DESIGN FOR FUTURE CLIMATE CHANGE

To:	**Cabinet – 12.9.2013**
Main Portfolio Area:	**Housing and Planning Services**
By:	**Madeline Homer, Director of Community Services**
Classification:	**Unrestricted**
Ward:	**Cliftonville West**

Summary: **The report examines the findings of the Technology Strategy Board funded 'Design for Future Climate Change' study focussed on Dalby Square Cliftonville and seeks endorsement of its findings**

<u>For Decision</u>

1.0 Introduction and Background

1.1 In July 2011, Thanet District Council bid for, and was awarded, a £99,498.00 (100%) grant from the Technology Strategy Board (TSB) under their *Design for Future Climate Change II* programme. The purpose of the project was to explore whether the current buildings in Cliftonville West (which mostly date from the late Victorian period) would still be 'fit for purpose' in the future, and to design a strategy for adapting buildings and open spaces to the climate as it is projected to be in the year 2080. The focus of the project was Dalby Square in Cliftonville West and the project was in parallel with the (ultimately successful) Heritage Lottery Fund bid for a Townscape Heritage Initiative (THI) scheme - also centred on Dalby Square. The THI has a budget of £2.5m to be spent on upgrading buildings in Dalby Square, Dalby Road and Arthur Road over a five year period which began in January 2013, and employs two full-time officers who are 'hosted' by Thanet District Council. The TSB project also has synergy with the Kent County Council led *Coastal Communities 2150* programme, and joint meetings between these two groups have been held.

A separate, 100%, small grant was also given by the TSB to commission a predictive, climate change scenarios model especially for Cliftonville in the year 2080. This was produced by the University of Exeter using their *Prometheus* data sets, in conjunction with the UK Climate Impact Projections 2009 data.

Buildings of the type found in Cliftonville are of a style to be found in many British seaside towns and, hence, the findings of the project were seen to be reproducible in other places. One of the undertakings made in the initial application was that *…the Council will use its elected Member Cabinet system to endorse the recommendations of the Design for Future Climate Change project.*

1.2 Thanet District Council put together a multi-disciplinary team to carry out the project. The team included an Architect, a Landscape Architect, a Quantity Surveyor, a Sustainable Design Consultant and a Regeneration Consultant. The Kent School of Architecture was also involved during the earlier stages of the programme. The team studied buildings in Dalby Square, and the gardens in the centre of the Square, against the projected climate scenario of Cliftonville in the year 2080. The team produced a final report in March 2013, together with a summary report in June 2013 *'Climate Change Adaptation: Retrofitting Communities'* (which is appended to this report). Accompanying the main report are five appendixes containing background information; including photographic surveys, drawings, cost tables, thermal modelling results, risk assessment documentation and a landscape strategy.

2.0 Scope of work, Methodology and the Findings of the Team

2.1 The 'Prometheus' data suggests that the climate in Cliftonville in the year 2080 will be significantly different from that of today. Average summer temperatures will be between 3degc and 5degc – and winter temperatures between 2degc and 3.5degc – higher than today. Average summer precipitation will have **de**creased by between 30% and 60%, and winter precipitation **in**creased by between 15% and 30%, compared with the present day. Rain will also be likely to fall in more concentrated downpours, and rainfall occurrence will be more erratic. 'Hot summers' – such as those which happened in 1995 and 2003 – may occur in three out of every five years. In short, the Cliftonville climate in 2080 will be much more like that of the southern Mediterranean today. However, in the years running up to 2080, it is likely that there will repeated disruptions in climate patterns, including, possibly, prolonged cold spells.

2.2 If this is the case; the consequences will be profound. Buildings will be at far higher risk of overheating in the summer and external spaces may become unbearably hot. However, buildings will still need to be heated in the winter, at a time when fuel costs will no doubt be, proportionally, much higher than today. Soil moisture will be greatly reduced in the summer and autumn, and water supplies stressed for a significant proportion of the year. Increased downpours and 'micro floods' will increase soil erosion and stress weather-proofing details on buildings. Undoubtedly, world food production will become increasingly stressed as we approach the twenty-second century.

