesia (peta negara kesatuan Republik Indonesia)



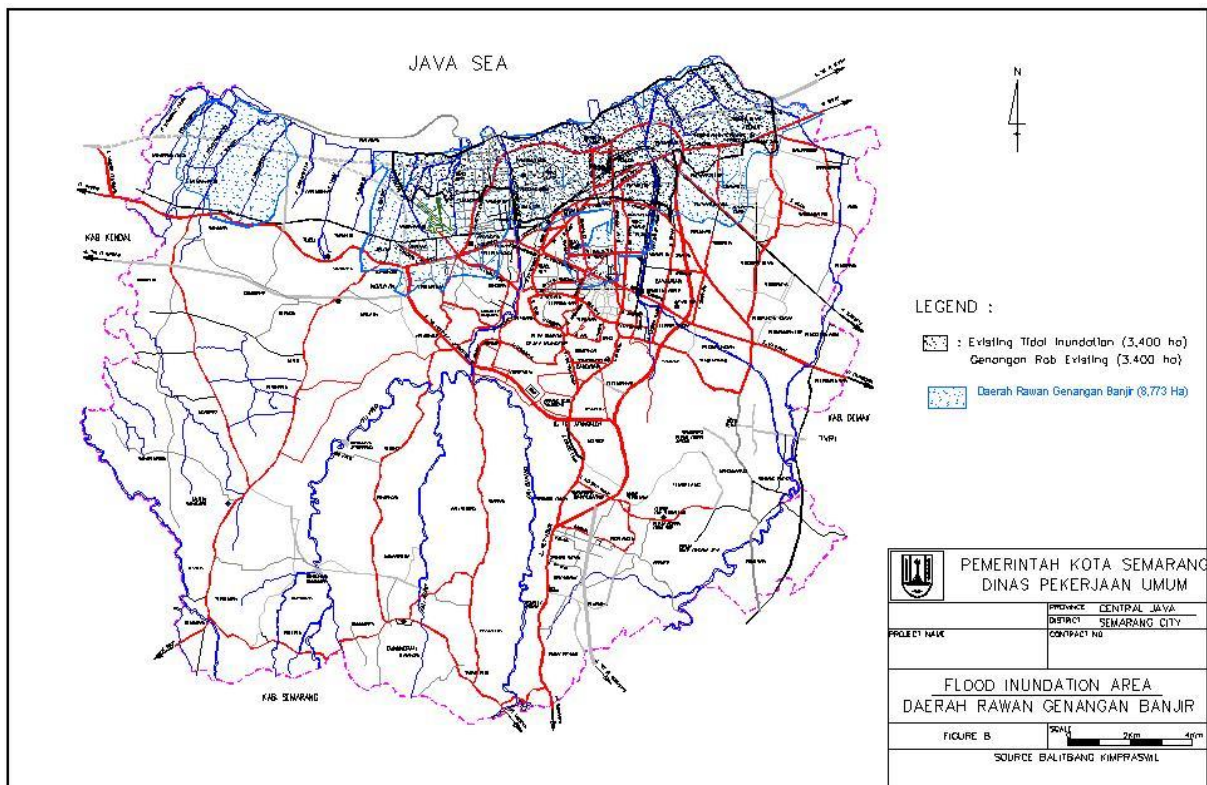


iii. Map of rob area (*peta sebaran rob*) in 2001 (2002)



Source: Sarbidi, 2002, "Pengaruh Rob pada Permukiman Pantai (Kasus Semarang)", in *Proceeding Kerugian pada Bangunan dan Kawasan Akibat Kenaikan Muka Air Laut pada Kota-Kota Pantai di Indonesia*, Jakarta.

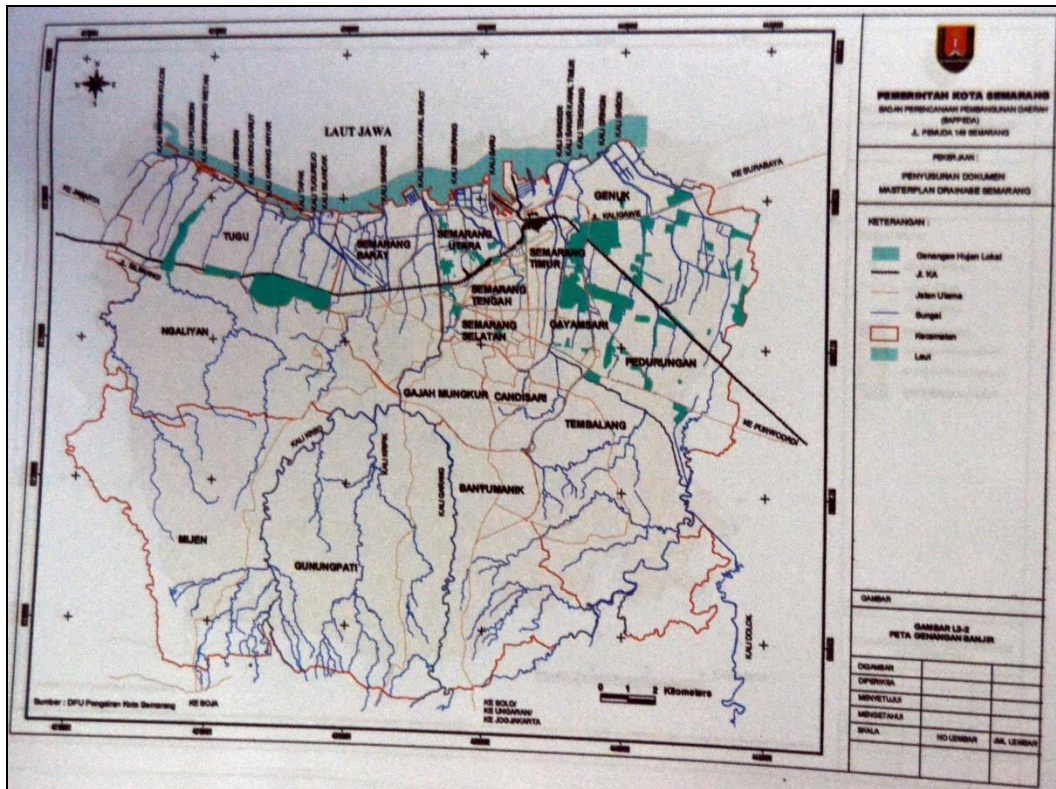
iv. Map of inundation potency of flood and rob in Semarang City (*peta potensi genangan rob & banjir Kota Semarang*) in 2006



Source: *Daerah Rawan Genangan Banjir (Flood Inundation Area)* [Map], 2006, Semarang: Department of Public Works.

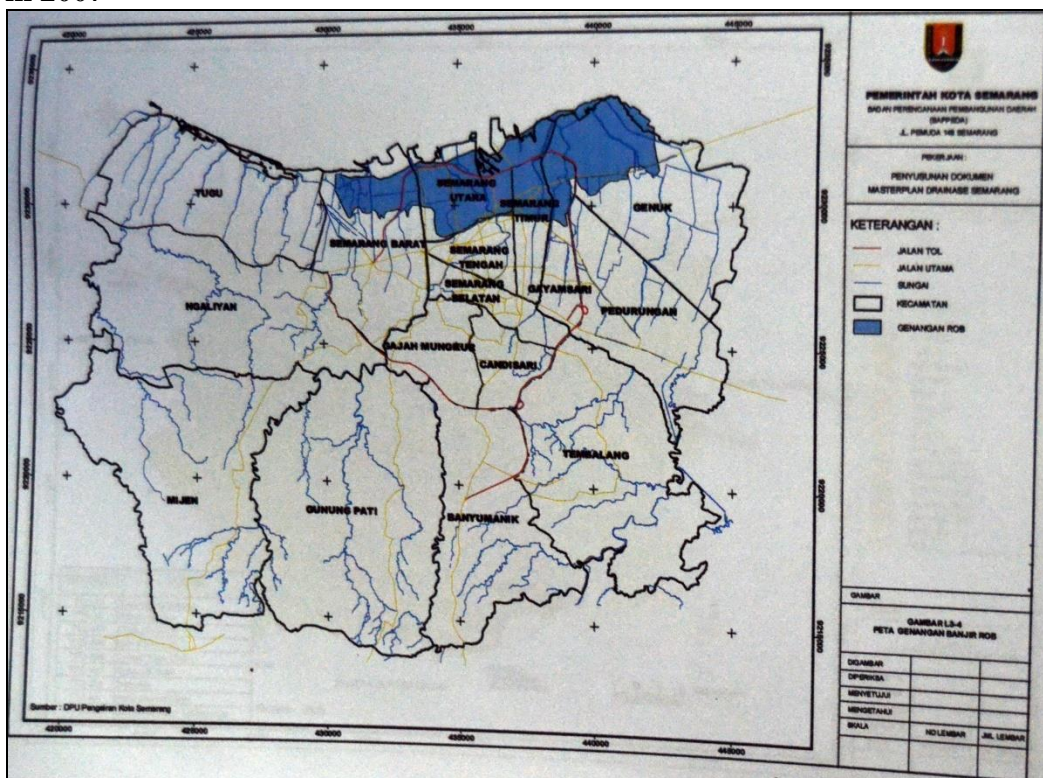


v. Map of flood inundation in Semarang City (*peta genangan banjir Kota Semarang*) in 2007



Source: “Genangan Banjir (Inundation of flood)” [Map], *Urban drainage masterplan of Semarang City*, 2007, Semarang: Regional Development Planning Agency.

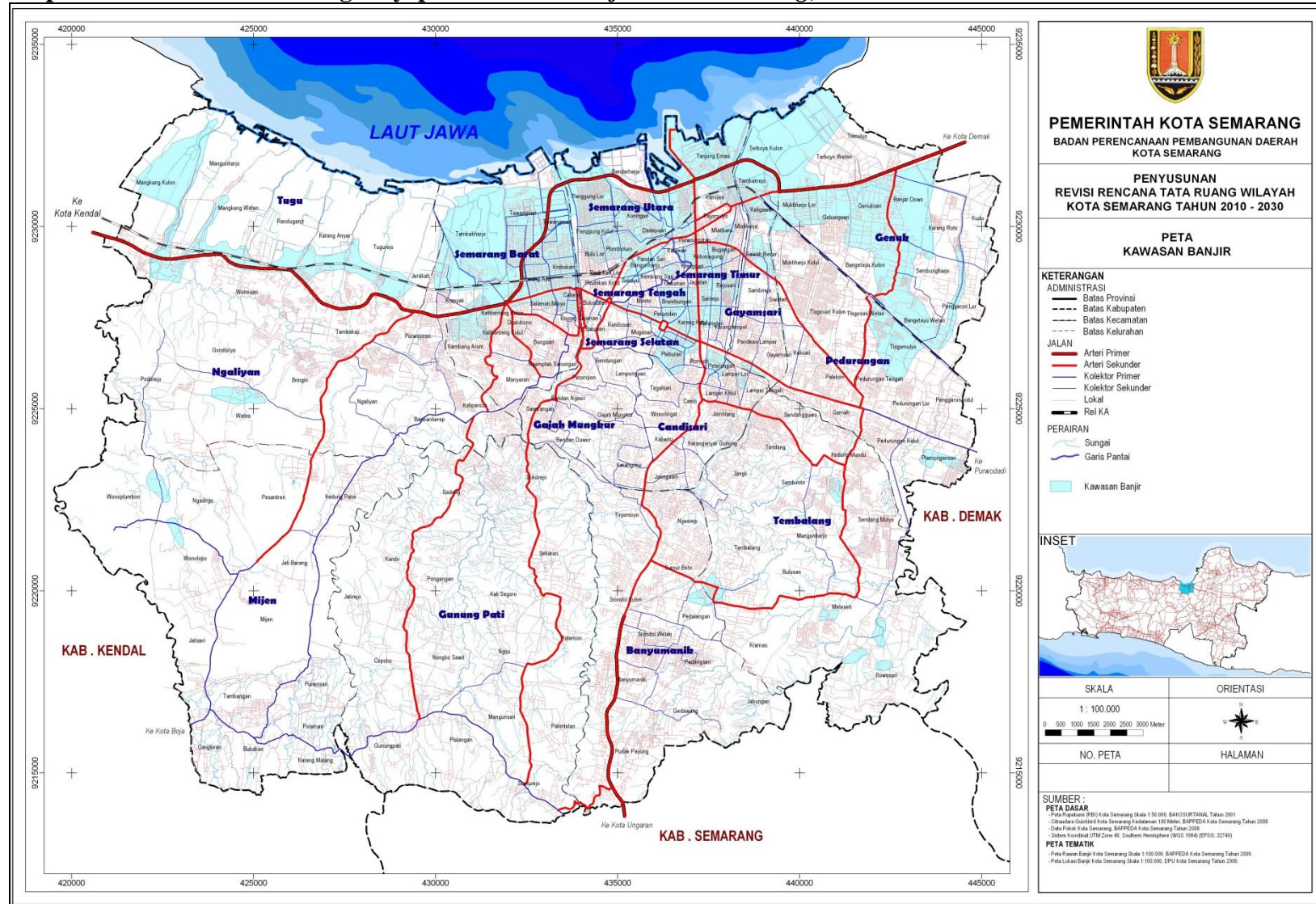
vi. Map of rob inundation in Semarang City (*peta genangan rob Kota Semarang*) in 2007



Source: “Genangan Banjir Rob(Inundation of rob)” [Map], *Urban drainage masterplan of Semarang City*, 2007, Semarang: Regional Development Planning Agency.

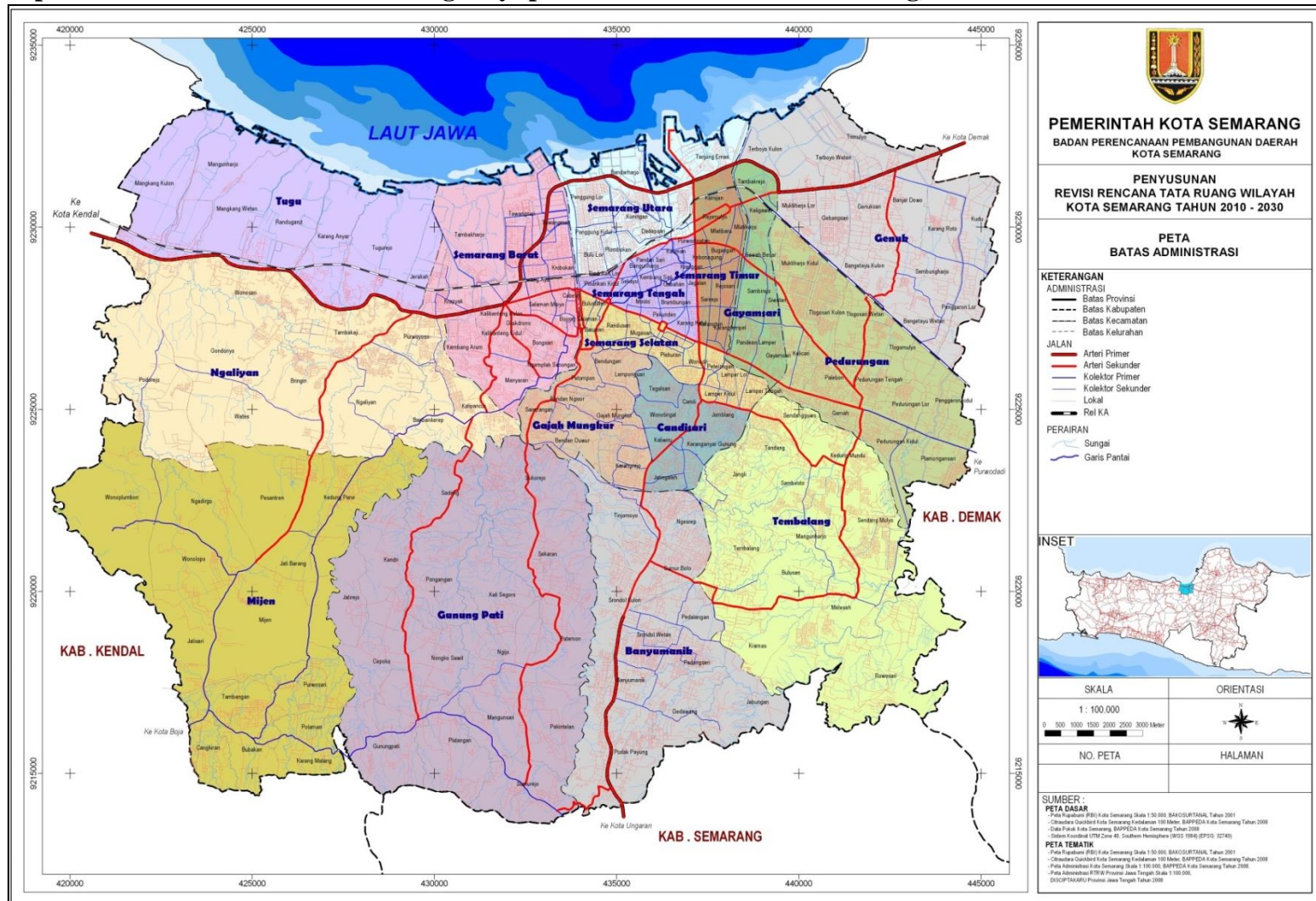


vii. Map of flood area in Semarang City (*peta kawasan banjir Kota Semarang*) in 2011



Source: “Kawasan Banjir (Flood Area)” [Map], *Spatial planning of Semarang City for 2011-2031*, 2011, Semarang: Regional Development Planning Agency.

viii. Map of the administration of Semarang City (peta administrasi Kota Semarang) in 2011



Source: “Batas Administrasi (Administration boundary)” [Map], *Spatial planning of Semarang City for 2011-2031*, 2011, Semarang: Regional Development Planning Agency.



**ix. Ikonos satellite image of Semarang City in 2008**



Source: *Ikonos satellite image of Semarang City in 2008* [Map], Semarang: Department of Marine and Fisheries of Semarang City.

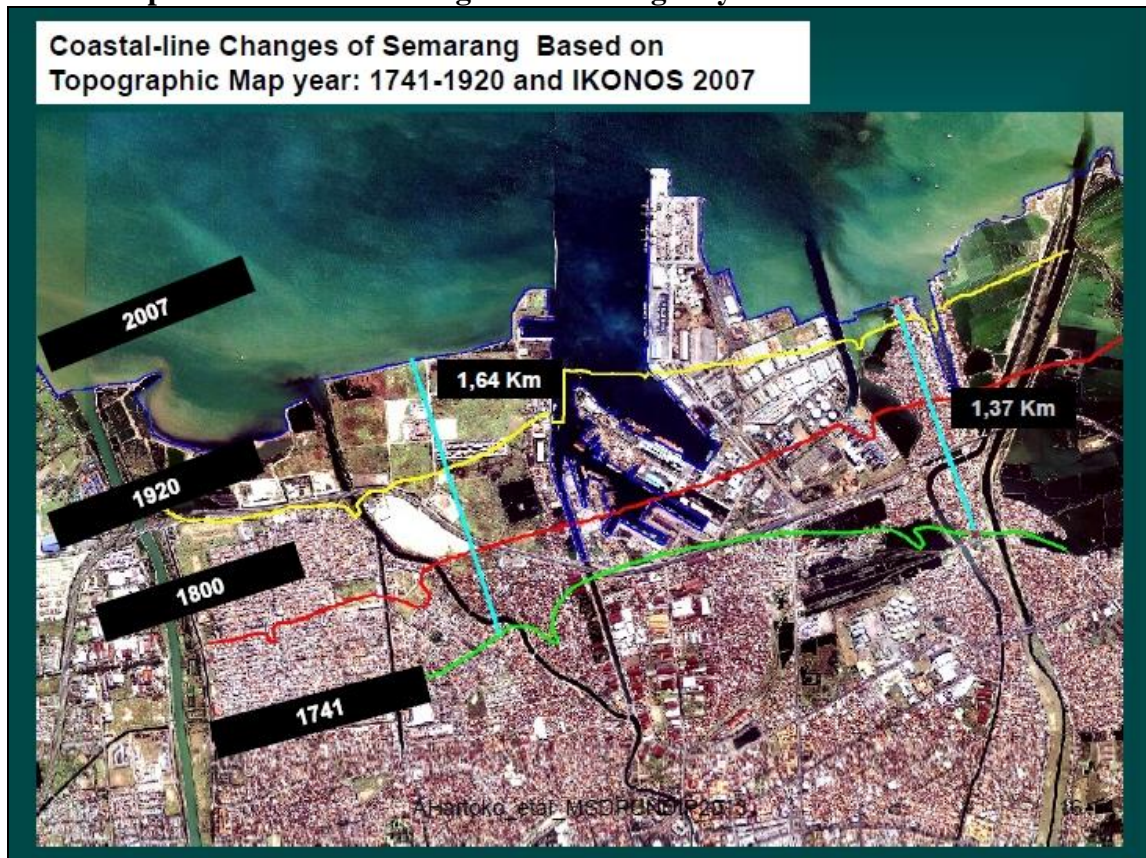
**x. Map of rob (flood) risk in Semarang City (in 2012/2013)**



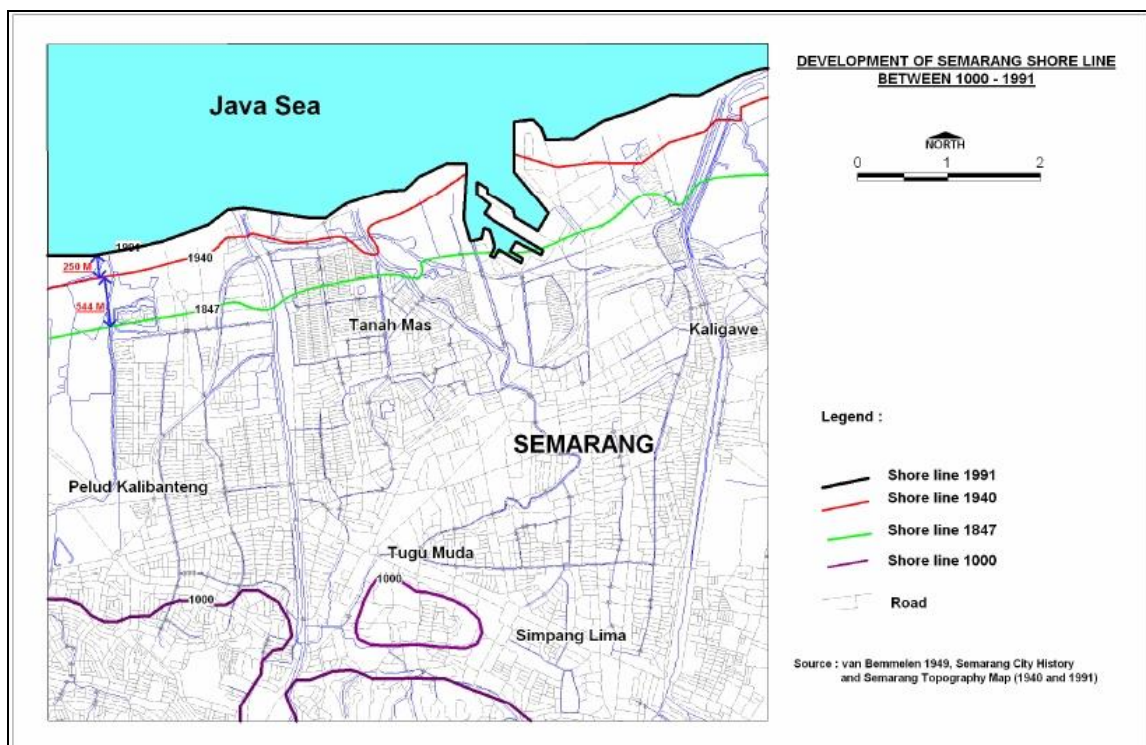
Source: "Peta Ancaman (Hazard Map)" [Map], *Peta online Risiko Banjir Rob Kota Semarang* [Web], retrieved December 28<sup>th</sup>, 2015, from <http://geodesi.undip.ac.id/gis/index.php#>



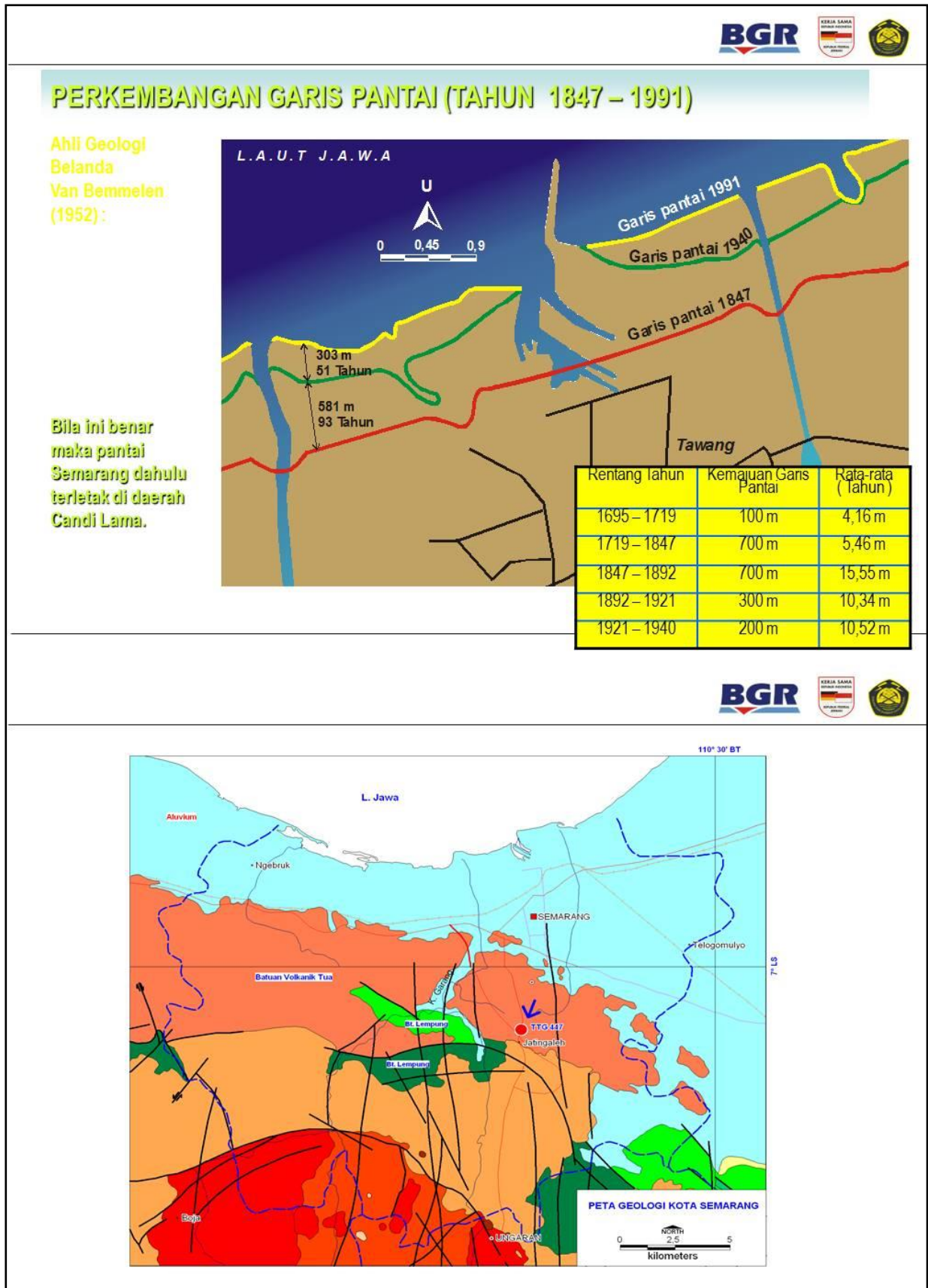
### xi. Maps of Coastal line change of Semarang City



Source: Hartoko, A., Wirasatriya, A., Helmi, M., Rochaddi, B., Hariyadi, 2013, *Land Subsidence Spatial Model and Subsidence Vulnerability Index of Semarang Coastal City- Indonesia* [Presentation], Semarang: Marine Geomatic Center, Diponegoro University –BMKG



