AGENDA
- Background
- Introduction to grey water reuse and rainwater harvesting
- Water quality standards
- Treatment technologies
- Life cycle cost
- System planning and considerations
- Proposed regulatory framework
- Introduction to water efficiency labeling system
- Q&A

BACKGROUND

INTRODUCTION TO GREY WATER REUSE AND RAINWATER HARVESTING

TWM Strategy
Key Initiatives for Water Management

- Actively consider rainwater harvesting
- Actively consider reuse of grey water
- Promote use of water saving devices
GREY WATER OVERVIEW

<table>
<thead>
<tr>
<th>Level</th>
<th>Sources</th>
<th>Characteristics</th>
<th>% Domestic Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>A/C condensate, bathroom wash basins, baths, showers, swimming pool drains</td>
<td>Low level of contamination</td>
<td>30%</td>
</tr>
<tr>
<td>II</td>
<td>Kitchen sinks, Clothes washers/laundry</td>
<td>High level of contamination, require biological treatment</td>
<td>40%</td>
</tr>
</tbody>
</table>

RAIN WATER OVERVIEW

- Rain water can be captured from:
  - Roofs
  - Paved areas (car parks, walkways)
  - Grass and landscaped areas
  - Vertical faces of high-rise buildings

- Potential contaminants:
  - Bird droppings
  - Organic matter from grass & plants
  - Dirt

- Controlled by:
  - Selection of surface
  - 1st flush diversion
  - Treatment

- Availability of rain water:
  - Rainfall profile
  - Size of storage
  - Size of catchment
  - Losses

POTENTIAL USES

Recommended Usage of Treated Grey Water and Rainwater in New Developments

- Toilet Flushing
- External Cleaning
- Irrigation
- Water Features
- Car Washing
- Other Non-Potable Uses

WATER QUALITY STANDARDS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>Recommended WQ Standards</th>
<th>EPA (USA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>E. coli</td>
<td>no./100 ml</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>Total residual chlorine*</td>
<td>mg/l</td>
<td>≥1 / ≥0.2</td>
<td>≥1</td>
</tr>
<tr>
<td>Dissolved oxygen</td>
<td>mg/l</td>
<td>≥2</td>
<td>N/A</td>
</tr>
<tr>
<td>Total suspended solids</td>
<td>mg/l</td>
<td>≤10</td>
<td>N/A</td>
</tr>
<tr>
<td>Colour</td>
<td>Hazen unit</td>
<td>≤20</td>
<td>N/A</td>
</tr>
<tr>
<td>Turbidity</td>
<td>NTU</td>
<td>≤10</td>
<td>≤20</td>
</tr>
<tr>
<td>pH</td>
<td></td>
<td>6 - 9</td>
<td>6 - 9</td>
</tr>
<tr>
<td>Threshold Odour Number</td>
<td></td>
<td>≤100</td>
<td>N/A</td>
</tr>
<tr>
<td>5-day Biochemical oxygen demand</td>
<td>mg/l</td>
<td>≤10</td>
<td>≤10</td>
</tr>
<tr>
<td>Ammonical nitrogen</td>
<td>mg/l as N</td>
<td>≤1</td>
<td>N/A</td>
</tr>
<tr>
<td>Synthetic detergents</td>
<td>mg/l</td>
<td>≤5</td>
<td>N/A</td>
</tr>
</tbody>
</table>

*Where recycled water is treated for immediate usage, the level of total residual chlorine may be lower than the one specified in this table.

