RAINWATER HARVESTING SYSTEM AT HYDRAULIC AND INSTRUMENTATION LABORATORY

PRESENTED BY :
Ir. Ts. ICAHRI BIN HJ. CHATTA



TABLE OF CONTENT

- Introduction
- Problem Statement
- Objectives
- Innovation
- Implementation of Rainwater Harvesting System
- Water Consumption in 2024
- Benefits
- Potential
- Costs
- Conclusion

INTRODUCTION

- The Hydraulics and Instrumentation Laboratory (MHI) has been fully operational since the end of 2007.
- Covering an area of 12,000 m².
- Equipped with various facilities for research in the field of physical modeling such as Basin 30m, Basin 50m, Flume 50m & Flume 100m.





HYDRAULIC AND INSTRUMENTATION LABORATORY FACILITIES

Basin 30m

Basin area 30 x 30 x 1.2 meter
Max water volume : 720 m^3



Basin 50m

Basin area : 50 x 30 x 1.2 meter
Max water volume : 1,200 m^3



- This facility can be used in various research areas:
  - Study the interaction of waves on all types of structures and hydraulic products (e.g.: breakwaters, coastal protection, ports).
  - Study the impact of coastal structure development on its environment.
  - Study the efficiency and effectiveness of hydraulic structures and products.
  - Laboratory scale research and experiments on renewable energy products based on water kinetics.

