

# Achieving climate change mitigation and adaptation in masterplanning

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## Climate change mitigation

- Climate change mitigation aims to reduce greenhouse gas emissions to slow down or stop climate change

Issues relevant at masterplanning scale include:

- Location close to transport, employment, schools, shops etc
- Renewable energy
- Passive solar design / orientation of buildings
- Good movement networks
- Mixed use development



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At the masterplan scale, measures to mitigate against climate change can relate to:

- First of all the location for development – so for example it is not a dormitory from which everyone will have to get into their car to commute to work, schools or shops.
- Providing low carbon energy supplies, including renewable energy – often far more efficient at the masterplan scale.
- Minimising the energy use of buildings, for example through passive solar design, and the orientation of buildings.
- Getting the structure of development right in terms of movement networks, and mix of use allowing people to lead a low carbon lifestyle

## Climate change adaptation

- Climate change adaptation aims to adjust society to cope with changes that are already happening or are likely consequences of greenhouse gas emissions.

Issues relevant at masterplanning scale include:

- Flood risk assessment
- SUDs (sustainable urban drainage)
- Urban heat island effect
- Passive solar design / orientation of buildings
- Minimising water use e.g. rainwater harvesting / greywater recycling



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Measures to adapt development to climate change that is already underway are equally relevant at the masterplan scale.

It is difficult for an individual building to deal with flooding, for example, as effectively as it can be dealt with through a masterplan. And whilst for some sites, flood risk may preclude development, one of the case studies I will show later, demonstrates place making opportunities that solutions to flooding can create.

Likewise, sustainable urban drainage and urban heat island effects are far more likely to be effectively addressed on the scale of a masterplan, than would be possible building by building.

And just as passive solar design can minimise energy use, it is an equally important adaptation issue – requiring us to think carefully for example about how habitable single aspect south facing flats might be in a hotter future.

Again thinking about water means considering how to minimise water use through rainwater recycling or greywater harvesting.

## Module content

- Planning policies
  - Masterplan process
- Tea break
- Technical assessments
  - Adaptation and mitigation strategies



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## Planning policies: NPPF

Climate change requirements at the masterplan scale:

- plan for new development in locations and ways which reduce greenhouse gas emissions (para 95)
- comply with adopted Local Plan policies on local requirements for decentralised energy supply (para 96)
- take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption (para 96)
- using opportunities offered by new development to reduce the causes and impacts of flooding (para 100)



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The NPPF places strong emphasis on the role of planning in addressing climate change.

Much of what the NPPF requires planning authorities to do in terms of climate change, can only be achieved at the masterplan scale.

Examples above.

## Planning policies: local authority level

We will look at how planning policies can support masterplanning for climate change adaptation and mitigation at three levels:

Local Plan / Core Strategy - strategic

Supplementary Planning Documents – area specific

Guidance for Scheme Design – project specific



## Planning policies: Local Plan and Core Strategy

Potential to support masterplanning for climate change by:

- identifying the best locations for development
- setting a strategy for enhancing public transport
- establishing a green infrastructure strategy
- promoting renewable energy generation and distribution
- promoting sustainable management of water resources
- ensuring a mix of development to support low carbon lifestyles



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The local plan, and in particular the core strategy, is an important tool for local planning authorities to tackle climate change. It is particularly valuable because it has a long term perspective, integrates social, environmental and economic issues, is democratic and widely consulted on, and requires testing and resolution of conflicting interests.

Some of the ways local authorities can proactively address climate change adaptation and mitigation through their Local Plans and Core Strategies include:

Location – ensuring development takes place close to employment, with access to public transport, facilities including schools, shops, healthcare – all of which are needed to allow people to live low carbon lifestyles.

Public transport strategies – to enable new development to encourage people to walk, cycle and use public transport rather than drive

Green infrastructure – can help address urban heat island, allow rainwater infiltration, avoid flooding, and even contribute to local food production

Renewable energy generation – a local authority wide strategy is needed to identify the best sites for energy generation, whether through waste incineration, CHP or wind.

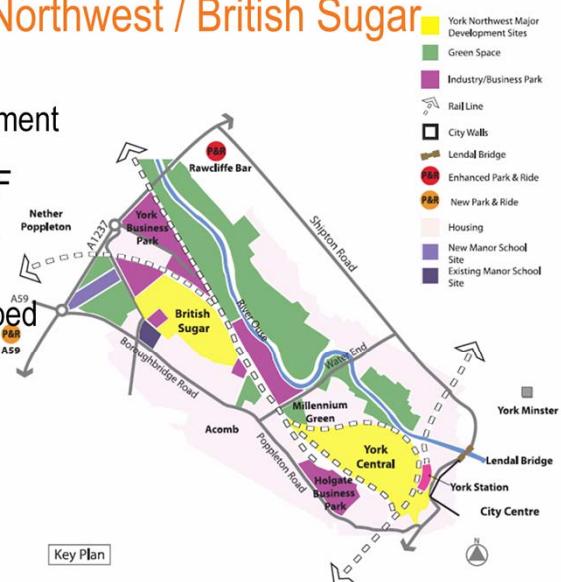
Energy distribution – can identify potential synergies between different developments, perhaps locating new housing adjacent to a retail development, could allow heat

produced generating energy for the shops to benefit nearby homes.

Water resources – might address flood control and coastal defences

## Planning policies: York Northwest / British Sugar

- Vision for an urban eco-settlement
- Development principles in LDF
- AAP Issues and options 2007
- Separate SPDs being developed
- Contaminated land
- Flooding
- Poor access



York Northwest is one of four housing sites aiming to achieve Urban Eco-Settlement status in the Leeds City Region. There is a desire at each of these sites to deliver highly sustainable housing on brownfield land; making the most of sustainable locations, with access to new and existing jobs and services.

York Northwest is made up of two sites: British Sugar and York Central, which are being dealt with through separate planning documents, because of their timescales for development are likely to be quite different.

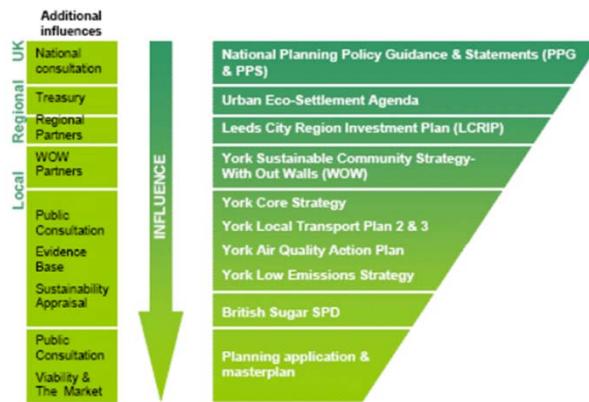
York are in the process of developing planning policies that set a clear brief for future masterplanning work, with high level principles for the site in the LDF, and more detailed site specific policies. Initially in 2007 a single AAP was proposed, and then separate SPDs because the timescales for development of the two sites are likely to be very different. York are now looking again at the AAP route – but however the policies are finally structured, the climate change principles developed by York are likely to still apply.

Before the full development potential of the area can be achieved, however, there are a number of constraints, such as contaminated land, the risk of flooding and poor access, which will have to be overcome.

The following slides quote from a draft SPD for the British Sugar site, which illustrates how local planning policies can set the agenda for climate change mitigation and

adaptation at a masterplan scale.

## Planning policies: British Sugar Site, York



Consultation Draft Former Manor School / British Sugar SPD (City of York, 2010, p 14, fig 5)



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Policy Flowchart taken from the Former Manor School / British Sugar Supplementary Planning Document (City of York, 2010, page 14)

Clearly some of this is now out of date with NPPF now at the top.

## Planning policies: British Sugar Site, York

Development principles that would influence masterplanning include:

"To maximise integration, connectivity and accessibility to and from the site giving priority to sustainable travel "

"To deliver new development within a framework of linked multifunctional green infrastructure"

"To ensure that social infrastructure requirements of the new community are met through provision of integrated facilities"

Consultation Draft Former Manor School / British Sugar SPD (City of York, 2010, p 15, fig 6)



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An example of this is York's LDF where a section on the British Sugar Site, sets out aspirations for this to become an Urban Eco-Settlement.

This is a site where development of around 1300 homes, together with open space and community facilities is proposed.

Development principles are set out in the LDF, which provide a clear brief for the future development of the site, in terms of climate change goals.

Examples above.

## Planning policies: British Sugar Site, York

### Research base for planning policy

"The council has undertaken a number of city-wide studies to support the LDF that are of relevance to York Northwest. These cover issues such as housing, employment, retail, flood risk, green infrastructure, open space and renewable energy. In addition, the council and stakeholders have undertaken a significant amount of background work to explore specific site issues including transport, financial viability, open space, landscape and tree assessment, ecology, geotechnical issues and education."

Consultation Draft Former Manor School / British Sugar SPD (City of York, 2010, p 16, para 3.5)



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In addition to setting an aspirational vision for the future of the York Northwest sites through development principles, the LDF also refers to the research base, commissioned by York to support development of the site.

This provides the technical assessments of required to develop a strong approach to climate change adaptation and mitigation.

## Planning policies: British Sugar Site, York

- British Sugar – Draft Supplementary Planning Document (Dec 2010)

### Integration, connectivity and accessibility

“An approach to transport movement should be developed to facilitate pedestrian, cycling, public transport and vehicular movements to and from the site. This approach will need to take account of the need to prioritise provision of sustainable routes in line with the hierarchy of users”

“The work should be informed by detailed assessment of where future residents are likely to travel to and from.”

