Appendices

Appendix A

To access these documents, please
Click on the paperclip button on the left,
and then open the appropriate PDF.

- Flood risk and surface water management technical note
- Water quality and wastewater treatment technical note
- Water resources technical note
- Wastewater effluent flood risk assessment
- Water supply infrastructure assessment
- Wastewater network infrastructure assessment
- Wastewater treatment infrastructure assessment
- Housing and commercial development data
- Linking the lakes drawing library

Appendix B

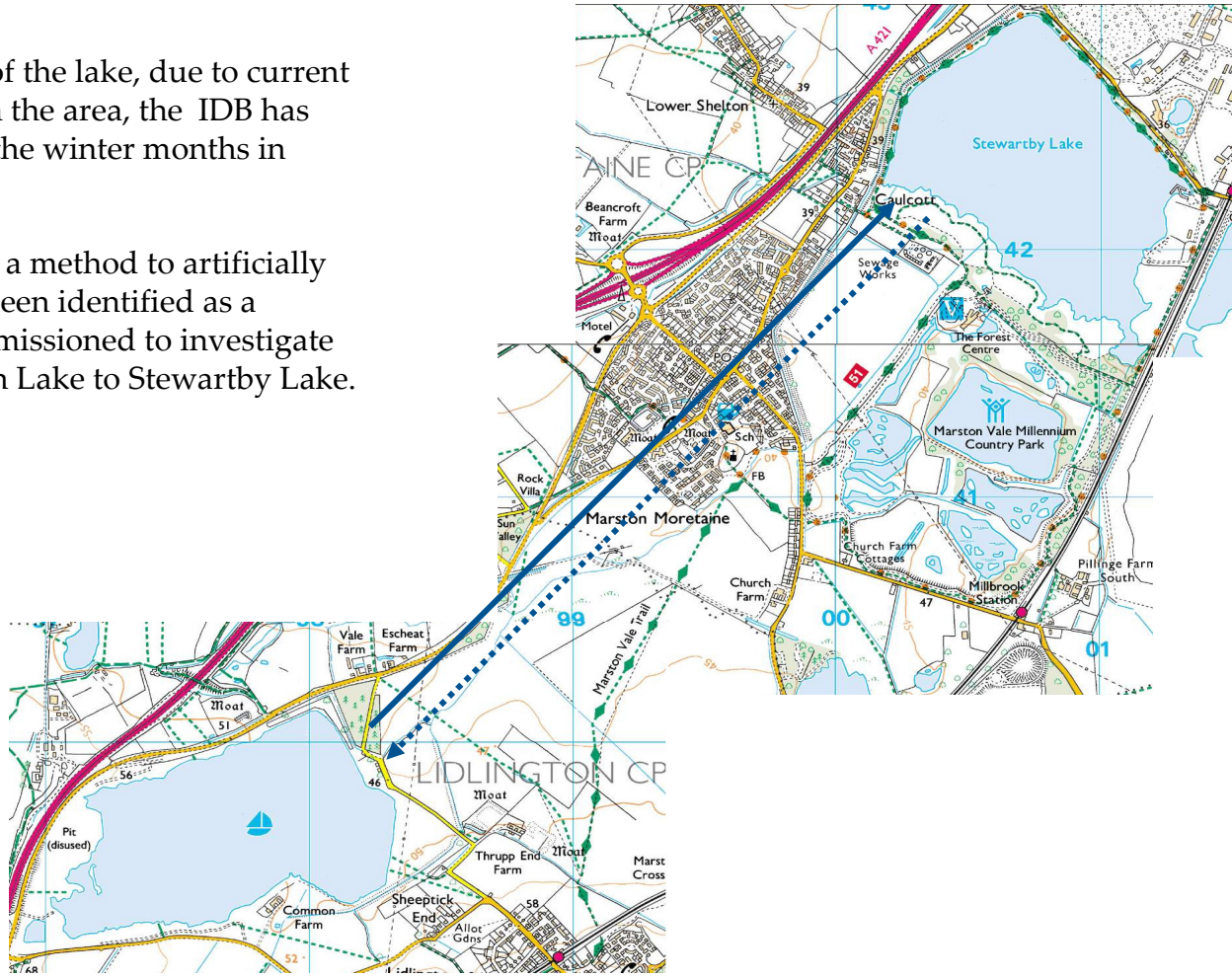
Linking the Lakes – feasibility study

Scope

Stewartby Lake is a disused clay pit which has been converted into a waterbody and which is currently used as a multipurpose lake/reservoir. The Bedford Group of IDBs operate the lake as a flood storage reservoir and a sailing club uses the lake for recreational purposes.

In order to increase the current flood storage capacity of the lake, due to current and future housing and multipurpose developments in the area, the IDB has expressed a desire to draw the reservoir down during the winter months in order to increase its storage capacity.

In order to not impact on existing recreational facilities a method to artificially refill the reservoir is required. Brogborough Lake has been identified as a potential water source and a feasibility study was commissioned to investigate potential means to convey the water from Brogborough Lake to Stewartby Lake.



Brogborough Lake has a limited hydrological catchment at it is uncertain how long it would take to replenish the levels at Brogborough lake if it were to be drawn down to top-up the levels at Stewartby Lake. Therefore, the study was also required to consider the feasibility of a system to convey water from Stewartby Lake back up the catchment to Brogborough Lake.

Three potential options were envisaged at the scoping stage:

(a) Use of the Elstow Brook which has existing links to both lakes.

(b) A new pipe conveyance system

(c) Use of a section of the proposed Milton Keynes to Bedford waterway

Proposed Milton Keynes to Bedford Waterway

The proposed section of canal/waterway between Stewartby Lake and Brogborough Lake would form part of a wider project to provide a new navigable canal between Milton Keynes and Bedford. The intention of which is to provide recreational enhancements to the area and link the Grand Union Canal to the River Great Ouse.

There are two main technical challenges on the proposed 32km route of the Bedford & Milton Keynes Waterway. The first is the crossing of the M1 motorway the second is Brogborough Hill which is in close vicinity of Brogborough Lake.

Land Drainage requirements for area

The catchment for Stewartby Lake is a mixed rural and urban catchment. Elstow Brook is a heavily modified waterbody with Water Framework Directive status of Moderate potential. The brook has numerous field drains discharging into it and has been partly engineered to cater for these drainage flows.

There are currently ongoing housing developments along the proposed line of the canal as well as existing farmland. It is our understanding that the current drainage arrangement discharges into Stewartby Lake. O&H properties who are the landowners for the areas being developed have a presumed right to discharge flows from future developments into the lake, although cormal consent is required from the IDB under the Land Drainage Act 1991.

Initial estimate of required flows

Initial assessments of potential flows required in order to fill Stewartby Lake up to enable water sports to take place were undertaken, assuming a 15 day refill period was acceptable.

Component	m AOD
Dam Spillway (Green Lane road level)	36.50
Gate top level	35.23
Gate bottom level	34.23
Summer target level	34.73
Winter target level	34.60
Preferred minimum for water sports club	34.83

Data taken from "Stewartby Lake Telemetry Analysis 2002-2009.pdf and 20090922 96123 water level graphic .pdf" obtained from Hannah Reed for the Elstow Brook Flood mapping project.

Results suggest that a flow of up to around 0.4m3/s may need to be provided , leading to a drawdown at Brogborough Lake of up to 0.7m.

