

北京市污水再生利用政策与污泥处理处置规划

Policy For Treated Wastewater Reuse and Planning of Sludge Disposal in Beijing

黄 鸥

Huang Ou

中国 · 北京市市政工程设计研究总院

**Beijing General Municipal Engineering Design and
Research Institute, China**

2011.10

北京市市政工程设计研究总院

CONTENTS



1. BACKGROUND

2. POLICY FOR TREATED WASTEWATER REUSE

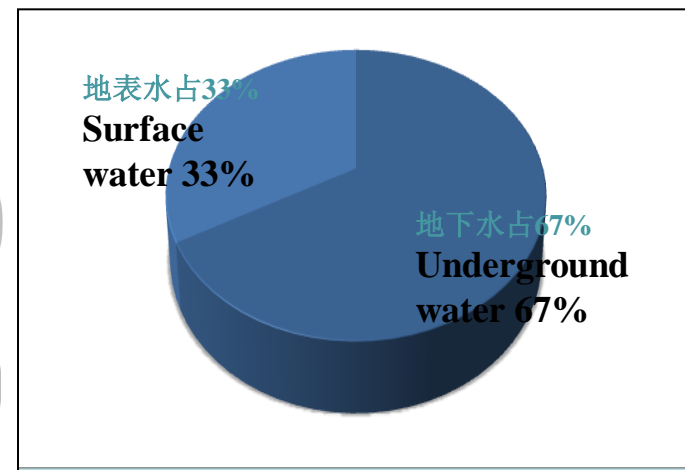
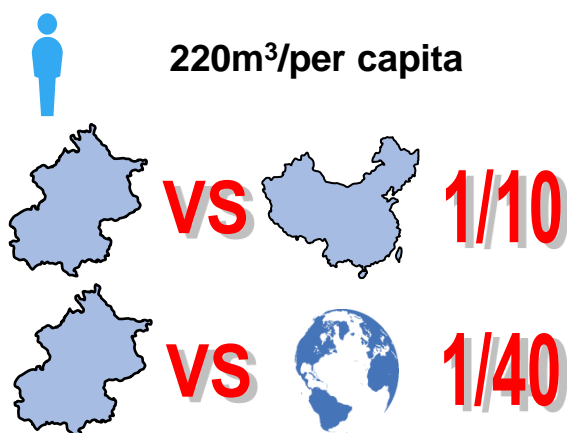
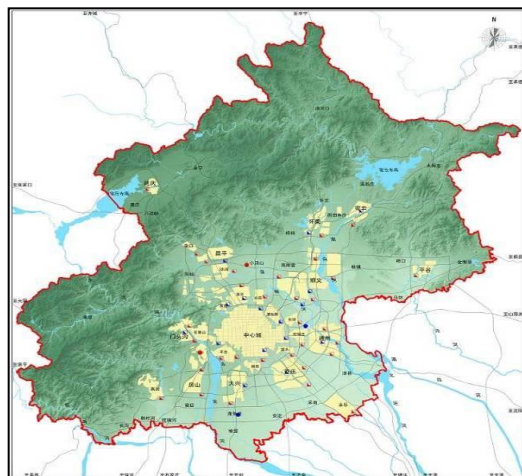
3. EXISTING OF SLUDGE DISPOSAL IN BEIJING

4. CHARACTERISTICS OF SLUDGE

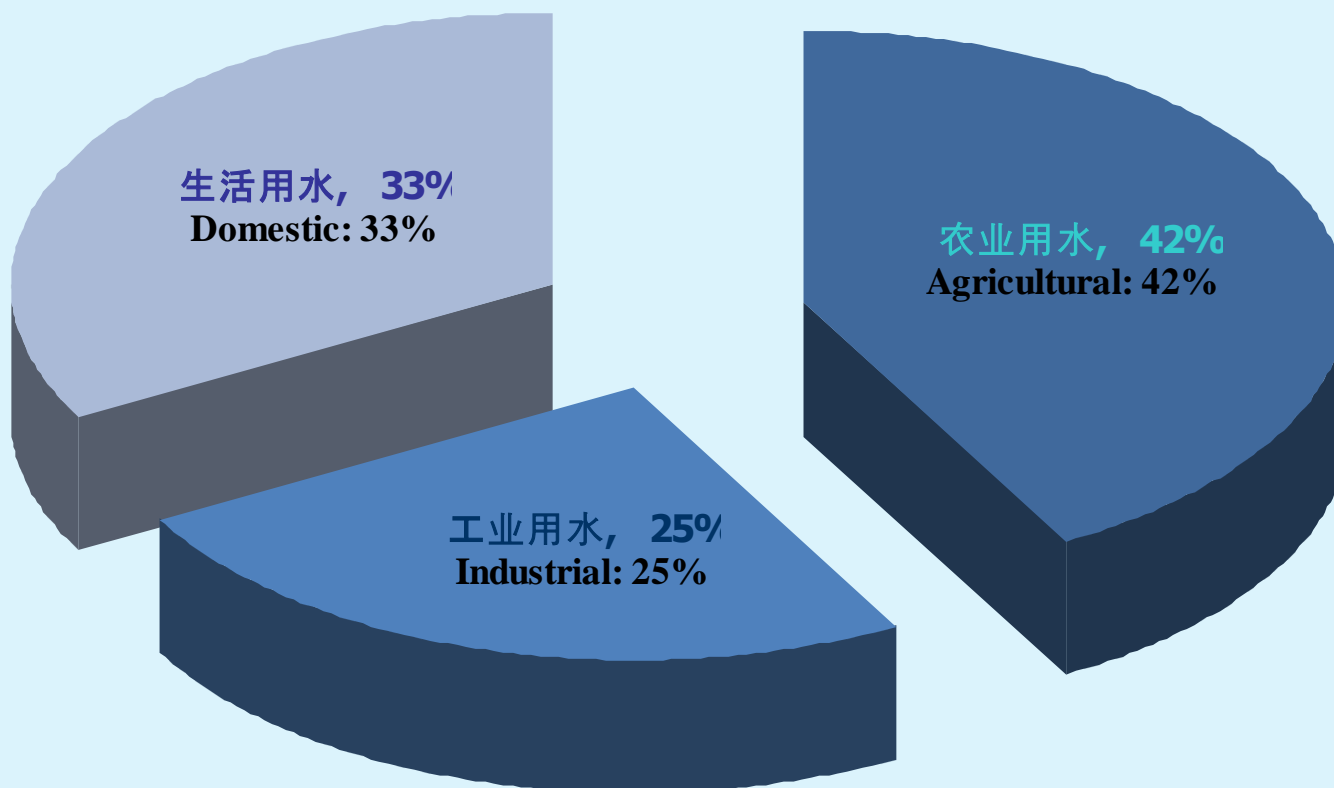
5. PLANNING OF SLUDGE DISPOSAL IN BEIJING



