

環境影響評估河川水質 評估模式講習班

劉成均

美國夏威夷大學土木與環境工程系教授

Clark C.K. Liu, Professor

Dept. Civil and Environmental Engineering, University of
Hawaii at Manoa

2011.02

Session 1: A Review on U.S. Water Quality Management Efforts in the Last 40 Years

第一單元：美國近四十年來水質管理工作概況

1. 美國聯邦淨水法案簡介

Introduction to U.S. Federal Clean Water Act

2. 過去40年美國在水質改善維護上所作的努力及其成果和獲致的經驗

Accomplishments and Lessons Obtained from implementing U.S. Federal Clean Water Act

3. 美國水質管理的發展趨勢

The Trend of Water Quality Management in USA

4. 實例分析和小組討論

Tutorial Session and Group Discussion

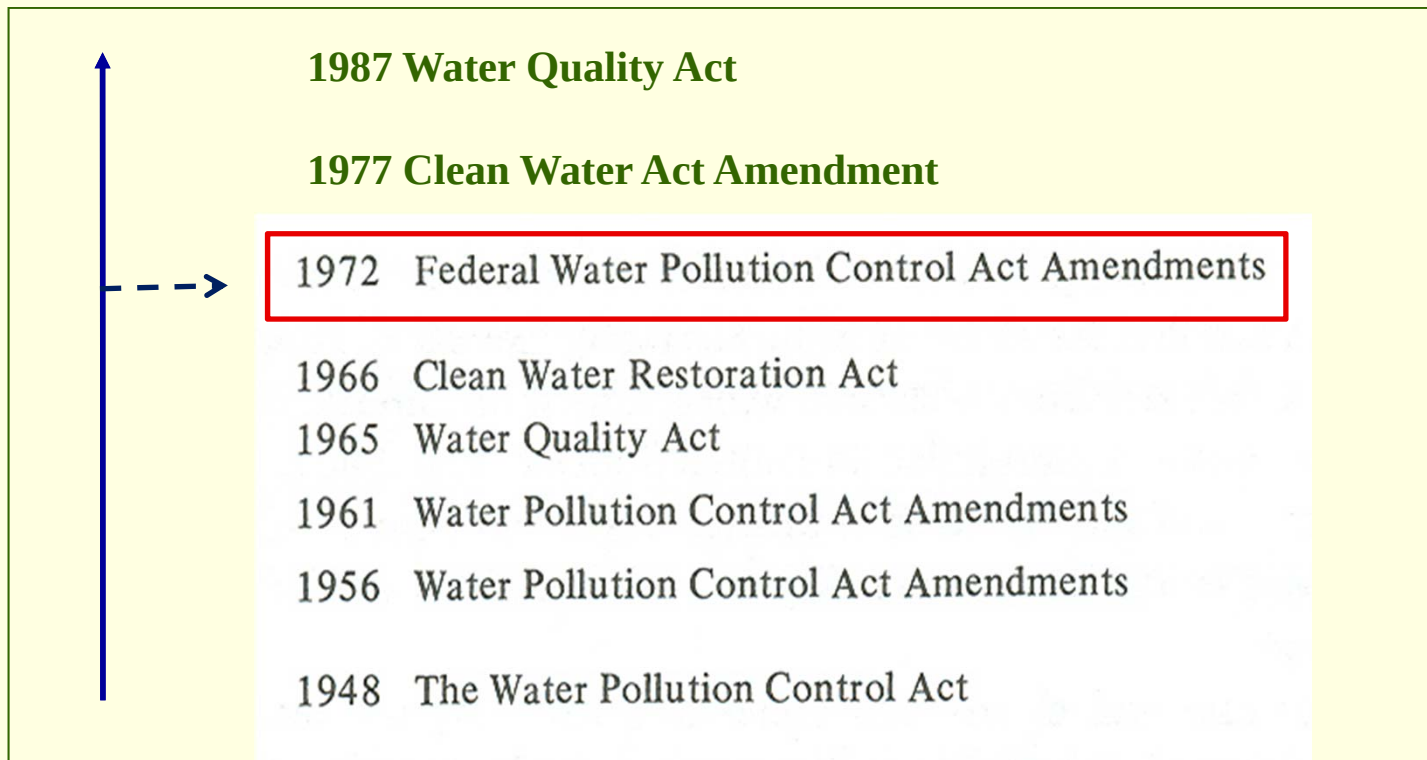
Note: In USA, the Clean Water ACT (CWA) and the Safe Drinking Water Act (SDWA) are the two main federal laws that protect the nation's waters. This lecture is only in relation to CWA.

1. 美國聯邦淨水法案簡介

Introduction to US Federal Clean Water Act

美國水染防治聯邦法律的演變

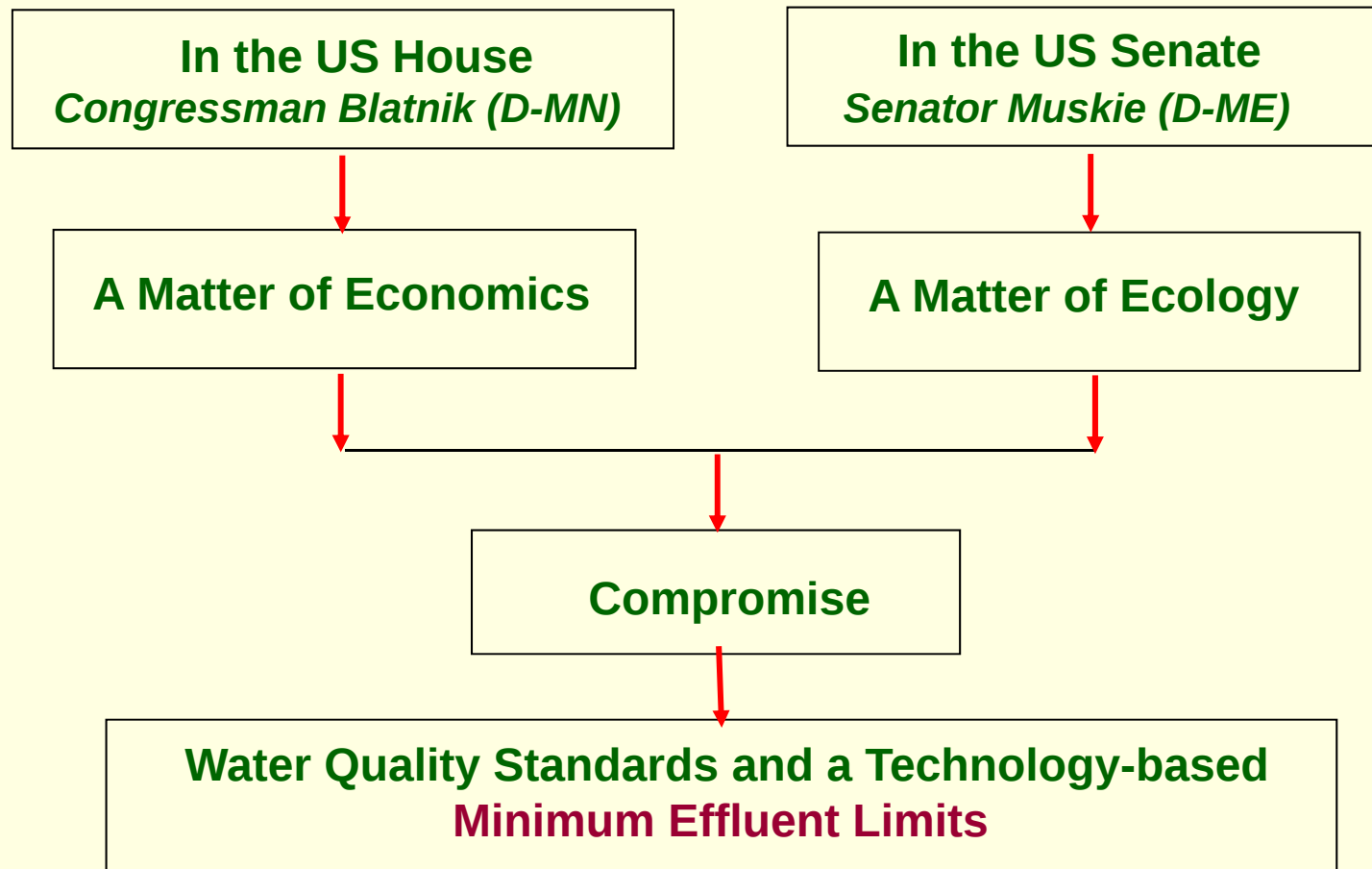
History of Water Pollution Control in U.S.



