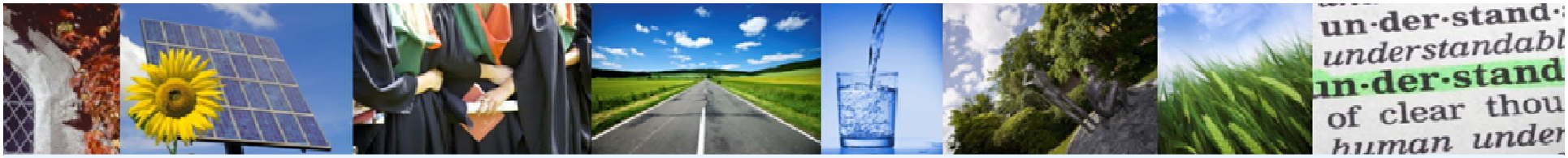
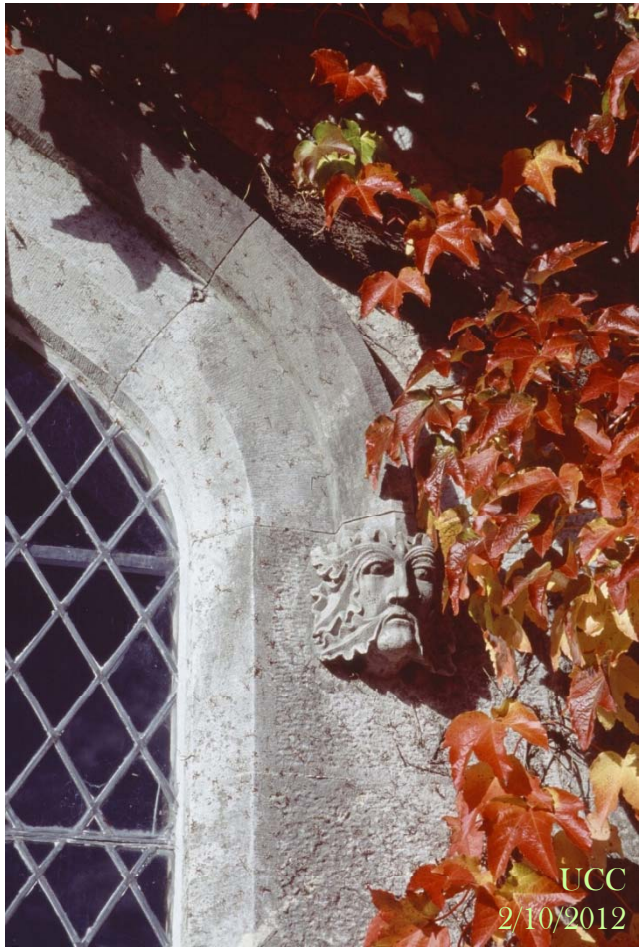


Sustainability and Modern Society



ACE
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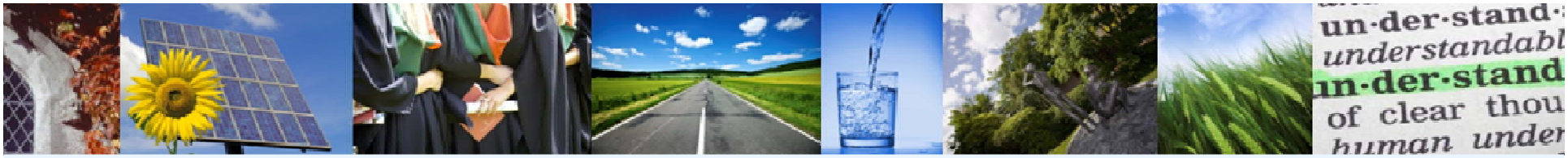
Adult Continuing Education Seminar Series

Moving to a sustainable societal construct: Freshwater for the future

Dr Debbie Chapman
School of Biological, Earth and Environmental Sciences



The issues

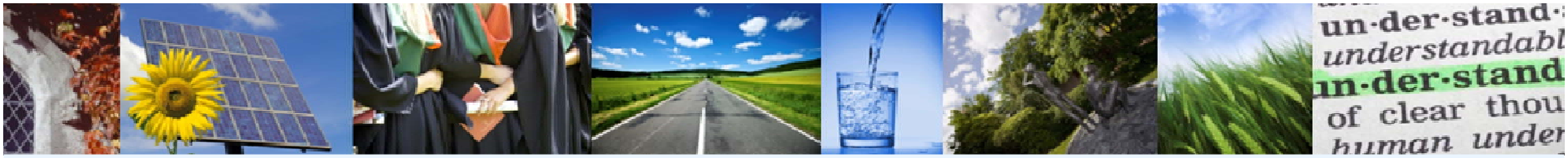
Quantity

- A finite resource
- Freshwater is not distributed evenly over the Earth
- Climate change leading to new patterns of water availability
- Population growth leading to increased demand
- Unsustainable abstraction of surface and ground waters
- Profligate use

