
# Outline of the Aichi Irrigation Project

# Start of the Aichi Irrigation Project


## Local Situation

- Aichi Prefecture's Chita Peninsula lacks water
- Major successive droughts in 1944 and 1947
- Strong local movements for irrigation canals

## National Policy

- Acute postwar food shortages
- Trend for emphasis on land development

# Aichi Prefecture's Chita Peninsula Lacks Water

- No large rivers
- Ensuring agricultural water with storage reservoirs
- Ensuring domestic water with beach wells

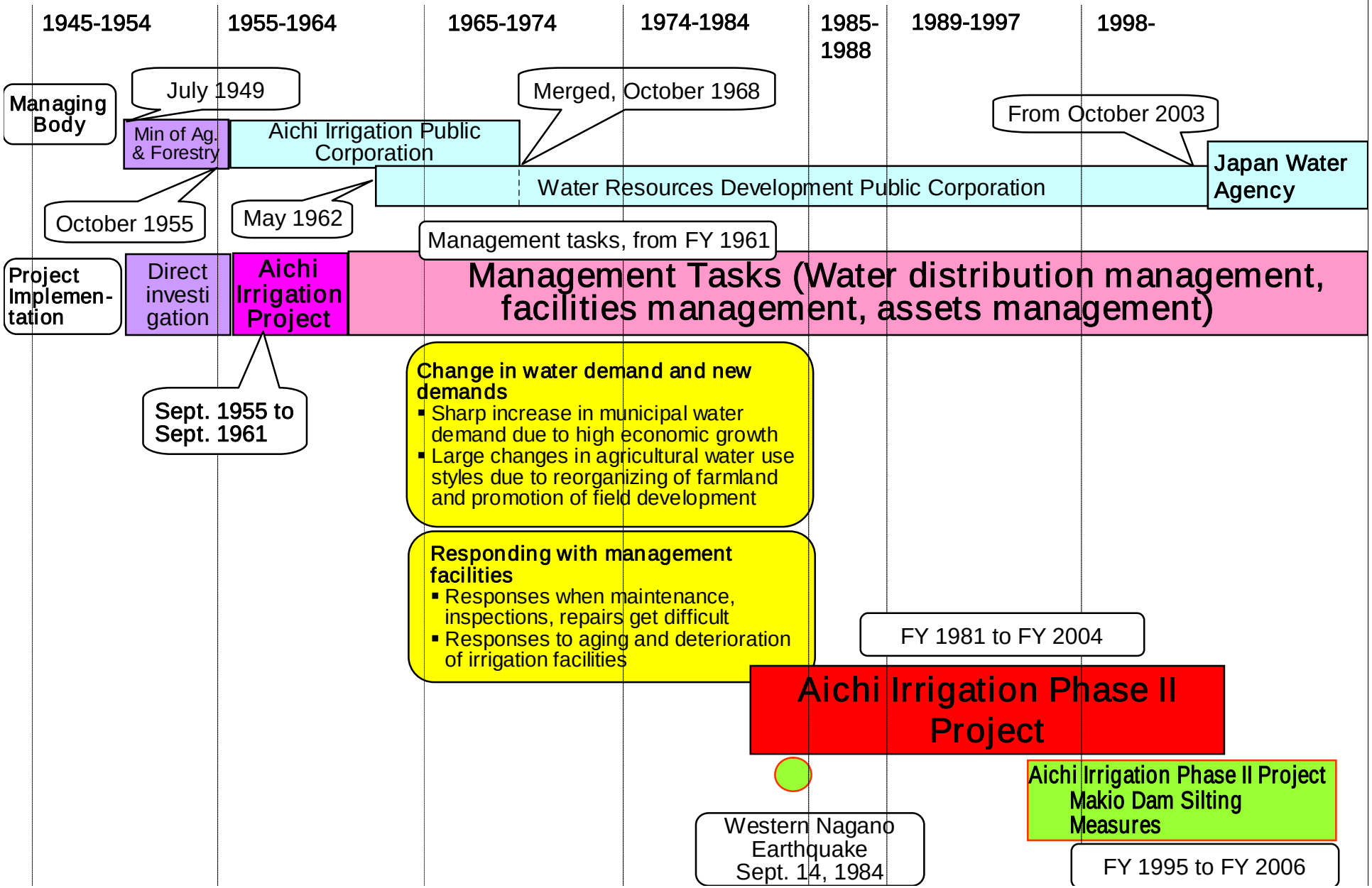
Scooping up groundwater

Housewives carrying water from beach wells

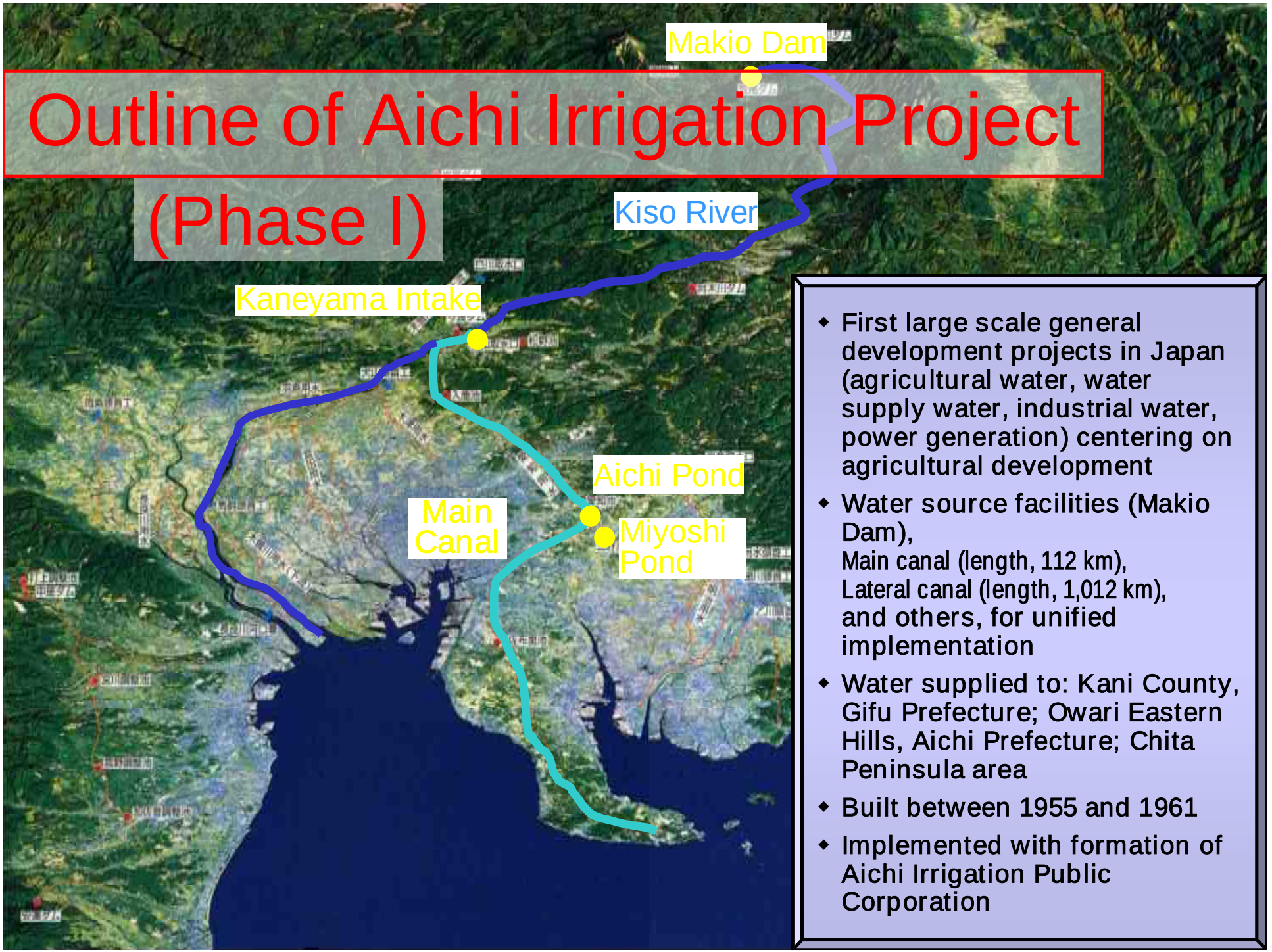
# Strong Local Movements for Irrigation Canals

A passionate explanation meeting to bring about irrigation canals in Aichi

# History of Aichi Irrigation



# Outline of Aichi Irrigation Project (Phase I)




- First large scale general development projects in Japan (agricultural water, water supply water, industrial water, power generation) centering on agricultural development
- Water source facilities (Makio Dam),
  Main canal (length, 112 km),
  Lateral canal (length, 1,012 km),
  and others, for unified implementation
- Water supplied to: Kani County, Gifu Prefecture; Owari Eastern Hills, Aichi Prefecture; Chita Peninsula area
- Built between 1955 and 1961
- Implemented with formation of Aichi Irrigation Public Corporation

# Characteristics of Phase I Project

❶ Brought in foreign capital (World Bank loans)

❷ Establishment of Aichi Irrigation Public Corporation

❸ Active cooperation of related organizations

❹ Unified implementation **(from dams to terminal waterways, canals, and power generation facilities)**

