

Integrated Improvement of Urban Black-odor Waterbody Environment in China: Policy and Recent Advances

Sept. 11th,2018 , Xi' an

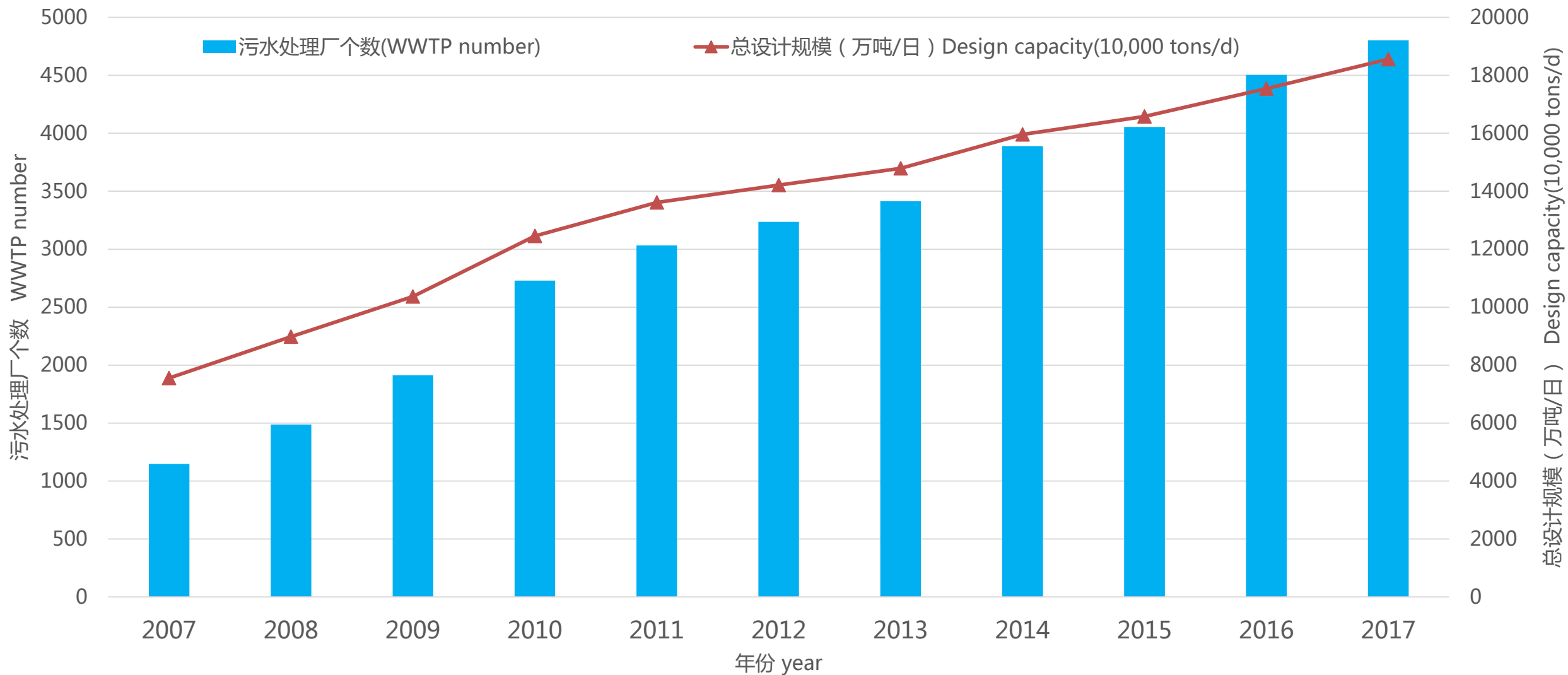
WANG Jiazhao

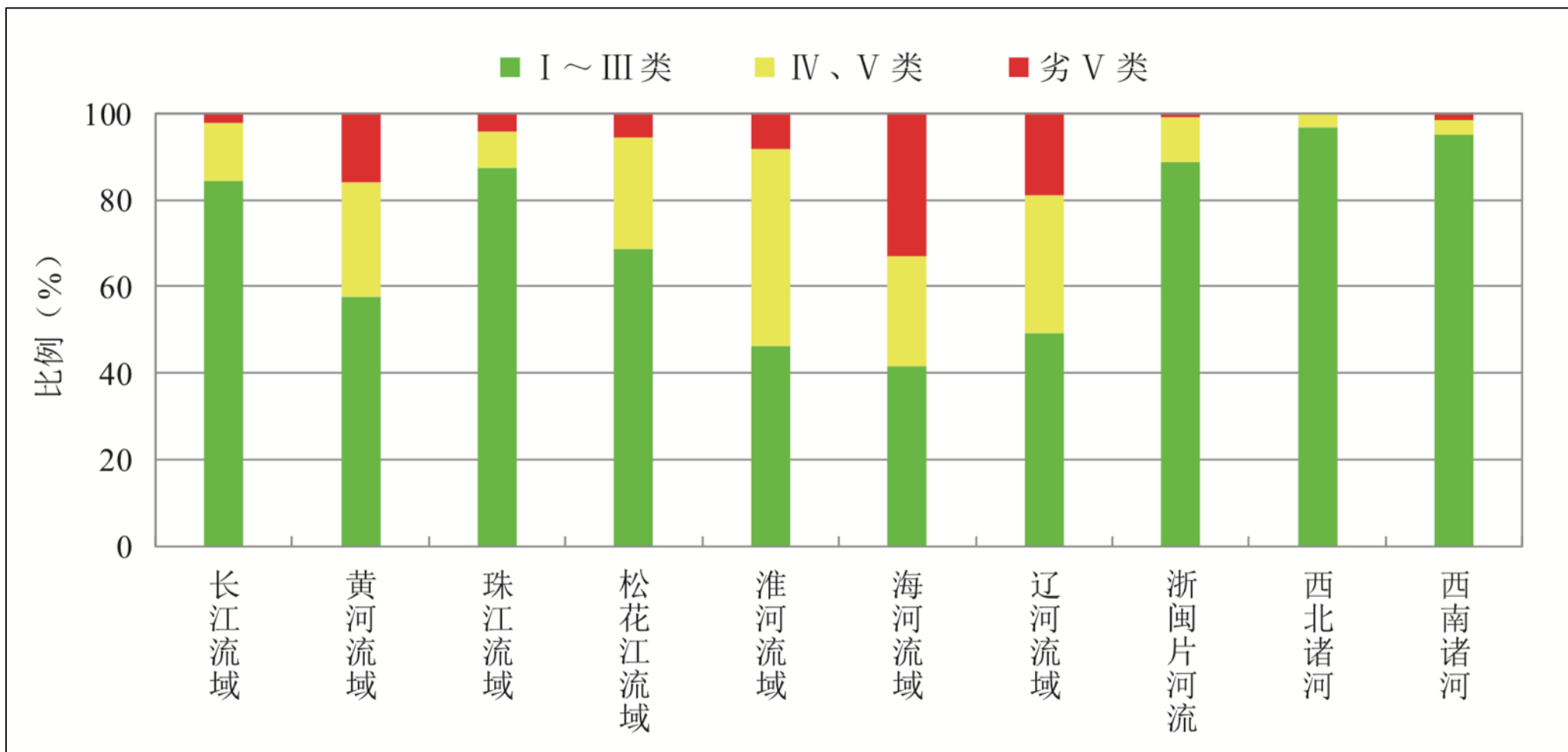
China Academy of Urban Planning and Design

Outline

1. Urban Water Environment in China
2. National Policy
3. Causes of Pollution and Solution
4. Sponge city and urban water environment improvement
5. Case Study

Urban WWTP number and its capacity growth from 2007 to 2017





Water environment of main river basins in China in 2017

1 Urban Water Environment in China



全国城市黑臭水体整治监管平台

水质

公众



治理态势

全国

多选

总体态势

治理进展

公众监管

总认定数

单位:个

2100

未启动

方案制定

治理中

完成治理

0

190

790

1120

新疆 2

青海 26

西藏 0

甘肃 17

宁夏 13

陕西 5

山西 72

河南 128

湖北 145

重庆 31

湖南 170

贵州 14

江西 26

福建 87

广西 63

广东 243

四川 99

云南 12

海南 29

内蒙古 14

北京 25

天津 25

辽宁 61

吉林 97

黑龙江 22

山东 165

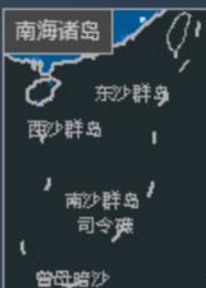
江苏 152

安徽 217

浙江 6

上海 56

台湾 0



指标

省份

区域

流域

过程

< 全国 2100

全部

按地区排序

按数量排序 ↑

未启动

方案制定

治理中

完成治理

1 北京

61

2 天津

25

3 河北

42

4 山西

72

5 内蒙古

14

6 辽宁

61

7 吉林

97

8 黑龙江

22

9 上海

56

10 江苏

152

11 浙江

6

12 安徽

217

1 Urban Water Environment in China



1

Urban Water Environment in China



- The Ministry of Ecology & Environment and the Ministry of Housing and Urban-rural Development jointly launched the special inspection on the control of black-odor water bodies in 70 important cities in 2018.
- 919 of 993 black and odorous water bodies reported to have been completed were certified to have been completed officially.
- 274 new black-odor water bodies were found.