Initial identification of services

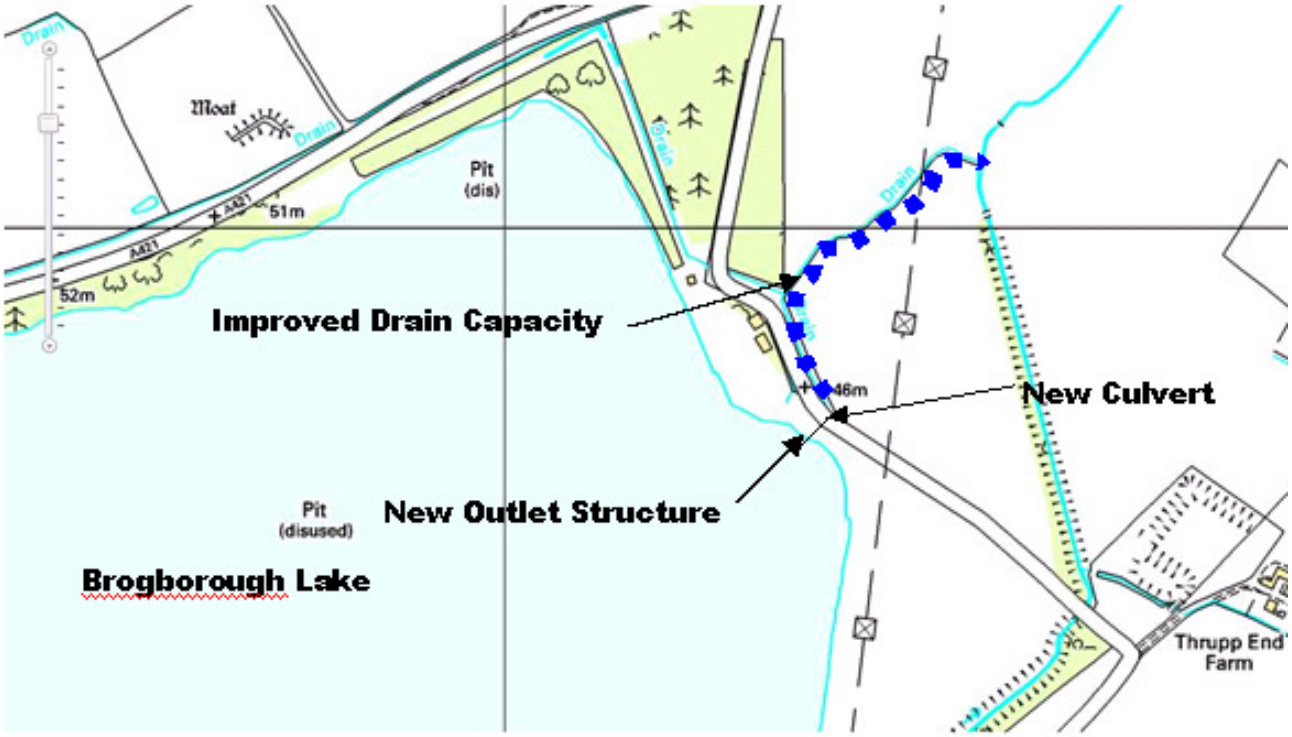
A basic review of potential services was undertaken, there appear to be two key areas where services may need to be accommodated/ diverted. In the vicinity of the entrance to the new development/ Marston Vale Millennium Country Park and in the vicinity of the STP around the south-western corner of Stewartby Lake. It should also be noted that High Voltage lines servicing the National Grid also cross the site.

Initial feasibility assessment of proposed options

(a) Elstow Brook

Connecting the lakes, could be done by providing a means to draw Broborough Lake down at the existing manmade outlet and by improving the existing drain for the initial portion, as sufficient capacity appears to have been provided further downstream. Existing culvert capacity would also need to be confirmed.

Works are likely to consist of the creation of a formal outlet structure, which is likely to consist of a reinforced concrete structure with a sluice gate, a new culvert under the existing unclassified road and an increase in capacity of a section of drain which discharges into Elstow Brook, as shown below.



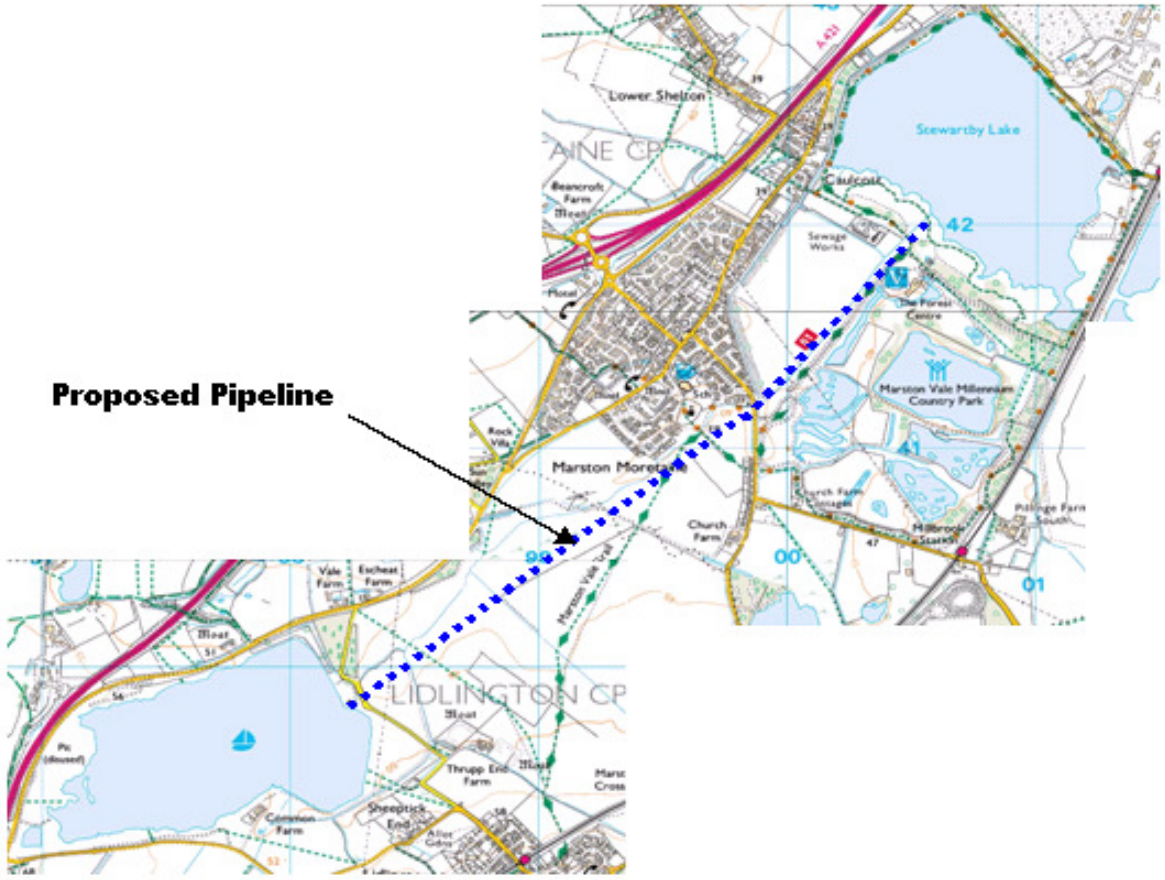
Initial feasibility assessment of proposed options

(b) Piped network

A new piped system connecting the lakes could be provided, with a concrete piped gravity system enabling the linking of Brogborough to Stewartby. If flows are required in from Stewartby to Brogborough a rising main could be installed in the same trench. A gated inlet and outlet structure would be required in both lakes, with manholes provided along the pipeline to enable inspection and maintenance works to take place.

Connecting the lakes using a piped system would separate the 'top-up' flows from natural run-off thus not affecting the required capacities of Elstow Brook. This would remove the opportunity of allowing water from Brogborough lake to be used to suplement flows in the Elstow Brook during periods of low flow.

Our initial costings suggest that capital costs for installing a new piped system would be higher than enhancing sections of the brook, this option is therefore considered less desirable than the use of Elstow Brook. This option would be more attractive if the need to pump between the two lakes is confirmed, because the pipe could be laid at the same time as the pump rising main.



Initial feasibility assessment of proposed options

(c) Waterway

We have prepared an outline design of a waterway that would link the two lakes, and plans and maps of this design are presented in the following pages. The outline design has taken all known constraints into account to identify the route. The route has also been chosen to ensure a balanced cut and fill, ensuring that no excavations would need to be disposed of. The outline design includes the structures in the table on the right.