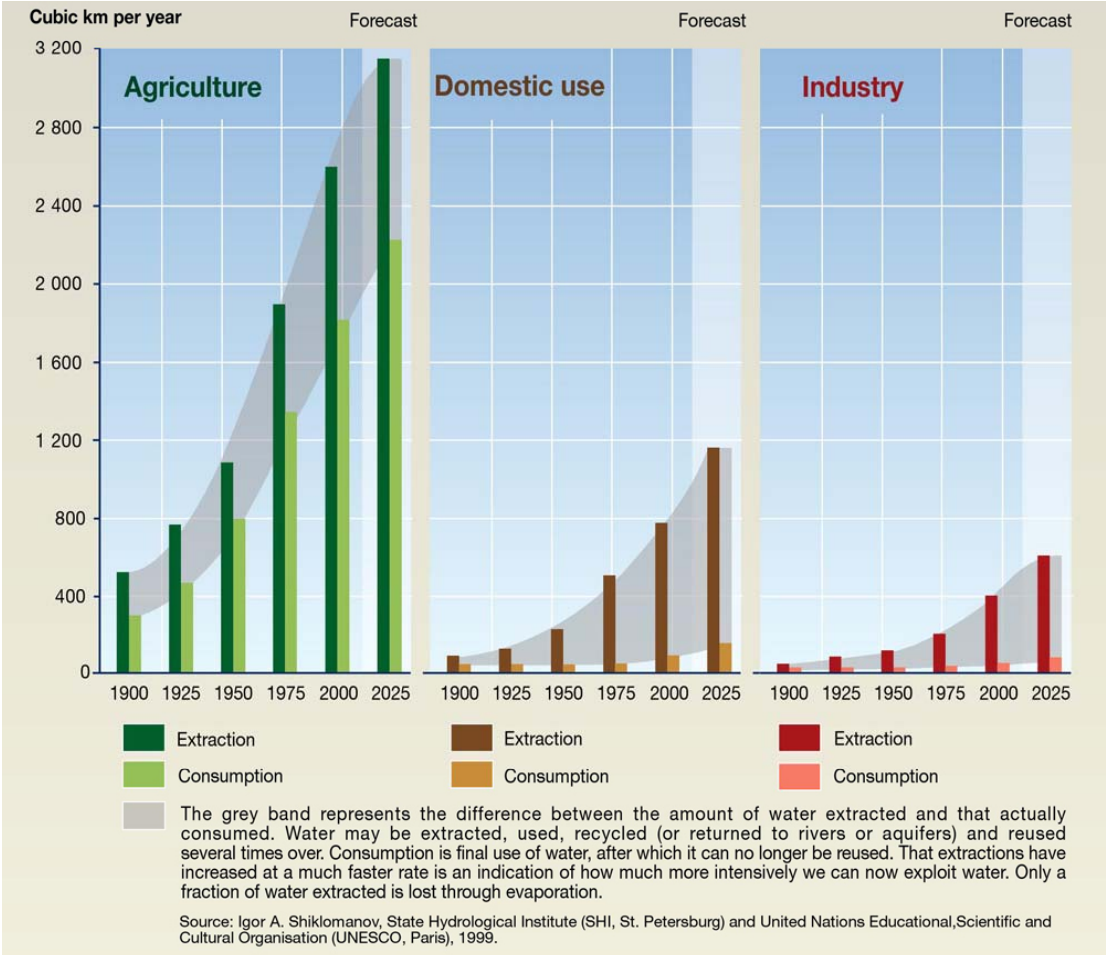
Quality

- Water used generates wastewater
- Long-term degradation of available water resources
- Available water may not be of suitable quality for all uses
- Water treatment, especially to potable standard, is expensive

Human demands for quantity, together with impacts on quality, affect aquatic systems, both nationally and internationally

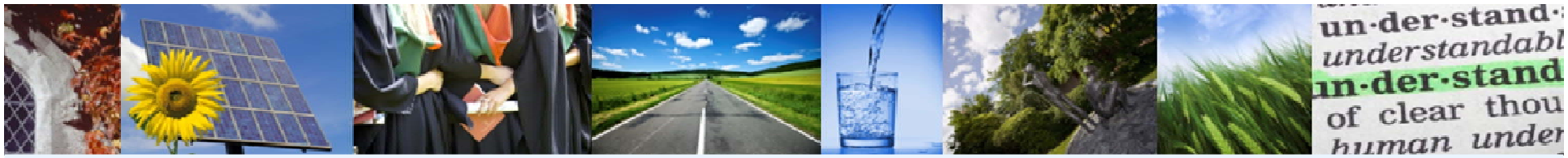


Projected freshwater use



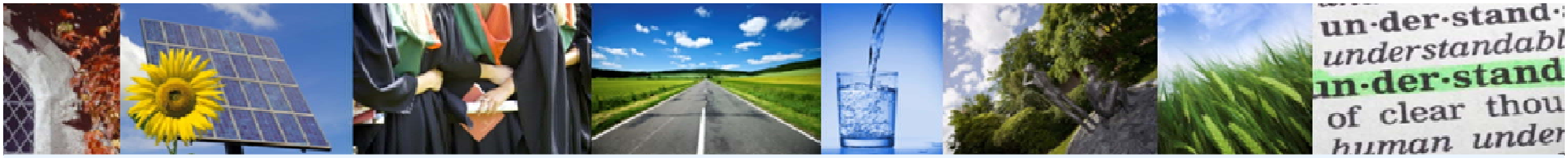
- Most of the water extracted for domestic and industrial use **can be** returned to aquatic systems or reused/recycled
- Agriculture is the major consumptive use of water

UNEP/GRID-Arendal, Trends in global water use by sector, *UNEP/GRID-Arendal Maps and Graphics Library*, http://maps.grida.no/go/graphic/trends-in-global-water-use-by-sector (Accessed 15 February 2012)



If water is going to be more scarce or precious then we need to manage demand

- Shortage traditionally led to augmenting supplies rather than managing demand
- Developed countries have tended to maximise use of water resources (residual flows considered as wastage !)
- Previous approaches have paid little attention to "environmental" and downstream uses
- Typical short-term "demand management":
  - Rationing
  - Prohibited uses (e.g. hosepipe bans)
  - Appeals for public co-operation
  - Standpipes
  - Disconnection of supplies



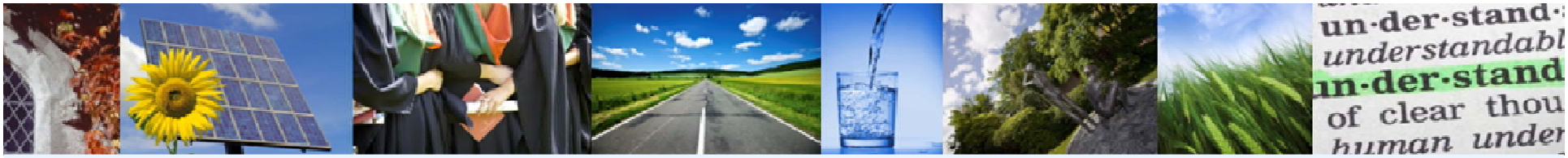
Domestic use

Average daily water consumption per person in Ireland

	Average litres/person/day
Shower	35
Toilet	27
Laundry Wash	40
Hand wash	12
Teeth Brushing	12
Dish wash	10
Cooking	10
Drinking	2
Total	**148**

