“LESSONS ON PREPARING AND IMPLEMENTING A LAKE AND WETLANDS MANAGEMENT PLAN within an urban development framework: THE CASE OF PUTRAJAYA LAKE AND WETLAND”

• INTEGRATED URBAN DEVELOPMENT – Putrajaya Lake and Wetland
• TECHNICAL INTERVENTIONS IN LAKE BASIN MANAGEMENT
• PREPARING AND IMPLEMENTING A MANAGEMENT PLAN
• ROLE OF INFORMATION/MONITORING
• THE PUTRAJAYA LAKE AND WETLAND MAINTENANCE
• LESSON LEARNED

By: Akashah Majizat
INTEGRATED URBAN DEVELOPMENT PLANNING
– Putrajaya Lake and Wetland

• Introduction
• The Development Concept for Putrajaya
• Functionalism in Planning
• Sociogenic Environment Function
• Environmental management target
• Public Education and Research
• The Recreational Function and Ecotourism Destination
• Ecological Function
• Water body function in Putrajaya ecosystem

  Hydrological Processes
  The Hydrological Control
  The Drainage Master Plan
  The Putrajaya Urban Stormwater Management Guidelines
The largest integrated urban development project in the history of Malaysia, combining the development of government institutions, commercial, residential, public amenities and infrastructure
RATIONALE FOR RELOCATION

The Malaysian Government decided to move from Kuala Lumpur to Putrajaya in June 1993

• To relieve the pressure on Kuala Lumpur’s over-stretched infrastructure

• Scarcity of Government land in Kuala Lumpur to cater for increase in demand for Government office space

• To have a well-planned administrative centre with modern facilities and technology to enhance government efficiency and productivity
DEVELOPMENT OF PUTRAJAYA

To develop a federal government administrative centre with the capacity and amenities to meet the challenges of the next millennium;

To develop a conducive residential, commercial and recreational environment where people can enjoy a high quality of life;

To build a city that reflects the rich cultural and natural heritage of Malaysia;

To build a well-planned modern city based on the concept of sustainable development;
### PUTRAJAYA - MASTERPLAN

<table>
<thead>
<tr>
<th>LANDUSE</th>
<th>ACREAGE (ACRE)</th>
<th>(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GOVERNMENT</td>
<td>597.7</td>
<td>5.3</td>
</tr>
<tr>
<td>COMMERCIAL</td>
<td>327.8</td>
<td>2.9</td>
</tr>
<tr>
<td>HOUSING</td>
<td>2,888.8</td>
<td>25.5</td>
</tr>
<tr>
<td>CIVIC &amp; CULTURAL</td>
<td>25.1</td>
<td>0.2</td>
</tr>
<tr>
<td>PUBLIC FACILITIES</td>
<td>1,103.0</td>
<td>9.7</td>
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<tr>
<td>UTILITY &amp; INFRASTRUCTURE</td>
<td>2,123.2</td>
<td>18.8</td>
</tr>
<tr>
<td>OPEN SPACE</td>
<td>4,254.1</td>
<td>37.6</td>
</tr>
<tr>
<td>TOTAL</td>
<td>11,320ac</td>
<td>100</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LANDUSE</th>
<th>ACREAGE (hec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL</td>
<td>4581.1hec</td>
</tr>
</tbody>
</table>
Main features of Putrajaya Masterplan:

- “Garden city” - large proportion of the city area is designated as green open space
- Self-sufficient administrative city
- Emphasis on public transportation
- Creation of Waterbody (man-made lake and wetlands) Waterfront area created by the lake
- Respect for the natural topography, minimize earthworks
THE PUTRAJAYA MASTERPLAN

• Based on the “City in a Garden” concept

• City in harmony with nature

• Macro, strategic level of planning and design

• Sets the overall framework for planning and development

• Comprehensive policies and guidelines for:
  • land use distributions
  • transportation system
  • utilities and infrastructure
  • housing
  • public amenities
  • landscape and parks
## Breakdown in Land Use of the Putrajaya Wetlands (Area in Hectares)