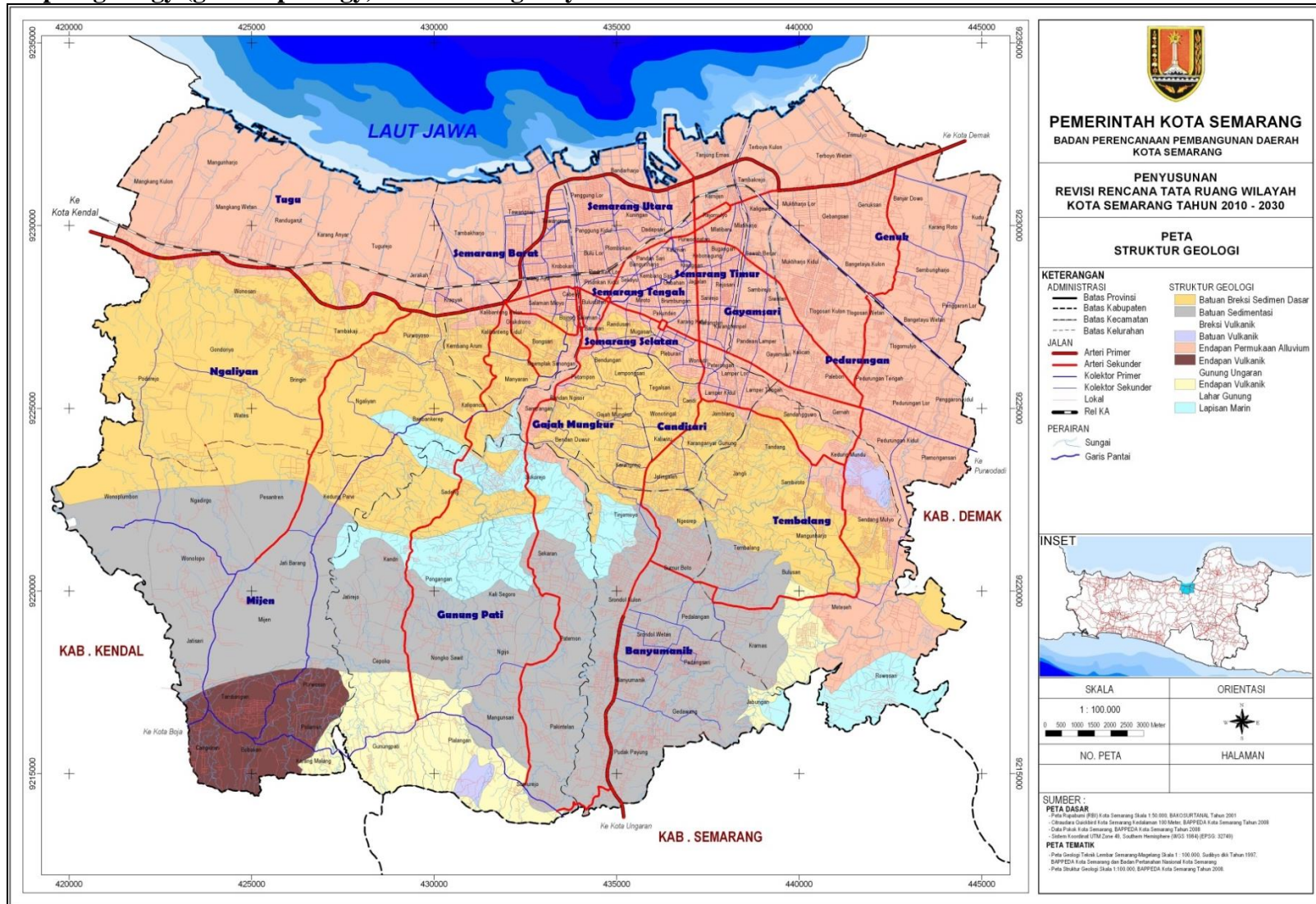
Source: Ringkasan dan hasil lokakarya amblesan tanah Semarang (executive summary of land subsidence in Semarang), 2008, Bandung: German-Indonesian Technical Cooperation on Mitigation of Georisk (Bundesanstalt für Geowissenschaften und Rohstoffe (BGR) and Ministry of Energy and Mineral Resources).



Source: Murdohardono, D., Hartanto, 2007, *Titik ketinggian (peil) stabil bedrock bench mark di area yang mengalami land subsidence di Kota Semarang* [PowerPoint], Semarang: Geology Agency, Ministry of Energy and Mineral resources.

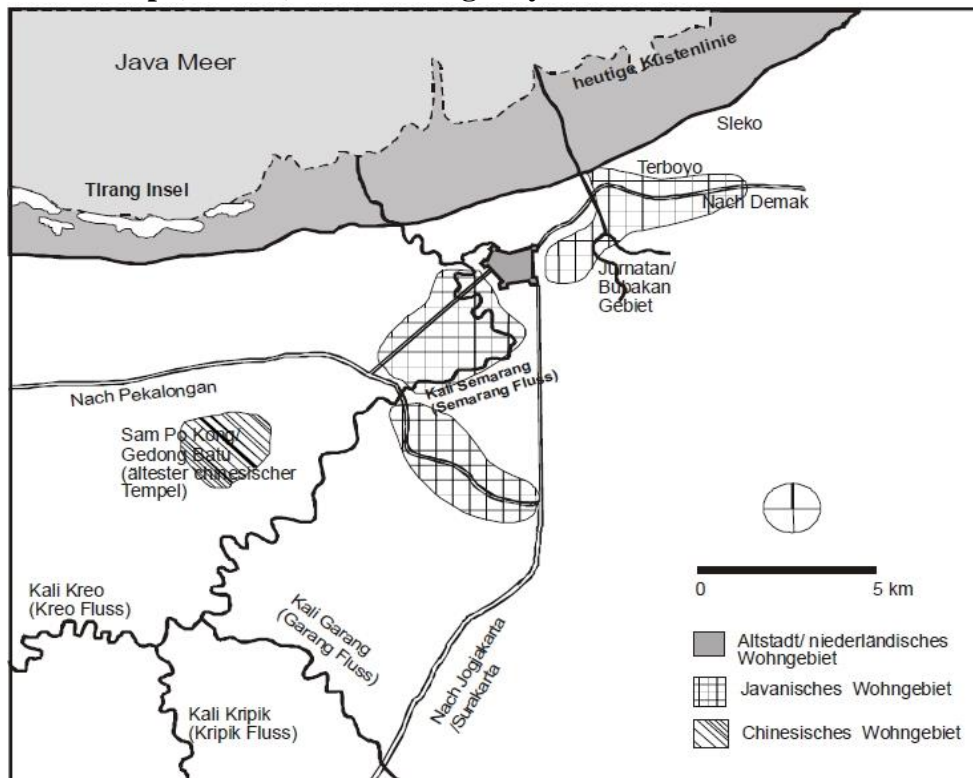


xii. Map of geology (geomorphology) of Semarang City



Source: "Struktur Geologi (Geological Structure)" [Map], *Spatial planning of Semarang City for 2011-2031*, 2011, Semarang: Regional Development Planning Agency.

### xiii. Map (schema) of Semarang City in 1650



Source: Purwanto, L.M.F, 2005, "Kota kolonial lama Semarang, tinjauan umum sejarah perkembangan arsitektur kota", *Dimensi teknik arsitektur*, n°1, July 2005, Surabaya, pp. 27-33.

### xiv. Map of Semarang City situation in 1741



Source: *Karta van Samarang en omstreken, Benevens aanwysing van 's Comp.s Leger en 's vyands vlugt. Gecommandeert en chef door commandant Gerrit Non. Anno 1741* [Map], Retrieved December 25<sup>th</sup>, 2015, from gahetNA, [http://www.gahetna.nl/en/collectie/afbeeldingen/kaartencollectie/zoeken/start/10/weergave/detail/tstart/0/q/zoekterm/semarang/q/commentaar/1/f/Geografisch\\_trefwoord/Semarang](http://www.gahetna.nl/en/collectie/afbeeldingen/kaartencollectie/zoeken/start/10/weergave/detail/tstart/0/q/zoekterm/semarang/q/commentaar/1/f/Geografisch_trefwoord/Semarang)

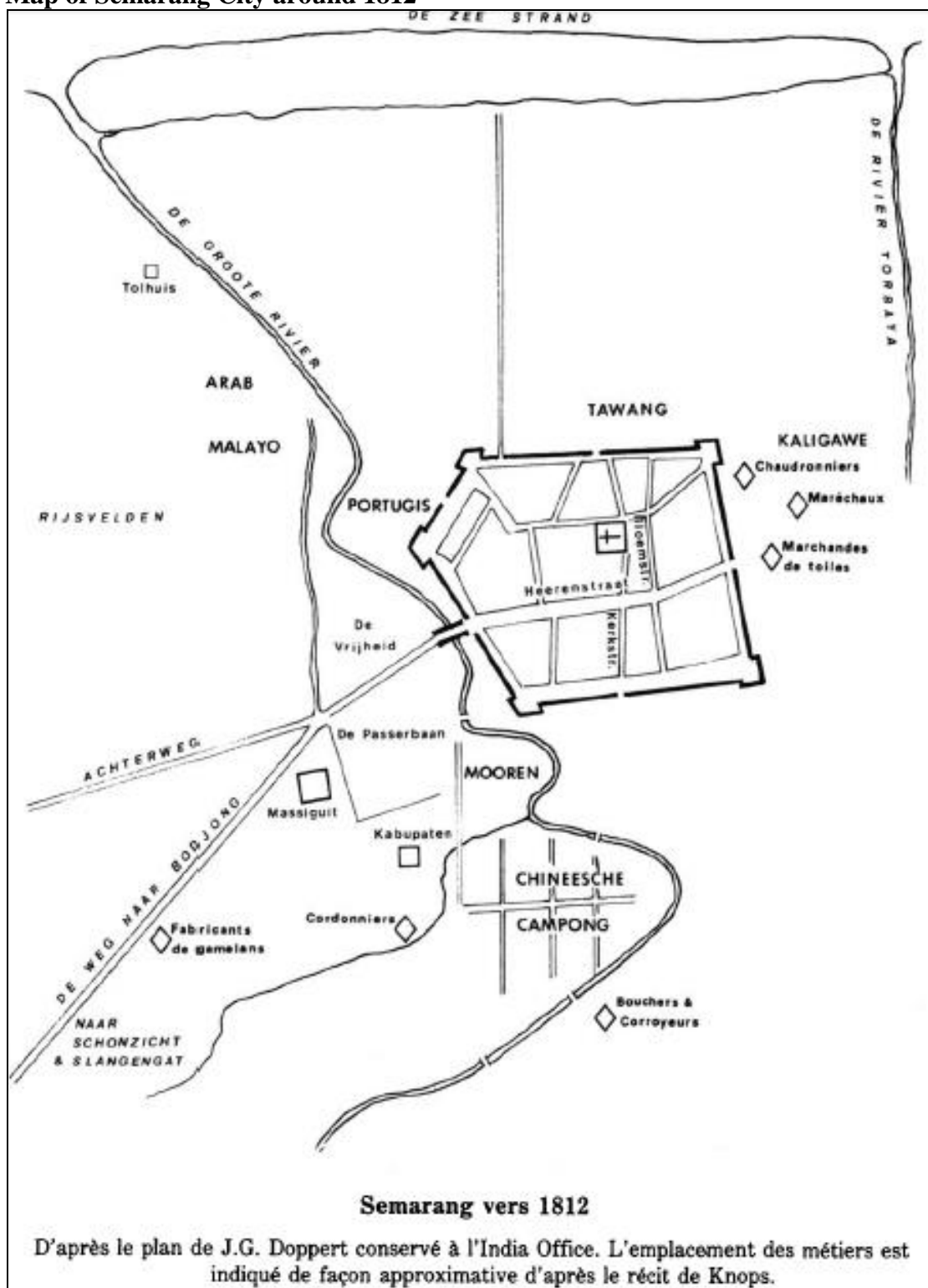


xv. Map of Semarang City around the early nineteenth century (1800)



Source: Busscher, K.F., *Plan of plattegrond van Semarang, met dies environs* [Map], early nineteenth century (1800), retrieved December 25<sup>th</sup> 2015, from GahetNA, <http://www.gahetna.nl>.

## xvi. Map of Semarang City around 1812



Source: Lombard, D., 1989, "Une description de la ville de Semarang vers 1812", *Archipel*, vol. 37, pp. 263-277.



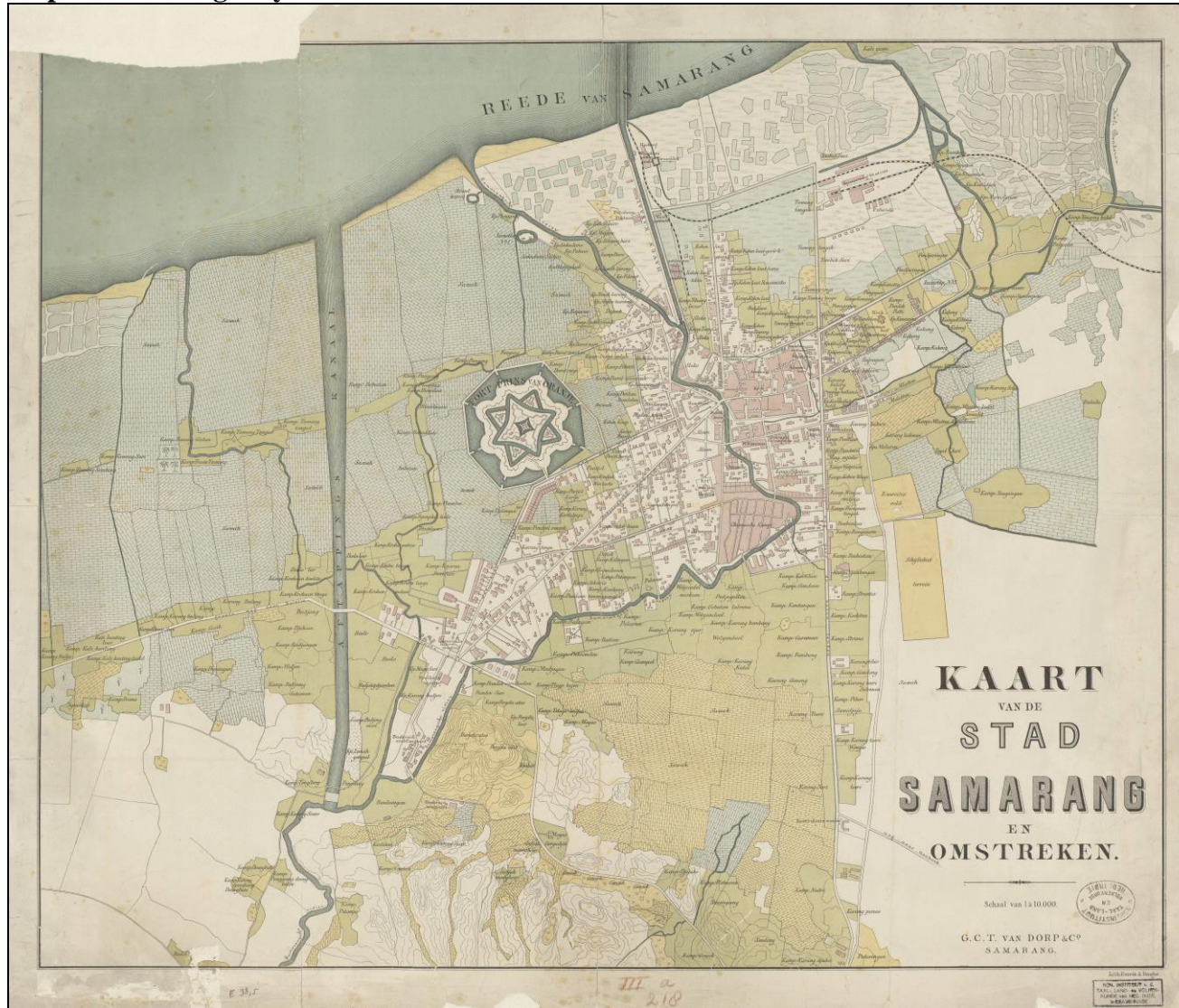
xvii. Map of Semarang City around 1875



Source: Kaart van de Hoofdplaats Semarang en Omstreken/Topographisch Bureau [Map], 1875, KITLV, Leiden.



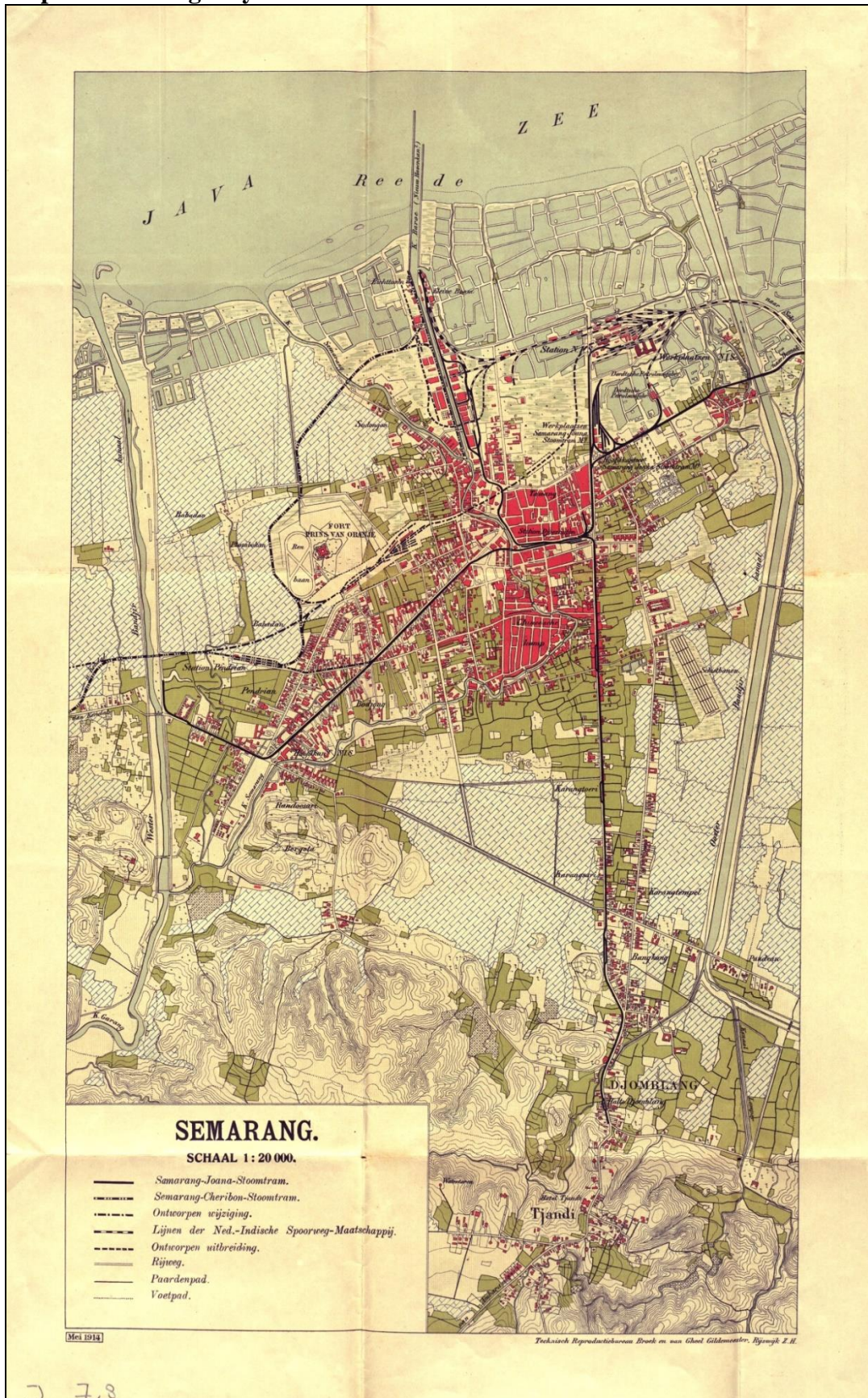
xviii. Map of Semarang City around 1886



Source: Kaart van de stad Samarang en Omstreken [Map], 1886, KITLV, Leiden.



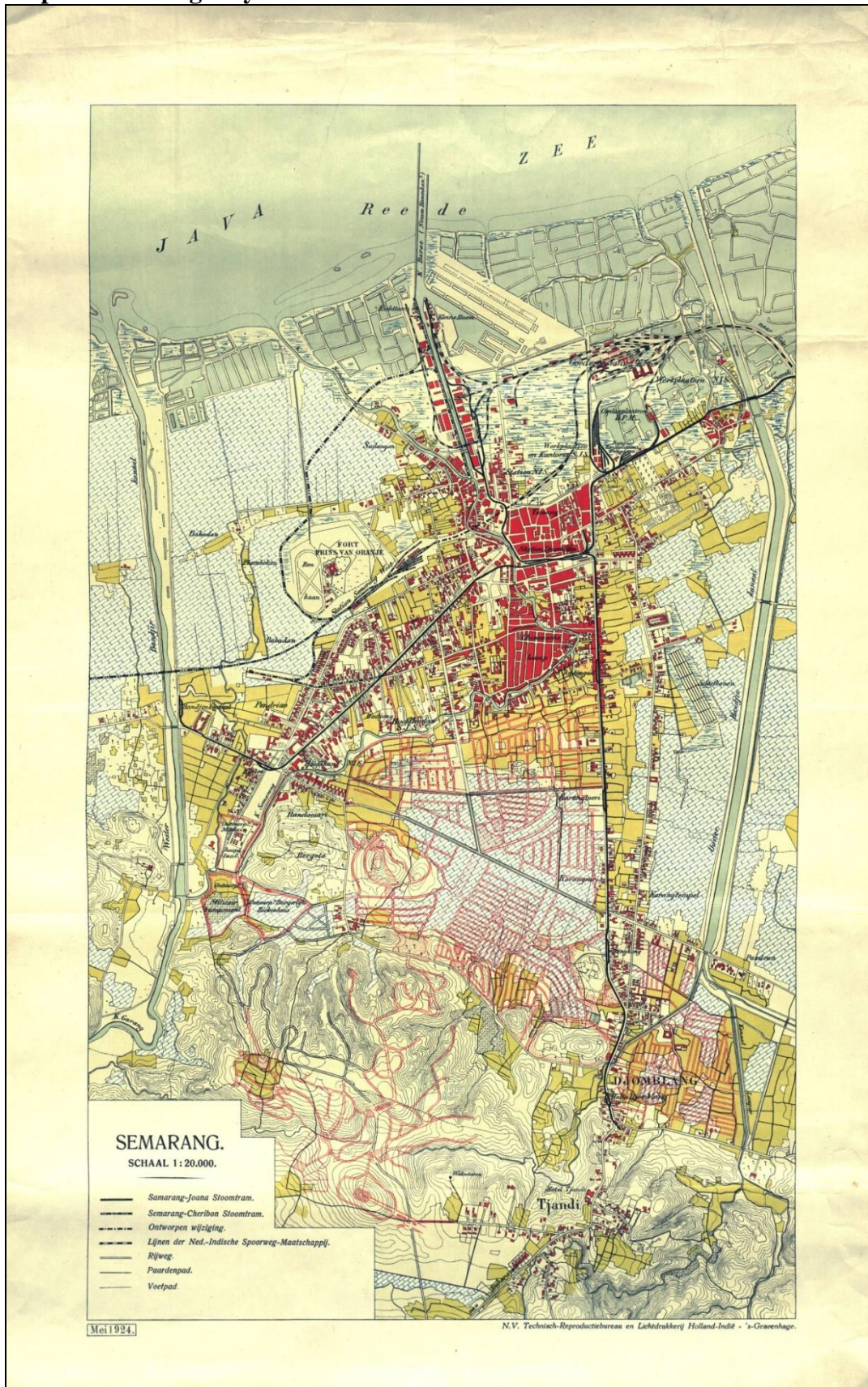
xix. Map of Semarang City in 1914



Source: Technisch Reproductiebureau Broek en van Gheel Gildemeester, Rijsmijk Z.H, *Semarang* [Map], 1914, KITLV, Leiden.