2.3 The project addressed the following issues, using Nos 30, 31 and 1 Dalby Square, and the garden square itself, as models:-

- Keeping cool – building design
- Keeping cool – external spaces
- Keeping warm – building design
- Structural stability – below ground
- Structural stability – above ground
- Weatherproofing – building design
- Building use
- Communal garden use
- Water conservation
- Drainage
- Costings

The project consisted of the following elements: -

- Historical survey
- Establish existing and future demography
- Carry out physical surveys of the study buildings
- Establish risk profile using Prometheus / UKCP09 data (Met Office Climate Data)
- Developing appropriate design solutions for the study buildings
- Qualitative assessment of non-modellable features
- Thermal modelling
- Building regulations consultation
- Lifecycle costs
- User guide for future implementation
- Dissemination strategy

Through the project, several design options for each of the issues were examined and costed. The solutions outlined below are those which proved the most effective when scored against multiple criteria.

2.4 **Keeping Cool – Building Design.** At present, overheating – defined as the period of time that internal spaces are over 28degc – in the study buildings is not an issue. It is unlikely that any of the buildings in Dalby Square have experienced internal temperatures as high as this in recent years; except perhaps for short periods of time during the summers of 1995 and 2003. The layout of the buildings in Dalby Square is standard throughout. They are constructed in massive masonry with high ceilings and an open stairwell from the basement to the top floor. The buildings are arranged in terraces, which minimises their external wall area, and have a relatively low window to wall ratio. Additionally, they are large, in the region of 500msq, and with a greater volume to floor area ratio than modern houses. These aspects of their design mean that they are already well adapted to cope with increased temperatures.

However, the ‘Prometheus’ data, and the thermal modelling based on it, indicates that, even given the distinct advantages that the Dalby Square-type building possess, by the year 2080 the number of hours during which rooms within the Dalby Square houses will experience temperatures in excess of 28degc will be in the region of 1000 per annum.

Mitigating measures were considered against a cost/benefit analysis and were subject to a ‘SWOT’ test. In terms of these criteria, the mitigating measures were; in order of their effectiveness: -

- Shading through use of blinds. Given the conservation area status of the facades of the buildings facing the Square, the most appropriate being internal louvered blinds, although historically external canvas awnings were extensively used in the Square (see page 21 of the annex 1).
- The use of the staircase core for ventilation through the introduction of an automatically opening roof vent at the head of the stairs.
- The utilisation of the existing chimney stack system to create room-specific ventilation.
- The use of solar glass to reduce solar gain.
- More energy efficient lighting.
- Mechanical cooling systems (air-conditioning) – a highly energy inefficient solution in a high energy cost environment.

Properties on both sides of the Square (Nos 30 and 31, with their front elevations facing west, and No 1 facing east) were examined but this revealed that orientation made little difference with regard to overheating.

2.5 **Keeping Cool – External Spaces** A garden square has a mitigating impact on urban temperatures and consequently on urban liveability. For example; a sizable tree can deliver the same cooling capacity as five large air conditioning units running for twenty hours a day during hot weather (but it can only do so if it has sufficient water).

As well as being a considerable communal and social asset, the Dalby Square central gardens – by virtue of their north-south orientation, with the northern end open to the sea - already have a mitigating effect in controlling temperature through generating air-flow through the Square.

The current garden layout is a relatively new creation, funded through the Big Lottery. The gardens are often cold and 'wind-blasted' during the winter, and there is no shade in the summer. The cost/benefit – SWOT analysis indicated that additions to the existing provision would be the most effective solution, rather than comprehensive remodelling.

The preferred solution retains existing paths, steps, walls and infrastructure wherever possible. The (little-used) car park at the north of the gardens is replaced by a Multi-Use Games Area (MUGA) and the existing playground replaced by a smaller, shaded, play area. The gardens are broken up by a series of east-west orientated shelter belts (pleached trees), bioporous walls and semi-mature trees. Further shade is provided by pergolas and vine-covered verandas. There is also provision for rainwater storage and the addition of Biochar (a climate change mitigating charcoal-based additive) to the soil. This initial option has been costed at £162,000.