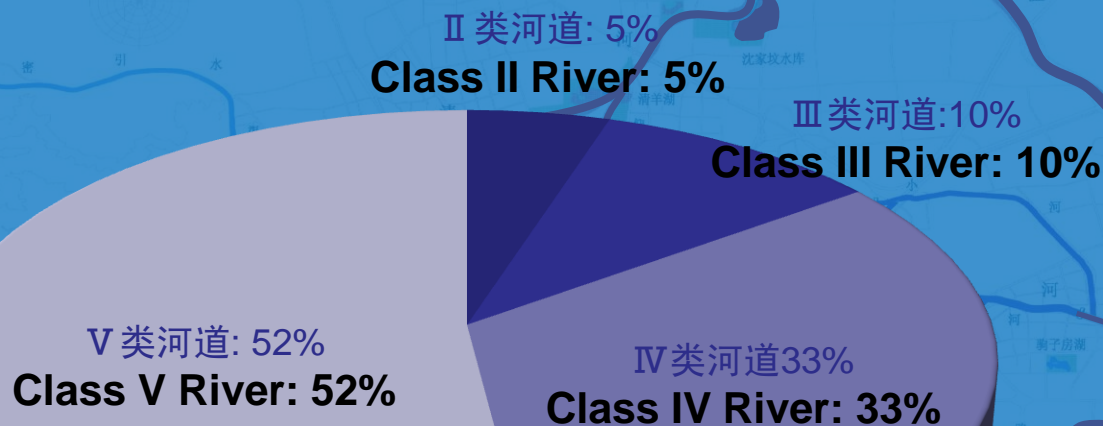
- 北京是中华人民共和国的首都。
Beijing is the capital of P.R.China.
- 北京市行政区域面积为16800km²，中心城区面积1040km²，常住人口1755万人。
The whole city area is about 16,800 km², the constructed area is about 1040 km². There are 17.55 million permanent residents in the constructed area.
- 北京人均水资源占有量为220m³，是中国人均水资源占有量的1/10，世界人均水资源占有量的1/40。
The average per capita water resources of Beijing is about 220m³. It is one-tenth of whole nation and one fortieth of the whole world.



北京城市用水比例 Ratio of water consumption



北京市城市污水处理厂再生水回用规划—河湖水系水体分类图



市内河流均为无基流季节性河道

There is almost effluent which from existing wastewater treatment plant in the river within constructed area, without more fresh water in dry season.

