13.0 CLIMATE CHANGE ASSESSMENT

13.1 Introduction

13.1.1 The elements and impacts of climate change are summarised in the February 2005 Consultation Paper 'Adapting to Climate Change: A Checklist for Development' issued by the Three Regions Climate Change Group and 'The Planning Response to Climate Change' Advise on Better Practice by the ODPM.

13.1.2 As a result of increasing atmospheric concentrations of carbon dioxide (CO_2) and other greenhouse gases from the burning of fossil fuels and other land use changes, the Earth's climate is changing and is expected to continue to change over this century and beyond.

13.2 Global Climate Change

13.2.1 Impacts to date include:

- Over the past 100 years global mean temperature has increased by 0.6 degrees Celsius and in Europe by about 1.2 degrees Celsius
- The 1990s was the warmest decade over the past 150 years (EU environ site)

13.2.2 The main impacts of climate change are:

- warmer, wetter winters;
- hotter, drier summers;
- extreme rainfall events may happen twice as often by the 2080s;
- rising sea levels;
- intensification of the urban heat island effect.

13.3 UK Climate Change

13.3.1 Climate change in the UK can be measured in records extending back over 350 years. The 1990s was the warmest decade in central England since records began in the 1660s. Other climate data show a variety of changes for the UK climate.

The growing season for plants in central England has lengthened by about one month since 1900. Heat waves have become more frequent in summer, while there are now fewer frosts and winter cold spells. Winters over the last 200 years have become much wetter relative to summers throughout the UK. A larger proportion of winter precipitation (rain and snow) now falls on heavy rainfall days than was the case 50 years ago. After adjusting for natural land movements, the average sea level around the UK is now about 10cm higher than it was in 1900.

13.3.2 The latest UK climate change scenarios indicate that, on average, summers will become hotter and drier, there will also be an intensification of the heat island effect in urban areas. Winters will be milder and wetter leading to increased flood risk. The temperature of coastal waters will also increase, although not as rapidly as over land. High summer temperatures will become more frequent, whilst very cold winters will become increasingly rare. Winters will become wetter and summers may become drier throughout the UK

13.3.3 As well as seasonal changes, there will be more extreme climate events – very hot days and intense downpours of rain, leading to an increased risk of flooding in some areas, as typified by the summer heat wave in 2003 and the extensive flooding in Central Europe in 2002.

13.3.4 Sea levels will continue to rise, increasing the risk of coastal flooding and erosion, and current extremes of high water levels will occur more frequently. The number of storms crossing the UK in winter could also increase.

13.3.5 It should be noted that there will be changes to both the average and extreme weather conditions, and that not all years will fit a clear trend of, for example, “hotter, drier summers”, as the weather becomes more unpredictable in a changing climate

13.4 Local Climate Change

The anticipated local climatic changes, predicted by UKCIP for the West Midlands by 2080, can be summarised as:

Temperature	Will rise by 0.5 ^{o}C to 3^{o}C by 2050s and by 1 ^{o}C to 5^{o}C by 2080s
	Increased number of days with high temperatures
	Potentially greater increases in summer temperatures in major urban areas.
	Increased occurrence of daily maximum temperatures of 33^{o}C.
Rainfall	Wetter winters: winter precipitation will increase between 15% and 30%.
	Drier summers: summer precipitation will reduce between 30% and 60%.
	Heavy winter precipitation might become more frequent
Soil Moisture	Reduced by 40% in Summer, more days at 'field capacity' in Winter

More detailed information on the anticipated changes is included as Annex A.

13.5 Bilston Urban Village – Climate Change Mitigation

13.5.1 Bilston Urban Village will include approximately 1040 new dwellings, new employment space, leisure and community facilities. This development could potentially contribute to climate change, and therefore mitigation measures are proposed that could not only reduce the village's impact on climate change but could help reduce contribution from the surrounding conurbation. The following measures are proposed:

13.5.2 Infrastructure Mitigation and Adaptation

13.5.3 The initial stage of Bilston Urban Village will comprise provision of the primary infrastructure that will enable development of the residential, commercial and mixed use areas. The infrastructure provided will include highways and drainage, sustainable drainage features, major underground services, earthworks plateaus and ground profiling, landscaping and perennial water features. All of these elements may be affected by climate change.

Approximately 2.25Ha of road area will drain into the proposed main swale along the main spine road before discharging into a pond. The total length of swale draining to the pond is 590m.

Using a typical 5m width x 1m deep dished channel the typical depth of water during a 1 in 100 year flood based on current climate conditions has been predicted to be between 150mm-175mm in the swale. Allowing for a 20% measures due to climate change the depth would increase to only 200mm.

The main pond will require storage of approximately 3,500m^3 if the plot areas drain into the pond. The additional volume of 20% (+700m^3) that could be required due to climate change will not impact significantly on the pond.

