Rainwater harvesting over sewer mining
- CH2 case study

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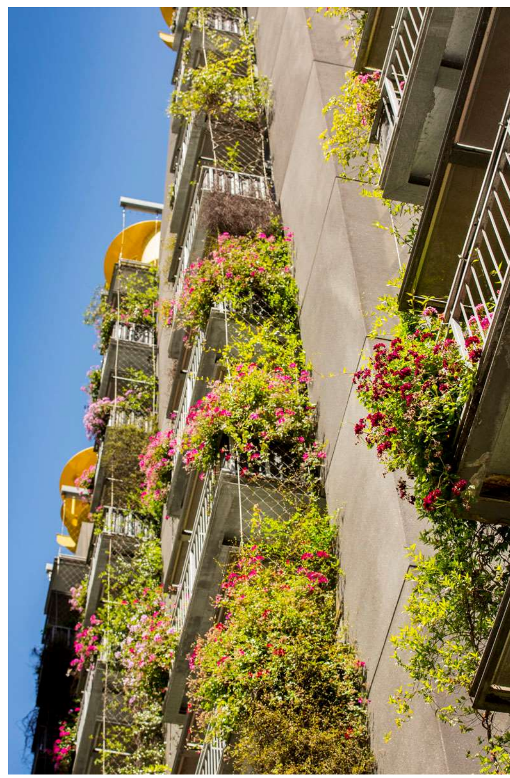
CITY OF MELBOURNE