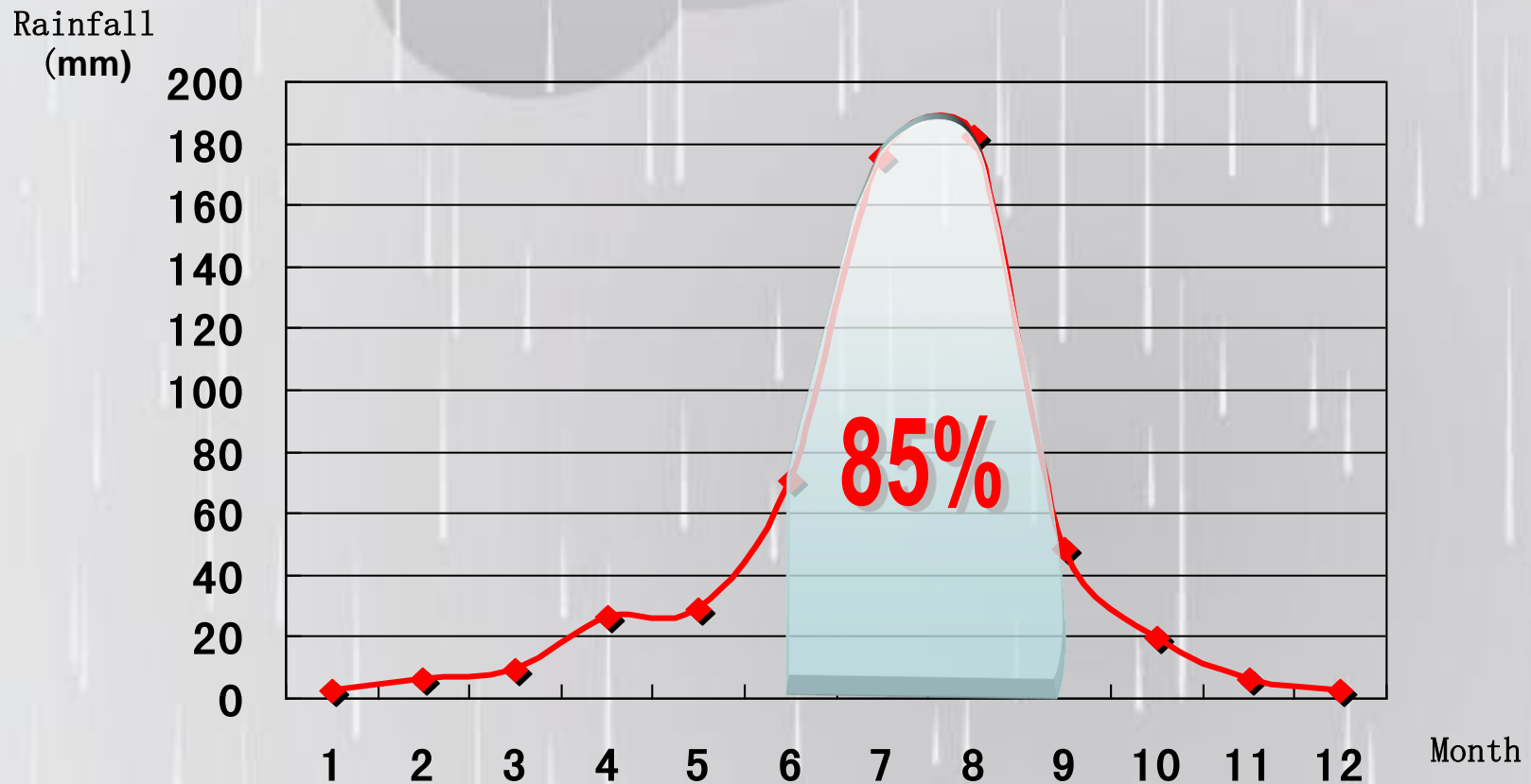
图例



每年的降水量分配不均

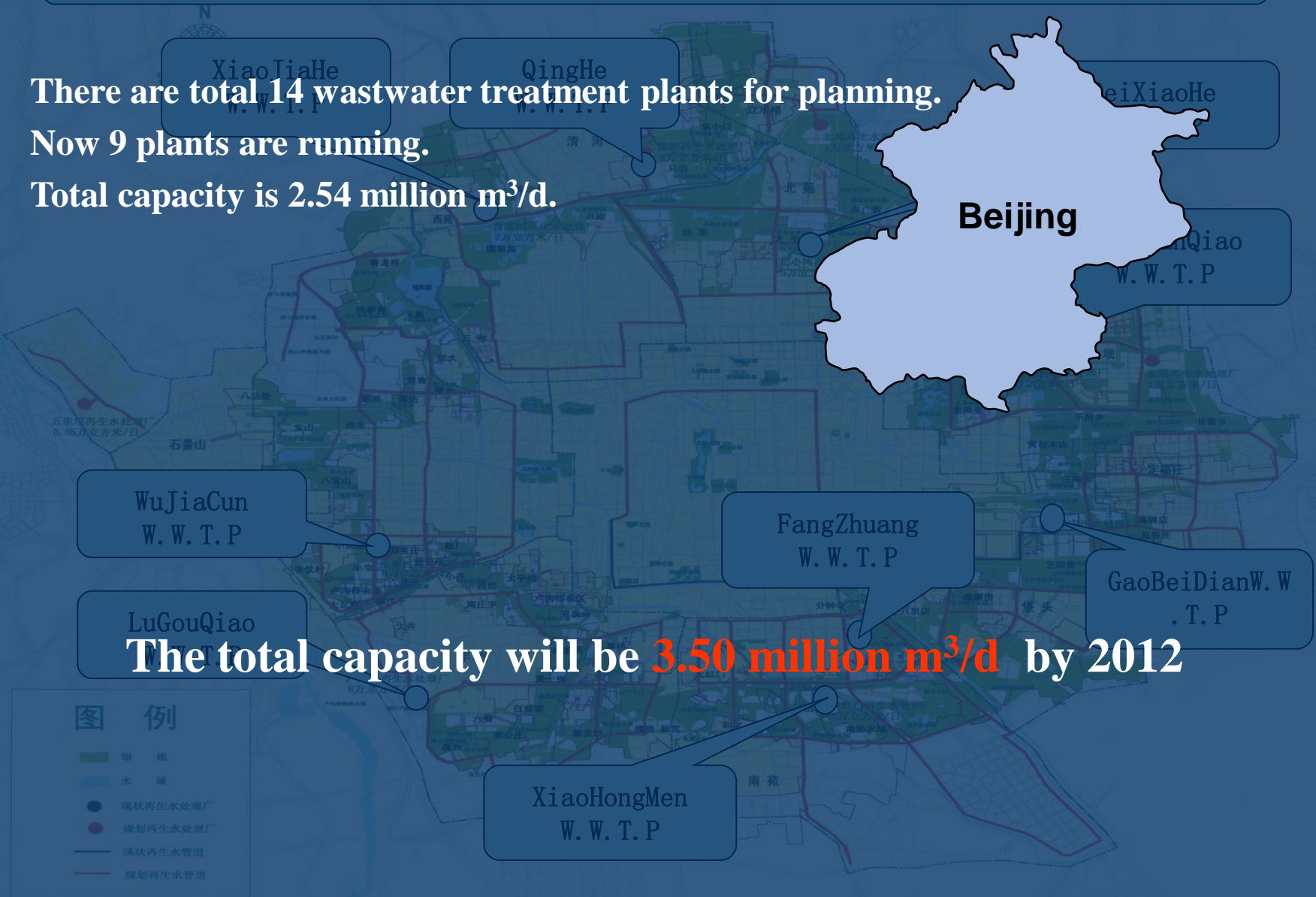
Rainfall distribution is not balanced in one year

- 多年平均降雨量**595mm**
- Annual average precipitation for years in Beijing is 595mm.
- **6-9月汛期降水占全年降水85%**
- The precipitation during June and September is about 85% of whole year.



Existing Layout of W.W.T.P in Beijing City

- There are total 14 wastewater treatment plants for planning.
- Now 9 plants are running.
- Total capacity is 2.54 million m³/d.



No.	Name of W.W.T.P	Capacity of W.W.T.P	Capacity of water reuse facilities	Purposes
1	QingHe	400	80	Olympic Lake, River (Qinghe river)
2	BeiXiaoHe	100	60	Olympic Lake, Power Station
3	JiuXianQiao	200	60	Power Station, Greening
4	GaoBeiDian	1000	470	Power Station
5	FangZhuang	40	10	Wash Car, Greening
6	WuJiaCun	80	40	Greening
7	LuGouQiao	100	/	/
8	XiaoHongMen	600	300	Irrigation
9	XiaoJiaHe	20	20	River (Qinghe river)
10	Total	2540	1040	

Unit: 1,000m³/d

Items	Unit	Coagulation Sedimentation+filtration for Jiuxiaoqiao, Fangzhuang, Wujiacun W.W.T.P	UF for Qinghe W.W.T.P	MBR for Beixiaohe W.W.T.P	MBR+RO for Beixiaohe W.W.T.P
COD _{cr}	mg/L	15~20	8~10	12~22	<10
BOD ₅	mg/L	<2	<2	<2	<2
TN	mg/L	5~15	<15	8~15	<1
NH ₄ ⁺ -N	mg/L	0.3~4.5	<0.3	<1	<0.025
TP	mg/L	0.1~0.7	<0.4	<0.5	<0.025
Color	Degree	7~26	5~12	7~10	7
Turbidity	NTU	<3	<0.5	<1.5	<0.5



水资源匮乏始终是北京经济发展和环境改善的瓶颈

The economy development and environment improvement of Beijing are restricted by water problem.

污水再生利用是改善北京市水资源短缺的有效方法之一

The treated wastewater reuse is one effective way for the water problem.

政策:

Policy from the government:

1、污水全部需再生利用

1、 All the effluent from existing W.W.T.P in Beijing should be reused.

2、所有的污水处理厂全部进行升级改造。

2、 All the wastewater treatment plants should be reformed so as to meet a new and higher level.

3、主要水质指标达到地表水IV类水体标准。

3、 The main index of treated wastewater quality after plant reformed should be met the requirement of Class IV of Surface Water Environment Quality Standard.

4、提高再生水的适用性，实现市区污水全部资源化。

4、 To improve the applicability of reclaimed water, to achieve all of the resources of urban sewage.

5、逐步改善、修复河湖水环境，实现北京市河道水质全面达标。

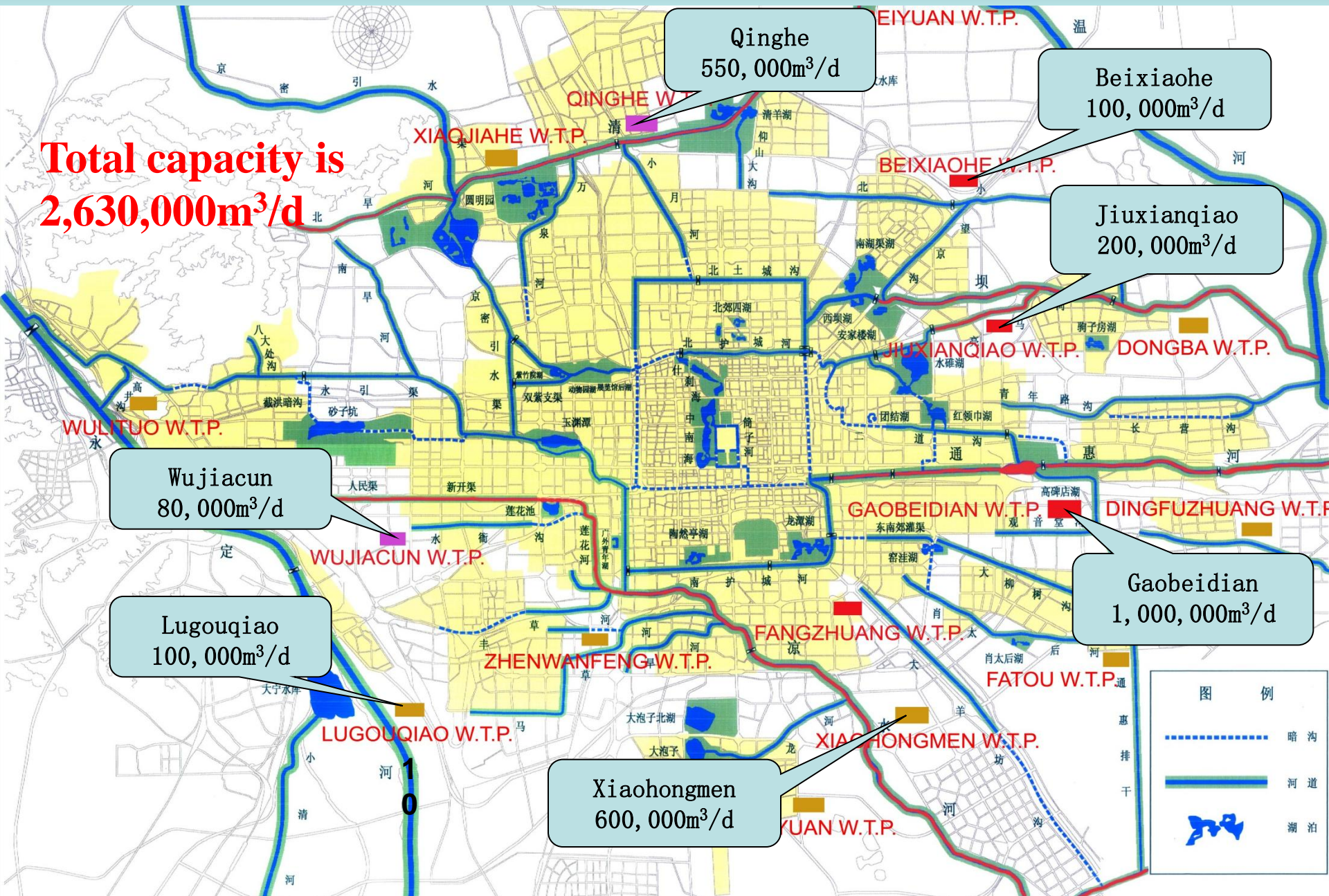
5、 To improve and renovate water environment of river and lake, so as to let water quality of river meet the requirement of standard.