Structures	
Locks	9
Culverts	7
Road Bridges	3
Farm Bridges	4

Using the waterway for water conveyance would need infrastructure which would allow the bypassing of the locks. Fixed crest side weirs in order to allow for passive operation of the system could be used for example.

The waterway would also be constrained by the levels between the lakes and the alignment would need to reflect this.

If the waterway connected the two lakes directly the structures would need to accommodate the variations in level of the respective lakes in order to ensure that it remains operable. This may be achieved by having an additional lock at either end. If the lakes are not connected directly a draw-off mechanism would be required to transfer flows into the lake.

Drawings for both options are presented in the following pages. The full drawing library is available in Appendix A.

Outline design indicative costs

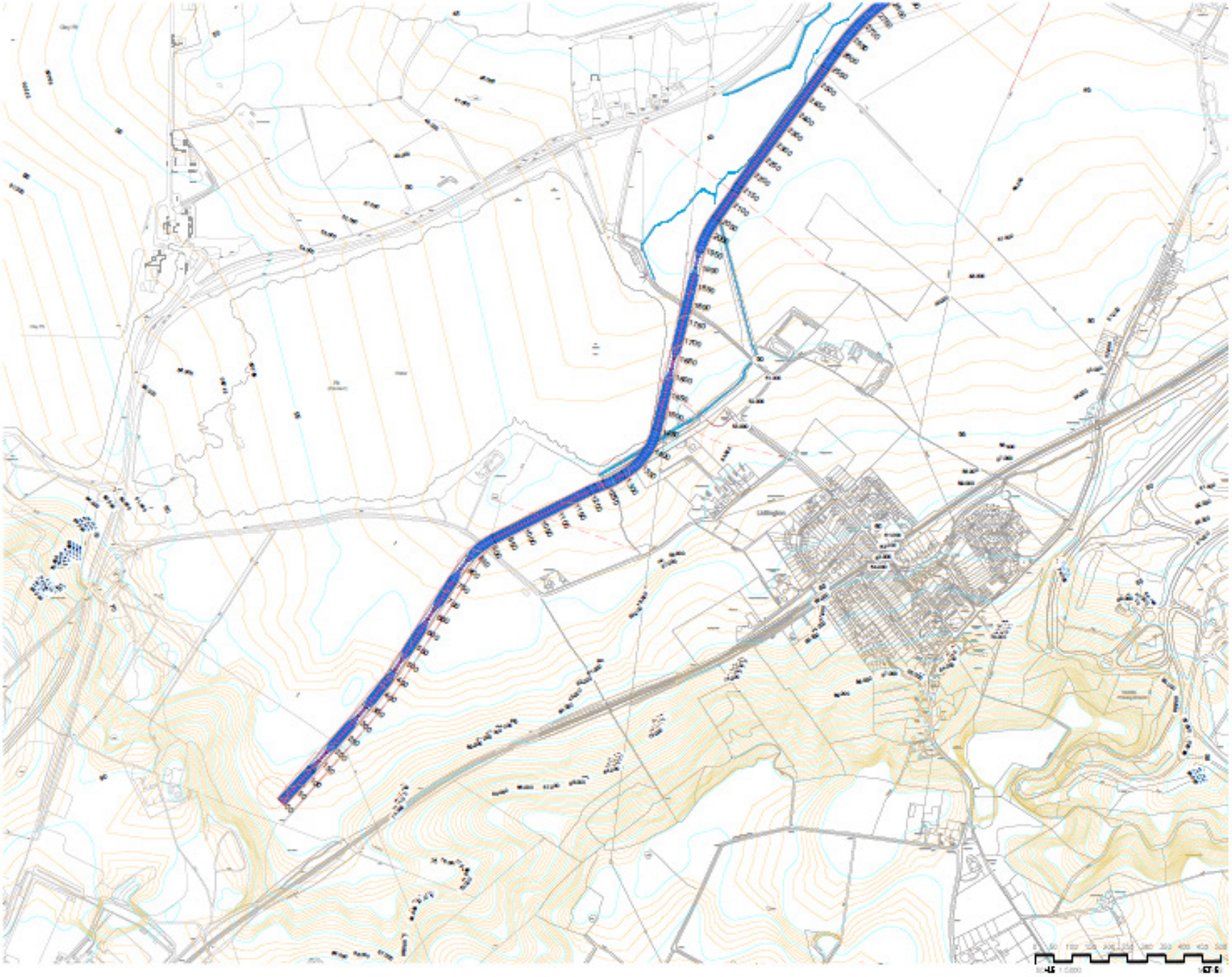
Outline costs were prepared using simplifying assumptions in order to provide initial relative cost estimates for comparative purposes.

Additional structural detailing and requirements on the proposed waterway to accommodate the ability to convey flows from one lake to the other are likely to cost more than the option of formalising the outlet at Brogborough Lake.

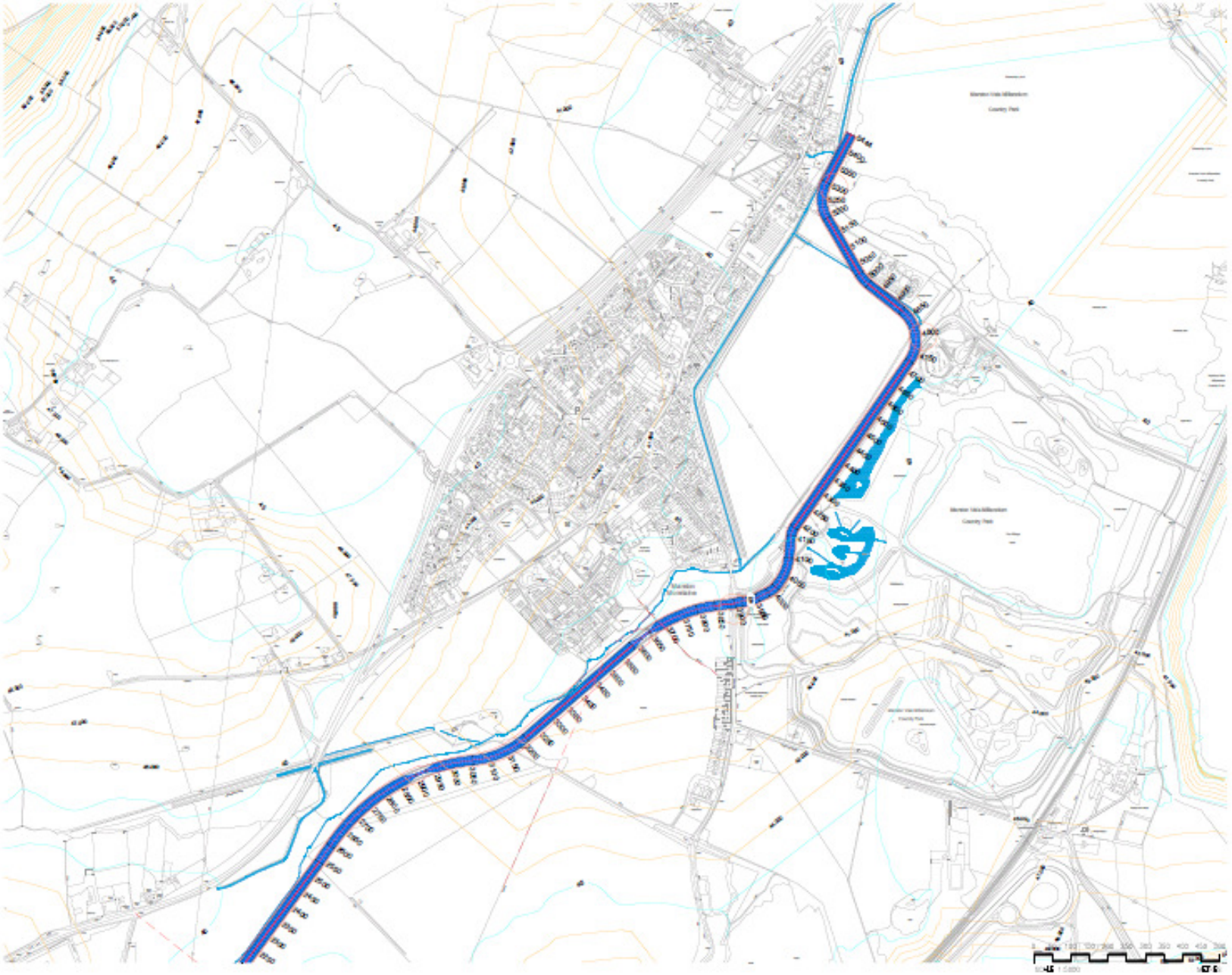
If the requirement for the ability to bring water from Stewartby to Brogborough is confirmed capital and operation & maintenance costs will significantly increase. The need for this requirement should therefore be carefully considered.

