

# RO Water Harvesting

## MRHT

10<sup>th</sup> October 2017

# Tullamore Hospital Campus



- Construction started in 2002; PC in 2007
- 30,000m<sup>2</sup> over 3 floors
  - › 298 inpatient beds,
  - › 68 day patient beds
  - › 6 theatres (2 with UCV)
  - › 20 bed Renal Dialysis unit
  - › Fully serviced 23m<sup>2</sup> hydrotherapy pool
  - › Nuclear medicine (2008)
  - › Full MRI suite (2017)



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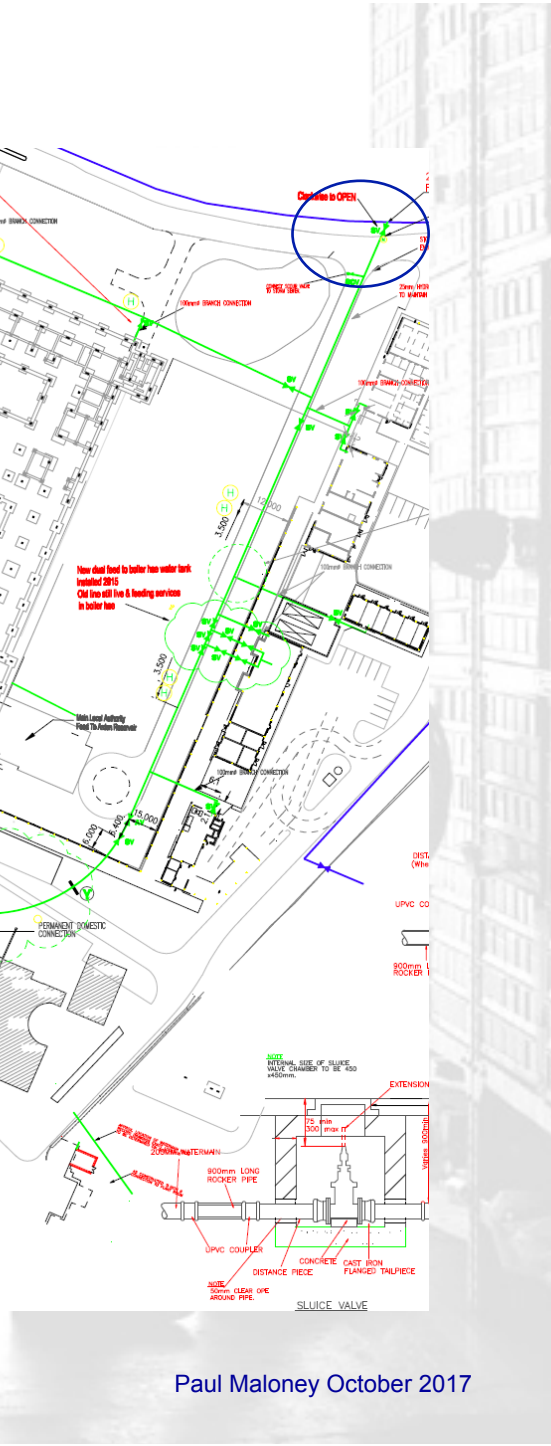
Midland Area



Midland  
Regional  
Hospital  
Tullamore

Paul Maloney October 2017





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# Utilities

- **MV Electrical supply; MIC 1,300kVA**
- **3 x 3,000kW natural gas fired LPHW boilers**
- **3 separate connections to council water supply**
- **Central Duplex ion exchange water softener (70m<sup>3</sup>/side)**
- **Trend BMS system on dedicated LAN with circa 85 o/s.**
- **40 Air Handling Units; 2no 200kW chillers**
- **4no under-floor heating circuits**
- **80 radiator circuits (3 port weather compensation)**
- **10 no DHW calorifiers**

