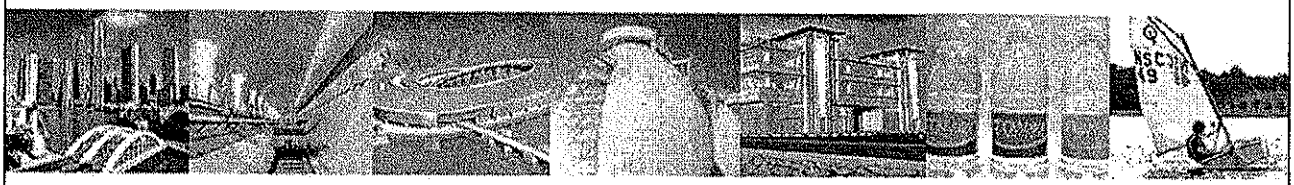
Water for All
Conserve, Value, Enjoy
PUB

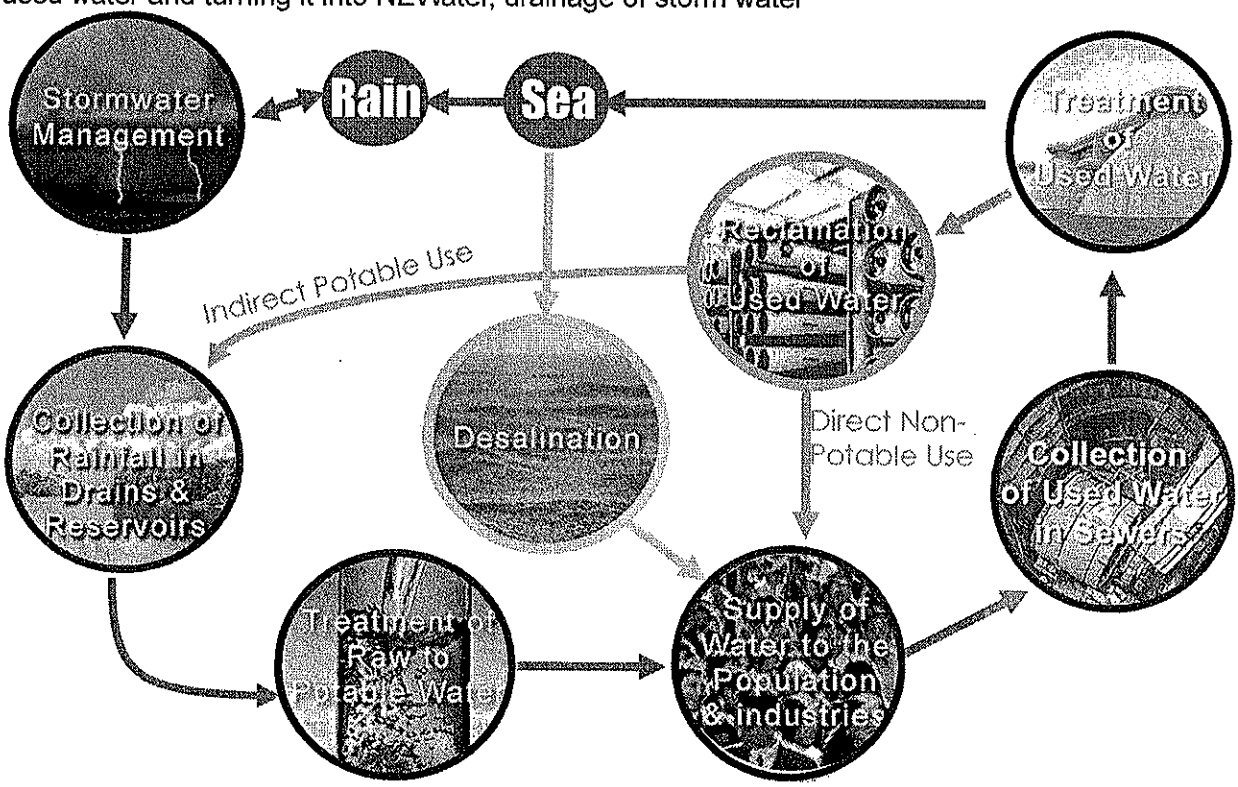


Water Efficiency

Wong Wai Cheng – Senior Principal Engineer, Water Supply (Network) Department

PUB Manages the Complete Water Cycle

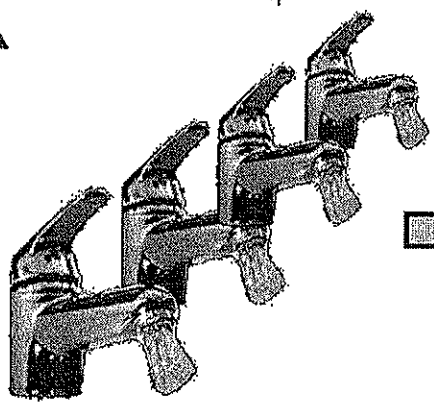
From sourcing, collection, purification and supply of drinking water, to treatment of used water and turning it into NEWater, drainage of storm water



Sustainable Water Management

"Water for All"

4 National Taps



Supply

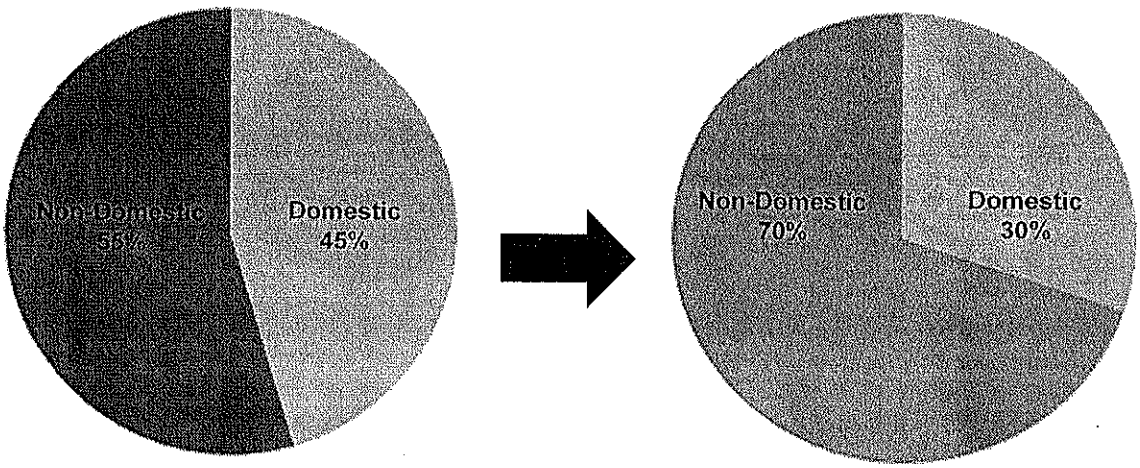
"Conserve, Value, Enjoy"

3P Approach



Demand

Breakdown of Singapore's Total Water Consumption

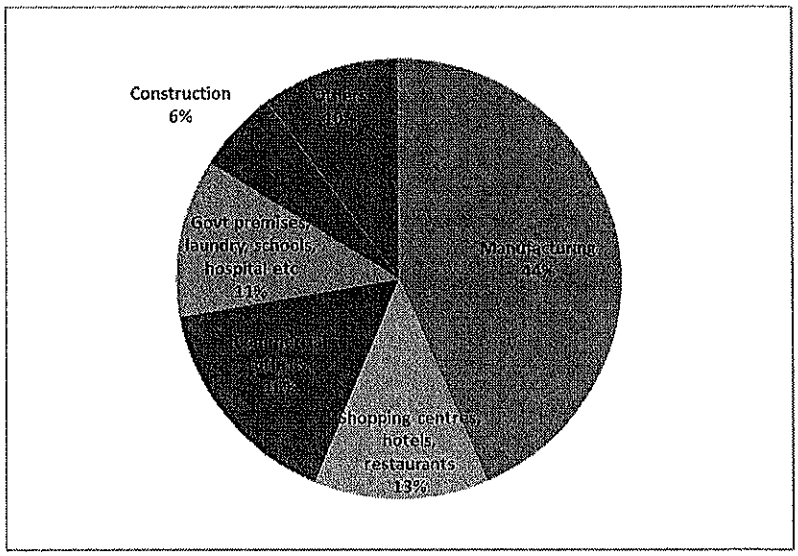


Current
~ 400 mgd

2060
Double

Key Consumers in the Non-Domestic Sector

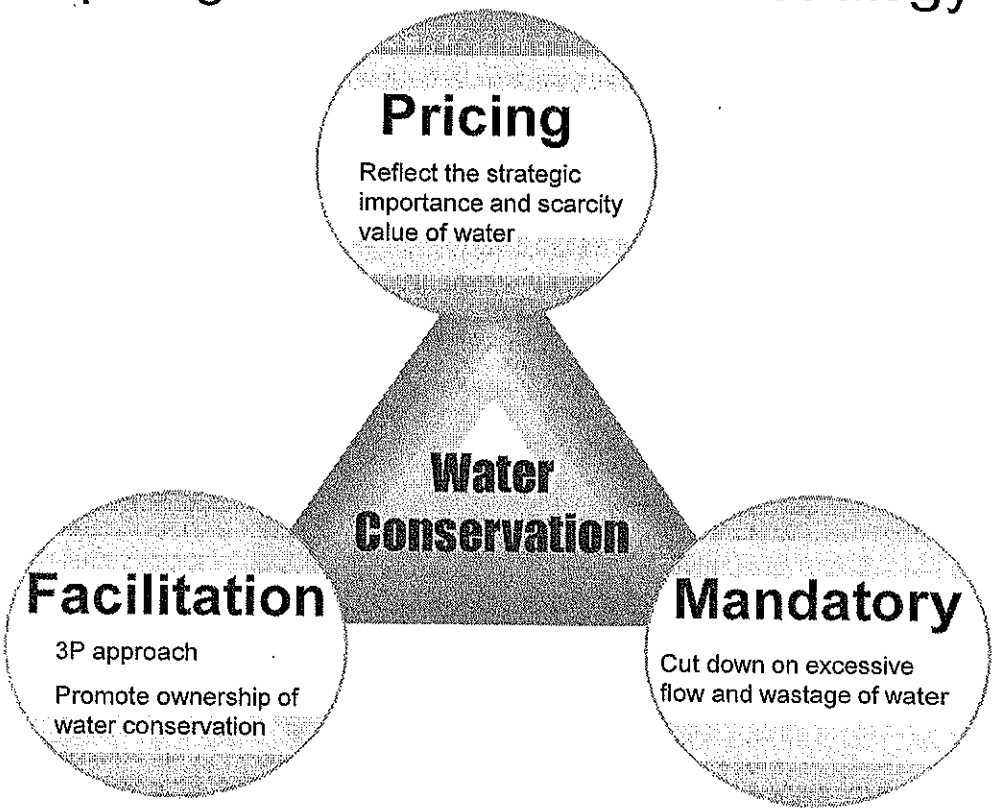
- Manufacturing
- Commercial Offices
- Commerce (Hotels, Retail, F&B)
- Community (Schools and government buildings)



Definition of Water Efficiency

- The accomplishment of a function, task, process, or result with minimal amount of water feasible
- Degree of water efficiency can be computed by a comparison of the actual water usage against the targeted minimum water usage expressed as a percentage
- Water efficiency focuses on reducing waste, not restricting use.

