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JOINT RESEARCH PROJECT between U of Peradeniya and NSC

Approach for Improving Water Quality in Sanaru Lake

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Water and Environmental Consultants

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Water and Environmental Consultants

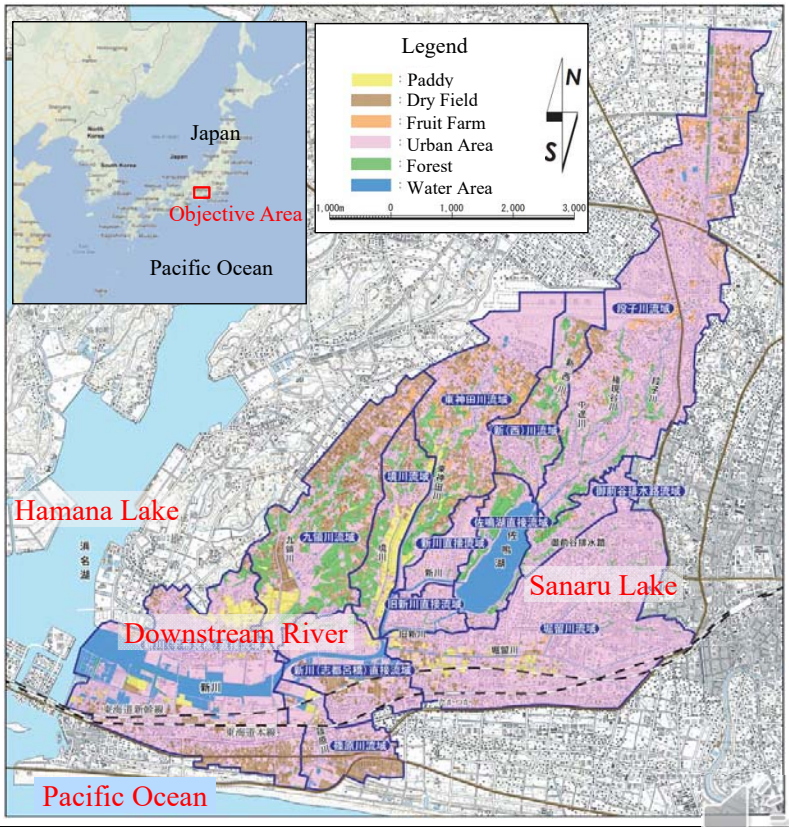
1. Introduction

Feature of the Lake

- Shizuoka prefecture, upstream of Hamana Lake
- Brackish-water lake
- Salt water flow into the Lake through the downstream river from Hamana Lake, Pacific Ocean
- Lake area ; 1.2km^2
- Lake depth ; 2.5m(deepest point)
- Downstream river length ; 6km

Feature of the Basin in 2007

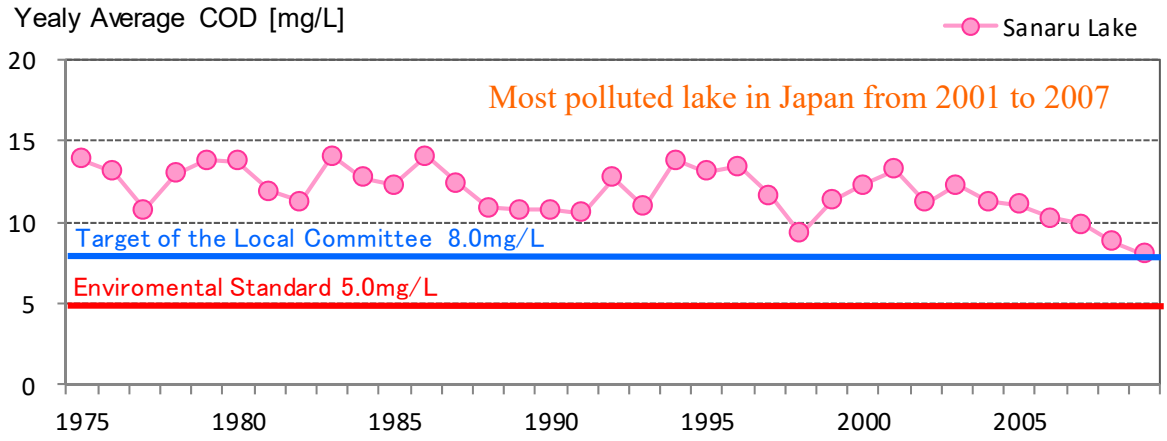
- Basin area ; 58km^2
- Urban area ; 40km^2 (70%)
- Population ; 164,400 people
- Sewage coverage ; 90%



