Morrison's Car Park
(Camden Goods Yard)

Detailed Response to GLA/LBC Comments (Provisional)

18-09-17

Part 1 – GLA Comments

Be Lean

Point 1. – Overview of proposals

The GLA response noting that the proposals broadly follow the energy hierarchy is welcomed.

Point 3. – Non-residential cooling demand

The non-residential cooling demand figures were provided on 14-08-17, and the GLA have confirmed that nothing further is required.

Point 5. – Penthouse summer overheating

The "internal" elevation design of these two units has been revised (the elevation facing into the roof-top courtyard which does not form part of any of the main elevations of the building) and the window areas have been reduced. The revised building has been modelled and the results now demonstrate compliance. The results will be submitted as an addendum to the report.

Point 6. – Mechanical cooling to residential units

The emissions from residential cooling, which are fully accounted for in all the calculations, amount to just 0.54% of the total emissions from the development. These results demonstrate that the residential cooling demand has been successfully minimised in accordance with Policy 5.9.

Be Clean

Point 8. – Connection to a future Kentish Town West Decentralised Energy Network

A meeting was held with LBC Officers and Consultants on 06/09/17 to review the potential for the development to connect to the proposed Kentish Town West Decentralised Energy Network. The feasibility study work on this possible network is ongoing, and there is no certainty as yet as to whether it will proceed. It is not therefore possible to submit firm proposals for a connection. However, the Applicant will submit a plan for the proposed network route which provides for a connection to the network on Chalk Farm Road, and for that network to extend across the site and, in future, to supply network heat to the buildings in Gilbey's Yard.

It is important to note that the Applicant does not own the land under the railway bridge that crosses the access road to the main site: this is owned by Network Rail. Therefore, it will only be possible to make the connection if the necessary third-party consents can be obtained.

This information could not be submitted with the Application since the LBC Study had not advanced to the necessary stage at that date, and no information had been issued by LBC.

Point 10. – Use of local ASHPs to provide heating and cooling to the PFS office building

The M&E strategy for the modest PFS site office building is to use ASHPs – a recognised form of renewable energy technology that is very suitable for commercial buildings that require both heating and cooling. The information and calculation results provided in the Energy Statement show that the PFS building cooling demand is 108.0 MJ/m^2 versus a heating demand of 57.3 MJ/m^2. This mix of energy uses is entirely normal for a building of this type.

The total heat demand for the whole site (Main Site plus PFS Site) is 2,078 MWh/yr, of which the PFS Site is 128 MWh/yr, so just 6% of the total heat.

However, while the proposed use of the site does not at present justify a network connection, it is acknowledged that in future the building use could change, and that a network connection might become desirable. Therefore, the plans for the site and network that will be submitted will propose that should the Kentish Town West Decentralised Energy Network go forward, space for an identified connection point will be reserved and the necessary street chamber will be constructed, to allow a future connection, although no actual pipework will be installed at this stage.

Point 11. – Retention of space for an on-site Energy Centre

The space allocated for the on-site Energy Centre will be constructed and reserved for this use, as per the submitted plans. The space will be sufficient for the proposed CHP Unit, buffer vessels, and boilers, and this plant will be installed to provide heat to the development unless the timescale of the development of the possible future Kentish Town West Decentralised Energy Network is such that it is not necessary.

At the meeting held with LBC Officers and Consultants on 06/09/17, the Consultants tabled a proposal for an alternative configuration of heating plant, that would retain the boilers, but replace the CHP Unit with roof-top mounted ASHP units. Subject to this being demonstrated to be acceptable both technically and in terms of carbon policy, the Applicant is willing to proceed with this alternative approach. In either case on-site plant would be provided.

Be Green

Point 15. – Future DHN connection to the PFS building

See response to Point 10 above.

Point 16. – Roof layouts showing the roof utilisation and PV panel proposals

As stated in the Energy Statement, the roof layouts showing the areas available for the PV panels were included on the Architect's drawings in the Design and Access Statement. However, to further clarify the PV proposals and the basis of the PV area calculations, drawings are appended to this document that show the available areas for PV panels.