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- By 2020, the black-odor water bodies in the built-up area above the city level should be controlled within 10%.
- Black-odor water bodies should be basically eliminated before the end of 2017 in the built-up areas of 36 most important cities.
- By 2030, the black-odor water bodies in the urban built-up area were eliminated completely.

000592

国务院文件

国发〔2015〕17号

国务院关于印发水污染防治行动计划的通知

各省、自治区、直辖市人民政府，国务院各部委、各直属机构：
现将《水污染防治行动计划》印发给你们，请认真贯彻落实。



(此件公开发布)

2

National Policy

- ❑ On May 16, 2018, National Conference on ecology and environment protection was held in Beijing.
- ❑ The meeting suggested that China should fight and win 7 major battles in the field of pollution prevention and control.
- ❑ “Clean and fishable water body with beautiful bank”
- ❑ “Strengthening the Protection of the Ecological Environment and Winning Battles in Pollution Prevention and Control” was issued on June 16 , 2018.



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中共中央 国务院关于全面加强生态环境保护 坚决打好污染防治攻坚战的意见

2018-06-24 22:59 来源：新华社

【字体：大 中 小】 打印 分享

新华社北京6月24日电

中共中央 国务院
关于全面加强生态环境保护
坚决打好污染防治攻坚战的意见
(2018年6月16日)

2 National Policy

- Implementation of urban sewage system “quality and efficiency” three-year action.
- Full coverage, full collection and full treatment.
- Financial support to western regions from central government.
- Focusing on urban non-point source pollution reduction.
- By 2020, the elimination ratio of black and odorous water in the built-up area above the city level should more than 90%.



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- In 2016, MOHURD released the “Technical guide for drainage outlets, pipelines and manhole”
- The pollution phenomenon is in the water
- The primary cause is on shore.
- The core of the solution is sewer network.
- The key is discharge outlet..



城市黑臭水体整治——排水口、管道及
检查井治理技术指南
(试行)

住房和城乡建设部
2016年8月

- (1) Imperfect sewer pipeline leads to directly discharge of domestic wastewater without treatment.
- (2) Misconnection of sewage and stormwater drainage.
- (3) Internal pollution sources from sediment.
- (4) Industrial wastewater pollution
- (5) Agricultural and rural related pollution
- (6) Poor CSO control.
- (7) Severe inflow and Infiltration.
- (8) Lack of urban non-point source pollution control
- (9) Poor self purification of water bodies.

3

Causes of Pollution and Solution

(1) Imperfect sewer pipeline leads to directly discharge of domestic wastewater



3

Causes of Pollution and Solution

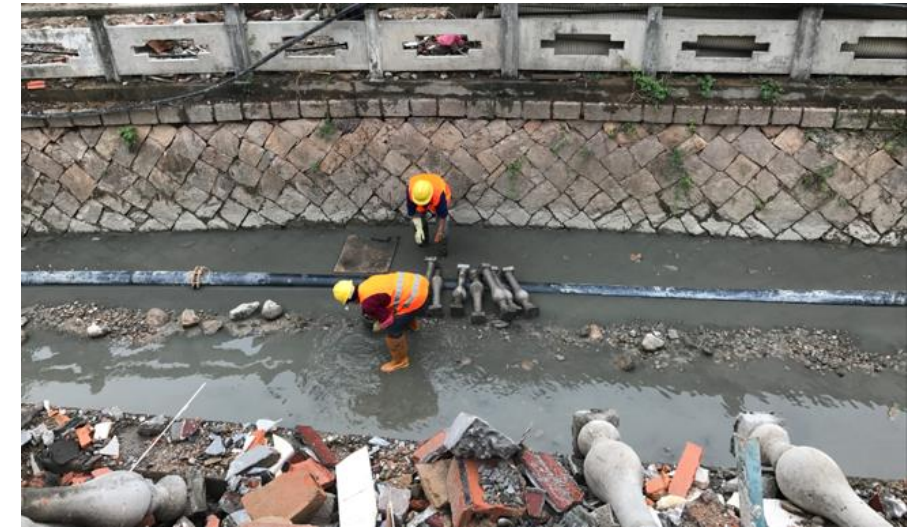
(2) Misconnection of sewer and stormwater drainage



3

Causes of Pollution and Solution

(3) Internal pollution sources from sediment.



3

Causes of Pollution and Solution

(4) Industrial wastewater pollution



3

Causes of Pollution and Solution

(5) Agricultural and rural related pollution

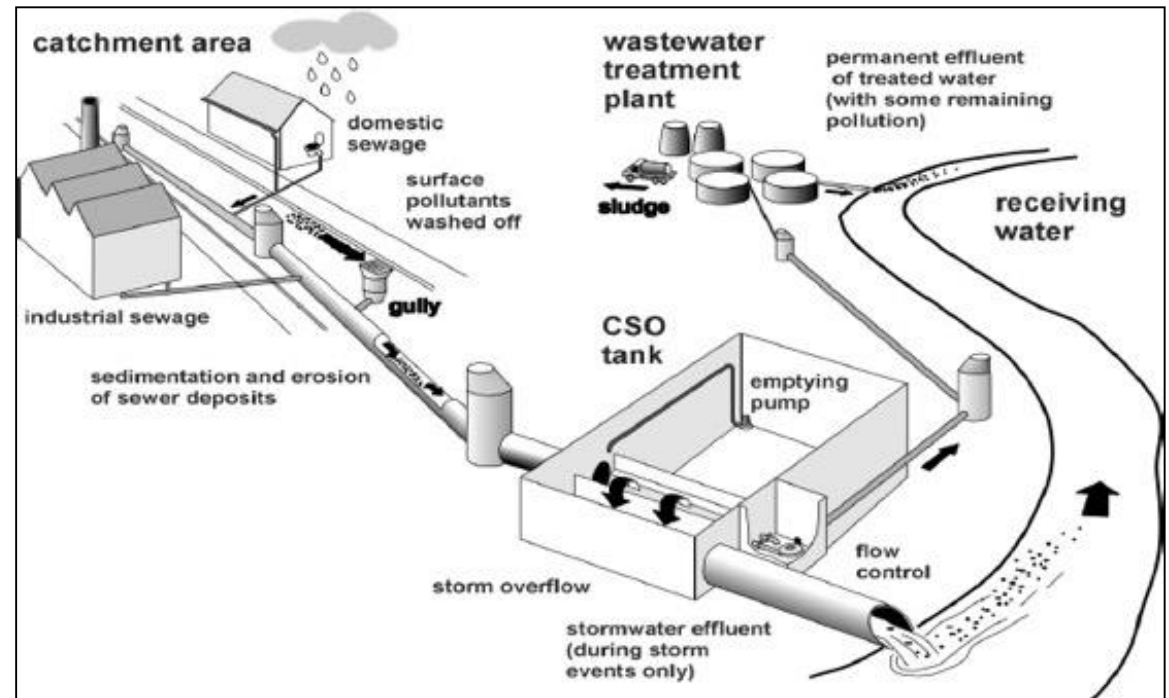


3

Causes of Pollution and Solution

(6) Poor CSO control

- 1/3 drainage is combined system in China .
- No national policy, no technical guidelines for CSO control.
- Low interception ratio, lack of storage facility, and lack of rainwater source control
- Frequent overflow in most combined sewer system