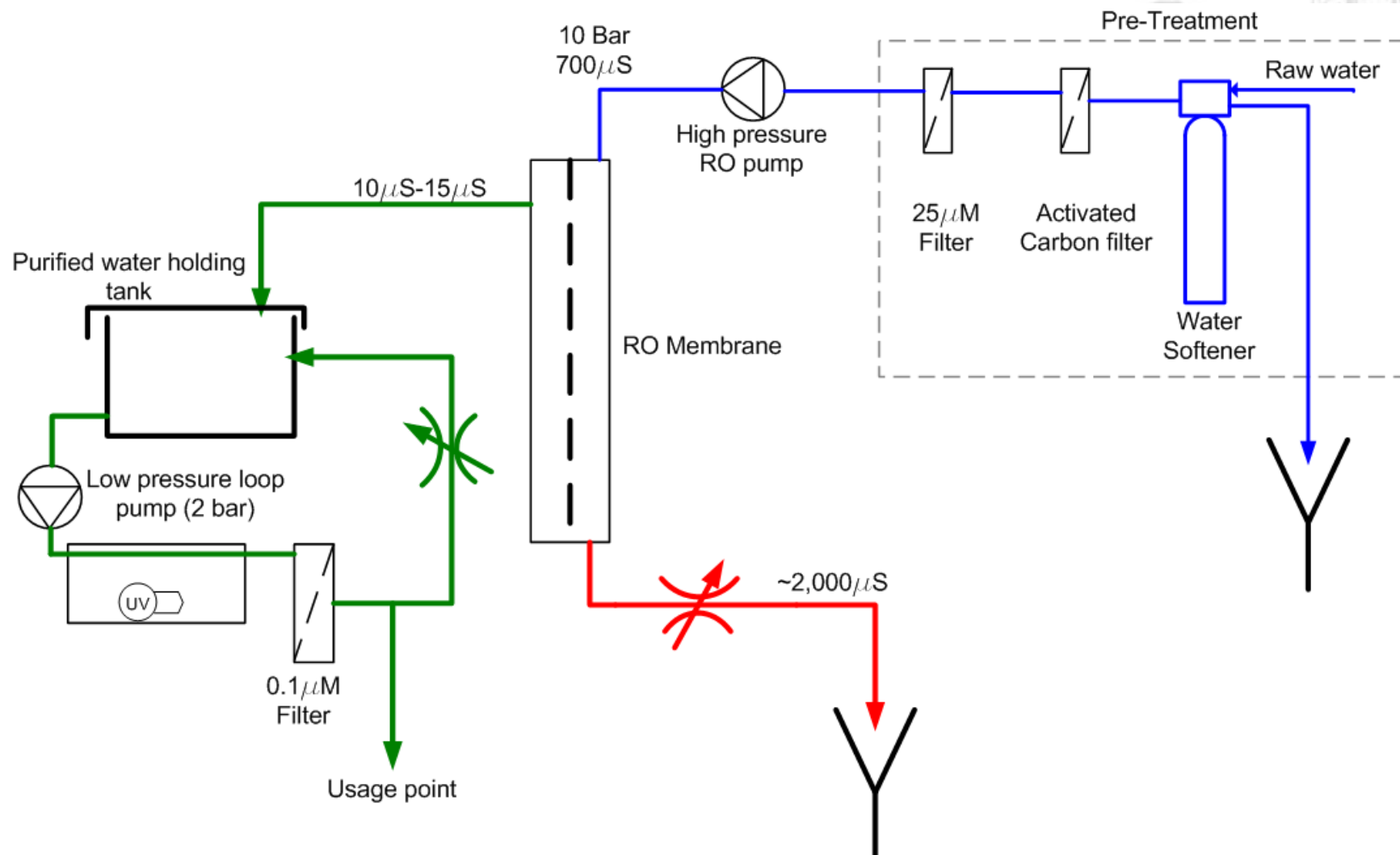
# Utility Costs Tullamore Campus 2016

Utility	Quantity	2016 Cost
Natural Gas	6,574,424 kwhr	€296,722
Electricity	6,497,600 kwhr	€661,770
Water	68,600m <sup>3</sup>	€166,012
<b>Total</b>		<b>€1,124,504</b>