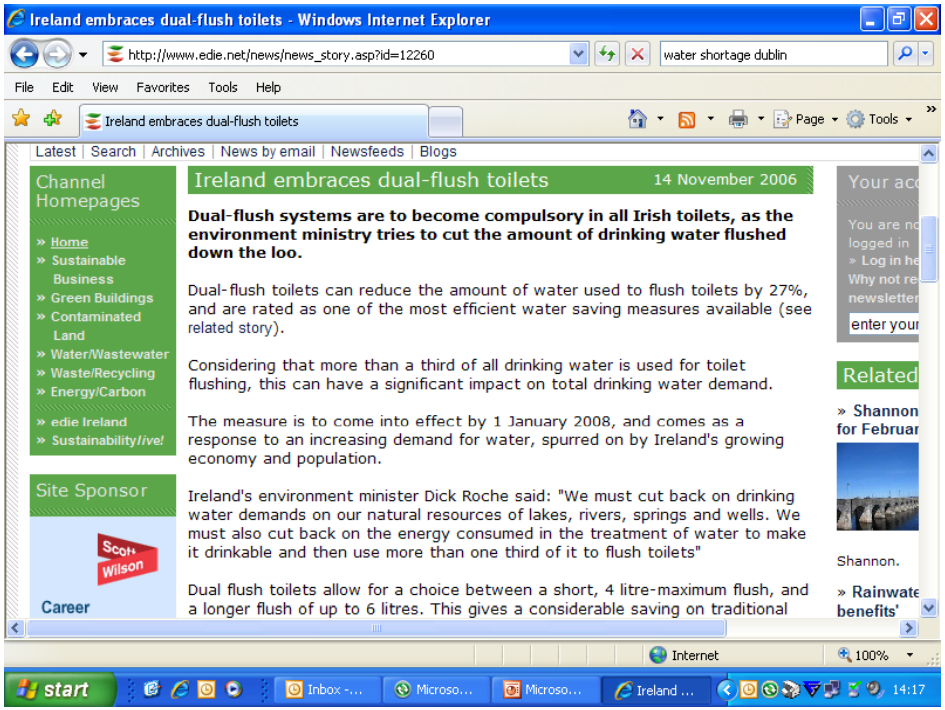
Water used generates wastewater

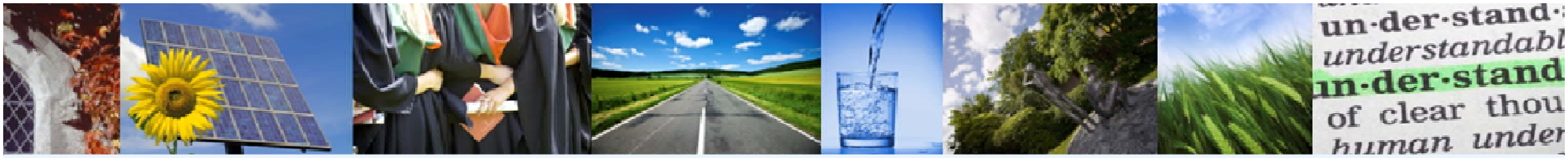
www.taptips.ie



Tackling domestic and municipal consumption

- Policy (e.g. legislation for water saving initiatives)
- Charges
- Public/corporate awareness
- Water efficiency measures

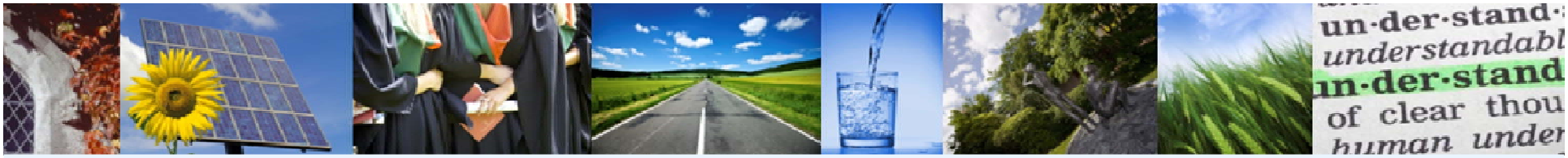




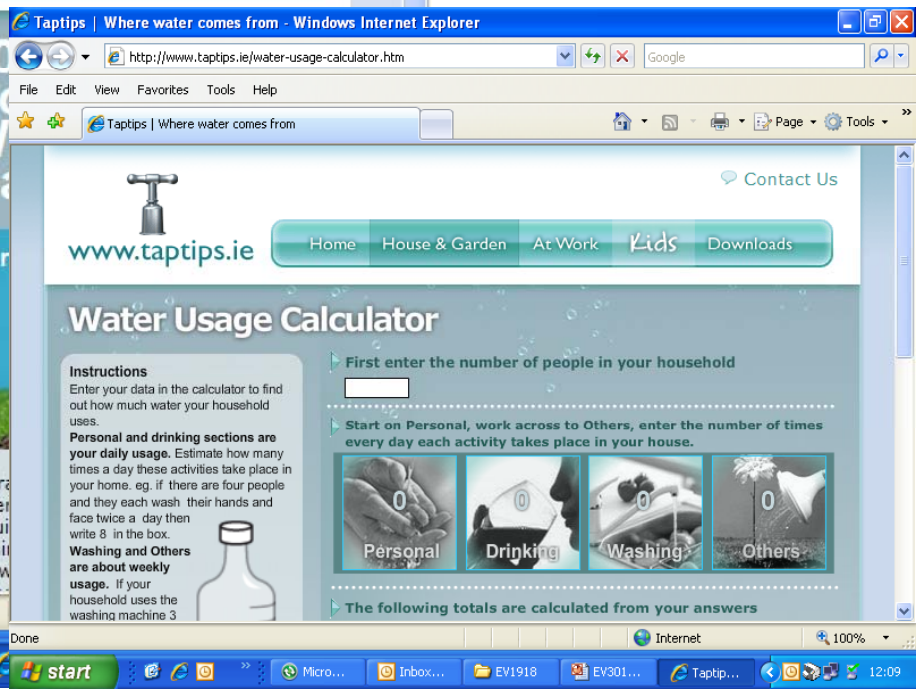
Water charges in Ireland

- Recover cost of supplying drinking water to domestic users
- Encourage conservation and economic use
- Likely to commence in January 2014
- Customer database to be constructed
- Metering for public water supplies only
- Installation of meters will commence in 2013
- Pricing model and tariff structure to be agreed

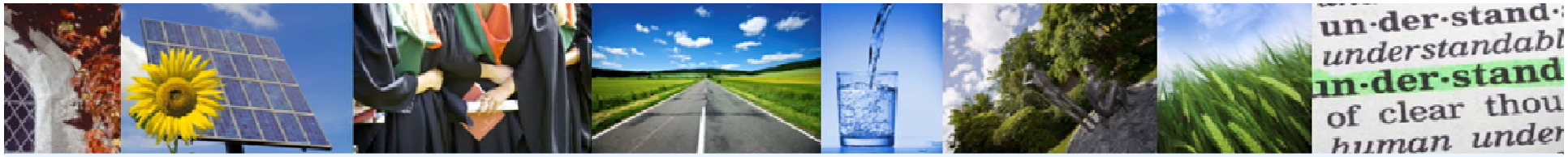
Ivan Grimes, Water Services Policy Section, DECLG, Nov 2012



