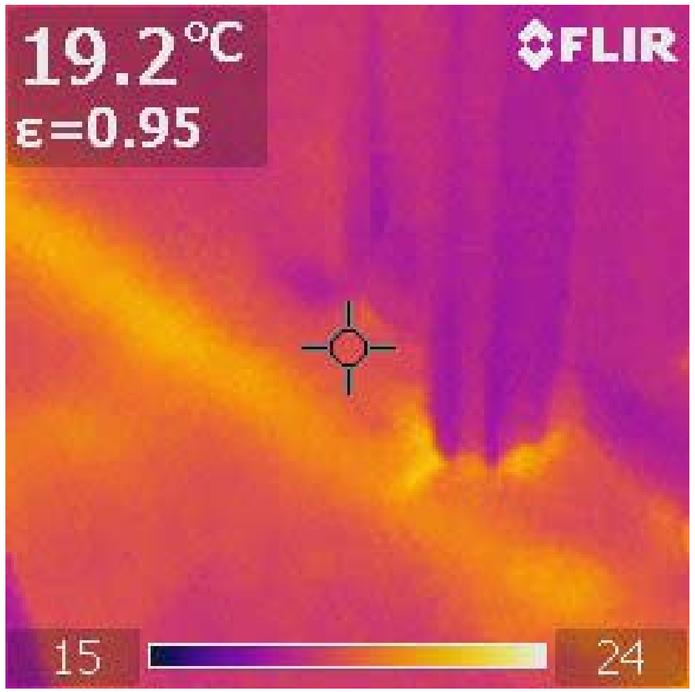
AECB Water Standards: case study of domestic retrofit

water meter



thermographic image of dead leg

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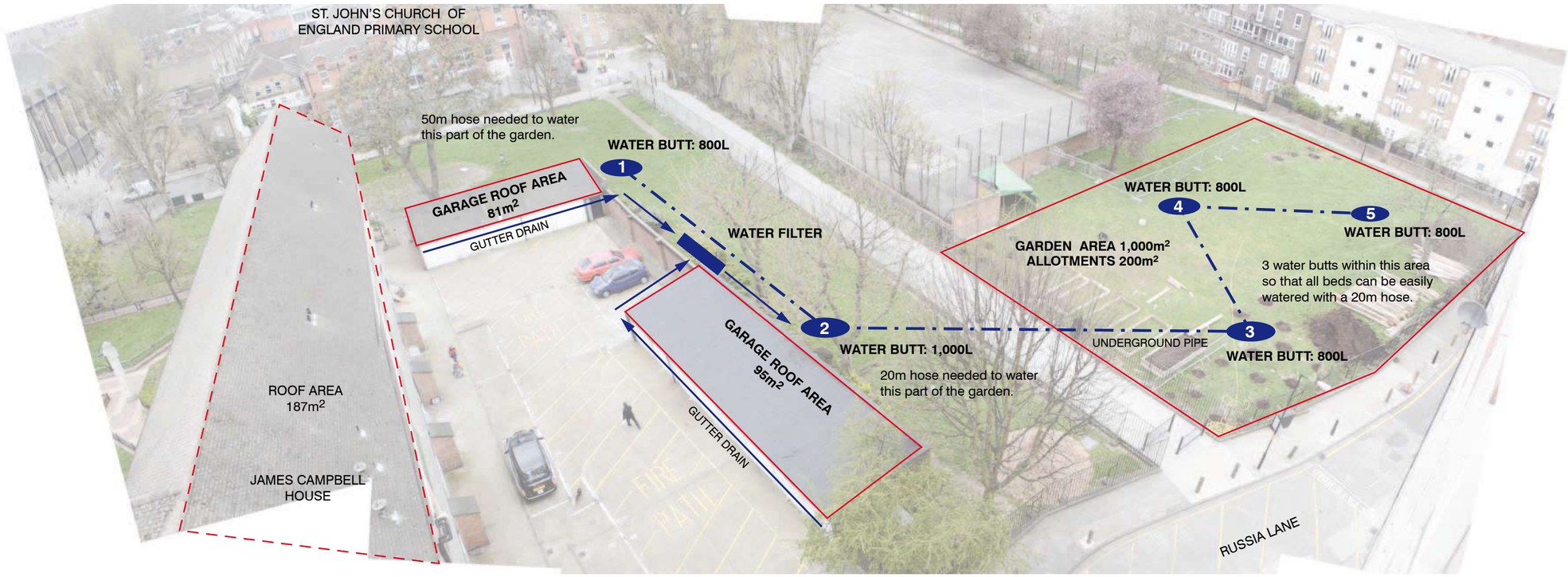
email: harry@arborealarchitecture.com
twitter: @harrypaticas

Presentation Overview

- Introduction to Arboreal
- AECB Water Standards Overview
- Case Study Context
- Proposed Installation
- AECB Water Standards Achieved
- Suggestions for Implemention

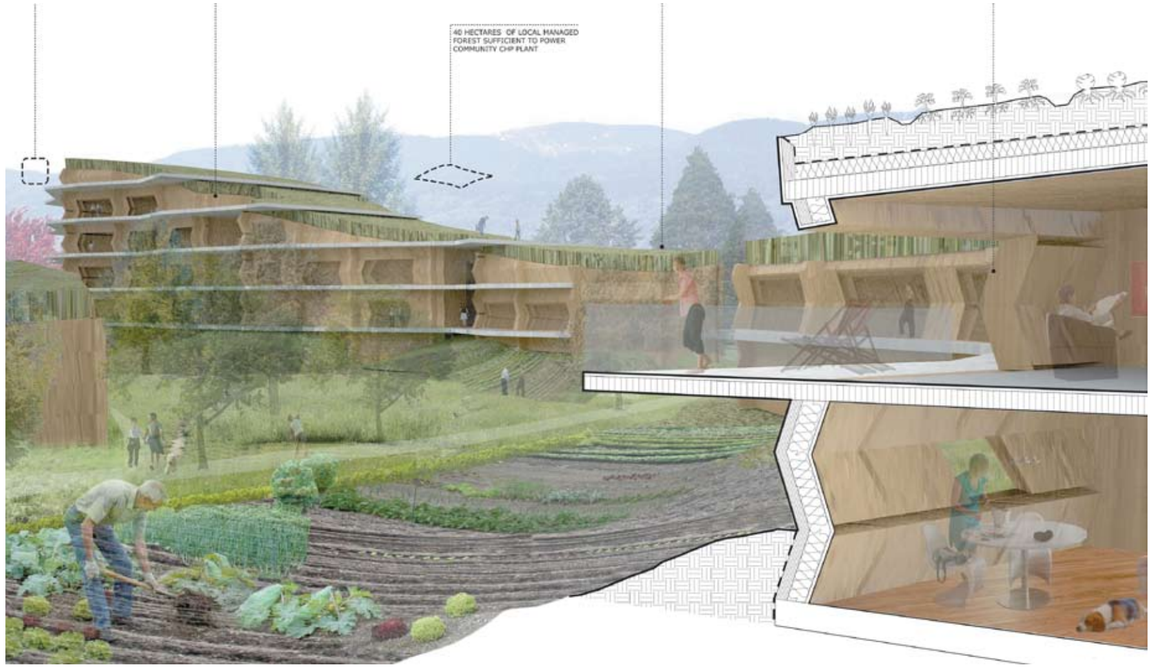
Introduction: Rainwater collection for food growing