1. Introduction

Water Quality in Sanaru Lake

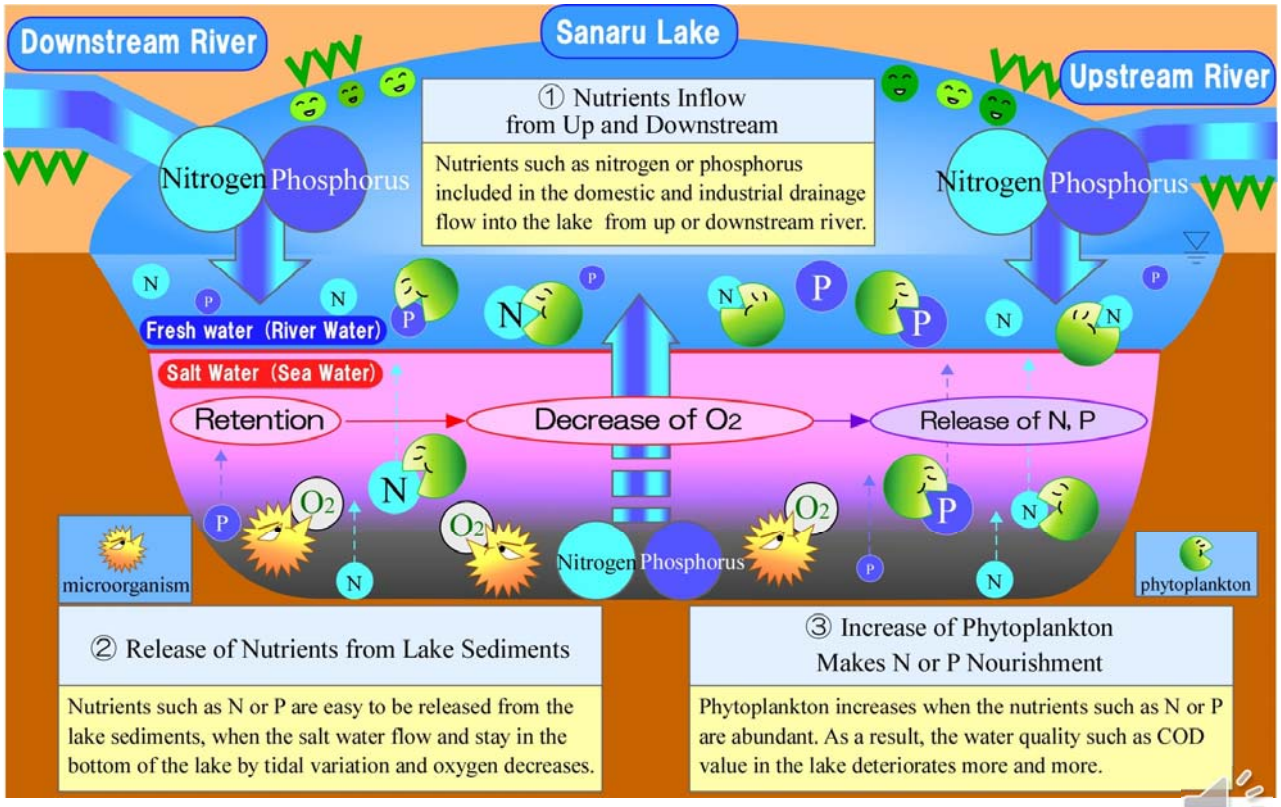
The water quality had deteriorated from the 1960s, because of the rapid urbanization and industrialization in the watershed.