Flume 100m

Flume area : 100 x 1.5 x 2.0 meter

Max water volume : 225 m^3





Flume 50m

Flume area : 50 x 1.5 x 2.0 meter

Max water volume : 112.5 m^3

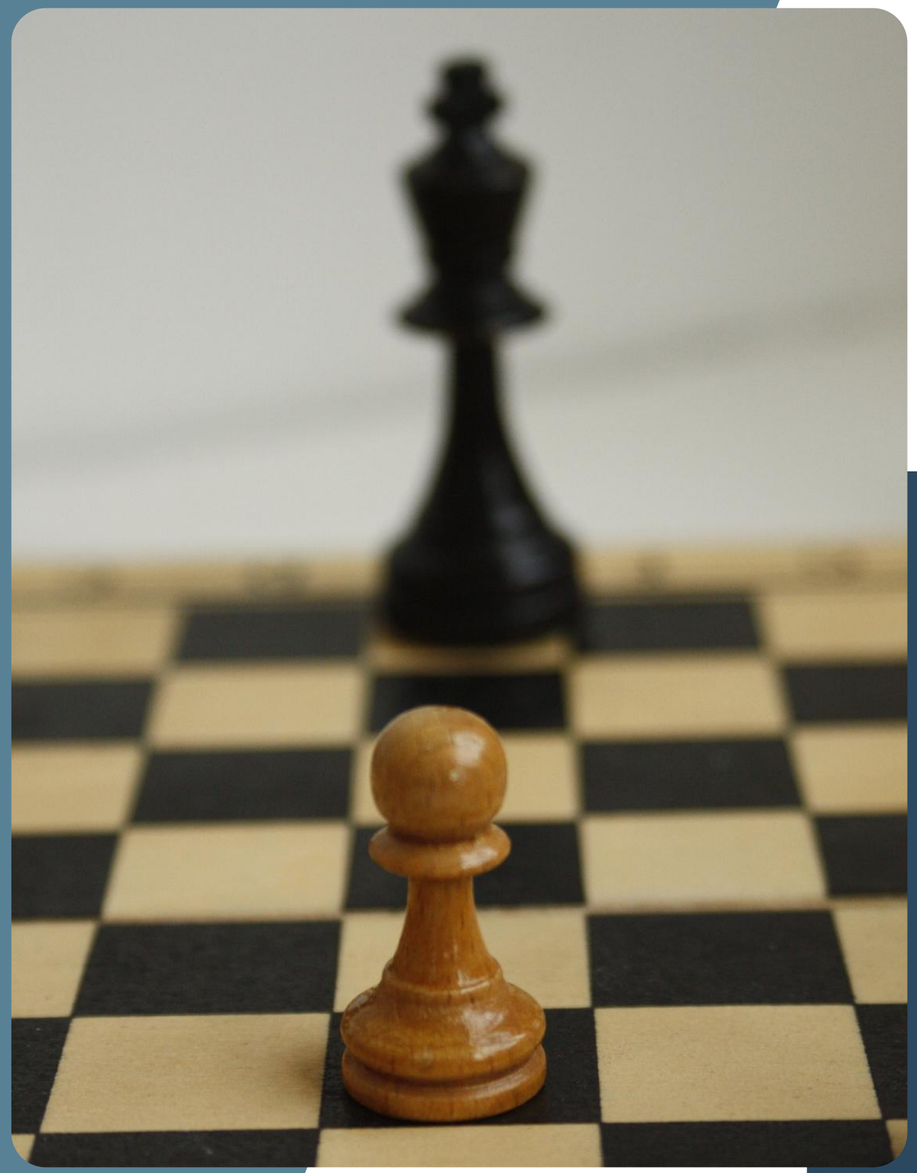


- Study the interaction of waves on a specific part of a hydraulic structure (e.g.: wave overflow on a beach guard).
- Study the efficiency and effectiveness of a specific part of a hydraulic structure. (e.g.: stability of breakwater and beach guard).
- Study the interaction of a structure and hydraulic products at a specific current flow rate.
- Flume 100m facility is equipped with a Tsunami Generator.

PROBLEMS STATEMENT

- 100% dependence on treated water supply.
- Long water filling time.
- Service charge to customers includes cost of treated water usage.
- Productivity affected due to long physical modeling period
- Productivity affected when public water supply is interrupted.





OBJECTIVES

- Produce sustainable alternative water by development of an innovation system:
  - High efficiency
  - High economic value.
  - Contribute to environmental conservation.
  - Utilize natural resources.

INNOVATION

- Development and Innovation of an upgraded Rainwater Harvesting System (RHS):
  - Implementation of the concept of using rainwater from MHI catchment area and recycle it for optimal use.
  - Specifically for physical modeling use (no additional cost for water treatment).



IMPLEMENTATION OF RAINWATER HARVESTING SYSTEM

COMPONENTS

CATCHMENT SURFACE

- The roof of the existing MHI building with a maximum catchment size of 12,000 m².

ROOF DRAINAGE SYSTEM

- A gutter and pipe system that channels rainwater from the roof and transfers it to the existing reservoir A and B.

STORAGE CAPACITY

- Reservoir A with HDPE liner : 2,466 m³
- Reservoir B : 700 m³
- G.I. storage tank : 552 m³
- Total equivalent is 3,718 m³

DISTRIBUTION SYSTEM

- The water distribution process to the physical modeling facility will be through pipes and a pump system transporting water from Reservoirs A and B to the internal storage tank (GI).




Catchment
Coverage area : 12,000m3
NAHRIM
Reservoir A (Pond)
Capacity area : 2,466 m3





Reservoir B (Underground)

Capacity area : 700 m^3

Location : MHI Walkway (underground)