The practical number of panels that can be installed depends first on the type of roof. On pitched roofs of modest size (e.g. on a typical house) that face in orientations from east through south, to west, the panels can be fitted closely together and the active area will approximate to the available

area. However, on flat roofs, the panels have to be spaced apart and attached to frames which set them at the correct pitch. Furthermore, on schemes such as this where green roofs are provided, the spacing has to be sufficient to allow enough light to reach the surface. The accepted nominal array spacing on green roofs is a spacing at least equal to the panel width – i.e. 1m on 1m x 1.6m panels when they are arranged in "landscape" format. It is also necessary to provide a clear width around the edge of each roof to permit access for maintenance to the upstands or parapet walls. Finally, the panel position can be affected by the many roof penetrations that are required – particularly for SVPs. To account for these constraints, an active area of 35% of the flat roof area inside the perimeter safe access strip has been assumed for most roofs. The exception is the PFS building which will not have the number of SVPs, so for this roof 40% has been used.

The estimates of PV active area and hence electrical rating and annual emissions savings for each array or building are listed in the following table. The number of panels has been rounded to a number that could typically be connected as a "string" to an inverter, and the panel size is the standard 1m x 1.6m type, with a rating of 275W

Building	Available area	Active fraction	Active area	Number of panels	Rating
Block A	430 m^2	35%	151 m^2	90	24.75 kWp
Block B	Panels not proposed as roof is occupied by glasshouses				
Block C	293 m^2	35%	103 m^2	64	17.60 kWp
Block D	375 m^2	35%	131 m^2	80	22.00 kWp
Block E1	232 m^2	35%	81 m^2	50	13.75 kWp
Block E2*	132 m^2 (flat) 114 m^2 (pitch)	35% 100%	47 m^2 114 m^2	30 68	26.95 kWp
Block F*	151 m^2 (flat) 80 m^2 (pitch)	35% 100%	53 m^2 80 m^2	32 50	22.55 kWp
PFS building	550 m^2	40%	220 m^2	136	37.40 kWp
			Total number of panels:	**600**	
				Total panel rating:	**165 kWp**

* The electrical output of the panels depends on the pitch and orientation. The assessment of the emissions savings from PV panel in the Energy Statement takes account of this and the outputs from the flat and pitched panels are assessed separately.

No panels could be provided to Block B since the entire roof is utilised either for glasshouses or as amenity space. It is not possible to mount panels on the glasshouse roof for two reasons: they would create excessive shade and substantially affect the growing condition beneath; and safe access for routine maintenance could not be provided to the lightweight roof structure of the glasshouse.

The area of panels to the roof of Block F is severely limited by the roof design. The careful consideration of CDM safety matters concluded that panels could only be located on roofs that could either be reached from the ground level using a “cherry picker” (limited to 6 storeys) or from flat roofs where access hatches and parapet walls or fall arrest systems could be installed. Safe access cannot be provided to pitched roofs without edge protection at the upper storeys (7th floor and above) of this building.

We would further note that unlike Block B, Block F has a very carefully designed eclectic style, appearing as a disparate yet harmonious collection of mixed roof types and heights, located on the interface between the lower and higher rise elements of the scheme. This architectural and townscape approach was explored in depth with a range of stakeholders as the scheme was developed, and it was always understood and accepted that this would compromise the ability to attach PV panels to the roof of this building.

Part 2 – LBC Response – Compliance with CGY Planning Framework

Energy strategy, carbon emissions factors and LZC technology

Point 1. – Connection to a forthcoming DHN

The LBC response was provided to the Applicant during the course of a meeting held with LBC Officers and Consultants on 06/09/17. The purpose of the meeting was to discuss the preliminary results finding of a feasibility study that has been commissioned by LBC to examine the possibility of developing a *Kentish Town West Decentralised Energy Network.*

As stated in the Sustainable Design and Construction Statement, the Applicant would welcome such a network and will actively engage with LBC to facilitate this. Moreover, the Applicant is willing to permit the network heat main to cross the site and to supply heat to the buildings in Gilbey's Yard, should this prove desirable. However, since at the date of validation, no proposals had been published by LBC, it was not possible to include any details in the original application documents.

All this is in accordance with *Policy 5.6 Decentralised energy in development proposals* of the London Plan 2016.

Point 2. – Carbon emissions savings and technology selection

The London Plan 2016 (and associated GLA guidance) sets out a number of clear principles that must be followed when energy strategies for major schemes are developed. The key policy is *Policy 5.2: Minimising carbon dioxide emissions* which sets out both how energy assessments are to be carried out and the targets for emissions saving that should be satisfied. It is pertinent to note that The London Plan 2016 continues to refer to Part L1A/L2A: 2010 as the reference method, although the current GLA guidance has translated this to a Part L1A/L2A: 2013 basis.