3

Causes of Pollution and Solution



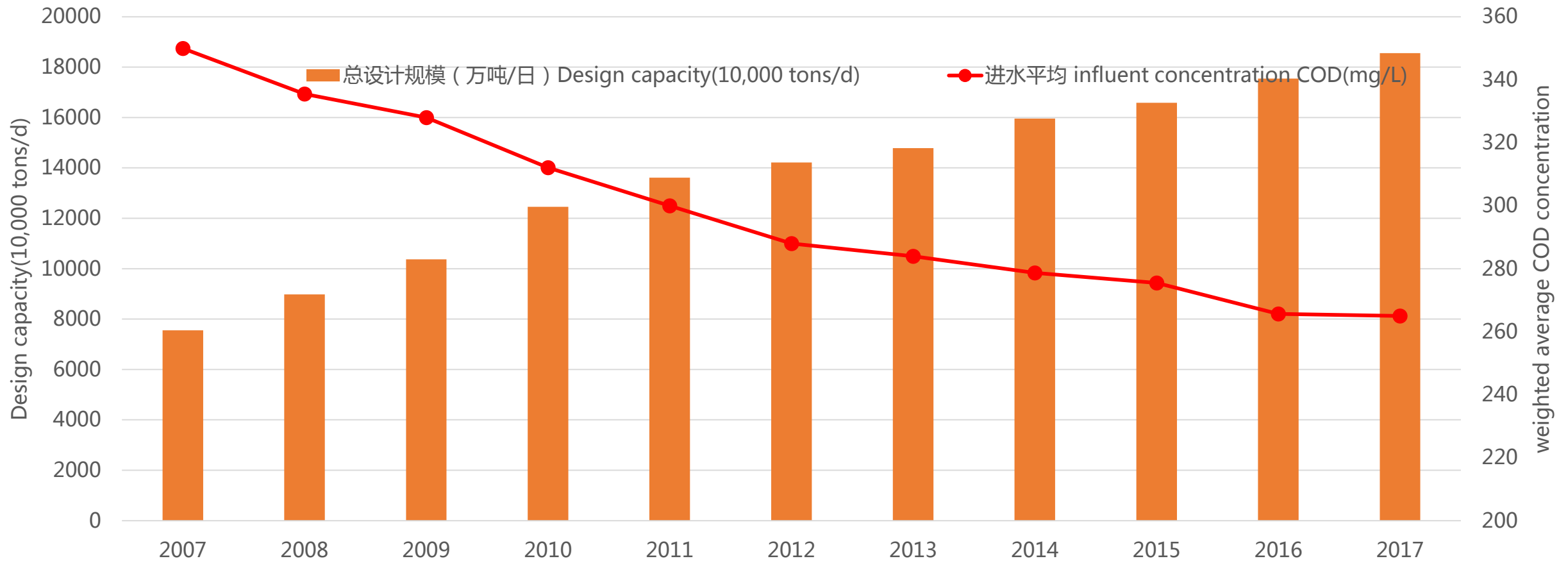
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Causes of Pollution and Solution



