

Flooding in Jakarta
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Abstrak

Banjir merupakan peristiwa yang akrab bagi kota-kota di Pantai utara Jawa. Dari tahun ke tahun banjir selalu terjadi menimpa daerah perkotaan dan pedesaan. Kondisi banjir, bukan hanya masalah kesehatan dan drainase kota yang harus dibahas, tetapi juga bagaimana banjir tadi menimbulkan berbagai masalah sosial.

Jakarta yang dibangun oleh Jan Pietersz. Coen di awal abad the 17 dengan satu konsepsi kota air (waterfront city), merupakan kota yang akrab dengan permasalahan banjir. Pada waktu didirikan di tahun 1619, Batavia dirancang dengan kanal-kanal seperti kota Amsterdam atau kota-kota lain di Belanda. Kanal tadi sudah sejak awal sering kering dan suatu ketika tergenang air yang lebih tinggi dari kotanya sehingga banjir tak terelakkan. Dari semenjak awal abad ke 20 Belanda membangun kanal untuk menanggulangi banjir tadi. Tetapi bagaimana garam yang ditebar kelautan, setiap tahun pula banjir bertambah besar dan selalu menjadi lebih sulit untuk ditangani. Tulisan ini mengungkap sisi sejarah kota tentang banjir secara runtut. Dengan belajar dari sejarah mampukah kita mengatasi banjir?

Banjir di Jakarta yang terjadi pada 1996 selain menggenangi hampir seluruh penjuru kota juga menjadi tragedi nasional yang menjadi perhatian dunia. Banjir besar ini dipercaya sebagai banjir lima tahunan yang akan berulang setiap lima tahun. Pada awal 2002 banjir kembali melanda ibukota. Bukan hanya daerah permukiman saja yang tergenang tetapi juga halaman Istana Merdeka yang menjadi simbol kekukuhan kekuasaan satu pemerintah. Banjir yang terjadi saat itu juga tak pernah diduga akan menimbulkan konflik antara penduduk kota karena jika pintu air di Manggarai ditutup maka banjir di daerah Cipinang akan semakin tinggi dan jika dibuka daerah perdagangan serta istana presiden akan kebanjiran.

Melihat kompleksnya permasalahan, tulisan ini akan mengurai banjir dalam sejarah kota, kehidupan sehari-hari, tantangannya ke depan dan prospek dari kota ini terhadap banjir. Mengapa banjir di kota ini tak pernah terpecahkan? Mampukah perencanaan drainase kota nantinya akan mampu memecahkan masalah ini? Banjir merupakan bagian sejarah kota Jakarta yang teramat penting untuk diungkap. Selain banjir tadi mempengaruhi perencanaan kota, juga mempengaruhi realita nilai suatu kawasan. Sejarah Jakarta adalah perkembangan kota yang mencoba mencari kualitas lingkungan yang lebih baik, strategi mengatasi degradasi lingkungan yang semakin buruk dari hari ke hari.

A. Introduction

When Jakarta was founded at the place of the small port town of Kalapa, later changing names into Jayakarta, Jacatra, Batavia and eventually Jakarta, people could not imagine that this small settlement at the supposedly 5000-year-old alluvial fanlike plain made up by the debris of the Salak, Pangrango and Gedeh Vulcanoes located south of present-day city of Bogor, would develop into a multi-million settlement and even become the core of a mega-urban region counting tens of millions of inhabitants. This

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site, at a seashore slowly expanding because of the sediment carried by the rivers and taking the shape of a large bay in front of numerous small islands, was situated at an altitude just above sea level. That is why this lowland area as depicted in Figure 1 has naturally always been subject to regular flooding by the waterways cutting through the plain, such as the Cisadane, Angke, Ciliwung, Bekasi and Citarum Rivers. In the hot season discharges of these rivers are low and urban canals show mostly muddy, dirty and smelly bottom conditions. But during the wet season when these rivers carry down the largest part of their sediment, silt that in the course of time has grown in quantity because of upstream human-induced eroding developments, the risk of flooding becomes paramount and has large impact. The often disastrous consequences have aggravated in the course of time because of rapid urbanization leading to more extensive parts of the built environment and greater numbers of humans to be effected, as well as to human action and inaction that have led to obstruction and deterioration of the drainage system seriously reducing its discharge capacity.

Figure 1: Outline map of the bay of Jakarta with the hinterland, scale 1 : 1,000,000. Stippled: alluvial plane. Source: Verstappen, 1953: 8.

From this depiction of the Jakarta conditions it will be clear that the capital of Indonesia has a problem to deal with. This problematic is extensively covered in newspapers and other publications every year when the inundations or *banjir* take place in the lower parts of the city and these floods hamper normal city life in some cases even to the point of total disruption and standstill, people staying at home not being able to reach their place of work, while the distribution of fuel and food and other necessary services in extreme cases also is blocked.

In this article we will describe the flood conditions in Jakarta by presenting a historic overview, a description of daily life and problems in times of *banjir* and an evaluation of the current infrastructure works as well as the existing administrative views, plans and problems. The study is based on life experience with floods in Jakarta and in addition to interviews with experts, the study of historic material, newspapers and official reports. The core question to be answered is: Why has the persistent problem of regular flooding in Jakarta never been solved?

B. Batavia *banjir*

After the founding of Batavia in 1619 gradually a system of canals was dug, very much alike that of Amsterdam at the time, while the reclaimed ground was used to raise the land for construction purposes. Already in 1633 complaints were uttered about the stench when the canals were lying dry and in 1665 it was pointed out that the water sometimes came higher than the town, while in 1670 some streets were inundated because of springtide. In his comprehensive work on the situation in old Batavia, de Haan (1922) reported extensively on the canal and flood conditions. The difference between the tides, although generally being quite limited, sometimes led to flooding at springtide and to the drying up of some of the canals at low tide. Problems with sandbanks at the entrance of the Ciliwung and with the extension of the coastline were also brought to the fore in the early days of Batavia. By means of a palisade wall construction it was tried – without much success – to protect the castle against the extension of the coast, but finally a canal had to be dug in the newly accrued terrain. The

sandbank in the river mouth was dredged with help of nets and dredging mills powered by horses.¹

De Haan mentioned a number of causes, effects and solutions of the flooding in the town. As roots he brought up the low level of the land and the small difference between the tides. The cutting of trees upstream of the Ciliwung led to higher water levels in this river and raised its sediment. The crumbling down of the canal borders also augmented the quantity of sediment transport. Another factor was the water distribution over extended *sawah* areas, which led to the dispersal of the water over larger areas rendering it unmanageable. He also mentioned the use of the river and canals for the removal of solid waste. Especially the sugar mills were indicated because of the large quantities of organic waste dumped in the river before the stream entered Batavia.

Yet, the general principle is the sinking of mud at places where the current is less strong or comes to a standstill because of debris, at the inner corners of the canals and near the coastline where there is only a limited flow. In these quiet waters the mud gets more time to form sandbanks that can grow out to small mud pools and even end up becoming islands that are growing and changing place in the course of time.

The effects of the situation were of course regular inundations and muddy, stinking canals when the water became scarce. In the lower parts of the town it was impossible to construct sewage systems, as the water would come out of the piping.