Consultation Draft Former Manor School / British Sugar SPD (City of York, 2010, p 49, para 7.8)



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The British Sugar SPD, which gives very clear guidance about the priority that must be given to integration, connectivity and accessibility.

It provides a strong vision for development, that sets the agenda for a masterplanning approach to climate change adaptation and mitigation.

This can be illustrated through some extracts from the SPD – here dealing with movement networks.

## Planning policy: York's hierarchy of transport users

- 1) Pedestrians
- 2) People with mobility problems
- 3) Cyclists
- 4) Public transport users (including rail, bus, taxi, coach & water)
- 5) Powered two wheelers
- 6) Commercial/business users (including deliveries & HGVs)
- 7) Car borne shoppers and visitors
- 8) Car borne commuters



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The SPD refers to York's transport plan, which reinforces the policy argument for low carbon forms of movement and transport.

## Planning policies: British Sugar Site, York

- British Sugar – Draft Supplementary Planning Document (Dec 2010)

### Green infrastructure

"A Green Infrastructure Strategy should show how open space should be configured within the site so as to form a green spine and fingers which also incorporates green routes, sustainable transport links, access to key facilities and blue infrastructure including Sustainable Urban Drainage Solutions (SUDS) where appropriate."

"Trees have an important amenity function as well as acting as carbon and water sinks, and providing an important habitat for wildlife."

Consultation Draft Former Manor School / British Sugar SPD (City of York, 2010, p 43, para 6.29)



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Here an extract on green infrastructure makes the role this has to play in addressing climate change clear.

It also paints a picture of a place that's likely to be a joy to live in.

## Planning policies: British Sugar Site, York

- British Sugar – Draft Supplementary Planning Document (Dec 2010)

### Social infrastructure

“Social infrastructure such as education and healthcare facilities provide crucial day-to-day services...It is important that these new services are not only provided at an appropriate level and time to meet both the immediate and long-term needs of the community, but that they are also constructed, occupied and accessed in a sustainable manner, together forming a vibrant community hub which is integrated with other social facilities/ sustainable transport provision and acts as a focus for social activity within the development.”

Consultation Draft Former Manor School / British Sugar SPD (City of York, 2010, p 26, para 5.22)



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In this extract from the SPD on social infrastructure, again there is a very clear steer about the facilities which are an essential part of day to day life and should be integral to the development.

This is fundamental to York's vision for creating a place that is not a dormitory, but a new neighbourhood. By thinking about the activities of day to day life, the SPD points towards a development where people are not car or even public transport dependant.

Huge potential saving of carbon emissions for a new place where 3,000 people may live.

## Planning policies: Woking

### Climate change good practice guides

- 1: Location and transport
- 2: Site layout and design
- 3: Energy
- 4: Sustainable drainage (suds)
- 5: Water conservation and recycling



Going into even further detail than an SPD, Woking have produced a series of climate change good practice guides, which have relevance to all sorts of development, but particularly to masterplans.

These guides are organised thematically, and can be used to set the agenda for conversations with scheme promoters at during pre-application negotiations. They also act as an aide memoire or crib sheet for designers, to test their own thinking.

## Planning policies: Woking

- Location close to travel destinations / town centre
- Flood risk and transport
- Supporting low / zero carbon transport

**Location and Transport**

**Good Practice**

- New development should be located close to local travel destinations (such as the town centre) or where there is good access to public transport
- New development should be located away from areas liable to flooding, and should not be dependent on transport links (roads, footpaths etc) liable to flooding
- New development should include facilities to support the use of low/zero carbon fuelled vehicles, such as the charging of electric vehicles from green electricity sources and measures to reduce private car use

**Background**

Location of new development, the need to travel and climate change

Average car drivers produce over 1 tonne of CO<sub>2</sub> emissions a year, equivalent to approximately 1 ton of the household generated CO<sub>2</sub>. Nearly half of all households in the through have one or more cars. The location of new development, in respect of the need for people to travel to places of work, shops, schools and entertainment, can have a significant impact on CO<sub>2</sub> emissions. By locating new development near to public transport services it is needed, thereby reducing travel distances can be achieved. Accessing to public transport in the town has been reviewed on the basis of Woking town centre as the primary destination. Reference to the Public Transport Accessibility Model (PTAM) provides a general indication of how dependent the occupiers of a new development may be on private transport.

After Woking BID Consultation

**CLIMATE NEUTRAL DEVELOPMENT**  
A good practice guide

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Lowering Co<sub>2</sub> emissions by reducing dependence on private car travel:

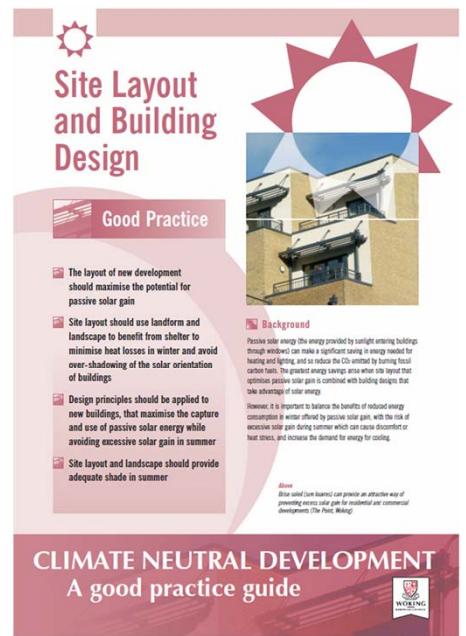
- New development should be located close to local travel destinations (such as the town centre) or where there is good access to public transport.

Enabling alternatives to fossil fuelled transport

- New development should include facilities to support the use of low carbon vehicles, such as the charging of electric vehicles from green energy sources

## Planning policies: Woking

- Passive solar energy
- Orientation
- Distance between buildings
- Landscape
- Building design



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Lowering Co2 emissions by reducing energy demands for heating and cooling

- Site layout should maximise the potential for passive solar design
- Site layout should use landform and landscape to benefit from shelter and avoid overshadowing of dwellings
- Design principles should be applied to new buildings that maximise the capture and use of passive solar energy, but avoid excessive solar gain in summer

Building in resilience to high summer temperatures

- Site layout and landscape should provide adequate shade in summer
- Building design should ensure thermal comfort in summer by using passive cooling and natural ventilation and preventing excess solar gain through techniques such as shutters, sun screens and pv shading.

## Planning policies: Woking

- Targets for reducing CO<sub>2</sub> emissions / energy consumption
- Combined Heat and Power (CHP)
- Renewable energy
- Delivery and management

**Energy**

**Good Practice**

- The energy consumed by new development should meet the target of reducing green house gas emissions to a level equivalent to 80% of CO<sub>2</sub> emissions (compared to the previous use of the land in 1990)
- Resilience to climate change should be designed into new developments by making them less dependent on grid distributed energy and fossil carbon fuels
- The energy requirements of new development should be met through sustainable energy and renewable energy generation

**Background - Climate Change and Energy**

The ways we generate and consume energy impact on the causes of climate change.

- Buildings account for most of the UK's CO<sub>2</sub> emissions. For example, dwellings alone account for 30% of UK energy consumption and 23% of the resulting CO<sub>2</sub> emissions. However, most of the CO<sub>2</sub> emissions from buildings come from the energy used to heat them. Wasted energy from power stations and the national grid in the UK is approximately double the energy consumed by transport.
- Most of the energy produced by UK centralised power generation is lost which is wasted by being converted into the atmosphere through the burning of fossil fuels, turbines, generators, transmission and distribution losses and the use of individual boilers to provide heat, wastes enough energy to heat every home in the UK. It is estimated that nearly 1 billion units of electricity is lost each year in the UK distribution networks alone.

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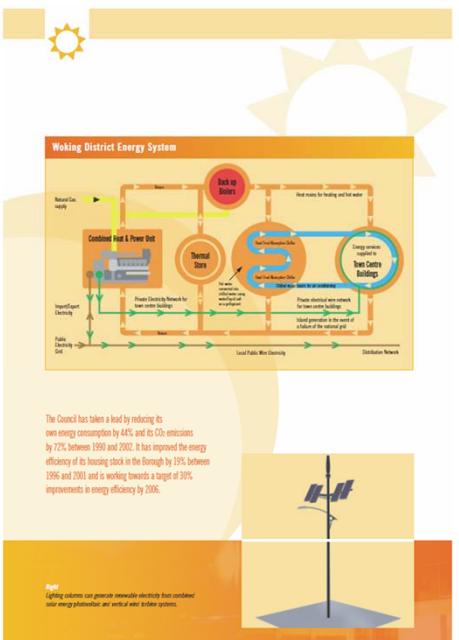
Reducing Co<sub>2</sub> emissions by building developments that use sustainable and renewable energy

- Setting targets for reductions in Co<sub>2</sub> emissions
- Resilience to climate change should be designed into new developments by making them less dependent on grid distributed energy and fossil carbon fuels

Note – whole discussion about a de-carbonised grid

- The energy requirements of a new development should be met through on site generation of sustainable and / or renewable energy

## Planning policies: Woking



### District energy system

"The Council has taken a lead by reducing its own energy consumption by 44% and its CO<sub>2</sub> emissions by 72% between 1990 and 2002. It has improved the energy efficiency of its housing stock in the Borough by 19% between 1996 and 2001 and is working towards a target of 30% improvements in energy efficiency by 2006."