Option	Cost estimate
Elstow Brook	£250,000
Piped System	£800,000
Waterway (Option A)	£19,000,000
Waterway (Option B)	£17,000,000

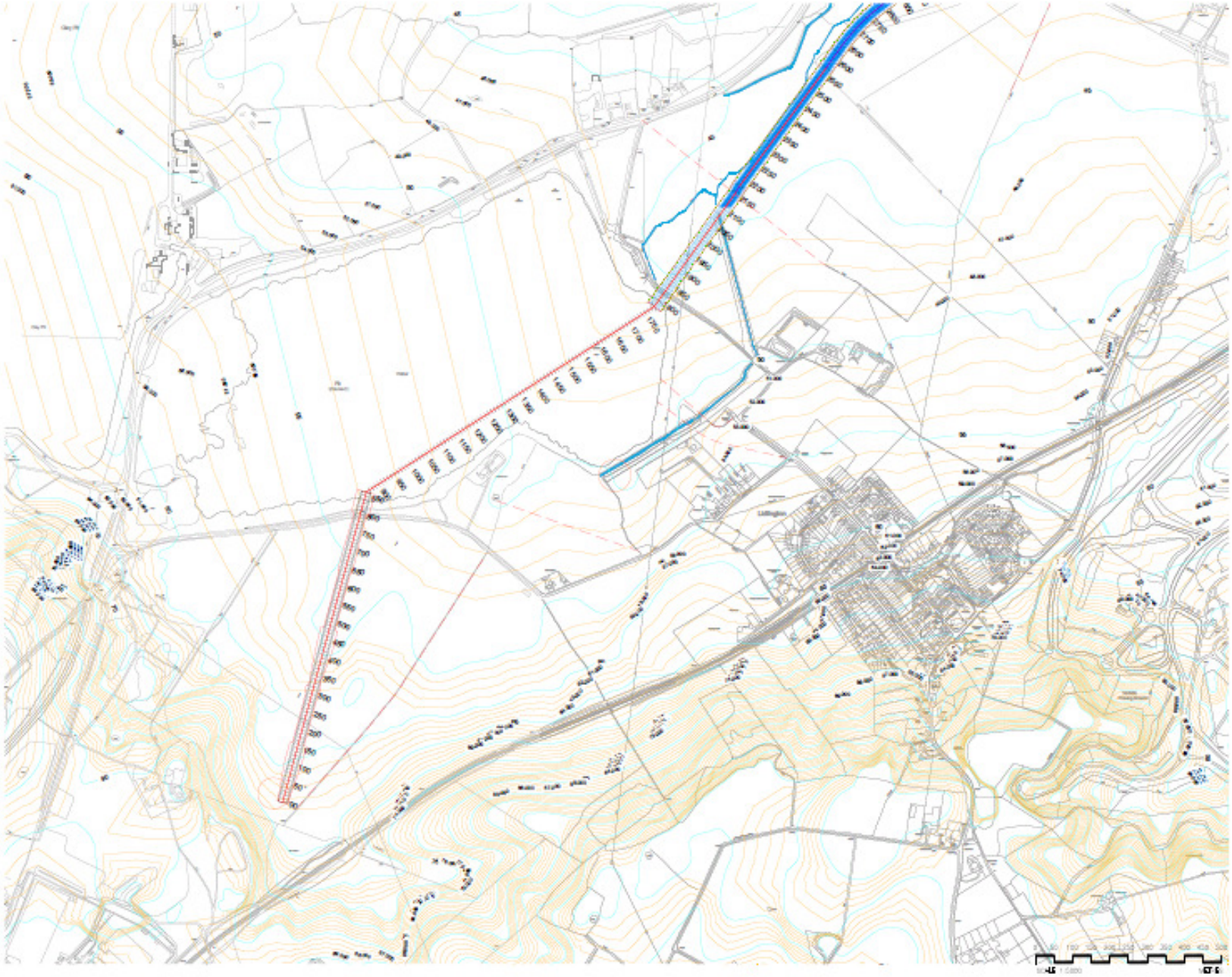
Original proposed route of canal



New proposed route of canal (Upper)



New proposed route of canal (lower)



Discussion and recommendations

Any requirement to provide stormwater attenuation for new housing must be available all year round, and not just in winter periods. If Stewartby Lake needs to be drawn down to provide flood risk attenuation, we consider that this should be provided year round.

The use of Stewartby Lake for mitigation for stormwater runoff from new housing

Therefore any requirement for attenuation to mitigate for additional stormwater runoff generated from new housing developments should be provided on the housing development site through the provision of SUDS. This should be regulated through the planning and development control process in consultation with the IDB.

Conveyance routes feasibility

If development surface water is to be controlled within developments sites, flood risk attenuation and surface water management is no longer a driver for the waterway. However, we have still assessed the options for the most feasible conveyance route or top up water should the IDB wish to use topup water to satisfy recreational users.

We do not consider the waterway to be a feasible option. The costs are significantly higher than the other options assessed, and would almost certainly make the developments unviable if the costs were to be recovered from developers. Additionally, water level management of waterway is such an exact science that it is unlikely that a waterway could provide an effective solution for irregular or ad hoc movements of water.

The most cost effective option would be to improve the drainage capacity of the existing drainage ditch and Elstow Brook, and provide a new operating control on Brogbrough Lake. Detailed modelling would be required to ensure that there are no flood risk implications of the proposals.

Proposed route for waterway

Although we do not consider the waterway to be a feasible part of a solution to manage surface water flows from new developments in Marston Vale, we understand the wider benefits of a waterway, and have provided an outline design for the waterway, which takes all known constraints, including services, into account.

The drawing library is available in Appendix A

Appendix C

Demand management action plan

Key measures that in combination help achieve water neutrality, or limit the impact of development on the environment can include:

- Expanded metering;
- Enhanced regulation for water efficiency;
- Water efficient devices and retrofitting;
- Greywater recycling;
- Rain water and stormwater recycling;
- Education and community wide public awareness
- Economic measures and tariff structures.

The overall objective is that new development should have a benign effect upon the water environment. Where water neutrality cannot be achieved options for augmenting water resources can be considered, i.e. rain water harvesting.

Metering

The measures included in the scenarios above may not be practical to implement in some cases. Environment Agency preferred metering of 95% of existing properties by 2016 is an ambitious target and requires around 6,900 properties a year from 2010 to 2016 to be connected to a meter in the WCS area, at a cost of up to £500 each.

In 2008 60% of AWS customers were connected to a meter, which is about twice the national average and AWS forecast a continued annual 2% growth in meter uptake to 90% by 2035. Some areas such as the WCS area are considered water stressed and as such will be targeted for the AWS Enhanced Metering Project, accelerating penetration to 90% by 2023/2024. This targets customers, providing a comparison between unmeasured and measured bills, and a trial offering free household water efficiency assessments with installation of water efficiency devices.