The solutions tried out in the course of time were numerous. Efforts were made to stop the silting up by dredging with nets, with dredging mills and by manual (forced) labour with small baskets. The pier in the bay of Jakarta was extended, but the sandbank at the mouth of the river appeared to be pushed forwards only. The lack of effect of the palisade wall along the castle and need for the construction of a canal have been mentioned earlier. Strong efforts were made to prevent waste to be dumped in the canals. In 1740 the river was even led through different canals in which it entered at a right angle to stop the strong current and rinse out the mud. All sorts of waterworks were constructed such as solid canal banks, sluices and dams.

In 1725 the water of the Ciliwung was forced by a dam through the Westerse Vaart, but in times of *banjir* the river tried to retake its old bed and the dam had to be opened to prevent its complete destruction. This is the first in a series of flood canals intended to bridle the Ciliwung. All the early canals aimed at control of the floods were directed westward, such as the Bacherachtsgracht and the Mookervaart. Only relatively recent an eastern *banjir* canal, under construction now, has been taken into consideration.

For later centuries, other authors also relate about the flood problems of Batavia. Abeyasekere (1987) pointed at the high frequency of the flooding in the nineteenth century often leading to the government remaining idle. Supposedly a certain accustoming of the people and the officials as well as an undeniable fatalism were detriment to this. According to her the authorities only felt obliged to undertake large drainage works when there were particularly bad floods. This was the case in the 1870s. Some of the canals in the lower town were filled in then and some new ones were dug further upstream to divert the floods.

In the twentieth century the proposal for a westward flood canal, the Bajir Canal, made by H. van Breen was realized. In Figure 2 the course of the projected canal is given. It diverts the water of the Ciliwung south of Menteng to the west and the north, finally entering the sea near Muara Angke. It is interesting to see that along the north coast a polder is proposed of which the level is heightened by dredged mud. Van Breen also proposed a variety of smaller works to improve hygiene and drainage. Several of

¹ These mills were dismantled in 1709.

these were implemented as was reported by Eggink (1930) in his commemorative publication on the 25th anniversary of Batavia.

Figure 2: The planned situation in Batavia after the construction of the Banjir Canal. Source: Van Breen, 1917: 2b.

In the 1940s W.J. van Blommestein developed a comprehensive plan for the irrigation and drainage of the whole of West Java. It consist of dams and lakes in the Citarum River for white electricity, new irrigation fields near the town of Cilacap and the construction of a dyke along the sea between Batavia and Tanjung Priok to develop a polder with several basins at the site of the coastal fish ponds. Van Blommestein also listed several other elements necessary for better water supply and drainage in Batavia, such as the deepening of the canal system, pumping installations, sluices and a drinking water installation.

Figure 3: Plan for Batavia and Tanjung Priok by H.J. van Blommestein (n.y.: Plaat I).

This historical review leads to the insight that in the course of time many solutions for the flooding problems of the city were proposed and sometimes realized. Most of these aimed at westward drainage through new canals. Regular maintenance was also implied but generally quite deficient. The idea of a system of basins in a polder along the coast was brought forward, but not realized. These plans and projects had to follow the tremendous expansion of the city that took place over the centuries and clearly lacked behind it. A definitive answer has not been found and regular flooding has kept scourging the inhabitants of Jakarta.

C. Jakarta *banjir*

Based on the *Jakarta Masterplan 1965-1985*, Sethuraman presented an evaluation of the drainage and flood control conditions in the 1960s. He pointed out that:

- (a) nearly all the rivers flowing in the city, in combination with the drains network, are now functioning in a very unsatisfactory manner;
- (b) most of the rivers and drains have become shallow owing to the practice of dumping refuse and waste directly into them, and because of inadequate maintenance and dredging;
- (c) most estuaries have already become shallow through a continuous silting-up process which greatly hampers the flow of water;
- (d) almost all of the water constructions are completely damaged and operating inefficiently;
- (e) many areas are periodically submerged as a result of ineffective road drainage; and
- (f) there is insufficient open ground, and total water permeability is thus diminished.

However, in 1965 the Office of Public Works initiated a long-term project

which foresaw the excavation of 3.4 million cubic metres of earth to provide water reservoirs, the construction of 89 kilometres of canals and the dredging of 750,000 cubic metres of earth in rivers and estuaries, as well as the construction of pumps, bridges and flood control gates and the relocation of the population from an area of 478 hectares. It is reported that two-fifths of the project was completed in the first

three years (1965-67). In 1967 expenditure on the project amounted to Rp. 28.5 million (Sethuraman, 1976: 38-39).

Besides these anti-flood activities the planning of Jakarta was developed in a wider context and a more structural way within the framework of the Jabotabek planning-region. The idea was that the growth of Jakarta had to be curbed towards the other cities in the planning region, namely Bogor, Tangerang and Bekasi, in order to protect the capital city from the overwhelming problems resulting from rapid population increase and under Governor Ali Sadikin it was even tried to close the city, albeit without much success. In this city-planning model flood protection could be easily integrated as substantial green areas between the centres were implied. Yet, a better solution for the recurrent flooding was still aimed for and in the beginning of the 1970s Dutch consultants (NEDECO) proposed an eastern flood canal. The plans for this East Banjir Canal (EBC) were further detailed in the 1990s by Japanese consultants. It is intended to lead the water of the five rivers east of the Ciliwung to the sea and should be finished in 2010, but some delay may be expected.

In the mean time the planning concept of Pantura, Pantai Utara or North Coast, was developed because of drinking water problems resulting from severe groundwater pumping.² This practice which is very common in Jakarta, with household pumping water from higher groundwater layers and hotels and industries from lower layers, causes the emptying of these layers and intrusion of seawater so that nowadays the northern part of the city is not able to use groundwater any more. This drinking water situation has led to the idea that Jakarta should not extend to the south aggravating the groundwater problem, but to the east and the west. These concepts of Jabotabek and Pantura are very well discerned in the current master plan.

The Jakarta master plan of 1984 for the period 1985-2005 mentioned flood control and drainage extensively. The main targets are the improvement of the flow of water, the storage of rainwater for flushing during the dry season and the integration of macro, semi-macro and micro-drainage networks. The flood control system is divided in three parts: central zone, west zone and east zone. In the central zone the Depok Dam and the improvement of the existing polder system with among others new pumps are emphasized, in the west zone the completion of the Cengkarang Flood Canal takes priority and in the east zone the completion of the upstream part of the East Flood Canal is indicated for 2005 (Jakarta 2005: 23). The action programme lists several points of priority, such as the construction of the Depok Dam, the continued use of the artificial lakes in upstream areas for flood control, the improvement of the coordination between the various responsible agencies to ensure that clean rivers can be kept free from garbage, household sewage and industrial waste, and the restriction of urban construction in the southern parts of the city (Jakarta 2005: 55).

The report also stresses that the handling of micro drainage and sub-micro drainage for flood control because of high costs needs a very large investment. Cooperation with central government is deemed essential and therefore should be continuously stimulated (Jakarta 2005: 69).

Figure 4: Flood control and drainage plan Jakarta 2005 (Source: Jakarta 2005: 54).

² The planning concept of PANTURA should not be confused with the large-scale plans for land reclamation that also carry the name PANTURA. Between 1990 and 1999 the government of Jakarta approved this massive land reclamation project. The project comprises reclamation of 2,700 ha of land from the sea in Jakarta Bay, stretching along 32 km of present coastline from Banten Province along DKI Jakarta up until West Java Province. Early 2003 the Minister of Environment released a decree rejecting the project for environmental reasons.