Approach gardens

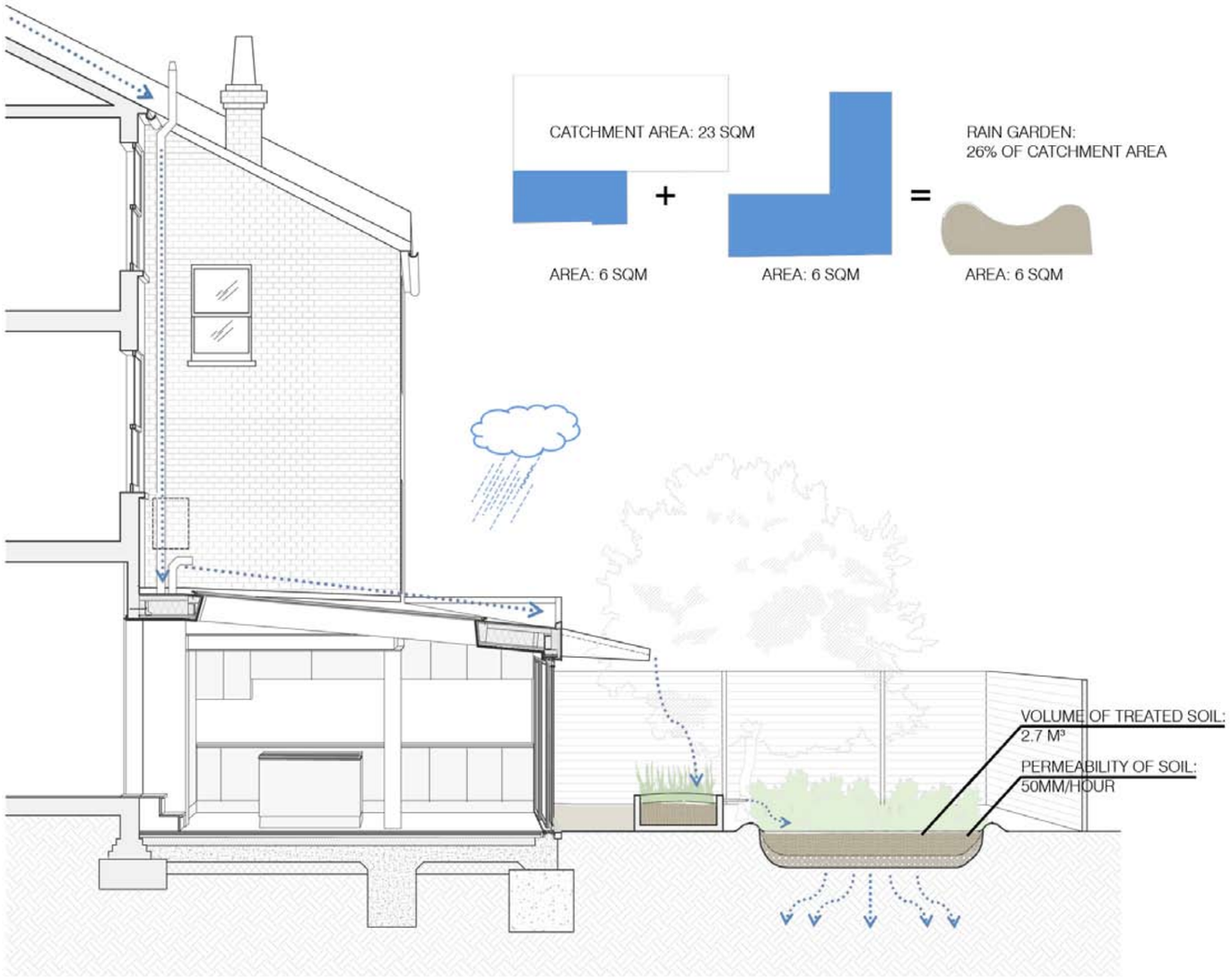
Introduction: Integrated buildings and landscapes

Intensive Ground (site plan)



Intensive Ground (sectional perspective)

