

WORKSHOP OF PLANNING AND URBAN DESIGN

BANGKOK - RIVER CITY

From May 31st to June 13th 2008



Preparatory document

THE CHAO PHRAYA RETURN

Organizing the city around the river, dynamizing its water fronts, living our era's blue city are processes which have already changed the physiognomy, geography and customs of many cities in the world. Some of them like Paris, Budapest, Prague, Vienna, Lisbon... have achieved these objectives in earlier stages, others have more recently engaged in urban renewal. Other river-towns, London, Tokyo, New York, Buenos Aires, Montreal... can be mentioned.

In Bangkok, the former spatial and functional logic of waterways has been profoundly transformed. In a sense, through filling, mere supposition and oversight, it had given up a major part of its river existence. Today town councillors wish to develop the river by retying with Chao Phraya. Considering the scale of the aquatic territory which has nevertheless remained and the functions it can still fulfil on its course as on its banks and waterside districts, this second alliance will strongly contribute to the revival of the whole city.

Because time has passed, because certain realities have faded, because new ones have appeared, this second alliance cannot be considered as a (nostalgic) rehabilitation but must be appreciated as a mutation (not without memory of the past). It is necessary to elaborate from the existing city, a new "blue city". A first order construction site opens here, in the future of Bangkok, as in Rome, Canton, Shanghai, Seoul, Seville, Lyon... and it is to this task that the experts gathered by the Ateliers are asked to contribute by their diversified skills, their experience, their enthusiasm and their generosity.

"We sailed down the river with the wide, lazy and happy flow. Huts on piles nestled on the water's edge in the greenery of banks"¹ said Somerset Maugham. The river is always there, wide, idle and attractive. Upstream and downstream, houses on piles follow each other, one right next to the other, sometimes they are in ruin, sometimes bright and fresh, but always delicate, luxurious or modest. They testify to a past when living there, in this delta plain subjected to the will of the waters, above all meant composing with the river. The asset which Chao Phraya represents can find in these settlements, minor but long-lived, the origin from which would stem the new "Bangkok, river city".



The ecological context has been globally, profoundly and dramatically transformed. Dykings, fillings of canals, the excessive discharge have transformed the relationship with the river. To a relation of friendship and respect between the city and the river succeeded a devastating war which can be lethal, especially since Bangkok has to face the floods which ruin public and private investments, which maintain the most powerless populations in states of precariousness and ill-being, as well as the risk of its ground sinking. The alarm has been given, but we have entered the state of urgency.

But the river and some canals are still alive, as shows the intense traffic of cargo boats, ferries, "long tails", sampans and diverse barges or the kids who bathe there (our friend Sumet tells us that they are "vaccinated" because they've swam there since their youngest age), or the thousands of city-dwellers who use it every day, or again the hotels which build their terraces on its edge. It is also alive for property developers who're discovering the market value of the "view on the river" and try to get the best profit out of a land tax which becomes rarer everyday, by piling up floors, higher and higher.

To offer Bangkok a calm and glorified relationship with its river, to serve the economic and social development of the city, to enjoy Chao Phraya as a wild, familiar and prolific nature... How to make these dreams real? Twenty one talents, twenty one skills, twenty one imaginations, twenty one experts will not be too many to take up this challenge.

Claude Prelorenzo



¹ William Somerset Maugham, *Un gentleman en Asie*, Éditions du Rocher, 2000 (original publishing, *The Gentleman in the Parlour*, 1930).



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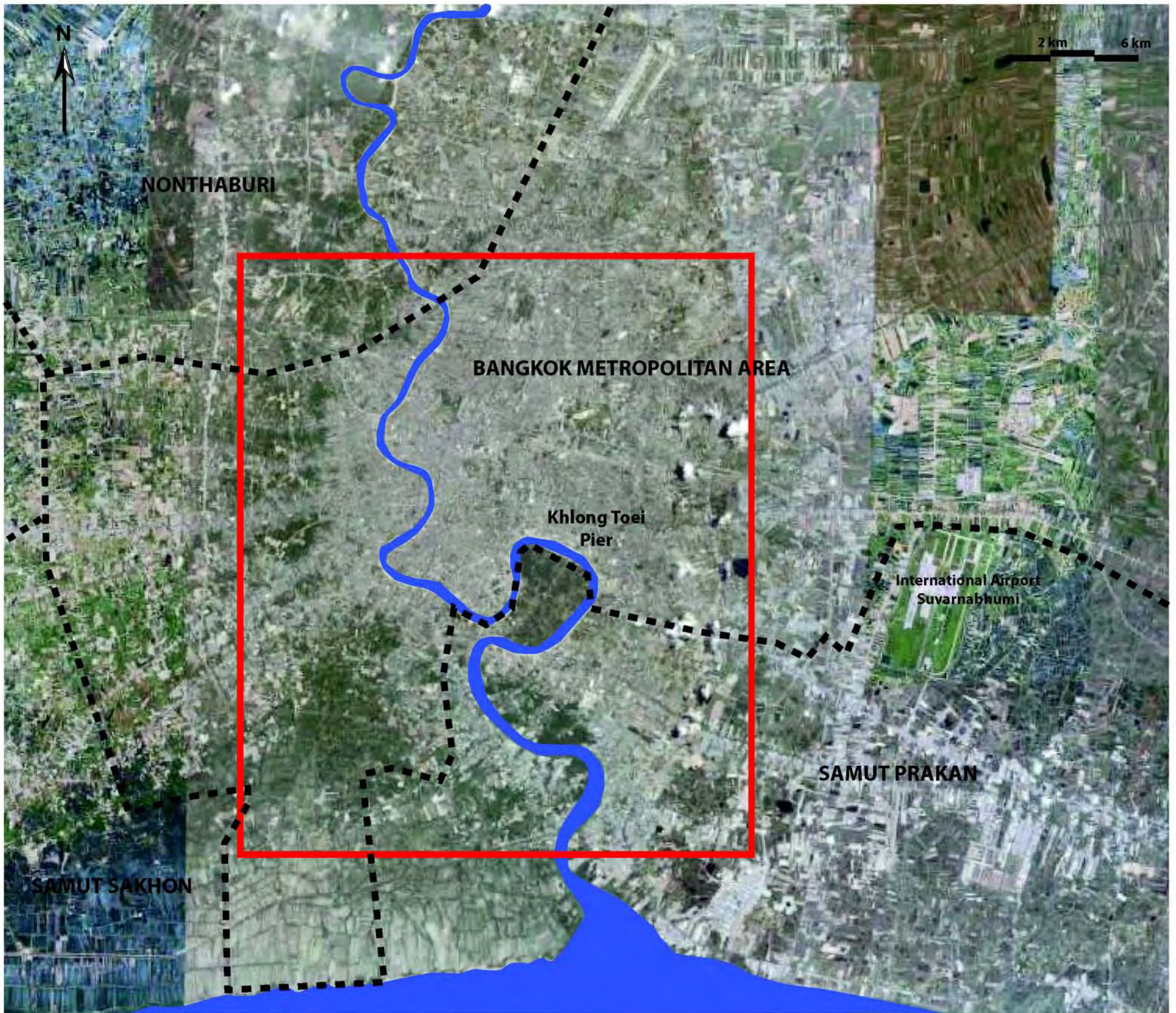
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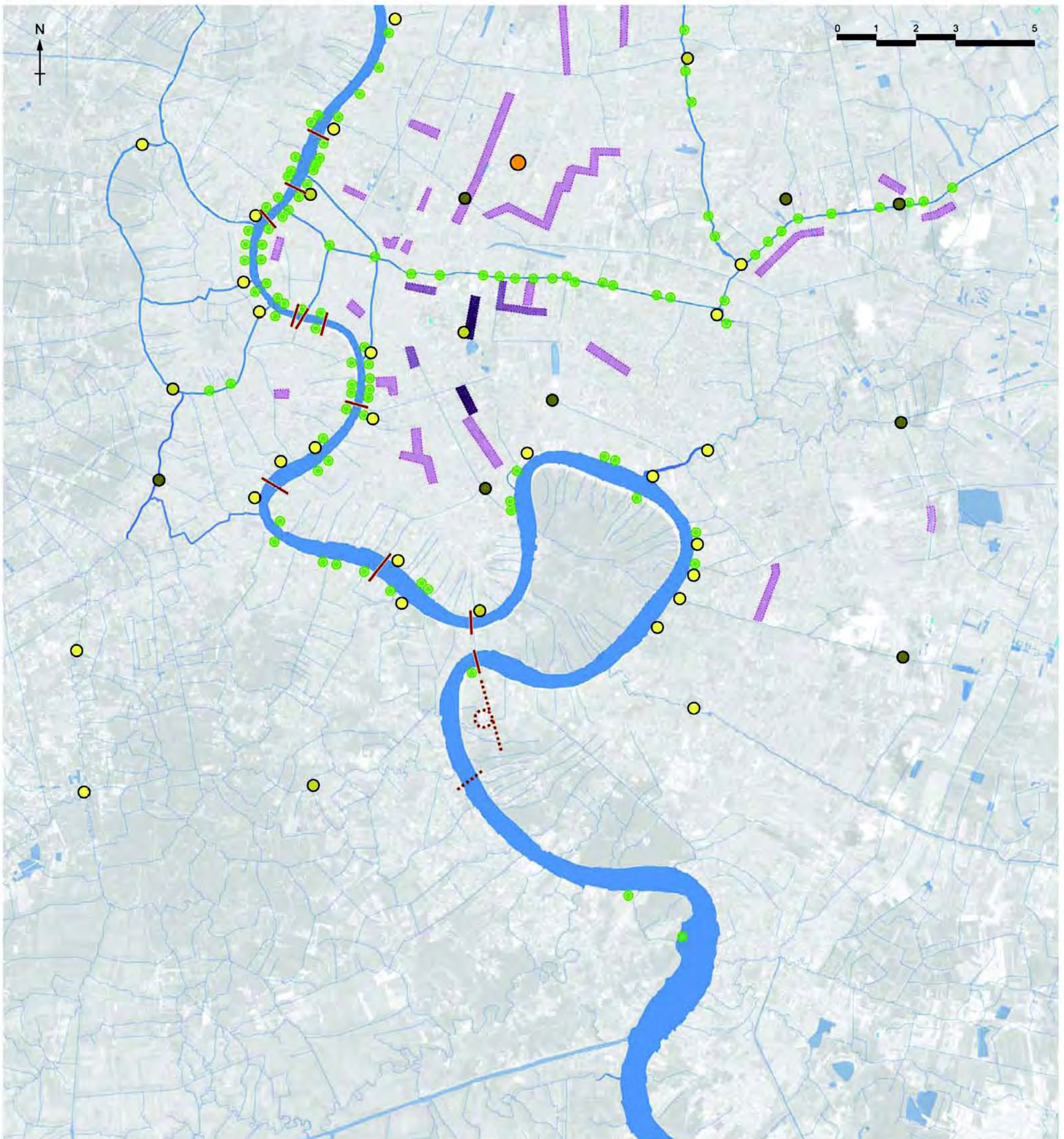
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- Administrative limits
- Map atlas zoom (Scale 1:50000e)



The river Chao Phraya goes through the metropolis of Bangkok on about twenty kilometres before throwing itself into the Gulf of Thailand, splitting the city in two. Both banks of the river present different urban characteristics:

- the right bank (which corresponds to the former province of Thonburi before the creation of the BMA) hasn't been urbanized a lot but is the object of important stakes of extension today.
- the left bank (Phra Nakhon) where we find the historical centre, the big office and housing buildings, shopping centres and the main transport networks.

About ten bridges permit to cross the river. The most recent one, which steps over the buckle of the river south of the city, inaugurated in 2006, is the biggest double cable-stayed bridge of the world. The river still constitutes an important barrier to the continuity of urban traffic. The connection between both banks is also insured by "long tails" boats and some parts by river lines.