Vehicle Useage & Location

13.5.4 Bilston Urban Village will encourage sustainable forms of transport, including walking and cycling, with a major pedestrian/cycle route through the centre of the site. This will help to reduce the CO_2 emissions that are contributing to climate change. The good location of the site, adjacent to public transport such as the bus route, and metro station will also encourage sustainable transport. The mixed use nature of the site will encourage residents to live and work within Bilston Urban Village, and will improve existing links to the town centre, reducing the need to use private vehicles for the existing residents.

Masterplan & Built Form Mitigation

There are a number of significant opportunities to both combat climate change, and cope with the changes in the climate within the design of the development, the following opportunities are highlighted as relevant to Bilston Urban Village:

- Higher density development around the settlement centre and close to public routes
- Connected street networks to provide clear and direct routes, particularly for pedestrians and cyclists
- Range of community facilities that are easily accessible by the local community by foot and cycle
- Building Fabric – insulation and thermal mass, solar gain – opportunities to reduce emissions and other impacts on the environment while adapting to impacts from the a changing climate on the development

- Building orientation – determines potential for passive solar heating and reducing affects of extreme weather
- Building Layout – significant reductions in heat requirements possible
- Outdoor space – create sheltered areas (potential extreme weather)

Habitats Mitigation

13.5.5 The changing climate in Bilston could potentially lead to a change in the flora and fauna of local semi-natural habitats. This may include the shrinking or drying of wetlands, ponds, seasonal watercourses and wet woodlands, and a decline in the extent of wet grasslands.

New habitats at Bilston Urban Village will include trees and shrubs, open water, marsh, amenity grassland and neutral grassland. These habitats are currently suitable for the existing climate and will be planted with species that are native and local to the area.

Use of native species in habitat creation will ensure a degree of tolerance to climate change and create communities that will develop naturally as climate changes. In addition to natural changes habitats will be monitored in the future in order to ensure that they continue to provide diversity and value to local wildlife.

Landscape 'mitigation'

Individual landscape features may be vulnerable to the effects of climate change. Trees in particular are vulnerable to drought, and lower summer rainfall may affect parkland and urban street trees. The combination of more frequent winter gales and waterlogged ground arising from increasing rainfall levels may cause damage to trees and woodlands.

The following 'adaptation' measures will help to combat these changes:

- Use water to create cooler micro-climates within park
- Create minimal hard surfaced areas within the neighbourhood park (which would gain heat)
- Reducing water requirements
- Shrub planting within urban areas will be minimised, reducing requirements for watering during summer months. Shrub planting will be concentrated within the central neighbourhood park.

- Mulching to plants will reduce water requirements
- Raised beds will be avoided, as these require more watering.
- Hardy tree species will be used throughout the site, suitable for their town location. Species such as limes and *Acer campestre* ‘streetwise’ will be tolerant of atmospheric pollution.
- Ornamental Grass species will be used where appropriate.

Conclusion

The design of the scheme is responsive to the current guidelines on sustainability in its broadest sense and will consequently make a positive contribution to both mitigation and adaptation regarding climate change. Proposed measures within the development can be summarised as:

- Providing a sustainable, mixed use development that encourages pedestrian, cycle and public transport alternatives to the private vehicle.
- Creating higher density development adjacent to Bilston Town Centre and close to public routes
- Connecting street networks to provide clear and direct routes, particularly for pedestrians and cyclists
- Providing a range of community facilities that are easily accessible by the local community by foot and cycle
- Providing a network of open space and nature conservation areas that are tolerant to potential climate change
- High energy efficiency and performance in the new buildings
- Ensuring profiles, groundworks and primary infrastructure are designed to be resilient to climate change
- Creating a SUDs network that will minimise the quantity and improve the quality of water before it is discharged from the development, helping to prevent flooding and pollution

Asset	Climate factor	Potential effect from climate change	Adaptation required
Highway	Temperature:	Increased Summer temperatures – potential for softening of surfacing and it	Modify pavement material design
		Warmer winters – less potential frost damage More marginal calls re. gritting (greater incidence of salt ‘wash off’ etc)	Responsive mechanisms required
		Increased thermal expansion– concrete roads	Modify joint details / reinforcement

	Precipitation	Increased intensity – increased run-off Increased intensity of rainfall showing up any weaknesses in gullies or their maintenance Potential for water scouring from flash flooding and 'de-lamination' of asphalt Road debris - soil / gravel onto roads due to wash off Surface water / spray - safety issues)	Additional gullies to maintain same level of service Additional flow paths when run-off exceeds drain capacity Comprehensive maintenance regime required Improved bonding considered Consideration given to levels of verges and surrounding topography 'Low noise' asphalt considered - better draining and less spray
		Higher water table – reduced foundation strength Possible increased activity of pollutants	Increased sub-base / capping thickness
	Soil Moisture	Potentially drier conditions at foundation level (in summer)	None
		Ground movements	Ensure that moisture susceptible materials not placed close to formation level
Drainage	Temperature	Increased evaporation from attenuation pools leading to significant level changes	Care needed in profiles and marginal planting to avoid poor aesthetic

