part 7
resource management

resource management

7 RESOURCE MANAGEMENT

7.1 Introduction

7.1.1 This part deals with design issues resulting from climate change and includes guidance on adapting to climate change, resource management, energy efficiency, flood risk and water management.

7.1.2 Climate change predictions forecast sea level rise and an increase in the frequency and severity of extreme weather events including local flooding incidents. The predictions include warmer drier summers; milder, wetter winters; the possible intensification of heat due to the dome of warm air that frequently builds up over cities; the so called the 'urban heat island effect'; and higher wind speeds. There is also potential for the European climate to cool. Southampton City Council has addressed these issues in detail in the Climate Change Strategy (see Appendix L for weblink).

7.1.3 With increasing densities of development in the city potable water is becoming increasingly in short supply. Measures that reduce demand on water abstraction in the Southampton area do therefore need to be considered in order to prevent water shortages and potentially limit capacity for future development.

7.2 Adaptability to climate change

7.2.1 **The location, layout, design, and materials of the development should be robust and adaptable to a variety of weather conditions**.

7.2.2 Developments can potentially be affected by climate change impacts, such as subsidence due to drought, and flooding. It is vital to consider the effects of climate change for the lifetime of the development, especially with regard to its location, design, choice of materials and maintenance of ecological integrity.

7.2.3 Designers should optimise natural ventilation, a balance between natural cooling and solar gain, and make use of sustainable drainage. This can be achieved by careful design of buildings and layouts, and selection of construction materials. Buildings of between 9 and 13 metres in depth give maximum flexibility for natural ventilation and lighting and reducing the ratio of building height to the spacing between buildings generally has a positive effect on natural ventilation. Green roofs can insulate against heat gains, absorb rainfall and provide useable outdoor space as well as improving the external environment. Deciduous trees can provide shade in summer, while permitting light to penetrate buildings in winter providing opportunity for passive solar gain. Further information is provided in the Building Regulations ; Part F (ventilation), Part H (drainage and waste disposal) and L (energy efficiency).

New development built on the flood plain needs to take account of the potential for flooding of; the River Itchen above and River Test below

Energy efficient housing - Portswood, Southampton

Ecohomes - award winning energy efficient housing; a joint venture project between Countryside Properties and SEEDA, St Mary's Island, Chatham Maritime, Kent -
Developer: Countryside Properties
Architect: Countryside Properties Architects with OSP Architecture
© Countryside Properties

7.3 New housing development should meet minimum standards set by the Code for Sustainable Homes.

7.3.1 Increased resource use, levels of pollution, and waste generation are forecast at global, national, and local levels. The scientific consensus is that man-made emissions are now giving rise to possible long term climatic effects, which in the UK include rising sea levels, changes in weather patterns, higher temperatures, and worsening pollution problems in urban areas.

7.3.2 As a result we need to mitigate increased resource use, by improving energy efficiency, increasing the amount of energy we obtain from renewable sources, and reducing greenhouse gas emissions. By setting new minimum standards and adapting current lifestyles we can ensure that our actions do not further compromise future generations.

7.3.3 The Government will be publishing a new Code for Sustainable Homes to further increase standards over and above building regulations. This Code will impact on the external design of dwellings and build on the approach of the EcoHomes standard and will set star ratings for home buyers on the energy efficiency and environmental sustainability of new homes. The first star rating will be more comprehensive and demanding than current building regulations, and the highest star rating will require cutting edge technology to achieve carbon neutral development. This also builds on measures already taken to increase the energy efficiency of new homes by 40 per cent, since 2002.

7.3.4 The Code for Sustainable Homes will set minimum standards for the following, some which will be essential and some optional:

Proposed essential elements:
- Energy efficiency (conservation of fuel and power);
- Water efficiency (reuse of potable water);
- Surface water management;
- Site waste management (during construction);
- Household waste management (during occupation and use);
- Use of materials.

Proposed optional elements:
- Lifetime Homes;
- Security;
- Soundproofing;
- Private external space;
- Daylighting;
- Home User guide.