RECOMMENDED WATER QUALITY STANDARDS FOR UNRESTRICTED REUSE

These recommended water quality standards are subjected to review upon comments received during the consultation.
TREATMENT TECHNOLOGIES

RECOMMENDED OPTIONS

Individual Building

Multiple Buildings

RECOMMENDED TREATMENT – RAINWATER SCHEME

- Rainwater Collection
- Pretreatment
- Filtration
- Disinfection
- Storage and Distribution

Key:
- Treatment process
- Supply
- Source water
- Disinfection
- Chlorine disinfection (chlorine tablets or sodium hypochlorite depending on system size) or UV disinfection with residual chlorine dosage (residual chlorine not necessary for immediate use)
- Secondary Storage if supply is to be gravity fed
- Primary Storage
- Reclaimed Water Supply
- Pump
- Reclaimed Water Supply
- Roof RW collection
- Remove first flush of RW
- Rainwater from surface
- Oil trap
- Remove first flush of RW
- Rainwater storage
- Settled out material and overflow drained to storm drain
- Pre-treatment
- Coarse filter - 250 micron self cleaning filters
- Granular activated carbon (GAC) filter to remove hydrocarbon
- Coarse filtration system may be installed upstream of rainwater storage in vertical downpipes. Sand filter and GAC filter could be combined
- Filtration
- Sand filter (backwashable)
- Cartridge filter (disposable)
- or

PHOTOS OF AN ACTUAL RAINWATER TREATMENT PLANT ROOM – HOUSING DEPARTMENT'S YAU LAI SHOPPING CENTRE

- Storage Tank
- Granular and Activated Carbon Filter
- System Panel
- Pipework
- UV Lamp
- Control Panel

RECOMMENDED TREATMENT – COMBINED SCHEME

- Rainwater Collection
- Pretreatment
- Biological Treatment & Filtration
- Disinfection
- Storage and Distribution

- Grey Water Collection
- Pretreatment

- Storage and Distribution
TREATMENT TECHNOLOGIES

RECOMMENDED TREATMENT – COMBINED SCHEME

LIFE CYCLE COST

ESTIMATE COSTS

COSTS – LIFE CYCLE UNIT COSTS

<table>
<thead>
<tr>
<th>Size Class</th>
<th>Capacity (m³/day)</th>
<th>Rainwater /m³</th>
<th>Grey Water /m³</th>
<th>Combined System /m³</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual</td>
<td>50</td>
<td>$17</td>
<td>$18</td>
<td>$18</td>
</tr>
<tr>
<td>Multiple Buildings</td>
<td>500</td>
<td>$10</td>
<td>$9</td>
<td>$10</td>
</tr>
</tbody>
</table>

Current water and sewage tariff (commercial):
- water = $4.58/m³
- sewage = $1.71/m³
TOTAL = $6.29/m³

SYSTEM PLANNING AND CONSIDERATIONS

ESTIMATING DEMAND (EXAMPLE R2 RESIDENTIAL – 1000 RESIDENTS)

<table>
<thead>
<tr>
<th>Potential Supply</th>
<th>GW Design Flow Rates</th>
<th>111 ltr/ person/ day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potential Demand</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type of Usage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Toilet flushing</td>
<td>90 ltr/ person/ day</td>
<td></td>
</tr>
<tr>
<td>Landscape Irrigation</td>
<td>7 ltr/ day/m²</td>
<td></td>
</tr>
<tr>
<td>Car Washing</td>
<td>6 ltr/ car/ day</td>
<td></td>
</tr>
<tr>
<td>External Cleaning</td>
<td>2 ltr/ day/m²</td>
<td></td>
</tr>
<tr>
<td>Fire Fighting</td>
<td>18,000 ltr/ replacement for building with GFA of over 230m² but not exceeding 460m²</td>
<td></td>
</tr>
<tr>
<td>Water cooling</td>
<td>0.56 m³ / m² / yr</td>
<td></td>
</tr>
</tbody>
</table>

Forms to assist estimating grey water supply and potential uses
SPACE REQUIREMENTS

<table>
<thead>
<tr>
<th>Size Class</th>
<th>Indicative Size</th>
<th>Typical Capacity (m³/day)</th>
<th>Space Requirements for Treatment Facilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual Building</td>
<td>Single building</td>
<td>10 to 100</td>
<td>50 to 200</td>
</tr>
<tr>
<td></td>
<td>Multiple Buildings</td>
<td>Small groups (&lt;5 buildings)</td>
<td>120 to 500 to 600 to 300 to 750</td>
</tr>
</tbody>
</table>

CODE OF PRACTICE, GUIDELINES AND TECHNICAL SPECIFICATIONS

- **Code of Practice**: Specified requirements for design, installation and commissioning.
- **Guidelines**: Non-mandatory technical guidelines for design, installation, O&M, and WQ monitoring.
- **Technical Specifications**: Technical requirements for Grey Water/Reuse & Rain Water Harvesting systems.

