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## RESOURCE EFFICIENCY OF THE BUILT FORM

### TOWARDS A ZERO CARBON COMMUNITY

Sherford has, as one of its key objectives, the reduction of the carbon footprint of the Town towards zero. The approach Red Tree is taking towards sustainability, in its widest definition, is a thread running through the entire Masterplan Book and Town Code. This section deals more explicitly with the following issues: how materials and human resource will be procured through the construction process; how construction waste will be dealt with; the standards buildings will be built to; how they are proposed to perform; what opportunities for sustainable living they will offer including waste and recycling; and how it is proposed that innovations and technological advances will be applied and developed over time.

### RECYCLED AND LOCAL MATERIALS

The overarching objective is to localise the sourcing of materials. This has a multiple benefit profile including enhancing local distinctiveness, reducing haulage distances and stimulating the local economy. Sherford is well-placed for instance with aggregates immediately on its doorstep.

Procurement will be weighted by a system of cascading source locations and priority will be given in order (so long as knowledge of the system is not used to lever uneconomic terms) to supply from:

- 50 mile road catchment
- Devon and Cornwall
- South West
- United Kingdom
- Europe
- the rest of the World

These terms may be modified where over-riding regard to ethical production, lifespan and renewability of source material is concerned.

This will also apply to the engagement of trades. Where on-site pre-fabrication or processing systems are appropriate, they will be adopted. Sherford will promote training and apprentice schemes which will both reinvest in the local community and deliver to the development the required skills.

The specific materials targets for Sherford are as follows:

- Sherford will seek to localise the sourcing of bulk materials with an aspiration to acquire 65% (with a minimum requirement of 35%) by mass from within 50 miles (by road) of the development (106.5 miles is the industry average)

- Materials used in the construction of road and external hard surfaces will utilise a 30% recycled content from local (within 50 miles) reclaimed or recycled sources
- Bulk building materials will include 15% (as a percentage of the value of materials used) recycled content
- The general disposition is towards use of recycled products but this will be moderated by considerations such as availability, delivery distance, lifespan, energy performance and cost
- 100% of construction timber will be Forest Stewardship Council certified or equivalent and preference shall be given to renewable locally sourced and milled timber from within the Devon or South West area
- The Community Park provides an opportunity to grow the replacements for the trees consumed in the construction of Sherford. This tree growth will also provide a carbon sink that further enhances Sherford's carbon performance towards neutrality. There is an obvious opportunity also to plan for supplies of renewable woodfuels to be provided and this would fit well with the desire to install localised CHP and could provide income for the Community Trust but this will require careful management to differentiate between planting objectives. Red Tree is sensitive for instance to the inherent conflict between wood planted for carbon sink and that planted and culled for wood-fuel. Carbon sink planting however could be a useful source of construction materials. For further details regarding Carbon Sink opportunities please refer to the Landscape Strategy
- Consideration of the degradation of road surfaces due to extreme weather conditions will contribute to the choice of materials used
- PVC products are excluded from the development
- Formaldehyde and other noxious chemical products will be excluded where more sustainable alternatives exist

## EMBODIED ENERGY AND ENVIRONMENTAL IMPACT OF MATERIALS

Sherford will aim to utilise materials in the construction of dwellings that have been proven to have a low embodied energy and low environmental impact, for example, the selection process for materials should be informed by BRE Green Guide or equivalent.

As important as the materials used to construct the building at Sherford, are the appliances and fittings installed in them. These should be selected on the basis of their energy and water efficiency and performance.

In regards to energy efficiency, all lighting will be fitted with Compact Fluorescent Lamps when installed. In addition, where the developer fits or supplies appliances as part of the construction and sales process, these will be A rated for energy use. Those appliances requiring an A rating are:

- Fridge and Freezer
- Washing machine and dryer
- Dishwasher
- Oven

Further, water efficiency should be a key factor in the selection of appliances and internal fittings. The developer will install low flush toilets, water efficient showers and aerated taps to all sinks. When considering the location of water tanks and plumbing layouts, consideration will be given to minimising pipe runs to high use hot water taps. In addition, where the developer fits or supplies appliances as part of the construction and sales process, these will be A rated for water use. Those appliances requiring an A rating are:

- Washing machine
- Dishwasher

## CONSTRUCTION STANDARDS

- A Site Waste Management Plan (SWMP) will be an integral part of the 'Construction Environmental Management Plan'. This plan will seek to reduce the amount of waste produced on the site and ensure that

the percentage of this waste disposed of via land-fill is kept to a minimum through waste segregation, recycling, and packaging reduction initiatives.