美國1972年聯邦淨水法案的製訂過程

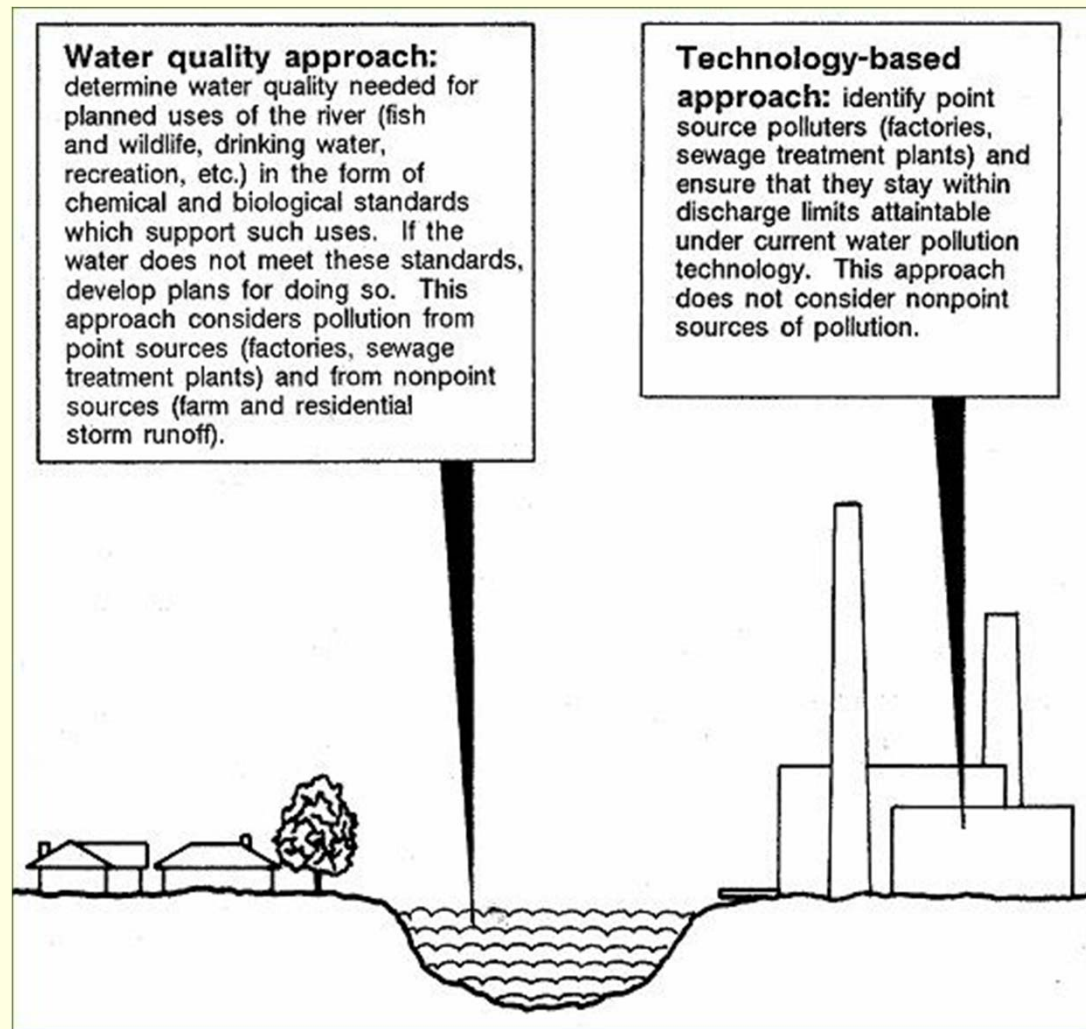
Legislation of the 1972 Clean Water Act

美國1972年聯邦淨水法案是在參眾兩院妥協後完成
1972 Clean Water Act was a product of compromise



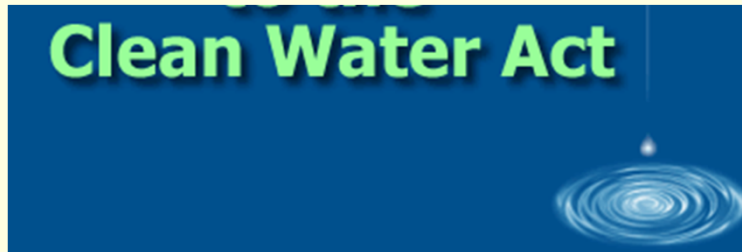
以水體水質和以排放水水質為標準的水污染防治

Water-Quality-Based and Effluent-Based Approaches in Water Pollution Control



美國淨水法案的綱要

A Synopsis of the US Federal Clean Water Act



Title I - Research and Related Programs

Title II - Grants for Construction of Treatment Works

Title III - Standards and Enforcement

Title IV - Permits and Licenses

Title V - General Provisions

Title VI - State Water Pollution Control Revolving Funds

根據淨水法的水質管理工作

Clean Water Act and water quality management



1. Every state adopts goals or standards that need to be met for its waters, based on the intended uses of the waterbodies. Different goals are set for different waterbody uses.
2. Scientists monitor the waters
3. give them one of the following scores: GOOD - The waterbody fully supports its intended uses.
IMPAIRED - The waterbody does not support one or more of its intended uses.
4. The impaired waters are then targeted by pollution control programs to reduce the discharge of pollutants into those waters.

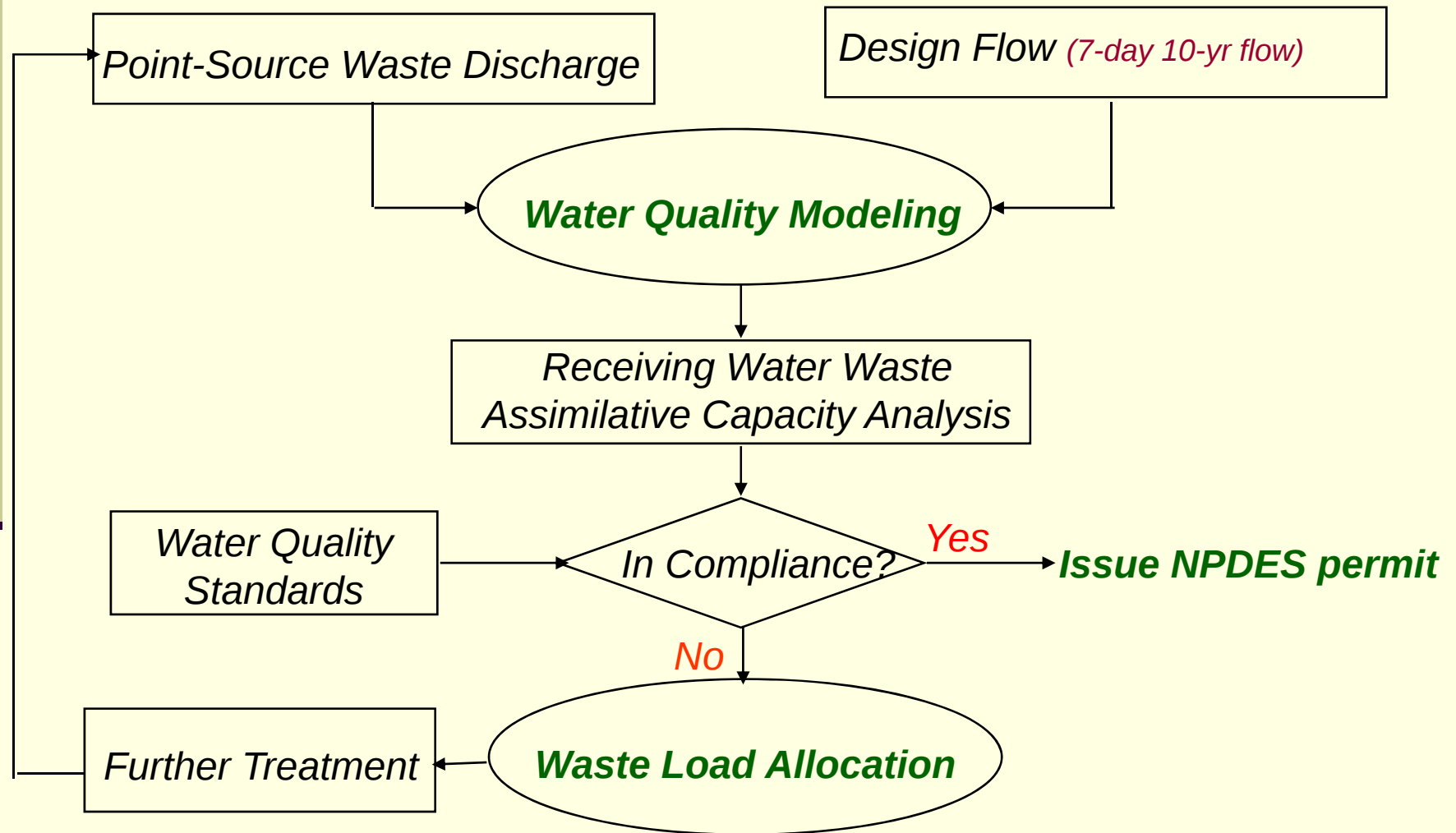
自然水體的可能最佳使用及其水質標準

The Beneficial Uses and Water Quality Standards of Receiving Waters

Class	Use	Quality Criteria	Required Treatment
A ^b	Water supply, recreation	Coliform bacteria, color, turbidity, pH, dissolved oxygen, toxic materials, taste- and odor-producing chemicals, temperature	Secondary (tertiary in some cases to meet criteria) plus disinfection
B ^b	Bathing, fish life, recreation	Coliform bacteria, pH, dissolved oxygen, toxic materials, color and turbidity (at high levels), temperature	Secondary plus disinfection
C	Industrial, agricultural, navigation, fish life	Dissolved oxygen, pH, floating and settleable solids, temperature	Primary and, in some cases, secondary
D	Navigation, cooling, water	Nuisance-free conditions, floating material, pH	Primary

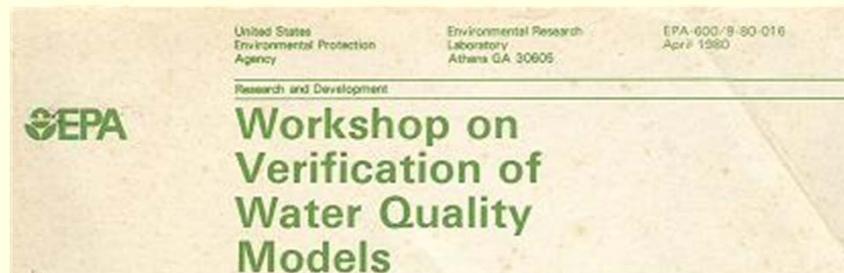
淨水法案及點源污染防治

1972 Clean Water Act and Point-Source Water Pollution Control



水質模式和河川污染涵容能力分析

Water Quality Modeling for the Implementation of Clean Water Act



- Evaluate the state-of-the-art of water quality modeling.
- Make recommendations for the direction of future modeling efforts.