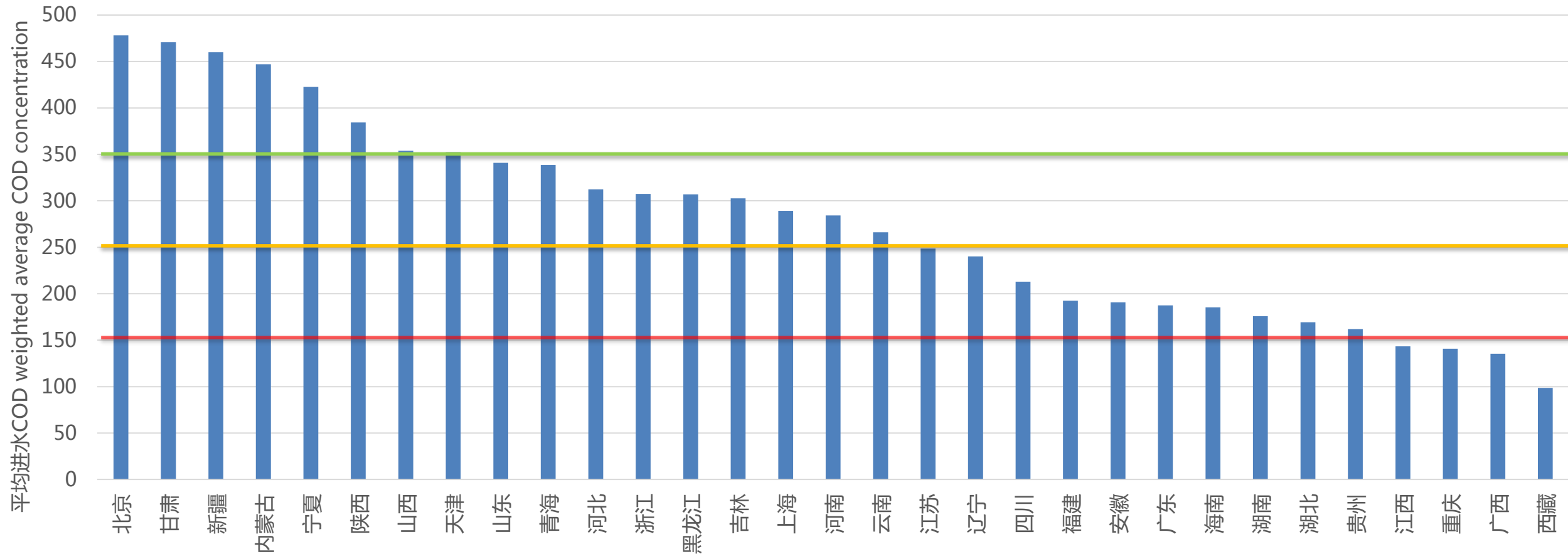
(7) Severe inflow and Infiltration

Design capacity and influent concentration of WWTP in China from 2007 to 2017



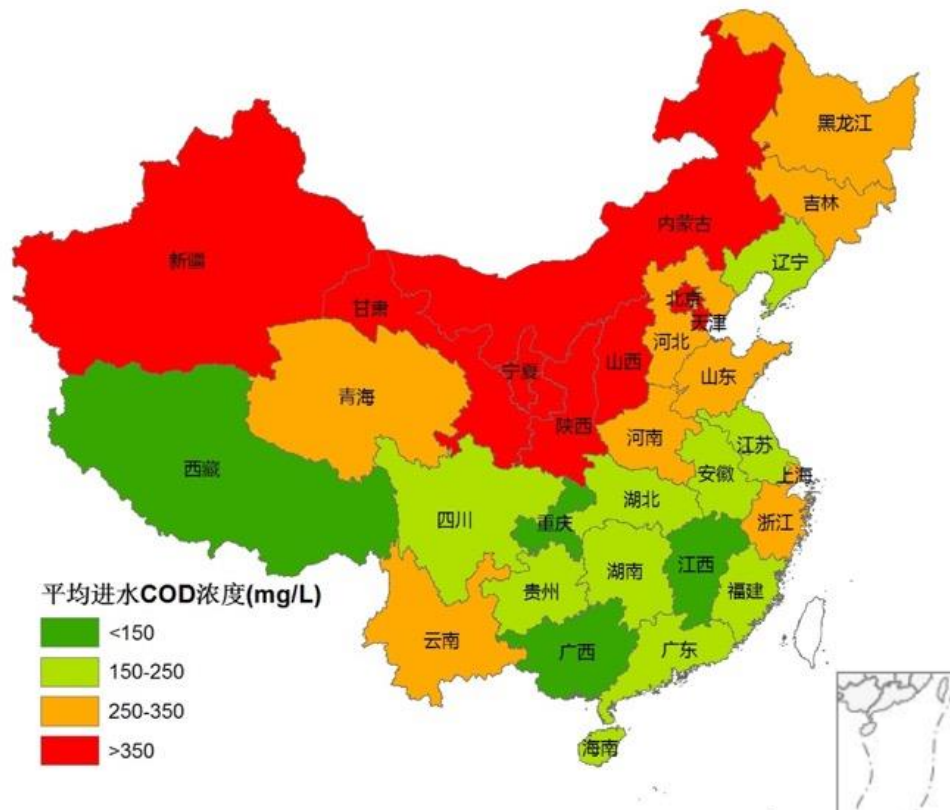
(7) Severe inflow and Infiltration

weighted average influent COD concentration of WWTP of each province in 2017

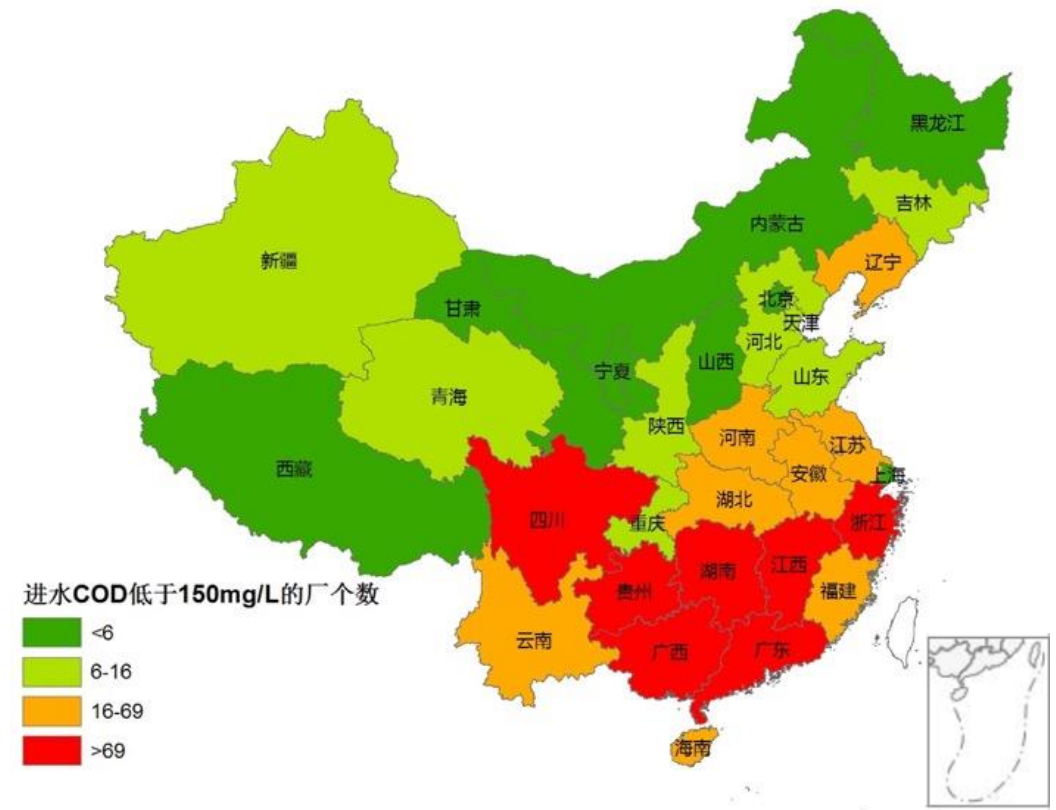


(7) Severe inflow and Infiltration

weighted average influent COD concentration of WWTP of each province in 2017



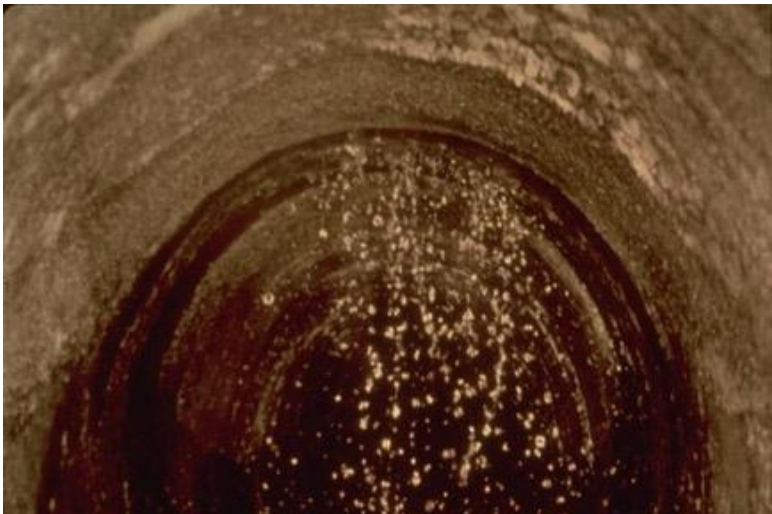
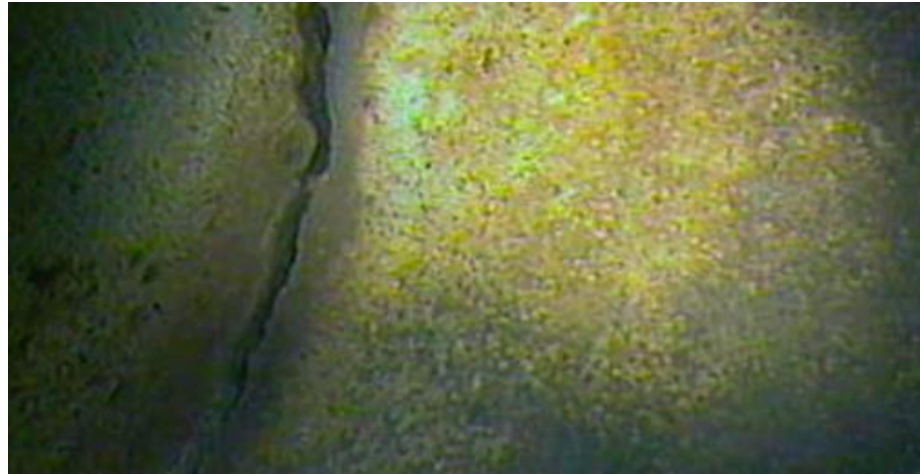
Number of WWTP that weighted average influent COD concentration is less than 150mg/L in each province in 2017



3

Causes of Pollution and Solution

(7) Severe inflow and Infiltration

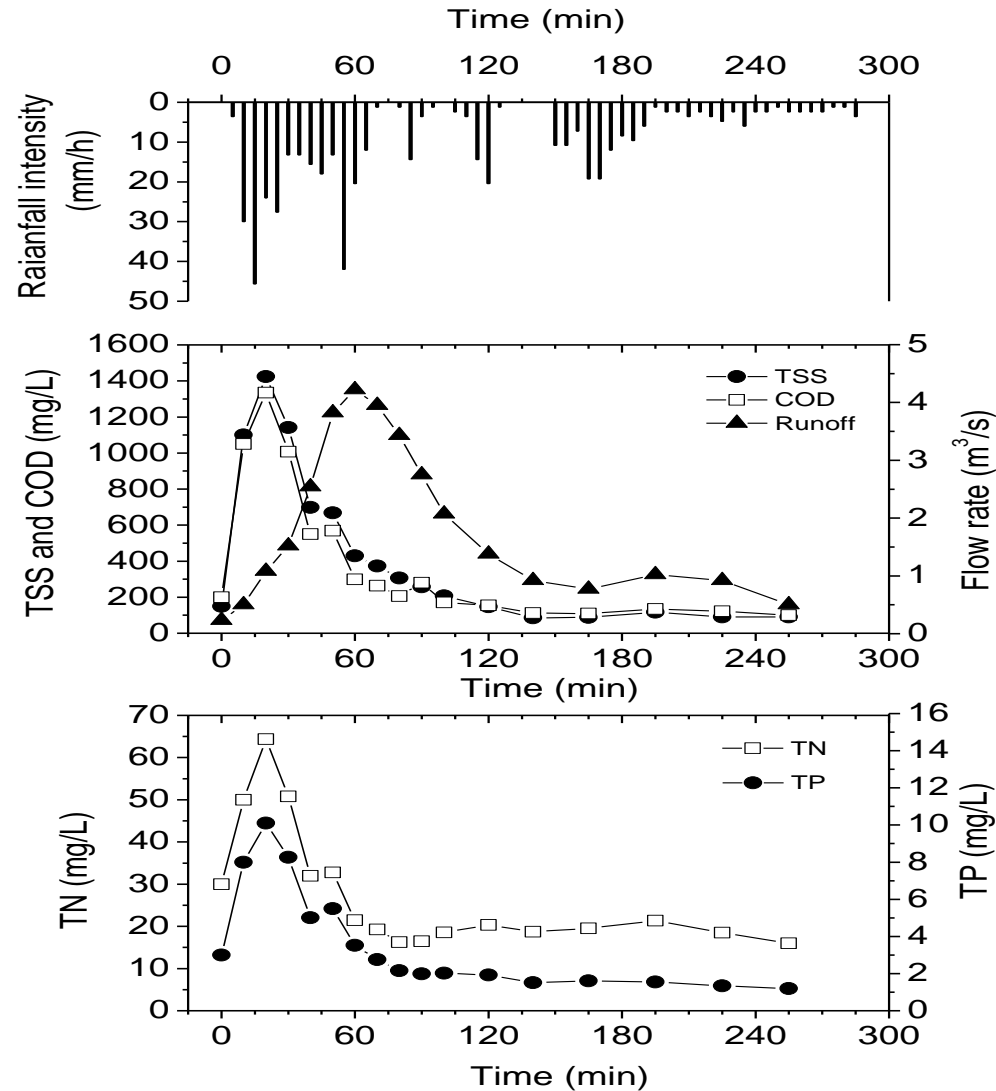


3

Causes of Pollution and Solution

(8) Lack of urban non-point source pollution control

- Air pollution, coupled with poor road cleaning and bad maintenance of the sewer system contribute to serious pollution caused by first flush.