PROPOSED REGULATORY FRAMEWORK

<table>
<thead>
<tr>
<th>Approach</th>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voluntary</td>
<td>1. Flexibility on adoption; 2. Nominal social impact; 3. Little administration and enforcement work</td>
<td>1. Lack widespread adoption 2. Insignificant water conservation achieved</td>
</tr>
<tr>
<td>Contractual</td>
<td>1. Less rigorous compared to statutory 2. Government has control over area of adoption 3. Ensure satisfactory level of adoption and water conservation</td>
<td>1. Difficult to ensure operation of the systems 2. Wider social impact compared to voluntary approach 3. Resources required for implementation and enforcement</td>
</tr>
</tbody>
</table>

PROS & CONS OF DIFFERENT IMPLEMENTATION SCHEMES

- “Contractual” approach selected for further exploration
- Drafting Instruction for lease conditions prepared by B&V

PROPOSED DRAFTING INSTRUCTION

- Introducing new requirements in 3 stages of development
  1. Planning
  2. Land Sale
  3. Building Management
PROPOSED DRAFTING INSTRUCTION

1. Planning Stage
   - Work under existing statutory framework
   - Incorporate requirements in Planning Brief for early notification
   - Consequentially, Master Layout Plan (MLP) submitted should include remarks on water conservation measures, e.g. designating area for water treatment plant room, to acknowledge new requirements
   - Similar provisions for land that required submission of MLP by LandsD

PROPOSED DRAFTING INSTRUCTION

Lands Sale Stage
   - Incorporate new requirements in Special Lease Conditions
     - To provide and maintain the water conservation measures
     - To permit inspections by the authority
     - To provide necessary education and training
     - Government can enter and carry out necessary work on the plant in case of non-compliance
     - To pay liquidated damages in cases of non-compliance
     - Breach of conditions entitles Government to terminate the lease

PROPOSED DRAFTING INSTRUCTION

Building Management Stage
   - To maintain records of operation and submit to WSD on request
   - To allow random inspections by the authority
   - To carry out bi-annual certification by AP on operation
   - To carry out certification by AP on any alteration
   - Non-compliance equates to breach of lease conditions

INTRODUCTION TO WATER EFFICIENCY LABELING SYSTEM (WELS)

Promote Water Saving Devices
   - Voluntary Water Efficiency Labelling Scheme (WELS)
     - Showers for bathing
     - Taps
     - Washing machines
     - Urinal equipments
   - Retrofitting water saving devices in existing government buildings and schools
   - Installing water saving appliances in new government buildings
   - In cooperation with the Hong Kong Green Building Council, incorporate water conservation in the design of buildings in developing the green labelling system, BEAM Plus.
   - Best Practice Guidelines for Water Efficiency in Government Departments

Q & A
Thank You

Our collaboration will build successful implementation of water conservation measures

COSTS – GREY WATER

<table>
<thead>
<tr>
<th>Size Class</th>
<th>Indicative Size</th>
<th>Capacity (m³/day)</th>
<th>Capital Cost (HK$)</th>
<th>Recurrent Cost (HK$/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual Building</td>
<td>Single building</td>
<td>50</td>
<td>$2.6 Million</td>
<td>$65K</td>
</tr>
<tr>
<td>Multiple Buildings</td>
<td>Small group (&lt;5) of buildings</td>
<td>500</td>
<td>$14 Million</td>
<td>$380K</td>
</tr>
<tr>
<td>Sub-District</td>
<td>Larger group (&gt;5) buildings</td>
<td>4,000</td>
<td>$46 Million</td>
<td>$2.4 Million</td>
</tr>
</tbody>
</table>