6、率先启动市区7座污水处理厂升级改造，然后向郊区推进。

6、 To start the reforming project of seven wastewater treatment plants in the constructed area at once, and then to start in suburbs.

Layout of reclaimed water works

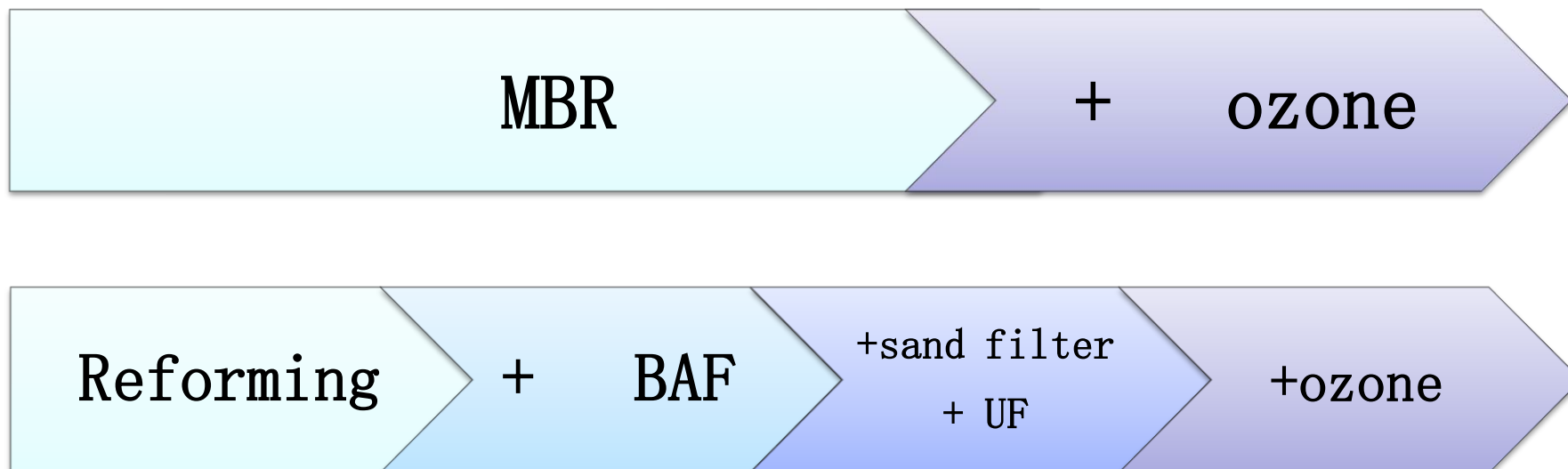
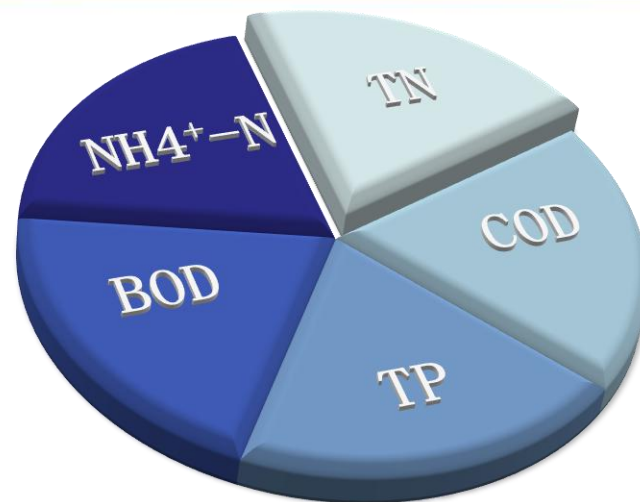
**Total capacity is
2,630,000m³/d**



Water quality after reforming

Items	Water Quality
BOD ₅ (mg/L)	≤ 6
COD _{Cr} (mg/L)	≤ 30
TN (mg/L)	≤ 10
NH ₄ ⁺ -N (mg/L)	≤ 1.5
TP (mg/L)	≤ 0.3
colon bacillus (set/L)	500
Color (Degree)	≤ 15
Turbidity (NTU)	≤ 5