❺ Technical cooperation from U.S. consultants

❻ Totally mechanized implementation

⊙ Project completed in the short time of five years

| | | |
|---|---|---|
| Oct. | 1955 | Aichi Irrigation Public Corporation established |
| Aug. | 1957 | World Bank loan contracts and government guarantee contracts signed |
| Nov. | 1957 | Work starts |
| Sept. | 1961 | Construction work completed/Water starts flowing |

★ Results rapidly apparent

★ Later major contributions to civil engineering techniques

# Construction Work (Makio Dam)

Night rush work

December 1, 1958: Main body begins construction

May 28, 1961: Makio Dam completed

# Construction Work (Open canals)

## Casting thin lining concrete

# Outline of the Aichi Irrigation Phase II Project

# Waterway Areas Being More And More Developed

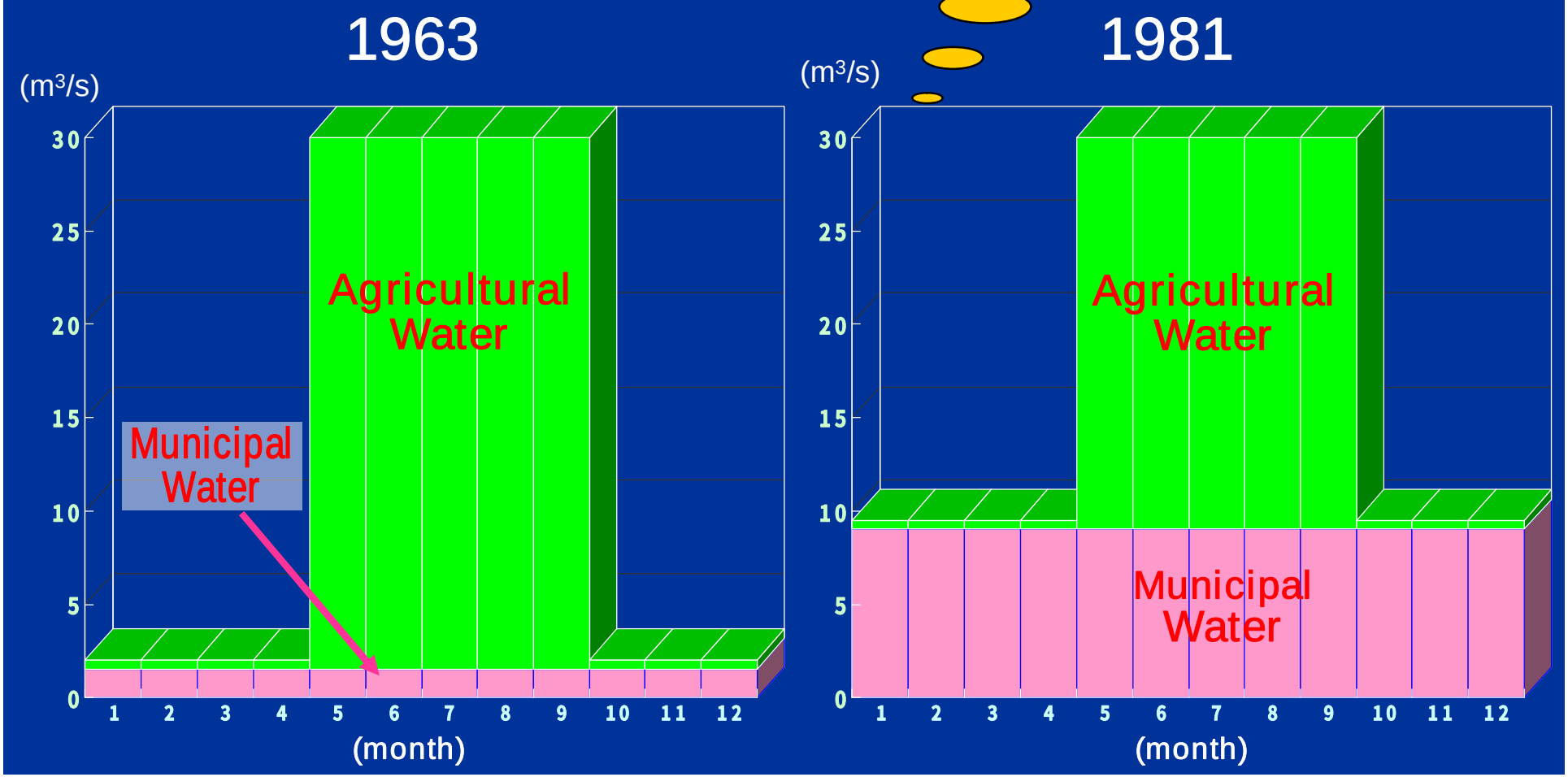
Kasugai City Kozoji New Town

Kozoji

# Sharp Increase in Municipal Water Demands due to High Economic Growth

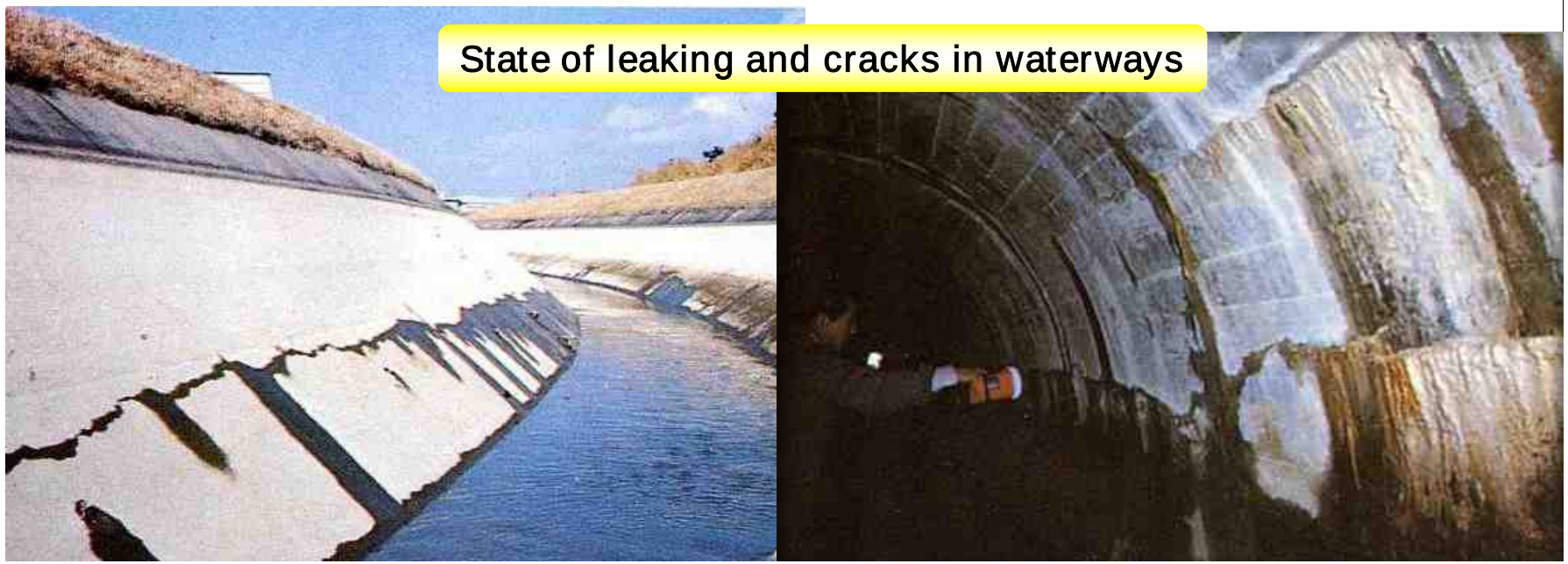
Intake pattern (plan)

Cannot cut off water



# Loss of Durability and Carrying Capability through Aging





# Development into Phase II

## ◇ Changes in water demand and new demands

- Sharp increase in municipal water demands due to high economic growth
- Large changes in agricultural water use styles due to reorganizing of farmland and promotion of field development

## ◇ A wealth of management facilities

- Responses to aging and deterioration of irrigation facilities
- Responses when maintenance, inspections, repairs get difficult

