



# 面向未来城镇水环境技术发展的 国合环境研究院

**AWRERI – An Institution to Promote  
Technological Development for Urban Water  
Environment toward Future**

国合环境研究院（中国·宜兴）

AWR Environmental Research Institute (AWRERI)

# 研究院成立的背景

## (Background for establishing AWRERI)



中国宜兴环保科技工业园（环科园）与国家城市非传统水资源开发利用国际科技合作基地（国合基地）于2015年12月 签署《共建战略合作协议》

A Strategic Cooperation Agreement was signed between ES&TP and Int'l AWR Center in Dec. 2015



基于该战略合作协议于2016年成立了  
国合环境研究院（中国·宜兴）  
AWR Environmental Research Institute was  
established in 2016 based on the agreement



# 研究院成立的背景 (Background for establishing AWRERI)



- 国际水协会与西安建筑科技大学  
2014年7月签署国合基地共建协议  
Agreement between International Water  
Association (IWA) and Xi'an University  
of Architecture and Technology (XAUAT)  
in July, 2014
- 2015年3月通过陕西省科技厅认定  
Approved by the Department of Science  
and Technology, Shaanxi Province in  
March, 2015
- 2015年10月通过科技部国际合作  
司认定为国家级国合基地  
Approved by the Department of  
International Cooperation, Ministry of  
Science and Technology (MOST) in  
October, 2015



# 研究院的支撑构架 (AWRERI's backup framework)



## 国合环境研究院

AWR Environmental Research Institute (AWRERI)

院长：王晓昌

President: Xiaochang Wang

国际水协会杰出会士

IWA Distinguished Fellow

IWA非传统水资源委员会中国区主席  
Chair, IWA AWR Cluster – China Chapter

## 国合研究团队

AWR Research Group

教授：6人

Professor: 6 people

副教授：8人

Associate Professor: 8 people

讲师、工程师：10人

Lecturer/Engineer: 10 people

博士学位获得者：19人

Professionals with PhD Degree: 19 people

## 国家城市非传统水资源 开发利用国际科技合作基地

International Science & Technology  
Cooperation Center for Urban Alternative  
Water Resources Development

## 国家城市非传统水资源开发 利用国际科技合作基地

International Science & Technology Cooperation Center  
for Urban Alternative Water Resources Development

科学技术部国际合作司

## 国际水协会

International Water Association

## 西安建筑科技大学

Xi'an University of Architecture and Technology

环境工程国家重点学科

National Key Discipline

国家重点实验室培育基地

State Key Laboratory Cultivation Base

教育部重点实验室

Key Lab of Ministry of Education

城市规划研究院 (甲级)

Urban Planning Institute

建筑设计研究院 (甲级)

Architecture Design Institute

# 研究院的支撑构架 (AWRERI's backup framework)



## 国际顾问委员会

Int'l Advisory Committee



姓名/Name	单位/Affiliation	职务/Title
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REITER Paul	莱特国际水处理有限公司，美国 / Reiter IWS Ltd., USA	委员 / Member

# 研究院的支撑构架

## (AWRERI's backup framework)



### 学术委员会

Academic Committee



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# 研究院的支撑构架 (AWRERI's backup framework)



国合环境研究院

AWR Environment Research Institute



国际水协会  
International Water  
Association



中国宜兴环保科技工业园  
China Yixing Industrial Park for  
Environmental Science &  
Technology



# 研究院的理念、方向和作用

## (Concept, Directions and Missions)



### 1 One Core Concept 一个核心理念



- 流域（区域）水循环管理的理念

The concept of water cycle management for basins or regions

--最大限度维持水文循环过程的自然性

To maintain the hydrological cycle as it is, as far as possible

--尽可能依照自然法则进行系统设计及技术选择与集成

To follow the nature's manner, as far as possible, in system design and technology selection/integration

### 2 Two Key Directions 两个重点方向



- 非传统水资源开发利用

Alternative water resources development and utilization

- 健康水生态系统构建与水环境安全保障

Construction of healthy water ecosystem and water environment security

### 3 Three Major Missions 三个重要作用



- 为环科园的环境保护与建设提供科研技术服务

To provide scientific and technical services to ES&TP for environmental protection

- 为国内外环境科技合作提供研发平台

To provide a platform for the development of environmental science and technology cooperation at home and abroad

- 推动环境保护领域的新理念、新技术的推广工程和工程转化

To promote the application of new concepts and technologies for environmental protection



# 研究院的理念、方向和作用 (Concept, Directions and Missions)



# 1

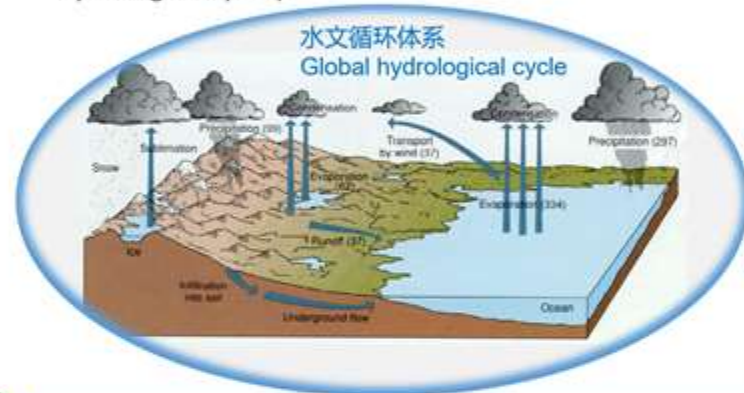
One Core Concept  
一个核心理念



流域（区域）水循环管理的理念

The concept of water cycle management for basins or regions

- 水资源是自然界通过水文循环给予人类的恩惠  
(Water resources are gifts from the nature through the hydrological cycle)



水文循环的作用  
Functions of the hydrological cycle

- 水量维持 (To secure renewable water resources)
- 水质保障 (To secure water)

- 水循环管理是水环境系统规划的基本原则  
(Water cycle management as the principle water system planning)