7.4 Reuse and recycle building materials

7.4.1 **Developers should provide evidence of careful design and selection of building materials to limit energy use and safeguard finite sources, using, wherever possible, materials that are recycled, reused, nontoxic and/or sourced locally.**

7.4.2 Many conventional building materials have environmental impacts at each stage of their life cycle. These are often referred to as an embodied energy value, which incorporates the total amount of energy used in their manufacture, transportation, use and disposal. Selecting reused, recycled, or locally sourced materials can minimise these impacts and often provide a more cost effective option in the long term. Reuse materials are preferred in environmental terms because energy, resource use, and often energy used in transport, are less than that of recycled materials. Materials should be of high quality and durability, and positively contribute to the enhancement of local character of the area. Using natural building materials can improve indoor air quality, reducing impacts to human health.

7.4.3 Design documentation and procurement contracts should include clauses that stipulate the use of selected recycled materials, and mitigate against wastage through requirements to minimise over ordering, and to re-use surplus materials or return the excess to suppliers.

The two storey conservatory provides a thermal buffer; warming cool air before it enters the house

7.5 Passive design

7.5.1 **Designs should incorporate and maximise the use of renewable energy sources and demonstrate energy efficient methods of heating and ventilation systems and passive design features to harness renewable sources of heat and light.**

Energy efficient housing that incorporates passive solar gain and photovoltaic cells, amongst many other features - BedZed

Ventilation cowls draw out hot air providing natural ventilation by the 'stack' effect - BedZed

7.5.2 These are explained in some detail below, however the technology is developing rapidly and therefore it is recommended that further advice is obtained from the City Council's Climate Change Officer.

- Passive solar gain;
- Avoidance of overshadowing;
- Natural ventilation and thermal buffering;
- Improved insulation and ventilation standards;
- Thermal zoning;
- Passive landscape design and roof gardens.

7.5.3 **Passive solar gain:**
The orientation of buildings and elevations to maximise solar gain through large windows is desirable. Natural ventilation is also important; to encourage circulation of warmer air through the building. The use of high thermal mass materials such as concrete floors and internal walls can be used to absorb and retain solar heat during the day. This will be then be released over the evening and night providing heat at colder periods of the day.

7.5.4 **Avoidance of overshadowing:**
To maximise solar gain, buildings should be located to minimise overshadowing from other buildings and structures. This also applies, to some extent to overshadowing by trees, although in this case the sustainability and other benefits of trees should also be taken into account.

7.5.5 **Natural ventilation and thermal buffering:**
Good design will aid warming in the winter and cooling in the summer and should provide good natural ventilation by cross ventilation that will also keep occupants healthy. The movement of warm air to colder parts of the building is often referred to as the 'stack' effect where warm air expands, becomes lighter and rises, so drawing in colder air to replace it. Care must be taken not to create strong drafts by creating a 'chimney' effect where the creation of too much warm air in a limited space can create a strong upward draft. Conservatories can be used to good effect to warm air before it enters the house. Conservatories also provide a 'thermal buffer' that acts as an intermediate heating zone providing an additional layer of insulation to the walls of the dwelling.