Public awareness



http://www.taptips.ie/



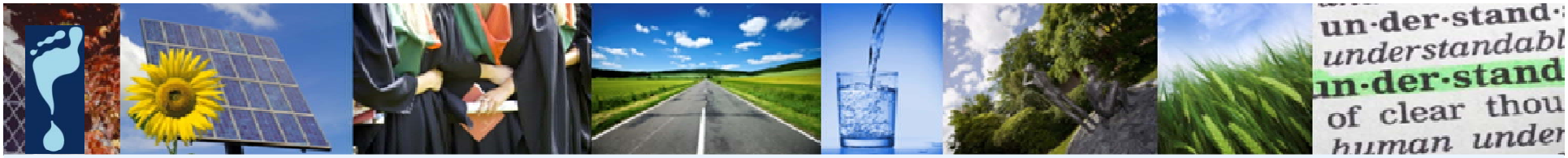
Taking public awareness to the next level

Water Footprint

Global average virtual water content of some selected products. per unit of product

Product	Virtual water content (litres)
1 glass of beer (250ml)	75
1 glass of milk (200ml)	200
1 glass of wine (125ml)	120
1 glass of apple juice (125ml)	190
1 cup of coffee (125ml)	140
1 cup of tea (125ml)	35
1 slice of bread (30g)	40
1 slice of bread (30g) with cheese (10g)	90

Product	Virtual water content (litres)
1 potato (100g)	25
1 bag of potato crisps (200g)	185
1 egg (40g)	135
1 hamburger (150g)	2400
1 cotton T-shirt (medium, 500g)	4100
1 sheet A4 paper (80g/m^2)	10
1 pair of shoes (bovine leather)	8000
1 microchip (2g)	32



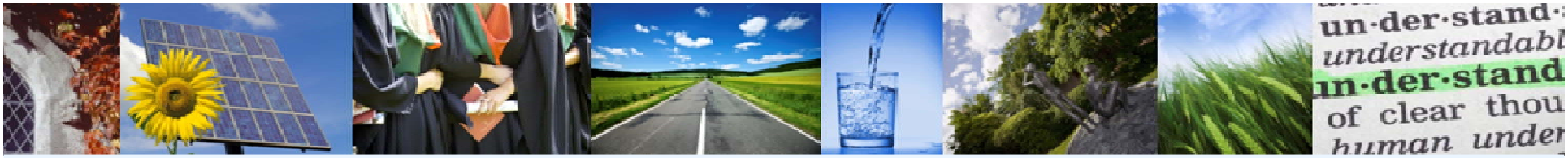
The total water footprint of a consumer in the UK

About 3% of water footprint is at home
150 litre/day

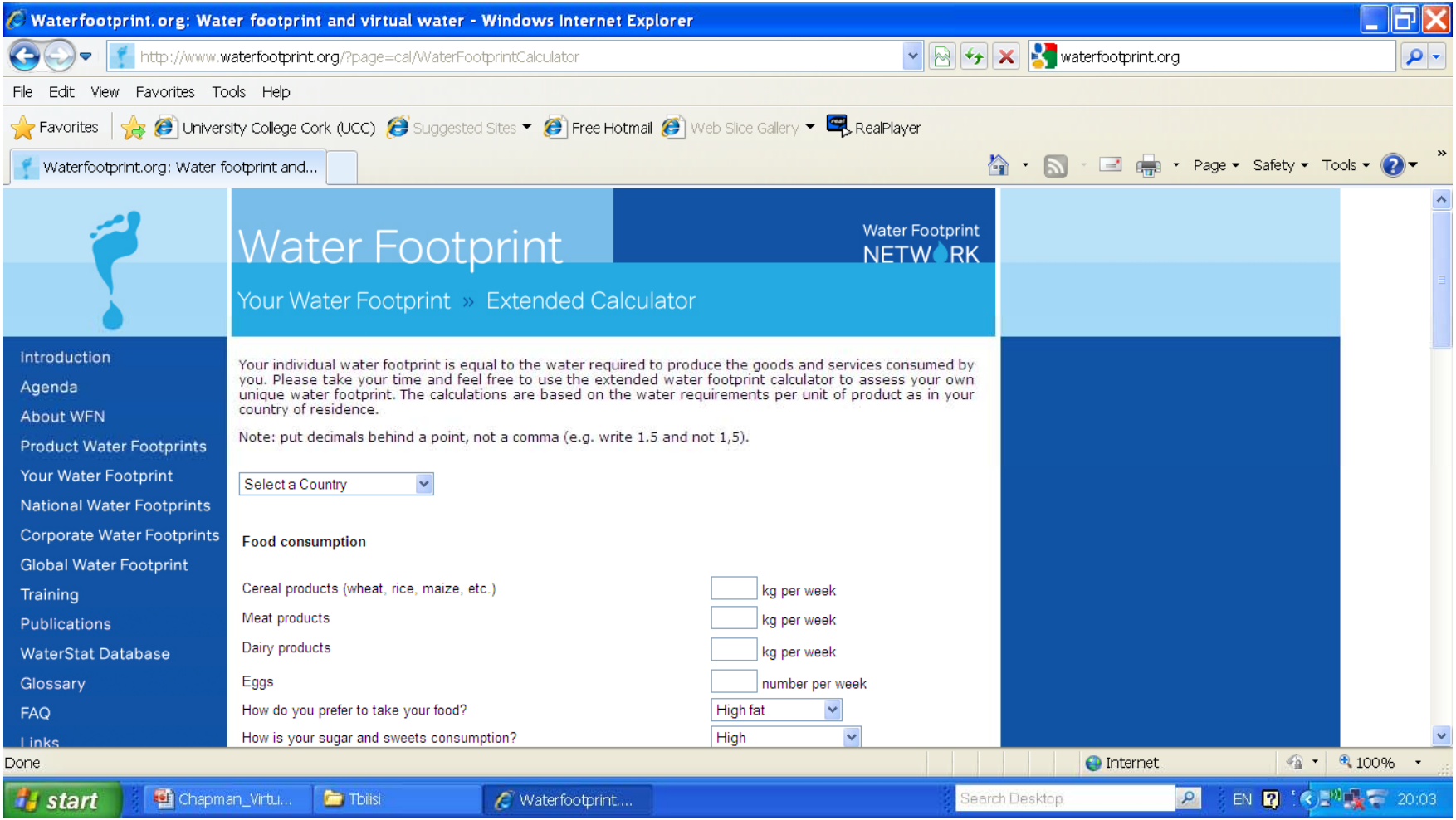
About 97% of water footprint is 'invisible', i.e. it is related to the products bought in the supermarket

