

Energy Strategy Report



19-5503

28 Redington Road, Hampstead, London, NW3 7RB

August 2019



Quality Standards Control

The signatories below verify that this document has been prepared in accordance with our quality control requirements. These procedures do not affect the content and views expressed by the originator.

Revision	Initial	Rev A	Rev B	Rev C
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1. Executive Summary

This Energy Statement demonstrates the predicted energy performance and carbon dioxide emissions of the proposed development at **28 Redington Road, Hampstead, London, NW3 7RB** based on the information provided by the design team. The proposed development is **refurbishment and extension of a detached house in the London Borough of Camden.**

1.1. Policy Requirements

The Council requires new developments to incorporate sustainable design and construction measures. The table below summarises the local policy requirements for this minor development.

Policies	Requirements	Compliance Notes		
Camden Local Policy CC1 8.8 and Planning Guidance Table 2a	Major residential refurbishment developments (10+ units or > 1000 sqm) will be required to demonstrate greatest possible reduction, meeting Building Regulation Part L1B.	The proposed development is classified as a major residential refurbishment (over 1000 sqm) and achieved an overall 69.7% carbon reduction via energy efficient measures, Ground Source Heat Pump and PV panels. Detailed strategies can be found in the table below and section 6-8 of this report.		
	For the major residential refurbishment, a 20% carbon reduction from renewables are requires at Be Green stage.	The proposed development achieved a 20.9% from the Ground Source Heat Pump and PV panels. Details can be found in section 8.2 of this report.		
Camden Local Policy CC2Extensions of 500sqm of residential floorspace to achieve "Excellent" in BREEAM domestic refurbishment.		The BREEAM pre-assessment has been produced in the appendix B of this report, showing "Excellent".		
Camden Local Policy CC3 8.55	Refurbishments and other non- domestic development will be expected to meet BREEAM water efficiency credits.	Total 4 credits have been targeted in BREEAM Water 01 – 03 category. Details can be found in the BREEAM pre-assessment.		

Table 1 Policy Requirements

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1.2. Methodology and Strategies

The methodology used to determine the CO_2 emissions is in accordance with the London Plan's threestep Energy Hierarchy (Policy 5.2). The below table shows the Energy Hierarchy and suggested strategies for the proposed development.

Stages	Strategies		
BE LEAN Energy efficient design	 U-values better than Building Regulations Part L1B 2013 Efficient hot water cylinder. Natural ventilation with extract fans in wet rooms Low water consumption 100% Low energy lights 		
BE CLEAN District heat networks or CHP	• Not feasible on the site. Details are in Section 7.		
BE GREEN On-site renewable technologies	 Ground Source Heat Pumps for underfloor heating. 0.6kWp PV panels on South-East room. Details are in Section 8.2. 		

Table 2 Energy Hierarchy and suggested strategies

1.3. Assessment Results

After the application of all strategies based on the Energy Hierarchy, the regulated carbon dioxide emissions have been reduced as follows;

Energy Hierarchy		Carbon Emissions (Tonnes CO ₂ /yr.)			
		Regulated	Unregulated		
BASELINE	Existing Building Emissions	52.13	4.94		
BE LEAN	After energy demand reduction	19.96	4.94		
BE CLEAN	After CHP/ Communal Heating	19.96	4.94		
BE GREEN	After renewable energy	15.79	4.94		

Table 3 Carbon Emissions after each stage of the proposed strategy

















The carbon savings from each stage can be calculated based on the results above. The table below clearly shows that the development meets overall 69.7% carbon reduction including the 20% targeted reduction at Be Green stage.

Energy Hierarchy		Regulated Carbon Savings		
		Tonnes CO ₂ /yr	%	
BE LEAN	After energy demand reduction	32.17	61.71 %	
BE CLEAN After heat network/ CHP		0	0 %	
BE GREEN	After renewable energy	4.17	20.88 %	
Total Cumulative Savings		36.34	69.70 %	

Table 4 Carbon dioxide Emissions after each stage of the Energy Hierarchy

Figure 1 below illustrates the hierarchical approach adopted and the resultant reduction in overall CO_2 emissions.



The Energy Hierarchy





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2. Introduction

This Energy Statement will be included as part of the planning application that addresses the environmental impact of the development. This report focuses on the energy strategy for the proposed scheme and how energy consumption and carbon emissions will be minimised and to meet the targeted carbon emissions in accordance with the London Plan and Local planning policy.

This development is to be located in the London Borough of Camden and it is in close proximity to Hampstead station (approx 0.5miles to the South-East). The proposal is refurbishment and extension of a detached house at 28 Redington Road, Hampstead, London, NW3 7RB.





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The Government approved software, i.e. FSAP 2012 has been utilised to carry out Standard Assessment Procedure (SAP) calculations. Syntegra received the architectural drawings and relevant documents, and they were used to undertake the energy assessments. The document references are listed in table below.

No.	Document Name	Format	Received Date
1	1384-28 Redington Road London, NW3 7RB (Issue	dwg	02/07//2019
2	2900 100 Decement Dian	dwa	05/07/2010
Ζ	Zörr-100-BasementPlan	uwg	05/07/2019
4	28RR-101-GroundFloorPlan	dwg	05/07/2019
5	28RR-102-1stFloorPlan	dwg	05/07/2019
6	28RR-103-2ndFloorPlan	dwg	05/07/2019
7	28RR-104-RoofFloorPlan	dwg	05/07/2019
8	28RR-120-FrontElevation	dwg	05/07/2019
9	28RR-121-RearElevation	dwg	05/07/2019
10	28RR-122-NorthWestElevation	dwg	05/07/2019
11	28RR-123-SouthEastElevation	dwg	05/07/2019
12	28RR-140-SectionA	dwg	05/07/2019
13	28RR-141-SectionB	dwg	05/07/2019
14	28RR-142-SectionC	dwg	05/07/2019
15	28RR-143-SectionD	dwg	05/07/2019
16	28RR-144-SectionE	dwg	05/07/2019
17	OI1332760	dwg	05/07/2019

Table 5 The document list

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3. Planning Policy

3.1. National Planning Policy Framework (February 2019)

The National Planning Policy Framework is a key part of our reforms to make the planning system less complex and more accessible, to protect the environment and to promote sustainable growth.

3.2. The London Plan (March 2016)



Policy 5.2, 5.4, 5.5, 5.6, & 5.7

According to Policy 5.2 all major new developments should show carbon emissions reduction through the Mayor's energy hierarchy (Be Lean, Be Clean and Be Green), unless it can be demonstrated that such provision is not feasible. From October 2016 Zero Carbon Standard apply to all new major residential development (10 or more units). This means that at least 35% of carbon reductions against a Building Regulations Part L 2013 must be achieved on-site, with the remaining emissions, up to 100%, to be offset through a contribution to the Council's Carbon Offset Fund. For the non-residential development, must achieve a 35% reduction in CO₂ emissions against a Building Regulations Part L 2013 baseline.

For retrofitting developments, it will be a challenge to meet these targets. However, available reductions in carbon emissions should be demonstrated along with water saving measures as per Policy 5.4.

Furthermore, intent must be shown for connecting to a Decentralised Energy Network and utilizing a Combined Heat & Power according to Policy 5.5 and 5.6. The Mayor and boroughs should in their DPDs adopt a presumption that developments will achieve a reduction in carbon dioxide emissions of 20% from onsite renewable energy generation according to paragraph 5.42 of Policy 5.7

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3.3. London Borough of Camden



Camden Local Plan (Adopted in 2017)

Policy CC1 Climate Change Mitigation

The Council will require all development to minimise the effects of climate change and encourage all developments to meet the highest feasible environmental standards that are financially viable during construction and occupation.

We will:

- a. promote zero carbon development and require all development to reduce carbon dioxide emissions through following the steps in the energy hierarchy;
- b. require all major development to demonstrate how London Plan targets for carbon dioxide emissions have been meet;
- a. ensure that the location of development and mix of land uses minimize the need to travel by car and help to support decentralized energy networks;
- b. support and encourage sensitive energy efficiency improvements to existing buildings;
- c. require all proposals that involve substantial demolition to demonstrate that it is not possible to retain and improve the existing building; and
- d. expect all developments to optimize resource efficiency.

For decentralised energy networks, we will promote decentralised energy by:

- e. working with local organizations and developers to implement decentralized energy networks in the parts of Camden most likely to support them;
- f. protecting existing decentralized energy networks (e.g. at Gower Street, Bloomsbury, King's Cross, Gospel Oak and Somers Town) and safeguarding potential network routes; and
- g. requiring all major developments to assess the feasibility of connecting to an existing decentralized energy network, or where this is not possible establishing a new network.

To ensure that the Council can monitor the effectiveness of renewable and low carbon technologies, major developments will be required to install appropriate monitoring equipment.





Policy CC2 Adapting to climate change

The Council will require development to be resilient to climate change.

All development should adopt appropriate climate change adaptation measures such as;

- a. the protection of existing green spaces and promoting new appropriate green infrastructure;
- b. not increasing, and wherever possible reducing, surfaces and use of Sustainable Drainage Systems;
- c. incorporating bio-diverse roofs, combination green and blue roofs and green walls where appropriate; and
- d. measures to reduce the impact of urban and dwelling overheating, including application of the cooling hierarchy.

Any development involving 5 or more residential units or 500 sqm or more of any additional floorspace is required to demonstrate the above in a Sustainability Statement.

Sustainable design and construction measures

The Council will promote and measure sustainable design and construction by:

- e. ensuring development schemes demonstrate how adaptation measures and sustainable development principles have been incorporated into the design and proposed implementation;
- f. encourage new build residential development to use the Home Quality Mark and Passivhause design standards;
- g. encouraging conversions and extensions of 500 sqm of residential floorspace or above or five or more dwellings to achieve "excellent" in BREEAM domestic refurbishment; and
- h. expecting non-domestic developments of 500 sqm of floorspace or above to achieve "excellent" in BREEAM assessments and encouraging zero carbon in new development from 2019.

Policy CC3 Water and Flooding

The Council will seek to ensure that development does not increase flood risk and reduces the risk of flooding where possible.

We will require development to:

- a. incorporate water efficiency measures;
- b. avoid harm to the water environment and improve water quality;
- c. consider the impact of development in areas at risk of flooding (including drainage);
- d. incorporate flood resilient measures in areas prone to flooding;
- e. utilise Sustainable Drainage Systems (SuDS) in line with the drainage hierarchy to achieve a greenfield run-off rate where feasible; and
- f. not locate vulnerable development in flood-prone areas.

Where an assessment of flood risk is required, developments should consider surface water flooding in detail and groundwater flooding where applicable.



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The Council will protect the borough's existing drinking water and foul water infrastructure, including the reservoirs at Barrow Hill, Hampstead Heath, Highgate and Kidderpore.

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8.55 Developments must be designed to be water efficient. This can be achieved through the installation of water efficient fittings and appliances (which can help reduce energy consumption as well as water consumption) and by capturing and re-using rainwater and grey water on-site. Residential developments will be expected to meet the requirement of 110 litres per person per day (including 5 litres for external water use). Refurbishments and other non-domestic development will be expected to meet BREEAM water efficiency credits. Major developments and high or intense water use developments, such as hotels, hostels and student housing, should include a grey water and rainwater harvesting system. Where such a system is not feasible or practical, developers must demonstrate to the Council's satisfaction that this is the case.

Camden Planning Guidance (Adopted in March 2019)

Table 2a Energy reduction targets, domestic

Development should comply with these standards/provide	Residential New Build (assessed under L1A)			Residential Refurbishment (assessed under L1B)		
this information	Major (10+ units or >1,000 sqm new floor space)	Medium (5-9 units, >500sq.m and <1,000 sqm new floor space)	Minor All new dwellings (up to 4 units and <500 sqm new floor space)	Major (10+ units or >1,000 sqm)	Medium (5-9 units, >500sq.m and <1,000 sqm)	Minor (up to 4 units and <500 sqm)
Energy and carbon reduction targets	5					
Overall carbon reduction targets:	Zero Carbon (minimum 35% reduction beyond Part L on site) (London Plan 5.2, Local Plan CC1)	19% below Part L of 2013 Building Regulations (Local Plan	19% below Part L of 2013 Building Regulations (Local Plan	Greatest possible reduction - meeting Part L1B for retained thermal	Greatest possible reduction - meeting Part L1B for retained thermal	Greatest possible reduction - meeting Part L1B for retained thermal

		CC1)	CC1)	elements (London Plan 5.4, Local Plan CC1)	elements (London Plan 5.4, Local Plan CC1)	elements (London Plan 5.4, Local Plan CC1)
Reduction in CO2 from onsite renewables (after all other energy efficiency measures have been incorporated)	20% (London Plan 5.7, Local Plan CC1)	20% (London Plan 5.7, Local Plan CC1)	Incorporate renewables where feasible	20% (London Plan 5.4, 5.7, Local Plan CC1)	20% (London Plan 5.4, 5.7, Local Plan CC1)	20% (London Plan 5.4, 5.7, Local Plan CC1)

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4. Assessment Methodology

4.1. Mayor's Energy Hierarchy

The energy hierarchy is a classification of different methods to improve energy performance in a parallel sequence. This includes primarily a focus on reducing energy use by avoiding unnecessary use, to then improving the efficiency of energy systems to minimise loss, this is followed by exploiting renewable energy sources and then low carbon energy solutions for energy needs and finally, any remaining demand can be catered for by conventional fuel sources.

The Mayor's Energy Strategy adopts a set of principles to guide design development and decisions regarding energy, balanced with the need to optimise environmental and economic benefits. These guiding principles have been reordered since the publication of the Mayor's Energy Strategy in Feb 2004 and the adopted replacement London Plan 2011 with further alterations in 2015 stating that the following hierarchy should be used to assess applications:

- **BE LEAN** By using less energy and taking into account the further energy efficiency measure in comparison to the baseline building.
- **BE CLEAN** By supplying energy efficiently. The clean building looks at further carbon dioxide emission savings over the lean building by taking into consideration the use of decentralise energy via CHP.
- **BE GREEN** By integrating renewable energy into the scheme which can further reduce the carbon dioxide emission rate.



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5. Baseline – Target Emission Rate

The baseline (known as Target Emission Rate), as calculated in line with the Building Regulation 2013, is the maximum amount of carbon dioxide a dwelling or non-residential unit is allowed to emit. The Target Emission Rate (TER) includes carbon dioxide emissions which are covered by Part L of the Building Regulations, known as regulated emissions (space and water heating, ventilation, lighting, pumps, fans & controls). The baseline energy uses and resulting CO₂ emissions rates of the development have been assessed using the Government approved software.

In regard to the conversion/ refurbishment area, the baseline energy use and CO_2 emissions for the development are calculated based on the notional existing building conditions in accordance with GLA Guidance on preparing energy assessments. The inputs were gathered during the site survey or assumed by the Reduced Data SAP (RdSAP) when the data was not available. The existing building conditions are summarised in the table below.

		Existing Specifications (Age band B set by SAP 2012 Appendix S)	
	Wall	2.1 (solid brick as built)	
	Window	3.1 (double glazing)	
U-value	Rooflight	3.1 (double glazing)	
(W/m² K)	Floor	1.2 (as built/ insulation unknown)	
	Roof	2.3 (flat/ pitched)	
	Door	3.0	
Air Permeability (m ³ /h.m ² at 50 Pa)		15	
Heating Sy	stem	Gas combi boiler with radiators	
Hot Water System		From gas combi boiler	
Lighting		0% Low Energy Light	
Ventilation		Natural ventilation with extract fans in wet room	

Table 6 Existing Specifications used for energy assessment



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The 'baseline' regulated CO_2 emission for the development is presented in the tables below:



BASELINE	Regulated CO ₂ Emissions (Tonnes CO ₂ /yr)
28 Redington Road	52.13

Table 7 Regulated Carbon Emissions at Baseline

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6. BE LEAN – Energy Efficient Design

This section outlines the energy efficient measures taken in order to minimise the building's energy demand and therefore reduce energy use and CO₂ emissions further than the Baseline requirements (Building Regulations 2013 Part L compliance).

6.1. Passive Design Measures

• Enhanced Building Elements

At the 'BE LEAN' stage of the energy hierarchy, energy efficient building elements have been incorporated into the build. The heat loss of different building element is dependent upon their U-value and air tightness. Therefore, better U-values and air permeability than the minimum values set in the Part L 2013 have been suggested in this development. Please see below more specifically.

		Part L1B 2 required	2013 min. d values	Proposed building values		
		New	Upgrade	New	Upgrade	
	Wall	0.28	0.3 – 0.55	0.28	0.3	
U-value (W/m ² K)	Window	1.6		1.6		
	Roof lights	1.6		1.6		
	Floor	0.22 0.25		0.22	0.25	
	Roof	0.16 - 0.18		0.16		
	Door	1.8		1.8		
Air Permeability (m ³ /h.m ² at 50 Pa)		-		15		

Table 8 Proposed building elements

• Orientation & Natural Daylighting

Passive solar gain reduces the amount of energy required for space heating during the winter months. The houses are positioned having front roads and rear gardens, which can maximise the passive solar gains into the building throughout the day. Moreover, the internal layout, windows, and roof lights have been designed to improve daylighting in all habitable spaces, as a way of improving the health and wellbeing of occupants.



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The dwelling will incorporate internal blinds or curtains to reduce the solar heat coming into the dwelling, and thus can reduce the cooling demand during summer.

Natural Ventilation

A natural ventilation strategy has been adopted with extract fans in wet rooms; toilets, bathrooms, kitchen and utility. Therefore, higher energy consumption and CO2 emissions due to mechanical ventilation can be avoided.

6.2. Active Design Measures

• Heating and Hot Water System

At the 'BE LEAN' stage, condensing gas boiler (89.5% efficiency) have been examined for space heating and hot water. Detailed specifications used at BE LEAN stage are in the table below.

Please note that the system below has been used only for carbon emissions calculation at BE LEAN stage as per GLA Guidance on energy assessment. The suggested system will be mentioned at BE GREEN stage as a renewable technology (GSHP) has been suggested – Section 8.2.

Systems	General Specification	Controls/ Other inputs
Heating	Condensing gas boiler with radiators (efficiency of 89.5%)	 Time and temperature zone control by suitable arrangement of plumbing and electrical services Boiler interlocked Fan flued
Hot-water	From gas boiler	 Cylinder – 300 litres Loss factor - 1.9 kWh/day Cylinder in heated space Cylinderstat Primary pipe work insulated

Table 9 Heating and Hot water systems

• High Efficiency Lighting

The proposed light fittings will be low energy efficient fittings. These can be T5 fluorescent fittings with high frequency ballasts, or LED fittings. The suggested specifications should be reviewed at detailed design stage with electric engineers.

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The following table demonstrates the reduction in CO_2 emissions from the energy efficiency measures mentioned above. As shown in the table below, the carbon reduction of <u>61.71%</u> can be achieved on the site at BE LEAN stage against the existing building emissions.

📥 BE LEAN STAGE

	Regulated CO ₂ Emiss	ions (Tonnes CO ₂ /yr)	Carbon Reduction
	BASELINE	BE LEAN	(%)
28 Redington Road	52.13	19.96	61.71 %

Table 10 Regulated Carbon Emissions at Be Lean Stage

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7. BE CLEAN – CHP & Decentralised Energy Networks

The Energy Hierarchy encourages the use of a CHP system and the connection to District Heating system to reduce CO₂ emissions further.

7.1. Decentralised Energy Network

The Mayor's Energy Strategy favours community heating systems because they offer:

- Potential economies of scale in respect of efficiency and therefore reduced carbon emissions; and
- Greater potential for future replacement with Low or Zero Carbon (LZC) technologies.

The feasibility of connecting into an existing heating network or providing the building with its own combined heat and power plant has been assessed alongside the **London Heat Map Study for the London Borough of Camden** as part of this assessment. The study identifies that the site is not located near the existing/ potential district heating networks. This is demonstrated clearly from the London Heat Map (http://www.londonheatmap.org.uk) snapshot below.



Figure 3 London Heat Map near the site



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Moreover, the London heat map below identifies existing DH networks in more broaden area, and it could not find any existing DH networks (in yellow) within 1Km radius from the property. The costs involved in extending the existing DH network would outweigh the advantages in this small development. Therefore, utilisation of the DH network has not been a feasible option for this development.



Figure 4 Existing DH Network near the site











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7.2. CHP

The Energy Hierarchy identifies the combined heat and power (CHP) as a method of producing heat and electricity with much lower emissions than separate heat and power. Also, it encourages the creation of district heating systems supplied by CHP. The implementation of a CHP strategy should be decided according to good practice design. Key factors for the efficient implementation of the CHP system are:

- Development with high heating load for the majority of the year.
- CHP operation based on maximum heat load for minimum 10 hours per day.
- CHP operation at maximum capacity of 90% of its operating period.

To ensure that CHP is financially viable it is essential that the unit is selected to meet the base heat load and that this load is maintained over a large proportion of the day (a figure of 14 - 17 hours per day is often quoted subject to the load profiles and gas and electricity prices) to ensure that the additional costs (maintenance) associated with running a CHP unit can be recovered. This need to run the CHP plant, as far as possible continuously makes the building load profile of prime importance when reviewing the viability of such solutions and in particular the summer time heat load profile. To enable the CHP plant to run continuously when it is operating, a thermal store is often used so that excess CHP capacity can be used to generate hot water for use at a later time.

Since this development consists of only one dwelling that does not require high heating loads, installing the CHP system would not be beneficial given the cost. According to the Local Plan Policy LP22, developments of 50 units or more will need to provide an assessment of the provision of CHP. Hence the CHP system has not been considered for this development at BE CLEAN stage.

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In this section the viable renewable energy technologies that could reduce the development's CO₂ emissions are examined. In determining the appropriate renewable technology for the site, the following factors were considered;

- Renewable energy resource or fuel availability of the LZC technology on the site.
- Space limitations due to building design and urban location of the site.
- Capital, operating and maintenance cost.
- Planning Permission
- Implementation with regards the overall M&E design strategy for building type
- Available Grants

The table below summarises the various low zero carbon technologies considered for the projects, and we have identified that **Ground Source Heat Pumps and PV panels** would be the most appropriate option in this development.

Technology	Local Planning Requirements	Carbon Payback	Grants/ Funding	Feasibility
Air Source Heat Pumps (ASHP)	Noise Issues from External units	High	Renewable Heat Incentive (RHI)	MEDIUM
Solar Thermal	Spatial and Shadowing	Low	Renewable Heat Incentive (RHI)	MEDIUM
Photovoltaic (PV)	Spatial and Shadowing	High	-	HIGH
Ground Source Heat Pumps (GSHP)	Spatial issues for boring holes and noise	Medium	Renewable Heat Incentive (RHI)	HIGH
Biomass	Spatial requirement for fuel storage and biomass odour	High	Renewable Heat Incentive (RHI)	LOW
Wind Power	Extensive planning requirements for noise and local biodiversity	Low	-	LOW
Hydro Power	Extensive planning requirements for noise and water quality	None	-	ZERO

Table 11 Feasibility Study of LZC Technologies

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8.1. Non-feasible Technology

• Air Source Heat Pumps (ASHP)

ASHP can meet the space heating demands on site efficiently in comparison with gas boilers. Although this low carbon technology consumes electricity to operate due to higher efficiency the heat output is much greater. However, the efficiency of heat pumps is very much dependent on the temperature difference between the heat source and the space required to be heated. As a result, ASHPs tend to have a lower COP than GSHPs. This is due to the varying levels of air temperature throughout the year when compared to the relatively stable ground temperature. Moreover, any noise associated with the external units could potentially be an issue at night due to the proximity of the neighboring residential buildings. Therefore, the use of ASHP is not a suitable option for this development.

• Solar Thermal

The use of solar thermal for this development would be limited to domestic hot water only. The use of solar thermal for space heating would not be practical as it is not required when solar thermal is at its most effective during the summer months. Therefore, this system would require additional plumbing and space for hot water storage, incurring additional financial cost. Moreover, the amount of carbon offset from the system is generally lower than other technologies. Therefore, this technology is deemed to be unsuitable for this development.

• Hydro power

Although River Thames is close to the site, there is no river or lake within the development site boundaries. Therefore, small scale hydro-electric will not be studied any further because of the location and the spatial limitations of the development.

Wind Power

Wind turbines need extensive planning requirements and they are only feasible at consistent wind speed. Moreover, since the development is located in an urban area, the site does not have sufficient wind speed to operate wind turbine at the height of 10 meters as shown below (http://www.renew-reuse-recycle.com/noabl.pl?n=503). Hence this option has been discounted.

Wind abov	speed at e ground (m/s)	10m level	Wind	speed at e ground (m/s)	25m level	Wind abov	speed at e ground (m/s)	45m level
5	5.5	5.8	5.8	6.3	6.5	6.3	6.7	6.9
5	5.7	5.9	5.8	6.4	6.6	6.3	6.8	7
1.9	5.3	5.6	5.7	6	6.3	6.2	6.5	6.7

Estimated average windspeeds around NW3 7..

Squares surrounding the central square correspond to wind speeds for surrounding grid squares. Power generated is related to windspeed by a cubic ratio. That means if you halve the windspeed, the power goes down by a factor of 8 (which is $2 \times 2 \times 2$). A quarter of the windspeed gives you a 64^{th} of





the power (4 x 4 x 4). As a rough guide, if your turbine is rated at producing 1KW at 12m/s then it will produce 125W at 6m/s and 15W at 3m/s.