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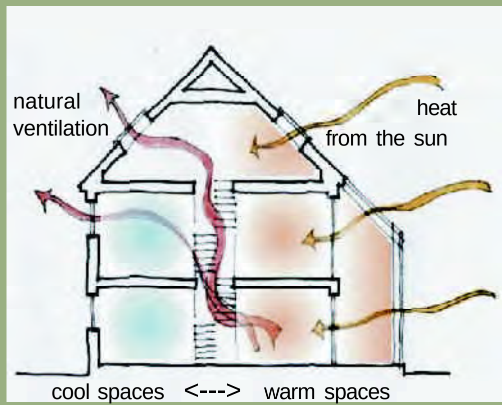
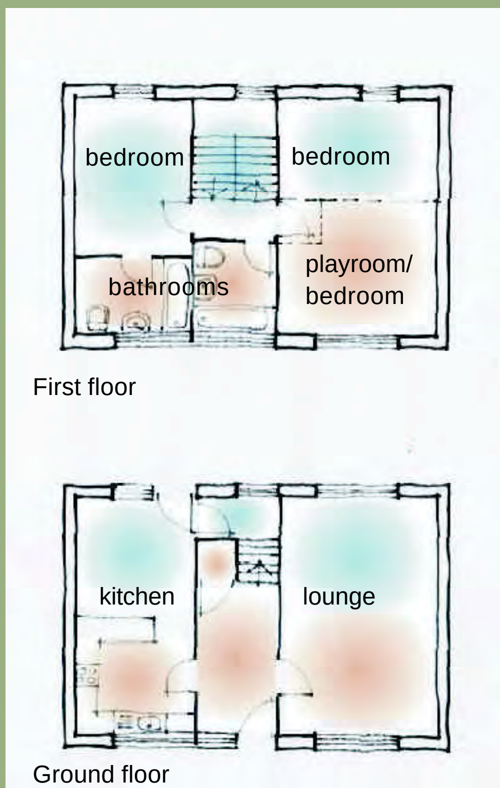
7.5.6 Improved insulation and ventilation standards:
The Building Regulations have increased insulation requirements considerably over the last 20 years, requiring the design of heavily insulated floors, walls and roofs as well as double glazing. Part F Ventilation and Part L - Energy Efficiency have recently been changed to improve existing energy efficiency standards by 40% and reduce carbon dioxide emissions, and will come into effect in April 2006. These regulations will have an impact on the visual appearance of new homes as they affect the design and detailing of walls, windows and roofs. They also make it more of a luxury to provide a traditional chimney feature as open fires are discouraged due to relatively high carbon dioxide emissions of solid mineral fuel fires and their inefficiency through loss of warm air through the chimney flue.

7.5.7 Thermal zoning:
Energy can be saved by designing the plan of a dwelling so that it takes account of the different temperatures we find comfortable for different spaces. Thermal zoning of these spaces involves locating hot spaces in the centre of a dwelling and warm spaces on the south side of a dwelling. Cool spaces should be located on the east side and cold spaces on the north side or outside the dwelling. This will make best use of passive solar gain, natural light and ventilation as well as heat sources within the dwelling such as boilers and cookers.

7.5.8 Passive landscape design and roof gardens:
Good landscape design can play a key role in improving energy efficiency in housing design. Trees and shrubs can be planted to create a windbreak reducing the wind chill affect on a building, however care must be taken not to cause excessive overshadowing and reduce solar gain. There are two types of roof gardens that can also be used to improve energy efficiency. The 'extensive' roof garden cannot be used for leisure purposes and is primarily used for its visual attractiveness can be incorporated in roof construction to include low maintenance plants such as sedums (succulents), indigenous herbs and grasses to create a 'green' roof. The 'intensive' roof garden is designed to be used for leisure purposes and must be maintained and managed through the year. These have several advantages both ecologically and environmentally. Extensive roof gardens can absorb up to 40% of rainwater, and intensive ones up to 90%, and release a much slower rate of run off of the remaining water thereby reducing load on stormwater systems. They also provide good thermal insulation helping to moderate thermal gain and loss. The plants improve air quality, absorb dust and noise, particularly when wet. They also create a habitat for insects and birds and many of the materials used are recycled.



The two storey conservatory provides a thermal buffer; warming cool air before it enters the house



Sketch plans for a dwelling orientated so that the frontage faces south. The plans show how thermal zoning can be planned to make best use of solar gain to warm rooms that people prefer to be warm

7.6 Energy efficiency/minimisation features

7.6.1 **Controls and measures to reduce the consumption of resources, water, gas and electricity, including the specification of white goods appliances, should be implemented in new developments, to levels at least as good as current recognised standards.**

7.6.2 The use of insulation in walls, roofs and floors is now common place in new development. High levels of insulation can reduce energy consumption considerably, allowing the heating of a room to be kept warm by a single light bulb. Pressure tests are now carried out as part of Building Regulation Approval to ensure there are no air gaps in the walls.

7.6.3 External lighting should minimise light lost to the sky, should be energy efficient, provide high quality consistent illumination and be controlled by passive infrared sensors, by timers or ideally photo-electric sensors for 'dusk to dawn' operation. Due to their vulnerability to vandal attack and their efficiency and ineffectiveness, particularly within carparks lighting bollards are not acceptable.