# Work Plan for Phase II

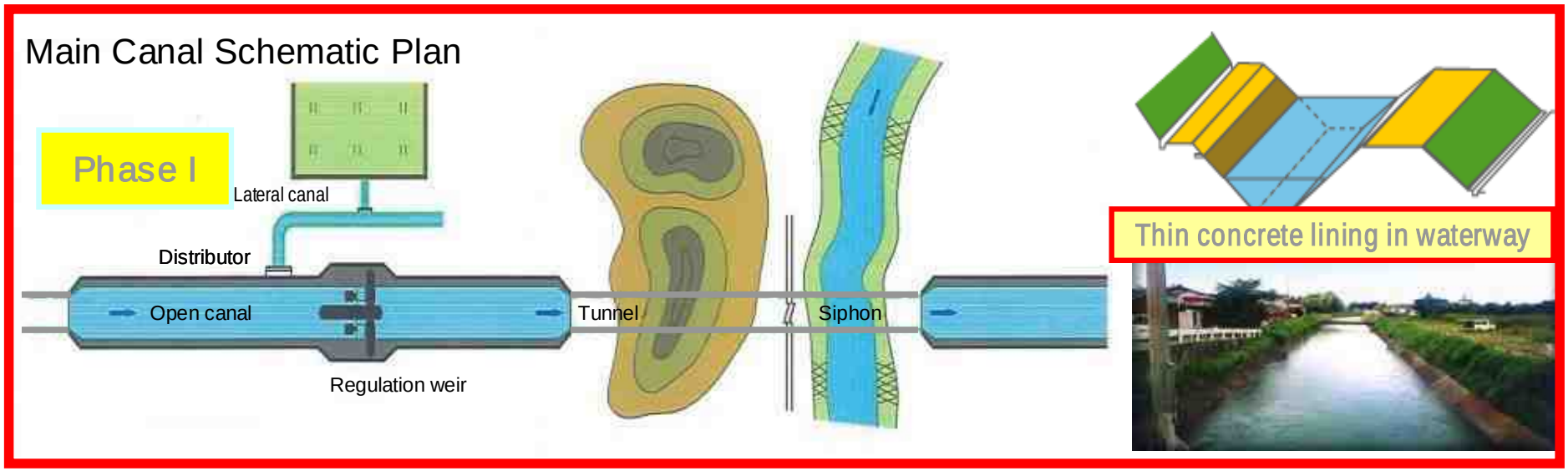
## Reconstruction of Main Canal Facilities, etc. (FY 1981–FY 2004)

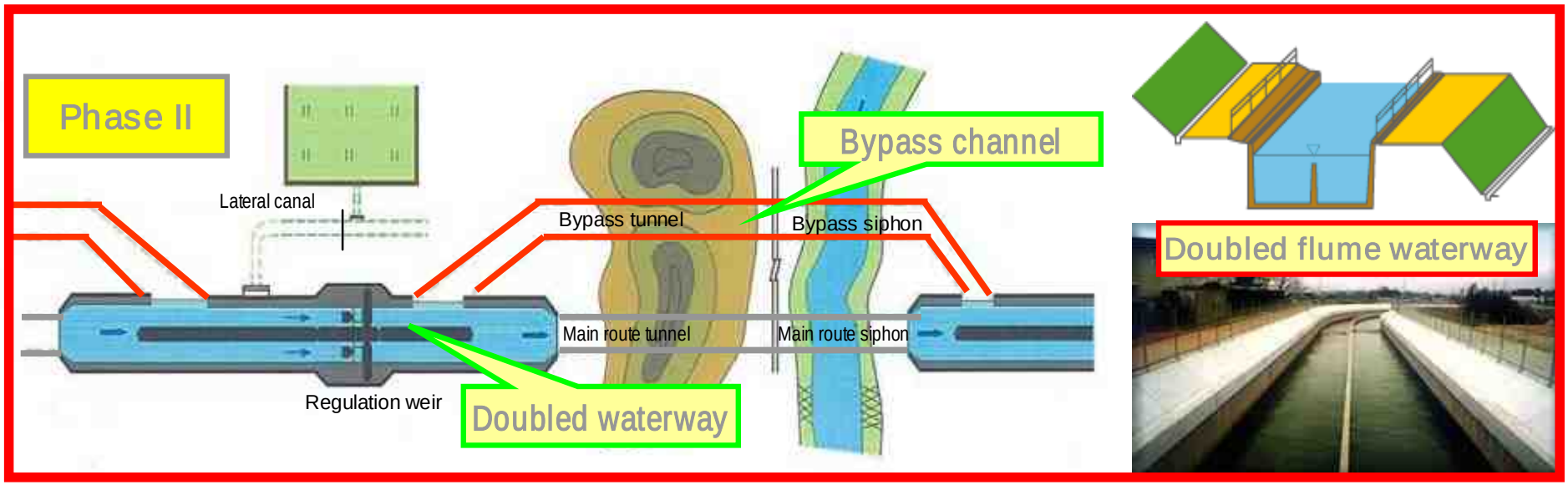
- Doubling of main canals
- Increase of flow capacity
- Modernization of water management facilities
- New terminal balancing reservoir
- Making lateral canals into pipelines

## Makio Dam Silting Measures (FY 1995–FY 2006)

- Silt removal (approx. 5,480,000 $m^3$)

# Doubling of Main Canals (Waterway schematic plan)

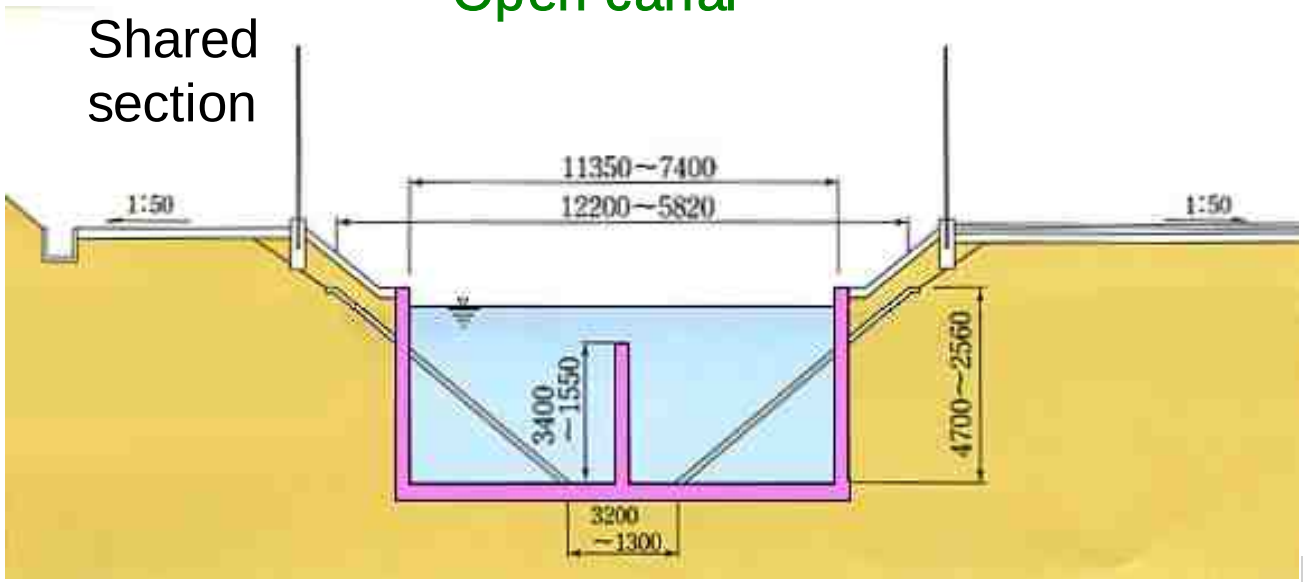


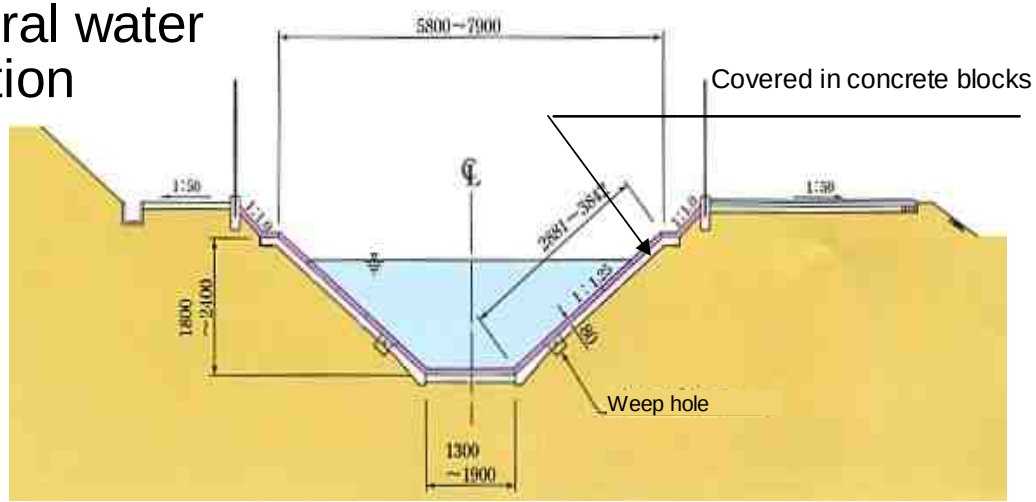
# Doubling of Main Canals (Standard cross-section)

## Open canal

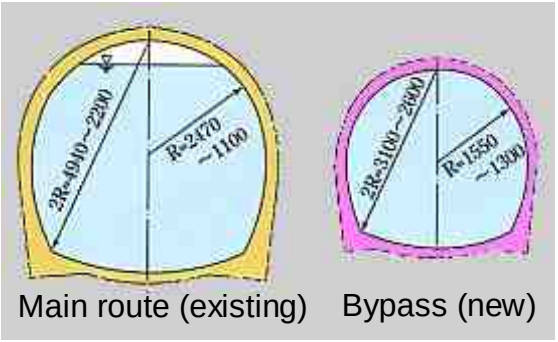
Shared section




Agricultural water only section



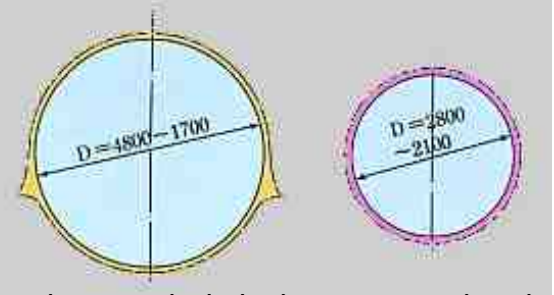

## Tunnel




Main route (existing) Bypass (new)

Full flow in bypass tunnel

## Siphon




Main route (existing) Bypass (new)

# Modernization of Water Management Facilities

## Migration to centralized facilities method

- From management relying on human interaction to introduction of remote monitoring/control and centralized management
- Reduction of time and labor needed for water management
- Early detection of abnormalities and early determination of abnormal locations

## Placing of water management devices

- Remote monitoring and control
  (main intakes, outlet, etc.)
- Remote monitoring
  (trunk flow volume, trunk water levels, check gate open angles, diverted water amount, device status, etc.)