3-prong Water Conservation Strategy



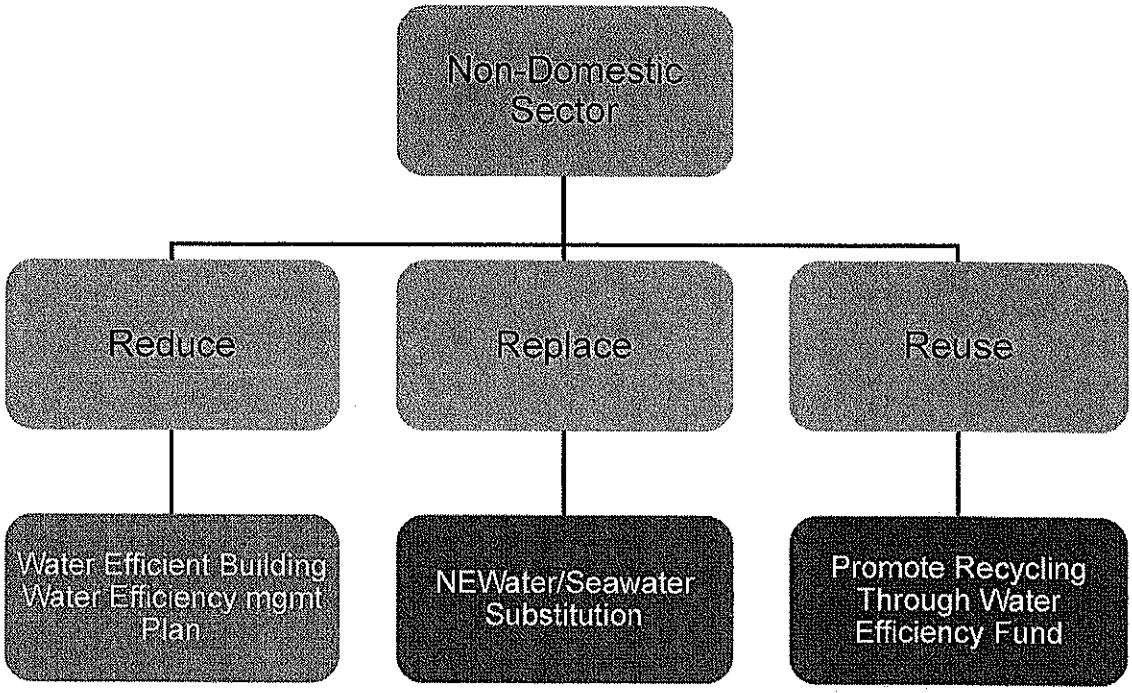
Pricing

Water Tariff Structure

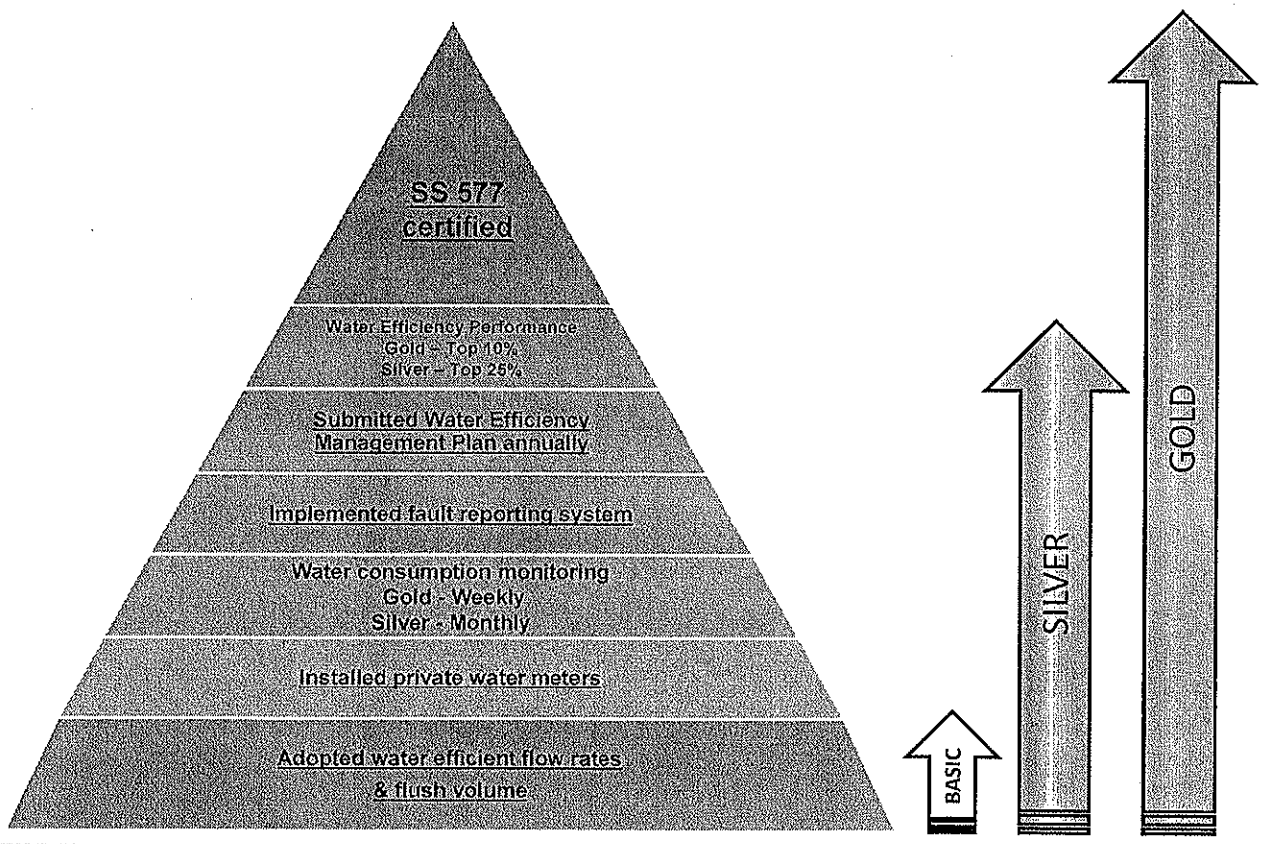
Tariff Category	Consumption Block (m3 per month)	With Effect from 1 July 2000	
		Tariff (cents per m3)	Water Conservation Tax or WCT (%)
Domestic	1 to 40	117	30
	Above 40	140	45
Non-Domestic	All Units	117	30

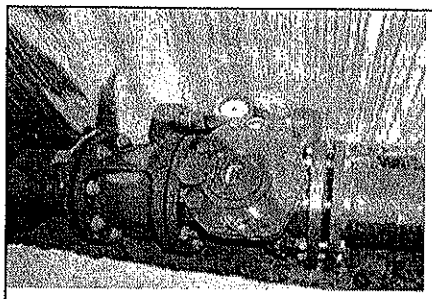
WCT : Water Conservation Tax - Broad-based Tax levied by the Government

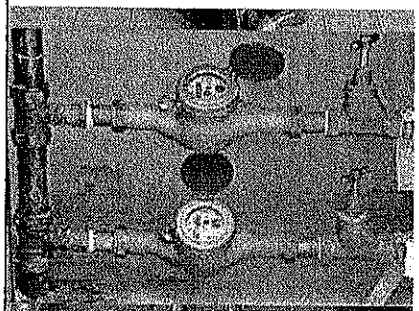
Non Domestic – Water Efficient Strategy (3Rs)

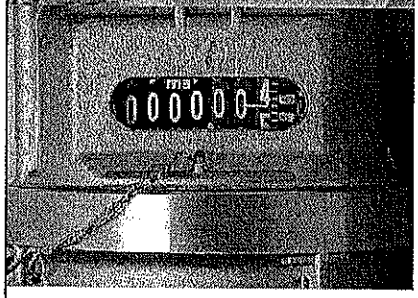


Water Efficient Building Certification

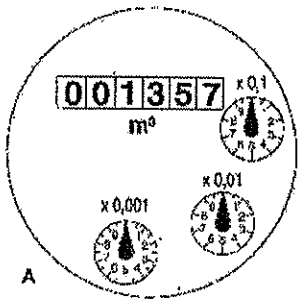


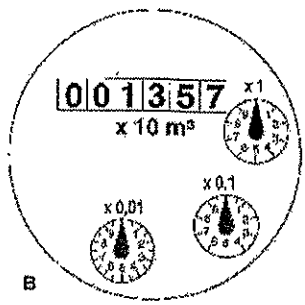




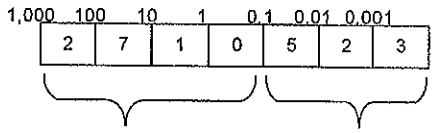


Bulk Meter





meter A reads 1357 m³, meter B read 13570 m³.



Typically, the first four numbers in black will indicate the cumulative water used in cubic metres.

Subsequent numbers in red indcates the water used after the decimal point.

*Meter reading 2710.5

Reduce: *Installation of Private Water Meters & Regular Monitoring*

PRIVATE METERS TO BE INSTALLED TO MONITOR CONSUMPTION AT EACH OF THE FOLLOWING WATER USAGE AREAS

Sector	Private meters to be installed to monitor consumption at each of the following water usage areas
1. Industries	(a) Processes (b) Cooling tower (c) Boiler (d) Scrubber (e) Cooking area / Kitchen (f) Toilets
2. Hotel	(a) Guestrooms (b) Cooling tower (c) Food and beverage outlets (d) Production kitchens (e) Laundry (f) Cold water inlet to hot water supply / Boilers (g) Swimming pool

Reduce: *Installation of Private Water Meters & Regular Monitoring*

PRIVATE METERS TO BE INSTALLED TO MONITOR CONSUMPTION AT EACH OF THE FOLLOWING WATER USAGE AREAS

Sector	Private meters to be installed to monitor consumption at each of the following water usage areas
3. Tertiary institution, prison, or military or defence installation	(a) Cooling tower (b) Toilets (block level) (c) Common / General area washing (d) Swimming pool
4. Hospitals	(a) Cooling tower (b) Toilets / Wards / Operating Theatres (block level) (c) Kitchens (d) Cold water inlet to hot water supply/ Boilers

Reduce: *Installation of Private Water Meters & Regular Monitoring*

PRIVATE METERS TO BE INSTALLED TO MONITOR CONSUMPTION AT EACH OF THE FOLLOWING WATER USAGE AREAS

Sector	Private meters to be installed to monitor consumption at each of the following water usage areas
5. Dormitories	(a) Toilets (block level) (b) Cooking area usage (c) Laundry (d) Common / General area washing
6. Construction / Concrete Batching Plant	(a) Construction Activities (b) Recharge Well (c) Concrete production (d) Toilets (e) Vehicle washing

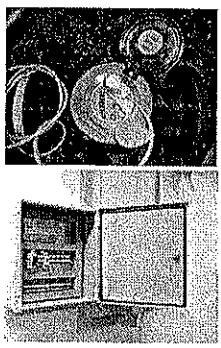
Reduce: *Installation of Private Water Meters & Regular Monitoring*

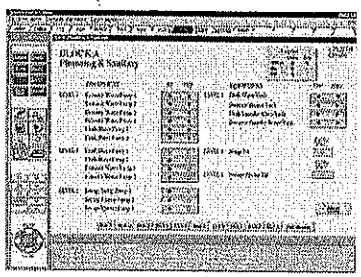
PRIVATE METERS TO BE INSTALLED TO MONITOR CONSUMPTION AT EACH OF THE FOLLOWING WATER USAGE AREAS

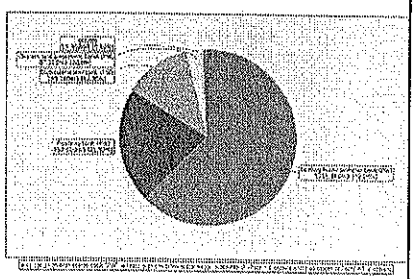
Sector	Private meters to be installed to monitor consumption at each of the following water usage areas
7. Places of interest	(a) Cooling tower (b) Exhibits / Enclosures (c) Common / General area washing (d) Toilets (e) Food and beverage outlets (f) Irrigation
8. Office or retail building, or any other building not mentioned in items 1 to 7	(a) Cooling tower (b) Toilets

Remote Metering

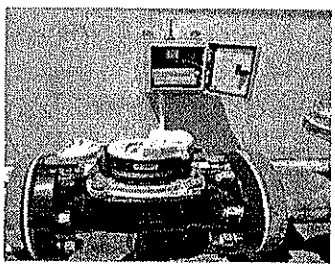
- Link the private water meters via:
  - Building Management System (BMS)
  - Automatic Meter Reading System (AMR)

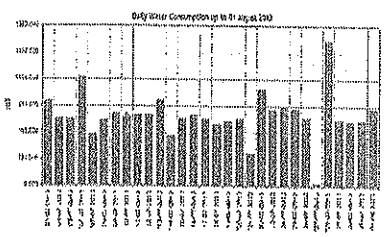






Building Management System





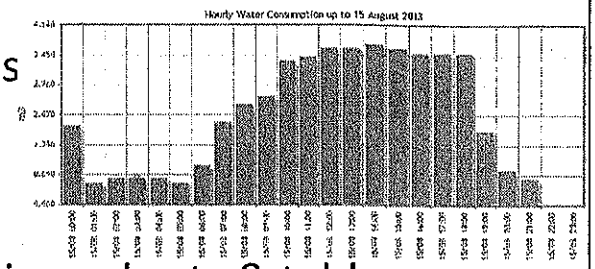
PUB Web Portal

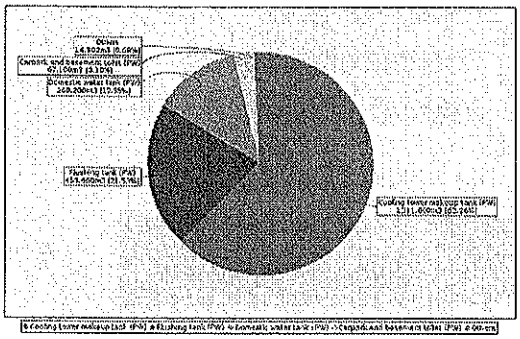
Automatic Meter Reading System

PUB Web Portal

Features :

- Water meter reading records
- Water end use breakdown
- Water consumption charts
- Water consumption comparison charts & tables
- Alert system – leakage & high consumption





Alert Configuration

Location : Cooling tower makeup tank (PW)

Alert Type	Enabled/Disabled	Value	Remark
High Consumption	☑	6980.0	m3/day
Leakage	☐		
Static Reading	☐	0	day

Update Configuration

Water Efficiency Fund

- Feasibility Study Project
  - I) Certification to SS 577:2012 Water Efficiency Management Systems
  - II) Others
- Water Audit Project
- Recycling Efforts / Use of Alternative Source of Water
- Community-wide Water Conservation Campaigns and Programmes

Water Efficiency Fund

Water Audit Project

Water Audit +	Remote Metering
Co-fund 90% of water audit cost, cap at $15,000*	Additional grant of 90% of the upgrading or installation costs, cap at $15,000*

+ Includes cost of procuring and installation of water meters. Water meters shall be procured from PUB subject to availability.

For premises with monthly water consumption of 1,000 cu m or less, the funding cap will be **$5,000. For customers with monthly water consumption ≤ 3,000 m³/mth, the funding cap is **$10,000**.*

Reduce: *Water Efficiency Fund*

Water Audit Project

Computation of fund (based on hypothetical scenario) for user consuming more than 3,000 m³/mth

•Water Audit -- include costs for i) water audit consultancy, ii) procurement of meters, & iii) installation of meters

- Cost of water audit consultancy = $4,000
- Cost of private water meters (procured from PUB) = $1,500
- Cost of installation of private water meters = $10,000
- Total cost of water audit = $4,000 + $1,500 + $10,000
  = $15,500

- 90% co-funding = 90% x $15,500 = $13,950

PUB will offer a grant not exceeding $13,950 (consisting of private water meters provided by PUB and $12,450 (= $13,950 - $1,500)).

Water Audit Project

Computation of fund (based on hypothetical scenario) for user consuming more than 3,000 m^3/mth

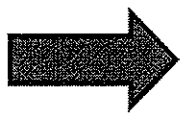
•Remote metering

- Cost of sensing elements for remote metering (provided by PUB) = $1,500
- Cost of upgrading/installation of remote metering system = $20,000
- Total cost for remote metering = $1,500 + $20,000 = $21,500
- 90% co-funding = 90% x $21,500 = $19,350

However, funding cap is at $15,000

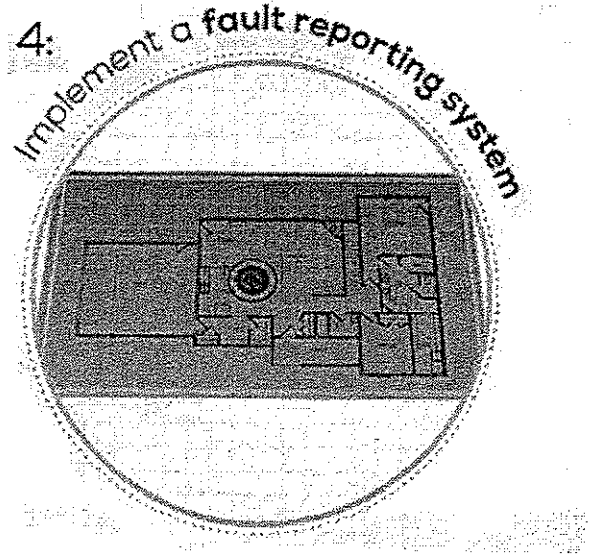
PUB will offer a grant not exceeding $15,000 (consisting of sensing elements provided by PUB and $13,500 (= $15,000 - $1,500)).