In all cases, where feasible, gas-fired CHP is the technology of choice, and policy requires that all calculations are carried out using SAP 2013 and SBEM 2014, the National Calculation Methods (NCMs), using the carbon dioxide emissions factors set out in the applicable supporting documents, and using nationally approved software.

The CGY energy strategy was carefully developed in the light of these policies and guidance documents, and the GLA have confirmed that the approach taken is policy-compliant.
In contrast, the LBC Consultants have put forward an alternative approach which while similar in many ways, contains key differences. Most importantly, and contrary to London policy, it is forward-looking and predicts results for future emissions trends, and proposes technologies that will achieve future savings if these trends materialise. In particular, the approach proposes the use of Air Source Heat Pumps (ASHPs) as the lead on-site heat source, on the basis that in future the emissions associated with the electricity used will be lower than those from the gas consumed by a CHP unit.

Any such proposal put forward by the applicant could not be judged to be compliant with *current* policy, and indeed, the Applicant is not in a position to predict what the future trends in emissions factors might be, nor how future public policy might change. However, if the GLA and LBC see fit to agree that these predicted future emissions trends should be used to guide the technology selection on this development, the Applicant is content to amend the scheme proposals to align with the LBC Consultants' report.

However, since the approved NCM Energy Assessment Software that implements the necessary calculations has not been revised to use future emissions factors, it is not possible to submit energy assessment calculations that use these factors. Indeed, since on every revision of the methodology numerous other changes are typically also implemented, until the revision process is completed and the new software is approved and issued, any attempt to estimate the impact of revised emissions factors will be just that – an estimate.

Therefore, the only approach that could be taken would be the repeat the calculations with the alternative ASHP technology, but using the *current* calculation methodologies. If this is done, the savings demonstrated will be significantly lower than those that would be achieved using CHP. And since the whole basis of the approach is that these results will not be valid in the future, there seems to be little value in doing this. We have completed this exercise on a trial basis, and the results so far indicate that as expected, the saving from ASHPs will be approximately 10% compared to a saving of 24% from the proposed CHP unit.

Notwithstanding the Applicant's willingness to consider amending the proposals, the approach put forward by the LBC Consultants is not in our view compliant with the London Plan 2016 with respect to carbon dioxide emissions.

Furthermore, although LBC has adopted a Camden Goods Yard Planning Framework, which promotes the concept of a local Ultra Low Emissions Zone (ULEZ) – in relation to combustion products, and NOx in particular – this document cannot amend adopted Regional and Local policy, either with regard to carbon dioxide emissions reduction, or in terms of NOx targets. The Energy Strategy as submitted is fully compliant with the London Plan 2016 requirements with regard to both "on-site" carbon dioxide emissions reductions, and the proposed NOx emissions from heating combustion plant (the plant meets or exceeds the technical standards for NOx emissions rate, and the development is significantly better than "Air Quality Neutral").

Point 3. – ASHP performance parameters

The LBC Consultants have determined the performance parameters for the heating network and plant that they consider should be achievable by the system.

The figures are as follows:

Design annual ASHP heat fraction: 64%
Design ASHP co-efficient of performance (CoP): 2.40
The Applicant and its advisers has certain reservations about the practical feasibility of satisfying these parameters based on substantial practical experience gained from numerous residential communal heating schemes. However, it is willing to proceed at this stage on the basis that these figures are possible, subject to the obligation being only to implement the technology in accordance with the LBC Consultants' proposals, and to no liability attaching to deliver these performance parameters in practice.

Furthermore, if future statutory guidance or methodologies are issued which have the effect that for the technology concerned, other parameters have to be used, with the result that the performance is worse than expected, again, no liability will attach to the Applicant with regard to delivering the scheme in accordance with any planning permission granted.

The proposed location of the ASHPs, on the roofs of Block A, and which will we are advised will occupy an area of approximately 90 m^2, appear to fit within the plant enclosures already included within the submitted plans and elevations. Therefore, there should be no impact on the PV arrays.

Point 4. – Carbon offset charges

The Applicant considers that the carbon offset charge cannot exceed a level that is calculated in accordance with the adopted policy, and that would be payable if the scheme was delivered with an on-site saving of 35%, as originally proposed.