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And it uses the example of its own district energy system to illustrate the benefits to energy consumption and carbon emissions.

## Planning policies: Woking

- Sustainable Urban Drainage (SUDs)
- Within the curtilage of development
- Public amenity benefits
- Wildlife conservation / biodiversity
- Storage of rainwater for re-use – irrigation or flushing WCs

**Sustainable Drainage Systems**

**Good Practice**

- New development should provide appropriate sustainable drainage systems (SuDS) for the disposal of surface water
- SuDS should be applied within the curtilage of the development site. If this is not possible, developments should contribute towards the cost of off-site SuDS
- SuDS can be designed to provide multi-use benefits, such as public amenity and wildlife improvements
- Where possible, rainwater should be stored for re-use such as irrigation or toilet flushing (see Water Conservation and Recycling)

**Background - Climate Change and Drainage**

Climate change is likely to result in more rainfall in the South East, of up to 20%, with significantly wetter winters (between 15-20% more winter rain), and an increase in frequency of severe weather. Parts of Woking are already susceptible to flooding, and over 70 properties were flooded in the 1997 Shere and Hinchliffe cummings floods, which took place in a normal year. Furthermore, predicted drier summers may also lead to an increased risk in flash flooding when sudden storms cause very rapid run-off over dry, impermeable ground.

**CLIMATE NEUTRAL DEVELOPMENT**  
A good practice guide



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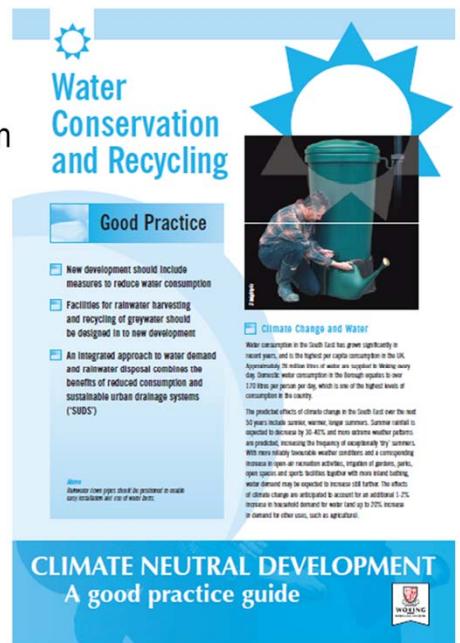
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Responding positively to predicted increases in rainfall by ensuring that

- New development should include appropriate SUDs for the disposal of surface water
- Wherever possible SUDs should be provided within the curtilage of the development
- The opportunity should be taken to develop SUDs which provide benefits such as public amenity or wildlife conservation

## Planning policies: Woking

- Measures to reduce water consumption
- Rainwater harvesting
- Recycling of greywater
- Integrated approach to water demand and rainwater disposal



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Reducing dependence on mains water in new development by providing:

- Measures to reduce water consumption
- Facilities for rainwater harvesting and recycling of grey water
- An integrated approach to water demand and rainwater disposal that combines the benefits of SUDs with reduced consumption

## Planning policies: Woking

- Applicant's checklist
- Each of the five guidance topics
- To be returned with applications
- Sets agenda pre-application



The image shows the front cover of the 'Applicants' Checklist' document. The cover is black and orange. At the top right, there is a sunburst graphic with the text: 'This checklist is to be used in conjunction with the Council's Climate Neutral Development Good Practice Note. Please complete the checklist and return it with your application form.' Below this, the title 'Applicants' Checklist' is prominently displayed. A small logo of a sun is in the top left corner. The bottom half of the cover features the text 'CLIMATE NEUTRAL DEVELOPMENT A good practice guide' and the Woking Council logo.



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The five climate change guidance sheets culminate in an applicants checklist

Questions on each of the five guidance topics – yes / no

To be returned with applications

Sets the agenda for pre-application discussions about climate change in a very helpful and accessible way

## Planning policies: group exercise

Design your own climate change checklist

to be returned with masterplan planning applications

- 1: Location and transport
- 2: Site layout and building design
- 3: Energy
- 4: Sustainable drainage (suds)
- 5: Water conservation and recycling



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## The masterplan process

- Masterplanning creates proposals for buildings, spaces, movement strategy and land use in three dimensions, together with a delivery strategy.

**Masterplanning stages** (Creating Successful Masterplans, CABE)

- Preparation for the masterplan process
- Defining the project brief
- Designing the masterplan
- Implementing the masterplan



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Having talked about some of the ways planning policies can provide the foundations for climate change issues in masterplanning, we are going to look at the masterplan process that might follow.

Masterplanning creates proposals for buildings, spaces, movement strategy and land use in three dimensions, together with a delivery strategy.

The CABE document *Creating Successful Masterplans* provides one way of defining masterplan stages.

## RIBA Work Stages

- Stage A – Appraisal
- Stage B – Design brief
- Stage C – Concept
- Stage D – Design development
- Stage E – Technical design
- F, G, H – Pre-construction
- J, K – Construction
- L – Post practical completion

### RIBA Outline Plan of Work 2007



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Another way of defining the different stages in a masterplan process is by using the RIBA work stages. Design teams often use this to describe the stage they have reached in their design process.

Stages A to E are probably most relevant to masterplanning.

## Masterplan process: Bath Western Riverside

- Feilden Clegg Bradley Architects for Crest Nicholson



As a way of illustrating the masterplan process, I am going to use the example of a scheme called Bath Western Riverside, designed by Feilden Clegg Bradley for Crest Nicholson.

7.65 hectare site to the south of the River Avon and west of Bath city centre

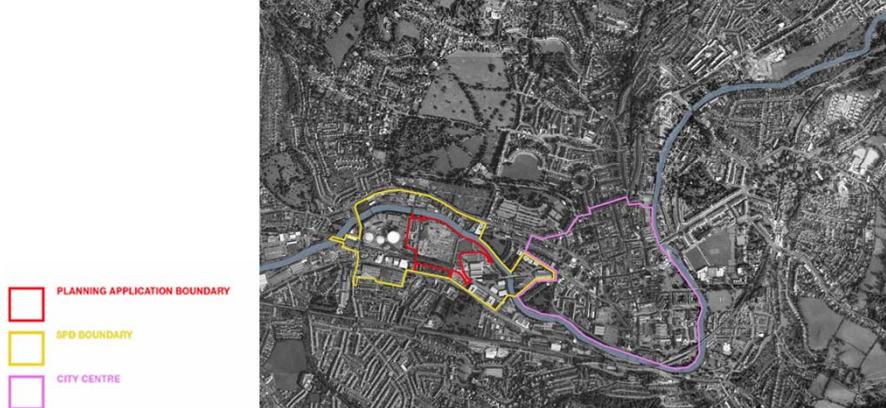
This aerial view from the south west illustrates the partially operational gas works in the foreground

and the now derelict portion of the site to the east formerly occupied by the Stothert & Pitt engineering works.

You can see the Royal Crescent in the top left corner of the photograph.

## Masterplan process: Bath Western Riverside

- Bath Western Riverside Supplementary Planning Document



Here the masterplan process is underpinned by an SPD setting out Bath and North East Somerset Council's vision for the redevelopment of the BWR site.

The SPD area is outlined in yellow.

The city centre is pink.

This describes the council's aspirations for development seamlessly knitted into the fabric of Bath, with a mix of uses for living and working, reinforcing Bath's World Heritage Status.

This places sustainability and climate change goals clearly on the agenda:

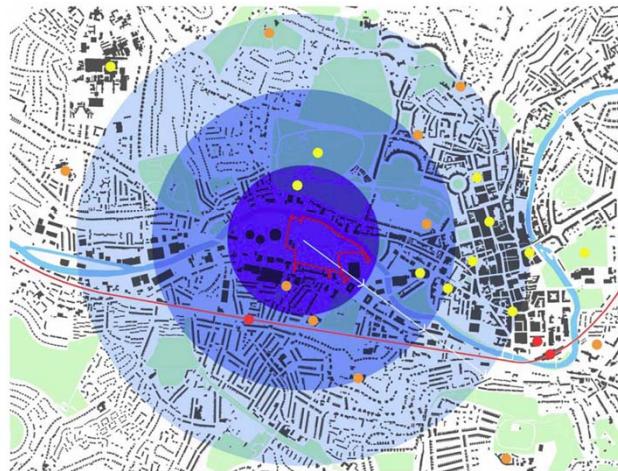
To create a beacon of sustainable development and living through the concept of 'embedded' sustainability.

Achieve a significant modal shift from the private car to public transport, cycling and walking.

Ensure that the wider Bath community benefits from the regeneration of BWR.

## Masterplan process: Bath Western Riverside

- Context appraisal



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To illustrate some of the work done by the architects during the appraisal stage, this drawing shows a context appraisal:

Red – main public transport interchanges

Yellow – hospitals, cultural buildings, amenity spaces

Orange – schools

Important information to ensure a development is well connected to its surroundings.

Approximate walking distances are indicated by the blue circles, each circle representing approximately 5 minutes or 400 metres for a typical adult walking speed (approximately 4.8 kph or 3.2 mph).