Introduction: Rain Gardens

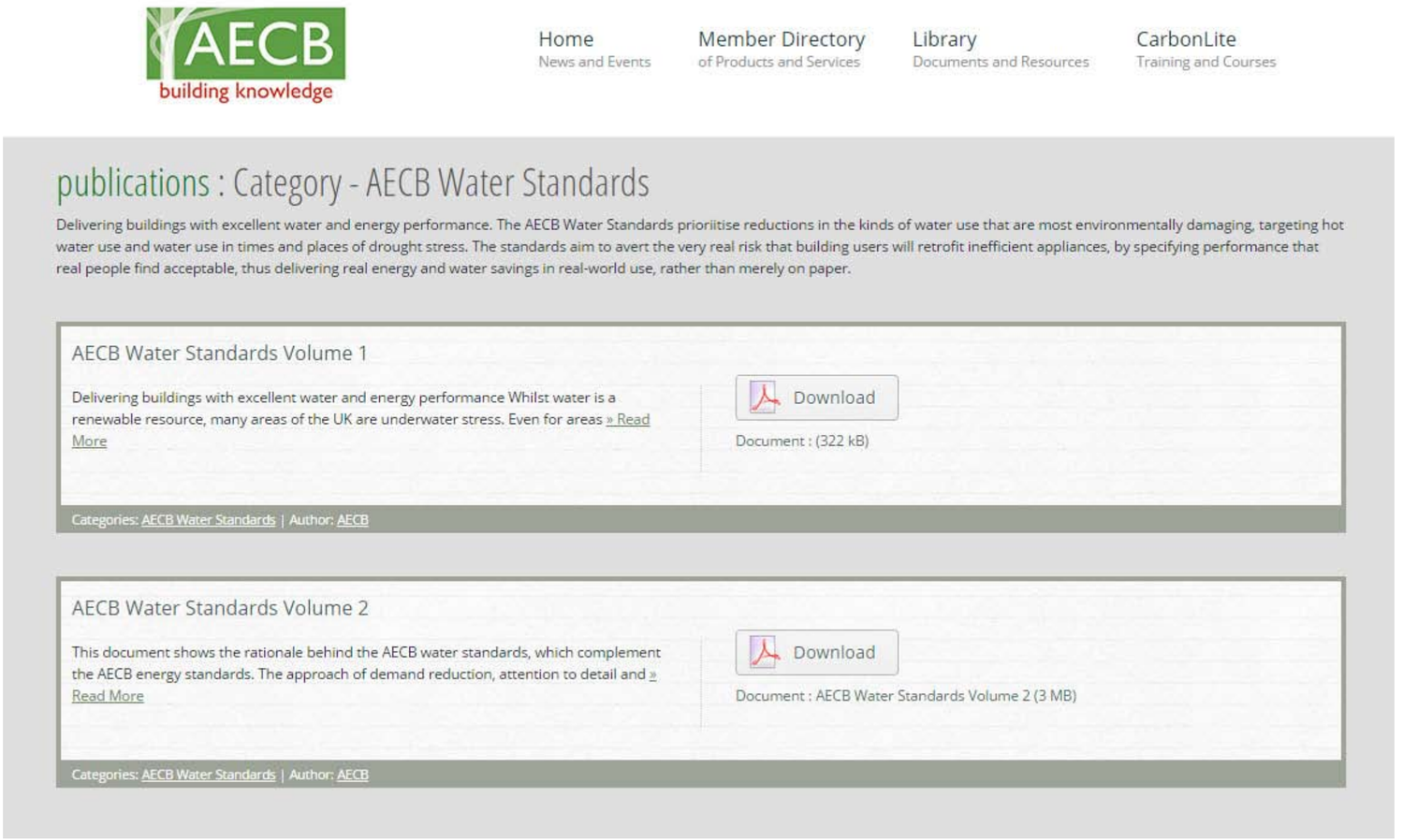


rain garden schematic

Introduction: Rain Gardens

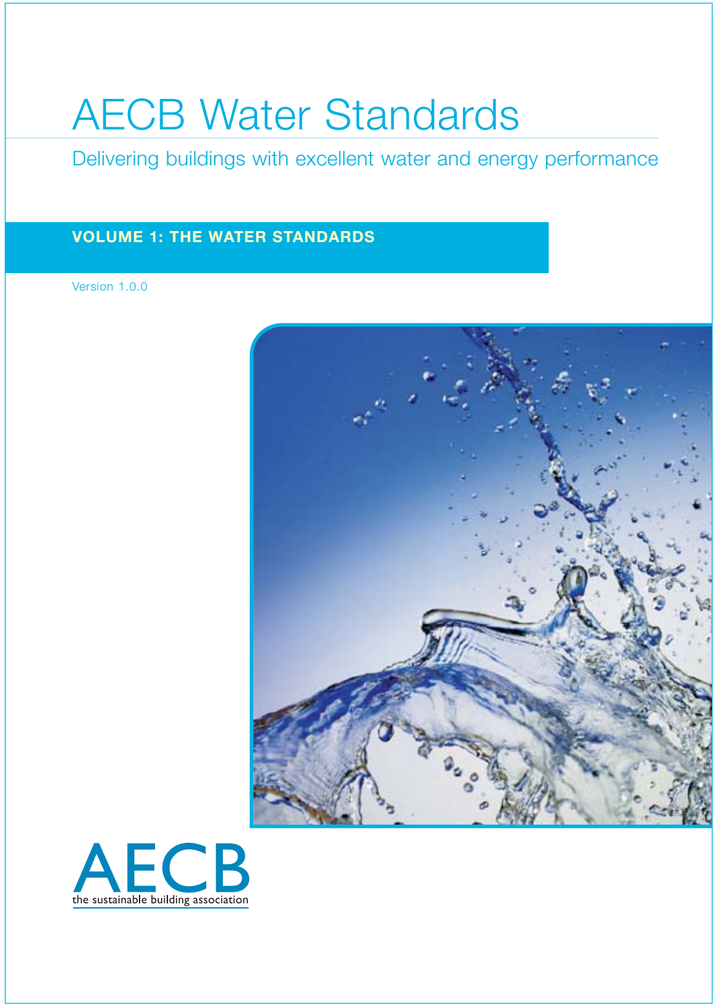
rain garden spout under construction

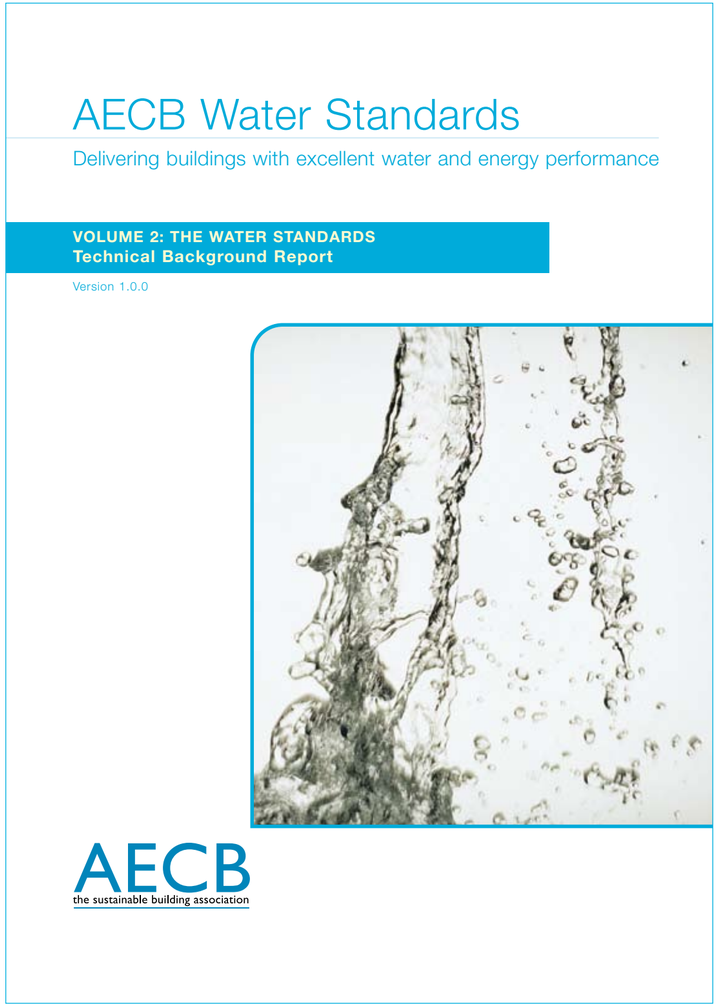
AECB Water Standards: Overview



http://www.aecb.net/publications/publication-categories/aecb-water-standards/

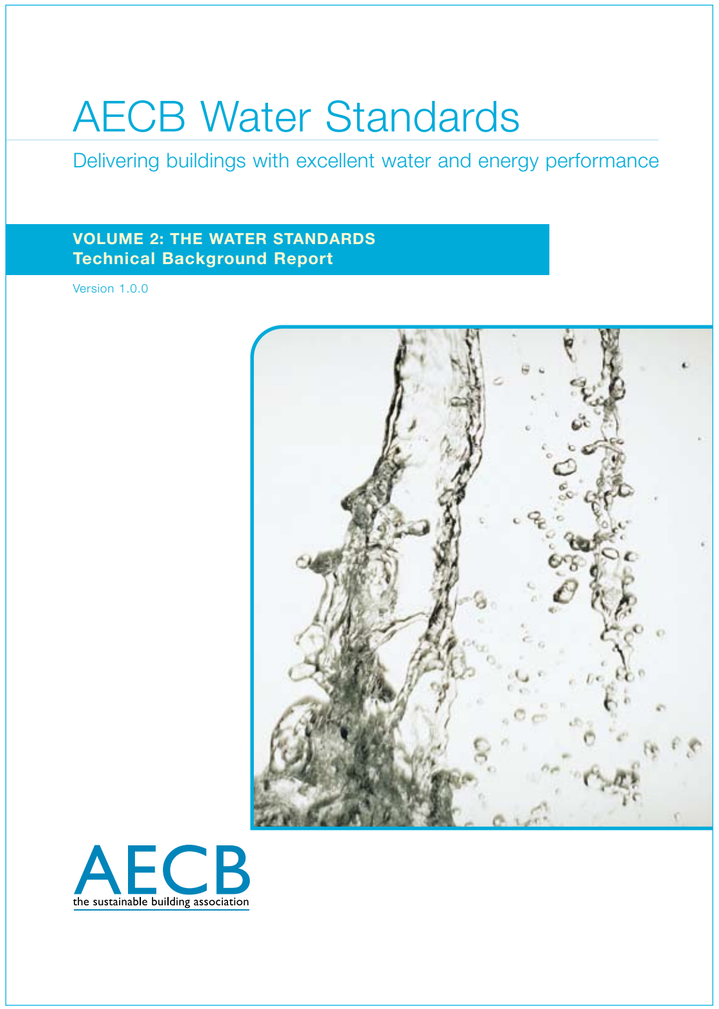
AECB Water Standards: Overview





AECB Water Standards: Overview

- First published in 2009



AECB Water Standards: Overview

- First published in 2009
- Prioritisation of hot water savings

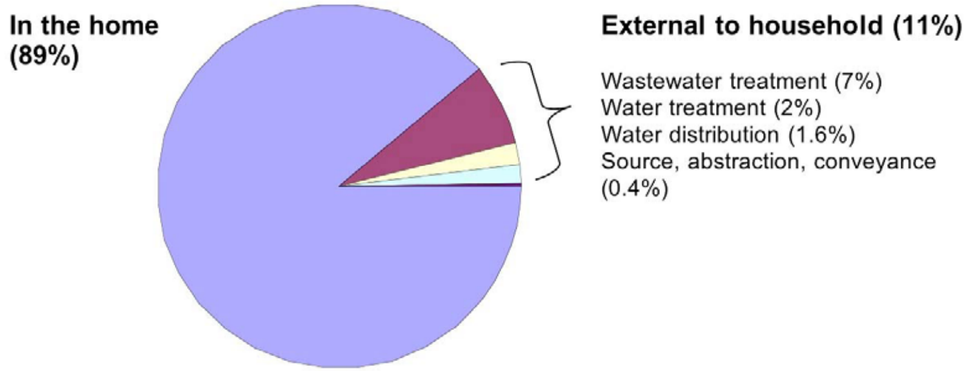


Figure 1. Greenhouse gas emissions due to domestic water use. From Environment Agency Briefing Note; greenhouse gas implications of future water resource options.

AECB Water Standards: Overview

- First published in 2009
- Prioritisation of hot water savings
- Performance requirements for individual devices

Table 1. Summary of performance requirements, further details in text.