STATE-OF-THE-ART REPORT

of the

Dissolved Oxygen/Temperature Committee

Clarence Velz - Chairman

Members

Joe M. Dietzel
C. S. Fang
James M. Greenfield
Clark C. K. Liu

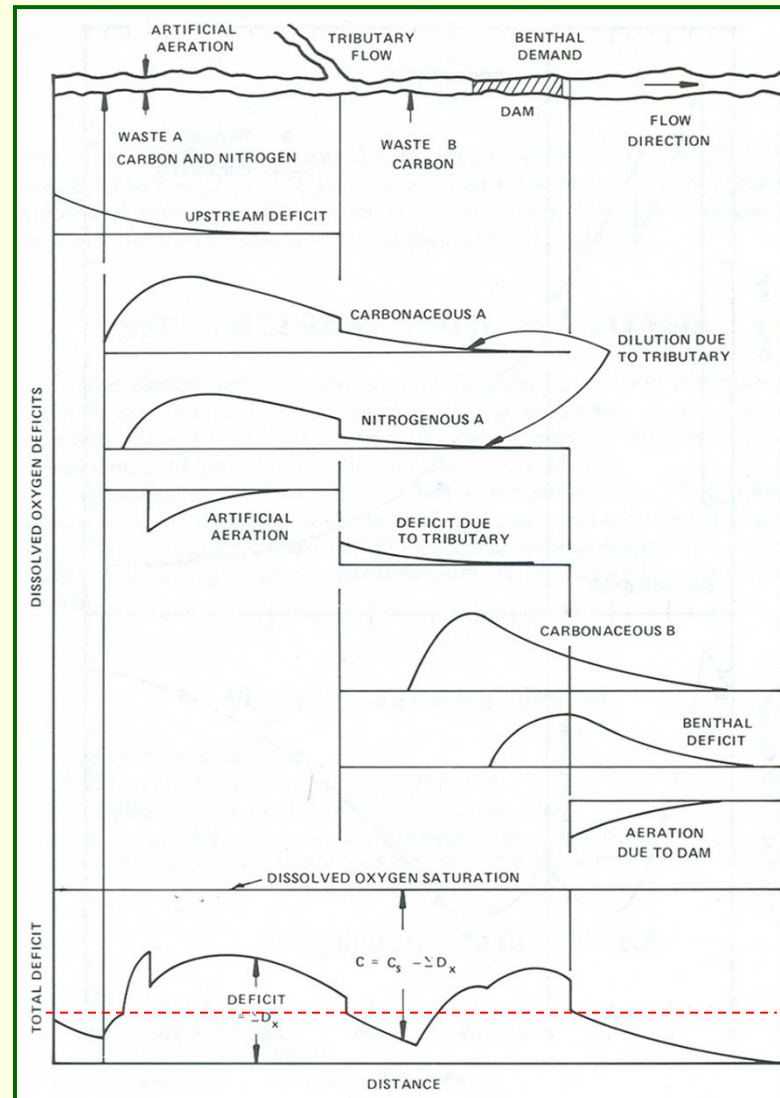
John T. Marlar
Ronald E. Rathbun
Peter G. Robertson
Daniel S. Szumski

Introduction

Our committee was composed of modelers working in government, academia, and private practice, and even though there was considerable discussion during the deliberation of the issues, there was a surprising consensus of opinion. This gives us cause to believe this report reflects a relatively accurate assessment of the state-of-the-art in DO/TEMP modeling.

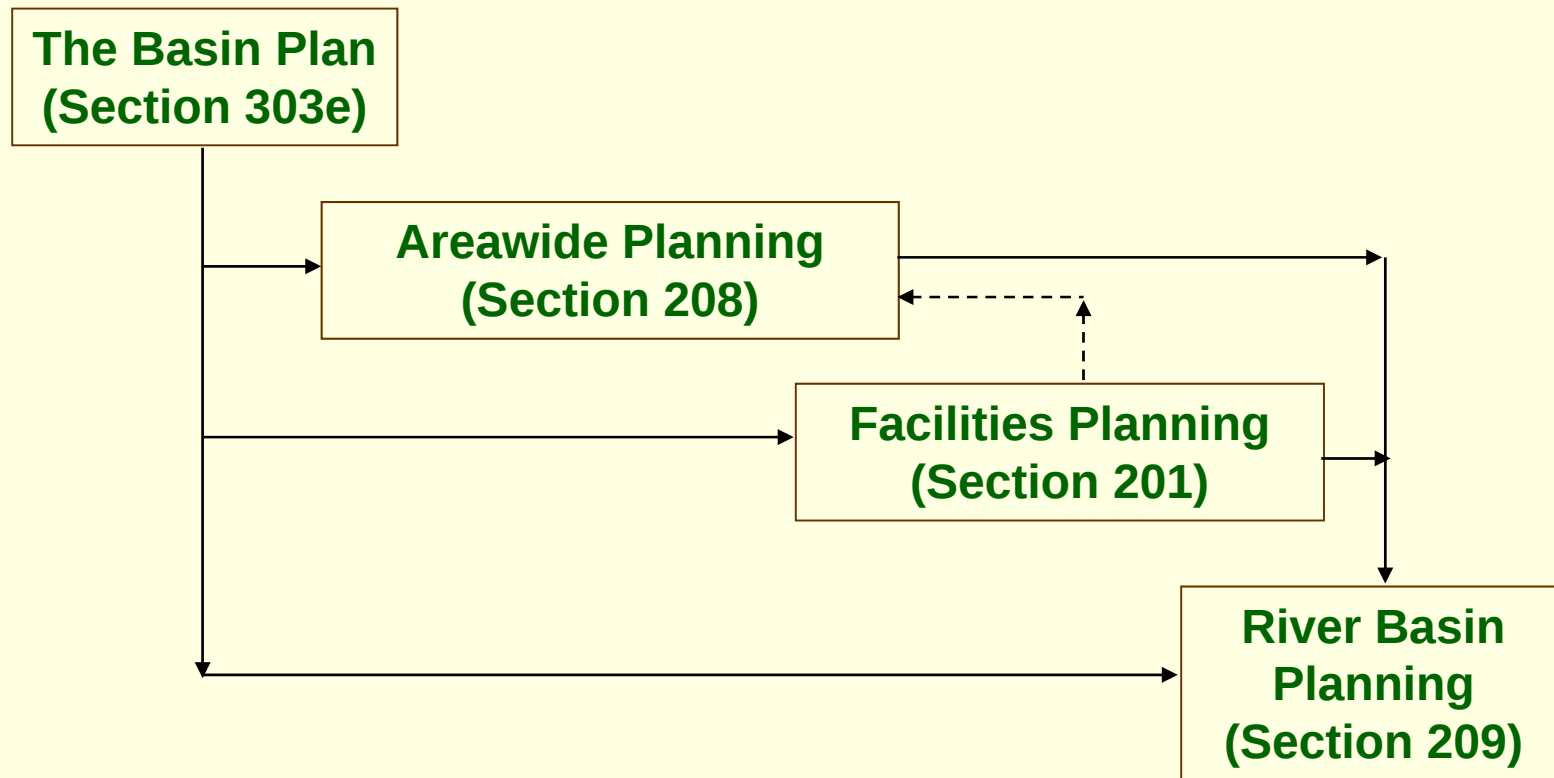
河川污染涵容能力分析和污染物排放量分配

Waste Assimilative Analysis and Waste Load Allocation



水污染法案所須的規劃措施

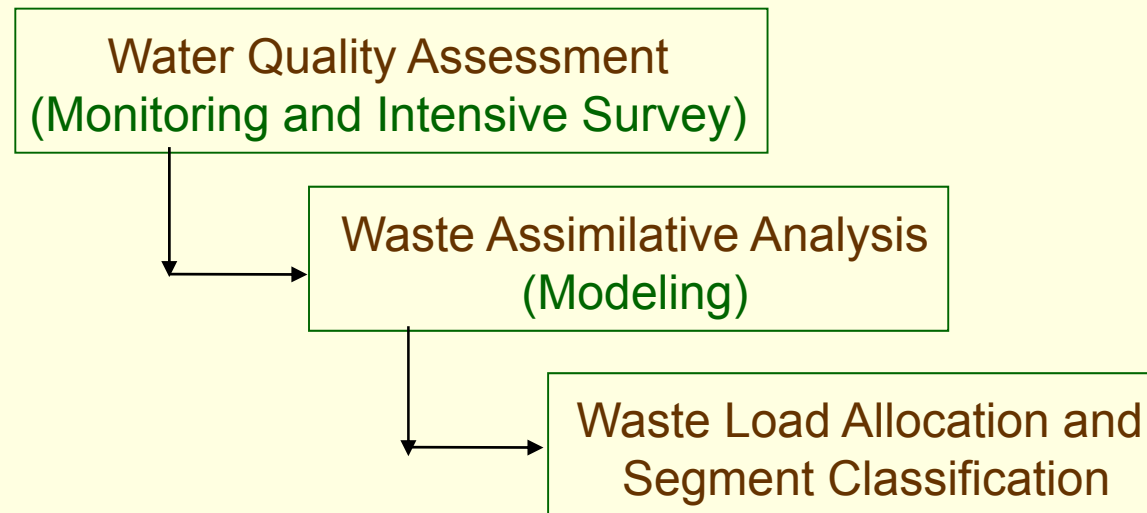
HIERARCHY OF CWA Planning Provisions



聯邦水污染法303(e)流域規劃

Basin Planning, Section 303 (e)