Purpose of Study

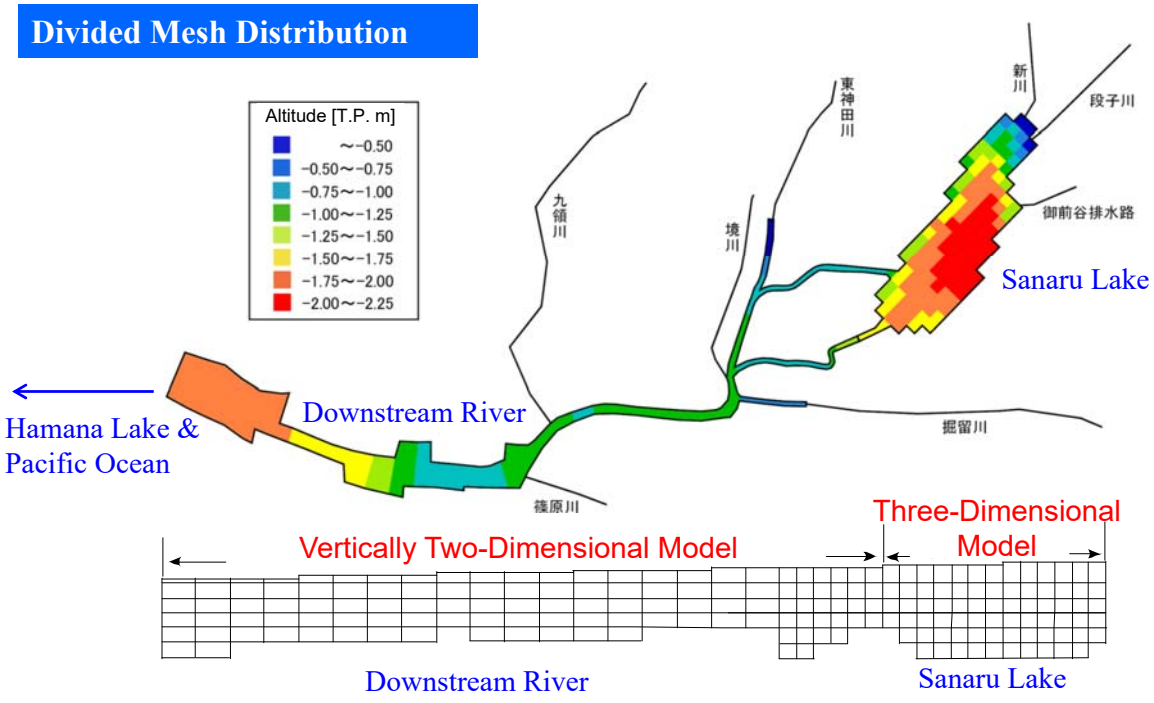
To figure out the feature of water pollution, and evaluate the effect of purification measures by developing and applying the simulation model based on the feature of water pollution in Sanaru lake.

2. Feature of Water Pollution based on Monitoring



3. Water Quality Simulation Model

Divided Mesh Distribution



This NSC original model can calculate the complicated feature of the water quality in brackish or closed water body with accuracy.

3. Water Quality Simulation Model

Hydraulic Model

Equation for Continuity

- Vertical flow velocity
- Water level (water volume)

