

Integrated Water Resources Management in Laguna de Bay, Philippines

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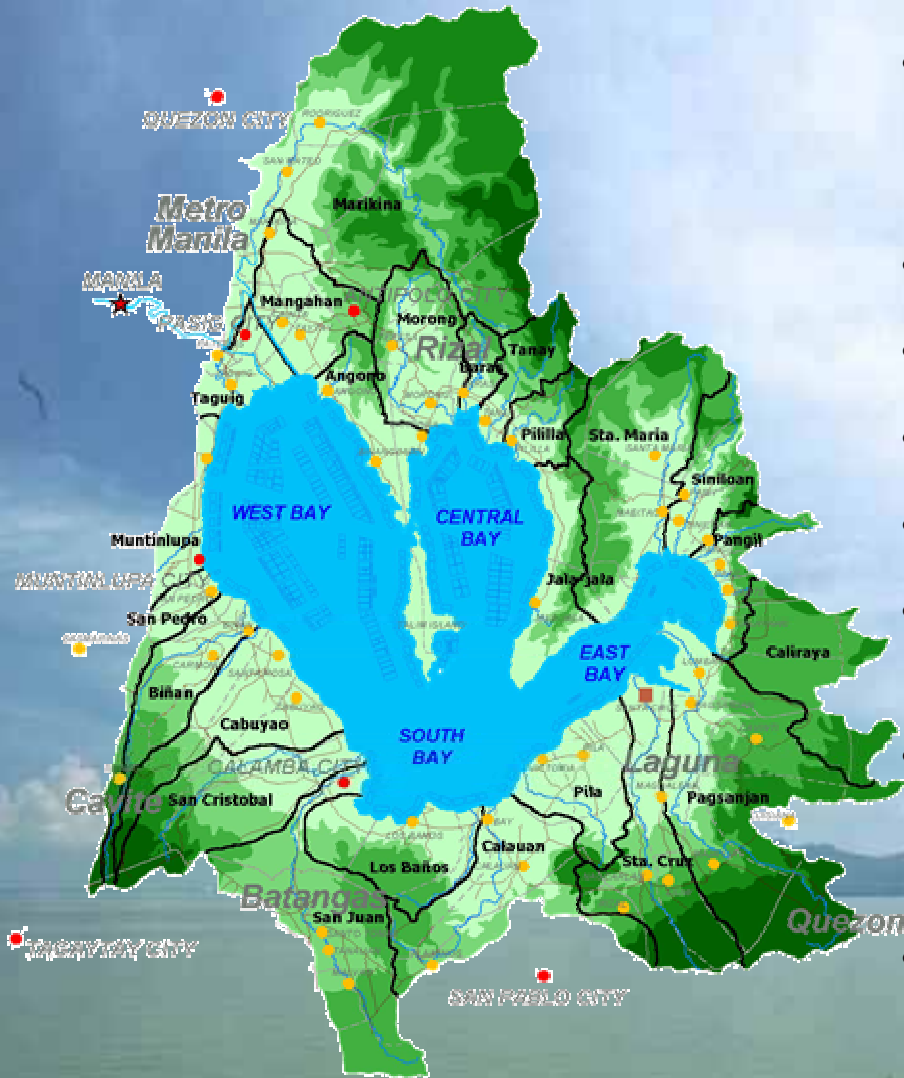
Integrated River Basin Management and Modelling

