RIVER WATER QUALITY ASSESSMENT MODULE

BY

CONTENT

RIVER WATER QUALITY ASSESSMENT

- Physical assessment
- Chemical assessment
- Biological assessment

WATER DEMAND MANAGEMENT

- **Calculations of daily water consumption per person per day**
- **THE N-PARK NEGALITRES PROJECT – A BEST MANAGEMENT PRACTICE (BMP) INVOLVING GOVERNMENT-INDUSTRY-NGO SMART-PARTNERSHIPS**

PART 1: PHYSICAL ASSESSMENT OF RIVER

PHYSICAL ASSESSMENT OF RIVER

- River Velocity
- Color and clarity of the river
- Classes of River in Malaysia
- Odor
- Presence of animal/fish carcasses
- Water turbidity

River Velocity

Flowing river is rich in oxygen and aquatic life, nutrient flow,balanced pH, etc.

Stagnant river is lack of oxygen, low pH, eutriphication etc.

Measuring River Velocity

- **Materials needed:**
  - ✓ Timer
  - ✓ Measuring tape
  - ✓ A plastic ball (eg. Pingpong ball)
- **Steps/Methods**
  - Using the measuring tape, create a chord with the range of at least 2 meters .
  - Allow the floating ball to move from one end to the other end.
  - Record the time it takes for the ball to reach the second chord.
  - Repeat at least 3 times to get the average velocity of the stream in meter per second (m/s.

The Importance of Measuring River Velocity

- Velocity increases when the water volume in the river increases.
- Velocity also determines types of organism/macro invertebrates that can survive in the a particular river (Some survive in a calm section of a river while some are able to survive in a high velocity river.
- Precipitations present in calm-quiet-flowing river, accumulate quickly in the riverbed . A gushing river will allow suspended sediments on river water column.
- Flowing rivers generally provides higher level of oxygen due to presence of aeration.

Source: US EPA,2012

Colors and Clarity of River

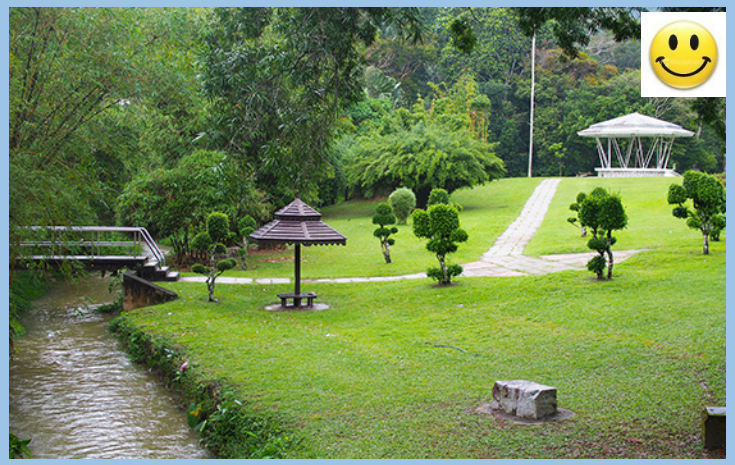
CLEAR WATER => CLEAN RIVER

COLORED WATER => POLLUTED RIVER

MUDDY WATER => POLLUTED RIVER

Classes of River in Malaysia

Downstream of Sungai Pinang: Presence of rubbish in and around the river => Smelly River => Polluted River => Class V



Upper stream of Waterfall River, Penang Botanic Gardens: Class II River

Class I = Very clean, can be used as water supply (no treatment needed)

Class II = Clean but treatment is needed to become water supply

Class III = Quite polluted, proper water treatment is needed

Class IV = Polluted, cannot be used as water supply, recommended only for transportation

Class V = Very polluted, cannot be used for any purpose at all

Source: Interim National Water Quality Standards (INWQS)

Odor

Smelly vs Natural Smell vs Odorless

Clear looking river CAN also be smelly due to pollution by organic compound

Murky river water can also be smelly ifpolluted

a) Poor Quality: Strong, unpleasant odor => Organic compound, sewage, not completely natural, etc.
b) Good/Best Quality: Some odor, natural smell => Leaves, soil, fishes etc.