The city is crossed by a network of canals (khlongs) built from the XVIth century to facilitate the transport of goods and to

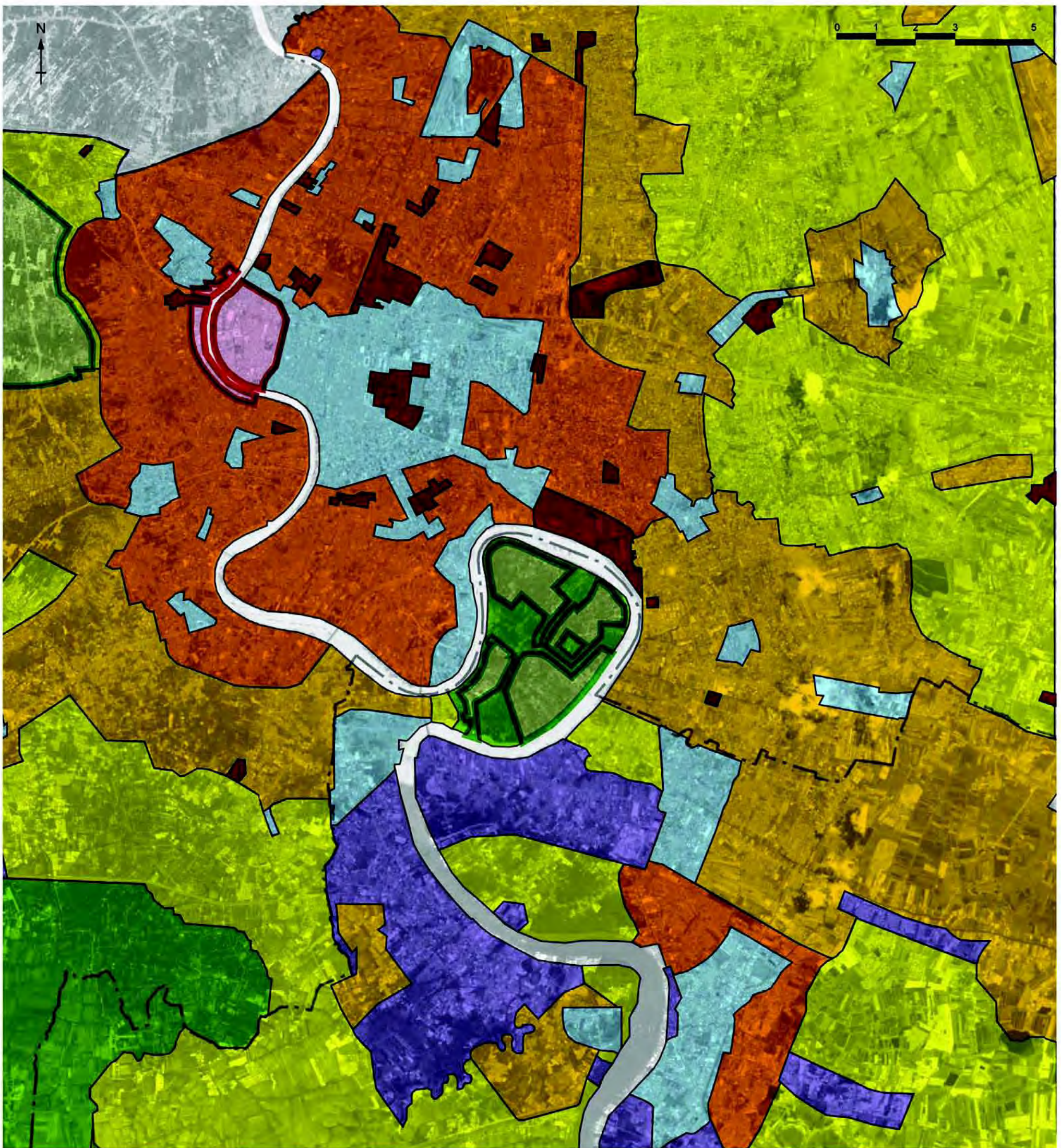
develop irrigated agriculture. Formerly main infra-urban communications, the majority of khlongs are now covered to the benefit of land ways and urbanization. Today, there are few remaining navigable canals and many of them serve as the recuperation network of waste waters.

The level of the city being at less than meters above the sea level, the river often floods the banks due to monsoon storms and high tides (September). Since the 1995 floods, the authorities have elaborated a prevention plan which rests mainly on the control centres of water regime and watergates.

	Fleuve/ voies navigables Rivers/ navigable waterways
	Canaux/ voies non navigables/ canalisations Canals/ non-navigable waterways/pipings
	Etangs Wetlands
	Ponts/ ponts en projet Bridges/ bridges in project
	Embarcadères Piers
	Zones inondables profondeur 5-12 cm Floodplain zones - depth 5-12 cm
	Zones inondables profondeur 13-20 cm Floodplain zones - depth 13-20 cm
	Zones inondables profondeur 21-30 cm Floodplain zones - depth 21-30 cm
	Zones inondables profondeur 31-40 cm Floodplain zones - depth 31-40 cm
	Centre de contrôle Control center
	Stations de drainage Drainage stations
	Portes d'eau Watergates
	Stations de mesure Mesure stations

* source année 2002

* source année 1998

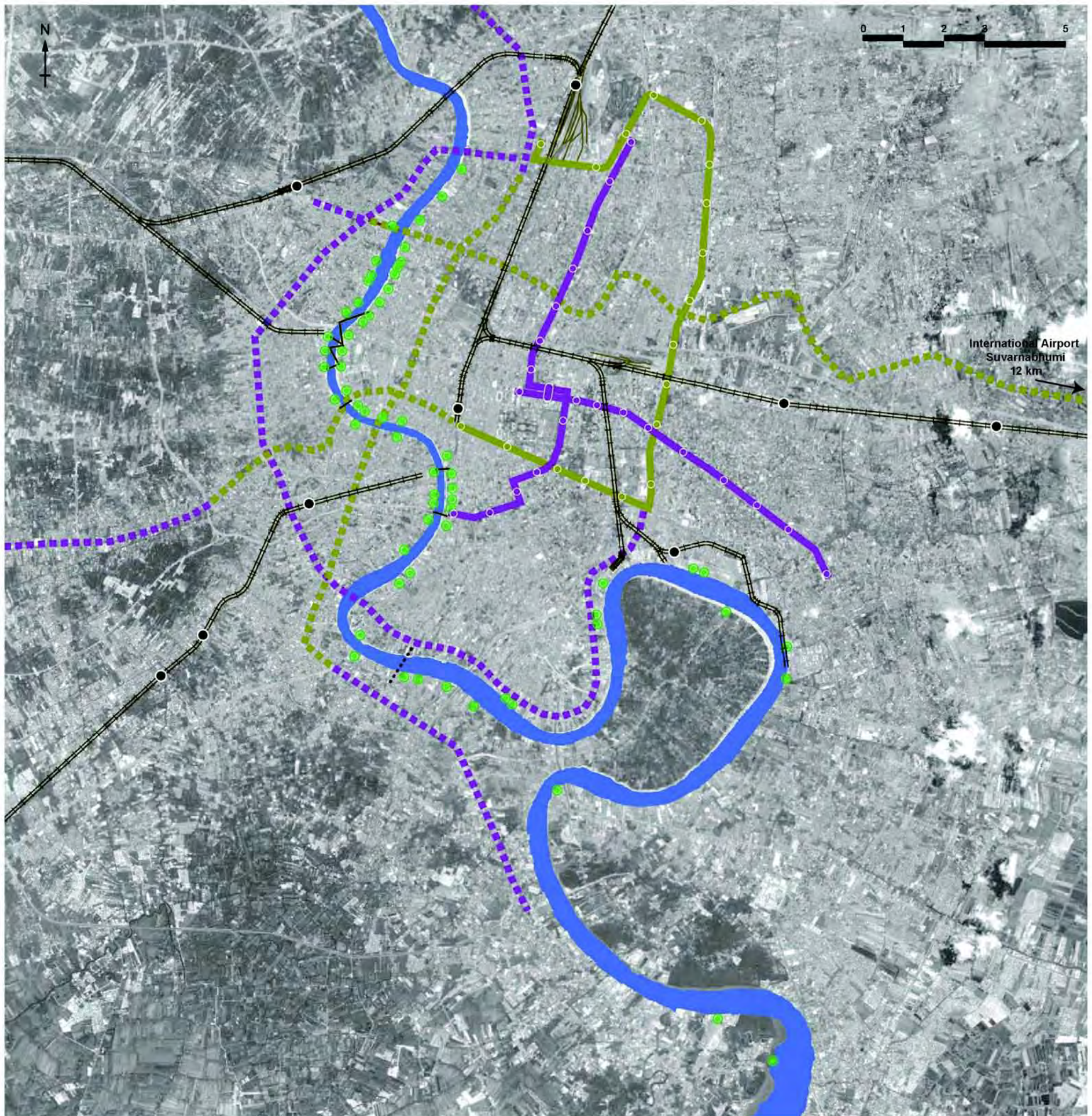


The city of Bangkok has entered a process of metropolisation now for several years. A concentration of people and activities with strong added value and a redefining of spaces within the city has been observed. So the functions which eat up space such as the industrial parks and zones of warehouses are pushed outside the city in the peripheral provinces (notably in Samut Prakan in the South East of Bangkok).

Concerning the distribution of the functions, the zone of Bangkok is marked:

- by a protected historical centre
- by a very high concentration of commercial zones on the left bank
- by very dense residential areas on each side of the Chao Phraya.

	Zones industrielles <small>Industrial zones</small>
	Zones commerciales <small>Commercial zones</small>
	Zones agricoles <small>Agriculture zones</small>
	Zones appartenant à l'Etat <small>Zones belong to the state</small>
	Habitat haute densité <small>High density residence</small>
	Habitat moyenne densité <small>Normal density residence</small>
	Habitat basse densité <small>Low density residence</small>
	Zones naturelles <small>Natural area</small>
	Centre historique protégé <small>Preservation area for Thai cultural art</small>



The urban transport system has been greatly developed from the end of the 90s to face the heavy city traffic. The extension of the metropolis makes this issue a central one for the inhabitants and town councillors. Apart from the tramway which has disappeared, Bangkok has all the means of urban transport at its disposal.

Road transport :

- Buses : around 16000. They are managed directly by the BMTA (Bus Mass Transit Authority) or granted to private companies
- Mini-vans, Songtaews and Tuk-Tuks
- Taxis (around 65000)
- Moto-taxis

Urban railway transport:

- BTS Sky Train : Elevated railway consisting of 2 lines for 23 km of network. It was inaugurated in 1999. It is managed by a private company, the BTSC, under concession of the BMA
- MRT: underground subway inaugurated in 2004. It consists of a line for 27 km of network. The extension of the network is at present in progress. It will eventually cover 118 km

To face the congestion of the traffic and to answer to the increase of movements, the authorities in charge of public transports launched several extension projects which are at present in progress:

- Extension of the BTS Sky Train supervised by the BMA (11,9 more km)
- Airport Link (creation of a fast 28 km connection with the Suvarnabhumi airport)
- 5 supplementary subway lines planned for the end of 2009 (equivalent to 91km)

River transport :

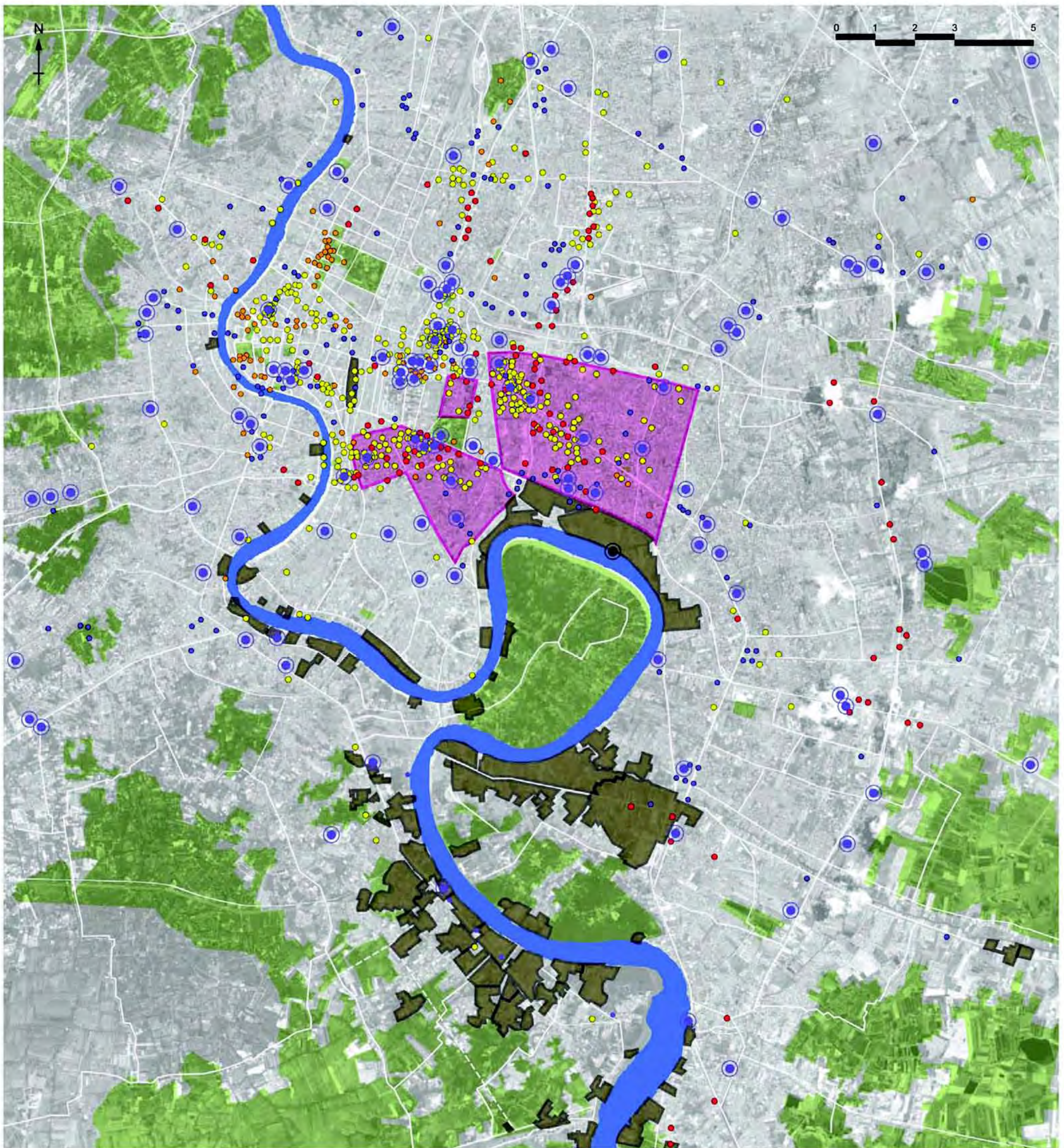
Formerly the main means of transportation, it has gradually been replaced by the road transport from the 1960s. Numerous canals which earned Bangkok the nickname of "eastern Venice" were gradually covered or filled to create ground ways or build buildings. Today, water transport is mainly confined to transport on the river Chao Phraya and to less than about ten canals.