Please note that bear in mind that the NOABL windspeed dataset used here is a model of windspeeds across the country, assuming completely flat terrain. It isn't a database of measured windspeeds. Other factors such as hills, houses, trees and other obstructions in your vicinity need to be considered as well as they can have a significant effect. If you're thinking about installing a wind turbine, you should perform your own windspeed measurements using an anemometer to determine what the actual figures are.

Biomass

A biomass system designed for this development would be fueled by wood pellets which have a high energy content. However, a biomass system would not be an appropriate technology for the site for the following reasons:

- i. The burning of wood pellets releases substantially more NOx emissions when compared to similar gas boilers. As the development is situated within an urban area, the installation of a biomass boiler would further impact on the air quality in this area.
- ii. the lack of spaces for pellet boiler and storage on the site.
- iii. Pellets would need to be transported from local pellet suppliers, which causes carbon emissions to the air.

However, if the biomass system is considered at detailed design stage, local suppliers can be found near the site as shown in the map below (http://biomass-suppliers-list.service.gov.uk).







Company name	Postcode	Contact	Fuel Supplied	Telephone
Travis Perkins Trading Co. Ltd	NW6 1SD	www.travisperkins.co.uk johnny.farmer@travisperkins.co.uk	Pellets	020 7794 8151
Wolseley UK Ltd	N6 4JD	www.draincenter.co.uk qdn.Highgate@wolseley.co.uk	Pellets	0208 3400793
Travis Perkins Trading Co. Ltd	NW10 3NB	www.travisperkins.co.uk lee.gilmore@travisperkins.co.uk	Pellets	020 8964 9000
Wolseley UK Ltd	NW2 7LZ	www.plumbcenter.co.uk YH.StaplesCorner@wolseley.co.uk	Pellets	0208 8309106
Travis Perkins Trading Co. Ltd	N19 5UN	www.travisperkins.co.uk toby.duncan@travisperkins.co.uk	Pellets	0207 561 0516
Wolseley UK Ltd	NW1 OBY	www.plumbcenter.co.uk FFP.Camden@wolseley.co.uk	Pellets	0207 4240957
Travis Perkins Trading Co. Ltd	NW10 5NY	www.travisperkins.co.uk daniel.mccafferty@travisperkins.co.uk	Pellets	0208 969 2000
Travis Perkins Trading Co. Ltd	W2 6NA	www.travisperkins.co.uk liam.clancy@travisperkins.co.uk	Pellets	020 7262 6602
Travis Perkins Trading Co. Ltd	NW1 OPT	www.travisperkins.co.uk sean.mahon@travisperkins.co.uk	Pellets	0207 380 6480
Travis Perkins Trading Co. Ltd	NW10 1RZ	www.travisperkins.co.uk phil.pilditch@travisperkins.co.uk	Pellets	0208 4386 715

8.2. Proposed Technology

• Ground Source Heat Pumps (GSHP)

Ground-source heat pumps (GSHPs) operate similarly to ASHPs, except that the ground serves as the heat source. As the ground remains at relatively stable temperatures throughout the year, SCoPs may be consistently high at above 5.0, producing low-carbon heat suitable for space heating and domestic hot water. Ground loops or boreholes are required, especially on a small footprint where unusually deep boreholes would be required to meet heating demand.

The specifications used for this energy assessment are below, however the mechanical engineer should be reviewed the specification during the design development.

Systems	General Specification	Controls/ Other inputs
Heating	Ground Source Heat Pumps for underfloor heating (170% efficiency)	 Flow temperature ≤35°C Control – Programmer and at least two room thermostats MCS certified
Hot Water	Electric immersion cylinder	 300 litres with the loss factor of 1.9 kWh/day Cylinder in heated space Cylinderstat

Table 12 Be Green Stage systems

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Tariffs that apply for domestic Renewable Heat Incentive (RHI) are as shown in the table below based on the following link. https://www.ofgem.gov.uk/environmental-programmes/domesticrhi/contacts-guidance-and-resources/tariffs-and-payments-domestic-rhi/current-future-tariffs

Tariff name	Applications submitted	Tariff Rate
Crowed Sources	01/07/2019 – 30/09/2019	20.89 pence per kWh
Heat Pumps	01/10/2019 – 30/12/2019	If any new tariff changes are to be made due to digression, the announcement by BEIS would be made by 1 August 2019

Table 13 GSHP RHI

• Photovoltaic (PV)

Based on the feasibility study above, PV would be the most suitable renewable technology for the following reasons:

- i. The installation of PV is much simpler when compared to other renewable technologies
- ii. There is sufficient roof space available to install enough PV modules to have a significant impact on carbon emissions of the development
- iii. PV panels sited on the roof within an urban area are less visually intrusive when compared to wind turbines

The PV system capacity for the whole development depends upon the selection of the heating system. Therefore, the amount of PV relating to the proposed heating system option is outlined below:

GSHP + 0.6 kWh PV

Orientation	South-East	Number of Panels	3 panels
Panel Tilt	45°	Power Output	200 W per panel
Overshading	Less than 20 percent	Annual Output	Approximately 482 kWh

Table 14 Suggested PV details

For the 0.6kWp system, 3 panels (200W per panel) would to be installed at 45° on the South-East roof. The proposed PV panels are subject to further consideration at detailed design stage. In order to qualify both the installer and the equipment, the system must be certified under the Microgeneration Certification Scheme (MCS).

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Given the proposed LZC technologies on the site (**GSHP and PV**), the overall CO_2 reduction at BE GREEN stage can be calculated as shown below. And, it can be seen that the overall CO_2 reduction via on-site renewables is <u>**20.88%</u>** against the BE LEAN stage.</u>

📥 BE GREEN stage

	Regulated CO ₂ Emiss	ions (Tonnes CO ₂ /yr)	Carbon Reduction
	BE LEAN	BE GREEN	(%)
28 Redington Road	19.96	15.79	20.88 %

Table 15 Regulated Energy Use and Carbon Reduction at Be Green Stage

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BREEAM

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This report assesses the predicted energy performance and carbon dioxide emissions of the proposed development at **28 Redington Road, Hampstead, London, NW3 7RB,** based on the information provided by the design team.

In line with the local Council's three step energy hierarchy, the regulated CO₂ emissions for the development have been reduced by **69.7% including a 20.9% via renewable technologies.**

The table below clearly shows that the development meets the planning requirements.

Energy Hierarchy		Regulated Carbon Savings		
		Tonnes CO ₂ /yr	%	
BE LEAN	After energy demand reduction	32.17	61.71 %	
BE CLEAN	After heat network/ CHP	0	0 %	
BE GREEN After renewable energy		4.17	20.88 %	
Total Cumulative Savings		36.34	69.70 %	

Table 16 Carbon dioxide Emissions after each stage of the Energy Hierarchy

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10. Appendix A – SAP Reports

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Block Compliance WorkSheet: 28 Redington Road

		User Details				
Assessor Name: Software Name:	Stroma FSAP	Stroma Number: Software Version: Version: 1.0.4.18		4.18		
		Calculation Deta	ils			
Dwelling		DER	TER	DFEE	TFEE	TFA
Existing - BASELINE (1	ſER)	52.02	12.96	193.4	60.6	1002.21
Proposed - BE LEAN		19.94	12.93	81.9	60.6	1002.21
Proposed - BE GREEN		15.76	19.59	81.9	60.6	1002.21
			•	• •	•	• •

Calculation Summary

Total Floor Area	3006.63
Average TER	15.16
Average DER	29.24
Average DFEE	119.07
Average TFEE	60.60
Compliance	Fail
% Improvement DER TER	N/A
% Improvement DFEE TFEE	N/A

				User D	etails:						
Assessor Name:	Su Lee				Strom	a Num	ber:		STRC	031315	
Software Name:	Stroma FS	AP 201	2		Softwa	are Ver	sion:		Versio	on: 1.0.4.18	
			Р	roperty <i>i</i>	Address:	Propos	ed - BE (GREEN			
Address :	28, Redingt	on Road	, LOND	ON, NW	3 7RB						
1. Overall dwelling dime	nsions:										
D				Area	a(m²)		Av. Hei	ght(m)	1	Volume(m ³	[*])
Basement				23	35.61	(1a) x	2.	5	(2a) =	589.03	(3a)
Ground floor				30	62.55	(1b) x	3.1	16	(2b) =	1145.66	(3b)
First floor				23	36.76	(1c) x	3.0)6	(2c) =	724.49	(3c)
Second floor				10	67.29	(1d) x	3.0	01	(2d) =	503.54	(3d)
Total floor area TFA = (1a	a)+(1b)+(1c)+	(1d)+(1e))+(1r	I) 10	02.21	(4)			-		
Dwelling volume						(3a)+(3b))+(3c)+(3d)	+(3e)+	.(3n) =	2962.71	(5)
2. Ventilation rate:					a tha a n		tetel				
	heating	se	eating	у — —	otner		total			m [°] per nou	r
Number of chimneys	0	+	0	+	0	=	0	X 4	40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x	20 =	0	(6b)
Number of intermittent far	าร						18	x ′	10 =	180	(7a)
Number of passive vents							0	x ′	10 =	0	(7b)
Number of flueless gas fin	res					Γ	0	X 4	40 =	0	(7c)
									Air ch	nanges per ho	bur
Infiltration due to chimney	s, flues and f	ans = <mark>(6</mark> a	a)+(6b)+(7	a)+(7b)+(7c) =		180	<u> </u>	÷ (5) =	0.06	(8)
If a pressurisation test has b	een carried out o	r is intende	d, procee	d to (17), d	otherwise c	ontinue fro	om (9) to (1	6)			
Number of storeys in th	e dwelling (n	5)								0	(9)
Additional infiltration	OE for steel o	timborf	romo or	0.25 for			uction	[(9)	-1]x0.1 =	0	(10)
if both types of wall are pr	esent. use the va		ondina to	the areat	er wall area	y constr a (after	uction			0	(11)
deducting areas of openin	gs); if equal user	0.35		<u>g</u>		. (
If suspended wooden f	loor, enter 0.2	(unseale	ed) or 0.	1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, ent	er 0.05, else	enter 0								0	(13)
Percentage of windows	and doors dr	aught sti	ripped				1			0	(14)
Window infiltration					0.25 - [0.2	x (14) ÷ 1	00] =	(45)		0	(15)
Infiltration rate	50	12			(8) + (10) -	+ (11) + (1	2) + (13) +	(15) =		0	(16)
Air permeability value,	q50, expresse	(19) - [(1	$r = \frac{1}{2}$	s per no	our per so	quare m	etre of er	ivelope	area	15	
Air permeability value applies	s if a pressurisation	on test has	been don	e or a dec	gree air per	meability	is being us	ed		0.81	(18)
Number of sides sheltere	d						2			2	(19)
Shelter factor					(20) = 1 - [0.075 x (1	9)] =			0.85	(20)
Infiltration rate incorporat	ing shelter fac	tor			(21) = (18)	x (20) =				0.69	(21)
Infiltration rate modified for	or monthly wir	nd speed									_
Jan Feb	Mar Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec]	

Month	ly avera	age wind	speed f	rom Tab	le 7									
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind F	Eactor (222)m –	(22)m ·	1										
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		
			L	I				<u> </u>						
Adjust	ed infilt	ration rat	e (allow	ring for sl	helter an	d wind s	peed) =	(21a) x	(22a)m	0.74	0.70			
Calcul	ate effe	octive air	change	rate for t	the appli	0.65 Cable ca	0.65 Se	0.64	0.69	0.74	0.78	0.81		
lf m	echanic	al ventila	ation:									[0	(23a)
lf exh	aust air h	neat pump	using App	endix N, (2	23b) = (23a	ı) × Fmv (e	equation (I	N5)) , othe	rwise (23b) = (23a)		[0	(23b)
If bal	anced wit	h heat reco	overy: effi	ciency in %	allowing f	or in-use f	actor (fron	n Table 4h) =			[0	(23c)
a) If	balanc	ed mech	anical v	entilation	with hea	at recove	ery (MVI	HR) (24a	a)m = (22	2b)m + (23b) × [1 – (23c)	÷ 100]	
(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24a)
b) If	balanc	ed mech	anical v	entilation	without	heat rec	overy (N	MV) (24t	o)m = (22	2b)m + (23b)	,		
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If	whole I	nouse ex	tract ve	ntilation (or positiv	e input v	ventilatio	on from (outside	E (00k	.)			
(24c)m		m < 0.5 >	(230),		c) = (23c)			C) = (22)	$\frac{5}{1} + 0.$.5 × (230				(24c)
-(۲۹۵) ا		vontiloti					vontiloti			0	0	Ū		(210)
u) II	if (22b)	m = 1, th	en (24d	m = (22)	b)m othe	e input erwise (2	4d)m =	0.5 + [(2	2b)m ² x	0.5]				
(24d)m=	0.89	0.87	0.86	0.79	0.77	0.71	0.71	0.7	0.74	0.77	0.8	0.83		(24d)
Effe	ctive ai	r change	rate - e	nter (24a	a) or (24k	o) or (24	c) or (24	d) in bo	x (25)					
(25)m=	0.89	0.87	0.86	0.79	0.77	0.71	0.71	0.7	0.74	0.77	0.8	0.83		(25)
3. He	at losse	es and he	eat loss	paramet	er:									
ELEN	/IENT	Gros	SS	Openir	igs	Net Ar	ea	U-val	ue	ΑXU		k-value		AXk
_		area	(m²)	n	²	A ,r	n²	W/m2	2K	(W/	K)	kJ/m²∙k	K	kJ/K
Doors	Type 1					1.89	×	1.8	=	3.402				(26)
Doors	Type 2					2.32	x	1.8	= [4.176				(26)
Windo	ws Typ	e 1				0.67	x1	/[1/(1.6)+	0.04] =	1.01				(27)
Windo	ws Typ	e 2				1.09	x1	/[1/(1.6)+	0.04] =	1.64				(27)
Windo	ws Typ	e 3				0.95	x1	/[1/(1.6)+	0.04] =	1.43				(27)
Windo	ws Typ	e 4				0.95	x1	/[1/(1.6)+	0.04] =	1.43				(27)
Windo	ws Typ	e 5				0.95	x1	/[1/(1.6)+	0.04] =	1.43				(27)
Windo	ws Typ	e 6				2.22	x1	/[1/(1.6)+	0.04] =	3.34				(27)
Windo	ws Typ	e 7				0.84	x1	/[1/(1.6)+	0.04] =	1.26				(27)
Windo	ws Typ	e 8				0.84	x1	/[1/(1.6)+	0.04] =	1.26				(27)
Windo	ws Typ	e 9				0.67	x1	/[1/(1.6)+	0.04] =	1.01				(27)
Windo	ws Typ	e 10				0.84	x1	/[1/(1.6)+	0.04] =	1.26	=			(27)
Windo	ws Typ	e 11				0.84		/[1/(1.6)+	0.04] =	1.26	Ħ			(27)
Windo	ws Typ	e 12				0.84	x1	/[1/(1.6)+	0.04] =	1.26	=			(27)

Windows Type 13 Windows Type 14 Windows Type 15 Windows Type 16 Windows Type 17 Windows Type 18 Windows Type 19 Windows Type 20 Windows Type 21 Windows Type 22 Windows Type 23 Windows Type 24 Windows Type 25 Windows Type 26 Windows Type 27 Windows Type 28 Windows Type 29 Windows Type 30 Windows Type 31 Windows Type 32 Windows Type 33 Windows Type 34 Windows Type 35 Windows Type 36 Windows Type 37 Windows Type 38 Windows Type 39 Windows Type 40 Windows Type 41 Windows Type 42 Windows Type 43 Rooflights Type 1 Rooflights Type 2 **Rooflights Type 3** Rooflights Type 4 Rooflights Type 5 Rooflights Type 6 Rooflights Type 7

Rooflights Type 8

	_			
1.4	x1/[1/(1.6)+ 0.04] =	2.11	(2	27)
1.4	x1/[1/(1.6)+0.04] =	2.11	(2	27)
1.4	x1/[1/(1.6)+0.04] =	2.11	(2	27)
2.23	x1/[1/(1.6)+ 0.04] =	3.35	(2	27)
1.39	x1/[1/(1.6)+ 0.04] =	2.09	(2	27)
7.702	x1/[1/(1.6)+ 0.04] =	11.58	(2	27)
9.22	x1/[1/(1.6)+ 0.04] =	13.86	(2	27)
5.15	x1/[1/(1.6)+0.04] =	7.74	(2	27)
9.49	x1/[1/(1.6)+0.04] =	14.27	(2	27)
2.1	$x^{1/[1/(1.6)+0.04]} =$	3.16	(2	27)
3.93	$x^{1/[1/(1.6)+0.04]} =$	5.91	(2	27)
2.61	$x^{1/[1/(1.6)+0.04]} =$	3.92	(2	27)
6.83	$x^{1/[1/(1.6)+0.04]} =$	10.27	(2	27)
2.9	$x^{1/[1/(1.6)+0.04]} =$	4.36	(2	27)
1.68	$x^{1/[1/(1.6)+0.04]} =$	2.53	(2	27)
1.68	$x^{1/[1/(1.6)+0.04]} =$	2.53	(2	27)
1.68	$x^{1/[1/(1.6)+0.04]} =$	2.53	(2	27)
1.89	$x^{1/[1/(1.6)+0.04]} =$	2.84	(2	27)
7.43	$x^{1/[1/(1.6)+0.04]} =$	11.17	(2	27)
1.81	$x^{1/[1/(1.6)+0.04]} =$	2.72	(2	27)
1.81	$x^{1/[1/(1.6)+0.04]} =$	2.72	(2	27)
8.28	$x^{1/[1/(1.6)+0.04]} =$	12.45	(2	27)
5.69	$x^{1/[1/(1.6)+0.04]} =$	8.56	(2	27)
2.68	$x^{1/[1/(1.6)+0.04]} =$	4.03	(2	27)
2.33	$x^{1/[1/(1.6)+0.04]} =$	3.5	(2	27)
4.04	$x^{1/[1/(1.6)+0.04]} =$	6.08	(2	27)
4.04	$x^{1/[1/(1.6)+0.04]} =$	6.08	(2	27)
1.16	$x^{1/[1/(1.6)+0.04]} =$	1.74	(2	27)
1.16	$x^{1/[1/(1.6)+0.04]} =$	1.74	(2	27)
4.99	$x^{1/[1/(1.6)+0.04]} =$	7.5	(2	27)
2.06	$x^{1/[1/(1.6)+0.04]} =$	3.1	(2	27)
1.08	$x^{1/[1/(1.6) + 0.04]} =$	1.728	(2	27b)
1.08	$x^{1/[1/(1.6) + 0.04]} =$	1.728	(2	27b)
1.08	$x^{1/[1/(1.6) + 0.04]} =$	1.728	(2	27b)
0.98	$x^{1/[1/(1.6) + 0.04]} =$	1.568	(2	2 7 b)
0.86	$x^{1/[1/(1.6) + 0.04]} =$	1.376	(2	2 7 b)
0.49	$x^{1/[1/(1.6) + 0.04]} =$	0.784	(2	27b)
0.49	$x^{1/[1/(1.6) + 0.04]} =$	0.784	(2	27b)
1.38	$x^{1/[1/(1.6) + 0.04]} =$	2.208	(2	27b)

Rooflights Type	9				2.36		x1/	[1/(1.6) + ().04]	= [3.776	٦				(27b)
Floor Type 1					235.6	1	×	0.25		= [58.9025	īΓ				(28)
Floor Type 2					58.41		x [0.25	=	= [14.6025	ī ī		Ē		(28)
Floor Type 3					43.88	3	× [0.25		= [10.97	īĒ		Ē		(28)
Floor Type 4					30.08	3	× [0.22		= [6.6176	ĪĪ		=		(28)
Walls Type1	39.83		0		39.83	3	× [0.28		= [11.15	ĪĪ				(29)
Walls Type2	74.6		0		74.6		x [0.3		=	22.38	ĪĪ				(29)
Walls Type3	82.62		0		82.62	2	x [0.3		= [24.79	ĪĪ				(29)
Walls Type4	15.7		12.3		3.4		× [0.28		= [0.95	Ī				(29)
Walls Type5	181.23	3	47.31		133.9	2	× [0.28		=	37.5					(29)
Walls Type6	151.49	Э	13.43		138.0	6	× [0.3		=	41.42					(29)
Walls Type7	122.82	2	13.51		109.3	1	× [0.28		= [30.61					(29)
Walls Type8	82.7		33.42		49.28	;	x [0.3		=	14.78					(29)
Walls Type9	58.8		10.4		48.4		× [0.28		=	13.55					(29)
Walls Type10	73.15		10		63.15	;	× [0.3		=	18.94					(29)
Walls Type11	7.3		0		7.3		× [0.28		=	2.04					(29)
Roof Type1	7.3		0		7.3		× [0.16		=	1.17					(30)
Roof Type2	9.01		0		9.01		× [0.16		=	1.44					(30)
Roof Type3	62.97		0		62.97	,	× [0.16		=	10.08					(30)
Roof Type4	60.25		0		$\begin{array}{c ccccccccccccccccccccccccccccccccccc$											(30)
Roof Type5	53.15		7.56		45.59)	x [0.16		=	7.29					(30)
Roof Type6	13.83		0		13.83	3	× [0.16		=	2.21					(30)
Roof Type7	89.11		6.93		82.18	3	x [0.16		= [13.15					(30)
Roof Type8	68.32		0		68.32	2	x [0.16		= [10.93					(30)
Roof Type9	20.39		0.49		19.9		x [0.16		= [3.18					(30)
Roof Type10	19.18		0		19.18	3	x [0.16		= [3.07					(30)
Total area of ele	ements,	m²			1661.7	72										(31)
* for windows and re	oof windov	vs, use ef ides of int	fective wir	dow U-va	alue calcula	ated us	sing	formula 1/	/[(1/U-\	valu	ıe)+0.04] as	given in	paragraph	3.2		
Fabric heat loss	, W/K =	S (A x I	J)	, and part				(26)(30)	+ (32)) =				60)6.23	(33)
Heat capacity C	, m = S(A	xxk)	,						((2	28)	(30) + (32)	+ (32a).	(32e) =		0	(34)
Thermal mass p	aramete	er (TMP	= Cm ÷	TFA) ir	n kJ/m²K				Inc	dica	tive Value: N	Medium			250	(35)
For design assessn can be used instead	nents whe I of a deta	re the det	ails of the lation.	constructi	ion are not	t knowr	n pre	ecisely the	indica	ative	e values of T	MP in Ta	able 1f			
Thermal bridges	s : S (L x	(Y) calc	ulated u	sing Ap	pendix k	<								24	49.26	(36)
if details of thermal	bridging a	re not kno	own (36) =	0.05 x (3	1)											
Total fabric hear	t loss								(33	3) +	(36) =			85	55.49	(37)
Ventilation heat	loss cal	culated	monthly						(38	8)m	= 0.33 × (25	5)m x (5)	1			
Jan	Feb	Mar	Apr	May	Jun	Ju		Aug	Se	ep	Oct	Nov	Dec			
(38)m= 866.26	851.6	837.24	769.76	757.14	698.37	698.3	37	687.49	721.(U1	757.14	782.68	809.38			(38)
Heat transfer co	efficient	:, W/K	ı					I	(39	9)m	= (37) + (38	8)m	1	I		
(39)m= 1721.75	1707.09	1692.73	1625.25	1612.63	1553.86	1553.	86	1542.98	1576	6.5	1612.63	1638.17	1664.87	16	25 10	(39)
											woraye = 3	un(09)1	12714		20.13	(00)