Figure 4 presents the flood control and drainage plan as indicated in the Jakarta 2005 master plan. The flood prone areas in the western and in the eastern parts of Jakarta appear to be substantial. In fact these are large extension areas between the city and the International Cengkareng Airport and between the city and the Tanjung Priok Harbour: mangrove, swampy as well as *sawah* areas. The solution for both sides of the city is clearly sought in the respective flood canals: Cengkareng and Eastern Flood Canal (the latter still being under construction). The central city zone, including the old town and Menteng, constitutes a polder and is protected by the West Flood Canal. A new polder is proposed for the area directly under the Tanjung Priok Port. The southern cone of the city is marked for retarded urban development in order to minimize surface flow of water to the build-up parts of the city. The implementation of these plans has got a strong impetus from the 2002 flooding that set large parts of the city under water including parts of Menteng, while the stairs of the Presidential palace at Merdeka Square were also under threat. That is why it is important to present a sketch of these events before dealing with the current situation of the flood and drainage system and its strengths and weaknesses.

D. The 2002 flooding

In the beginning of January 2002 the city government of Jakarta did not expect that large parts of Jakarta would be submerged during the starting rainy season, although as early as 3 January 2002 the board of meteorology and geophysics had given a warning that from mid of January to February large flooding would occur in Jakarta. During those days the spring tide of the sea would be at a maximum along with the highest average rainfall. Yet, the city government considered this a regular event that did not need any special attention. They only had old equipment, which was actually not adequate anymore, at their disposal to prepare for the flood.³

Sunday 27 January a large flood entered Jakarta and inundated several parts of the city. The rain showered the city from 27 January evening to 28 January morning and the dike south of Jakarta broke down. The black, smelling water, altogether with a lot of garbage, was pouring onto the main road to Bogor, Kramat Jati and East Jakarta. In North Jakarta, at Kelurahan Pejagalan, Kecamatan Penjaringan, the flood occurred from midnight to 5 o'clock in the morning and reached levels as high as 20 cm. Meanwhile Kelurahan Kapuk Muara was inundated till 70 cm. And so far there had been no evacuation. There also were no alert warnings from the city government.⁴

In West Jakarta the flood struck houses and important streets. At Kelurahan Tanjung Duren Utara the flood reached 120 cm high since the dike of Sekretaris and Gendong Rivers broke down while the water at the Tomang Barat Reservoir could not be controlled any more. The river water spread out over the housing estates and urban kampungs of West Jakarta.⁵

Daan Mogot Street and the housing in its surrounding were reached first by the giant flood. Cars had to be evacuated before they were sinking into the deluge and all furniture on the first floor of two storey houses had to be moved to the second floor. Sometimes furniture had to be evacuated to the roof of a building. The housing area along the western canal became a large swimming pool with dirty and stinking water

³ Kompas, 3 January 2003, Pertengahan Januari diperkirakan Jakarta mulai banjir.

⁴ Suara Pembaruan, 28 January 2003, Hujan lebat guyur Jakarta sejumlah permukiman tergenang.

⁵ Suara Pembaruan, 28 January 2002, Hujan Lebat Guyur Jakarta Sejumlah Permukiman Tergenang.

from the canal, as the rain did not stop for a half day. The green villa housing estate in the surrounding of Daan Mogot Street was flooded for one meter. The rich people who lived in this luxurious estate had to flee their houses since the flood stayed there for weeks.

The flood also occurred at Kelurahan Bambu Utara, Kecamatan Pal Merah, where more than 385 houses were inundated for 15 cm. But so far no inhabitants were evacuated. A number of streets in West Jakarta, such as Daan Mogot Street and Pesing (Kecamatan grogol Petamburan), Kedoya Street (Kecamatan Kebon Jeruk), Kelapa Dua Street, and streets in the surrounding of the Green Garden Duri Kepa Estate, suffered from 30 cm high flooding.

In South Jakarta the location of the flood was at Paku Buwono Street, Kebayoran Baru. It inundated the area as high as 30 cm. In East Jakarta the Cipinang River overflowed the whole of Kelurahan Cipinang Besar. It inundated the area as high as 50 cm, and no inhabitants were evacuated. Meanwhile the dike of Kalibaru at the roadside to Bogor at km 21 broke down and the water overflowed the highway as high as 50 cm. This caused a long traffic jam. The water also overflowed the kampongs behind the dike. A flood of one metre took place in Serdang (Kecamatan Kemayoran), Central Jakarta.

Yet, no evacuation took place. The inhabitants of Jakarta and their government had the idea that the flood was already at its climax and would soon go down. The people still went to work and in spite of everything urban transportation was going on.

During the whole Monday of 28 January thousands of houses in Jakarta were inundated as rain continued falling in large quantities. On the other side of the city at Cililitan and Kampung Melayu the water had been raising as high as two metres, flooding the houses. All the inhabitants had to move to the roof of the houses. At Pejaten, landslide occurred at the bank of Ciliwung River taking four houses in the flood, killing six people in the accident. Ironically the city government took no action to ease the burden of the people until Monday evening. Sutiyoso, the governor of Jakarta, still believed that it was not necessary to declare the highest emergency level.⁶

At East Jakarta the flood had become worse and worse. Cipinang River overflowed and more houses were inundated. A luxurious estate, Cipinang Indah, was flooded as high as two meters. Many of the houses were abandoned by their inhabitants without enough time to save their property. A consulting firm in the area lost all the computers, books, maps and project data as the house was flooded abruptly on 29 January early in the morning.

The situation became worse when young people began to ask money from those who passed by. They were groups of young gangster who forced people to give their cash, something that did not happen in normal Jakarta.

On 30 Januari at 4 o'clock in the morning, Suratno, a *soto* hawker at Dewi Sartika Street, was awoken by his wife when the five kilograms of noodles he recently bought at the market, were already floating in the unexpected water that had entered the first floor of his temporary 2 x 2 meters house. Suratno hurried to bring his only small television up stairs because the water level was rising fast. The whole family was in a state of panic to save their property from the flood. But suddenly electricity went off and it became dark everywhere.⁷

The flood became a serious problem as more than three quarters of Jakarta were inundated. The city became like a giant Titanic, which lost its control when attacked by the water. The traffic stuck for more than ten hours. That is what happened in West Jakarta at the Kebon Jeruk Junction. People had to stop the motor and in the middle of

⁶ Kompas, 29 Januari 2003, Banjir genangi Jakarta ribuan penduduk mengungsi.

⁷ Penabur, 2 Januari 2002, Kisah pilu dari daerah banjir.

the blockage could not do anything; the cars were surrounded by water like a tanker sailing on the sea. Public transportation, which normally is abundant on the streets and stops everywhere, became very scarce at the end of January and the beginning of February 2002 during flood time. Many inhabitants had to walk home for kilometres. In East Jakarta a group of men hijacked a mini bus to bring them to Pulo Gadung.

The water that in the beginning only flooded a few spots of the city, on 30 January 2002 covered the whole of Jakarta. Only Menteng, Pondok Indah, and Pantai Indah Kapuk were not hit. More than 40 thousand people were fleeing from their houses. Traffic jams occurred along Daan Mogot Street, Cengkareng and Grogol. The alternative traffic through Semanan also stopped. Similar traffic jams appeared at Puri Indah, Kembangan and Meruya.⁸

Those who were already on the street to go to the office had to return home when they noticed that lining cars in the traffic jam did not move. The cause of the traffic jam was the inundation of the main street as high as 80 cm, so that cars could not pass while several had already been caught by the water.