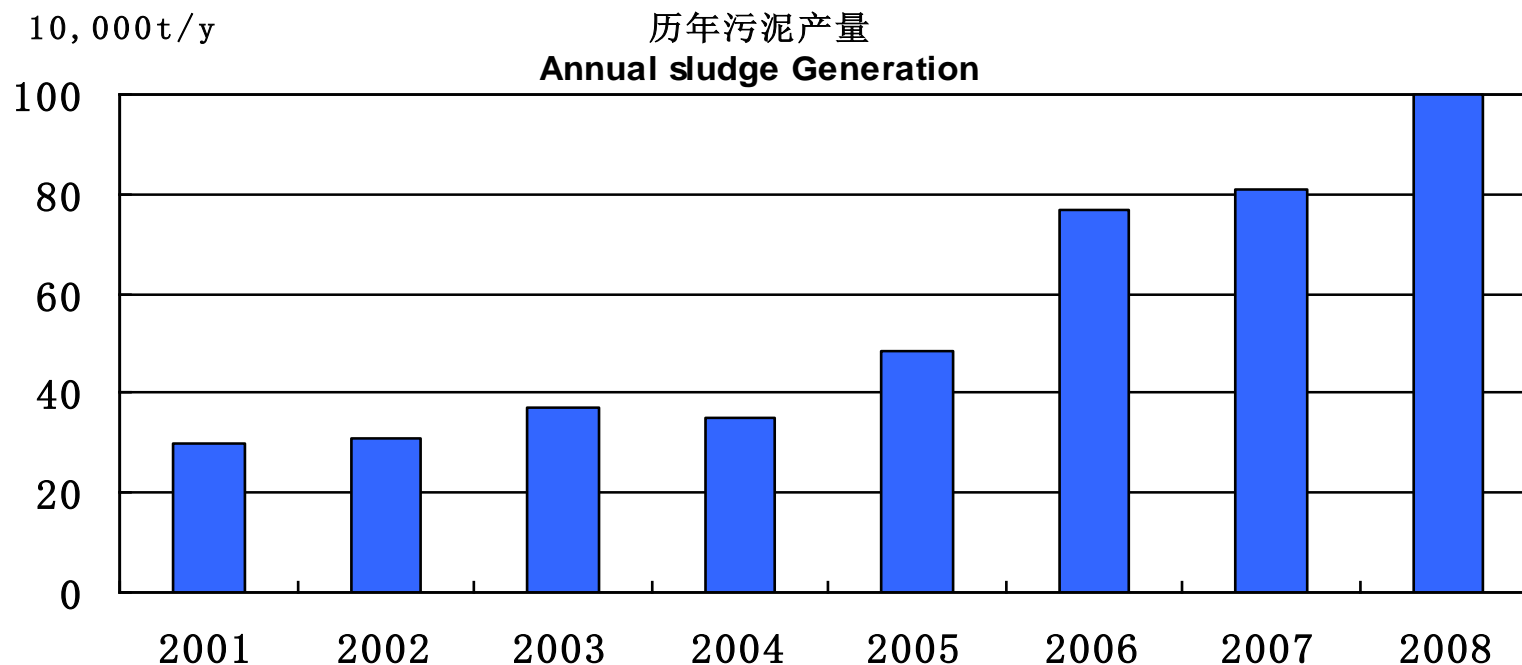
The key problem of water quality is COD and TN



W. W. T. P	Capacity (1000m ³ /d)			Process	Plan
	Biological	Existing reclaimed water works	New Build		
Qinghe	550	80	470	150,000m ³ /d, MBR+O ₃ 320,000m ³ /d, BAF+SAND FILTER+O ₃	For building
Beixiaohe	100	60	40	MBR+O ₃	For building
Lugouqiao	100		100	BAF+SAND FILTER+O ₃	For building
Jiuxianqiao	200	60	140	BAF+CLOTH FILTER+O ₃	Preliminary design
Wujiacun	80	40	40	BAF+CLOTH FILTER+O ₃	Preliminary design
Gaobeidian	1000		1000	A ² /O+BAF+UF+O ₃	Preliminary design
Xiaohongmen	600		600	BAF+CLOTH FILTER+O ₃	Preliminary design
Total	2630	240	2390		

北京市污泥产量

Annual sludge generation of Beijing



2008年：中心城 2440 吨/日，郊区 400吨/日。

Year 2008: 2440t/d in urban area, 400t/d in suburban

2015年：中心城 2800 吨/日，郊区 800吨/日。

Year 2015: 3205t/d in urban area, 800t/d in suburban

Sludge Quantity of W.W.T.Ps in Beijing and Current Status of Treatment & Disposal

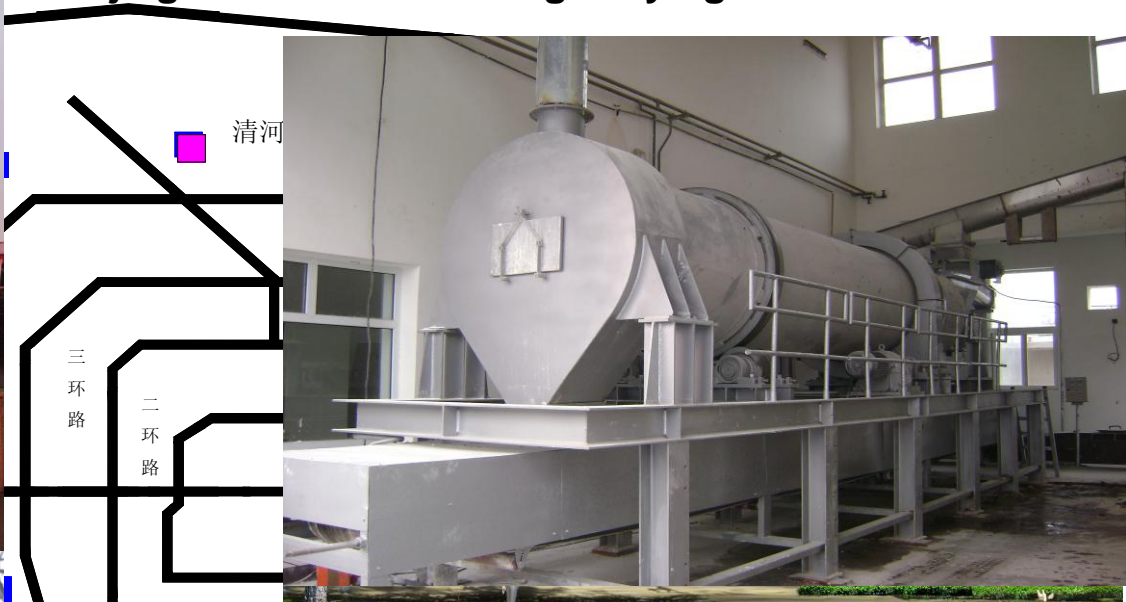
Name	Capacity (10,000t/d)	Sludge Produced (t/d)	Qinghe Thermal Drying Plant (Capacity 400t/d)	Beijing Cement Plant Sludge Drying & Incineration Plant (Capacity 500t/d)	Fangzhuang Sludge Lime Drying Plant (Capacity 30t/d)	DaXing Compost Plant (Capacity 300t/d)	Simple Disposal (t/d)
清河污水厂 QingHe WWTP	40	500	400	100			
北小河污水厂 BeiXiaoHe WWTP	10	100		100			
酒仙桥污水厂 JiuXianQiao WWTP	17	300		300			
芦沟桥污水厂 LuGouQiao WWTP	10	100					100
吴家村污水厂 WuJiaChun WWTP	8	100					100
方庄污水厂 FangZhuang WWTP	4	30			30		
高碑店污水厂 GaoBeiDian WWTP	100	700				300	400
小红门污水厂 XiaoHongMen WWTP	60	570					570
肖家河污水厂 XiaoJiaHe WWTP	5	40					40
总计 Total	254	2440	400	500	30	300	1210