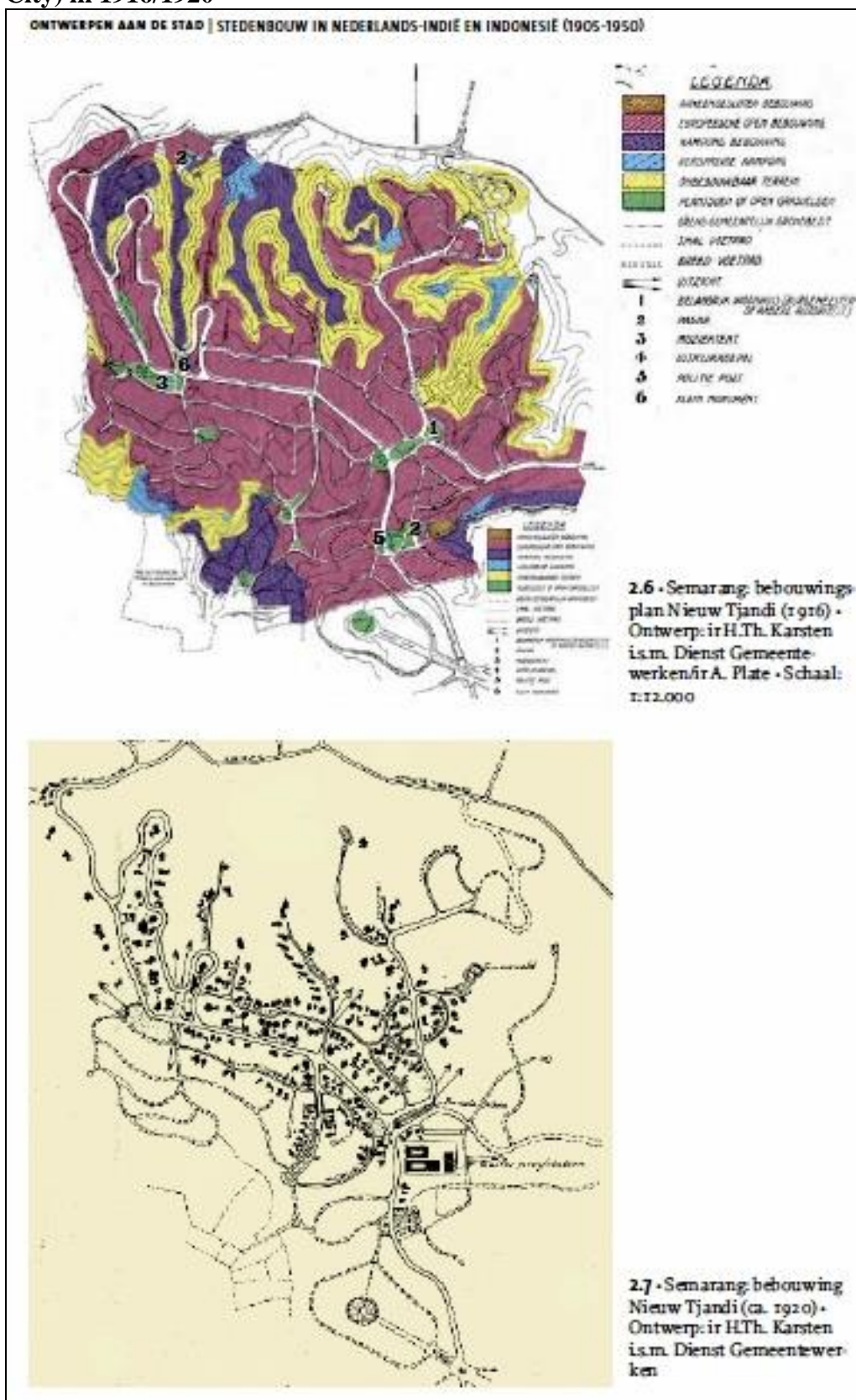
## xx. Map of Semarang City in 1924



Source: N.V. Technisch-Reproductiebureau en Lichtdrukkerij Holland-Indië – ,s-Gravenhage, Semarang [Map], 1924, KITLV, Leiden.



xxi. Map (design) of urban extension plan in New Candi Area (hills of Semarang City) in 1916/1920

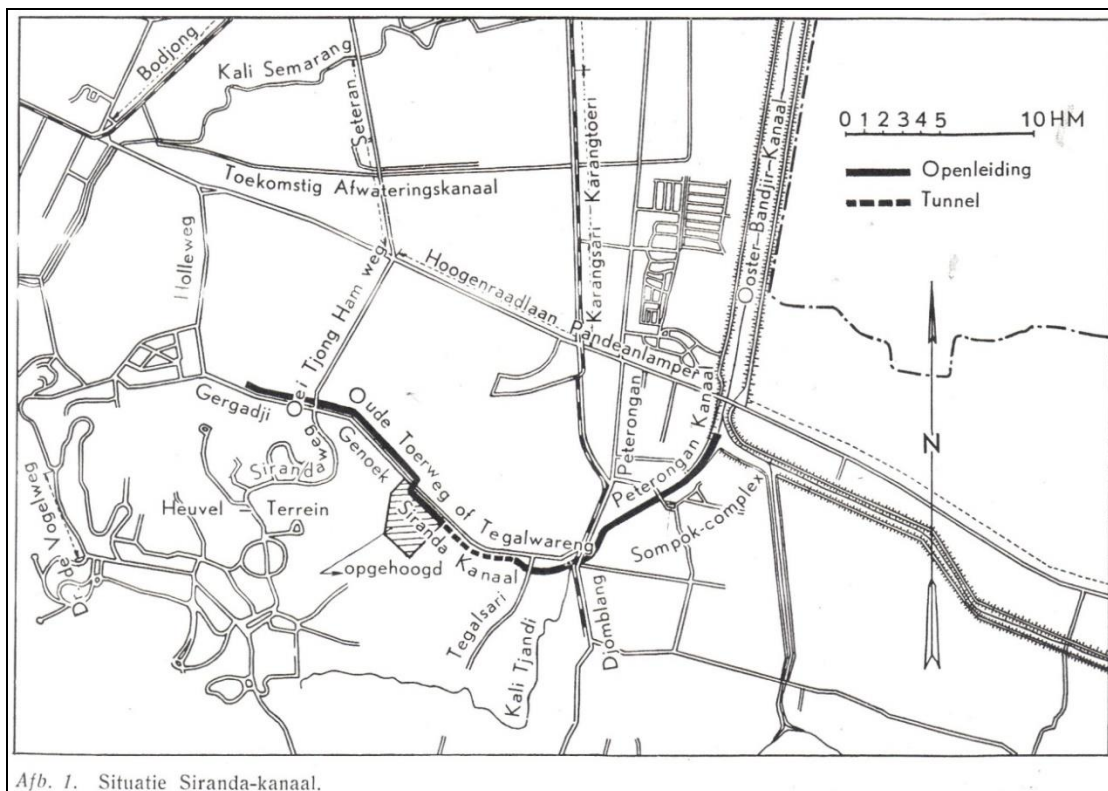


Source: Roosmalen, P.K.M., 2008, *Ontwerpen aan de stad Stedenbouw in Nederlands-Indië en Indonesië (1905-1950)*, PhD. Dissertation in Architecture, Delft University of Technology.

xxii. Map of Semarang City in 1946



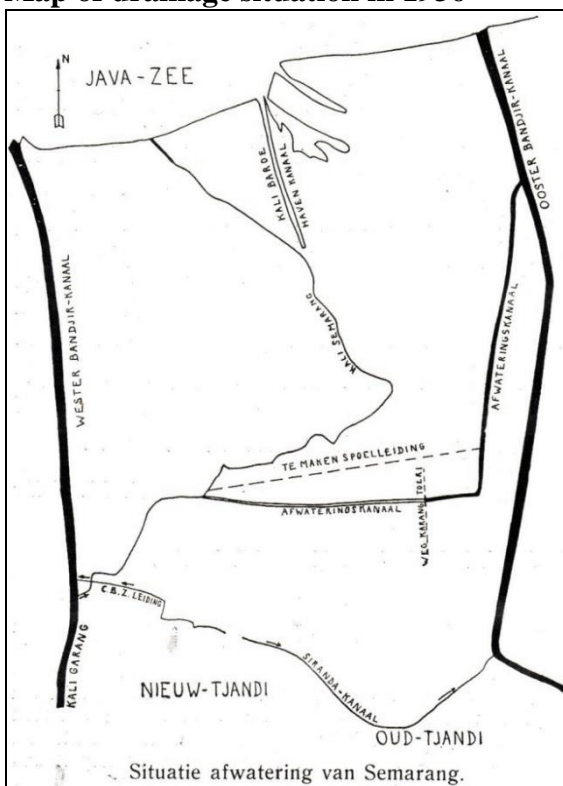




Afb. 1. Situatie Siranda-kanaal.

Source: "De aanleg van het sirandakanaal in de stadsgemeente Semarang", *I.B.T. Locale Techniek*, n° 3, May/June 1937.

#### xxiv. Map of drainage situation in 1936



Situatie afwatering van Semarang.

Source: "De afwatering van Semarang", *I.B.T. Locale Techniek*, 1936, n° 5, September 1936.

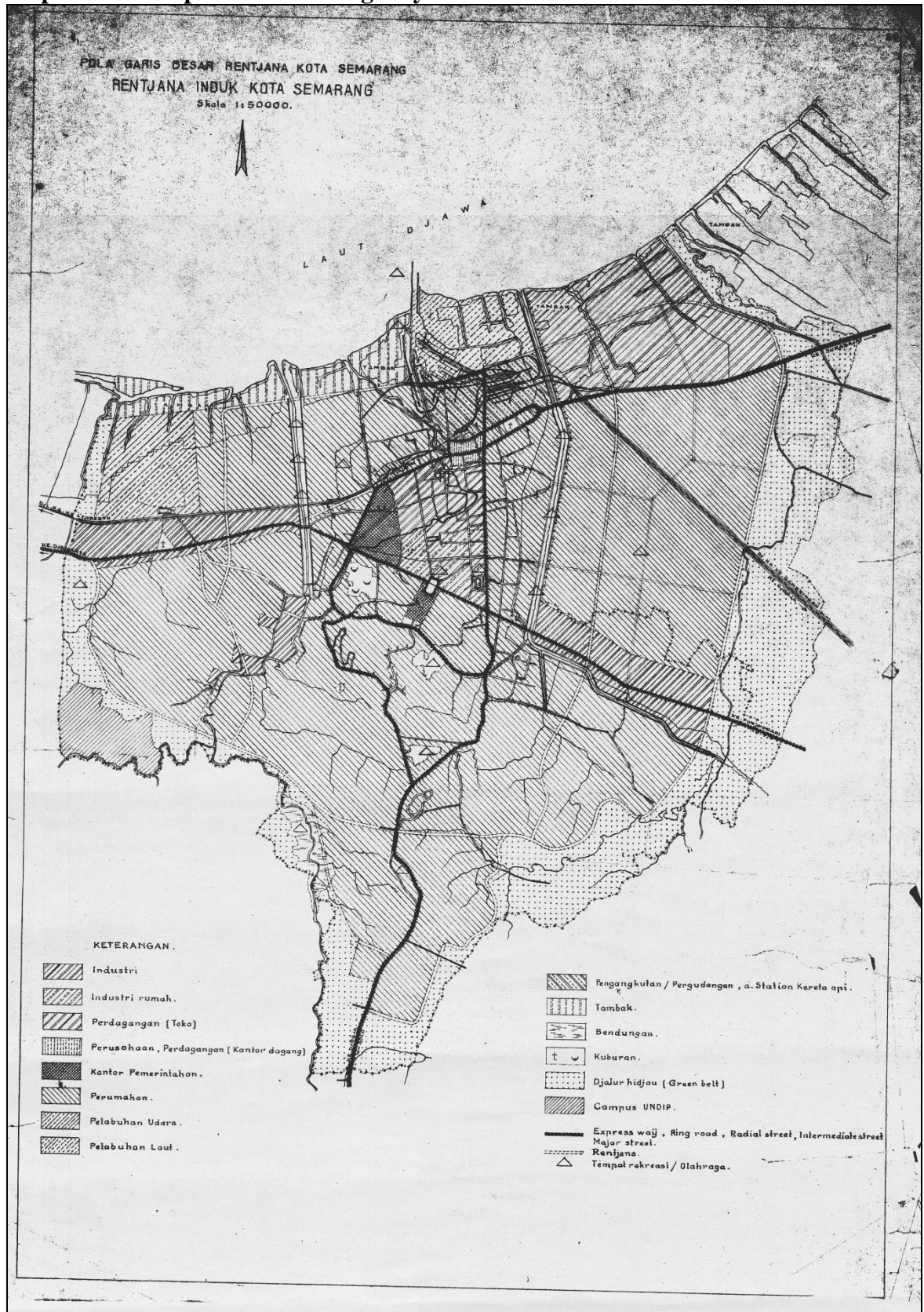
"Exploitatie en bebouwing van het land Mlaten Semarang", *I.B.T. Locale Techniek*, n° 1-2, January-April 1932.







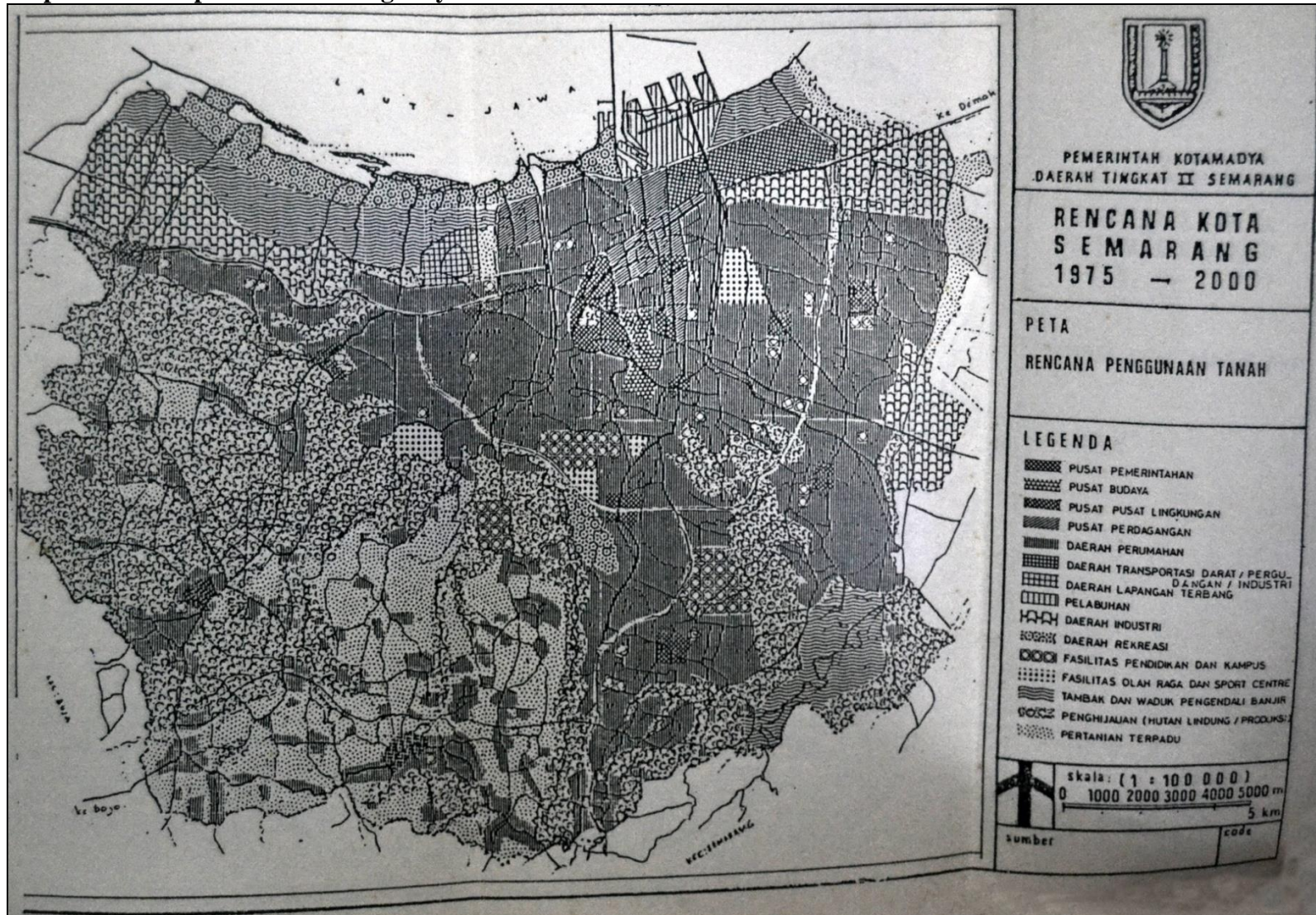
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Source: "Pola garis besar (Outline pattern/zoning) plan" [Map], *Master Plan of Semarang City for 1972-1992*, 1971/1972, Semarang: Department of Urban Planning and Settlement of Semarang City.

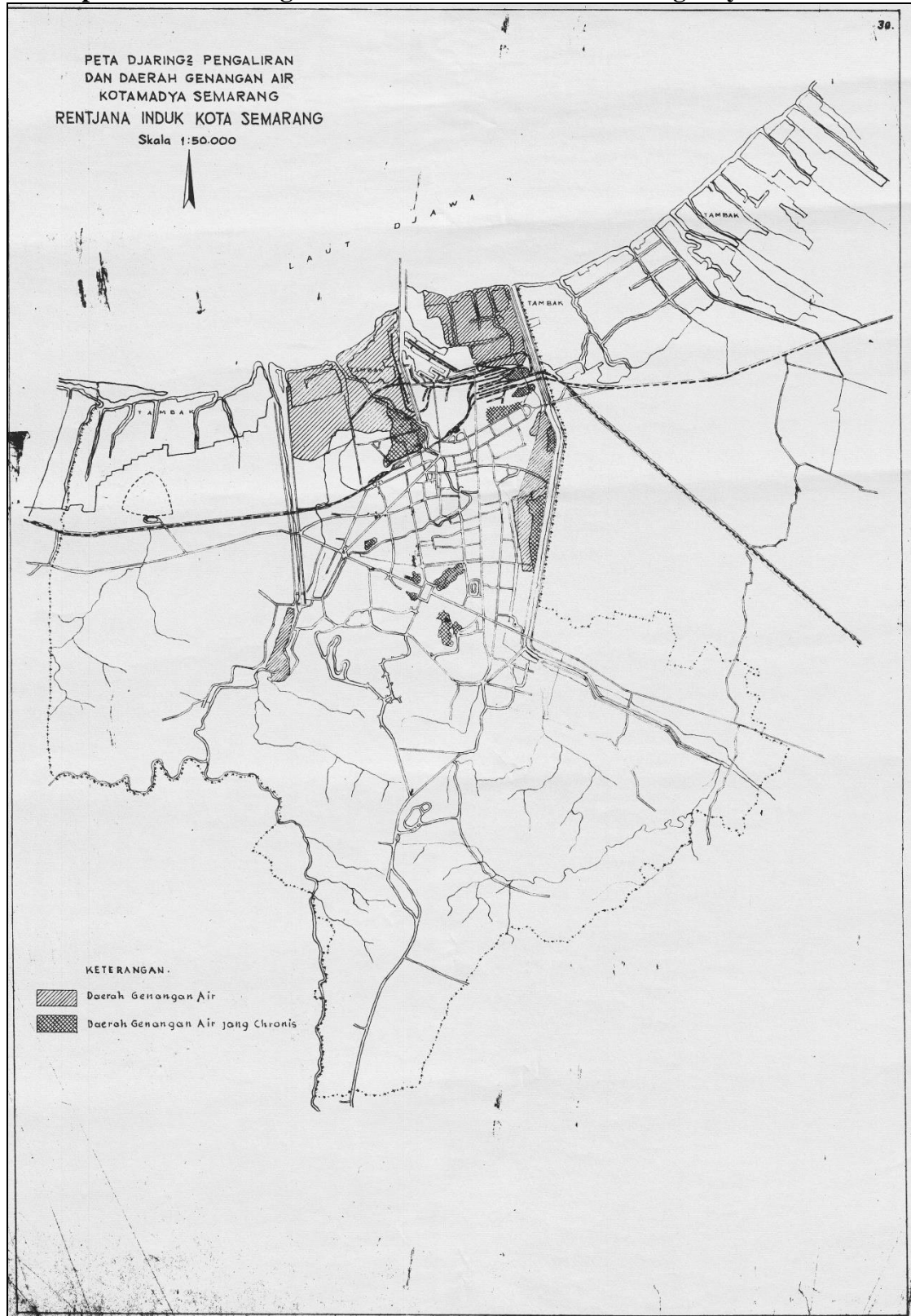


xxviii. Map of land use plan of Semarang City for 1975-2000



Source: "Rencana Penggunaan Tanah (Land Use Plan)" [Map], *Master Plan of Semarang City for 1975-2000*, 1975, Semarang: Department of Urban Planning and Settlement of Semarang City.

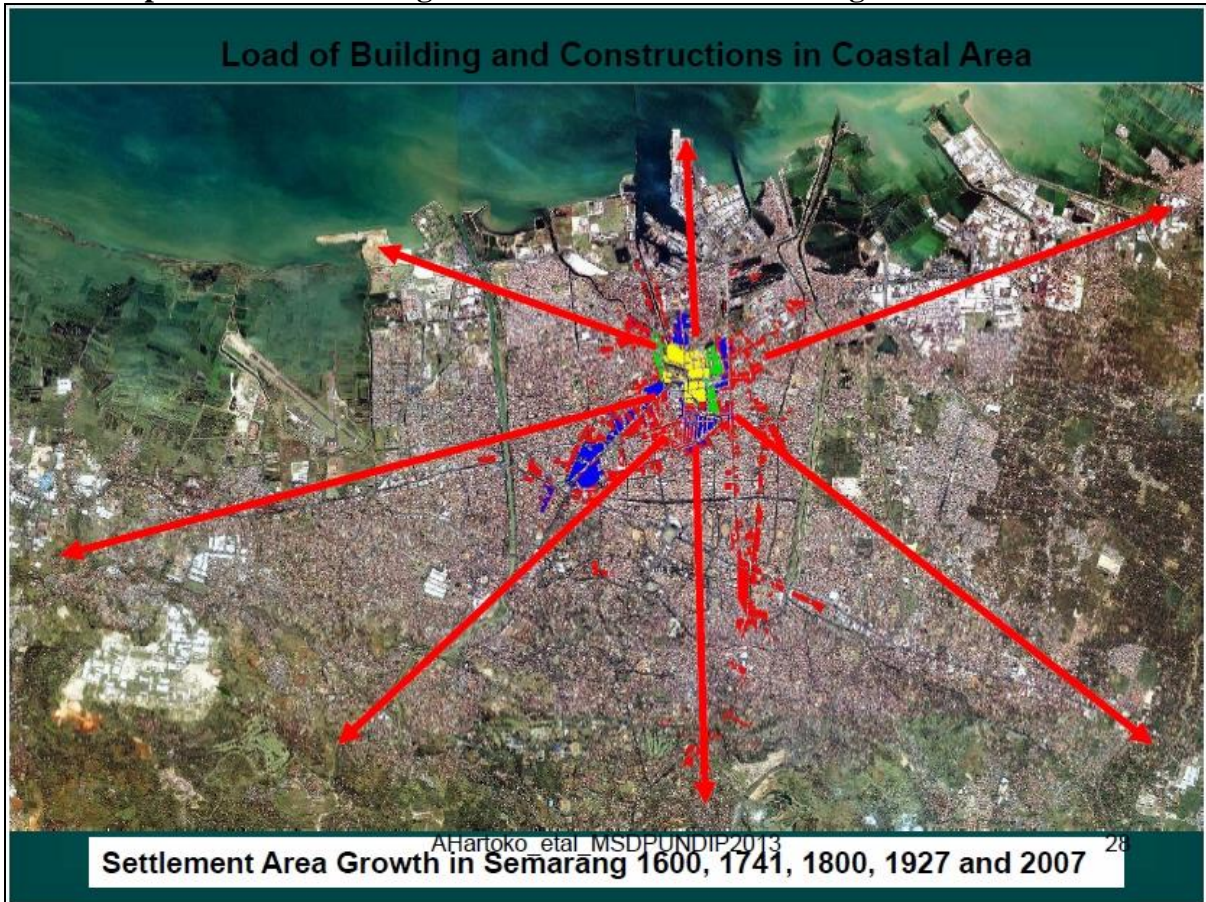
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Source: Department of Urban Planning and Settlement of Semarang City, "Master Plan of Semarang City for 1972 "Djaring2 Pengaliran dan Daerah Genangan Air (Irrigation and inundated areas)" [Map], *Master Plan of Semarang City for 1972*

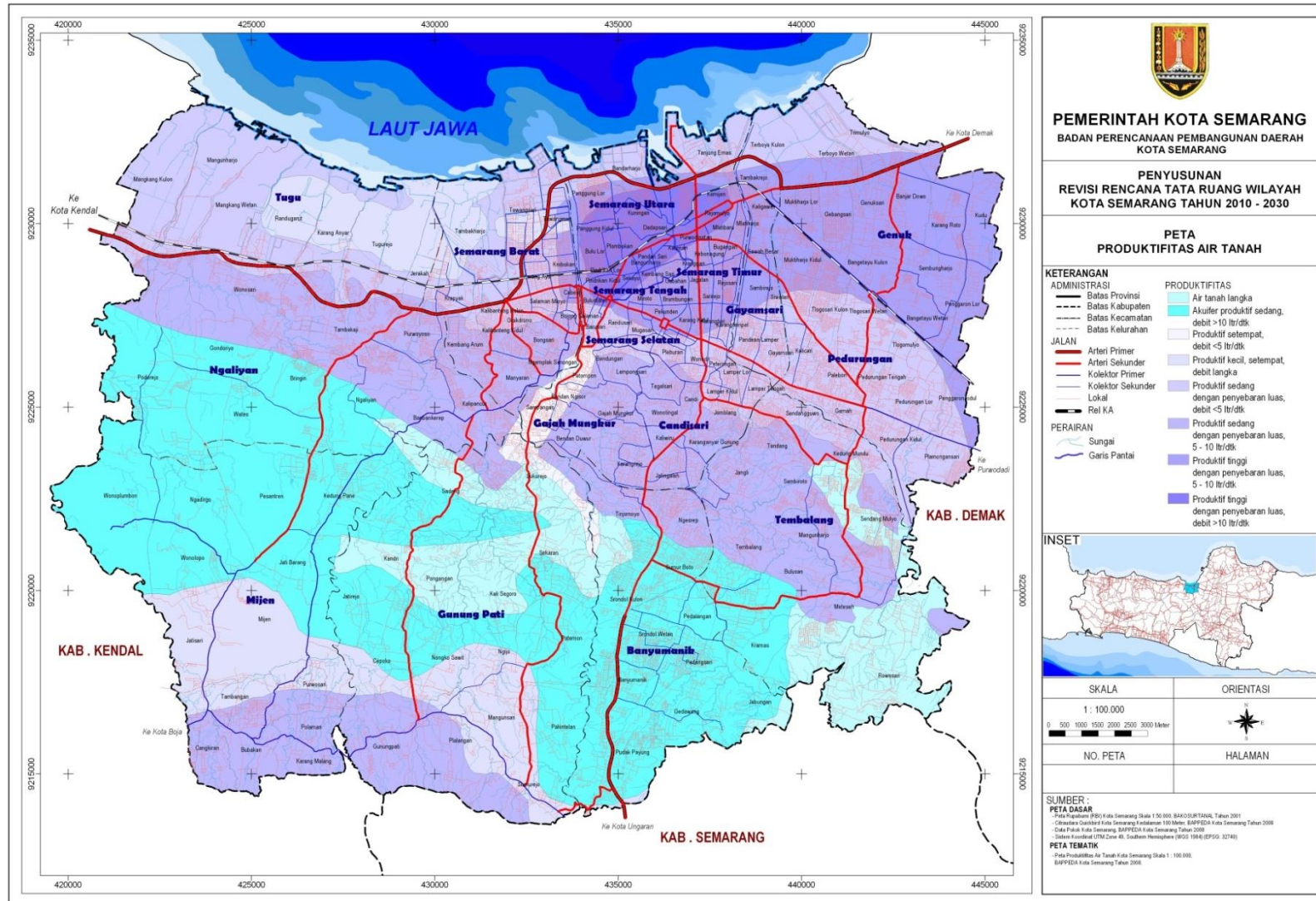


xxx. Maps of load of building and constructions in Semarang coastal area



Source: Hartoko, A., Wirasatriya, A., Helmi, M., Rochaddi, B., Hariyadi, 2013, *Land Subsidence Spatial Model and Subsidence Vulnerability Index of Semarang Coastal City- Indonesia* [Presentation], Semarang: Marine Geomatic Center, Diponegoro University –BMKG

xxxi. Map of groundwater productivity of Semarang City

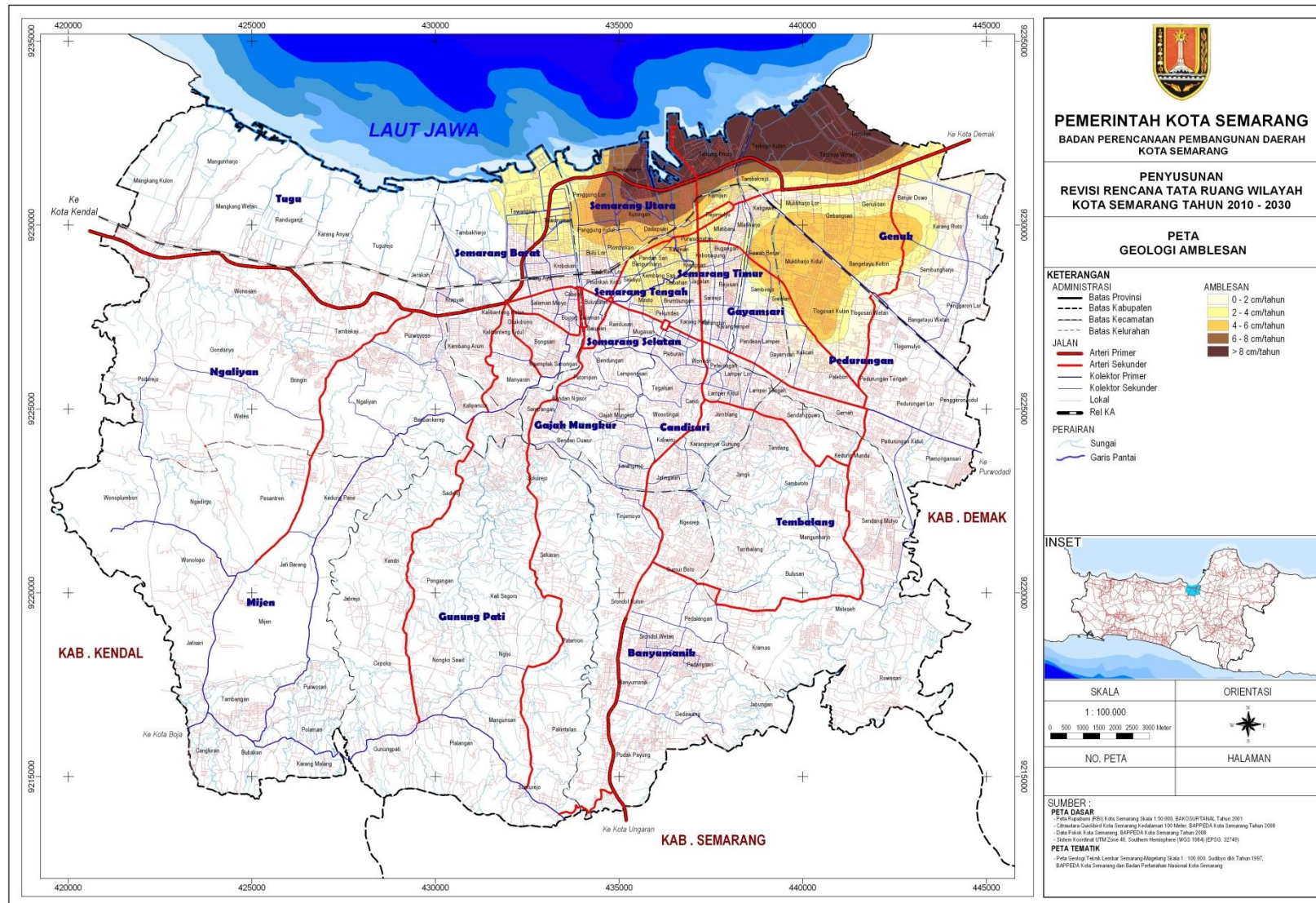


Source: “Produktivitas Air Tanah (Groundwater productivity)” [Map], *Spatial planning of Semarang City for 2011-2031*, 2011, Semarang: Regional Development Planning Agency.