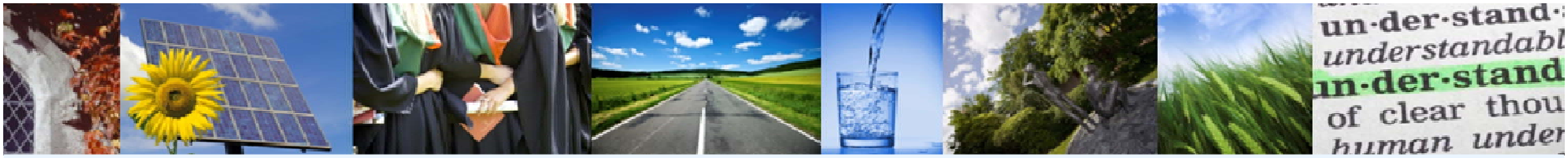
- 3,400 litre/day for agricultural products
- 1,100 litre/day for industrial products

About 60 to 65% of water footprint lies abroad



Public and corporate awareness



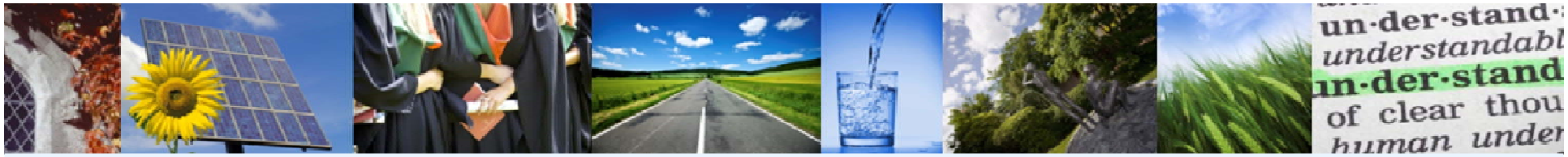


Awareness will encourage water efficiency

- Efficient use of water – reuse and cycling
- Water efficient products
- Sustainable homes

The Water Calculator

http://www.thewatercalculator.org.uk/faq.asp

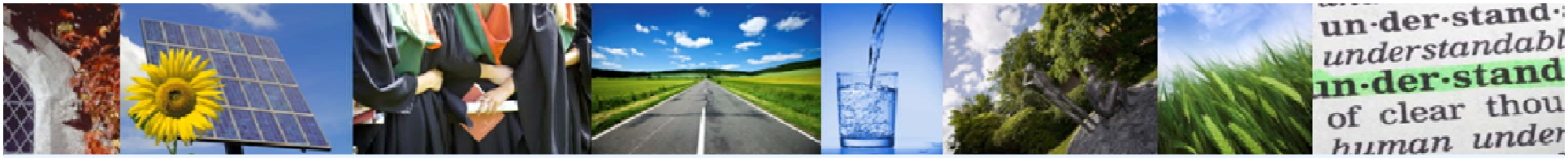


Tackling domestic and municipal consumption

Non-potable use

Do we need to treat all domestic and municipal water to drinking water quality?

On-site reuse for toilet flushing and urinals can offset potable water use by as much as 75% in a typical office building



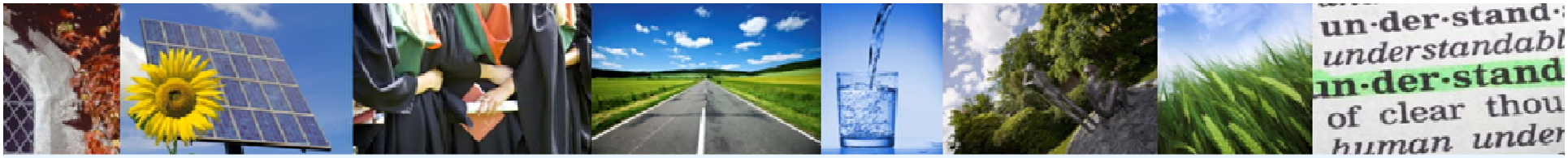
Tackling domestic and municipal consumption

Non-potable use

- Rainwater
- Stormwater (external drains)
- Greywater (laundry, showers, kitchen, etc.)
- Blackwater (contains human waste from toilets)

Bord na Mona Environmental Ltd

www.waterwise.org.uk

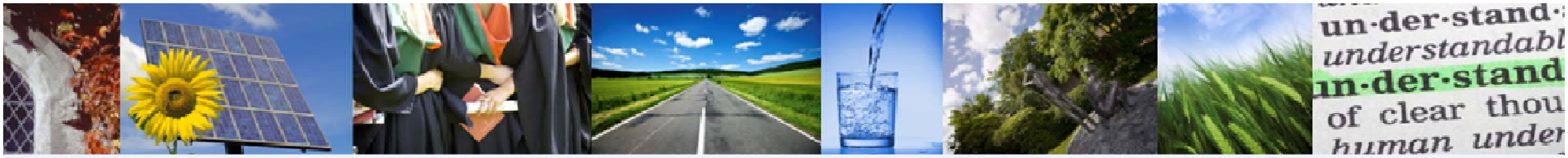


Rainwater: Northern Ireland Water office complex

12,000 litre underground storage tank which collects rainwater from the roof

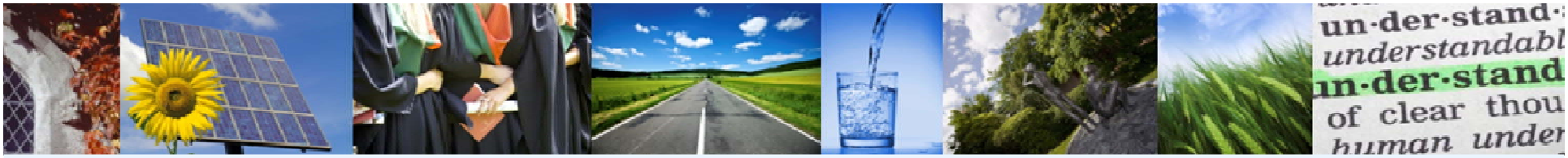
The water collected is used for flushing toilets

The symbolism of NI Water pursuing water efficiency at a site adjacent to one of its largest service reservoirs (49,500,000 litres) is a powerful public awareness tool