北京市现有污泥处理处置设施

Existing Facilities in Beijing

北京水泥厂污泥干化设施

Beijing Cement Plant Sludge Drying & Incineration Plant



方庄石灰干化

Fangzhuang Lime Drying Plant



大兴污泥堆肥场

Daxing Compost Plant

北京市市政工程设计研究总院



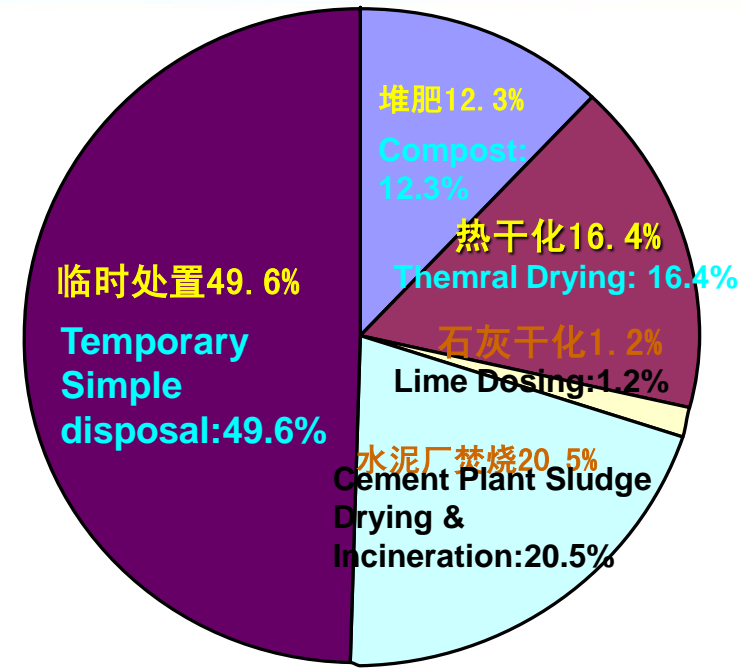
北京市污泥处置存在问题

Existing Problems of Sludge Disposal in Beijing

- 污泥产量大、处理和处置的设施不足。
Sludge quantity is large and treatment or disposal facilities are not sufficient.
- 运往郊区、采用临时简易的处置方法、运距远。
The substantial sludge is transported by vehicle to the suburban for temporary simple disposal, long distance for transportation.
- 临时处置方式占据大量场地和空间。
Temporary simple disposal method covers more land.
- 产生臭味、滋生蚊蝇、污染环境。
There is obvious odor and breed fly, and causes environment pollution.
- 污泥处置的运行费用不足。
Operation costs for sludge disposal is not enough.



环境问题
Environment Problem



(1) 营养物质丰富。中心城区污水处理厂污泥氮、磷、钾和有机质含量分别为3.1%、1.9%、4200mg/kg (0.42%) 和62%。

1) Rich nutrition. The contents of nitrogen, phosphorous, potassium and organic in the sludge from the urban WWTPs are 3.1%, 1.9%, 4200mg/kg (0.42%) and 62% respectively.

(2) 有较高的热值。以中心城为例，干污泥的燃烧热值可达到3000~3300大卡/公斤。

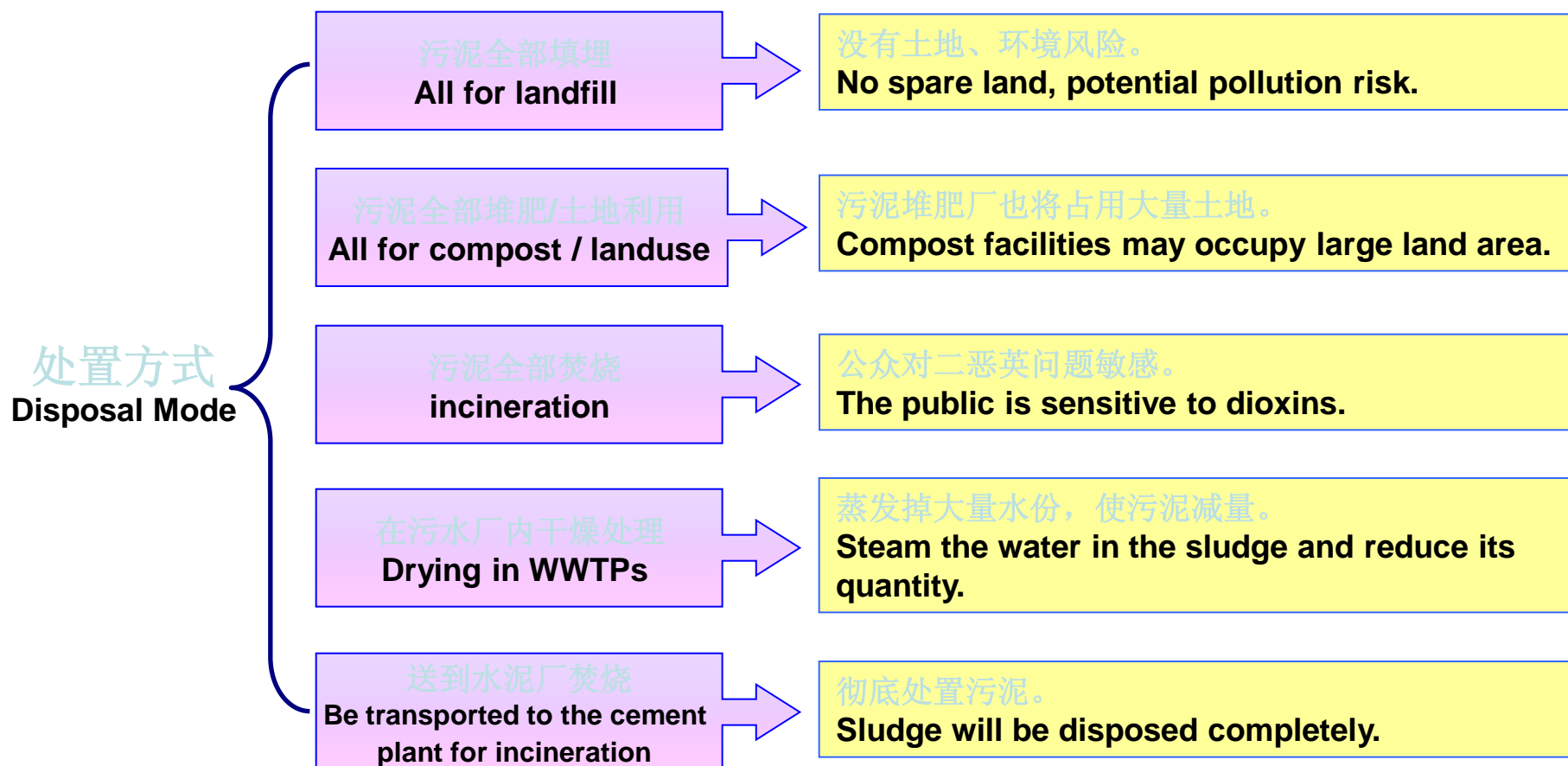
2) Fairly high calorific value. Used the downtown as an example, the dry sludge incineration calorific value can reach 3000 to 3300Kcal/kg.

(3) 重金属及有毒有机物符合标准要求。2006年以来，城区污水处理厂污泥重金属指标已基本满足现行国家标准《城镇污水处理厂污泥处置土地改良用泥质》CJ/T 291-2008、《城镇污水处理厂污泥处置园林绿化用泥质》GB/T 23486-2009和《城镇污水处理厂污泥处置农用泥质标准》CJ/T 309-2009(B级)要求。

3) Heavy metal and toxic organic meet the standard requirements. Since 2006, sludge heavy metal index meets the standards: “CJ/T 291-2008 *The disposal of sludge from municipal wastewater treatment plant—Sludge quality for land improvement*”, “GB/T 23486-2009 *Disposal of sludge from municipal wastewater treatment plant—Quality of sludge used in gardens or parks*”, and “CJ/T 309-2009(Class B) *Disposal of sludge from municipal wastewater treatment plant—Control standard for agricultural use*”.