Daejeon, Korea

Nov 14- 18, 2005



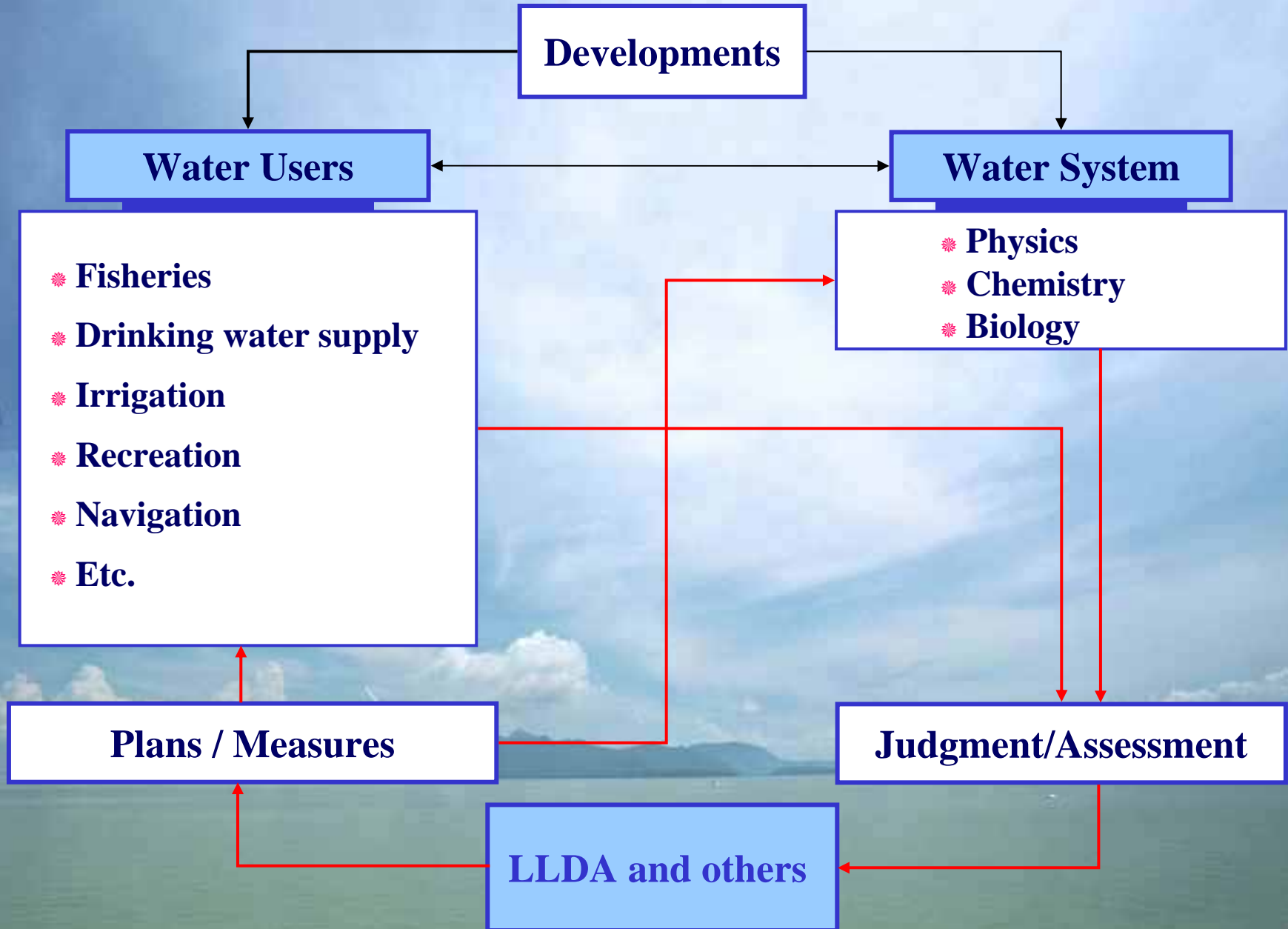
Salient Features of Laguna de Bay



- largest lake in the Philippines
- It cradles a region encompassing 6 provinces, 12 cities, 49 municipalities and 2,656 barangays, 187 of which are within lakeshore
- Pasig River is the only outlet of the lake
- total surface area = some 900 km²
- shoreline length = some 220 kilometers
- watershed area = approx. 3,820 km²
- catchment total human population = about six (6) million
- divided into twenty-four (24) hydrological sub-basins with some 100 streams that drain into the lake
- average depth of the lake is 2.5 meters