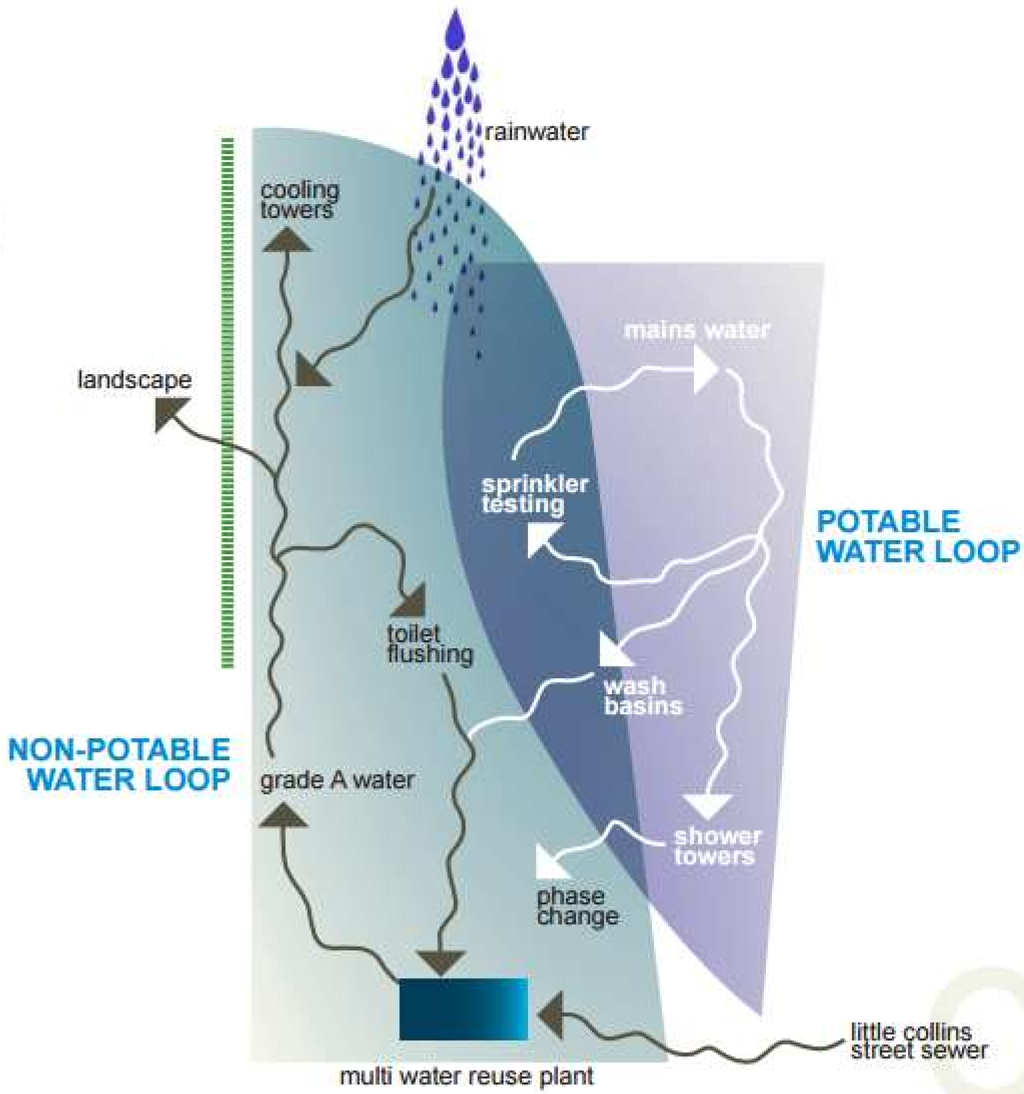
CH2



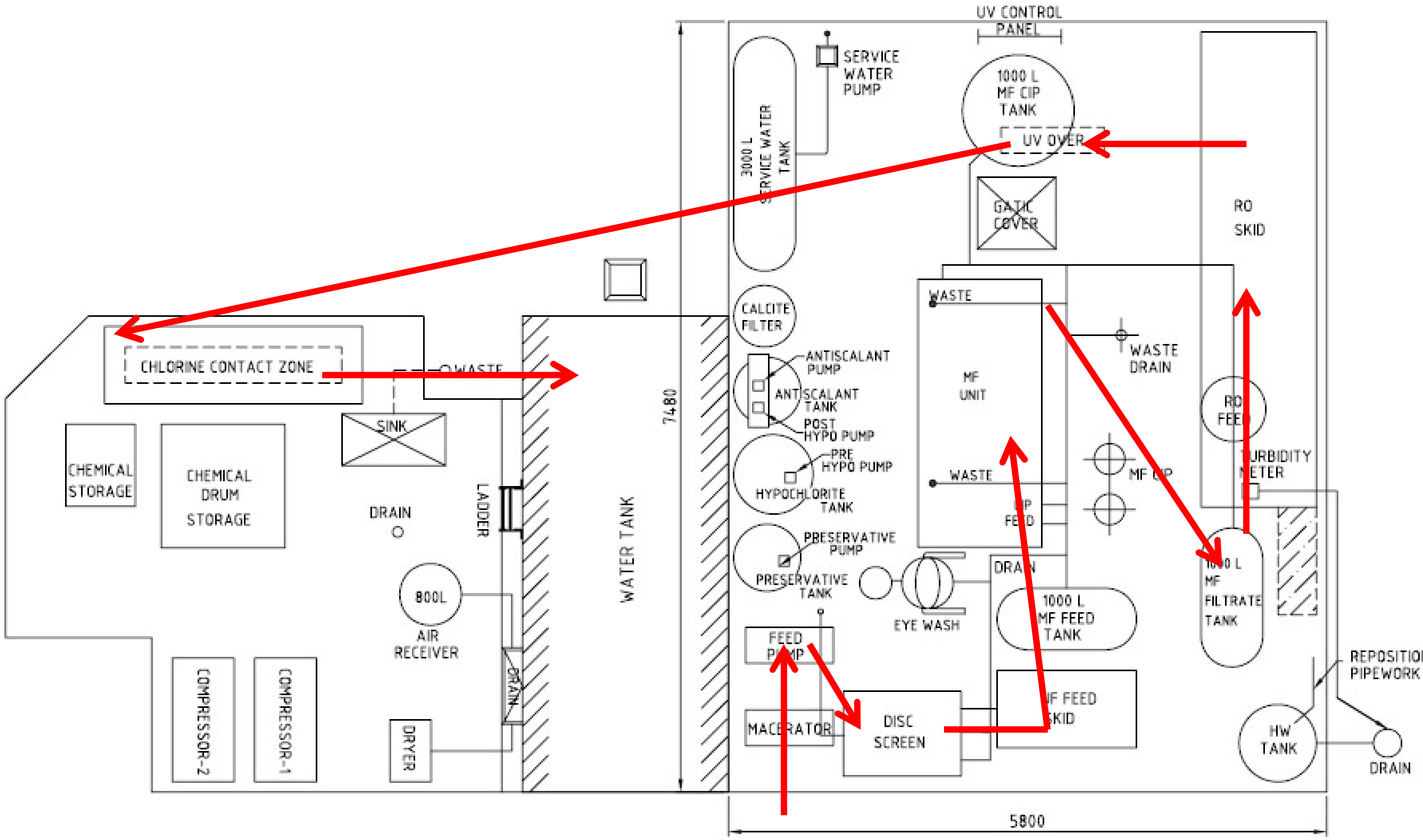
Background

- CH2 was the first Green Star 6 designed office building
- Construction completed in 2006
- Sewer mine was a late edition to the proposed recycled water system added after construction had begun
- Constrained by basement height, access etc.
- Recently trial non-biological sewer mining process look promising

Water cycle image (concept)

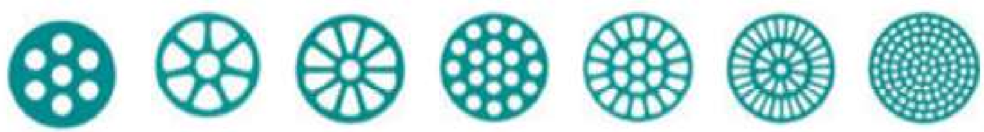


Basic layout drawing



Ceramic UF filter (1st attempt)