However, since the basis of the LBC Consultants' proposal is that in future the emissions factors will reduce, the Applicant would wish to explore how this reduction would affect the cumulative emissions over the forthcoming 30-year period. It is apparent that the predicted future reductions in the emissions from grid electricity, that underlie the LBC Consultants' proposals, would mean that the offset charges should not be calculated at a single fixed rate (based on current 2013 factors, which for both natural gas and grid electricity, are at historical peak values) but should perhaps instead be calculated using the predicted reducing factors that are the basis of the proposed approach.

So far, the LBC Consultants have not released to the Applicant the predicted future carbon emissions factors that they have used for their future years emissions assessments. Therefore the only data available to the Applicant is that set out in the draft SAP 2016 document.

Part 3 – LBC Response – Sustainable Design and Construction Statement

Energy strategy

Point 1. – y-values (thermal bridging)

The LBC response states that "Y-values are particularly low". The reason for this comment is unclear since no figures for y-values (or, more correctly, psi-values) are provided. In fact, SAP2012 no longer permits the use of generic "y-value sets" (e.g. ACDs or ECDs) but for compliance purposes all non-repeating junctions have to be measured, and accurate psi-values determined for each junction. In practice, we find that on buildings of the type proposed the "y-value equivalent figure" is typically in the range 0.10 to 0.12 (W/m^2K). Accordingly, values in this range, which accurately reflect the likely performance of the proposed concrete frame high-rise construction, were used for all the modelling.

This is not a particularly low figure, but is intrinsic to the building type. It may be contrasted to the typical figures of 0.08 W/m^2K for ACD compliant traditional low-rise masonry construction, or 0.04 W/m^2K that can be achieved where timber frame or insulating aircrete blockwork can be used.

It is possible that the reference to "Y-value" was intended to be a reference to "U-value". If so, we agree that the proposed U-values are very good, but they are achievable with concrete frame construction, and are the primary reason why the passive performance is so good. The element build-ups typically used are as follows:

Walls: 110 mm phenolic foam on fully filled 100 mm metsec stud
Roofs: 260 mm enhanced CO_2-blown extruded polystyrene in an inverted roof configuration
Floors: 150 mm PIR foam above the slab, and under the screed

Note: these descriptions are indicative only. Recent developments with regard to use of flammable materials in the external walls of tall buildings may affect the choice of materials, but will not prevent the proposed U-values or performance commitments from being realised.

Point 2. – Glazing ratios

The penthouses that failed the CIBSE TM52 assessment were Block F, plots F1-43 and F1-48. The elevations of these two plots have been revised to reduce the window areas and both plots are now compliant. Further details are provided in the Addendum to the Thermal Comfort Assessment report. See also the response to GLA Point 5.

Point 3. – PV panel provision

Please see the response to GLA Point 16 and the accompanying roof plans.

Point 4. – Scope of BREEAM assessment

There are a variety of non-residential spaces within the scheme, and it would have been impracticable to provide a BREEAM pre-assessment for every building type. Furthermore, for the majority of the smaller units, which will be completed by the Applicant to the "shell and core" stage only, while the BREEAM scheme requires a separate assessment, the construction elements completed by the Applicant will be very similar, and the divergences will only occur at the fitout stage. Regarding the scope of the proposed assessment and certification, it is considered reasonable

to fully complete the BREEAM certification process for the supermarket and the larger office units (Main Site and PFS site) only.

The smaller units will be completed to the "shell and core" stage with tenant fitout. Experience shows that requiring individual tenants to complete the BREEAM certification has a severe negative impact on the potential to let the units – neither the tenants nor the fitout contractors understand BREEAM, and the cost of employing Assessors is disproportionate.

The Applicant proposes to agree with LBC the exact nature and scope of the assessments, but would seek an approach that can provide the necessary assurance regarding the environmental credentials of the development without creating an unacceptable certification burden for tenants.

Point 5. – Cooling hierarchy

The necessary mitigation (reduced widow areas) has been incorporated into revised elevations now submitted. Please see Point 2., above.