## Management systems and division of labor

- Distributed water management
  From distributed management to centralized management
- Facilities management
  From four distributed management offices to three
  (main canals)

# Modernization of Water Management Facilities

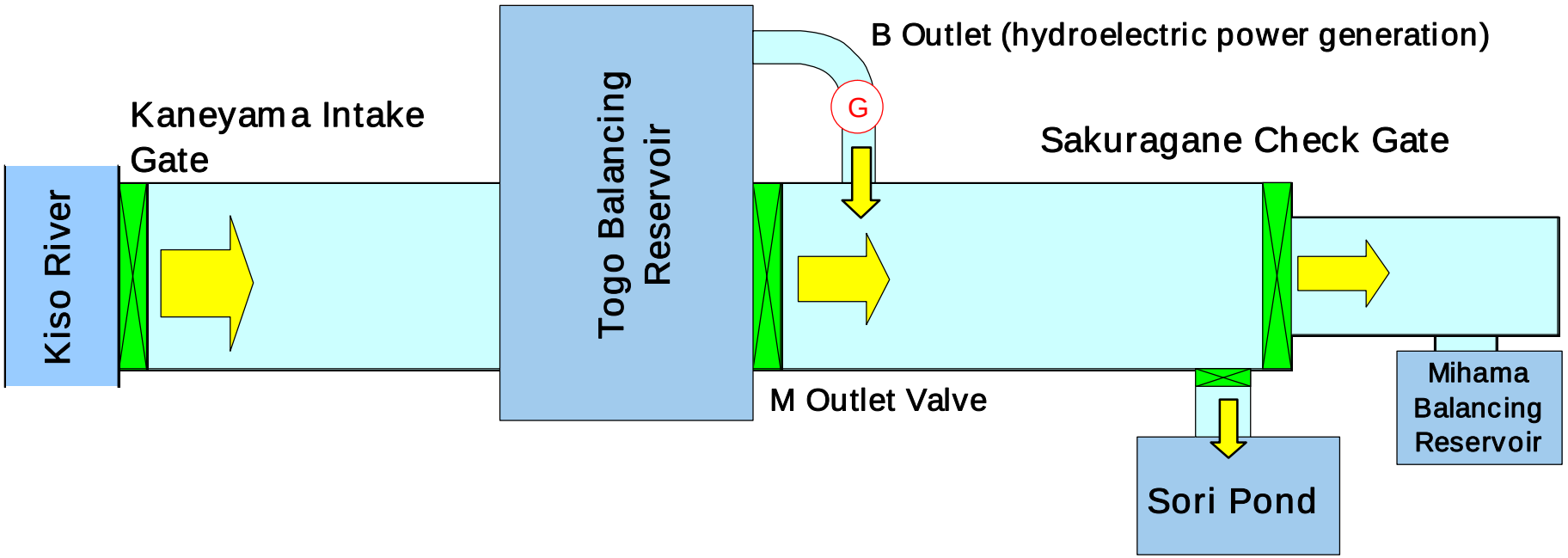
# Remote Monitoring and Control of Principle Facilities

## Main intakes, outlet, etc.

Main facilities deemed necessary to respond immediately to water source status, water demand, weather conditions, and other changes where frequent flow regulation operation is required

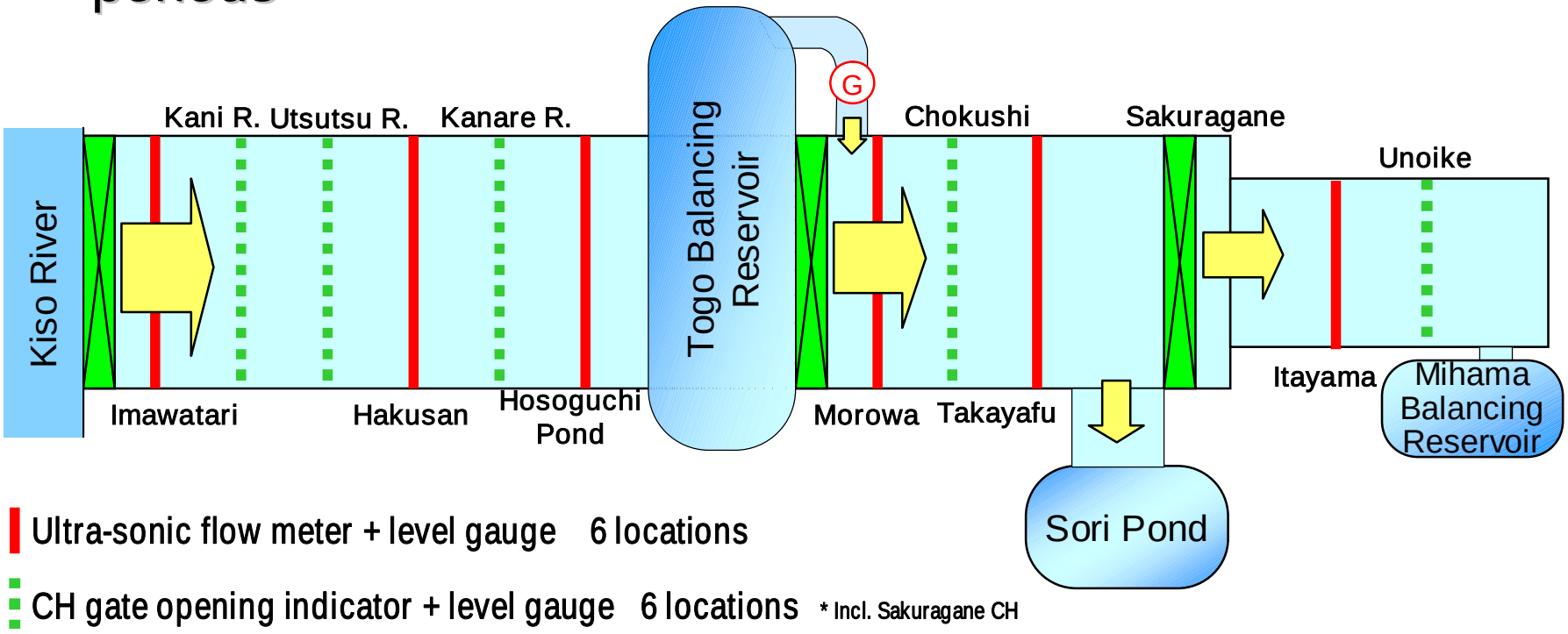
Facilities where emergency operation is required

- Kaneyama Intake Gate
- Togo Balancing Reservoirs M, B Outlet
- Sakuragane CH Gate, Sori Pond Distributor



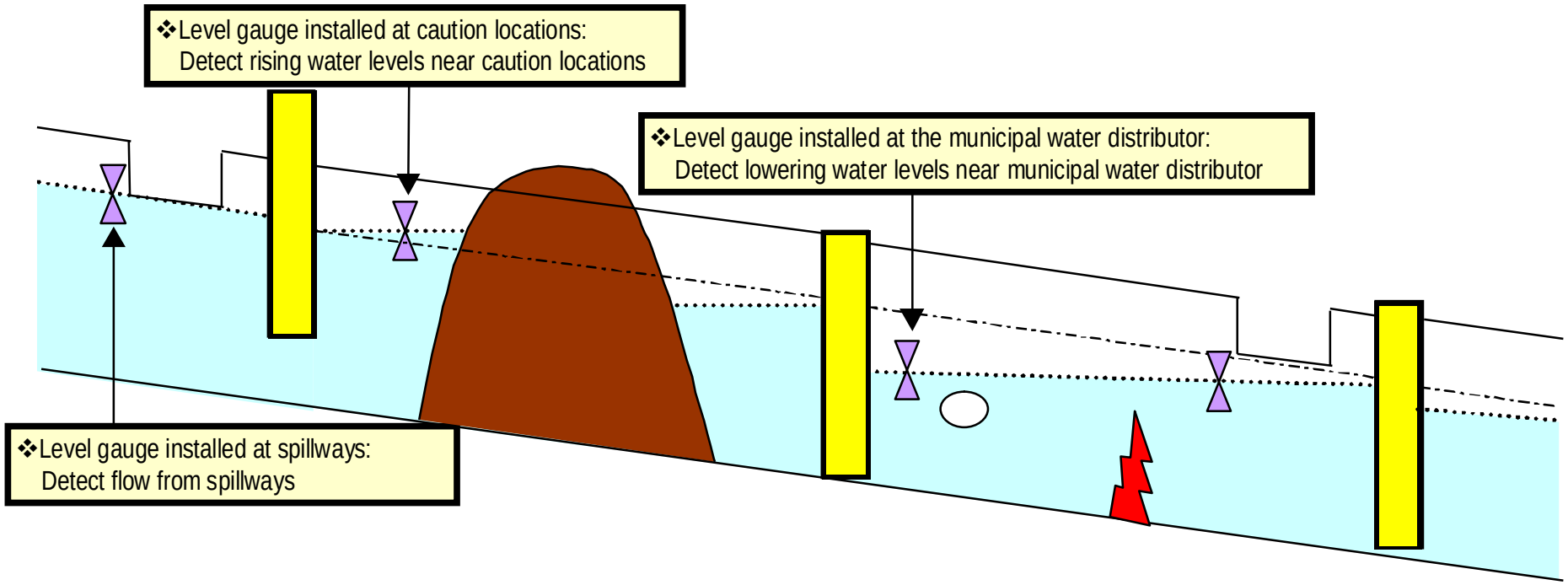
# Remote Monitoring of Trunk Flow Volumes