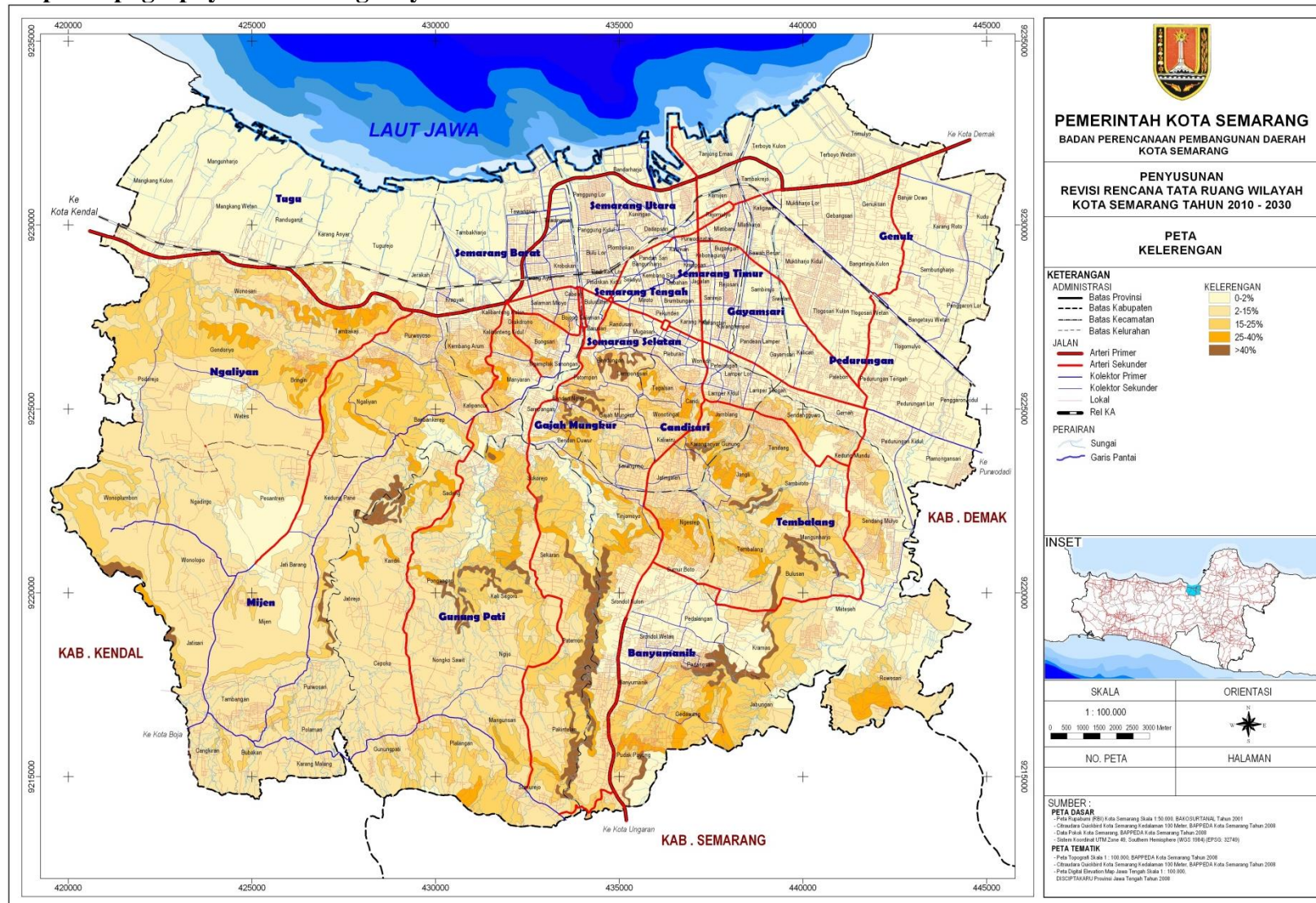
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Source: “Geologi Amblesan (Land Subsidence)” [Map], *Spatial planning of Semarang City for 2011-2031*, 2011, Semarang: Regional Development Planning Agency.



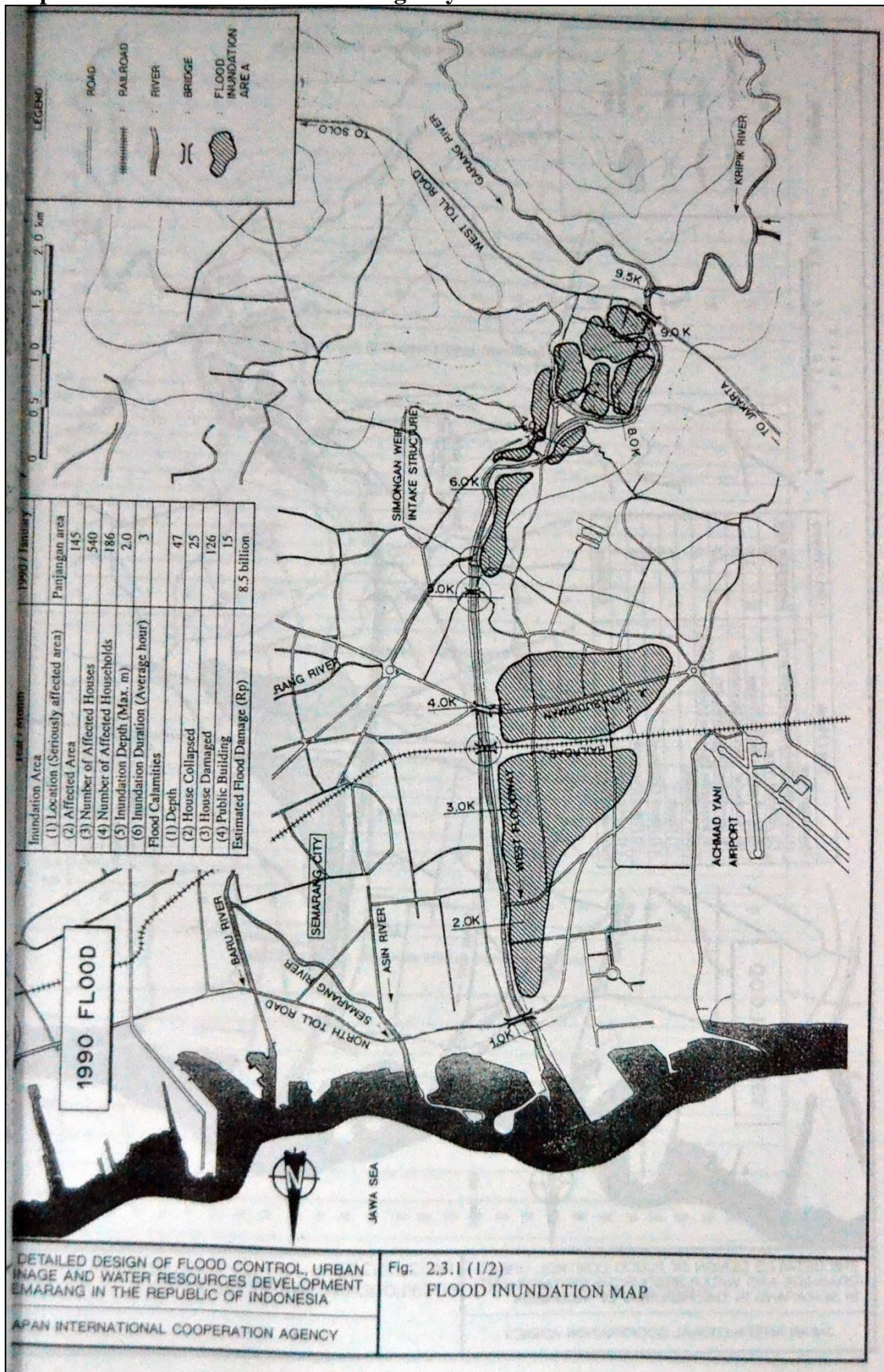
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Source: “Kelerengan (Topography)” [Map], *Spatial planning of Semarang City for 2011-2031*, 2011, Semarang: Regional Development Planning Agency.



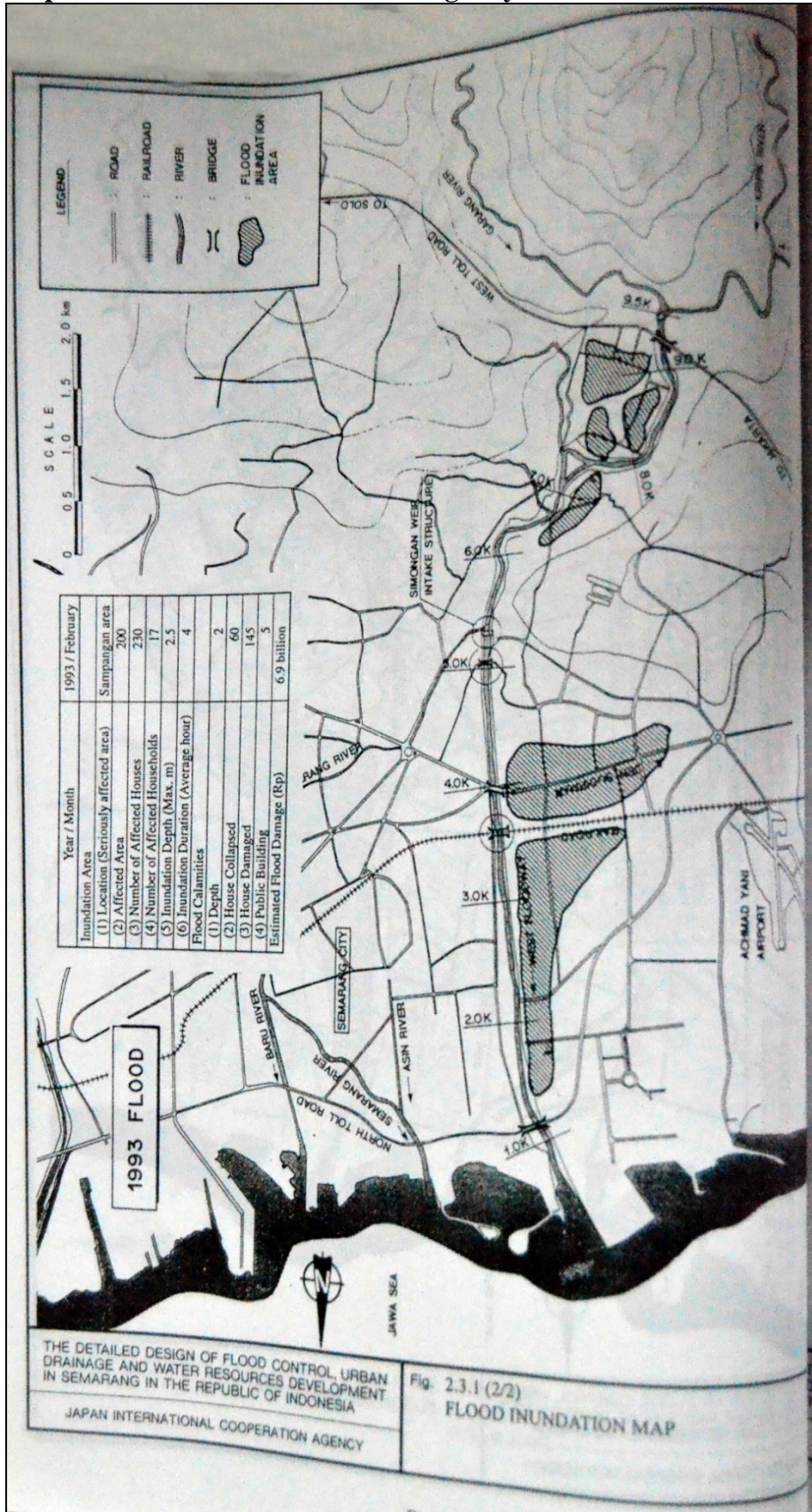
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Source: "Flood Inundation Map 1990", *The Detail Design of Flood Control, Urban Drainage and Water Resources Development in Semarang in the Republic of Indonesia*, 2000, Semarang: Japan International Cooperation Agency (JICA).

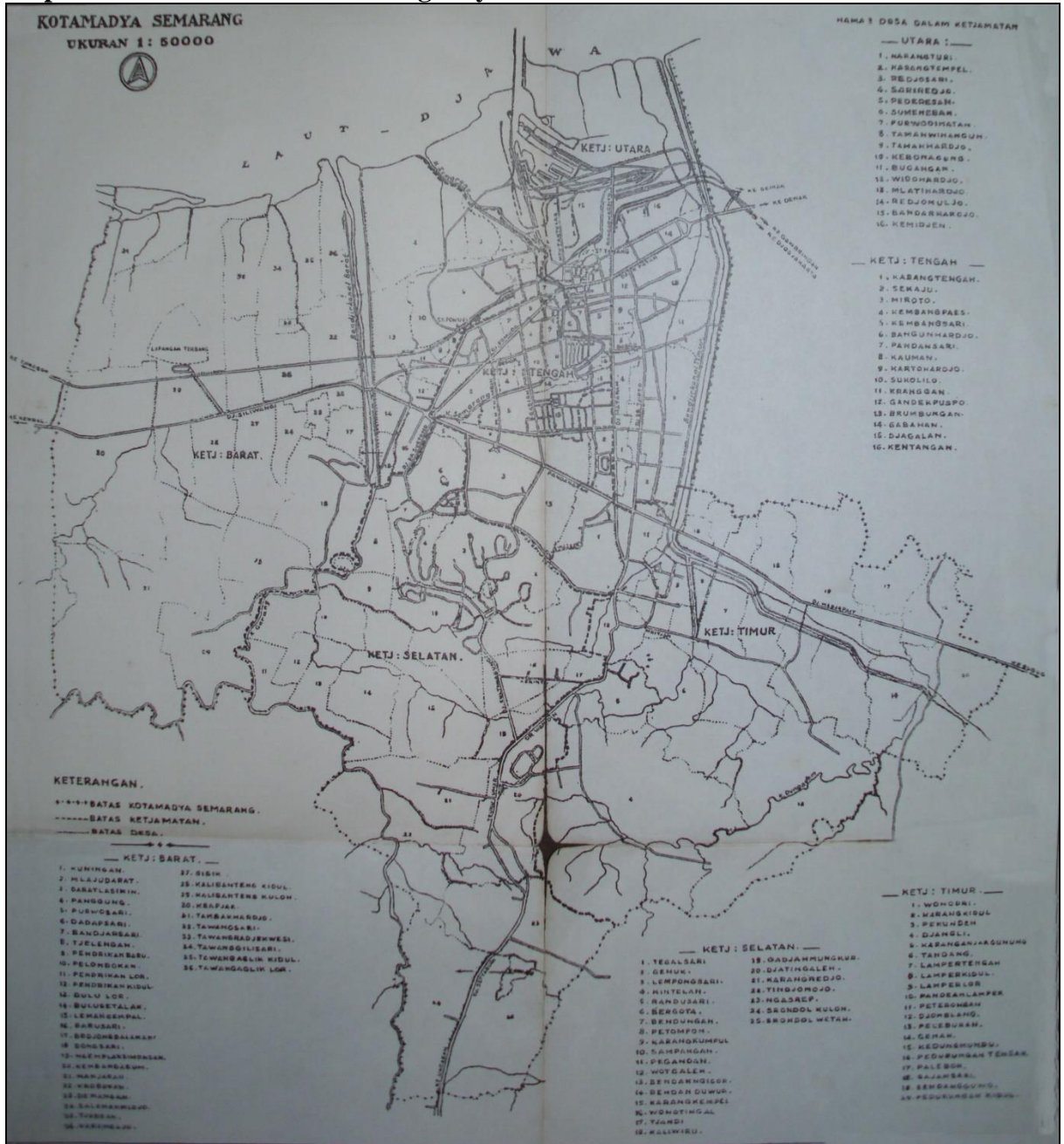


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Source: "Flood Inundation Map 1993", *The Detail Design of Flood Control, Urban Drainage and Water Resources Development in Semarang in the Republic of Indonesia*, 2000, Semarang: Japan International Cooperation Agency (JICA).

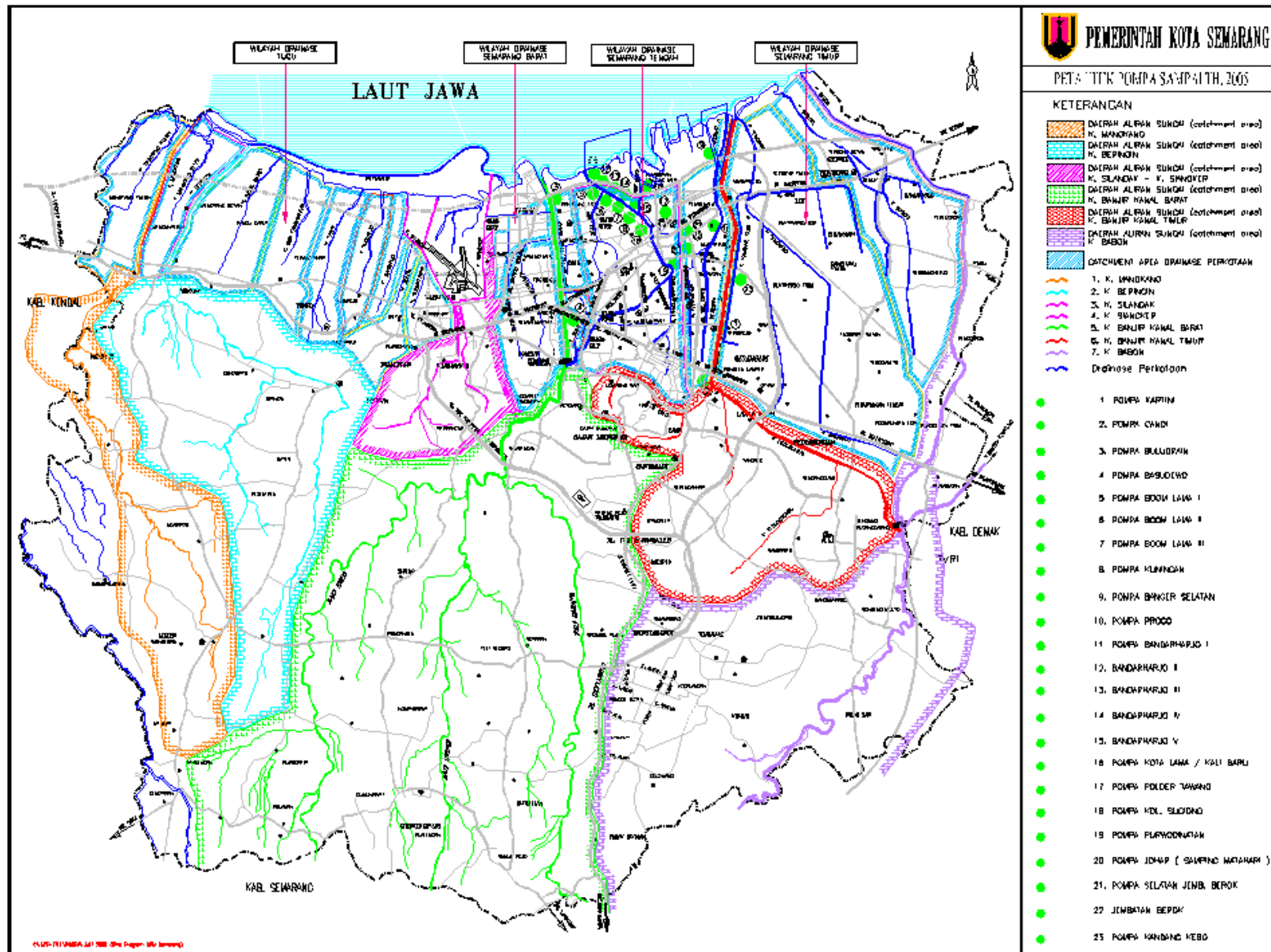
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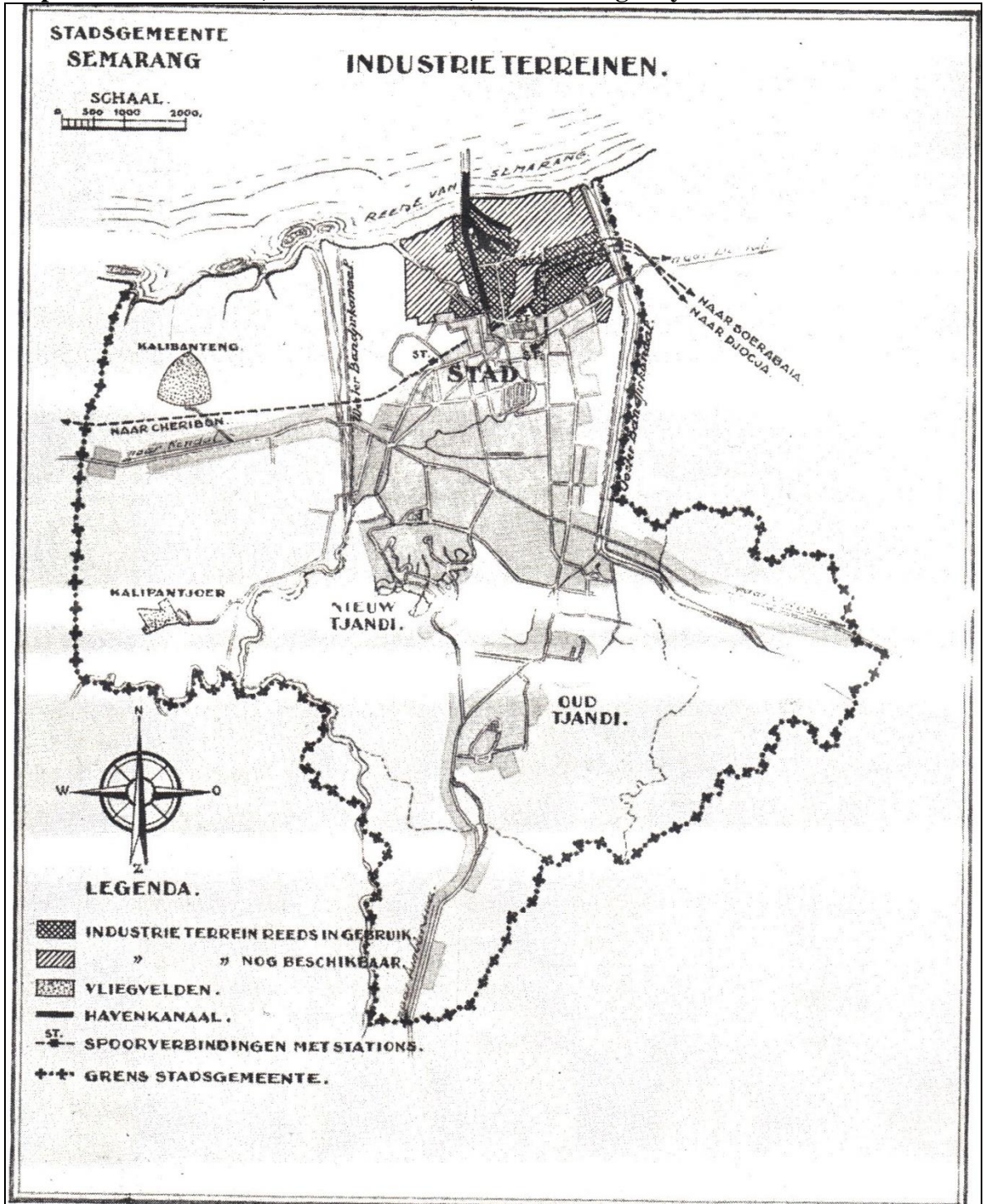
Source: "Kotamadya Semarang (Semarang City)" [Map], *Statistical Year Book of Semarang City in 1973*, 1973, Semarang: Central Bureau of Statistics of Semarang City.



xxxviii. Map of pumps locations in Semarang City in 2005



Source: Peta Titik Pompa Sampai Th. 2005 (Map of Pump Station in 2005) [Map], *Buku pintar pengelolaan sumber daya air Kota Semarang (Smart book of water resources management of Semarang City)*, 2010, Semarang: Department of Water Resources, Energy and Mineral Resources of Semarang City.

xxxix. Map of Industrial site (*industrie terreinen*) in Semarang City in 1938

Afb. 1. Industrieterreinen van Semarang.  
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Source: Baldinger, H.TH., "Semarang als industrie-stad", *Locale Techniek Indisch Bouwkundig Tijdschrift*, March-April 1938.