The measures that will be taken to reduce heat gains are primarily to design the communal distribution system to minimise losses as per *CIBSE / ADE Heat networks: Code of Practice for the UK (2015)*, and the total annual heat loss should not exceed 10% of the sum of the estimated heat consumption of all the connected buildings. In addition, specific attention will be given to all options to limit losses, including minimising distribution temperatures, minimising pipe run lengths and sizes, and taking due account of diversity. All parts of the hydraulic network will be insulated to best practice standards, subject to the thickness of the insulation being selected to minimise lifecycle costs in accordance with the CoP.

The two overheating assessments contain different information with regard to glazing and opening areas. In the case of the SAP Appendix P results, the figures quoted refer to the glazing as a percentage of either the floor area or the heat-loss façade area of the dwelling concerned. The SAP methodology does not consider the window opening area since it makes assumptions based on air change rate, which in turn is based on the dwelling complying with the mandatory ventilation requirements set out in Part F of the Building Regulations. The CIBSE TM52 assessment is much more detailed and considers the opening area of each window. Therefore, the areas and percentages quoted refer to two entirely different sets of criteria.

Point 6. – Materials, sourcing, and waste

Non-residential buildings (subject to the BREEAM Assessment)

This matter is covered in the BREEAM Pre-assessment Category 6: Materials. The target for this part of the development is to achieve 3 of the 5 available credits (for the following elements: ground floor; upper floor slabs; external walls; roof; and windows). The credits will be calculated using the BREEAM Mat01 calculator which combines the generic *Green Guide* ratings, with allowances for other performance indicators such as whether the particular product has an independent, specific, Environmental Product Declaration (EPD).

Residential buildings

The Written Ministerial Statement, issued on 25th March 2015 by The Rt Hon Sir Eric Pickles, is a statement of National Planning Policy. It has not since been amended or superseded, so remains binding on Local Planning Authorities, who must give it full weight when plan making or making

planning decisions. The text is available here: https://www.gov.uk/government/speeches/planning-update-march-2015 .

The particular point at issue relates to the section of this policy statement that deals with residential developments, the withdrawal of the Code for Sustainable Homes, and related matters. The text of this part of the statements is as follows:

From the date the Deregulation Bill 2015 is given Royal Assent, local planning authorities and qualifying bodies preparing neighbourhood plans should not set in their emerging Local Plans, neighbourhood plans, or supplementary planning documents, any additional local technical standards or requirements relating to the construction, internal layout or performance of new dwellings. This includes any policy requiring any level of the Code for Sustainable Homes to be achieved by new development; the government has now withdrawn the code, aside from the management of legacy cases. Particular standards or requirements for energy performance are considered later in this statement.

Local planning authorities and qualifying bodies preparing neighbourhood plans should consider their existing plan policies on technical housing standards or requirements and update them as appropriate, for example through a partial Local Plan review, or a full neighbourhood plan replacement in due course. Local planning authorities may also need to review their local information requirements to ensure that technical detail that is no longer necessary is not requested to support planning applications.

The optional new national technical standards should only be required through any new Local Plan policies if they address a clearly evidenced need, and where their impact on viability has been considered, in accordance with the National Planning Policy Framework and Planning Guidance. Neighbourhood plans should not be used to apply the new national technical standards.

For the specific issue of energy performance, local planning authorities will continue to be able to set and apply policies in their Local Plans which require compliance with energy performance standards that exceed the energy requirements of Building Regulations until commencement of amendments to the Planning and Energy Act 2008 in the Deregulation Bill 2015.

This is expected to happen alongside the introduction of zero carbon homes policy in late 2016. The government has stated that, from then, the energy performance requirements in Building Regulations will be set at a level equivalent to the (outgoing) Code for Sustainable Homes Level 4. Until the amendment is commenced, we would expect local planning authorities to take this statement of the government's intention into account in applying existing policies and not set conditions with requirements above a Code level 4 equivalent. This statement does not modify the National Planning Policy Framework policy allowing the connection of new housing development to low carbon infrastructure such as district heating networks.

Measures relating to flood resilience and resistance and external noise will remain a matter to be dealt with through the planning process, in line with the existing national policy and guidance. In cases of very specific and clearly evidenced housing accessibility needs, where individual household requirements are clearly outside the new national technical standards, local planning authorities may ask for specific requirements outside of the access standard, subject to overall viability considerations.