Equation for Conservation of Momentum

- Horizontal flow velocity

Equation for Shear Stress

- Bottom layer
- Water surface by wind

Equation for Density

Water Quality Model

Equation for Salinity Balance

- Advection and diffusion

Equation for Temperature Balance

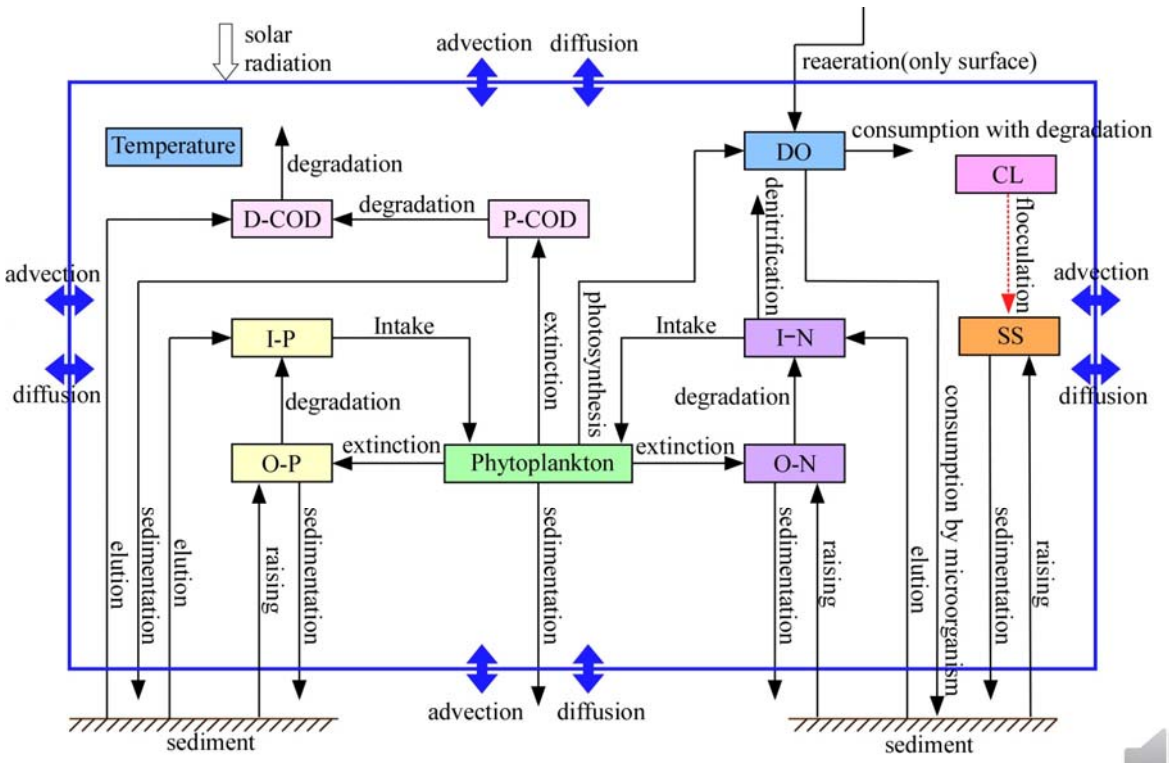
- Advection and diffusion
- Sunshine and heat loss in water surface

Equation for Ecological Model

- Advection and diffusion
- Chl-a (Phytoplankton)
- DO
- COD (Dissolved and Particulate)
- Nitrogen and Phosphorus (Inorganic and Organic)