3

Causes of Pollution and Solution

(9) Poor self-purification of water bodies



Primary solution

Sewage interception , source control

Dredging, internal pollution reduction

Ecological rehabilitation

water replenishing , ensuing base flow

River administrator mechanism

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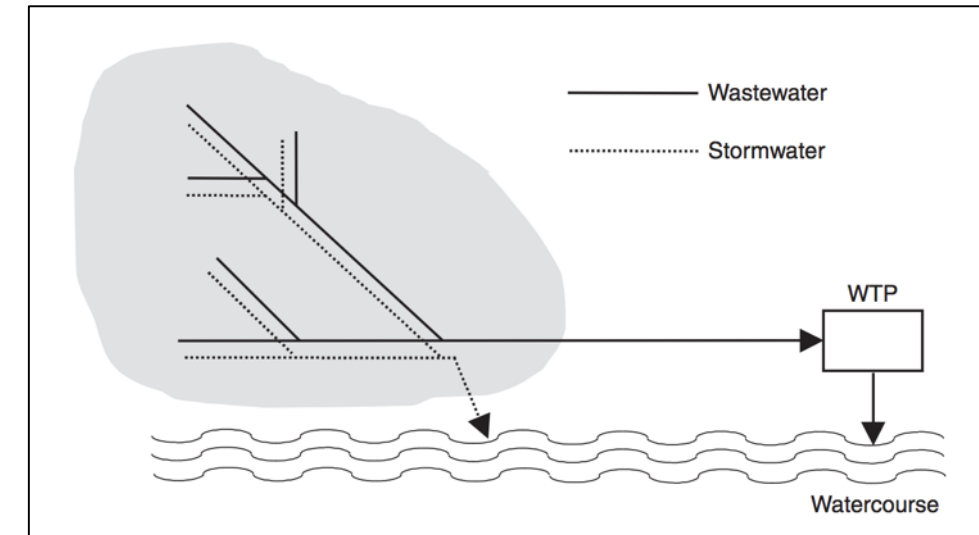
4 Sponge city and urban water environment improvement

- Sponge city construction could contribute significantly to urban water environment improvement, although most cities are still focusing on urban flooding mitigation in the sponge city initiatives.
- In the national policy document issued by the State Council in 2015, urban water environment improvement and black-odor water body elimination was set as one of the four objectives for sponge city construction.
- Black-odor water body elimination would be necessary concern for the final examination for the pilot city initiatives.



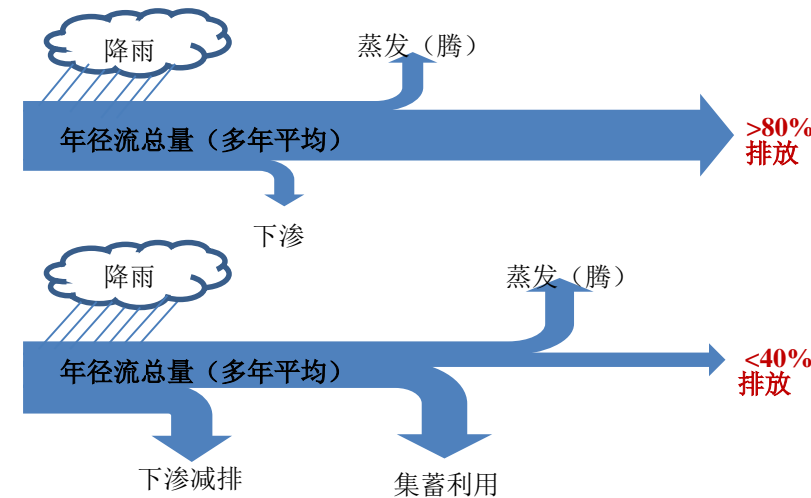
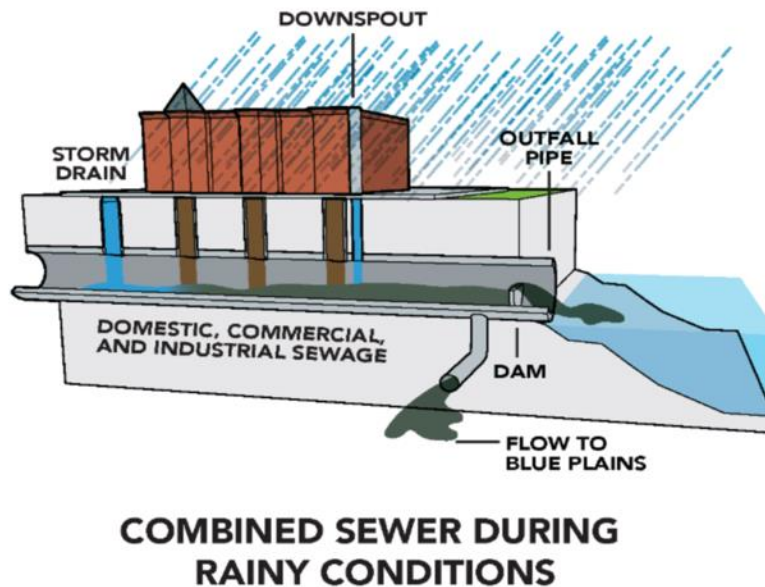
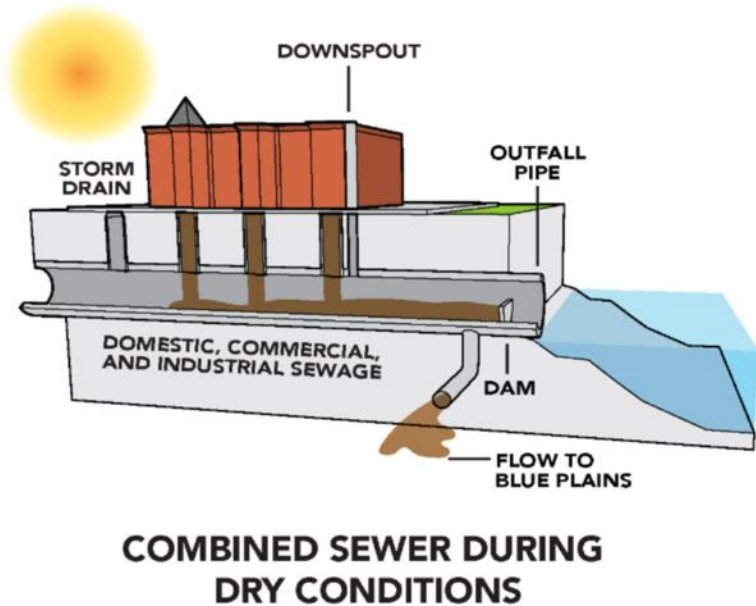
4 Sponge city and urban water environment improvement

- The contribution of sponge cities to the water environment is manifested in two aspects:
 - one is the control of Combined Sewer Overflow,
 - the other is the control of urban non-point source pollution in the separated sewer area.



4 Sponge city and urban water environment improvement

- Combined Sewer overflow will be triggered when too much rainwater enters the system that exceeds the discharge capacity of the interception pipeline and no storage facility is available.
- Sponge city can effectively reduce the overflow by keeping rainwater out of the system.



How does SPU address Combined Sewer Overflows?

SPU uses a three-pronged approach:



1. Fix it First - Sewer System Improvements

These are relatively simple improvements to the existing system that provide more capacity for storage or make the system operate more effectively. These solutions can be much more cost-effective than building new facilities. Some examples include raising overflow weirs and replacing mechanical parts that regulate gates.