PRESENCE OF ANIMAL/FISH CARCASSES

Carcasses (presence of dead fishes/animals) => Polluted River

Presence of insects as shown below indicates clean river (*the larvae of those insects can only survive in a clean water environment)

TURBIDITY

- Murkiness of water-body.
- Caused by suspended solids.
- Acceptable turbidity range must be as low as possible. (WHO acceptable range: 1000 NTU)

Turbidity Meter in NTU (Nephelometric **Turbidity** Unit

A 'Sacchi disk' to measure turbidity in JTU (Jackson Turbidity Unit)

SUSPENDED SOLIDS

- Mass (organics and minerals) that is not diluted in thewater.
- Drinking water : < 1NTU

*Acceptable turbidity range must be as low as possible.

- High suspended solid

⇓

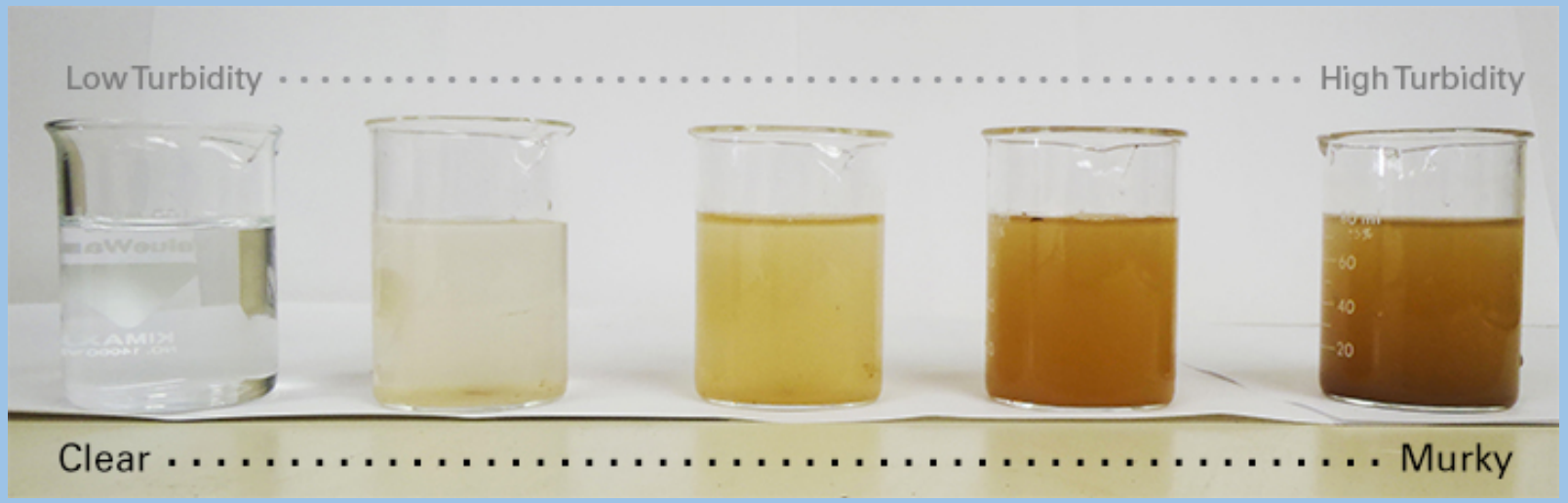
- Increase sedimentation and siltation

⇓

- Pollutes aquatic habitat

⇓

- Blocks the sunlight from penetrating deep into the river
(Water treatment will be a challenging task)



Source: http://chasebc.ca (2018)

PART 2:
CHEMICAL ASSESSMENT

CHEMICAL ASSESSMENT OF RIVER

- **Dissolved Oxygen (DO)**
- **pH**
- **Temperature**

DISSOLVED OXYGEN (DO)

- The concentration of oxygen or dissolved oxygen (DO) is a measurement of the relative amount of dissolved oxygen contained in a given medium.
- DO is important and critical for the survival of aquatic plants and animals
- Low DO does not only show signs of contamination , but also harmful to the fish community .
- Acceptable range of DO:

  5–6 ppm – The optimum level for most species

  <3 ppm – Pressure on many species of aquatic

  <2 ppm – Fatal to many species

  *ppm = parts per million (equivalent to mg/L)