3. Water Quality Simulation Model

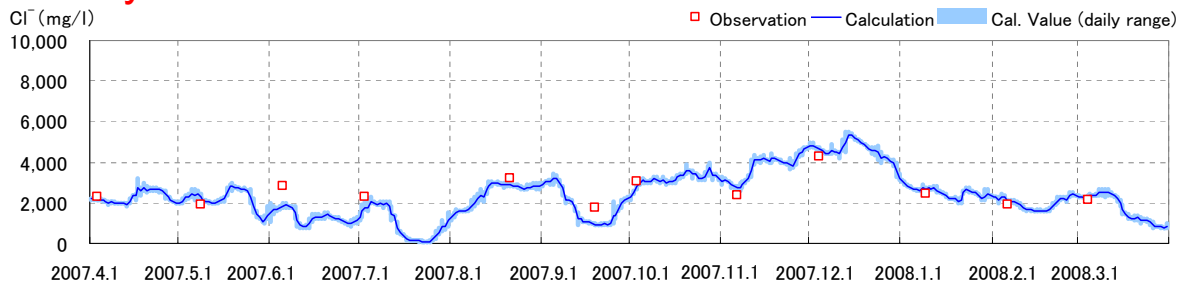
Ecological Model



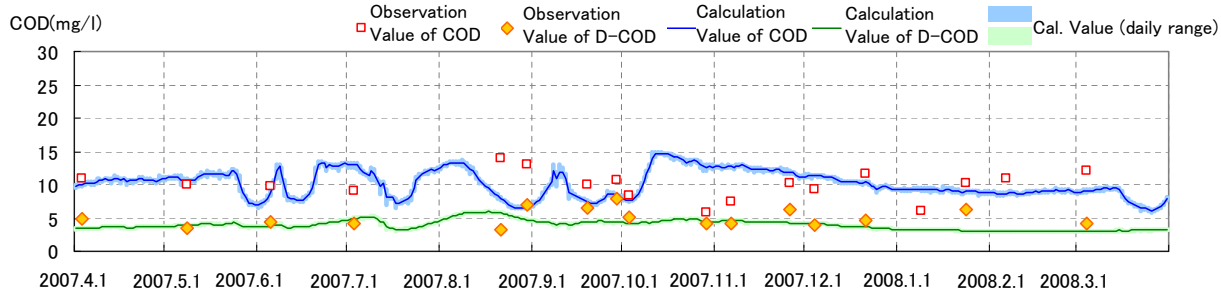
3. Water Quality Simulation Model

Model Reliability

Salinity



COD



4. Evaluation of Purification Measures

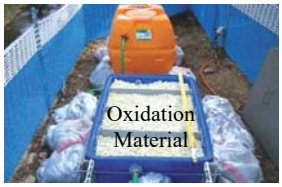
Purification Measures

In the River or Lake

Dredging in River

Improvement of Purification Facility in Lake

Nitrogen Removal in Upper Stream



In the Watershed

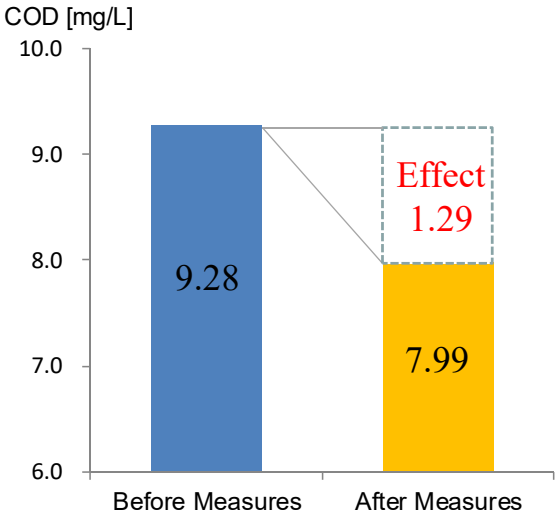
Improvement and Connection to Sewerage in Domestic Drainage

Installation of Advanced Domestic Wastewater Treatment Tank

Connection to Sewerage in Industrial Drainage

4. Evaluation of Purification Measures

Effect of Purification Measures by Applying the Model



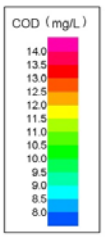
- Yearly average COD value in Sanaru lake became under 8.0mg/L in 2007 condition by carrying out the all purification measures.

Measure	Effect
Dredging in River	0.37 mg/L
Improvement of Purification Facility in Lake	0.02 mg/L
Nitrogen Removal in Upper Stream	0.11 mg/L
Subtotal In the River or Lake	0.50 mg/L
Improvement and Connection to Sewerage in Domestic Drainage	0.66 mg/L
Connection to Sewerage in Industrial Drainage	0.10 mg/L
Installation of Advanced Domestic Wastewater Treatment Tank	0.03 mg/L
Subtotal In the Watershed	0.79 mg/L
Total	1.29 mg/L