303 (e) Plan deals with a river basin to arrive at a strategy for bringing substandard waters in compliance with the established water quality standards.



Stream Segments Classification:

1. **Effluent Limiting:** Water quality standards is expected to meet after the application of minimum level treatment.
2. **Water Quality Limiting:** Water quality standards is not expected to meet after the application of minimum level treatment.

聯邦水污染法208區域規劃

Area Planning – Section 208

The 208 planning is generally confined to those areas of the basins where there are complex urban/industrial and nonpoint source water quality problems. The Governor of each State designates areas for the areawide planning program.

Technical contents of a 208 plan:

- 1. The identification of priority water quality problems in the area.**
- 2. Recognition of any constraints in dealing with the problems.**
- 3. Development of alternatives to achieve water quality goals.**

聯邦水污染法201 - 處理設施規劃

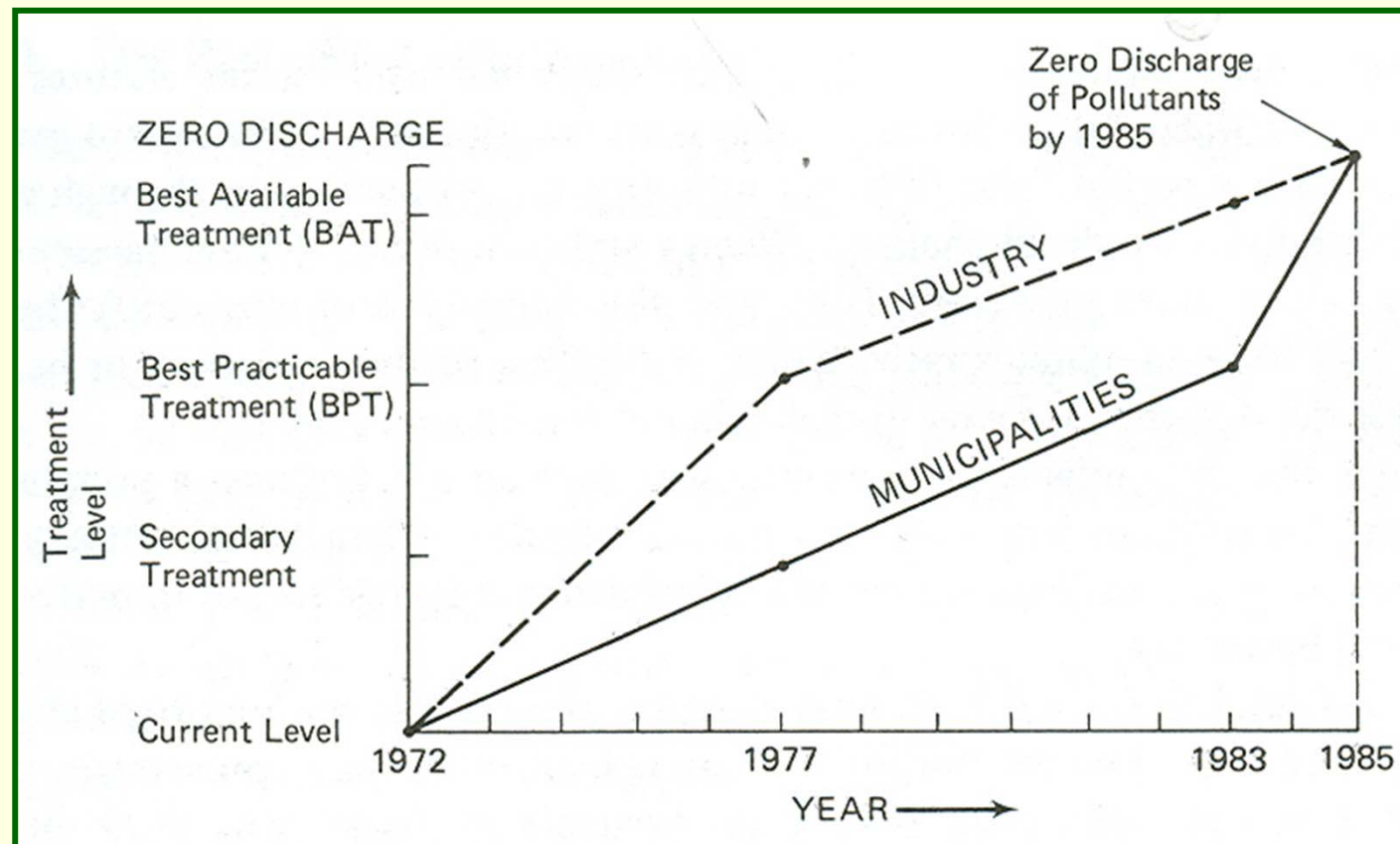
Wastewater Facilities Planning – Section 201

The 201 Wastewater Facilities Plan deals with the actual facilities needed to achieve water quality improvement and maintenance.

- 1. Major activities:**
- 2. Establish water quality management goals.**
- 3. Initiate a public participation program.**
- 4. Develop a detailed inventory of existing wastewater treatment systems.**
- 5. Prepare an environmental inventory.**
- 6. Estimate future wastewater flows and wasteloads.**
- 7. Develop technical alternatives.**
- 8. Develop implementation arrangements.**
- 9. Prepare a cost-effective analysis.**
- 10. Select a 201 plan from the alternatives.**

1972聯邦淨水法的污水處理程度的達成目標

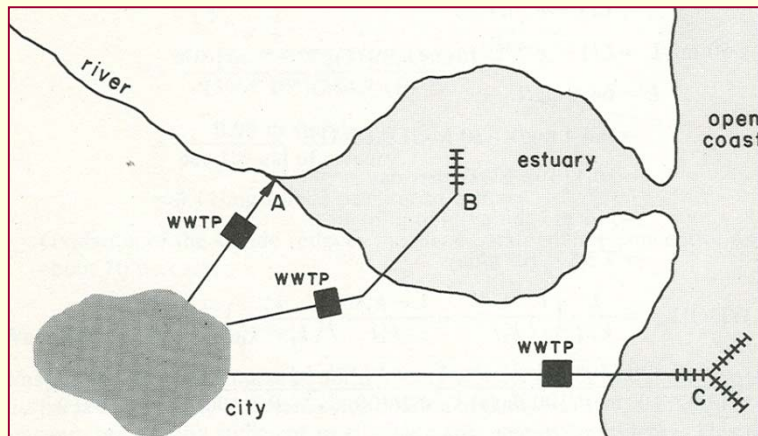
Wastewater Treatment Goals Established by 1972 Clean Water Act