Heat lo	oss para	ameter (H	HLP), W	/m²K					(40)m	= (39)m ÷	(4)			
(40)m=	1.72	1.7	1.69	1.62	1.61	1.55	1.55	1.54	1.57	1.61	1.63	1.66		
Numbe	er of day	u vs in mou	nth (Tab	le 1a)					,	Average =	Sum(40)1.	12 /12=	1.62	(40)
- turno t	Jan	Feb	Mar	Apr	May	Jun	Jul	Αυα	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
	_		-		-		_	-		-		-		
4. Wa	iter hea	ting ene	rgy requ	irement:								kWh/ye	ear:	
Assum if TF if TF	ied occi A > 13. A £ 13.	upancy, l 9, N = 1 9, N = 1	N + 1.76 x	[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.(0013 x (⁻	TFA -13.	4. 9)	04		(42)
Annua Reduce not more	l averag the annu e that 125	ge hot wa al average 5 litres per j	ater usag hot water person pel	ge in litre usage by r day (all w	es per da 5% if the d vater use, l	ay Vd,av Iwelling is hot and co	erage = designed ld)	(25 x N) to achieve	+ 36 a water us	se target o	130).26		(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage i	in litres per	r day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)						
(44)m=	143.29	138.08	132.87	127.66	122.45	117.24	117.24	122.45	127.66	132.87	138.08	143.29		
Enerav	content o	f hot water	used - cal	culated m	onthly – 4	190 x Vd r	m y nm y [)Tm / 3600	-) kWh/mor	Total = Su	m(44) ₁₁₂ =	- c 1d)	1563.17	(44)
(45)m-	2125	195.95	101 79	167.2	160.42	129 //	129.20	147.21	149.07	172.61	180.51	205 70		
(43)11=	212.5	105.05	191.70	107.2	100.43	130.44	120.29	147.21	140.97	Total – Su	m(45), =	205.79	2049 56	(45)
lf instant	taneous v	vater heatii	ng at point	of use (no	o hot water	r storage),	enter 0 in	boxes (46)) to (61)		111()112 -		2040.00	
(46)m=	31.87	27.88	28.77	25.08	24.06	20.77	19.24	22.08	22.35	26.04	28.43	30.87		(46)
Water	storage	loss:												
Storag	e volum	ne (litres)) includir	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		300		(47)
If comr	munity h	neating a	ind no ta	nk in dw r (this in	/elling, e	nter 110 nstantar) litres in	i (47) Imbi boil	ore) onto	ar '()' in <i>(</i>	47)			
Water	storage	loss:	not wate	51 (ti 115 11		nstantai								
a) If m	anufac	turer's de	eclared I	oss facto	or is kno	wn (kWł	n/day):				1	.9		(48)
Tempe	erature f	actor fro	m Table	2b							0	.6		(49)
Energy	/ lost fro	om water	storage	, kWh/ye	ear			(48) x (49)) =		1.	14		(50)
b) If m	anufac	turer's de	eclared of footor fr	cylinder l	oss fact	or is not	known:					-		(54)
If comr	nunity h	age ioss neating s	ee secti	on 4.3	e z (kvv	n/nne/ua	ay)					0		(51)
Volum	e factor	from Ta	ble 2a									0		(52)
Tempe	erature f	actor fro	m Table	2b								0		(53)
Energy	/ lost fro	om water	· storage	, kWh/ye	ear			(47) x (51)	x (52) x (53) =		0		(54)
Enter	(50) or	(54) in (5	55)								1.	14		(55)
Water	storage	loss cal	culated	for each	month	-	-	((56)m = (55) × (41)ı	m				
(56)m=	35.34	31.92	35.34	34.2	35.34	34.2	35.34	35.34	34.2	35.34	34.2	35.34		(56)
If cylinde	er contain	s dedicate	d solar sto	rage, (57)ı	m = (56)m	x [(50) – ([H11)] ÷ (5 -	i0), else (5	7)m = (56)	m where (H11) is fro	m Append	ix H	
(57)m=	35.34	31.92	35.34	34.2	35.34	34.2	35.34	35.34	34.2	35.34	34.2	35.34		(57)
Primar	y circuit	t loss (ar	nnual) fro	om Table	e 3							0		(58)
Primar	y circuit	t loss cal	culated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m					
(mod	dified by	/ tactor fi	rom Tab	IE H5 if t	nere is s	solar wat	ter heati	ng and a	cylinde	r thermo	stat)	_		(50)
(59)m=	U	U	U	U	U	U	0	U	U	U	U	U		(59)

Combi	loss ca	alculated	for each	month	(61)m =	(60) ÷ 3	65 × (41))m						
(61)m=	0	0	0	0	0	0	0	0	0	0	0	0		(61)
Total h	eat req	uired for	water h	eating ca	alculated	l for eac	h month	(62)m =	= 0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	247.84	217.77	227.12	201.4	195.77	172.64	163.63	182.55	183.17	208.95	223.71	241.13		(62)
Solar DI	-IW input	calculated	using App	endix G o	r Appendix	H (negati	ve quantity	/) (enter '0	' if no sola	r contribut	ion to wate	er heating)		
(add a	dditiona	al lines if	FGHRS	and/or \	WWHRS	applies	, see Ap	pendix (G)				_	
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output	from w	vater hea	ter											
(64)m=	247.84	217.77	227.12	201.4	195.77	172.64	163.63	182.55	183.17	208.95	223.71	241.13		
				•	•			Out	out from w	ater heate	r (annual)₁	12	2465.66	(64)
Heat g	ains fro	m water	heating	, kWh/m	onth 0.2	5 ´ [0.85	× (45)m	+ (61)n	n] + 0.8 x	k [(46)m	+ (57)m	+ (59)m]	
(65)m=	98.93	87.33	92.04	82.95	81.62	73.39	70.93	77.22	76.89	86	90.37	96.7		(65)
inclu	ide (57))m in calo	culation	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ater is fi	rom com	munity h	eating	
5. Int	ternal d	ains (see	Table 5	5 and 5a):	•		-				•	-	
Metab	olic azi	ns (Table	5) Wat	He										
metab	Jan	Feb	Mar		Mav	Jun	Jul	Aua	Sep	Oct	Nov	Dec		
(66)m=	202.24	202.24	202.24	202.24	202.24	202.24	202.24	202.24	202.24	202.24	202.24	202.24		(66)
Lightin	a dains	(calcula	ted in Ai	n Dendix	L. equat	ion L9 o	r L9a), a	lso see	Table 5				1	
(67)m=	85.67	76.09	61.88	46.85	35.02	29.56	31.95	41.52	55.73	70.77	82.6	88.05		(67)
Annlia		l ains (calc	L ulated ir	I Annen	l divled	L	13 or I 1	<u>1</u> 3a) also	l See Ta	l hle 5			I	
(68)m-	912 89	922 36	898.49	847 67	783 52	723 23	682.95	673.48	697 35	748 17	812 32	872 61]	(68)
Cookir				ppopdiv		ion 15	or 150			5	012.02	072.01	l	()
(60)m-	19 yain:				L, equal		01 L 13a	13 22		13.22	13.22	13.22	1	(69)
(03)III-	40.22	40.22	43.22	4 3.22	43.22	40.22	43.22	43.22	43.22	40.22	43.22	43.22	J	(00)
Pumps	s and fa	ins gains		5a)									1	(70)
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3		(70)
Losses	s e.g. e r	vaporatio	n (nega	tive valu T	es) (Tab I	le 5)				1	I.	1	1	
(71)m=	-161.79	-161.79	-161.79	-161.79	-161.79	-161.79	-161.79	-161.79	-161.79	-161.79	-161.79	-161.79		(71)
Water	heating) gains (T	able 5)								ı —		1	()
(72)m=	132.97	129.96	123.71	115.21	109.7	101.93	95.33	103.79	106.79	115.59	125.51	129.97		(72)
Total i	nterna	l gains =				(66)m + (67)m	n + (68)m ·	+ (69)m + ((70)m + (7	'1)m + (72)	m	1	
(73)m=	1218.2	1215.08	1170.75	1096.41	1014.91	941.4	896.9	905.46	946.55	1021.19	1107.1	1177.3		(73)
6. So	lar gain	S:												
Solar g	ains are	calculated	using sola	ar flux from	Table 6a	and assoc	iated equa	tions to co	onvert to th	ne applicat	ole orientat	ion.	. .	
Orienta	ation:	Access F Table 6d	actor	Area		Flu Ta	IX hle 6a	т	g_ able 6b	т	FF able 6c		Gains	
								,		, , ,			(**)	-
North	0.9x	0.77	x	1.8	31	×	10.63	×	0.76		0.7	=	7.1	(74)
North	0.9x	0.77	X	1.8	31	×	20.32		0.76		0.7	=	13.56	(74) T
North	0.9x	0.77	×	1.8	31	×;	34.53	×	0.76	_ × L	0.7	=	23.04	(74)
North	0.9x	0.77	x	1.8	31	x	55.46	×	0.76	×	0.7	=	37.01	(74)
North	0.9x	0.77	×	1.8	31	x	74.72	x	0.76	×	0.7	=	49.86	(74)

North	0.9x	0.77	x	1.81	x	79.99	x	0.76	x	0.7] =	53.37	(74)
North	0.9x	0.77	x	1.81	x	74.68	x	0.76	×	0.7] =	49.83	(74)
North	0.9x	0.77	x	1.81	x	59.25	x	0.76	x	0.7] =	39.54	(74)
North	0.9x	0.77	x	1.81	x	41.52	x	0.76	x	0.7	=	27.7	(74)
North	0.9x	0.77	x	1.81	x	24.19	x	0.76	x	0.7] =	16.14	(74)
North	0.9x	0.77	x	1.81	x	13.12	x	0.76	x	0.7] =	8.75	(74)
North	0.9x	0.77	x	1.81	x	8.86	x	0.76	x	0.7	=	5.92	(74)
Northeas	st <u>0.9</u> x	0.77	x	9.22	x	11.28	x	0.76	x	0.7	=	38.35	(75)
Northeas	st 0.9x	0.77	x	9.49	x	11.28	x	0.76	x	0.7	=	39.48	(75)
Northeas	st 0.9x	0.77	x	2.61	x	11.28	x	0.76	x	0.7	=	10.86	(75)
Northeas	st 0.9x	0.77	x	7.43	x	11.28	x	0.76	x	0.7	=	30.91	(75)
Northeas	st 0.9x	0.77	x	8.28	x	11.28	x	0.76	x	0.7	=	34.44	(75)
Northeas	st 0.9x	0.77	x	5.69	x	11.28	x	0.76	x	0.7	=	23.67	(75)
Northeas	st 0.9x	0.77	x	4.04	x	11.28	x	0.76	x	0.7	=	16.81	(75)
Northeas	st 0.9x	0.77	x	4.04	x	11.28	x	0.76	x	0.7	=	16.81	(75)
Northeas	st 0.9x	0.77	x	4.99	x	11.28	x	0.76	x	0.7	=	20.76	(75)
Northeas	st <mark>0.9x</mark>	0.77	x	9.22	x	22.97	x	0.76	x	0.7	=	78.07	(75)
Northeas	st <mark>0.9</mark> x	0.77	x	9.49	x	22.97	x	0.76	x	0.7] =	80.35	(75)
Northeas	st <mark>0.9x</mark>	0.77	x	2.61	x	22.97	x	0.76	x	0.7] =	22.1	(75)
Northeas	st <mark>0.9</mark> x	0.77	x	7.43	x	22.97	x	0.76	x	0.7] =	62.91	(75)
Northeas	st <mark>0.9</mark> x	0.77	x	8.28	x	22.97	x	0.76	x	0.7	=	70.11	(75)
Northeas	st <mark>0.9x</mark>	0.77	x	5.69	x	22.97	x	0.76	x	0.7] =	48.18	(75)
Northeas	st <mark>0.9</mark> x	0.77	x	4.04	x	22.97	x	0.76	x	0.7] =	34.21	(75)
Northeas	st <mark>0.9</mark> x	0.77	x	4.04	x	22.97	x	0.76	x	0.7	=	34.21	(75)
Northeas	st <mark>0.9</mark> x	0.77	x	4.99	x	22.97	x	0.76	x	0.7	=	42.25	(75)
Northeas	st <mark>0.9</mark> x	0.77	x	9.22	x	41.38	x	0.76	x	0.7	=	140.65	(75)
Northeas	st <mark>0.9</mark> x	0.77	x	9.49	x	41.38	x	0.76	x	0.7	=	144.77	(75)
Northeas	st <mark>0.9</mark> x	0.77	x	2.61	x	41.38	x	0.76	x	0.7] =	39.82	(75)
Northeas	st <mark>0.9</mark> x	0.77	x	7.43	x	41.38	x	0.76	x	0.7	=	113.35	(75)
Northeas	st 0.9x	0.77	x	8.28	x	41.38	x	0.76	x	0.7	=	126.31	(75)
Northeas	st <mark>0.9</mark> x	0.77	x	5.69	x	41.38	x	0.76	x	0.7	=	86.8	(75)
Northeas	st 0.9x	0.77	x	4.04	x	41.38	x	0.76	x	0.7	=	61.63	(75)
Northeas	st 0.9x	0.77	x	4.04	x	41.38	x	0.76	x	0.7	=	61.63	(75)
Northeas	st 0.9x	0.77	x	4.99	x	41.38	x	0.76	x	0.7	=	76.12	(75)
Northeas	st 0.9x	0.77	x	9.22	x	67.96	x	0.76	x	0.7	=	230.99	(75)
Northeas	st 0.9x	0.77	x	9.49	x	67.96	x	0.76	x	0.7	=	237.76	(75)
Northeas	st 0.9x	0.77	x	2.61	x	67.96	x	0.76	x	0.7	=	65.39	(75)
Northeas	st <mark>0.9x</mark>	0.77	x	7.43	x	67.96	x	0.76	x	0.7	=	186.15	(75)
Northeas	st <mark>0.9x</mark>	0.77	x	8.28	×	67.96	×	0.76	×	0.7] =	207.44	(75)
Northeas	st <mark>0.9x</mark>	0.77	x	5.69	x	67.96	x	0.76	x	0.7	=	142.56	(75)
Northeas	st 0.9x	0.77	x	4.04	x	67.96	x	0.76	x	0.7	=	101.22	(75)

Northeast 0.9x	0.77	l x	4 04	l x	67.96	1 x	0.76	x	0.7] =	101 22	7(75)
Northeast 0.9x	0.77	」 】 _	4 99	l l x	67.96	」 】 x	0.76	l x	0.7	」 _	125.02](75)
Northeast 0.9x	0.77	」 ^ 】 x	9.22	l ^ l x	91 35	」 ^ 】 x	0.76	x	0.7] _	310.5](^(, c))] ₍₇₅₎
Northeast 0.9x	0.77] ~] x	9.49	l x	91.35] ~] x	0.76	x	0.7] =	319.6](⁷⁵)
Northeast 0.9x	0.77]] x	2.61	l ×	91.35] ~] x	0.76	x	0.7	」] _	87.9	$]_{(75)}^{(10)}$
Northeast 0.9x	0.77	」 ^ 】 x	7.43	l ^ l x	91.35	」 ^ 】 x	0.76	x	0.7] _	250.22](^(, c))] ₍₇₅₎
Northeast 0.9x	0.77	」 ^ 】 x	8.28	l ^ l x	91.35	」 ^ 】 x	0.76	x	0.7] _	278.85](^(, c))] ₍₇₅₎
Northeast o 9x	0.77	」 ^ 1 _	5.69		91.35] ^] _x	0.76	x	0.7]] _	191.62	$]^{(10)}_{(75)}$
Northeast 0.9x	0.77	」 ^] _	4.04	l ^ l x	91.35	」 ^ 】 x	0.76	x	0.7	 _	136.06	$]^{(10)}_{(75)}$
Northeast 0.9x	0.77	」 ^ 】 x	4.04	l ^ l x	91.35] ^] x	0.76	x	0.7	 =	136.06] ^(, e)] ₍₇₅₎
Northeast 0.9x	0.77	」 】 _	4 99	」 】 ×	91.35	」 】 _	0.76	l x	0.7	」 】 _	168.05](75)
Northeast 0.9x	0.77	」 ^ 】 x	9.22	l ^ l x	97.38	」 ^ 】 x	0.76	x	0.7] _	331.03	$]^{(10)}_{(75)}$
Northeast o 9x	0.77	」 ^ 1 _	9.22		97.30] ^] _	0.76	×	0.7]] _	340.72	$]^{(10)}_{(75)}$
Northeast 0 9x	0.77	」 ^]	2.61		07.29] ^] _	0.76		0.7] _] _	03.71	$]^{(70)}_{(75)}$
Northeast 0.0x	0.77	」 ^ 1 ↓	7.42		97.30] ^] ↓	0.70		0.7] -] _	93.71	$]^{(75)}$
Northeast 0.0x	0.77	」^ 」	0.20		97.30	」 ^ 1 ↓	0.76		0.7] -] _	200.78	$]^{(75)}_{(75)}$
Northeast 0.0x	0.77	」^ ┐、	0.20		97.38] ^] _	0.76		0.7	- _	297.28	$]^{(75)}$
Northeast 0.0x	0.77	」^ ┐、	5.69		97.38] ^] _	0.76		0.7	- _	204.29	$]^{(73)}_{(75)}$
Northeast o or	0.77	」 ^ 1	4.04		97.38] ^] _	0.76		0.7] - 1	145.05	$\int_{(75)}^{(75)}$
Northeast o.o.	0.77	」× 1	4.04	× 	97.38] × 1	0.76		0.7	= 	145.05](75)] ₍₇₅₎
Northoast a a	0.77	」 × 1 …	4.99	X 	97.38] × 1	0.76	X	0.7	= 1	179.16	_(75)
Northoast a a	0.77] × ī	9.22	X 	91.1] × 1	0.76	X	0.7	= 1	309.67	_(75)
Northeast 0.9x	0.77	X N	9.49	X I	91.1	X 1	0.76	X	0.7	=	318.74	_(75)
Northeast 0.9x	0.77	×	2.61	X	91.1	X	0.76	X	0.7	=	87.66	_(75)
Northeast 0.9x	0.77	×	7.43	X	91.1	X	0.76	X	0.7	=	249.55	(75)
Northeast 0.9x	0.77	×	8.28	x	91.1	X	0.76	X	0.7	=	278.1	(75)
Northeast 0.9x	0.77	×	5.69	×	91.1	X	0.76	X	0.7	=	191.11	(75)
Northeast 0.9x	0.77	×	4.04	×	91.1	X	0.76	x	0.7	=	135.69	(75)
Northeast 0.9x	0.77	x	4.04	×	91.1	x	0.76	x	0.7	=	135.69	(75)
Northeast 0.9x	0.77	x	4.99	x	91.1	x	0.76	x	0.7	=	167.6	(75)
Northeast 0.9x	0.77	x	9.22	×	72.63	x	0.76	x	0.7	=	246.87	(75)
Northeast 0.9x	0.77	x	9.49	x	72.63	x	0.76	x	0.7	=	254.1	(75)
Northeast 0.9x	0.77	x	2.61	x	72.63	x	0.76	x	0.7	=	69.88	(75)
Northeast 0.9x	0.77	x	7.43	×	72.63	x	0.76	x	0.7	=	198.94	(75)
Northeast 0.9x	0.77	x	8.28	x	72.63	x	0.76	x	0.7	=	221.7	(75)
Northeast 0.9x	0.77	x	5.69	x	72.63	x	0.76	x	0.7	=	152.35	(75)
Northeast 0.9x	0.77	x	4.04	x	72.63	x	0.76	x	0.7] =	108.17	(75)
Northeast 0.9x	0.77	x	4.04	×	72.63	x	0.76	x	0.7] =	108.17	(75)
Northeast 0.9x	0.77	x	4.99	×	72.63	x	0.76	x	0.7	=	133.61	(75)
Northeast 0.9x	0.77	x	9.22	×	50.42	x	0.76	x	0.7] =	171.39	(75)
Northeast 0.9x	0.77	x	9.49	×	50.42	x	0.76	x	0.7] =	176.41	(75)
Northeast 0.9x	0.77	x	2.61	×	50.42	x	0.76	x	0.7] =	48.52	(75)
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Northeast	0.9x	0.77	x	7.43	x	50.42	x	0.76	x	0.7	=	138.12	(75)
Northeast	0.9x	0.77	x	8.28	x	50.42	x	0.76	x	0.7] =	153.92	(75)
Northeast	0.9x	0.77	x	5.69	x	50.42	x	0.76	x	0.7] =	105.77	(75)
Northeast	0.9x	0.77	x	4.04	x	50.42	x	0.76	x	0.7	=	75.1	(75)
Northeast	0.9x	0.77	x	4.04	x	50.42	x	0.76	x	0.7] =	75.1	(75)
Northeast	0.9x	0.77	x	4.99	x	50.42	x	0.76	x	0.7] =	92.76	(75)
Northeast	0.9x	0.77	x	9.22	x	28.07	x	0.76	x	0.7	=	95.41	(75)
Northeast	0.9x	0.77	x	9.49	x	28.07	x	0.76	x	0.7] =	98.2	(75)
Northeast	0.9x	0.77	x	2.61	x	28.07	x	0.76	x	0.7	=	27.01	(75)
Northeast	0.9x	0.77	x	7.43	x	28.07	x	0.76	x	0.7	=	76.88	(75)
Northeast	0.9x	0.77	x	8.28	x	28.07	x	0.76	x	0.7] =	85.68	(75)
Northeast	0.9x	0.77	x	5.69	x	28.07	x	0.76	x	0.7] =	58.88	(75)
Northeast	0.9x	0.77	x	4.04	x	28.07	x	0.76	x	0.7] =	41.8	(75)
Northeast	0.9x	0.77	x	4.04	x	28.07	x	0.76	x	0.7] =	41.8	(75)
Northeast	0.9x	0.77	x	4.99	x	28.07	x	0.76	x	0.7	=	51.64	(75)
Northeast	0.9x	0.77	x	9.22	x	14.2	x	0.76	x	0.7] =	48.26	(75)
Northeast	0.9x	0.77	x	9.49	x	14.2	x	0.76	x	0.7	=	49.67	(75)
Northeast	0.9x	0.77	x	2.61	x	14.2	x	0.76	x	0.7	=	13.66	(75)
Northeast	0.9x	0.77	x	7.43	x	14.2	x	0.76	x	0.7] =	38.89	(75)
Northeast	0.9x	0.77	x	8.28	x	14.2	x	0.76	x	0.7	=	43.34	(75)
Northeast	0.9x	0.77	x	5.69	x	14.2	x	0.76	x	0.7	=	29.78	(75)
Northeast	0.9x	0.77	x	4.04	x	14.2	x	0.76	x	0.7] =	21.15	(75)
Northeast	0.9x	0.77	x	4.04	x	14.2	x	0.76	x	0.7	=	21.15	(75)
Northeast	0.9x	0.77	x	4.99	x	14.2	x	0.76	x	0.7	=	26.12	(75)
Northeast	0.9x	0.77	x	9.22	x	9.21	x	0.76	x	0.7	=	31.32	(75)
Northeast	0.9x	0.77	x	9.49	x	9.21	x	0.76	x	0.7	=	32.24	(75)
Northeast	0.9x	0.77	x	2.61	x	9.21	x	0.76	x	0.7	=	8.87	(75)
Northeast	0.9x	0.77	x	7.43	x	9.21	x	0.76	x	0.7	=	25.24	(75)
Northeast	0.9x	0.77	x	8.28	x	9.21	x	0.76	x	0.7	=	28.13	(75)
Northeast	0.9x	0.77	x	5.69	x	9.21	x	0.76	x	0.7	=	19.33	(75)
Northeast	0.9x	0.77	x	4.04	x	9.21	x	0.76	x	0.7	=	13.72	(75)
Northeast	0.9x	0.77	x	4.04	x	9.21	x	0.76	x	0.7	=	13.72	(75)
Northeast	0.9x	0.77	x	4.99	x	9.21	x	0.76	x	0.7	=	16.95	(75)
East	0.9x	0.77	x	1.81	x	19.64	x	0.76	x	0.7] =	13.11	(76)
East	0.9x	0.77	x	1.81	x	38.42	x	0.76	x	0.7] =	25.64	(76)
East	0.9x	0.77	x	1.81	x	63.27	x	0.76	x	0.7] =	42.22	(76)
East	0.9x	0.77	x	1.81	x	92.28	x	0.76	×	0.7] =	61.58	(76)
East	0.9x	0.77	x	1.81	×	113.09	x	0.76	x	0.7	=	75.47	(76)
East	0.9x	0.77	x	1.81	x	115.77	x	0.76	×	0.7] =	77.25	(76)
East	0.9x	0.77	x	1.81	×	110.22	×	0.76	x	0.7	=	73.55	(76)
East	0.9x	0.77	x	1.81	x	94.68	x	0.76	x	0.7	=	63.18	(76)