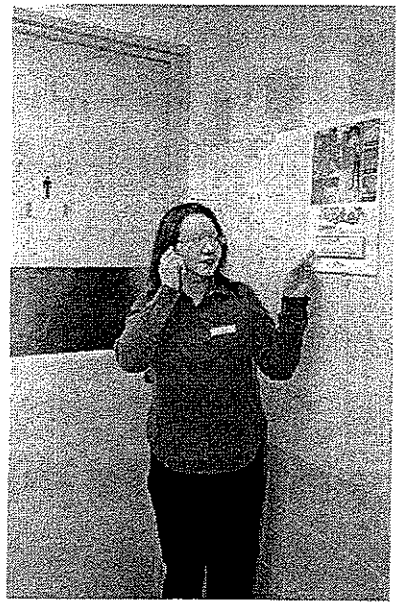
Total funding (for water audit and remote metering)
= $13,950 + $15,000
= $28,950
(inclusive of meters & sensing elements procured from PUB)

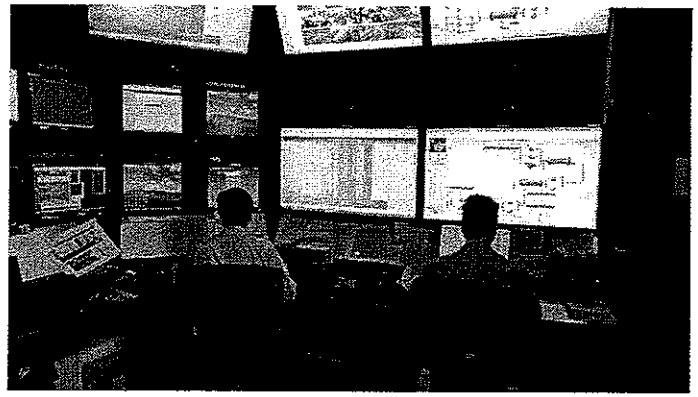


Implement Fault reporting system

- Leaks /Faults can be reported promptly
- Minimise Water Wastage



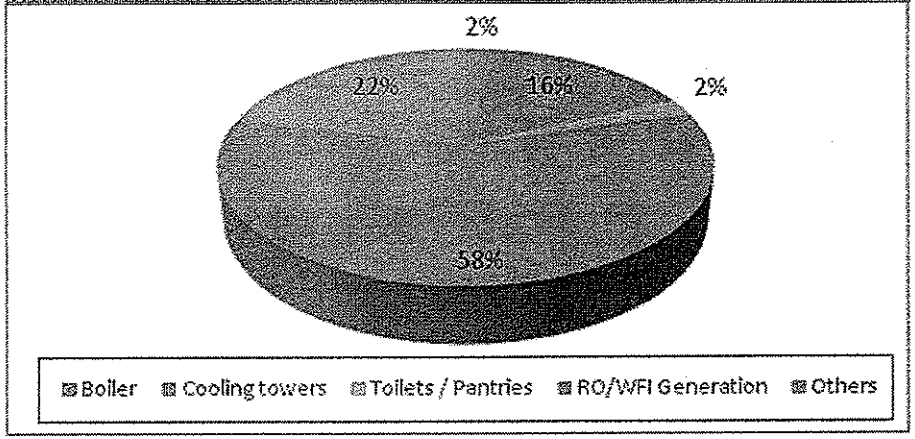




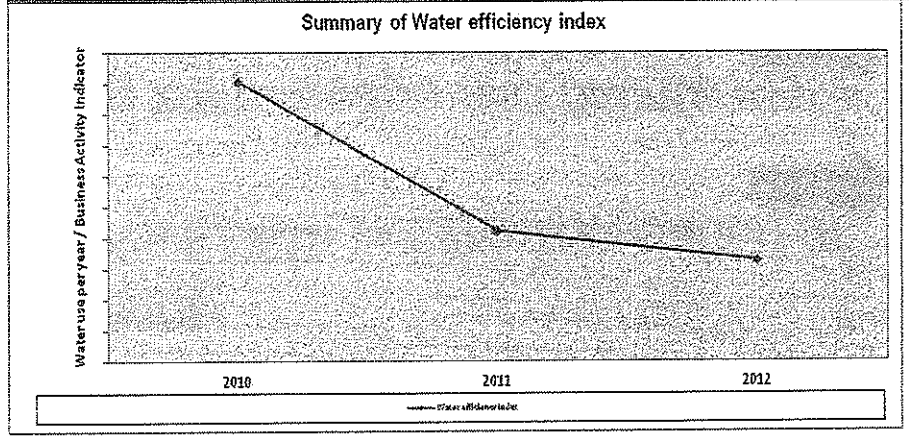
Reduce: *Water Efficiency Management Plan (WEMP)*

- The WEMP includes:
  - ✓ analysis of current water use
  - ✓ identification of potential water saving measures
  - ✓ action plan and implementation timelines
- Apply Water Efficiency Fund to implement measures

Breakdown of Water Usage



Trending of annual Water Efficiency Index / recycling rates



Action Plan

Action	Description of project	Due date for implementation	Water savings m^3/y	Comments
1	Divert RO Reject to Cooling Tower	01-Feb-12	111,953	If 100% goes to Cooling Tower

Reduce: *Water Efficiency Management Plan (WEMP)*

- Mandatory from 2015, all large water users (≥ 60,000 cu m in the preceding calendar year)
  - To submit WEMPs to PUB by Jun **annually**
  - To submit for at least 3 consecutive years
  - To submit through same portal as NEA's EDMA (where applicable) or via PUB's portal
  - Submit Water Balance Chart indicating water usage and private meter positions
- To install private meters for measurement and monitoring of water consumption to account for the breakdown of the various water end use areas in the premises

- *Consider tapping onto PUB's Water Efficiency Fund to comply to requirements, and for other water efficiency projects*

Reduce: *Water Efficiency Management Plan (WEMP)*

- The water use threshold of 60,000 cu m in the preceding calendar year is computed based on a **summation** of all types of water used by the business activities at the premises.
- Examples of the types of water included are :
  - *Potable water (PW)*
  - *NEWater (NW)*
  - *Industrial Water (IW)*
  - *Raw water*
  - *Water obtained from private utility suppliers (e.g. demineralised water, high-grade industrial water)*
  - *Water collected from other water users (e.g. wastewater, steam condensate, etc.)*
  - *Steam obtained from private utility suppliers*
  - *Seawater*

Reduce: *Water Efficiency Management Plan (WEMP)*

- Large water users (≥ 60,000 cu m in the preceding calendar year) must submit WEMP for at least three consecutive years

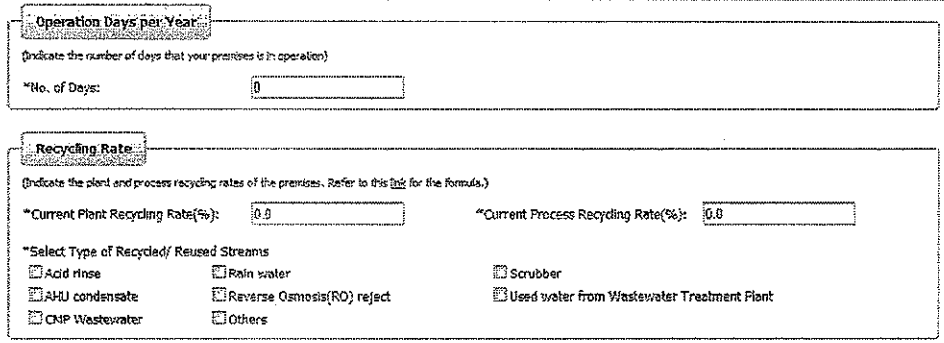
2014	2015	2016	2017	2018
≥ 60,000 cu m	To submit WEMP	To submit WEMP	To submit WEMP	??

- If water use threshold is attained in 2014, WEMP must be submitted for 2015 – 2017 regardless of water use in 2015, 2016 or 2017.
- Submission in 2018 depends on water use in 2015, 2016, or 2017.

≥ 60,000 cu m	To submit WEMP	To submit WEMP	To submit WEMP	**No need to submit WEMP**
≥ 60,000 cu m	To submit WEMP	To submit WEMP	To submit WEMP	**Need to submit WEMP**

≥ 60,000 cu m < 60,000 cu m

Reduce: *WEMP Web Portal Template*



Operation Days per Year

(Indicate the number of days that your premises is in operation)

*No. of Days: 0

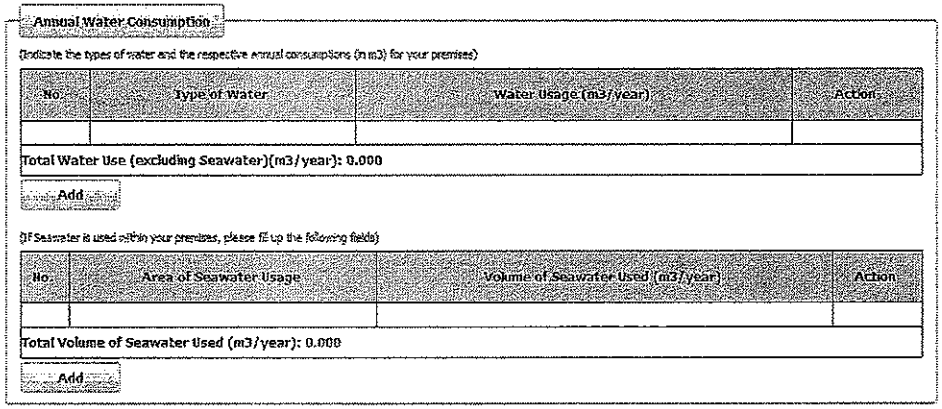
Recycling Rate

(Indicate the plant and process recycling rates of the premises. Refer to this link for the formula.)

*Current Plant Recycling Rate(%): 0.0 *Current Process Recycling Rate(%): 0.0

*Select Type of Recycled/ Reused Streams

- Acid rinse
- Rain water
- Scrubber
- AHU condensate
- Reverse Osmosis(RO) reject
- Used water from Wastewater Treatment Plant
- CNP Wastewater
- Others



Annual Water Consumption

(Indicate the types of water and the respective annual consumptions (in m3) for your premises)

No.	Type of Water	Water Usage (m3/year)	Action

Total Water Use (excluding Seawater)(m3/year): 0.000

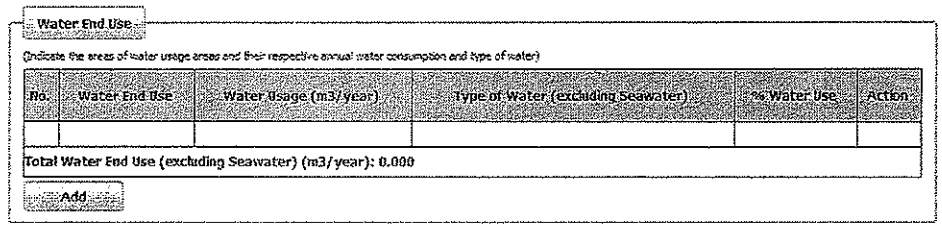
Add

(If Seawater is used within your premises, please fill up the following fields)

No.	Area of Seawater Usage	Volume of Seawater Used (m3/year)	Action

Total Volume of Seawater Used (m3/year): 0.000

Add



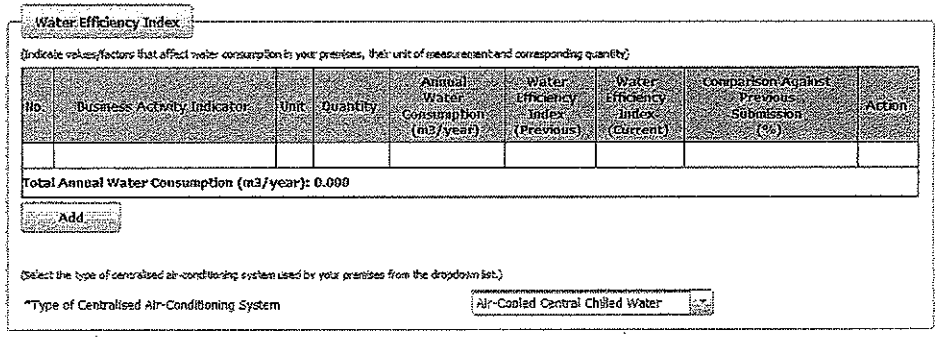
Water End Use

(Indicate the areas of water usage areas and their respective annual water consumption and type of water)

No.	Water End Use	Water Usage (m3/year)	Type of Water (excluding Seawater)	% Water Use	Action

Total Water End Use (excluding Seawater) (m3/year): 0.000

Add



Water Efficiency Index

(Indicate values/factors that affect water consumption in your premises, their unit of measurement and corresponding quantity)

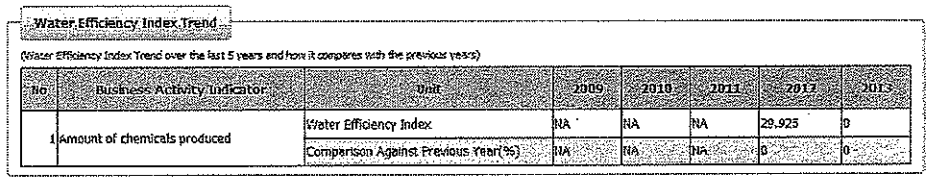
No.	Business Activity Indicator	Unit	Quantity	Annual Water Consumption (m3/year)	Water Efficiency Index (Previous)	Water Efficiency Index (Current)	Comparison Against Previous Submission (%)	Action

Total Annual Water Consumption (m3/year): 0.000

Add

(Select the type of centralised air-conditioning system used by your premises from the dropdown list.)