A Dissolved Oxygen Meter

DISSOLVED OXYGEN

- **High Dissolved Oxygen (Eg. 8 mg/litre)**

✓ Good water quality

- **Low Dissolved Oxygen (Eg. 2 mg/litre)**

x Low water quality

Dissolved Oxygen in Relation to River Velocity

High Velocity => Rich in Dissolved Oxygen

Low Velocity => Poor in Dissolved Oxygen

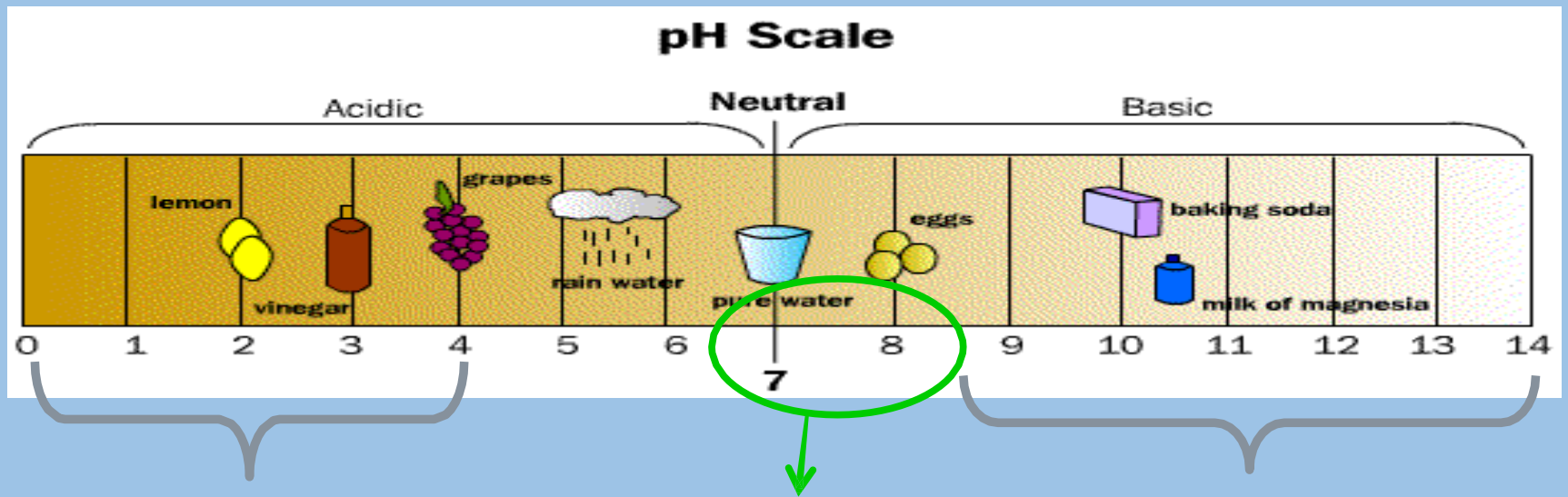
pH

- Daily biological processes will be affected in a very high (alkaline) or low pH (acidic)
- Extreme pH readings probably indicates presence of pollution.

  Optimum pH in a river : Between pH 6.5 to pH 8.5.

  Note: Neutral pH 7 does not exist naturally in any natural water bosy

pH



pH < 4
Will kill most aquatic life in the river

pH 6.5 - 8.5
High variations of aquatic life

pH > 8.5
Reduction in biodiversity variations in a river.

pH meter

Temperature

- Important because it influences water chemistry. (Eg. Dissolved oxygen depends on the water temperature, high temperature will result in lower dissolved oxygen due to oxidation process.
- Depending on certain regions, optimal temperature for aquatic life must not be higher than 27 degrees Celcius.

A multipurpose meter that includes temperature reading

PART 3:
Biological Assessment

What is BIOLOGICAL ASSESSMENT?

- Aquatic plant or animal communities (micro or macroscopic) may provide information on the quality of its environment.

- Macro-invertebrates – Young aquatic stages of insects within this bottom dwelling community indicates sensitivity and tolerance to pollution.

Eg. Some species are very sensitive to fluctuations in dissolved oxygen and will not be found in areas where oxygen levels are not consistently high.

ITEMS NEEDED FOR BIOLOGICAL ASSESSMENT

- Net
- Small aquarium / container (with cover)
- Spoon
- Magnifying glass
- Biological Indicator Assessment chart
- Stationery
- Camera (optional)

Sample Collection Point

- In a ‘SAFE’ depth of a river (depth should be lower than knee level, moderate water flow and avoid rainy days)
- Along the river side
- Bottom part of the river
- Rocky area

How to collect samples (Macro invertebrates) ?