However, with the important congestion of motor traffic, the transport by inland waterway becomes interesting again. The rehabilitation of canals is also a question of protection of a particular heritage which contributes to the identity of the city.

The main company of river shuttles is "Chao Phraya Express Boat" which covers a distance of 21 km. The transport by inland waterway is used as much by the inhabitants as by the tourists.

Because of the delay taken in the management of the urban traffic, the articulation between the various means (in particular land / water) is not very satisfactory and deserves a specific policy. This same gap which led to the filling of numerous khlongs has strengthened the Asian "model" of elevated circulation, with sometimes two or even three levels of freeways and railways.





Thailand has boomed economically since the sixties. Formerly based on agricultural activities (notably the production of rice and rubber), the economy was gradually directed to the industrial production intended mainly for exportation. Tourist activities constitute the second pillar of the Thai economy and the first source of currencies.

The main national and international investments focused on the capital, thereby strengthening the urban superiority of Bangkok and the regional imbalance, with the exception of the more diffuse tourist industry, with the concentrations of Phuket and Pattaya. The economic growth of the city is often situated above the average of the country and its part in the national GDP is of 43%.

From the 1980s onwards, the industrial activities were gradually delocalized outside of Bangkok in the bordering provinces where important industrial parks developed, notably at Samut Prakan. However the fact that some craftsmanship and that some industrial parks linked to the port of Khlong Toei (first river port of the country) remains is to be noted.








The tertiary activities are characterized by an important weight of the trade and services sectors. In 1997, it represented more than half the jobs (53,3 %) of the capital.

The commercial offer: business played an important role in the formation of the townscape of Bangkok and constitutes "urban marks" for the inhabitants. The multipolar development of the city does not allow the

constitution of true commercial districts. There nevertheless is a commercial concentration in the centre (Siam Square, Silom...). The commercial activity in Bangkok is very diverse; from street vendor to small shop to huge commercial centres which appeared in the 80s.

Offices: there are several business centres, in very high skyscrapers, which contain the head offices of the big state-owned and international companies. They are concentrated in the central part (CBD) and along the main axes of communication of the city. The city counts about 7 millions of m² of offices with a rate of 13 % vacancy (against 40 % in 1999, at the height of the real-estate crisis). The prices are much cheaper than in other asian metropolis (the price of office m² in Tokyo is 10 times higher than in Bangkok).

Hotels: linked to the tourist development of the country, the hotel offer has boomed from the 1980s. Bangkok offers a great variety of hotels from "youth hostels" up to the international luxury hotels, one of very first in the world being the Imperial, at the edge of the Chao Phraya.

-  **Centre commerciaux**
Super market department stores
-  **Marchés**
Markets
-  **Bureaux**
Office buildings
-  **Loisirs**
Recreations
-  **Hôtels**
Hotels
-  **La Douane de Khlong Toei**
The Custom Department Khlong Toei
-  **Zones Industrielles**
Industrial zones
-  **Central Business District**



In the urban perimeter, agricultural lands, fallow lands, public spaces, parks and gardens, river and klongs, stadiums and golf, wide avenues draw a city opened to the sky, offering in return of a hectic rhythm and of car oppression, places to rest, to play (the famous kites of the Royal Palace square), quiet and pleasant places.

The map proposed here does not render this dimension properly because its scale does not show the whole opened green network (planted lines, small public gardens, modest gardens...). It brings to light on the other hand worrying differences between urban sectors.

Parks and green spaces

The city of Bangkok counts numerous parks and green spaces right in the city centre. The Lumpini Park, in the densest heart of the city, is the most well-known and the most used of Bangkok.

To city parks can be added the opened public spaces of university campuses, hospitals, the army. We can note quite particularly the campus of Kasetsart University, specialized in... agronomy.

The protected natural spaces and agricultural zones

A zone of nature conservation of 50 km² occupies, in a central position, all the Chao Phraya buckle. It is perceived as the "green lung" of the city.

From the 1960s the horizontal extension of the urbanization entailed the disappearance of a big part of farmlands nonetheless very fertile. Here as elsewhere the city has expanded over the most profitable rural space.

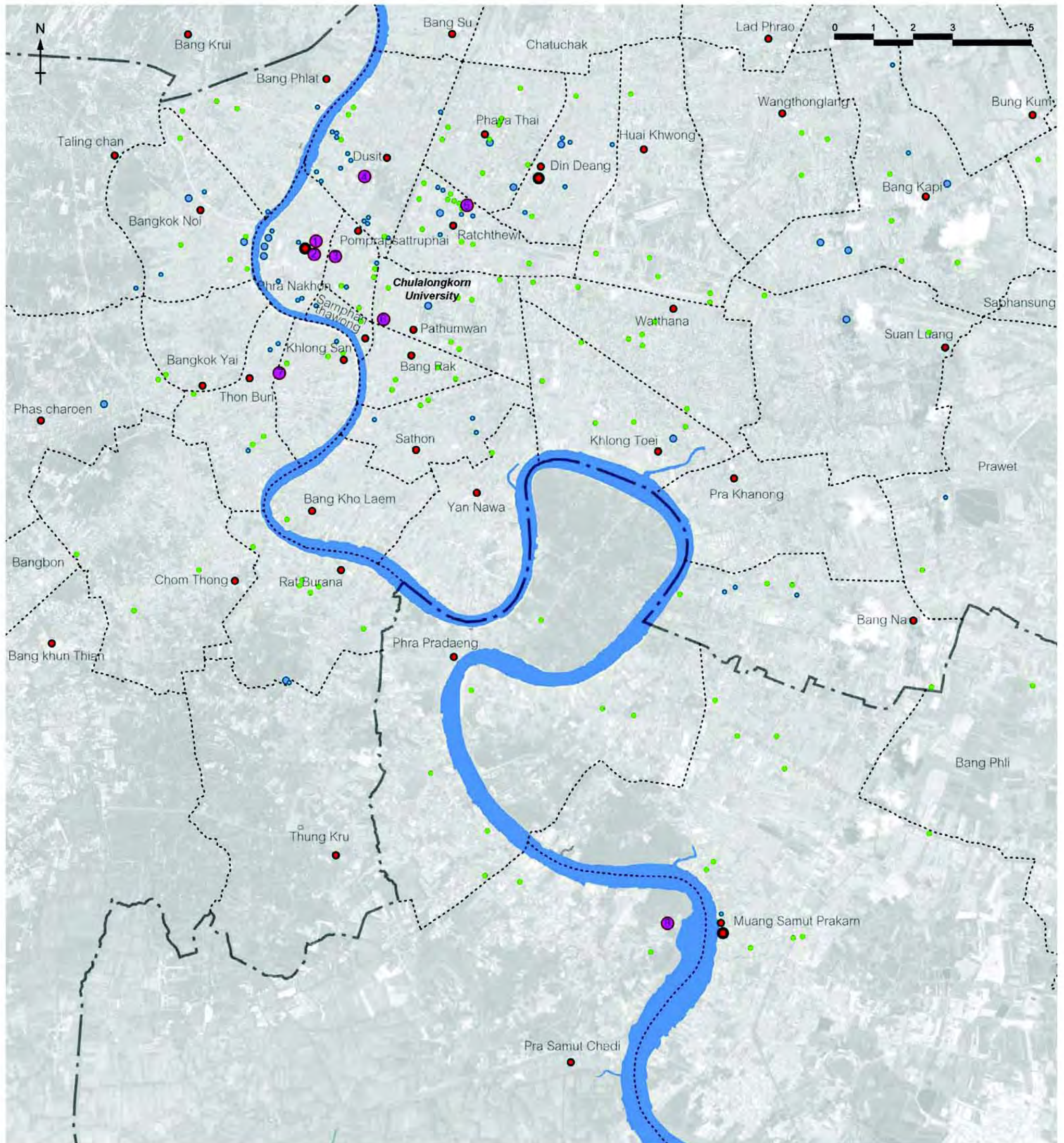
Palaces and temples

There are several palaces in Bangkok, those of the former kings, sometimes transformed into Museums, that of the ruling king and the rich dwellings of the nobility. These Palaces are surrounded by large parks, seen at the edge of the river.

The green network

Difficult to notice on the map, all the open planted spaces air the urban fabric. Main avenues are mostly shaded, even hot Silom Road seems cool in its western part.

-  **Parcs**
Parks
-  **Palais**
Palaces
-  **Temples**
Temples / Wat
-  **Espaces verts**
Green space
-  **Zones agricoles**
Agriculture zones



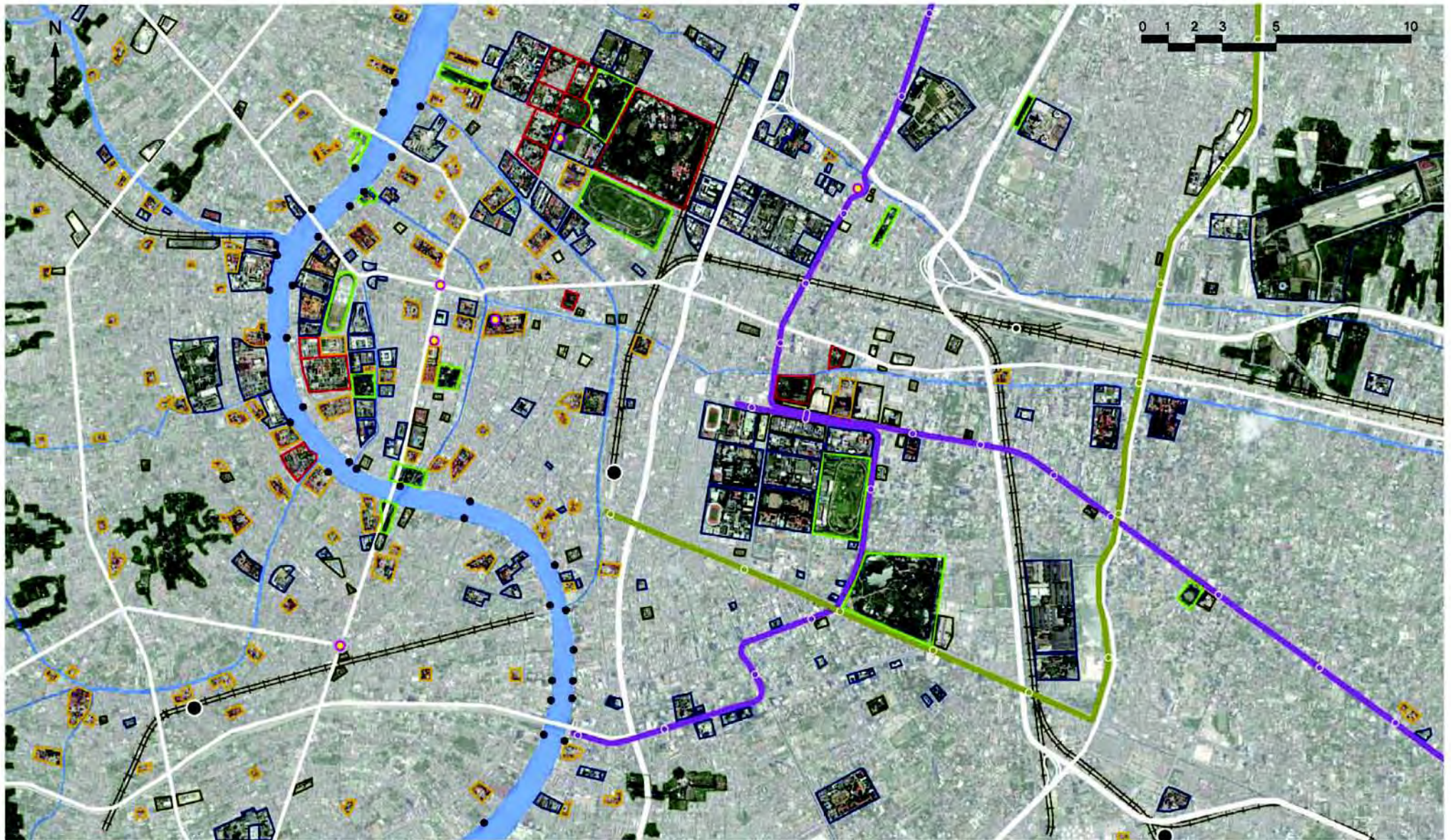
As capital, Bangkok offers an array of public services in terms of health, education, etc. incomparable to other Thai cities.