Since October 2007, water companies within seriously water stressed areas have been given extended powers to increase compulsory metering. AWS have no current or developing policy for compulsory metering, though this is to be reviewed for AMP 6. AWS have not implemented enforced meter installation upon change of occupancy, which they have reviewed and consider uneconomic.

It is recommended that current metering uptake levels are continued as a minimum and further consideration taken to accelerate meter uptake, including meter installation upon change of occupancy.

Water Consumption in New Properties

A range of water consumption targets have been identified for new properties. The governments strategy has a requirement for a standard of 120 litres per day (l/p/d) for new properties which it anticipates will be achieved by ensuring that all new homes have fittings with a good standard of water efficiency. The current requirement in Building regulations is for properties to built to a standards of 125l/h/d

It is recommended that the Code for Sustainable Homes is supported as much as practicably possible depending upon each individual development. The code should be specifically targeted through local planning regime at the largest developments where the benefits from development wide collection systems would be greatest. Staggering development should also be considered so the largest developments are built later within the planning period, in the hope that by which time the code may be statutory and technology will be in place to make the more stringent levels of the code more cost-efficient and feasible.

Predictions for possible reductions in water consumption through the utilisation of water efficient fixtures and fittings for new homes are shown overleaf In Table C.1.

Water Efficient Devices

The government expects the demand for water efficient products from new housing to help drive the market and improve the efficiency of everyday water using products over time. To further facilitate these improved levels of efficiency, the Water Supply (Water Fittings) Regulations 1999 will be reviewed. These cover for example the maximum water use of toilets, urinals, washing machines etc. The review will also consider enforcement issues, advances in technical standards and water conservation, and the case for setting new performance standards for key water fittings. This will also support the CSH.

Most water companies offer water efficient devices either free of charge or at a reduced price. These can include:

- Cistern displacement device, low flush toilet, dual flush toilet, retrofit dual flush valve;
- Push-on taps, aerated tap (bathroom), flow restrictors, aerated shower head;
- Contoured low volume bath;
- Shower timer;
- Flow recirculation;
- Low water use washing machine;
- Water butts.

Table C:1 Water Efficiency Measures.

This table shows the forecast per capita consumption for a range of properties with water efficient fittings, and shows how the total water consumption can be further reduced with further demand management measures.

			Water efficient property example A		Water efficient property example B		Water efficient property example C		Water efficient property example D	
Fitting/appliance	Average No. per property	Volume (litre per use)	With power shower & low flush toilet		With power shower & dual flush toilet		With standard shower & low flush toilet		With standard shower & dual flush toilet	
			Use no/day	Use l/h/d	Use no/day	Use l/h/d	Use no/day	Use l/h/d	Use no/day	Use l/h/d
4,5 l flush toilet	1	4.5	3.1	14.0	0	0	3.1	14.0	0	0
4l/2l flush toilet	1	4	0	0	1	4	0	0	1	4
	1	2	0	0	2.1	4.2	0	0	2.1	4.2
Bath	0.15	70.0	1	10.5	1	10.5	1	10.5	1	10.5
Power shower	0.7	63.0	1	44.1	1	44.1	0	0	0	0
Standard shower	0.7	40.0	0	0	0	0	1	28.0	1	28.0
Hand basin	3.1	4.8	1	14.9	1	14.9	1	14.9	1	14.9
Kitchen tap	2.0	7.2	1	14.4	1	14.4	1	14.4	1	14.4
Washing machine	0.3	36.0	1	10.8	1	10.8	1	10.8	1	10.8
Dishwasher	0.3	12.0	1	3.4	1	3.4	1	3.4	1	3.4
Dishwashing by hand	0.15	16.0	1	2.4	1	2.4	1	2.4	1	2.4
Outdoor use	1.0	0.8	1	0.8	1	0.8	1	0.8	1	0.8
Miscellaneous	0.9	4.8	0.9	3.8	0.9	3.8	0.9	3.8	0.9	3.8
Total				**120.0**		**114.2**		**103.9**		**98.1**
	Reduction (litre)			**Revised total (l/h/d)**						
Water recirculation	-4.6			**115.4**		**109.6**		**101.6**		**95.8**
Water butt plus pump	-0.8			**114.6**		**108.8**		**100.8**		**95.0**
Grey water direct recirculation	-7.0			**107.6**		**104.7**		**93.8**		**90.9**
Rainwater harvesting	-21.3			**94.1**		**89.8**		**80.3**		**75.9**

Greywater Recycling

Greywater is wastewater from showers, baths, washbasins, washing machines and kitchen sinks, which can be reused to reduce water demands.

The physical and microbiological characteristics of greywater vary significantly depending on its origin. Water from baths, showers and wash basins is generally less heavily contaminated than that originating from the kitchen or laundry, which can contain detergents, fats, nitrogen and phosphorous. For this reason most domestic greywater reuse or recycling systems exclude the later.

Greywater can be reused directly, i.e. without treatment, if it is not stored for any length of time. Direct reuse of greywater is generally limited to subsoil garden irrigation and toilet flushing

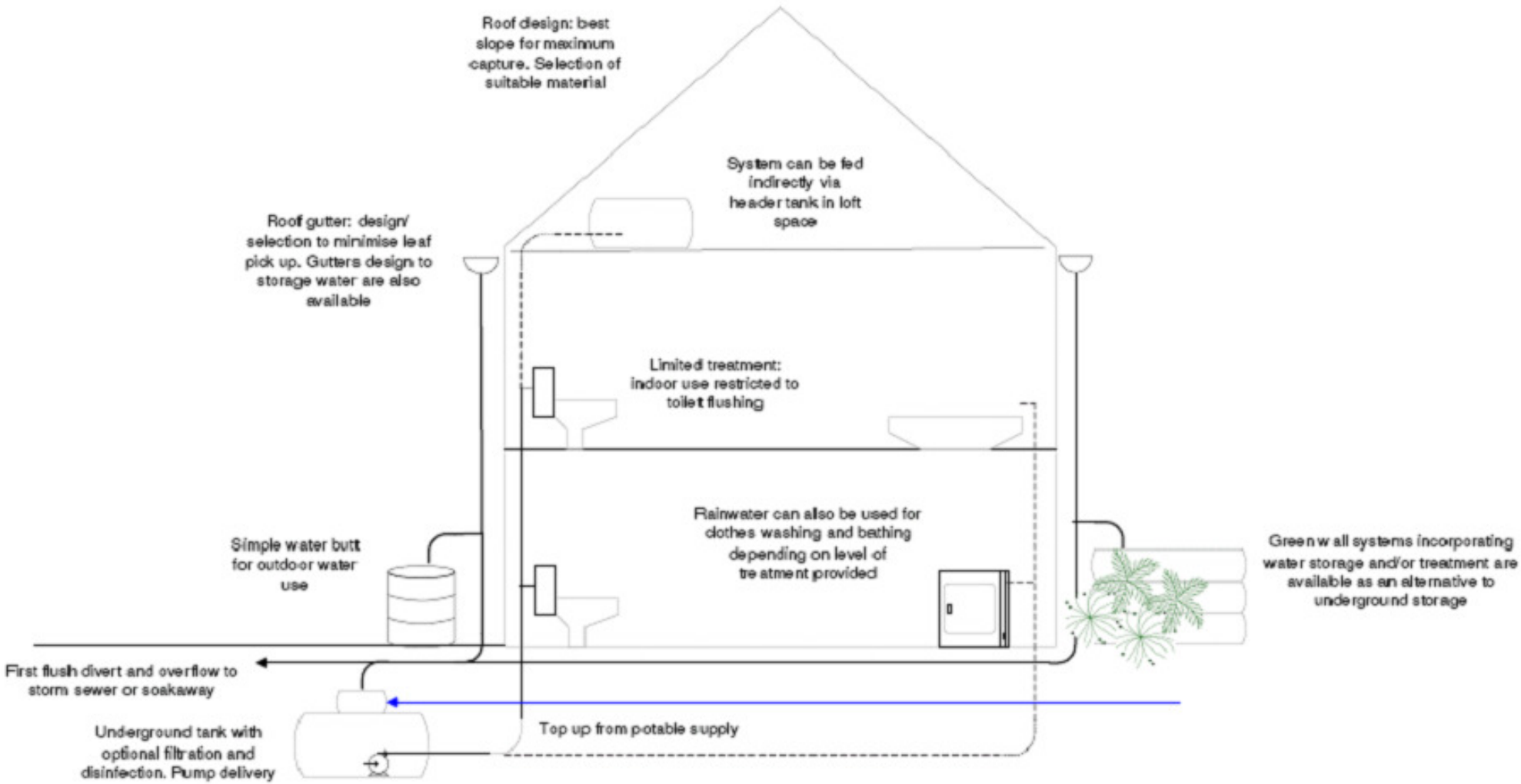
Untreated grey water can be used for more general use in the garden. For example once cooled it may be stored in a water butt for above ground irrigation. However, care should be taken to avoid long storage periods, sprinkler or spray systems and direct reuse on fruit and vegetable crops. Short retention systems containing simple valves are available to discharge greywater either to storage for outside use or to waste. Systems are also available to automatically empty tanks if water turnover is poor.