<table>
<thead>
<tr>
<th>Wetland</th>
<th>Total Area</th>
<th>Planted Area</th>
<th>Open Water</th>
<th>Weir &amp; Islands</th>
<th>ZII</th>
<th>Maintenance Tracks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper North</td>
<td>54.1</td>
<td>27.3</td>
<td>11.0</td>
<td>3.6</td>
<td>7.7</td>
<td>4.5</td>
</tr>
<tr>
<td>Upper West</td>
<td>38.5</td>
<td>23.0</td>
<td>4.0</td>
<td>2.6</td>
<td>6.6</td>
<td>2.3</td>
</tr>
<tr>
<td>Upper East</td>
<td>15.8</td>
<td>8.7</td>
<td>2.1</td>
<td>1.1</td>
<td>2.8</td>
<td>1.1</td>
</tr>
<tr>
<td>Lower East</td>
<td>14.3</td>
<td>5.0</td>
<td>4.3</td>
<td>0.8</td>
<td>3.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Bisa</td>
<td>23.6</td>
<td>4.0</td>
<td>16.6</td>
<td>0.5</td>
<td>2.0</td>
<td>0.5</td>
</tr>
<tr>
<td>Central</td>
<td>50.9</td>
<td>9.7</td>
<td>38.6</td>
<td>1.0</td>
<td>1.6</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>197.2</strong></td>
<td><strong>77.7</strong></td>
<td><strong>76.8</strong></td>
<td><strong>9.6</strong></td>
<td><strong>23.7</strong></td>
<td><strong>9.4</strong></td>
</tr>
</tbody>
</table>

*Note: ZII denotes Zone of Intermittent Inundation.*

## Area and Storage Capacity of the Wetland System

<table>
<thead>
<tr>
<th></th>
<th>Upper West</th>
<th>Upper North</th>
<th>Upper East</th>
<th>Lower East</th>
<th>Upper Bisa</th>
<th>Central Wetlands</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catchment Area (square kilometres)</td>
<td>5.53</td>
<td>11.54</td>
<td>3.34</td>
<td>1.73</td>
<td>4.03</td>
<td>24.7</td>
</tr>
<tr>
<td>Wetland Inundated Area (hectares)</td>
<td>27.0</td>
<td>38.3</td>
<td>10.8</td>
<td>9.5</td>
<td>20.6</td>
<td>48.3</td>
</tr>
<tr>
<td>Volume (million litres)</td>
<td>230</td>
<td>310</td>
<td>130</td>
<td>150</td>
<td>430</td>
<td>1200</td>
</tr>
<tr>
<td>% of Catchment Area</td>
<td>4.9</td>
<td>3.5</td>
<td>3.2</td>
<td>5.5</td>
<td>5.1</td>
<td>2.0</td>
</tr>
</tbody>
</table>
Putrajaya - a plan-based city

- Putrajaya Master Plan
- Precinct Layout Plan
- Urban Design Guidelines

- Landscape Master Plan
- Lake Use and Navigation Master Plan
- Utilities Master Plan
- Transportation Master Plan
- Irrigation Master Plan
- Lighting Master Plan

- Fencing Design Guidelines
- Signage and Advertisement Design Guidelines
- Environmental Impact Assessment (EIA)
FUNCTION OF LAKE AND WETLANDS

► HYDROLOGICAL
  • flood mitigation;
  • storm and flood storage.

► SOCIAL/RECREATIONAL AND EDUCATION
  • recreational value;
  • open space and aesthetics;
  • scientific and research opportunities.

► GEOMORPHOLOGICAL
  • erosion protection.

► BIOCHEMICAL
  • sediment trapping;
  • nutrient removal;
  • biogeochemical cycle (many biogeochemical cycles are closed by reducing N, C, S, Fe etc in anaerobic mud);
  • influence atmospheric and climatic fluctuations.

► ECOLOGICAL
  • habitats and nursery grounds for wildlife;
  • maintenance of biodiversity.
Man-made wetlands are designed to be self-sustaining ecological systems. They are, however, also a dynamic environment requiring best practice management. As a result, Perbadanan Putrajaya developed a Wetland Management Plan to help meet its design objectives.

With the parks and greenery comes wildlife and nature experience:

- Lakefront parks have introduced a range of habitats into Putrajaya
- Open water zone - bird, fish, invertebrates, frogs and turtles
- Edge water plants - invertebrates and wading birds
WETLAND CELLS

PUTRAJAYA WETLANDS – IS THIS WHAT YOU WANT?
PUTRAJAYA WETLANDS – IS THIS WHAT YOU WANT?