# Purified Water Systems Healthcare

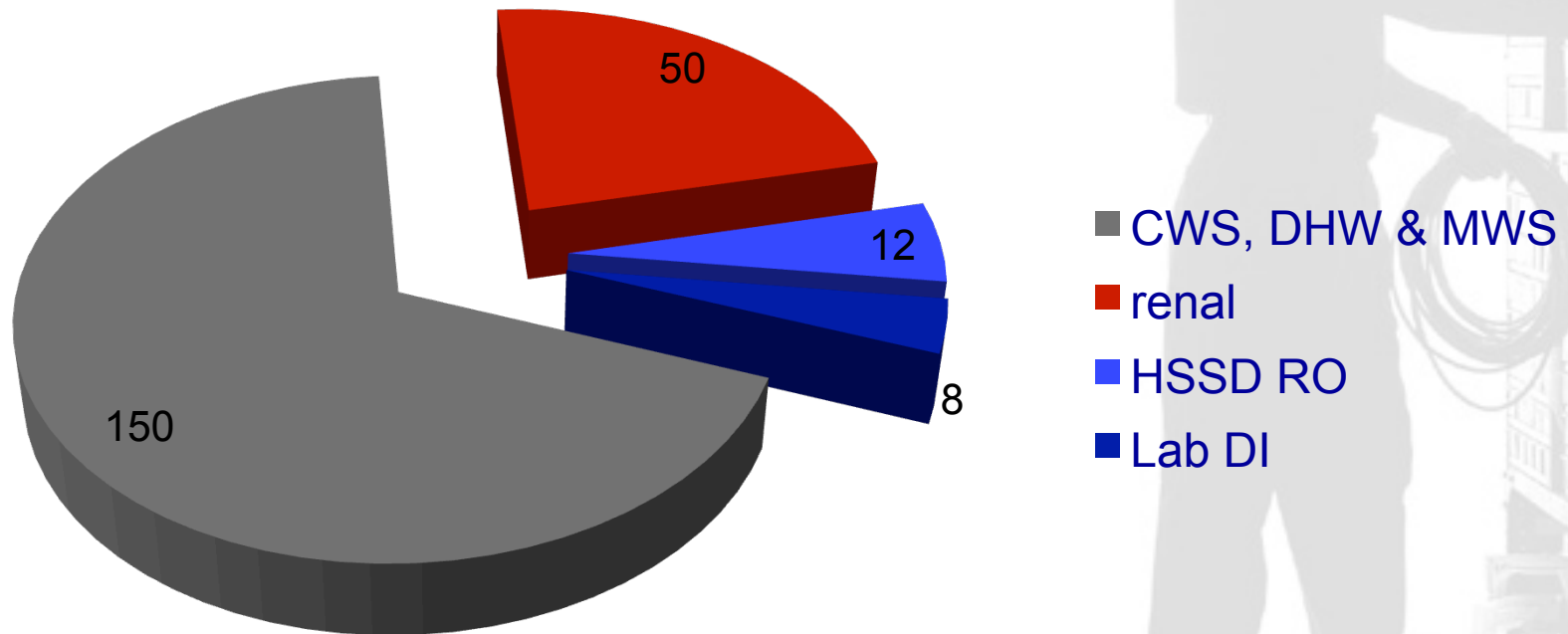
- Final rinse supply to W/D & Autoclave (HSSD)
- Renal Dialysis
- Endoscope Re-processing
- Pathology Lab Analysers (DI water)
- Water Feed Steam Boilers

# Reverse Osmosis



# Typical Daily Water Consumption (before)

Water consumption (m3)





# RO Water Consumption MRHT

System	Raw Water Intake	Reject Water
Renal	50m <sup>3</sup>	25m <sup>3</sup>
HSSD	12m <sup>3</sup>	8.4m <sup>3</sup>
Pathology	8.0m <sup>3</sup>	2.4m <sup>3</sup>

# Existing Infrastructure #1

- **Sluice Water System (SWS) tanks & down services to all wards**
- **Complete segregation from CWS**
- **Daily consumption ~3m<sup>3</sup>/day**
- **Only included Dirty Utility cold feeds**
- **231 cold fill cisterns (connected to CWS)**

# Existing Infrastructure #2

Litres per flush	8 litres
No of flushes per 24 hr period (estimate)	15
No of flushes per WC per annum	5,475
Total number of flushes all WC's per annum	1,264,725
Average daily WC water usage (m <sup>3</sup> )	28m <sup>3</sup>
<b>Annual WC water consumption</b>	<b>10,118m<sup>3</sup></b>
Total sluice water usage p.a.(projected) m <sup>3</sup>	1,300m <sup>3</sup>
<b>Total per annum water usage (m<sup>3</sup>)</b>	<b>11,418m<sup>3</sup></b>

