

**There is water there is life**

# Waterways as a drinking water resource for major cities - Vietnam case

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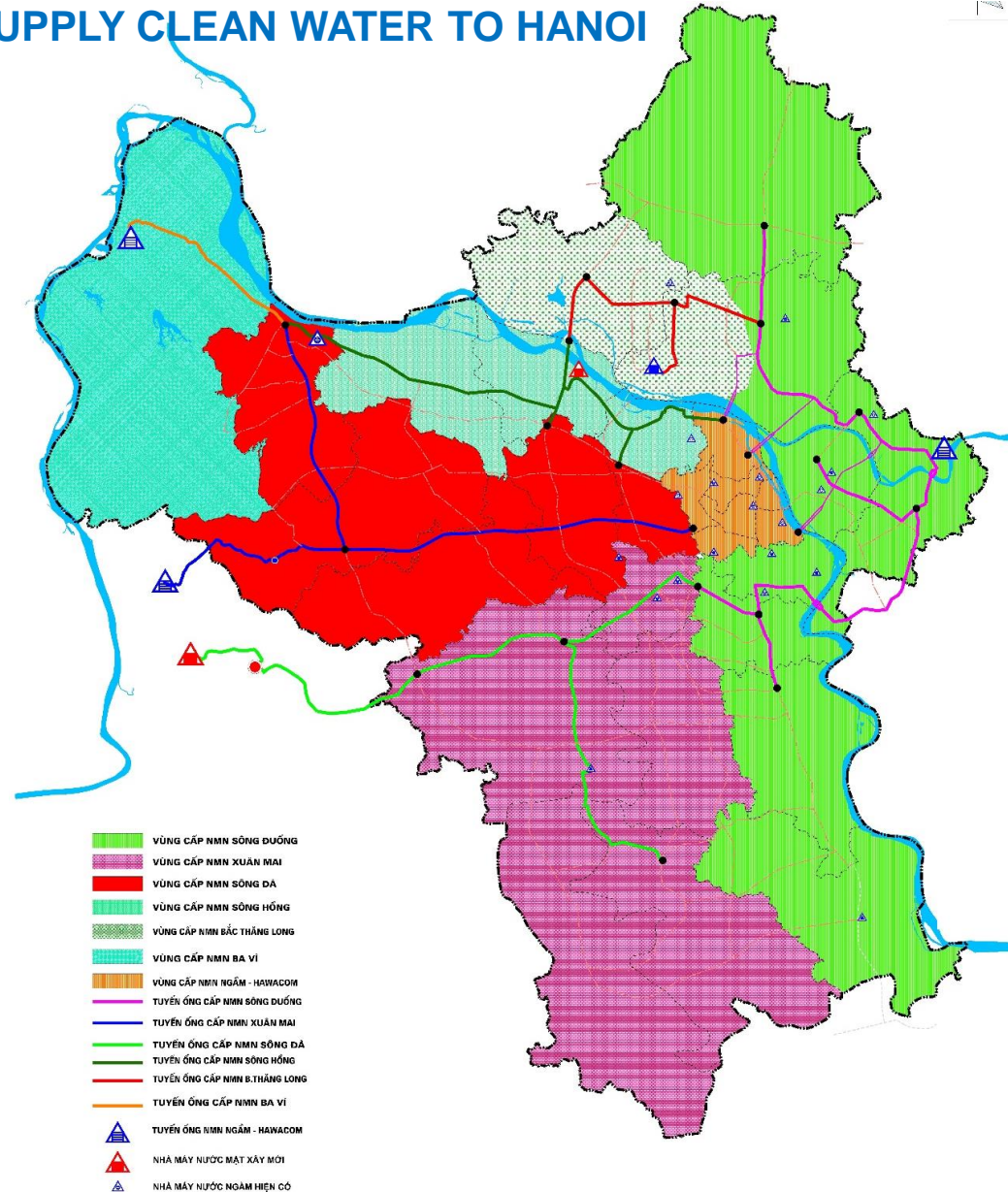
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# I. EXAMPLE OF DUONG RIVER AS A MODERN WTP TO SUPPLY HANOI

## DUONG RIVER AS A MODERN WTP TO SUPPLY CLEAN WATER TO HANOI

- **Project:** Duong river surface water treatment plant
- **Location:** Hanoi City
- **Water resource:** Duong river
- **Capacity:** Phase 1A&1B – 300,000m<sup>3</sup>/day
- Construction: 3/2017-10/2018
- Status: On operation (Stage 1A from 10/2018; Stage 1B from 10/2019)
- Commercial start: 1/2019
- **EP Contractor:** Aone Deutschland AG (Process and technology)
- **Service area:**
  - Hanoi city: one third of Hanoi area
  - Bac Ninh province
  - Hung Yen province:



➤ **Small Video**

# I. EXAMPLE OF DUONG RIVER AS A MODERN WTP TO SUPPLY HANOI

## ➤ Small Video



## II. URBAN AND INDUSTRIAL DEVELOPMENT AND WATER DEMANDS

### KEY DRIVERS OF CLEAN WATER DEMAND IN VIETNAM

- **Strong Industrialization Push:** Global Trade War has been forcing global manufacturers to install production plants in Vietnam industry.
- **Rapid Urbanization:** Urbanization trend: fast rising urban population (**expected to exceed 40% in 2025**) pushes up modern housing with stronger demand for clean water. .
- **Growing Middle Class**



# III. URBAN AND INDUSTRIAL DEVELOPMENT AND WATER DEMANDS

## WATER DEMAND FOR URBAN AND INDUSTRIAL DEVELOPMENT IN VIETNAM

Total capacity of rural and urban water treatment plant: 11,2million m<sup>3</sup>/day; in which:

- Surface water is around **87%**,
- Underground water is around **13%**,
- Percentage of urban population provided with clean water **92%**,
- Average water loss rate **17,5%**,
- The water demands for industrial development **from 2000 to 2050 will increase around 400%**. Although water use for this purpose is small compared to other using demands.