Selection of primary and secondary schools within walking distance

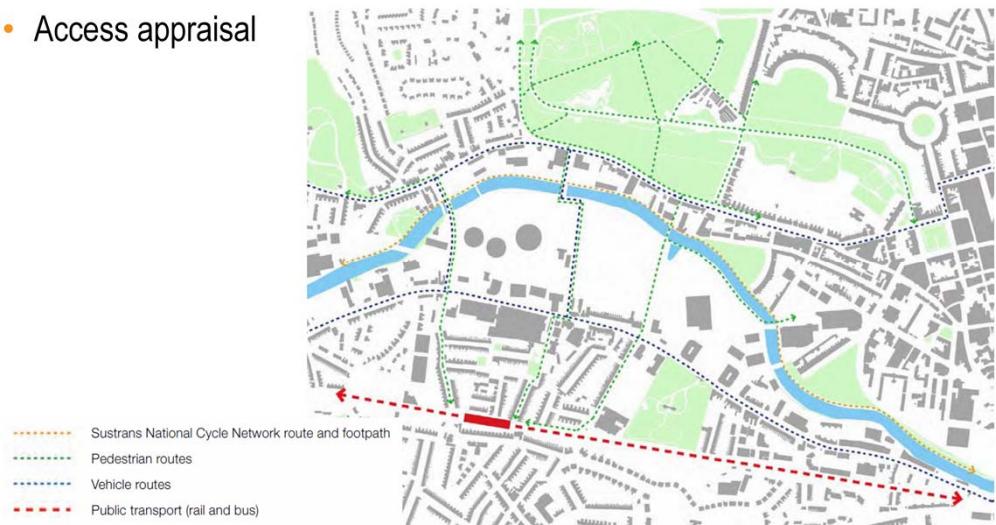
Oldfield Park Railway station is 6 – 7 mins walk from the centre of the site.

Bath Spa Central station and bus station are about 20 minutes walk.

This type of analysis is important in masterplanning to reduce carbon emissions associated with transport – by designing new places that allow people to walk, cycle or take public transport in their day to day life.

## Masterplan process: Bath Western Riverside

- Access appraisal



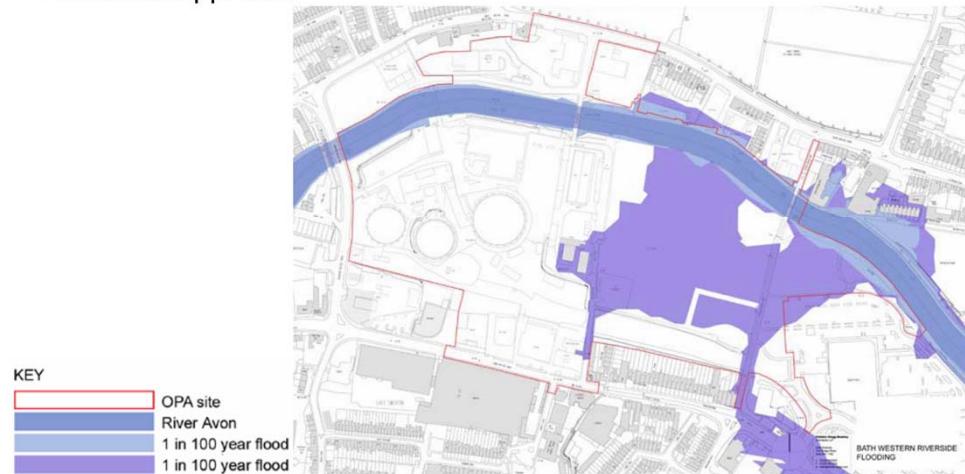
Again at the appraisal stage, the architects have looked at access to the site.

This helps demonstrate how well connected the site is in terms of public transport, walking and cycling routes

As the basis for an access strategy that minimises carbon emissions associated with transport.

## Masterplan process: Bath Western Riverside

- Flood risk appraisal

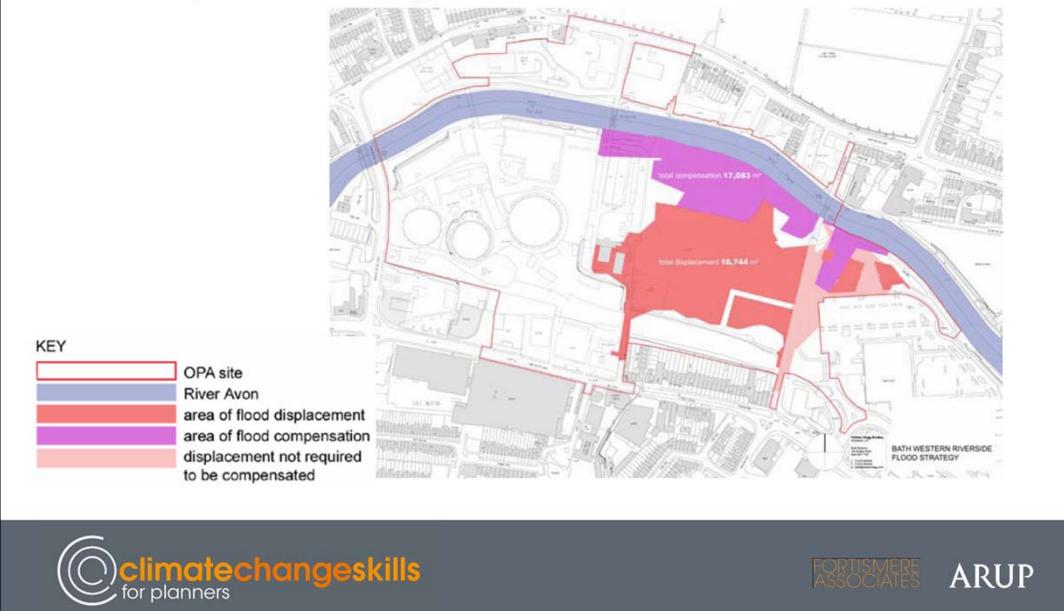


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Again, as part of the site appraisal, flood risk analysis was carried out, which shows that a large area of the site could be affected by a 1 in 100 year flood.

## Masterplan process: Bath Western Riverside

- Flood displacement strategy



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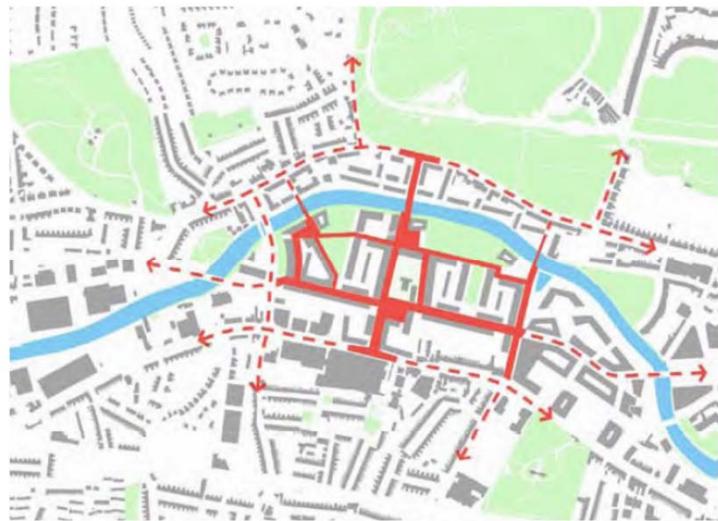
Obviously those are just a small sample of the appraisal work carried out, which very directly inform the design strategies developed by Fielden Clegg Bradley.

Here for example, is a diagram showing the flood displacement strategy for the site, raising the red area of the site, where buildings are to be constructed, and creating a lower landscaped area, that could be allowed to flood.

In this case the purple area of flood compensation becomes a riverside park – so the need to deal with flood risk provides a fantastic facility, and helps give the development a unique identity.

## Masterplan process: Bath Western Riverside

- Street pattern



Again building on the analysis of movement patterns, a strategy is developed for street patterns across the site.

This is intended to be consistent with the pattern elsewhere in the city, and to create a place where it is easy to walk around and find your way.

## Masterplan process: Bath Western Riverside

- Mixed use strategy



Lastly building on the context appraisal work, a mixed use strategy has been developed, which will be essential for the vitality of the new place.

Providing the facilities that people need for their daily lives helps reduce carbon emissions allowing people to shop, go to the gym, eat out, or take their children to nursery without getting into their cars.

## Masterplan process: Bath Western Riverside

- Energy strategy:
  - Improved u-values and air tightness
  - Low energy lighting and appliances
  - 10% renewable energy generation (biomass CHP and solar hot water)
  - Communal heating systems – CHP and shared gas boilers
  - Energy Services Company (ESCo)



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## Masterplan process: Bath Western Riverside



- Implementation plan:
- Parameter based outline planning application
- Followed by detailed applications for phased development
- ESCo to deliver energy supply
- Rapid transport system – employment and facilities in city centre
- BUT a design code could have given greater assurance

As masterplan work progresses towards a planning application, thinking carefully about implementation is essential to ensure that the strength of climate change strategies is maintained in a completed development.

At Bath Western Riverside, a parameter based outline application was submitted, followed by detailed applications for phased development. This means that at outline application stage the principles of the development were fixed – for example the amount and mix of development, the range of building heights, their footprints, street pattern, open spaces etc. This requires careful thought about what needs to be fixed at the outline stage, and measures to address climate change issues such as flooding, can be an important part of this.

An ESCo was established to deliver energy supply.

And the local authority took a lead in the delivery of a rapid transport system, giving quick access to employment and facilities in the city centre.

However, when CABE reviewed the scheme, it advised that a design code could give further assurance.