East 0.9x	0.77	x	1.81	x	73.59	x	0.76	x	0.7] =	49.11	(76)
East 0.9x	0.77	x	1.81	×	45.59	x	0.76	x	0.7	j =	30.42	(76)
East 0.9x	0.77	x	1.81	x	24.49	x	0.76	x	0.7	=	16.34	(76)
East 0.9x	0.77	x	1.81	×	16.15	x	0.76	x	0.7] =	10.78	(76)
Southeast 0.9x	0.54	x	0.67	×	36.79	×	0.76	x	0.7	j =	6.37	(77)
Southeast 0.9x	0.77	x	5.15	×	36.79	x	0.76	x	0.7] =	69.86	(77)
Southeast 0.9x	0.77	x	2.33	×	36.79	x	0.76	x	0.7] =	31.61	(77)
Southeast 0.9x	0.77	x	1.16	x	36.79	x	0.76	x	0.7	=	15.74	(77)
Southeast 0.9x	0.54	x	2.06	x	36.79	x	0.76	x	0.7	=	19.6	(77)
Southeast 0.9x	0.54	x	0.67	x	62.67	x	0.76	x	0.7	=	10.86	(77)
Southeast 0.9x	0.77	x	5.15	x	62.67	x	0.76	x	0.7	=	119	(77)
Southeast 0.9x	0.77	x	2.33	x	62.67	x	0.76	x	0.7	=	53.84	(77)
Southeast 0.9x	0.77	x	1.16	×	62.67	x	0.76	x	0.7] =	26.8	(77)
Southeast 0.9x	0.54	x	2.06	×	62.67	x	0.76	x	0.7	=	33.38	(77)
Southeast 0.9x	0.54	x	0.67	x	85.75	x	0.76	x	0.7	=	14.85	(77)
Southeast 0.9x	0.77	x	5.15	x	85.75	x	0.76	x	0.7] =	162.82	(77)
Southeast 0.9x	0.77	x	2.33	x	85.75	x	0.76	x	0.7	=	73.66	(77)
Southeast 0.9x	0.77	x	1.16	x	85.75	x	0.76	x	0.7	=	36.67	(77)
Southeast 0.9x	0.54	x	2.06	x	85.75	x	0.76	x	0.7] =	45.67	(77)
Southeast 0.9x	0.54	x	0.67	x	106.25	x	0.76	x	0.7	=	18.41	(77)
Southeast 0.9x	0.77	x	5.15	x	106.25	x	0.76	x	0.7	=	201.74	(77)
Southeast 0.9x	0.77	x	2.33	x	106.25	x	0.76	x	0.7	=	91.27	(77)
Southeast 0.9x	0.77	x	1.16	x	106.25	x	0.76	x	0.7	=	45.44	(77)
Southeast 0.9x	0.54	x	2.06	×	106.25	x	0.76	x	0.7	=	56.59	(77)
Southeast 0.9x	0.54	x	0.67	x	119.01	x	0.76	x	0.7	=	20.62	(77)
Southeast 0.9x	0.77	x	5.15	×	119.01	x	0.76	x	0.7	=	225.96	(77)
Southeast 0.9x	0.77	x	2.33	x	119.01	x	0.76	x	0.7	=	102.23	(77)
Southeast 0.9x	0.77	x	1.16	x	119.01	x	0.76	x	0.7	=	50.9	(77)
Southeast 0.9x	0.54	x	2.06	×	119.01	x	0.76	x	0.7] =	63.39	(77)
Southeast 0.9x	0.54	x	0.67	x	118.15	x	0.76	x	0.7	=	20.47	(77)
Southeast 0.9x	0.77	x	5.15	x	118.15	x	0.76	x	0.7] =	224.33	(77)
Southeast 0.9x	0.77	x	2.33	x	118.15	x	0.76	x	0.7] =	101.49	(77)
Southeast 0.9x	0.77	x	1.16	x	118.15	x	0.76	x	0.7	=	50.53	(77)
Southeast 0.9x	0.54	x	2.06	x	118.15	x	0.76	x	0.7] =	62.93	(77)
Southeast 0.9x	0.54	x	0.67	x	113.91	x	0.76	x	0.7	=	19.73	(77)
Southeast 0.9x	0.77	x	5.15	×	113.91	x	0.76	x	0.7] =	216.28	(77)
Southeast 0.9x	0.77	x	2.33	×	113.91	x	0.76	x	0.7	=	97.85	(77)
Southeast 0.9x	0.77	x	1.16	×	113.91	x	0.76	×	0.7] =	48.71	(77)
Southeast 0.9x	0.54	x	2.06	×	113.91	x	0.76	x	0.7	=	60.67	(77)
Southeast 0.9x	0.54	x	0.67	×	104.39	x	0.76	x	0.7	=	18.08	(77)
Southeast 0.9x	0.77	x	5.15	×	104.39	x	0.76	×	0.7	=	198.2	(77)

Southeast	0.9x	0.77	x	2.33	x	104.39	x	0.76	x	0.7	=	89.67	(77)
Southeast	0.9x	0.77	x	1.16	x	104.39	x	0.76	x	0.7] =	44.64	(77)
Southeast	0.9x	0.54	x	2.06	x	104.39	x	0.76	x	0.7] =	55.6	(77)
Southeast	0.9x	0.54	x	0.67	x	92.85	x	0.76	x	0.7	=	16.08	(77)
Southeast	0.9x	0.77	x	5.15	x	92.85	x	0.76	x	0.7] =	176.3	(77)
Southeast	0.9x	0.77	x	2.33	×	92.85	x	0.76	x	0.7] =	79.76	(77)
Southeast	0.9x	0.77	x	1.16	x	92.85	x	0.76	x	0.7] =	39.71	(77)
Southeast	0.9x	0.54	x	2.06	x	92.85	x	0.76	x	0.7	=	49.45	(77)
Southeast	0.9x	0.54	x	0.67	x	69.27	x	0.76	x	0.7	=	12	(77)
Southeast	0.9x	0.77	x	5.15	x	69.27	x	0.76	x	0.7	=	131.52	(77)
Southeast	0.9x	0.77	x	2.33	x	69.27	x	0.76	x	0.7	=	59.5	(77)
Southeast	0.9x	0.77	x	1.16	x	69.27	x	0.76	x	0.7	=	29.62	(77)
Southeast	0.9x	0.54	x	2.06	x	69.27	x	0.76	x	0.7	=	36.89	(77)
Southeast	0.9x	0.54	x	0.67	x	44.07	x	0.76	x	0.7	=	7.63	(77)
Southeast	0.9x	0.77	x	5.15	x	44.07	x	0.76	x	0.7	=	83.68	(77)
Southeast	0.9x	0.77	x	2.33	x	44.07	x	0.76	x	0.7	=	37.86	(77)
Southeast	0.9x	0.77	x	1.16	x	44.07	x	0.76	x	0.7	=	18.85	(77)
Southeast	0.9x	0.54	x	2.06	x	44.07	x	0.76	x	0.7	=	23.47	(77)
Southeast	0.9x	0.54	x	0.67	x	31.49	x	0.76	x	0.7	=	5.45	(77)
Southeast	0.9x	0.77	x	5.15	x	31.49	x	0.76	x	0.7	=	59.79	(77)
Southeast	0.9x	0.77	x	2.33	x	31.49	x	0.76	x	0.7	=	27.05	(77)
Southeast	0.9x	0.77	x	1.16	x	31.49	x	0.76	x	0.7	=	13.47	(77)
Southeast	0.9x	0.54	x	2.06	x	31.49	x	0.76	x	0.7	=	16.77	(77)
South	0.9x	0.54	x	0.95	×	46.75	x	0.76	x	0.7] =	11.48	(78)
South	0.9x	0.54	x	0.84	×	46.75	x	0.76	x	0.7] =	10.15	(78)
South	0.9x	0.77	x	0.84	x	46.75	x	0.76	x	0.7	=	14.48	(78)
South	0.9x	0.77	x	1.4	×	46.75	x	0.76	x	0.7] =	24.13	(78)
South	0.9x	0.77	x	1.68	x	46.75	x	0.76	x	0.7] =	28.96	(78)
South	0.9x	0.54	x	0.95	x	76.57	x	0.76	x	0.7] =	18.81	(78)
South	0.9x	0.54	x	0.84	x	76.57	x	0.76	x	0.7	=	16.63	(78)
South	0.9x	0.77	x	0.84	x	76.57	x	0.76	x	0.7] =	23.71	(78)
South	0.9x	0.77	x	1.4	x	76.57	x	0.76	x	0.7	=	39.52	(78)
South	0.9x	0.77	x	1.68	x	76.57	x	0.76	x	0.7	=	47.42	(78)
South	0.9x	0.54	x	0.95	x	97.53	x	0.76	x	0.7	=	23.96	(78)
South	0.9x	0.54	x	0.84	x	97.53	x	0.76	x	0.7	=	21.18	(78)
South	0.9x	0.77	x	0.84	×	97.53	x	0.76	x	0.7] =	30.21	(78)
South	0.9x	0.77	x	1.4	×	97.53	x	0.76	x	0.7] =	50.34	(78)
South	0.9x	0.77	x	1.68	×	97.53	x	0.76	x	0.7	=	60.41	(78)
South	0.9x	0.54	x	0.95	×	110.23	x	0.76	x	0.7	=	27.08	(78)
South	0.9x	0.54	x	0.84	×	110.23	x	0.76	x	0.7	=	23.94	(78)
South	0.9x	0.77	x	0.84	×	110.23	x	0.76	x	0.7	=	34.14	(78)

South	0.9x	0.77	x	1.4	x	110.23	x	0.76	x	0.7] =	56.9	(78)
South	0.9x	0.77	×	1.68	x	110.23	×	0.76	x	0.7] =	68.28	(78)
South	0.9x	0.54	×	0.95	x	114.87	×	0.76	x	0.7	=	28.22	(78)
South	0.9x	0.54	x	0.84	x	114.87	x	0.76	x	0.7	=	24.95	(78)
South	0.9x	0.77	x	0.84	x	114.87	x	0.76	x	0.7	=	35.57	(78)
South	0.9x	0.77	x	1.4	x	114.87	x	0.76	x	0.7	=	59.29	(78)
South	0.9x	0.77	x	1.68	x	114.87	x	0.76	x	0.7] =	71.15	(78)
South	0.9x	0.54	x	0.95	x	110.55	x	0.76	x	0.7] =	27.15	(78)
South	0.9x	0.54	×	0.84	x	110.55	×	0.76	x	0.7	=	24.01	(78)
South	0.9x	0.77	x	0.84	x	110.55	x	0.76	x	0.7	=	34.24	(78)
South	0.9x	0.77	×	1.4	x	110.55	×	0.76	x	0.7	=	57.06	(78)
South	0.9x	0.77	×	1.68	x	110.55	x	0.76	x	0.7	=	68.47	(78)
South	0.9x	0.54	×	0.95	x	108.01	×	0.76	x	0.7	=	26.53	(78)
South	0.9x	0.54	x	0.84	x	108.01	x	0.76	x	0.7	=	23.46	(78)
South	0.9x	0.77	x	0.84	x	108.01	x	0.76	x	0.7	=	33.45	(78)
South	0.9x	0.77	x	1.4	x	108.01	x	0.76	x	0.7] =	55.75	(78)
South	0.9x	0.77	×	1.68	x	108.01	×	0.76	x	0.7	=	66.9	(78)
South	0.9x	0.54	×	0.95	x	104.89	×	0.76	x	0.7	=	25.76	(78)
South	0.9x	0.54	x	0.84	x	104.89	x	0.76	x	0.7] =	22.78	(78)
South	0.9x	0.77	x	0.84	x	104.89	x	0.76	x	0.7	=	32.48	(78)
South	0.9x	0.77	x	1.4	x	104.89	x	0.76	x	0.7	=	54.14	(78)
South	0.9x	0.77	x	1.68	x	104.89	x	0.76	x	0.7	=	64.97	(78)
South	0.9x	0.54	x	0.95	x	101.89	x	0.76	x	0.7	=	25.03	(78)
South	0.9x	0.54	x	0.84	x	101.89	x	0.76	x	0.7	=	22.13	(78)
South	0.9x	0.77	x	0.84	x	101.89	x	0.76	x	0.7	=	31.55	(78)
South	0.9x	0.77	x	1.4	x	101.89	×	0.76	x	0.7	=	52.59	(78)
South	0.9x	0.77	×	1.68	x	101.89	×	0.76	x	0.7] =	63.11	(78)
South	0.9x	0.54	x	0.95	x	82.59	x	0.76	x	0.7	=	20.29	(78)
South	0.9x	0.54	x	0.84	x	82.59	x	0.76	x	0.7	=	17.94	(78)
South	0.9x	0.77	x	0.84	x	82.59	x	0.76	x	0.7	=	25.58	(78)
South	0.9x	0.77	x	1.4	x	82.59	x	0.76	x	0.7	=	42.63	(78)
South	0.9x	0.77	x	1.68	x	82.59	x	0.76	x	0.7	=	51.15	(78)
South	0.9x	0.54	x	0.95	x	55.42	x	0.76	x	0.7	=	13.61	(78)
South	0.9x	0.54	x	0.84	x	55.42	x	0.76	x	0.7	=	12.04	(78)
South	0.9x	0.77	x	0.84	x	55.42	x	0.76	x	0.7	=	17.16	(78)
South	0.9x	0.77	x	1.4	x	55.42	x	0.76	x	0.7	=	28.6	(78)
South	0.9x	0.77	×	1.68	x	55.42	×	0.76	x	0.7	=	34.32	(78)
South	0.9x	0.54	×	0.95	×	40.4	×	0.76	×	0.7] =	9.92	(78)
South	0.9x	0.54	×	0.84	x	40.4	×	0.76	x	0.7	=	8.77	(78)
South	0.9x	0.77	×	0.84	×	40.4	×	0.76	×	0.7] =	12.51	(78)
South	0.9x	0.77	×	1.4	×	40.4	×	0.76	×	0.7] =	20.85	(78)

South 0.9x	0.77	x	1.68	x	40.4	x	0.76	x	0.7	=	25.02	(78)
Southwest _{0.9x}	0.54	x	0.95	x	36.79		0.76	x	0.7] =	27.11	(79)
Southwest _{0.9x}	0.54	x	2.22	×	36.79	Ì	0.76	x	0.7	=	21.12	(79)
Southwest _{0.9x}	0.54	x	0.67	×	36.79		0.76	x	0.7] =	12.75	(79)
Southwest _{0.9x}	0.77	x	0.84	×	36.79	Ì	0.76	x	0.7] =	34.18	(79)
Southwest _{0.9x}	0.77	x	1.4	x	36.79		0.76	x	0.7] =	56.97	(79)
Southwest0.9x	0.77	x	2.23	x	36.79		0.76	x	0.7	=	30.25	(79)
Southwest _{0.9x}	0.77	x	6.83	×	36.79		0.76	x	0.7	=	92.65	(79)
Southwest _{0.9x}	0.77	x	2.9	x	36.79		0.76	x	0.7	=	39.34	(79)
Southwest0.9x	0.77	x	1.68	x	36.79		0.76	x	0.7	=	68.37	(79)
Southwest _{0.9x}	0.77	x	2.68	×	36.79]	0.76	x	0.7	=	36.35	(79)
Southwest _{0.9x}	0.54	x	0.95	x	62.67		0.76	x	0.7	=	46.18	(79)
Southwest _{0.9x}	0.54	x	2.22	×	62.67]	0.76	x	0.7	=	35.97	(79)
Southwest0.9x	0.54	x	0.67	x	62.67		0.76	x	0.7] =	21.71	(79)
Southwest _{0.9x}	0.77	x	0.84	×	62.67		0.76	x	0.7] =	58.23	(79)
Southwest _{0.9x}	0.77	x	1.4	×	62.67]	0.76	x	0.7	=	97.05	(79)
Southwest _{0.9x}	0.77	x	2.23	×	62.67		0.76	x	0.7	=	51.53	(79)
Southwest _{0.9x}	0.77	x	6.83	x	62.67		0.76	x	0.7	=	157.82	(79)
Southwest _{0.9x}	0.77	x	2.9	×	62.67		0.76	x	0.7	=	67.01	(79)
Southwest _{0.9x}	0.77	x	1.68	×	62.67		0.76	x	0.7	=	116.46	(79)
Southwest _{0.9x}	0.77	x	2.68	x	62.67		0.76	x	0.7	=	61.92	(79)
Southwest _{0.9x}	0.54	x	0.95	×	85.75]	0.76	x	0.7	=	63.19	(79)
Southwest _{0.9x}	0.54	x	2.22	×	85.75		0.76	x	0.7	=	49.22	(79)
Southwest _{0.9x}	0.54	x	0.67	×	85.75		0.76	x	0.7] =	29.71	(79)
Southwest _{0.9x}	0.77	x	0.84	×	85.75		0.76	x	0.7	=	79.67	(79)
Southwest _{0.9x}	0.77	x	1.4	×	85.75]	0.76	x	0.7] =	132.78	(79)
Southwest _{0.9x}	0.77	x	2.23	×	85.75		0.76	x	0.7] =	70.5	(79)
Southwest _{0.9x}	0.77	x	6.83	×	85.75		0.76	x	0.7	=	215.93	(79)
Southwest0.9x	0.77	x	2.9	×	85.75		0.76	x	0.7	=	91.68	(79)
Southwest0.9x	0.77	x	1.68	×	85.75		0.76	x	0.7	=	159.34	(79)
Southwest _{0.9x}	0.77	x	2.68	x	85.75		0.76	x	0.7] =	84.73	(79)
Southwest0.9x	0.54	x	0.95	x	106.25		0.76	x	0.7] =	78.29	(79)
Southwest0.9x	0.54	x	2.22	×	106.25		0.76	x	0.7] =	60.99	(79)
Southwest0.9x	0.54	x	0.67	x	106.25		0.76	x	0.7] =	36.81	(79)
Southwest0.9x	0.77	x	0.84	×	106.25		0.76	x	0.7	=	98.71	(79)
Southwest0.9x	0.77	x	1.4	x	106.25		0.76	x	0.7] =	164.52	(79)
Southwest _{0.9x}	0.77	x	2.23	×	106.25]	0.76	x	0.7] =	87.35	(79)
Southwest _{0.9x}	0.77	x	6.83	×	106.25]	0.76	x	0.7] =	267.55	(79)
Southwest <mark>0.9x</mark>	0.77	x	2.9	×	106.25]	0.76	x	0.7	=	113.6	(79)
Southwest <mark>0.9x</mark>	0.77	x	1.68	×	106.25		0.76	x	0.7	=	197.43	(79)
Southwest _{0.9x}	0.77	x	2.68	×	106.25]	0.76	x	0.7] =	104.98	(79)

Southwest0.9x	0.54	x	0.95	x	119.01		0.76	x	0.7	=	87.7	(79)
Southwest _{0.9x}	0.54	x	2.22	×	119.01	ĺ	0.76	x	0.7	=	68.31	_ (79)
Southwest _{0.9x}	0.54	x	0.67	x	119.01	İ	0.76	x	0.7	=	41.23	_ (79)
Southwest _{0.9x}	0.77	x	0.84	×	119.01		0.76	x	0.7	=	110.57	_ (79)
Southwest _{0.9x}	0.77	x	1.4	×	119.01	İ	0.76	x	0.7	=	184.28	- (79)
Southwest _{0.9x}	0.77	x	2.23	×	119.01		0.76	x	0.7] =	97.84	(79)
Southwest0.9x	0.77	x	6.83	×	119.01		0.76	x	0.7] =	299.68	(79)
Southwest0.9x	0.77	x	2.9	x	119.01		0.76	x	0.7	=	127.24	(79)
Southwest0.9x	0.77	x	1.68	x	119.01		0.76	x	0.7	=	221.14	(79)
Southwest0.9x	0.77	x	2.68	x	119.01		0.76	x	0.7	=	117.59	(79)
Southwest0.9x	0.54	x	0.95	x	118.15		0.76	x	0.7	=	87.06	(79)
Southwest0.9x	0.54	x	2.22	x	118.15		0.76	x	0.7	=	67.82	(79)
Southwest0.9x	0.54	x	0.67	x	118.15		0.76	x	0.7	=	40.93	(79)
Southwest _{0.9x}	0.77	x	0.84	x	118.15		0.76	x	0.7	=	109.77	(79)
Southwest0.9x	0.77	x	1.4	x	118.15		0.76	x	0.7	=	182.95	(79)
Southwest _{0.9x}	0.77	x	2.23	x	118.15		0.76	x	0.7	=	97.14	(79)
Southwest0.9x	0.77	x	6.83	x	118.15		0.76	x	0.7	=	297.51	(79)
Southwest0.9x	0.77	x	2.9	x	118.15		0.76	x	0.7	=	126.32	(79)
Southwest _{0.9x}	0.77	x	1.68	×	118.15		0.76	x	0.7	=	219.54	(79)
Southwest0.9x	0.77	x	2.68	x	118.15		0.76	x	0.7	=	116.74	(79)
Southwest0.9x	0.54	x	0.95	x	113.91		0.76	x	0.7	=	83.94	(79)
Southwest _{0.9x}	0.54	x	2.22	×	113.91		0.76	x	0.7] =	65.38	(79)
Southwest _{0.9x}	0.54	x	0.67	x	113.91		0.76	x	0.7	=	39.46	(79)
Southwest0.9x	0.77	x	0.84	x	113.91		0.76	x	0.7	=	105.83	(79)
Southwest _{0.9x}	0.77	x	1.4	x	113.91		0.76	x	0.7	=	176.38	(79)
Southwest _{0.9x}	0.77	x	2.23	x	113.91		0.76	x	0.7	=	93.65	(79)
Southwest0.9x	0.77	x	6.83	x	113.91		0.76	x	0.7	=	286.83	(79)
Southwest _{0.9x}	0.77	x	2.9	×	113.91		0.76	x	0.7	=	121.79	(79)
Southwest0.9x	0.77	x	1.68	x	113.91		0.76	x	0.7	=	211.66	(79)
Southwest0.9x	0.77	x	2.68	×	113.91		0.76	x	0.7] =	112.55	(79)
Southwest0.9x	0.54	x	0.95	x	104.39		0.76	x	0.7	=	76.92	(79)
Southwest _{0.9x}	0.54	x	2.22	x	104.39		0.76	x	0.7	=	59.92	(79)
Southwest0.9x	0.54	x	0.67	x	104.39		0.76	x	0.7	=	36.17	(79)
Southwest0.9x	0.77	x	0.84	x	104.39		0.76	x	0.7	=	96.99	(79)
Southwest0.9x	0.77	x	1.4	x	104.39		0.76	x	0.7	=	161.64	(79)
Southwest _{0.9x}	0.77	x	2.23	x	104.39		0.76	x	0.7	=	85.82	(79)
Southwest _{0.9x}	0.77	x	6.83	×	104.39		0.76	x	0.7	=	262.86	(79)
Southwest _{0.9x}	0.77	x	2.9	×	104.39		0.76	×	0.7] =	111.61	(79)
Southwest _{0.9x}	0.77	x	1.68	×	104.39		0.76	x	0.7] =	193.97	(79)
Southwest _{0.9x}	0.77	x	2.68	×	104.39		0.76	x	0.7] =	103.14	(79)
Southwest _{0.9x}	0.54	x	0.95	×	92.85		0.76	x	0.7] =	68.42	(79)