Rain Water Recycling

Rain water harvesting systems potentially offer the combined benefits of reduced water consumption from the public water supply system and reduced surface water runoff discharged to the public sewerage system. Available systems vary from installation of a simple water butt for garden watering to propriety units providing treatment, storage and delivery; depending on the level of treatment provided harvested water can be used for all purposes except drinking and food preparation

At its simplest rainwater can be collected in above ground butt for outdoor use such as garden watering and car washing. Typical systems for indoor use comprise:

- First flush diverter - To divert initial rainfall containing dust or other material from the roof;
- Filter - to removes debris from the collected rainwater and discharge it to a soakaway or the storm water sewer;
- Water storage tank – such as “green wall” systems, consisting of modular sections of polyethylene vertical tank with high storage volume-low footprint designs (www.waterwall.com.au); or rainsaver storage gutters (www.rainsaverstoragegutters.com) fed by gravity to toilet cisterns or garden watering, with overflow going direct to the storm drain or discharge system.


Roof design: best slope for maximum capture. Selection of suitable material
System can be fed indirectly via header tank in loft space
Roof gutter: design/ selection to minimise leaf pick up. Gutters design to storage water are also available
Limited treatment: indoor use restricted to toilet flushing
Rainwater can also be used for clothes washing and bathing depending on level of tre atment provided
Simple water butt for outdoor water use
Green w all systems incorporating water storage and/or treatment are available as an alternative to underground storage
First flush divert and overflow to storm sewer or soakaway
Top up from potable supply
Underground tank with optional filtration and disinfection. Pump delivery

Stormwater Harvesting

Stormwater Harvesting can be defined as the diversion, storage and treatment of stormwater runoff from urban catchments for reuse (see). Roof water harvesting differs from this in that it harnesses only relatively uncontaminated runoff from roof areas. Stormwater harvesting can include roof water harvesting and non-urban runoff as part of a broader scheme.

The components of a stormwater harvesting system are:

- **Stormwater catchment** generating stormwater runoff;
- **Conveyance system** (conveying stormwater to the diversion) which could be a mix of overland and piped flows;
- **Stormwater quality treatment system** such as a bio-retention basin as part of a Sustainable Urban Drainage System;
- **Diversion** to take the primary treated stormwater to stormwater storage;
- **Stormwater storage system** (above or below ground);
- **Water treatment system** (to ensure water is fit for purpose);
- **Treated water distribution system** (pumped and piped reticulation).

Urban stormwater runoff can be considered a primary cause of aquatic ecosystem degradation due to pollution impacts on water quality, physical stream disturbance, sedimentation and alteration of riparian flow patterns.

The environmental benefits of stormwater harvesting and its associated water savings are not only reduced overall water demand, which could delay the need to build further infrastructure, but include the potential to:

- Reduce pollutant loads entering aquatic ecosystems;
- Manage peak stormwater flows discharged from urban catchments;
- Reduce the volume and frequency of stormwater runoff;
- Provide a valuable source of water to meet urban water demands

A recent study was commissioned by the Queensland Water Commission on Stormwater Harvesting , involving case studies on two new mixed use developments in South East Queensland, Australia. The resulting factors for successful stormwater harvesting were found to be:

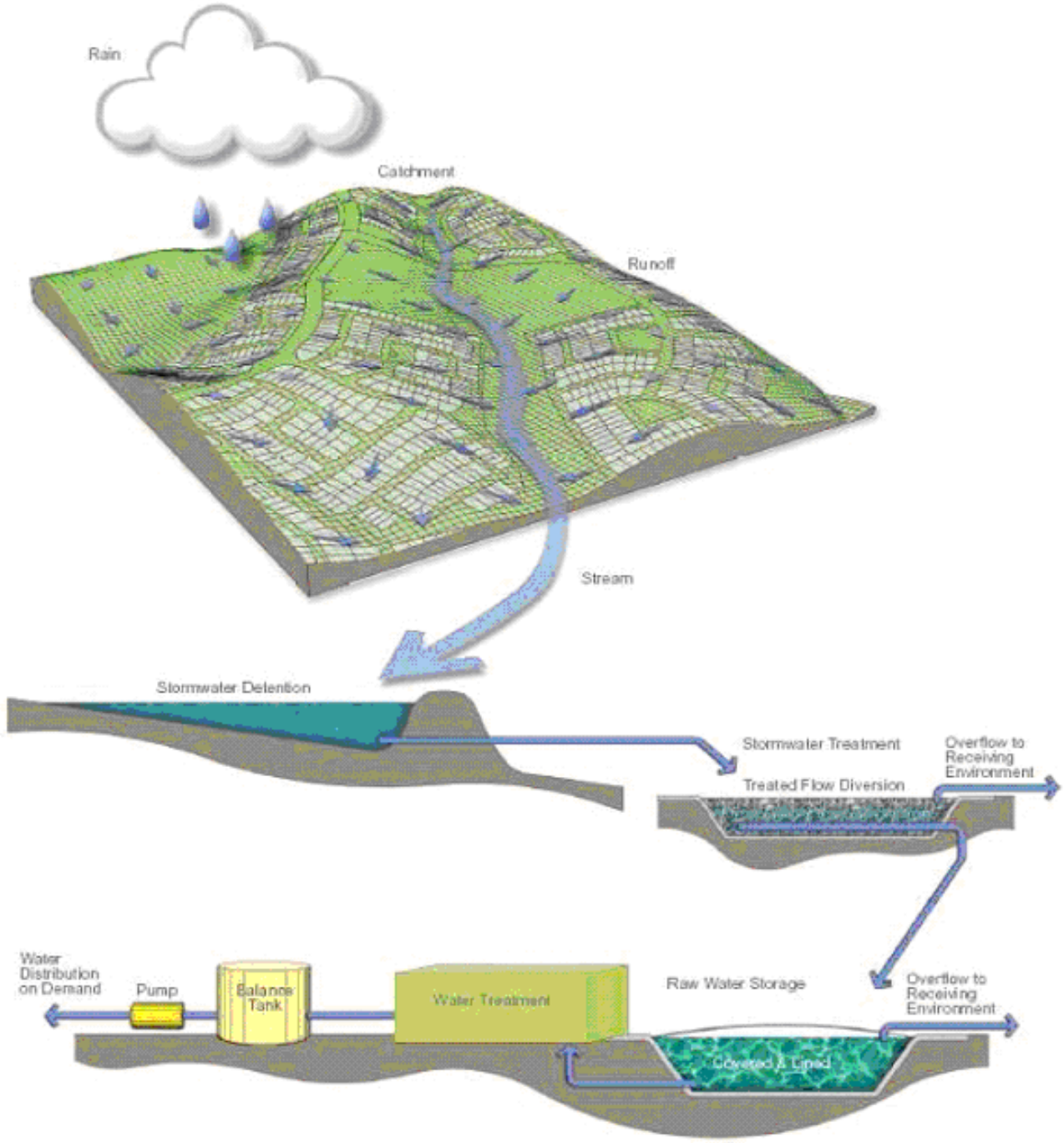
•Largescale development;

•High water demands;

•Moderate slopes which drain to singe/few points;

•Low cost storage.