Design Codes are documents that can sit alongside outline planning applications to illustrate the way in which detailed designs should be developed. They vary enormously in content and quality – so should be used with caution, but can be valuable for masterplans that will be phased over long periods of time, particularly where development parcels are likely to be sold off to different developers. They could be used to guide detailed designs in achieving climate change objectives – for example, describing orientation for passive solar design, use of materials with low embodied energy.

## Masterplan process: Bath Western Riverside



These are recent photographs of Bath Western Riverside, now under construction, with the first phase of development complete.

Top right photo shows the retaining wall along the edge of the riverside park, which provides flood attenuation

Further reserved matters applications will be submitted for the rest of the site.  
12 – 18 years until the whole development is completed.

## Masterplanning process: group exercise

- SCENARIO 1: early meeting with the design team for a masterplan
- QUESTION 1: what other types of appraisal might you ask for that could help them develop a strong approach to climate change?
- SCENARIO 2: at a first meeting to discuss a masterplan
- QUESTION 2: what design strategies could you ask the design team to consider to achieve climate change goals?
- SCENARIO 3: for a masterplan about to be submitted for outline planning
- QUESTION 3: what planning tools / implementation strategies could help ensure that climate change aspirations are achieved.



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At each stage in the masterplanning process, the type of conversations you are likely to be involved in as planners will be slightly different. You have the potential to set the agenda, for discussion of climate change mitigation and adaptation.

In groups around your tables, I'd like you consider the questions you might ask at a consultation meeting with a masterplan design team:

Scenario 1: Imagine yourselves at an early meeting with a masterplan team, before they have put pen to paper to design a scheme. Think about what types of appraisal they should do to inform their thinking about climate change. For BWR we looked at just 3 – flood risk appraisal, access appraisal and context appraisal. What else?

Scenario 2: Imagine yourselves a first meeting to discuss a masterplan, still well before a planning application is submitted, so with time for the scheme to develop. Think about the spatial planning or technical strategies they should consider in terms of climate change. For BWR we looked at Flood mitigation strategy, street pattern, energy, and mix of uses. What else?

Scenario 3: Imagine yourselves at a meeting to discuss a masterplan that is about to be submitted for planning approval. You are supportive of the approach to climate change, but need to ensure that a planning approval secures firm commitments, so that what has been promised is delivered on the ground. Think about the planning tools you could

use to achieve this. For BWR we looked at a parameters based planning application, and the idea of using design codes. What else?

Three scenarios as above – 20 minutes – then feedback to the room as a whole.

## Masterplanning process: group exercise

A few possible answers SCENARIO 1 - appraisal

- Microclimate analysis
- Orientation and sun paths
- Carbon footprint benchmarking
- Analysis of surrounding building uses
- Ground conditions
- Heat mapping
- Air quality / noise sources



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Microclimate analysis – e.g. help decide whether need a design that addresses urban heat island effects

Orientation and sun path – e.g. inform passive solar design

Carbon footprint benchmarking – to set measurable targets for new development

Analysis of surrounding building uses – e.g. scope to create heat networks beyond site boundaries NB. EXISTING + PROPOSED

Ground conditions – e.g. whether suitable for ground source heat pump systems

Heat mapping – identifying opportunities for renewable heat by analysis of current or potential heat supplies and demands

Air quality / noise sources – may determine whether natural ventilation is possible

## Masterplanning process: group exercise

A few possible answers SCENARIO 2 – design strategies

- Construction materials – low embodied energy
- Transport – car clubs, cycle parking, bus stops, footpaths etc
- Long life loose fit design
- Earth sheltered buildings – minimise heat loss
- Green roofs / green infrastructure – address urban heat island effects
- High density development close to transport nodes
- Proximity to or provision of employment / education / retail opportunities



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## Masterplanning process: group exercise

A few possible answers SCENARIO 3 – implementation

- Ensuring planning documents set clear targets / not woolly aspirations
- Might involve legal agreements, for example relating to energy supply
- Clarity about development phasing, for example when CHP delivered
- Design Codes, especially useful where sites parcelled up
- Codes can also deal with materials, orientation, micro-generation etc
- Section 106 / CIL – for example subsidy of car club / bus service / upgrading energy efficiency of neighbouring homes



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## Technical assessments: Arup

### Decentralised & Low Carbon Energy:

- Drivers
- Opportunity identification
- Technical/Impact assessments
- District heating networks
- Delivery Partner procurement



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2. Methods and tools for identification
3. Methods and tools for assessing opportunities
4. Introduction to DH network layouts and phasing
5. Outline of scheme delivery options and partner procurement

## Decentralised & Low Carbon Energy



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1. Low Carbon – the goal, decentralised energy – the method of delivery

## Decentralised & Low Carbon Energy: Drivers

### Moving carbon up the masterplanning agenda:

- Increasing requirement for developments to reduce carbon
- Masterplanning stage key to 'designing in' measures to deliver reductions
- Infrastructure playing an increasing important role
- Technical analyses now accompanied by (detailed) commercial appraisals and carbon economics calculations



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1. Incremental tightening of UK Building Regulations requirements for reductions in non-residential building carbon emissions
1. Code for Sustainable Homes (CfSH) driving for similar trajectory in residential buildings
2. Increasing emphasis falling on low-carbon decentralised energy generation, to (primarily) displace consumption of grid-electricity
2. Self-generation requires early consideration to enable suitable site integration
3. DE and District heating a proven method of facilitating generation and distribution of lower carbon heat
3. Related infrastructure fundamentally 'fuel agnostic' and provides future-proofing for future lower/zero-carbon generation
4. Commercial appraisal and modelling increasingly sophisticated to account for all fuel purchase, energy generation and related sales

## Decentralised & Low Carbon Energy: Identification

### DECC National Heat Map:

- Tool to help identification of opportunity
- Heat density is mapped in 4 categories:
  1. Public Buildings
  2. Commercial
  3. Industrial
  4. Residential
- Existing CHP Installations and Thermal Power stations shown
- Reporting for selected areas



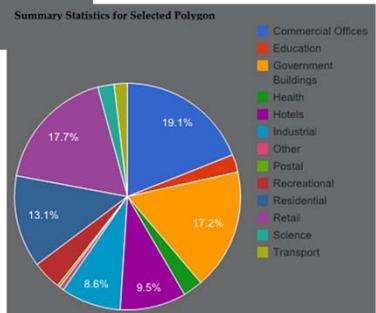
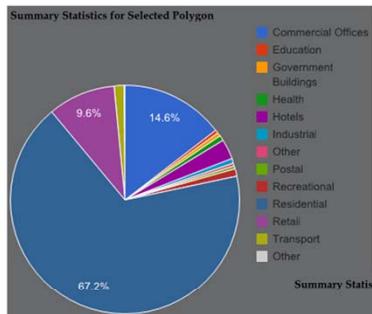
(not covering in detail as covered in previous Module)

1. Displays heat density in terms of kWh consumed per m<sup>2</sup> per year
2. Different categories recognise differing profiles of demand relative to consumption
4. Area can be selected by radius or bespoke polygon

## Decentralised & Low Carbon Energy: Identification

### DECC National Heat Map:

Sector	Heat Demand (kWh)	Number of Addresses	Heat Density (kWh/m <sup>2</sup> )
Commercial Offices	42,400,000	1,200	26.1
Education	5,450,000	35	3.36
Government Buildings	38,200,000	45	23.5
Health	6,410,000	56	3.94
Hotels	21,000,000	234	12.9
Industrial	19,000,000	62	11.7
Other	1,510,000	31	0.930
Postal	793,000	29	0.488
Recreational	9,280,000	94	5.71
Residential	29,200,000	5,531	18.0
Retail	39,500,000	787	24.3
Science	5,460,000	6	3.36
Transport	4,120,000	117	2.54
<b>Total</b>	<b>222,000,000</b>	<b>8,227</b>	<b>137</b>



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- Greater detail and sector type available via area reporting
- Similar considerations as for new/emerging schemes

## Decentralised & Low Carbon Energy: Assessment

DECC guidance on “Valuation of energy use and greenhouse gas emissions for appraisal and evaluation” October 2011:

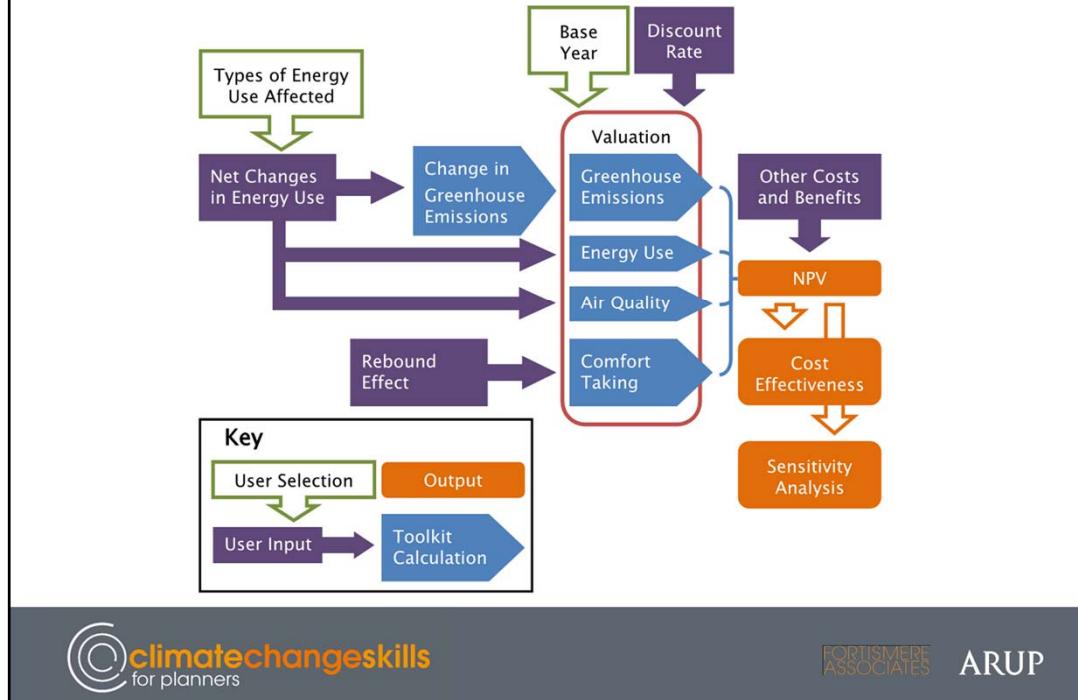
- Assessment of proposals leading to changes in GHG emissions
- Covers proposals with both a direct impact of energy use & supply AND indirect impacts through planning, construction and land use change
- Methodology document and accompanying spreadsheet tool
- Assessments are against notional ‘do nothing’ and ‘do minimum’ options
- Output values (£): changes in energy use, emissions & air quality impacts