External diameter (mm): ø 25 ø 41

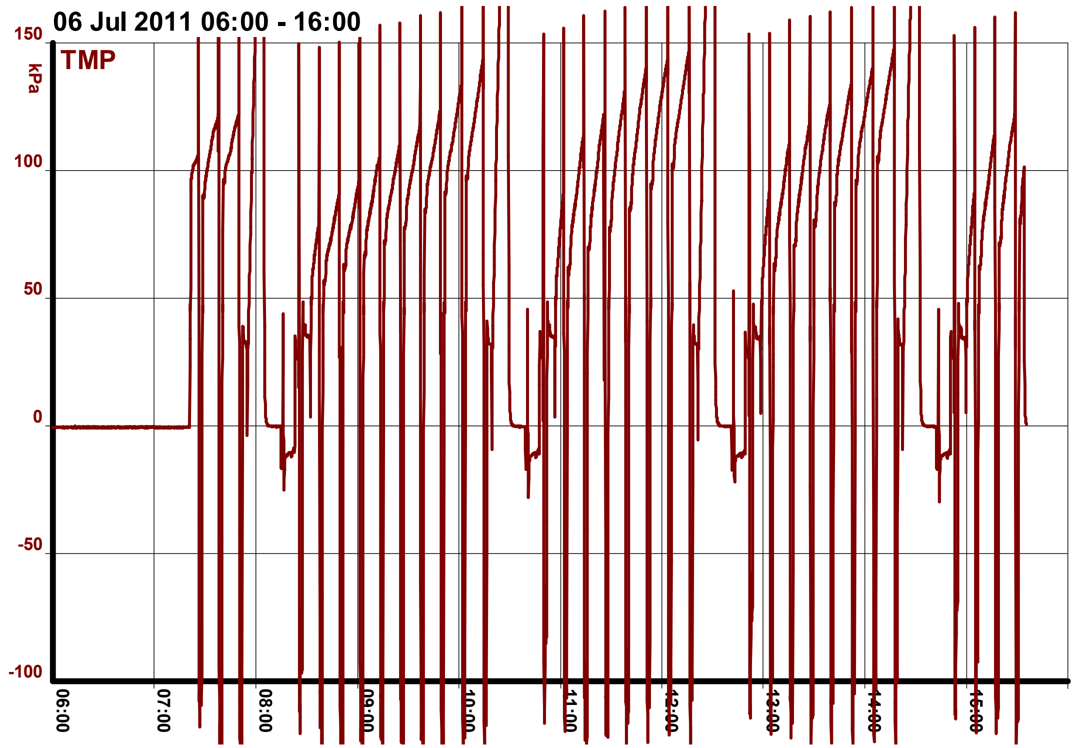


External diameter Ø 25 L=1178 mm*							
Number of channels:	07	08	11	19	23	39	93
Hydraulic diameter:	6	6	4.6	3.5	3.5	2.5	1.6
Area (sqm):	0.16	0.20	0.25	0.25	0.35	0.50	0.60
Available cut-offs**:	MFT/UF/ Fine UF	MFT/UF/ Fine UF	MFT/UF	MFT/UF/ Fine UF	MFT/UF/ Fine UF	MFT/UF/ Fine UF	MFT/UF

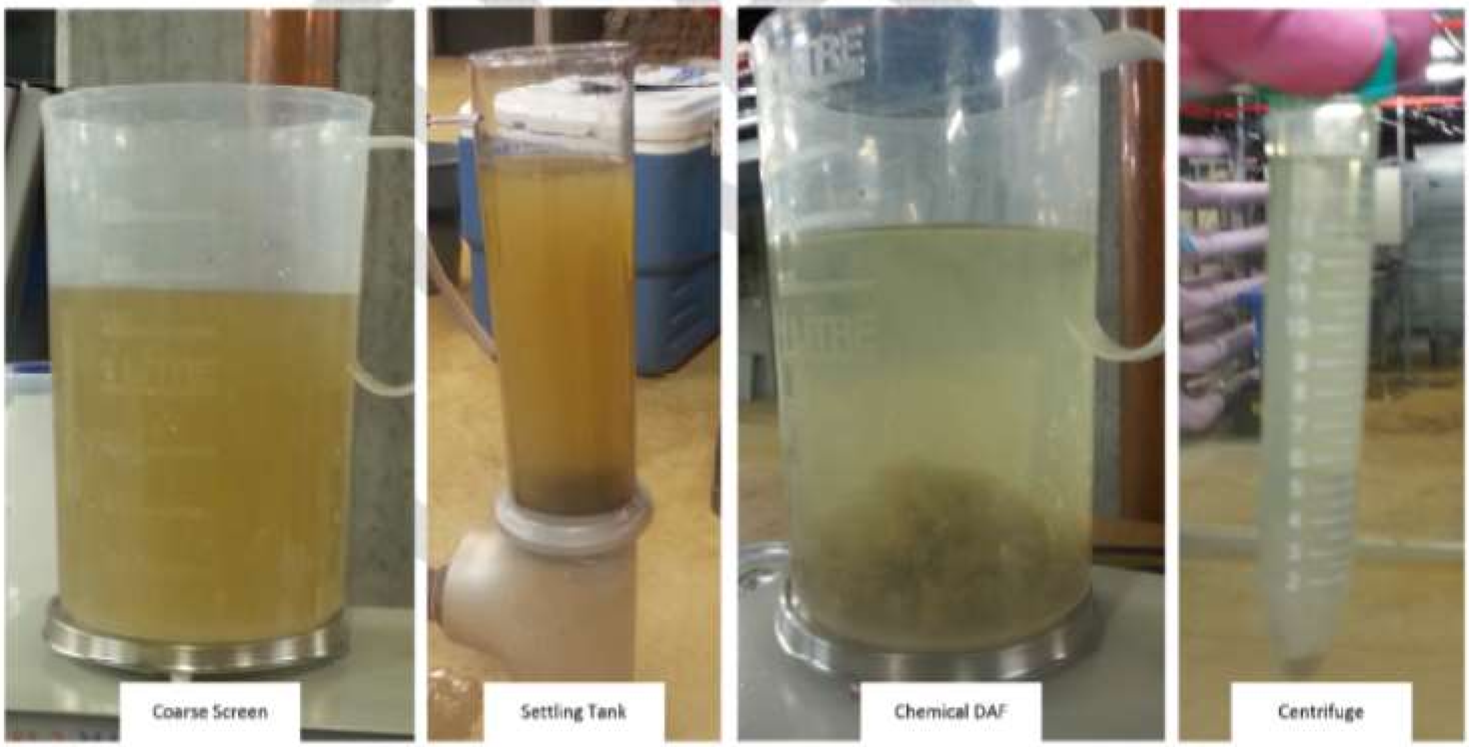
* Available lengths: 580, 850, 1020, 1178 mm.