### And also:

- **Industrial areas are placed in dedicated areas** with big amount using and,
- **Wastewater discharge** from production activities are huge

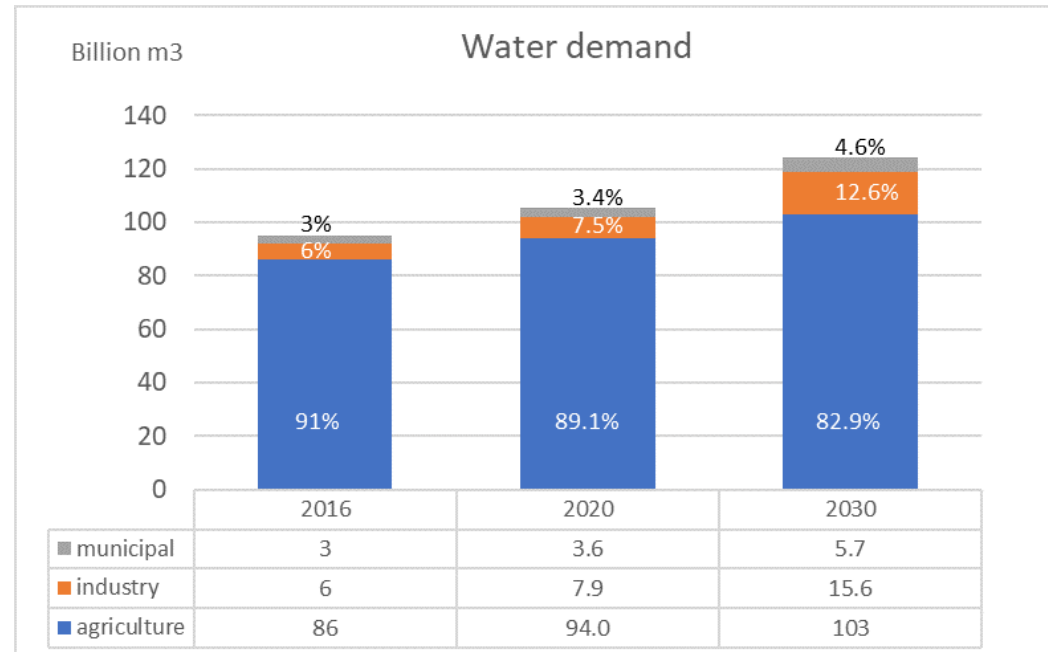


Figure 1: Water use structure in 2016 and projection in 2020, 2030 in Vietnam (adapted from 2030WRG<sup>3</sup>)

# III. WATER RESOURCES AND THEIR KEY CHALLENGES

## WATER RESOURCES IN VIETNAM

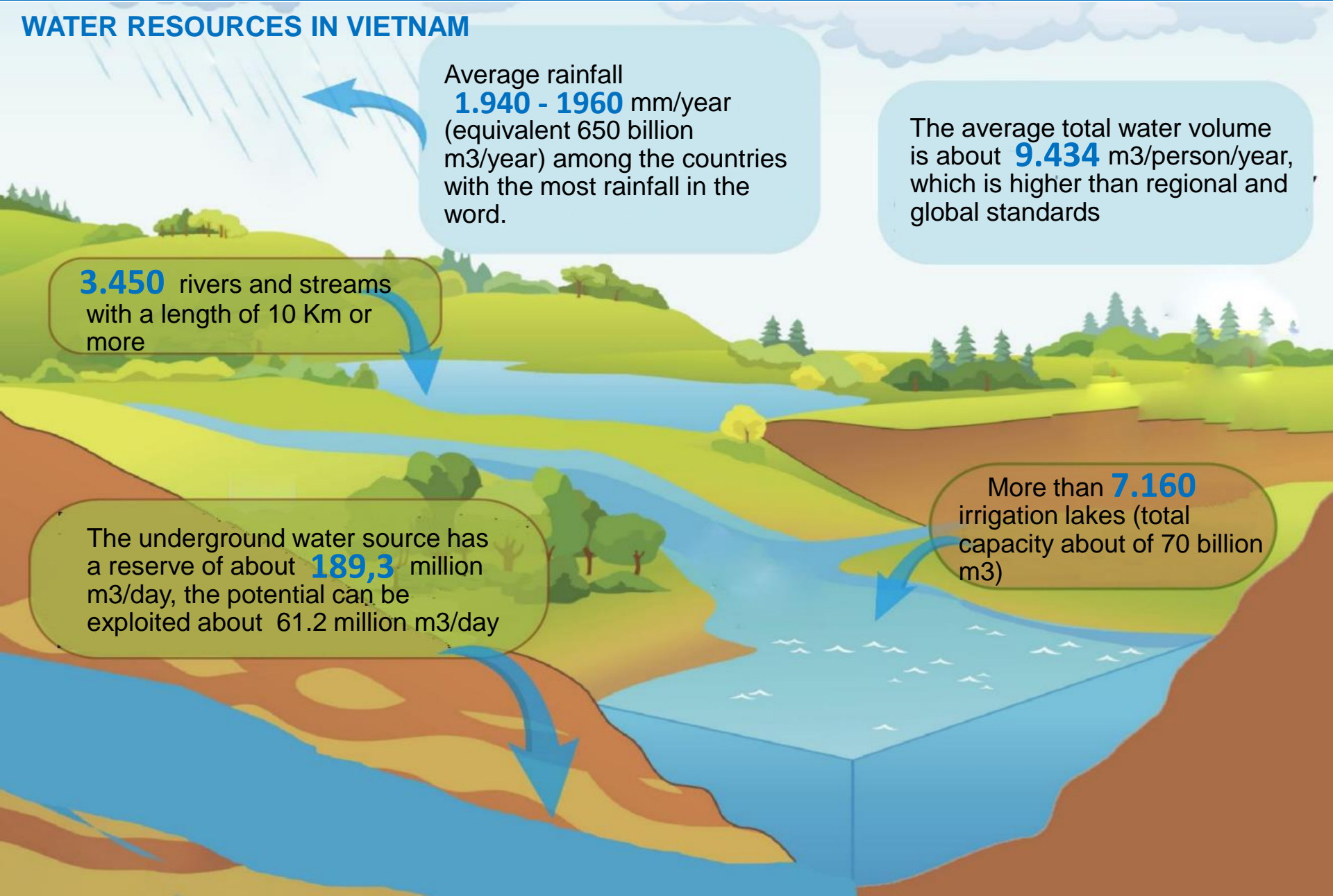
Average rainfall  
**1.940 - 1960** mm/year  
(equivalent 650 billion  
m<sup>3</sup>/year) among the countries  
with the most rainfall in the  
world.

The average total water volume  
is about **9.434** m<sup>3</sup>/person/year,  
which is higher than regional and  
global standards

**3.450** rivers and streams  
with a length of 10 Km or  
more

The underground water source has  
a reserve of about **189,3** million  
m<sup>3</sup>/day, the potential can be  
exploited about 61.2 million m<sup>3</sup>/day

More than **7.160**  
irrigation lakes (total  
capacity about of 70 billion  
m<sup>3</sup>)



# III. WATER RESOURCES AND THEIR KEY CHALLENGES

## UNDERGROUND WATER AND POLLUTED ISSUE

- **The groundwater resources** in Viet Nam are abundant – estimated at nearly 60 bill. m<sup>3</sup> per year.
- **Groundwater is an important source** of water for domestic, industrial, and agricultural uses.