The city counts:

- 173 hospitals (among which 42 public hospitals)
- 1657 schools and colleges
- 19 public universities and 18 private universities

Situated near Siam Square, Chulalongkorn University is the oldest university in Thailand and the most prestigious. It is also recognized at the international level.

- **Monuments historiques**
Historical monuments
 1. Democracy monument
 2. Giant swing
 3. Golden mountain
 4. King Rama VI statue
 5. Victory monument
 6. Bangkok train station
 7. King Taksin monument
 8. Prasamutchedi
- **Universités/collèges**
Universities/colleges
- **Hôpitaux**
Hospitals
- **Hôtels de ville**
City halls
- **Bureaux de district**
District office
- **Périmètre BMA**
Boundary
- - - **Périmètre des districts**
District boundary



-  **Parcs**
Parks
-  **Palais**
Palaces
-  **Equipements**
Equipments
-  **Temples**
Temple/ Wat
-  **Zones d'actièrs**
Activity zones
-  **Espaces verts**
Green areas
-  **Embarcadères**
Piers
-  **Monuments**
Monuments
-  **Lignes de BTS Sky train**
Skytrain lines
-  **Lignes de MRT Métro**
Subway lines
-  **Voies ferrées**
Railways



Contemporary Condominiums



Monument

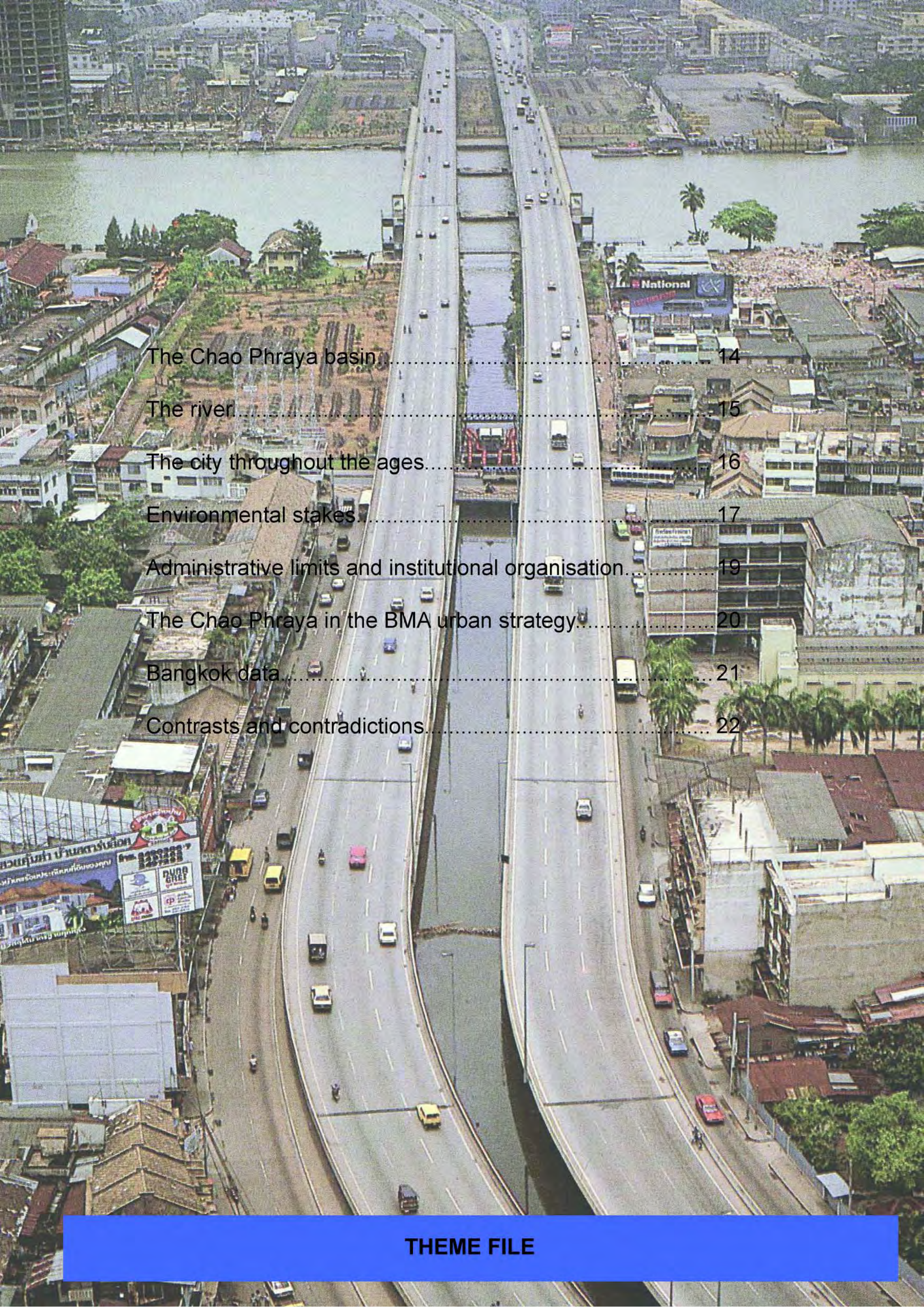


Restaurant



Public space

The historical town centre, on the bank side, shows a relative heterogeneity: Among the numerous temples and palaces, we find all urban functions: residential with in particular the great condominiums, historical monuments, some restaurants and public spaces.



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Thailand's biggest river basin

The Chao Phraya basin is the most important river basin belonging exclusively to Thailand:

- By its surface: 157 924 km² is 30 % of the territory
- by its population: 23 millions (1996) that is 40 % of the Thai population
- by its economic weight: generates 66 % of the national GDP (among which 43 % only for Bangkok).

The Chao Phraya is divided into 8 smaller basins (by order of importance of surface in km²):

- Ping (35 535 km²)
- Nan (32 854 km²)
- Chao Phraya (21 521 km²)
- Yom (19 516 km²)
- Tha Chin (18 105 km²)
- Pasak (15 647 km²)
- Wang (11 084 km²)
- Sakae Krang (5 020 km²)

Four big rivers of the North, the Ping, the Wang, the Yom and the Nan, join at Nakhon Sawan in the central plain to form the Chao Phraya, "the river of kings" which throws itself into the gulf of Thailand ...

A basin with important socioeconomic contrasts:

Population :

The Chao Phraya sub-basin, which includes the megalopolis of Bangkok, is the most densely populated (533hab. /km²) and the richest economically (average density: 136 hab. /km², whole country: 118 hab. /km²).

Bangkok alone, which is located in the bottom of the sub-basin, is home to 50 % of the population and has a density of 1497 hab. / km². The most populated second sub-basin is the superior basin of the Ping which hosts Chiang Mai, the second big city of Thailand.

The population of the basin, which constitutes 68 % of the total population, is mainly rural but presents important variations. 95 % of the population of the superior basin is rural against 45% in the bottom. The current tendency is to increase of the rate of urbanization of the basin.

Socio-economic conditions:

Including Bangkok, the sub-basin of Chao Phraya is the most important from the economic point of view, alone generating 78.2 % of the total GDP of the pond and owning the highest growth rate.

The basin of Chao Phraya can be economically divided into three parts with the North and the South industrialized and prosperous and a rural and poor centre. There are great income disparities between these regions. Thus, the per capita income is six times higher in Bangkok than in rural areas.

Soil management :

The Chao Phraya basin is 90% covered by agriculture (3/4) and forests. Forest zones are in constant reduction to the benefit of agriculture.

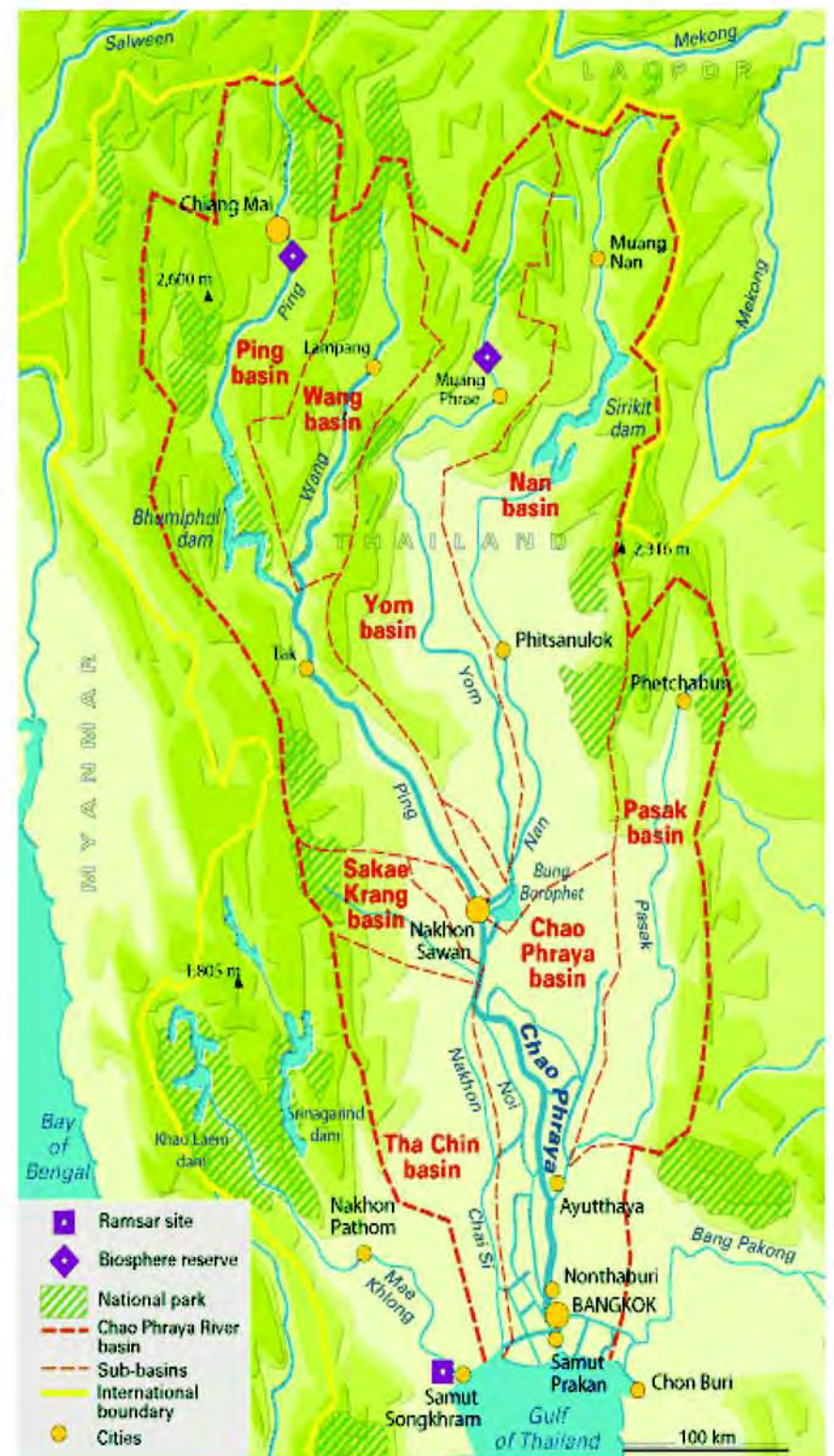
A river region:

Navigation and transport by inland waterway:

Chao Phraya has always been a major axis for transport and trade allowing to penetrate far upstream to the central plain. The transport by inland waterway still represents an important part of the transport of goods. However, the use of the river for irrigation led to an important decline in the water level and during the dry season certain boats exceeding a certain size cannot navigate.

Quality of the water :

Chao Phraya and Tha Chin are the most polluted rivers of the basin with high levels of organic and bacterial pollution. This pollution is due to domestic, industrial and agricultural discharges in rivers. The authorities in charge of the quality of the water launched a vast program at the beginning of the 1990s for the improvement and protection of the quality of the water (development of supervision and the implementation of strict regulations on discharges).