- Early detection of abnormalities and early determination of abnormal locations
- Check of water arrival when flow volume changes or large volumes are introduced
- Highly accurate water distribution implementation (effective use of water resources)
- Supplementation for flow volume change or device change periods

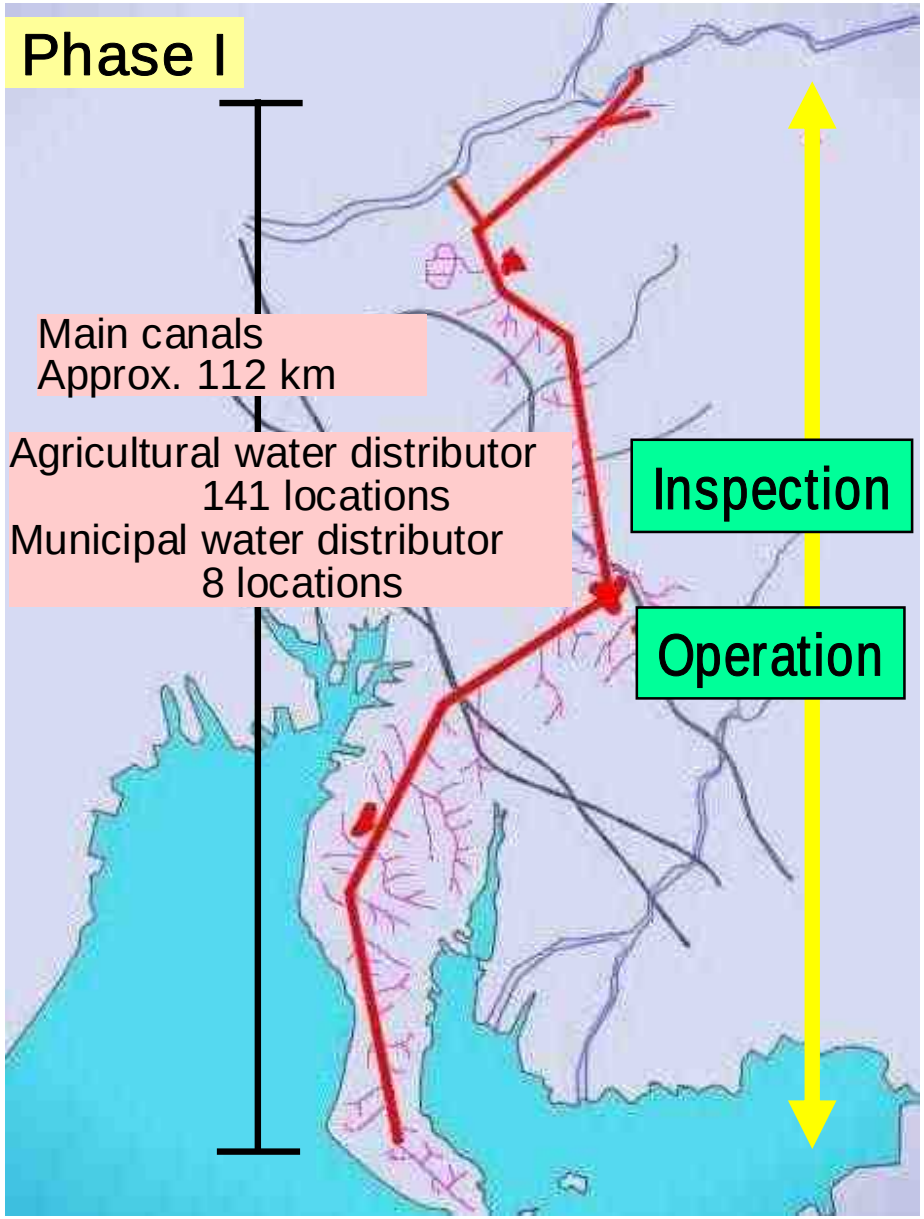


# Remote Monitoring of Trunk Water Levels

- Ensuring appropriate trunk water levels
- Checking water arrival when flow amount changes or floods are introduced (CH lower reaches)
- Early detection of abnormalities and early determination of abnormal locations (locations that need watching)
- Grasping storage volume in main canals (agricultural water use only sections)



# Water Level Adjustment Gates (Check Gates) Non-Motive Automation

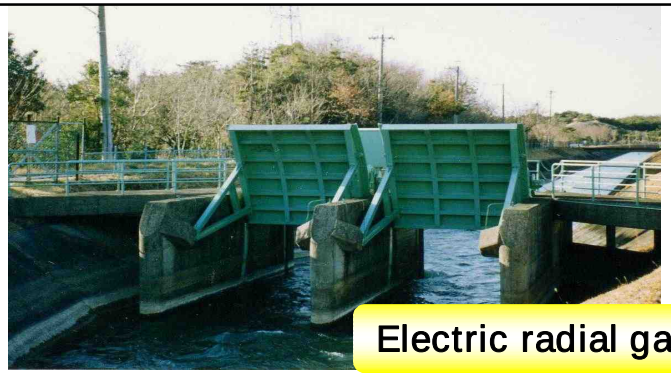



**Phase I**

Maintenance of appropriate trunk water levels and distributor water levels during trunk flow volume change

Of 37 total trunk gates, 18 electric gates are mechanically operated

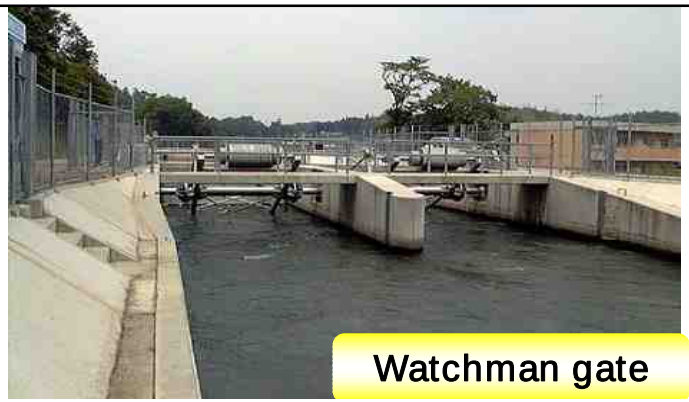
Water management to ensure parallel flow with pilot



Electric radial gate

**Phase II**

14 trunk CH gate locations changed to non-motive automation



Watchman gate

# New Terminal Balancing Reservoir
# (Mihama Balancing Reservoir)


1. Goals of construction

   Along with storing and using the unused water that flows down to the terminus of the Aichi irrigation main canal, it is intended to provide a stable supply of agricultural water downstream from the balancing reservoir during periods when the arrival water volume is low. It is also designed to increase the degree of freedom in water management by making the trunk water flow hold its width by using the empty storage capacity of the balancing reservoir.

2. Balancing reservoir stats

   Stored water volume: Approx. 100,000 $m^3$ (surface area when filled: approx. 2.3 ha)
   Effective water depth: 5 m

Storage of unused water

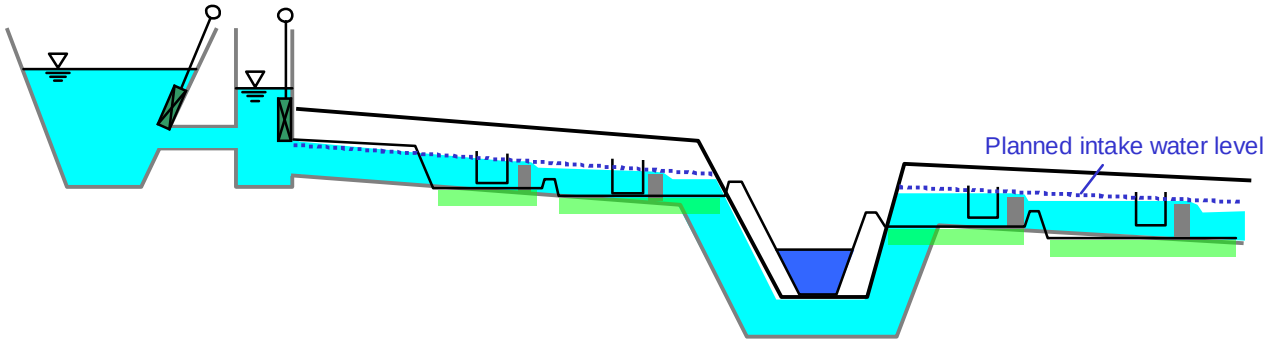
Responses to lack of arrived water volume