**However:**

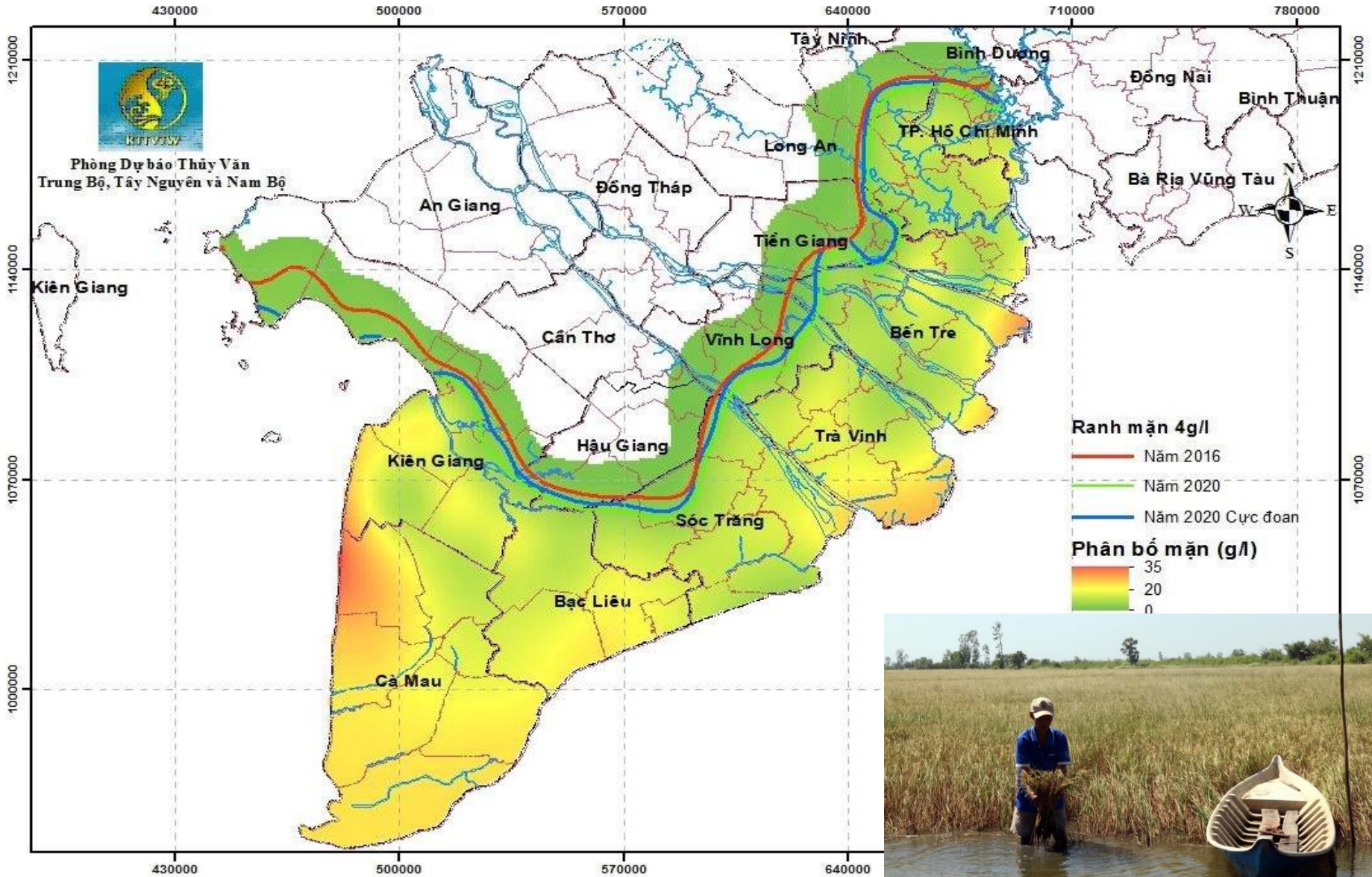
- 1. Pollution**, including arsenic in alluvial deposits
- 2. The level of ammonia contamination** in the treated water at various treatment plants is higher than the national standard by 2-8 times. .
- 3. A high risk of lowering the water table down** and the groundwater pollution would spread over the Hanoi and Ho Chi Minh City.
- 4. Salinity intrusion is taking place** in the Red River Delta, the Central Coastal Regions and in the Mekong River Delta.
5. Due to **increased groundwater exploitation** salinity intrusion increases and poses a threat to safe water supply.
- 6. Approximately 35% of tube wells** found with arsenic higher than 0.01 mg/l and 0.05 mg/l.





# III. WATER RESOURCES AND THEIR KEY CHALLENGES

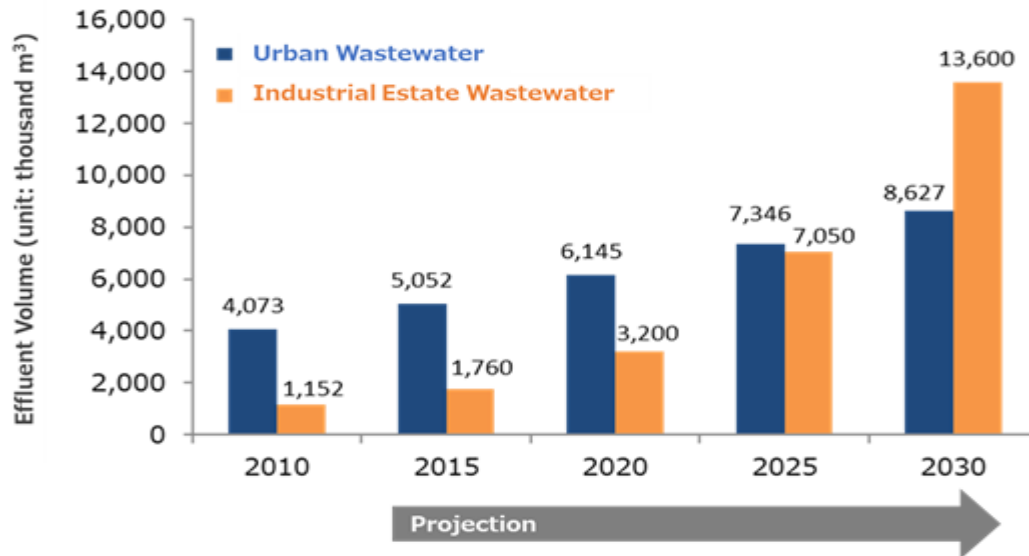
## SALINIZATION ISSUES IN MEKONG DELTA ON DRY SEASON IN VIETNAM in 2019-2020



# III. WATER RESOURCES AND THEIR KEY CHALLENGES

## POLLUTED SURFACE WATER IN VIETNAM

Predicted volume of urban wastewater and industrial estate wastewater in Vietnam



This file photo shows Vedan uses concealed pipes to illegally dump untreated wastewater into the Thi Vai River (Photo:SGGP)