COSTS - RAINWATER

<table>
<thead>
<tr>
<th>Size Class</th>
<th>Indicative Size</th>
<th>Storage Capacity (m³)</th>
<th>Capital Cost (HK$)</th>
<th>Recurrent Cost (HK$/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual Building</td>
<td>Single building</td>
<td>40</td>
<td>$590K</td>
<td>$23K</td>
</tr>
<tr>
<td>Multiple Buildings</td>
<td>Small group (&lt;5) of buildings</td>
<td>200</td>
<td>$4.3 Million</td>
<td>$62K</td>
</tr>
<tr>
<td>Sub-District</td>
<td>&gt;5 high-rise buildings</td>
<td>1,600</td>
<td>$24 Million</td>
<td>$300K</td>
</tr>
<tr>
<td>District</td>
<td>Integrated scheme for all/most buildings and including infrastructure</td>
<td>4,000</td>
<td>$49 Million</td>
<td>$620K</td>
</tr>
</tbody>
</table>

COSTS - COMBINED

<table>
<thead>
<tr>
<th>Size Class</th>
<th>Indicative Size</th>
<th>Capacity (m³/day)</th>
<th>Capital Cost (HK$)</th>
<th>Recurrent Cost (HK$/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual Building</td>
<td>Single government building</td>
<td>50</td>
<td>$2.8 Million</td>
<td>$70K</td>
</tr>
<tr>
<td>Multiple Buildings</td>
<td>Small group (&lt;5) of buildings</td>
<td>500</td>
<td>$15 Million</td>
<td>$400K</td>
</tr>
<tr>
<td>Sub-District</td>
<td>&gt;5 high-rise buildings</td>
<td>4,000</td>
<td>$93 Million</td>
<td>$2.5 Million</td>
</tr>
</tbody>
</table>

COST FROM LOCAL INSTALLATIONS

<table>
<thead>
<tr>
<th>Project</th>
<th>Manufacturer/ Vendor</th>
<th>Capacity (m³/day)</th>
<th>Capital Cost (HK$)</th>
<th>Recurrent Cost (HK$/month)</th>
</tr>
</thead>
<tbody>
<tr>
<td>City University of Hong Kong</td>
<td>HPC</td>
<td>70</td>
<td>$1.1 Million</td>
<td>$2k</td>
</tr>
<tr>
<td>EMSD Headquarters</td>
<td>Kubota/Koi</td>
<td>30</td>
<td>$1 Million</td>
<td>-</td>
</tr>
<tr>
<td>TKO Area 86</td>
<td>GWS Grey Water System/ APMC</td>
<td>440</td>
<td>$6.7 Million</td>
<td>$20K</td>
</tr>
</tbody>
</table>

Site visits to local installations:
- Kwun Tong PTW (MBR Pilot Plant, 45 m³/day, Mitsubishi Rayon)
- Chai Wan PTW (MBR Pilot Plant, 45 m³/day, Mitsubishi Rayon)
- City University of Hong Kong Grey Water Treatment Plant
Revised Registered Fire Engineer Scheme
for the Implementation of
Third Party Certification in Hong Kong

Objectives
- FSD to play a regulatory role
- Inspection & certification shift to the industry
  - Shorten the process time for issuing a license
  - Enhance business friendliness

Preamble
- Consultation Paper in 2007
  - To government bureaux, departments, and professional institutions and trade
  - 30 written submissions received with majority in principle supportive to the proposal

Major Revision
- Abolishing the requirement for applicants to become MHKIE
- Adding option for Categorizing RFE into RFE(RA), RFE(FSI) and RFE(Vent)
- Incorporating fire risk assessment and formulating fire safety recommendations for licensed premises into the scope of works for RFE

Registration of RFE (Revised)
Registered as RPE under
(Engineers Registration Ordinance)
(Chapter 409)