The Cisadane River overflowed along Daan Mogot. Many vehicles were trapped on the street and could not move. A heavy traffic jam also occurred on the Toll Way to Merak where thousands of vehicles were lining for kilometres meeting with those coming from Kebon Jeruk. They were surrounded by flood as high as 50 cm and they could not go anywhere.

Another traffic jam occurred at East Jakarta. Molek River at Pondok Gede overflowed the street for as high as one meter. The vehicles were stuck waiting for the flood decreasing. Not only the floods did create traffic jams, but also the cancellation of train and flight services has this effect. At the Soekarno-Hatta Airport about 80 percent of the air flights were delayed. These mainly were domestic flights. A few international flights, taking off in the morning, were also behind schedule.

Those who were trapped in a traffic jam and had enough money, preferred to sleep in hotels located along the street. However, to find a room in the hotels was not easy, since most hotels were full of rich refugees whose houses were inundated. Hotels offered a temporary place to avoid the flood. But when the flood was getting higher, the basements of the hotels, where the cars were parked, were inundated. In the end, when the generators were also flooded, electricity turned out and the rich got the same problems as the other city inhabitants.⁹

The flood stopped the glamorous life of Jakarta when people had to be evacuated from hotels. Electricity stopped and elevators did not move. The red-light districts at Mangga Besar and Gajah Mada Street stopped to offer its usual entertainment services. Jakarta as a symbol of modern Indonesia life was hit very hard. Nobody admired Jakarta as a dream place any more, the destination of young people to find a job. The flood that in several places such as Kampung Melayu and Cililitan reached over six meters traumatized the inhabitants.

For the rich people of Jakarta 2 February 2002 was predicted to be a lucky day because of its unique number 02022002. Hence, on that day many couple planned to get married. Of course the wedding party is a very important event for them to show their wealth. In this business, there are firms specialising to create a wedding program that includes luxurious cars, an expensive meeting hall, delicious food and a high-class hotel for the bride and the bridegroom. Those who had paid for the wedding party were disappointed. A marriage in a luxurious hotel at Kuningan hosted just a few guests in contrast to the numerous people that had been invited. The poor bride cried realizing

⁸ Kompas, 30 Januari 2003, Banjir makin meluas.

⁹ Kompas, 3 February 2003, Perkawinan batal: Penghuni hotel mengungsi.

that the event would take place once in her life only. As a consequence of the flooding glamour life was completely extinguished in Jakarta.

The flooded areas were not only those of the low-income class, but also included the Kelapa Gading area inhabited by high-income people. Fighting between the residents of Sunter and Kelapa Gading arose when they argued whether the floodgate at Sunter River should be opened or not. Kelapa Gading and Sunter are two large housing estates just across the Yos Sudarso Bypass. If the floodgate was closed the water would overflow. The Kelapa Gading Estate and the housing at Sunter remained safe. According to an inhabitant of Kelapa Gading, the floodgate was closed by a person from Sunter. The car factory Astra located at the Sunter side hired soldiers to guard the closed floodgate. If this gate was opened, Astra would have lost quintillion Rupiah because of their new cars inundated. As a consequence of this floodgate closing, the flood went to Kelapa Gading. This luxurious estate occupied by rich people became a lake. The inhabitants of Kelapa Gading came to the floodgate to ask the guardian to open it half. After a long debate the floodgate was opened a few centimetres and then the equipment to open the floodgate was cut off. Kelapa Gading was inundated during a week. To go out of their houses, people have to pay dearly, until a hundred thousand Rupiah, to get into a raft.¹⁰

Until 2002 the system of dealing with flood was still in accordance to H. van Breen's plans of 1920 that divided the Ciliwung River into two, the Banjir Kanal Barat going to the Southern and Western part of the city, and the continuing Ciliwung River, called Inner-City Ciliwung River, going to Kenari Street, Raden Saleh Street, Kalipasir Kwitang, and Istiqal where it was divided into two smaller rivers, the one that passes Pasar Baru and Gunung Sahari till Ancol, and the other one that is going to Gajahmada Street and to Kota. Manggarai is the place where the floodgate is located. It was guarded by soldiers. At that time the floodgate to the Banjir Kanal Barat was opened so that the flood covered the area of western Jakarta. Meanwhile the floodgate to the Inner-City Ciliwung was closed. If this floodgate was opened the Presidential Palace, Thamrin Street and Kota would be inundated. Since this floodgate was closed, the flood at the eastern part such as Cililitan and Kampung Melayu was very high. People went to the Manggarai floodgate and wanted to open the floodgate, but they had to face the soldiers who were ready to shoot anyone who opened the floodgate.

Finally, on the early morning of Saturday 2 February, the central government announced the highest emergency situation for Jakarta. The floodgate at the Inner-City Ciliwung River was opened. The yard surrounding the presidential palace, the National Monument and Kota, forming the central administrative and economic area of the country, were flooded.¹¹

The water had stopped the economic activities of the capital. All offices including banks were closed. Jammed streets were a common scene at the periphery. The golden triangle of M.H. Thamrin, Jendral Sudirman, Gatot Subroto and H.R. Rasuna Said was very quiet. The same happened at Kota, Hayam Wuruk, Gajah Mada, Roxy, Tomang and Cempaka that normally are busy and in a traffic jam. Meanwhile, the three-day-old flood caused the State Electric Company (PLN) Rp.15-16 billion losses since it was forced to shut off 120 electric relay-station posts supplying 400 megawatt of power. A number of trains were rendered inoperative and the route from Pasar Minggu, Manggarai and Gondangdia could only go as far as the Tebet Station. The flood also affected the Tanah Abang Station, which could not cope with the deluge from the Flood Canal. Spill over from the canal forced cancellation of a series of electric train trips while other lines

¹⁰ Kompas, 3 February 2002, Perkawinan batal: Penghuni hotel mengungsi.

¹¹ Kompas, 2 February 2002, Jakarta terendam total.

experienced delay. Cancellation of the train trips and other train lines stranded thousands of commuters who were waiting in several stations.¹²

According to the Ciliwung-Cisadane River Basin Development Project (2002) about 15 per cent of the Jabotabek area of 100 km² was flooded. Local bottlenecks (mostly man-made structures) were believed to be responsible for most of the flooding at higher grounds in the city. At the lower levels closer to the sea most inundations were caused by low hydraulic gradients in combination with profile constriction and narrow bed width. An overview of the areas inundated within DKI Jakarta during the 2002 floods is presented in Figure 5. The most affected areas were situated in the north-west and north-east of Jakarta, with water depths over 1.5 m. These areas comprised the downstream reaches of the Cengkareng Floodway System, the Western Banjir Canal and the downstream reaches of the Eastern Banjir Canal System. Other affected areas comprised among others the remaining coastal area of North Jakarta and more upstream the areas along the Ciliwung and Pesangrahan Rivers. Flooding also occurred outside the DKI boundaries. The amount of deathly casualties caused by the flooding of 2002 is estimated at about 80. The direct costs of financial damage are estimated at Rp. 5.4 trillion whereas the indirect economic damage is estimated at Rp. 4.5 trillion (NEDECO, 2002).