- Collect the sample with a net
- DO NOT take the net out from water
- Wait for the sands and other substances to sink down
- Look closely for aquatic invertebrates while the net is still in water
- Transfer the aquatic invertebrates into the container

Identification of aquatic macroinvertebrates

Calculate the score based on biological indicator assessment chart* and determine the river class

Biological Water Quality Index

$$\text{Total score} = \frac{\text{Total score}}{\text{Total Number of animal types}}$$

River Classes

A. very clean water (score 7.6 - 10)
B. rather clean – clean water (score 5.1 - 7.5)
C. rather dirty water – average (score 2.6 - 5.0)
D. dirty water (score 1.0 - 2.5)
E. very dirty water (score 0 - 0.9)

* Contact Water Watch Penang to conduct the river and water monitoring programme for schools in Penang

FINAL STEP:

Release ALL the aquatic macro invertebrates into the river after sampling and identification.

WATER DEMAND MANAGEMENT

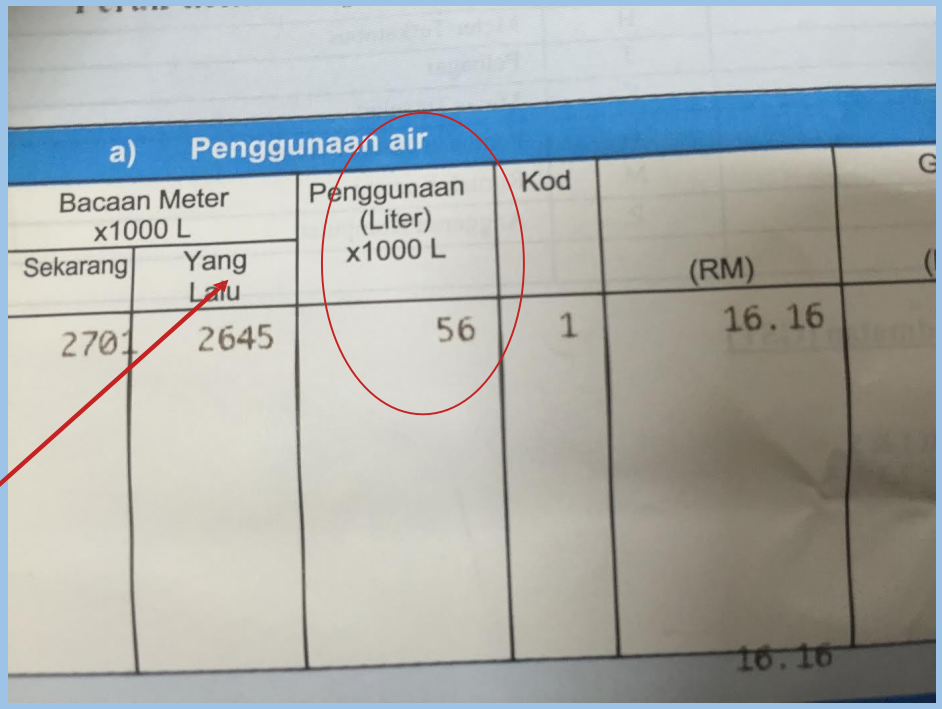
Part 4: Calculations of Daily Water Consumption per person per day.

Steps for Calculations of Daily Water Consumption per person per day

- PBAPP Water bill is obtained from any households.

  *The water bill is billed every 2 months (Bi-monthly)

1) Total Water Consumption
56 x 1000L = 56000 L



a) Penggunaan air

Bacaan Meter x1000 L		Penggunaan (Liter) x1000 L	Kod	(RM)	G
Sekarang	Yang Lalu				
2701	2645	56	1	16.16	
				16.16	

2) Total Water ConsumptionPer Person Per Day.

YEAR 2017 Data
National Average: 210 lpd
Penang Average : 286 lpd

Germany : 193 lpd
Singapore : 150 lpd
UK : 149 lpd
Kenya : 49 lpd

$$\frac{\text{Total Water Consumption}}{\text{Total Days x Total household members}}$$

$$= \frac{56000\ \text{L}}{60\ \text{days} \times 5\ \text{person}}$$

= 186.67 Litres per person per day.

Part 5: THE N-PARK NEGALITRES PROJECT – A BEST MANAGEMENT PRACTICE (BMP) INVOLVING GOVERNMENT-INDUSTRY-NGO SMART-PARTNERSHIPS