2. Keep Stormwater Out - Natural Drainage Systems

Natural drainage, also called green stormwater infrastructure (GSI), consists of a variety of practices that keep stormwater out of the sewer system by using natural processes to slow, filter, and absorb stormwater.



3. Store What's Left - Underground Storage

If the first two types of solutions don't solve the problem, then additional underground storage facilities would need to be built. Underground storage can include tanks, pipes, or tunnels.

Current Improvement Projects



Location of Combined Sewer Overflow Outfalls Managed by Seattle Public Utilities. SPU manages 86 sewage outfalls, 36 of which are uncontrolled and overflow more than once per year on average.

4 Sponge city and urban water environment improvement

60% of New York 's sewerage system is combined system.

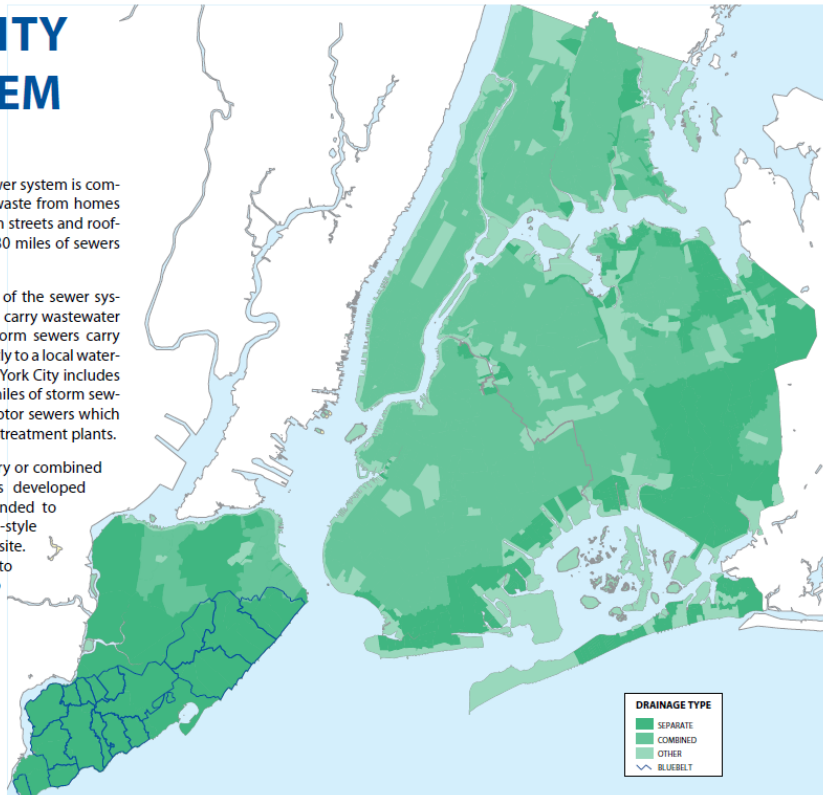
New York compiled the New York Green Infrastructure Plan in 2010 to address the problem of CSO problem.

NEW YORK CITY SEWER SYSTEM

Approximately 60% of New York City's sewer system is combined, meaning that it handles sanitary waste from homes and businesses as well as stormwater from streets and rooftops. This system includes more than 3,330 miles of sewers throughout the five boroughs.

Separate sewers make up the other 40% of the sewer system. In a separate system, sanitary sewers carry wastewater straight to the treatment plant, while storm sewers carry stormwater runoff in a separate pipe directly to a local waterway. The separated sewer system in New York City includes 2,220 miles of sanitary sewers and 1,820 miles of storm sewers. The City also has 138 miles of interceptor sewers which carry both stormwater and wastewater to treatment plants.

Some parts of the city do not have sanitary or combined sewers. Generally, these neighborhoods could be extended to reach them, and therefore have suburban-style septic systems that treat wastewater on-site. Recently DEP brought municipal sewers to Meadowmere in Queens, and continues to expand the sanitary and storm sewer network on the South Shore of Staten Island.



4 Sponge city and urban water environment improvement

New York City proved that green strategy could provide a greener, more economical and more sustainable ways for CSO control.