Chao Phraya's basin



River of giants

River's symbolism (Naga):

Up until the end of the XIXth century, the sovereigns of Thailand took the lustral bath in (Phrarajphithi Longson) or in the Chao Phraya waters. The river indeed hosts a divinity, Naga, the dragon of the waters. Source of life, the river is also the place which, in the Indian tradition, welcomes the remains of men cleansed by fire. The symbolism of water, and that of the river, is a determining part of south east Asian culture. "Possibly no other region in the world possesses as many water symbols as East and South-East Asia. Particularly in Siam, whether it is in ritual, dancing, folk art, painting, sculpture, architecture or city planning, a host of aquatic attributes underlies them all".

The hydraulic regime of the river:

The Chao Phraya's flow is about 917 m3/s. It is characterized by a widely variable annual hydrological regime which can be summarized by the formula: "too much water - not enough water". Too much water during the period of monsoons (between July and October), not enough water during the dry season ...

The river has undergone important transformations of its flow to facilitate the transport and allow the irrigation of the ricefields of the central plain. The table opposite shows the successive modifications between the XVIth and the XVIIIth century (in bold, the current direction of the river).

The river economic activities:

The commercial activities on the river gradually disappeared during the second half of the XXth century. The floating markets which remain are, for the main part, nothing more than tourist attractions.

- However, the river still plays an important economic role as:
- Regional axis of communication and urban means of transportation
 - major tourist attraction
 - desired real-estate location

Khlongs:

The city includes a canal network built from the XVIth century to facilitate the transport of goods and develop irrigated agriculture.

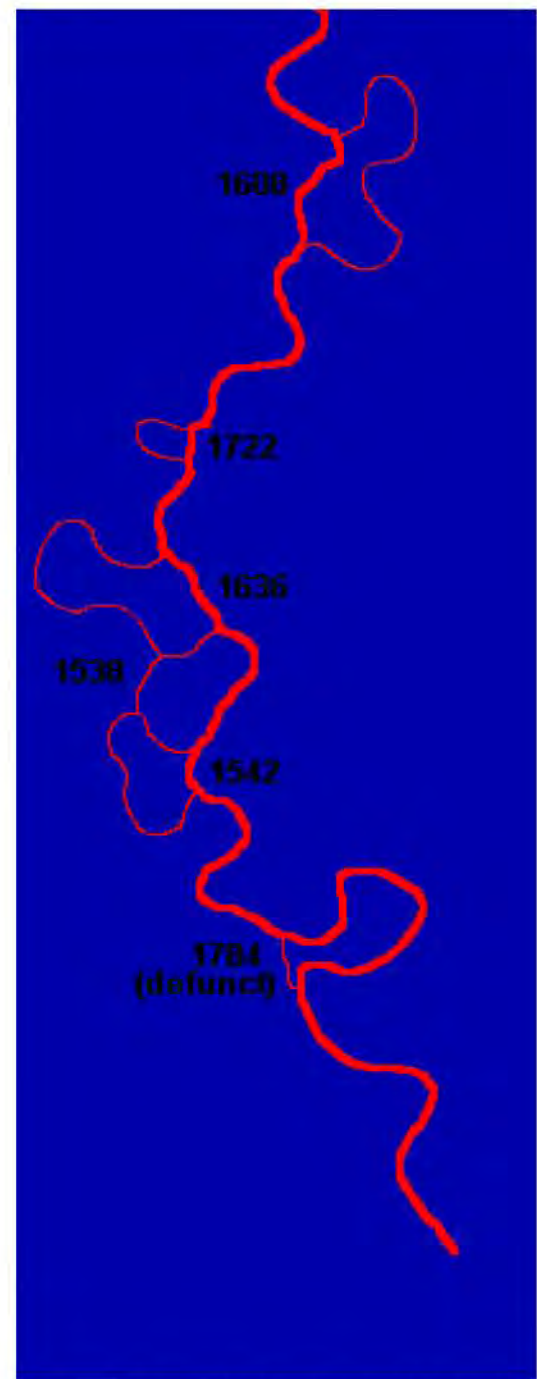
Because of traffic congestion, the use of canals for transport is a fast and relatively cheap means of transport. One of the main khlongs used for the public transport is the khlong Saen Saeb, 18 km in length which connects the Pom Prap Sattru Pha and Bang Kapi districts. In 2004, it transported 60 000 passengers a day. The transport of people mainly takes place on the river.

River bank activities:

The activity of the river banks is uneven and heterogeneous, which makes this territory soon to be very popular and open to important alterations. Today, a big confusion of ill-assorted urban forms can be observed, mixing gardens of temples and palaces, the terraces of hotels, craftsmanship establishments with their feet in the water, shanties and deteriorated housing but with an amazing "view", fallow lands, some cultivated fields, a multitude of jetties and pontoons and.... mushrooming tower blocks.



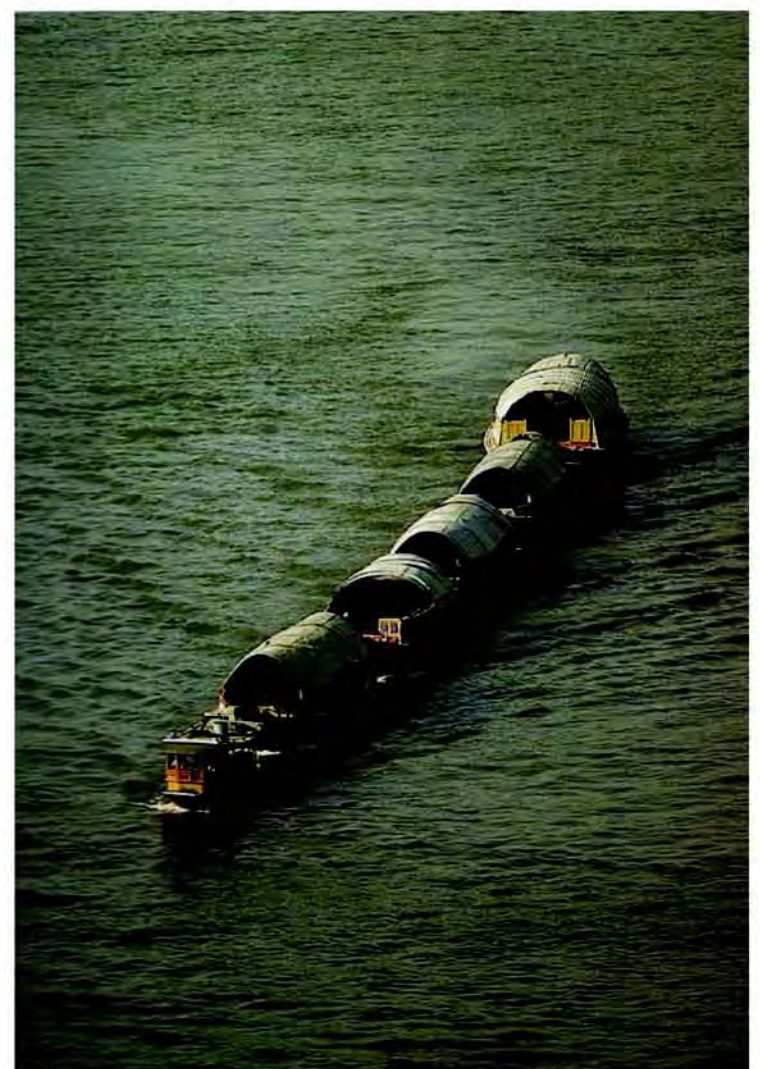
Khlong Saen Saeb



The river flow modified throughout the centuries

Rivers	Length (km)	Annual average flow (m3/s)
Amazone	6400	180 000
Congo	4371	40 000
Danube	2850	6 500
Rhin	1320	2 200
Seine	776	500
Chao Phraya	372	883

Figures of some great rivers



Drawn barge (sampan) on the Chao Phraya

THE ROYAL CITIES

Thailand possesses around ten royal cities. Built to mirror the kingdom's glory and to refrain the greed of nearby countries, they were military bastions as much as cultural and religious centres. In spite of their geographical and temporal scattering, the royal cities share common characteristics dictated by pragmatism and cosmology.

Their outlines were based on ancient Chinese models which we find in the names of places (for example, the term Chiang as in Chiang Mai or Chiang Rai indicates square or rectangular fortifications). Their fortifications were provided with moats, to protect the inhabitants but also for symbolic reasons. The fortifications and the moats symbolize the Meru Mountain, the mythical mountain where the Buddhist Gods dwelled. This divine city was surrounded by seven mountains and seven seas.

The royal cities were political and religious centres. The Royal Chronicles always mention the role of the *rusi* (hermits) which were responsible for choosing the sites of the new cities according to their mystic qualities and to the spirit of the place.

The city of Sukhothai is considered as the first capital of the Siam kingdom (Thailand's name until 1938). It is situated 600 km in the North of Bangkok, in the Chao Phraya valley. The city is a UNESCO World Heritage Site since 1991.

Ayutthaya, situated at the confluence of Pasak and Chao Phraya, is the second capital of the Siam kingdom. It was built in 1351 by king Ramthibodi. In spite of robust fortifications, the city was destroyed by the Burmese in 1767 after a siege of several months.

THE BANGKOK FOUNDATION

Bangkok (today reduced to the district of Thonburi) was a village situated on the east bank of the Chao Phraya river. After the destruction of Ayutthaya, the general Taksin, now king, withdrew in Bangkok and decided to start the new capital there.

In 1782, the general Chakri who succeeded him and founded the royal dynasty of the Chakri -Rama (always ruling) decided to move the capital to the left bank of the river for a better defence. He launched a vast construction program of the fortifications which shape the Big Palace (finished a century later) today, a real city which included the royal residence, the administrative and religious centre.

URBAN DEVELOPMENT

1782 – 1950 :

At the beginning of its development, Bangkok extended mainly around the Palace and along canals and rivers, which was the main means of transport at the time.

Because of the population growth and of the construction of a road network from the end of the XIXth century, the surface of the town quickly increased. The dendritic urban development, the star-shaped development along infrastructures, is the most common development model at that time.

1960 – 1997 :

After the Second World War, Bangkok grew economically very quickly because of foreign and particularly American investments; Thailand constituted a wall against the communist block during the Cold war and has thus taken advantage of the economic support of the United States.

This economic growth accelerates the rural immigration and between 1970 and 1985, the surface of the city is multiplied by 3, from 184 km² to 426 km².

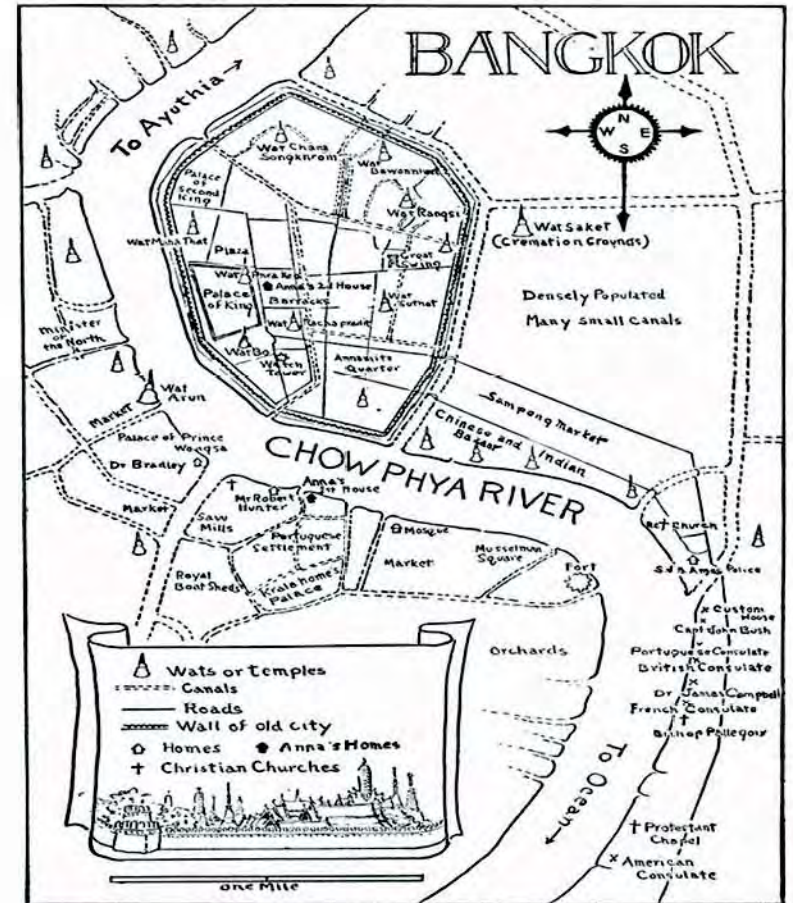
From the beginning of the 1980s, the development of Bangkok changes shape while the growth of the centre decreases at the expense of its suburb. The increase of land prices in the centre and the development of the road network in the suburb encourages companies to move towards the bordering provinces.

1997 :

The financial crisis of 1997 ended a decade of remarkable growth. This economic crisis came along an important real-estate and urban crisis. Numerous towers stand unfinished and constantly remind people of this period.