Fitting	Good practice	Best practice
Showers	6 to 8 l/min	≤ 6 l/min (e.g. aerating)[2]
Basin and bidet taps (domestic)	4 to 6 l/min	≤ 4 l/min with lower default[3]
Urinals (non-domestic)	See text	See text
Basin taps (washroom)	≤ 1.7 l/min spray dead leg ≤ 0.5 litres	As Good Practice dead leg ≤ 0.25 litres
Kitchen sink taps	6 to 8 l/min	≤ 6 l/min with lower default[4]
White goods	See energy standard	As Good Practice
Toilets	≤ 6 l/ full flush	≤ 4.5 l/full flush
Baths (shower must also be installed)	≤ 180 litres to overflow	As Good Practice
Dead legs	≤ 1.5 litres	≤ 0.85 litres
Dead legs off secondary circulation[5]	≤ 0.5 litres	≤ 0.25 litres
Water softeners	Location specific, see relevant section	
Outdoor	Location specific, see relevant section	

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- Attention to detail based on Passivhaus principles

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- Prioritisation of hot water savings
- Performance requirements for individual devices
- Attention to detail based on Passivhaus principles
- Avoids the CSH whole building approach

Table 2. Summary of key differences between AECB standard and CSH.

AECB Water Standard (aims)	**CSH Water**
Appliance limits	Total household limits
Min and Max flow limits	No minimum flow limits
Emphasis on demand reduction	Can emphasise grey and rain
Carbon saving prioritised	Water can be saved at cost of carbon
Cost effectiveness considered	Cost effectiveness not considered
Location considered	Same measures for Thames or Cumbria
Peak demand considered (e.g. summer outdoors)	Average demand considered
Good initial plumbing design encouraged	No requirements for good plumbing design

AECB Water Standards: Overview

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- Cost effectiveness
- User focussed
- Cautious towards innovative technologies

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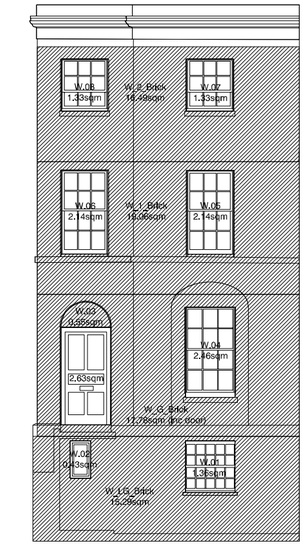
Case Study Context: deep retrofit to AECB Silver Standard

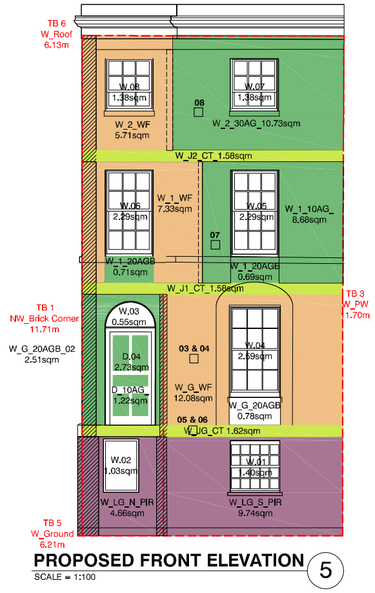
street context

Case Study Context: deep retrofit to AECB Silver Standard



EXISTING FRONT ELEVATION 2

SCALE = 1:100



PROPOSED FRONT ELEVATION 5

SCALE = 1:100

Case Study Context: deep retrofit to AECB Silver Standard

Space Heat Demand (SHD)

- Existing house (PHPP) - 180kWh/m2.a
- Retrofit (PHPP)- 40kWh/m2.a (78% reduction)
- Energy bills are being monitored over time

Airtightness

- Existing house - 9.6ach
- Retrofit - 1.8ach (with co-pressure)

Comfort and indoor air quality

- Clients have
- Internal RH 50-55% and temperature at 20

Case Study Context: deep retrofit to AECB Silver Standard

Name: Foamglas Perinsul
Material: high density foamed glass
Location: door and window sills
Thermal conductivity: 0.058 W/m.K
Vapour diff resistance (*μ*): ∞

Name: Remmers iQ therm
Material: PIR + capillary active plugs
Location: internal wall insulation
Thermal conductivity: 0.031 W/m.K
Vapour diff resistance (*μ*): 27

Name: Excel Warmcel 500
Material: blown cellulose
Location: loft floor + shutter boxes
Thermal conductivity: 0.04 W/m.K
Vapour diff resistance (*μ*): 2

Name: Technopor
Material: foamed glass granulate
Location: external perimeter
Thermal conductivity: 0.08 W/m.K
Vapour diff resistance (*μ*): low

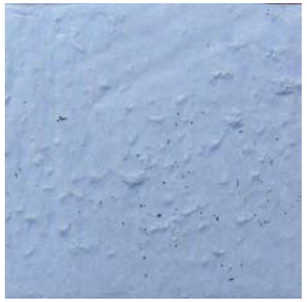
Name: Silvapor
Material: perlite beads
Location: stair stringer
Thermal conductivity: 0.045 W/m.K
Vapour diff resistance (*μ*): low

Name: Calsitherm
Material: calcium silicate board
Location: between joists
Thermal conductivity: 0.06 W/m.K
Vapour diff resistance (*μ*): 6

Name: Gutex Thermoroom
Material: woodfibre
Location: internal wall insulation
Thermal conductivity: 0.04 W/m.K
Vapour diff resistance (*μ*): 3

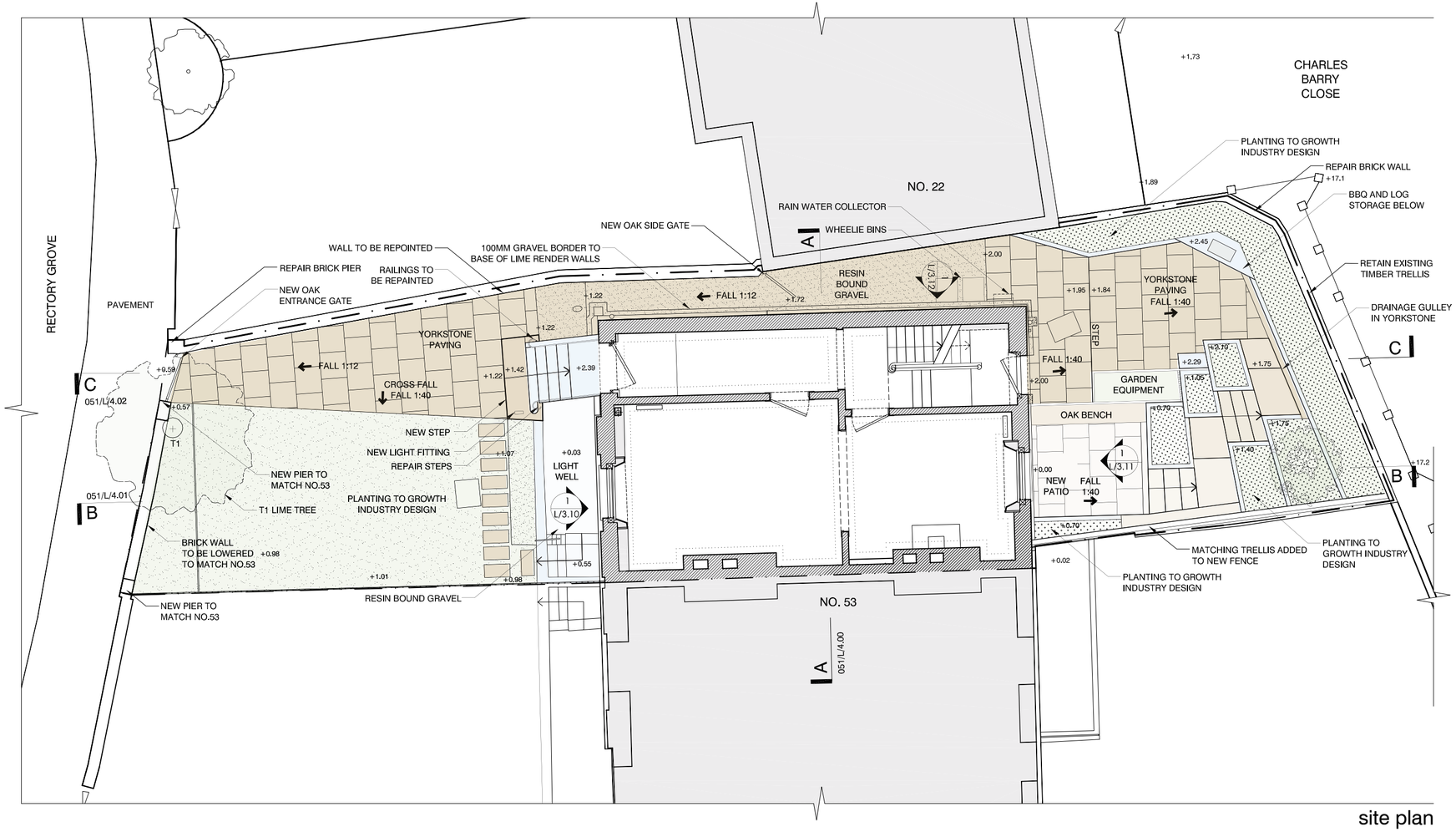
Name: Kevothermal VIP
Material: vacuum insulated panel
Location: ground floor below screed
Thermal conductivity: 0.007 W/m.K
Vapour diff resistance (*μ*): ∞