Figure 6: Predicted CSO Volume*

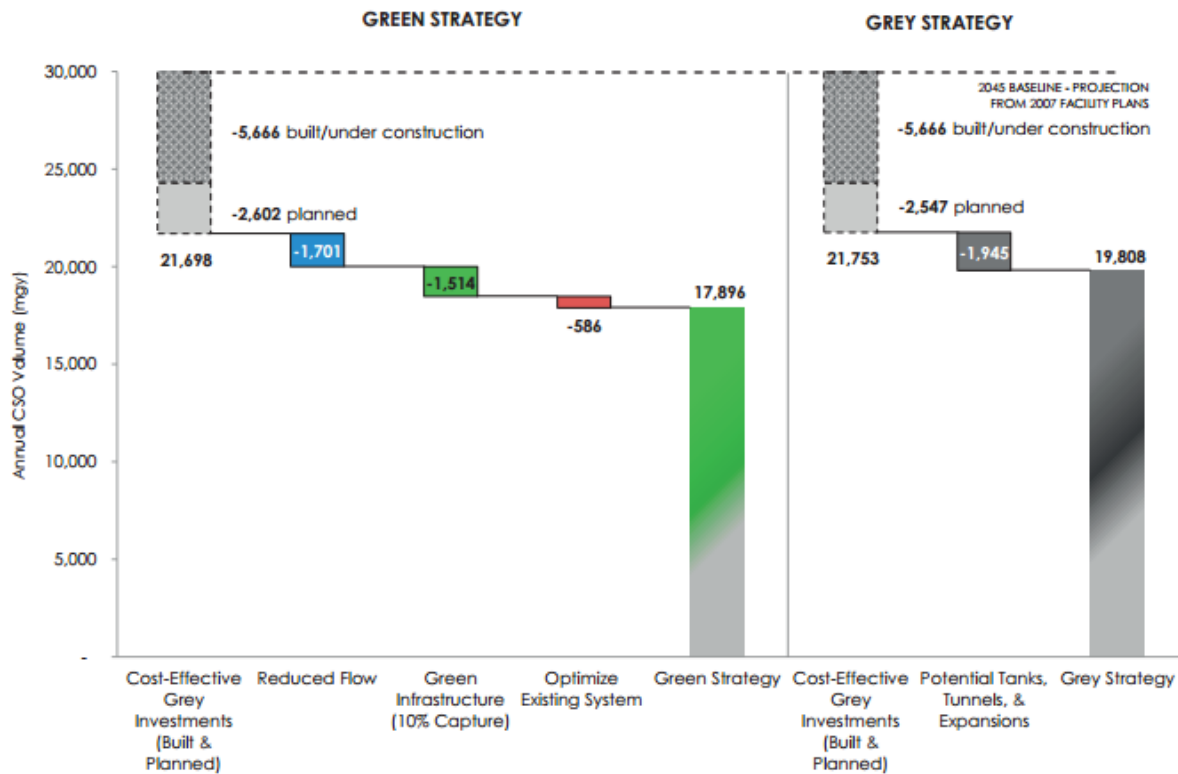
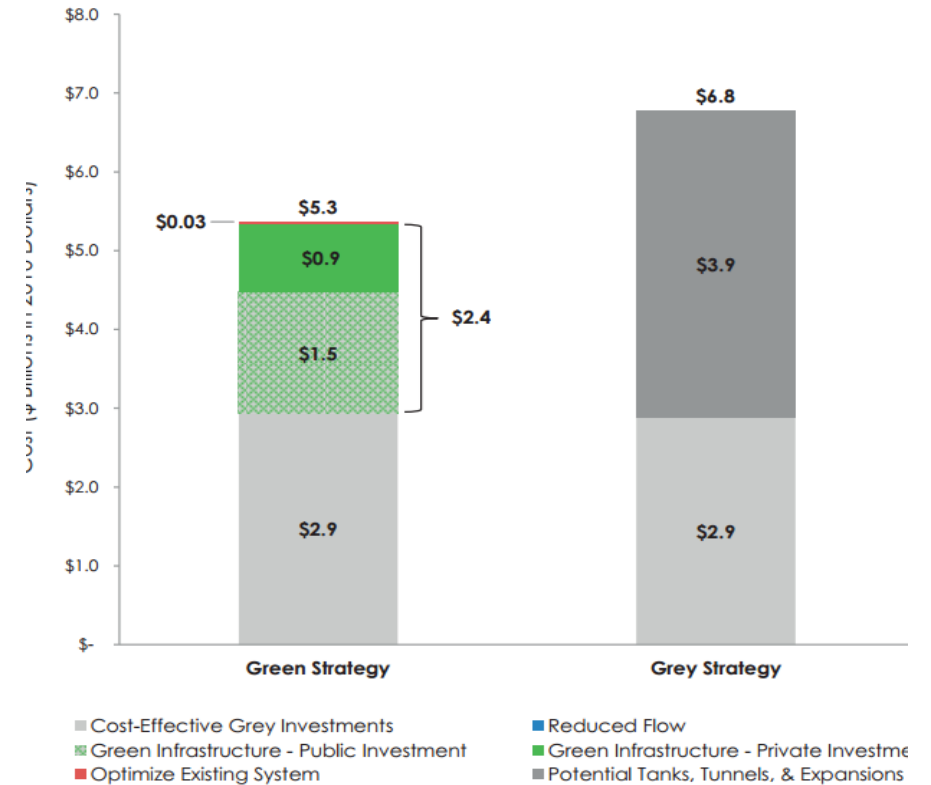
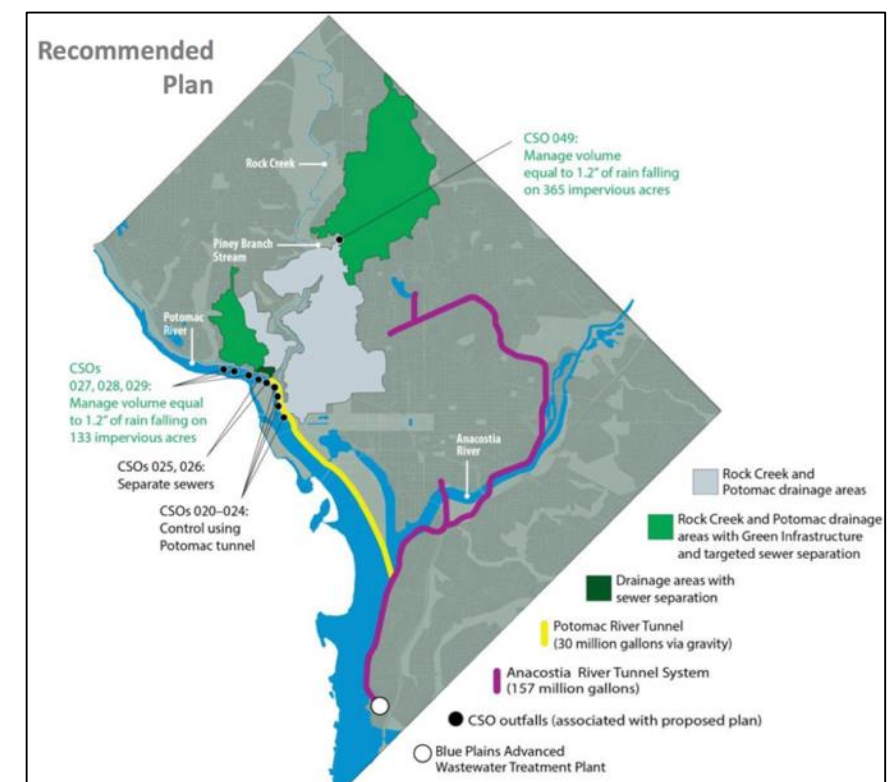
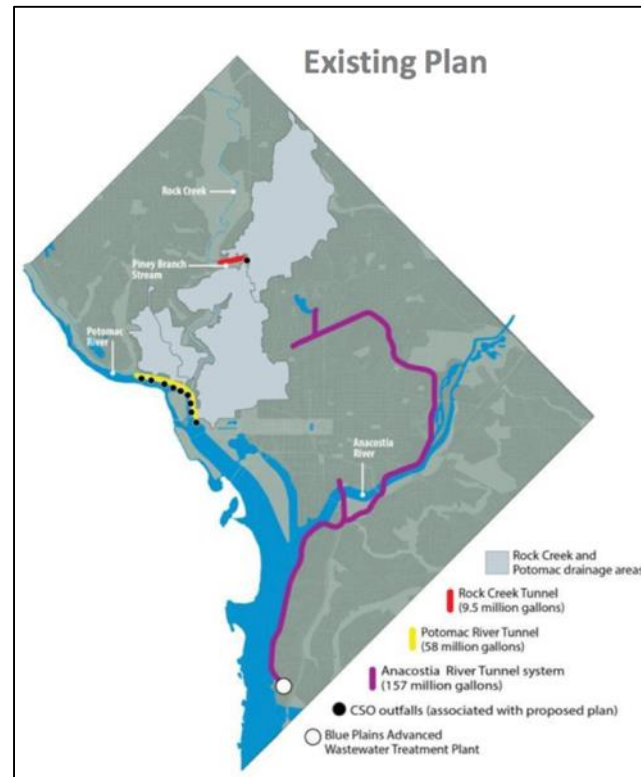
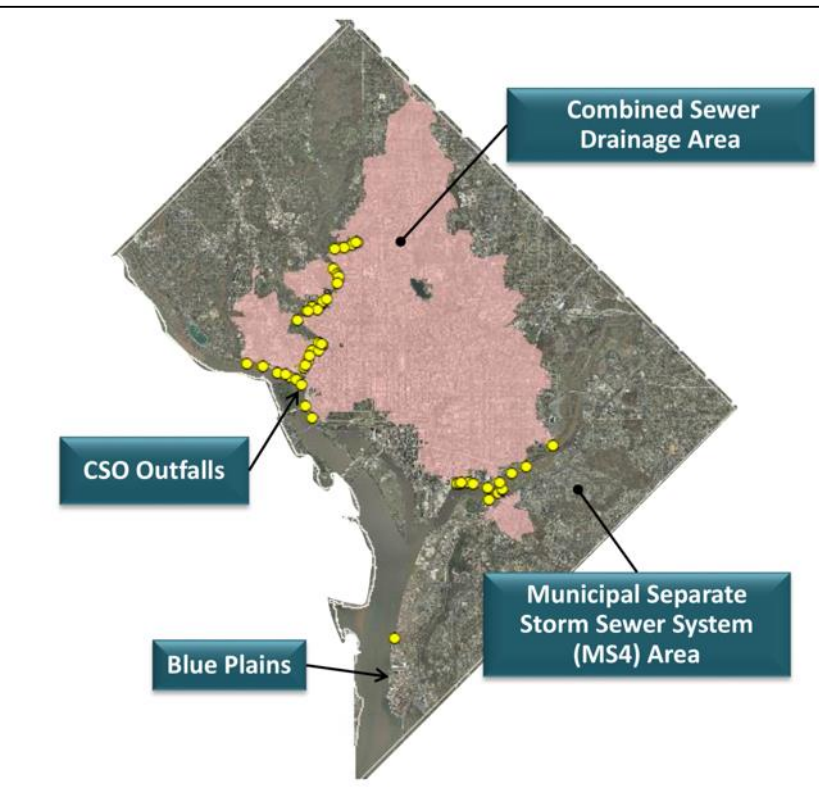


Figure 3: Citywide Costs of CSO Control Scenarios (after 20 year)



4 Sponge city and urban water environment improvement

Washington, D.C., using a combination of green and grey infrastructure to control CSO