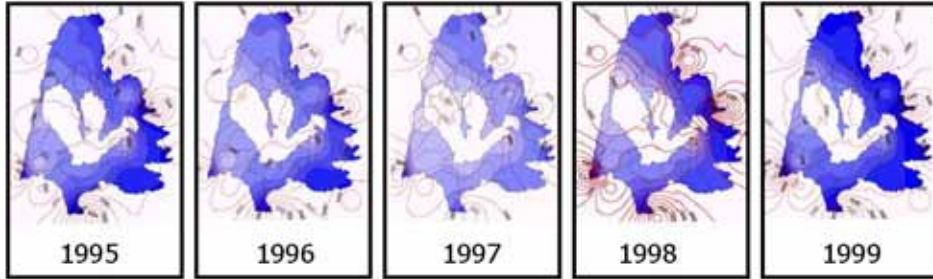


LLDA and the IWRM process



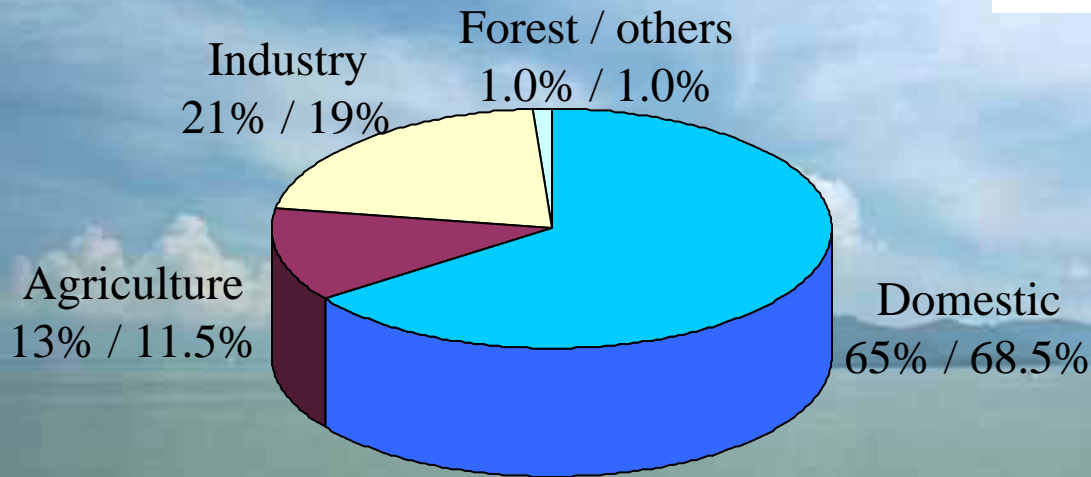
Water System

Rainfall Distribution in the Lake



Average catchment rainfall = 2,000 mm/yr

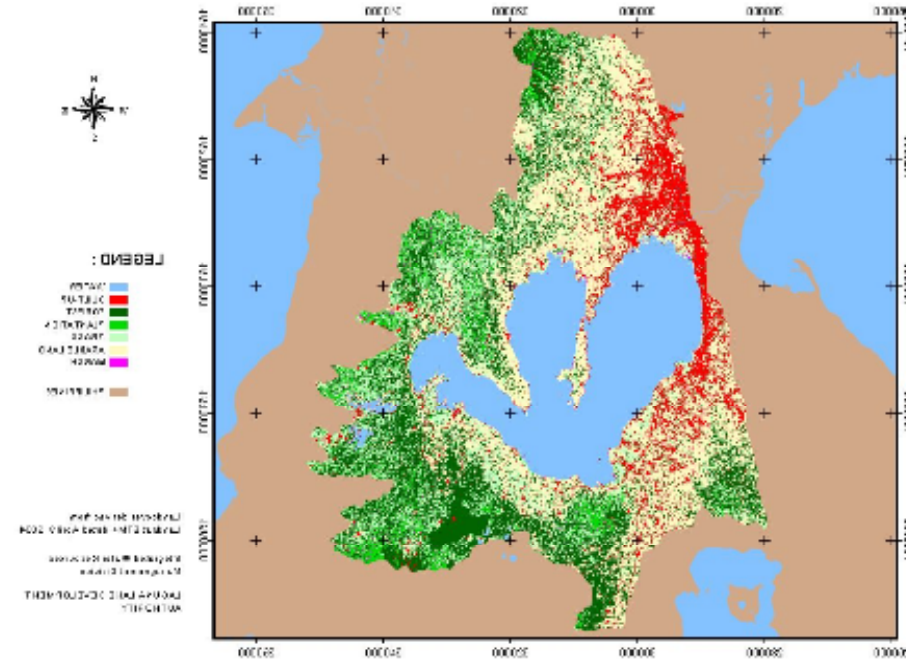
Calculated BOD loading (WLM) within the Laguna de Bay catchment 1995 / 2000