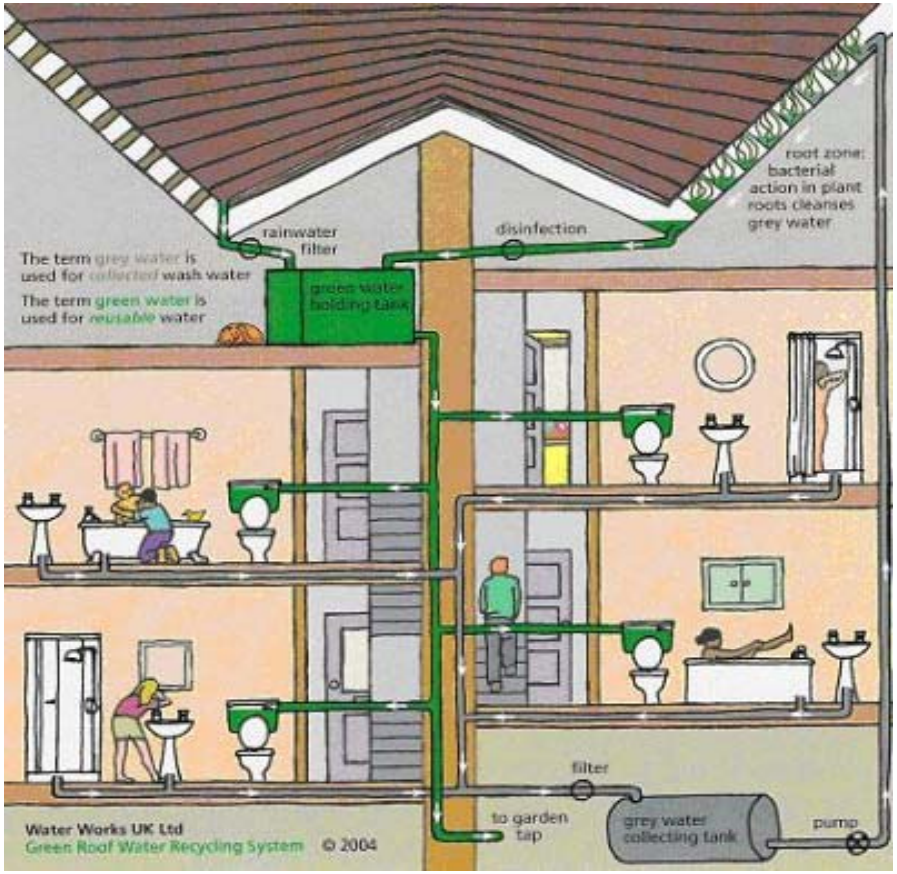


Greywater

- Filtration to remove hair, skin and soap products from the water
- Chemical or biological treatment prior to reuse
- Level of human contact with the recycled water in its end use determines level of treatment required
- Kitchen sink, dishwasher and washing machine water often too greasy and/or contains too many detergents to allow cost effective treatment



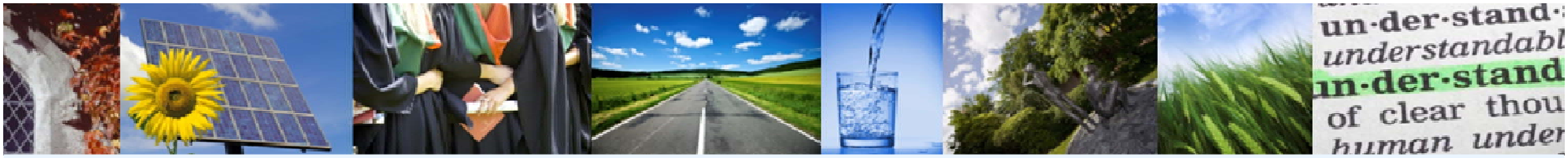
Greywater: award winning system for apartment complexes



WaterWorks UK http://www.wwuk.co.uk/

Rainwater is collected and used to flush toilets

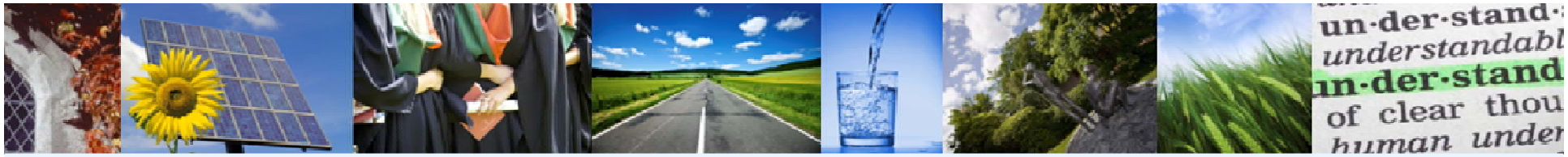
Greywater is collected and pumped to the roof where it passes through a biological filter system



Tap into Savings (Braintree) - Runner up in the UK Water Efficiency Awards (Built Environment) 2012

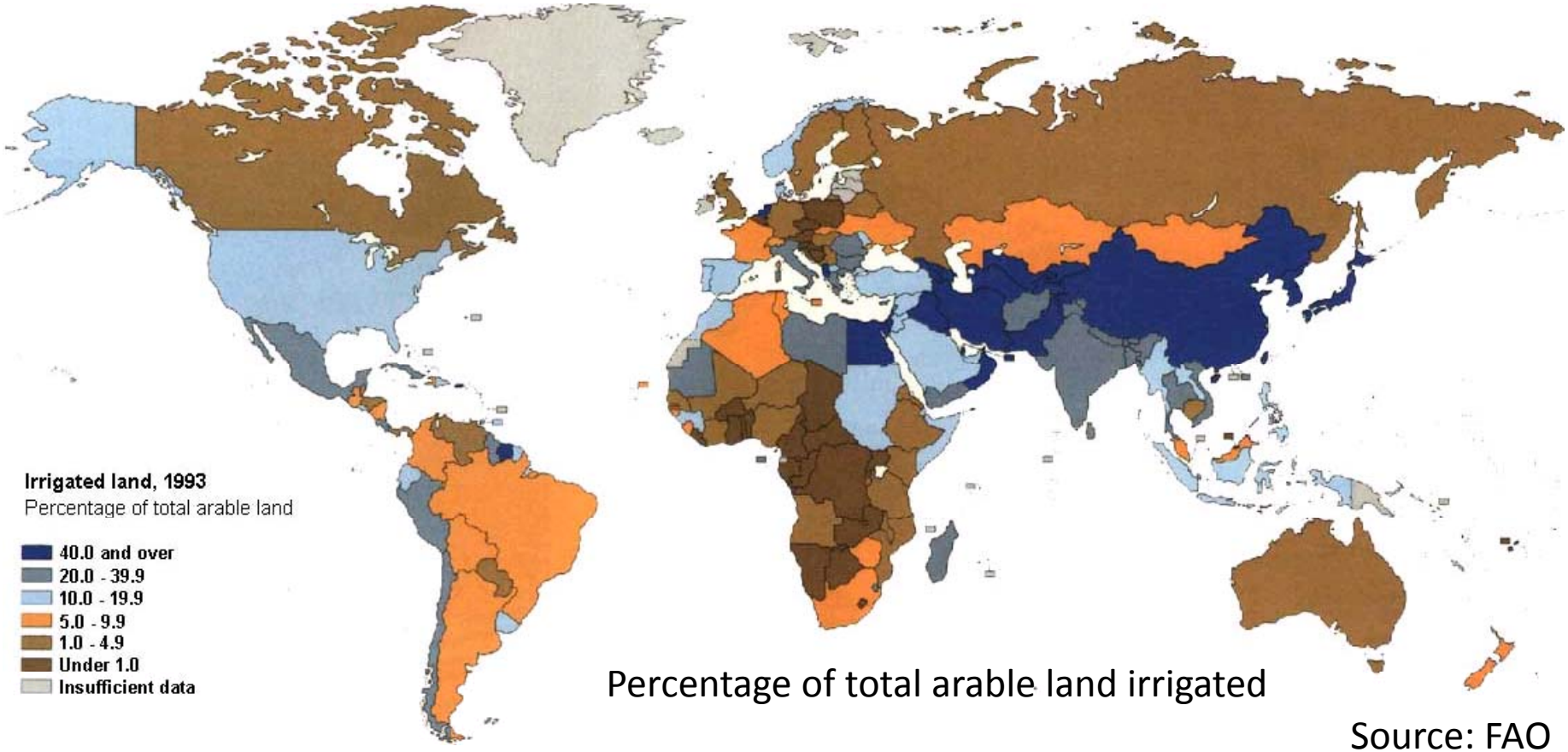
- Home retrofit visits, DIY pack distribution and EcoTeams
- 3,142 homes
- Savings of about 15% of water use per home
  - Just over 28 litres per day (£20 from annual metered water bill)