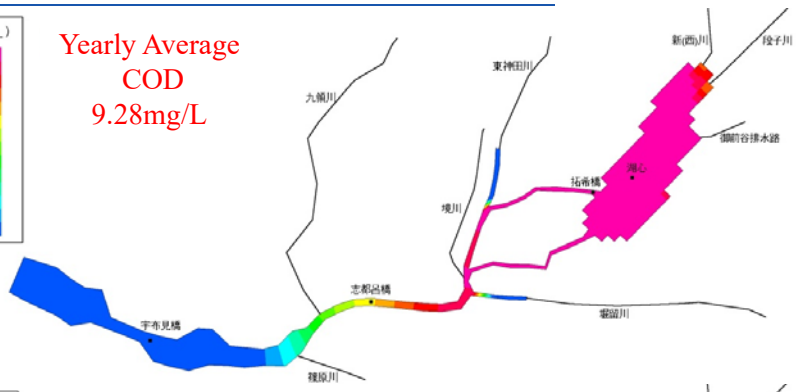
4. Evaluation of Purification Measures

Before Measures

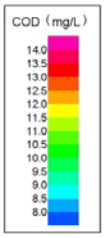
Existing Situation in 2007



Yearly Average COD 9.28mg/L



After Measures



Yearly Average COD 7.99mg/L

In fact, the actual water quality in Sanaru Lake has become under 8.0mg/L and achieved water quality target of the Local Committee in 2009 and 2011.

5. Conclusion

➢ The approach of Monitoring-Modeling-Evaluation is important to carry out the water purification effectively.

Monitoring
- Periodical and effective monitoring
- Feature of water pollution by monitoring results
- Check of progress on purification measures

Modeling
- Construction of simulation model based on feature
- Reliability check of simulation model

Evaluation
- Evaluation of purification measures by applying simulation model
- Figure out effective purification measures

Execute Measures

Educational Activity in Sanaru Lake

Environmental Education

Water Survey by Basin Residents

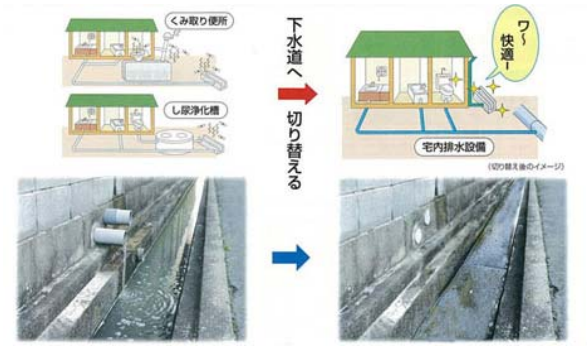
Garbage Clean up by Basin Residents

Holding some Events

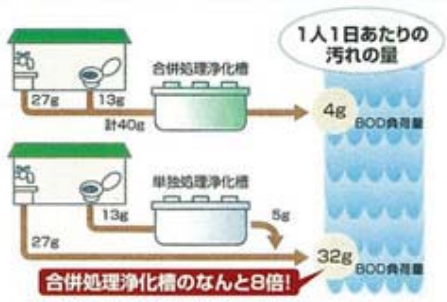
Educational Activity in Sanaru Lake

Distributing Pamphlet for Publicity Activities

Connection to Sewerage



Installation of Advanced Domestic Wastewater Treatment Tank



Kind Treatment in Domestic Drainage

Effect of water quality improvement

For water supply resources

- Take stable water regarding water quantity and quality

Algal Bloom

- Cause odor problem for water supply

Effect of water quality improvement

For public water body

- Improvement of ecological service
- Improvement of recreation and scenery

Ecological Service

Fish and Fishing

Plant

Bird

Effect of water quality improvement

Recreation and Scenery

Easy Access and Activity

Beautiful Scenery

Approach for Improving Water Environment in KANDY LAKE

(1) Water Quality Monitoring

- Implement the water quality monitoring regularly and continuously in Kandy Lake under the collaboration with University of Peradeniya and NWSDB (or possibly CEA or IWMI), and Nihon Suido Consultants Co., Ltd. in Japan.

(2) Water Quality Modeling

- Develop a water quality simulation model considering data availability and independent simulation use in Sri Lankan agencies.
- Apply the water quality simulation model to evaluate the water quality improving effect by various options (e.g. Wastewater disposal project, vegetation…).

- Thank you very much for your kind attention.

Acknowledgement

Special thanks to Shizuoka Prefecture, Hamamatsu City, and Local Committee of Water Renaissance in Snaru Lake.