→ Effective use of water resources

→ Stable supply

# Making Lateral Canals into Pipelines

**Phase I** (Open-type waterways) Supply initiated waterway

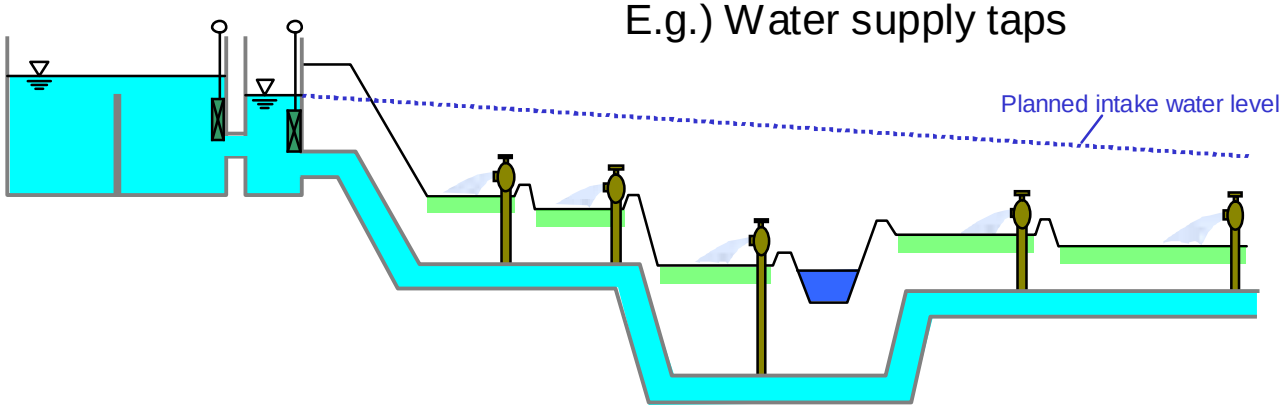



Upstream priority

Assurance of conveyance, improvement of durability
Shortens time for water arrival to fields
Reduces time and labor related to water management and facilities management
Provides a stable supply to fields
Effective use of water resources through reducing unused water, non-arriving water volume, and management water
Reduction of time and labor relating to trunk distributor operation

**Phase II** (Pipe-type waterways) Demand initiated waterway

E.g.) Water supply taps




Lower areas priority

# Makio Dam Silting Measures

The massive amount of silt that flowed into the dam lake as a result of the Western Nagano Earthquake (Sept. 1984) was removed, and the reservoir functions restored.

# New Responses with Phase II Project

| Phase I Issues | Phase II Responses |
| --- | --- |
| Maintenance inspections in non-suspension water was difficult | Doubling of main canals |
| Flow management and distribution management required time and labor | Non-motive automation of water level regulation gates |
| Early detection of flow status/distribution status and abnormalities was difficult | Introduction of remote monitoring and control |
| Response to agricultural water with its highly variable demands (in particular, the agricultural water only section downstream from the Sakuragane CH) | Reinforced use of existing waterways (assurance of storage capacity) Addition of downstream water level catchup functions to check gates and storage functions |
| Occurrence of unused water at the trunk terminal and response to lack of arrival water amount | New terminal balancing reservoir |
| Water management of lateral canals | Making lateral canals into pipelines |

# Main Effects of the Phase II Project

## ◆ Responses in Phase II

- Non-motive automation of water level regulating weirs
- Making lateral canals into pipelines
- Introduction of a remote monitoring and control system

- Increase of conveyance ability
- Doubling of main canals

- New terminal balancing reservoir

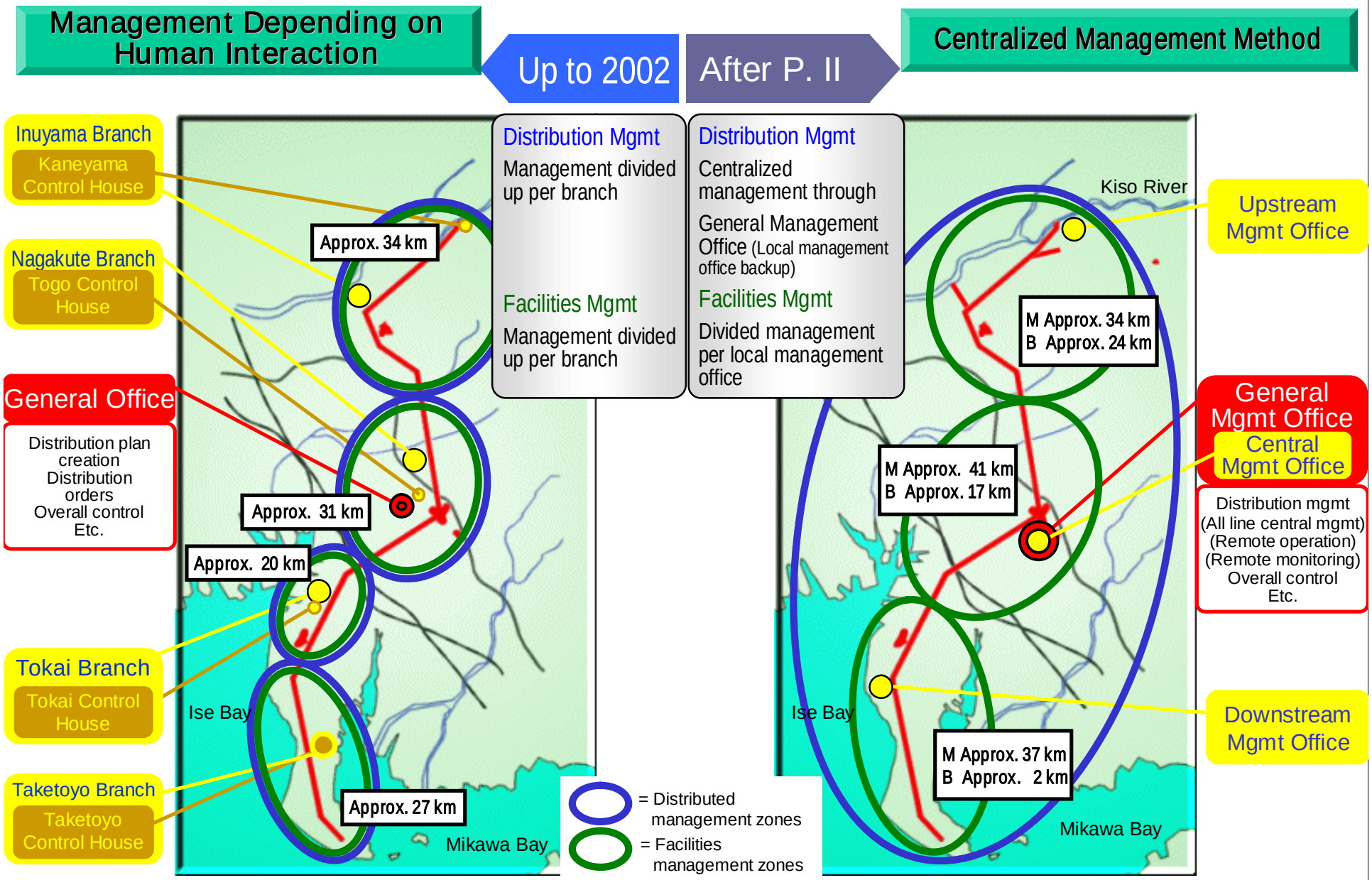
## ◇ Effects

- Work efficiency and reduction of labor through unified centralization of management allowed a reduction in the management staff

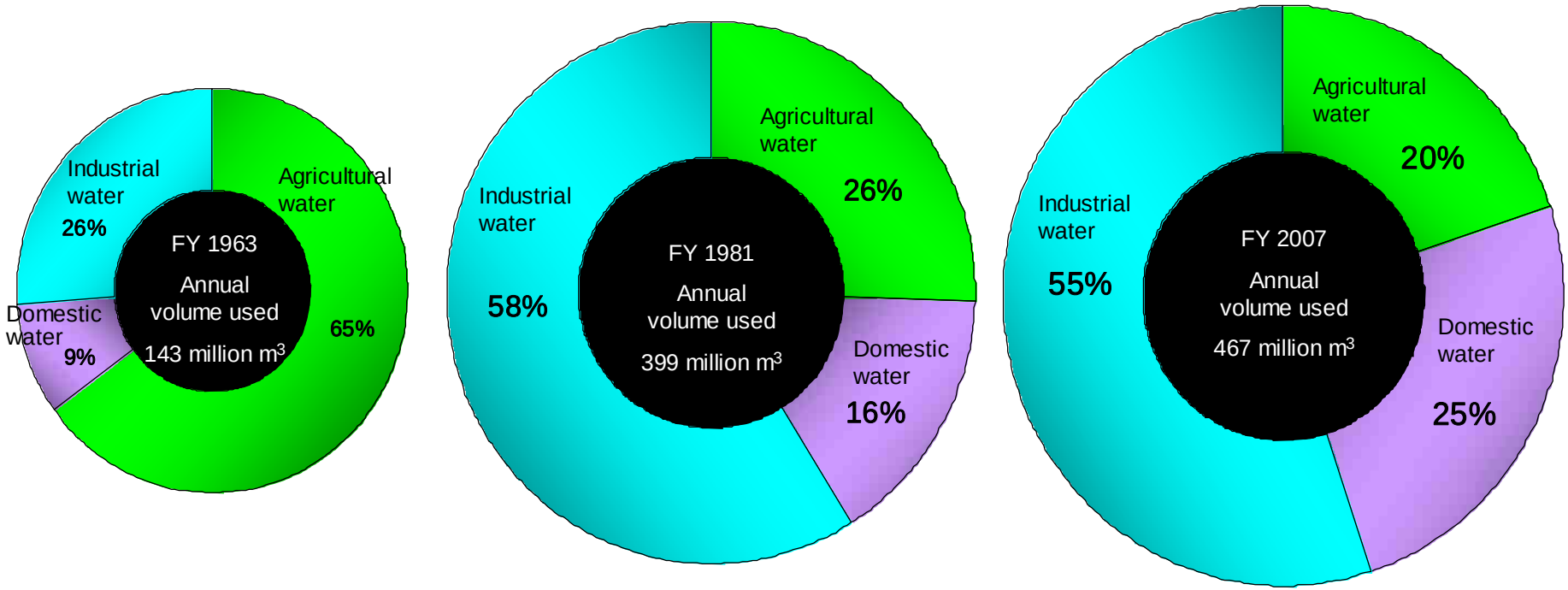
- Responding to changes in water demand, and contributing greatly to local development
- Made it possible for maintenance inspection by using single-sided flow
- Extending the life of facilities through preventive maintenance measures