## GLOSSARY OF TERMS AND ABBREVIATION

Anggaran Pendapatan Belanja Daerah (APBD)	:	Regional (Municipality) Budget
Anggaran Pendapatan Belanja Nasional (APBN)	:	State Budget
Badan Geologi	:	Geological Agency
Badan Lingkungan Hidup	:	Agency of Environment
Badan Meteorologi, Klimatologi, dan Geofisika	:	Agency for Meteorological, Climatological, and Geophysics
Badan Nasional Penanggulangan Bencana (BNPB)	:	National Disaster Management Agency
Badan Penanggulangan Bencana Daerah (BPBD)	:	Regional Disaster Management Agency
Badan Perencanaan Pembangunan Daerah (Bappeda)	:	Regional Development Planning Agency
Badan Perencanaan Pembangunan Nasional (Bappenas)	:	National Development Planning Agency
Balai Besar Wilayah Sungai	:	Large River Basin Organization
Balai Pengelolaan Sumber Daya Air (BPSDA) Provinsi Jawa Tengah	:	Water Resources Management Agency, Central Java Province
Dewan Perwakilan Rakyat Daerah (DPRD)	:	Local Parliaments
Dinas Cipta Karya dan Tata Ruang, Provinsi Jawa Tengah	:	Department of Human Settlement and Spatial Planning, Central Java Province
Dinas Kelautan dan Perikanan	:	Department of Marine and Fisheries
Dinas Kesehatan	:	Department of Healthy
Dinas Pengelolaan Sumberdaya Air dan Energi and Sumber Daya Mineral (Dinas PSDA dan ESDM)	:	Department of Water Resources Management, and Energy and Mineral Resources Management
Dinas Energi and Sumber Daya Mineral Provinsi Jawa Tengah	:	Department of Energy and Mineral Resources of Central Java Province
Dinas Sosial, Pemuda dan Olahraga	:	Department of Social, Youth and Sports
Dinas Tata Kota dan Perumahan (DTKP)	:	Department of Urban Planning and Settlement
Direktorat Jendral Cipta Karya	:	Directorate General of Human Settlement
Direktorat Jendral Penataan Ruang	:	Directorate of Spatial Planning
Kabupaten	:	Regency
Kantor Kecamatan	:	District Office
Kantor Kelurahan	:	Sub-district Office
Kecamatan	:	District
Kelurahan	:	Sub-district
Kementerian Pekerjaan Umum	:	Ministry of Public Works
Kota	:	City

Lembaga Swadaya Masyarakat (LSM)	:	Non-Governmental Organization (NGO)
Lembaga Pemberdayaan Masyarakat Kelurahan (LPMK)	:	Community empowerment board
Pemerintah Daerah (Pemda)	:	Municipality
Perusahaan Daerah Air Minum (PDAM)	:	Regional Drinking Water Company
PT. Indonesian Power	:	Indonesian Power Corporation
PT. Kereta Api Indonesia (PT. KAI)	:	Indonesian Railway Company
PT. Pelabuhan Indonesia (Pelindo)	:	Indonesian Port Corporation
Perusahaan Pertambangan Minyak dan Gas Bumi Negara (PT. Pertamina)	:	Pertamina Company
Rukun Tetangga (RT)	:	Cohesive group of households ( <i>RT</i> community)
Rukun Warga (RW)	:	Group of RT's ((RW community)
Rupiah (Rp.)	:	Indonesian Rupiah (IDR)



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## **RESUME SUBSTANTIEL**

**Communities' Contributions to Urban Resilience Process:  
a Case Study of Semarang City (Indonesia)  
Toward Coastal Hydrological Risk**

**{Contributions des communautés au processus de la résilience  
urbaine : une étude de cas de la ville de Semarang (Indonésie)  
face au risque hydrologique côtier}**

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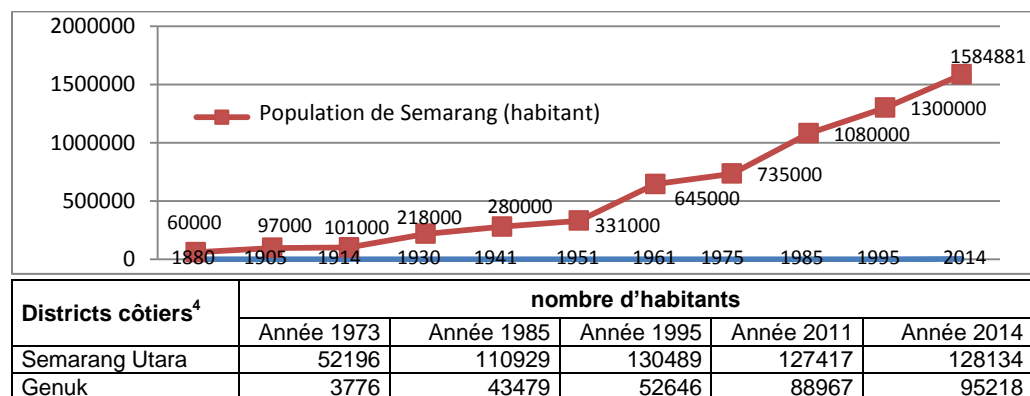
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## I. Problématique

### La ville de Semarang est emblématique des villes indonésiennes vulnérables au risque hydrologique côtier

Semarang est une des villes côtières de Java qui est l'île la plus densément peuplée dans le monde.<sup>1</sup> Elle est une des plus grandes villes indonésiennes avec une population d'environ 1, 584, 068 habitants en 2014.<sup>2</sup> En tant que capitale de la province de Java central, cette ville joue un rôle central pour le développement régional. Par ailleurs, elle a été désignée par le gouvernement national comme l'un des centres économiques de l'île de Java qui doit soutenir le développement national, en particulier l'industrialisation et la prestation de services entre 2011 et 2025.<sup>3</sup> L'existence du port de Tanjung Mas au nord de la ville influence la croissance urbaine et le développement urbain de Semarang. Ce point nodal pour le commerce et l'industrialisation renforce le développement économique de la province de Java central et de celle de Yogyakarta. Semarang était une ville importante depuis l'époque du gouvernement hollandais (1800-1942). Dans cette période, Semarang a été développée par l'autorité hollandaise comme une zone du commerce (port) et une zone de défense (l'ancienne zone urbaine). Semarang a connu une croissance significative depuis les années 1960. La population a presque doublé pendant les années 1950 et les années 1960. Cependant, la croissance de la population dans les années 1960 était différente de celle de l'époque de la municipalité hollandaise qui contrôlait la croissance de la population de la ville de Semarang. Des habitants ont également quitté la ville pendant la période de la guerre, ce qui eut un impact sur le volume de la population de Semarang durant cette période.



**Figure 1. Croissance démographique de la ville de Semarang**

Source: Cobban, J.L., 1992, "Exporting Planning: The work of Thomas Karsten in Colonial Indonesia", in: Dutt, A.K., Costa, F.J., Aggarwal, S., Noble, A.G. (eds), 1994, *The Asian City: Processes of Development, Characteristics and Planning*, Dordrecht / Boston: Kluwer Academic Publishers; Brommer, B., Budiharjo, E., Montens, A.B., Setiadi, S., Sidharta, A., Siswanto, A., Soewarno, Mr., Stevens, Th., 1995, *Semarang Beeld van Eenstad*, Purmerend: Asia Maior; *Kotamadya Semarang dalam Angka 1973*, Semarang: Bureau central des statistiques de la ville de Semarang; *Kotamadya Daerah Tingkat II Semarang dalam Angka 1995*, Semarang: Bureau central des statistiques de la ville de Semarang; *Kota Semarang dalam Angka 2011*, Semarang: Semarang: Bureau central des statistiques de la ville de Semarang; *Kota Semarang dalam Angka 2015*, Semarang: Semarang: Bureau central des statistiques de la ville de Semarang; *Penduduk Kodya Dati II Semarang Pertengahan Tahun 1985*, Semarang: Bureau central des statistiques de la ville de Semarang.

*Semarang connaît encore une croissance démographique positive. Cette situation indique que le processus de l'urbanisation de la ville de Semarang et la croissance économique régionale de la province de Java central se poursuivent toujours.*

<sup>1</sup> La population de l'île de Java en 2010 est environ 136.610.590 habitants (57, 4 % de la population indonésienne). Cf. Statistic Indonesia, *Population of Indonesia by Province 1971, 1980, 1990, 1995, 2000 and 2010* [Web], récupéré le 28 Décembre, 2015, du site://www.bps.go.id/linkTabelStatis/ view/id/1267.

<sup>2</sup> *Semarang in Figures 2015*, Semarang: Central Bureau of Statistics of Semarang City.

<sup>3</sup> *Masterplan Acceleration and Expansion of Indonesia Economic Development, 2011-2025*, 2011, Jakarta: Ministry for Economic Affairs.

<sup>4</sup> Les zones industrielles dans la région côtière de Semarang sont concentrées dans les deux districts qui ont une forte densité de peuplement. De plus, l'ancienne ville coloniale est située dans le district de Semarang Utara. Ce district est l'un des centres urbains de Semarang.



L'éventail des productions indonésiennes s'est largement ouvert lors de la rapide industrialisation qui a marqué les années 1970 ainsi que la fin des années 1980; et la plupart des entreprises industrielles sont installées à Java et aussi Sumatra.<sup>5</sup> La politique de l'industrialisation en Indonésie a désigné la ville de Semarang comme le centre du développement de la province de Java central depuis les années 1980. Ce processus a accéléré l'exode rural vers la ville de Semarang où les peuples sont concentrés dans la région côtière. Par conséquent, cette zone a connu une rapide croissance démographique qui a entraîné l'étalement de l'espace urbain construit. Cependant, même si avaient cours la croissance économique urbaine et l'urbanisation, l'esprit de convivialité a toujours existé dans la vie des communautés urbaines.

Parallèlement à son rôle important dans la province de Java central, la ville de Semarang est vulnérable face à un risque d'inondation. En effet, des inondations ont récemment touché quelques villes côtières indonésiennes. Mais, dans notre cas, la ville de Semarang est soumise au risque d'inondation depuis longtemps. Génération après génération, il menace encore la ville de Semarang. Depuis l'époque du gouvernement hollandais, la municipalité a tenté de réduire le risque d'inondation par le développement du système de drainage urbain ayant entraîné la mise en œuvre de canalisations et canaux de dérivation. Néanmoins, ce problème n'a pas encore été résolu, et cette situation demeure un obstacle pour le développement urbain.

Le risque d'inondation dans la ville de Semarang n'est pas seulement causé par l'insuffisance du système de drainage urbain pour permettre l'évacuation des eaux pluviales, en particulier lors de la saison des pluies, mais aussi par les effets des hautes marées, en particulier dans la zone côtière. Le phénomène de *Rob*<sup>6</sup> menace souvent cette ville depuis le milieu des années 1980 en raison de l'industrialisation et de la rapide croissance démographique. Les activités portuaires et les zones industrielles accélèrent l'urbanisation dans la ville de Semarang par l'augmentation du nombre d'établissements et l'extension de la zone urbaine. La construction des zones urbaines augmente l'écoulement des eaux en réduisant la quantité du terrain qui puisse absorber les précipitations.<sup>7</sup> Cela accentue aussi l'affaissement du sol qui se produit dans la zone côtière de Semarang. En raison de ce processus, la côte nord de la ville de Semarang a connu une croissance des phénomènes d'inondation par la mer au cours des trois dernières décennies.<sup>8</sup> Le risque d'inondation augmente à cause de la croissance urbaine et rend également les gens plus vulnérables et menace les biens économiques ; l'aléa d'inondation augmente également en raison de la réduction de l'alluvionnement du delta, l'affaissement lié à l'exploitation des ressources naturelles, les effets du changement climatique incluant, par exemple, les événements météorologiques extrêmes, tels que des typhons, et la montée du niveau de la mer.<sup>9</sup> Ces événements sont observables notamment dans la ville de Semarang. Le risque d'inondation, en particulier, sous la forme de *rob*, perturbe les activités urbaines, tandis que les communautés et leur environnement sont plus vulnérables. Le risque du *rob* est aggravé par les hautes marées mensuelles ; donc, cela menace la vie quotidienne des communautés

<sup>5</sup> Franck, M., 1991, "Deux processus d'urbanisation à Java-Est en Indonésie", *Cahiers de géographie du Québec*, vol. 35, n° 96, pp. 513-534.

<sup>6</sup> *Rob* est une expression locale qui désigne l'inondation à cause de la marée.

<sup>7</sup> Florida Division of Emergency Management, "Flooding Brochure", récupéré le 28 décembre 2015, du site <http://floridadisaster.org/EMTOOLS/Severe/documents/Flood%20Brochure.pdf>.

<sup>8</sup> Abidin, H.Z., Andreas, H., Gumilar, I., Sidiq, T.P., Gamal, M., Murdohardono, D., Supriyadi, Fukuda, Y., 2010, "Studying Land Subsidence in Semarang (Indonesia) Using Geodetic Methods", in: *FIG Congress Facing the Challenges-Building the Capacity*, Sydney.

<sup>9</sup> Chan, F.K.S., Mitchell, G., Adekola, O., McDonald, A., 2012, "Flood Risk in Asia's Urban Mega-Deltas Drivers, Impacts and Response", *Environment and Urbanization ASIA*, vol. 3, n° 1, pp. 41-61.

côtières. Le phénomène du *rob* peut se produire sur la côte de Semarang, même lorsqu'il n'y a aucune pluie. Cela est pire pendant la saison de la pluie.<sup>10</sup>

### **Le risque d'inondation est-il le problème urbain non résolu de la ville de Semarang ?**

Depuis les années 1980, l'accélération de la croissance urbaine de la ville de Semarang n'a pas été étayée par les infrastructures adéquates. Les caractéristiques de la zone côtière sont très peu prises en compte dans le développement urbain. Par conséquent, le risque d'inondation, en particulier le phénomène du *rob* devient le problème chronique de la ville de Semarang. Dans les documents locaux d'urbanisme entre 1975 et 2000, les enjeux du risque du *rob* n'étaient pas considérés. En conséquence, les dégradations environnementales et les destructions des infrastructures se poursuivent dans la zone côtière de Semarang. Par ailleurs, la vie communautaire est toujours menacée par le risque d'inondation. Toutefois, les récents documents locaux d'urbanisme de la ville de Semarang avaient fait des progrès considérables dans les enjeux du risque côtier; le nombre des enjeux relatifs aux catastrophes discutés dans les documents locaux d'urbanisme de 2010 à 2030 est beaucoup plus élevé que ceux de 2000 à 2010.<sup>11</sup> Cette situation indique que les institutions urbaines sont de plus en plus conscientes des risques côtiers, lorsqu'ils élaborent les politiques de la gestion du risque urbain, y compris les efforts pour résoudre les risques d'inondation dans la ville de Semarang. L'aménagement du territoire en Indonésie<sup>12</sup> devrait aussi prendre davantage en compte les efforts de la réduction du risque urbain.

Les institutions urbaines ont établi quelques plans du système de drainage urbain en collaboration avec les acteurs internationaux pour résoudre le risque d'inondation dans la ville de Semarang depuis les années 1990 comme le schéma directeur du développement des ressources en eaux et l'étude de faisabilité pour le contrôle urgent des crues et le drainage urbain de la ville de Semarang et de sa périphérie élaborée par Agence japonaise de coopération internationale/JICA (1993), le projet du contrôle des crues et l'étude de la préparation de la collaboration créée par Snowy Mountains Engineering Corporation/ SMEC (Australia) (1999), le projet du schéma directeur du drainage urbain de Semarang élaboré par le ministère des Travaux publics (2000), la conception détaillée du contrôle des crues, du drainage urbain et du développement des ressources en eaux de la ville de Semarang créée par CTI Engineering International Co., Ltd/ JICA (2000), et le schéma directeur du drainage urbain (2007). Le dernier schéma directeur est composé des plans hydrologiques globaux et est basé sur les précédents schémas directeurs ou les études de faisabilité du système de drainage urbain.

En fait, quelques projets hydrologiques, qui sont fondés sur ces plans, ont été mis en place pour résoudre le risque d'inondation en particulier le phénomène du *rob* depuis les années 1990 tels que les réhabilitations des canaux de dérivation et des rivières, le développement du polder de Tawang<sup>13</sup>, et quelques systèmes du pompage dans la zone côtière de Semarang. Mais ces projets étaient inefficaces. En conséquence, le risque d'inondation continue de menacer la ville de Semarang, et les communautés côtières qui sont très vulnérables en cas du risque d'inondation. Même si des améliorations ont été faites, les systèmes récents de la gestion de l'inondation ont échoué à résoudre l'ensemble des

<sup>11</sup> Sutanta, H., Rajabifard, A., Bishop, I., 2010, "Studying Spatial Plan in Coastal Urban Environment-Facing Global Threat and Adapting to Local Condition", in: *FIG Congress Facing the Challenges-Building the Capacity*, Sydney.

<sup>12</sup> L'aménagement du territoire (en Indonésie), loi n°26/2007. L'émergence de cette loi s'effectue en conjonction avec la loi n° 24/2007 concernant la gestion de la catastrophe. La précédente loi de l'aménagement du territoire (n° 24/1992) était très peu prise en compte dans la gestion du risque urbain.

<sup>13</sup> Le polder (bassin de rétention) était construit sur une superficie d'un hectare qui est situé dans le district de Semarang Utara.

problèmes de l'inondation côtière.<sup>14</sup> Le gouvernement local croit que l'usage conjoint des mesures structurelles et non-structurelles est la meilleure façon de résoudre les phénomènes d'inondation. Malheureusement, ces efforts n'ont pas été suffisants pour surmonter les problèmes qui ont causé la fréquente inondation dans la ville.<sup>15 16</sup>

Par ailleurs, les institutions urbaines visent à résoudre le risque d'inondation par quelques plans et projets, tels que le paquet du projet du Barrage de Jatibarang en collaboration avec le gouvernement japonais, le projet pilote du Polder de Banger en coopération avec le gouvernement hollandais, et aussi le projet de la résilience urbaine dans la programme d'Asian Cities Climate Change Resilience Network (ACCCRN) initié par Mercy Corps (ONG internationale). Les institutions urbaines ont été soutenues par le gouvernement central (national et celui de la province de Java central) pour la mise en œuvre de ces projets. Néanmoins, ces projets sont encore en cours de réalisation ; donc, l'efficacité de la réduction du risque d'inondation peut être questionnée. L'efficacité des projets hydrologiques urbains ne peut pas être clairement mesurée. L'inondation devient le risque naturel côtier qui n'est pas séparé de la croissance urbaine et de la vie des habitants.

### **Les efforts d'auto-assistance de la communauté comme pratiques locales de l'adaptation au risque hydrologique à l'échelle du quartier**

À l'origine de cette étude, il y a trois observations. Premièrement, le risque d'inondation existe dans la ville de Semarang depuis plusieurs siècles, mais les projets et plans hydrologiques n'ont pas résolu ce problème. Deuxièmement, il existe des habitats qui perdurent et des activités urbaines qui restent dynamiques malgré le risque permanent d'inondation. La zone côtière de la ville de Semarang continue de s'étendre et le centre urbain reste toujours sur la côte comme par le passé, survivant à l'inondation et à ses impacts à court et moyen termes. Par conséquent, les communautés semblent réduire l'impact du risque hydrologique par leurs capacités d'auto-assistance. Elles ont produit des formes locales adaptées au risque par des transformations et pratiques architecturales. Les communautés ont cherché à limiter les risques d'inondation par la rénovation des infrastructures du quartier telles que la construction et l'élévation des niveaux de rues, l'amélioration des digues autour des drainages urbains et des rivières, le nettoyage des drainages locaux, y compris le dragage des déchets et des sédiments, et aussi la réhabilitation des espaces publics locaux. Les communautés ont mis en place des efforts collectifs avec l'esprit du *gotong royong*. Ce dernier est dérivé des traditions du village javanais qui sont associées au travail communautaire et à la responsabilité des individus dans le sens où ils ont certaines obligations morales envers la société en général.<sup>17</sup> De plus, les ménages des communautés côtières tentent de rénover leurs maisons eux-mêmes par leur surélévation, chaque année,

<sup>14</sup> Marfai, M. A., King, L., 2008, "Coastal Flood Management in Semarang, Indonesia", *Environmental Geology*, Vol. 55, pp. 1507–1518.

<sup>15</sup> Dewi, A., 2007, "Community-Based Analysis of Coping with Urban Flooding: a Case Study in Semarang, Indonesia", Master thesis in Geo-Information Science and Earth Observation, ITC-University of Twente.

<sup>16</sup> Les mesures structurelles sont toutes les constructions physiques destinées à réduire ou éviter les impacts possibles des aléas, ou les mesures qui relèvent de l'application de techniques pour le développement de la résilience et la résistance aux aléas dans des systèmes ou des structures. En revanche, les mesures non-structurelles représentent les mesures autres que celles relevant de la construction physique : ce sont, donc, celles qui utilisent de la connaissance, des pratiques ou d'accord pour la réduction des risques et des impacts, notamment grâce à la politique, aux règlements, à la sensibilisation du public, à la formation et à l'éducation. Cf. United Nations Office for Disaster Risk Reduction, "Structural and non-structural measures", *Terminology* [Web], récupéré le 19 Janvier 2015, du site://www.preventionweb.net/english/professional/terminology/v.php?id=505.

<sup>17</sup> Rigg, J., Allott, A., Harrison, R., Kratz, U., 1999, "Understanding Language of Modernization: A Southeast Asian View", *Modern Asian Studies*, vol. 33, Issue 3, pp. 581-602.

pour réduire l'impact du risque hydrologique. Cependant, ces efforts individuels dépendent des capacités de chaque ménage. Certains ménages ont rénové entièrement leurs maisons, mais les autres peuvent rénover partiellement leurs maisons, par exemple, avec l'élévation des étages. Les efforts de la communauté sont temporaires et les pratiques modestes. Néanmoins, les communautés effectuent régulièrement ces initiatives depuis l'émergence du risque du *rob*.

Cette situation nous incite à interroger le processus de résilience à l'échelle de la communauté. En fait, les institutions urbaines gèrent le risque hydrologique avec beaucoup de difficultés ; c'est dans ce contexte que l'efficacité du processus de résilience urbaine peut être questionnée. Les communautés mettent en œuvre leurs efforts d'adaptation en se fondant sur leurs capacités d'auto-assistance pour assurer leur viabilité et leur qualité de vie. Les situations montrent que le risque est lié à la culture et aux pratiques des communautés. Dans le domaine de l'eau, le risque inondation fait l'objet de politiques de prévention et de gestion qui, avec les mesures de sensibilisation du public, constituent le corpus de ce que l'on appelle la « culture du risque ». <sup>18 19</sup> A l'échelle de la communauté, la culture du risque est associée à la prévention et à la politique de gestion qui sont initiées et organisées par les efforts d'auto-assistance des communautés. Ces mesures sont certainement fondées sur la conscience du risque d'inondation dans leurs territoires. En plus, la culture du risque est liée aux perceptions des communautés concernant l'existence du risque. Le phénomène du *rob* menace souvent la vie quotidienne des communautés et influence leurs perceptions du risque et leurs réactions face au risque. L'existence du risque d'inondation de la ville de Semarang n'est pas une nouvelle situation dans la vie de communautés côtières.

Cependant, la résilience de la communauté (formes et effets) peut être analysée comme l'un des éléments du processus de résilience urbaine. L'influence de la résilience de la communauté peut se refléter dans le processus de résilience à l'échelle de la ville. Comment le processus de résilience de la communauté contribue-t-elle à la gestion du risque urbain ? Ces situations nous font comprendre que le rôle et la participation des communautés, ses dimensions sociales, et comment les communautés influencent la gestion du risque urbain et de la résilience face aux risques hydrologiques dans la ville de Semarang.

## II. Objectif et hypothèses

L'objectif de cette recherche est de comprendre les formes et les influences de la résilience à l'échelle locale (communautés et ses quartiers) et aussi les interactions entre le processus de résilience dans le contexte local et le contexte urbain. Les dynamiques du développement de cet espace, et les usages des ressources et ses impacts écologiques dépendent de la répartition géographique des activités humaines et ses interactions avec les processus biophysiques à différentes échelles.<sup>20</sup> La ville est une unité de l'espace qui est utile pour décrire ces interactions. Dans notre analyse, la gestion du risque hydrologique urbain est aussi liée aux relations entre les communautés et les institutions urbaines lorsqu'ils développent la résilience urbaine face au risque hydrologique par les transformations spatiales, les projets hydrologiques urbains et les pratiques locales. Ils s'efforcent de créer des infrastructures pour la gestion de l'environnement et d'établir les capacités de s'adapter au risque d'inondation.

<sup>18</sup> Aubry, H., Marcondes, L. (eds.), 2014, *La culture du risque en question. Des inondations aux débordements nucléaires*, Paris : La Dispute.

<sup>19</sup> C'est la connaissance par tous les acteurs (élus, techniciens, citoyens, etc.) des phénomènes naturels et l'appréhension de la vulnérabilité. Cf. Ministère de l'écologie du développement durable et de l'énergie, "culture du risque", Glossaire [Web], récupéré le 19 Janvier 2016, du site://www.georisques.gouv.fr.

<sup>20</sup> Alberti, M., 2008, *Advances in Urban Ecology Integrating Humans and Ecological Processes in Urban Ecosystems*, New York: Springer US.



L'analyse de la résilience urbaine face à l'inondation produit la connaissance des interactions entre les acteurs urbains (institutions et communautés) et leur réactivité au risque d'inondation. Leurs capacités d'adaptation deviennent un facteur-clef pour développer la résilience urbaine. La réduction de la vulnérabilité et le renforcement de la capacité d'adaptation : la politique et les collectivités décisionnelles d'une part, et le grand public d'autre part.<sup>21</sup>

Pour répondre à notre objectif, nous développons une hypothèse que l'inefficacité de la gestion du risque hydrologique (plans et projets) et l'aménagement du territoire affectent les communautés. Ces dernières cherchent des solutions fondées sur leurs perceptions et initiatives pour protéger leurs quartiers par les pratiques locales et transformations spatiales comme les formes d'adaptation au risque hydrologique. D'un côté, ces situations accélèrent le processus de la résilience territoriale, mais d'un autre côté elles génèrent des inégalités territoriales au sein de la ville. Ces situations indiquent que la résilience du risque hydrologique manque à l'échelle urbaine, mais qu'en revanche, elle fonctionne à l'échelle locale. Néanmoins, la résilience urbaine face à l'inondation et la réduction du risque d'inondation nécessitent la combinaison entre les pratiques d'adaptation et un système adéquat créé par les institutions urbaines.

Si la gestion du risque hydrologique urbain (plans et projets) et l'aménagement du territoire sont inefficaces, le risque hydrologique menace toujours la ville, malgré plusieurs projets urbains qui ont été mis en œuvre par les institutions urbaines. En outre, la rapide croissance urbaine de la zone côtière de Semarang aggrave le risque hydrologique et témoigne de l'inefficacité de l'aménagement du territoire. Les communautés côtières ont tenté de réduire les impacts du risque hydrologique dans leurs quartiers depuis longtemps. Elles mettent en œuvre des pratiques locales qui sont basées sur leur connaissance du risque hydrologique. Elles développent des efforts temporaires et routiniers pour s'adapter au risque. Elles essaient principalement d'éviter l'aléa d'inondation. Elles ont des idées et des plans qui restent d'ampleur limitée pour la réduction du risque hydrologique. Cependant, ils mettent toujours en œuvre des pratiques locales afin de limiter les impacts de l'aléa hydrologique avant, pendant, et après les occurrences. Ces situations ne révèlent pas un processus de résistance, mais plutôt de résilience. Elle est la capacité d'un système qui persiste même s'il est perturbé, sans aucune réaction.<sup>22</sup>

Néanmoins, nous supposons que les pratiques communautaires pour la réduction du risque d'inondation ont des conséquences négatives comme l'inégalité spatiale. Cette notion est discutée en termes d'accessibilité inégale aux services publics entre les différents groupes de la population ; ceci est observable dans un endroit où la densité de population est élevée par rapport aux services disponibles.<sup>23</sup> Trois facteurs majeurs sont susceptibles d'influer sur le degré de cohésion territoriale ou de ségrégation dans un pays en développement, en incluant le rôle directeur du public (autorités locales) combiné aux stratégies des entreprises privées qui favorise ou non la cohésion sociale et territoriale, les inégalités d'accessibilité qui peuvent être dues au financement insuffisant, et le problème de l'accès à l'eau qui est dû en partie à l'urbanisation incontrôlée et au fort développement des quartiers périphériques.<sup>24</sup>

<sup>21</sup> Vogel, C., Moser, S.C., Kasperson, R.E., Dabelko, G.D., 2007, "Linking Vulnerability, Adaptation, and Resilience Science to Practice: Pathways, Players and Partnerships", *Global Environmental Change*, vol. 17, Issues 3-4, pp. 349-364.

<sup>22</sup> Ashley, R., Garvin, S., Pasche, E., Vassilopoulos, A., Zevenbergen, C., 2007, *Advances in Urban Flood Management*, London: Taylor & Francis Group.

<sup>23</sup> Lee, G., Hong, I., 2013, "Measuring Spatial Accessibility in the Context of Spatial Disparity between Demand and Supply of Urban Park Service", *Landscape and Urban Planning*, vol. 119, pp. 85-90.

<sup>24</sup> Pflieger, G., Matthieussent, S., 2008, "Water and Power in Santiago de Chile: Socio-Spatial Segregation through Network Integration", *Geoforum*, vol. 39, n° 6, pp. 1907-1921.

Dans notre contexte, nous considérons que l'inégalité territoriale a lieu en raison de l'inégale accessibilité aux infrastructures urbaines et du fait de l'inégale mise en œuvre d'une gestion du risque hydrologique par les communautés. Les systèmes du drainage urbain approprié et les projets de la gestion du risque ne couvrent pas encore toute la ville, notamment dans la zone côtière. En conséquence, les communautés tentent d'anticiper ces faiblesses au moyen d'efforts d'auto-assistance qui dépendent des capacités de l'économie communautaire. Les pratiques du développement urbain, comme la mise en valeur des sols, qui sont mises en œuvre par les entreprises privées aggravent la vulnérabilité urbaine face au risque d'inondation et l'inégalité territoriale. Ces situations affaiblissent l'adaptation et le processus d'apprentissage des acteurs urbains. La participation insuffisante de la communauté dans la gestion du risque hydrologique augmente la vulnérabilité face à l'inondation et entrave le processus de résilience.