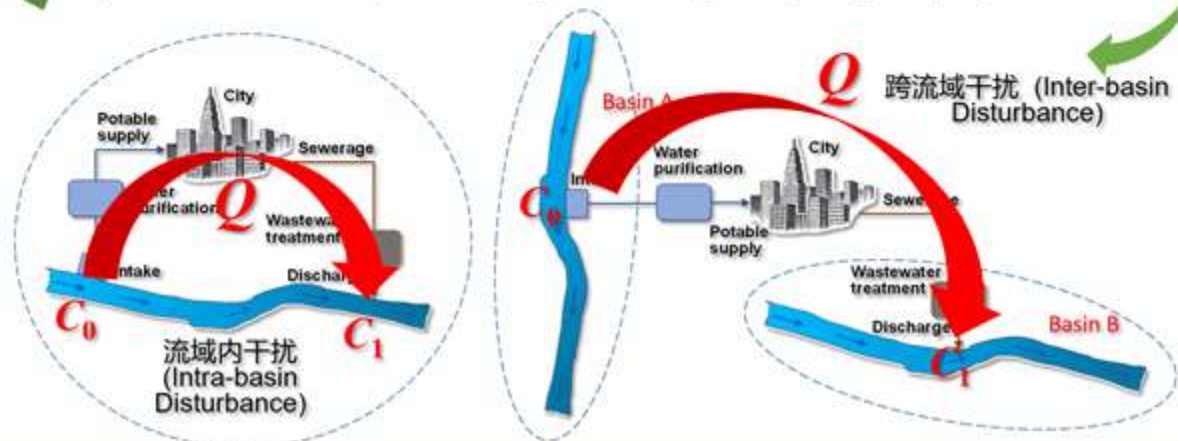
水循环管理  
(Water Cycle Management)

- 最大限度维持水文循环过程的自然性 (To maintain the hydrological cycle as it is, as far as possible)
- 尽可能依照自然法则进行系统设计及技术选择与集成 (To follow the nature's manner, as far as possible, in system design and technology selection/integration)

自然水系统的重要特征 (Characteristics of the natural water system)

- 太阳能为动力来源—典型的清洁生产过程 (Driven by solar energy—therefore associated with green processes)
- 处于动态平衡之中—热力学最佳状态 (Under dynamic equilibrium condition—a thermodynamically sound system)

- 人类取水用水导致对水文循环过程的干扰  
(The process of water use by human beings is disturbing the hydrological cycle)



# 研究院的理念、方向和作用 (Concept, Directions and Missions)



## 2 Two Key Directions 两个重点方向



### • 非传统水资源开发利用

Alternative water resources development and utilization

### • 健康水生态系统构建与水环境安全保障

Construction of healthy water ecosystem and water environment security

#### • 什么是非传统水资源？(What are alternative water resources?)

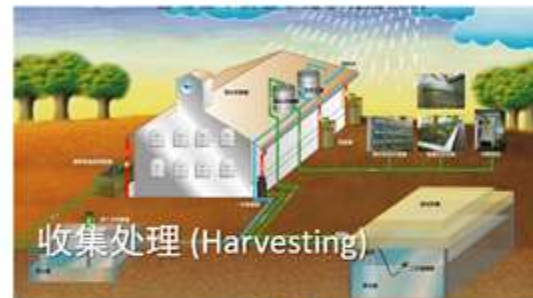
污水 (Used water)



再生 (Reclamation)



雨水 (Rainwater)



收集处理 (Harvesting)

海水 (Seawater)



淡化 (Desalination)



非饮用 (Non-potable)



饮用 (Potable)

#### • 什么是健康水生态系统？(What is a healthy water ecosystem?)

优良水质 (Good quality)



水生植物健康  
(Healthy aquatic vegetation)



水生动物健康  
(Healthy aquatic animals)



# 研究院的理念、方向和作用

(Concept, Directions and Missions)



## 3 Three Major Missions 个重要作用



- 为环科园的环境保护与建设提供科研技术服务  
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- 为国内外环境科技合作提供研发平台  
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To promote the application of new concepts and technologies for environmental protection



技术转化与工程应用

# 国合团队的科技积累 (Recent R/D Projects)



- **水再生利用与卫生环境保障是团队的传统研究方向**  
(Water reuse and health/environment protection as traditional R/D direction)

## 国家自然科学基金重点项目 (NSFC Key Projects)

- **西部干旱缺水地区水资源再生利用研究** (A study on water reclamation and reuse in water deficient area in Western China)
- **城市污水生态回用及水环境质量保障** (Ecological reuse of domestic wastewater and safeguard of water environmental quality)

## 国家自然科学基金重大国际合作项目 (NSFC Key Int'l Joint Projects)

- **新型可持续卫生系统研究和健康风险评估** (A Study on the Improvement of sanitary conditions and reduction of health risk by sustainable sanitation approach)
- **可持续卫生系统的环境与健康风险控制的理论与技术研究** (A Study on environmental and health risk management by sustainable sanitation approaches)

# 国合团队的科技积累

## (Recent R/D Projects)



- **污水处理技术研发也是团队的主要方向**

(Technology development for wastewater treatment as another direction)

### 国家863计划项目 (National High-Tech Development Project)

- **生物造粒流化床物化-生化组合污水处理技术与设备开发** (Development of a fluidized pellet-bed bioreactor for wastewater treatment)

### 国家科技支撑计划项目 (National Science and Technology Support Program)

- **印染工业园区废水循环利用技术与示范** (Technology demonstration for wastewater recycling in printing and dyeing industrial park)

### 国家自然科学基金项目 (NSFC Projects)

- **城市污水处理中的有机物归趋和腐殖酸繁衍特性及再生水质控制技术** (Technology for reclaimed water quality control targeting organics and humic substances)
- **有机物去除的臭氧混凝互促增效机制及再生水深度处理技术** (Mutual promotion of ozonation and coagulation: mechanisms and application for water reclamation)

# 国合团队的科技积累 (Recent R/D Projects)



- **城市水环境改善是团队近年来的新研究方向**

(Urban water environmental improvement as the new research direction)

## 国家“十一五”重大水专项 (National Major Projects Under 11<sup>th</sup> 5-yr Plan)

- **项目：城镇水污染控制与治理共性关键技术研究工程示范** (Technological research and engineering demonstration of urban water pollution control)
- **课题：缺水城市雨污水再生处理和不同途径用水的关键技术研究工程示范** (Technological research and engineering demonstration of wastewater/rainwater treatment and reclamation for various reuse purposes in water deficient cities)
- **课题：城镇水污染控制与治理共性技术综合集成** (Technology integration for urban water pollution control and governance)

## 陕西省重大研究计划项目 (Key R/D Project of Shaanxi Province)

- **渭河水污染防治关键技术研究工程示范** (Technology development and engineering demonstration of water pollution control for Weihe River)