As clearly stated, National Policy now prohibits LPAs from considering CSH compliance as a planning matter when deciding residential development applications, and equally import, prohibits the application of similar requirements on a piecemeal basis. Therefore notwithstanding the current status of any such Local Policy, these requirements must be dis-applied. In particular the policy prohibits the application, within *Local Plans, neighbourhood plans, or supplementary planning documents, any additional local technical standards or requirements relating to the construction, internal layout or performance of new dwellings.*

The Deregulation Bill (Act) received Royal Assent on 26th March 2015.

Clearly, the type of materials to be used and the recycled content they contain, is a matter that relates to the construction of the dwellings. This information was not provided since it is no longer pertinent to the planning decision.

It is also important to note that many of the *BRE Green Guide Ratings* are very dated. Many date from 2008, and the most recent update appears to have taken place in 2012. Given that the ratings attempt to assess issues such as carbon dioxide emission from embodied energy, and that these continue to change, (being at the centre of the discussion around the London energy strategies), it is apparent that unless they are kept up-to-date, they will be of diminishing value.

Point 7. – Green space

This matter is covered in detail in the Landscape section of the Design and Access Statement. The quantum of green space is limited by the intensive use of the site, and the location of the trees is constrained by the extensive basement.

Point 8. – Run-off rates

This matter is covered in detail in the Flood Risk assessment and Drainage Strategy, and direct discussions are understood to be ongoing with the LBC on this matter.

Point 9. – Drought resistant species

This matter is covered in detail in the Landscape section of the Design and Access Statement. When selecting species, the designer often faces a dichotomy: native species are greatly to be preferred for their value to the local ecology, but, due to the UK climate, they can have limited drought-resistance, whereas drought-resistant species are usually non-native and therefore have lower ecological value. At the same time, the designers would wish to design landscaping that will thrive over the longer term, and often therefore some form of limited irrigation e.g. seep hoses, becomes essential.

Where necessary, low-water ground level irrigation will be provided, and where feasible, this will be connected to the main rainwater harvesting tank(s). However, the pumping energy and pipe lengths required, may mean that local systems filled from potable mains water will have to be used at the site extremities. Moreover, the system will be designed in accordance with BS8515: 2013, and as such, the tanks will be sized to suit the available roof area and projected rain water yield, and the extent of the irrigation system served will be limited to that which can be usefully served by the volume of rain water that is predicted to be collected.

Point 10. – Grey water recycling

While grey water recycling provides a regular predictable water supply that is constant year-round, the water can only be use for WC flushing, so any saving is limited to the amount of water that would otherwise be used for this purpose. The daily water use for WCs can be predicted using the water use calculation set out in Part G of the Building Regulations. With the low water WCs proposed the daily water use is 15.5 Litres per resident, so 17 m^3 per annum for a typical 3-person household. The current Thames Water charge (2017-18) is £2.08 per m^3 (including water supply and wastewater disposal). Thus the annual saving per household would be a maximum of £35.

Grey water recycling can be implemented in three different ways: either by using "in bathroom" packaged modules; individual "in-the-ground" systems for houses with gardens, and communal systems constructed to serve apartment buildings or a complete development.

The first of the options, an "in-bathroom" packaged system was launched in the UK as the "Ecoplay" system in 2010, but was not commercially successful, and is no longer available. A second prototype system, developed in 2013, also never reached production, and as far as we are aware no such systems are currently available commercially.

The second option, using an underground tank, is available from a number of suppliers, but is only applicable to dwellings with gardens where the tank can be located. The systems require regular maintenance and dosing with disinfectant chemicals, and in this case, the individual underground tanks could only be accommodated in the gardens of the five townhouses. However, these houses are all "affordable rent" tenure, and it is considered unacceptable to burden the residents with the costs and the responsibility of the additional maintenance necessary.

The third option would be to install communal systems for some or all of the apartment buildings. Communal systems result in significant additional complexity in the public health and water supply networks within the buildings which add to both the capital and operational costs. The following specific matters have to be addressed:

i. Grey water recycling requires that the waste water from the baths, showers, and wash hand basins (but not the WCs or kitchen sinks) is routed via a separate network of pipes to a processing plant. This means that every waste water stack across each building must be duplicated, and this doubles the number of stacks required. The additional stacks take up significant space within the floor plan of each dwelling.

ii. At the base of the building the stacks need to be combined, and in a conventional system there is a single layer network which routes off-site to a foul sewer. If grey water recycling is introduced a two-layer network is required so that the "grey water" and so-called "black water" pipes can be routed separately. The additional void required will typically add at least 200 mm to the height of the building (or the excavation underneath).