Total load 1995 = 66,305 tons / yr

Total load 2000 = 74,300 tons / yr

2002 Land-Use Map



Built-up area = 12.5%
 Agricultural Area = 36.3%
 Forested area = 26.6%
 Grassland = 18.7%
 Plantation = 5.8%



Water users



Fisheries



Irrigation



Industrial cooling



Navigation



Power Generation



Recreation



Drinking water supply

Water Administration

- Need for a focused body to take the lead in planning and management of programs for the sustainable development of the lake and its watershed.
- The LLDA has been in place since 1966 and has been given the primary responsibility to promote the development of the Laguna de Bay, while providing for environmental management and control, preservation of the quality of life and ecological systems and the prevention of undue ecological disturbance, deterioration and pollution.

Other Agencies

- Several agencies have become involved in the management of the Lake and its watersheds by virtue of their own mandates.
 - DENR : national line agency
 - 2 Regional ENR offices: decentralized regulatory responsibilities
 - Over 30 other water-related agencies
 - 66 LGUs with environment-related functions (1991 Local Government Code)



Challenges and Opportunities

- The lake has become an important economic resource to a growing population
- The lake is a viable source of raw water to address the current and future water requirement
- Fast growing population and development activities seriously pose grave threats to environmental quality and productivity of the lake watershed resources.
- Existing and increasing land and water use conflicts
- Inefficient institutional arrangements to resolve and manage the conflicts
- Internal constraints particularly the capacity for infrastructure development



Strategies and Approaches

- Multi-stakeholder/inter-agency arrangements
- Optimum mix of market-based instruments and command-and-control approaches to protection and conservation of lake and watershed resources
- Development and implementation of environmental and water-related infrastructure

Flagship Programs of the LLDA

• Environmental User Fee System

- A pioneer market based instrument for pollution control and abatement in the Philippines

• River Rehabilitation Program

- A model in multi-sectoral/multi-agency river basin approach
- Fully intensified river rehabilitation efforts by covering all tributary river systems

• Implementation of the Revised Zoning and Management Plan (ZOMAP)

- Most feasible management system for equitable allocation of lake fishery resource
- Adopted a water resource pricing mechanism for aquaculture development thru public bidding process