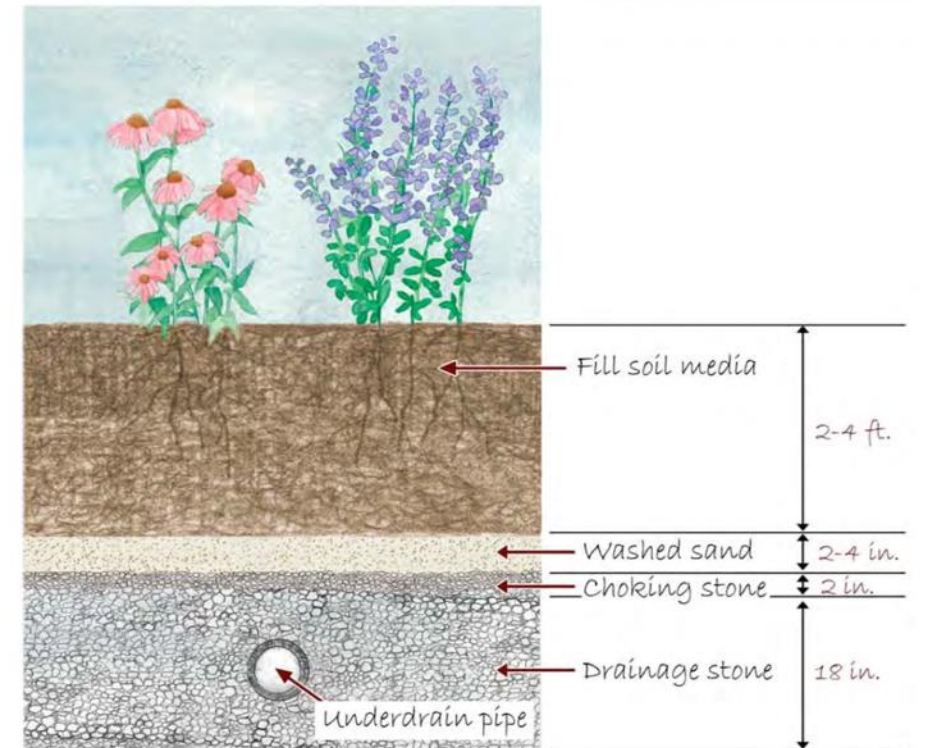


4 Sponge city and urban water environment improvement

- Some cities in China mistakenly believe that the combined sewer system is a bad system, and the only solution is to separate sewerage and stormwater drainage, which will cost huge money.
- The two drainage systems have their advantages and disadvantages. The combined drainage system overflow problem, but the separated sewer system also has the problem of non-point source pollution.
- Sponge city concept provides a new and more sustainable way to solve the problem of CSO.

4 Sponge city and urban water environment improvement

- Sponge city is also significant for water quality improvement in the separated sewer area.
- The capture ratio of annual rainfall (about 25 mm) have less effect on flood mitigation, but more effect on non-point source pollution control.
- It is necessary to strengthen the construction of bioretention, especially the filter media.

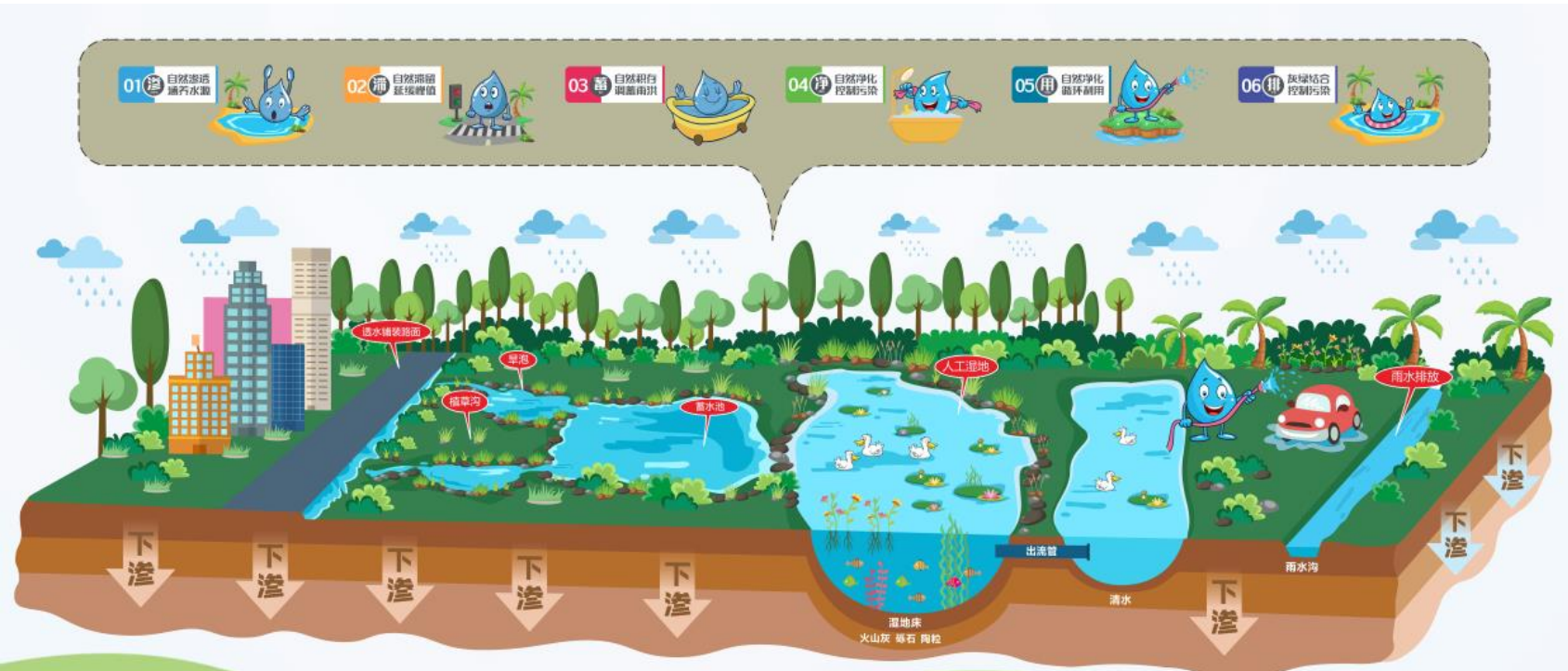


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5. **Case Study**

5 case study

In the construction of Fengxiang Park, sponge city concept was introduced. Facilities including infiltration, storage, purification and utilization were constructed to control the pollution



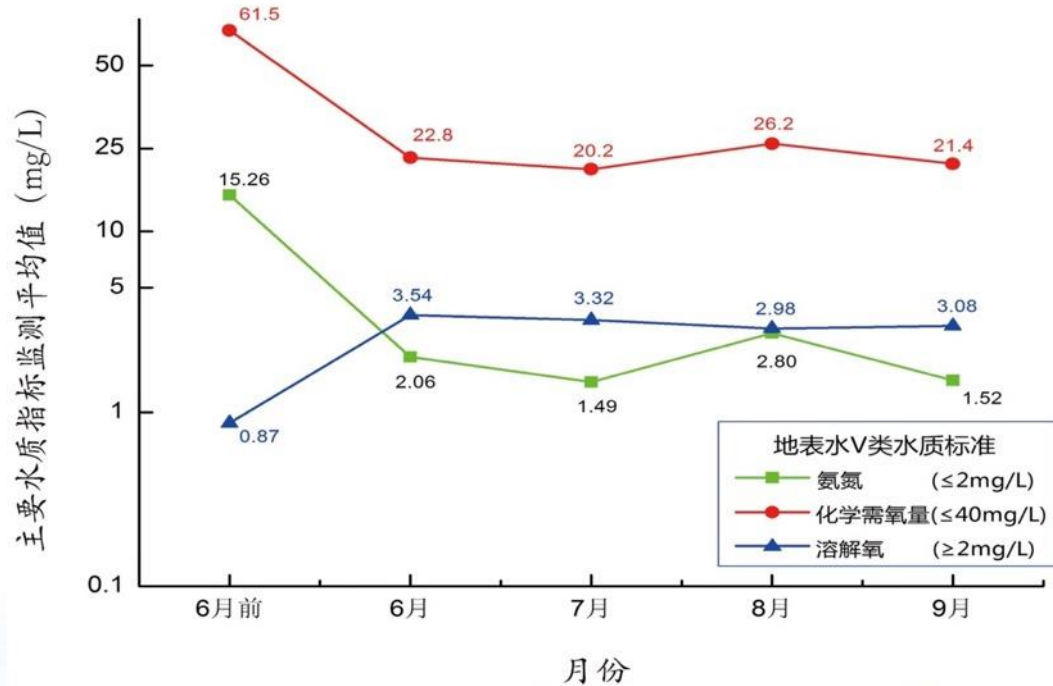
5 case study

- ✓ A vertical flow wetland covers an area of 14000m² was constructed.
- ✓ Treating 3500 tons domestic wastewater per day currently and 10000 tons of WWTP effluent in the future.



5 case study

- Monitoring data indicates that ammonia nitrogen, COD_{Cr} and DO concentration has already reached standard V for surface water.



Before



5

case study

After



5

case study

Before



After



5

case study

Before



After



Before



After



Before

After



Before

After



Thanks