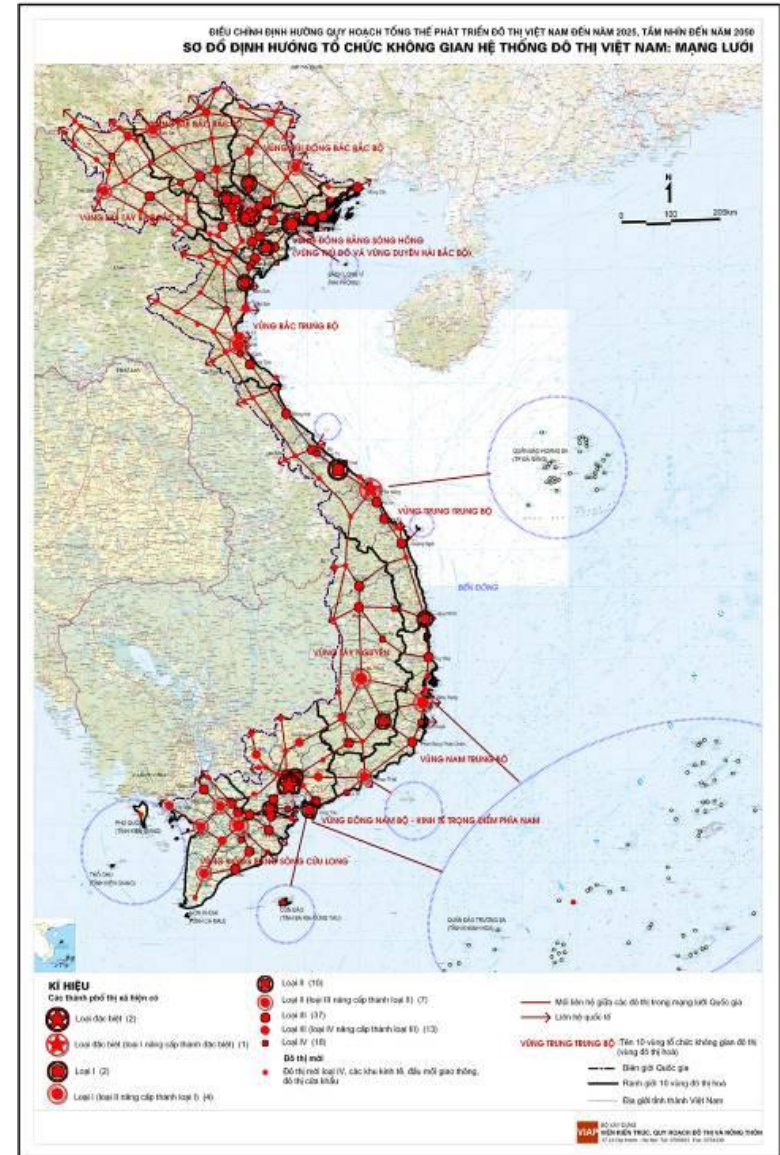
- **Vietnam need to strictly enforce** the building of WWTPs in all urban and industrial areas immediately
- **Encourage the private sector in investment** of WWTPs through the endow policies and right tariff and transparency

Persistent organic pollutants in sediments from Sai Gon-Dong Nai River Basin, Vietnam

# IV. ADVANTAGES OF WATERWAYS AS DRINKING WATER RESOURCE

## WATERWAYS ARE IN CLOSE CONNECTION TO URBAN DEVELOPMENT IN VIETNAM

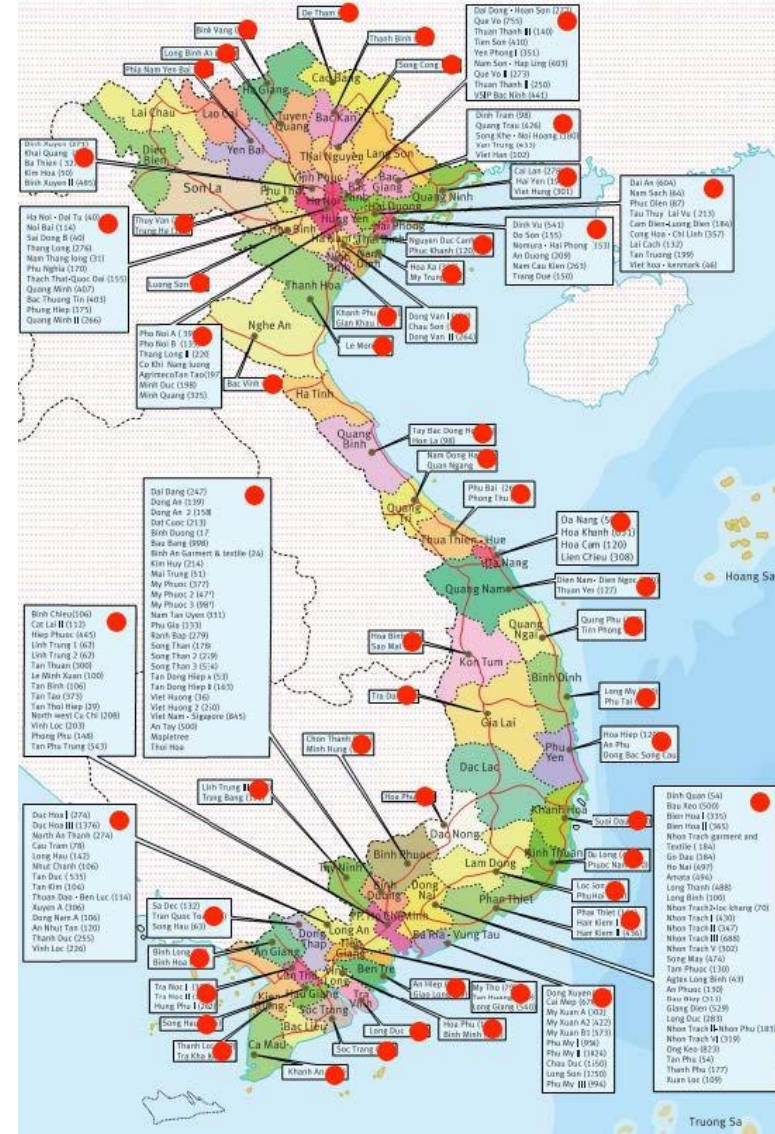
- **Việt Nam has 63 provinces and cities** in which with 5 big cities (Hanoi; Ho Chi Minh city; Hai Phong; Da Nang and Can Tho) and 58 provinces.
- **Urban system and urbanization** in Vietnam has developed dramatically in recent years.
- Vietnam also know as the country **with population of around 97 million people on 2019**; 3rd largest population in Southeast Asia and 15th largest in the world.
- With population; **the urban population accounts for around 35% of population in which focus mainly on 03 big areas** Red river basin (Hanoi; Hai Phong); Mekong delta basin and Dong Nai river basin (Ho Chi Minh; Binh Duong; Can Tho)



# IV. ADVANTAGES OF WATERWAYS AS DRINKING WATER RESOURCE

## WATERWAYS ARE IN CLOSE CONNECTION TO INDUSTRIAL DEVELOPMENT IN VIETNAM

- By the end of 9/2021, Vietnam has **563 industrial zones (Ips)** in Master plan of development planning of industrial zones in Vietnam (including industrial zones in coastal economic zones and border gate economic zones) with a **total natural land area is about 210,900 ha**, accounting for about 0.6% of the total natural land area of the country
- **Industrial zones also place in nearby main river basins** of country such as Red River basins - Thai Binh, Cucu Long, Dong Nai and Mekong delta.