MF Plant (2nd attempt)

Non-recovery of membranes

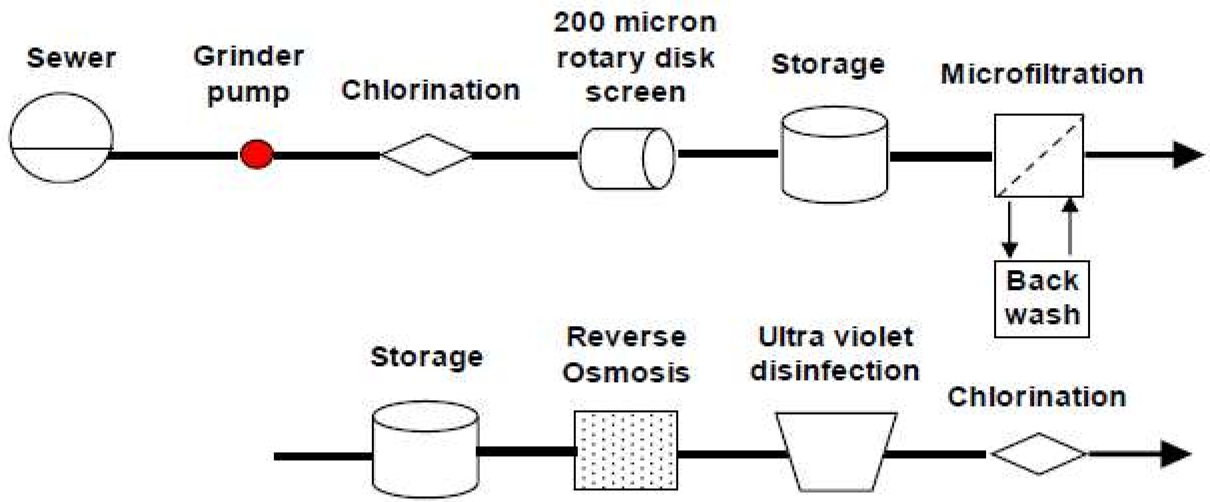


Sampling of the inflow sewer

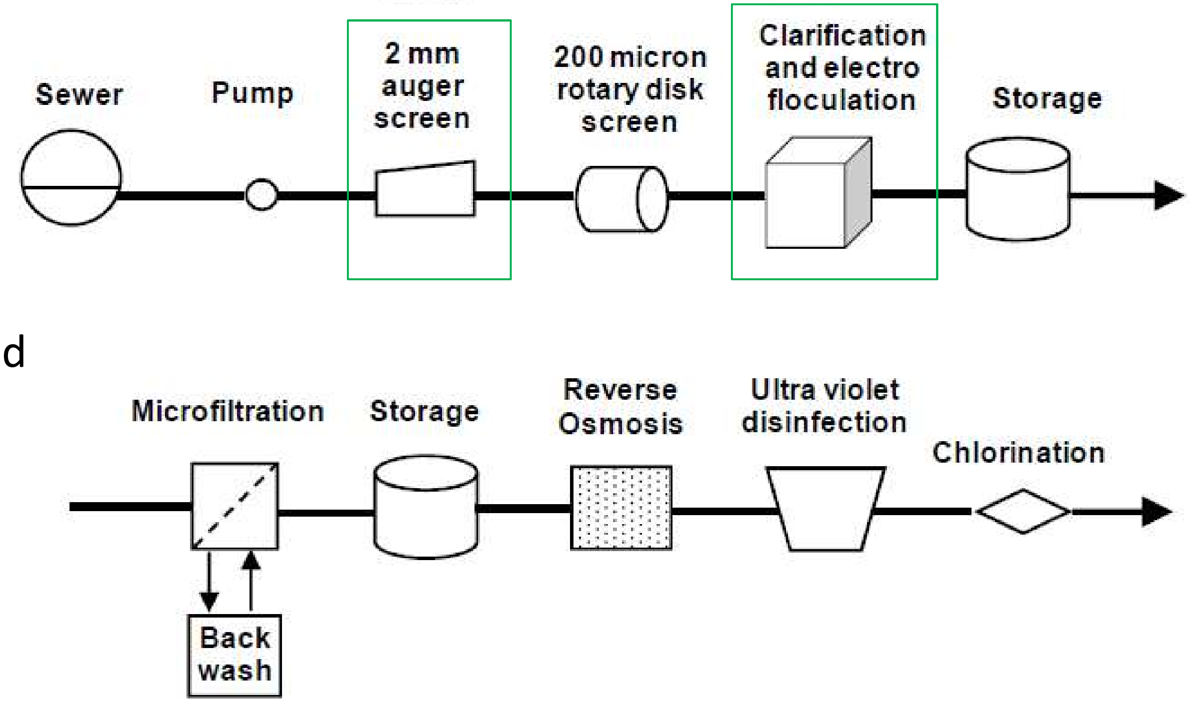


Bonacci water concept

Existing



Proposed



Biological concept

Concept costing for building scale sewer mine

- $220,000 yearly rental fee

(including operational cost and capital over 5 years)

