PUTRAJAYA DAM
MONITORING & ASSESSMENT

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OUTLINE

1. Background of Dam
2. Monitoring Objectives & Scope
3. Monitoring Component
4. Summary & Recommendations
1. Background of Dam

**Construction Completed:**
2001 (18 years old)

**Impoundment:**
12/1-3/5/2002

**Wetland:**
6 wetlands (24 weirs)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Dam</th>
<th>ICOLD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height (m)</td>
<td>30</td>
<td>&gt;15</td>
</tr>
<tr>
<td>Dam Length (m)</td>
<td>750</td>
<td>&gt;500</td>
</tr>
<tr>
<td>Reservoir Capacity (mil m$^3$)</td>
<td>23.5</td>
<td>&gt;1</td>
</tr>
<tr>
<td>Max. Spillway Discharge (m$^3$/s)</td>
<td>904</td>
<td>&gt;2000</td>
</tr>
<tr>
<td>Catchment Area (km$^2$)</td>
<td>51.0</td>
<td>-</td>
</tr>
<tr>
<td>Full Supply Level (mRL)</td>
<td>21.0</td>
<td>-</td>
</tr>
<tr>
<td>Surface Area (ha)</td>
<td>400</td>
<td>-</td>
</tr>
<tr>
<td>Average Depth (m)</td>
<td>6.6</td>
<td>-</td>
</tr>
<tr>
<td>Average Catchment Inflow (mil m$^3$)</td>
<td>0.2</td>
<td>-</td>
</tr>
<tr>
<td>Average Retention (day)</td>
<td>132</td>
<td>-</td>
</tr>
</tbody>
</table>

Putrajaya Dam = LARGE DAM under ICOLD
Putrajaya Wetlands & Lake
2. Monitoring Objective & Scope

Objectives

• ensure **functionality** of all dam components by conducting regular inspection

• ensure **dam stability & integrity**

Scope

• collect, check & analyse data to **access dam performance** and establish comprehensive data for **evaluation**

• observe changes in **phreatic surface** (groundwater surface profile in the embankment) & **seepage**
### 3. Monitoring Component

<table>
<thead>
<tr>
<th>No</th>
<th>Instrument</th>
<th>Purpose to measure</th>
<th>No. of Station</th>
<th>Freq.</th>
<th>Equipment</th>
<th>Design limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Inclinometer</td>
<td>horizontal movement of embankment or foundation below surface</td>
<td>3</td>
<td>Every 3mth</td>
<td>Inclinometer</td>
<td>AB/CD direction Displacement &lt;84mm</td>
</tr>
<tr>
<td>2</td>
<td>Magnetic probe extensometer</td>
<td>vertical settlement of dam crest</td>
<td>3</td>
<td>Every 3mth</td>
<td>Extensometer</td>
<td>Dam crest vertical settlement &lt;100 mm</td>
</tr>
<tr>
<td>3</td>
<td>Surface settlement markers</td>
<td>settlement of dam embankment, toe and surroundings</td>
<td>21</td>
<td>Every 3mth</td>
<td>Total Station</td>
<td>Dam crest long term consolidation&lt;50mm</td>
</tr>
<tr>
<td>4</td>
<td>Vibrating wire piezometer</td>
<td>pore water pressure in clay core</td>
<td>24</td>
<td>Every 1mth</td>
<td>VWP Data Logger</td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td>Standpipe piezometer</td>
<td>piezometric levels at berm at dam downstream</td>
<td>5</td>
<td>Every 1mth</td>
<td>Dipmeter</td>
<td>-</td>
</tr>
<tr>
<td>6</td>
<td>Seepage chamber</td>
<td>dam seepage water</td>
<td>3</td>
<td>8 times/mth</td>
<td>Steel Ruler</td>
<td>Flow @1 SC=0.5 l/s Flow @3 SC=1.5 l/s</td>
</tr>
<tr>
<td>7</td>
<td>Rainfall and Spillway Level</td>
<td>rainfall &amp; flow discharge from dam</td>
<td>1</td>
<td>8 times/mth</td>
<td>Telemetry station</td>
<td>-</td>
</tr>
<tr>
<td>8</td>
<td>Visual Inspection</td>
<td>Report on site condition: erosion, cracks &amp; etc</td>
<td>Overall dam</td>
<td>2 times/mth</td>
<td>Checklist</td>
<td>-</td>
</tr>
</tbody>
</table>
From this point onward, cables run parallel to the dam axis to join the main trench at CH 402 WL (about 21 m RL). Dam Crest (23.5 m RL) Downstream Level (-14 m RL) Excavation Level (-3.15 m RL)
Inclinometer ID: IN 3003

AB Cumulative Displacement (mm) Against Level (mRL)

73.93 mm < 84 mm (Design Limit)

Maximum allowable lateral displacement = 84 mm

Figure 3.8 AB Cumulative Displacement against Level at IN 3003

Note: Section View
(2) Magnetic Probe Extensometer

Extenesometer Total Settlement Vs Time

Total settlement for all station < Design Limit (100mm)

Maximum allowable vertical displacement taking into long term consolidation = 100 mm
(3) Surface Settlement Markers (SSM)

Vertical Displacement for Surface Settlement Markers (2019) at Dam Crest (29 Dec 2013)

Settlement at Dam Crest < Design Limit (50mm)
From this point onward, cable runs parallel to dam axis to join VWP Terminal at CH 402.

Overall trends of pore pressures in the dam clay core were stable.
Piezometer readings are relatively stable after flushing.
(6) Seepage Chamber

Coverage of SC01 (250 m)
Coverage of SC02 (170 m)
Coverage of SC03 (315 m)

Allowable total limit of 1.5 L/s
Total seepage < Design Limit (1.5 l/s) during dry period

Total seepage < Design Limit (1.5 l/s) during dry period
Allowable limit of 0.5 L/s per chamber

Water Flow (l/sec)

Water Level

Time (Date)

(7) Rainfall & Spillway Level

Rain gauge

Water Level Sensor
(8) Visual Inspection

Water Level and weather during visual inspection
- Intake Tower
- Upstream Embankment
- Dam Crest
- Spillway
- Downstream Embankment
- Access Road
- Dam Instruments

Report on site condition: damage, erosion, cracks, misalignment, inappropriate vegetation growth, sign of instability & etc.
3. Visual Inspection - June 2019

1.) Intake Tower
2.) u/s Embankment
3.) d/s Embankment
4.) Dam Crest
5.) Access Road
6.) Spillway
4. Summary & Recommendations

• Overall status of Putrajaya Dam are in good condition based on monitoring data and visual inspection.

• The studies that are required to be carried out according to MyDAMS, 2017:
  a.) Dam Break Analysis
  b.) Dam Hazard Rating
  c.) Emergency Action Plan
  d.) Comprehensive Dam Safety Inspection

• Proposed the Consultancy services for dam monitoring etc. to be taken out from the maintenance contract and award to consultant directly.
THANK YOU