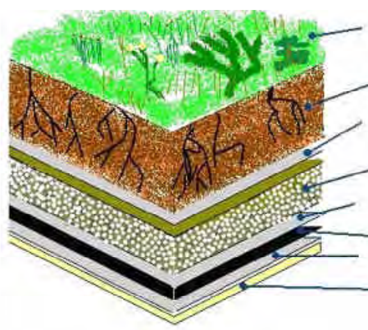
A green roof with sedum planting used on a public toilet block at Weston Shore, Southampton, designed by Southampton City Council Building Design Services

7.6.4 Grey water recycling systems that reuse waste water from hand wash basins, baths and showers are advocated. Water is diverted to a central holding facility for treatment and such uses as toilet flushing or irrigation. Rainwater recycling systems collect rainwater run-off from roofs and other hard surfaces for similar uses without requiring treatment. One or both of these systems should be installed where roof gardens or other raised planting beds are proposed. A simple system using a water butt to collect rainwater can be used for garden irrigation.

7.6.5 More efficient appliances, such as ovens and fridges, more effective controls and sub-metering should be installed in dwellings, to enable better use of resources and easy monitoring of use by the occupier.

7.6.6 Although not an issue for planning regulations it is best practice to select appliances with an energy efficiency rating or install simple energy saving devises to reduce overall demand. Appliances with an 'A' or 'A*' rating from the European Community Energy Label scheme are the most energy efficient appliances available.

Section through an extensive green roof system manufactured by Delston - www.delston.co.uk
© Delston



7.7 Small-scale renewable energy technology

7.7.1 **The use of renewable energy technology is encouraged in all new development and in extensions to dwellings, however these technologies should be fully integrated into the design providing a balanced composition of features that enhances the existing character of the local area.**

7.7.2 It should be clearly demonstrated that a full investigation has been made of the potential for installation of any of the following renewable energy features. This should include the consideration of the cost effectiveness of capital and revenue costs throughout the lifetime of the product, the reduction in use of non renewable sources of energy and reduction in carbon dioxide emissions compared with conventional systems:

- Solar Water Heating;
- Photovoltaics;
- Combined Heat and Power;
- Ground source heat pumps;
- Biomass systems;
- Small scale wind and hydro powered systems.

7.7.3 National planning guidance encourages local planning authorities to seek to maximise the contribution of such technologies in order to meet government targets. In addition the proposed revisions to the Building Regulations encourage the use of renewable forms of energy and may allow more flexibility in the use of other fabrics in the design of the development.

7.7.4 Careful design can optimise the capacity for renewable technology installations in new developments and extensions to dwellings, both at the time of construction and for future retrofitting and adaptation of existing buildings.

7.7.5 **Solar water heating:**
This system can be installed on south-east to south-west facing roofs of 2-5 m^2 which receive the sun for the main part of the day. An additional hot water storage system is required. They can provide nearly all hot water for a dwelling in the summer months and up to 50% for the rest of the year. They also reduce carbon dioxide emissions of conventional heating systems by about 23%. Ideally they should be placed on roofs of rear elevations and advice must be sought if they are to be placed on elevations of listed buildings and in conservation areas.

Dwelling fitted with solar water heating panels (right) and photovoltaics to the roof © Bre 2004

Dwelling fitted with solar water heating panels and large south facing conservatory for passive solar gain © Bre 2005

The Utilicom combined heat and power plant in Southampton
© Utilicom Ltd

The combined heat and power plant in Southampton feeds these apartments in the Polygon

7.7.6 **Photovoltaics:**

Photovoltaic cells can also be used to create electricity for heating and lighting but consideration should be given to the cost effectiveness of these over the life time of the product. There are many schemes, particularly in Europe that use these as a roof finish providing an energy source for the development and potential to feed surplus energy back into the national electricity grid.

7.7.7 **Combined heating and power (CHP):**

Southampton City Council, in partnership with the operator Utilicom, has developed a Southampton District Energy System using CHP in its council buildings, and an increasing number of major developments and housing schemes across the city since 1986. Developers of large housing schemes in the city are actively encouraged to adopt this form of heating called 'community heating system' because of its energy efficiency and ability to reduce carbon dioxide emissions. The system uses energy from geothermal sources and gas fired boilers which is supplied by a system of well insulated pipes supplying space heating and domestic hot water to each dwelling. It is between 15% and 25% lower in cost than conventional systems depending on the location of the mains pipework and can reduce carbon dioxide emissions by 38%. Supply costs are between 10% and 15% lower than conventional costs. There is also no need for a boiler and therefore more space available for other uses, no annual maintenance costs and lower long term capital costs to replace heat exchangers compared with boiler replacement.