*Type of Centralised Air-Conditioning System: Air-Cooled Central Chilled Water

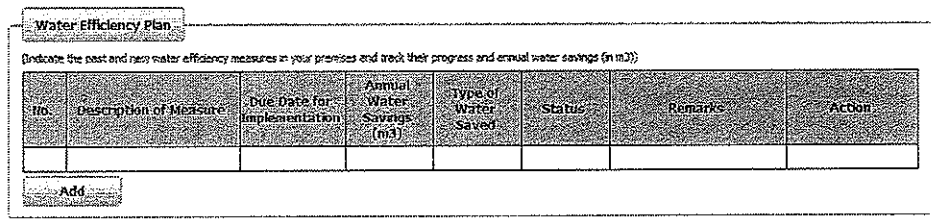


Water Efficiency Index Trend

(Water Efficiency Index Trend over the last 5 years and how it compares with the previous years)

No.	Business Activity Indicator	Unit	2009	2010	2011	2012	2013
1	Amount of chemicals produced	Water Efficiency Index	NA	NA	NA	29.925	0
		Comparison Against Previous Year(%)	NA	NA	NA	0	0

*** Trend is based on past submitted data. Not required to key in any data in this section.*

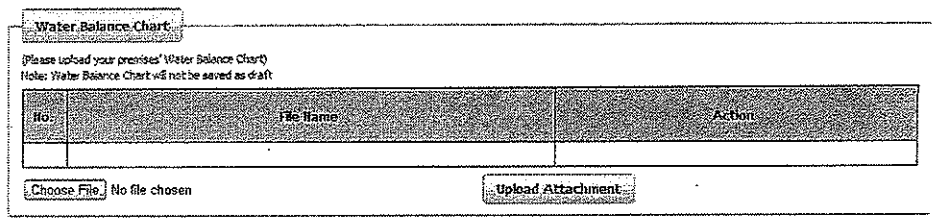


Water Efficiency Plan

(Indicate the past and new water efficiency measures in your premises and track their progress and annual water savings (in m3))

No.	Description of Measure	Due Date for Implementation	Annual Water Savings (m3)	Type of Water Saved	Status	Remarks	Action

Add



Water Balance Chart

(Please upload your premises' Water Balance Chart)

Note: Water Balance Chart will not be saved as draft

No.	File Name	Action

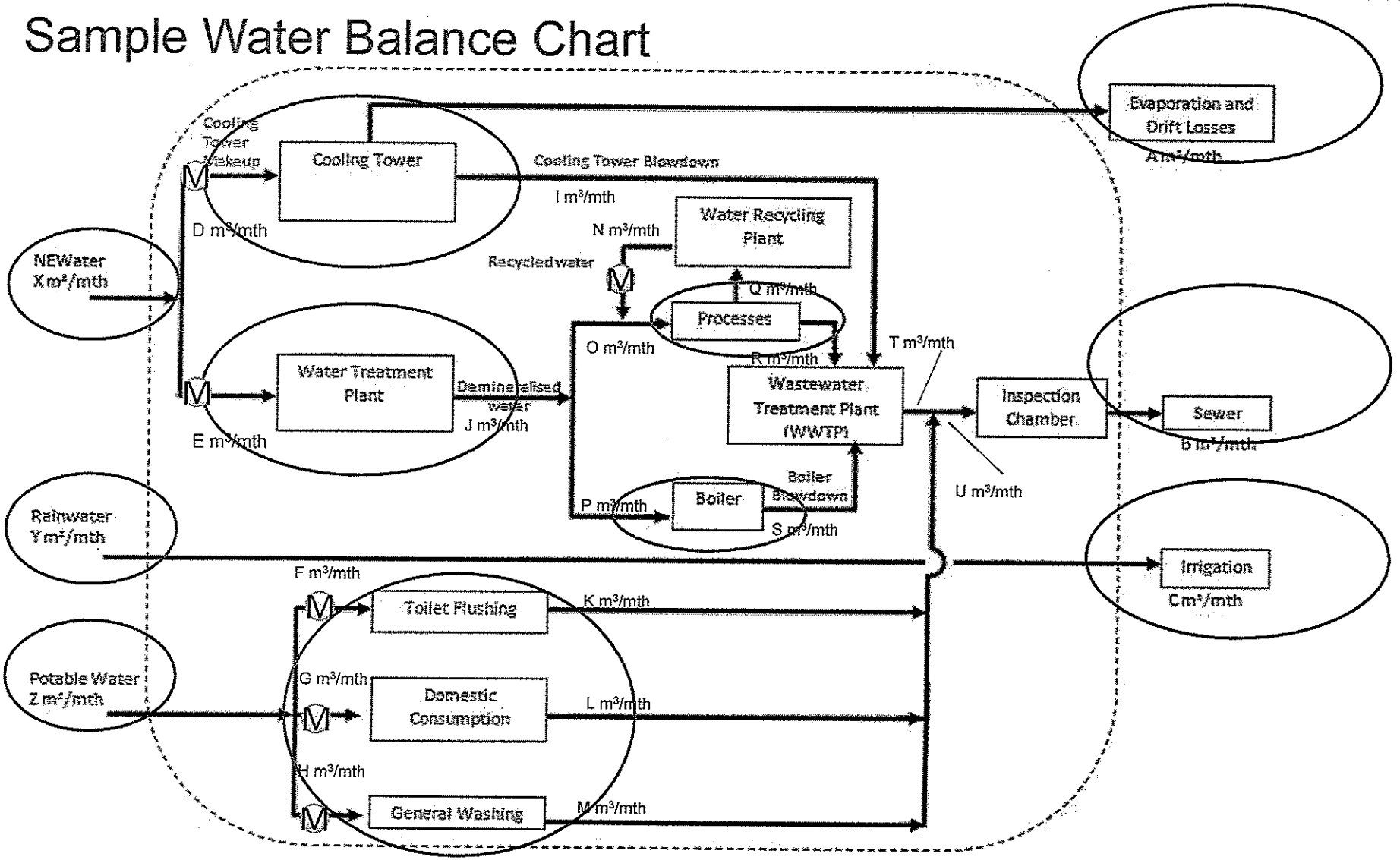
Choose File No file chosen Upload Attachment

- Subject to further revisions
- Offline template available



Reduce: *Water Efficiency Management Plan (WEMP)*

Sample Water Balance Chart



Water balance equation: (Total Water Input to boundary) = (Total Water Output of boundary)

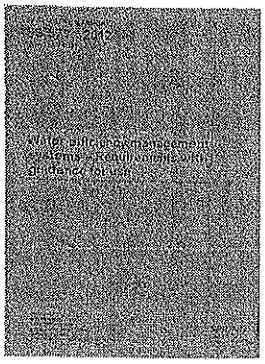
X+Y+Z = A+B+C

Ⓜ Private water meters

SS 577 : 2012 Water Efficiency Management Systems

Objectives :

- specifies requirements that contribute to water efficiency:
  - Leadership & commitment, water usage, monitoring, measurement, documentation and reporting, design and procurement practices for equipment, systems, processes and personnel
- enable organisation to take a systematic approach :
  - to achieve continual improvement of water efficiency and to develop and implement water saving measures
- Facilitate organisations to prepare their WEMP
- Launched in Mar 2013
- 4 Organisations have obtained certification in 2013







Funding Schemes for Certification to SS 577 : 2012

SPRING Singapore's Capability Development Grant - SMEs	PUB's Water Efficiency Fund (Feasibility Study) – Other Customers
Grant of 70% of the total cost^, cap at $20,000	Grant of 50% of the total costs+, cap at $10,000*

^ Manpower, Consultancy and 1st year Certification audit cost

+Consultancy and 1st year Certification audit cost

For premises with monthly water consumption ≤ 1,000 m³/mth, the funding cap is **$5,000.*

Reduce: *Application for Water Efficient Building Certification*

1) WEB (Basic) Certification:

•Contact PUB at pub_conserve@pub.gov.sg when your premises is ready for certification

2) WEB (Gold/Silver) Certification:

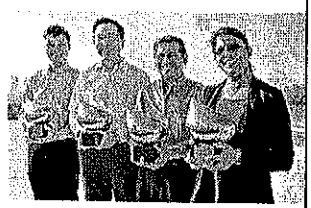
•Submit a copy of the completed application form, together with all relevant supporting documents either by

- post to PUB, or
- electronic mail to pub_conserve@pub.gov.sg

•Certification period : Every 3 years

Dates	Application Stage
Sep 14 – Mar 15	Consultation period
Jan 15 – end Mar 15	Application for Certification & Site Verification
Apr 15 – May 15	Evaluation & confirmation of recipients
Jun 15 – Sep 15	Certificate Presentation Ceremony

Watermark AWARD



- Recognise advocates for their outstanding contributions and commitment towards protecting and raising awareness of Singapore's precious water resources

- Nominations are open to all individuals and organisations from 1 Jul – 31 Aug 2014.

To be considered for the award, nominees must have:

•made significant contributions towards protecting and raising awareness of Singapore's water resources consistently over the past one year; and

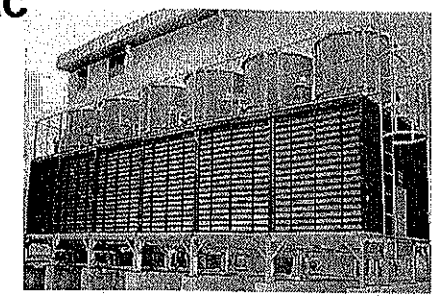
•contributed beyond core work scope, direct economic interest and regulatory requirements.

•Attaining WEB(GOLD) is one of the key criteria

For more information, you can visit: www.pub.gov.sg/watermarkaward

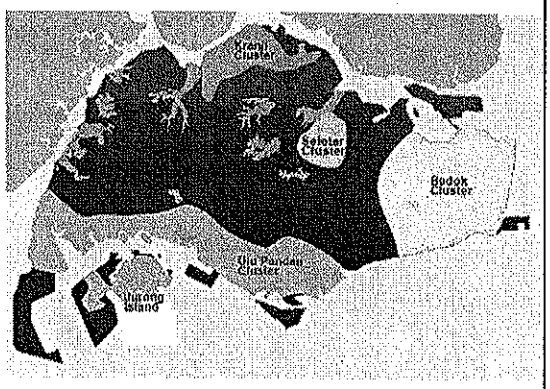
Enquiries about Watermark Award, email : pub_watermark_award@pub.gov.sg

REPLACE – NEWater, Seawater etc



- Encourage substitution with NEWater, rainwater and Sea water

- NEWater :
  i) frees up potable water for other uses
  ii) quality suitable for process use (UPW), boilers, laundry, air-con cooling towers, toilet flushing, general washing
  iii) lower price - ($1.52 to $1.22)



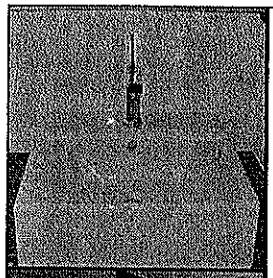
- Rainwater Harvesting allowed
  - To consult PUB for any rainwater collection system
  - To comply with NEA's requirements on mosquito prevention

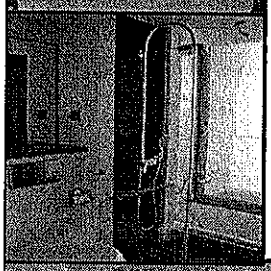
Regulatory Requirements

Code of Practice for Water Services –SS CP 48 : 2005 NEWater (Cl 1.3.3)

- All new commercial and industrial development proposals are required to provide a dedicated NEWater pipe system to take in NEWater for air-conditioning cooling towers and for suitable process water use in industrial premises when the NEWater supply becomes available.

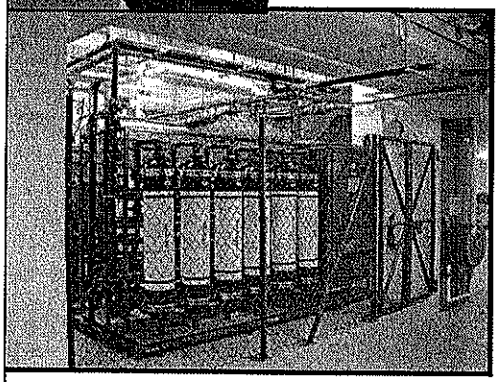
Recycling for Reuse

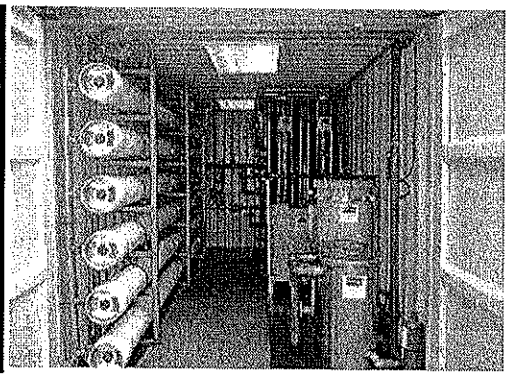




Encourage recycling of the following for reuse for non-potable purposes:

- Process water
- Greywater



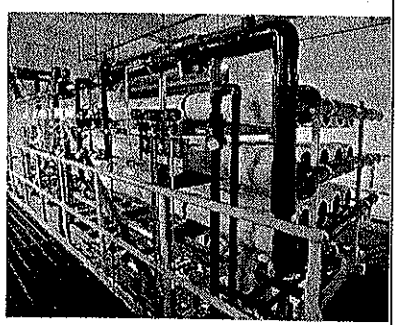


Water Efficiency Fund

Recycling Efforts / Use of Alternative Sources of Water (revised in 2014)

- Funding is offered based on: **water savings** of potable water (PW)/NEWater (NW)/industrial water (IW) or **capital cost** of the facilities, whichever is lower, cap at $1,000,000

Water Savings*	Capital Cost
$0.60 / m^3 of PW saved **$0.30 /** m^3 of NW saved **$0.10 /** m^3 of IW saved	50% of the capital cost of the facilities



** Over the economic life of the facilities or 7 years, whichever is earlier.*

Water Efficiency Fund

Recycling Efforts / Use of Alternative Sources of Water (revised with effect from 1 Apr 2014)

Computation of fund (based on hypothetical scenario)

- Economic life of facilities = 7 years
- Computation of funding based on water savings
  - Projected savings of PW = 20,000 m^3 / mth
  - Projected savings of PW over 7 years
    = 20,000 m^3 / mth x 12 mths x 7 yrs
    = 1,680,000 m^3
  - Based on **$0.60 /** m^3 of PW saved, funding amount based on water savings = $0.60 / m^3 x 1,680,000 m^3 = **$1,008,000**
- Computation of funding based on capital cost
  - Capital cost of facilities = $2,500,000
  - 50% of capital cost of facilities = **$1,250,000**
- Funding amount is lower of computation based on water savings and computation on capital cost = $1,008,000 (based on water savings)
- But, funding amount is capped at $1,000,000, so :

Approved funding amount = $1,000,000

Water Efficiency Fund

Recycling Efforts / Use of Alternative Sources of Water (revised with effect from 1 Apr 2014)

Disbursement of Fund

a) PUB will disburse 30% of the approved funding amount upon commissioning of facilities installed.

b) The remaining 70% of the approved funding amount will be disbursed annually based on actual savings up to 7 years and subject to cap of approved amount.