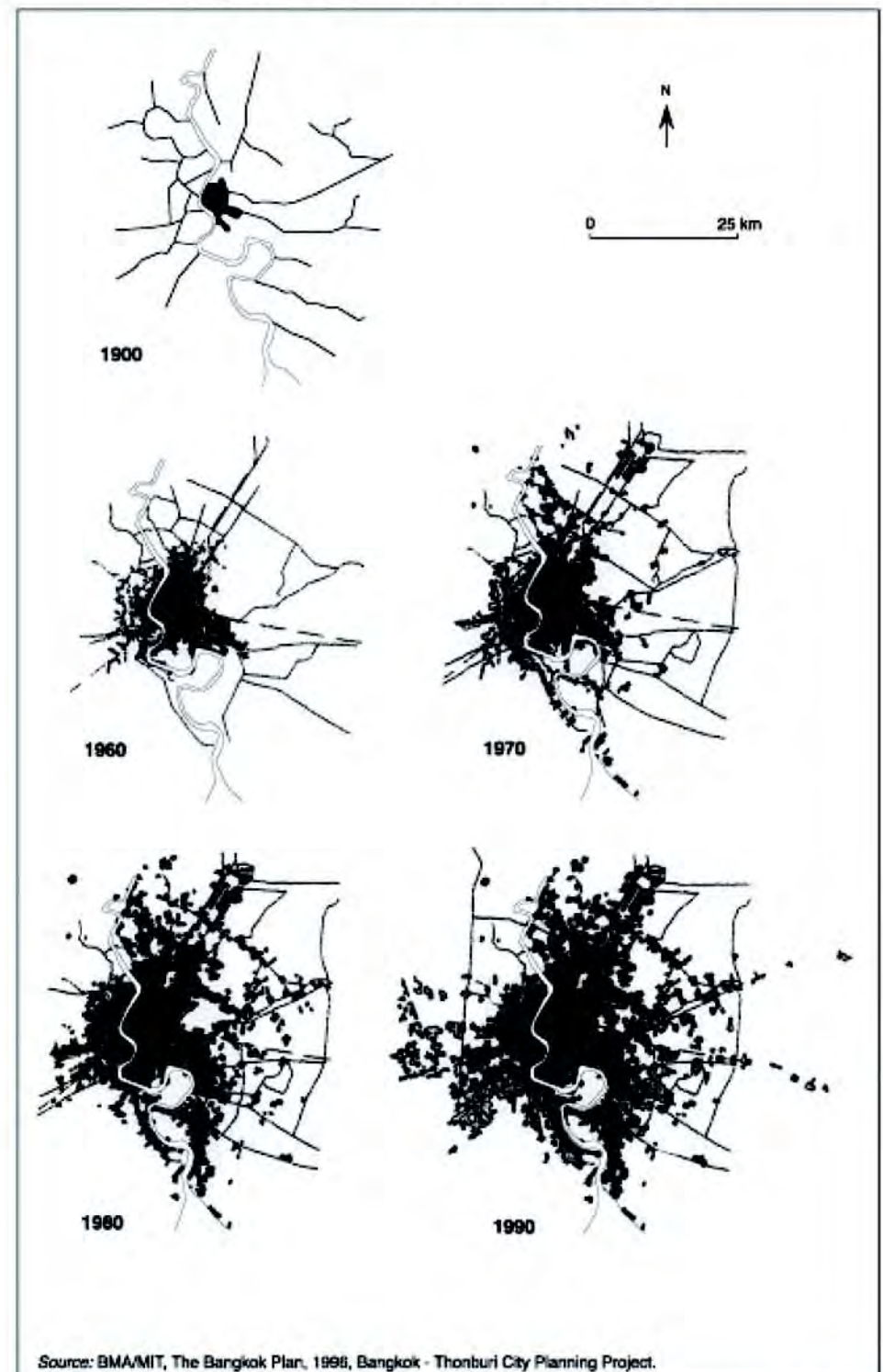
2008 :

Today, the city covers 1568 km².



Bangkok, 1922

Bangkok: urban expansion (1900-1990)



Source: BMA/MIT, The Bangkok Plan, 1996, Bangkok - Thonburi City Planning Project.

LCA - M. Danard

The city of Bangkok, following the example of the world megalopolises, is confronted to big urban and environmental problems; the congestion of the traffic, the air and water pollution, the urban spreading, etc. (Part I).

As coastal and river city, it is confronted to more problems which, with global warming, are increasingly problematic for the future of the city. (Part II). A recent OECD report (Ranking port cities with high exposure and vulnerability to climate extremes, 2007) places Bangkok among the most exposed cities to the consequences of climate change.

The population growth and the economic development of the region of Bangkok during the last half of the XXth century were insufficiently monitored by the local and national authorities. Today, in spite of the efforts made, these authorities have a hard time catching up and the city's gigantism make global actions even more difficult.

URBAN PROBLEMS LINKED TO AN EXPONENTIAL AND UNCONTROLLED URBAN GROWTH

Congestion of the traffic:

The most important urban problem for Bangkok and its region is no doubt the congestion of the traffic. Two main factors cause this situation. On one hand, the urban growth and the development of motorization from the 80s were such that local authorities have not managed to develop sufficient road infrastructures to absorb the growth.

On the other hand, the offer of public transports have for a long time been insufficient to offer an alternative to the car. Today, numerous road and railway infrastructures have been built or are under construction.

The air pollution:

Bangkok and its region suffer from a strongly degraded air quality mainly because of the congestion of the traffic and the concentration of industries.

The metropolis with its 12 million inhabitants releases about 26 million tons of carbon dioxide every year, that is 20 % of the total emissions of CO₂ of Thailand. It is responsible for 70 % of the industrial pollution of the country.

The local authorities have launched numerous actions for about twenty years, allowing to appreciably improve the air quality (reduction of the standards of emission, promotion of gas-run vehicles, construction sites checks, etc...). However, the urban growth and the continuous increase of the mobility of people makes of Bangkok one of the most polluted cities in the world.

The distribution and the quality of the water:

At present, two thirds of the water consumed in Bangkok comes from the river Chao Phraya. The third remainder comes from aquifers. Water in the region of Bangkok is managed by the MWA (Metropolitan Waterworks Authority), created in 1967. It manages the greatest water network in the world today, with 25000km of aqueducts. Its supply capacities are of 5 millions of m³ a day which meet the needs of only 4,5 million inhabitants, that is 50 % of the population of the metropolitan region. The incapacity of the public network to satisfy the demand has forced companies and private individuals to stock up individually by digging "instant wells". The water constitutes a major challenge for the region of Bangkok. As needs continue to grow, the overexploitation of subterranean waters by the city as much as by the private people led to a significant decline of the level of waters and to a correspondent collapse of the ground in certain zones (cf. infra). The most affected population by the problems of supply is the inhabitants of the shanty towns who, for lack of access to the public network, consume the polluted water of the river or are forced to buy it the high price to private merchants.

The pollution of surface and subterranean water:

A study made in 1997 by the Thailand Environmental Institute on the quality of the water in the central river basin showed that Chao Phraya was the most polluted river of the region. The human concentration, the industrial and agricultural activities on the banks of the river explain this heavy pollution.

Aquifers which feed Bangkok and its region also have a high rate of sodium and chlorinates

The collapse of the ground:

Built on the swampy banks of the river, Bangkok's ground, of which the superficial layers are made of soft clay, raises numerous problems for the technical conception and the construction of infrastructures and of high buildings - difficulties which generate important supplementary costs. The underground subway, for example, has had to be built 20 metres under the ground instead of 10 or 15 meters on average for cities on more solid ground.

The bad earth quality is deteriorated by collapses in the region of Bangkok due to the overexploitation of aquifers (mainly for municipal and industrial needs). As an example, while the level of aquifers has not stopped falling in two decades, the pumping by the MWA increased by 300 %. Between 1978 and 1981, the rate of collapse of the ground exceeded 10 cm / year in the suburb of Bangkok and 5 to 10 cm in the city centre. In 1982, the lowest point of the city, situated in 4 cm below the sea level, was the University of Ramthankaeng.

Measures to reduce the overexploitation of aquifers (notably the ban on wells dug on sites supplied by the public network) and thus to slow down the collapse have been implemented since 1982. These various measures have had considerable effects for several years, but the economic and demographic growth which accelerated at the same time was such that, from 1988, the pumping of aquifers went up again.

Today, the university is 50cm below the sea level! And the falling of the ground level in the eastern part of Bangkok between 1930 and 1990 is estimated at 1.60 metres (strong concentration of industrial parks).

From the middle of the 1990s, numerous industries moved to the bordering provinces thereby allowing to limit the phenomenon of collapse of the ground in Bangkok but subjecting the new sites to the same problem. Indeed, in these provinces, notably in Samut Sakhon where numerous industrial parks developed, there is no surface supply and all the water for the city comes from wells.

Waste water treatment:

Bangkok has a system of mains drainage, but even today, a big part of metropolis' waste water is recuperated by septic tanks or poured directly in canals or the river, without the slightest treatment. We consider that 70 % of the population of Bangkok uses a system of autonomous purification (septic tanks or pits with constant water level).

Not being able to generalize a public network of recuperation of waste water in all the metropolis, septic tanks still remain a better means than the discharge in canals or river. However, during the period of monsoons, between July and October, it is very frequent that pits overflow and pour in the network of khlongs.

Waste management:

The problem of solid waste treatment is not new in Bangkok. It appeared with the fast population growth of the city and the "industrial revolution". The organized collection of waste is organized by the city from 1915. However, up to the fifties, heaps of garbage were commonly found in the streets of densely populated zones.

Most of the garbage, as waste water, was directly thrown in the river or the canals. For some years now, the BMA has made important efforts to insure an effective collection of waste in the city - mainly through the implementation of big containers in public spaces and shopping centres. Three centres of stampings complete the device but it still remains insufficient considering the quantities to be treated.

The BMA has also started to reflect on the implementation of a burying centre for the waste which can not be treated by the centres of stamping.

The main problem which the city has to face to collect and to adapt treatment lies mainly in the considerable spreading of the city

II. THE COAST, THE RIVER AND GLOBAL WARMING

Floods:

The city of Bangkok is situated on a plain liable to flooding. The flooding season begins in September but torrent rains can cause floods from May. However, the most important floods take place in October when the rivers of the North of the Thailand, inflated by the monsoon, fill the Chao Phraya basin. Furthermore, annual high tides come at this time and add on to the high water levels.

Even though the inhabitants of Bangkok have long adapted to annual floods, the latter induce heavy economic loss due to the rapid urbanisation of Bangkok surroundings (implying the limitation of the water's expansion and the waterproofing of the ground) and to the intensification of agriculture.

The eastern part of the city is the most vulnerable to floods due to torrent rains because tropical thunderstorms come to Thailand from the South of the China Sea. It is also in the East that the canal network is the most developed. During the period of the high tides, the sea water penetrates in the city through the canal system swelling the floods.

"Watergates" are structures of control of the floods and have been conceived to prevent this phenomenon, but when the city is flooded and when the level of the river is highest, the water manages to pass over "watergates". After the heavy rains, the volume of water to be drained is very important and the fewer and fewer khlongs in the city, which are often badly maintained, do not allow a sufficient drainage. The waters can therefore stagnate in the city for a long time, increasing the development of illnesses.

Sea flooding:

The sea floods also constitute an important problem for Bangkok and its region. The rise of the sea level due to global warming combined with the collapse of the ground deteriorates the situation. Modellings showed that before 2100, the sea level would increase from 50 to 100 cm. It will result in permanent flooding of a part of the coastal zone which in turn will lead to more erosion of the coast, the exacerbation of the sea floods and the increase of the salinity of aquifers and estuaries.

Thus, more than 40 % of Bangkok could be immersed under 1 metre of water. Needless to emphasize the importance of the protection of Bangkok when dealing with these phenomena.

Environmental stakes at the national level: the example of the quality of water and air

The environmental problems are particularly clear in the region of Bangkok. However, the rest of the country is not spared by these problems notably because of the development of the secondary cities. The consideration of these stakes at the national level is nevertheless relatively recent (at the beginning of the 90s for the quality of the water and the air).

1992 constitutes a landmark in the implementation of a policy to improve the quality of the air and water.