	Precipitation	intensity – increased run-off	Increase drainage capacity – or accept and plan for increased localised flooding Additional flow paths when run-off exceeds drain capacity
	Soil Moisture	Ground movements	Additional attention to specification at cut/fill interface
		Reduced run-off from non paved areas in Summer, more days at 'field capacity' in winter	None
SUDs	Temperature	Increased evaporation from attenuation ponds	As noted above
	Precipitation	Increased flow to attenuation ponds	Increase volume of ponds or allow controlled flooding of other areas
		Decreased allowable outflow to Bilston Brook, and potential flooding from the culvert	Increase volume of ponds or allow controlled flooding of other areas
	Soil moisture	Reduced run-off from non paved areas	– potentially reduced inflow to attenuation ponds
		Increased potential for infiltration to soakaways, etc	None – soakaways not suitable for use on BUV site
	loud cover and humidity	Reduced cloud cover and relative humidity will potentially increase evaporation from attenuation ponds	As noted above

Asset	Climate factor	al effect from climate change	Adaptation required
Services	Temperature	Increased demand for# air conditioning	Services undertakers to allow for demands. Construction phase to consider Passive Stack Ventilation Systems in preference to 'active' systems
	Precipitation	Increased flooding of chambers and ducts	Services undertakers to allow for these adaptations
		Risk that electricity sub-stations, major telecoms junction boxes, etc could be affected by flooding	Positioning of these features to be in areas of no/minimal risk of flooding
	Soil Moisture	Ground movements	Water and gas mains be designed to provide for a degree of differential settlement.
Earthworks	Temperature	n/a	
	Precipitation	Increased intensity – increased run-off. Potential erosion if drainage paths unprotected	Drainage paths to be designed to prevent erosion of earthworks slopes. Erosion protection required at exposed locations.
	Soil Moisture	Ground movement due to shrinkage/heave cycle resulting from increased variation in soil moisture	Modify earthworks specification to minimise effects. Avoid use of moisture susceptible material close to formation or treat to reduce susceptibility.
Landscaping	Temperature Precipitation Cloud cover Humidity Soil moisture	Species not tolerant to changes in conditions Landscape features may assist in construction phase adaptation to	Trees and plants selected for tolerance to anticipated changes in conditions Landscape utilised in close relation to built element to assist to climate change – ie deciduous trees providing shade in summer while allowing passive solar

		climate change	gain in winter etc Objective driven Landscape strategy required
Water feature	Temperature Precipitation Cloud cover Humidity Soil moisture	Increased evaporation and leakage losses	Increased requirements for facilities to provide water for sustainability of the water level. Abstraction licence and pumping system to provide for future increase in demand for water supply to the water feature.

ANNEX A: Details of potential Climatic Changes

	Low emission scenario	High emission scenario
Temperature	Summer temps = + 1.5 to 2.^{0}C (2050)	Summer temps = + 1.5 to 2.0^{0}C (2050)
	Summer temps = + 2.5 to 3.0^{0}C (2080)	Summer temps = + 2.5 to 3.0^{0}C (2080)
	By 2080s estimated 63% probability that summers 3.4% warmer than current average By 2080s 1% probability of summer temperature of 40^{o}C	
Precipitation	Estimated mean annual change <10% by 2050 for all scenarios	
	Daily mean changes	Daily mean changes
	Winter . = +10 to +10% (2050)	Winter. = +10 to +20% (2050)
	Winter = +10 to +20% (2080)	Winter = +20 to +30% (2080)
	Summer = -10 to -20% (2050)	Summer = -20 to -30% (2050)
	Summer = -20 to -30% (2080)	Summer = -40 to -50% (2080)
	Maximum daily precipitation could increase by >20% in winter (2080s)	
Cloud cover	Overall decrease of 0 to 6% by the 2050s	
	Daily mean changes	Daily mean changes
	Winter. = 0 to -2% (2050)	Winter. = 0 to -2% (2050)
	Winter = 0 to -2% (2080)	Winter = -2 to -4% (2080)
	Summer = -4 to -6% (2050)	Summer = -6 to -10% (2050)
	Summer = -6 to -8% (2080)	Summer = -12 to -14% (2080
Relative Humidity	Overall decrease by 2%(winter) in 2020s and 2 to 8%(summer) in 2050s	
	Daily mean changes	Daily mean changes
	Winter. = 0 to -2% (2050)	Winter. = 0 to -2% (2050)
	Winter = 0 to -2% (2080)	Winter = -2 to -4% (2080)
	Summer = -4 to -6% (2050)	Summer = -6 to -8% (2050)
	Summer = -4 to -8% (2080)	Summer = -10 to -12% (2080)
Soil Moisture	Overall decrease by 5 to 35% in summer (2050s), but increase in winter	
	Daily mean changes	Daily mean changes
	Winter. = 0 to -5% (2050)	Winter. = 0 to -5% (2050)
	Winter = 0 to -5% (2080)	Winter = 0 to -5% (2080)
	Summer = -10 to -20% (2050)	Summer = -20 to -25% (2050)
	Summer = -20 to -25% (2080)	Summer = -35 to -45% (2080)