# Proposal

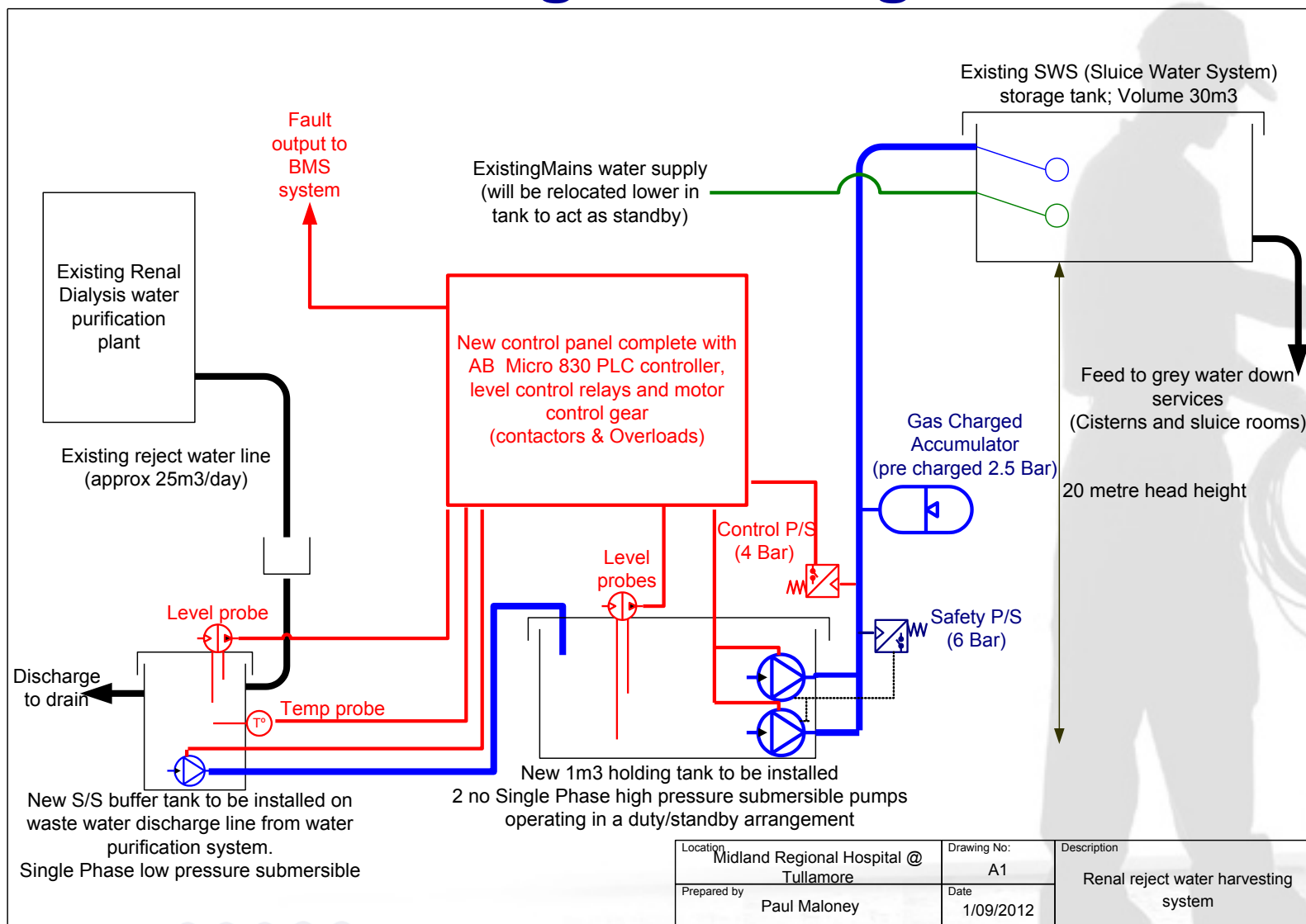
- Fit manufacturer high recovery kit to HSSD RO. (500 litre/hr. raw water saving).
- Lab DI not economically viable to recover
- Recover renal reject water to SWS and transfer 231 cisterns to SWS supply



# Design Requirements Renal Recovery

- Design Flow rate 1,000 litres/hr
- Maintain air gap with Renal RO system
- Excess unwanted water flow to drain unhindered
- Fully automatic with fault reporting (BMS)
- Run dry and flood protection
- Fault redundant
- Reject unsuitable water (Hot water from thermal disinfection and brine back wash).
- Transfer cisterns to SWS system.