# 国合团队的科技积累 (Recent R/D Projects)

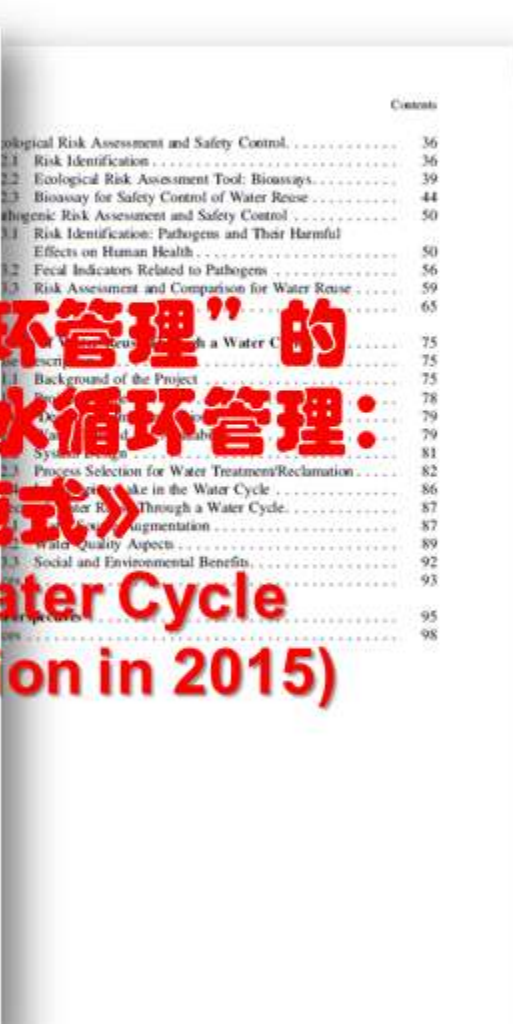
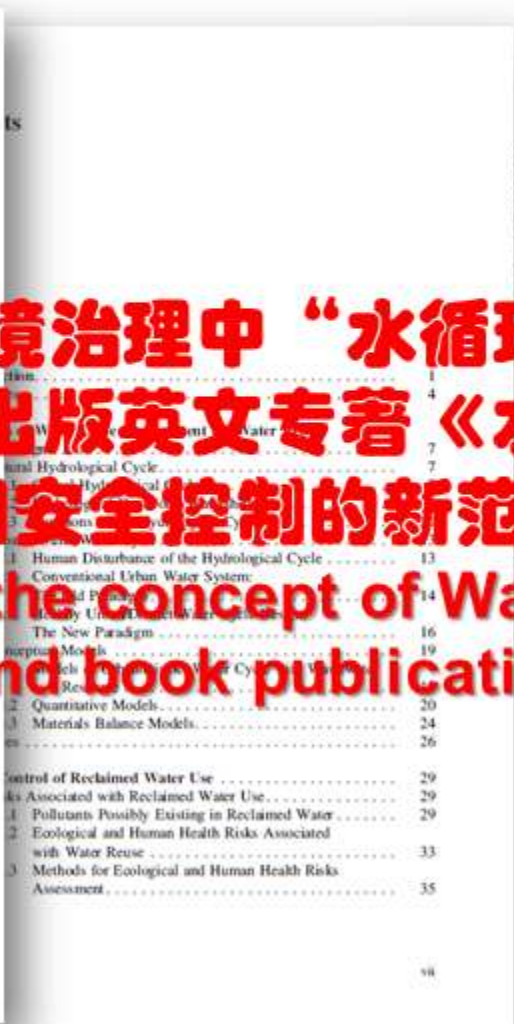
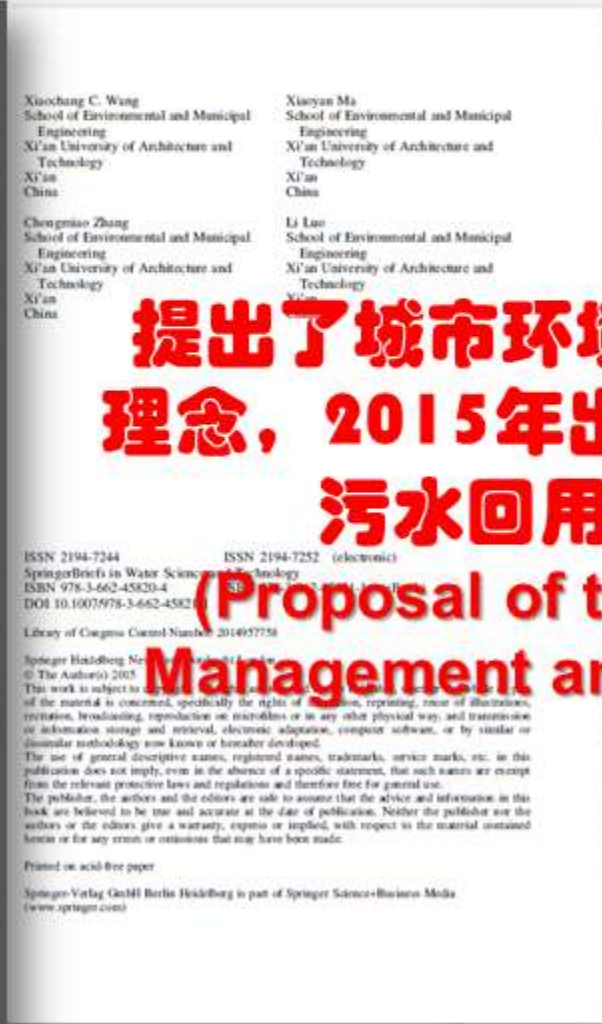
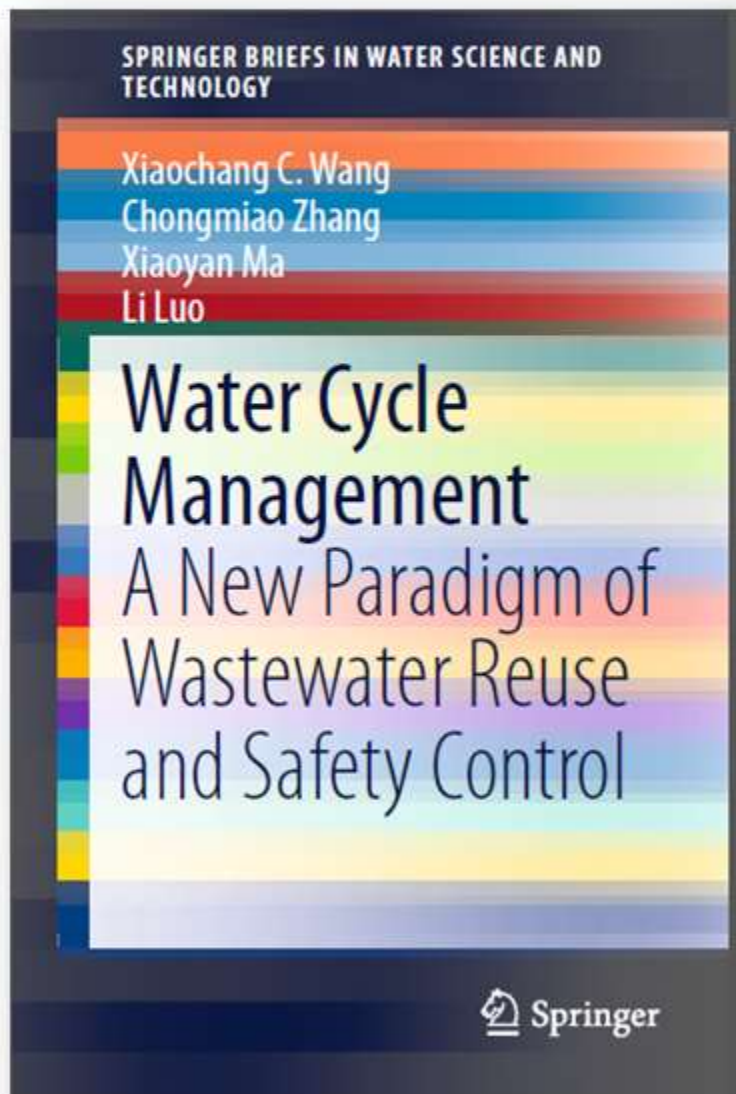