- $60,000 electricity cost
- 36,500 kl/yr recycled water produced
- $7.67/kl
- $6.03/kl potential benefit (saving potable and wastewater charge & selling excess)

Precinct scale sewer mine with CWW

- Existing conditions restriction
  - 200m^2 area
  - 2.0 - 2.5m ceiling height
  - Access hatch 6m x 2m
- Restricts plant size to 100kl/d max.
- Costs (to CWW standards)
  - $1.8 - $2.7m capital
  - $170 - $230k/y opex
- $12.8 – 14.1kl/y

Summary points – sewer mining

- Filtration only process clogged too quickly – not enough pre-treatment?
- Risk in using innovative processes.
- Biological process proven but need space, especially height
- Building scale system expensive/kL
- High energy and maintenance costs
- Precinct scale needed more space (buffer storage) and guaranteed demands to make it economically viable

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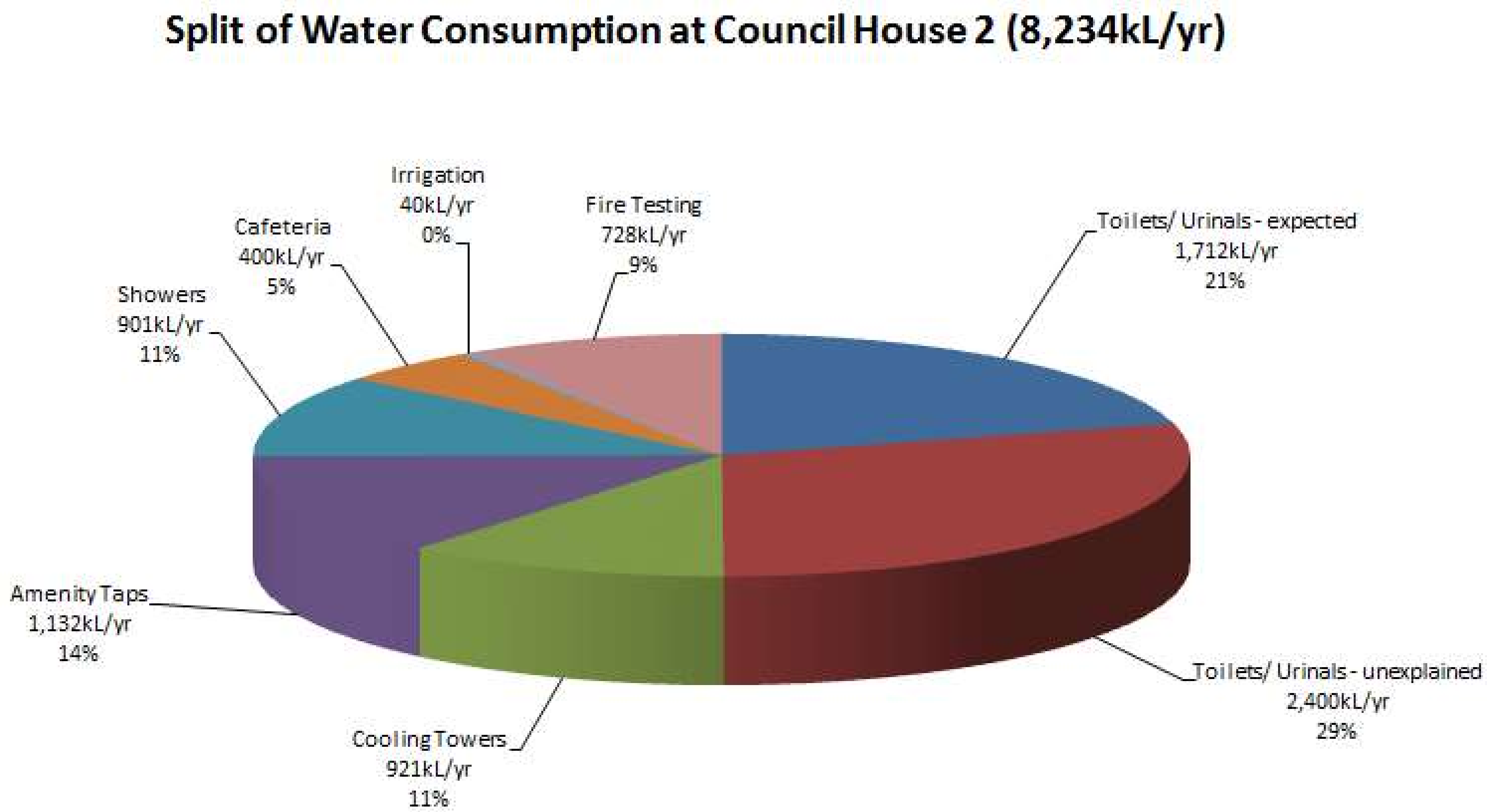
- May 2017 -

Overview

1. Non-potable water assessment
2. Non-potable water options
3. Implemented options
4. Details on unexpected water usage

Non-Potable Water Assessment

A water balance has been created for CH2, based on annual water consumption and site activities.