Name: Thermablok SP
Material: aerogel blanket
Location: internal wall insulation
Thermal conductivity: 0.014 W/m.K
Vapour diff resistance (*μ*): 5.5



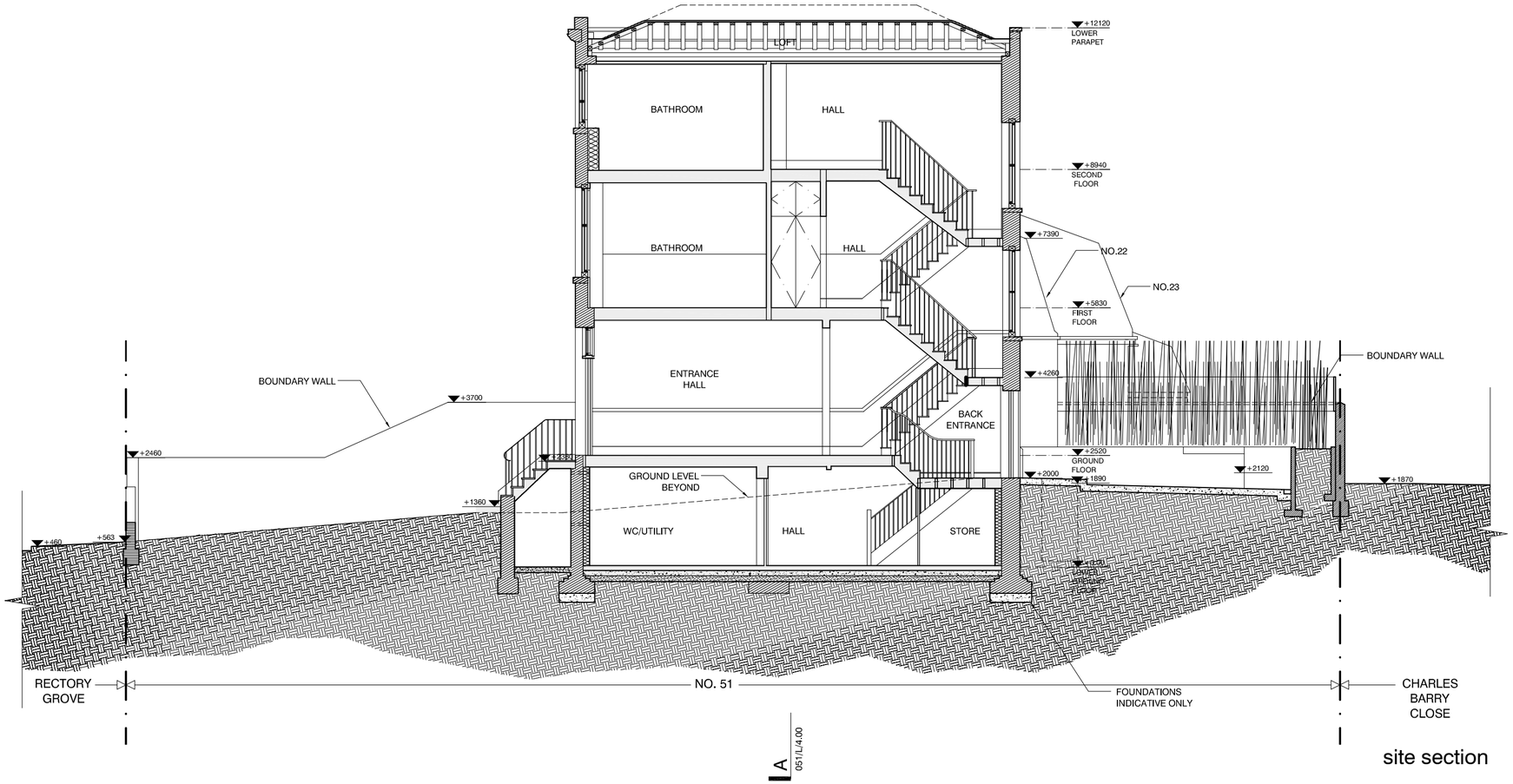
Name: Kingspan Styrozone N300R
Material: extruded polystyrene
Location: below ground external
Thermal conductivity: 0.038 W/m.K
Vapour diff resistance (*μ*): high