- **城市水环境改善是团队近年来的新研究方向**  
(Urban water environmental improvement as the new research direction)

## 国家“十二五”重大水专项 (National Major Projects Under 12<sup>th</sup> 5-yr Plan)

- **课题：城市内湖氮磷去除及富营养化控制技术研究** (Technological research for nitrogen/phosphorus removal and eutrophication control of urban lakes)
- **课题：(宜兴) 城市核心区水环境改善技术与综合示范** (Demonstration of urban water environmental improvement in Yixing central area)
- **子课题：城市水污染控制与水环境整治技术与工程体系研究** (Systematic study of technologies and engineering means for urban water pollution control)
- **子课题：城市水污染控制与治理关键技术应用及示范工程绩效评估** (Performance evaluation of technology application and demonstrative projects for urban water pollution control)

# 国合团队的科技积累 (Recent R/D Projects)



**提出了城市环境治理中“水循环管理”的理念，2015年出版英文专著《水循环管理：污水回用安全控制的新范式》**  
**(Proposal of the Concept of Water Cycle Management and book publication in 2015)**





# 国合团队的科技积累 (Recent R/D Projects)



## 总结“十一五”水专项项目成果，2016年 出版专著《小城镇水污染控制与治理技术》

(Publication of a book in 2016 on Water Pollution  
Control for Small Towns)

第7章 小城镇水污染控制与治理系统运行管理	222
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7.2.1 他山之石——国外可参考的经验	225
7.2.2 我国小城镇污水处理设施专业性集约化管理体制的构建	232
7.2.3 水环境综合管理	233

结合国外成功经验，强调专业性集约化管理体制构建  
(Called for intensive management of small systems based on  
international experiences)

# 国合团队的获奖成果 (AWR Group's S/T Awards)



## 2012年国际水协会全球项目创新奖 再生水滋润绿色校园 ——分散式零排放污水回用系统

IWA Global Project Innovation Award in 2012  
Green Campus Nourished by Reclaimed Water – Decentralized  
System of Zero Discharge and Maximized Water Reuse

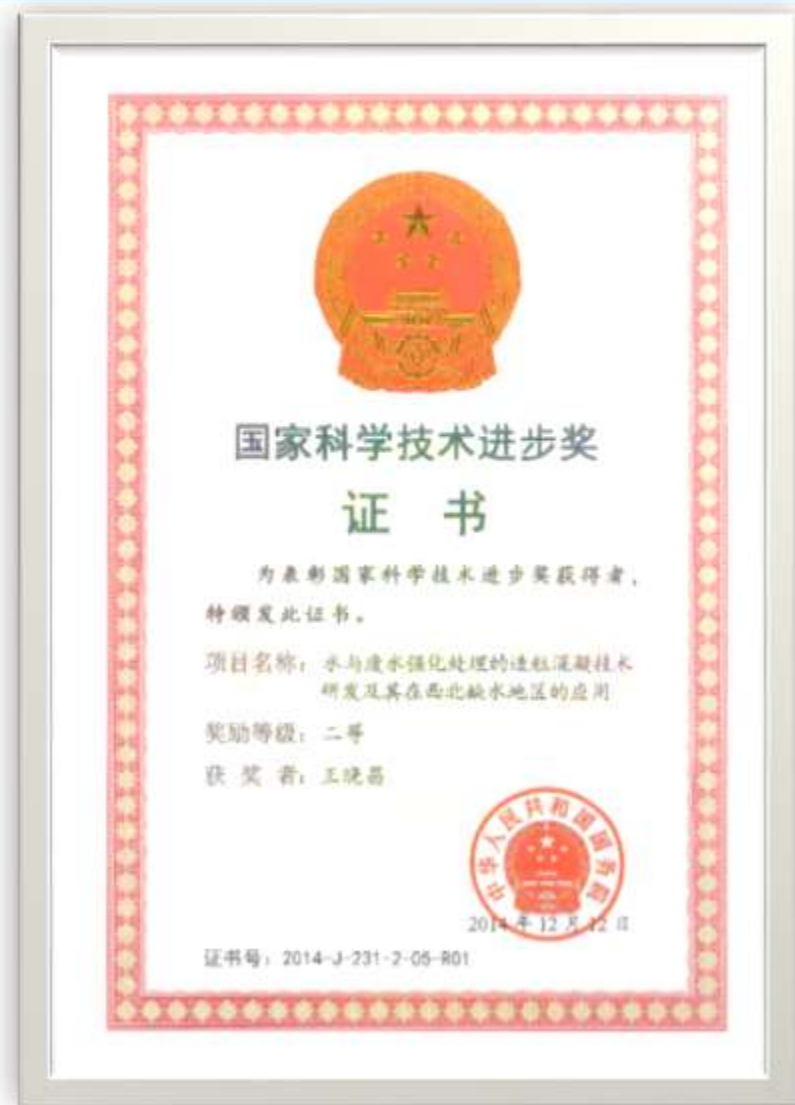


# 国合团队的获奖成果 (AWR Group's S/T Awards)



## 2014年国家科技进步二等奖 水与废水强化处理的造粒混凝技术研发 及其在西北缺水地区的应用

Second Class National Science and Technology Progress Award in 2014  
Development of Pelleting Coagulation Technology for Enhanced Water and  
Wastewater Treatment and Its Application in Water Deficient Northwest Region



# 国合团队的获奖成果 (AWR Group's S/T Awards)



2014年陕西省科学技术一等奖

## 黄土塬区油气田废弃钻井液安全处置 与水再生利用关键技术装备开发及应用

First Class Science and Technology Prize of Shaanxi Province in 2014  
Technology and Equipment Development for Safe Disposal of Drilling  
Wastewater and Water Reuse in Oil & Gas Fields in Loess Plateau Area

2012年陕西省科学技术一等奖

## 缺水城市污水再生与不同途径回用 关键技术研究与应用

First Class Science and Technology Prize of Shaanxi Province in 2012  
Technology Development and Application for Wastewater  
Reclamation and Various Reuse in Water Deficient Cities