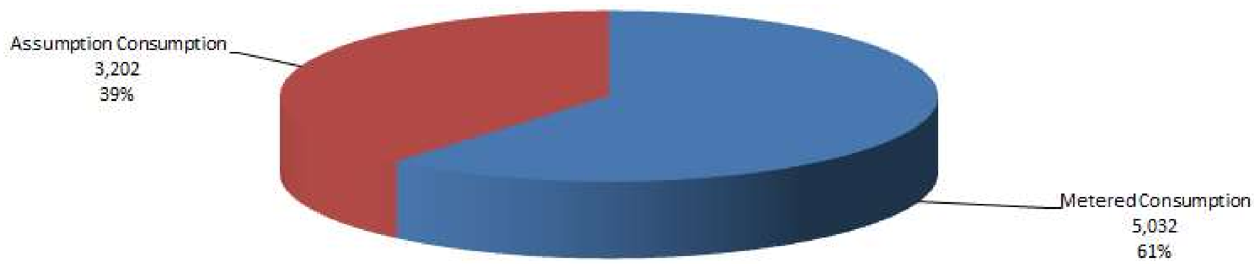


Non-Potable Water Assessment

Model information is understood to be reliable:

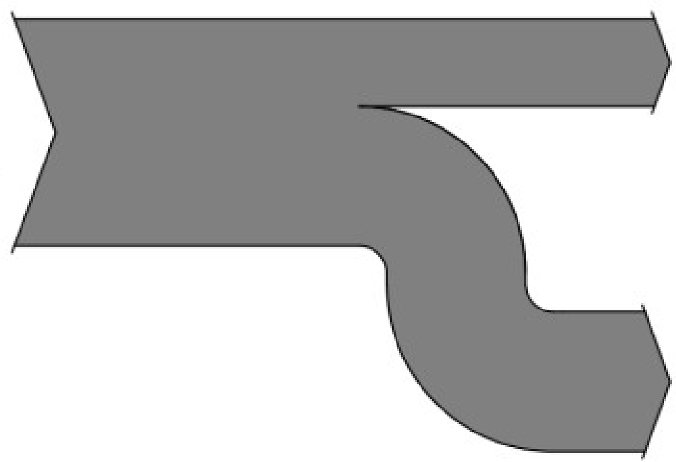
61% of the annual consumption is metered, 39% has been assumed.

Metered and Assumed Consumption in CH2 Water Balance



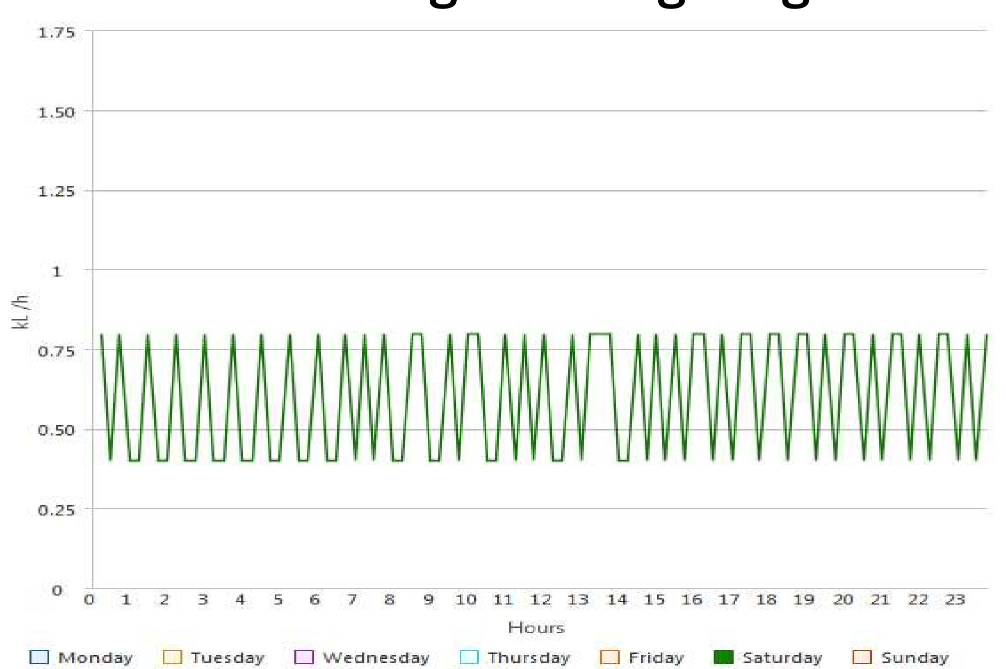
Non-Potable Water Demand

Based on the water balance, 62% of the annual water demand could be replaced by non-potable water sources.