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1. Intended to help in assessment of proposals leading to a reduction (or increase) in energy use or GHG emissions

## Decentralised & Low Carbon Energy: Assessment



Graphic displays related toolkit model processes

## Decentralised & Low Carbon Energy: Assessment

### Environmental Impact Assessments (EIA):

- EIA's aim to identify and quantify effects of new developments / projects
- Spatial scope determined by applicant and lead assessor
- Most assessments focussed on direct site-attributable effects
- Assessment follows '*Identification – Quantification – Mitigation*' hierarchy for all perceived impacts
- Production includes a non-technical summary (EIS) intended for public viewing and understanding



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2. / 3. Continuing point of discussion regarding true boundaries of indirect impacts for larger projects (e.g. Airports)
4. Impacts deemed 'significant' to be described, with definitions varying a matrix approach is often used

## Decentralised & Low Carbon Energy: Assessment

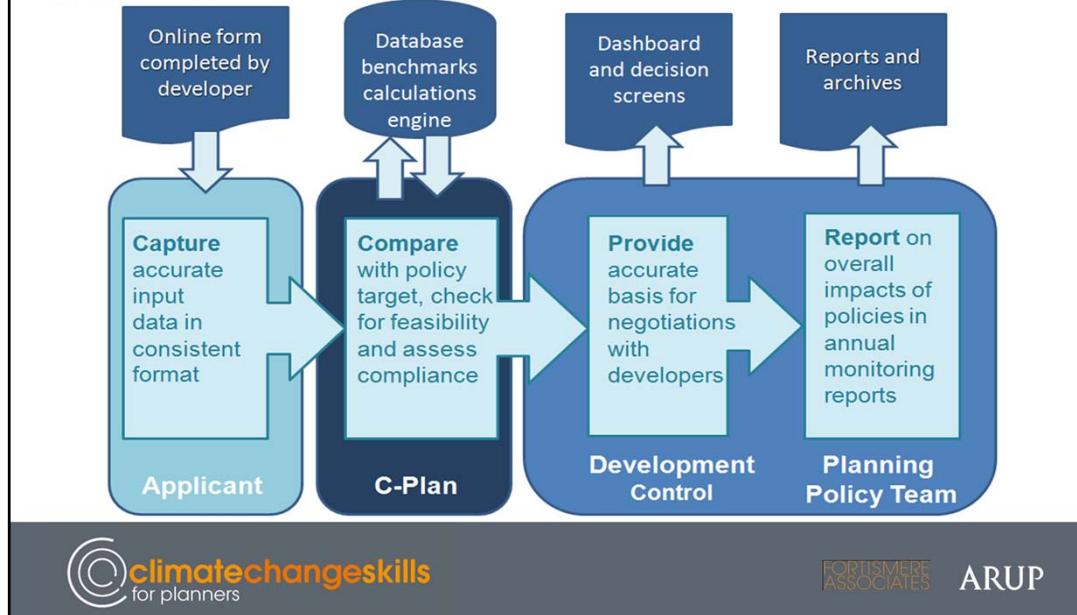
### CPLAN Carbon Impact Assessment:

- Developed by ECSC with London South Bank University
- Designed specifically to assess planning compliance
- Prototyped with local authority planners in 2008
- CPLAN Briefing Note and Presentation part of hand-outs



## Decentralised & Low Carbon Energy: Assessment

### CPLAN Process



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## Decentralised & Low Carbon Energy: Assessment

### Energy Statements:

- Normally required for developments featuring residential units or comprising a built floor area of 100 m<sup>2</sup> or more
- Presents energy demand and CO<sub>2</sub> emissions of the site / project
- Shows how both have been reduced via:
  1. 'Using less energy'
  2. 'Using renewable energy'
  3. 'Supplying energy efficiently'



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3. Common hierarchy around reducing demand first then meeting what is left efficiently and via low carbon means

## Decentralised & Low Carbon Energy: Assessment

### Energy Statements:

- Commonly required information:
  1. Baseline energy consumption
  2. Baseline CO<sub>2</sub> emissions
  3. Effects of energy efficiency measures
  4. Reductions achieved via efficient energy supply
  5. CO<sub>2</sub> reductions via renewable energy technologies
- Next Steps
  - a) Advice at Outline Planning Application stage
  - b) Provision of evidence for Detailed Planning



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1. Using SAP or SBEM methodology
2. Based on gas and grid electricity use
3. Normally through construction design elements such as building fabric, windows etc
4. Includes use of CHP and / or district heating
5. Comprised (chiefly) building-integrated technology use
  - a. Outline steps including more detailed energy assessment at detailed design stage
  - b. Also evidence for any Section 106 agreement

## Decentralised & Low Carbon Energy: District Heating

### Distribution Networks

- Heat distribution networks represent largest cost item of DH schemes
- Pipework routing can seek to use common services trenching
- Early route optimisation advisable
- Route a function of loads to be connected and point of generation



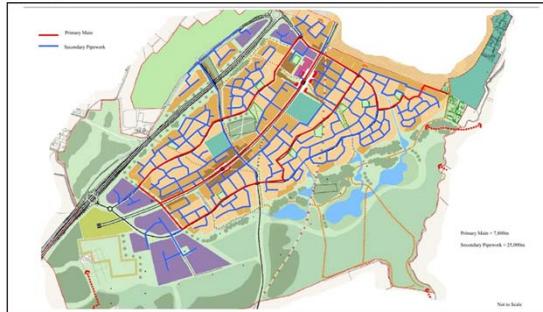
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1. With very few exceptions – pipework and trenching costs often 50%+ of total scheme
2. With physical trenching for pipework representing a major element of network costs (especially in developed / urban areas), common services routing can seek to save on additional trench works

## Decentralised & Low Carbon Energy: District Heating

### Network Phasing

- DH networks sometimes phased in line with developments
- Prior appreciation of ultimate scheme extents and scale required
- Typically comprises primary and secondary pipework



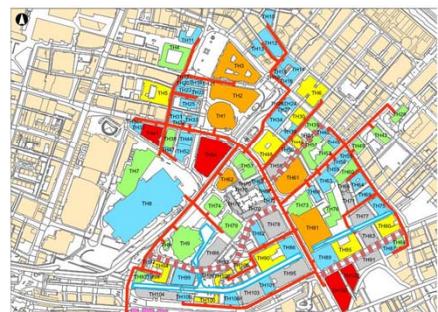
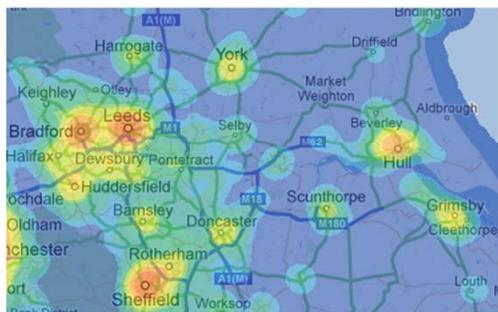
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1. Network construction feature high initial capital investment
2. Initially installed pipework must have diameter and according capacity for final scheme
3. Similar to electrical distribution, primary 'transmission' pipework will be larger diameter (and sometimes higher temperatures), with smaller local pipework connecting to buildings, hydraulically separated via heat exchangers

# Decentralised & Low Carbon Energy: District Heating

## Development Layout

- Heat density a metric for DH



- Clear link to achieving network efficiency and cost savings
- Energy centre location a key element



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1. Heat density a defining factor in suitability to district heating
2. Minimising of distribution pipework desirable
3. Largest diameter pipework (and therefore trenching) at point of generation and distribution

## Decentralised & Low Carbon Energy: Delivery Partners

### Engagement:

- Typically after 'Feasibility Stage' work for projects
- 'Soft Market Testing'
  1. Brief introduction
  2. High level information
  3. Outline technical and outcomes
- More formal issue of a Prior Information Notice (PIN)



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1. Opportunities first identified (possibly via heat mapping) and sufficient detail gathered/provided to facilitate a feasibility study which will feature technical outputs (maximum energy demands and possible plant capacities), less likely commercial outputs
2. Soft Market Testing involves the provision of a brief project/scheme briefing paper describing the opportunity and outlining initial conclusions & outputs of feasibility study
3. PIN a well understood process to publicise upcoming tendering of project