Future additions to this proposal – such as a photo-voltaic gantry over the MUGA, and enhanced water storage – were also considered and costed.

2.6 **Keeping Warm – Building Design** The upgrading of building insulation saves resources and has a relatively short (and increasingly shorter) 'pay-back' period. The conservation area status of Dalby Square precludes the external insulation of walls fronting public spaces, since this would be a degradation of the historic character of the area. External insulation is a more efficient way of upgrading masonry buildings since it since it retains the masonry mass within the thermal envelope and this mass acts as a 'thermal flywheel', serving to keep the building cool in summer and warm in winter. However, the front elevations, displaying high quality brick and stucco work, are an asset in themselves, part of the unique character of the area and hence a potential economic driver. Internal insulation to the front elevation is still a cost effective intervention; as are external insulation to the rear elevation and insulation in the roof void. Most of the heat lost from historic dwellings is through drafts caused by poorly sealed windows and external doors.
In order of cost/benefit, the interventions are:-

- Improved draught proofing.
- Internal shutters (already in place in many Dalby Square buildings).
- Increased insulation to roof voids
- External insulation to rear elevations

- Internal insulation to front elevation
- Insulation of basement floor

2.7.1 **Structural Stability – Below Ground** This is very much an issue on clay soils and above mine workings. However, the Dalby Square buildings are founded on free-draining chalk bedrock, well away from the cliff face which is itself protected by a concrete apron, and the risk of any issues arising as a result of climate change are minimal.

2.8 **Structural Stability – Above Ground** The Dalby Square buildings are solidly built of good quality materials and have lasted, to a greater part externally unaltered, for 140 years. The major issues concerning structural stability centre around weatherproofing, considered at 2.9.

2.9 **Weatherproofing – Building Design** The typical roof design of the Dalby Square buildings is a double pitch parallel to the front elevation with central and front valley gutters which drain to the rear of the building via a lead-lined open trough in the roof void. The object of this somewhat convoluted arrangement was to minimise the visual impact of the roof when viewed from the ground, and to avoid having rainwater downpipes running down the front elevation. A recurring problem is that the outlets in the valleys tend to block – dead birds and melting snow being common reasons - causing water to build up and over-top the valleys, which in turn floods the interior of the building. The predicted increased occurrence of sudden downpours in the future can only serve to exacerbate this problem. The study proposes that a new roof with a gentle incline be constructed over the central valley (slightly below the ridge lines of the two pitches so as to not be visible from the street) and that rainwater is discharged to the rear both from this roof and the front parapet valley via sealed pipes.

2.10 **Building Uses** The Dalby Square buildings were designed to be lived in by extended households; often with servants. It became clear during the course of the study that their subdivision, particularly the subdivision of the stairwell, worked against keeping the house cool in the summer and that the separate heating systems required in a subdivided property necessitated increased energy consumption. However, the Dalby Square buildings are very large; too large to comfortably accommodate most modern life styles.

The study looked at adapting the houses for multi-generational living. Multi-generational living is a concept growing in popularity, especially in the United States. It is also know as 3 Generational (3G) living.

3G is based on the idea that the blending of families, the elderly and students under one roof builds a more cohesive community, reduces individual living costs and combats loneliness. It is also an efficient use of large properties where the economic environment is working increasingly against the young getting on the ‘property ladder’.

The study looked at adapting No 30 Dalby Square into a 3G house, where the oldest generation lived in the basement, the middle generation on the ground and first floors and the youngest on the second and third. Each unit had its own kitchen and bathroom areas but the entire building was open to all residents. The design was developed with the TDC Building Control Section, especially with regard to access for those with disabilities, fire safety and the conservation of energy.

The study also looked at 30 Dalby Square as a hotel, again with regard to disability, fire safety and energy conservation.

2.11 **Communal Garden Use** The study looked at using the central gardens for food production, rainwater storage, energy generation, carbon storage and communal activities.