- Non-effective outflow suppressed

# Unified Centralized Management



# Changes of Water Use




Annual volume used FY 2007: Approx. 470,000,000 m³
(Approx. 376 times the volume of the Nagoya Dome)

The volume is more than triple that of FY 1963

The weight has shifted from agricultural water to municipal water
(agricultural water 1/5; municipal water 4/5)

# Effects of the Project

## Agricultural water

Agricultural gross value
FY 2003: Approx. 67 billion yen

## Domestic water

Population served by piped water
FY 2005: Approx. 1,130,000

## Industrial water

Produced article shipment total
FY 2003: Approx. 3.4 trillion yen

| Agricultural gross value | (millions of yen) |
|---|---|
| Division | Related municipalities |
| FY 1963 (A) | 25,566 |
| FY 2003 (B) | 67,013 |
| Ratio (B/A) | 2.62 |

| Population served by waterworks | (thousands of people) |
|---|---|
| Division | Population served by piped water |
| FY 1963 (A) | 195 |
| FY 2005 (B) | 1,130 |
| Ratio (B/A) | 5.79 |

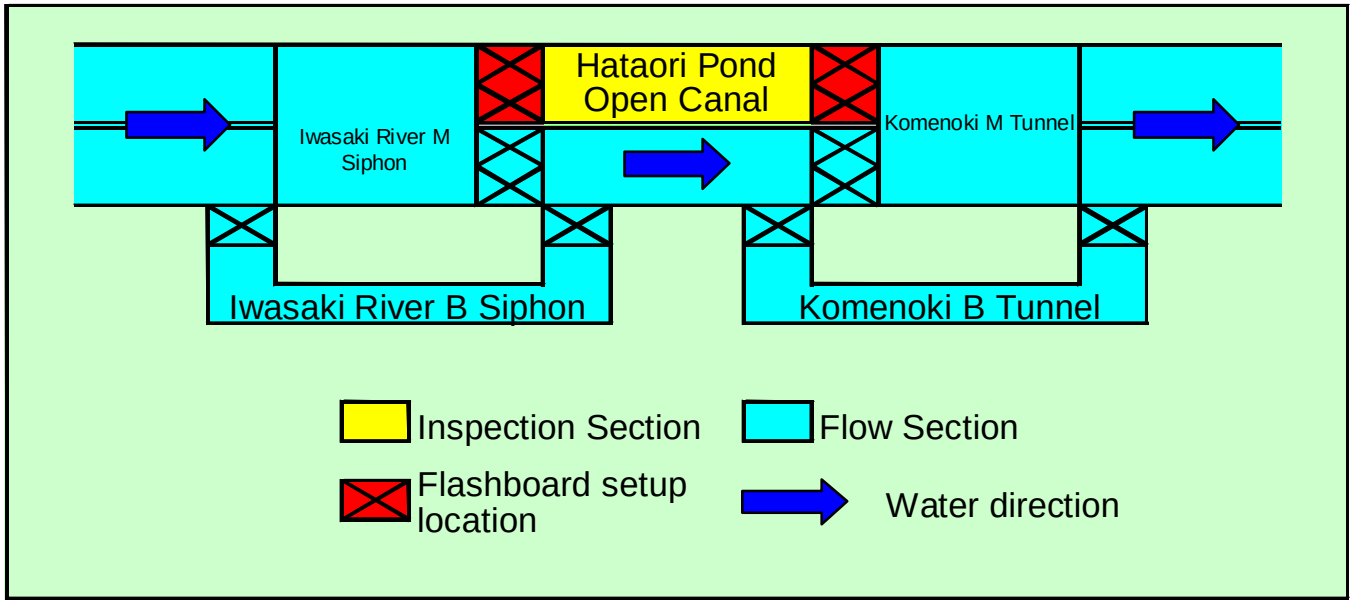
* Includes Gifu Pref. Tono area

| Produced article shipment amount etc. total | (hundred billions of yen) |
|---|---|
| Division | Related municipalities |
| FY 1963 (A) | 3,259 |
| FY 2003 (B) | 34,382 |
| Ratio (B/A) | 10.55 |

* 76 offices

# Maintenance Inspections in Non-Suspension Water

Empty water image



# Maintenance Inspection

## (1) Cleaning inside the waterways, removal of sediment from the waterways

Cleaning

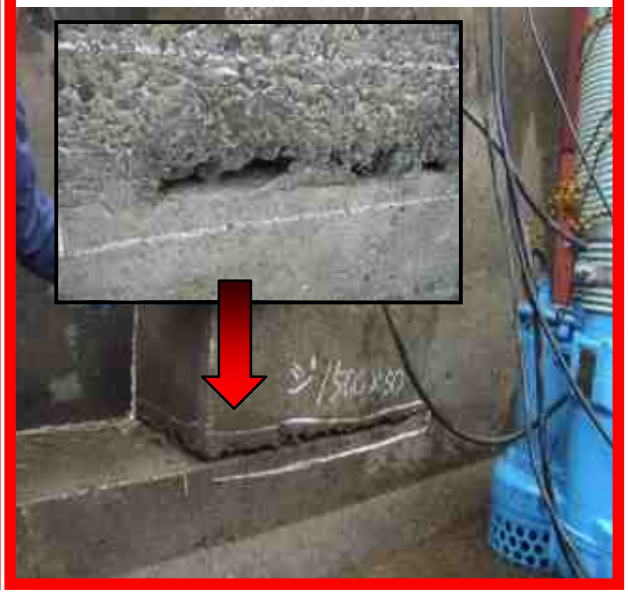
Silted sediment

Removal of silt and sediment

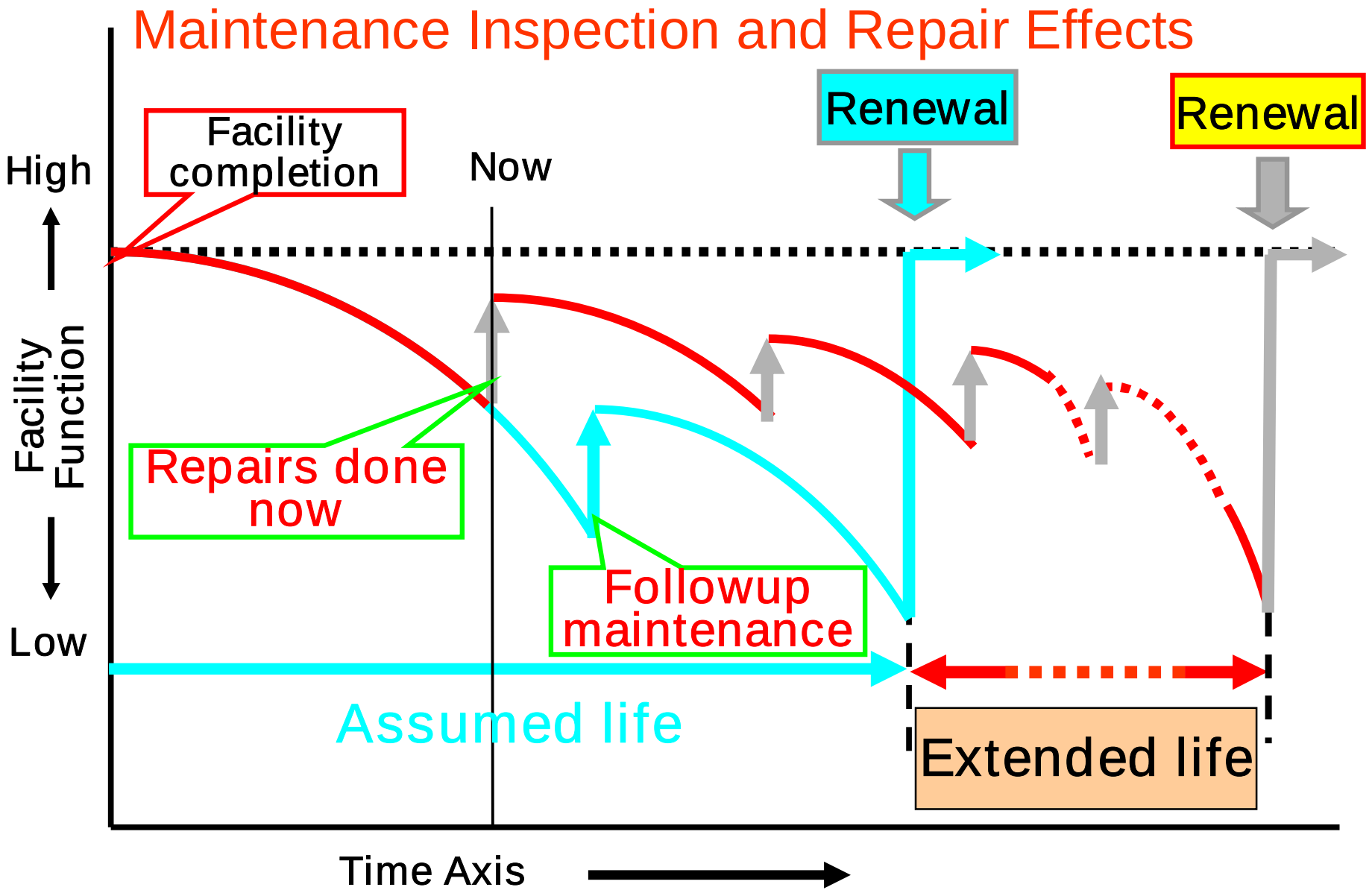
# (2) Inspection and maintenance work in the waterways