Case Study Context: deep retrofit to AECB Silver Standard



site plan

Case Study Context: deep retrofit to AECB Silver Standard

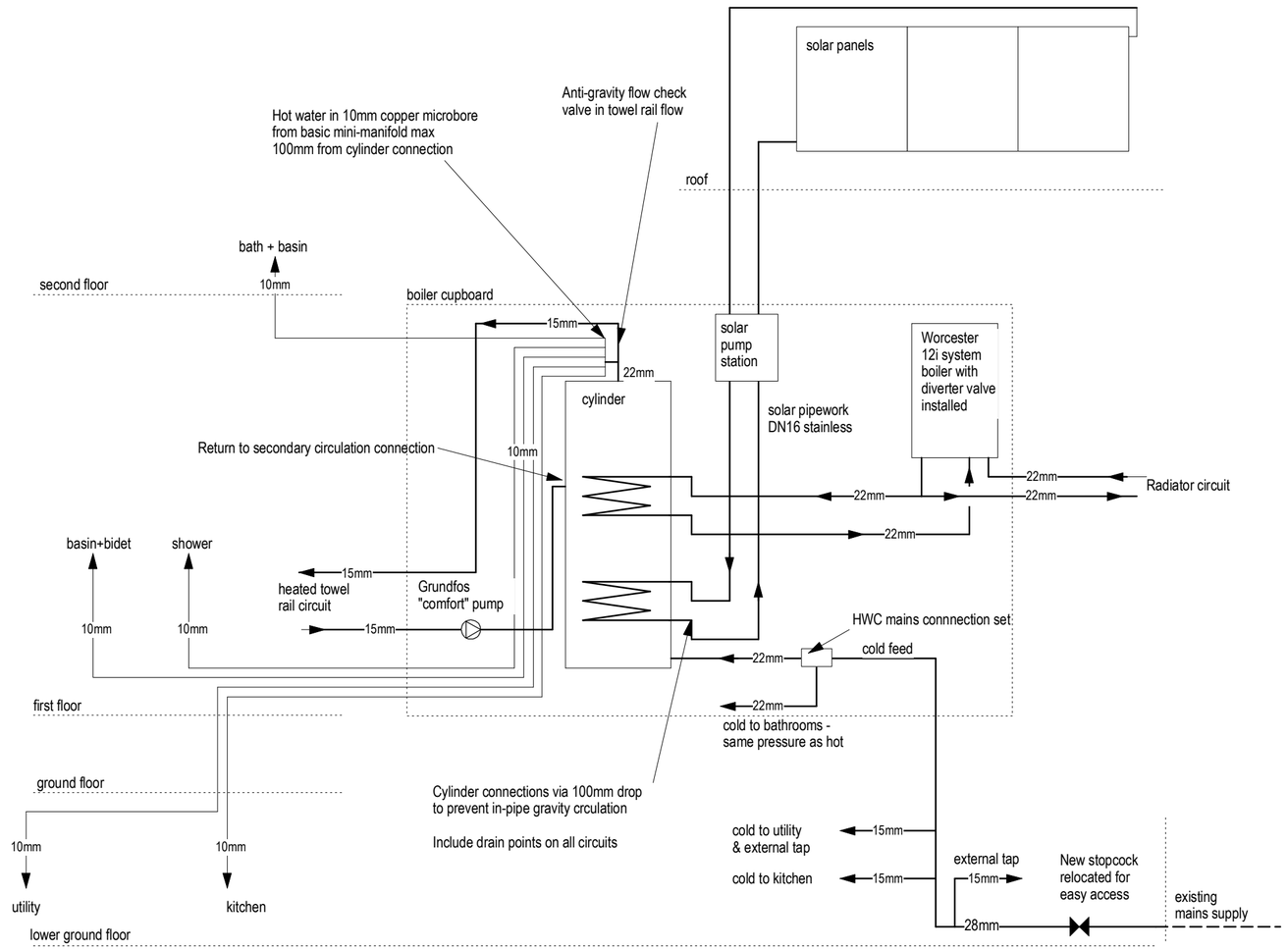


site section

Proposed installation

- restrictions due to grade II listed status
- water fed from header tank in loft - new system mains fed to prevent risk of freezing
- solar panels installed on roof with antifreeze in circuit
- unvented heating system (cylinder and boiler) for higher pressure
- 10mm microbore pipework for hot water supply to minimise deadlegs
- insulated pipe runs with carefully planned routes
- mains pressure 3.7bar so pressure regulator installed on incoming mains
- fittings with integrated mixer valves, flow regulation and aerated outlets

Proposed installation



plumbing schematic (Alan Clarke)

AECB Water Standards Achieved

water pressure tester

flow rate testing

AECB Water Standards Achieved

Room	Element	NOT MET	GOOD	BEST
2nd floor bathroom	Bath	**140+70**		
	Overhead shower			**5.6 l/min**
	Sink		**4.6 l/min**	
	WC flush			**4.5**
	Dead leg (shower)			**0.45**
	Dead leg (sink)			**0.41**

2nd floor bathroom

AECB Water Standards Achieved

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1st floor showerroom	Shower		**6.1 l/min**	
	Bidet	**7 l/min**		
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	WC flush			**4.5 to 2 litres**
	Dead leg (shower)			**0.22**
	Dead leg (bidet)			**0.38**
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1st floor shower room

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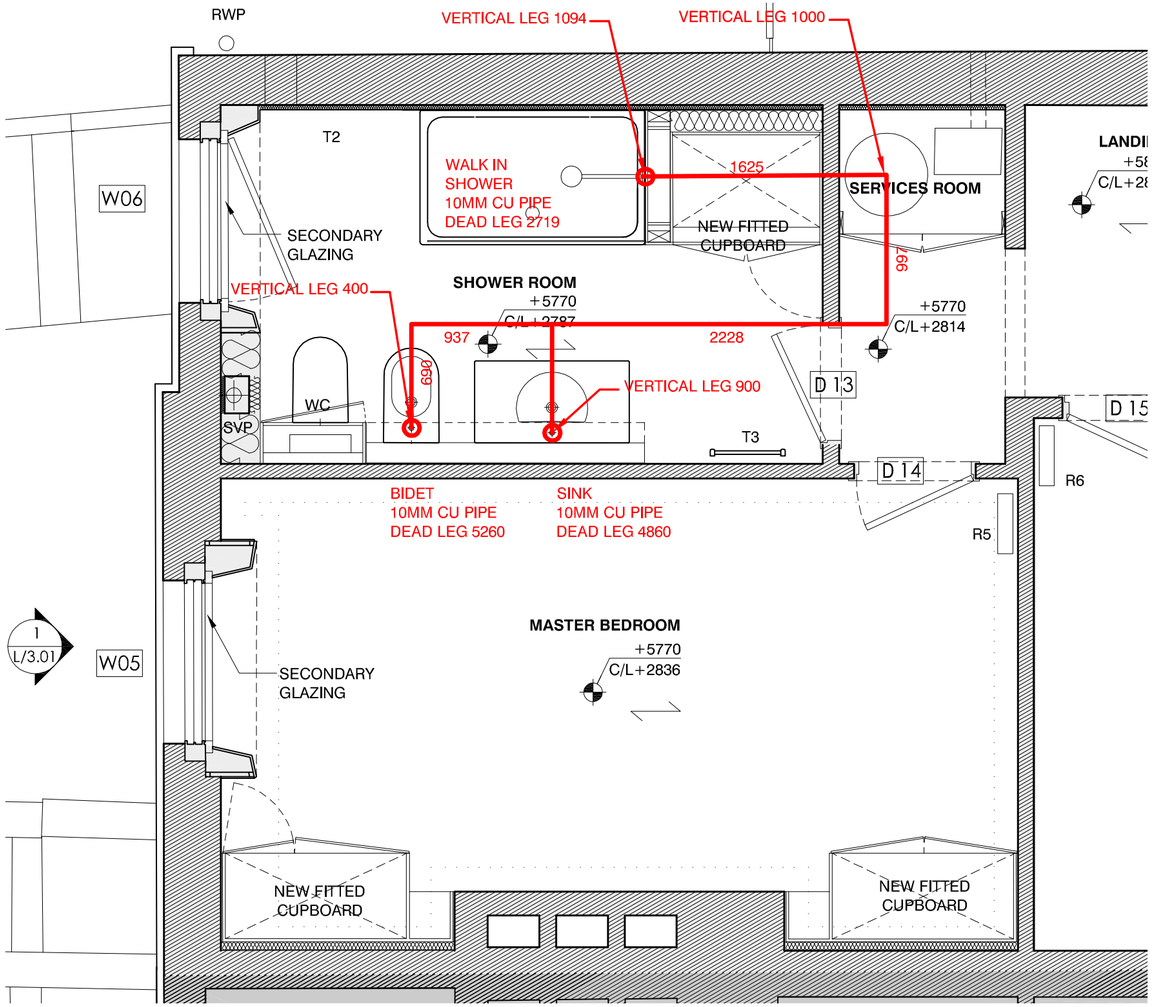

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Lower ground floor WC	Sink		**4.9 l/min**	
	WC flush		**≤ 6 litres**	**4.5 to 2 litres**
	Washing machine		**A+**	
	Dead leg (sink)			**0.83**