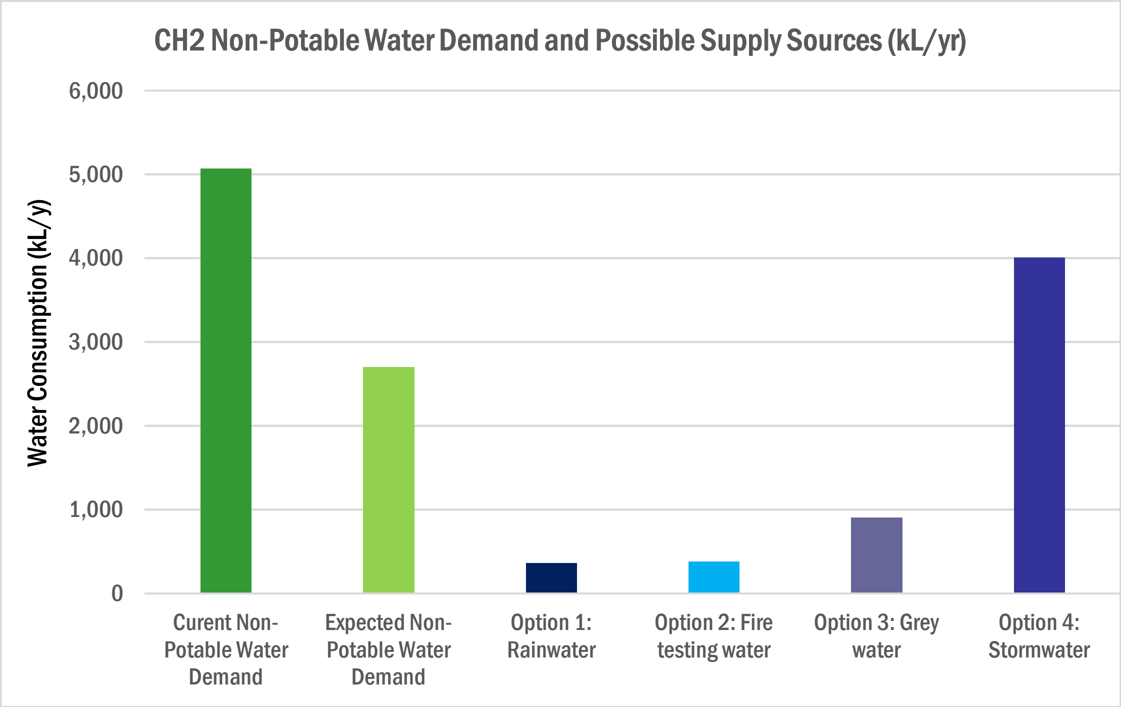
Non-Potable Water Demand

- Collected data showed sporadic overnight base flows from toilet flushing
- Maintenance confirmed occasionally running toilets
- Non-potable water demand was adjusted to take into account toilet base flow
- Long-term aim is to reduce high flushing usage



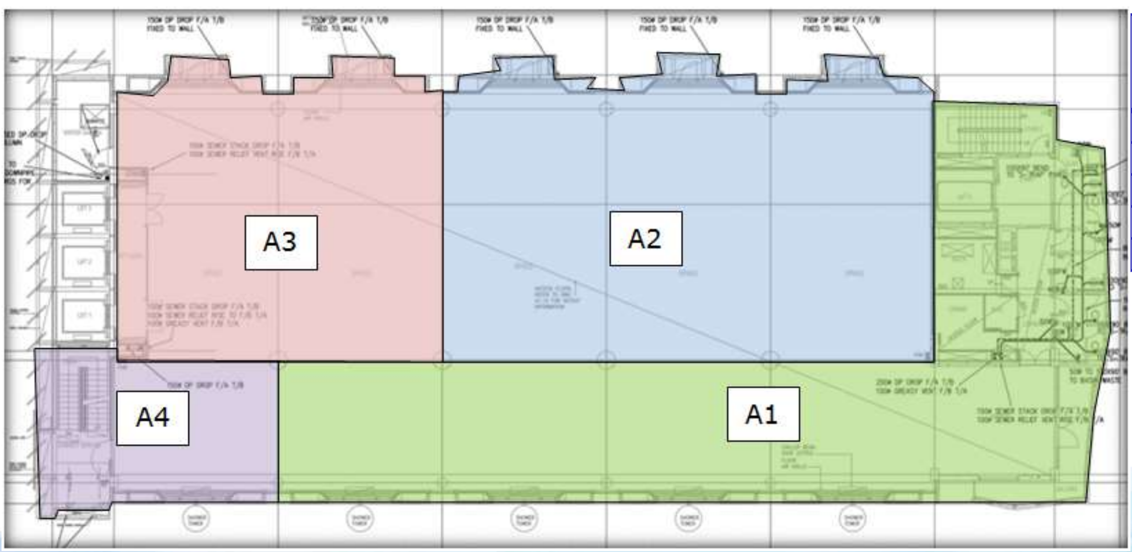
Demand vs Possible Supply

It assumes that the 'unexplained' toilet flushing demand can be reduced by 2,400kL/yr



Option 1 - Rainwater Harvesting

- CH2's total roof size is 890m² - approx. 360kL of rainwater can be harvested per year
- 'A1' is part of existing RWH scheme (33% roof) – 67% more roof space available (or approx. 240kL additional rainwater)
- No 'advanced' water treatment required before consumption, low maintenance costs
- Additional roof areas can be relatively easy added



Roof Section	Area (m²)	Area (%)	Associated Water Savings (kL/yr)	Connected to RWH
A1	293	33%	120	yes
A2	347	39%	141	no
A3	173	19%	71	no
A4	77	9	31	no
Total	890	100%	363	partly