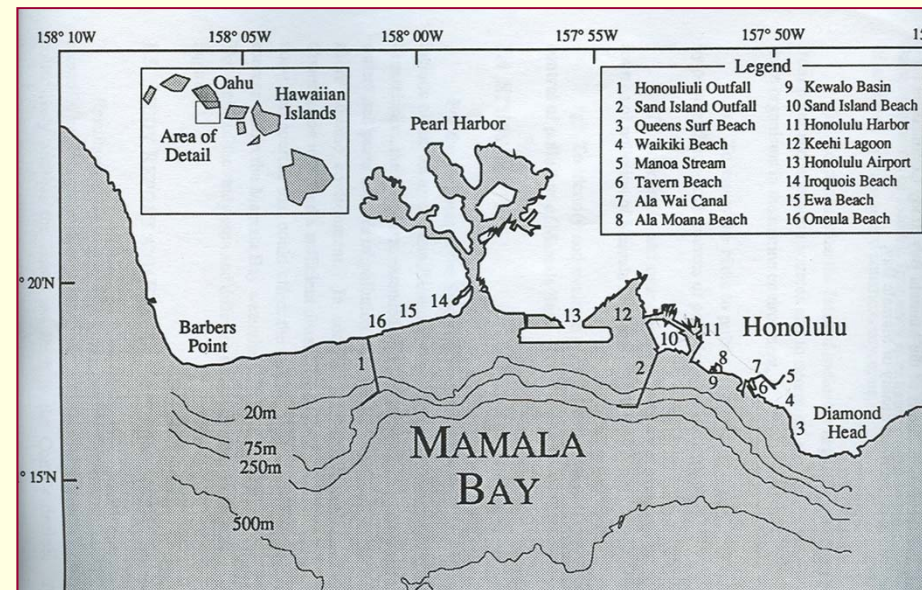
聯邦淨水法1977年修正案

1977 CWA amendment 301(h)

Secondary waiver for Marine Discharge of Municipal Wastewater



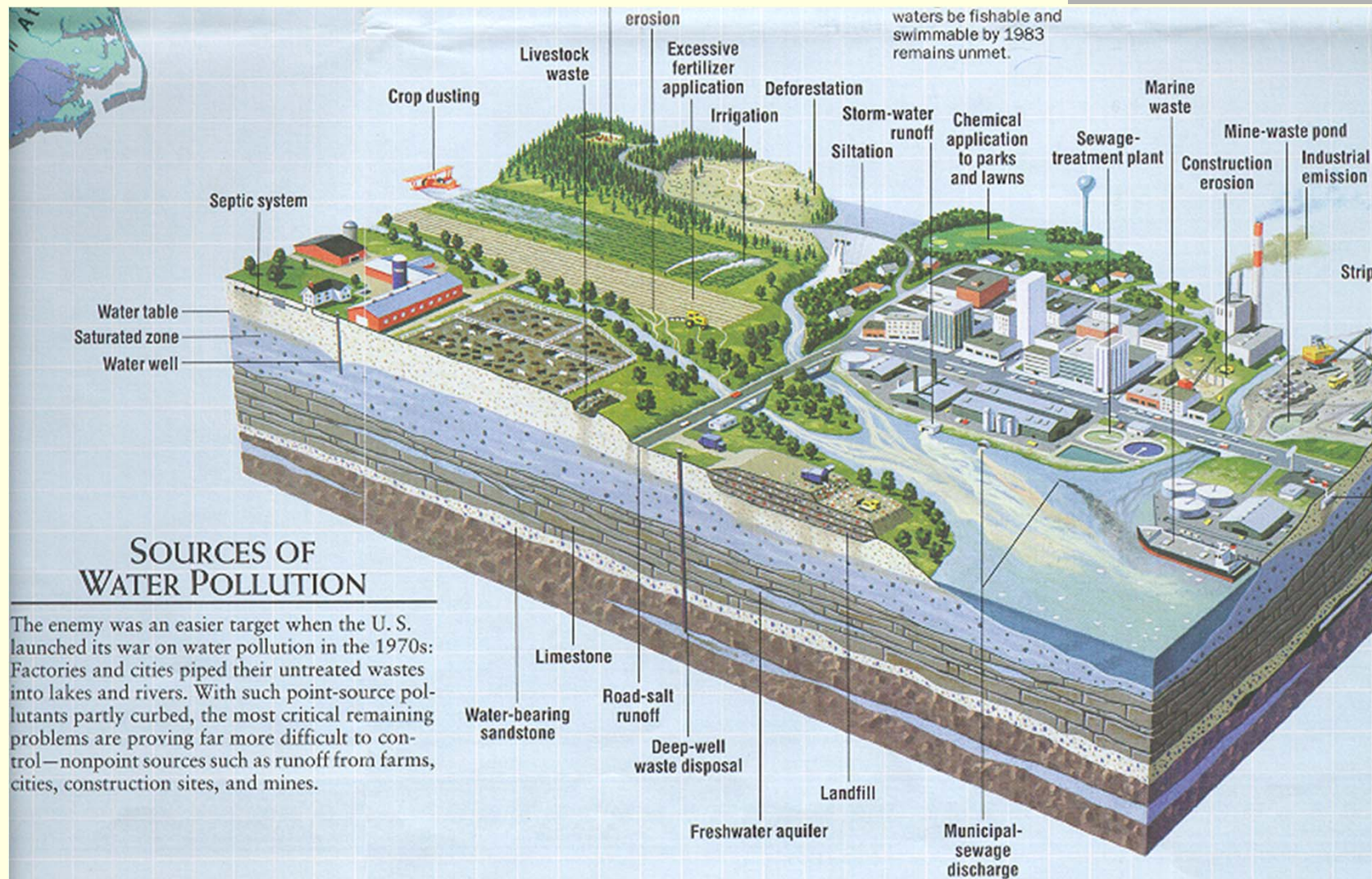
Alternatives of Wastewater effluent disposal



Honouliuli and Sand Island Wastewater Disposal on Oahu

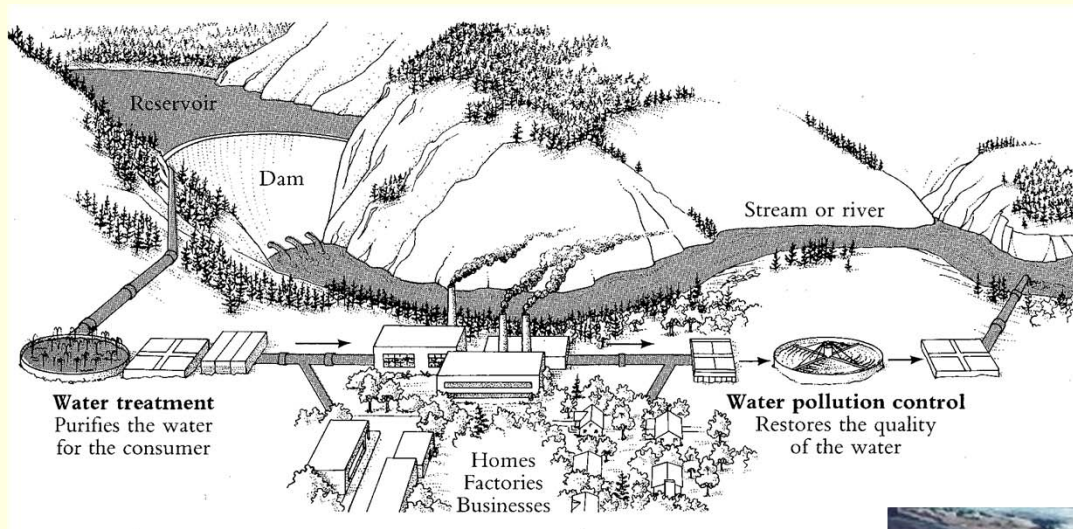
2. 40年來美國在水質改善維護上取得的成果和 猶待努力的事項

Accomplishments and Lessons Derived by Clean Water Act Implementation Since 1972



都市及鄉鎮污水系統的完成

Completion of Municipal Wastewater Collection/Treatment Systems



嚴重污染河川湖泊重現生機

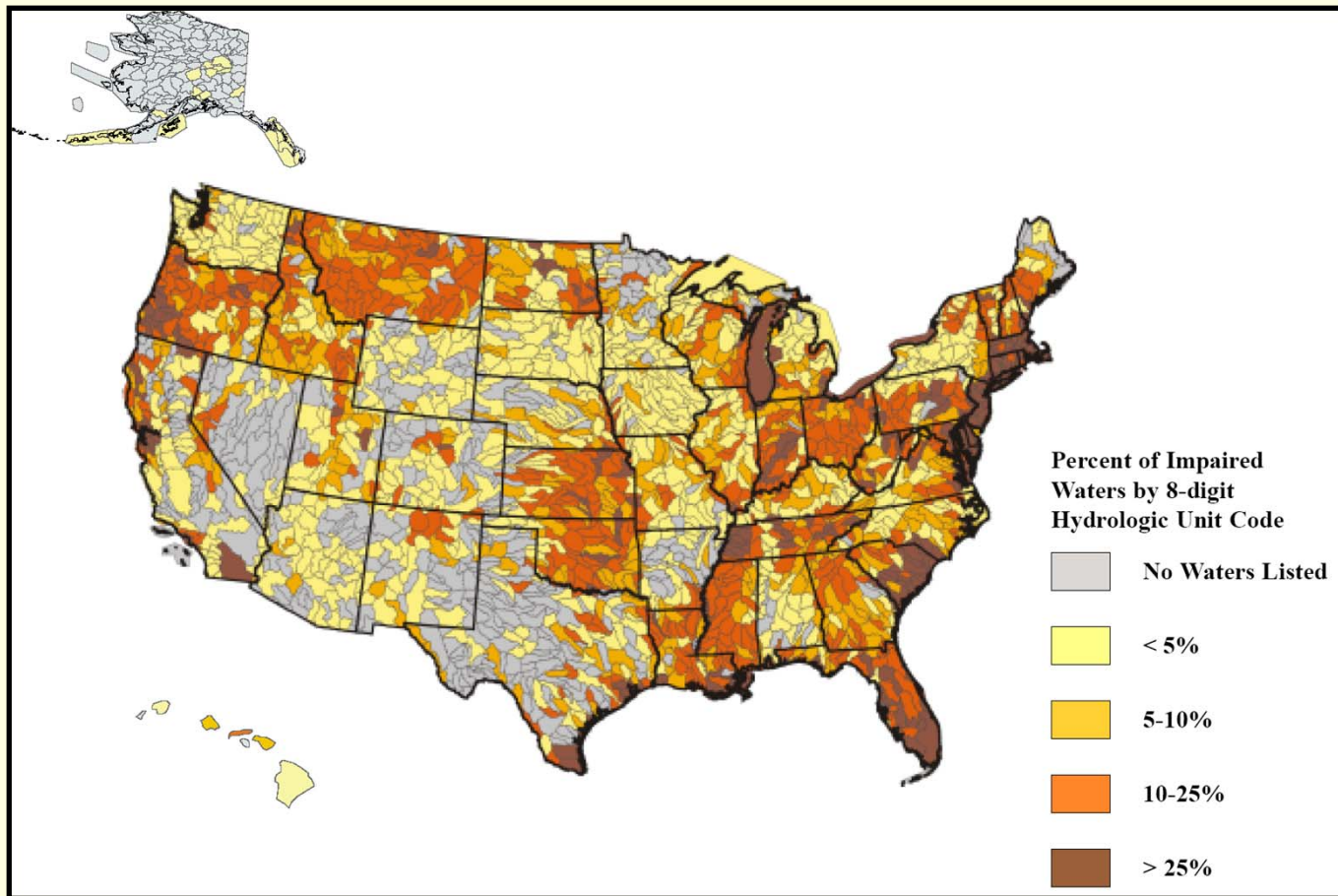
Re-birth of Dead Rivers, Lakes and Estuaries