- A device to convert single flush to dual flush toilets
- Kitchen and bathroom tap inserts (saves up to 1,000 washing-up bowls of water or £5 per year from gas/electricity bill)
- Hose guns (reduces the amount of water used by 50%)
- A 'Shower-save' flow regulator (saves up to 2,000 watering cans of water or £25 from annual metered water bill)
- Cistern displacement devices



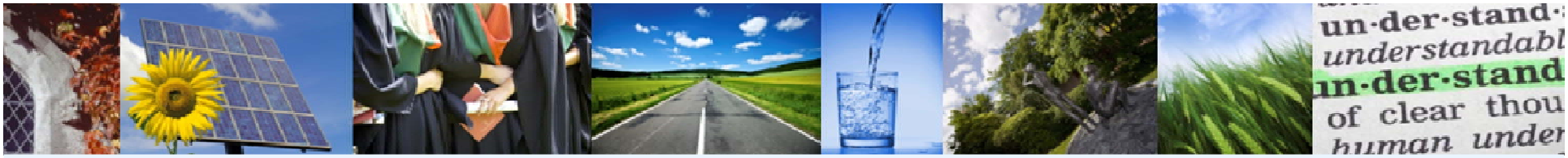
Agricultural water use

Irrigation is the major agricultural water use at global scale



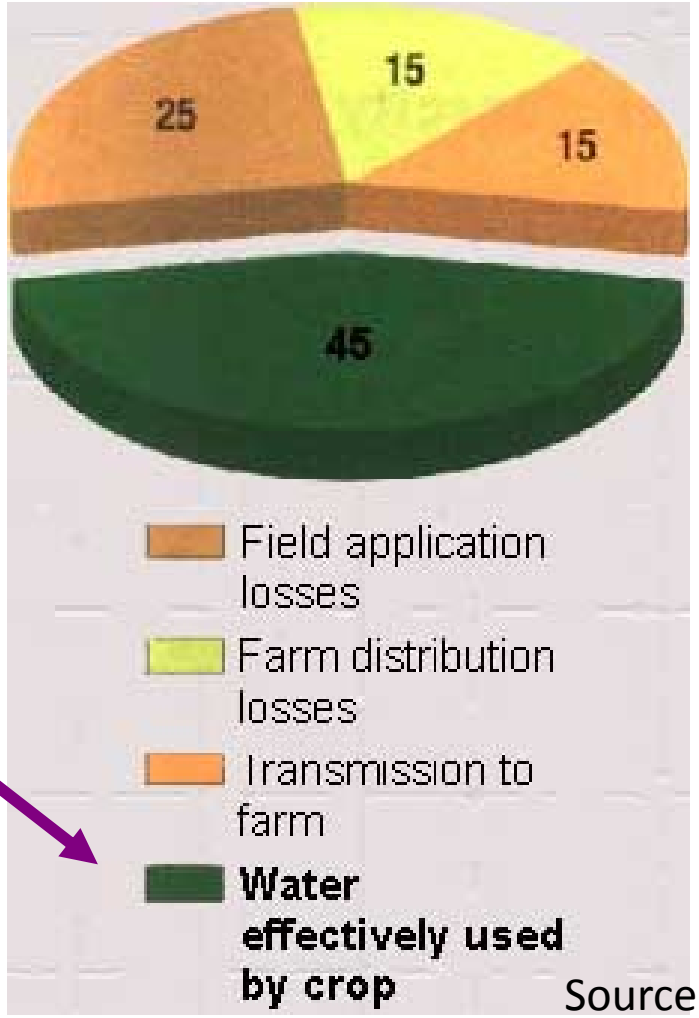
Percentage of total arable land irrigated

Source: FAO

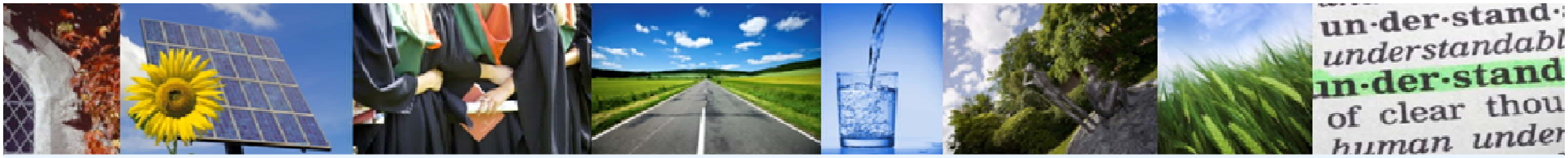


Irrigation losses

Irrigation often leads to more water being wasted/lost than is effectively used by the receiving crops