- Energy efficient construction systems will be utilised to reduce energy consumption and water use.
- A target of one 7 yard skip of waste per dwelling will be set
- 50% of all construction waste (by mass), will be recycled. This will ensure that no more than 50% of construction waste will be disposed via landfill
- Sherford will achieve a 50% benchmark score in regards to the 'Constructing Excellence' KPI for energy and mains water use within the construction process
- On-site training opportunities will be created at Sherford for local residents (within 20 miles) and school leavers within the construction process. Much of this training will be in the form of structure skills training and apprenticeships
- Shared transport will be provided by developers at Sherford to move operatives to and from the site. On site parking will be limited in order to ensure modal shift

## RESIDENTIAL BUILDING STANDARDS

- All dwellings to be built to EcoHomes 'Excellent' standards
- Energy efficiency targets:
  - CO<sub>2</sub> emissions for 1st 1,000 dwellings to be 25% below 2006 Building Regulations Part L
  - CO<sub>2</sub> emissions for 1,001-2,000 dwellings to be 35% below 2006 Building Regulations Part L
  - CO<sub>2</sub> emissions for 2,001-3,000 dwellings to be 50% below 2006 Building Regulations Part L
  - CO<sub>2</sub> emissions thereafter to be 60% below 2006 Building Regulations Part L
- Rainwater harvesting to be utilised for 80% of roofs
- 100% of roofs will be designed to be capable of accommodating renewable energy devices
- Conservatories will not be allowed to be ar-

tificially heated

- Target lifespan of the basic structure of the buildings to be 300 years
- Life Cycle Assessment will be utilised
- Passive cooling, ventilation and heat recovery techniques are to be utilised at Sherford, where practical
- High thermal mass wall materials will be used (where timber structural panels are used then an equivalent decrement delay should be achieved to avoid overheating)
- High thermal performance glass will be utilised in accordance with Energy Efficiency Partnership Best Practice Standards. Windows will have provision for the future fitting of external, adjustable blinds/shutters and sunscreens
- Window sizes will, where practical, be sensitive to their orientation acknowledging the cooler northern facing elevations. When choosing house types with north facing facades consideration will be given to house types that have smaller glazed elements to the north and larger areas to the south. When choosing house types with south facing facades consideration will be given to house types that have larger glazed areas towards the south and smaller areas to the colder northern elevations.
- Zoned lighting will be installed in all dwellings which utilises one switch per light
- Design of the urban form will take into consideration access to daylight for all occupants. The following standards should be applied:
  - BS8206: Pt 2 standards:
    - In the kitchen; and
    - In living rooms, dining rooms and studies.
  - Dwellings will be arranged so that main living areas and bedrooms are sympathetic to the southerly aspect subject to the type and orientation of the building within the block
  - Garages may be used to shelter north elevations, where appropriate;
  - Plant shelterbelts and wall climbing plants to north and southwest walls can also be used to reduce wind chill factor
  - Design and construction methods will allow for flexibility in both the workspace and living areas. This will ensure that properties can be adapted to different uses in the

future

- Each phase at Sherford will be designed to 'secure by design' standards (or equivalent) following consultation with a Police Architectural Liaison Officer or a Crime Reduction Design Officer
- All dwellings will meet the criteria for Eco-Homes credit Tra 4 relating to home office provision
- 'Lifetime Homes' standards will be applied as follows:
  - 75% of 'Lifetime Homes' standards will be applied to 100% of all dwellings
  - 100% of all 'Lifetime Homes' standards will be applied to 10% of dwellings
- Exterior fittings for all dwellings should be designed and specified to withstand any forecast increases in wind and rainfall over the expected lifetime of the building