### III. L'état de l'art

Le terme de résilience est devenu un objet de recherches et de projets depuis les années 2000, mais il a émergé dès les années 1970. André Dauphiné et Damienne Provitolo (2007), géographes qui sont experts dans la science de la gestion des catastrophes, ont mentionné que le terme de résilience vient du latin *resilio* qui signifie rebondir.<sup>25</sup> Cutter et al (2008), chercheurs dans le domaine de l'aléa et de la vulnérabilité face au risque, ont indiqué que C.S. Holling (1973) a également utilisé le terme de résilience dans la science de l'écologie.<sup>26</sup> C.S. Holling, professeur dans la science d'écologie, a mis en évidence que la résilience détermine la persistance de la relation dans un système. Elle mesure la capacité de ces systèmes à absorber les changements des variables d'état, des variables de conduite, et les paramètres, et à persister.<sup>27</sup> Récemment, Mark Pelling (2003), professeur de géographie et expert dans le domaine de l'évaluation du risque, a montré que la résilience est la capacité d'ajustement aux menaces ; d'atténuation ou d'évitement des dommages ; elle peut être observée dans les constructions au regard de leur capacité de résistance aux aléas ou de la capacité d'adaptation d'un système social.<sup>28</sup>

Thomas J. Campanella et Lawrence J. Vale (2005), professeurs d'urbanisme, affirment que la résilience urbaine implique la capacité physique de rebondir après avoir été confronté à un obstacle significatif, telle une balle en caoutchouc qui rebondit sur le trottoir ; mais les villes ne sont pas des balles en caoutchouc et les catastrophes ne sont pas une surface d'asphalte, à partir de laquelle un rebond peut être prédit avec exactitude à l'aide d'un ensemble d'équations mathématiques.<sup>29</sup>

Lisa Benton-Short et John Rennie Short, professeurs et experts dans le domaine de l'évaluation de l'environnement urbain, affirment dans leur ouvrage « Cities and Nature » que les villes résilientes expriment la puissance de l'espoir et de l'opportunité face à la catastrophe. Selon eux, la plupart des inventions humaines, telles les villes expriment aussi les émotions humaines, notamment l'espoir face à l'adversité. Ils ont également déclaré que

<sup>25</sup> Dauphiné, A., Provitolo, D., 2007, "La résilience : un concept pour la gestion des risques", *Annales de géographie*, n° 654, pp. 115-125.

<sup>26</sup> Cutter, S.L., Barnes, L., Berry, M., Burton, C., Evans, E., Tate, E., Webb, J., 2008, "A Place-Based Model for Understanding Community Resilience to Natural Disasters", *Global Environmental Change*, vol. 18, Issue 4, pp. 598-606.

<sup>27</sup> Holling, C.S., 1973, "Resilience and Stability of Ecological Systems", *Annual Review of Ecology and Systematics* 4, pp. 1-23.

<sup>28</sup> Pelling, M., 2003, *The Vulnerability of Cities: Natural Disaster and Social Resilience*, London: Earthscan Publications Ltd.

<sup>29</sup> Campanella, T.J., and Vale, L.J., 2005, *The Resilient City: How Modern Cities Recover from Disaster*, Oxford: Oxford University Press.

les villes résilientes ont connu des catastrophes environnementales et les ont surmontées.<sup>30</sup> A l'intersection de ces différents points de vue, la résilience devient la capacité d'un système pour absorber et pour s'adapter aux perturbations (situation négative) pendant les événements de risque et pour se rétablir dans les post-événements, de sorte que le système peut anticiper et éviter les occurrences futures.

En outre, la résilience dans un contexte urbain entremêle deux dimensions: la capacité d'un système physique urbain et la capacité d'un système humain pour absorber et pour s'adapter au risque. David R. Godschalk (2003), professeur émérite dans le domaine de la planification urbaine et régionale, et aussi chercheur au Centre des aléas côtiers des États-Unis, a fait valoir que la ville résiliente est un réseau durable de systèmes physiques et de communautés humaines.<sup>31</sup>

Il a affirmé que les systèmes physiques sont les composantes de l'environnement construit et naturel de la ville, y compris les routes, les bâtiments, les infrastructures, les communications et les installations d'énergie, ainsi que les cours d'eau, les sols, la topographie, la géologie, et d'autres systèmes naturels. En outre, Chris Zevenbergen et Assela Pathirana, professeurs et chercheurs au département du génie de l'eau de l'UNESCO-IHE, affirment que la résilience des villes dépend à la fois de ses formes physiques et de caractéristiques, ainsi que de la capacité des personnes et de leur comportement social.<sup>32</sup>

Dans notre recherche, ces dimensions sont prises en compte pour analyser le processus de résilience urbaine. Le système physique urbain (la gestion de l'occupation du sol et les infrastructures), et le système humain (communautés) constituent une unité spatiale, de sorte que la résilience urbaine est explorée à travers les capacités des deux systèmes. Ces dimensions peuvent être analysées comme des entités qui affectent les autres. Le niveau optimal de la résilience urbaine est atteint lorsque les deux systèmes fonctionnent correctement. Notre cas indique que le manque des capacités du système physique urbain est tel que le système humain devient l'objet principal de l'évaluation des processus de résilience dans les villes.

Jusqu'à présent, la résilience urbaine a été évaluée selon une seule dimension, que ce soit le système physique urbain ou le système humain. La plupart des chercheurs dans le domaine du génie urbain examine la résilience urbaine à l'aune des capacités des infrastructures. Bruno Barroca et Damien Serre (2014) ont affirmé que la résilience des systèmes techniques est basée sur l'identification de quatre types complémentaires de résilience: cognitifs, fonctionnels, corrélatifs, et organisationnels.<sup>33</sup> Ils soutiennent que la résilience cognitive se réfère à la culture qui permet le développement de systèmes techniques ; de même, les résiliences fonctionnelle et corrélative désignent les capacités (de l'offre et de la demande) des systèmes techniques, tandis que la résilience organisationnelle met l'accent sur la gestion des systèmes techniques. De même, Hélène Beraud (2013) analyse la résilience des infrastructures de gestion des déchets lorsqu'elles sont confrontées au risque d'inondation dans sa thèse "*Initier la résilience du service de gestion des déchets aux catastrophes naturelles, le cas des territoires urbains et de l'inondation*".<sup>34</sup> En outre, Marie Toubin (2014) explique que

<sup>30</sup> Benton, L., Short, J.R., 2008, *Cities and Nature*, London: Routledge.

<sup>31</sup> Godschalk, D.R., 2003, "Urban Hazard Mitigation: Creating Resilient Cities", *Journal of Natural Hazards Review*, vol. 4, Issue 3, pp. 136–143.

<sup>32</sup> Zevenbergen, C., Pathirana, A., 2013, "Managing Urban Flooding in the Face of Continuous Change" in: Serre, D., Barroca, B., Laganier, R., *Resilience and Urban Risk Management*, London: Taylor & Francis Group.

<sup>33</sup> Barroca, B., Serre, D., 2014, "Behind the Barriers: A Conceptual Model", *SAPIENS*, Vol. 6, n° 1, pp.1-10.

<sup>34</sup> Beraud, H., 2013, *Initier la résilience du service de gestion des déchets aux catastrophes naturelles, le cas des territoires urbains et de l'inondation*, Thèse en génie urbain, Université Paris-Est.

la résilience urbaine est liée aux capacités des infrastructures et à la gestion institutionnelle chargée de faire face aux risques d'inondation.<sup>35</sup>

A l'inverse, la résilience urbaine a parfois été évaluée au regard des capacités du système humain à faire face aux risques. Les capacités d'adaptation des communautés constituent, dès lors, l'objet essentiel de l'étude. Prasad et al. (2009), chercheurs en pratique des changements climatiques à l'Institut de la Banque mondiale, indiquent qu'une société résiliente peut résister aux chocs et se rétablir quand il est nécessaire. Ils affirment également que la résilience des systèmes sociaux donne à la communauté cette valeur ajoutée que forme la capacité humaine à anticiper et planifier l'avenir ; selon eux, les habitants dépendent de la résilience pour leur survie.<sup>36</sup> En outre, Peter Walters (2015), chercheur dans le domaine de la sociologie urbaine, soutient que la résilience de la communauté est un concept qui a émergé dans les sciences sociales au sein de la littérature écologique comme un moyen d'évaluer et de mesurer la capacité des communautés à répondre et s'adapter à une catastrophe.<sup>37</sup>

Loy Rego et Arghya Sinha Roy (2009), chercheurs de l'Asian Disaster Preparedness Center, indiquent que la résilience d'une communauté, en tant qu'elle est confrontée aux événements de l'aléa potentiel, est déterminée par le degré plus ou moins élevé selon lequel la communauté dispose des ressources nécessaires et est capable de s'organiser à la fois avant et pendant le temps de l'occurrence de l'aléa.<sup>38</sup> Les chercheurs du Community and Regional Resilience Institute définissent la résilience de la communauté comme la capacité d'anticiper les risques, afin de limiter l'impact, et de rebondir rapidement par la survie, l'adaptabilité, l'évolution et la croissance dans un contexte de perturbation.<sup>39</sup> En outre, Peter Eachus, chercheur en psychologie, a fait valoir que la résilience des personnes provient de leur interaction avec leur environnement, au sein des institutions concernées, par exemple les collectivités locales ou les groupements présents au sein de la communauté – ceci renforçant ainsi la résilience de la communauté.<sup>40</sup> Ces affirmations indiquent comment la résilience de la communauté est liée aux capacités du système humain et de ses institutions pour faire face aux risques urbains.

Notre recherche se concentre sur la résilience de la communauté. Cependant, nous allons analyser le développement de la résilience de la communauté dans un contexte urbain. Non seulement nous analysons la résilience de la communauté à l'échelle locale, mais nous cherchons également à révéler comment les communautés et leurs aspects sociaux influencent le processus de résilience urbaine. Jusqu'à présent, les recherches antérieures sur la résilience de la communauté sont très peu prises en compte dans le contexte du processus de résilience urbaine comme une échelle pour examiner les formes et les effets de la résilience de la communauté. En outre, les aspects sociaux de la communauté sont très peu pris en compte dans l'analyse de la résilience, en particulier la culture et de la gestion des risques. Les communautés sont souvent considérées que comme des récepteurs passifs dans

<sup>35</sup> Toubin, M., 2014, *Améliorer la résilience urbaine par un diagnostic collaboratif, l'exemple des services urbains parisiens face à l'inondation*, Thèse de doctorat en géographie, Université Paris Diderot (Paris 7).

<sup>36</sup> Prasad, N., Raghieri, F., Trohanis, F.S.Z, Kessler, E., Sinha, R., 2009, *Climate Resilient Cities, A Primer on Reducing Vulnerabilities to Disasters*, Washington, DC: The International Bank for Reconstruction and Development (World Bank).

<sup>37</sup> Walters, P., 2015, "The Problem of Community Resilience in Two Flooded Cities: Dhaka 1998 and Brisbane 2011", *Habitat International*, vol. 50, pp. 51-56.

<sup>38</sup> Rego, L., Roy, A.S., 2009, *Regional Training Manual on Disaster Risk Reduction for Coastal Zone Managers*, Bangkok: Asian Disaster Preparedness Center (ADPC).

<sup>39</sup> *Definitions of Community Resilience: an Analysis*, 2013, Washington, DC: Community and Regional Resilience Institute, récupéré le 25 Décembre 2015, du site: <http://www.resilientus.org/wp-content/uploads/2013/08/definitions-of-community-resilience.pdf>.

<sup>40</sup> Eachus, P., 2014, "Community Resilience: Is it greater than the sum of the parts of individual resilience?", *Procedia Economics and Finance*, vol. 18, pp. 345-351.



la gestion des risques. Dans notre recherche, les communautés ne sont pas seulement les victimes de l'existence des aléas. Ils jouent un rôle actif dans leur protection contre l'impact des risques. Ils sont aussi les sujets ou les acteurs parties prenantes du processus de résilience. Nous considérons les communautés comme des acteurs urbains dans notre étude et nous évaluons leur rôle pour développer le processus de résilience aux échelles locales et urbaines.

### **Les perspectives pluridisciplinaires sur le risque hydrologique de la ville de Semarang**

Plusieurs chercheurs (de la géographie physique, la géologie ...) relient le risque hydrologique de la ville de Semarang à l'aléa géomorphologique, tels que l'affaissement du sol.<sup>41</sup> Ces études analysent les causes de l'affaissement du sol, de la diminution et de l'exploitation des eaux souterraines, l'intrusion d'eau de mer, l'évolution de la ligne côtière et le processus d'érosion dans la ville de Semarang. Ils affirment que l'affaissement du sol est le principal problème provoquant des risques d'inondation, en particulier le phénomène du *rob*. En outre, plusieurs chercheurs en géodésie et en science marine ont évalué le risque hydrologique de la ville de Semarang dans le passé et dans le futur. Ils ont tenté de faciliter l'élaboration de la cartographie de ses inondations.<sup>42</sup>

D'autres chercheurs en sciences de la géographie humaine se concentrent sur l'évaluation de la vulnérabilité urbaine face aux inondations, en particulier pour le phénomène du *rob* à l'échelle communautaire. Selon Marfai, King, Sarto Hadi, Sudrajat, Budiani et Yulianto (2008), l'inondation de marée (*rob*) a des impacts sur les activités quotidiennes de la communauté. Les activités du travail et les activités domestiques ne peuvent pas être effectuées normalement ; les rues dans le quartier sont bloquées par les inondations, ainsi que les services publics pour soutenir les activités domestiques, comme l'approvisionnement en eau et l'électricité qui ne peut pas être utilisée lors de la montée de l'eau de mer.<sup>43</sup> Plusieurs chercheurs se concentrent sur la façon dont les perspectives économiques sont affectées par les risques d'inondation, les pertes économiques en particulier en raison de l'existence du risque hydrologique. Rahmatullah (2010) indique que le *rob* affecte la fluidité des transports de marchandises ou des circulations humaines ; ces pertes pourraient même atteindre un milliard de roupies par jour dans la mesure où de nombreuses entreprises sont perturbées.<sup>44</sup> Par ailleurs, Ali (2010) indique que les pertes économiques sont dues aux destructions des

<sup>41</sup> Marsudi, 2001, *Prediksi Laju Amblesan Tanah di Dataran Aluvial Semarang Propinsi Jawa Tengah*, These en hydrogéologie- génie minier, l'Institut de Technologie de Bandung; Abidin, H.Z., Andreas, H., Gumilar, I., Sidiq, T.P., Fukuda, Y., 2012 (2013), "Land Subsidence in Coastal City of Semarang (Indonesia): Characteristics, Impacts and Causes", *Geomatics, Natural Hazards and Risk*, vol. 4, Issue 3, pp. 226-240; Lubis, A.M., Sato, T., Tomiyama, N., Isezaki, N., Yamanokuchi, T., 2011, "Ground Subsidence in Semarang-Indonesia Investigated by ALOS-PALSAR Satellite SAR Interferometry", *Journal of Asian Earth Sciences*, vol. 40, Issue 5, pp. 1079-1088; Marfai, M. A., King, L., 2007, "Monitoring Land Subsidence in Semarang, Indonesia", *Environmental Geology*, vol. 53, pp. 651-659; Kuehn, F., Albiol, D., Cooksley, G., Duro, J., Granda, J., Haas, S., Hoffmann-Rothe, A., Murdohardono, D., 2010, "Detection of Land Subsidence in Semarang, Indonesia, Using Stable Points Network (SPN) Technique", *Environmental Earth Sciences*, vol. 60, Issue 5, pp. 909-921.

<sup>42</sup> Nugraha, A.L., 2013, *Penyusunan dan Penyajian Peta Online Risiko Banjir rob Kota Semarang*, Master thesis in Geomatics Engineering, Gadjahmada University; Wirasatria, A., Hartoko, A., Suripin, 2006, "Study of Sea Level Rise as a Base for Rob Problem Solving in Coastal Region of Semarang City", *Jurnal Pasir Laut*, vol. 1, n° 2, pp. 31-42.

<sup>43</sup> Marfai, M.A., King, L., Sartohadi, J., Sudrajat, Budiani, S.R., Yulianto, F., 2008, "The Impact of Tidal Flooding on a Coastal Community in Semarang, Indonesia", *Environmentalist*, vol. 28, pp. 237-248.

<sup>44</sup> Rahmatullah, A.R., 2010, "Impact of Rob to Semarang Economy", *Proceeding of 1<sup>st</sup> International Conference on Regional Development*, Semarang.

bâtiments, ce qui représenterait un montant d'environ 16 milliards de roupies –soit 1 million d'euros) dans le sous-district de Bandarharjo (District de Semarang Utara).<sup>45</sup>

La côte de Semarang est très vulnérable à l'élévation du niveau de la mer. Les conséquences d'une telle catastrophe peuvent inclure des aspects physiques de construction, des aspects socio-économiques pour la communauté, des aspects démographiques, des aspects environnementaux et, enfin, des impacts sur l'économie régionale.<sup>46</sup> Ces recherches peuvent donner des informations préliminaires sur la vulnérabilité aux inondations de la zone côtière de Semarang au cours des dernières années.

Dans notre recherche, nous allons expliquer la chronologie du risque d'inondation de la ville de Semarang de l'époque coloniale néerlandaise jusqu'à aujourd'hui. Comment le risque hydrologique a-t-il émergé dans la ville de Semarang? Quelles dynamiques mettre en œuvre? Comment les acteurs urbains ont fait face à ce risque au cours du temps? La comparaison entre les différents efforts visant à réduire les risques d'inondation à différentes périodes fournira une compréhension globale de la gestion des risques d'inondation et des capacités d'adaptation en milieu urbain ; elle illustre, également, la façon dont le processus de résilience urbaine a lieu.

En outre, plusieurs chercheurs se concentrent sur l'évaluation des capacités d'adaptation de la communauté. Selon Marfai et Hizbaron (2011), les méthodes d'adaptation physique recourent à certaines techniques telles que celles de mettre l'immeuble sur le lieu le plus élevé, d'augmenter le niveau de la cour autour de la maison, d'augmenter le niveau du rez-de-chaussée et de faire un petit barrage pour empêcher l'eau d'entrer dans la maison.<sup>47</sup> Kobayashi (2004) a indiqué que, dans les maisons qui ont subsisté, les habitants dépensent une partie de leurs revenus pour financer une accumulation de sable au rez-de-chaussée, tandis que certaines familles qui en ont la possibilité, démolissent les maisons endommagées, récupèrent la terre et reconstruisent des maisons plus élevées.<sup>48</sup> Prawitasari (2009) fait valoir que la capacité à s'adapter et à faire face au risque futur d'inondation de marée est évaluable au regard des ressources économiques, des informations et des compétences, des infrastructures, de la technologie et de l'accès aux ressources.<sup>49</sup> De même, certaines études se concentrent sur les capacités d'adaptation institutionnelles pour la réduction du risque hydrologique dans la ville de Semarang. Yunita (2010) a évalué la capacité d'adaptation du projet pilote du Polder Banger (BPPP) dans *Adaptive Capacity Wheel*.<sup>50 51</sup>

<sup>45</sup> Ali, M., 2010, “*Kerugian bangunan perumahan akibat rob dan arah kebijakan penanganannya di Kelurahan Bandarharjo Kota Semarang*”, Mémoire du master du développement urbain et régional, Université Diponegoro.

<sup>46</sup> Miladan, Nur., 2009, “*Kajian kerentanan wilayah pesisir Kota Semarang terhadap perubahan iklim (Vulnerability assessment of Semarang City Coast toward Climate Change)*”, Mémoire du master du développement urbain et régional, Université Diponegoro.

<sup>47</sup> Marfai, M.A, Hizbaron, D.R., 2011, “Community Adaptive Capacity Due to Coastal Flooding in Semarang Coastal city, Indonesia”, *Analele Universităţii din Oradea – Seria Geografie*, Year XXI, n° 2, pp. 209-221.

<sup>48</sup> Kobayashi, H., 2004, “Impact Evaluation of Sea Level Rise on Indonesia Coastal Cities: Micro Approach through Field Survey and Macro Approach through Satellite Image Analysis”, *Journal of Global Environment Engineering*, vol. 10, pp.77-91.

<sup>49</sup> Harwitasari, D., 2009, “Adaptation responses to tidal flooding in Semarang, Indonesia, Master thesis in urban management and development, HIS-Erasmus University Rotterdam.

<sup>50</sup> Gupta et al. ont mis en évidence qu'il y a six dimensions pour évaluer la capacité d'adaptation de l'institution, tels que la variété, la capacité d'apprentissage, l'espace pour le changement autonome, le *leadership*, la disponibilité des ressources et la gouvernance équitable. Cf. Gupta, J., Termeer, C., Klostermann, J., Meijerink, S., Brink, M.V.D., Jong, P., Nootboom, S., Bergsma, E., 2010, “The Adaptive Capacity Wheel: a Method to Assess the Inherent Characteristics of Institutions to Enable the Adaptive Capacity of Society”, *Environmental Science & Policy*, vol. 13, Issue 6, pp. 459-471.

<sup>51</sup> Yunita, F.T., 2010, *A Developing Country Perspective on the Adaptive Capacity: Flood defence Institutions for Climate Change Adaptation in Indonesia*, Master thesis, Groningen University-Bandung Institute of Technology.

Ces perspectives seront approfondies dans notre recherche. Nous soutenons qu'il existe différentes capacités d'adaptation des acteurs urbains partie prenantes du processus. Nous allons explorer les capacités d'adaptation de chaque acteur urbain, et nous allons évaluer les relations entre ces différents moyens utilisés. D'une part, les capacités d'adaptation de la communauté devraient être analysées selon une approche sociologique. Les efforts communautaires (mesures conjoncturelles et mesures structurelles) sont, en effet, basés sur des faits socioculturels. La culture influence fortement les comportements résidentiels des différents groupes ethniques qui composent ces centres urbains et joue un rôle important dans la structure résidentielle urbaine.<sup>52</sup> Pour décrire de manière approfondie les capacités communautaires d'adaptation, nous allons non seulement analyser les diverses formes des pratiques locales pour la réduction du risque hydrologique, mais aussi expliquer leurs origines rationnelles. D'autre part, nous allons évaluer l'ensemble de la gestion du risque hydrologique de la ville de Semarang. Jusqu'à présent, ses institutions n'ont pas encore été explorées dans les études précédentes. La gestion du risque hydrologique peut être examinée à travers ses projets hydrologiques urbains, mais cette analyse devrait aussi impliquer l'évaluation des plans hydrologiques urbains. En outre, cette recherche retracera le changement de la gestion urbaine du risque hydrologique. Nous allons étudier la gestion urbaine du risque hydrologique à différentes périodes: à l'époque coloniale néerlandaise, à l'époque du premier gouvernement indonésien, et dans la dernière décennie. Nous considérons que les capacités d'adaptation institutionnelles doivent être décrites chronologiquement afin de mieux comprendre le processus de résilience aux inondations.

Il n'y a eu aucune recherche qui a mis l'accent sur la résilience urbaine face aux inondations de cas de la ville de Semarang. Le concept de résilience urbaine de la ville de Semarang a commencé à être pris en compte par la municipalité en 2009 et 2010 lorsque le projet d'ACCCRN a été conçu. Cette initiative vise à développer la résilience aux risques des changements climatiques à la ville de Semarang.<sup>53</sup>

Dans le projet d'ACCCRN, les impacts du changement climatique comprennent l'inondation et le *rob*, l'érosion côtière, le glissement de terrain, et la sécheresse dans la ville de Semarang.<sup>54</sup> En outre, ce projet indique que la résilience urbaine au changement climatique ne signifie pas seulement que les systèmes dont les résidents de la ville dépendent doivent survivre aux chocs et aux contraintes mais que les personnes et les organisations sociales, qui prennent les décisions courantes, sont également capables de faire face à ces contraintes ; il affirme aussi que les structures institutionnelles urbaines servent à soutenir, plutôt qu'à nuire à la capacité des personnes et des organisations à atteindre leurs objectifs.<sup>55</sup>

Nous allons analyser le projet d'ACCCRN qui constitue la contribution des acteurs externes dans le développement du processus de la résilience urbaine. Comment soutiennent-ils la résilience urbaine de Semarang? Favorisent-ils des approches pratiques telles que le renforcement des institutions urbaines, le développement des compétences d'adaptation de la communauté (le transfert de connaissances) et l'assistance financière pour des actions

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<sup>52</sup> Segun, O., 2012, "Behavioral Outcomes of Culture and Socio-Economic Status on Urban Residential Morphology. A Case Study of Lagos", *Procedia - Social and Behavioral Sciences*, vol. 50, pp. 294-306.

<sup>53</sup> En Indonésie, les questions des changements climatiques ont commencé à être discutées au milieu des années 2000. Elle a été marquée par le règlement présidentiel n° 46/2008 sur le changement climatique. A cette époque, le document émanant du gouvernement national a porté sur l'effet de serre ou le réchauffement planétaire. Cependant, les questions de changement climatique ont été discutées au niveau international depuis la fin des années 1980. Elle a été marquée par l'émergence du Groupe d'experts intergouvernemental sur les changements climatiques. Récemment, le changement climatique a été liée à des risques naturels, y compris la sécheresse, les incendies, les glissements de terrain, les inondations, l'élévation du niveau de la mer, et les températures élevées.

<sup>54</sup> Brown, A.L., 2011, "Building climate change resilience in Semarang" [Presentation], in: *Asian Cities Climate Change Resilience Network (ACCCRN)*, 2<sup>nd</sup> World Congress on Cities and Adaptation, Bonn.

<sup>55</sup> *ACCCRN City Projects*, 2013, Bangkok: Asian Cities Climate Change Network (ACCCRN), The Rockefeller Foundation, Asia Office.

d'adaptation de la communauté? Cependant, nous allons nous concentrer seulement sur la résilience urbaine de Semarang face aux inondations, en particulier dans la zone côtière. Nous espérons que cette recherche fournira une évaluation complémentaire pour le projet de développement de la résilience urbaine de Semarang face aux changements climatiques, en particulier au regard des questions du risque d'inondation. En outre, cette recherche permettra non seulement d'évaluer les institutions, mais aussi les transformations spatiales afin de donner un compte rendu global de la résilience urbaine face aux inondations.

#### IV. Méthodologie de recherche

L'approche pluridisciplinaire s'appuie sur la combinaison de la méthode qualitative et celle quantitative. Aujourd'hui, nous croyons que la prise en compte des approches offertes par les différentes disciplines permet de discuter les perceptions complémentaires du même phénomène et de les intégrer dans une combinaison qui entraîne une meilleure compréhension des systèmes urbains complexes.<sup>56</sup> Cette analyse pluridisciplinaire tente d'expliquer le processus de résilience dans le contexte urbain, y compris les efforts rationnels de gestion de la ville tenant compte des différentes perspectives définies par la géographie, l'histoire, l'architecture, la sociologie, et l'économie.<sup>57</sup> L'approche pluridisciplinaire intervient dans trois étapes de la recherche. La première étape de l'analyse porte notamment sur l'évolution du risque urbain. Cette analyse va expliquer comment le risque d'inondation apparaît et ses évolutions dans la ville de Semarang, en particulier dans la zone côtière.

La deuxième étape de l'analyse se concentre sur la gestion du risque hydrologique par les acteurs urbains. Cette analyse s'intéresse à la compréhension des capacités du système urbain (des infrastructures) pour la réduction et l'adaptation au risque hydrologique, et aussi sa gestion ou son système institutionnel. La troisième étape de l'analyse cherche à mettre en évidence l'existence d'un processus de résilience aux échelles locales (communautés). Les capacités d'adaptation de la communauté au risque d'inondation sont analysées selon la méthode phénoménologique. Chaque analyse s'attachera à mettre en évidence un processus de résilience du risque hydrologique dans la ville de Semarang. La connaissance du processus de résilience urbaine consiste à la synthèse de ces analyses. Ces dernières sont donc complémentaires, et ses résultats seront décrits sur des bases comparatives. L'analyse de la résilience de chaque territoire est un élément constitutif de la compréhension concernant le processus de résilience ayant lieu à l'échelle territoriale et urbaine.