In addition to the environmental benefits, the cost of stormwater was found to be around the lower end of costing for rain tanks, with cost of land for storage the main issue; though storage in an existing drainage reserve or aquifer significantly reduces costs.



Education and Community Wide "Soft" Measures

Water efficiency campaigns can be very successful in reducing water consumption and are continuously undertaken by water companies. AWS promotes a range of water efficiency measures and is involved in a number of trials and schemes to raise awareness of and promote water efficiency.

Public involvement is crucial if water resources are to be managed without the need for economic measures. Community wide soft measures are broadly designed to change water use behaviour and practices and create a water saving and efficiency culture. Provision of clear information about water use and the impact on the environment is of paramount importance if householders are to make informed decisions on water saving.

Water conservation messages can be quite difficult to market, encouraged by the perception of plentiful rainfall and the prevalence of flat rate pricing for water. Public awareness campaigns need to target long term changes in individual behaviour through:

- Creating awareness and interest;
- Educating;
- Providing necessary skills to effect change.

Components could include:

Young persons' campaigns, Adult campaigns, Water company led home water audits, raising the profile of the aquatic environment green labelling and green plumbers.

Young persons'campaigns: young people are agents of change. Engaging and making them interested in protecting water resources will help and impact the change of behaviour and habits from an early stage on. With the help of information and education materials, interactive games, cartoons, outdoor activities, etc. the young generation can learn about the importance of water in its different environments. Emphasis can also be placed on creative work incorporating water into different means of expression e.g. photographs, videos, theatre plays.

Adult campaigns: these can include lectures, small workshops, exchanges with experts, public exhibition, water audit for typical household, water saving devices, details of cost and expected savings, provide details (with model?) of raw water sources used for public water supply and potential impact of over abstraction, public visits to headworks and treatment facilities, articles in local papers, lorry with volume of water consumed by typical household.

Education and Community Wide "Soft" Measures

Water company led audits: Water company led audits can provide more easily accessible information on areas of high consumption or waste and the payback period of water conserving equipment. There is some merit in undertaking water audits with energy audits since reducing hot water consumption also reduces energy use.

Raising the profile of aquatic environment: the objective of these measures would be to engage existing residents in the local environment and in particular the aquatic environment, and hence increase their desire to protect and conserve it. Actions could include making sure all community areas are attractive, well maintained, with low water requirement; increasing access to the environment by for example, constructing attractive activity park(s) in areas of less ecological value – aerial runway, mountain bike tracks, café etc, regular events to shout about the local natural environment, kids after school activities e.g. green gym, local competition for best wildlife or natural environment photo.

Green labelling: clear labelling of the water efficiency of plant such as washing machines, dishwashers. Labelling is a simple and direct way of communicating information about a product to purchasers. There are a number of different green labelling schemes including Waterwise's Marque.

The Marque is awarded annually to products which reduce water wastage or raise the awareness of water efficiency. 27 Marques have been awarded across a broad spectrum of products including dishwashers, showerheads, water storing gels for the garden, toilets and urinals, drought resistant turf, domestic water recycling products, water butts, a waterless carwash, tap flow restrictors, a shower timer and devices to reduce the amount of water used when flushing the toilet.

Councils could be proactive in encouraging all retailers to 1) display green labels and 2) provide information on the different schemes where appropriate.

Green plumbers: council maintained and advertised register of plumbers having attended an accredited training programme on their role in protecting the environment.

Economic Measures

Volumetric Charging

Traditionally water use in England has been unmetered with customers paying according to the rateable value of the property. Volumetric charging increases the cost of billing but is deemed to be a fairer pricing mechanism and encourages water saving.

At present the Government does not compel water companies to install meters, although residents have a right to pay a metered charge and can request the water company install a meter free of charge, unless for particular reasons the cost is prohibitive.

As mentioned, AWS state they will maintain voluntary metering (for review in 2014), though as part of their customer demand management programme they underpin the encouragement of the change to measured charging with a 'switchback promise'. This enables customers to revert back to unmeasured charges within a year of choosing measured charges, though less than 2% do so.

Due to historic pricing polices, economic instruments have not been widely used to promote water conservation in the UK and limited data is available on the elasticity of demand. The recent introduction of volumetric charging for some households (in particular those electing to have a meter and new build houses) has had a limited impact on domestic water consumption (reported reduction of 10% over unmetered users). This is considered to be due to the relatively low price of water in the UK rather than the inherent value of the instrument as a means of reducing water consumption.

Notwithstanding significant real price increases since privatisation of the water companies, average water and sewerage charges in England are approximately 1% to 2% of household income. This compares to the recommended maximum (WHO) of 4% to 5% of household income.

The EU Water Framework Directive reinforces use of economic concepts to control water resource management. Article 9.1 states that member states shall ensure that, by 2010, water pricing polices provide adequate incentives to ensure the efficient use of water.

Assuming the adoption of volumetric charging, options exist in terms of the:

- Type of meter: dumb or smart, smart meters are approximately 3 to 5 times the price of dumb meters but provide greater opportunities for the introduction of varying tariff structures, more cost effective reading (and hence more frequent reading) and facilitate improved leakage detection. Smart meters also provide the opportunity of providing customers with an easily accessible readout of water use;
- Level of charges, water use being related to level of charges;
- Tariff structure, rising block and or seasonal tariff structure can provide good incentives to reduce excessive water consumption without raising the basic rate for low volume water use. Seasonal tariffs are appropriate to encourage consumers to be extra careful with water during the summer months when water is less plentiful.

Economic Measures (cont.)

It is recognised that compulsory metering is not universally welcomed. Therefore, prior to the metering programme, consideration could be given to undertaking an intensive education and public awareness campaign together with the provision of subsidised water saving devices (cistern displacement, tap aerators, flow restrictors etc). Meters could be installed and read for a minimum of 3 months prior to the application of the new tariffs; this would allow residents to appreciate volumes of water used and undertake measures as appropriate to reduce consumption.

During this period, the water company could also consider undertaking a high profile leakage detection and reduction. In addition to reducing water abstraction, this will be designed to increase acceptance of water saving measures by existing households (surveys indicate a reticence on the part of the public to make savings whilst a significant proportion of water into supply is "lost").

In authorising the proposed tariff structure and level of charges, it is assumed that the economic regulator will make due allowance for the investment made by the water company in order to protect the environment at the cost of loss of sales.

Local Environmental Tax

The objective of the local environmental tax would be to provide economic incentive to conserve water and raise revenue for local projects. In principle, if viable and legal the tax for environmental conservation could be set by local council, collected by the water service provider and ring-fenced for local community projects. Alternatively the tax could be applied nationally and managed on similar lines to the land fill tax.

The Cost of Water Efficiency

Approximately 24% of domestic energy consumption in the UK goes to heating water (DTI 2002). This excludes space heating. Showering alone accounts for approximately 1% of total UK carbon emissions (MTP 2008). In addition, the treatment and distribution of water by water companies accounts for large amounts of energy consumption – e.g. Anglian Water is the largest single energy user in the East of England region, and recent estimates suggest that water companies consume more than 1% of the energy produced in the UK.

Energy prices are currently high and rising. In situations where more efficient hot water using fixtures and fittings, such as showers, baths and hot water taps are installed a major cost savings gained by the user will be through savings on the energy bill as well as the water bill.

The implementation of water efficiency measures not only reduce water demand and demand on water resources but produce associated savings in energy, financial costs and carbon emissions. Reductions in water demand can also reduce the need for additional infrastructure, resulting in further savings.