## Decentralised & Low Carbon Energy: Delivery Partners

### Contract Delivery Options:

#### 1. Third Party

- Utilising traditional contract procurement method
- Flexible and simple to implement
- Suitable for most partnership approaches

#### 2. Wholly-owned Subsidiary or 'Special Purpose' Vehicle (SPV)

- High level of LA control
- Council responsible for securing finance
- No transfer of risk
- Consideration around State Aid
- Vehicle must be appropriate for life of venture



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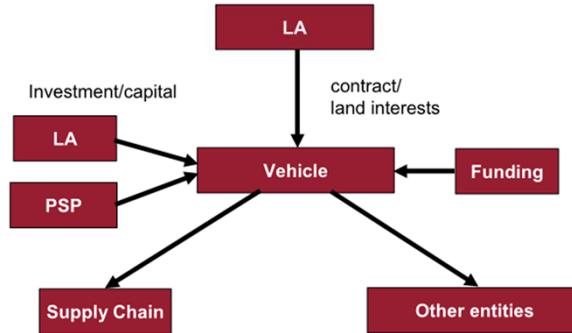
2. iv if assets/land/finance are transferred from Council to Subsidiary
- v) vehicle structure cannot be 'swapped' without significant transaction costs and commercial & taxation impact [source is HM Treasury Joint Venture Guidance 2010]

## Decentralised & Low Carbon Energy: Delivery Partners

### Contract Delivery Options:

#### 3. Joint Venture

- Requirement that interests are aligned
- Sharing of risk (*NOT* transfer)



3. i) alignment tested via business case development and competitive procurement
- ii) suitable when a JV structure offers better scope to manage and mitigate risks

## Adaptation & mitigation strategies: Queen Elizabeth Olympic Park



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It would be impossible to give a talk about masterplanning for climate change without mentioning the Olympic Park, which could be seen as a test bed for solutions to this challenge in the UK. It is also a great example to look at because it is so recently completed, so provides an absolutely contemporary illustration of the challenges and opportunities.

It pioneers techniques for almost every area of masterplanning for climate change - not all of which may be applicable to more modest projects – there is likely to be some element to inspire almost every scheme.

## Adaptation & mitigation strategies: Queen Elizabeth Olympic Park

- Carbon Footprinting
- Demolition and reclamation
- District heat and power
- Carbon reduction schemes
- BREEAM and Code for Sustainable Homes
- Sustainable Drainage Systems and Flood Mitigation
- Black water recycling
- Drought resistant planting

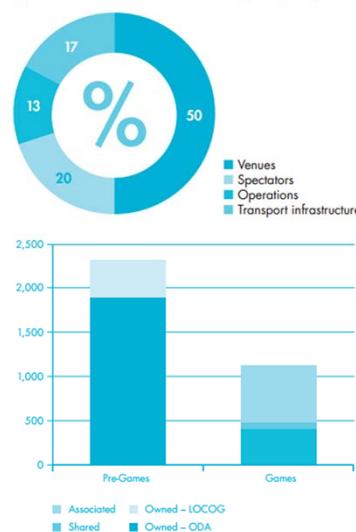


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## Adaptation & mitigation strategies: Queen Elizabeth Olympic Park

- Carbon Footprint
  - London 2012 reference footprint
- Estimated to be 3.4 million tonnes of carbon dioxide equivalents
- 50% venue construction
- 20% spectators
- 13% operations
- 17% transport infrastructure

Figure R1: Total London 2012 reference footprint by component [in ktCO<sub>2</sub>e]



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One of London 2012's most significant achievements has been to attempt to quantify its environmental impacts. In terms of climate change mitigation, and one of the ways this has been done is by measuring its carbon footprint.

A carbon footprint for a masterplan is its total impact on greenhouse gasses that contribute to global warming.

In the original London 2012 bid, a commitment was made to deliver a 'low carbon Games'. To define performance against this aspiration meant that Games-related emissions needed to be measured and understood. This process could apply equally to any masterplan.

London 2012's carbon footprint was estimated at 3.4 million tonnes of carbon dioxide equivalents. Most is generated pre-Games: 50% from venue construction and 17% from transport infrastructure. The study demystified many preconceptions about Olympic and Paralympic Games, particularly by showing the relatively smaller role played by spectator air travel. This demonstrated that reducing carbon emissions associated with the construction of venues could have a dramatic effect on the overall carbon footprint for the Games.

As a result of this research work, the Olympic Delivery Authority set itself a target of achieving a 50% reduction in carbon emissions for the built environment by 2013

(against 2006 Building Regulations).

## Adaptation & mitigation strategies: Queen Elizabeth Olympic Park

- Demolition and reclamation



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The Olympic Delivery Authority set itself a challenging target that 90% by weight of demolition material from the site should be reused or recycled. This is relevant to masterplanning for climate change mitigation, because of the potentially very significant savings in the embodied energy of construction materials.

This had important implications for the way in which existing buildings could be demolished or dismantled. If materials were to be reclaimed they had to be carefully dismantled, inventoried and securely stockpiled. Overall a figure of 98.5% was achieved – however the majority of this was through recycling rather than re-use.

BioRegional documented the dismantling process, working with demolition contractors and reclamation specialists to survey stockpiled materials and communicate to design teams what was available.

Recycling included the cleaning and reuse hundreds of thousands of tonnes of soil which would otherwise have to be transported off site. An on-site ‘soil hospital’ produced clean material which has been used in the creation of the correct land levels, foundations and parklands.

One lesson learned is that recycling is cheaper and easier for contractors than re-use. The only way of ensuring that re-use takes place would be to have specific targets for reclamation, recycling and re-use.

## Adaptation & mitigation strategies: Queen Elizabeth Olympic Park

- District Heat and Power



An Energy Centre houses a Combined Cooling Heat & Power (CCHP) plant that provides both electricity and district heating to the Olympic Park. The district heating reduces the operational carbon emissions of the Olympic Park and its venues by approximately 20% compared with a conventional approach of individual plant rooms.

At the stage when the Olympic Park was being planned, there were very few precedents for district heating – Woking and Sheffield being notable exceptions. The cleared 2.5 square kilometre site of the Olympic Park, with its mix of venues, and residential development offered an opportunity to test the market for private investment in district heating. There was also an opportunity to tie this into the Westfield shopping centre development at Stratford City.

The Olympic Delivery Authority tendered the district heating contract in 2007 and it was awarded to Cofely, a subsidiary of GDF-Suez Energy Services for a 40 year concession to supply the Olympic Park.

The district heating system represents an approximately £100 million investment, supplies the Olympic Park Venues, the Olympic and Paralympic Village, and the Westfield site via two interconnected energy centres.

The CCHP engines are fuelled by natural gas, which is converted into electricity and hot and cooled water, distributed via a 40km network of pipes.

Both energy centres include several vacant bays that could accommodate additional plant as post Games development increases demand, or alternative technologies or lower carbon fuel sources become available.

## Adaptation & mitigation strategies: Queen Elizabeth Olympic Park

- Carbon reduction schemes



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A proposal for a permanent 120m high wind turbine on the Olympic Park was granted planning permission in September 2007. This was to be located at Eton Manor, to the north of the Park, where it was far enough from any housing, and its shadow would not be cast over any sporting venues.

However as design work progressed, there were concerns following UK incidents of a turbine blade falling off, and ice throw from a wind turbine. In addition, changes to the EU Machinery Directive made the proposed lift inside the turbine non-compliant. Because of this, and the fixed timescale for the project, the supplier withdrew, and none of the other previously shortlisted suppliers were willing to replace them.

The cancellation of the turbine forced the Olympic Delivery Authority to re-examine its commitment to achieve 20% renewable energy. To make up the shortfall, the ODA has invested £1.7 million in carbon reduction schemes in the four host Boroughs adjacent to the Park – improving the energy efficiency of homes and schools.

This budget will allow improvements to be made to 12 local schools, and approximately 2,800 homes. The scheme will focus on simple measures such as installing low energy light-bulbs and shower timers, hot water tank insulation and draught proofing, as well as loft and cavity wall insulation where appropriate.

This may be less iconic than a wind turbine, but brings tangible benefits to the communities living around the Olympic Park.

This approach also has the very important advantage of providing a means of addressing fuel poverty in existing communities around a masterplan area – it seems to me that planning policies which require a similar approach for masterplans elsewhere could be a very powerful way of addressing fuel poverty.

## Adaptation & mitigation strategies: Queen Elizabeth Olympic Park

- BREEAM and Code for Sustainable Homes



BREEAM and Code for Sustainable Homes provide another method of setting targets for buildings within a masterplan, or quantifying their performance against climate change goals.

The Olympic Delivery Authority stipulated that permanent venues should achieve BREEAM excellent, and the Olympic Village should achieve Code for Sustainable Homes Level 4. The elegant form of the Velodrome in the picture results from a building envelope 'shrink wrapped' around the cycling track, to minimise the internal volume that needs to be air conditioned.

Some local authorities also set more detailed targets for specific categories within BREEAM or Code for Sustainable Homes Assessments.

For example Camden's LDF requires BREEAM ratings of 'very good' or 'excellent' as well as at least 60% of the credits in Energy and Water and 40% of the credits in Materials.

## Adaptation & mitigation strategies: Queen Elizabeth Olympic Park

- Sustainable Drainage Systems and Flood Mitigation



The movement and treatment of water is fundamental to the Olympic Park's design. LDA and Hargreaves, the landscape architects for the Park's concept was for an absorbent landscape that could resist flooding. Their design includes wetlands that slow water absorption, and clean rainwater runoff.