In the post flooding time Jakarta became a field of illness: diarrhoea, cold and skin diseases became very common in the city. Everywhere people cleaned their houses from the mud. Most of the families whose houses were inundated lost valuable items such as furniture and vehicles. According to Mari'i Mohamad, the head of Red Cross Indonesia, the post flood situation was more complex for the poor people, as they did not have any money to buy a new bed and repair their house.¹³

The impact of the flood largely influenced the property market. The criteria to buy a house are not only made up by a strategic location that is close to school, place of work and mall, but also by being free of flood. The price of places like Kelapa Gading, which was famous as a strategic place in Jakarta, was declining as it was inundated for a week during the flood of 2002. According to Info Tempo 68,4 per cent of the house owners whose houses were inundated, tended to sell their houses, 24,6 percent did not want to sell their houses, and another 6,8 percent tended to wait and see. Unfortunately those who want to sell the house do not find a purchaser so that they still live in their house.¹⁴ After the flood, Kelapa Gading suffered from declining property value.

¹² Kompas, 30 January 2003, Flood declared national disaster, economic activities paralyzed, 8 dead, 80 percent of flights suffered delay.

¹³ Mari'i Mohamad, Koran Tempo, 25 February 2002, Banjir, kemiskinan dan korupsi.

¹⁴ Kalim, Nurdin and Sulaeman Dian N.; Biar terpencil asal bebas banjir, Info Tempo.

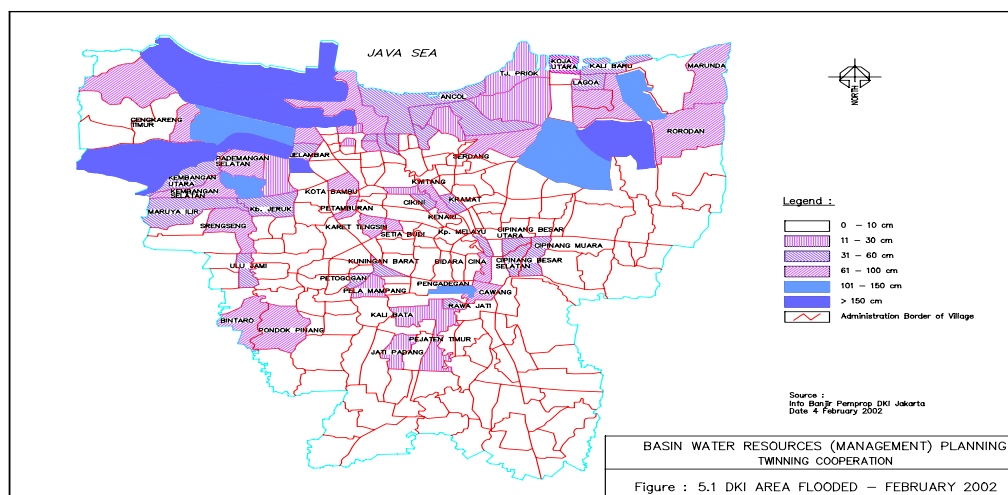


Figure 5: Areas inundated during 2002 flooding event (Source: Rijkswaterstaat et al., 2003).

After the flood had gone, people put sacks of sand along the street to protect their living area from the flood. They raised their house floors often without permission of the city planning board. Developers raised the estate ground level several meters. The new Mangga Dua Mall at Gunung Sahari is situated two meter higher than the level of the houses in its surrounding. But even here the street level was raised for two meter, so that only three meter of space was left under the railroad viaduct that crosses the street. All these reactions show that the people in the capital mainly care for the safety of their own property without assessing the behaviour of the others. The rich who managed to pay the construction of new higher floors did not bother the situation of their unfortunate neighbours'. As a consequence the poor who did not have the money to raise their floor levels will suffer higher flooding of their houses. The reactions show how large the gap is between rich and poor.

The central government through the National Planning Board intends to spend 15 quintillion Rupiah to overcome the problem of flooding in Jakarta within 10 years. Hence, each year there will be 1,5 quintillion Rupiah for the city government to run the project for solving the flood problem. The reaction of the public in Jakarta is negative. They believe this sum will lead to further corruption by the city government and cause new scandals. A coalition of several NGOs who are against this plan has protested at the head of the National Planning Board.

Moreover, the public criticized the city government of Jakarta to revise its budget for the year 2002. The budget of 9 quintillion Rupiah that has been agreed on by the City Council actually assigned a larger portion to routine cost, such as salary and other fees, then to flood problems. The public wanted the budget to be revised in order to use a 30-percent portion to tackle the flooding problems.¹⁵

In this kind of situation, the main public figure criticized by the public was of course Sutiyoso, the governor of Jakarta. He responded too late to the flood. People reproached him for ignoring the warning of Meteorology and Geophysics Board so that when the flood took place the city government did not know how to respond. As many as 29 NGOs and other organizations belonging to the community stated that Governor Sutiyoso had failed to lead the city. He made wrong decisions in solving the flood problems. Hence they asked the Assembly of Jakarta to decline Sitoyoso from his

¹⁵ Kompas, 4 February 2002, DKI harus revisi RAPBD.

position as Governor.¹⁶ The main director of change in the capital had a difficult moment. To avoid further attacks Sutiyoso took the initiative to destroy his own villa at the Puncak, an area that has been settled rapidly in the last two decades by the rich, which is believed to be one of the causes of the flooding in Jakarta.¹⁷

The second person that became a target is Ciputra. This famous developer built many housing areas including Pantai Indah Kapuk that got no flood while their surroundings were inundated.¹⁸ According to critics, this Pantai Indah Kapuk, of which the ground level was built higher than the housing area in its surroundings, caused the flooding that covered the toll road to the airport and other areas of Jakarta that previously never were flooded. Nevertheless, the polder itself is made with its own internal water management system which means that the water is discharged in the adjacent drains and not burdening the bordering areas.

The third person criticized for the flooding was Megawati, the President of Indonesia. She was blamed to be very late to react. In fact she visited the victims on 31 January, four days after the flood struck the city.¹⁹ It was shameful that the President and her crew encountered protest from the flood victims they visited.

The floods of 2002 show that in the Reformasi Era people have become more critical to the government. They openly blame the governor for mismanagement. The social phenomena related to the floods show that corruption and flooding were portrayed side by side in every event during the tragedy. Flood was considered the result of the mismanagement of the city that taking place for decades. The flooding killed city life for almost a week and left a trauma for more than a month.

Now several years after the floods, it is interesting to notice that the city government seems to have forgotten the tragedy that took place in 2002. When the flood was there for some time, the bureaucrats finally reacted, but it is still not clear to the public what decisions are taken and plans realized to prevent the city from another – probably worse – rainy season. The city government even plans to reclaim the coastal line for 2,700 ha and predicts that they will earn 12 quintillion Rupiah from the investors. As the floods were caused by a lack of water-catchment areas, such reclamation without other measures would result in wider flooding in Jakarta.²⁰

Nowadays the people of Jakarta also have forgotten the tragedy. The plan of 15 quintillion Rupiah is not found in the press anymore. The NGOs are busy with other things that cause more sensation than floods in a situation without flooding. The housing estates that became the victim of the floods have been forgotten. The people do not think about it anymore. Garbage that was to blame as one of the factors that cause floods is out of debate now and is still stuck in the rivers and canals of the city everywhere. The boats for the evacuating of the victims have been put in the storehouses. The Puncak area is still an attractive place for the rich to build their villas. There is no discussion on the problem of water-catchment areas anymore as was the case in February 2002.