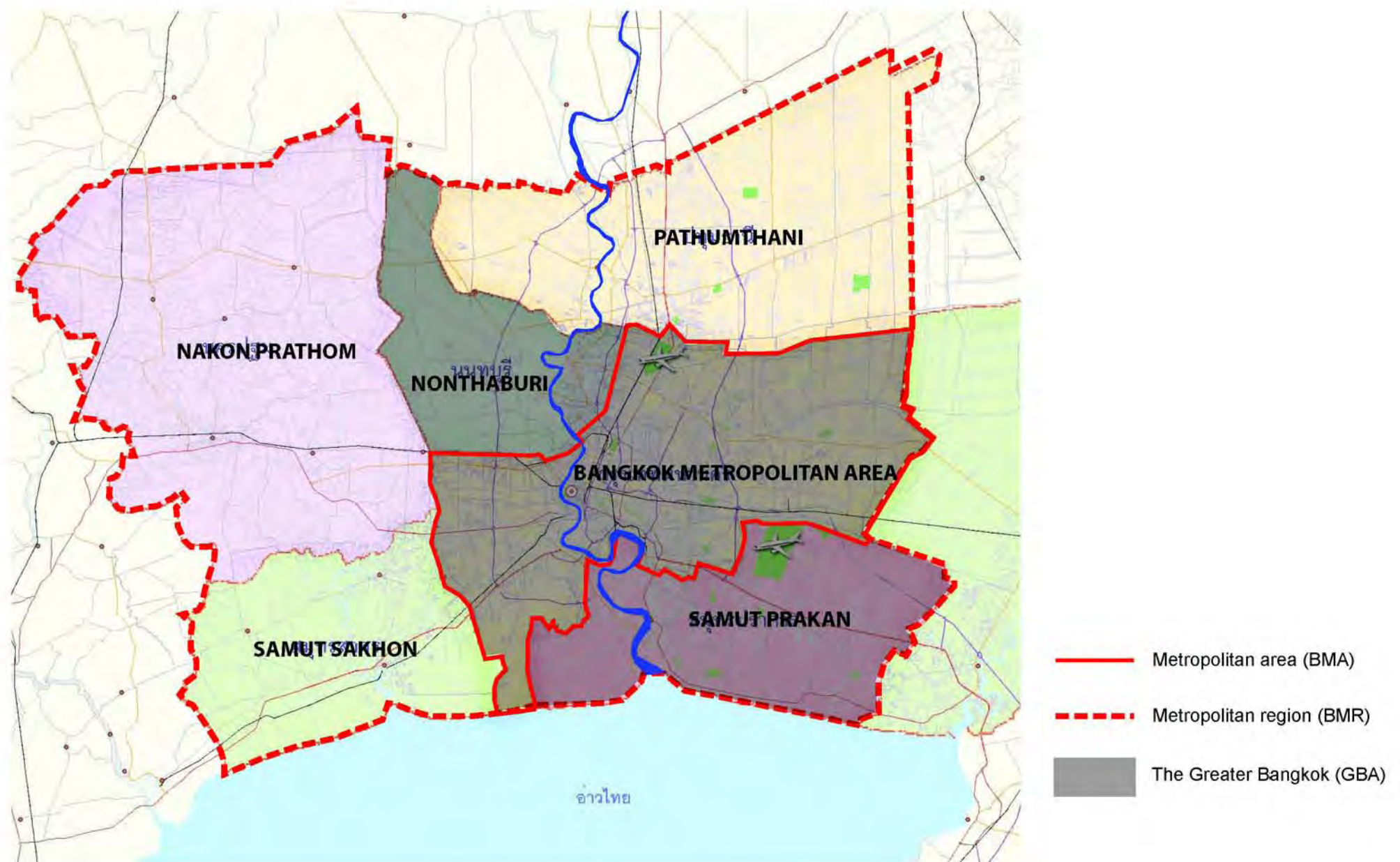
Several sectional laws were voted by the Thai government:

- Factories Act : Regulates the construction and the functioning of factories in terms of safety and pollution.
- Enhancement and Conservation National Quality Act: regulation of the wastewater disposal in the network of public purification and in the environment
- Navigation in Thai Waterways Act and Cleanliness and Tidiness of the Country Act: two laws which forbid the discharge of any waste - notably oils and chemical components - in rivers, canals and lakes which could pollute the environment or to disrupt the good functioning of waterways.
- Public Health Act: regulates activities which produce nuisances, such as smoke and smells, which could have fatal effects on the health of the people.

It is also in 1992 that the Five Year Plan on Economic and Social Development, established since 1961, has included for the first time the stakes of sustainable development.

Whereas the first plans focused on the economic development through the exploitation of natural resources, the 7th five year plan of 1992-1996 asserted the government's commitment for the promotion of an environment-friendly sustainable economic development.

One of the key actions of this 7th plan concerned the rehabilitation of the quality of the water of the lower basin of the Chao Phraya and the Tha Chin (the two most polluted waters in the country).



Bangkok or "Krung Thep" (literally "The city of angels")

The metropolitan area: BMA (Bangkok Metropolitan Area) was created in 1972 by the grouping of the Krung Thep and Tuna Buri provinces. It covers 1568 km² and counts officially 6 million inhabitants (2005). This figure does not take into account the "floating population" estimated to be 1 million constituted mainly by so-called "temporary" migrants registered in their province of origin.

The BMA is divided into 50 districts.

The centre of Bangkok usually indicates the dense historic city which covers an area of about 145km².

Big Bangkok (GBA - The Greater Bangkok) includes the BMA and the two neighbouring provinces of Nonthaburi and Samut Prakan. This perimeter was used for urban planning in the 60s and 70s. Its surface is 3195 km².

The metropolitan region: BMR (Bangkok Metropolitan Region) includes the BMA and 5 bordering provinces: Nonthaburi, Samut Sakhon, Samut Prakan, Pathum Thani and Nakhon Prathom. It covers a 7500 km² surface and has officially 9.2 million inhabitants (15 % of the total population and 50 % of the urban population of the country).

The BMR is not an official administrative entity but the term is usually used in the domains of soil management and planification. It constitutes the economic city and the heart of the whole country's development (it supplies 48% of the national GDP).

Institutional organisation of the BMA

The metropolitan administration is managed by a Governor and a "Metropolitan council" (BMA Council).

The Governor is the leader of the administration of the metropolis. He is elected for a period of four years. His role is to define the policies, to oversee and to check the action of the various departments.

The Metropolitan council consists of elected members (the number of elected representatives varies according to the population of Bangkok, a counsellor representing 100 000 inhabitants). Today, there are about 60 counsellors. The council is the legal body of the metropolis, and it is also responsible for the vote and the distribution of the annual budget. There are also department councils.

The BMA is divided into:

- **3 offices:** the Governor's Secretary, the council and the Civil Service Commission
- **14 departments:** the 14 departments are under the decision-making power of the governor

- Permanent Secretary department	- Drainage and sanitization
- Planning	- Public cleanness
- medical Service	- Social action
- Health	- Justice
- Education	- Community development
- Finances	- Traffic and public transport
- Public works	- Town planning and management
- **50 district offices**

THE CHAO PHRAYA RIVER: A LONG NEGLECTED NATURAL ASSET

The Chao Phraya river constitutes a major element of the presence of nature in the city, it has nevertheless been neglected for a long time. Even if it still constitutes an important axis of communication, the city, during its development, has ignored it. Today, the local authorities place the "regeneration of Chao Phraya and its urbanisation" at the heart of the urban strategy.

To rearrange the river in an urban environment isn't specific to Bangkok. In many European river cities, one can witness a will to make the river a major element of the city. Jean Labasse says that after the time of "sacrificed rivers" comes the time of "the rehabilitation of the rivers". This change in perspective can be explained in part because environmental issues and quality of life in the city are being taken into account. The BMA slogan puts it in a nutshell: "Bangkok, clean and beautiful city".

To rearrange the river means to take several things into account:

- Tourism and economic stakes: the river is an important tourist asset with its palaces, temples and gardens by the water. It is also an important axis of communication for the transport of goods.
- Environmental stakes: the Chao Phraya river is polluted. One of the BMA's ambitions is to improve the quality of the water.
- Social stakes: many slums stand on the river banks and regenerating the river means taking into account this precarious dwelling.
- Land stakes: the surroundings of the river, even in the most central parts, aren't used a lot (gardens, warehouses, fallow lands), they thus constitute an important land "reserve", in particular on the less urbanized right bank, which investors are beginning to waste.

THE FIVE STRATEGIC AXES TO REARRANGE THE RIVER BANKS

There are 5 axes in BMA's urban strategy to the regeneration of the Chao Phraya river:

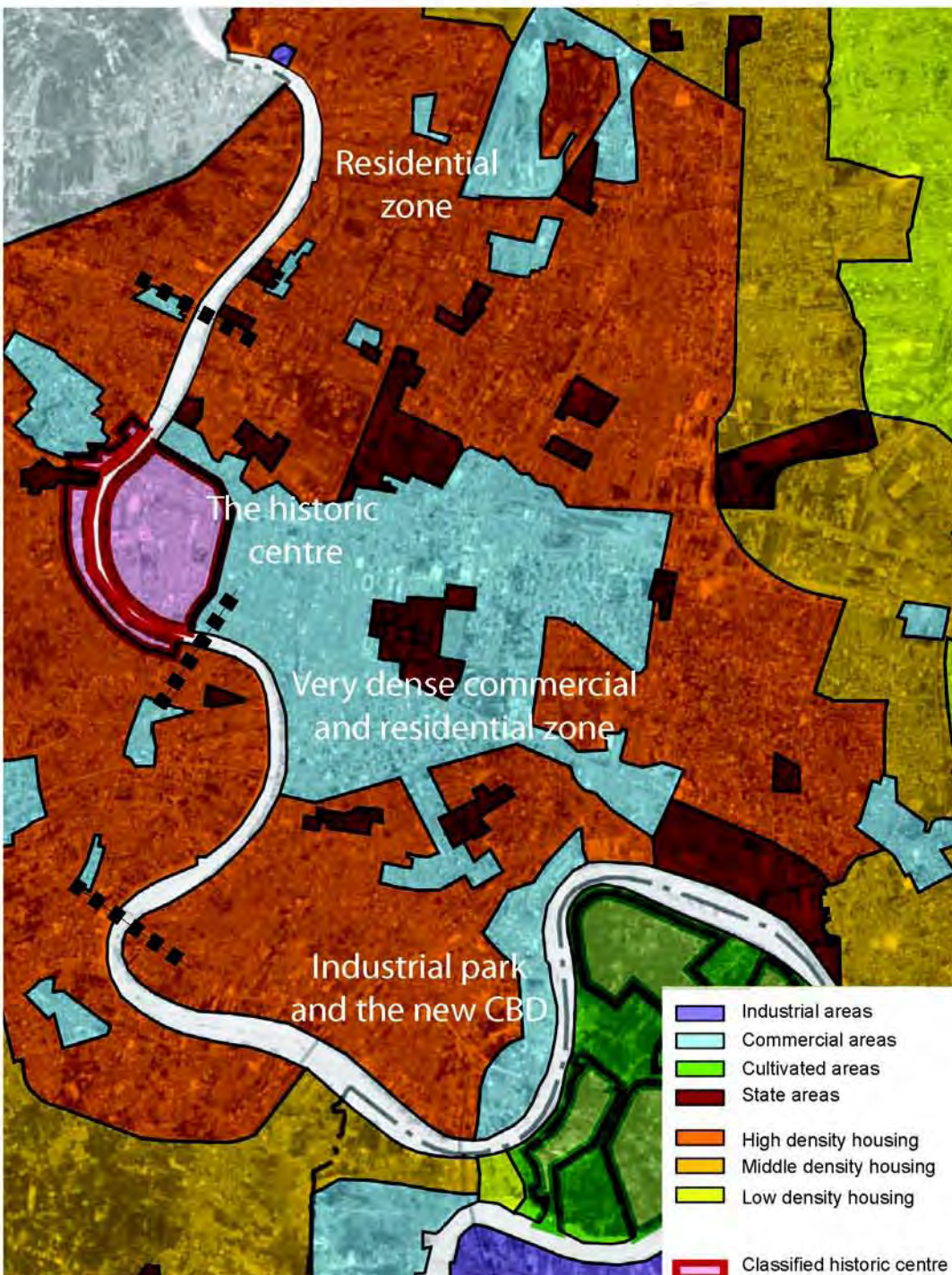
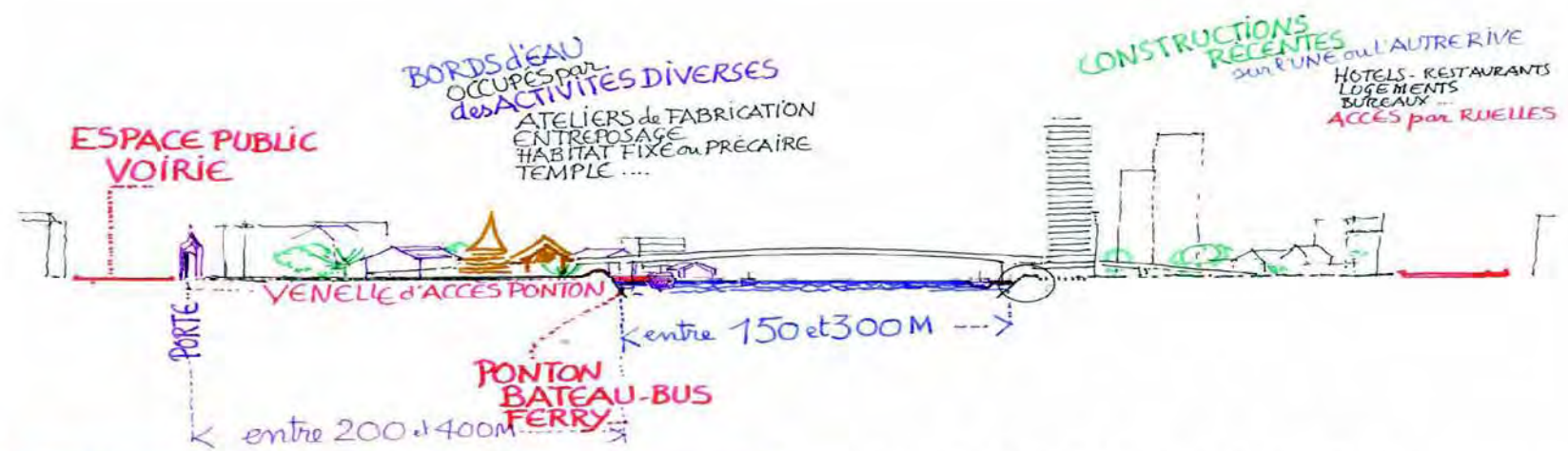
First axis: develop the embankments and access to the river
Linear access to river banks is almost inexistent. Most of the links to the river are perpendicular.