Key objectives were to resolve problems of sewage effluent flowing onto the site from the Thames during high tides, and to mitigate potential flooding in communities to the north.

## Adaptation & mitigation strategies: Queen Elizabeth Olympic Park

- Black Water Recycling



Water for irrigation of the Olympic Park and flushing WCs in legacy venues is provided by the Old Ford Black Water Recycling Plant. The building has been designed by John Lyall Architects, and funded jointly by the ODA and Thames Water.

It is a pilot research project, and takes sewage from the Northern Outfall Sewer crossing the Olympic Park, and cleans it through a multi step process. This reduces overall drinking water demand by approximately 40%.

## Adaptation & mitigation strategies: Queen Elizabeth Olympic Park

- Drought resistant planting

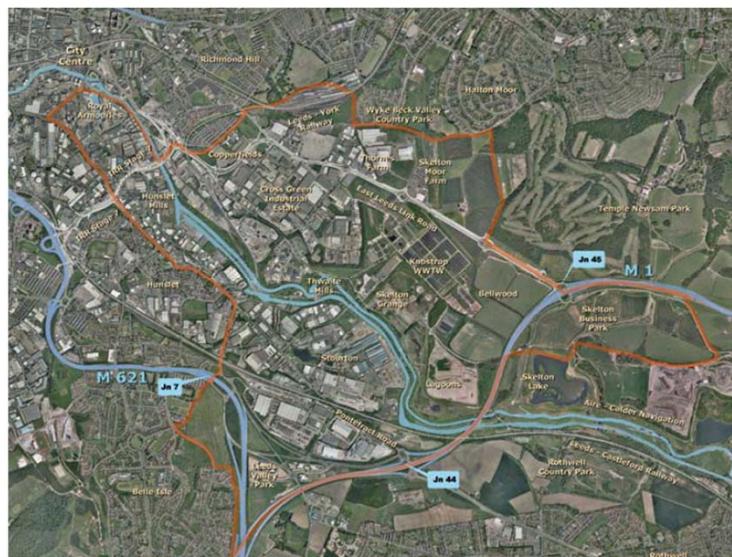


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Drought resistant trees and plants have been specified in anticipation of higher temperatures and reduced water conditions due to climate change. Wildflower meadows planted with annuals to peak during the Olympic and Paralympic Games will be replaced with perennial meadows.

## Adaptation and mitigation strategies: Leeds Aire Valley



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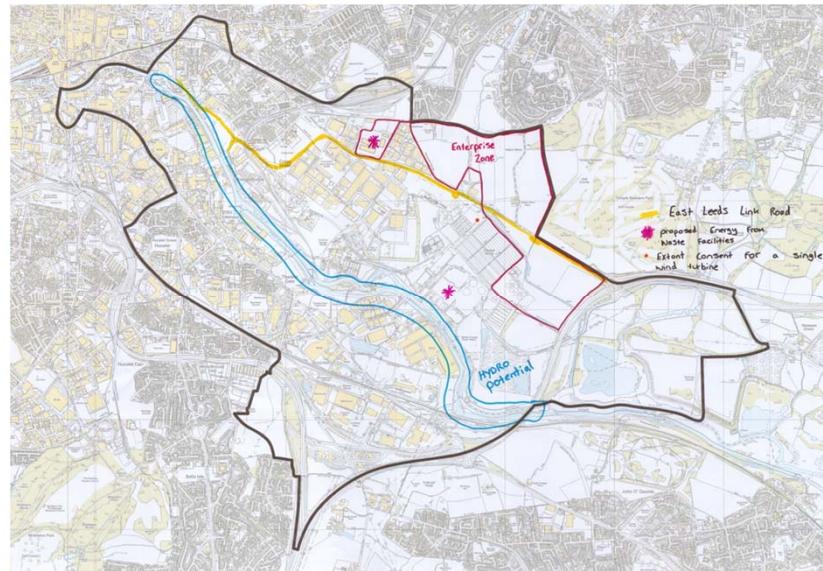
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Final group exercise: using the example of the Leeds Aire Valley as a basis for brainstorming ideas for climate change mitigation and adaptation.

### Some Information on Aire Valley

- 400 hectare site (400 football pitches)
- Between the city centre and the M1 motorway and beyond
- Leeds – Castleford railway to the south
- River Aire
- Temple Newsom park to the NE
- Wyke Beck Valley Country Park to the N
- Rothwell Country Park to the SE
  
- Leeds City Council is producing an area action plan for the Aire Valley.
  
- This promotes a mix of residential and commercial use. Up to 15,000 new homes.
  
- The Aire Valley is also identified as an Urban Eco Settlement (along with a number of other sites in Leeds City Region), which was developed as a Leeds City Region response to the Eco Town proposals. The sites were well-positioned brownfield sites that had the potential to deliver sustainable growth.

## Adaptation and mitigation strategies: Leeds Aire Valley



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Arup did some work looking at the potential sustainable credentials of the Aire Valley in 2009, and to help you with the group exercise, they have prepared a briefing note, and provided a marked up plan.

- There is a large Waste Water Treatment Works called Knostrop, which is in the middle of the Aire Valley. There are no plans for this site to be moved and Yorkshire Water plan to continue to operate from the site.
- The vacant parts of the Aire valley that are not being considered for housing are part of an Enterprise Zone. This is made up of four sites (which are identified on the map).
- There is an extant consent for a single wind turbine by the Knostrop WwTW site, which is likely to be constructed next year.
- The East Leeds Link Road runs through the site providing connectivity to the city centre and directly to the M1. Whilst this is beneficial it also segregates the area from the community to the north.
- Flood risk is an issue, but Leeds City Council and the Environment Agency have designed a Flood Alleviation Scheme that covers much of the Aire Valley.
- The Council's Core Strategy considers the potential for hydro power along the river.
- There are two energy from waste facilities, currently going through planning system. The first is on a large site off the A63 at Newmarket Lane (and would take municipal and commercial waste). The second would process only commercial waste and is located near the river (see map).

## Adaptation and mitigation strategies: Group exercise

**Leeds Aire Valley** - on the site plan provided, please mark up:

1. Connections into the site: vehicles; buses; cyclists; pedestrians
2. Neighbourhood centre: primary school; doctor's surgery; shops etc
3. Green infrastructure: parks; allotments etc
4. Energy: orientation; energy centre; waste heat sources
5. Water: flood displacement; sustainable urban drainage (SUDs)

For each of the above, think about the implications for planning process:

- Public consultation / CPO / design codes / CIL



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Thinking back to the example of Bath Western Riverside, as well as the technical strategies for the Olympic Park, we would like you to use the example of the Leeds Aire Valley to brainstorm ideas for climate change adaptation and mitigation.

Using the coloured marker pens provided, diagrammatically, mark up the drawing to show some first thoughts about:

Connections that allow people to walk, cycle and use public transport – as well as making sure that existing communities benefit from new facilities on the site.

Where a neighbourhood centre might be located – again thinking about the benefit to people outside the red line boundary of the site. What mix of uses do you think might be needed.

Public space – where might this be located, and what might it consist of to achieve climate change goals.

Energy – think about orientation and how that might influence building layout for passive solar design, is there a location that might be appropriate for a CCHP plant

Water – if there is a flood risk how might you deal with that, how might you

accommodate SUDs, can it be part of a landscape strategy.

For each of the above, think about the implications for planning process:

Public consultation / CPO / design codes /S106 agreements

## Conclusion: the role of planners

- Strategic decisions about location
- Planning and delivery of infrastructure projects
- Finding beneficial links between different developments
- Ensuring new development benefits existing communities
- Brokering agreements, e.g. on energy supply
- Setting priorities in negotiations with developers



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What I have tried to show today, is the potential for planners to be influential at each stage of the masterplanning process, in helping achieve climate change mitigation and adaptation.

You are collectively in a unique position of being able to guide:

Strategic decisions about development location

Take leadership in the planning and delivery of infrastructure projects

Finding the beneficial links between different developments

Ensuring that new development benefits existing communities

Brokering agreements, for example on energy supply

Setting priorities for masterplanning in negotiation with developers

I hope I've also given you confidence that you don't have to be technical expert to push thinking on climate change forward. Very often, your role is to ask the right questions. There's also a huge amount of information available to help, some of which are listed on the next slide.

## Web resources / publications

- CABE Sustainable Places web site [www.cabe.org.uk/sustainable-places](http://www.cabe.org.uk/sustainable-places)
- Creating Successful Masterplans: a guide for clients (CABE 2004) [www.cabe.org.uk](http://www.cabe.org.uk)
- RIBA Climate Change Toolkit [www.architecture.com](http://www.architecture.com)
- The Environmental Handbook [www.theenvironmentalhandbook.com](http://www.theenvironmentalhandbook.com)
- ATLAS: planning for large scale development [www.atlasplanning.com](http://www.atlasplanning.com)
- Hammarby Sjostad [www.hammarbysjostad.se/glashusett/](http://www.hammarbysjostad.se/glashusett/)
- Woking [www.woking.gov.uk/planning/service/publications](http://www.woking.gov.uk/planning/service/publications)
- London 2012 Sustainable Design (Hattie Hartman, Wiley 2012)
- Kings Cross (example of parameter based outline application with urban design guidelines) [www.kingscrosscentral.com](http://www.kingscrosscentral.com)



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Thank you: any questions?

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