■ 适合北京的污泥处理处置方式

■ Suitable Treatment and Disposal Modes for Beijing



■ 适合北京的污泥处理处置方式

■ **Suitable Modes for Beijing**

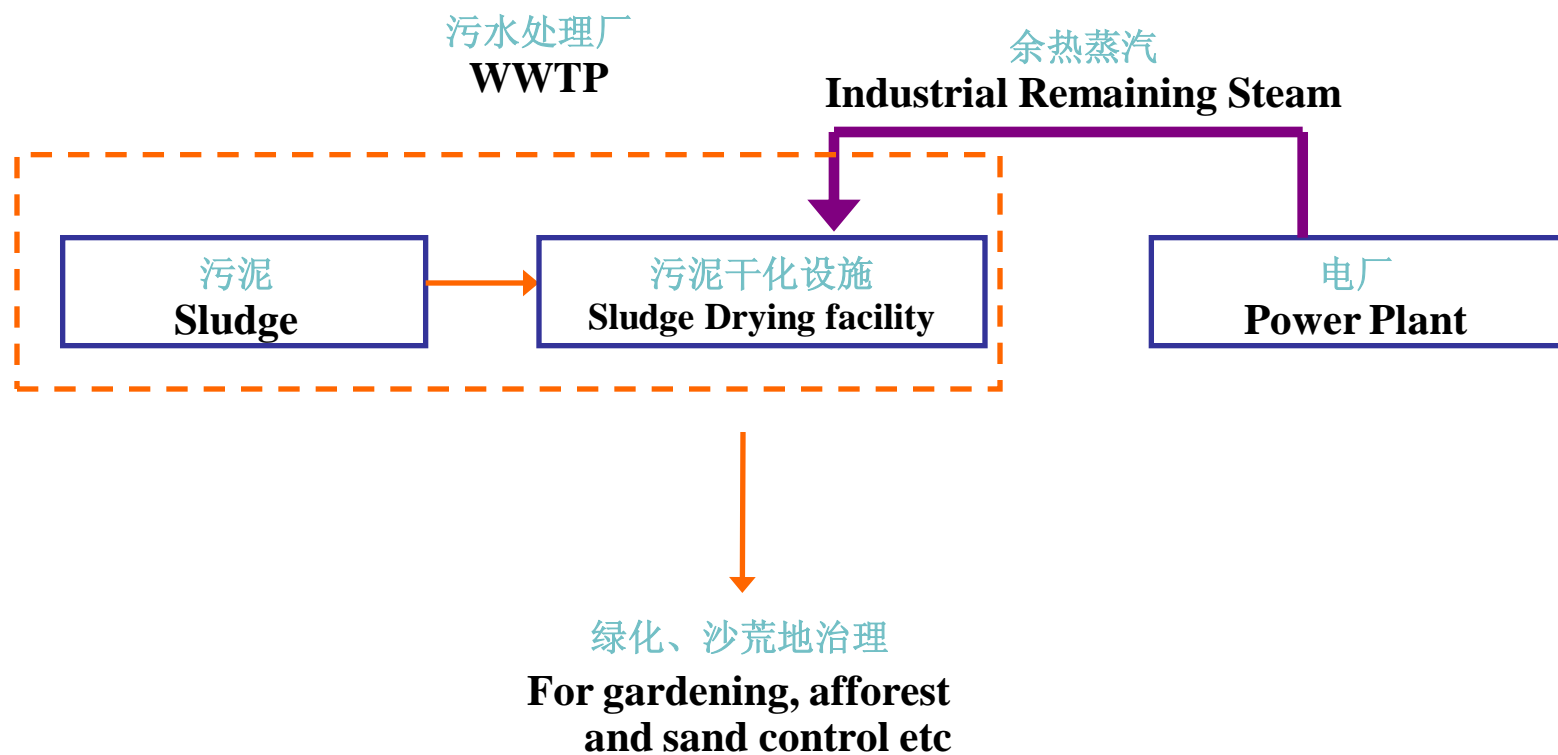
(1) 将工业余热引到污水厂对污泥进行热干化处理，将污泥中的水份进行蒸发，使污泥达到减量化和稳定化的目标，然后再将这些污泥用于园林绿化、沙荒地治理等。

1) To introduce the industrial remaining heat to the WWTPs for thermal drying treatment of sludge, steam the water in the sludge and reduce quantity and stabilize sludge; and then such sludge can be used for gardening, afforest and sand control etc.



例如：计划建设的北京高碑店污水处理厂污泥干燥项目技术路线

For example: the technology principle of planning drying plant of GaoBeiDian WWTP.



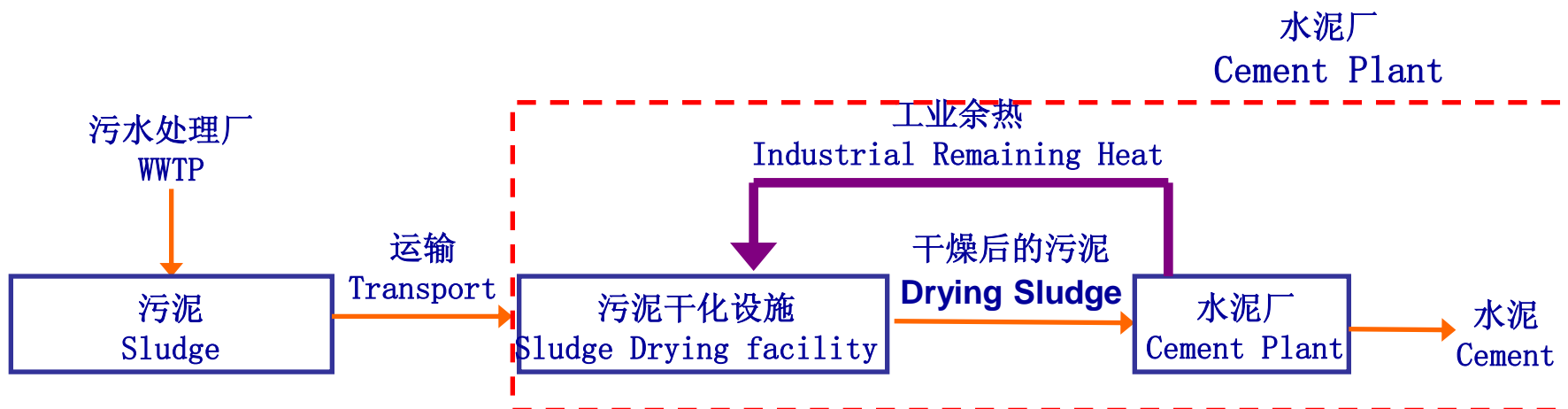
(2) 将脱水污泥运往有工业余热和燃烧设施的工厂，对污泥进行干燥处理后直接送入燃烧装置内进行焚烧，彻底消灭污泥并利用其中的热值。

2) To convey the dewatered sludge to the plant with industrial remaining heat and burning facility, drying the sludge and then put it directly into the burning facility for incineration, to get rid of sludge entirely and use the calorific value.