7.7.8 **Ground source heat pumps:**

Over recent years techniques have been developed to extract heat from the ground using a closed system of pipes buried underground on the site. These connect to a heat pump that transfers heat to the building's heating system via a heat exchanger and can be used for cooling as well. These systems are most suitable where there is a relatively large area of the site available for laying the pipework under ground however there are different techniques that can be used depending on the geology of the site and the type of construction used. They typically use 30% less energy than conventional heating systems resulting in 50% reduction in carbon dioxide emissions. They have similar capital costs to conventional heating systems but lower running costs over the lifetime of the system.

7.7.9 Biomass systems:
Biomass or bio-fuel are products made from recently made organic matter such as forest cuttings that has not taken million of years to evolve. Specially designed stoves and boilers can be installed to serve single or groups of dwellings and can be cost effective when locally sourced fuel such as wood pellets, chippings or logs are used and there is no local gas mains supply. The main advantage of this system of space and water heating is that it is environmentally friendly, reducing pressure on non renewable sources of energy. Where this system is used for large groups of dwellings surplus electricity can be sold back to the national grid.

7.7.10 Small scale wind and hydro powered systems:
The city does have potential to make use of both of these sources of energy (and potentially tidal energy). Hydro powered systems would have considerable impact on the two rivers in the city and would need to be large scale to be economical. However with new technology more efficient and less invasive systems may become available that might derive energy via small turbines from the small water courses in the city. The involvement of the Environment Agency and other stakeholders would be a necessity if this was proposed. Wind powered systems are another possibility in Southampton as it has many potential sites where high wind speeds are achieved and turbulence is minimal, such as those close to large expanses of open space or water and on or above high rise development. A rotating blade creates a direct current that needs to be converted into an alternating current for domestic use. Currently diesel generators are used to provide energy at low wind speeds, however the technology is developing and over the next few years more efficient systems are likely to be more widely available for domestic situations. Key considerations will be the impact of the blade and its supporting structure and the impact of noise on the local environment.

A biomass boiler suitable for serving a group of dwellings
© Bre 2005

Wind turbines in use in a country park
© Bre 2004

7.8 Flood Prevention

7.8.1 **Early advice should be sought from the Environment Agency to ensure that new development is designed so that it will not contribute to flood risk in the surrounding area and risks from potential flood incidents are minimised.**

7.8.2 Global warming is increasing sea levels and as much of the city's shores are exposed to tidal waters flooding is a potential risk that should be considered at the earliest stages of design development. High tides coupled with strong onshore winds and low pressure can increase risks considerably. Historic records and advice from Environment Agency should be sought (flood maps are available from the latter).

7.8.3 The following measures should be applied:

- Provision of surface water storage areas;
- Flow limiting devices in conjunction with surface or subsurface storage;
- Use of infiltration areas or soakaways;
- "Soft" sustainable drainage systems to mimic natural drainage;

7.8.4 New development or changing the use of existing buildings can have a significant increase on localised flood risk from the reduction of surface permeability by replacing vegetated ground with roofs and paved areas. This can damage watercourses and create occasional pollution incidents. Good design should mitigate against such effects.

7.8.5 Areas currently not at significant risk from flooding could become so during the lifetime of developments. New development must not increase the flood risk and where possible should reduce the risk.

7.8.6 Sustainable drainage systems (SuDS) aim to reduce flooding by managing urban run-off and higher peak flows in a way most suited to the specific development. Common features of SuDS include soakaways and ponds. Natural vegetation and green roofs can also form a valuable component of SuDS. Ownership should be established and maintenance plans should be agreed prior to planning approval.

7.8.7 **Early advice should be sought from the Environment Agency to ensure that new development is designed to minimise risks from potential flood incidents.**

7.8.8 A combination of the following design strategies should be utilised:

- Utilising parts of a site at higher risk of flooding for open space or other recreational provision;
- Upper levels of converted structures might be appropriate for living accommodation with public areas and other uses at a lower level;
- Flood-proofing measures in lower levels of buildings;
- Enabling sufficient access for emergency services and escape from the development;
- Designing higher level defensive road systems, and using landscape features such as soakaways and ponds.