#### NON-RESIDENTIAL BUILDING STANDARDS

- All non residential buildings to be to BREEAM 'Excellent' standards
- Energy efficiency targets will be the same as for residential
- Rainwater harvesting to be used for 80% of non residential buildings
- Target lifespan of the basic structure of the buildings to be 300 years
- Passive cooling, ventilation and heating techniques will be utilised throughout Sherford. These systems should make use of the latest energy efficient technologies
- Green and Brown roofs will be utilised on non-residential buildings as part of Sherford's overall SUDS strategy subject to compliance with the Town Code
- High thermal performance glass, in accordance with Energy Efficiency Partnership Best Practice Standards, should be utilised. Where their fitting does not create a conflict with the Town Code, Brise Soleil will be utilised on buildings to assist cooling
- High thermal mass wall materials will be utilised (where timber structural panels are used then an equivalent decrement delay should be achieved to avoid overheating)
- Prior to the commencement of design, a study will be conducted on the facilities re-

quired within each non-residential building in order to promote cycling as a real alternative to the use of private cars for shorter journeys. The results of this study will be implemented within the subsequent design

- Non residential building exterior fittings should be designed and specified to withstand any forecast increases in wind and rainfall over the expected lifetime of the building

#### CLIMATE CHANGE

All building designs will be adaptable to allow for changes in weather patterns and temperature, for example thermal mass to retain heat and provide cooling opportunities and window shutters to mitigate solar gains

#### MINIMISING WASTE AND RECYCLING

- Every household will be provided with the maximum opportunities to recycle their waste via internal and external storage facilities. The developer will work with the local planning authorities and Community Trust to establish an integrated waste strategy that is designed to achieve maximum credits from the waste section of BRE, Eco-Homes
- In order to promote sustainable lifestyles, a welcome pack will be provided to all residents with the following information:
  - Local travel services
  - Utility suppliers
  - Energy efficiency measures
  - Local amenities
  - Refuse collection
  - Recycling facilities
  - Local organisations and community groups
  - Sherford's environmental technologies
  - Each dwelling's environmental technologies
  - A water efficiency information pack
  - Wildlife gardening advice and advice on appropriate planting for private gardens
- Areas will be made available for home

composting where appropriate. Block scale composting will also be encouraged where block typologies allow

- Blocks will be designed to include ‘waste storage pavilions’ with easy access for drop off and collection of household waste and recycling. This will make the process of waste collection more efficient
- A re-use/repair centre will be provided on land close to the Park & Ride facility
- Facilities for bulky waste goods will not be available at Sherford. By agreement with Devon County Council these would be collected and transferred to the waste and recycling centre in Ivybridge
- Convenient waste deposit areas will be provided for street recycling bins and wheelie bins within each block

#### INNOVATION IN CONSTRUCTION AND ENERGY EFFICIENCY

Red Tree will provide the opportunity for the establishment of a Research and Development (R&D) Centre within the Town. This R&D centre may be tasked with to:

- Ensuring adaptability for future technologies – future-proofing the design
- Monitor and review performance of the buildings phase on phase
- Review advances in construction technology for application at Sherford
- Provide ‘test bed’ opportunities to advance more sustainable construction compatible with volume production
- Monitor and review the performance of Sherford against target criteria and aspirations and against other similar developments in the UK
- Review all construction technologies using life cycle analysis methods to ensure appropriate use of materials and methods

The R&D Centre will also ensure that the development remains at the forefront of sustainable housing and communities in the UK via a consistent programme of monitoring and reviewing phase by phase.

#### STREET LIGHTING DESIGN AND

#### ENERGY EFFICIENCY

The design of the street and communal area lighting at Sherford will ensure that not only is the build form enhanced, but also that the energy use and effect on the local environment is minimised throughout its operation. This is achieved by:

- All lanterns to be fitted with flat glass protectors / bowls or low profile bowls to enable the lighting scheme to comply with an E2 environment zone lighting system. The design of all lighting will seek to zero the amount of upward light transmission
- Lanterns must be capable of being fitted with internal shields and or baffles to prevent light trespass into neighbouring residential windows
- Lamps shall give a white light output
- All street lighting will use low energy lamps
- All lighting equipment will be controlled via photoelectric cells. These will be programmed to switch on a 55 lux and off at 28 lux
- Photoelectric cells shall be capable of switching at lower lux levels in order to reduce energy usage
- All highway luminaries are to be connected to a suitable central monitoring system with an open protocol. The monitoring system will be capable of being used for
  - Part night switching
  - Dimming
  - Fault reporting
  - Remote energy reporting
- Where lanterns are mounted onto buildings Way Leaves will be obtained by the developer
- All lighting levels to conform to the BS EN 134201 and BS 5489-1:2003 Codes of practice for design of road lighting and public amenity areas, and its future successors
- The Main Street, Northern and Southern Avenues and the key streets are to be lit to code of practice lighting class as shown in table L1 of the above BS’s and at approx 10.00 p.m. subject to traffic flows, the lighting will be dimmed by one lighting category
- Lighting in town centre and high public