# 国合团队的获奖成果 (AWR Group's S/T Awards)



2013年陕西省科学技术二等奖

## 油田压裂废水多途径再生利用关键技术研究 与装备开发及工程应用

Second Class Science and Technology Prize of Shaanxi Province in 2013  
Technological Research, Equipment Development and Engineering  
Application for Oil Field Fracturing Wastewater Treatment and Reuse

2009年陕西省科学技术二等奖

## 西部干旱缺水地区污水再生利用 的理论和技术研究

Second Class Science and Technology Prize of Shaanxi Province in 2009  
Theoretical and Technological Research on Wastewater Treatment and  
Reuse in Dry and Water Deficient Area in Western China

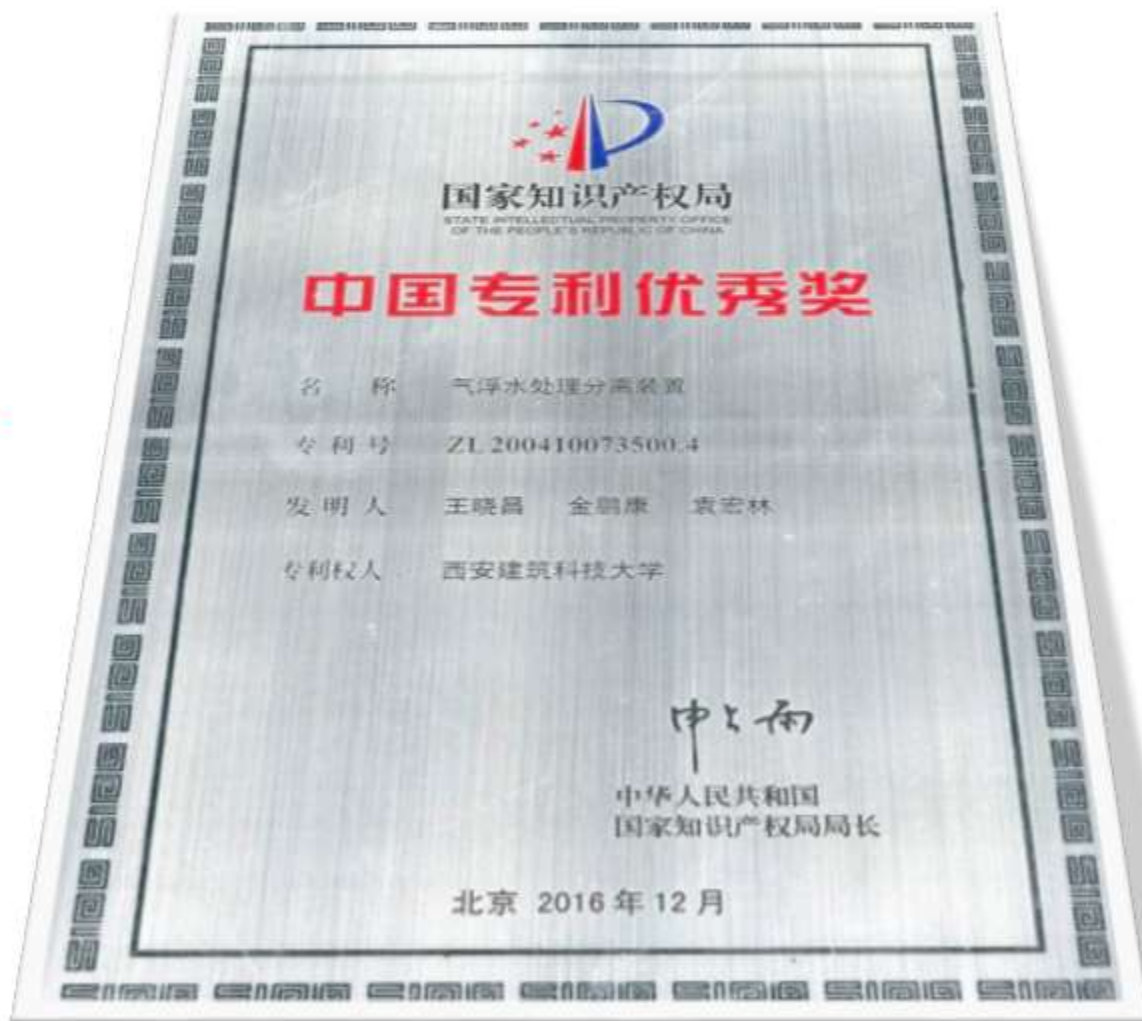


# 国合团队的获奖成果 (AWR Group's S/T Awards)

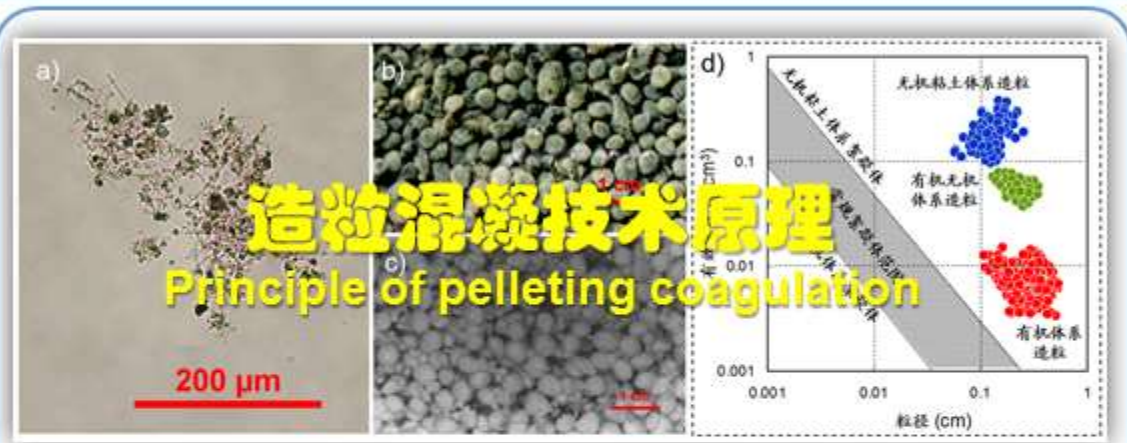


2016年中国专利优秀奖  