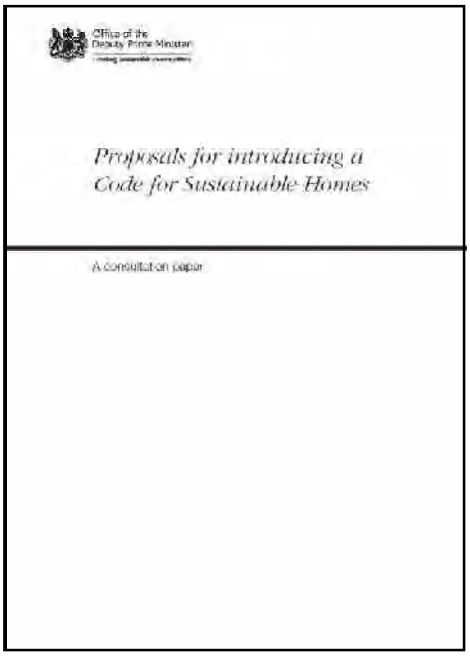
7.8.9 **A Flood Risk Assessment report must be submitted for any developments proposed in flood risk areas. Refer to guidance provided by the Environment Agency for further information.**

7.8.10 Flooding from rivers and coastal waters is an important process that shapes the natural environment, yet it can also cause damage to people and property due to the nature and location of settlement and land use. Understanding and accounting for such natural processes in development planning can help to reduce the level of flood risk and the amount of damage caused.

7.8.11 A risk based approach to planning new development using sequential and exception tests is advocated as set out in the draft Planning Policy Statement 25 - Development and Flood Risk. Features will need to be included at the design stage to ensure that developments are resistant and able to adapt and respond to flooding incidents. Despite these measures certain types of development may still not be appropriate.

7.8.12 New residential development in a flood zone shall not incorporate any bedroom or sleeping accommodation that is below 3.16m AOD (current at the time of publishing - please check for up to date advice). A planning condition will normally be imposed to ensure such accommodation is never used as a bedroom or sleeping area.

Flood gates fitted to boundary walls of 225mm thickness to provide resistance to potential flooding of individual terraces - Hythe


Office of the Deputy Prime Minister

Proposals for introducing a Code for Sustainable Homes

A consultation paper

Proposed new Code for Sustainable Homes

7.9 Use of water resources

7.9.1 **New developments and refurbishments should include installation of as many water efficiency measures as possible with the aim of at least meeting the minimum standards for usage of potable water and surface water management as set out in the consultation paper on the Code for Sustainable Homes.**

7.9.2 Although the requirement for water efficiency measures is not necessary under planning legislation, these measures may be required by Building Regulations and are included here as best practice. The minimum standards to be achieved are:

Water efficiency (potable water) - no greater than 125 litres per head per day ($46m^3$/bedspace/year), achieved by using:

- Water efficiency rated new appliances;
- Spray taps;
- Flow regulation and leak detection devices;
- Low-volume capacity baths;
- Dual/low flush WC.

Surface water management - ensuring that peak run-off rates will be no worse than the original conditions of the site, achieved by using:

- Rainwater harvesting or grey-water recycling systems;
- Intensive or extensive green roof gardens;
- Water attenuation schemes; where tanks and pipework are specially designed as on-site holding tanks for storm water allowing a controlled flow of water out from the site into existing stormwater systems. This can be underground or used as a landscape feature on the site, and can also be used as an on site irrigation system;
- Use of porous surfacing materials to hard standings, particularly to minimise risk of flooding neighbouring sites.

7.9.3 Increases in population, household size and affluence in recent years have seen the amount of water we use in the home steadily increase, putting great pressure on the resources that are currently available to us. Climate change will increase the demand for water and reduce supply, particularly during summer droughts.

7.9.4 It is essential to address the balance between water supply and water demand to ensure the protection of the environment and security of future water supply. Household demand for water can be significantly reduced through the installation of water efficient appliances and domestic water recycling systems.