1972聯邦淨水法未盡全功

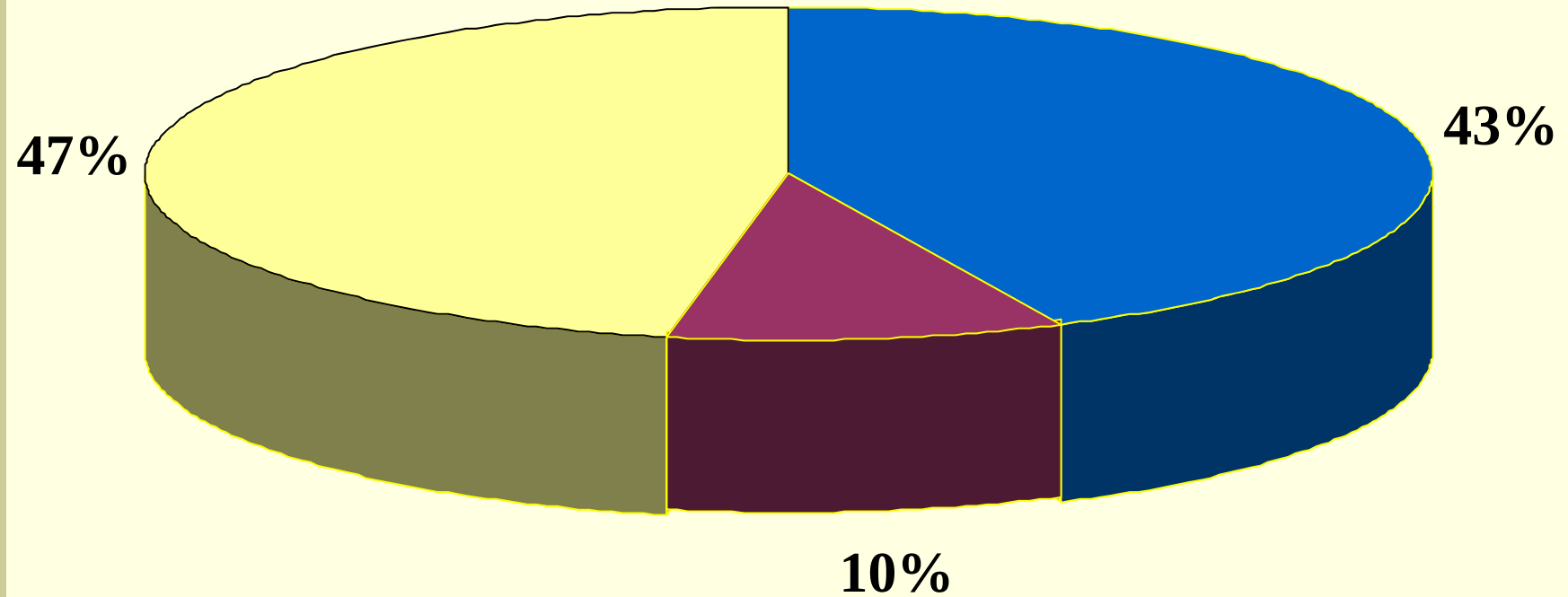
1972 Clean Water Act: A Partial Successful Story

National Inventory of Impaired Waters, 2003



淨水法治理目標未能完全達成的原因

Causes of Water Quality Impairment



- Nonpoint Sources Only
- Point Sources Only
- Combination of Point & Nonpoint Sources

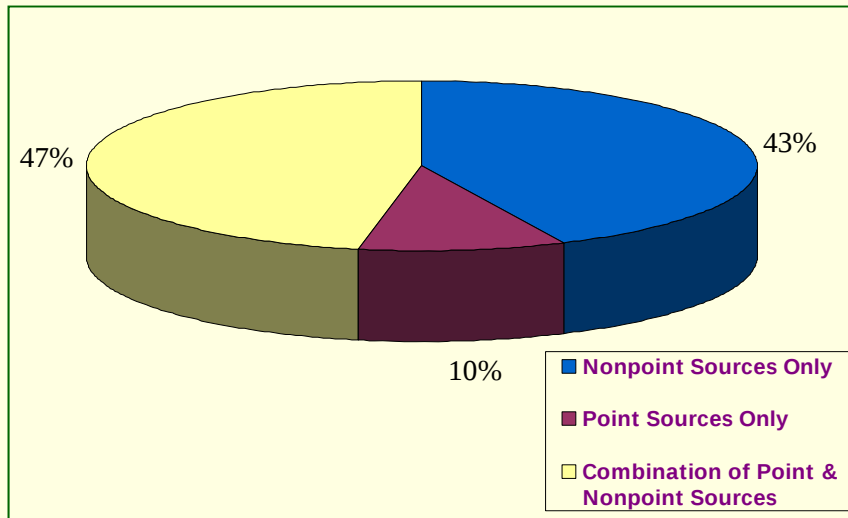
聯邦淨水法1987年修正案及非點源污染防治

1987 Clean Water Act and Non-Point Pollution Control

Section 319 was added to 1987 Water Quality Act. It directs states to develop and implement management programs targeting their major nonpoint sources. Federal grants, covering up to 60 percent of the program costs, also were authorized to assist states in tackling this difficult pollution problem

非點源污染治理及每日最大污染負荷量 (TMDL) 管制

Nonpoint-Source Pollution Management and Total Maximum Daily Load (TMDL)



Sources of Impairment by Category from the 1998 Water Quality Survey

FINAL 2004 LIST OF IMPAIRED WATERS IN HAWAII PREPARED UNDER CLEAN WATER ACT §303(d)



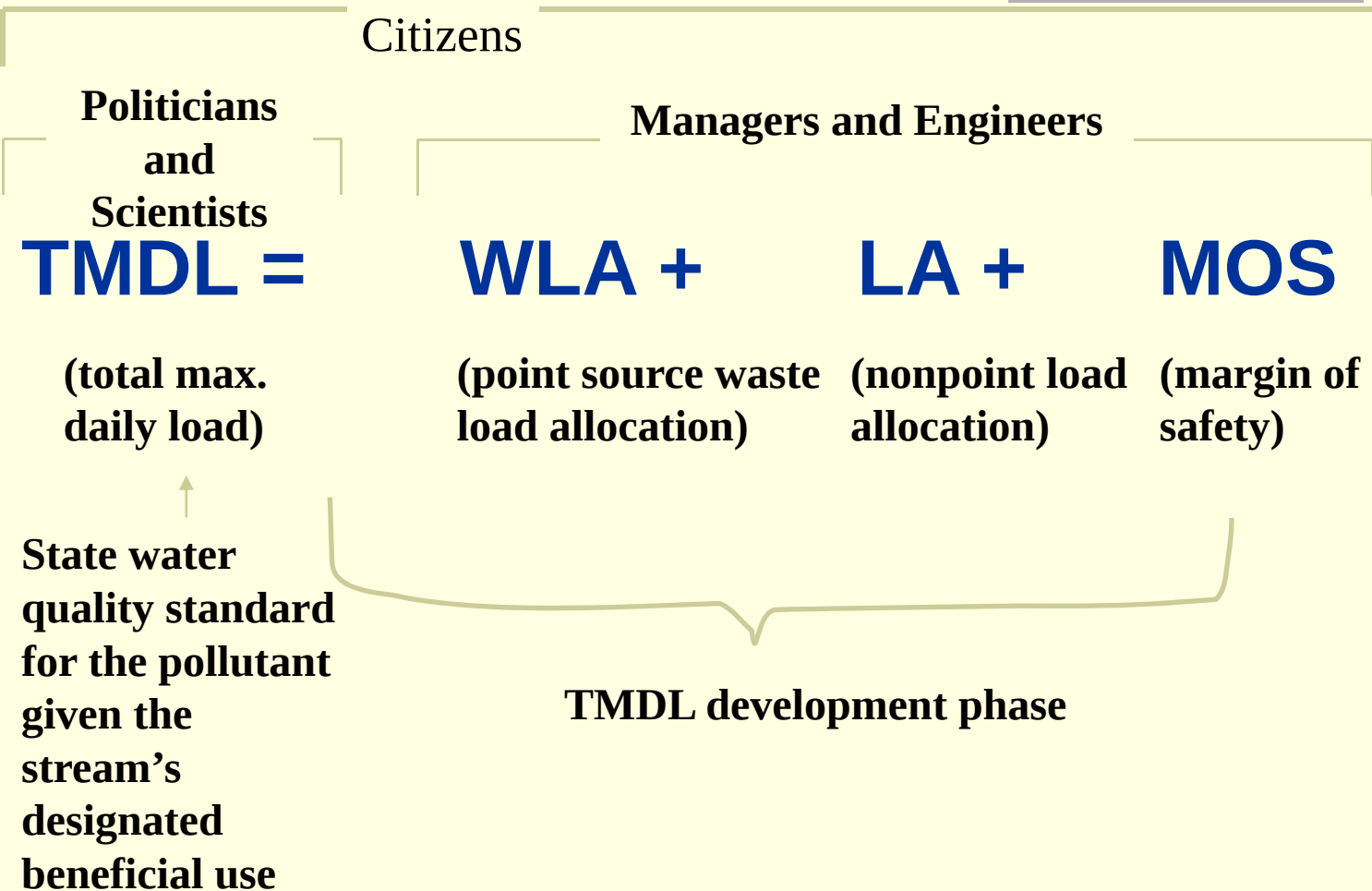
Kaukonahua Stream below Wahiawa Reservoir