# Water Harvesting Line Diagram



# Costs and ROI

Item	Cost (incl. VAT)
Copper and ancillaries for pipe work install from renal water to SWS tank	€1,436.31
Copper and ancillaries to convert 231 cisterns from CWS to SWS	€4,873.44
Stainless Steel sump tank & hopper	€850.00
500 litre intermediate storage tank c/w duty standby pumps & controller	€3,140.00
Submersible pump c/w barrel float	€271.00
Electrical control panel c/w PLC, overloads etc	€1,380.00
Electrical cabling and ancillaries	€304.15
ABS piping for connection between sump tanks intermediate storage tank	€276.75
<b>Total</b>	<b>€12,531.65</b>

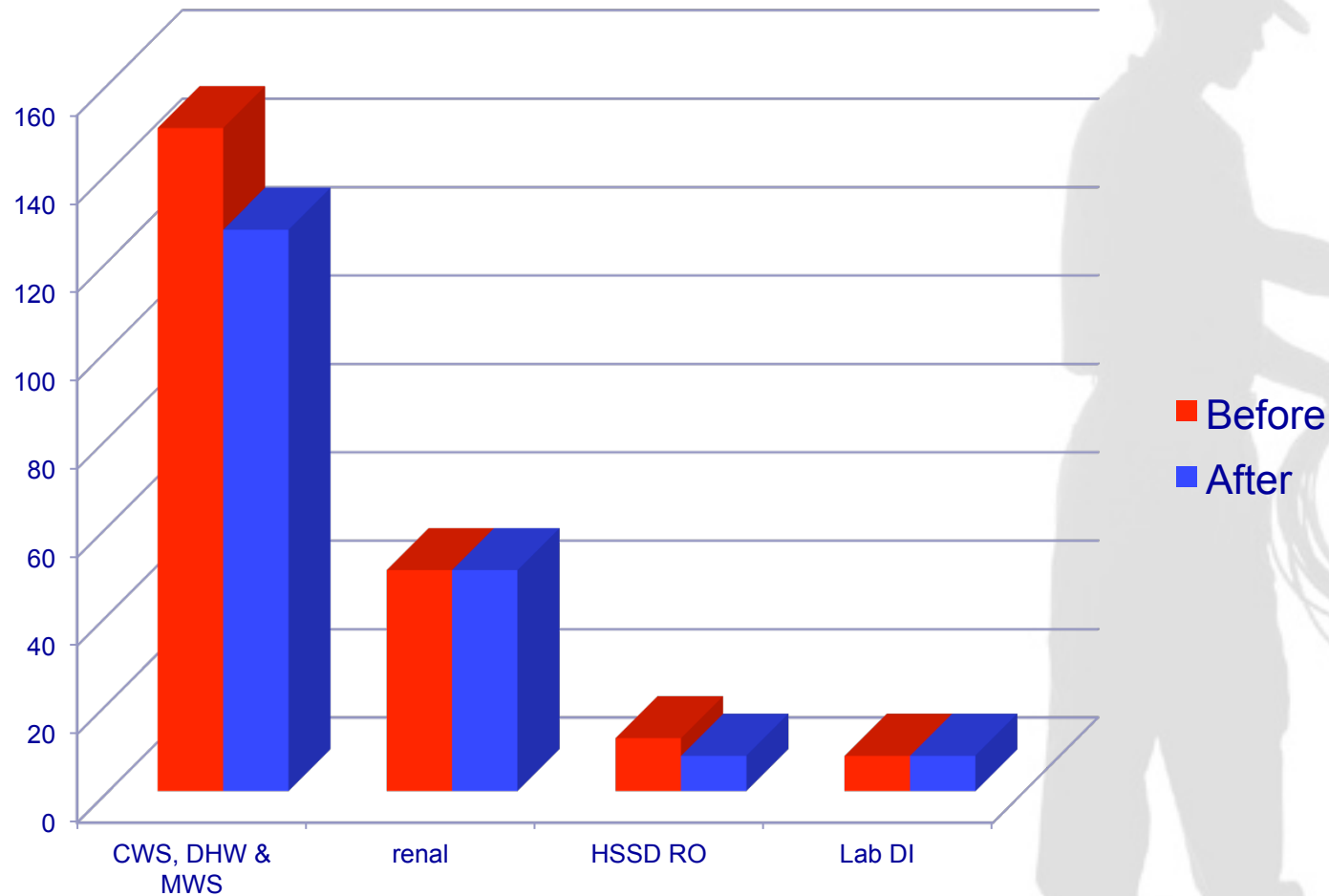
- **Projected daily recovery ~25m<sup>3</sup>/day**
- **∴ €2.42/m<sup>3</sup> x 25 x 365 = €22,082.50**
- **ROI: €12,531.65/€22,082.50 = 0.56 *years* (~7 *months*)**