G.I. Storage Tank

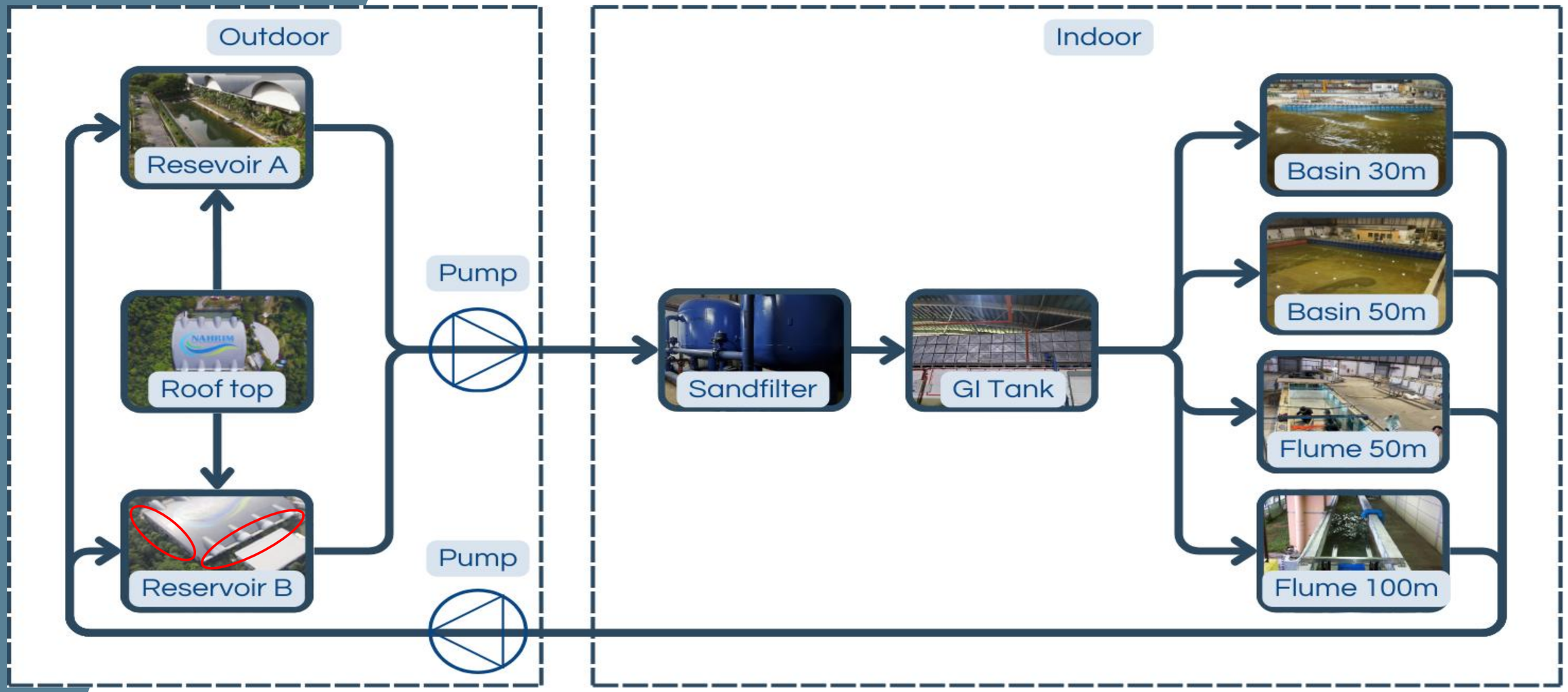
Capacity area : 552 m^3



Sand Filter



FLOWCHART


Outdoor
Indoor
Resevoir A
Roof top
Reservoir B
Pump
Pump
Sandfilter
GI Tank
Basin 30m
Basin 50m
Flume 50m
Flume 100m

WATER CONSUMPTION IN 2024

Facility	Total by facility per year
Basin 30m	2,700m³
Basin 50m	5,250m³
Flume 50m	3,375m³
Flume 100m	10,710m³
Total Consumption	22,035m³