Two Options

<table>
<thead>
<tr>
<th>Option A</th>
<th>Scope of Works</th>
</tr>
</thead>
</table>
| RFE(Fire) | 1. Fire risk assessment and formulating fire safety requirements  
2. Compliance inspection for fire safety & VentS requirements and issue Fire Safety Certificate upon confirmation of compliance. |

With 1 year of relevant professional experience within the 3 years preceding the date of application

According to the amended (Fire Services Ordinance)
(Chapter 95) Registered as a Registered Fire Engineer
Two Options

<table>
<thead>
<tr>
<th>Option B</th>
<th>Scope of Works</th>
</tr>
</thead>
<tbody>
<tr>
<td>RFE(RA)</td>
<td>Fire risk assessment and formulating fire safety requirements</td>
</tr>
<tr>
<td>RFE(FSI)</td>
<td>Compliance inspection for fire safety requirements and issue Fire Safety Certificate upon confirmation of compliance.</td>
</tr>
<tr>
<td>RFE(VentS)</td>
<td>Compliance inspection for the fire safety of VentS and issue Fire Safety Certificate upon confirmation of compliance.</td>
</tr>
</tbody>
</table>

Comparison of the Two Options

<table>
<thead>
<tr>
<th>Option A</th>
<th>Option B</th>
</tr>
</thead>
<tbody>
<tr>
<td>RFE(Fire) can provide one-stop-shop service for license applicants</td>
<td>License applicants can choose the services among the three classes of RFE according to their need</td>
</tr>
<tr>
<td>No. of RFE(Fire) will be limited and the service charge may be higher</td>
<td>More RFE will be available for selection and the service charge may be lower</td>
</tr>
</tbody>
</table>

Existing Mechanism

1. FSD receives referral from licensing authority
2. FSD conducts risk assessment
3. FSD issues Fire Safety Certificate / Letter of Compliance
4. FSD conducts compliance inspection upon report of completion of works by FSIC or VC
5. FSD endorses fire safety requirement

Route 1

1. Applicant hires services of RFE
2. RFE conducts risk assessment
3. RFE issues Fire Safety requirements, including those on fire safety aspects of work
4. RFE conducts compliance inspection upon report of completion of works by FSIC or VC
5. FSD endorses fire safety requirement

Route 2

1. Applicant hires services of RFE
2. RFE conducts risk assessment
3. RFE issues Fire Safety requirements, including those on fire safety aspects of work
4. FSD receives referral from licensing authority
5. FSD conducts compliance inspection upon report of completion of works by FSIC or VC
6. FSD endorses fire safety requirement

Route 3

1. FSD receives referral from licensing authority
2. FSD conducts risk assessment
3. FSD issues Fire Safety Certificate
4. RFE conducts compliance inspection upon report of completion of works by FSIC or VC
5. RFE issues Fire Safety Certificate
**Audit Inspection**
- FSD may conduct random audit inspections within 7 working days for cases certified by RFE after issuance of the Fire Safety Certificate to license application
- To assess the quality of certification work of the RFE

**Control Mechanism**
- Establish Registration Committees with members from FSD, ERB and professionals/academics
- Chaired by FSD representative with a total of not more than nine members

**Control Mechanism**
- Form a Disciplinary Panel to deal with cases of alleged failing to exercise reasonable care in the discharge of his/her duties, misconduct and substandard performance
- Membership comprises representatives from relevant trade federations and professionals/academics appointed by D of FS

**Communication Channel between FSD & RFE**
- Regular liaison meeting between FSD and RFE to ensure consistent interpretation of codes and to align standards
- FSD issue guidelines/code of practice/standard requirements for reference

**Phased Implementation**
- Review the scheme after 24 months of implementation
- Consider to cover the area in:-
  - Certification of building FSI alteration and addition works
  - New building FSI compliance check
  - Certification of fire safety upgrading works

**Way Forward**
- Consultation Period:
- Draft of legislative amendment proposal (FS Ordinance and other relevant Ordinances) and then submit to the LegCo
- Consultation Paper
Q & A Session

Thank you