# As Installed



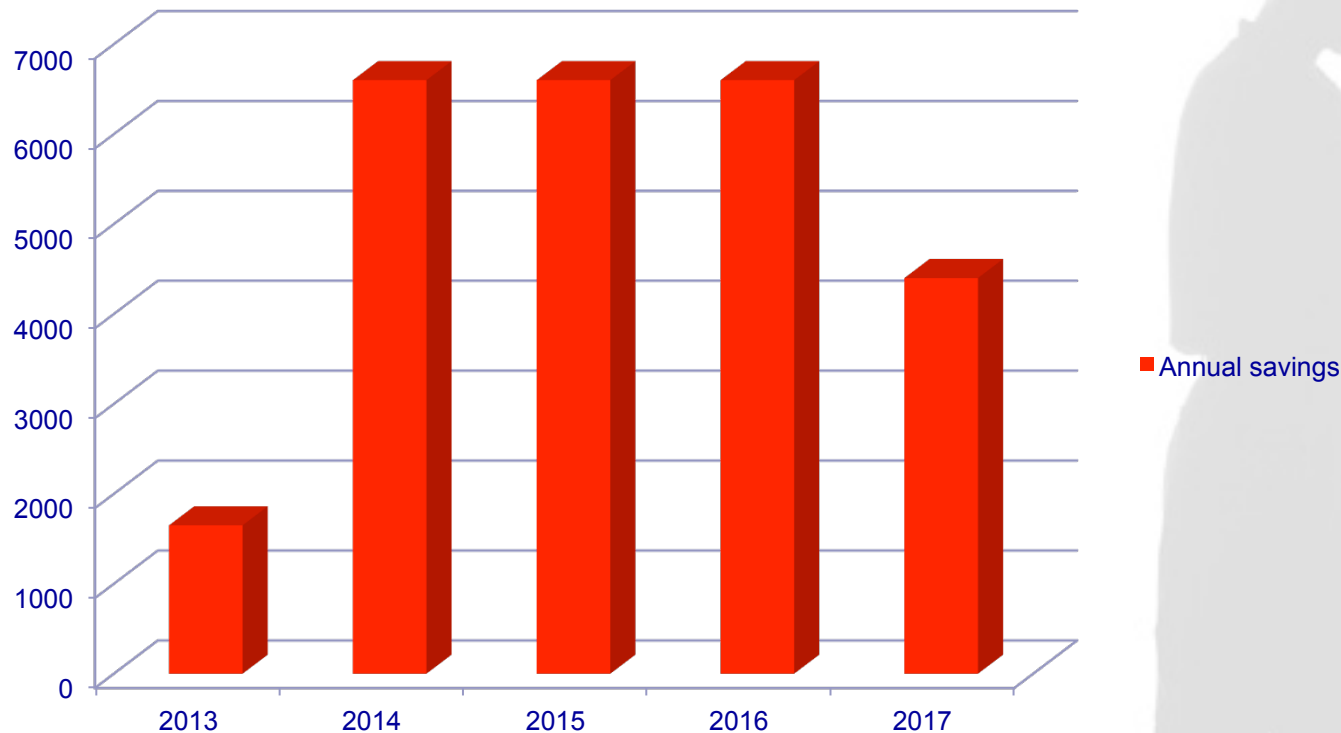


# Typical Daily Water Consumption (after)



# Renal Water Harvesting System

Annual savings (m3)



- Capital Cost (2013) €12,531K
- 2016 savings 6,624m<sup>3</sup>: €16,030
- Total Savings (Aug 2017) 25,384m<sup>3</sup>: €61,429

# Learnings

- Actual water recovered 16-20m<sup>3</sup>/day (vs. projected 25m<sup>3</sup>/day)
- Reliable & simple design (low maintenance)
- Cistern usage closer to 30 flushes/day (only 140 WCs' transferred)
- Installation can be managed through internal resources
- Potential for blending reject water back to CWS could be explored



# Thank you



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