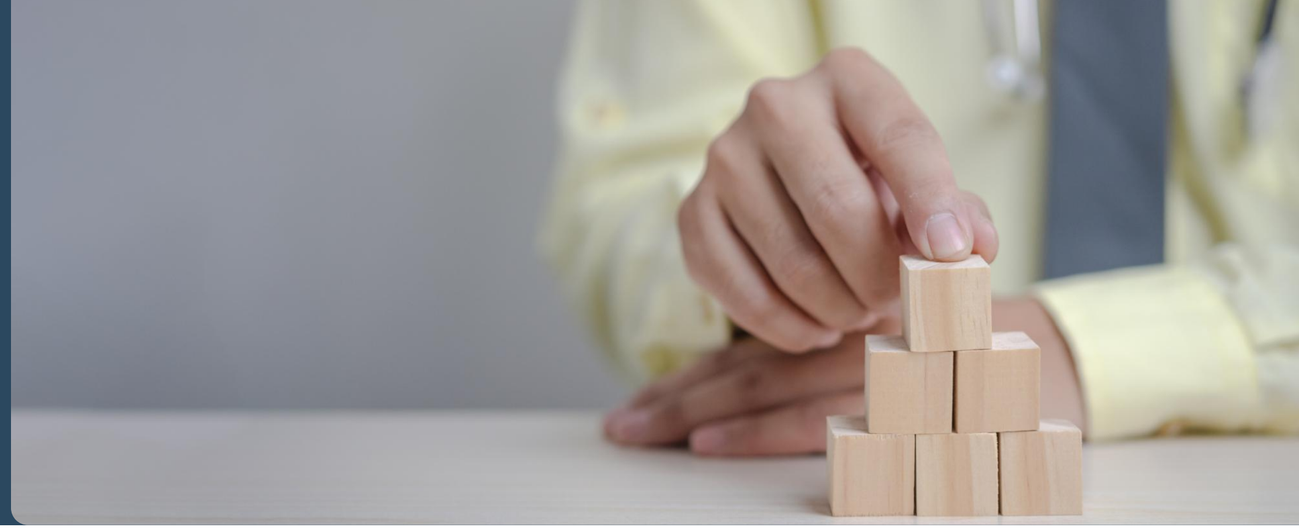


BENEFITS



- Air Selangor company sets water supply rate for non domestic at **RM2.94/m³**.
- Average total water usage for physical modelling in 2024 is **22,035m³**.
- By no longer using **22,035m³** from Air Selangor supply, MHI RHS is able to save water usage costs for physical modelling purposes by **RM64,782.90** for 2024.

POTENTIAL



- Catchment capacity can be further increased in the future.
- Current storage capacity is **3,718m³**.
- Roof catchment area is **12,000m²**.
- Average total annual rainfall is **2,540mm** per year
- Runoff Coefficient is **0.9** (Source: Pacey, Arnold & Adrian, 1989)
- Amount of rainfall that can be utilized is 12,000m² x 2.54m x 0.9 = **27,432m³** per year.
- The concept can be implemented by all other departments and agencies.

COST



- Total cost of structural repairs and construction of rainwater harvesting pond is **RM140,650.00**.
- Cost of upgrading pumps and M&E systems is **RM39,860.00**.
- Cost of upgrading rainwater harvesting pond capacity and underground storage is **RM400,000.00**.
- Total expenditure on innovation production is **RM580,510.00**.
- Total expenditure can be recovered through:
  - Savings from rainwater usage.
  - Enhancement of physical modeling efficiency that can be applied.

CONCLUSION



- This RHS is a viable option in providing new water resources, water conservation, economic advantages, environmental benefits and also added value in MHI's core operations and services.
- Reduces dependence on public water supply systems for physical modeling purposes.
- The system can be an excellent alternative water source for hydraulic testing, instrumentation calibration, and environmental monitoring, while also promoting eco-friendly practices.
- With the water consumption and water bill rate in MHI facilities, the expected ROI is within 9 years.

ACCREDITATION & RECOGNITION

- The Largest Rainwater Harvesting for Laboratory (December 5,2018)
- Biggest Hydraulics Scale Model (January 8, 2020)

- Accredited with ISO 9001, which is validated in the field of "Physical Modeling Management in Water Hydraulic Engineering" both nationally (Malaysian Standard) and internationally (UKAS).

THANK YOU