Option 2 - Fire Testing Water Reuse

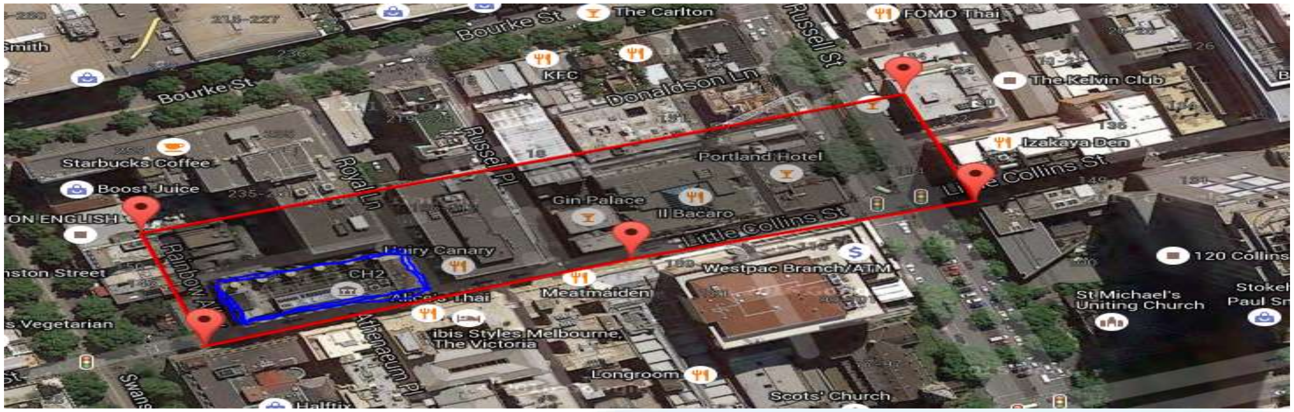
- Regular mandatory tests of fire equipment – fire booster pumps run during sprinkler tests and for pump performance tests
- A minimum reject flow of 10 to 15L/s is required to ensure correct operation of pumps. This water is rejected to stormwater unless used otherwise
- Water quality is above rainwater and a decommissioned discharge tank available
- Relatively easy to add to existing rainwater harvesting scheme

Option 3 - Greywater Recycling

- Greywater from showers at Basement 1 could be used as water source
- More advanced treatment required (e.g. biological treatment), higher maintenance costs and regular water quality tests required
- Estimated greywater volume is relatively small in comparison to demand

Option 4 – External Stormwater

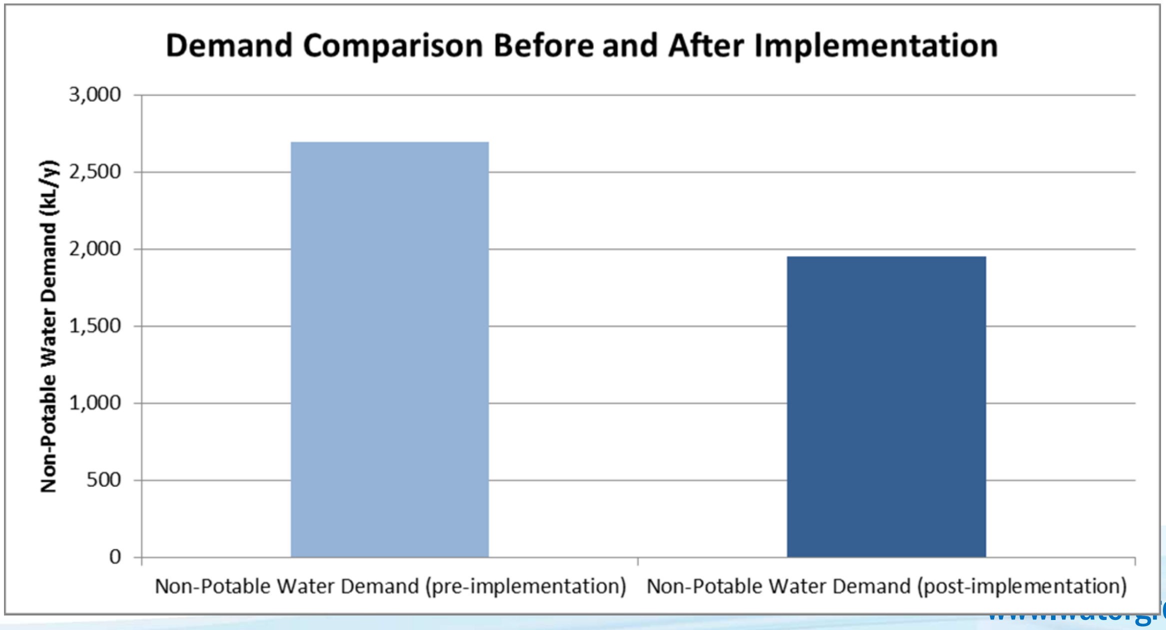
- Stormwater could be intercepted from a stormwater pipe outside CH2, which would collect stormwater from approx. 30,000m².
- This could yield over 6,000 kL/yr of water.
- 200kL of additional tank storage and 'advance' water treatment would be required (e.g. filtration, UV treatment)



Conclusion

Option 1 – Rainwater	✓	Easy to integrate with existing infrastructure
Option 2 – Fire Testing Water	✓	Easy to integrate with existing infrastructure
Option 3 – Grey Water	✗	Too small to be viable
Option 4 - Stormwater	✗	Capital costs too high

750 kL (15%) of current non-potable water demand is saved every year



Summary of Water Recycling Options

- Options 1 and 2: have been implemented since it was relatively easy to integrate with existing scheme, reducing demand by 750 kL/y
- Option 3: too small volume to make it viable
- Option 4: capital costs too high
- Approx. 15% of current non-potable water demand is supplied by non-potable sources