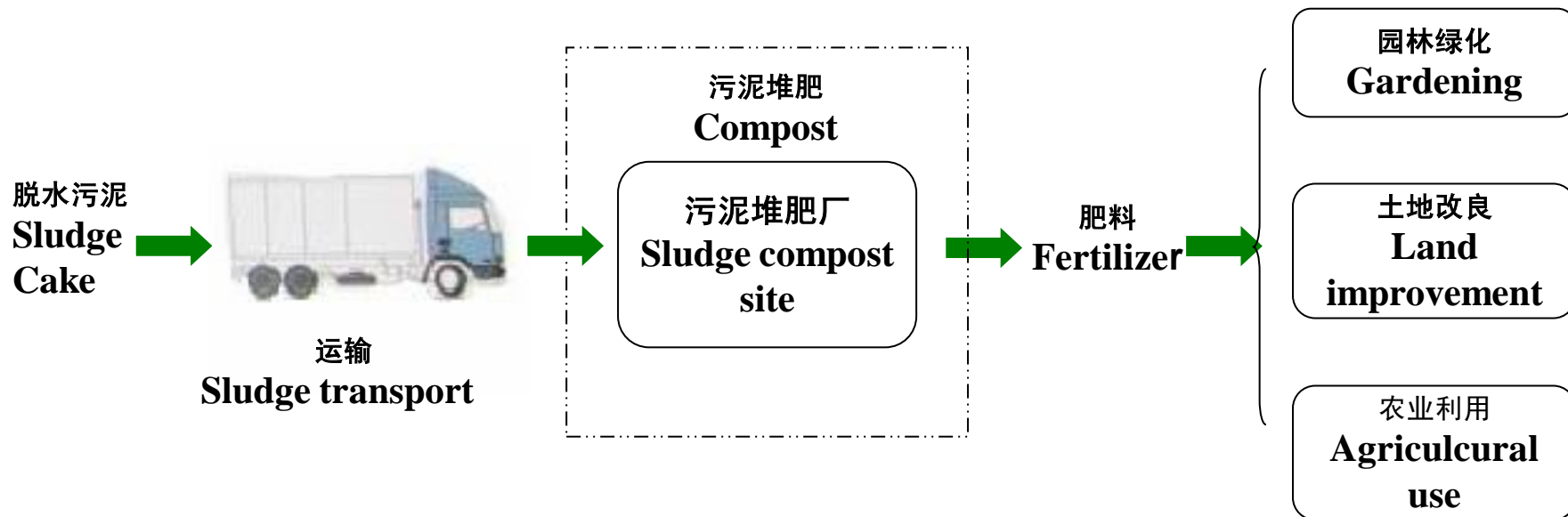
例如：计划建设的北京琉璃河水泥厂污泥干燥焚烧项目技术路线

For example: the technology principle of planning drying & incineration plant of Liulihe Cement Plant.



(3) 前两者处理剩余的脱水污泥送到环境敏感程度较低的地点进行堆肥处理，制成肥料。

3) The remaining dewatered sludge treated by the above two ways be transported to the place where the environment sensitive is low for composting and produce fertilizer.

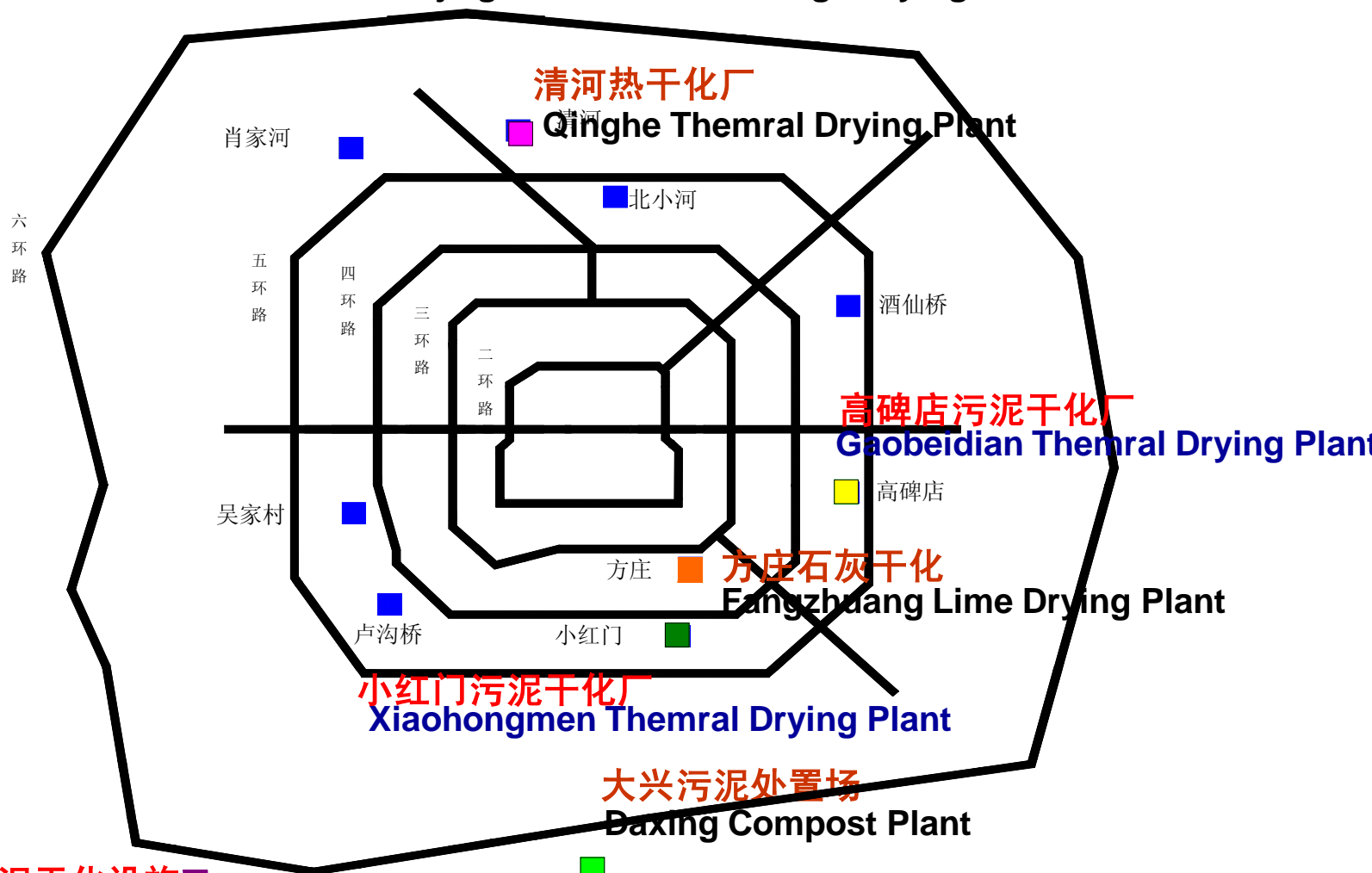


北京水泥厂干化设施

■ Beijing Cement Plant Sludge Drying & Incineration Plant

清河热干化厂

■ Qinghe Thermal Drying Plant



小红门污泥干化厂

■ Xiaohongmen Thermal Drying Plant

大兴污泥处置场

■ Daxing Compost Plant

琉璃河水泥厂污泥干化设施

■ Liulihe Cement Plant Sludge Drying & Incineration Plant

北京市市政工程设计研究总院

Thank you