The flood is like a monster that is patiently waiting for the idleness of the city inhabitants and their officials; at a certain time it will return to demolish city life, worse than before! The flooding event in January and the beginning of February 2002 shows that Jabotabek's flooding problem has become worse than ever before. High intensity and long duration rainfall inundated vast areas, also those that were normally unaffected

¹⁶ Kompas, 6 February 2002, DPRD Didesak berhentikan Sutiyoso.

¹⁷ Suara Merdeka, 14 February 2003.

¹⁸ Media Indonesia, 10 February 2002, Pantai Indah Kapuk penyebab banjir.

¹⁹ Suara Pembaruan, 1 February 2002.

²⁰ Kompas, 4 December 2003, Pemprov DKI kejar keuntungan Rp 12 trilyun.

by the floods. Many people had to flee their homes, illnesses broke out, power plants shut down, and toll roads and the main thoroughfares of Jakarta were closed. The 2002 flooding led to a large number of human casualties, a city that was disrupted for over a month and significant direct and indirect damage to property and economy.

E.The current situation

But in addition these descriptions of the historical development of the flooding problematic and the 2002 impact on daily life of common people in the city, how do the experts perceive the present *banjir* situation in Jakarta? What water management projects are under construction and improvement measures taken by the government? Do the experts have comprehensive insights outside the official public scene and the interests of the mass media to explain why the *banjir* problems of Jakarta have not been solved in the past? And besides, do they think that these problems can be solved at all and how?

Responsibility for functioning of the drainage system lies in the hands of both the central government and the local government. The central government (through the Ministry of KIMPRASWIL) takes care of the river systems whereas the local governments of DKI Jakarta, Banten and West Java Provinces take care of the main drain system and of the majority of the local drainage works.

Altogether the drainage system of JABOTABEK consists of a comprehensive system of rivers, main drains, local drains, canals, retention basins, polders, flood gates, regulating gates, siphons and pumping stations, which regulate the discharge and retention of rain water towards the Java sea. An overview of the rivers and main drains is given in Figure 6 depicting the total water-catchment area of JABOTABEK.

In 1997, under the title *Study on Comprehensive River Water Management Plan Jabotabek*, on request of the Japanese International Cooperation Agency (JICA) an extensive investigation on drainage and flood control was completed by NIKKEN Consultants and NIPPON KOEI & Co. for the government of Indonesia. In 2002 the latest study in this field was carried out by NEDECO under the title *Final Report Quick Reconnaissance Study Flood JABODATABEK 2002*. In those studies the drainage system of Jabotabek is divided in river basins. Because of their significance for the present-day comprehensive planning approach, on the bases of these two studies, the most relevant of these river basins will be briefly outlined hereafter, namely the Cisadane River Basin, Cengkareng Floodway System Basin, Western Banjir Canal System Basin, proposed Eastern Banjir Canal System Basin, Cikarang-Bekasi-Laut (CBL) Floodway System Basin, and the Residual Basins and Urban Drainage Area in DKI Jakarta.

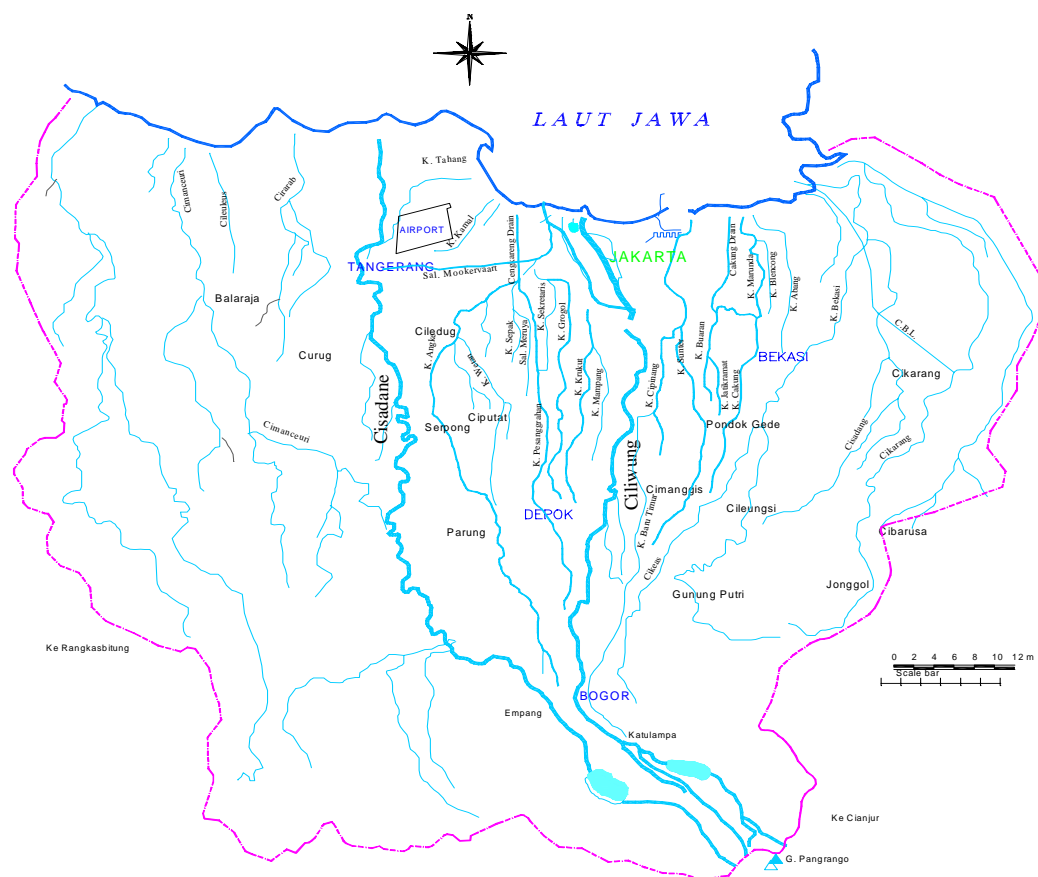


Figure 6: Rivers and main drains in Jabotabek (source: NEDECO, 2002).

In the Cisadane River Basin (1,411 km²) the Cisadane is the largest river originating on the slopes of Mount Kendeng, Mount Perbakti and Mount Salak. The middle and lower reaches of the river flow through the fast growing urban area of the city of Tangerang before discharging in the Java Sea. Water levels in the river can reach dangerous levels at the city of Tangerang. As observed in 1997 the water is sometimes dammed up by the downstream Pasar Baru Barrage built in 1937. In 1997 it was also indicated that only 5 out of 10 gates operated properly due to a lack of proper maintenance. Furthermore backwater effects of the Cisadane River to the Sabi River are mentioned as a reason for inundation in Tangerang. The Tangerang area has no urban drainage system, only some isolated channel networks.