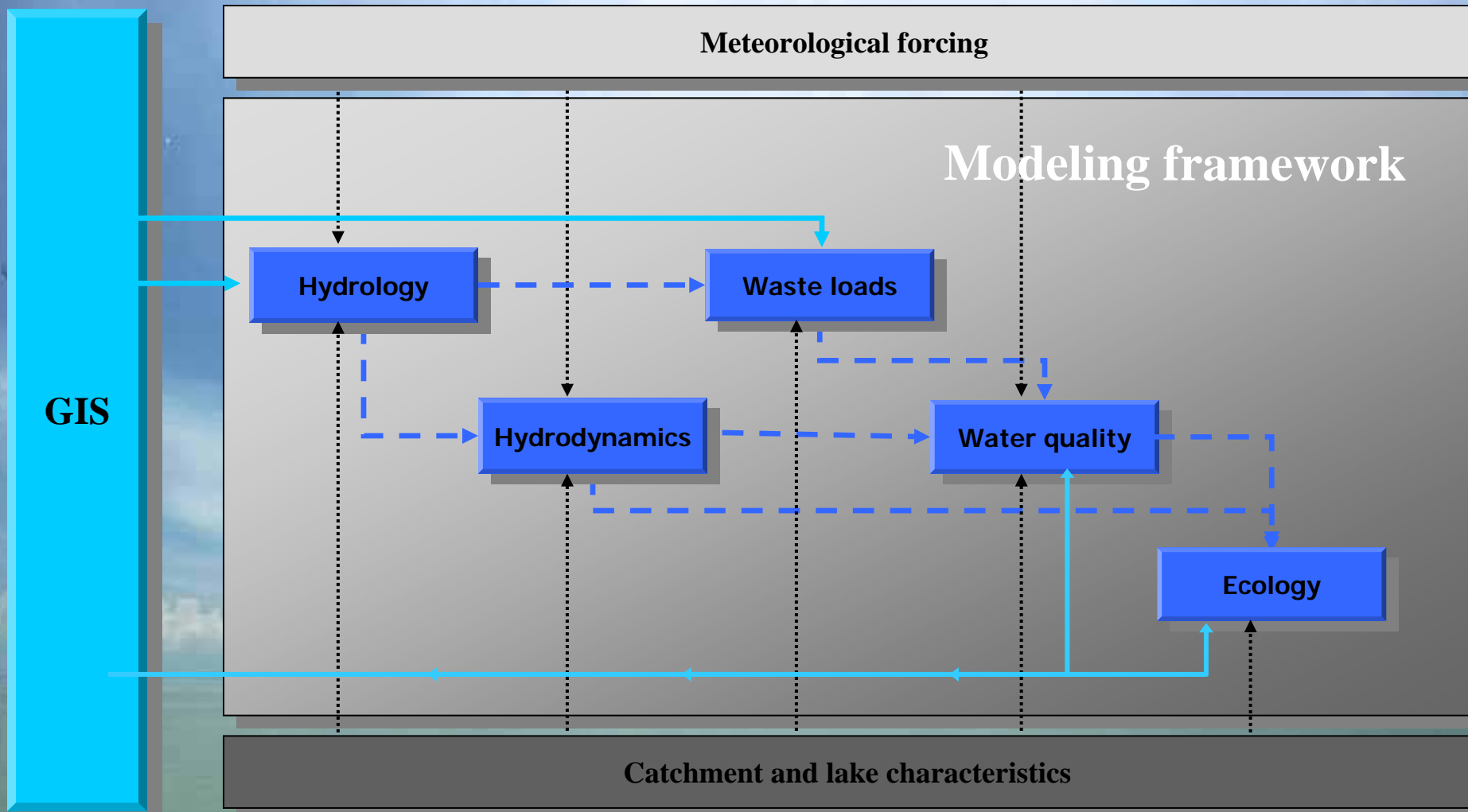
• Shoreland Management Program

- Approved the “Policy Guidelines on the Use/Occupancy of Shoreland Areas in Laguna de Bay” and the Implementing Guidelines Governing the Lease of the Laguna de Bay Shoreland Areas



LLDA Decision Support System

an integrated set of mathematical models and supporting software, which provides a comprehensive scientific description of water systems for the comparison of different strategies and measures.



Delft-Ecology Model

Delft3D-WAQ Model (Water Quality Modeling)

Provides information on concentrations of various modeled water quality parameters in each grid cell of the hydrodynamic grid.

- ✓ Post-processed outputs presented as average, minimum, and maximum values for each substance and computed for the wet season, dry season and yearly averages.

Delft3D-Flow Model (Hydrodynamic Modeling)

Provides information on:

- ✓ water circulation
- ✓ water level variations
- ✓ sediment transport
- ✓ flow velocity
- ✓ the amount and concentration of saltwater intrusion during the occurrence of Pasig River backflow
- ✓ effect of tidal and meteorological forcing.