Time	Actual water savings (m^3/yr)	Incentive amount ($)	Incentives accumulated ($)	Disbursement ($)	Total Disbursement received ($)
Upon commissioning				300,000	300,000
Year 1	240,000	144,000	144,000	0	300,000
Year 2	240,000	144,000	288,000	0	300,000
Year 3	240,000	144,000	432,000	132,000	432,000
Year 4	240,000	144,000	576,000	144,000	576,000
Year 5	240,000	144,000	720,000	144,000	720,000
Year 6	240,000	144,000	864,000	144,000	864,000
Year 7	240,000	144,000	1,008,000	136,000	1,000,000

30%disbursement upon commissioning

Incentives accumulated > total disbursement received, so disbursement
= $432,000 – $300,000 = $132,000

Incentives accumulated < total disbursement received

Incentives accumulated more than approved funding amount of $1,000,000. Hence, disbursement = $1,000,000 – $864,000 = $136,000

Water Efficiency Fund

Feasibility Study Project

Other types of feasibility studies

Grant of 50% of total cost, cap at $50,000 upon full scale implementation of project#

 # If the project is not implemented at full scale, a grant of 10% of total cost is offered, cap at $10,000

Community-wide Water Conservation Campaigns and Programmes

Grant of 50% of the costs of organising the programme, cap at $200 - $5,000 (depending on type of programme)

Water Efficiency Manager Course

SINGAPORE POLYTECHNIC
Opening Minds Shaping Lives

- **Objective:** To equip facilities managers with the knowledge and skills to:
  - conduct water audits
  - apply water efficiency measures to reduce water consumption in commercial/residential buildings.



- **Target Audience**
  - Facilities & Estates Managers
  - Building Owners
  - Engineers & Architects
- **Award**
  - Pass MCQ test, achieved minimum 75 % attendance and must submit the Water Efficiency Management Plan
  - Certificate of proficiency upon completion of the course.
- **Duration** : 3 days
- **Course Fees** : S$481.50 (with GST) per participant
- **Eligible for SDF Claims and PDU points**

Water Efficiency Manager Course

SINGAPORE POLYTECHNIC
Opening Minds Shaping Lives

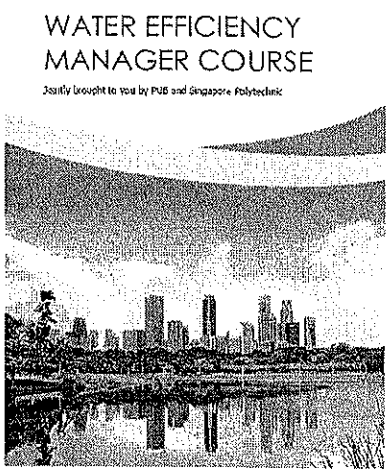
Course Content

- Regulatory requirements, Incentive, Water Efficiency Planning
- Cooling Tower Water Management
- Water Efficient Irrigation & Landscape
- Swimming Pool
- Audit Methodology & Tools
- Industrial Water Solutions
- Site visits

http://www.sp.edu.sg/

Public Run Dates

- 2015
  - 21, 28 and 29 Jan
  - 11, 18 and 19 Mar
  - 13, 20 and 21 May
  - 22, 29 and 30 Jul
  - 4, 11 and 12 Nov



Green Mark Scheme
- Water Efficiency Criteria

BCA GREEN MARK

EXISTING BUILDINGS

- Non residential buildings (ver 3) wef April 12
- Water Efficiency – **24 points** out of 180
  - Water Monitoring – 4 pts
  - Water Efficient Fittings – 12 pts
  - Alternative Water Sources – 3 pts
  - Water Efficiency Improvement Plans – 1 pt
  - Irrigation System and Landscaping – 2 pts
  - Cooling Towers – 2 pts

GREEN MARK ASSESSMENT CRITERIA

Water Efficiency – Existing Buildings

Part 2 – Water Efficiency (Total Points: 24)	Green Mark Points
2-1 Water Monitoring (4 points)	
Provide private-metering and leak detection system for better control and monitoring.	
a)To monitor the water consumption on monthly basis	1 point
b)Provision of private-meters for major water uses (e.g. cooling tower, water features, irrigation, swimming pools, tenants' usage)	1 point
c)Provision of automated / smart metering for monitoring and leaking detection	2 points

GREEN MARK ASSESSMENT CRITERIA

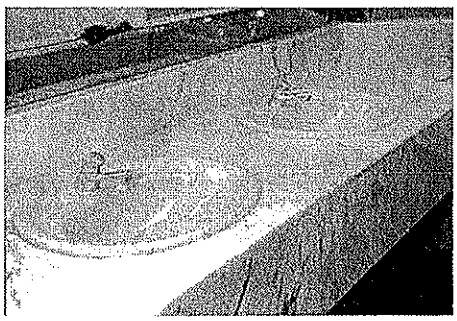
Water Efficiency – Existing Buildings

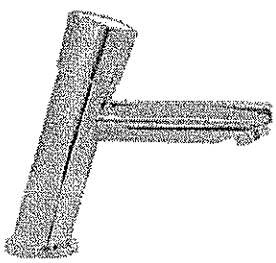
Part 2 – Water Efficiency (Total Points: 24)	Green Mark Points
2-2 Water Efficient Fittings (12 points) Encourage the use of water efficient fittings under Water Efficiency Labelling Scheme (WELS) or adopt equivalent water efficient flow-rate/flush volumes for water fittings:- ▪Basin taps and mixers ▪Showers ▪Sink/Bib taps and mixers ▪Urinals ▪Other water efficient fittings Or To have PUB Water-Efficient Building Certificate	Rating based on Water Efficiency Labelling Scheme (WELS) Very Good – 9 points Excellent – 12 points Points scored based on the number and water efficiency rating of the fitting type used (up to 12 points) 9 points

Regulatory Requirements

Code of Practice for Water Services –SS CP 48 : 2005 Water Conservation Measures (Cl 7.2)

- Install Self-Closing Delayed-Action Taps
  - All wash basins, shower pts
- **In all non domestic premises (including common amenities of condominiums)**

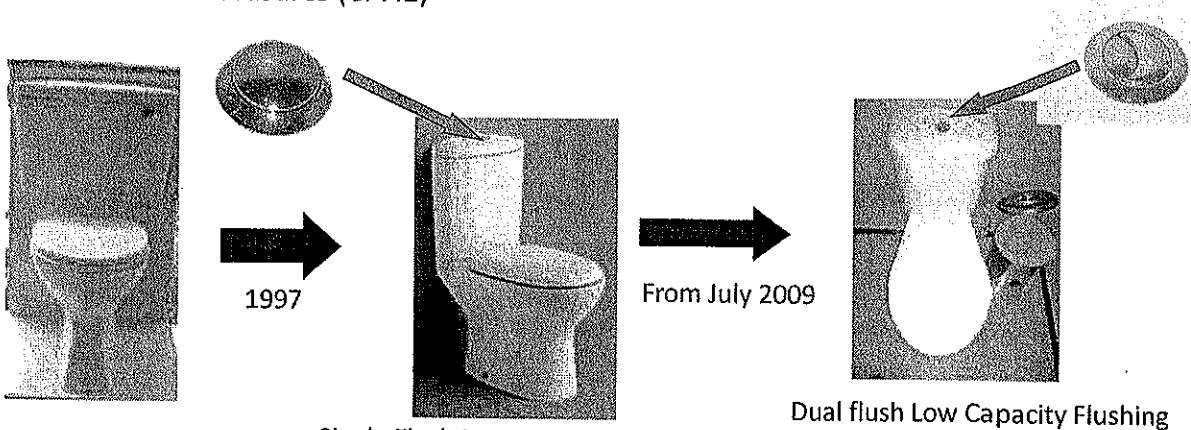






Manually-operated Sensor-operated
Self-Closing-Delayed-Action Tap

Code of Practice for Water Services –SS CP 48 : 2005
Water Conservation Measures (Cl 7.2)



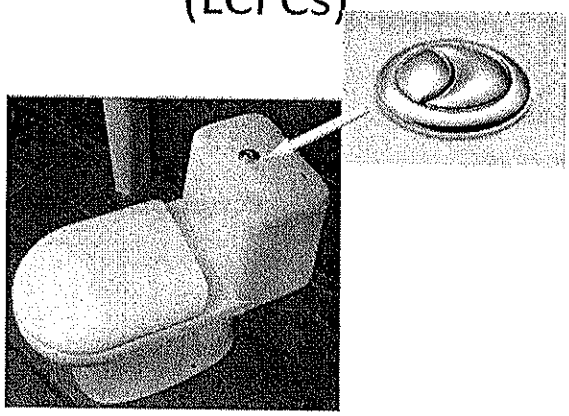
9 litre flushing cistern

Single Flush Low capacity flushing cistern (4.5 litres)

Dual flush Low Capacity Flushing Cistern

- Install dual flush low capacity flushing cisterns in new developments and existing domestic premises under renovation which involve the
  - replacement of water closets
  - applicable for non-domestic premises if flushing cisterns are to be used
  - applicable to all domestic premises

Dual Flush Low Capacity Flushing Cisterns (LCFCs)

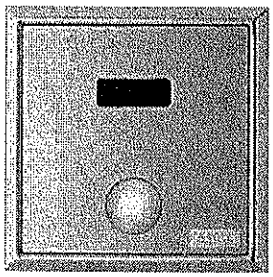


Dual flush LCFC

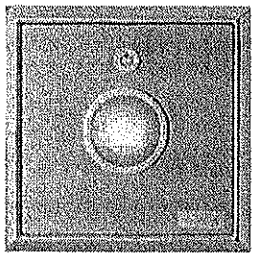
- Full flush not more than 4.5 litres
- Reduced flush not more than 3.0 litres
- Allow user to choose reduced flush for flushing liquid wastes
- Can save approximately 1.5 litres per flush

(Public toilets to be fitted with sensor operated flush valves as required by NEA)

Flush Valves



Sensor-operated
Flush Valve
With Sensor Faceplate

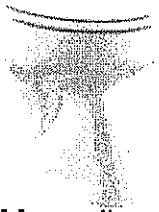


Manually-operated
Flush Valve
With Manual Button
Faceplate



Exposed Manually-operated
Urinal Flush Valve
With Manual Button





Exposed Manually-operated
Flush Valve

Code Of Practice On Environmental Health 2005
Definition of Public Toilet

A public toilet is defined as a toilet that the general public has free access, regardless of payment/ non-payment to access the premises. The general public is free to access the public toilet without having to be a resident, student, staff, member or a guest, or a regular client. Toilets in following places are classified as public toilets:

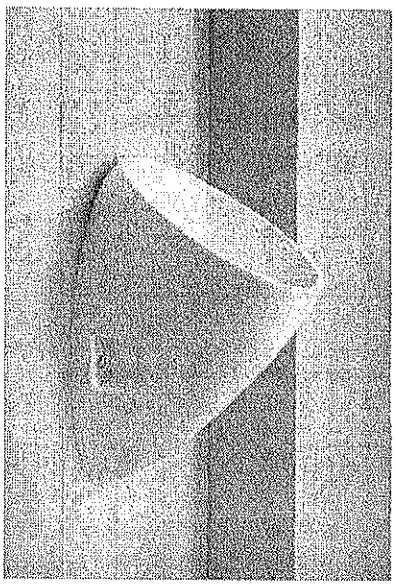
- shopping mall or centre, including the floor in commercial buildings with shops;
- supermarket and wet market;
- eating establishment and food centre (restaurant, coffeeshop, hawker centre, food court)/ bar/ nightclub/ discotheque/ pub;
- conference hall/ cinema/ theatre;
- park/ tourist site/;
- bus terminal/ interchange;
- petrol station;
- community centre/ community clubs;
- exhibition hall/ convention hall;
- MRT station;
- stadium;
- public swimming pool.