Prepared by Linda Koch, June Harrigan-Lum and Katina Henderson
Hawaii State Department of Health
Environmental Planning Office

June 16, 2004

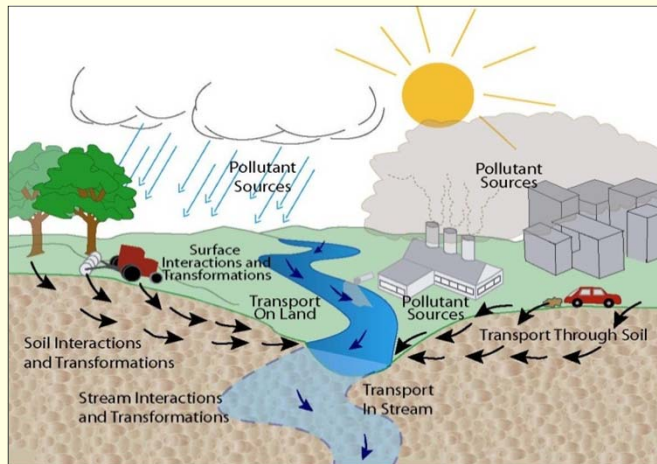
TMDL 的計算公式

EPA TMDL Equation



每日最大污染負荷量管制的執行

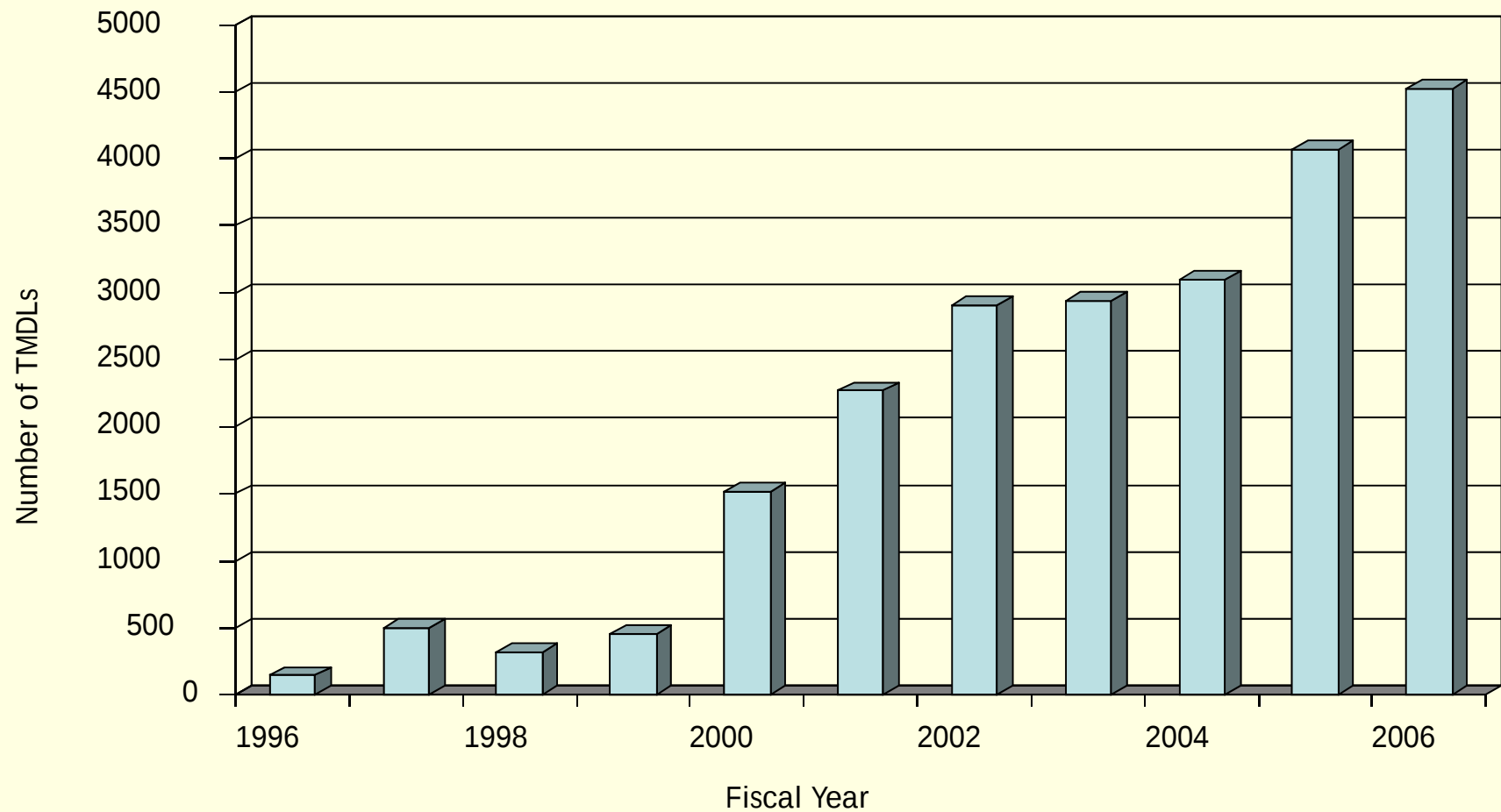
TMDL Implementation



Section 319 of the 1987 legislation, Congress authorized measures to address these diffuse sources of pollution by directing states to develop and implement management programs targeting their major nonpoint sources. Federal grants, covering up to 60 percent of the program costs, also were authorized to assist states in tackling this difficult pollution problem.

全美國已完成的TMDL總數

TMDLs Completed



3. 美國水質管理今後的發展趨勢

The Trend of Water Quality Management in USA

- A. The long-term goal of the elimination of discharge of pollutants is to be kept.
- B. A balance between effluent-based and water-quality-based approaches is to be maintained.
- C. An integrated water quality management plan centered on Section 303 (d) is to developed.
- D. Wastewater reuse and Resources recovery.