Southwest0.9x	0.54	x	2.22	x	92.85]	0.76	x	0.7	=	53.3	(79)
Southwest _{0.9x}	0.54	x	0.67	×	92.85	İ	0.76	×	0.7	=	32.17	
Southwest _{0.9x}	0.77	x	0.84	×	92.85]	0.76	×	0.7] =	86.27	(79)
Southwest0.9x	0.77	x	1.4	×	92.85]	0.76	×	0.7] =	143.78	(79)
Southwest _{0.9x}	0.77	x	2.23	×	92.85	j	0.76	×	0.7	=	76.34	(79)
Southwest _{0.9x}	0.77	x	6.83	×	92.85]	0.76	×	0.7] =	233.81	(79)
Southwest0.9x	0.77	x	2.9	×	92.85]	0.76	×	0.7] =	99.27	(79)
Southwest0.9x	0.77	x	1.68	x	92.85]	0.76	x	0.7	=	172.53	(79)
Southwest0.9x	0.77	x	2.68	x	92.85]	0.76	x	0.7	=	91.74	(79)
Southwest0.9x	0.54	x	0.95	×	69.27]	0.76	×	0.7] =	51.04	(79)
Southwest0.9x	0.54	x	2.22	x	69.27]	0.76	x	0.7	=	39.76	(79)
Southwest0.9x	0.54	x	0.67	x	69.27]	0.76	x	0.7	=	24	(79)
Southwest0.9x	0.77	x	0.84	x	69.27]	0.76	x	0.7] =	64.35	(79)
Southwest0.9x	0.77	x	1.4	x	69.27]	0.76	x	0.7	=	107.26	(79)
Southwest0.9x	0.77	x	2.23	x	69.27]	0.76	x	0.7] =	56.95	(79)
Southwest _{0.9x}	0.77	x	6.83	×	69.27	j	0.76	×	0.7	=	174.42	(79)
Southwest _{0.9x}	0.77	x	2.9	×	69.27]	0.76	×	0.7] =	74.06	(79)
Southwest0.9x	0.77	x	1.68	×	69.27]	0.76	x	0.7] =	128.71	(79)
Southwest0.9x	0.77	x	2.68	x	69.27]	0.76	x	0.7	=	68.44	(79)
Southwest0.9x	0.54	x	0.95	x	44.07]	0.76	x	0.7] =	32.47	(79)
Southwest0.9x	0.54	x	2.22	x	44.07]	0.76	x	0.7	=	25.3	(79)
Southwest _{0.9x}	0.54	x	0.67	×	44.07	İ	0.76	×	0.7	=	15.27	(79)
Southwest _{0.9x}	0.77	x	0.84	×	44.07]	0.76	×	0.7] =	40.94	(79)
Southwest _{0.9x}	0.77	x	1.4	×	44.07	j	0.76	×	0.7] =	68.24	(79)
Southwest _{0.9x}	0.77	x	2.23	×	44.07]	0.76	×	0.7] =	36.23	(79)
Southwest0.9x	0.77	x	6.83	x	44.07]	0.76	x	0.7] =	110.97	(79)
Southwest0.9x	0.77	x	2.9	×	44.07]	0.76	×	0.7] =	47.12	(79)
Southwest0.9x	0.77	x	1.68	x	44.07]	0.76	x	0.7] =	81.89	(79)
Southwest _{0.9x}	0.77	x	2.68	×	44.07]	0.76	×	0.7] =	43.54	(79)
Southwest0.9x	0.54	x	0.95	x	31.49]	0.76	x	0.7	=	23.2	(79)
Southwest _{0.9x}	0.54	x	2.22	×	31.49]	0.76	×	0.7] =	18.07	(79)
Southwest0.9x	0.54	x	0.67	x	31.49]	0.76	x	0.7] =	10.91	(79)
Southwest0.9x	0.77	x	0.84	×	31.49]	0.76	×	0.7] =	29.25	(79)
Southwest _{0.9x}	0.77	x	1.4	×	31.49	İ	0.76	x	0.7	=	48.76	(79)
Southwest _{0.9x}	0.77	x	2.23	×	31.49	Ī	0.76	×	0.7	=	25.89	(79)
Southwest _{0.9x}	0.77	x	6.83	×	31.49	j	0.76	×	0.7] =	79.29	(79)
Southwest _{0.9x}	0.77	x	2.9	×	31.49	Ī	0.76	×	0.7	=	33.67	(79)
Southwest _{0.9x}	0.77	x	1.68	×	31.49]	0.76	x	0.7] =	58.51	(79)
Southwest _{0.9x}	0.77	x	2.68	×	31.49]	0.76	x	0.7] =	31.11	(79)
West 0.9x	0.54	x	0.95	×	19.64	x	0.76	x	0.7] =	4.82	(80)
West 0.9x	0.54	x	0.84	×	19.64	×	0.76	×	0.7] =	4.27	(80)
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West	0.9x	0.77	x	0.84	x	19.64	x	0.76	x	0.7	=	6.08	(80)
West	0.9x	0.77	x	1.4	x	19.64	x	0.76	x	0.7] =	10.14	(80)
West	0.9x	0.77	x	1.68	x	19.64	x	0.76	x	0.7] =	12.16	(80)
West	0.9x	0.54	x	0.95	x	38.42	x	0.76	x	0.7	=	9.44	(80)
West	0.9x	0.54	x	0.84	x	38.42	x	0.76	x	0.7] =	8.34	(80)
West	0.9x	0.77	x	0.84	x	38.42	x	0.76	x	0.7	=	11.9	(80)
West	0.9x	0.77	x	1.4	x	38.42	x	0.76	x	0.7	=	19.83	(80)
West	0.9x	0.77	x	1.68	×	38.42	x	0.76	x	0.7	=	23.8	(80)
West	0.9x	0.54	x	0.95	x	63.27	x	0.76	x	0.7] =	15.54	(80)
West	0.9x	0.54	x	0.84	×	63.27	x	0.76	x	0.7	=	13.74	(80)
West	0.9x	0.77	x	0.84	×	63.27	x	0.76	x	0.7	=	19.59	(80)
West	0.9x	0.77	x	1.4	×	63.27	x	0.76	x	0.7	=	32.66	(80)
West	0.9x	0.77	x	1.68	×	63.27	x	0.76	x	0.7	=	39.19	(80)
West	0.9x	0.54	x	0.95	x	92.28	x	0.76	x	0.7	=	22.67	(80)
West	0.9x	0.54	x	0.84	x	92.28	x	0.76	x	0.7	=	20.04	(80)
West	0.9x	0.77	x	0.84	×	92.28	x	0.76	x	0.7	=	28.58	(80)
West	0.9x	0.77	x	1.4	x	92.28	x	0.76	x	0.7	=	47.63	(80)
West	0.9x	0.77	x	1.68	×	92.28	x	0.76	x	0.7] =	57.16	(80)
West	0.9x	0.54	x	0.95	x	113.09	x	0.76	x	0.7	=	27.78	(80)
West	0.9x	0.54	x	0.84	x	113.09	x	0.76	x	0.7	=	24.56	(80)
West	0.9x	0.77	x	0.84	×	113.09	x	0.76	x	0.7] =	35.02	(80)
West	0.9x	0.77	x	1.4	x	113.09	x	0.76	x	0.7	=	58.37	(80)
West	0.9x	0.77	x	1.68	x	113.09	x	0.76	x	0.7	=	70.05	(80)
West	0.9x	0.54	x	0.95	×	115.77	x	0.76	x	0.7] =	28.44	(80)
West	0.9x	0.54	x	0.84	x	115.77	x	0.76	x	0.7	=	25.14	(80)
West	0.9x	0.77	x	0.84	x	115.77	x	0.76	x	0.7	=	35.85	(80)
West	0.9x	0.77	x	1.4	×	115.77	x	0.76	x	0.7] =	59.75	(80)
West	0.9x	0.77	x	1.68	x	115.77	x	0.76	x	0.7	=	71.71	(80)
West	0.9x	0.54	x	0.95	x	110.22	x	0.76	x	0.7	=	27.07	(80)
West	0.9x	0.54	x	0.84	×	110.22	x	0.76	x	0.7	=	23.94	(80)
West	0.9x	0.77	x	0.84	x	110.22	x	0.76	x	0.7	=	34.13	(80)
West	0.9x	0.77	x	1.4	x	110.22	x	0.76	x	0.7	=	56.89	(80)
West	0.9x	0.77	x	1.68	×	110.22	x	0.76	x	0.7] =	68.27	(80)
West	0.9x	0.54	x	0.95	x	94.68	x	0.76	x	0.7	=	23.25	(80)
West	0.9x	0.54	x	0.84	×	94.68	x	0.76	x	0.7] =	20.56	(80)
West	0.9x	0.77	x	0.84	x	94.68	x	0.76	x	0.7	=	29.32	(80)
West	0.9x	0.77	x	1.4	×	94.68	x	0.76	x	0.7	=	48.87	(80)
West	0.9x	0.77	x	1.68	×	94.68	x	0.76	x	0.7	=	58.64	(80)
West	0.9x	0.54	x	0.95	×	73.59	x	0.76	×	0.7] =	18.08	(80)
West	0.9x	0.54	×	0.84	×	73.59	×	0.76	x	0.7	=	15.98	(80)
West	0.9x	0.77	x	0.84	×	73.59	x	0.76	x	0.7	=	22.79	(80)

West	0.9x	0.77	x	1.4	x	73.59	x	0.76	x	0.7	=	37.98	(80)
West	0.9x	0.77	x	1.68	x	73.59	x	0.76	x	0.7	=	45.58	(80)
West	0.9x	0.54	x	0.95	x	45.59	x	0.76	x	0.7	=	11.2	(80)
West	0.9x	0.54	x	0.84	x	45.59	x	0.76	x	0.7	=	9.9	(80)
West	0.9x	0.77	x	0.84	x	45.59	x	0.76	x	0.7	=	14.12	(80)
West	0.9x	0.77	x	1.4	x	45.59	x	0.76	x	0.7	=	23.53	(80)
West	0.9x	0.77	x	1.68	x	45.59	x	0.76	x	0.7	=	28.24	(80)
West	0.9x	0.54	x	0.95	x	24.49	x	0.76	x	0.7	=	6.02	(80)
West	0.9x	0.54	x	0.84	x	24.49	x	0.76	x	0.7	=	5.32	(80)
West	0.9x	0.77	x	0.84	x	24.49	x	0.76	x	0.7	=	7.58	(80)
West	0.9x	0.77	x	1.4	x	24.49	x	0.76	x	0.7	=	12.64	(80)
West	0.9x	0.77	x	1.68	x	24.49	x	0.76	x	0.7	=	15.17	(80)
West	0.9x	0.54	x	0.95	x	16.15	x	0.76	x	0.7	=	3.97	(80)
West	0.9x	0.54	x	0.84	x	16.15	x	0.76	x	0.7	=	3.51	(80)
West	0.9x	0.77	x	0.84	x	16.15	x	0.76	x	0.7	=	5	(80)
West	0.9x	0.77	x	1.4	x	16.15	x	0.76	x	0.7	=	8.34	(80)
West	0.9x	0.77	x	1.68	x	16.15	x	0.76	x	0.7	=	10	(80)
Northwe	est <mark>0.9x</mark>	0.54	x	1.09	x	11.28	x	0.76	x	0.7	=	3.18	(81)
Northwe	est <mark>0.9x</mark>	0.77	x	1.39	x	11.28	x	0.76	x	0.7	=	5.78	(81)
Northwe	est <mark>0.9x</mark>	0.77	x	7.7	x	11.28	x	0.76	x	0.7	=	32.04	(81)
Northwe	est <mark>0.9x</mark>	0.77	x	2.1	x	11.28	x	0.76	x	0.7	=	8.74	(81)
Northwe	est <mark>0.9x</mark>	0.77	x	3.93	x	11.28	x	0.76	x	0.7	=	16.35	(81)
Northwe	est <mark>0.9x</mark>	0.77	x	1.89	x	11.28	x	0.76	x	0.7	=	15.72	(81)
Northwe	est <mark>0.9x</mark>	0.77	x	1.16	x	11.28	x	0.76	x	0.7	=	4.83	(81)
Northwe	est <mark>0.9x</mark>	0.54	x	1.09	x	22.97	x	0.76	x	0.7	=	6.47	(81)
Northwe	est <mark>0.9x</mark>	0.77	x	1.39	x	22.97	x	0.76	x	0.7	=	11.77	(81)
Northwe	est <mark>0.9x</mark>	0.77	x	7.7	x	22.97	x	0.76	x	0.7	=	65.22	(81)
Northwe	est <mark>0.9x</mark>	0.77	x	2.1	x	22.97	x	0.76	x	0.7	=	17.78	(81)
Northwe	est <mark>0.9x</mark>	0.77	x	3.93	x	22.97	x	0.76	x	0.7	=	33.28	(81)
Northwe	est <mark>0.9</mark> x	0.77	x	1.89	x	22.97	x	0.76	x	0.7	=	32.01	(81)
Northwe	est <mark>0.9x</mark>	0.77	x	1.16	x	22.97	x	0.76	x	0.7	=	9.82	(81)
Northwe	est <mark>0.9x</mark>	0.54	x	1.09	x	41.38	x	0.76	x	0.7	=	11.66	(81)
Northwe	est <mark>0.9x</mark>	0.77	x	1.39	x	41.38	x	0.76	x	0.7	=	21.2	(81)
Northwe	est <mark>0.9</mark> x	0.77	x	7.7	x	41.38	x	0.76	x	0.7	=	117.5	(81)
Northwe	est <mark>0.9x</mark>	0.77	x	2.1	x	41.38	x	0.76	x	0.7	=	32.04	(81)
Northwe	est <mark>0.9x</mark>	0.77	x	3.93	x	41.38	x	0.76	x	0.7	=	59.95	(81)
Northwe	est <mark>0.9x</mark>	0.77	×	1.89	×	41.38	×	0.76	x	0.7	=	57.67	(81)
Northwe	est <mark>0.9x</mark>	0.77	×	1.16	×	41.38	×	0.76	x	0.7	=	17.7	(81)
Northwe	est <mark>0.9x</mark>	0.54	×	1.09	×	67.96	×	0.76	x	0.7	=	19.15	(81)
Northwe	est <mark>0.9x</mark>	0.77	×	1.39	×	67.96	×	0.76	x	0.7	=	34.82	(81)
Northwe	est <mark>0.9x</mark>	0.77	x	7.7	x	67.96	x	0.76	x	0.7	=	192.96	(81)

Northwest 0.9x	0.77	x	2.1	x	67.96	x	0.76	x	0.7] =	52.61	(81)
Northwest 0.9x	0.77	x	3.93	x	67.96	x	0.76	x	0.7	=	98.46	(81)
Northwest 0.9x	0.77	x	1.89	x	67.96	x	0.76	x	0.7	=	94.7	(81)
Northwest 0.9x	0.77	x	1.16	x	67.96	×	0.76	x	0.7	=	29.06	(81)
Northwest 0.9x	0.54	×	1.09	x	91.35	x	0.76	x	0.7	=	25.74	(81)
Northwest 0.9x	0.77	x	1.39	x	91.35	x	0.76	x	0.7] =	46.81	(81)
Northwest 0.9x	0.77	x	7.7	x	91.35	x	0.76	x	0.7	=	259.38	(81)
Northwest 0.9x	0.77	x	2.1	x	91.35	x	0.76	x	0.7	=	70.72	(81)
Northwest 0.9x	0.77	x	3.93	x	91.35	x	0.76	x	0.7	=	132.35	(81)
Northwest 0.9x	0.77	x	1.89	x	91.35	x	0.76	x	0.7] =	127.3	(81)
Northwest 0.9x	0.77	x	1.16	x	91.35	x	0.76	x	0.7	=	39.07	(81)
Northwest 0.9x	0.54	x	1.09	x	97.38	x	0.76	x	0.7	=	27.45	(81)
Northwest 0.9x	0.77	x	1.39	x	97.38	x	0.76	x	0.7	=	49.91	(81)
Northwest 0.9x	0.77	x	7.7	x	97.38	x	0.76	x	0.7] =	276.53	(81)
Northwest 0.9x	0.77	x	2.1	x	97.38	x	0.76	x	0.7	=	75.4	(81)
Northwest 0.9x	0.77	x	3.93	x	97.38	x	0.76	x	0.7	=	141.1	(81)
Northwest 0.9x	0.77	x	1.89	x	97.38	x	0.76	x	0.7	=	135.71	(81)
Northwest 0.9x	0.77	x	1.16	x	97.38	x	0.76	x	0.7	=	41.65	(81)
Northwest 0.9x	0.54	x	1.09	x	91.1	x	0.76	x	0.7	=	25.67	(81)
Northwest 0.9x	0.77	x	1.39	x	91.1	x	0.76	x	0.7	=	46.69	(81)
Northwest 0.9x	0.77	x	7.7	x	91.1	x	0.76	x	0.7	=	258.69	(81)
Northwest 0.9x	0.77	x	2.1	x	91.1	x	0.76	x	0.7	=	70.53	(81)
Northwest 0.9x	0.77	x	3.93	x	91.1	x	0.76	x	0.7	=	132	(81)
Northwest 0.9x	0.77	x	1.89	x	91.1	x	0.76	x	0.7	=	126.96	(81)
Northwest 0.9x	0.77	x	1.16	x	91.1	x	0.76	x	0.7] =	38.96	(81)
Northwest 0.9x	0.54	x	1.09	x	72.63	x	0.76	x	0.7] =	20.47	(81)
Northwest 0.9x	0.77	x	1.39	x	72.63	x	0.76	x	0.7] =	37.22	(81)
Northwest 0.9x	0.77	x	7.7	x	72.63	x	0.76	x	0.7	=	206.23	(81)
Northwest 0.9x	0.77	x	2.1	x	72.63	x	0.76	x	0.7] =	56.23	(81)
Northwest 0.9x	0.77	x	3.93	x	72.63	x	0.76	x	0.7	=	105.23	(81)
Northwest 0.9x	0.77	x	1.89	x	72.63	x	0.76	x	0.7	=	101.21	(81)
Northwest 0.9x	0.77	x	1.16	x	72.63	x	0.76	x	0.7] =	31.06	(81)
Northwest 0.9x	0.54	x	1.09	x	50.42	x	0.76	x	0.7] =	14.21	(81)
Northwest 0.9x	0.77	x	1.39	x	50.42	x	0.76	x	0.7] =	25.84	(81)
Northwest 0.9x	0.77	x	7.7	x	50.42	x	0.76	x	0.7	=	143.17	(81)
Northwest 0.9x	0.77	x	2.1	x	50.42	x	0.76	x	0.7] =	39.04	(81)
Northwest 0.9x	0.77	x	3.93	x	50.42	x	0.76	x	0.7	=	73.05	(81)
Northwest 0.9x	0.77	x	1.89	x	50.42	x	0.76	x	0.7] =	70.27	(81)
Northwest 0.9x	0.77	x	1.16	x	50.42	x	0.76	x	0.7	=	21.56	(81)
Northwest 0.9x	0.54	x	1.09	x	28.07	x	0.76	x	0.7	=	7.91	(81)
Northwest 0.9x	0.77	x	1.39	x	28.07	x	0.76	x	0.7	=	14.38	(81)

Northwest 0.9x	0.77	x	7.7	x	28.07	x	0.76	x	0.7] =	79.7	(81)
Northwest 0.9x	0.77	x	2.1	x	28.07	×	0.76	x	0.7	j =	21.73	(81)
Northwest 0.9x	0.77	x	3.93	x	28.07	x	0.76	x	0.7	=	40.67	(81)
Northwest 0.9x	0.77	x	1.89	x	28.07	×	0.76	x	0.7] =	39.11	(81)
Northwest 0.9x	0.77	x	1.16	x	28.07	x	0.76	x	0.7] =	12	(81)
Northwest 0.9x	0.54	x	1.09	x	14.2	x	0.76	x	0.7] =	4	(81)
Northwest 0.9x	0.77	x	1.39	x	14.2	x	0.76	x	0.7	=	7.28	(81)
Northwest 0.9x	0.77	x	7.7	x	14.2	x	0.76	x	0.7	=	40.31	(81)
Northwest 0.9x	0.77	x	2.1	x	14.2	x	0.76	x	0.7	=	10.99	(81)
Northwest 0.9x	0.77	x	3.93	x	14.2	x	0.76	x	0.7	=	20.57	(81)
Northwest 0.9x	0.77	x	1.89	x	14.2	x	0.76	x	0.7	=	19.78	(81)
Northwest 0.9x	0.77	x	1.16	x	14.2	x	0.76	x	0.7	=	6.07	(81)
Northwest 0.9x	0.54	x	1.09	x	9.21	x	0.76	x	0.7	=	2.6	(81)
Northwest 0.9x	0.77	x	1.39	x	9.21	x	0.76	x	0.7	=	4.72	(81)
Northwest 0.9x	0.77	x	7.7	x	9.21	x	0.76	x	0.7	=	26.16	(81)
Northwest 0.9x	0.77	x	2.1	x	9.21	x	0.76	x	0.7	=	7.13	(81)
Northwest 0.9x	0.77	x	3.93	x	9.21	x	0.76	x	0.7	=	13.35	(81)
Northwest 0.9x	0.77	x	1.89	x	9.21	x	0.76	x	0.7	=	12.84	(81)
Northwest 0.9x	0.77	x	1.16	x	9.21	x	0.76	x	0.7	=	3.94	(81)
Rooflights 0.9x	1	x	1.08	x	26	x	0.76	x	0.7	=	40.33	(82)
Rooflights 0.9x	1	x	1.08	x	26	x	0.76	x	0.7	=	40.33	(82)
Rooflights 0.9x	1	x	1.08	x	26	x	0.76	x	0.7] =	13.44	(82)
Rooflights 0.9x	1	x	0.98	x	40.65	x	0.76	x	0.7	=	19.07	(82)
Rooflights 0.9x	1	x	0.86	x	15.57	x	0.76	x	0.7	=	12.82	(82)
Rooflights 0.9x	1	x	0.49	x	15.92	x	0.76	x	0.7	=	3.73	(82)
Rooflights 0.9x	1	x	0.49	x	15.92	x	0.76	x	0.7	=	3.73	(82)
Rooflights 0.9x	1	x	1.38	x	40.5	x	0.76	x	0.7	=	26.76	(82)
Rooflights 0.9x	1	x	2.36	x	40.5	x	0.76	x	0.7	=	45.77	(82)
Rooflights 0.9x	1	x	1.08	x	54	x	0.76	x	0.7	=	83.77	(82)
Rooflights 0.9x	1	x	1.08	x	54	x	0.76	x	0.7	=	83.77	(82)
Rooflights 0.9x	1	x	1.08	x	54	x	0.76	x	0.7	=	27.92	(82)
Rooflights 0.9x	1	x	0.98	x	73.74	x	0.76	x	0.7	=	34.6	(82)
Rooflights 0.9x	1	x	0.86	x	31.61	x	0.76	x	0.7] =	26.03	(82)
Rooflights 0.9x	1	x	0.49	x	32.51	x	0.76	x	0.7	=	7.63	(82)
Rooflights 0.9x	1	x	0.49	x	32.51	x	0.76	x	0.7	=	7.63	(82)
Rooflights 0.9x	1	x	1.38	x	73.74	x	0.76	x	0.7	=	48.73	(82)
Rooflights 0.9x	1	x	2.36	x	73.74	x	0.76	x	0.7	=	83.33	(82)
Rooflights 0.9x	1	x	1.08	x	96	x	0.76	x	0.7	=	148.93	(82)
Rooflights 0.9x	1	x	1.08	x	96	x	0.76	x	0.7] =	148.93	(82)
Rooflights 0.9x	1	x	1.08	×	96	×	0.76	x	0.7	=	49.64	(82)
Rooflights 0.9x	1	x	0.98	x	110.48	x	0.76	x	0.7	=	51.84	(82)

Rooflights 0.9x	1	×	0.86	x	57.49	x	0.76	x	0.7	=	47.34	(82)
Rooflights 0.9x	1	×	0.49	x	59.5	x	0.76	x	0.7	i =	13.96	(82)
Rooflights 0.9x	1	x	0.49	x	59.5	x	0.76	x	0.7	i =	13.96	(82)
Rooflights 0.9x	1	x	1.38	x	111.06	x	0.76	x	0.7	=	73.38	(82)
Rooflights 0.9x	1	×	2.36	x	111.06	x	0.76	x	0.7	i =	125.49	(82)
Rooflights 0.9x	1	x	1.08	x	150	x	0.76	x	0.7	=	232.7	(82)
Rooflights 0.9x	1	×	1.08	x	150	x	0.76	x	0.7] =	232.7	(82)
Rooflights 0.9x	1	×	1.08	x	150	x	0.76	x	0.7] =	77.57	(82)
Rooflights 0.9x	1	×	0.98	x	149.12	x	0.76	x	0.7	=	69.97	(82)
Rooflights 0.9x	1	x	0.86	x	96.26	x	0.76	x	0.7	=	79.28	(82)
Rooflights 0.9x	1	×	0.49	x	100.03	x	0.76	x	0.7	=	23.47	(82)
Rooflights 0.9x	1	×	0.49	x	100.03	x	0.76	x	0.7	=	23.47	(82)
Rooflights 0.9x	1	x	1.38	x	150.59	x	0.76	x	0.7] =	99.5	(82)
Rooflights 0.9x	1	x	2.36	x	150.59	x	0.76	x	0.7	=	170.16	(82)
Rooflights 0.9x	1	×	1.08	x	192	x	0.76	x	0.7	=	297.85	(82)
Rooflights 0.9x	1	x	1.08	x	192	x	0.76	x	0.7] =	297.85	(82)
Rooflights 0.9x	1	×	1.08	x	192	x	0.76	x	0.7	=	99.28	(82)
Rooflights 0.9x	1	x	0.98	x	175.41	x	0.76	x	0.7	=	82.31	(82)
Rooflights 0.9x	1	×	0.86	x	131.51	x	0.76	x	0.7	=	108.31	(82)
Rooflights 0.9x	1	x	0.49	x	136.88	x	0.76	x	0.7	=	32.11	(82)
Rooflights 0.9x	1	x	0.49	x	136.88	x	0.76	x	0.7	=	32.11	(82)
Rooflights 0.9x	1	x	1.38	x	177.61	x	0.76	x	0.7	=	117.35	(82)
Rooflights 0.9x	1	×	2.36	x	177.61	x	0.76	x	0.7] =	200.69	(82)
Rooflights 0.9x	1	x	1.08	x	200	x	0.76	x	0.7	=	310.26	(82)
Rooflights 0.9x	1	×	1.08	x	200	x	0.76	x	0.7] =	310.26	(82)
Rooflights 0.9x	1	×	1.08	x	200	x	0.76	x	0.7	=	103.42	(82)
Rooflights 0.9x	1	×	0.98	x	177.08	x	0.76	x	0.7] =	83.09	(82)
Rooflights 0.9x	1	×	0.86	x	141.21	x	0.76	x	0.7] =	116.29	(82)
Rooflights 0.9x	1	x	0.49	x	147.03	x	0.76	x	0.7	=	34.49	(82)
Rooflights 0.9x	1	×	0.49	x	147.03	x	0.76	x	0.7	=	34.49	(82)
Rooflights 0.9x	1	x	1.38	x	179.47	x	0.76	x	0.7	=	118.58	(82)
Rooflights 0.9x	1	×	2.36	x	179.47	x	0.76	x	0.7	=	202.79	(82)
Rooflights 0.9x	1	×	1.08	x	189	x	0.76	x	0.7	=	293.2	(82)
Rooflights 0.9x	1	×	1.08	x	189	x	0.76	x	0.7	=	293.2	(82)
Rooflights 0.9x	1	×	1.08	x	189	x	0.76	x	0.7	=	97.73	(82)
Rooflights 0.9x	1	x	0.98	x	169.56	x	0.76	x	0.7	=	79.56	(82)
Rooflights 0.9x	1	x	0.86	x	131.69	x	0.76	×	0.7] =	108.45	(82)
Rooflights 0.9x	1	x	0.49	x	137.1	x	0.76	x	0.7	=	32.17	(82)
Rooflights 0.9x	1	x	0.49	x	137.1	x	0.76	x	0.7] =	32.17	(82)
Rooflights 0.9x	1	x	1.38	x	171.77	x	0.76	x	0.7	=	113.5	(82)
Rooflights 0.9x	1	x	2.36	x	171.77	x	0.76	x	0.7	=	194.1	(82)