The Cengkareng floodway system basin (459 km²) is dominated by the Angke River, which conflues with the Mookervaart Canal (connecting the Cisadane with the Angke), Pessangrahan and Grogol Rivers. The system discharges in the Java Sea through the Cengkareng Drain, which was constructed in 1983 as an alternative to the extension of the Western Banjir Canal proposed in the NEDECO Master Plan of 1973. The downstream reaches of these rivers flow through the densely populated area of West Jakarta. The Cengkareng Drain itself shows signs of being heavily silted up. Due to land subsidence, several bridges crossing the Cengkareng Drain have very low clearances between the water level and the bridge decks.

The Western Banjir Canal System Basin (421 km²) is dominated by the 17 km long Western Banjir Canal, which was build in 1918 and collects floodwaters from the Ciliwung and Krukut Rivers. It also receives water from the Cideng Drain and Angke Drain. The Ciliwung originates on the slopes of Mount Pangrango, cutting through Bogor and the heart of Jakarta and is one of the larger rivers in terms of the size of its

catchment area. In central Jakarta, at the Mangarai Flood Gate, the Ciliwung splits and discharges partly in the Western Banjir Canal and partly continues in multiple smaller drains that discharge in the Java Sea. The Krukut joins the West Banjir Canal at the Karet Weir. In 2002 large improvement works for the West Banjir Canal, such as strengthening of embankments, dredging works and reconstruction of bridges were under way (personal observation).

The Eastern Banjir Canal System Basin (207 km²) will be based on the East Banjir Canal that was first proposed by NEDECO in 1973 and is meant to divert run off from the Cipanang, Sunter, Jatikramat, Buaran and Cakung Rivers along the eastern border of DKI Jakarta. At present the East Banjir Canal has not yet been finished due to high costs for land acquisition and housing compensation. Until its completion these rivers discharge in the Java Sea at separate locations. In the existing situation the Cipanang joins the Sunter at Kelurahan Cipinang and continues as the Sunter, which discharges in the Java Sea at the port of Tanjung Priok. Near the east DKI Jakarta border the Buaran confluent with the Jatikramat and continues as the Buaran. More downstream the Buaram joins the Cakung and continues as the Cakung Drain. Before discharging in the Java Sea, the Cakung Drain splits in Cakung Drain and the old Cakung River course.

The Cikarang-Bekasi-Laut (CBL) Floodway System Basin (915 km²) is based on the 29 km long CBL Floodway that was constructed in 1985 to divert the run-off from the Bekasi, Cisadang and Cikarang Rivers. The most dominant river running straight to the centre of Bekasi, is the Kali Bekasi with a catchment area of 403 km². The fast growing city of Bekasi is built on the fluvial deposits of this river. Apart from some isolated channels, the urban area of Bekasi has no urban drainage system. One of the obstacles in the Bekasi River is the Bekasi Barrage, constructed in 1958 and located in the centre of town. The situation is quite similar to the situation in Tangerang since the barrage dams up the water during high discharges, which may lead to flooding.

The residual basins and urban drainage area of DKI Jakarta also can be seen as a catchment basin. Within the urban area rain water is collected by a local system of smaller drains and is discharged directly or through pumping stations into the rivers or main drains. DKI Jakarta has 18 pumping stations for urban drainage purposes. The existing reservoirs cover approximately 145 ha and are used as retention and retarding basins or regulating ponds for pumping stations. The Pluit Retention Basin of 80 ha is the largest. Close to Halim Airport, at Sunter, a large 110 ha retention basin is planned of which in 2002 only part has been implemented (Flood Management DKI Jakarta, 19..). More and larger ponds and reservoirs are present outside DKI Jakarta at Kabupaten Bogor, Kabupaten Tangerang and Kabupaten Bekasi. Furthermore, a large number of other regulating or connecting structures are part of the drainage system in DKI Jakarta, such as weirs, culverts, sluices and siphons.

The main point stressed by the experts is that this whole system of water-catchment areas relevant for JABOTABEK has to be taken into account in order to find an answer for the Jakarta *banjir* problem. Until recently in practise only specific parts of the area formed a component of the execution of the drainage plans. But the region has been urbanized in such a rapid way that no solution if any may be reached without taking the whole area into consideration. In the past the projects were often lagging behind reality as they were proposed at a certain moment for a city that was extending considerably and even doubling before the implementation of the project.

FIGURE HERE

Figure 7. Some photographs of drainage conditions.

a: Just upstream Sunda Kelapa harbour.

- b: Just upstream the river outlet of the Sunter.
- c: Idem.
- d: Just upstream the outlet of the Cakung drain.
- e: Idem.

F. Urbanization

In the past decades the population of JABOTABEK exploded from 2.7 million in 1960, 6 million in 1980 up to 11.5 million in 1995 (UN, 1995). The city expanded and developed rapidly whereas the existing drainage system was neglected. Uncontrolled urbanisation, poor spatial planning, a lack of maintenance and the government's inaction to implement improvements to the drainage system have led to the current situation in which most drains and rivers do not have sufficient discharge capacity to cope with the increasing peak flows. Flooding events have become more frequent and more extensive. The latest example of this trend was the 2002 flooding event, elaborated earlier, which is considered to be the most extensive and devastating flood event in modern Jakarta history in terms of the number of people displaced and the area affected

In the Suharto era and continuing under the new government, the city's need for additional space resulted in rampant housing and commercial developments in the Bogor and Puncak areas. Forests and paddy fields were quickly replaced by asphalt pavements and concrete buildings, herewith reducing the water retention capacity of the area. More rainwater is now diverted faster and directly to the nearest stream or river, thereby increasing river peak flows and discharges. As a result a certain amount of rainfall, which previously would be partly retained and would not cause any problems downstream, may now be the cause of flooding.

At the same time, due to deforestation and increasing peak flows, the amount of sediment towards and in the rivers increased. Sediment transportation capacity is generally high in the upstream sections of the river and does not cause any problems there. In the lower reaches however, in the urbanized areas, the sediment settles, herewith decreasing the flow cross-section. Without proper maintenance (dredging) in the river beds, the flow cross-sections will continue to decrease and rivers and drains overtop their banks more easily. This also holds for the river outlets of which some are heavily silted up. Small hydraulic gradients in the lower reaches of the rivers and drains lead to low flow velocities, especially during high tides. At present parts of North Jakarta easily inundate during spring tides and most of the water has to be discharged at lower tides (larger hydraulic gradient). Nevertheless, the sediment deposits at the river outlets keep hampering smooth outflow in the Java Sea, creating backwater effects.

Furthermore most drains and rivers are clogged by garbage, which is unrestrictedly dumped by many people in the rivers and drains. According to the World Bank (1994) only 40 per cent of trash and garbage is collected whereas 30 per cent is believed to get blown, washed or dumped into the rivers and drains. Garbage tends to heap up at the outlets, along the riverbanks, against bridge abutments, in front of flood gates or other man-made structures. This narrows flow cross-sections and can create backwater effects.

Even without garbage many of the human-made structures, such as flood gates or bridges, already narrow flow cross-sections and are known to create backwater effects that can cause flooding upstream. This may be caused by a lack of operation and maintenance or the structure may simply be outdated, not fitting anymore within the current requirements of discharge capacity. At some locations along the rivers and drains peak flows may be hampered by provisional wooden houses and other small structures

on the river banks, built by many of Jakarta's poor, who settled along the river banks and river mouths.