Second axis: regenerate communities on the river banks.
Slums are widespread on the river banks. Social problems aside, the aim is to recover the water's "urban culture".

Third axis: create links between banks
In spite of the creation of man bridges, the urban network is not orientated towards the river.

Fourth axis: develop green spaces and parks
There are many gardens on the river side, but most of them are private (palaces and temples).

Fifth axis: develop landscapes
The view on the river is an important part of the landscape. Yet, many buildings block the view to the river.



FOUR ZONES OF THE MAIN PLAN:

The banks of the river are characterized by the presence of numerous deteriorated constructions and former industrial sites which means they will probably be transformed. This heterogeneous group is next to elements of the historic and religious heritage of the city (temples, palaces, gardens).

The main plan for the banks of the river has been divided into 4 zones determined by their specific urban characteristics:

Zone 1: the residential zone (from the Rama VIII Bridge to the North of Bangkok)

Problems: the banks of this zone are characterized by the presence of slums and old warehouses.

Assets and potential: presence of important religious sites, possibility of important land transformations.

Zone 2: the historic centre - classified site (districts of Ratthanakosin and Thonburi)

Problems: presence of slums, commercial zones and deteriorated environment near important historic sites

Assets and potential: remarkable historic sites, huge tourist value, possibilities of developing transport thanks to the presence of numerous jetties, presence of traditional communities.

Zone 3: the very dense commercial and residential zone (from the Rama I bridge to Bangkok bridge)

Problems: presence of old damaged buildings, quays badly looked after
Assets and potential: improvement of the commercial zone on the bank, panoramic view, possibility of important land transformation.

Zone 4: the industrial park and the new CBD (from the Bangkok bridge to the South of the city)

Problems: presence of slums on banks, warehouses and abandoned buildings

Assets and potential: panoramic view, important land transformations, important presence of land belonging to the public domain of the State.

SOIL MANAGEMENT

Evolution of the soil management between 1986 and 2000

Soil management	Surface area (ha)			Evolution 1986-1995		Evolution 1995-2000	
	1986	1995	2000	ha	% /an	ha	% /an
Residential	18 099	33 150	38 254	15 051	5,04	5 104	2,66
Commercial	1 784	4 765	5 755	2 982	6,95	990	3,44
Industry	2 201	2 939	2 735	738	2,79	-204	-1,49
Warehouse	641	973	1 161	332	3,79	-187	-3,23
Administration	4 670	3 788	3 669	-882	-2,59	-119	-0,65
Education	1 310	1 616	1 823	306	2,10	207	2,27
Religion	708	876	860	167	2,12	-15	-0,35
Leisure activities	400	1 030	1 948	631	6,80	918	9,42
Road network	3 845	8 574	11 027	4 730	6,13	2 453	4,45
Agriculture	66 597	58 842	48 672	-7 755	-1,46	-10 174	-4,18
Green spaces	46 437	30 092	32 798	-16 345	-6,04	2 706	1,65
Water network	10 181	10 228	8 171		0,05	-2 057	-5,03
Total	158 860	158 869	158 874				

The evolution of the soil management in Bangkok between 1986 and 2000 is characterized by:

- An important decrease of the agricultural zones for other uses (notably residential, commercial zones).

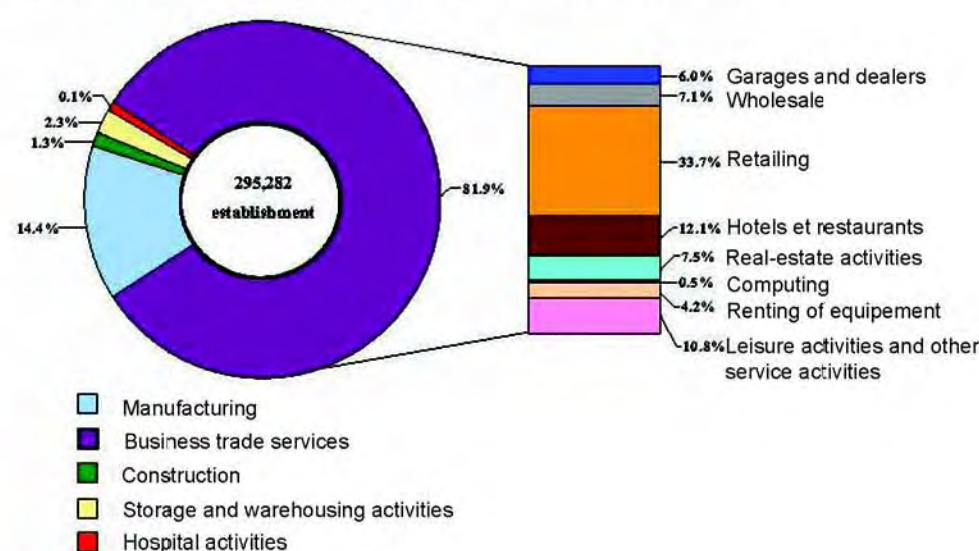
- A decrease of functions which take up space such as industrial parks and warehouses which are mainly delocalized in bordering provinces.

- A significant development of leisure activities and the increase of parks between 1995 and 2000 (while there is an important decline between 1986 and 2000).

Source: City Planning Department, BMA.

ECONOMY

Percentage of establishments by economic activities, in 1997



In 1997, Bangkok listed 295 282 companies mostly in the tertiary sector and more particularly activities connected to business.

The industrial sector is the second economic sector of the metropolis.

The activities connected to tourism are also important in Bangkok (hotels and restaurants, leisure activities).

Source: National bureau of statistics

ACCOMMODATION

Distribution of housing according to the typology, in 2000

	(x1000)	%
ROW HOUSE	562	32,3
INDIVIDUAL HOUSE	562	32,2
CONDOMINIUM	277	16
CITY HOUSE	217	12,5
OTHERS	121	6,4
TOTAL	1739	100

Source: National bureau of statistics

Percentage of owners: 55,6%

POPULATION

The population of Bangkok (BMA) in 2006 was 5.68 million inhabitants, that is 9.18 % of the total population of Thailand.

The population tends to decrease in the districts of the centre and to increase in suburbs. Between 1987 and 2000, the density of central districts have gone from 1527hab / km² (3.25 million inhabitants) to 1109ha / km² (2.36 million inhabitants). While at the same time, the density of the peripheral districts from 770 hab/km² (0.67 million inhabitants) to 1280 hab/km² (1.12 million inhabitants).

The immigrant population was of 450 000 inhabitants in 2000 (among which 53 % are from the North East of Thailand).

Evolution of the population according to age

	1990	2000
0-14 years	21,5	17,5
15-59 years	72,5	74,6
60 et +	6	7,9

Source: National Bureau of statistics

We observe in Bangkok as in numerous metropolises a relative ageing of the population.

The skyscraper, the temple, the house, the freeway, and the railway, the shopping centre and street vending, luxury and poverty, the skytrain and the "long queues", the subway and the tuk-tuks, tourism and work, pollution and parks, the food from the street and the big international restaurants, reference newspapers and the muckraking newspapers, the worship of water and the filling up of canals...

After centuries of horizontal growth, along the river, the city has experienced a real-estate fever for some decades now which made glass skyscrapers, offices and hotels, condominiums, commercial complexes shoot up as by spontaneous generation, without a particular logical localization.

This capital mixes all the architectures, those of the modern skyscrapers and those of the temples and palaces' heritage, as the Wat Pathumwanaram for example, snuggled up in the shadow of the Siam Paragon and of the Central World, the two biggest shopping centres of the country, with along the temple the titanic infrastructure of the elevated railway. A striking image of Bangkok is one of its air freeways which contrast with the peace of its alleys arranged like a comb which associates main roads, congested, noisy and filled with smoke, a more private and green network built as dead ends.

Bangkok's centre is reserved for the business centres because it is unusual for the inhabitants of Bangkok to live in a little flat in the centre, they prefer to live in the suburbs in an individual house, hidden under an overflowing roof, in a calm and natural environment.

Shopping centres are places to walk and find leisure activities which the Thai appreciate greatly. They are present in all the districts of the city, but the biggest shopping centres are in Siam Square with more than 100 stores, restaurants, cinemas on more than 100 000 m2 which attracts numerous Thai and foreign customers.

In spite of the image of a prosperous economic city (43 % of the national GDP), wealth and poverty are intertwined in this capital. The disparities between social classes are important, the rich too rich and the poor too poor. Even on pavements, the most extreme refinement, silks, jewels and beautiful limousines, neighbour with the absolute poverty of disabled beggars in rags.

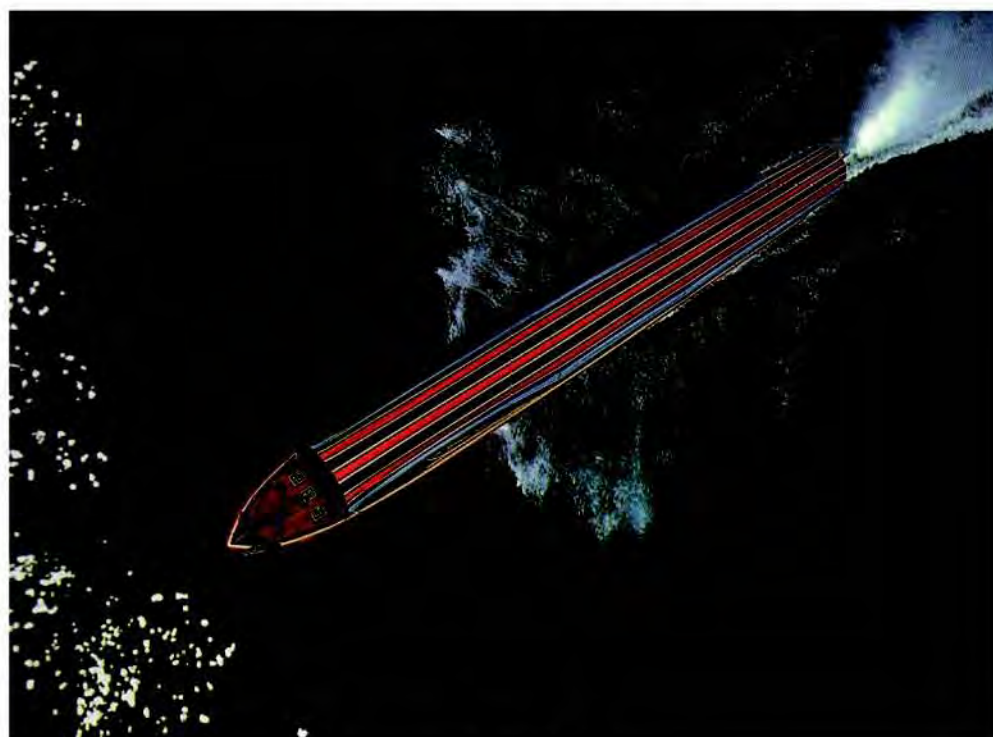
City of tourism, Bangkok is one of the world's favourite destinations (French people, Germans, Italians... Japanese, Kuwaiti, Australian and more and more Chinese and Russians) attracted by its culture, its traditions, its ancient and contemporary landscapes, its leisure activities, its hotel business, its crafts, its textile business.... This very diversified passing population gives it its cosmopolitan air...

To the stereotypical image of "sex capital", the offer of quality leisure activities (dancing, theatre, music) and the ancestral art of bodycare (acupuncture, massages and aromatherapy) can be opposed.

The genius of Bangkok may lie in its capacity to accept, to manage, to create these contrasts, to proceed by a sort of collage producing a colorful mosaic which has become the image of its identity.



Residential tower next to small buildings on the Chao Phraya river bank



"Long tail"



Bangkok's skyline

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