A. 持守淨水法案的目標

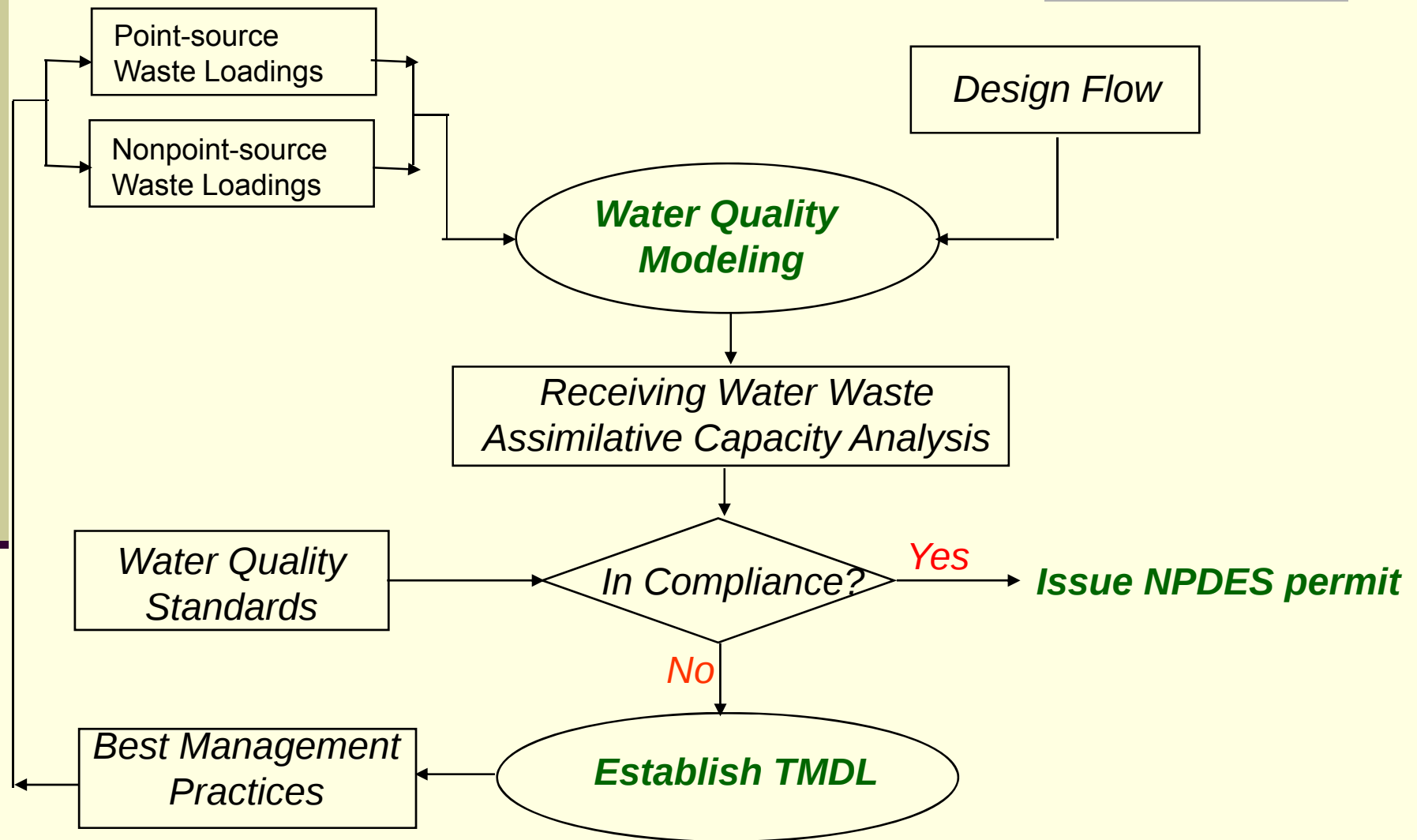
The long-term Goal of the elimination of discharge of pollutants should be kept

Clean Water Act Sec. 101: *“The objective of this Act is to restore and maintain the chemical, physical, and biological integrity of the Nation’s waters.”*



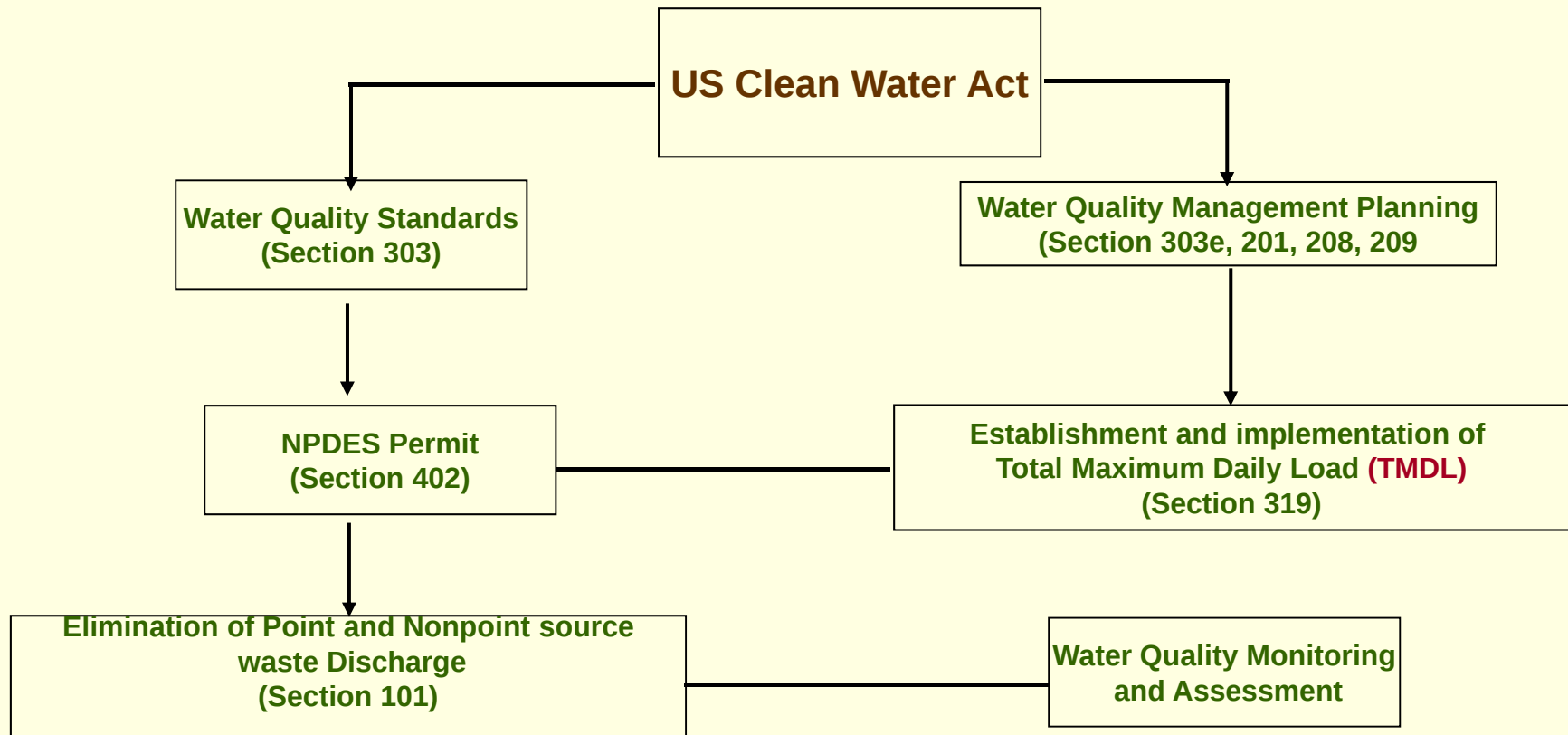
B. 點源和非點源污染的綜合整治

A Integrative Control of Point and Non—point Pollution Control



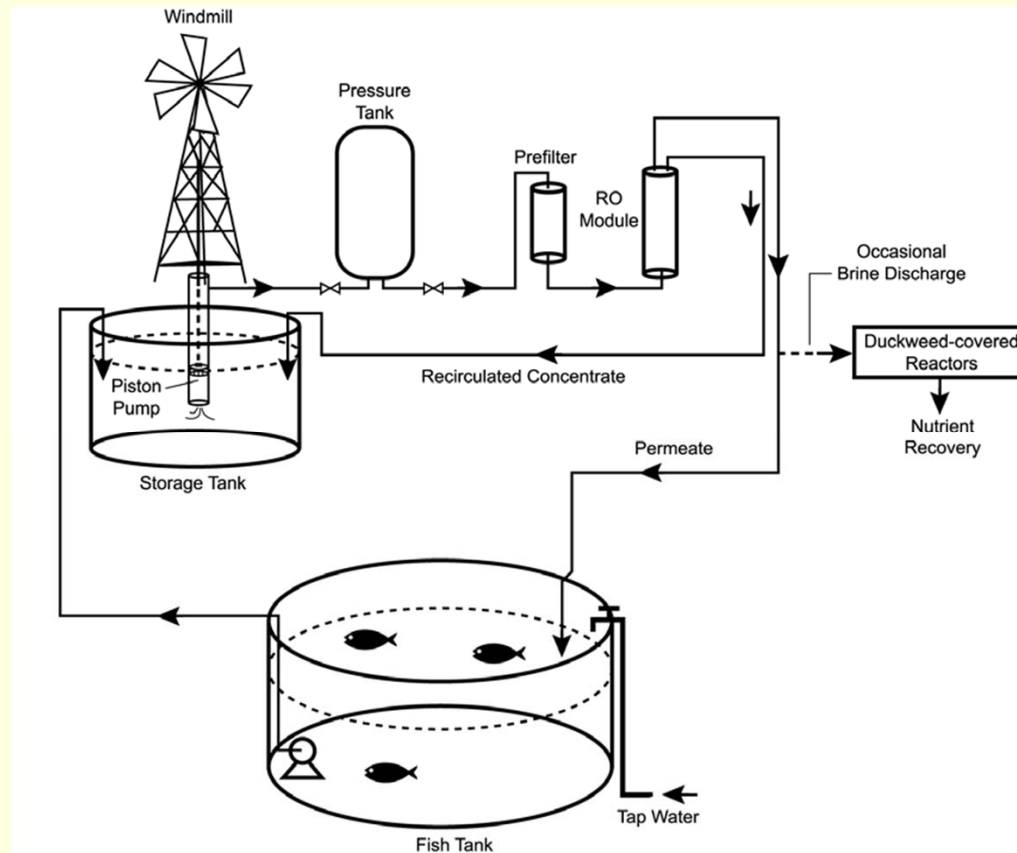
C. 以TMDL中心的水質管理

An integrated water quality management plan centered on TMDL



D. 污水及廢物的回收再用 wastewater reuse and resources recovery

A wind-driving Aquaculture Wastewater Treatment System with Water Reuse and Nutrient Recovery



4. 實例分析和小組討論

Tutorial Session and Group Discussion