# IV. ADVANTAGES OF WATERWAYS AS DRINKING WATER RESOURCE

## SURFACE WATER FROM WATERWAYS CAN BE EXPLOITED ON AN INDUSTRIAL SCALE

### Underground water

#### Strength:

- **Good quality** with low suspended sediment content
- **Easily and simple** treatment process
- **Low operation and maintenance** cost

#### Weakness:

- **Limitation** of volume exploited
- Contaminated by arsenic chemical,
- Unplanned drilling for underground water has damaged the geological surface in the long-term, causing collapse and subsidence.
- Groundwater in some coastal provinces (e.g the Mekong Delta) is experiencing a decline in the quality and quantity of groundwater.
- Risk of salinization and landslides...

### Ground Water

#### Strength:

- Is an **abundant and easy-to-exploit** water source.
- The **water quality in large rivers is suitable** for exploitation as an input source for domestic water treatment plants.

#### Weakness:

- **High turbidity** (high NTU) and seasonal variation.
- Affected by other activities (agricultural; aquaculture, transportation...)
- Easier polluted if wastewater discharging directly without treatment
- Depend on the river basin related to outside countries

# IV. ADVANTAGES OF WATERWAYS AS DRINKING WATER RESOURCE

## WATERWAYS THE FUTURE OF CLEAN WATER SUPPLY

- **The widespread drilling of underground water wells** will affect the geological layer, causing subsidence in the future.
- **Underground water wells have been drilled** for a long time, now the quality is gradually not guaranteed.
- Clean water suppliers will have to build surface water plants **due to limitation and pollution of underground water**
- **Large scale water treatment plants** are recommended to ensure safety and sustainability in water supply.
- WTP should use advanced technology and equipment; operating in compliance with strict water quality management regulations, standards and procedures



# IV. ADVANTAGES OF WATERWAYS AS DRINKING WATER RESOURCE

## WATERWAYS THE FUTURE OF CLEAN WATER SUPPLY

- Main urban and industrial areas in Vietnam placing nearby the **big river basins** such as
- Vietnam has **high priorities for sustainable and green development**
- The **economic development** in which industrial development will be a high target
- The **urban and industrial development** in Vietnam will be continuously boom in next 10 – 20 years



- **Investment in industrial development** at a fast pace requires infrastructure, especially clean water supply
- **Decree/Policy of the Government** on reducing and restricting groundwater exploitation; to reduce and replace groundwater with surface water step by step;

# IV. ADVANTAGES OF WATERWAYS AS DRINKING WATER RESOURCE

## WATERWAYS WILL BE LONG-TERM WATER RESOURCES FOR DRINKING WATER

- Vietnam is a country with abundant water resources in term of rainfall, surface water in river systems, lakes and underground water sources.
- It is necessary to exploit, produce and supply clean water regardless of administrative boundaries to increase water safety.
- Regarding surface water (total annual flow is about 840 billion m<sup>3</sup>, of which mainly concentrates in:
  - The Mekong River basin (about 57% - nearby the biggest city of Vietnam: Ho Chi Minh) and more than 16%
  - The Red – Thai Binh river basin (go though Hanoi Capital – the second biggest city).
- Regarding underground water, the actual exploitation of under ground is very small (13%) compare with the surface water (87%).Over-exploitation of ground water result in falling water tables and causes land subsidence and salinity instruction. It also increase contamination of groundwater harm water security.



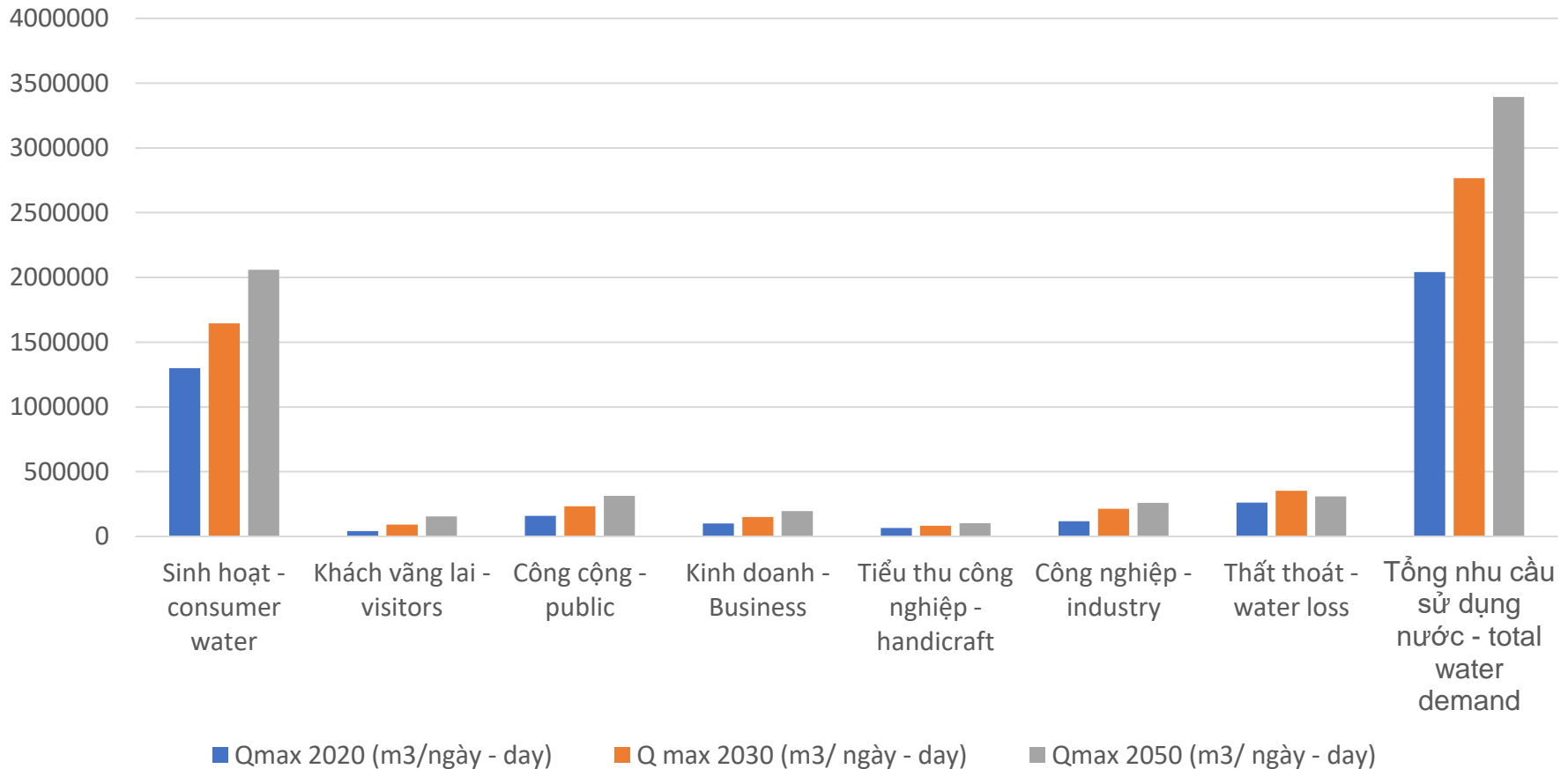


# V. EXAMPLE WATER DEVELOPMENT PLAN OF HANOI CITY

## HANOI CAPITAL – WATER DEMAND

Water treatment plant in Hanoi city according to the **Water supply master plan of Hanoi Capital throud 2030, vision to 2050**