气浮水处理分离装置

China Patent Excellence Award in 2016



# 典型技术应用案例 (Typical Engineering Practice)



**造粒混凝技术原理**

Principle of pelleting coagulation

200 μm



**工程应用**  
Engineering application

**黄河高浊度水处理**  
High turbidity water treatment

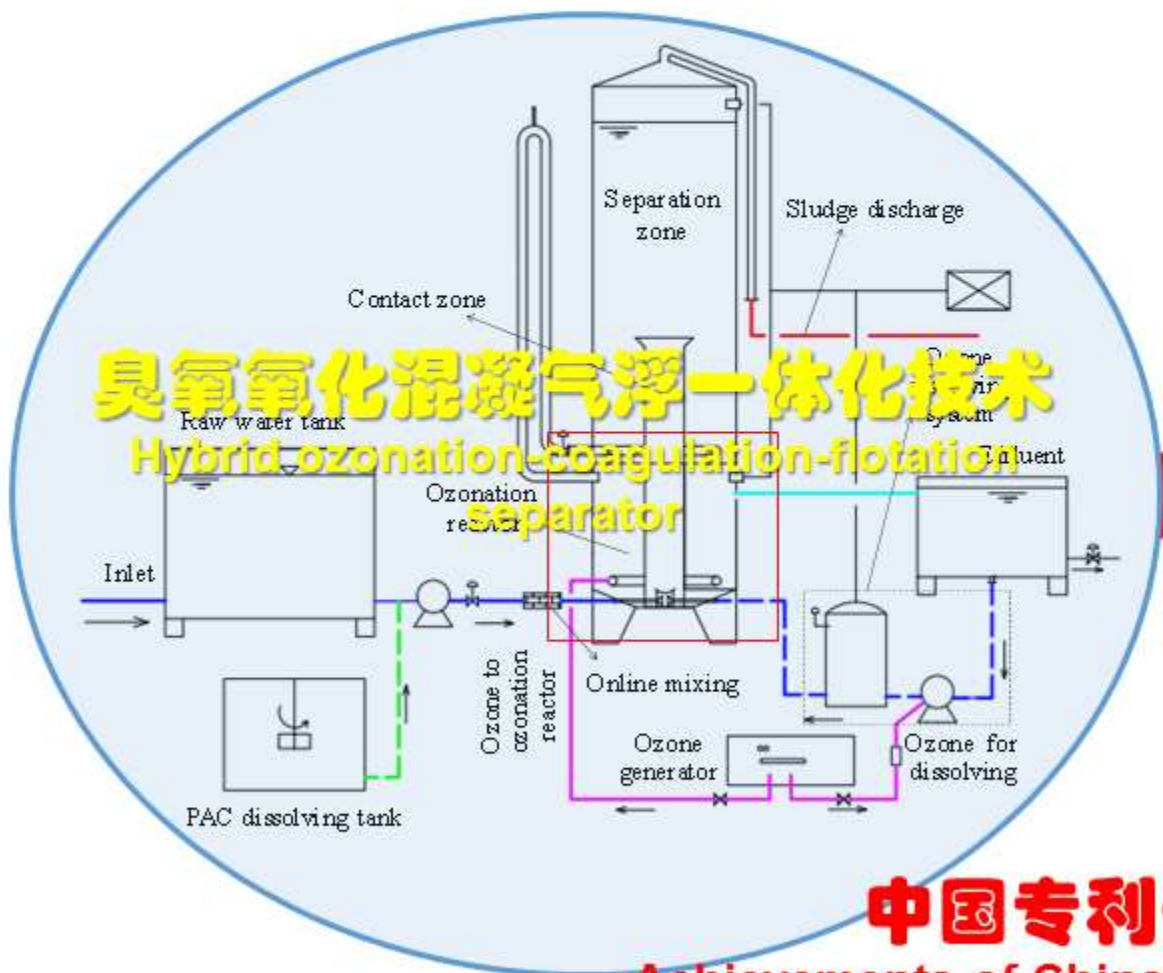
**污水处理回用**  
Wastewater treatment and reuse

**油田废水处理**  
Oil wastewater treatment

**油田钻井泥浆处理**  
Drilling sludge treatment

**国家科技进步奖成果**  
Achievements of National S/T Award

# 典型技术应用案例 (Typical Engineering Practice)



**工程应用**  
Engineering application

**污水深度处理**  
Wastewater treatment and reuse

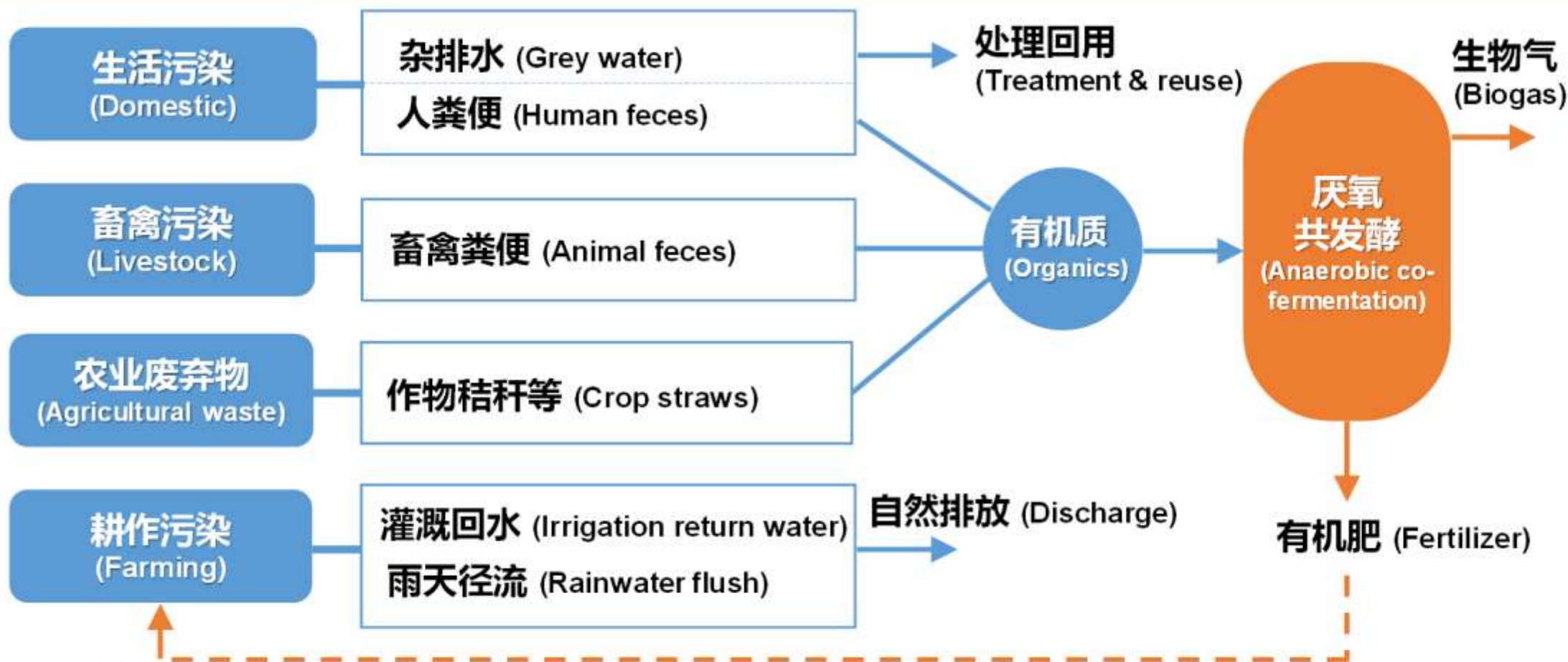
**工业废水处理**  
Industrial wastewater treatment