Rooflights 0.9x	1	×	1.08	x	157	x	0.76	x	0.7	=	243.56	(82)
Rooflights 0.9x	1	×	1.08	x	157	x	0.76	x	0.7	=	243.56	(82)
Rooflights 0.9x	1	×	1.08	x	157	x	0.76	x	0.7	=	81.19	(82)
Rooflights 0.9x	1	×	0.98	x	149.99	x	0.76	x	0.7	=	70.38	(82)
Rooflights 0.9x	1	×	0.86	x	103.62	x	0.76	x	0.7	i =	85.33	(82)
Rooflights 0.9x	1	×	0.49	x	107.76	x	0.76	x	0.7	=	25.28	(82)
Rooflights 0.9x	1	×	0.49	x	107.76	x	0.76	x	0.7] =	25.28	(82)
Rooflights 0.9x	1	×	1.38	x	151.65	x	0.76	x	0.7	=	100.21	(82)
Rooflights 0.9x	1	×	2.36	x	151.65	x	0.76	x	0.7	=	171.37	(82)
Rooflights 0.9x	1	x	1.08	x	115	x	0.76	x	0.7] =	178.4	(82)
Rooflights 0.9x	1	x	1.08	x	115	x	0.76	x	0.7] =	178.4	(82)
Rooflights 0.9x	1	x	1.08	x	115	x	0.76	x	0.7] =	59.47	(82)
Rooflights 0.9x	1	x	0.98	x	124.13	x	0.76	x	0.7	=	58.24	(82)
Rooflights 0.9x	1	x	0.86	x	70.56	x	0.76	x	0.7	=	58.11	(82)
Rooflights 0.9x	1	x	0.49	x	73.17	x	0.76	x	0.7] =	17.17	(82)
Rooflights 0.9x	1	x	0.49	x	73.17	x	0.76	x	0.7] =	17.17	(82)
Rooflights 0.9x	1	x	1.38	x	125.02	x	0.76	x	0.7] =	82.61	(82)
Rooflights 0.9x	1	x	2.36	x	125.02	x	0.76	x	0.7	=	141.27	(82)
Rooflights 0.9x	1	×	1.08	x	66	x	0.76	x	0.7] =	102.39	(82)
Rooflights 0.9x	1	x	1.08	x	66	x	0.76	x	0.7	=	102.39	(82)
Rooflights 0.9x	1	x	1.08	x	66	x	0.76	x	0.7	=	34.13	(82)
Rooflights 0.9x	1	x	0.98	x	84.31	x	0.76	x	0.7	=	39.56	(82)
Rooflights 0.9x	1	x	0.86	x	38.7	x	0.76	x	0.7	=	31.87	(82)
Rooflights 0.9x	1	x	0.49	x	39.91	x	0.76	x	0.7	=	9.36	(82)
Rooflights 0.9x	1	x	0.49	x	39.91	x	0.76	x	0.7	=	9.36	(82)
Rooflights 0.9x	1	x	1.38	x	84.48	x	0.76	x	0.7	=	55.82	(82)
Rooflights 0.9x	1	x	2.36	x	84.48	x	0.76	x	0.7	=	95.46	(82)
Rooflights 0.9x	1	x	1.08	x	33	x	0.76	x	0.7	=	51.19	(82)
Rooflights 0.9x	1	x	1.08	x	33	x	0.76	x	0.7	=	51.19	(82)
Rooflights 0.9x	1	x	1.08	x	33	x	0.76	x	0.7	=	17.06	(82)
Rooflights 0.9x	1	x	0.98	x	49.56	x	0.76	x	0.7	=	23.26	(82)
Rooflights 0.9x	1	x	0.86	x	19.56	x	0.76	x	0.7	=	16.1	(82)
Rooflights 0.9x	1	x	0.49	x	20.03	x	0.76	x	0.7] =	4.7	(82)
Rooflights 0.9x	1	x	0.49	x	20.03	x	0.76	x	0.7] =	4.7	(82)
Rooflights 0.9x	1	x	1.38	x	49.44	x	0.76	x	0.7] =	32.67	(82)
Rooflights 0.9x	1	x	2.36	x	49.44	x	0.76	x	0.7] =	55.86	(82)
Rooflights 0.9x	1	x	1.08	×	21	x	0.76	×	0.7] =	32.58	(82)
Rooflights 0.9x	1	x	1.08	×	21	x	0.76	x	0.7] =	32.58	(82)
Rooflights 0.9x	1	x	1.08	x	21	x	0.76	×	0.7] =	10.86	(82)
Rooflights 0.9x	1	x	0.98	×	34.19	x	0.76	x	0.7	=	16.04	(82)
Rooflights 0.9x	1	x	0.86	×	12.74	x	0.76	x	0.7	=	10.49	(82)

Rooflig	hts <mark>0.9x</mark>	1	x	0.4	49	x	1	3.01	x		0.76	x	0.7	=	3.05	(82)
Rooflig	hts <mark>0.9x</mark>	1	x	0.4	49	x	1	3.01	x		0.76	×	0.7	=	3.05	(82)
Rooflig	hts <mark>0.9x</mark>	1	x	1.3	38	x	3	34.03	x		0.76	_ x [0.7	=	22.49	(82)
Rooflig	hts 0.9x	1	x	2.3	36	x	3	34.03	x		0.76	= × [0.7	=	38.45	(82)
	L								1			L				
Solar	nains in	watts ca	alculated	l for eac	h month				(83)n	n = S	um(74)m .	(82)m				
(83)m=	1233.85	2268.48	3524.8	5037.01	6227.04	64	132.45	6097.85	517	6.36	4045.59	2622.79	1508.78	1035.63		(83)
Total g	lains – i	nternal a	and solar	r (84)m =	= (73)m ·	+ (8	83)m	, watts								
(84)m=	2452.05	3483.57	4695.55	6133.42	7241.95	73	373.84	6994.75	608	1.82	4992.14	3643.98	2615.88	2212.94		(84)
7 Mo	an inter	nal tomr	oraturo	(heating		1		1	1			l	1	1		
Tomp		during b			n the livi) na	area	from Tak		Th	1 (°C)				21	(85)
Littiliae		uunnig i				ng . (a			JIE 9	,	I (C)				21	(00)
Utilisa			ains ior	living an	ea, n1,m	i (s T					0.0.0	0-4	Nau	Dee		
()	Jan	Feb	iviar	Apr	iviay	┢	Jun	Jui	A	ug	Sep	Oct	NOV	Dec		(00)
(86)m=	1	1	1	0.99	0.97		0.9	0.79	0.8	36	0.97	1	1	1		(86)
Mean	interna	l temper	ature in	living ar	ea T1 (fo	ollo	w ste	ps 3 to 7	7 in T	Table	e 9c)					
(87)m=	19.25	19.39	19.66	20.05	20.41	2	20.71	20.85	20.	.81	20.54	20.08	19.63	19.27		(87)
Temp	erature	durina h	Neating r	eriods i	n rest of	dw	ellina	from Ta	hle (а ті	h2 (°ር.)		•			
(88)m=	19.53	19.54	19.55	19.6	19.61		9.65	19.65	19	66	19.63	19.61	19.59	19.57		(88)
(00)	10.00	10.01	10.00	10.0	10.01	<u> </u>	0.00	10.00			10.00	10.01	10.00	10.07		()
Utilisa	ation fac	tor for g	ains for	rest of d	welling,	h2,	,m (se	e Table	9a)						I	(22)
(89)m=	1	1	1	0.99	0.95		0.82	0.62	0.7	72	0.95	1	1	1		(89)
Mean	interna	l temper	ature in	the rest	of dwell	ing	T2 (f	ollow ste	eps 3	8 to 7	7 in Tabl	e 9c)				
(90)m=	17.94	18.09	18.36	18.79	19.16	1	9.47	19.56	19.	.55	19.3	18.83	18.37	17.99		(90)
						•			•		f	LA = Livii	ng area ÷ (4	4) =	0.08	(91)
Moon	intorna	l tompor	aturo (fo	r tho wh	olo dwo	Illin	a) – fl	I A ⊷ T1	т (1	_ fl	Λ) ∨ Τ2					
(92)m-	18.05		18 47	18.89	19 26		9) — II 9 57		+ (1 19	- IL 65	194	18.93	18.47	18.1		(92)
		nent to t	he mear			'	uro fro		40	who			10.47	10.1		()
(93)m-	18.05		18.47	18.89	19.26		9 57	19 66	10	65		18.03	18.47	18.1		(93)
			uiromont	10.00	13.20	I.'	5.57	10.00	10.	.00	10.4	10.00	10.47	10.1		(00)
O. Op	i to the	moon int		moorotu	ro obtoir			on 11 of	Toh		o oo tho	t Ti m-	(76)m on	d ro oolo	vuloto	
the ut	ilisation	factor fo	or gains	using Ta	able 9a	ieu	a 30	epiioi	Tab	16 31	J, 50 li la	t 11,111—1	(10)11 an	u ie-caic	Julate	
	Jan	Feb	Mar	Apr	Mav	Γ	Jun	Jul	A	ua	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for a	ains, hm	1 <u>'</u> 1:		1				5	1					
(94)m=	1	1	1	0.99	0.94		0.82	0.63	0.7	72	0.94	1	1	1		(94)
Usefu	l gains.	hmGm	. W = (94	4)m x (8	4)m	<u> </u>							1			
(95)m=	2451.55	3480.79	4680.32	6043.24	6817.61	60)25.31	4372.07	435	6.92	4706.5	3627.07	2614.66	2212.66		(95)
Month	nlv aver	age exte	rnal tem	perature	e from Ta	abl	e 8	1	<u> </u>							
(96)m=	4.3	4.9	6.5	8.9	11.7		14.6	16.6	16	.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	e for mea	an interr	al temp	erature.	L Lm	1.W=	=[(39)m	x [(9	3)m	– (96)m	1	1			
(97)m=	23666.31	22698.1	20254.87	16243.66	12184.49	77	, 15.43	4754.8	501	0.97	8360.22	13433	18619.19	23135.64		(97)
Space	e heatin	n reauire	ement fo	r each r	nonth. k	ı Wh	/mon	u th = 0.02	24 x	[(97])m – (95)ml x (4	1)m		I	
(98)m=	15783.79	12914.04	11587.46	7344.3	3992.96	Γ	0	0)	0	7295.61	11523.26	15566.7		
	L	ļ	I	I	ļ	1		I	I	Tota	l per vear	(kWh/vea	r) = Sum(9	8)15.912 =	86008.11	(98)
C	o becti				2hunner						1.1.700		, 23(0	,		
Space	e neatin	ig require	ement in	KVVN/M	ryear										85.82	(99)

02 Enorgy re	quiromor	nte <u>lo</u> d	ividual b	opting e	vetome i	ncluding	micro C	,HD) ——					
Snace heati	quirenier na:	ns – ma	Muuarn	eaung S	ystems I	nciuuing	-mero-C						
Fraction of s	pace hea	at from s	econdar	y/supple	mentary	system					[0	(201)
Fraction of s	pace hea	at from n	nain syst	em(s)			(202) = 1 -	- (201) =				1	(202)
Fraction of to	otal heatii	ng from	main sys	stem 1			(204) = (20	02) × [1 –	(203)] =			1	(204)
Efficiency of	main spa	ace heat	ing syste	em 1								319.7	(206)
Efficiency of	seconda	ry/suppl	ementar	y heating	g system	ח, %						0	(208)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	- Ir
Space heatir	ng require	ement (c	alculate	d above))								
15783.79	12914.04	11587.46	7344.3	3992.96	0	0	0	0	7295.61	11523.26	15566.7		
(211)m = {[(98	3)m x (20	4)] } x 1	100 ÷ (20)6)									(211)
4937.06	4039.42	3624.48	2297.25	1248.97	0	0	0	0	2282.02	3604.4	4869.16		1
_							lota	l (kWh/yea	ar) = Sum(2)	211) _{15,1012}	7	26902.76	(211)
Space heatir	ng fuel (s 01)1) x 1	econdar	ˈy), kWh/ vev	month									
$= \{[(90), 11, X, (2)]$ (215)m= 0		00 ÷ (20	0	0	0	0	0	0	0	0	0		
、	I			Į		[Tota	l (kWh/yea	ar) =Sum(2	L 215) _{15,1012}		0	(215)
Water heating	q										l		J
Output from w	vater hea	ter (calc	ulated a	bove)									
247.84	217.77	227.12	201.4	195.77	172.64	163.63	182.55	183.17	208.95	223.71	241.13		-
Efficiency of w	vater hea	iter		1		1			r	r		100	(216)
(217)m= 100	100	100	100	100	100	100	100	100	100	100	100		(217)
Fuel for water (219)m = (64	heating, m x 100	kWh/m₀ (217) ∸ (217)	onth Im										
(219)m= 247.84	217.77	227.12	201.4	195.77	172.64	163.63	182.55	183.17	208.95	223.71	241.13		
							Tota	I = Sum(2 ⁻	19a) ₁₁₂ =			2465.66	(219)
Annual totals	5								k	Wh/year		kWh/year	-
Space heating	g fuel use	ed, main	system	1								26902.76	
Water heating	fuel use	d										2465.66]
Electricity for	pumps, fa	ans and	electric	keep-ho	t								
central heating	ng pump:	:									30		(230c)
Total electricit	y for the	above, l	kWh/yea	ır			sum	of (230a).	(230g) =			30	(231)
Electricity for	lighting										ĺ	1512.93	(232)
Electricity gen	erated b	y PVs									ĺ	-481.92	(233)
12a. CO2 en	nissions -	– Individ	ual heat	ing syste	ems inclu	uding mi	cro-CHP						-
					En	~~~~~			Emico	ion foo	4.0.7	Emissions	
					k۷	/h/year			kg CO	2/kWh	101	kg CO2/yea	r
Space heating	g (main s	ystem 1)		(21	1) x			0.5	19	=	13962.53	(261)
Space heating	g (second	dary)			(21	5) x			0.5	19	=	0	(263)
Water heating	I				(219	9) x			0.5	19	=	1279.68	(264)
Space and wa	ater heati	ng			(26	1) + (262) -	+ (263) + (264) =			[15242.21	(265)

Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	15.57	(267)
Electricity for lighting	(232)	x	0.519	=	785.21	(268)
Energy saving/generation technologies Item 1			0.519] =	-250.12	(269)
Total CO2, kg/year			sum of (265)(271) =	-	15792.87	(272)
Dwelling CO2 Emission Rate			(272) ÷ (4) =		15.76	(273)
EI rating (section 14)					80	(274)



11. Appendix B – BREEAM Pre-assessment

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Registered Company No. 06408056 VAT Registration No. 980016044

BREEAM UK Domestic Refurbishment 2014 Pre-Assessment Estimator v0.1: Results Summary

Building name Indicative Building Score Indicative Building Rating			28 Redington Road, London NW3 7RB 70.83% BREEAM Excellent			
	Issue	Credits Available	Indicative Credits Achieved	Weighting	Section Score	
	Man 01	3	3			
	Man 02	2	1			
Management	Man 03	1	1	12%	8 73%	
management	Man 04	2	1	12/0	0.7570	
	Man 05	1	1			
	Man 06	2	1			
	Hea 01	2	0			
	Hea 02	4	1			
Health and	Hea 03	1	1	17%	8.50%	
Wellbeing	Hea 04	2	1	1770	0.0070	
	Hea 05	2	2			
	Hea 06	1	1			
	Ene 01	6	3.5			
	Ene 02	4	3.5			
	Ene 03	7	7			
	Ene 04	2	0			
Enorm	Ene 05	2	2	120/	25 50%	
Energy	Ene 06	1	1	43%	33.39%	
	Ene 07	2	2			
	Ene 08	2	2			
	Ene 09	2	2			
	Ene 10	1	1			
	Wat 01	3	2			
Water	Wat 02	1	1	11%	8.80%	
	Wat 03	1	1			
		_	_			
	Mat 01	25	10			
Materials	Mat 02	15	8	8%	3 67%	
Materials	Mat 02	8	0	070	5.0770	
	mat 05	U	4			
	Wee 01	2	2			
Waste	was 01	2	2	3%	1.80%	
	was uz	3	1			

2

1

2

0

6%

N/A

3.75%

0.00%

Pol 01

Pol 02 Pol 02

Pollution

Innovation

3

3

2

10

This assessment and indicative BREEAM rating is not a formal certified BREEAM assessment or rating and must not be communicated as such. The score presented is indicative of a dwelling's potential performance and is based on a simplified pre-formal BREEAM assessment and unverified commitments given at an early stage in the design process.

		N	/linimum Standarc	ls	
	Pass	Good	Very Good	Excellent	Outstanding
Ene 02	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark
Wat 01	\checkmark	\checkmark	\checkmark	\checkmark	×
Hea 05	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark
Hea 06	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark
Pol 03	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark
Mat 02	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark



BREEAM® UK

REEAM UK Domestic Refurbishme	ent 2014 Pre-Asse	ssment Estimator v0.1				B	REEAM
s assessment and indicative BREEAM ra h. The score presented is indicative of a	ating is not a formal a dwelling's potentia	certified BREEAM assessmen al performance and is based (t or rating and must not be comn on a simplified pre-formal BREEAN	nunicated as		Minimum Sta	ndards
essment and unverified commitments	given at an early sta	ge in the design process.		Ene 02	Pass Good V	/ery Good E	kcellent Outs
المتقدمة	Building name	28 Redington Ro	ad, London NW3 7RB	Wat 01	× ×	1	× .
Indicative	tive BREEAM rating	BREEA	M Excellent	Hea 06	× ×	×	~
lanagement Health & Wellbeing	Energy W	ater Materials Wa	ste Pollution	Pol 03 Mat 02	Y Y	y	V
INNOVATION		Section Weighting: 10%			Indicative Sect	ion Score: 0.0	0%
hments							
MANAGEMENT		Section Weighting: 12%			Indicative Sect	ion Score: 8.7	3%
n 01 Home Users Guide No. of BREEAM credits available	3		A	vailable contribution to	overall score	3.27%	
 of BREEAM innovation credits essment Criteria 	0			Minimum Standard	Is applicable:	No	Indicative Cre
ere a Home Users Guide be provided to	o all dwellings, cover	ring all issues set out in the 'U	Jsers Guide Contents list', three c	redits may be awarded		Ê	3
nments							
In 02 Responsible Construction Practi	ices		Δυ	ailable contribution to	overall score:	2 18%	
o. of BREEAM innovation credits	1	<u> </u>	AV	Minimum Standard	ls applicable:	2.18% No	
ere a compliant considerate construction	ion scheme will be us	sed, credits are awarded dep	ending the score achieved as out	lined below:		\Rightarrow	Indicative Cre 1
Large Scale - project with more	than 5 units	Or	e Credit	Two	Credits		
Considerate Constructo	ors Scheme	Score of 25-34 with a	score of 5 in each section	Score of 35-39 with a	score of 7 in eac	h section	
Alternative Compliant	t Scheme	Co	npliance	Beyond	Compliance		
Small Scale - project with 5 units	s or fewer	Or	e Credit	Two	Credits		
Considerate Constructo	ors Scheme	Score of 25-34 with a	score of 5 in each section	Score of 35-39 with a	score of 7 in eac	ch section	
Alternative Complian	it Scheme	Co	npliance	Beyond Compliance			
Checklist A-3	3	50% of th	optional items	80% of the optional items			
Exemplary Credit		L					ndicative Innov
Considerate Constructo	ors Scheme	Score of 40 or more wit	h a score of 7 in each section				Credits Achie
Alternative Complian	t Scheme	Exemplary	evel Compliance	_		,	Thease seres
Checklist A-3	*	All Items (Opt	ional & Mandatory)	* Small Scale Project Only			
					cocomy		
mments							
mments							
mments an 03 Construction Site Impacts No. of PBEEMM conditionality			Δ.	vailable contribution to	overall score	1 00%	
mments an 03 Construction Site Impacts No. of BREEAM credits available o. of BREEAM innovation credits	<u> </u>		A	vailable contribution to Minimum Standar	overall score	1.09% No	Indiantia Car
mments an 03 Construction Site Impacts No. of BREEAM credits available o. of BREEAM innovation credits ere evidence demonstrate that site imp	1 0 pacts will be monito	red, as detailed below:	A	vailable contribution to Minimum Standar	overall score ds applicable	1.09% No	Indicative Cre
mments an 03 Construction Site Impacts No. of BREEAM credits available o. of BREEAM innovation credits essment Criteria tere evidence demonstrate that site imp	1 0 ipacts will be monito	red, as detailed below:	An One Credit	vailable contribution to Minimum Standar	overall score ds applicable	1.09% No	Indicative Cre 1
mments an 03 Construction Site Impacts No. of BREEAM credits available to. of BREEAM innovation credits sessment Criteria here evidence demonstrate that site implement Criteria Large Scale	1 0 Ipacts will be monito	red, as detailed below: Where there is evidence	Ar One Credit e to demonstrate that 2 or more	vailable contribution to Minimum Standar	overall score ds applicable list A-4 are comp	1.09% No	Indicative Cre 1
mments an 03 Construction Site Impacts No. of BREEAM innovation credits sessment Criteria tere evidence demonstrate that site implement Large Scale Small Scale	1 0 pacts will be monito	red, as detailed below: Where there is evidence Where there is evidence	An One Credit e to demonstrate that 2 or more e to demonstrate that 2 or more	vailable contribution to Minimum Standar of the sections in Check of the sections in Check	overall score ds applicable ist A-4 are comp list A-5 are comp	1.09% No	Indicative Cre 1
mments an 03 Construction Site Impacts No. of BREEAM credits available o. of BREEAM innovation credits ere evidence demonstrate that site im Large Scale Small Scale	1 0 Ipacts will be monito	red, as detailed below: Where there is evidence Where there is evidence Sections	An One Credit to demonstrate that 2 or more to demonstrate that 2 or more of Checklist	vailable contribution to Minimum Standar of the sections in Check of the sections in Check	overall score ds applicable	1.09% No	Indicative Cre
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mments an 03 Construction Site Impacts No. of BREEAM credits available	1 0 pacts will be monito spacts will be monito scie activities pets for water consur activities th an environmental	red, as detailed below: Where there is evidence Where there is evidence Where there is evidence Sections f of energy use arising from nption arising from site materials policy	An One Credit e to demonstrate that 2 or more e to demonstrate that 2 or more of Checklist Set objectives for reducing CC Set objectives for reduc	vailable contribution to Minimum Standar of the sections in Check of the sections in Check II Scale - Checklist A-5 12 production from ener activities	overall score ds applicable list A-4 are comp list A-5 are comp gy use arising fro m site activities	1.09% No Deleted Deleted	Indicative Cre 1
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No. of BREEAM credits available 2 o. of BREEAM innovation credits 0	Available contribution to overall score: 2. Minimum Standards applicable:	No
essment Criteria ere the following requirements will be met:		Indicative Cred
One Credit Secure windows and doors	External doors and accessible windows meet minimum standards and appropriately certified	
	Principles and guidance of Secured by Design Section 2 are complied with	1
Two Credits Secured by design	A suitably qualified security consultant is consulted at the design stage and their recommendations are incorporated into the refurbishment	
mments		
an 05 Protection and Enhancement of Ecological Feature	25	
No. of BREEAM credits available 1 o. of BREEAM innovation credits 1	Available contribution to overall score: 1. Minimum Standards applicable:	.09% No
essment Criteria		Indicative Cred
	Site survey carried out to determine presence of ecological features	
One Credit	Statutory Nature Conservation Organisation notified of protected species	1
Protecting Ecological Features	Features of ecological value protected during refurbishment works	
		Indicative Innova
Exemplary Credit	A suitably qualified ecologist recommends features to enhance ecology of the site	
Ecological enhancement	adopts all general ecological recommendations	
nments		
an 06 Project Management No. of BREEAM credits available 2	Available contribution to overall score 2.	18%
an 06 Project Management No. of BREEAM credits available 2 o. of BREEAM innovation credits 2 essment Criteria	Available contribution to overall score 2. Minimum Standards applicable	18% No Indicative Cred
an 06 Project Management No. of BREEAM credits available 2 o. of BREEAM innovation credits 2 sessment Criteria ere the following requirements will be met:	Available contribution to overall score 2. Minimum Standards applicable	18% No Indicative Cred
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HEALTH & WELLBEING	Section Weighting: 17% Indicative Section Score	8.50%
Hea 01 Daylighting		
No. of BREEAM credits available 2 No. of BREEAM innovation credits 0	Available contribution to overall score 2.8 Minimum Standards applicable	3%
Assessment Criteria		Indicative Credits
awarded as follows: For Existing Dwellings and Change of Use Projects	t on daylighting or where minimum daylighting standards are met, up to two credits may be	U
First Credit Maintaining Good Daylighting	The refurbishment results in a neutral impact on the dwellings daylighting levels in the kitchen, living room, dining room and study	
Where the property is being extended	New spaces achieve minimum daylighting levels	ĺ
First Credit Maintaining Good Daylighting	The extension does not significantly reduce daylighting levels in the kitchen, living room, dining room or study of neighbouring properties	
For All Properties Second Credit Minimum Daylighting	The dwelling achieves minimum daylighting levels in the kitchen, living room, dining room and study	
Comments		
Hea 02 Sound Insulation No. of BREEAM credits available 4	Available contribution to overall score 5.6	7%
No. of BREEAM innovation credits 0	Minimum Standards applicable N	0
To ensure the provision of acceptable sound insulat Properties where sound testing has been carried of	ion standards and so minimise the likelihood of noise complaints.	1
Up to Four Credits	Four credits awarded according to the improvement over building regulations. See table in additional information in Technical Manual	
Properties where sound testing is not feasible and	not required by the appointed Building Control body	[
Two Credits	Where existing separating walls and floors are designed to meet the requirements of Building Regulations with compliant construction details	
	Where a Suitably Qualified Acoustician (SQA) provides recommendations for the specification of all existing separating walls and floors	
Up to Four Credits	SQA confirms in their professional opinion that they have the potential to meet or exceed the sound insulation credit requirements	
	Where these recommendations are implemented See table in additional information in Technical Manual	
Historic Buildings		l
	Where the dwelling is a Historic Building and sound testing results demonstrate existing separating walls and floor meet the Historic Building credit requirements	
	See table in additional information in Technical Manual	
Up to Four Credits	Where sound testing is not feasible and not required by the appointed Building Control body meeting criteria 2 and 3 using Table 12	
	Properties where sound testing has been carried out, credits awarded according to the improvement over building regulations. See table in additional information in Technical Manual	
	Where the dwelling is a detached property	
	Where the dwelling is a propertywith separating walls or floors only between non habitable rooms OR Testing not required by building control body	
Detached Properties		
Four Credits	By Default	l
Four Credits	By Default	
Hea 03 Volatile Organic Compounds		
No. of BREEAM credits available 1	Available contribution to overall score 1.4	2%
No. of BREEAM innovation credits 0 Assessment Criteria	Minimum Standards applicable N	o Indicative Credits
Where the refurbishment avoids the use of VOCs w	ith new products meeting the following requirements:	1
	Where all decorative paints and varnishes used in the refurbishment have met the requirement listed in table 5.4 in the Technical Manual	
One Credit Avoiding the use of VOCs	Where at least five of the eight remaining product categories listed in table 5.4 have met the testing requirements and emission levels for Volatile Organic Compound (VOC) emissions against the relevant standards identified within table 5.4 in the Technical Manual	
	Where five or less products are specified within the refurbishment, all must meet the requirements in order to achieve this credit.	
C		
comments		