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<sup>56</sup> Gurr, J.M., Walloth, C., 2014, "Introduction: Towards a Transdisciplinary Understanding of Complex Urban Systems", in: Walloth, C., Gurr, J.M., Schmidt, J.A., *Understanding Complex Urban Systems: Multidisciplinary Approaches to Modelling*, Cham: Springer.

<sup>57</sup> Pierre Merlin a expliqué que l'urbanisme, c'est un champ d'action, pluridisciplinaire par essence, qui vise à créer dans le temps une disposition ordonnée de l'espace en recherchant harmonie, bien-être et économie. Cf. Merlin, P., 2009, *L'urbanisme*, Paris: Presses Universitaires de France ; en revanche, Jacques Dreyfus a parlé d'une volonté de rationalité appliquée à l'espace (des villes) née du chaos de la société capitaliste industrielle et visant à assurer le bonheur de l'homme –volonté de rationalité devenue action. Cf. Dreyfus, J., 1976, *La ville disciplinaire*, Paris: Galilée.



**Tableau 1. La méthodologie de la recherche**

Analyses	Echelle	Méthodes	Outils	Sources (triangulation des données)
<p>L'existence et l'évolution du risque d'inondation</p> <ul style="list-style-type: none"> <li>- L'aléa de l'inondation</li> <li>- Les vulnérabilités urbaines à l'inondation</li> </ul>	Niveau urbain (zone côtière)	Méthode historique	<ul style="list-style-type: none"> <li>• Descriptive</li> <li>• Système d'information géographique</li> </ul>	<ul style="list-style-type: none"> <li>• Sources écrites: <ul style="list-style-type: none"> <li>- Manuscrits, témoignages écrits, rapports, et revues concernant la ville à l'époque du gouvernement hollandais</li> <li>- Rapports et relevés de la ville, documents statistiques urbains dans la situation récente</li> <li>- Articles scientifiques du risque d'inondation (articles, thèses, mémoires, revues, etc.)</li> <li>- Journaux locaux</li> </ul> </li> <li>• Interviews avec les acteurs urbains (gouvernement, chercheurs, partenaires universitaires, ONG)</li> <li>• Photographies, plans, et vidéos (relevés)</li> </ul>
<p>Capacités d'adaptation du système urbain</p> <ul style="list-style-type: none"> <li>- Système urbain</li> <li>- Gestion du risque hydrologique et son système institutionnel</li> </ul>	Niveau urbain (zone côtière)	<ul style="list-style-type: none"> <li>• Méthode descriptive</li> <li>• Méthode cartographique</li> </ul>	<ul style="list-style-type: none"> <li>• Quantitative</li> <li>• Qualitative comparative</li> </ul>	<ul style="list-style-type: none"> <li>• Plans locaux d'urbanisme</li> <li>• Projets de réduction du risque d'inondation et du risque hydrologique : plan directeurs du système de drainage, conception technique détaillée des projets hydrologiques, monographies (données statistiques) des événements du risque hydrologique</li> <li>• Articles scientifiques des infrastructures urbaines</li> <li>• Photographies, plans, et vidéos (relevés)</li> <li>• Interviews des acteurs urbains (gouvernement, ONG, secteur privé, notamment industriel)</li> </ul>
<p>Capacités d'adaptation de la communauté</p> <ul style="list-style-type: none"> <li>- L'existence du risque hydrologique dans les territoires locaux : l'aléa et les vulnérabilités</li> <li>- Perceptions cognitives et comportements des communautés</li> <li>- Réactions de la communauté : mesures structurelles (transformations des formes architecturales et territoriales, pratiques locales), et mesures non-structurelles</li> <li>- Influence des projets hydrologiques et des efforts des acteurs externes, et aussi de l'intervention de la communauté</li> </ul>	Territoires locaux/ quartiers (études de cas)	Méthode phénoménologique	<ul style="list-style-type: none"> <li>• Quantitative</li> <li>• Qualitative</li> </ul>	<ul style="list-style-type: none"> <li>• Questionnaires et interviews des communautés</li> <li>• Photographies, plans, et vidéos (relevés)</li> <li>• Articles scientifiques des communautés, des territoires locaux, et du risque hydrologique (article, thèses, mémoires, revues, etc.)</li> <li>• Journaux locaux</li> </ul>

Source: Miladan, 2014

## **Sites de la recherche**

Cette recherche est composée de deux échelles d'analyse. La première échelle est celle correspondant à la zone côtière de la ville de Semarang ; elle permet de mener une analyse générale de la gestion du risque urbain lié aux inondations. La deuxième échelle est celle des habitats côtiers dans la ville de Semarang ; elle permet de présenter des études de cas qui évaluent le processus de résilience à l'échelle locale.

- **La zone côtière de la ville de Semarang**

Le document de l'aménagement du territoire côtier de la ville de Semarang en 2008 indique six districts côtiers dans la ville de Semarang : Tugu, Semarang Barat, Semarang Utara, Genuk, Semarang Timur, et Gayamsari.<sup>58</sup> Cette recherche n'adopte pas directement la délimitation mentionnée par la municipalité. Tout d'abord, de la question de la délimitation et de la définition de la région côtière est étudiée par la bibliographie. La frontière entre la terre et la mer n'est généralement pas définie de la même manière, d'un plan à l'autre. Cette frontière a lieu dans la région transitoire. D'après Ketchum<sup>59</sup>, l'élément-clé de la définition de la zone côtière est l'espace subissant les impacts de l'interaction entre l'océan et la terre: elle est composée de l'espace de la terre qui interagit, d'une manière ou d'une autre, avec l'océan et, d'autre part, l'espace de l'océan qui interagit avec la terre.<sup>60</sup> Le phénomène du risque d'inondation dans la zone côtière de Semarang, en particulier le risque du *rob*, est l'élément important qui définit le site analysé. C'est une inondation qui est causée par des phénomènes maritimes. Donc, c'est raisonnable pour définir la zone côtière de Semarang peut être retenue comme site d'analyse. La zone affectée par le *rob* comprend sept districts avec une superficie de 3.915,16 ha.

- **Les habitats côtiers comme échantillons des études de case**

Le processus de résilience ne peut pas être évalué que par la dimension du système urbain des infrastructures, mais elle doit l'être aussi à travers les dimensions sociales. Il décrit les efforts des institutions urbaines et des communautés afin de s'adapter aux risques d'inondation dans les territoires locaux (quartiers). Ces initiatives façonnent la résilience et ont également des impacts sur les zones avoisinantes, y compris à l'échelle urbaine. La diversité des processus de résilience se reflète dans les différentes études de cas. La conjonction de ces multiples études de cas permettra aux chercheurs d'analyser en fonction de chaque paramètre et/ou en fonction de multiples paramètres.<sup>61</sup> La prise en compte de ces différentes études de cas explorera les similitudes et les différences entre les cas afin de fournir des perspectives générales sur les processus de résilience face à l'inondation à la ville de Semarang. L'échantillon a été élaboré, soit selon le cadre conceptuel initial qui a soutenu la question de recherche dès le départ, soit après une remise en cause de la grille de lecture initiale du fait de réflexions obtenues à partir des données recueillies dans les travaux

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<sup>58</sup> *Rencana Tata Ruang Pesisir Kota Semarang* (Plan d'urbanisme de la zone côtière de la ville de Semarang), 2008, Semarang: Département de la marine et de la pêche de la ville de Semarang.

<sup>59</sup> Dr. Bostwick H. Ketchum, chercheur émérite, a été associé à la *Woods Hole Oceanographic Institution* pendant plus de quarante ans. Cf. Woods Hole Oceanographic Institution, "Ketchum (Bostwick H.) papers", récupéré le 25 décembre 2015, du site [://archives.mblwhoilibrary.org/repositories/2/resources/18](http://archives.mblwhoilibrary.org/repositories/2/resources/18).

<sup>60</sup> Kay, R., Alder, J., 1999, *Coastal Planning and Management*, Routledge: London and New York. La définition de la zone côtière a été donnée par Ketchum dans son article "The Water's Edge: Critical Problems of the Coastal Zone".

<sup>61</sup> Baxter, P., Jack, S., 2008, "Qualitative Case Study Methodology: Study Design and Implementation for Novice Researchers", *The Qualitative Report*, vol. 13, n° 4, pp. 544-559.

de recherche.<sup>62</sup> Le cadre conceptuel a défini trois étapes qui caractérisent le processus de sélection des cas. La première étape porte sur les critères de la géographie ou l'environnement comprenant la concentration des secteurs bâtis et l'existence du risque hydrologique. La deuxième étape traite des critères de l'utilisation du sol et des formes d'occupation du territoire. L'observation préliminaire sur le terrain en 2010 et en 2011 et le mémoire de master rédigé en 2009<sup>63</sup> indiquent que l'habitat est la forme majeure de l'occupation du sol dans les parties situées au nord et à l'ouest de la zone côtière de Semarang. Généralement, les formes de l'habitat dans la zone côtière de Semarang, y compris les formes des bâtis et d'architecture, les structures des infrastructures locales et les espaces verts, ainsi que les villes indonésiennes sont divisées en deux types: *perumahan* (quartier résidentiel) et *kampung*. Un quartier résidentiel est un type d'habitat qui est généralement équipé avec les infrastructures locales adéquates. Il est établi, basé sur le schéma directeur, par les entreprises privées (promoteurs immobiliers), donc il tend à avoir des formes architecturales régulières. A l'inverse, les formes du *kampung* est la majorité des habitats dans la zone côtière de Semarang. *Kampung* –expression locale qui définit un type de l'habitat indigène propre à l'Asie du sud-est, a plusieurs significations. Il signifie l'habitat informel<sup>64,65,66,67</sup> mais aussi décrit un village urbain.<sup>68,69</sup>

<sup>62</sup> Curtis, S., Gesler, W., Smith, Glenn & Washburn, S., 2000, "Approaches to Sampling and Case Selection in Qualitative Research: Examples in the Geography of Health", *Social Science & Medicine*, vol. 50, Issues 7-8, pp. 1001-1014.

<sup>63</sup> Miladan, *ibid.*

<sup>64</sup> Bakti Setiawan a défini *kampung* comme une réalité géographique qui se réfère aux diverses formes des habitats urbains (allant des nouveaux squatters aux habitats) caractérisées par des niveaux inégaux de qualité physique (de l'habitat de très mauvaise qualité à l'habitat de meilleure qualité), situées dans différentes localisations au sein d'un environnement urbain (du centre à la périphérie), occupées par des groupes de personnes marqués par une diversité socio-économique et subissant constamment des évolutions. De plus, *kampung*, comme communauté urbaine et unité sociopolitique, signifie que cette réalité géographique renvoie à un groupe organisé de peuplement s'inscrivant dans un environnement particulier, dans lequel la population met en œuvre des initiatives et des actions collectives. Cf. Setiawan, B., 1998, *Local dynamics in informal settlement development: a case study of Yogyakarta, Indonesia*, PhD Dissertation in Community and Regional Planning, University of British Columbia.

<sup>65</sup> *Kampung* ont reconnu l'habitat traditionnel à l'Asie du sud-est depuis plusieurs siècles et la majorité des habitants est le group à faible revenu. Cf. Santosa, H.R., 2008, "Linking Open Building and Sustainable Livelihoods in the Kampung – Informal Settlement", *Proceedings of the Joint Conference of CIB W104 and W110*, Indiana.

<sup>66</sup> Raharjo, W., 2010, *Speculative Settlements: Built Form/Tenure Ambiguity in Kampung Development*, PhD Dissertation in Architecture, Building and Planning, The University of Melbourne.

<sup>67</sup> Zhu, J., 2010, *Symmetric Development of Informal Settlements and Gated Communities: Capacity of the State. The Case of Jakarta, Indonesia (ARI Working Paper Series No. 135)*, Singapore: Asia Research Institute.

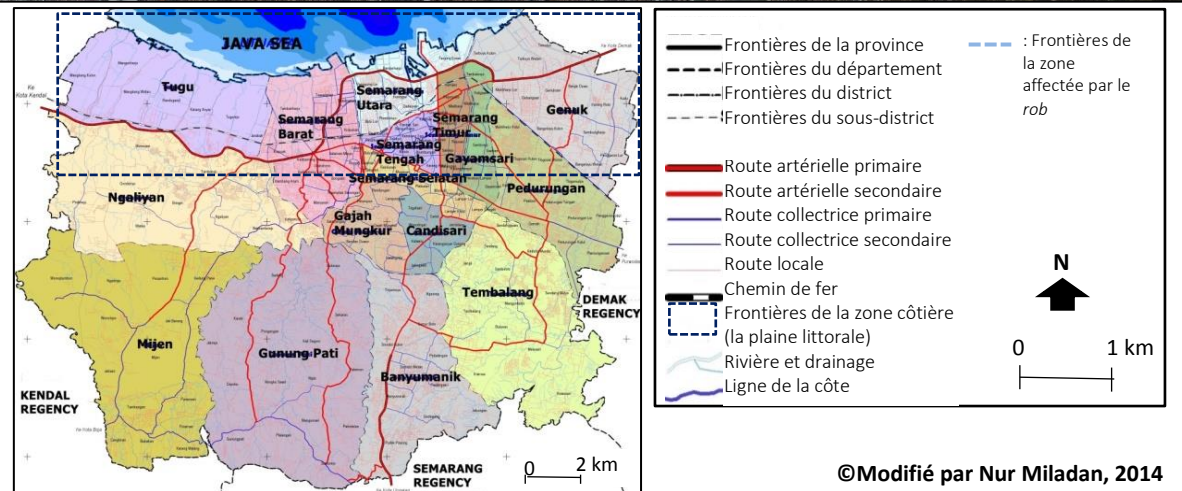
<sup>68</sup> Charles Goldblum a dit que le village urbain est pour rendre compte des établissements urbains trouvant leur références morphologiques ou sociales dans l'univers rural, c'est que celui-ci impose des rapprochements avec l'habitat villageois et en signale les effets de rémanence. Cf. Goldblum, C., 1987, *Métropoles de l'Asie du sud-est, stratégies urbaines et politiques du logement*, Paris : L'Harmattan.

<sup>69</sup> *Kampung* se définit comme l'habitat autochtone urbain en Indonésie qui est traditionnel, spontané, *fine-grain*, et sous diverses formes. Il grandit localement, organiquement, et progressivement pendant de nombreuses années sans suivre le guide de la planification ni les régulations, ni les codes du bâtiment, ni les exigences d'une prestation de services centralisée et coordonnée. Cf. Sihombing, A., 2007, "Living in the Kampung: A Firsthand Account of Experiences in Jakarta's Kampung", *FORUM International Journal of Postgraduate Studies Architecture, Planning and Landscape University of Newcastle*, vol. 7, no 1, pp. 15-22; Sihombing, A., 2014, "Drawing Kampung through Cognitive Maps Case Study: Jakarta", *APCBEE Procedia*, vol. 9, pp. 347-353.





La forte densité de l'espace bâti dans la zone côtière de Semarang est située dans la partie du nord et celle de l'est. Ces zones sont dominées par les habitats et les zones des services urbains, y compris la zone commerciale, la zone industrielle, et le quartier des affaires. En revanche, la partie de l'ouest est dominée par la zone d'aquaculture et un espace non bâti. Néanmoins, quelques habitats et la zone industrielle connaissent un processus d'étalement dans la partie du sud-ouest de la zone côtière de Semarang. Etant donné le risque du *rob* qui menace le long de la côte, la partie du nord et celle de l'est sont très vulnérables du fait de la forte densité de la zone bâtie. En outre, la zone affectée par le *rob* est environ 12% de la superficie de la ville de Semarang. Elle est aussi vulnérable à la crue (éclair) à cause des débordements des drainages urbains des zones hautes terres (collines).



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**Figure 2. Zone côtière (plaine littorale) de Semarang**

Source: *Plan d'urbanisme de la ville de Semarang 2011-2031*, 2011, Semarang: Agence de planification du développement régional; Image satellite Ikonos de Semarang en 2008; "Peta Ancaman (Plan d'alea)" [Photo], *Peta online Risiko Banjir Rob Kota Semarang* [Web], récupéré le 28 décembre 2015, du site <http://geodesi.undip.ac.id/gis/index.php#>



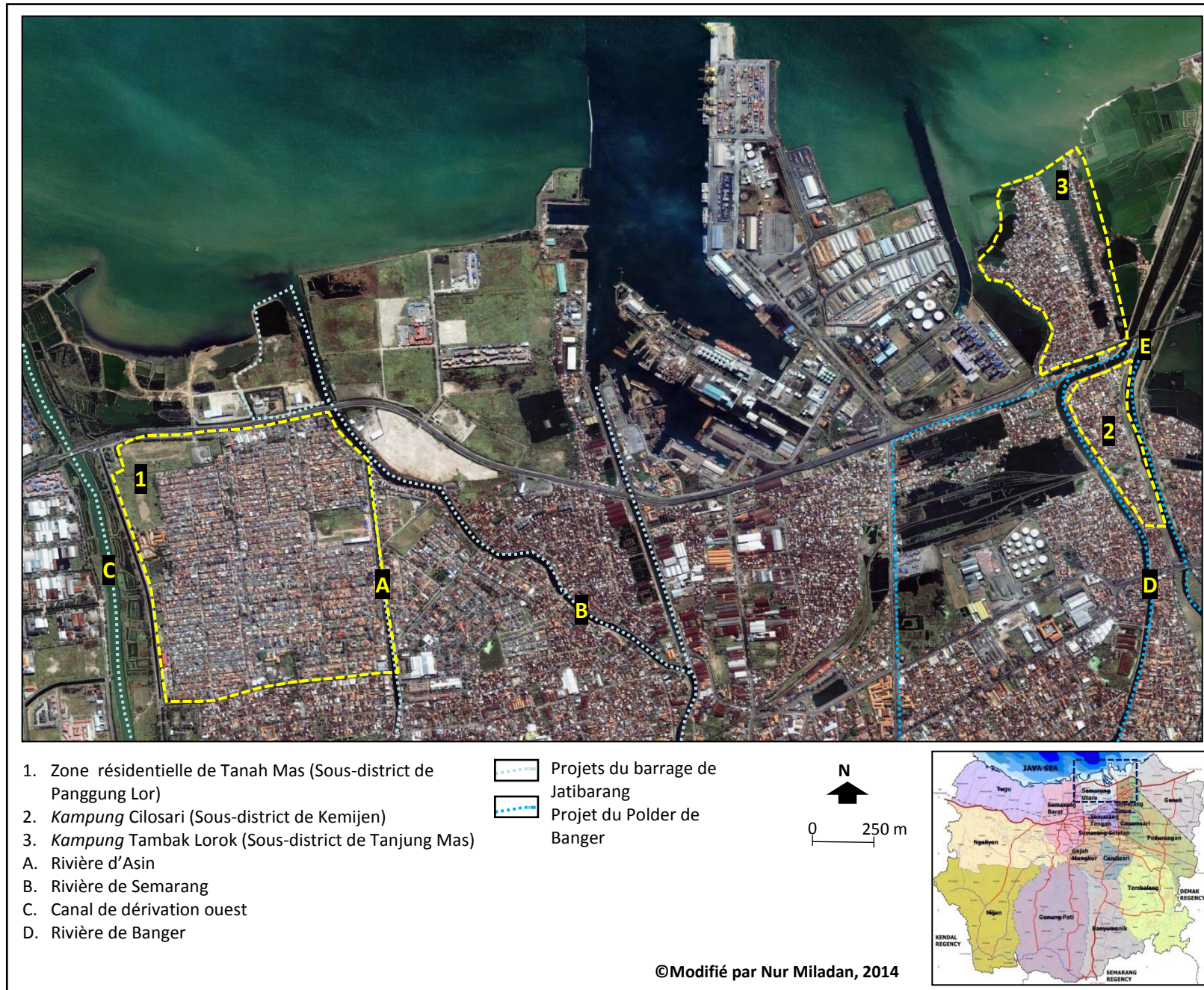
La troisième étape de la sélection de cas se concentre sur les paramètres des capacités socio-économiques de la communauté et l'existence des projets hydrologiques urbains. Les différentes valeurs de ces paramètres peuvent entraîner plusieurs conséquences significatives du processus de la résilience territoriale. La méthode de cette étude nécessite une sélection d'un ensemble de cas, au minimum, deux cas, qui visent à représenter l'ensemble des valeurs représentées caractérisant X, Y, ou des corrélations particulières X/Y.<sup>70</sup> Ce cadre conceptuel nous amène à choisir la zone résidentielle de Tanah Mas comme premier cas ; *kampung* Cilosari et *kampung* Tambak Lorok forment le deuxième cas représentant le quartier du *kampung* dans la zone côtière de Semarang. Ces territoires sont très vulnérables face aux risques hydrologiques. Ces deux cas représentent les différents types d'habitats côtiers, de capacités socio-économiques de la communauté ainsi que de projets hydrologiques urbains. En particulier, le cas du *kampung* est analysé à travers l'étude de deux quartiers qui représentent la majorité de l'habitat côtier et la diversité des capacités socio-économiques. La vie communautaire du *kampung* Tambak Lorok est dominée par les activités de la pêche (habitat de pêcheurs), tandis que la vie communautaire du *kampung* Cilosari est dominée par les activités industrielles et celles des secteurs informels. Deux habitats compléteront l'analyse du *kampung*. La diversité de situation de ces quartiers révèle celle du processus de résilience des communautés dans la zone côtière de Semarang.

## V. Résultat de recherche

Notre recherche démontre que les espaces occupés par l'eau et le cycle de l'eau forment un élément d'explication majeur dans la compréhension de la croissance urbaine mais aussi des menaces qui pèsent sur le développement urbain et les activités urbaines. L'investigation historique de l'existence et des fluctuations des inondations nous amène à percevoir les lacunes dans la prise en compte du risque hydrologique dans le processus de développement urbain. Les différentes époques qui se succèdent du gouvernement hollandais au gouvernement actuel révèlent des situations différentes quant à l'existence et la gestion du risque d'inondation. Néanmoins, l'aménagement du territoire et les stratégies de la réduction d'inondation influencent fortement la croissance du risque d'inondation dans la ville. Semarang est un cas indiquant l'existence d'adaptations, aux échelles urbaine et des communautés, qui a des effets sur le processus de résilience. De fait, la ville a été confrontée à de nombreuses contraintes dans la mise en œuvre de ce processus de résilience urbaine face à l'inondation à cause de la diversité de la gestion du risque et du fait d'un manque de plans et de projets urbains pendant les différentes périodes du gouvernement. Par ailleurs, les interventions du secteur privé aujourd'hui, d'une part, peuvent contribuer à soutenir le processus de résilience urbaine face à l'inondation aux échelles locales (des quartiers) mais aussi, inversement, entraîner la croissance du risque d'inondation aux différentes échelles. Le processus de l'adaptation urbaine face à l'inondation n'apparaît que dans certaines parties des espaces urbains et n'est pas observable dans la ville entière. L'insuffisance du processus de résilience face à l'inondation à l'échelle urbaine produit des situations différentes d'adaptations des communautés. C'est pourquoi la résilience de chaque communauté peut être questionnée. Néanmoins, la communauté est l'élément fondamental du développement de la résilience urbaine face à l'inondation. On peut s'interroger dans quelle mesure la résilience de la communauté peut être mise en œuvre, alors qu'on observe un manque de résilience à l'échelle urbaine. L'évaluation de la résilience urbaine n'analyse pas que les réseaux d'infrastructures urbaines et le système des acteurs institutionnels urbains, mais aussi la capacité des communautés.

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<sup>70</sup> Seawright, J. & Gerring, J., 2008, "Case Selection Techniques in Case Study Research: A Menu of Qualitative and Quantitative Options", *Political Research Quarterly*, vol. 61, n° 2, pp. 294-308.



**Figure 3. Terrains des études de cas**

Source: *Plan d'urbanisme de la ville de Semarang 2011-2031*, 2011, Semarang: Agence de planification du développement régional; Image satellite Ikonos de Semarang en 2008

L'urbanisation et l'industrialisation dans la ville de Semarang ont eu lieu depuis le début des années 1980. Cette situation entraîne des conséquences dans la zone côtière, tels qu'une croissance démographique rapide, la transformation rapide de l'utilisation du sol des espaces occupés par l'eau en un espace bâti. Ce processus n'a pas été soutenu par les réseaux urbains adéquats, donc la croissance des habitats côtiers a été, de fait, plutôt déterminée par les efforts d'auto-assistance des communautés et les efforts du secteur privé. Depuis la fin des années 1980, les risques hydrologiques menacent les habitats côtiers de la ville de Semarang. Nos études de cas montrent l'émergence de risques hydrologiques dans des quartiers caractérisés par des circonstances relativement similaires. Les problèmes de la conversion du terrain, de la provision des réseaux urbains, de l'affaissement du sol, et du phénomène côtier naturel ont engendré les risques hydrologiques dans ces habitats. Néanmoins, la vulnérabilité du *kampung* face au risque hydrologique est plus élevée que celle de la zone résidentielle à cause du manque des infrastructures locales. Par exemple, en raison du manque d'infrastructures d'adduction d'eau et de collecte des eaux usées, la nappe souterraine est exploitée massivement dans le *kampung*, ce qui a pour conséquence une aggravation de l'affaissement du sol et des risques hydrologiques.

Le manque d'efforts du gouvernement a rendu la situation plus critique ; les communautés ont donc été contraintes à rechercher des solutions par elles-mêmes. Leurs efforts sont influencés par leurs perceptions, leurs expériences, et leurs connaissances du risque hydrologique. En effet, les perceptions des différentes communautés sont relativement similaires. La plupart des habitants ont expliqué que le risque hydrologique perturbe leur vie ; selon leurs témoignages, la principale cause du risque hydrologique est le phénomène côtier naturel contre lequel ils ne peuvent lutter. Ils ont également expliqué que la conversion et l'exploitation du terrain, ainsi que les comportements humains détériorent l'environnement et transforment des risques hydrologiques en catastrophes. Cependant, leurs perceptions sont aussi déterminées par la connaissance de la communauté, leur éducation, et leur capacité économique limitée.

En outre, la perception des impacts du risque hydrologique est liée aux raisons du choix d'habiter en zone inondable. La plupart des habitants qui considèrent le risque hydrologique comme une perturbation pour la vie quotidienne ont choisi d'y habiter parce que la raison de leur choix d'implantation en une telle localisation est liée à la connaissance des efforts d'auto-assistance menée par la communauté pour la réduction du risque.

Ces affirmations indiquent qu'ils ont choisi de s'implanter, de rester ou de partir ; elles révèlent aussi que la plupart d'entre eux ont décidé d'y habiter ou d'y rester parce qu'ils pensent qu'ils peuvent anticiper les impacts du risque hydrologique par leurs efforts. En plus, ils considèrent qu'ils habitent dans des zones stratégiques du fait de la proximité des centres urbains et de ressources pour leur subsistance.

D'autre part, la plupart des habitants qui ont affirmé que les impacts du risque hydrologique constituent une catastrophe, pensent que la proximité des ressources pour leur subsistance est le facteur le plus important. La plupart des habitants du *kampung* travaillent dans les secteurs informels et dans le secteur de la pêche. Ils n'ont pas de revenus fixes ou bien ont des revenus très faibles. Ils ont des capacités économiques limitées ; par conséquent, le déménagement de leur habitation récente reste marginal. Ces circonstances causent le facteur de compulsion. Elles forcent les habitants à rester dans la zone affectée par l'inondation ; dès lors, ils se familiarisent avec le risque hydrologique. Ces conditions déterminent aussi leur capacité de résilience. En raison de leur choix d'habiter dans la zone impactée par le risque hydrologique, ils tentent de mettre en œuvre des efforts d'adaptation, individuels et collectifs.

Les communautés partagent une logique similaire. Ils améliorent la qualité de vie dans leurs habitats par la reconstruction de leurs maisons, des rues locales, des drainages, des



vannes, et aussi les développements du système de pompage. Ils ont été menacés par le risque hydrologique depuis longtemps ; ils estiment, donc, comprendre les caractéristiques de ce risque.