Regulatory Requirements

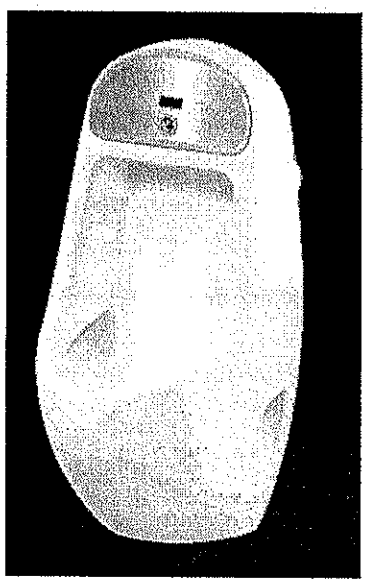
Urinals

- **Cl 4.2.6 SS CP 48 – Flush valves for urinals**
  - **All flush valves must be so adjusted as to give a flush of not more than 1.5 litres, 1 litre and 0.5 litre of water per flush for large, medium and small size urinals respectively.**

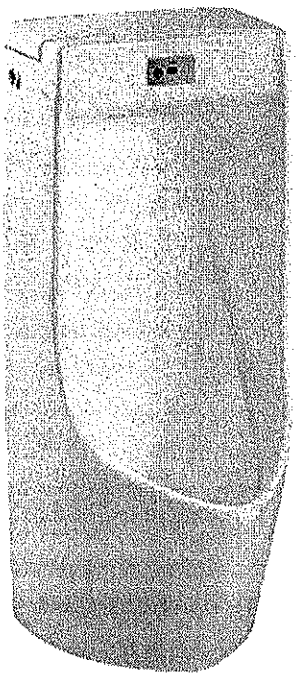
Size of urinal	Max allowable flush volume (litres)
small	0.5
medium	1.0
large	1.5



Small



Medium



Large

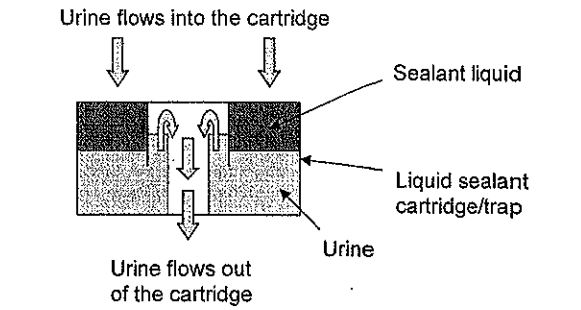
Waterless Urinals

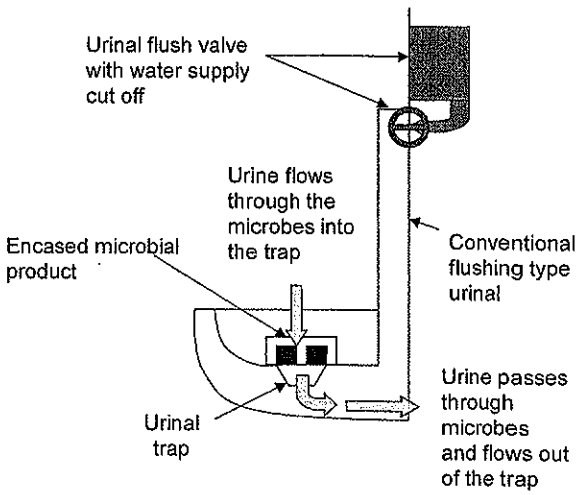
1. **Waterless Urinals (Liquid Sealant Type)**

- Working Principles: A proprietary urinal cartridge/trap designed to make use of a light density liquid sealant that forms a barrier between the environment and the offensive odour in the trap caused by the urine. Therefore no water flushing is necessary after use.

2. **Converting conventional flushing type urinals to waterless urinals by means of microbial products**

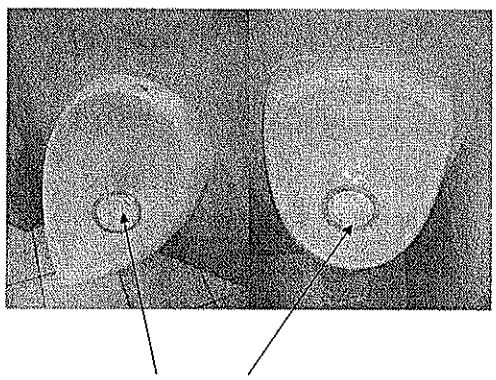
- Working Principles: By placing a proprietary microbial product near the urinal trap, the friendly bacteria will break the binding process between the unfriendly/faecal bacteria and the urine solids such that it eliminates the offensive odour. Therefore no flushing is necessary after use.





Waterless Urinals

Waterless Urinals (Liquid Sealant)

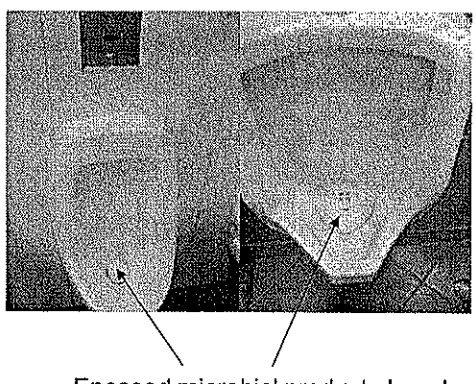


Liquid sealant cartridge

Examples Of Some Brands Available:

Zero Flush
Falcon

Converting conventional flushing type urinals to waterless urinals by means of microbial products



Encased microbial product placed near the urinal trap

Examples Of Some Brands Available:

Redlab Biotechnologies
Desert Cubes

Waterless Urinals

Cleaning & Maintenance

1. Waterless Urinals (Liquid Sealant Type)

- Pouring or splashing of water and the use of conventional detergents on the urinal are usually not advised.
- Some designs would require simple cleaning by light wiping on the urinal surface while some may not.
- Observation is required on the liquid sealant to ensure that it is in normal working condition. Cartridge/liquid sealant to be replaced when traces of sealant is visible on urinal bowl.
- Some designs require total replacement of the cartridge while some designs only require a top-up of the liquid sealant.

2. Converting conventional flushing type urinals to waterless urinals by means of microbial products

- Normal daily cleaning by means of brushing off the stains on the urinal bowl and trap is necessary in accordance with usual schedule.
- The use of conventional detergents on the urinal is usually not advised.
- Attention may be required in the cleaning of the urinal trap and the drain pipe downstream the trap.
- Observation is required on the microbial cubes and they have to be topped up when they are used.

Examples Of Locations Installed with Waterless Urinals

1. **Waterless Urinals (Liquid Sealant Type)**

a. Environment Building at Scotts Road

- Feedback: Easy to clean and maintain.

b. ITE College East at Simei

- Feedback: Not easy to maintain due to vandalisms.

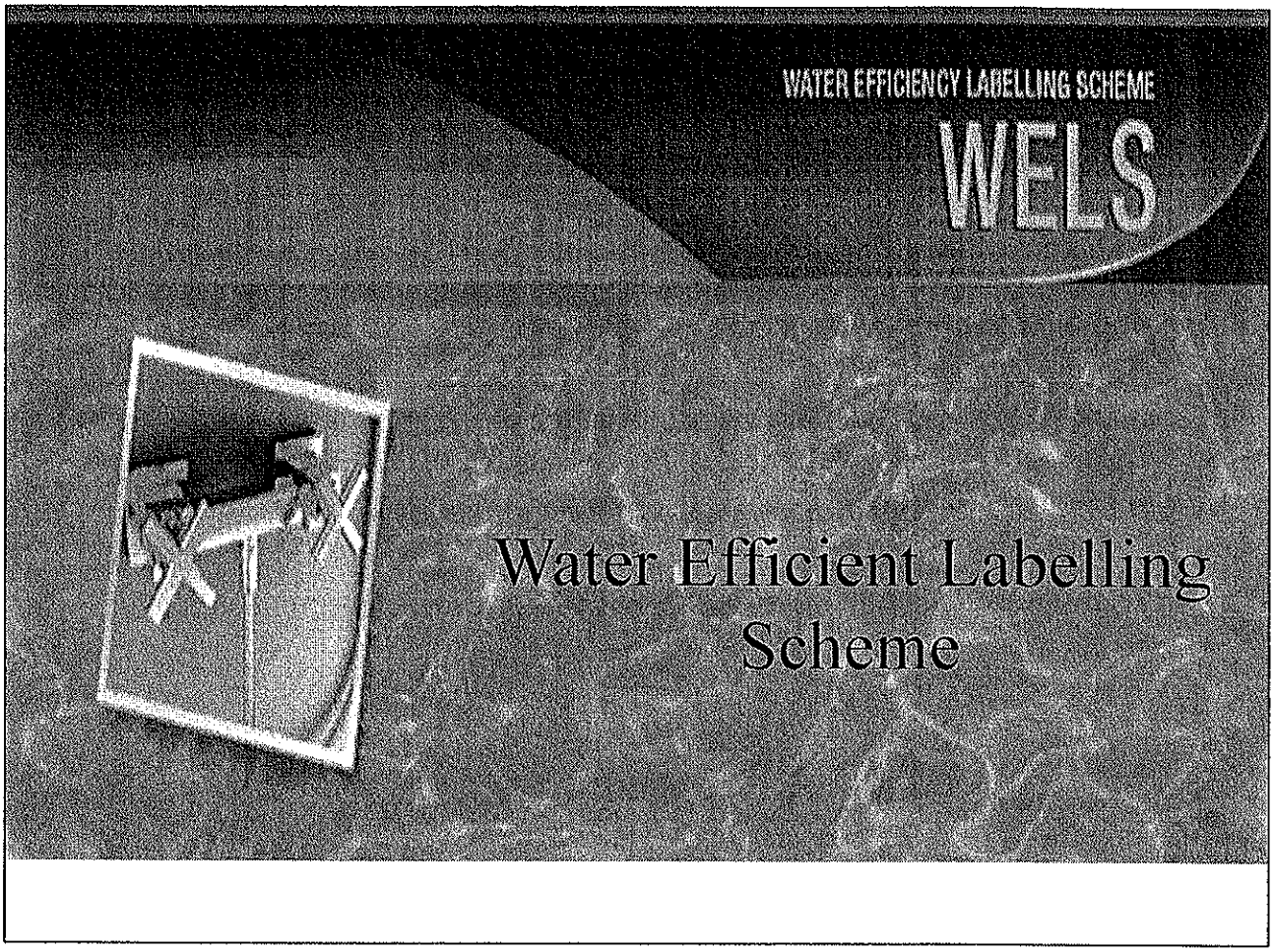
2. **Converting conventional flushing type urinals to waterless urinals by means of microbial products**

a. Cathay at Handy Road

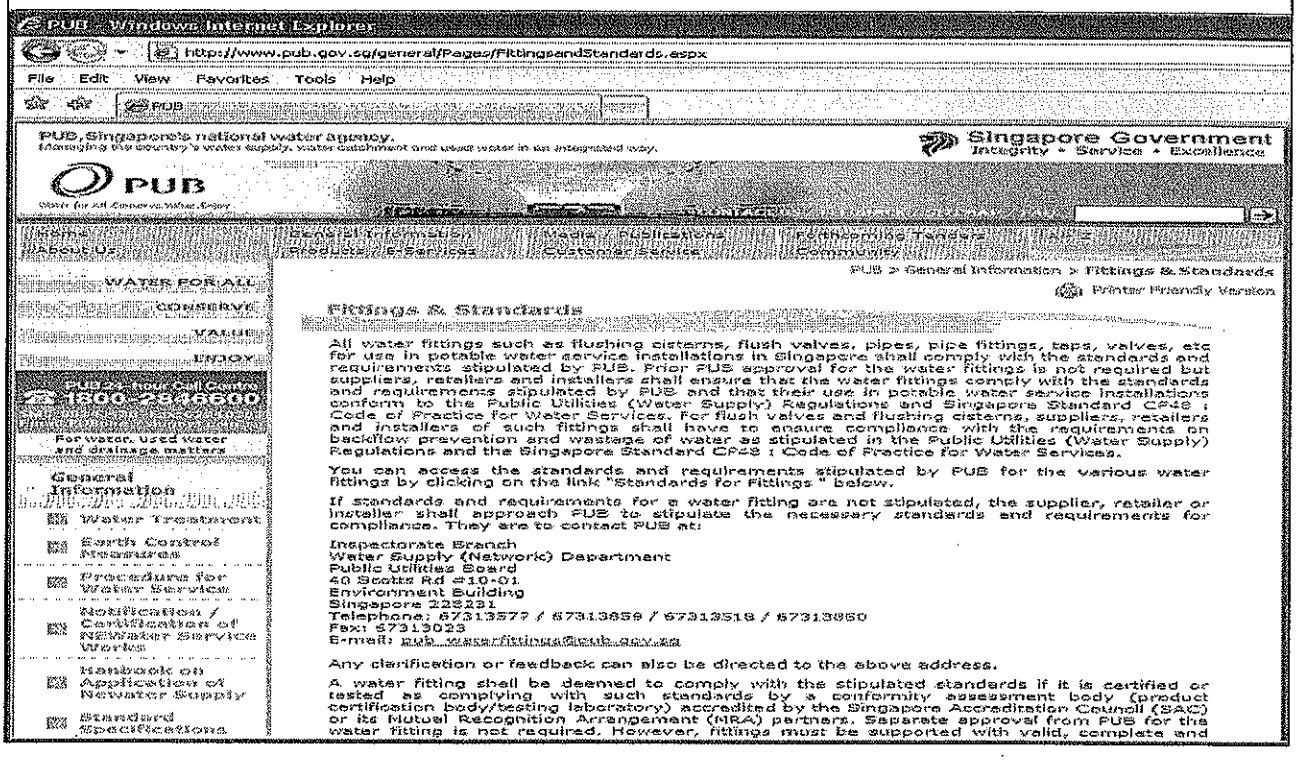
- Feedback: Requires more attention in cleaning and maintenance.

b. Vivo City at Telok Blangah Road

- Feedback: Approximately 25% savings realised.