**单体设备**  
Decentralized facility

**中国专利优秀奖成果**  
Achievements of China Patent Excellence Award



# 典型技术应用案例 (Typical Engineering Practice)



减少化肥使用  
(Chemical use reduction)

耕作利用 (Farming use)

国家重点研发计划农村供排水一体化与环境  
改善技术研究示范课题 (National Key R/D Program)

# 典型技术应用案例 (Typical Engineering Practice)



国际水协会全球项目创新奖成果  
Achievements of IWA Global PIA Award

# 典型技术应用案例 (Typical Engineering Practice)



## 污水厂尾水补水的生态公园 Eco-Park Replenished by WWTP Effluent



Ecological landscape lake  
(生态景观湖)

Constructed wetlands  
(人工湿地)

WWTP effluent inflow  
(处理水入口)

# 典型技术应用案例 (Typical Engineering Practice)



### City Water Stories: Xi'an

**Population**

- 10 million - The ancient capital city of China, dating back to more than 3000 years ago. Four urban expansion waves were seen in the past three decades, with only 2 million in 1980s.

**Water Challenges**

- Water shortages, deteriorated urban water environment, rapid industrialization & population growth increasing water resources.

**Water Strategy**

- Ensuring the quality & abundance of freshwater for the growing urban area and water quality improvement through integrated urban water management.

**IWA**  
The International Water Association

### Water Resources Management for the City

**An ancient Water City with "Eight Rivers Surrounding the Capital"**

Xi'an was the ancient capital city of China, dating back to 1048 BC for the West Zhou Dynasty, until AD 907. Xi'an had been the political center of China for 10 dynasties, the Qin Dynasty (221-206 BC) and the Han Dynasty (206 BC-220 AD) were established here. The city was surrounded by eight rivers flowing down from the nearby Qiling Mountains, feeding many rivers passing near the city and forming the "Eight Rivers Surrounding the Capital". The city's water resources are abundant, the environment is beautiful, and the water quality is good. However, the rapid industrialization and urbanization have led to the deterioration of water resources and the depletion of water resources. The city's water resources are abundant, the environment is beautiful, and the water quality is good. However, the rapid industrialization and urbanization have led to the deterioration of water resources and the depletion of water resources.

**IWA Case of Water Wise City**

The fast expansion of the city was seen from the rapidly updated urban development plans. This inevitably brought about increased demand for water supply and aggravated the problem of water pollution.

As local water resources are insufficient, the basic principles for urban water management are not as water conservation, equitable distribution, systematic governance, and increased utilization. Water saving, multifunctional and distributed water use, recharge farming, and water restoration are important measures in the urban water management plan implemented by Xi'an Water Authority.



## 基于水循环管理的“八水润西安”方案 Water cycle management for the “Eight-Rivers” project in Xi'an

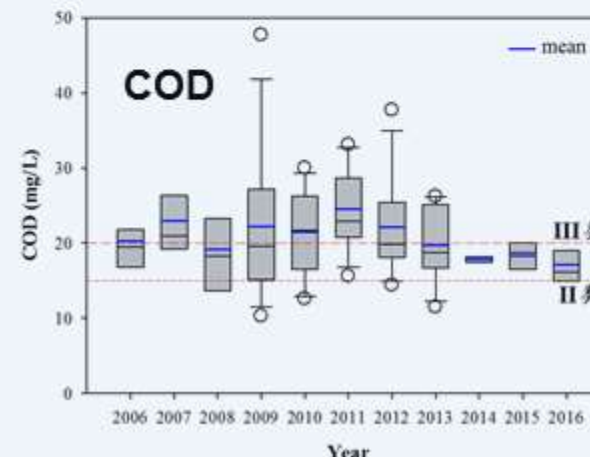
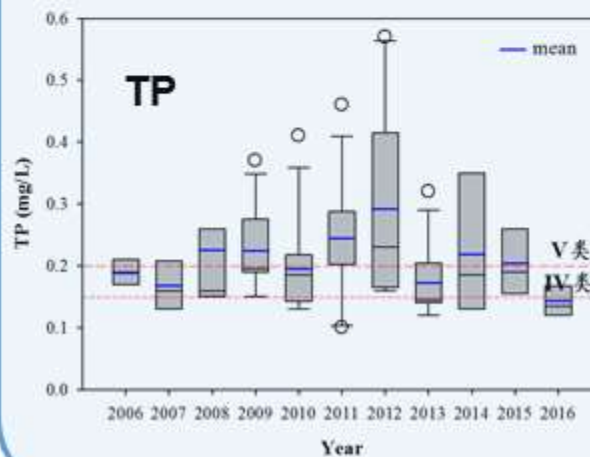
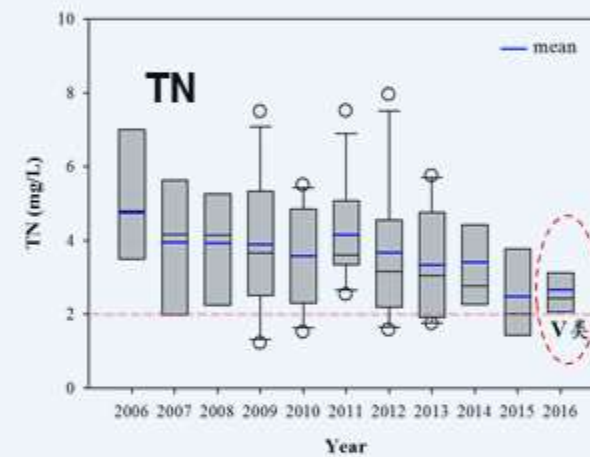
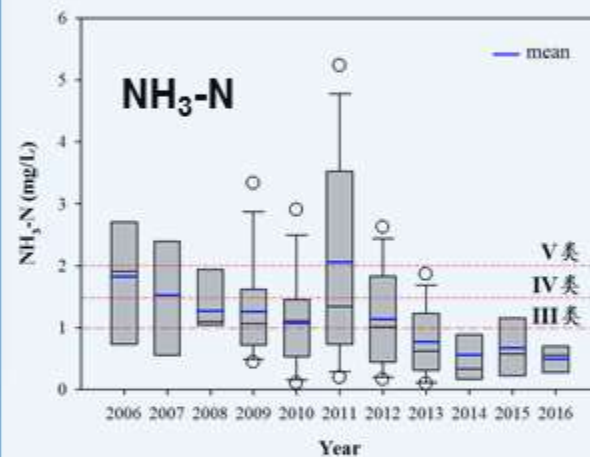
# 典型技术应用案例 (Typical Engineering Practice)