LG WC tap

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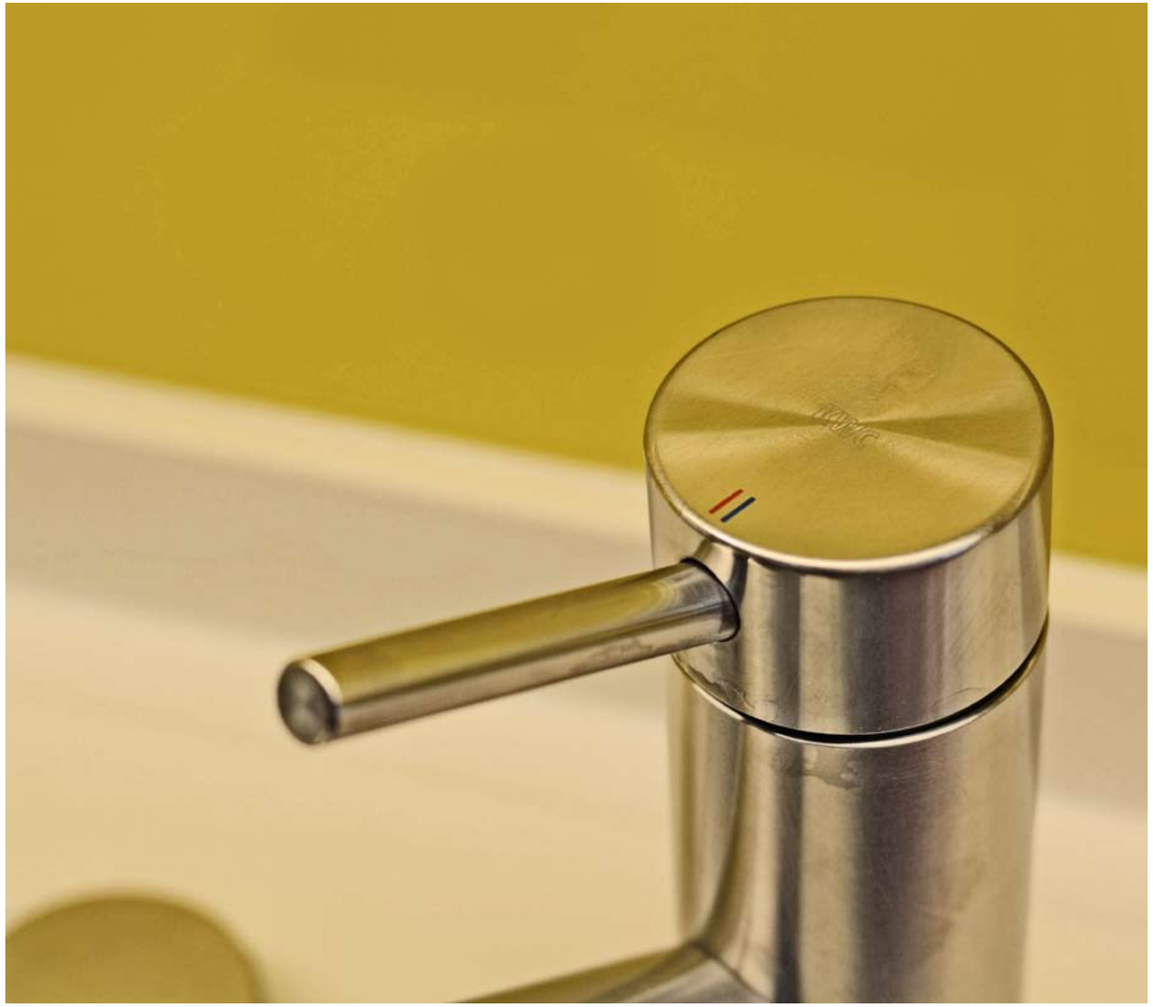
Lower ground floor Kitchen	Kitchen tap		**6.8 l/min**	
	Dead leg (kitchen sink)			**0.76**
	Dishwasher			**A+++**



kitchen tap

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A+++ dishwasher

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Pressure and metering	Pressure regulator		**installed**	
	Water meter inside	**not installed**		
	Leak detecton or shut off		**installed**	

pressure regulator

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	Water meter inside	**not installed**		
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Outside	Outside taps (2no.)	**no sub-meter**		
	Paving drains to planter		**installed**	
	Water butt		**installed**	

water butt (160 litres)

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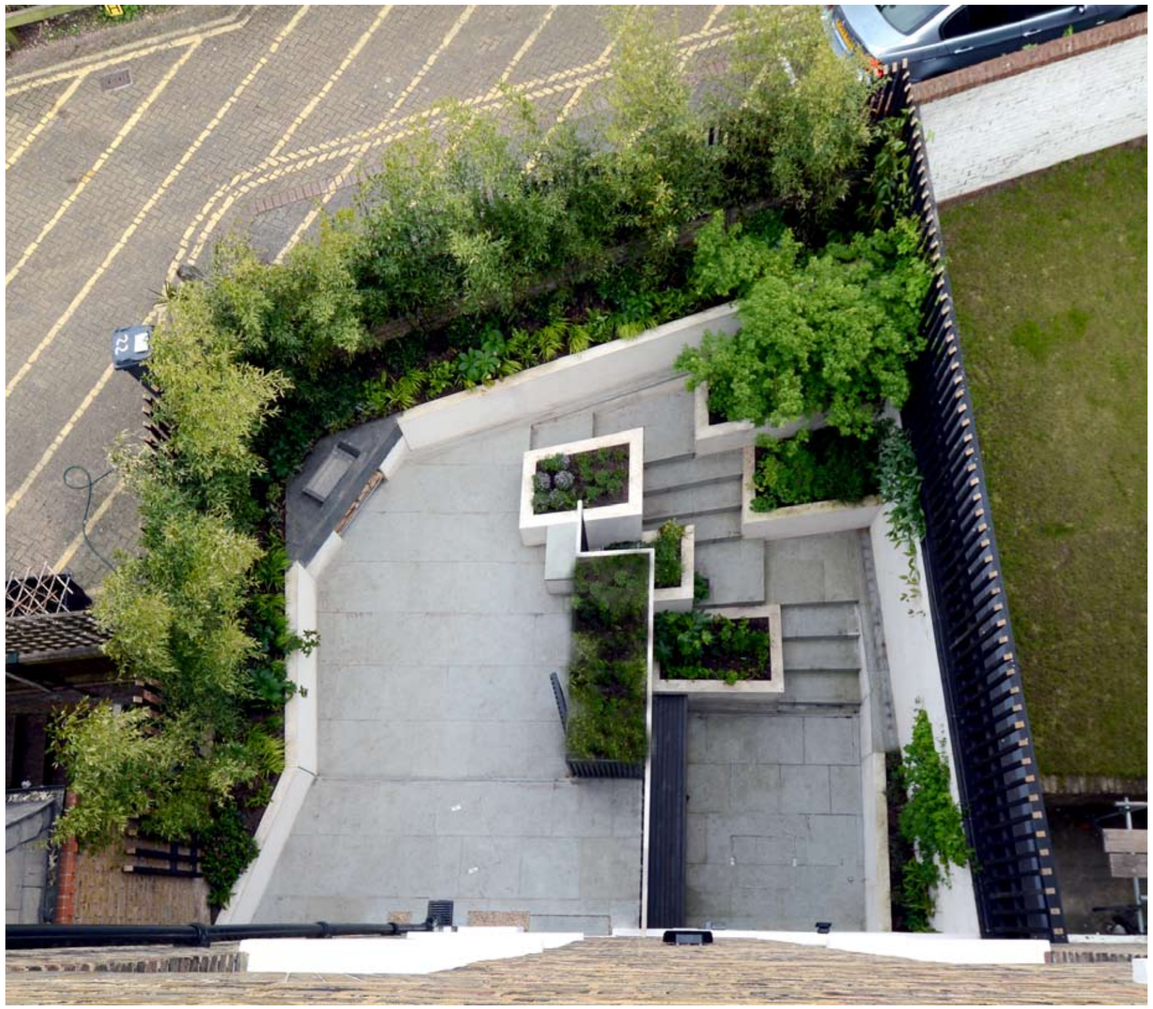
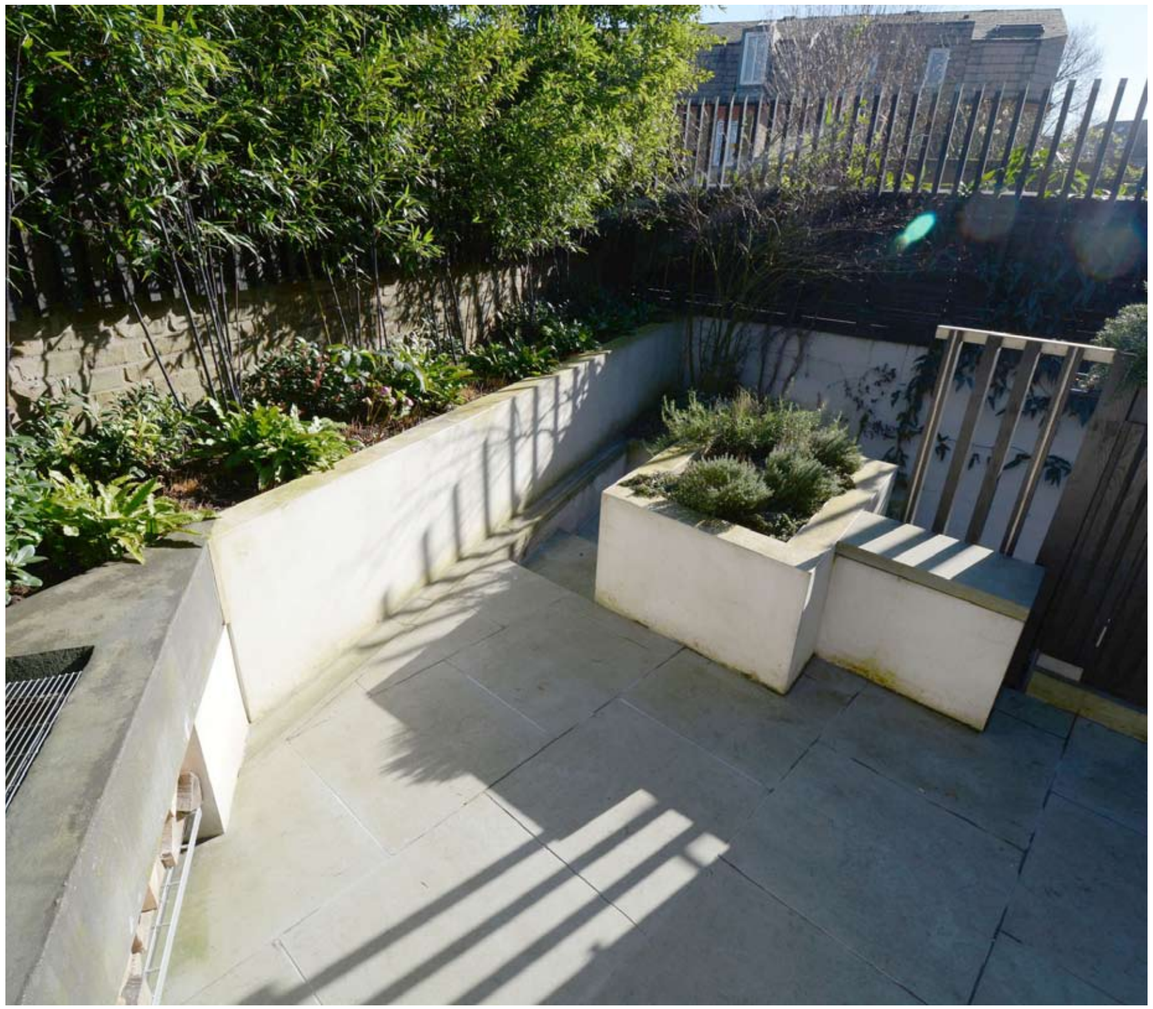