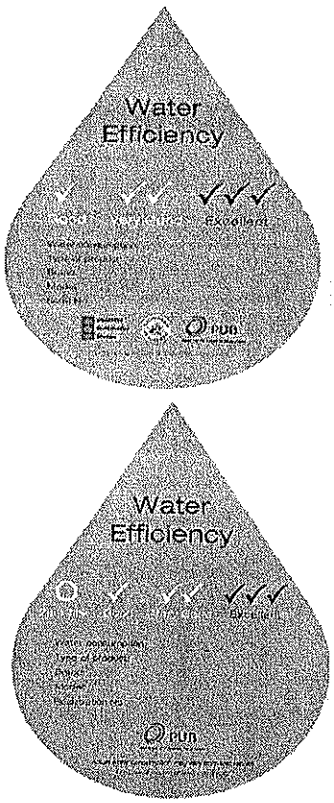
Current Requirements
Compliance with Standards stipulated by PUB



Current Requirements

- Fittings supported with valid test certificates/reports
- Certified or tested by a conformity assessment body (product certification body/testing laboratory) accredited by Singapore Accreditation Council (SAC) or its Mutual Recognition Arrangement (MRA) partners
- Test certificates/reports must be produced for verification upon request by PUB
- SUPPLIERS are to keep proper records of such reports.
- PUB continues to conduct checks and will take action against non-compliance

Water Efficiency Labelling Scheme

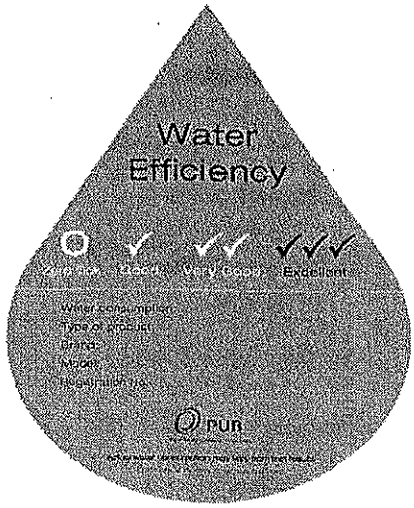


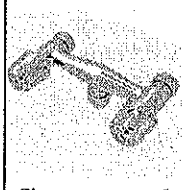
Background of WELS

- Voluntary Water Efficiency Labelling Scheme (WELS) launched on 31 Oct 06
- Scheme made mandatory from 1 Jul 09
- Objective of WELS
  Aims to help consumers make well-informed purchasing decisions and reduce their water consumption by providing information on the water efficiency of products
- WELS rate products in terms of water efficiency
- 1 tick for Good rating, 2 ticks for Very Good rating and 3 ticks for Excellent rating

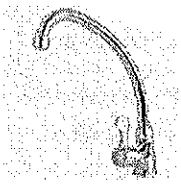
Mandatory Water Efficiency Labelling Scheme

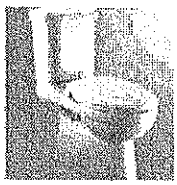
- To enhance the Scheme, PUB has mandated it through the Mandatory WELS (MWELS)
- Type of water fittings under Mandatory WELS
  - Basin taps & mixers
  - Shower taps & mixers
  - Sink/bib taps
  - Dual flush low capacity flushing cisterns (LCFC)
  - Urinals & urinal flush valve
  - Washing Machines

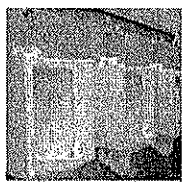


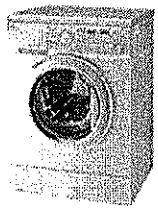

Shower taps and mixers


Basin taps and mixers


Sink/Bib taps and mixers

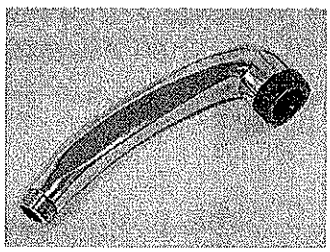

Low capacity flushing cisterns

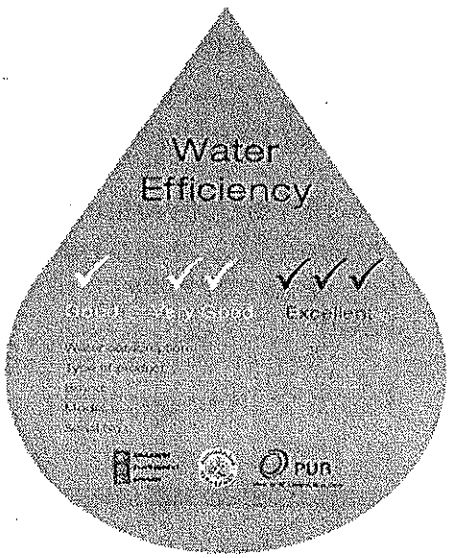

Urinals and urinal flush valves


Washing machines

Type of water fittings under Voluntary WELS

- Showerheads remains under Voluntary WELS


Showerheads



Criteria For Water Efficiency Labelling Scheme (WELS)

FITTINGS	MAXIMUM ALLOWABLE	✓ GOOD RATING	✓✓ VERY GOOD RATING	✓✓✓ EXCELLENT RATING (**)
Shower Taps, Mixers & Showerheads (L/min)	9	>7 to 9	>5 to 7	5 or less
Basin Taps & Mixers (L/min)	6	>4 to 6	>2 to 4	2 or less
Sink/Bib Taps (L/min)	8	>6 to 8	>4 to 6	4 or less
Flushing Cisterns – Dual Flush Type (L/flush)	4.5 (full flush) 3.0 (low flush)	> 4.0 - 4.5 (full flush) > 2.5 -3.0 (low flush)	>3.5 to 4.0 (full flush) > 2.5 – 3.0 (low flush)	3.5 or less (1) (full flush) 2.5 or less (low flush)
Urinals & Urinal Flush Valve (L/flush)	1.5	> 1.0 to 1.5	> 0.5 to 1.0	0.5 or less or (2) waterless urinals
Washing Machine (L/Kg)	15	> 12 -15	> 9 -12	9 or less

(1) To pass laboratory simulation test on waste transportation efficiency in pipes

(2) To pass dilution test

** The Excellent rated fittings shall also meet the minimum acceptable flowrates specified for the different fittings above

Code of Practice for Water Services –SS CP 48 : 2005 Max allowable flowrates (Cl 4.1) & Public Utilities Water Supply Regulations (Cl 40)

From 1 July 2009

- All taps, urinals and flushing cisterns to display MWELS labels prominently at point of sale and packaging.
- For all new developments and existing developments undergoing renovations, only water fittings/products that are labelled with at least 1-tick water efficiency rating and above under MWELS shall be installed and used.

From 1 October 2011

- All clothes washing machines to display MWELS labels prominently at point of sale and packaging.

From 1 April 2014

- Minimum Water Efficiency Standards (MWES) will be introduced for clothes washing machines.

Code of Practice for Water Services –SS CP 48 : 2005
Max allowable flowrates (Cl 4.1 Table 1)

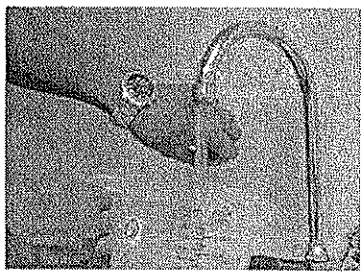
Area of Usage	Maximum Allowable Flowrate (litres/min) (2004)	WELS Flow Rating for Tick Label (July 2009)	Water Efficient Flow Rate (litres/min)	Remarks
Basin Tap & Self Closing Delayed Action Basin Tap	6	> 4 to 6	2 (toilets) 4 (others)	For *self closing delayed action basin taps, timing shall remain at between 2 and 3 sec
Sink / Kitchen Tap and Wash Area	8	> 6 to 8	6	
Shower Tap & Self-Closing Delayed Action Shower Tap	9 12 (hotels)	> 7 to 9	7 9 (hotels)	For self closing delayed action shower tap, timing shall remain at between 13 and 15 sec
Other Areas	8	> 6 to 8	6	

* Sensor self-closing delayed action basin taps with a flow rate of 2 litres/minute are allowed a maximum preset timing of not more than 60 seconds provided water supply from the tap is automatically cut off when the hand is moved away from beneath the tap.

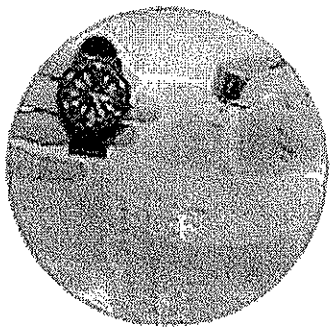
Measuring Flow Rate

How to measure flow rate

- **Items required :**
  - **A stopwatch / watch**
  - **A measuring cylinder**



- Procedure:
  1) Measure the flow rate for 6 seconds.
  2) Multiply the volume of water by 10.
  3) The flow rate will be in litres per minute.

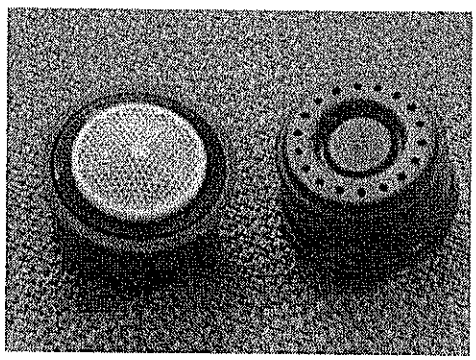


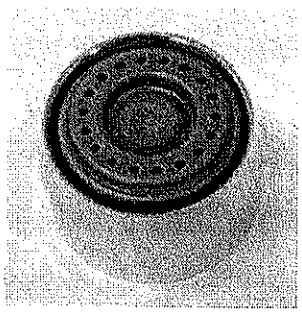
Estimate Water-Use

Item	Location	* Number of units (A)	Flow rate		* Operating time (per day) (D)	Total water used (cu m /day)		Water saving [1-2] (cu m/day)
			*Current (B)	Water-efficient model (C)		***Current (AxBxD) [1]**	Proposed (AxCxD) [2]	
Basin Taps	Toilets	8	6 L/min	2 L/min	15 mins	0.72	0.24	0.48
Sink taps	pantry	2	8 L/min	6 L/min	10 mins	0.16	0.12	0.04
Flushing cistern	Toilets	31	9 L/flush	4.5 L/flush	10 flushes	2.79	1.395	1.395
Irrigation & others	-		0.6 cu m /day	0.3 cu m /day		0.6	0.3	0.3
Cooling tower	roof	1	3.5 cu m/day	3.5 cum /day		3.5	3.5	0
Total						7.77	5.555	2.215

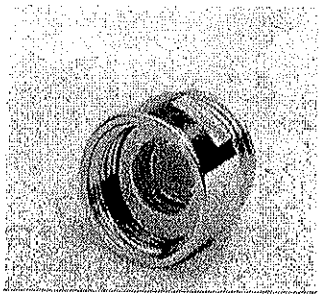
Component	**Water usage (cu m/day)**	**% usage**
Toilets and Pantry	3.67	47 %
Irrigation & others	0.6	8 %
Cooling tower	3.5	45 %

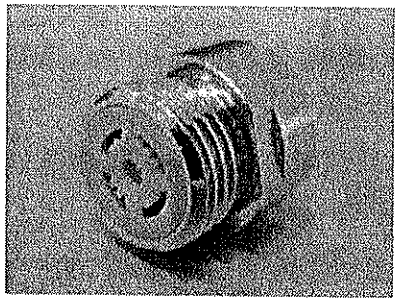
Terminal Constant flow regulator





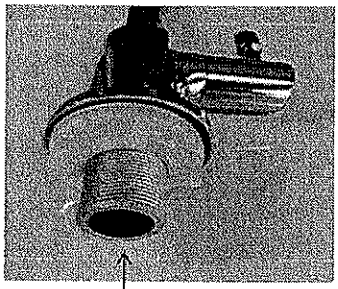
In line Constant flow regulator



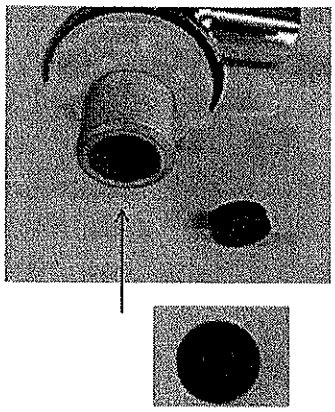


If low rate at taps abnormally low

- could be due to chokage of the flow regulator inside the taps.
- To rectify, remove flow regulator and clean before fitting back in the tap.



Flow regulator inserted here



Remove and clean the flow regulator and put it back in place

GREEN MARK ASSESSMENT CRITERIA

Water Efficiency – Existing Buildings

Part 2 – Water Efficiency (Total Points: 24)	Green Mark Points
2-3 Alternative Water Sources (3 points) Use of suitable systems that utilize alternative water sources for non-potable uses: irrigation, washing, water features, toilet flushing, etc (excluding cooling tower make up water) to reduce use of potable water. Alternative sources can include rainwater, greywater (for toilet flushing only), NEWater, AHU condensate and recycled water from approved sources.	Points awarded based on % reduction in total potable water usage of the applicable uses > 50 % - 3 points ≥ 10 % to 50 % - 2 points < 10 % - 1 point (Up to 3 points)

GREEN MARK ASSESSMENT CRITERIA

Water Efficiency – Existing Buildings

Part 2 – Water Efficiency (Total Points: 24)	Green Mark Points
2-4 Water Efficiency Improvement Plans (1 point) Targets to improve building water performance against own building water performance baseline should be set. To show intent, measures and implementation strategies of water efficiency improvement plans over the next three years. Committed water savings accrued from proposed measures should be quantified. (PUB water efficiency management plan is acceptable as evidence)	1 point

Completed Water Efficiency Management Plan submitted to PUB can be considered.

GREEN MARK ASSESSMENT CRITERIA

Water Efficiency – Existing Buildings

Part 2 – Water Efficiency (Total Points: 24)	Green Mark Points
2-5 Irrigation System and Landscaping (2 points)	
(a)Use of automatic water efficient irrigation system with rain sensor, soil moisture sensor or equivalent control system.	Extent of Coverage: At least 50% of the landscape areas are served by the system 1 point
(b) Use of drought tolerant plants that require minimal irrigation.	Extent of Coverage: At least 50% of the landscape areas 1 point

GREEN MARK ASSESSMENT CRITERIA

Water Efficiency – Existing Buildings

Part 2 – Water Efficiency (Total Points: 24)	Green Mark Points
2-5 Cooling Towers (2 points) Reduce potable water use for cooling purpose. (a) Use of cooling tower water treatment system which can achieve 7 or better cycles of concentration at acceptable water quality. (b) Use of NEWater or on-site recycled water from approved sources.	 1 point 1 point

GREEN MARK ASSESSMENT CRITERIA

WEB(GOLD) – Green Mark pts under Innovations

BCA Green Mark for Existing Non-Residential Buildings (Version 3.0)

Part 5 – Other Green Features (Total Points: 10)	Green Mark Points
ENRB 5-1 Green Features and Innovations To encourage the use of other green features which are innovative or/and have positive environmental impact. Examples : • Tenants with Green Mark for Office Interior or Restaurant certificate • Green Lease • Ultraviolet light-C band (UV) emitters in air handling units (AHUs) to improve indoor air quality • Provision of carpark guidance system • Use of self cleaning façade system • Use of grey water recycling system • Titanium Dioxide coating to remove odour in toilets • Use of pneumatic waste collection system • Use of double refuse chutes for separating recyclable from non-recyclable waste • Stormwater management	2 points for high impact item 1 point for medium impact item 0.5 point for low impact item (Up to 10 Points)

EXISTING BUILDINGS



- Residential buildings (ver 1) wef 19 May 2011
- Water Efficiency – 18 points out of 137
- Perquisites (6 points):
  - Water Monitoring (2 points)
  - Water Efficiency Improvement Plans (2 points)
  - Common Area Washing (2 points)

GREEN MARK ASSESSMENT CRITERIA

Water Efficiency – Existing Residential Buildings

BCA Green Mark Version ERB/1.0 | Existing Residential Building Criteria

Part 2 – Water Efficiency	Green Mark Points
2-1 Water Efficient Fittings Encourage the use of water efficient fittings for common areas covered under the Water Efficiency Labelling Scheme (WELS) or adopt equivalent water efficient flow rates/flush volume. (a)Basin taps and Mixers (b)Dual flushing low capacity flushing cistern (c)Showers (d)Sink/Bib taps and Mixers (e)Urinals (f)All other water fittings	Rating based on Water Efficiency Labelling Scheme (WELS) Very Good – 2 points Excellent – 3 points Points awarded based on the number and water efficiency rating of the fitting types used (Up to 3 points)

GREEN MARK ASSESSMENT CRITERIA

Water Efficiency – Existing Residential Buildings

BCA Green Mark Version ERB/1.0 | Existing Residential Building Criteria

Part 2 – Water Efficiency	Green Mark Points
2-2 Water Monitoring Encourage the design of system that can monitor and manage water consumption. Provision and monthly monitoring of main water meter readings for the whole development. Provision and monthly monitoring of water sub-meter readings to track water usage of major water consuming areas. (i.e. common area washing, irrigation, car washing, water feature, swimming pool etc.) Display of promotional posters to encourage water saving practices and to prevent illegal water tapping.	**1 point** 1 point **1 point**

GREEN MARK ASSESSMENT CRITERIA

Water Efficiency – Existing Residential Buildings

BCA Green Mark Version ERB/1.0 | Existing Residential Building Criteria

Part 2 – Water Efficiency	Green Mark Points
2-3 Water Efficiency Improvement Plans Set plans that include targets to improve building's water performance against its own historical baseline, a breakdown of the current water use, list of water saving measures, and implementation timelines for the measures over the next five years. Committed water savings accrued from proposed measures should be quantified.	**2 points**

Completed Water Efficiency Management Plan submitted to PUB can be considered.