night time usage areas to be as per code of practice and these areas will not be dimmed until one hour after licence premises close

- Residential streets within 50 metres from the main arterial roads to be lit to code of practice lighting class (S4) and at approx 10.00 p.m. each night the lighting will be dimmed by one lighting category
- Residential streets greater than 50 metres from the main arterial roads to be lit to code of practice lighting class (S5) and at approx 10.00 p.m. each night the lighting will be dimmed by one lighting category or switch off at mid-night

### CARBON PERFORMANCE

Table 1 below outlines the estimated carbon footprint expected of Sherford upon the completion of the Town given current building regulations. This equates to 29,141 tonnes of CO<sub>2</sub> per annum. However, the proposal for Sherford presented in this Masterplan Book seeks to substantially shrink the carbon footprint towards zero via a multi-level strategy of energy efficient construction, reduction in energy consumption, renewable energy production and the establishment of a carbon sink.

<b>Table 1: Carbon Footprint</b>					
Carbon Emissions Table – to building regs	Quantity	Area m <sup>2</sup> (est.)	Kg CO <sub>2</sub> /pa/m <sup>2</sup>	Tonnes CO <sub>2</sub> /pa	
Domestic (Including appliances estimated at 13kg/CO <sub>2</sub> /pa)		540,000	36	19,440	
Schools		14,764	30	443	
Health Centre		7,074	112	792	
Sports Centre		1,000	174	174	
Naturally ventilated office, cellular		67,000	28	1,876	
Retail Units		16,740	186	3,114	
Town Hall		9,600	61	586	
Food Retail		5,580	429	2,394	
Street Lights	2,500	N/A		323	
<b>Total</b>				<b>29,141</b>	<b>Carbon footprint if built to 2006 Building Regulations</b>
Figures obtained from: CO <sub>2</sub> emissions based upon CIBSE Energy Benchmarks from Dec 2003 for non residential CO <sub>2</sub> emissions based upon EST/BRE Part L1 Modelling for Building Regulations 2006 for residential					

*It should be noted that indicative numbers have been used here in relation to the carbon calculation. Numbers will be refined as we gain greater clarity on the detailed design and engineering for the construction of Sherford.*

<b>Table 2: Carbon Reduction Measures</b>					
Reductions to Carbon Emissions	Area m <sup>2</sup>	Kg CO <sub>2</sub> /pa/m <sup>2</sup>	Tonnes CO <sub>2</sub> /pa	% Carbon Reduction	% Carbon Reduction after energy efficiency measures
<b>Energy Efficiency Measures</b>					
0-1,000 dwellings	98,182	9.0	884	3%	n/a
1,001-2,000 dwellings	98,182	12.6	1,237	4%	n/a
2,001-3,000 dwellings	98,182	18.0	1,767	6%	n/a
3,001-4,000 dwellings	98,182	21.6	2,121	7%	n/a
4,001-5,500 dwellings	147,273	21.6	3,181	11%	n/a
<b>Total</b>			19,951		
Wind turbines - large scale (2 x 1.8MW)		4068	8,136	28%	41%
Wind turbines - small scale					
Solar Thermal					
PV			1,977	7%	10%
Biomass heating - neighbourhood/building scale					
Biomass CHP - neighbourhood/building/ scale					
			9,838	Balance of CO <sub>2</sub> emissions	
			127,890	Balance of CO <sub>2</sub> emissions over 13 Years	
Carbon sink, 1 ha = 1778 tonnes	70	1778	124,460		
Offsetting via carbon sink available for			13 Years		

*It should be noted that indicative numbers have been used here in relation to the carbon calculation. Numbers will be refined as we gain greater clarity on the detailed design and engineering for the construction of Sherford.*