Markade working working 1 Markade contribution to use of a local 1 We share working 1 Markade contribution to use of a local 1	Hea 04 Inclusive Design					
Analyse of the second s	No. of BREEAM credits available	2	A [_]	vailable contribution to overall score	2.83%	
there as a consistant must have been uned out using Checkits A if a this Technical Maxael Max	ssessment Criteria	1			Indi	icative Credits
Ordektik & dir bit relations Section 2" Section 2" Section 2" Orde Credit de Credit Orde Credit Orde Credit Orde Credit Orde Credit Orde Credit <th colspan="</td> <td>/here an access statement has bee</td> <td>n carried out using Chec</td> <td>klist A-8 of the Technical Manual to optimise the accessibility of</td> <td>the home as follows:</td> <td>\rightarrow</td> <td>1</td>	/here an access statement has bee	n carried out using Chec	klist A-8 of the Technical Manual to optimise the accessibility of	the home as follows:	\rightarrow	1
Note of earlier Section 3 Section 3 Image: Section 3 Completed with Evidence Completed with Evidence Completed with Evidence One Creat Where an excess expect shallwalp walifier member of the delight base has completed excitions 1, 2 and 3 of CheckSit A.B. Image: Creat State Sta			Checklist A-8 of the Tech	nnical Manual		
Material Constraint Complete with Kodenics Complete with Kodenics Unit on Cases Second S	One C	redit	Section 1	Section 2		
No Completed with Lodents Completed with Lodents With the production sequelated with backing sequelated with Lodents If and and	Minimum A	ccessibility	Completed with Evidence			
Image: production of the design task has completed actives 1, 2 and 3 of Checkins A. Image: production of the design task has a completed actives 1, 2 and 3 of Checkins A. Image: production of the design task has a completed actives 1, 2 and 3 of Checkins A. Image: production of the design task has a completed active 1, 2 and 3 of Checkins A. Image: production of the design task has a completed active 1, 2 and 3 of Checkins A. Image: production of the design task has a completed active 1, 2 and 3 of Checkins A. Image: production of the design task has a completed active 1, 2 and 3 of Checkins A. Image: production of the design task has a completed active 1, 2 and 3 of Checkins A. Image: production of the design task has a completed active 1, 2 and 3 of Checkins A. Image: production of the design task has a completed biology task has a completed active 1, 2 and 3 of Checkins A. Image: production of the design task has a completed biology task has a completed bio	Two Cr	redits	Completed with Evidence	Completed with Evidence		
One Certal Where an access regent situably qualified members of the design bases has completed exteriors 1, 2 and 2 dO basilite A. One Certal Anazaba completed exteriors 1, 2 and 2 dO basilite A. Note that the dot of the members of the design bases has completed exteriors 1, 2 and 2 dO basilite A. The dot of the members of	Exemplary Performance	ccessibility			Indica	ative Innovation
One Coeff The set state state template with involve provided of the regulational provided is in redulablement Ownerste		Whore an access experi	cuitably gualified member of the design team bas completed	continues 1 2 and 2 of Charklist A 9	Cre	edits Achieved
Available contribution to verial core 3 down and a state of the section of the se	One Credit	access statement temp	late with evidence provided of the measures implemented in th	ne refurbishment		0
Non-construction			···· · · · · · · · · · · · · · · · · ·			
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ENERGY Section Weighting: 43% Indicative Section Score 35.59% Ene 01 Improvement in Energy Efficiency Rating Available contribution to overall score 8.90% No. of BREEAM credits available 0 Minimum Standards applicable No Sesessment Criteria 0 Indicative Credits No Vhere the following targets are met for the improvement in Energy Efficiency Rating achieved as a result of refurbishment: Indicative Credits 3.5 2 5 0.5 1 3.5 2 21 2.5 3 2 21 2.5 2.5 2 26 3 3.5 2 36 4 2.42 2 42 4.5 2.5 2 36 4 2.42 2 42 4.5 2.5 2 36 4 2.42 2 42 4.5 2.5 2 60 6 6 2 60 6 6	Comments Hea 06 Safety No. of BREEAM credits available No. of BREEAM innovation credits Issessment Criteria Where a fire and carbon m One C Fire and Carbon Monoxi Alarm Sy tore CNB in Jac 06 for the	1 0 onoxide (CO) detection a redit ide (CO) Detection and ystems	A and alarm system is specified as follows: Where a compliant fire detection and fire alarm system is pro Carbon Monoxide detector installed if dwelling is supplied wi Mains supplied fire detection and alarm system if project inv Battery operated fire detection and alarm system if no re-wir	vailable contribution to overall score Minimum Standards applicable ovided th mains gas or other fossil fuel olves re-wiring*	1.42% Yes Ind	icative Credits 1
ENERGY Section Weighting: 43% Indicative Section Score 35.59% Ene 01 Improvement in Energy Efficiency Rating Available contribution to overall score Minimum Standards applicable 8.90% No. of BREEAM credits available 6 Available contribution to overall score Minimum Standards applicable 8.90% No. of BREEAM innovation credits 0 Indicative Credits 8.90% No. of BREEAM innovation credits 0 Indicative Credits No No. of BREEAM innovation treidits 0 Indicative Credits No Viewe the following targets are met for the improvement in EER Credits 0.5 1.5 29 1 3.5 3.5 3.5 210 2.5 3.5 3.5 221 2.5 3.5 3.5 236 4 4.2 4.5 236 4 5.5 5.5 260 6 5 5.5 260 6 6 5 254 5.5 6.0 6 254 5.5 6.0 6 260 6 6 6 260	The analysis of the second sec	1 0 onoxide (CO) detection a redit ide (CO) Detection and ystems e definition of re-wiring	A and alarm system is specified as follows: Where a compliant fire detection and fire alarm system is pro Carbon Monoxide detector installed if dwelling is supplied wi Mains supplied fire detection and alarm system if project inv Battery operated fire detection and alarm system if no re-wir	vailable contribution to overall score Minimum Standards applicable ovided th mains gas or other fossil fuel olves re-wiring* ing* is to take place	1.42% Yes Ind	icative Credits
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Improvement in Energy Efficiency Rating Available contribution to overall score Minimum Standards applicable No. of BREEAM inrovation credits O Sessessment Criteria No Where the following targets are met for the improvement in Energy Efficiency Rating achieved as a result of refurbishment: Indicative Credits No Improvement in EER Credits 2 9 1 3.5 2 17 2 3.5 2 26 3 3.5 2 26 3 3.5 2 36 4 4.5 2 48 5 5.5 2 48 5 5.5 2 60 6 6 2 00 6 6	Comments Hea 06 Safety No. of BREEAM credits available No. of BREEAM innovation credits Assessment Criteria Where a fire and carbon m One C Fire and Carbon Monoxi Alarm Sy * see CN9 in Hea 06 for the Comments	1 0 onoxide (CO) detection a redit ide (CO) Detection and ystems e definition of re-wiring	A and alarm system is specified as follows: Where a compliant fire detection and fire alarm system is pro Carbon Monoxide detector installed if dwelling is supplied wi Mains supplied fire detection and alarm system if project inv Battery operated fire detection and alarm system if no re-wir	vailable contribution to overall score Minimum Standards applicable ovided th mains gas or other fossil fuel olves re-wiring* ing* is to take place	1.42% Yes Ind	icative Credits 1
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Mere the following targets are met for the improvement in EER Credits Improvement in EER Credits ≥ 9 1 ≥ 13 1.5 ≥ 17 2 ≥ 26 3 ≥ 31 3.5 ≥ 26 3 ≥ 36 4 ≥ 42 4.5 ≥ 48 5 ≥ 54 5.5 ≥ 60 6	Comments Hea 06 Safety No. of BREEAM credits available No. of BREEAM innovation credits Assessment Criteria Where a fire and carbon m One C Fire and Carbon Monoxi Alarm Sy * see CN9 in Hea 06 for the Comments ENERGY Ene 01 Improvement in Energy Ef No. of BREEAM credits available	1 0 onoxide (CO) detection a redit ide (CO) Detection and ystems e definition of re-wiring ficiency Rating 6	A and alarm system is specified as follows: Where a compliant fire detection and fire alarm system is pro Carbon Monoxide detector installed if dwelling is supplied wi Mains supplied fire detection and alarm system if project invo Battery operated fire detection and alarm system if no re-wir Section Weighting: 43%	vailable contribution to overall score Minimum Standards applicable ovided th mains gas or other fossil fuel olves re-wiring* ing* is to take place Indicative Sect vailable contribution to overall score	1.42% Yes Indi	1
Improvement in EER Credits ≥ 5 0.5 ≥ 9 1 ≥ 13 1.5 ≥ 17 2 ≥ 21 2.5 ≥ 26 3 ≥ 36 4 ≥ 42 4.5 ≥ 48 5 ≥ 60 6	Comments Hea 06 Safety No. of BREEAM credits available No. of BREEAM innovation credits Sessment Criteria Where a fire and carbon m One C Fire and Carbon Monoxi Alarm Sy * see CN9 in Hea 06 for the Comments ENERGY Ene 01 Improvement in Energy Ef No. of BREEAM innovation credits Sessesment Criteria	1 0 onoxide (CO) detection a redit ide (CO) Detection and ystems e definition of re-wiring ficiency Rating 6 0	A and alarm system is specified as follows: Where a compliant fire detection and fire alarm system is pro Carbon Monoxide detector installed if dwelling is supplied wi Mains supplied fire detection and alarm system if project invo Battery operated fire detection and alarm system if no re-wir Section Weighting: 43%	vailable contribution to overall score Minimum Standards applicable ovided th mains gas or other fossil fuel olves re-wiring* ring* is to take place Indicative Sect vailable contribution to overall score Minimum Standards applicable	1.42% Yes Ind	icative Credits
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≥ 17 2 ≥ 21 2.5 ≥ 26 3 ≥ 31 3.5 ≥ 36 4 ≥ 42 4.5 ≥ 48 5 ≥ 54 5.5 ≥ 60 6	Anise Anise	1 0 onoxide (CO) detection a redit ide (CO) Detection and ystems e definition of re-wiring ficiency Rating ficiency Rating 6 0 0 t for the improvement in Improv	Ar and alarm system is specified as follows: Where a compliant fire detection and fire alarm system is pro- Carbon Monoxide detector installed if dwelling is supplied with Mains supplied fire detection and alarm system if project involutions Battery operated fire detection and alarm system if no re-with Section Weighting: 43% Section Weighting: 43% Energy Efficiency Rating achieved as a result of refurbishment: ement in EER Credits ≥ 5 0.5 > 0	vailable contribution to overall score Minimum Standards applicable ovided th mains gas or other fossil fuel olves re-wiring* ing* is to take place Indicative Sect vailable contribution to overall score Minimum Standards applicable	1.42% Yes Indi ion Score 35.59% 8.90% No No	icative Credits 1 icative Credits 3.5
≥ 21 2.5 ≥ 26 3 ≥ 31 3.5 ≥ 36 4 ≥ 42 4.5 ≥ 48 5 ≥ 54 5.5 ≥ 60 6	Anise Comments Hea 06 Safety No. of BREEAM innovation credits ssessment Criteria Where a fire and carbon m One C Fire and Carbon Monoxi Alarm Sy * see CN9 in Hea 06 for the comments ENERGY ENE 01 Improvement in Energy Eff No. of BREEAM innovation credits ssessment Criteria Where the following targets are met		Ar and alarm system is specified as follows: Where a compliant fire detection and fire alarm system is pro- Carbon Monoxide detector installed if dwelling is supplied with Mains supplied fire detection and alarm system if project involutions Battery operated fire detection and alarm system if no re-wire Section Weighting: 43% Energy Efficiency Rating achieved as a result of refurbishment: ement in EER Credits ≥ 9 1 ≥ 13 1.5	vailable contribution to overall score Minimum Standards applicable ovided th mains gas or other fossil fuel olves re-wiring* ing* is to take place Indicative Sect vailable contribution to overall score Minimum Standards applicable	1.42% Yes Indi ion Score 35.59% 8.90% No No Indi	icative Credits 1 icative Credits 3.5
≥ 31 3.5 ≥ 36 4 ≥ 42 4.5 ≥ 48 5 ≥ 54 5.5 ≥ 60 6	Comments Hea 06 Safety No. of BREEAM innovation credits Sessement Criteria Where a fire and carbon m One C Fire and Carbon Monoxi Alarm Sy * see CN9 in Hea 06 for the Comments ENERGY ENE 01 Improvement in Energy Eff No. of BREEAM innovation credits Sessement Criteria Where the following targets are met		Ar and alarm system is specified as follows: Where a compliant fire detection and fire alarm system is pro- Carbon Monoxide detector installed if dwelling is supplied wi Mains supplied fire detection and alarm system if project invo Battery operated fire detection and alarm system if no re-wir Section Weighting: 43% Energy Efficiency Rating achieved as a result of refurbishment: ement in EER Credits ≥ 5 0.5 ≥ 9 1 ≥ 13 1.5 ≥ 17 2	vailable contribution to overall score Minimum Standards applicable ovided th mains gas or other fossil fuel olves re-wiring* ing* is to take place Indicative Sect vailable contribution to overall score Minimum Standards applicable	1.42% Yes Indi	icative Credits 1 icative Credits 3.5
≥ 36 4 ≥ 42 4.5 ≥ 48 5 ≥ 54 5.5 ≥ 60 6 Comments	Comments Hea 06 Safety No. of BREEAM innovation credits Sasessment Criteria Where a fire and carbon m Fire and Carbon Monoxi Alarm Sy * see CN9 in Hea 06 for the Comments ENERGY ENE 01 Improvement in Energy Eff No. of BREEAM innovation credits Sasessment Criteria Where the following targets are met		Ar and alarm system is specified as follows: Where a compliant fire detection and fire alarm system is pro- Carbon Monoxide detector installed if dwelling is supplied wi Mains supplied fire detection and alarm system if project invo Battery operated fire detection and alarm system if no re-wir Section Weighting: 43% Energy Efficiency Rating achieved as a result of refurbishment: ement in EER Credits ≥ 5 0.5 ≥ 9 1 ≥ 17 2 ≥ 17 2 ≥ 17 2 ≥ 21 2.5	vailable contribution to overall score Minimum Standards applicable ovided th mains gas or other fossil fuel olves re-wiring* ing* is to take place Indicative Sect vailable contribution to overall score Minimum Standards applicable	1.42% Yes Ind	1 1 icative Credits icative Credits 3.5
≥ 42 4.5 ≥ 48 5 ≥ 54 5.5 ≥ 60 6Comments	Comments Hea 06 Safety No. of BREEAM innovation credits Sasessment Criteria Where a fire and carbon m Fire and Carbon Monoxi Alarm Sy * see CN9 in Hea 06 for the Comments ENERGY ENE 01 Improvement in Energy Eff No. of BREEAM innovation credits Sasessment Criteria Where the following targets are met		Ar and alarm system is specified as follows: Where a compliant fire detection and fire alarm system is pro- Carbon Monoxide detector installed if dwelling is supplied wi Mains supplied fire detection and alarm system if project invo Battery operated fire detection and alarm system if no re-wir Section Weighting: 43% Energy Efficiency Rating achieved as a result of refurbishment: ement in EER Credits ≥ 5 0.5 ≥ 9 1 ≥ 17 2 ≥ 17 2 ≥ 17 2 ≥ 26 3 ≥ 31 3.5	vailable contribution to overall score Minimum Standards applicable ovided th mains gas or other fossil fuel olves re-wiring* ing* is to take place Indicative Sect vailable contribution to overall score Minimum Standards applicable	1.42% Yes Ind	1 1 icative Credits icative Credits 3.5
≥ 54 5.5 ≥ 60 6 Comments 60	Comments Hea 06 Safety No. of BREEAM innovation credits Sasessment Criteria Where a fire and carbon m Fire and Carbon Monoxi Alarm Sy * see CN9 in Hea 06 for the Comments ENERGY ENE 01 Improvement in Energy Eff No. of BREEAM innovation credits Sasessment Criteria Where the following targets are met		Ar and alarm system is specified as follows: Where a compliant fire detection and fire alarm system is pro- Carbon Monoxide detector installed if dwelling is supplied wi Mains supplied fire detection and alarm system if project invo Battery operated fire detection and alarm system if no re-wir Section Weighting: 43% Energy Efficiency Rating achieved as a result of refurbishment: ement in EER Credits ≥ 5 0.5 ≥ 9 1 ≥ 17 2 ≥ 17 2 ≥ 17 2 ≥ 26 3 ≥ 31 3.5 ≥ 36 4	vailable contribution to overall score Minimum Standards applicable ovided th mains gas or other fossil fuel olves re-wiring* ing* is to take place Indicative Sect vailable contribution to overall score Minimum Standards applicable	1.42% Yes Ind	icative Credits 1 icative Credits icative Credits 3.5
Comments 60 6	Comments Hea 06 Safety No. of BREEAM innovation credits Sssessment Criteria Where a fire and carbon m Fire and Carbon Monoxi Alarm Sy * see CN9 in Hea 06 for the Comments ENERGY ENE 01 Improvement in Energy Eff No. of BREEAM innovation credits Sssessment Criteria Where the following targets are met		An and alarm system is specified as follows: Where a compliant fire detection and fire alarm system is pro- Carbon Monoxide detector installed if dwelling is supplied wi Mains supplied fire detection and alarm system if project invo Battery operated fire detection and alarm system if no re-wir Section Weighting: 43% An Energy Efficiency Rating achieved as a result of refurbishment: ement in EER Credits ≥ 5 0.5 ≥ 9 1 ≥ 13 1.5 ≥ 17 2 ≥ 26 3 ≥ 31 3.5 ≥ 36 4 ≥ 42 4.5	vailable contribution to overall score Minimum Standards applicable ovided th mains gas or other fossil fuel olves re-wiring* ing* is to take place Indicative Sect vailable contribution to overall score Minimum Standards applicable	1.42% Yes Ind	icative Credits 1 icative Credits 3.5
comments	Comments Hea 06 Safety No. of BREEAM credits available No. of BREEAM innovation credits Issessment Criteria Where a fire and carbon m One C Fire and Carbon Monoxi Alarm Sy * see CN9 in Hea 06 for the omments ENERGY Ene 01 Improvement in Energy Ef No. of BREEAM credits available No. of BREEAM credits available Vhere the following targets are met		An and alarm system is specified as follows: Where a compliant fire detection and fire alarm system is pro- Carbon Monoxide detector installed if dwelling is supplied wi Mains supplied fire detection and alarm system if project invo Battery operated fire detection and alarm system if no re-wir Section Weighting: 43% Lenergy Efficiency Rating achieved as a result of refurbishment: ement in EER Credits ≥ 5 0.5 ≥ 9 1 ≥ 13 1.5 ≥ 17 2 ≥ 21 2.5 ≥ 6 3 ≥ 31 3.5 ≥ 36 4 ≥ 42 4.5 ≥ 48 5	vailable contribution to overall score Minimum Standards applicable ovided th mains gas or other fossil fuel olves re-wiring* ing* is to take place Indicative Sect vailable contribution to overall score Minimum Standards applicable	1.42% Yes Ind	icative Credits 1 icative Credits 3.5
	Comments Hea 06 Safety No. of BREEAM credits available No. of BREEAM innovation credits Sasessment Criteria Where a fire and carbon m One C Fire and Carbon Monoxi Alarm Sy * see CN9 in Hea 06 for the Comments ENERGY ENE 01 Improvement in Energy Ef No. of BREEAM credits available No. of BREEAM credits available No. of BREEAM credits available Where the following targets are met		And alarm system is specified as follows: Where a compliant fire detection and fire alarm system is proceed of the detector installed if dwelling is supplied with Mains supplied fire detection and alarm system if project involutions Battery operated fire detection and alarm system if no re-wire Section Weighting: 43% Energy Efficiency Rating achieved as a result of refurbishment: ement in EER Credits ≥ 5 0.5 ≥ 9 1 ≥ 13 1.5 ≥ 17 2.2 ≥ 21 2.5 ≥ 60 4 ≥ 48 5 ≥ 54 5.5 ≥ 60 6	vailable contribution to overall score Minimum Standards applicable ovided th mains gas or other fossil fuel olves re-wiring* ing* is to take place Indicative Sect vailable contribution to overall score Minimum Standards applicable	1.42% Yes Ind	icative Credits 1 icative Credits icative Credits 3.5
	Comments Hea OG Safety No. of BREEAM credits available No. of BREEAM innovation credits Sasessment Criteria Where a fire and carbon m One C Fire and Carbon Monoxi Alarm Sy * see CN9 in Hea OG for the Comments ENERGY ENE O1 Improvement in Energy Eff No. of BREEAM credits available No.		Ar and alarm system is specified as follows: Where a compliant fire detection and fire alarm system is pro- Carbon Monoxide detector installed if dwelling is supplied with Mains supplied fire detection and alarm system if project involution. Battery operated fire detection and alarm system if no re-wire Section Weighting: 43% Energy Efficiency Rating achieved as a result of refurbishment: ement in EER Credits ≥ 5 0.5 ≥ 9 1 ≥ 13 1.5 ≥ 17 2.5 ≥ 26 3 ≥ 31 3.5 ≥ 36 44 ≤ 42 4.5 ≥ 48 5 ≥ 50 60	vailable contribution to overall score Minimum Standards applicable ovided th mains gas or other fossil fuel olves re-wiring* ing* is to take place Indicative Sect vailable contribution to overall score Minimum Standards applicable	1.42% Yes Ind ion Score 35.59% 8.90% No Ind	icative Credits 1 icative Credits 3.5