GREEN MARK ASSESSMENT CRITERIA

Water Efficiency – Existing Residential Buildings

BCA Green Mark Version ERB/1.0 | Existing Residential Building Criteria

Part 2 – Water Efficiency	Green Mark Points
2-4 Washing of Water Tanks Reuse the water from the annual water tank cleaning for non-potable usage such as common area washing, irrigation, etc.	2 points

GREEN MARK ASSESSMENT CRITERIA

Water Efficiency – Existing Residential Buildings

BCA Green Mark Version ERB/1.0 | Existing Residential Building Criteria

Part 2 – Water Efficiency	Green Mark Points
2-5 Irrigation System	
Provision of suitable systems that can utilise rainwater or recycled water for landscape irrigation, and use of plants that require minimal irrigation to reduce potable water consumption.	More than 50% of the applicable area: 1 point More than 25% of the applicable area: 0.5 point
Use of non-potable water for irrigation	1 point
Use of water efficient irrigation system	1 point
Use of drought tolerant plants	1 point

GREEN MARK ASSESSMENT CRITERIA

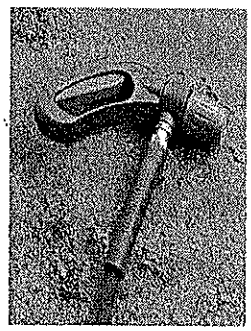
Water Efficiency – Existing Residential Buildings

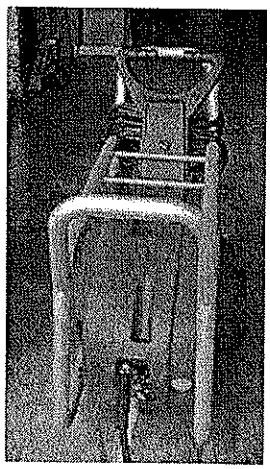
BCA Green Mark Version ERB/1.0 — Existing Residential Building

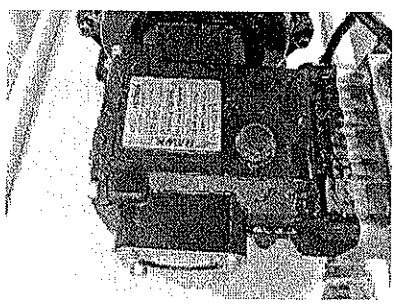
Criteria **Part 2 – Water Efficiency**	**Green Mark Points**
2-6 Common Area Washing	
Use of water efficient cleaning equipement with a flow-rate rating of;	
(a) Less than 12l/min	**1 point**
(b)Less than 8.5 l/min	2 points
The lance for the cleaning equipment to be equipped with a spring-loaded ON/OFF control to ensure that the pump and flow of water is immediately turned off when the spring-loaded control on the lance is released.	**1 point**
Use of non-potable water for common area washing	1 point
Part 2 – Water Efficiency Sub-Total :	**18 points**

High Pressure Washers

- Lance equipped with a spring-loaded control
- pump and flow of water immediately turned off when the spring-loaded control on the lance is released







-Pump for the high pressure washer high pressure washer shall be fitted with ON/OFF control
- automatically turns off the machine as well as the immediate flow of water when the machine is not in use

NEW BUILDINGS

BCA GREEN MARK

- 2 different categories for new buildings
  - Non residential buildings (ver 4.1)
  - Residential buildings (ver 4.1)

- Water efficiency – 17 points out of 190 (non residential)

  - 14 points out of 155 (residential)

GREEN MARK ASSESSMENT CRITERIA

Water Efficiency – New Buildings

BCA Green Mark Version NRB/4.1 Non-Residential Building Criteria

Part 2 – Water Efficiency	Green Mark Points		
NRB 2-1 Water Efficient Fittings Encourage the use of water efficient fittings covered under the Water Efficiency Labelling Scheme (WELS). (a)Basin taps and mixers (b)Flushing cistern (c)Shower taps, mixers or showerheads (d)Sink/Bib taps and mixers (e)Urinals and urinal flush valve	**Rating based on Water Efficiency Labelling Scheme (WELS)**		Points scored based on the number and water efficiency rating of the fitting type used (Up to 10 points)
	Very Good	Excellent	
	Weightage		
	8	10	

GREEN MARK ASSESSMENT CRITERIA

Water Efficiency – New Buildings

BCA Green Mark Version NRB/4.1 Non-Residential Building Criteria

Part 2 – Water Efficiency	Green Mark Points
NRB 2-2 Water Usage and Leak Detection Promote the use of sub-metering and leak detection system for better control and monitoring. (a) Provision of private meters to monitor the major water usage such as irrigation, cooling tower and tenants' usage. (b) Linking all private meters to the Building Management System (BMS) for leak detection	 1 point 1 point

GREEN MARK ASSESSMENT CRITERIA

Water Efficiency – New Buildings

BCA Green Mark Version NRB/4.1 Non-Residential Building Criteria

Part 2 – Water Efficiency	Green Mark Points
NRB 2-3 Irrigation System and Landscaping Provision of suitable systems that utilize rainwater or recycled water and use of plants that require minimal irrigation to reduce potable water consumption. (a)Use of non potable water including rainwater for landscape irrigation. (b)Use of automatic water efficient irrigation system with rain sensor. (c)Use of drought tolerant plants that require minimal irrigation.	 1 point Extent of Coverage : At least 50% of the landscape areas are served by the system 1 point Extent of Coverage : At least 80% of the landscape areas 1 point

GREEN MARK ASSESSMENT CRITERIA

Water Efficiency – New Buildings

BCA Green Mark Version NRB/4.1 Non-Residential Building Criteria

Part 2 – Water Efficiency	Green Mark Points
NRB 2-4 Water Consumption of Cooling Tower Reduce potable water use for cooling purpose. (a) Use of cooling tower water treatment system which can achieve 7 or better cycles of concentration at acceptable water quality. (b) Use of NEWater or on-site recycled water from approved sources	1 point 1 point
PART 2 – WATER EFFICIENCY CATEGORY SCORE :	Sum of Green Mark Points obtained from NRB 2-1 to 2-4

GREEN MARK ASSESSMENT CRITERIA

Water Efficiency – New Buildings

BCA Green Mark Version NRB/4.1 Non-Residential Building Criteria

Part 5 – Other Green Features	Green Mark Points
NRB 5-1 Green Features and Innovations Encourage the use of other green features that are innovative and/or have positive environmental impact. Examples : * Pneumatic waste collection system * Carbon footprint of development * Calculation of Concrete Usage Index (CUI) * Dual chute system * Self cleaning façade system * Conservation of existing building structure	2 points for high impact item 1 point for medium impact item 0.5 point for low impact item (Up to 7 points)

GREEN MARK ASSESSMENT CRITERIA
Water Efficiency – New Buildings

Green Mark Ver 4.1 — Residential

Part 2 – Water Efficiency	Green Mark Points	
RB 2-1 Water Efficient Fittings Encourage the use of water efficient fittings that are certified under the Water Efficiency Labelling Scheme (WELS) (a) Basin Taps and Mixers (b) Flushing Cistern (c) Shower taps, mixers or showerheads (d) Sink/Bib Taps and Mixers (e) All other water fittings	**Rating based on Water Efficiency Labelling Scheme (WELS)** Very Good / Excellent Weightage 8 / 10	Points scored based on the number and water efficiency rating of the fitting type used (Up to 10 points)
RB 2-2 Water Usage Provision of private meters to monitor the major water usage such as irrigation, swimming pools and other water features.	1 point	
RB 2-3 Irrigation System Provision of suitable systems that utilize rainwater or recycled water for landscape irrigation and use of plants that require minimal irrigation to reduce potable water consumption.		
(a) Use of non potable water including rainwater for landscape irrigation	1 point	
(b)Use of automatic water efficient irrigation system with rain sensor.	Extent of Coverage : At least 50% of the landscape areas are served by the system 1 point	
(c)Use of drought tolerant plants that require minimal irrigation.	Extent of Coverage : At least 50% of the landscape areas are served by the system 1 point	
PART 2 – WATER EFFICIENCY CATEGORY SCORE :	Sum of Green Mark Points obtained from RB 2-1 to 2-3	

Dry Spell (Jan-Mar 2014)



What Can You Do...

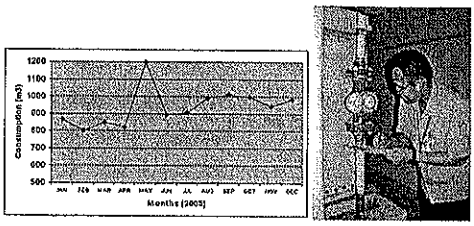
We urge Community and Businesses

- **CONSERVE** water
- Play our part to stretch our water resources
- Reduce your consumption now
  - ➢ Adopt Water Conservation Measures
- Reduce 10% during dry spell
  - ➢ Adopt further measures

10 Simple Ways to Reduce Water Usage

#1 - Monitor Water Usage

Take water meter readings regularly (daily/weekly/fortnightly)

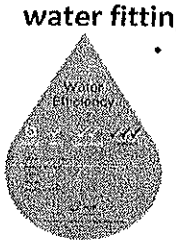


#2 - Check for Leaks

- Watch water meter during off peak period where there is no consumption/negligible consumption
- Display the maintenance office telephone number(s) so that users can report leaks Promptly



#3 – Adopt water efficient flowrates & flush volume for water fittings



- Install constant flow regulators / use high water-efficient labeled products

#4 – Adopt water efficient practices during irrigation

- Use drip irrigation system / water-efficient irrigation system / drought-tolerant plants that require minimal irrigation
- Irrigate plants only when necessary and between 4-7 am or 6-9 pm to minimise evaporation losses
- Use non-potable water for irrigation
- Avoid new plantings

10 Simple Ways to Reduce Water Usage

#5 - Adopt water efficient practices when carrying out washing activities/ water tanks

•Carry out washing activities only when necessary and supervise closely to ensure no wastage

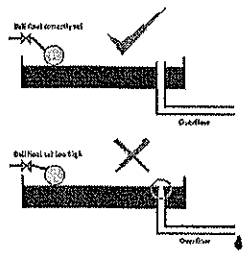
•Use water in water tank to around 150-200 mm above bottom of tank before isolating for cleaning & use water from draining of tank for non-potable uses e.g. irrigation

#6 - Adopt water efficient practices for cooling tower operation

•Check cooling towers regularly to prevent overflow and splashing. Avoid operating water cooled air-conditioning systems at temperatures below 24 °C.

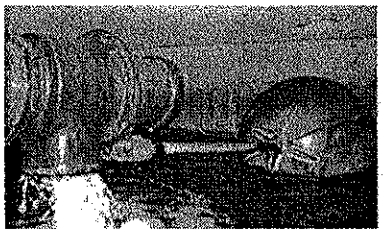
•Achieve 7 or better COC

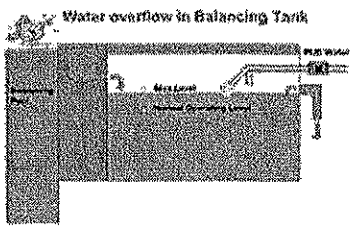
•Use variable speed drive circulation pumps



#7 – Adopt water efficient practices for swimming pool operation

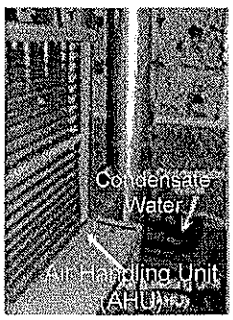
•Inspect water storage tanks especially the Swimming Pool's Balancing Tank regularly to ensure that the float switch mechanisms function properly to prevent overflow.





10 Simple Ways to Reduce Water Usage

#8 – Reuse for non-potable use



- Reuse AHU condensate for non-potable use such as cooling towers make-up.

#9 – Senior management & staff participation

•Senior management to encourage water efficiency practices

•Monitor work of Managing Agents, contractors, cleaners to reduce water usage & prevent wastage

•Display water conservation messages around premises to regularly employees to practise water conservation



#10 – Develop your Water Efficiency Management Plan

•To analyse water use, identify potential water-saving measures, and come up with action plan & implementation timelines

More info available at :

http://www.pub.gov.sg/conserve/WaterReductionMeasures/Pages/default.aspx

Further Measures During Dry Spell



Dry Spell Water Reduction Plan

- STOP leaks promptly
- STOP vehicle washing
- STOP running water features, fountains, water play areas & cascades
- STOP unnecessary watering of plants& turf
- STOP use of high pressure jets & hoses for washing activities
- Convert urinals to waterless type
- Reduce operating hours of water cooled air con systems
- Provide hand sanitizers to minimise hand washing
- Avoid new plantings

Thank You