- Introducing nature into the urban fabric
- Man made wetlands to act as a natural filter for lake water quality
- Diverse habitats and plants
Riparian Parks are located at the edge of Putrajaya Lake and downstream of major stormwater outlets. Their primary function is to complement the wetlands by cleansing surface run-off before it drains into the lake. They also act as balancing ponds preventing water form entering directly into the lake.
Flora and Fauna of Putrajaya Wetlands

Waterlily (Nymphaea nouchali)

Kinta Weed Vanda hookeriana
THE PUTRAJAYA LAKE
## Features of the Putrajaya Lake

<table>
<thead>
<tr>
<th>Catchment Area</th>
<th>Water Level</th>
<th>Surface Area</th>
<th>Storage Volume</th>
<th>Average Depth</th>
<th>Average Catchment Inflow</th>
<th>Average Retention Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>51.9 square kilometers</td>
<td>RL 21 meters</td>
<td>400 hectares</td>
<td>26.5 mill. Cu. meters</td>
<td>6.6 meters</td>
<td>200 million liters per day</td>
<td>132 days</td>
</tr>
</tbody>
</table>
THE CATCHMENT IMPROVEMENT

For areas outside Putrajaya there is generally a need to:

Ø improve the land use planning;
Ø upgrade sewage treatment facilities;
Ø stringent control of pesticide and fertilizer use;
Ø develop riparian buffer strips or landscaped zones along streams; and
Ø utilisation/development of existing and proposed ponds as mini-wetlands.
Putrajaya Wetlands was constructed by damming the upper reaches of Sungai Chuau. Its primary functions is to treat 60% of catchment run-off before it enters the lake. The remaining run-off filtered by gross pollutant traps and riparian parks. Together, they ensure that water entering the lake meets the Putrajaya Lake Water Quality Standards.
PREPARING AND IMPLEMENTING A MANAGEMENT PLAN

• Policy
• The description
• The Lake and wetlands evaluation
• Objectives
• Identification of Operational Objectives - derive management measures
• Preparing measurable objectives
• Operational limits
• Performance indicators and monitoring
• Formulation of measurable objectives
• Implementation Of Management Plans – Action Plan
• Management Review
Write a management plan

1. Describe the situation nowadays
2. Valuate the description
3. Do a problem analysis
4. Identify limits and opportunities
5. Formulate long term objectives
6. Identify constraints and assumptions
7. Formulate operational objectives
8. Derive measures
9. Set-up an action plan(ning)
The Vision

“
To manage the lake in order to ensure its aesthetic viability, sustain good water quality, and allow for different recreational uses, including primary and secondary contact activities.”
To complete The Putrajaya Lake Management Plan we have to deal with

<table>
<thead>
<tr>
<th>Catchments Management</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Key Processes</strong></td>
</tr>
<tr>
<td><strong>Management Measures</strong></td>
</tr>
<tr>
<td><strong>Monitoring Programs</strong></td>
</tr>
<tr>
<td><strong>Coordination – Study and Research</strong></td>
</tr>
</tbody>
</table>
*key processes

key processes are those processes which 'gear' the ecosystem as a whole or important parts: e.g. water level variations and sedimentation

Understanding key processes is crucial – enable us to decide on our operational objectives and finally to decide on the appropriate management measures
Wetlands perform a variety of functions in a hierarchy from simple to complex as a result of their physical, chemical, and biological attributes.
are a set of tools to execute, to achieve (a part of) an operational objective.
Management Measures

- Habitat Enhancement – for birds, fish etc
- Ensuring the health of aquatic life
- Fish Stocking
- Protection of rare and endangered bird species;
- Developing an integrated system of the wetlands and lake management
- Dredging Work – Desilting
• ROLE OF INFORMATION/MONITORING
• Monitoring Programs

• THE PUTRAJAYA LAKE AND WETLAND MAINTENANCE

the management of the wetland cells and lake
the condition of the wetland and lake at any one time
the water quality monitoring and investigation
the plant management
hydrological structural and access maintenance

OTHER DOCUMENTS

Lake Use Masterplan
Lake & Wetland Emergency Action Plan
Lake & Wetlands Rules and Regulation – Legislation and Enforcement
Monitoring is gathering a (time) series of data:

- to (e)valuate the impact of management measures and of human use on the ecosystem or parts of it

and:

- to be able to make decision on necessary changes.
<table>
<thead>
<tr>
<th>MONITORING TYPE</th>
<th>COMPONENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Wetland and Lake Ecology monitoring</td>
<td>Bird</td>
</tr>
<tr>
<td></td>
<td>Fauna</td>
</tr>
<tr>
<td>Biological monitoring</td>
<td>Plant Management</td>
</tr>
<tr>
<td></td>
<td>Fish</td>
</tr>
<tr>
<td></td>
<td>Sediment</td>
</tr>
<tr>
<td>Water Quality monitoring</td>
<td>The Catchment</td>
</tr>
<tr>
<td></td>
<td>Putrajaya area</td>
</tr>
<tr>
<td>Other Management Purpose</td>
<td>Maintenance</td>
</tr>
<tr>
<td></td>
<td>Education</td>
</tr>
<tr>
<td></td>
<td>Emergency and Security</td>
</tr>
<tr>
<td></td>
<td>Assets management</td>
</tr>
<tr>
<td></td>
<td>Data management</td>
</tr>
<tr>
<td></td>
<td>Activities</td>
</tr>
</tbody>
</table>
Assessment of the monitoring data is made for the following reasons:

- Sports & Recreational Use – suitable for waterbody contact,
- Aesthetics Value,
- Eutrophication,
- Acidification,
- Chemical, Microbiological and Radiation Contamination.
PUTRAJAYA LAKE AND WETLANDS

**Biological Survey and Inventory**

**Terrestrial Fauna** including birds, insects, reptiles, mammals & amphibians
- Development of biodiversity profiles
- Enhancement & establishment of a balance biodiversity

**Mosquito Monitoring**
- Determination of their species & population
- Confirming “zero threat” from mosquito

**Fish Management**
- Fish stocking
- Fish tagging (188 nos)
- Elimination of unwanted species
- Habitat enhancement

**Phytoplankton, Zooplankton and Macrobenthos Assessment**
- Identify & enumerate their species at selected sites
Fish Distribution

- Primary Lake
- Upper Bisa
- Upper West
- Upper East
- Upper North
- Central Wetland
- Lower East
Birds Distribution
THE MAINTENANCE

Basically the maintenance of the wetland involves a number of main components such as:

♦ The access
♦ The structures ie. Weirs, water inlet and outlet, dam, shorelines
♦ the management of the wetland cells
♦ the condition of the wetland at any one time
♦ the plant management
OPERATION & MAINTENANCE ACTIVITIES;
(Scope of Operation Maintenance)

Housekeeping, weed control and grass cutting
Fertilization and Plant Maintenance
Pest Control
Slope and maintenance track
Dam and weirs maintenance
ZONE 1: RESTRICTED ACCESS WETLAND ZONE
• SENSITIVE ECOLOGICAL AREAS
• No public water uses

ZONE 2: CONTROLLED ACCESS TRANQUIL RECREATION ZONE
CENTRAL WETLANDS ENVIRONMENTAL RESERVE
• Controlled public access
• Non-motorised and electric motorised hire boats
• Fishing
• Canoeing
• Bird watching

ZONE 3: PERMIT CONTROLLED ACCESS ZONE CRITICAL SECURITY & PRIVACY
• Boating access by permit
• Authorised tour boats
• Authorised dining & special function cruises
• Extended water sports courses organised by Boat Club with prior permit

ZONE 4: GENERAL NAVIGATION ZONE
• Generally unrestricted private & commercial boating
• Special advertised sporting, public display & festivity events
• Fishing (outside of restricted transport navigation corridors & terminals)

ZONE 5: ACTIVE RECREATION AND GENERAL NAVIGATION ZONE
• General private & commercial boating with restrictions on designated areas
• Particular motorised & non-motorised water sports / activities within designated areas
• Fishing (outside of restricted areas, transport navigation corridors & terminals)

ZONE 6: PASSIVE RECREATION & GENERAL NAVIGATION ZONE
• Restricted fish habitat sector(s)
• Speed restricted private & commercial boating outside designated fish habitat areas
• Fishing
THE PUTRAJAYA LAKE – IS THIS WHAT YOU WANT?
AN ATTRACTION FOR WATER SPORTS, RECREATION & TOURISM

International F1 Powerboat

Boating & Cruising

Canoeing

Formula Future
LESSON LEARNED

i. The Putrajaya Lake and Wetland Status
ii. Pollutants of concern and its alarm criteria or indicator
iii. The creation and maintenance of habitat
iv. Proper maintenance
v. Implementation of the management measures
v. Legislation and control
vi. Integrated Management System
vii. Ecosystem model
STUDY AND RESEARCH

- To improve understanding factors that govern performance of wetlands.
- Assist in the long term operation and maintenance of wetlands.
- Collaboration with research and higher learning institutes.
Management Review

The management review of the Putrajaya Lake and Wetlands Management Plan is to be done by the top management levels of the organizations. Details of the catchments status in terms of its physical as well as its ecological conditions will be presented. Management measures with its monitoring data which will show its status will be described.
THE PUTRAJAYA LAKE – IS THIS WHAT YOU WANT?
THANK YOU