back garden drainage to planters

AECB Water Standards Achieved

Room	Element	NOT MET	GOOD	BEST
2nd floor bathroom	Bath	**140+70**		
	Overhead shower			**5.6 l/min**
	Sink		**4.6 l/min**	
	WC flush			**4.5**
	Dead leg (shower)			**0.45**
	Dead leg (sink)			**0.41**
1st floor showerroom	Shower		**6.1 l/min**	
	Bidet	**7 l/min**		
	Sink		**5.1 l/min**	
	WC flush			**4.5 to 2 litres**
	Dead leg (shower)			**0.22**
	Dead leg (bidet)			**0.38**
	Dead leg (sink)			**0.35**
Lower ground floor WC	Sink		**4.9 l/min**	
	WC flush		**≤ 6 litres**	**4.5 to 2 litres**
	Washing machine		**A+**	
	Dead leg (sink)			**0.83**
Lower ground floor Kitchen	Kitchen tap		**6.8 l/min**	
	Dead leg (kitchen sink)			**0.76**
	Dishwasher			**A+++**
Pressure and metering	Pressure regulator		**installed**	
	Water meter inside	**not installed**		
	Leak detecton or shut off		**installed**	
Outside	Outside taps (2no.)	**no sub-meter**		
	Paving drains to planter		**installed**	
	Water butt		**installed**	



back garden drainage to planters

AECB Water Standards Achieved

Room	Element	NOT MET	GOOD	BEST
2nd floor bathroom	Bath	**140+70**		
	Overhead shower			**5.6 l/min**
	Sink		**4.6 l/min**	
	WC flush			**4.5**
	Dead leg (shower)			**0.45**
	Dead leg (sink)			**0.41**
1st floor showerroom	Shower		**6.1 l/min**	
	Bidet	**7 l/min**		
	Sink		**5.1 l/min**	
	WC flush			**4.5 to 2 litres**
	Dead leg (shower)			**0.22**
	Dead leg (bidet)			**0.38**
	Dead leg (sink)			**0.35**
Lower ground floor WC	Sink		**4.9 l/min**	
	WC flush		**≤ 6 litres**	**4.5 to 2 litres**
	Washing machine		**A+**	
	Dead leg (sink)			**0.83**
Lower ground floor Kitchen	Kitchen tap		**6.8 l/min**	
	Dead leg (kitchen sink)			**0.76**
	Dishwasher			**A+++**
Pressure and metering	Pressure regulator		**installed**	
	Water meter inside	**not installed**		
	Leak detecton or shut off		**installed**	
Outside	Outside taps (2no.)	**no sub-meter**		
	Paving drains to planter		**installed**	
	Water butt		**installed**	
User guide	User guide	**not issued**		
	Commissioning checklist	**not issued**		

Appendix IV: Design and commissioning checklist

The following items need to be included in a design and commissioning checklist, in a format appropriate to the dwelling. This checklist accompanies the Home User Guide.

General information
Property name and address
Water stress category of area
Water Company
Date commissioned
Mains water pressure at time of test
Good or Best Practice specification
Name and contact details of person carrying out the commissioning.

Appliance specific details
In all instances sufficient detail should be provided to verify that the appliance has been tested and delivers the correct flow rate or volume at installation. The Home User Guide should also give the householder sufficient information to allow replacement/maintenance (including manufacturer, product name, website/phone number for spares and further information). Where more than one appliance of a type is fitted, clear identification of each is needed, and test results for each.

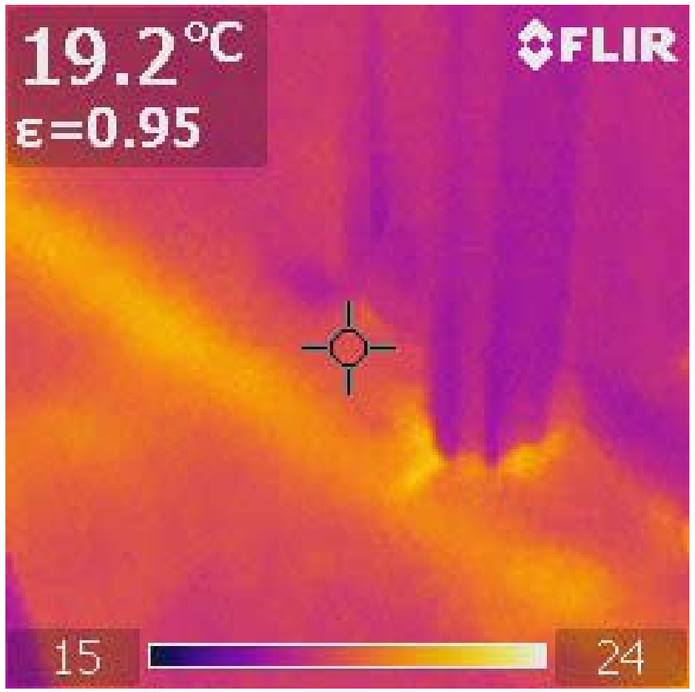
Water meters fitted (indoor, hot meter, outdoor tap)
Pressure regulator (if fitted)
Leak detection devices fitted, how to test for leaks for specific appliances.
Isolation valve on incoming main
Showers
Basin taps (domestic, washroom)
Sink taps
WCs
Baths
Bidets
Flow regulators (locations within the plumbing system must be clearly stated)
Water softener if fitted (including regeneration volume)
Details of garden landscape water efficiency measures
Dead legs (length, diameter, material, insulation λ, volume) for each dead leg in the property. Heat loss calculations (within PHPP, or using same calculation and assumptions).
Secondary circulation if fitted; pipe length, diameter, insulation, pump and control details
If experimental technologies are fitted sufficient details of these must be given to alert the householder to potential issues that may arise and how the item can be replaced.

Suggestions for Implemention

- propose AECB Water Standards to client at briefing Stage 1
- carry out early research:
  - test water pressure at an early stage
  - establish local water stress and hardness
- work with a good services engineer
- consider shortest pipework runs at an early layout design stage
- landscaping proposals to collect rainwater and be drought tolerant
- use checklist during design to ensure good/best practice on target
- tollbox talk with good plumber prior to construction
- allow additional time at completion for commissioning and flow rate checking

AECB Water Standards: case study of domestic retrofit

water meter



thermographic image of dead leg

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