### Summary of water demand in the period 2025, 2030, vision to 2050



Source: Summary explanation of forecasting water demand/Adjusting Hanoi capital's water supply master plan to 2030, vision to 2050

# V. EXAMPLE WATER DEVELOPMENT PLAN OF HANOI CITY

## HANOI CAPITAL – MASTERPLAN TO COVER THE DEMAND

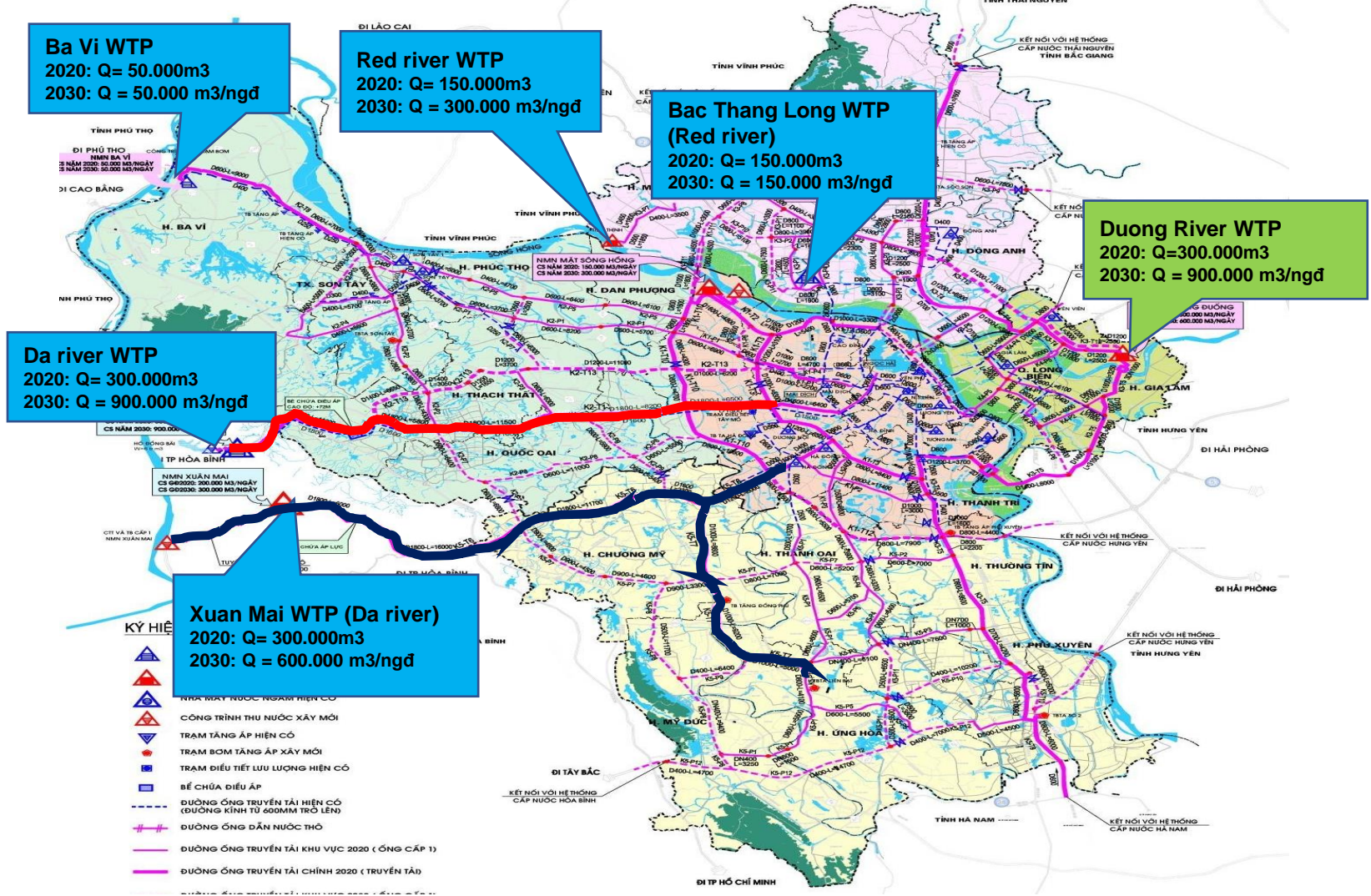
Water supply planning in Hanoi city with priority to use surface water from big rivers

No.	Water treatment plant	Capacity planning (m <sup>3</sup> /day)			
		On operation	2025	2030	2050
I	Underground water treatment plant (22 WTPs )	615.000	615.000	504.000	413.000
II	Surface WTPs	1.028.000	1.768.000	2.346.000	3.182.000
	Total capacity of surface WTPs		1.918.000	2.571.000	3.582.000
1	Bắc Thăng Long (Red river)	200.000	200.000	250.000	300.000
2	Ba Vì (Red river)	60.000	60.000	100.000	150.000
3	Da river	300.000	750.000	900.000	1.200.000
4	Duong river	300.000	300.000	600.000	900.000
5	Red river	-	300.000	300.000	450.000
6	Xuan Mai ( Da river)	-	200.000	300.000	500.000
7	Water from Ha nam province (Red River)	25.000	65.000	70.000	80.000
8	Other small WTPs	43.000	43.000	51.000	52.000
III	Total capacity of WTPs	1.643.000	2.533.000	3.075.000	3.995.000

# V. EXAMPLE WATER DEVELOPMENT PLAN OF HANOI CITY

## HANOI CAPITAL – FUTURE WATER SUPPLY STRUCTURE

Water supply planning in Hanoi city with priority to use surface water from big rivers



➤ It is show that as 2<sup>nd</sup> biggest city and capital of Vietnam; the requirement of using river water is planning and reducing the underground water

# VI. CONCLUSIONS

## PROPOSING SOLUTIONS AND STRATEGIES FOR WATERWAY MANAGEMENT

The using and development of waterways are obligatory and inevitable for economic development especially in Vietnam:

- **The limitation and problems of underground water** using which require us must be protect underground water through the extraction with stable volume; reduce and replace by surface water and control of pollution causing to underground water
- **The demands of water using for domestic and industrial purposes** are continuously increase which will require to invest more WTPs in big river basin
- **The waterways will contribute huge important role** for drinking water from domestic and industrial using



# VI. CONCLUSIONS

## PROPOSING SOLUTIONS AND STRATEGIES FOR WATERWAY MANAGEMENT

- **Strictly apply and enforce laws and regulations** in waterways management
- **Building and establishing the clear planning for river basins** which will use the water as drinking water sources
- **Participation of all sectors** to ensure the good performance of water resources management
- **International coordination and cooperation development** for capacity building; management experiences; together cooperation to protect river water resources.
- **Encourage the participation of private sector** in water supply and wastewater

## PROPOSING TO ENCOURAGE THE PARTICIPATION OF PRIVATE SECTOR IN WATER BUSINESS

- **Vietnam Clean water Industry** is a potential market for investment
- **Water tariff in Vietnam** is attractive compared water price in comparable countries.
- **The government allows price high to encourage development** of infrastructures and improved water supply service).
- **Regional Water treatment plants** using surface water is highly recommendation

# VI. CONCLUSIONS

## CONCLUSION AND RECOMENDATIONS

- **Waterways for drinking water will be continued as main water resources** for rural; urban and industrial development in future.
- **Extraction limitation of underground water resources**; which should only be use as balance volume.
- **Technologies and engineering continually improve** which help to treat water in different quality

**However;**

**To manage and protect the waterways for multiple- purposes which will require participation of all sectors:**

- **The good performance of water resources management** from government in term of strict legal and regulations.
- **Wastewater/ waste must be treated and managed** to prevent the pollution
- **Participations from other sectors** such as agriculture; aquaculture; water for domestic
- Must be have **long-term strategies and programs** to protect water resources
- **Green development / zero – discharge/ recycle and reuse** must be priority for economic development

# WATER TREATMENT PLANT – DUONG RIVER WTP HANOI CITY



# WATER TREATMENT PLANT – DUONG RIVER WTP HANOI CITY





# WATER TREATMENT PLANT – HAU RIVER WTP – HAU GIANG PROVINCE



# RAW WATER RESOURCES FROM LAKE – LONG AN PROVINCE



# RAW WATER RESOURCES FROM LAKE – BINH THUAN PROVINCE



# RAW WATER RESOURCES – MAIN RIVERS IN VIETNAM



## Mekong River – South Vietnam

- Length: 4.350 km
- Basin areas: 795.000 km<sup>2</sup>
- Upstream: Lasagongma Spring, China
- River water front: Mekong Delta

## Da river – North Vietnam

- Length: 910 km
- Basin areas: 52.900 km<sup>2</sup>
- Upstream: Van nam, China
- River water front: Red river



# RAW WATER RESOURCES – MAIN RIVERS IN VIETNAM



## Red river – North Vietnam

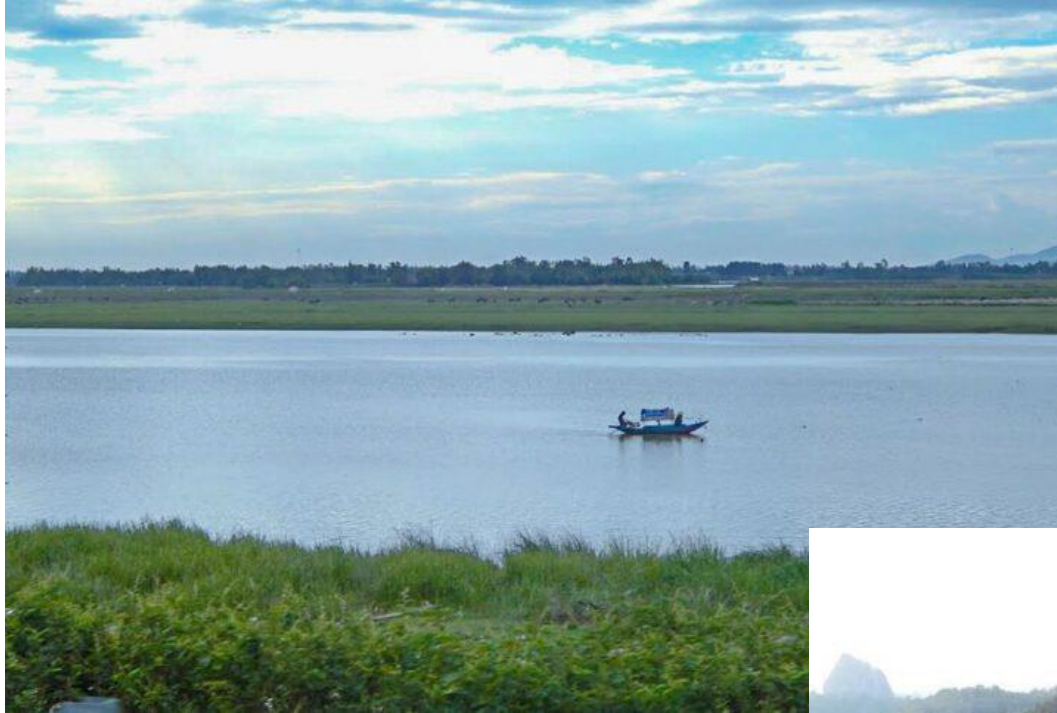
- Length: 1.149 km
- Basin areas: 143.700 km<sup>2</sup>
- Upstream: Hengduan Shan, China
- River water front: Ba La water from



## Dong Nai river – South Vietnam

- Length: 568 km
- Basin areas: 38.600 km<sup>2</sup>
- Upstream: Lam Dong plateau
- River water front: East Sea - Vietnam

# RAW WATER RESOURCES – MAIN RIVERS IN VIETNAM



## Lam river – Middle Vietnam

- Length: 513 km
- Basin areas: 27.200km<sup>2</sup>
- Upstream: Laos
- River water front: East Sea - Vietnam



## Ma river – North Vietnam

- Length: 512 km
- Basin areas: 28.400 km<sup>2</sup>
- Upstream: Dien Bien province - Vietnam
- River water front: East Sea - Vietnam