2.12 **Water Conservation** The study looked at the costs and benefits of reducing domestic water consumption to a level comparable with the *Code for Sustainable Homes* Level 3 potable water consumption standard (105 litres per person per day compared with the current national average of 160 litres). This reduced consumption level was achieved through the use of tap flow regulators, low volume baths, aerated showers, low volume wcs and water efficient appliances. Much greater efficiencies can be gained from combining this approach with rainwater harvesting.

2.13 **Drainage** Surface water from the road gullies in Dalby Square is discharged directly into the sea and surface water flooding in the area is therefore a very low risk. However, much of the rainwater from the buildings is currently discharged into a combined sewer system, which is stressing the sewage disposal system. In consultation with the TDC Building Control Section, the study looked at a range of options from simple soakaways within the curtilage of each property to domestic rainwater harvesting systems. The study also looked at rainwater storage, and potential demand, in the central gardens.

2.14 **Costings** Cost plans were prepared for each aspect of the project, from the simplest (draught-proofing, shutters) to the most complex (the hotel, alterations to the gardens). Energy generation (photo-voltaics) and heat generation (air source heat pumps, solar thermal) were also costed.

The study proved that the simplest measures (internal shutters, roof insulation, and water saving devices) are cost effective in the short term. However, paybacks calculated as a return on investment for more complex energy saving measures can run into decades and, given the low property values in Cliftonville at present, are not economic without public subsidy. What the study did not take into account was the highly likely, but impossible to quantify, element that relative energy costs will increasingly rise as we approach the year 2080.

2.15 **Conclusion** The study looked at the ability of the existing properties in Dalby Square, as well as the central gardens, to adapt to climate change, using the predicted climate in the year 2080. Its conclusions were: -

That the buildings by virtue of their construction and form are, to a considerable extent, ‘climate change ready’, more so than most modern buildings. This emphasises their sustainability, in addition to the advantage conferred on them by the embodied energy already contained within their structures.

That the central gardens in Dalby Square are already a climate change mitigating element and, by even simple adaptation, can provide shade, shelter and even modest food production which would greatly enhance the quality of life of local residents.

That the buildings in Dalby Square (and by extension, Cliftonville West) are easily adaptable to new uses – hotel, multi-generational house – but that given current property values in the area this is currently not possible without public subsidy.

That simple measures of climate adaptation and energy and resource efficiency are currently cost effective and that more complex measures are not. However, the study provides a framework for future adaptations when resources are scarcer and energy more expensive.

Finally, a key conclusion of the report is that measures need to be considered in terms of their multifunctionality – a measure can perform well across a range of criteria such that even if it doesn't make initial financial sense, it can be justified on other grounds.

3.0 Options

3.1 That Members accept the report and agree that its findings be incorporated into the Dalby Square THI Action Plan and the Cliftonville West Design Code where appropriate.

3.2 That Members do not accept the report.

4.0 Next Steps

4.1 The study is to be disseminated by the Technology Strategy Board as well as the Dalby Square website budgeted for under the Dalby Square Townscape Heritage Initiative scheme.

5.0 Corporate Implications

5.1 Financial and VAT

5.1.1 The project was 100% funded by the Technology Strategy Board.

5.2 Legal

5.2.1 It is not considered that there are legal implications to this report.

5.3 Corporate

5.3.1 The study contributes to Corporate Plan priorities 6 (a Cleaner and Greener District), 7 (Sustainable Communities) and 11 (Public Open Spaces)

5.4 Equity and Equalities

5.4.1 It is not considered that there are equity and equality implications to this report.

6.0 Recommendation(s)

6.1 As at 3.1 "That Members accept the report and agree that its findings be incorporated into the Dalby Square THI Action Plan and the Cliftonville West Design Code where appropriate".

7.0 Decision Making Process

7.1 This is a decision for Cabinet.

Future Meeting:	Date:
N/A	

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Reporting to:	Madeline Homer, Director of Community Services

Annex List

Annex 1	"Climate Change Adaptation: Retrofitting Communities" Booklet

Background Papers

Title	Details of where to access copy
None	N/A

Corporate Consultation Undertaken

Finance	Sarah Martin, Financial Services Manager
Legal	Harvey Patterson, Corporate & Regulatory Services Manager