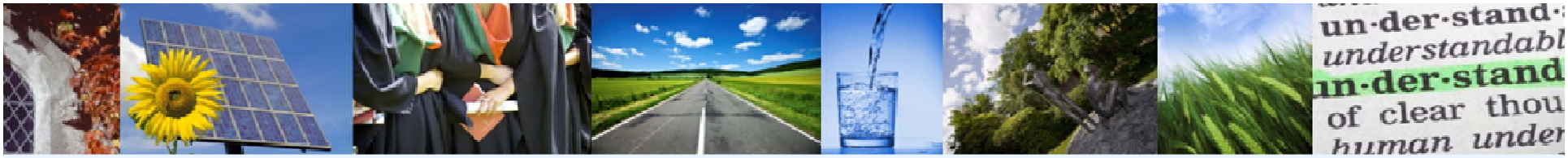


Source: FAO



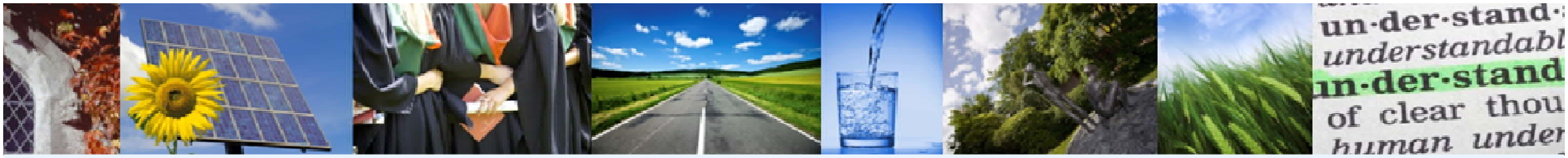
Wasteful forms of irrigation

- Overhead pivot spray
  - Waters the ground like rain
- Irrigation canal
  - Distributes water to furrows from which water reaches roots through capillary action
- Flood irrigation
  - Water is applied over the whole field and allowed to infiltrate into soil
- www.fao.org/docrep/U8480E/U8480E0c.htm



Localised irrigation

- Water applied around each plant or group of plants
- Only the root zone gets wet e.g. drip irrigation, micro-sprinklers
- Drip irrigation can save 30-60% of water use compared with sprinkler systems
- Improves irrigation efficiency by 90-95% over furrow and flood irrigation techniques

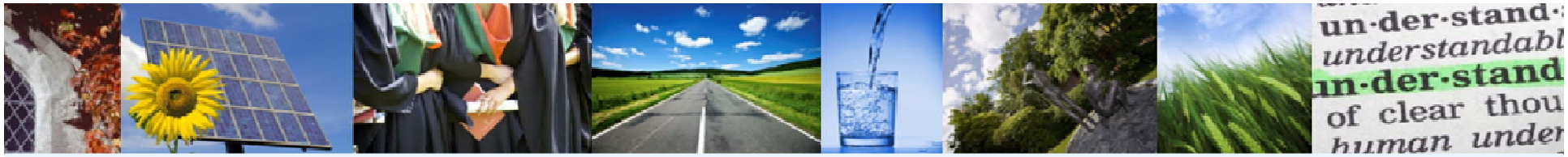


Sub-surface irrigation

- Water applied to the root zone
- Water reaches roots by capillary rise
  e.g. buried pipes

Photo courtesy USDA ARS

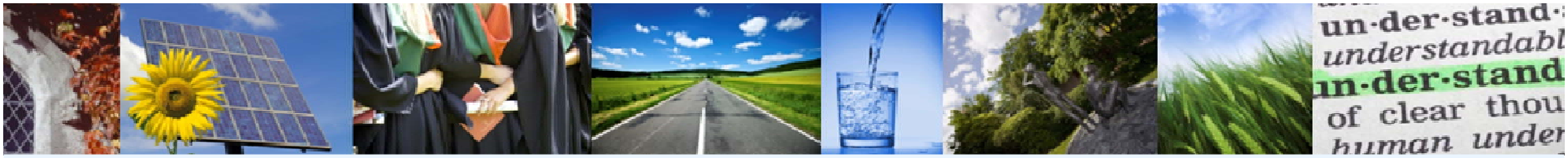
Photo credit Pete Mortimer



East Malling Research and South East Water: Runner up in the UK water efficiency awards 2012

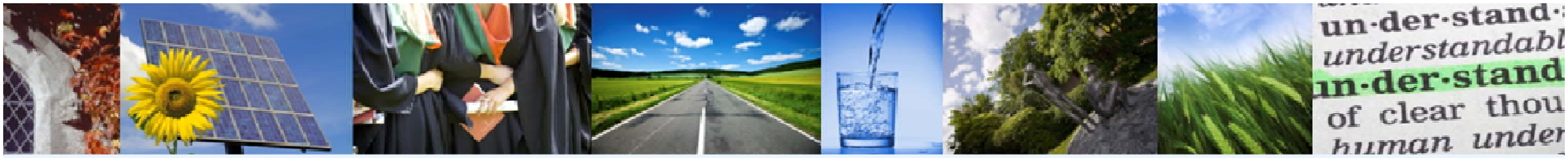
- New methodology for irrigating strawberries
- Water savings of around 30%
- Technology determines when the plants need watering and for how long

Eliminates the personal judgement of the grower ‘feeling’ the soil to judge for themselves if it is wet enough



What we haven't discussed

- Reducing wastewater quantity and quality
- Minimising the impacts of wastewater
- Restoring water resources for the future
- Impacts of major water development projects

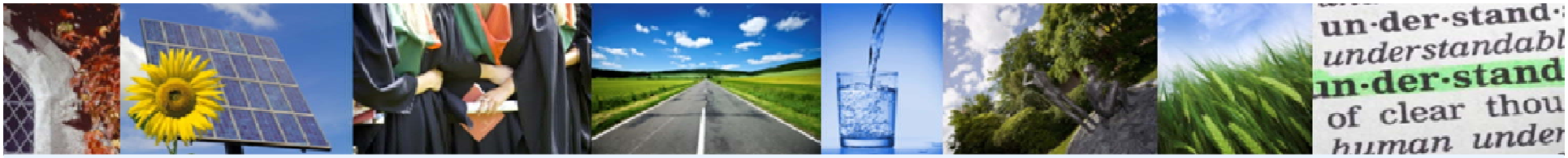


The bigger picture: managing water as a resource

Successful water resources management needs to:

- Link water quantity with water quality
- Incorporate the needs of ecosystems, e.g. through recognition of importance of flow regimes
- Define resources according to watersheds, river basins, or aquifers
- Recognise that human societies need naturally functioning ecosystems
- Use ecological principles in resource restoration
- Increase communication between engineers, hydrologists, economists and ecologists

Based on Baron *et al*. 2002



Take home messages

- We all need to be aware that water is a finite and precious resource
- We need to “value” water and not take it for granted
- We can all play a role in conserving water for the future

Thank you for listening ☺