# RAW WATER RESOURCES – MAIN RIVERS IN VIETNAM



## Chay river – North Vietnam

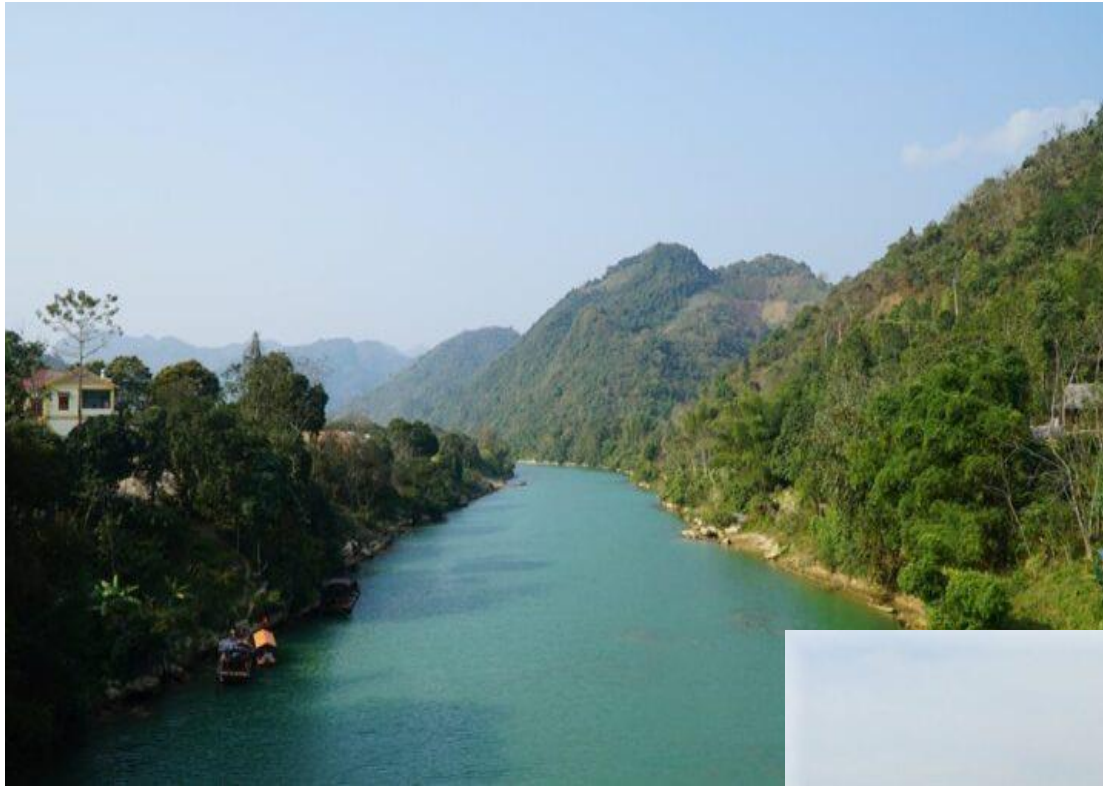
- Length: 470 km
- Basin areas: 22.600 km<sup>2</sup>
- Upstream: Van nam China
- River water front: Red river - Vietnam

## Serepok river – Middle Vietnam

- Length: 406 km
- Basin areas: 3.230 km<sup>2</sup>
- Upstream: Dak Lak province - Vietnam
- River water front: Mekong river



# RAW WATER RESOURCES – MAIN RIVERS IN VIETNAM



## Chay river – North Vietnam

- Length: 319 km
- Basin areas: 4.580 km<sup>2</sup>
- Upstream: Ha Giang province Vietnam
- River water front: Lo river

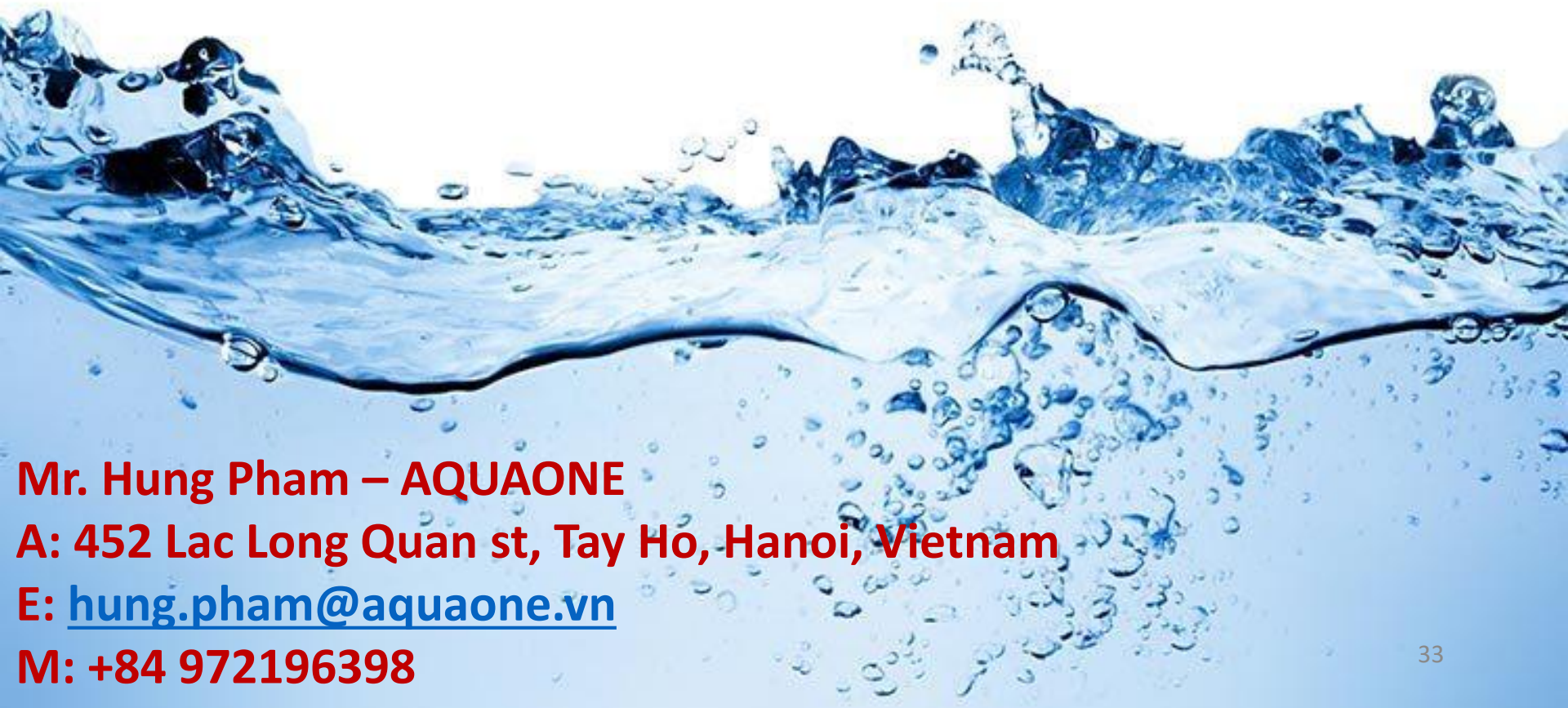
## Thai Binh river – South Vietnam

- Length: 406 km
- Basin areas: 3.230 km<sup>2</sup>
- Upstream: Dak Lak province - Vietnam
- River water front: Mekong river





**DANKE - THANK YOU - XIN CẢM ƠN  
QUESTION PLEASE**



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