En raison de la limitation des connaissances de la communauté, ils mettent en oeuvre des solutions modestes et temporaires, du fait de leurs capacités économiques limitées ; ils cherchent à anticiper sans recourir, néanmoins, à des technologies appropriées.

Même si les communautés mènent des efforts similaires, elles s'avèrent avoir des capacités de mise en oeuvre différentes. Les différentes ressources économiques de la communauté ont un effet sur la manière dont elles s'y prennent dans la réduction du risque hydrologique. En outre, l'efficacité des efforts d'auto-assistance de la communauté dépend beaucoup du rôle des agents locaux du changement tels que les chefs de la communauté de Tanah Mas. Ils ont conduit les efforts d'auto-assistance de la communauté. Ils peuvent déclencher le processus de la recherche d'idées et peuvent encourager les prises des décisions collectives indépendantes.

La gestion du système du pompage par la communauté devient une bonne pratique reconnue par le gouvernement et est, désormais, aussi adoptée par les autres communautés. Entre temps, le cas des communautés du *kampung* indique que le processus d'apprentissage est aussi influencé par les acteurs externes, tels que les ONG, les partenaires universitaires, le secteur privé. Ils jouent un rôle d'intermédiaire pour le développement de la participation de la communauté afin de développer les efforts d'auto-assistance de la communauté pour la réduction des risques hydrologiques. On peut noter que l'intervention des acteurs externes améliore les initiatives locales. Dans l'ensemble, les communautés mettent l'accent sur les efforts des ménages et, dans une moindre mesure, sur les efforts collectifs. Les communautés du *kampung* font preuve d'un grand sentiment de solidarité entre leurs membres ; mais leurs initiatives dépendent beaucoup de leurs chefs de communauté.

D'autre part, les efforts d'auto-assistance de la communauté sont à l'origine d'inégalités territoriales et sociales. Dans le *kampung*, ces situations entraînent parfois des relations difficiles voire conflictuelles entre voisins. La qualité du bâti et les aménagements des maisons constituent un élément d'inégalité entre eux. De manière concomitante, l'inégalité territoriale intervient également au niveau des communautés du *RT*.<sup>71</sup> L'inondation sévit dans les territoires des communautés pauvres du *RT* qui ne peuvent pas améliorer leurs territoires par la reconstruction des rues locales et des drainages. Ces situations causent des frictions entre eux et aggravent les autres problèmes sociaux. Entre temps, les inégalités sociales et territoriales n'affectent pas, en profondeur, la communauté de Tanah Mas mais produisent des relations difficiles avec les communautés voisines. Le système local de pompage est géré au moyen des efforts d'auto-assistance de la communauté, ce qui a pour effet de renforcer la solidarité entre les habitants de la communauté de Tanah Mas. Cette gestion change les comportements de la communauté en passant d'un fonctionnement individualiste à un fonctionnement communautaire. Néanmoins, ce système provoque une inégalité territoriale avec les communautés voisines du fait des caractéristiques naturelles de l'inondation qui s'écoule d'un niveau supérieur vers un niveau inférieur. Jusqu'à présent, les communautés côtières n'élaboraient pas collectivement leurs efforts de réduction du risque hydrologique. Chaque communauté se concentrait sur ses efforts d'auto-assistance. Concomitamment, l'intervention insuffisante des acteurs urbains entravait le développement de projets hydrologiques globaux.

En termes de transformations spatiales, le *kampung* évolue plus rapidement que la zone résidentielle. Les communautés du *kampung* ne peuvent pas développer librement leurs

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<sup>71</sup> *Rukun Tetangga (RT)*, c'est une expression locale qui signifie une association de voisinage (communauté) qui est liée au système administratif de la ville.



efforts d'auto-assistance tels qu'une gestion adéquate du système de pompage. Par conséquent, les reconstructions des rues locales, des drainages, des maisons et des installations publiques dans le *kampung* sont plus fréquentes que celles dans les zones résidentielles. La transformation spatiale dans le *kampung* de Tambak Lorok est la plus rapide car cet habitat a une vulnérabilité plus élevée du fait de sa situation géographique qui est très proche de la mer. En outre, les pratiques locales des usages des espaces publics par les populations côtières changent, en particulier dans le *kampung*. La grande densité des espaces bâtis et la limitation des capacités économiques entraînent l'utilisation des espaces publics comme zones d'évacuation. Musallah, qui est un lieu de culte, est utilisé par les communautés comme abri d'urgence, notamment pour les ménages pauvres, pendant l'occurrence de l'inondation. Ces situations montrent que les initiatives locales ont changé l'usage de certains espaces pour la réduction du risque hydrologique.

Les situations décrites ci-dessus montrent le processus de résilience de la communauté dans la zone côtière de Semarang. D'après Cohen et alii (2013), l'évaluation de la résilience de la communauté doit prendre en compte également le *leadership*, l'efficacité collective, l'état de préparation, l'attachement à un lieu, la confiance sociale, et les liens sociaux.<sup>72</sup> Ces facteurs sont observables dans notre cas. Cependant, peuvent être notés différents niveaux dans le processus de résilience des différentes communautés présentes dans la zone côtière de Semarang. Le niveau de résilience de la communauté de Tanah Mas est plus élevé que ceux des communautés de Cilosari et Tambak Lorok. La communauté de Tanah Mas a une plus forte confiance dans leur effort d'auto-assistance. Inversement, on observe, s'agissant des communautés de Cilosari et Tambak Lorok, un certain manque de confiance dans leurs efforts d'auto-assistance.

Les efforts des institutions urbaines et la gestion des projets hydrologiques sont des mesures nécessaires au développement du processus de résilience de la communauté. Les limites rencontrées par ce processus sont observables dans chaque habitat côtier, en particulier, dans le *kampung*, qui a besoin des interventions globales des institutions urbaines. Les efforts du gouvernement sont nécessaires pour soutenir le renforcement des capacités communautaires pour la réduction des risques hydrologiques et le développement des réseaux urbains.

## VI. Conclusion

### a) La résilience urbaine requiert une approche intégrée entre le système urbain et le système humain

La compréhension de la résilience urbaine exige une analyse des capacités du système urbain : des réseaux urbains, du milieu naturel, des institutions qui gèrent le risque urbain. Mais, elle évalue aussi la capacité de la communauté pour s'acclimater aux contraintes de la ville. Il a besoin d'évaluer les capacités des acteurs urbains (des institutions et des communautés) pour anticiper l'aléa naturel quand il survient : avant, pendant, et après l'événement. Ces capacités sont liées au processus d'apprentissage, aux efforts d'adaptation face au risque, tels que le développement du système urbain et les actions d'auto-assistance de la communauté. Néanmoins, lorsque le système urbain et/ ou les communautés n'ont pas réussi à relever le défi représenté par ce risque, la résilience urbaine a, néanmoins, engendré la durabilité urbaine.

La résilience territoriale qui est élaborée par la communauté joue le rôle important d'appui du processus de la résilience urbaine. Cependant, la résilience territoriale n'est pas à

<sup>72</sup> Cohen, O., Leykin, D., Lahad, M., Goldberg, A., Aharonson-Daniel, L., 2013, "The conjoint community resiliency assessment measure as a baseline for profiling and predicting community resilience for emergencies", *Technological Forecasting and Social Change*, vol. 80, Issue 9, pp. 1732–1741.

même de déclencher un processus de résilience urbaine à cause des inadéquations entre l'espace et les capacités de la communauté. Des échelles spatiales et temporelles différentes dans les stratégies de résilience sont requises<sup>73</sup> ; il en va de même pour les liens entre les concepts de régénération (les projets de reconstruction urbaine) et la résilience qui peuvent être observés à trois échelles : le bâtiment, le quartier et la ville; il s'agit, dès lors, de se concentrer sur le processus d'élaboration du projet de reconstruction en intégrant les impacts de la résilience, de la régénération (reconstruction urbaine), et de l'action collective.<sup>74</sup> Le processus de résilience urbaine s'avère plus efficace lorsque la résilience du système urbain et la résilience territoriale sont intégrées.

En outre, le système institutionnel joue un rôle important dans le processus de résilience urbaine. Les initiatives de l'institution urbaine accélèrent le développement des capacités d'adaptation des réseaux urbains. Lorsqu'on observe un manque d'initiative, le système des réseaux urbains est inefficace. De plus, le système humain peut perdre de sa réactivité et de son efficacité dans la mise en œuvre d'un processus de résilience à cause du manque du soutien du système institutionnel. Cependant, les acteurs externes, tels que le gouvernement national, les ONG, les acteurs internationaux, les partenaires universitaires peuvent contribuer au renforcement ou au développement du système institutionnel pour la réduction du risque urbain : le transfert et l'échange des connaissances et des initiatives, le financement, et les approches techniques pour le développement du système des réseaux urbains. D'ailleurs, dans certains cas, le processus de résilience territoriale dépend aussi de la collaboration entre les institutions urbaines et les acteurs externes. En raison du rôle important des acteurs externes, la connaissance de la résilience urbaine devient une nécessité majeure afin d'assurer des interventions pertinentes dans le processus de résilience urbaine. Lorsque les acteurs externes ne réussissent pas à transférer leurs connaissances de la résilience urbaine (la vision globale et les efforts d'adaptation) aux institutions urbaines et aux communautés, l'amélioration de la résilience urbaine est limitée.

D'ailleurs, les capacités d'auto-assistance du système humain (les efforts individuels et collectifs pour apprendre à connaître et le risque et s'y adapter) sont les éléments clés dans la détermination du processus de résilience territoriale et urbaine. Le système humain, pour réduire les impacts du risque, s'appuie sur les cultures et les expériences acquises en tenant compte des contraintes du système des réseaux urbains. Cependant, la réduction du risque devrait être soutenue par le système des réseaux urbains pour garantir l'efficacité du processus de résilience urbaine.

#### **b) La culture de la communauté est un capital social qui contribue le processus de la résilience urbaine**

Les villes modernes où des activités urbaines sont liées aux réseaux urbains, tels que le système de transports, le réseau d'électricité, le système d'adduction d'eau, sont très vulnérables au risque de catastrophe lorsque les communautés urbaines sont caractérisées par un manque de capacité d'adaptation. La communauté est, à la fois, un sujet et un objet du processus de la résilience urbaine. La résilience du système des réseaux urbains est accompagnée par la résilience du système humain, lui-même influencé par les aspects culturels et socio-économiques.

Dans le cas de la ville de Semarang, les capacités de la communauté sont l'élément clé pour la réduction du risque d'inondation du fait de la défaillance du système des réseaux

<sup>73</sup> Bach, C., Bouchon, S, Fekete, A., Birkmann, J., Serre, D, 2013, "Adding Value to Critical Infrastructure Research and Disaster Risk Management: the Resilience Concept", *SAPIENS*, vol. 6, n° 1.

<sup>74</sup> Oliver, A. Thomas, I and Thompson, M.M., 2013, "Resilient and Regenerative Design in New Orleans: the Case of the Make it Right Project", *SAPIENS*, vol. 6, n° 1, pp. 1-13.

urbains. Les risques hydrologiques évoluent en liaison avec la capacité d'adaptation des efforts d'auto-assistance. Les initiatives de la communauté sont influencées par la culture et les perceptions de la communauté. L'esprit de *gotong royong* qui est un des fondements de la philosophie indonésienne<sup>75</sup> renvoie à une forme socio-culturelle de la convivialité qui joue au sein de la communauté dans sa confrontation au risque hydrologique.

Les efforts d'auto-assistance de la communauté pour la réduction du risque (par exemple, l'association locale) sont élaborés par les chefs des communautés et les représentants locaux. Ils sont liés à la structure sociale et à la culture de la communauté. Cette situation indique que le capital social est nécessaire pour la réduction du risque. Quoique les communautés aient réalisé leurs efforts d'auto-assistance, ce qui, en aucun cas, ne saurait entraîner la résolution du problème, ils mettent l'accent sur la nécessité de l'implication de la collaboration des habitants (communautés) pour réduction du risque. Bien que l'aléa survienne fréquemment et que le système des réseaux urbains soit défaillant, les communautés tentent d'éliminer ces risques au moyen de leurs ressources limitées.

En outre, la culture de la communauté, confrontée aux fréquents risques d'inondation, incite à développer une résilience territoriale. La culture de la communauté influence leur perception des impacts de l'inondation. Les communautés considèrent que le risque d'inondation n'est pas la catastrophe absolue, mais seulement une perturbation dans la vie quotidienne. Par conséquent, les communautés tentent de survivre dans cette incertitude quotidienne. Notre cas du *kampung* a mis en évidence l'existence d'une attitude javanaise, qui est désigné par l'expression "*nerimo ing pandum*", c'est-à-dire celle qui consiste à accepter tout comme un don de Dieu sans se plaindre. Cette attitude est l'élément fondamental de la culture qui permet à la communauté d'accepter le risque dans leur vie quotidienne. Elle perçoit le risque d'inondation comme faisant partie de leur destin mais elle tente aussi d'améliorer leur qualité de vie avec leurs ressources économiques limitées. La culture de la communauté influence aussi les initiatives et les perceptions de la communauté dans leurs efforts d'adaptation face au risque d'inondation. Cette situation indique aussi le processus de résilience individuelle des habitants.

Cependant, les activités urbaines récentes dans la zone côtière de Semarang influencent le processus de résilience territoriale face à l'inondation. Les zones stratégiques, telles que les zones de transports (le port, la gare et l'aéroport), les zones industrielles, les zones commerciales traditionnelles et modernes, les quartiers des affaires et aussi les zones d'aquaculture, fournissent les ressources de subsistance pour les communautés. La zone urbaine côtière de Semarang est dominée par l'existence du *kampung* où les ressources de subsistance des communautés dépendent beaucoup de ces secteurs urbains. La majorité des habitants travaille dans les secteurs informels<sup>76</sup> liés aux secteurs urbains formels. En raison de leurs compétences limitées, ils travaillent dans les secteurs informels où les revenus sont incertains. Les contraintes économiques expliquent que les communautés restent dans les zones affectées par le risque hydrologique. Ce cas met en évidence que l'organisation spatiale et la culture de la communauté sont des éléments sociaux interdépendants qui soutiennent le processus de résilience territoriale. Ces faits montrent que la résilience urbaine n'est pas

<sup>75</sup> *Gotong royong* est une notion sociale très usitée dans plusieurs régions d'Indonésie ; elle constitue l'un des principaux éléments de la philosophie indonésienne. Cf. Fahrudin, A., 2013, "Social Welfare and Social Work in Indonesia", in: Furuto, H.B.C.L, *Social Welfare in East Asia and the Pacific*, New York: Columbia university press.

<sup>76</sup> Le secteur informel couvre la grande variété du marché du travail qui combine deux groupes de différente nature. D'un côté, le secteur informel est déterminé par les comportements des individus et des familles dans l'environnement économique où les opportunités d'emploi sont rares. D'un autre côté, le secteur informel est un résultat du comportement rationnel des entrepreneurs qui désirent échapper aux régulations mises en œuvre par l'Etat. Cf. World Bank, "Concept of Informal Sector", *The World Bank* [Web], récupéré le 28 décembre 2015, du site://lnweb90.worldbank.org.

caractérisée que par les capacités du système des réseaux urbains, mais aussi ceux du système socio-culturel.

**c) L'insuffisance de la gestion selon des approches urbaines globales pour l'apprentissage et le processus d'adaptation ne permet pas de soutenir la résilience locale face au risque hydrologique**

Le processus de résilience urbaine de Semarang dépend de l'évolution du risque et des approches du gouvernement. Le risque d'inondation a été moins élevé pendant l'époque du gouvernement hollandais. En plus, la gouvernance était centralisée par la municipalité hollandaise ; c'est pourquoi le processus de réduction et d'adaptation a dépendu du système des réseaux urbains. A cette époque, l'adaptation de la communauté n'était pas le facteur principal pour le processus de résilience urbaine. La discontinuité de la planification urbaine entre l'époque du gouvernement hollandais et l'époque du premier gouvernement indonésien a augmenté les risques hydrologiques de la ville de Semarang.

Aujourd'hui, l'augmentation des risques hydrologiques est liée à la défaillance du système des réseaux urbains et des approches urbaines globales, ce qui a accentué l'importance de la résilience locale influençant le processus de la résilience urbaine. Cependant, les différents processus de la résilience locale ont lieu et, en conséquence, produisent des inégalités entre les communautés, notamment car les efforts communautaires d'auto-assistance restent isolés dans chaque quartier et sans concertation avec les autres, ce qui entraîne une absence de consensus et de collaboration dans la mise en œuvre de ces projets communautaires.

La municipalité n'est pas encore associée aux efforts communautaires d'auto-assistance ni les communautés ne sont associées au système de la gestion du risque hydrologique par la municipalité. Jusqu'à présent, la municipalité, à travers le bureau de la gestion des catastrophes de la ville de Semarang, a organisé la prévention d'inondation et des efforts de rétablissement (reprise) après les événements des inondations pour les communautés côtières. Mais leurs projets et plans globaux ne partent pas de l'approche élaborée par la communauté (approche ascendante) mais relèvent plutôt d'une approche descendante. Dans cette dernière approche, les décisions sont élaborées par les institutions gouvernementales ; le public est ensuite plus ou moins tenu informé ; d'autres décisions émanent des contextes coopératif et normatif.<sup>77</sup>

Le processus d'apprentissage des institutions urbaines et celui des communautés sont différents et ne sont pas en synergie. Aujourd'hui, les acteurs externes, y compris les ONG et les acteurs internationaux contribuent à la compréhension des efforts des institutions urbaines dans la réduction du risque hydrologique. Les institutions urbaines tendent à développer le processus de la résilience urbaine par l'amélioration des réseaux urbains en s'appuyant sur l'apprentissage des acteurs externes. Cependant, quelques facteurs inhibent la mise en œuvre et la durabilité des projets hydrologiques ; donc, cette situation affaiblit le développement du processus de résilience urbaine. D'ailleurs, le transfert de connaissances des institutions urbaines aux communautés rencontrent plusieurs obstacles. La faible compréhension des projets gouvernementaux par les communautés constitue un de ces obstacles.

D'un autre côté, quelques ONG et les partenaires universitaires tentent de développer les capacités communautaires d'auto-assistance, particulièrement dans les communautés côtières pauvres. Néanmoins, leurs efforts ne concernent pas directement les initiatives et les

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<sup>77</sup> Dans le contexte de l'approche ascendante (*community-based/ bottom up approaches*), la gestion de la zone côtière est élaborée par les acteurs locaux, les représentants des gouvernements définissant des limites et des lignes directrices; les décisions alternatives sont coordonnées ou sont mises en œuvre par les approches ascendantes. Cf. Zagonari, F., 2008, "Integrated Coastal Management: Top-down vs. Community-Based Approaches", *Journal of Environmental Management*, vol. 88, Issue 4, pp. 796-804.



programmes de la réduction du risque d'inondation. Ils portent sur l'augmentation des capacités économiques des communautés, ce qui peut avoir une incidence sur les efforts d'auto-assistance pour la réduction des impacts du risque hydrologique. Cependant, ces efforts ne renforcent pas d'une manière significative la résilience de la communauté face à l'inondation.

Les situations ci-dessus démontrent l'insuffisance des approches urbaines globales pour le développement du processus des résiliences locale et urbaine. Les institutions urbaines et les communautés ont mis en œuvre des initiatives, même si ces efforts demeurent séparés. Les approches urbaines globales requièrent la transparence entre les efforts des institutions urbaines et des communautés pour le développement d'efforts intégrés. Cependant, la durabilité des efforts communautaires d'auto-assistance et leur coordination avec les approches urbaines globales est nécessaire afin de limiter l'inégalité urbaine dans les efforts de réduction du risque hydrologique. Récemment, le projet d'Asian Cities Climate Change Resilience Network (ACCCRN) est un projet pilote du développement de la résilience urbaine qui est élaboré par les institutions gouvernementales et les communautés. Néanmoins, ce projet n'affecte pas encore la résilience des communautés côtières. Ce projet porte sur la résilience urbaine de Semarang face aux changements climatiques liés à certains risques naturels. Cependant, la résilience urbaine face au risque d'inondation devrait être une priorité du programme de résilience de Semarang, dans la mesure où le risque d'inondation est le risque majeur dans cette ville.

**d) Une organisation autonome de la gestion du risque hydrologique permettrait de prendre en compte l'approche descendante et l'approche ascendante entre le niveau de la communauté et celui de la ville afin d'assurer la gouvernance de la résilience urbaine**

L'approche ascendante n'est pas encore appliquée dans la gestion du risque hydrologique. Les projets et plans hydrologiques sont fondés sur les initiatives des décideurs politiques. Néanmoins, les initiatives de la communauté pourraient être adaptées afin d'être intégrées dans la gestion du risque hydrologique. La création d'une organisation autonome permettrait de se concentrer sur la gestion du système hydrologique et du risque et pourrait être une alternative qui résoudrait l'inégalité urbaine dans les efforts élaborés par les communautés côtières de Semarang pour réduire le risque hydrologique. Cette organisation impliquerait les institutions urbaines et les communautés côtières. Elle viserait à gérer le système hydrologique comprenant le contrôle et la réduction des inondations et aussi l'approche globale intégrée avec l'aménagement urbain pour l'adaptation et la réduction du risque hydrologique.

On peut souligner que l'approche ascendante et l'approche descendante seraient appliquées conjointement dans ces efforts de collaboration. L'approche ascendante permettrait de faciliter les initiatives et participations de la communauté dans la gestion du système hydrologique côtier pour limiter l'inégalité territoriale. Pour l'instant, l'approche descendante est encore considérée comme la seule solution pour de nombreux responsables administratifs.

En outre, la participation du secteur privé, tels que les acteurs industriels qui sont implantés dans la zone côtière de Semarang, à des actions de la réduction du risque hydrologique est actuellement très faible. Ce sont des acteurs qui sont intéressés par les investissements urbains et, dans le développement de leurs activités, ils ont besoin d'espaces adaptés à la présence de ce risque. Le secteur privé ne joue pas actuellement un rôle important dans le développement des espaces économiques qui constitue un élément d'appui du processus de la résilience urbaine. Dans notre cas, la participation du secteur privé pourrait se concentrer sur les opportunités désignées sous le terme de responsabilité sociale

d'entreprise (RSE). Jusqu'à présent, la RSE est peu intégrée aux efforts de réduction et d'adaptation du risque. Ce programme est encore focalisé sur le développement des programmes socio-économiques de la communauté, y compris le développement des petites et moyennes entreprises et de services publics. L'absence d'organisation autonome est un élément qui explique le manque d'efficacité dans les processus de réflexion et de conception de plans pour la réduction et l'adaptation au risque hydrologique urbain, comme on peut l'observer pour l'instant dans la planification des programmes prioritaires et des projets incluant la participation du secteur privé.

**e) La transformation spatiale fonctionnelle et la capacité urbaine comme outils de planification urbaine pour l'évaluation de la vulnérabilité urbaine liée au développement de la résilience urbaine**

Le risque hydrologique dans la ville de Semarang est lié aux transformations des fonctions des espaces. La densité de la zone bâtie s'accroît conjointement au risque hydrologique, notamment dans la zone côtière de Semarang. L'évaluation des transformations spatiales n'est actuellement pas suffisamment prise en compte. L'importance des dynamiques de l'occupation du sol caractérisée par une pression forte sur les ressources du milieu est intégrée dans l'évaluation des impacts de l'aléa d'inondation dans la zone côtière.<sup>78</sup> Parmi toutes les mesures possibles, l'aménagement de l'occupation du sol est considéré comme la meilleure méthode de prévention de la catastrophe.<sup>79</sup>

Les projets de mise en valeur des terres n'utilisent pas les conceptions du système du polder et du paysage aquatique pour la réduction de la croissance du risque hydrologique. De même, la mise en valeur des terres n'a pas encore été influencée par le principe du « développement avec la nature ». Cette approche consiste en l'intégration la terre à la mer, et celle de l'eau à la terre de telle manière que la prochaine génération pourra utiliser les ressources côtières d'une manière durable, y compris avec un effort minime pour maintenir la bande côtière et la promotion d'un système d'usages multiples.<sup>80</sup> Ces concepts soulignent la nécessité d'une création d'espaces aquatiques dans le développement côtier urbain. Récemment, la municipalité a mis l'accent sur l'approche géologique pour évaluer les capacités urbaines.<sup>81</sup> Néanmoins, l'évaluation de la capacité de la zone urbaine côtière n'a pas encore été explorée complètement. Cette évaluation ne se reflète pas encore dans les plans et les politiques de l'occupation du sol de la zone côtière. En pratique, cette évaluation ne prend pas en compte, dans son analyse, le concept d'empreinte écologique. Cet indicateur synthétique permet de décrire et d'estimer les pressions des activités humaines exercées sur l'environnement naturel et la capacité de régénération de l'écosystème, ceci étant applicable à toutes les échelles de la société humaine.<sup>82</sup>

Quelques chercheurs ont expliqué que le calcul de l'empreinte écologique de la zone industrielle du District de Genuk (la partie de l'est de Semarang) a outrepassé sa capacité

<sup>78</sup> Canters, F., Vanderhaegen, S., Khan, A.Z, Engelen, G., Uljee, I., 2014, "Land-use Simulation as a Supporting Tool for Flood Risk Assessment and Coastal Safety Planning: The Case of the Belgian coast", *Ocean & Coastal Management*, vol. 101, Part B, pp. 102-113.

<sup>79</sup> Chang, Hsueh-Sheng, Hsieh, Hsin-Ying, 2013, "An Exploratory Study on Land Use Planning of Disaster Prevention. A Case Study of Kaohsiung New Town", *Procedia Environmental Sciences*, vol. 17, pp. 382-391.

<sup>80</sup> Waterman, R.E., Misdorp, R., Mol, A., 1998, "Interactions between Water and Land in the Netherlands", *Journal of Coastal Conservation*, vol. 4, pp. 115-126.

<sup>81</sup> Il s'agit d'*Atlas informasi geologi lingkungan kota Semarang, Jawa Tengah (Atlas of environmental geological information of Semarang City)* qui a été établi en 2009.

<sup>82</sup> Cordeau, E., Nascimento, I., 2005, *L'empreinte écologique des habitants de la région Ile-de-France*, Paris: Institut d'aménagement et d'urbanisme de la région d'Ile-de-France-IAURIF/ Conseil Régional d'Ile-de-France, récupéré le 25 décembre 2015, du site [http://trolldegrognon.free.fr/NiCo/M2DUD/projet\\_SDRIF/fiches/empreinte\\_ecologique.pdf](http://trolldegrognon.free.fr/NiCo/M2DUD/projet_SDRIF/fiches/empreinte_ecologique.pdf).

environnementale.<sup>83</sup> Pour le moment, l'évaluation de l'empreinte écologique n'est pas encore appliquée aux politiques de gestion de l'occupation du sol dans la zone côtière de Semarang. Cependant, les transformations des usages de l'espace sont perçues comme l'élément-clé pour soutenir la réduction et l'adaptation au risque hydrologique et aussi pour pallier le manque de projets hydrologiques urbains dans le processus de résilience urbaine.

La ville de Semarang est une étude de cas qui fournit l'opportunité de l'analyse du rôle des communautés locales pour garantir leur protection face aux inondations. Dans ce cas, la participation des habitants est faiblement prise en compte dans les politiques publiques. Cette recherche a souligné les mérites et limites de la participation de la communauté qui ne sont qu'une contribution au développement de la capacité de résilience du système urbain. La résilience face aux risques naturels s'avère résulter d'une politique globale qui élabore des mesures conjoncturelles et structurelles, aux différentes échelles.

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<sup>83</sup> Cf. Budihardjo, S, Hadi, S.P., Sutikno, Purwanto, 2013, "The Ecological Footprint Analysis for Assessing Carrying Capacity of Industrial Zone in Semarang", *Journal of Human Resource and Sustainability Studies*, vol. 1, n° 2, pp. 14-20.