A specification for indoor water use of 120 litres per person per day, as per Part G of the Building Regulations and Levels 1/2 of the Code can be achieved through installing a combination of standard and efficient fittings and fixtures. CLG estimate that this will not add any cost to a new home (CLG 2008).

Code Level 3/4 with a water consumption specification of 105 litres per person per day can also achieved by installation of efficient water using fixtures and fittings, with CLG estimating an addition of £125 to the cost of a new home (CLG 2008). Developers Countryside Properties and Taylor Wimpey have estimated £400 and £280 respectively. The variation arises from different scales of business or assumptions on scales of business, dwelling type or assumptions on dwelling type and therefore style or desirability of fittings.

To achieve a specification of 80 litres per person per day required for Code Level 5/6, it is generally accepted that some form of water recycling is required. Inclusion of a rainwater or greywater recycling system is relatively costly. CLG estimate that achieving Code Level 5/6 would add £2650 to a new standard home. However, this is likely to be less per dwelling if communal water recycling systems are installed, and CLG (2008) estimate £800 for apartments.

The cost of meeting the Code will fall as demand increases. Bathroom manufacturer Grohe have estimated that, assuming bulk supply of the fittings and fixtures, the cost of meeting Code Level 3 /4 would drop to as little as £12.50 (Grohe 2008).

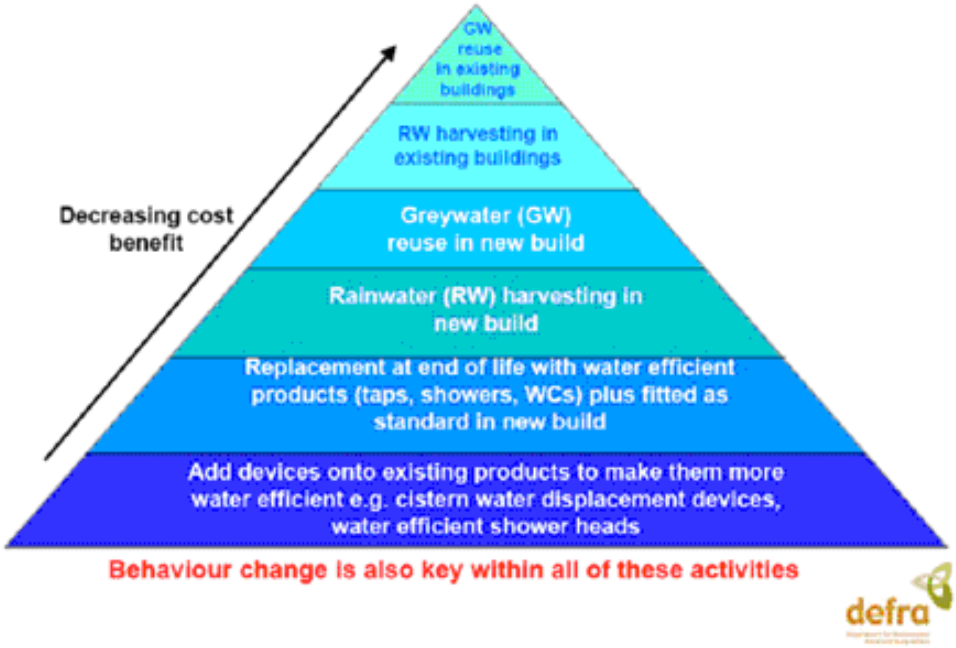
The Governments stated intention is to kick-start the market transformation process by requiring the public housing sector to build to medium level Code specification. However, this means that the relatively higher costs of meeting the Code during the early stages of market transformation are borne by housing associations. The National Housing Federation is lobbying for private developers to be subject to the same Code implementation timetable. At least at this stage, achieving Code Level 3/4 specification for water consumption is one of the cheapest aspects of Code implementation.

The average unit price for a metered water customer in 2008 is approximately 0.3 pence per litre including waste water charges. Average per capita consumption is about 150 litres per person per day in the UK, 130 litres per head per day in Anglian Water's region. Assuming that actual water use in the home meets the target specification, savings on water bills can be estimated as shown in the table to the right of the page.

Average PCC	Target Specification	Savings (litres per day)	Unit cost of water (pence per litre)	Savings (pounds per person per year)	Savings per household per year (assuming 2.4 people)
150	120	30	0.3	£32.85	£98.55
150	105	45	0.3	£49.27	£147.82
150	80	70	0.3	£76.75	£229.95

For water bills, the payback time for specifications meeting Part G and Code Levels 1 through 4 ranges from immediately to a few years. If water recycling systems are added, the payback time is significantly longer – in the order of 10-20 years for systems supplying single homes. Savings on energy bills also need to be considered and in general these will at least match, and often exceed, the savings on metered water bills. Dwellings with water recycling systems will also save energy if efficient fittings are installed, but recycling systems will use energy for pumping and water treatment.

In conclusion, payback times for specifications involving efficient fittings and fixtures are reassuringly quick – a few years at most. Payback times for specifications that include recycling systems are significantly longer. Defra's water efficiency hierarchy (right) illustrates this



Indicative Action Plan

A possible future action plan could include:

Council Led

Local Development Framework policies

Given the well developed evidence base and clear policy at the regional level, Bedford Borough and Central Bedfordshire should ensure that Local Development Framework policies requiring new developments to be water efficient are enforced. Where these policies only require compliance with the mandatory implementation of the code for Sustainable homes, consideration should be given in future revisions of planning policy documents to secure faster implementation of the higher levels of the Code for Sustainable Homes.

Pride in our community campaign

Objective – engaging existing residents, making them proud of their natural and built environment. Target – raising public awareness of their environment.

Action: review existing community facilities, are they good enough can they be improved? Brain storm additional facilities and events to improve quality of life.

Examples: make sure all community areas are attractive, well maintained, with low water requirement. Identify areas with lesser ecological value, construct attractive activity park – aerial runway, mountain bike tracks, café etc. Introduce regular events to shout about Central Beds natural environment, kids after school activities e.g. green gym. Local competition for best wildlife or natural environment photo.

Importance of water campaign

Objective – engage existing residents on need to conserve water.

Action: - review existing community facilities and implement measures to reduce water e.g. spray taps, grey water recycling, rainwater harvesting, advertise action taken and results achieved.

Education programmes in school. Public exhibition, water audit for typical household, water saving devices, details of cost and expected savings, make spray taps, flow restrictors, water butts etc available at subsidised cost. Provide details (with model?) of underlying aquifers. Public visits to headworks and treatment facilities. Articles in local papers. Lorry-side advertisement with volume of water consumed by typical households.

Indicative Action Plan (cont.)

Council Led

Reduction of water consumption in Social Housing

Objective: deliver significant water savings and catalyse residents of social housing to make pro-environmental changes.

Action – appoint part time facilitator to work with Anglian Water, housing authorities and other partners to support residents in green lifestyle changes through technological and behavioural change. Investigate options for joint water and power audit/saving campaign.

Note: Waterwise (www.waterwise.org.uk) are in the process of appointing a number of such facilitators and may be able to provide assistance.

Water use audit of all public buildings

Objective: reduce water consumption.

Action: structured audit of all public buildings. Measures implemented where appropriate to reduce consumption. Advertise successes in local paper etc.

Use of water efficient devices

Objective: raise awareness people's choices.

Action: encourage all retailers to stock water efficient devices, water consumption rating is prominently displayed. Maintain and actively promote a register of green plumbers. Show house where water saving devices such as simple bath waste diverters, green walls, etc can be seen in action by the public.

Indicative Action Plan (cont.)

Water Company Led

Increased metering

Objective: to provide economic incentive to conserve water and better data on system performance

Action: progress enhanced metering scheme throughout the region with targeted advertising campaigns addressing the economic and environmental benefits of water metering.

Leakage reduction programme

Objective: reduce water abstraction and also increase acceptability of meters.

Action: use improved data provided by universal metering to target areas of higher than average losses. Advertise successes in local paper etc.

Promotion of water efficiency devices

Objective: further general promotion of water efficiency devices.