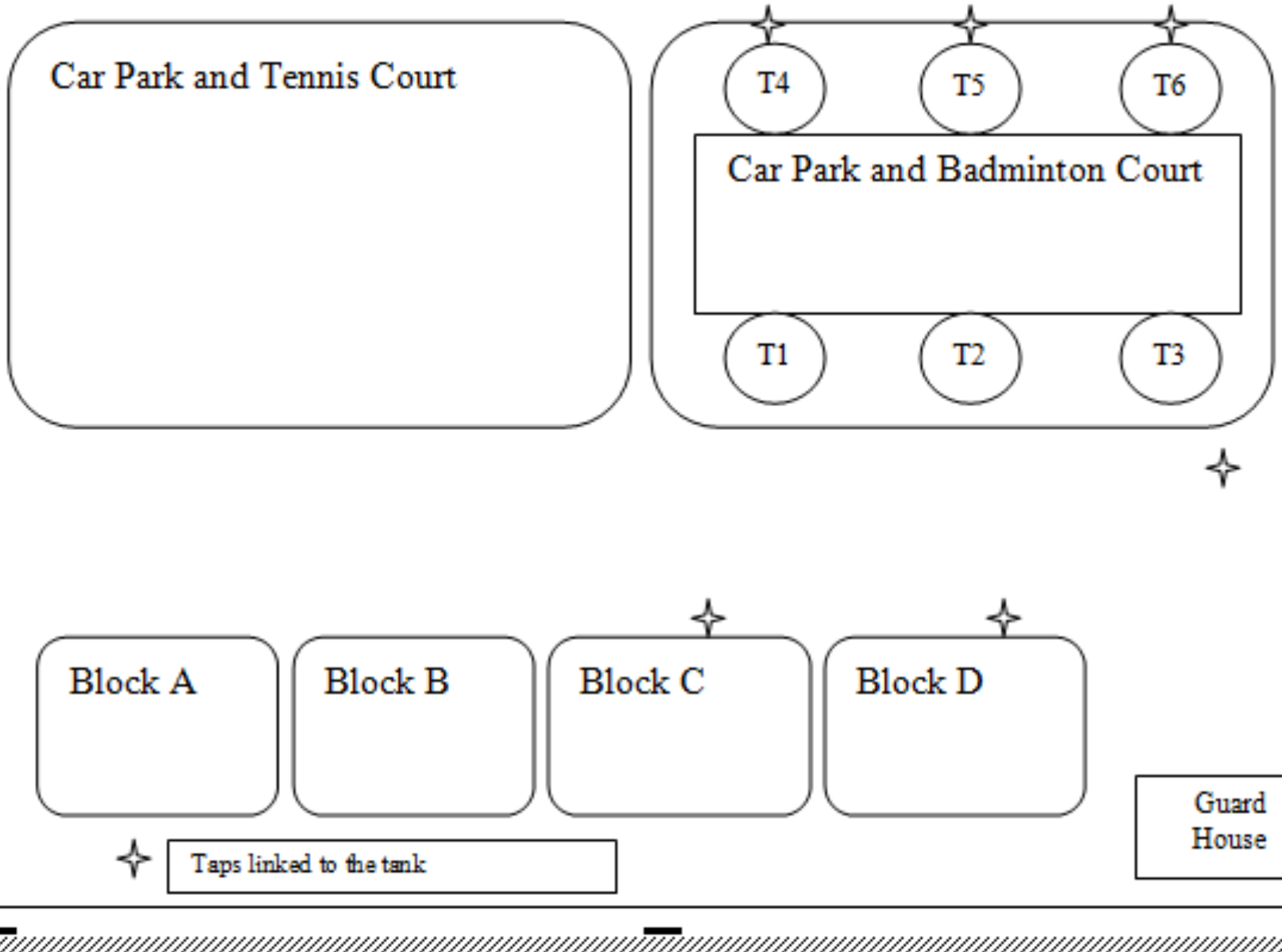
PROJECT DETAILS

- Installation of rainwater harvesting system
- Installation of water saving equipment in common areas
- Installation of water saving equipments in participating household units

Rainwater Harvesting System

Pipes were connected to the rainwater harvesting tanks and rainwater is supplied via gravity flow.

Layout of the Rainwater Harvesting Tank installed in N-Park



INSTALLATION OF WATER SAVING EQUIPMENT IN COMMON GROUND

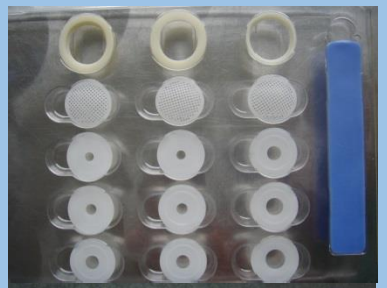
Types of Water Saving Equipment Installed:

- Dual flush
- Push tap
- Push Urinal

Areas Involved:

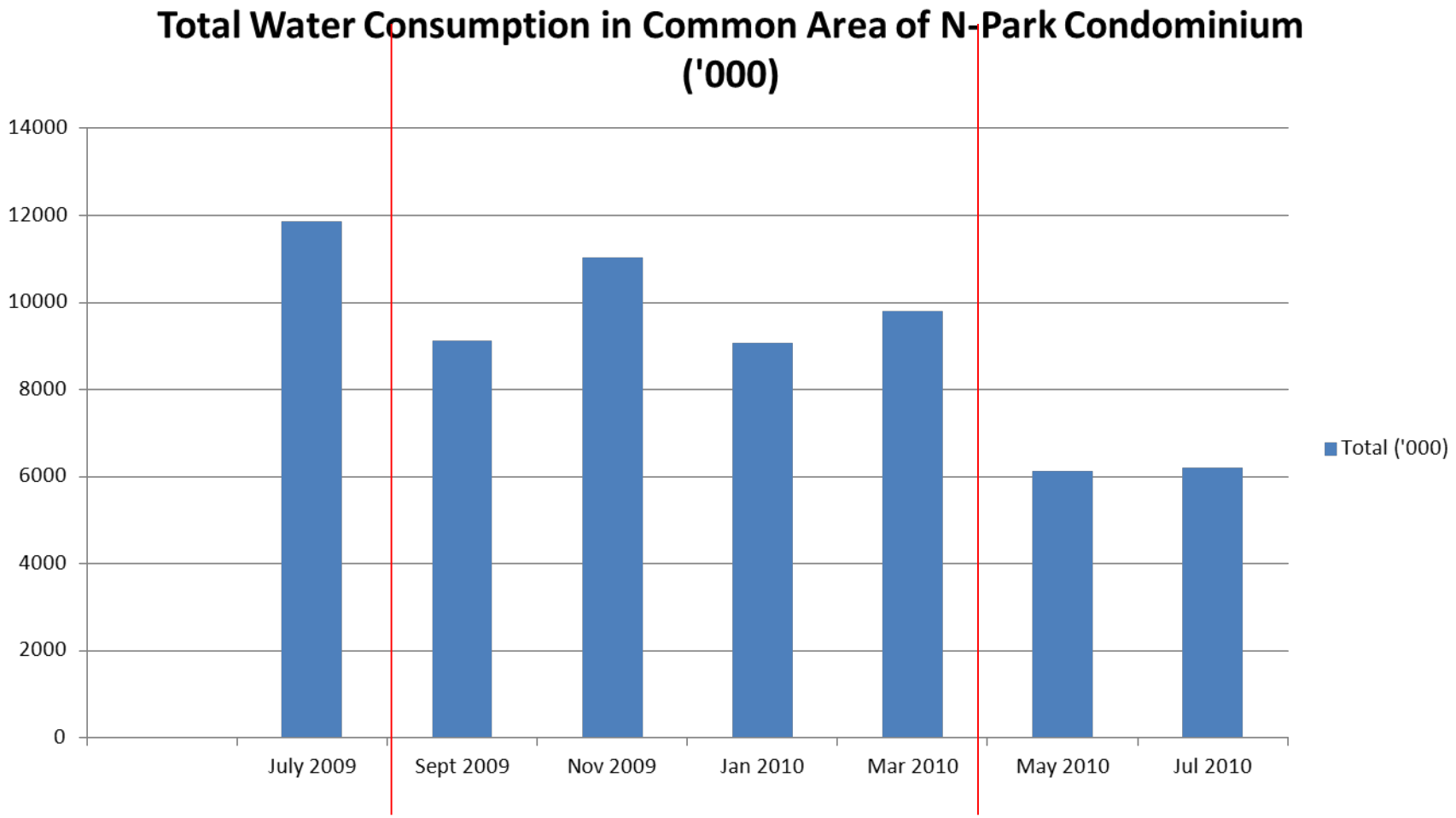
- Toilets in Block A, Block B, Block C & Block D

Installation of Water Saving Equipment in Household Units



TYPES OF WATER SAVING EQUIPMENT INSTALLED

- Internal Regulator
- External Regulator


Total Water Consumption in Common Area of N-Park Condominium ('000)
14000
12000
10000
8000
6000
4000
2000
0
July 2009
Sept 2009
Nov 2009
Jan 2010
Mar 2010
May 2010
Jul 2010
Total ('000)
Installation of Rainfall Harvesting System 31 Oct 2009
Installation of Water Saving Equipment 20 April 2010

THIS MODULE IS PREPARED

BY