iii. Communal treatment plant is required. It can be possible to combine the systems for several buildings, but only if the levels allow. In this case it might be possible to allocate space within the basement, but in any event a significant area would be needed. An estimate for the space requirement for a typical system for 200 apartments is 30 m^2, so for the whole scheme a plant space of 90 – 100 m^2 would be required. A typical treatment plant contains three tanks – settlement, treatment, and post-treatment storage, together with the dosing equipment, filters, pumps and control panel. In addition to the treatment plant, additional booster pump sets will be required to pump the grey water to the apartments.

iv. The amount of grey water collected by the stacks – the total of all the water used for baths showers and wash basins – will substantially exceed the normal demand for grey water, however to facilitate the operation of the system it will all be routed first to the basement. If the treatment plant level is below the invert of the public foul sewer, the surplus must be pumped back to the sewer level via a holding tank. Although not large, the energy for these pumps is wholly additional and due only to the provision of the grey water system. Part H of the Building Regulations may require that 24 hour holding tanks are installed to cater for the failure of the foul water pumps.

v. The grey water must be supplied to each apartment using a separate network of pipes, with separate metering. The additional metering operation would need to be undertaken by the management company and the metering costs would be added to the residents' charges.

vi. The substantial capital cost of the grey water system would have to be borne by the Applicant, but the ongoing maintenance and future refurbishment costs would have to be borne by the residents. These costs comprise three components:

a. The cost of routine maintenance. Depending on the systems, the maintenance interval can be limited to a single servicing visit per year to remove sediment and generally clean and test the systems. However, an additional six-monthly inspection is also likely to be necessary. The annual cost, assuming no spare parts are required, is therefore estimated to be approximately £2000 per year for a system serving 200 dwellings. The cost per apartment is therefore £10 per year. Note this does not include the cost of routine checks on water quality, which may be required, and may be necessary to reassure residents regarding the safety of the water supply. It has not been possible to evaluate this issue fully, but see the Environment Agency report referenced below.

b. Provision for emergency repair and eventual replacement. The reliability of such units is largely unproven and components are generally given only a 2-year warranty. Furthermore, the plant has a limited life. Manufacturers advise that a life of 10 years can be expected following which replacement of major components will be necessary. At current prices, the cost of replacement or refurbishment is estimated to be £50,000 for a system serving 200 dwellings. Ignoring inflation, the annual provision for this expenditure will need to be £5,000 or £25 per apartment.

c. Billing and metering costs. The grey water must be separately metered to ensure that the costs of water used are distributed equably between apartments. Billing systems operation, which will be separate from the heat and any cooling billing, typically costs at least £15 per year per apartment.

Further information is given in a report produced by the *Environment Agency: Greywater for domestic users: an information guide (May 2011)* which highlights other issues such as the acceptability to residents of using water from a communal system (there appears to be greater user resistance to "local" systems where people know the other users of the system compared to "city wide" anonymous systems). It also identifies user concerns about the need to check water quality for presence of contaminants and pathogens, and guidelines for routine monitoring are being developed. The cost of such monitoring is not included in the above estimates.

In summary therefore, communal grey water systems are estimated to result in an ongoing additional cost to each household of at least £50 per year, compared to a maximum saving in water bills of £35. It should be noted that these costs are estimates only since there is very little experience of communal grey water systems in the UK at present.

Taking all the foregoing into consideration, the following are apparent:

- The installation of communal grey water systems is technically complex, and would add a considerable sum to the development costs.

- The necessary additional waste water collection network, and grey water distribution pipework, plus the processing plant would take up substantial space.

- The operating, billing and replacement cost of the plant would significantly outweigh the saving on water use costs, and these costs would have to be borne by the residents.

- There is no evidence to show that the “embodied” environmental costs (energy use, raw materials consumption – including water, toxicity impact etc.) of a communal “development scale” grey water system installation achieves a net environmental benefit.

- There is no clear guidance available yet on the safety precautions necessary to ensure that that all the recycled water is safe at all times, and that there is no hazard from aerosols produced during the normal WC flushing process.

- There is apparently public resistance to such “communal” plant due to concerns over maintenance and bio-safety, and city-wide solutions are seen as preferable.

For all these reasons, grey water recycling was not proposed.