## 宜兴水环境分析 (Water environment analysis for Yixing)



## 西洮水质 (2006-2016)



# 典型技术应用案例 (Typical Engineering Practice)



## 基本思路 (Basic idea)

- 污染源治理 (Source control)
- 健康水系营造 (Healthy water system)
- 水环境承载力提升 (Carrying capacity)

## 技术路线 (Technology roadmap)

- 1 点源根治 + 面源削减 (Point & Nonpoint source reduction)
- 2 水量水质调控 + 动态循环 (Quantity/quality control & circulating)
- 3 生态修复 + 自然功能强化 (Bio-restoration & natural function enhancement)

## 宜兴市域的面源污染削减 (Nonpoint source control) 2

### 基本策略

#### 面源治理

- 城市排水防涝体系健全与面源污染削减
- 推进海绵城市建设, 控制降雨径流污染
- 农业面源控制与水产养殖的规范化管理

### 治理途径

全面削减主城区  
面源负荷

有效控制  
初期降雨径流

水域周边的  
农·渔污染根治

## 宜兴市域的污水处理强化 (WWTP upgrading) 1

### 城市污水处理

污水处理一级A稳定达标: 处理  
设施升级改造 + 优化运行管理

+

处理水优质排放 (TN<8mg/L):  
尾水生态净化

### 村镇污水处理

污水全收集 + 物化·生化组合  
处理 + 就地生态利用

+

专业性集约化系统管理:  
设计 + 施工 + 运行 + 维护

## 宜兴市健康水环境系统构建 3

### 基本理念

#### 水循环管理

(Water cycle  
management)

### 自然水文循环原理的延伸

- 通过循环回路的形成增大水系的动态流量
- 通过水的循环强化水系的水质净化功能

# 典型技术应用案例 (Typical Engineering Practice)



## 太湖南岸水生态区



## 马公荡生态湿地



## 西太湖水源保护区



## 河网生态区



# 未来的专业技术服务领域 (Future fields of Professional Service)



1

## 城市/区域水污染治理与水环境改善

Urban/regional water pollution control & water environmental improvement

海绵城市建设、黑臭水体治理

Sponge city construction, black and odorous water treatment

规划、设计、工程技术服务

Planning, design & engineering service





# 未来的专业技术服务领域 (Future fields of Professional Service)



2

## 城市/工业污水处理

Urban/industrial wastewater treatment

常规处理、深度处理

Conventional treatment & advanced treatment

技术研发、成果转化、工程设计与技术服务

Technology development, technical transformation, engineering design & technical service



# 未来的专业技术服务领域 (Future fields of Professional Service)



3

## 非传统水资源开发利用

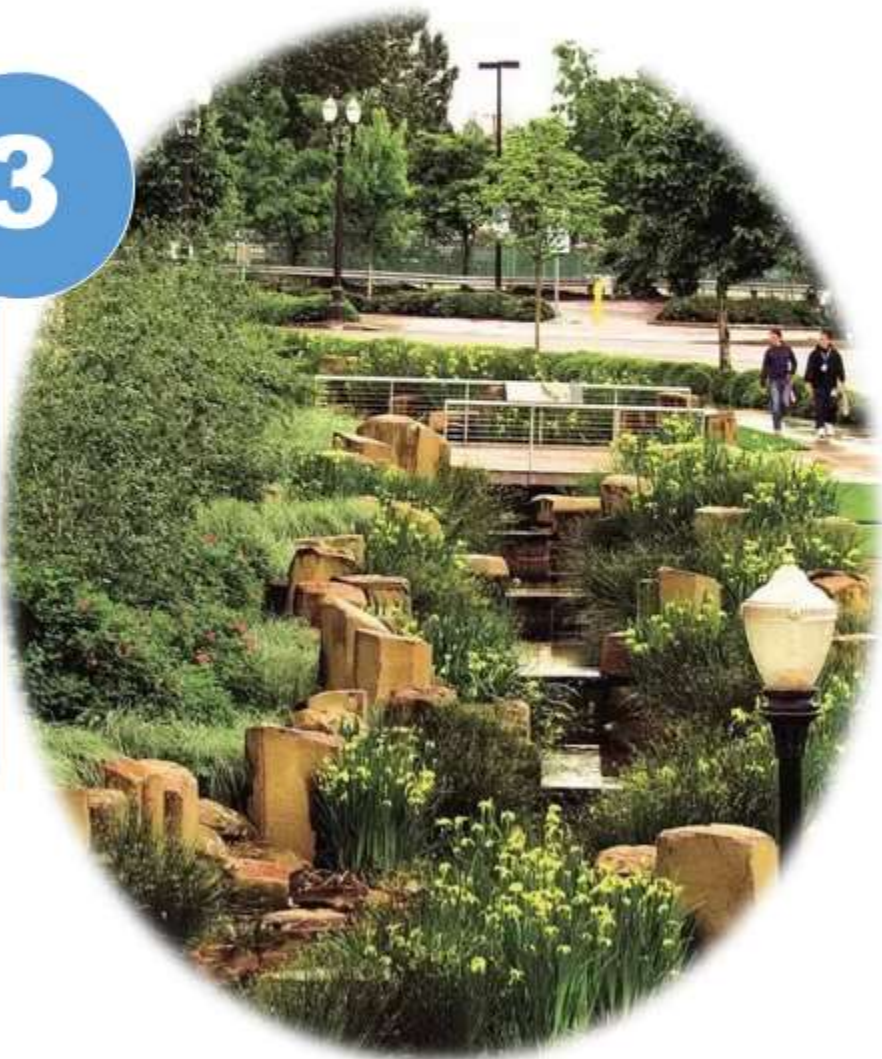
Alternative water resources development & application

污水再生利用、雨水资源化利用

Wastewater reclamation, rainwater harvesting & reuse

技术研发、系统设计、工程技术服务

Technology development, facility design & engineering service



# 未来的专业技术服务领域 (Future fields of Professional Service)



4

## 国际化环境教育与技术培训

International environmental education & technical training

专门化课程开设

Regular specialized courses

委托技术培训

Commissioned technical training



# 结语

## (Concluding Remarks)



- 衷心感谢各位领导、各位来宾对国合环境研究院的厚爱 (Heartfelt thanks to all the guests for attending this ceremony)
- 衷心感谢宜兴环科园和国内外同仁对国合环境研究院的支持 (Heartfelt thanks to ES&EP and colleagues both home and abroad for your support to AWRERI)
- 国合团队将不负众望，为推进水环境领域的国际合作和技术进步而努力 (Our team will strive for international cooperation and technical progress in the field of water environment)



谢谢!  
Thanks!