Inspection

Junker



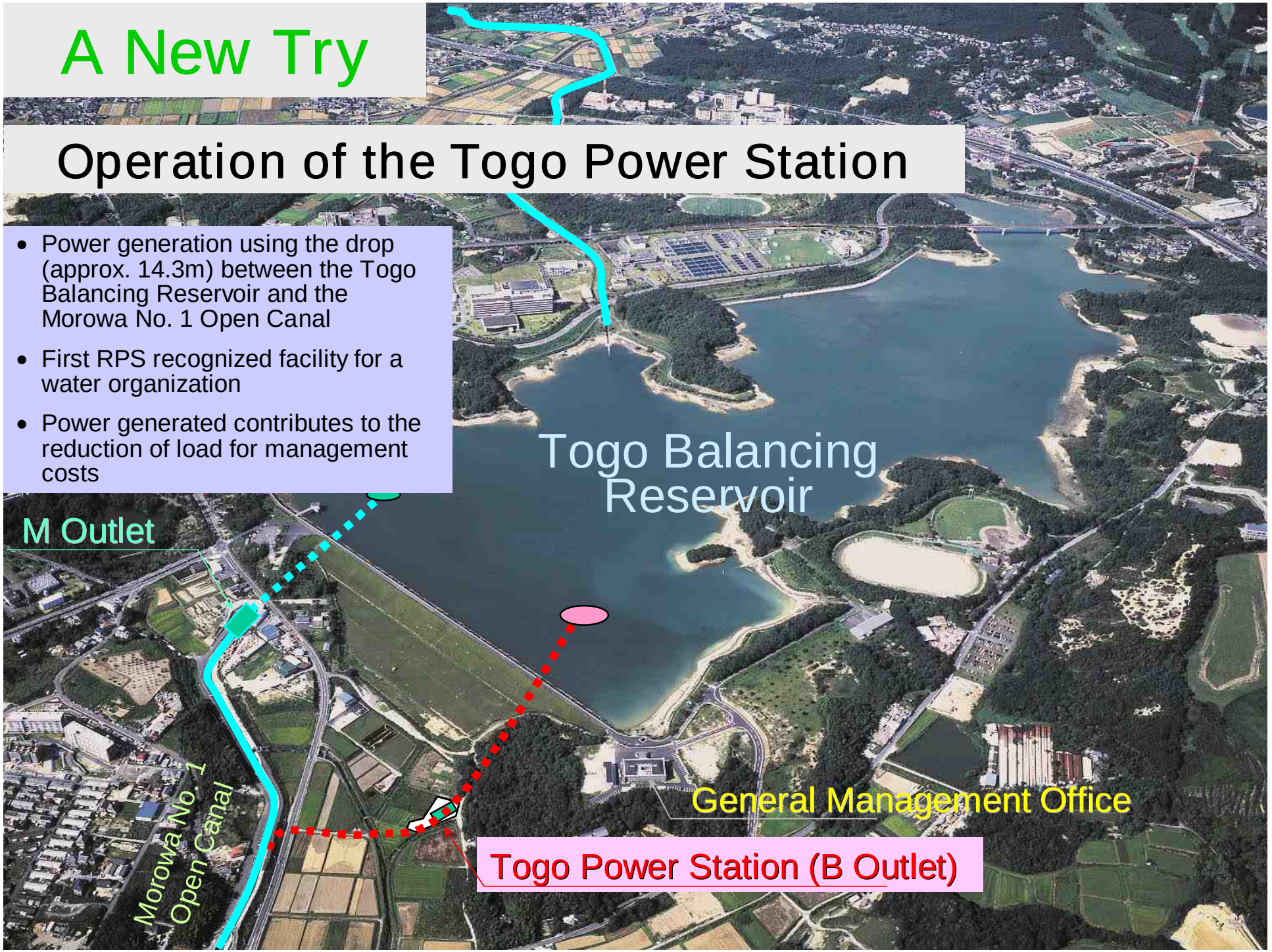
Repairing


Maintenance Inspection and Repair Effects
Facility completion
Now
Renewal
Renewal
High
Facility Function
Low
Repairs done now
Followup maintenance
Assumed life
Extended life
Time Axis

# A New Try

## Operation of the Togo Power Station

- Power generation using the drop (approx. 14.3m) between the Togo Balancing Reservoir and the Morowa No. 1 Open Canal
- First RPS recognized facility for a water organization
- Power generated contributes to the reduction of load for management costs



# Large-Scale Solar Power Generation System in Aichi Pond

# Aichi Pond Large-Scale Solar Power Generation System

**Part of the "FY 2007 Global Warming Prevention Technology Development Program" (Ministry of the Environment)**

## ● Goal of Technical Development

With the aim of putting the large-scale solar power generation system that uses the surface of water into practical use, the Japan Water Agency is carrying out the following technical developments:

**(1) Increasing the energy efficiency through cooling the solar cells**

**(2) Reducing the costs of the floats the solar cells are on**

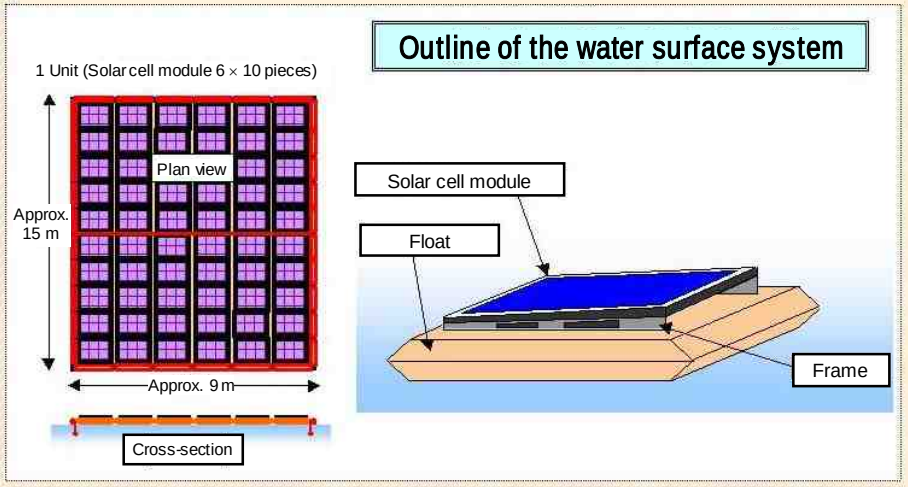
Solar cells are generally believed to drop 0.5% in energy production efficiency with every 1 degree rise in temperature, with 25°C being standard.


## ● Solar Power Generation System (30 kW)

### <Water Surface>

**10 kW × 2 units (on water surface)**

Air-cooled: Solar cells are cooled by wind on the water surface
Air-cooled + water-cooled: Solar cells are cooled with sprinklers using the pond water
(Water is sprinkled for one minute every ten minutes)




### <Land>

**10 kW × 1 unit (facing south, angled at 30°, 20 m × 4 m)**

## ● Implementation Period

**FY 2007– FY 2008 (scheduled)** **Start of power generation: August 2007**

(The facility is scheduled to be enlarged in FY 2008)

## ● Effects on Global Warming Prevention

**The 30 kW solar power generation system produces the equivalent of enough electricity to run eight typical households for a year (approx. 30,000 kWh).**

*** The effects of this global warming prevention measure are…**

**Q : What does this come to when converted into the amount of carbon dioxide prevented?**

**A: It comes to the equivalent of 21 tons a year (about ten years of output for a typical person in a household)**

**Q : What does this come to when converted to forest area?**

**A: It has the same function as approx. 6 ha of forest area**

* This technical development is being carried out jointly between the Japan Water Agency and Kureha Engineering Co. Ltd.


● ● Inquiries ● ●
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愛知用水
Thank you for your attention