No. of BREEAM readits available No. of BREEAM innovation credits Assessment Criteria Where the following Energy Efficiency f	4 2 lating benchmarks wil				
Absorbate Criteria Where the following Energy Efficiency F	≥ tating benchmarks wil	1	Ava	illable contribution to overall score	5.93% Ves
Where the following Energy Efficiency F	ating benchmarks wil				Indicative Credits
		be met as a result of refurbis	hment:		3.5
	EER post	efurbishment	Credits	Minimum requireme	nts
		≥50 >FF	0.5	'Pass' level EER of 5	0
		≥55 >60	1	'Good' level EER of S	38
		≥65	2	'Very Good level' EER o	of 65
		≥70	2.5	'Excellent' level EER o	f 70
		≥75	3		
		≥80	3.5	'Outstanding' level EER	of 81
		≥85	4		1
	Eve	mplan	Cradita		Indicative Innovatio
	EAC	>90	1		
		≥100	2		,
Comments					
Ene 03 Primary energy demand					
No. of BREEAM credits available	7]	Ava	ilable contribution to overall score	10.38%
No. of BREEAM innovation credits	0			Minimum Standards applicable	No
ssessment Criteria		I he met as a result of refurbic	hmont		Indicative Credits
mere the following Primary Energy De	Primary Energy Dem	and Post Refurbishment	Credits		
		≤ 400 <u> </u>	0.5		
		≤ 370	1		
		≤ 340	1.5		
		≤ 320	2		
		< 300 < 280	2.5		
		≤ 260 <u> </u>	3.5		
		≤ 240	4		
		≤ 220	4.5		
		≤ 200	5		
		≤ 180	5.5		
		≤ 160 < 140	65		
		< 120	7		
omments		120	· · ·		
No. of BREEAM innovation credits	0		Ava	Minimum Standards applicable	2.97% No
Assessment Criteria					
Vhere the dwelling will meet the follow	ving % contribution fro	om renewables and primary er	nergy demand targets as a result o	f refurbishment	
	Dwelling Type	Primary Energy Demand	Percentage from I	Renewables	
De	etached		>10%	>20%	
Se	mi-Detached	< 250 kW/b /m ² /waar	≥10%	≥20%	
BL	ingalow	S 250 KWN/III /year	≥10%	≥20%	
En	d of Terrace		≥10% >10%	≥20%	
	w Rise Flat		>10%	>20%	
M	id Rise Flat	≤ 220 kWh/m²/year	≥10%	≥15%	
Hi	gh Rise Flat		≥10%	≥15%	
omments					
onments					
oninents					
Energy Labelled White Goods			۸	ilable contribution to sucrell easier	2.07%
Ene 05 Energy Labelled White Goods No. of BREEAM credits available	2		Ava	ilable contribution to overall score	2.97% No
Ene 05 Energy Labelled White Goods No. of BREEAM credits available No. of BREEAM innovation credits seessment Criteria	2 0		Ava	ilable contribution to overall score Minimum Standards applicable	2.97% No Indicative Credits
ine 05 Energy Labelled White Goods No. of BREEAM credits available No. of BREEAM innovation credits sessement Criteria /here Energy Efficiency White goods a	2 0 re to be provided as fo	llows:	Ava	ilable contribution to overall score Minimum Standards applicable	2.97% No Indicative Credits 2
ine 05 Energy Labelled White Goods No. of BREEAM credits available No. of BREEAM innovation credits sessment Criteria /here Energy Efficiency White goods a First Credit	2 0 re to be provided as fo	bilows:	Ava	ilable contribution to overall score Minimum Standards applicable	2.97% No Indicative Credits 2
Ene 05 Energy Labelled White Goods No. of BREEAM credits available No. of BREEAM innovation credits ssessment Criteria /here Energy Efficiency White goods a First Credit Applianc	2 0 re to be provided as fo	ollows:	Ava	ilable contribution to overall score Minimum Standards applicable Appliance not to be provided	2.97% No Indicative Credits 2
Ene 05 Energy Labelled White Goods No. of BREEAM innovation credits ssessment Criteria /here Energy Efficiency White goods a First Credit Applianc	2 0 re to be provided as fo	Applian	Ava	ilable contribution to overall score Minimum Standards applicable Appliance not to be provided EU Energy Efficiency Labelling Sche	2.97% No Indicative Credits 2
Ene 05 Energy Labelled White Goods No. of BREEAM credits available No. of BREEAM innovation credits seessment Criteria /here Energy Efficiency White goods a First Credit Applianc Fridges, Freezers and I	2 0 re to be provided as fo e :ridge-Freezers	Illows: Applian A+ Rating under EU Energ	Ava nce provided gy Efficiency Labelling Scheme	Appliance not to be provided EU Energy Efficiency Labeling Sche Information Leaflet provided to all dw	2.97% No Indicative Credits 2
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Ene 06 Drying Space						
No. of BREEAM credits available	1		Available contr	ibution to overall score	1.48%	1
No. of BREEAM innovation credits	0		Minimu	m Standards applicable	No	t
Assessment Criteria					Indicati	ive Credits
Where adequate, secure internal or	external space with posts	and footings or fixings is pro	ovided with the following:			1
		1 Credit				
		Number of bedrooms	Drying line required			
		1-2	4m+			
		3+	6m+			
Comments						
Ene 07 Lighting						
No. of BREEAM credits available	2		Available contr	ibution to overall score	2.97%	1
No. of BREEAM innovation credits	0		Minimu	m Standards applicable	No	t
Assessment Criteria		•			Indicati	ive Credits
Where energy efficient internal and	external lighting is provid	ed as follows:				2
	External Lighting - 1					
	Energy Efficient Space Lie	phting of more than 45 lume	ns per circuit watt and Energy Efficient Security	Lighting OR		
			is per circuit mate and Energy Enclene Security	Lighting off		
	Where Energy Efficient S	pace Lighting is provided UN	ILY			
	Internal Lighting - 1					
-	Maximum average watta	ge across the total floor are	a of the dwelling of 9 watts/m2			
Comments						
Ene 08 Display Energy Devices						
No. of BREEAM credits available	2		Available contr	ibution to overall score	2.97%	1
No. of BREEAM innovation credits	1		Minimu	m Standards applicable	No	t
Assessment Criteria					Indicati	ive Credits
Where consumption data is displaye	d to occupants by a comp	liant energy display device				2
	Flastricity.usa		Primary Heating Fuel			
	Electricity usa	ge data displayed	Electricity	Other		
	Electricity usa	ge data displayed	2 credits awarded	1 credit awarded		
	Primary Heating Fu	el usage data displayed	N/A	1 credit awarded		
	Electricity & Primary He	ating Fuel usage displayed	N/A	2 credits awarded		
	Exemplary Credits					
	One	e credit	Where the first two credits are	achieved	Indicative	Innovation
	Recording co	nsumption data	where any compliant Energy Display Device	is capable of recording	Credits	Achieved
Commonte	-		consumption data		/	0
comments						
Ene 09 Cycle Storage						
No. of BREEAM credits available	2		Available contr	ibution to overall score	2.97%	
No. of BREEAM innovation credits	0		Minimu	m Standards applicable	No	
Assessment Criteria					Indicati	ive Credits
Where individual or communal comp	pliant cycle storage is prov	rided as follows:				2
	Dwelling Size	One Credit	I wo Credits			
	Studios/ 1 bedroom	1 per two dwellings	1 per dwelling			
	2-3 bedrooms	1 per dwelling	2 per dwelling			
-	4 bedrooms	2 per dwelling	4 per dwelling			
Comments						
Ene 10 Home Office						
No. of BREEAM credits available	1		Available contr	ibution to overall score	1.48%	
No. of BREEAM innovation credits	0		Minimu	m Standards applicable	No	
Assessment Criteria					Indicati	ive Credits
Where sufficient space and services	will be provided to allow	occupants to set up a home	office in a suitable room with adequate ventilat	ion		1
Commonto			· · · · · · · · · · · · · · · · · · ·			
Comments						

WATER						
Wat 01 Internal Water Use	hla 2				avarali	
o. of BREEAM innovation cred	dits 1	-	Avai	Minimum Standa	rds applicable	6.t
essment Criteria						ļ
re the dwellings water consu lards:	umption meets the following	consumption benchmarks, o	r where terminal fittings meet the fo	ollowing water consu	mption	_
Calculated Water						
Consumption	Equivalent termi	nal fitting standards	Minimum Standa	rd	Credits	
(litres/person/day)						
>150	Typical basel	ine performance	N/A		0	
from 140 to ≤ 150	All showers specified to	Good' OR All taps and WC's	N/A		0.5	
	to 'Good' OR Kitchen fit	tings specified to 'Excellent'				
	All showers specified to	'Excellent' OR All showers				
from 129 to < 140	and bathroo	m taps to 'Good'	BREEAM Very Goo	bd	1	
	All bathroom and WC	room fittings specified to				
from 118 to < 129	'Good' OR All bathro	oom fittings specified to	N/A		1.5	
	'Ex	cellent'				
	All Bathroom and WC	room fittings specified to				
from 107 to < 118	'Excellent' OR All Bath 'Excellent' and WC roor	room fittings Specified to n fitting specified to 'Good'	BREEAM Excellen	ht.	2	
	OR All Bathroom fitting	s, kitchen and utility sittings	Ditelani Extenen		2	
	specifie	d to 'Good'				
	All kitchen, bathroom,	utility room and WC room				
from 96 to < 107	fittings specified to '	Good' OR All bathrooms,	N/A		2.5	
	kitchens and utility roc	ms specified to 'Excellent'				
	All bathroom fittings spe	cified to 'Excellent' and WC				
< 96	room, kitchen and utilit	y room fittings specified to	BREEAM Outstand	ing	3	
	"(iood'				
NOTE: 'Good' fittings are	e equivalent to good practice	e fittings with "Excellent" fitti	ngs equivalent to best practice fittin	gs (see the technical	manual for full deta	ils.
		Exemplary Credit	IT the water consumption is less the	an 801/person/day		Ì
ients			·			
17 Evtornal Water Lice						
of BREEAM credits availal	ble 1		Avai	lable contribution to	overall score	2.2
of BREEAM credits availal BREEAM innovation cred	ble <u>1</u> dits O	-	Avai	lable contribution to Minimum Standa	o overall score	2.2 N
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of BREEAM innovation cred of BREEAM innovation cred sment Criteria e the following requirement	ble 1 dits 0 ts will be met: Requirements:	Where a compliant rainwat	Avai	lable contribution to Minimum Standa	as been provided to	2.2
of BREEAM credits availal of BREEAM innovation cred ment Criteria the following requirement	ble 1 dits 0 ts will be met: Requirements: One Credit	Where a compliant rainwat dwellings.	Avai	lable contribution to Minimum Standa ernal irrigation use h	as been provided to	2.2
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of BREEAM credits availal f BREEAM innovation cred ment Criteria the following requirement	ble 1 dits 0 ts will be met: Requirements: One Credit	Where a compliant rainwat dwellings. OR Where dwellings have no in	Avai er collection system for external/inte dividual or communal garden space.	lable contribution to Minimum Standa ernal irrigation use h	overall score	2.2
of BREEAM credits availal of BREEAM innovation cred sment Criteria e the following requirement the following requirement	ble 1 dits 0 ts will be met: Requirements: One Credit	Where a compliant rainwat dwellings. OR Where dwellings have no in	Avai er collection system for external/inte dividual or communal garden space.	lable contribution to Minimum Standa ernal irrigation use h	overall score	2.2
of BREEAM credits availal f BREEAM innovation cred ment Criteria the following requirement ents	ble 1 dits 0 ts will be met: Requirements: One Credit	Where a compliant rainwat dwellings. OR Where dwellings have no in	Avai	lable contribution to Minimum Standa ernal irrigation use h	overall score	
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of BREEAM credits availal BREEAM innovation cred nent Criteria the following requirement ints Water Meter of BREEAM credits availal BREEAM innovation cred	ble 1 dits 0 ts will be met: Requirements: One Credit ble 1 dits 0	Where a compliant rainwat dwellings. OR Where dwellings have no in	Avai er collection system for external/inte dividual or communal garden space.	lable contribution to Minimum Standa ernal irrigation use h	overall score	2.2
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	ble 1 dits 0 ts will be met: Requirements: One Credit ble 1 dits 0 ter for measuring usage of m of Materials ble 25 dits 0 with credits calculated using	Where a compliant rainwat dwellings. OR Where dwellings have no in ains potable water meter has <u>Section Weighting: 8%</u>	Avai er collection system for external/inte dividual or communal garden space. Avai s been provided to dwelling(s), one c Avai The table below shows the maximum	lable contribution to Minimum Standa ernal irrigation use hi	o overall score rds applicable as been provided to o overall score rds applicable ad Indicative Sectio o overall score rds applicable vailable for	2.2
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Constant of the second se	ble 1 dits 0 ts will be met: Requirements: One Credit Dife 1 dits 0 ter for measuring usage of m dits 0 ter for measuring usage of m dits 0 ter for measuring usage of m dits 0 with credits calculated using ements Roof rnal walls uding separating walls) d Ground Floor indows S credits represents all of the S Rating A+ (6) A+ (3)	Where a compliant rainwat dwellings. OR Where dwellings have no in ains potable water meter has section Weighting: 8% the Mat 01 calculator tool. ⁻ Green Guide R elements containing refurb	Avai er collection system for external/internal idividual or communal garden space. Avai s been provided to dwelling(s), one c s been provided to dwelling(s), one c Avai fhe table below shows the maximum ating credits available 5 6 4.6 </td <td>lable contribution to Minimum Standa ernal irrigation use hi internal irrigation use hi Minimum Standa credit may be awarde lable contribution to Minimum Standa n number of credits a Thermal perform the Green Guide Ra Points for</td> <td>o overall score rds applicable as been provided to o overall score rds applicable d Indicative Section o overall score rds applicable vailable for ance credits available 3.8 - 1.2 2 ting of A+(6) r new elements</td> <td>2.3 N 2.3 N N 2.3 N N N L L L L L L L L L L L L L</td>	lable contribution to Minimum Standa ernal irrigation use hi internal irrigation use hi Minimum Standa credit may be awarde lable contribution to Minimum Standa n number of credits a Thermal perform the Green Guide Ra Points for	o overall score rds applicable as been provided to o overall score rds applicable d Indicative Section o overall score rds applicable vailable for ance credits available 3.8 - 1.2 2 ting of A+(6) r new elements	2.3 N 2.3 N N 2.3 N N N L L L L L L L L L L L L L
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22 External work over one of the second sec	ble 1 dits 0 ts will be met: Requirements: One Credit 0 for Credit 0 for Credit 1 for Credit 0 for Credit 1 for Credit	Where a compliant rainwat dwellings. OR Where dwellings have no in ains potable water meter has <u>Section Weighting: 8%</u> the Mat 01 calculator tool. <u>Green Guide R</u> elements containing refurb Points for existing	Avai er collection system for external/inte dividual or communal garden space. Avai s been provided to dwelling(s), one c s been provided to dwelling(s), one c the table below shows the maximum ating credits available 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	lable contribution to Minimum Standa ernal irrigation use he isolated in the second standa redit may be awarded lable contribution to Minimum Standa redit may be awarded in number of credits a Thermal perform the Green Guide Ra Points for the Green Guide Ra Points for	overall score rds applicable as been provided to overall score rds applicable indicative Sectio overall score rds applicable vailable for ance credits available 3 3.8 - 1.2 2 ting of A+(6) rnew elements 3 2 1 0.5 0.25 0	2.3 N
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2 External water Ose of BREEAM credits availal f BREEAM innovation cred ment Criteria the following requirement of BREEAM credits availal f BREEAM innovation cred ment Criteria an appropriate water met ents MATERIALS I Environmental Impact of BREEAM credits availal if BREAM credits availal if BREEAM cred	ble 1 dits 0 ts will be met: Requirements: One Credit Die 1 dits 0 ter for measuring usage of m dits 0 ter for measuring usage of m dits 0 ter for measuring usage of m dits 0 with credits calculated using ements Roof rnal walls uding separating walls) d Ground Floor tindows 5 credits represents all of the f Rating A+ (6) A+ (2) A+ (4) A+ (2) A+ A (2) D E ts cannot be achieved the sco- thieved when achieving the n	Where a compliant rainwat dwellings. OR Where dwellings have no in ains potable water meter has section Weighting: 8% the Mat 01 calculator tool. T Green Guide R C C C C C C C C C C C C C C C C C C C	Avai er collection system for external/inte dividual or communal garden space. Avai s been provided to dwelling(s), one c s been provided to dwelling(s), one c been provided to dwelling(s), one c avai s been provided to dwelling(s), one c been provided to dwelling(s), one c c avai s been provided to dwelling(s), one c been provided to dwelling(s), one c c avai s been provided to dwelling(s), one c been provided to dwelling(s), one c been provided to dwelling(s), one c been provided to dwelling(s), one c been provided to dwelling(s), one c been provided to dwelling(s), one c been provided to dwelling(s), one c been provided to dwelling(s), one c been provided to dwelling(s), one c been provided to dwelling(s), one c been provided to dwelling(s), one c been provided to dwelling(s), one c been provided to dwelling(s), one c been provided to dwelling(s), one c been provided to dwelling(s), one c been provided to dwelling(s), one c been provided to dwelling(s), one c been provided to dwelling(s), one c been provided to dwelling(s), one c been provided to dwelling(s), one c been provided t	lable contribution to Minimum Standa ernal irrigation use he isolation in the second standa redit may be awarde in a number of credits a Thermal perform the Green Guide Ra Points for Points for	o overall score as been provided to o overall score as been provided to o overall score rds applicable ad Indicative Sectio o overall score rds applicable ad Indicative Sectio ance credits availab 3.8 - 1.2 2 ting of A+(6) rew elements 3 3 2 1 0.5 0 cerformance credits Minimum U-Va 0.11 0.15	2.3 N 2.7 N 2.7 N 2.7 N 2.7 N 2.7 N 1.0 N 1.

Windows 1.4

Mat 02 Responsible Sourcing of M	aterials					
No. of BREEAM credits available	15	_	Available contribution to overall	score	2.50%	
No. of BREEAM innovation credits Assessment Criteria	0		Minimum Standards appli	icable	Yes Indica	tive Credits
Where new materials are responsible	y sourced, up to 12 credit	ts may be awarded where 80	% of new materials for an element are responsibly sourced. The		\rightarrow	8
credits achieved are dependent on %	of point achieved which	is based upon the responsib	le sourcing tier level of each material sourced as detailed below:			
	The principal contractor	Sustainable Procur sources materials for the pro	ment Plan (3 BREEAM credits) oject in accordance with a documented sustainable	Will be s	all new timber use ourced in accorda	d in the project ce with the UK
	procurement plan	ore the principal contractor	is a Small Company (up to 2 DDEEAM stadits)	Gov	vernment's Timbe	r Procurement
		Checklist A-9 is fille	ed in with supporting evidence	<u> </u>	Tes	
Table 1	BRFF	AM credits	% of available points achieved			
	DILLE	12	≥54%			
		10 8	≥45%			
		6	≥ 27%			
		2	≥ 18% ≥ 9%			
Comments			·			
Mat 03 Insulation						
No. of BREEAM credits available	8	_	Available contribution to overall	score	1.33%	
No. of BREEAM innovation credits Assessment Criteria	0		Minimum Standards appli	icable	No Indica	tive Credits
Where any new insulation specified	for use within external w	alls, ground floor, roof and b	uildings services meet the following requirements:		\rightarrow	4
	Requirements					
		Where the Ins	ulation Index for new insulation used in the buildings is ≥ 2			
	4 Credits					
		Where Green Guide r	atings are determined using the Green Guide to specification tool			
	Requirements					
	4 Credits	Where ≥ 80% of the new t	hermal insulation used in the building elements is responsibly sou	rced.		
Comments						
WASTE		Section Weighting: 3%	Indica	tive Section	n Score 1.80%	
Was 01 Household Waste			Austickie enteileutice de aussell		4.20%	-
No. of BREEAM innovation credits	0		Available contribution to overall Minimum Standards appli	icable	1.20% No	
Assessment Criteria	acting facilities are prov	idad un ta tura aradite march	a awardad as fallows		Indica	tive Credits
where compliant recycling and com	Josting facilities are prov	First Credit - Recycli	ng Facilities			2
Scena	ario		Internal recycling storage requirements			
		3 internal recycling	containers provided where recycling is not sorted post collection			
		1 internal recyclin	g container provided where recycling is sorted post collection			
Compliant collectio	n scheme in place	Internarrecyclin	ig container provided where recycling is sorted post collection			
		Minimum 30 litr	e total capacity, no single container less than 7 litre capacity			
		Dedica	ited position in accordance with compliance note 1			
No compliant collecti	on scheme in place		3 internal recycling containers provided Minimum 60 litre total capacity			
No adequate ex	ternal storage	Dedica	ated position in accordance with compliance note 1			
No compliant collecti Adequate external	on scheme in place storage provided	Minimum 30 litre	total capacity, no single container smaller than 7 litre capacity			
		Dedica	ated position in accordance with compliance note 1			
	Mith or	Second c	redit - Composting facilities			
	Where a composting s	ervice or facility is provided	Where a composting service or facility is provided for kitchen wa	ste		
	for green,	/garden waste	where a compositing service of racinty is provided for kitchen wa	ste		
	where a composting so for kite	ervice or facility is provided	of at least 7 litres	waste		
	Where an interior conta	ainer is provided for kitchen				
°ommonte	composting was	ste of at least 7 litres				
comments						
Was 02 Refurbishment Site Waste	Management				1.00%	
No. of BREEAM innovation credits	3 1		Available Contribution to overall Minimum Standards appli	icable	1.80% No	
Assessment Criteria Jp to three credits are available dep	ending on the site waste	management plan to be imp	lemented as follows			tive Credits 1
Projects up to £100k						
Three C	redits	Where waste generated th Checklist A-9	rough the refurbishment process is managed in accordance with		Indicatio	ve Innovation ts Achieved
						ise Select
Exemplar	y Credit	Where a compliant Level 1;	Site Waste Management Plan (SWMP) is in place			
Projects up to £300k						
Three C	redits	Where a compliant Level 1;	; Site Waste Management Plan (SWMP) is in place			
		Where a compliant Level 2;	Site Waste Management Plan (SWMP) is in place			
		Non-hazardous constructio	n waste generated by the dwellings refurbishment meets or exce	eds		
Exemplar	y Credit	the resource efficiency ben	chmark -			
		The percentage of non-haz	ardous construction waste and demolition waste generated by the	e		

	project has been diverted from landfill and meets or exceeds the refurbishment & demolition waste diversion benchmarks			
Projects over £300k				
First Credit Management Plan	Where a compliant Level 2; Site Waste Management Plan (SWMP) is in place			
	First credit achieved			
	Non-hazardous construction waste generated by the dwellings refurbishment meets or exceeds the resource efficiency benchmark			
Second Credit Good Practice Waste Benchmarks	Amount of waste generated against £100,000 of project value is recorded in the SWMP			
	Pre-refurbishment audit of the existing building is completed			
	If demolition is included as part of the refurbishment programme, then the audit should also cover demolition materials			
	Where the first two credits have been achieved achieved			
Third Credit Best Practice Waste Benchmarks	Where Non-hazardous demolition waste generated by the dwellings refurbishment meets or exceeds the refurbishment & demolition waste diversion benchmarks			
Examplary Cradit	Where non-hazardous construction waste generated by the dwellings refurbishment meets or exceeds the <i>exemplary level resource efficiency benchmark</i>			
	Where Non-hazardous demolition waste generated by the dwellings refurbishment meets or exceeds the exemplary level diversion benchmarks			
nts				

POLLUTION	Section Weighting: 6%	Indicative Se	ection Score 3.75%	
Pol 01 NOx Emissions	_	Available contribution to overall score	2 25%	
No. of BREEAM innovation credits 0		Minimum Standards applicable	No	
Assessment Criteria			Indicative Credit	ts
Credits are awarded on the basis of NOX emissions arising t	rom the operation of space he	ating and not water systems for each refurbished dwelling as follows:	,	
C	ne Credit	≤100 mg/kWh (NOx class 4 boiler)		
	wo Credits	≤70 mg/kWh (NOx class 5 boiler)		
Comments	ree credits	S40 mg/kwn		
No. of BREEAM credits available 3	_	Available contribution to overall score	2.25%	
No. of BREEAM innovation credits 1 Assessment Criteria		Minimum Standards applicable	No Indicative Credit	ts
Where impacts of the refurbishment on surface water runo	ff are neutralised or where ru	noff is reduced as a result of refurbishment, up to three credits can be		
awarded as follows: Requirements				
	New hard standing areas	nust be permeable		
One Credit Neutral Impact on Surface Water	If building on to previously	permeable area additional run-off must be managed on site		
	Calculations should be carr	ied out by an appropriately qualified professional		
Requirements	Where the criteria needed	for One Credit has been achieved		
OR Second Credits	Where all run-off from the	roof for rainfall depths up to 5 mm, have been managed on site using sou	urce control	
	methods Include rupoff from all avia	ting and new parts of the roof		
Reducing Run-Off From Site: Basic		nonfersional should be used to design an appropriate design as the	or the site	
	An appropriately qualified	professional should be used to design an appropriate drainage strategy fo	or the SITE	
Requirements				
	Where run-off as a result of	f the refurbishment is managed on site using source control		
	An appropriately qualified	professional should be used to design an appropriate drainage strategy fo	or the site.	
OB Three Credits	The neak rate of run-off as	a result of the refurbishment for the 1 in 100 year event has been reduce	ed by 75%	
	from the existing site.			
Reducing Run-Off From Site: Advanced	The total volume of run-of 1 in 100 year event of 6 ho	f discharged into the watercourses and sewers as a result of the refurbish ur duration has been reduced by 75%.	ment, for a	
	An allowance for climate c	hange must be included for all of the above calculations, in accordance wi	ith current	
Requirements	best practice (FF 525, 2010).		
	Where all run-off from the	developed site is managed on site using source control	Indicative Innovat	tion
	The peak rate of run-off as	a result of the refurbishment for the 1 in 1 year event is reduced to	Credits Achiever Please Select	d
	zero. The peak rate of run-off as	a result of the refurbishment for the 1 in 100 year event is reduced to		
Exemplary Credit	2010.			
	There is no volume of run- refurbishment. for a 1 in 10	off discharged into the watercourses and sewers as a result of the 00 year event of 6 hour duration.		
	-			
	An allowance for climate of	change must be included for all of the above calculations, in accordance with current best practice (PPS25, 2010)		
Comments				
Pol 03 Flooding				
No. of BREEAM credits available 2		Available contribution to overall score	1.50%	
Assessment Criteria			Indicative Credit	ts
where the dwelling is located in a low flood risk zone, or where the dwelling is located in a low flood risk zone, or where the second	here in a medium to high flood	i risk zone and a flood resilience/resistance strategy has been		
Bálining an contract of the second se	A minimum of two	prodite must be ashioural for this issue at the Evenllout and Outstanding la	avels.	
Winimum Standards	A minimum of two	crearis must be achieved for this issue at the Excellent and Outstanding le	IVEI5	
Option 1 - Low Flood Risk	Million of Land A	mant (FDA) has been registed as to activity of the U.S. of the		
Two Credits	where a Flood Risk Assess	ment (FKA) has been carried out and the assessed dwellings are defined a low annual probability of flooding.	as naving a	
Option 2 - Medium / High Flood Risk				
	Where a Flood Risk Assess medium or high annual pro	ment (FRA) has been carried out and the assessed dwellings are defined a bability of flooding.	is having a	
Two Credits	Two credits are awarded w dwelling is defined as achie	where as a result of the dwellings floor level or measures to keep water aw eving avoidance from flooding by following Checklist A-10; Decision Strate	vay the 2gy Flow	
	Chart.			
	Where avoidance is not po	ssible, two credits are achieved where a full flood resilience/resistance st	rategy is	
	Professional	miss in accordance with recommendations made by a suitably Qualified B	unung	
			ł	
comments				