In North Jakarta flood risks are increasing by the effect of land subsidence, caused by uncontrolled and unlimited deep groundwater extraction. In some areas of north Jakarta rates of 6 cm per year have been measured. It is expected that land subsidence will continue in the near future and parts of North Jakarta will slowly sink below sea level. Flood risks will increase by subsiding river dikes and larger inundation depths and flood water velocities during flooding, leading to more damage. At the same time bridges and other drain or river spanning infrastructure are subsiding. At some locations hardly any free space is left between the bridge deck level and flood water levels. The bridge has than become a major obstacle in flood water discharge.

Besides rainfall and the low ground level urbanization is clearly one of the main factors in the *banjir* problem. It is the cause of loss of retention capacity also in the upstream areas where deforestation is occurring and lays at the roots of gradual land subsistence in certain particularly northern parts of the city. Lack of capacity and maintenance drainage infrastructure are also important, while socio-cultural factors related to policy implementation and solid waste dumping and management are not without impact. These general causes as a matter of course can be specified for different parts and infrastructure conditions in JABOTABEK. In the expert reports many concrete proposals for the improvement of the drainage system are presented that do not need to be repeated here. A comprehensive approach is proposed that besides retention areas also comprises a flood monitoring and early warning system as inundations clearly will continue to occur in the foreseeable future.

In expert reports the burden of the flooding is often laid on the shoulder of urban and other officials. These reports often claim that the authorities are not capable of dealing satisfactorily with all sorts of urban development issues, such as spatial planning, upper watershed management, urban infrastructure, solid waste management, housing and settlements, and water resources (NEDECO, 2002). All sorts of public financial, institutional, managerial, cooperative, participative and human resource problems of the governmental system are considered to lay at the basis of the total inability to solve the flooding problem in Jakarta. However, without denying governmental shortcomings the question may be raised whether or not it is possible at all to master all the flooding problems including urbanization with reasonable investment levels. Obviously the answer is no. And that is why water specialist nowadays more and more are proposing to develop a risk approach to deal with the flooding problem. Such approach takes into consideration both the probability and consequences of a flood event in a certain area. This means that an area without people but the same chance of flooding as another area with many inhabitants is characterized by a much a lower risk level. A plain chance approach only takes into account the probability of flooding without reference to the material and immaterial consequences for the population involved (loss of property, human casualties and so on).

G. *Banjir* solutions

The flood solutions range from all sorts of short term measures such as cleaning, better solid waste management, removal of obstacles, dredging, enhancement of operation and maintenance and improvement of infrastructure to institutional strengthening by technical training, awareness programs, law enforcement and early warning and emergency assistance systems, as well as long term improvements by means of upper watershed planning and management, and the improvement of discharge capacity and retention capacity (NEDECO, 2002). The latest developments focus on

extensive dredging works, evictions of illegal settlers from riverbanks and the setting up of an early warning system. Major plans are the massive land reclamation project, called PANTURA - not to be confused with the regional planning strategy carrying the same name, the Eastern Banjir Canal currently under construction, the Ciliwung-Cisadana Tunnel and the Cisadan-Angke Floodway.

The construction of the East Banjir Canal (EBC) was first recommended in the 1972 master plan of NEDECO and elaborated by Japanese consultants in 1990. The proposed floodway has a length of 23 km and aims to protect a large area east of the Ciliwung. EBC is planned to divert run off from the Cipanang, Sunter, Jatikramat, Buaran and Cakung Rivers along the eastern border of DKI Jakarta. The planned floodway starts at Cipanang just north-east of Cawang and runs in eastern direction towards Cakung continuing north along the DKI Jakarta border, discharging in the Java sea at Marunda. Besides construction of the floodway the project also includes rehabilitation works on the Sunter, Cipanang and Buaran Rivers as well as construction of sills, outlets, weirs, drainage outlets, roads and bridges. The total costs are estimated at Rp. 5 trillion with almost half of this budget required for land acquisition and housing compensation. At present realisation is hampered by the time required for land acquisition. The most recent planning shows that the project can be realised before 2010. Public opinion often considers the Eastern Banjir Canal as *the* solution to Jakarta flooding. Realisation of this expensive flood control project will indeed relieve the burden caused by the rivers in east Jakarta. One should be careful, however, to perceive this plan as the solution of the *banjir* problem, but it is more realistic to just consider it as the completion of a 30 years old master plan.

Two project proposals still in an early stage that have been formulated by the Japanese consultants (NIKKEN Consultants & NIPPON KOEI, 1997) are the Ciliwung-Cisadana Floodway and the Cisadan-Angke Floodway. The Ciliwung-Cisadana Floodway upstream Bogor between the Cisadane and the Ciliwung is about 900 meters and aims to divert Ciliwung flows towards the Cisadane. The plan also includes the construction of two sediment and retention reservoirs. It found strong opposition from the Tangerang Regency and Banten Province because of the environmental impact. The morphologic consequences and expected discharges should be studied in more detail. The Cisadan-Angke Floodway near the border of Tangerang and Serpong is about 4 km long and meant to divert the water of the Angke River to the Cisadane.

These important infrastructure projects, just listed briefly here, if realized will result in a certain relieve for the residents, but no full guarantees may be expected as the urbanization process of the region will be proceeding rapidly and partly in unpredictable or undesirable ways and directions.

H. Conclusion

From its beginnings Jakarta has been prone to flooding due to its unfavourably low location on the coast of the Java Sea. It is situated within the river basin of several rivers transporting large amounts of water during the rainy season. Although technically speaking solutions for the *banjir* problem may be envisaged, these will require enormous, unrealistic amounts of funding, while the technical specialists in this field are more and more inclined to think in remaining chances and probabilities of flooding instead of complete cures. The engineers agree that the key to flood prevention lays in a risk management approach taking into account both probabilities and consequences, and that the focus in Jakarta should initially be on the rehabilitation of the existing infrastructure. The problem is aggravated by the rapid urbanization along with severe water extraction leading to steady sinking of the ground level. To raise the level by means of addition of

sand leads to the reduction of part of the benefit from the heavy load causing further sinking. That is why measures on spatial planning and the directions of urbanization should be tied in with the rehabilitation envisaged. Future policies to reduce the risk of *banjir* in Jakarta should be based on comprehensive water catchment area policy and inclusive urbanization planning. As the past colonial and postcolonial anti-flooding measures were often strongly lacking behind the rapid growth of the city – parts of them being implemented when the city population and built area were extended already two to three times – comprehensive water and urbanization planning should be aimed for. Perhaps the main solution has to be found in an elaborate system of polders. Such polders already exist in Jakarta and in the colonial period additional proposals for polder extension were launched. A sinking city probably should be turned into a polder city. It is expected that Jakarta will count over twenty million people in 2015. Without doubt this future development will require large flood control and flood risk management investments. As history shows that government agencies are often too late implementing flood control measures, it is clear that the cultural aspect can not be considered a strong incentive for improvement. During the centuries the inhabitants and government officials of Jakarta have become acquainted with the inconveniences, which are likely been forgotten all too soon with the beginning of the dry season. Moreover, they do not affect all parts of the city to the same extent, although in the more severe cases of *banjir* also richer areas are not able to escape, particularly when the city comes to a virtual standstill as we have seen earlier for the year 2002. Notwithstanding the fact that at this very moment many small and large water infrastructure improvements are in the course of being implemented in Jakarta, the overall aim should be to tackle the problem on the basis of one comprehensive cultural, water catchment area and urbanization plan. But even then the specialists will point out that what can be aimed at is just risk reduction.

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