ArcView-GIS Mapping

Provides all map-related GIS-data

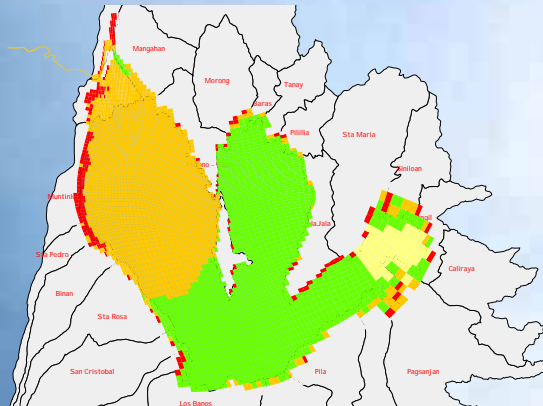
- ✓ surface area of each grid cell in the hydrodynamic grid used in hydrodynamic and water quality modeling
- ✓ habitat maps
- ✓ interpolated monitoring maps of the lake's heavy metal concentration and sediment composition.



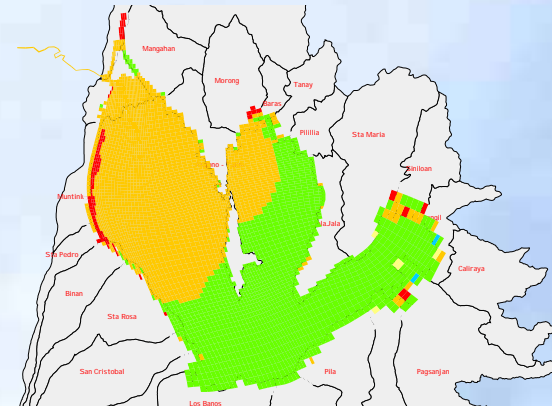
Ecology Maps of Laguna de Bay

I. Present situation

Without salt intrusion

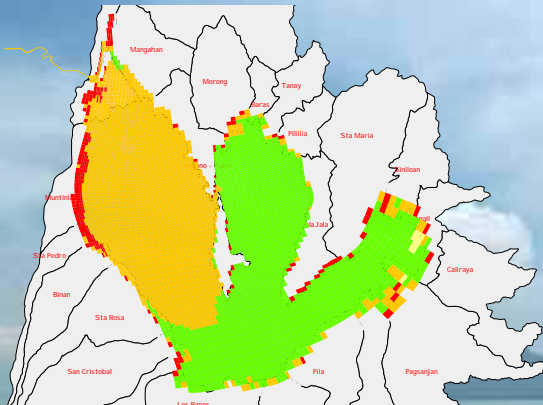


With salt intrusion

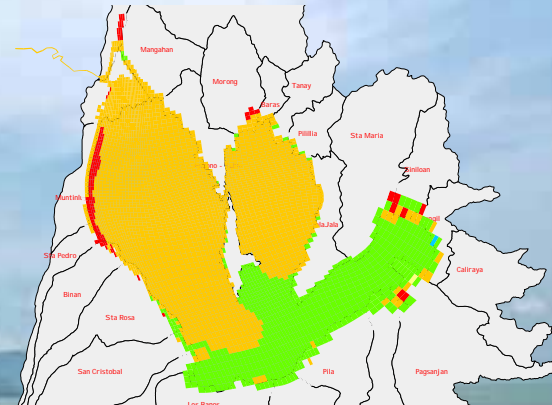


II. After 10 years, without intervention







Without salt intrusion



With salt intrusion



Legend : DENR Class (Uses)

| | | | |
|---|---------------------|---|---------------------|
|  | Worse than Class D |  | Class B. recreation |
|  | Class D. irrigation |  | Class A. drinking |
|  | Class C. fishery |  | Not classified |



Thank you!



Our website: www.lda.gov.ph

