Overheating Assessment

Campus Park East, Welwyn Garden City

On behalf of Bellway Homes Limited (North London)

R02

Date: November 22

energist®

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REVISION HISTORY

Revision	Issue Date	Description	Issued By	Checked By
R00	03/10/2022	Draft	MA	JA
R01	06/10/2022	Incorporating comments	MA	TW
R02	01/11/2022	Updated Floor Plans	MA	RP

All advice provided by Energist regarding the performance of materials is limited solely to the purposes of demonstrating compliance with the CIBSE TM59 and AD O methodologies. The performance of materials under other criteria, including but not limited to fire, structural, acoustics are not considered in our advice. It is the responsibility of the client to ensure the wider suitability of materials specified in our assessments.

Calculations contained within this report have been produced based on information supplied by the Client and the design team. Any alterations to the technical specification on which this report is based will invalidate its findings.

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EXECUTIVE SUMMARY

Energist UK has been instructed by Bellway Homes Limited (North London) (“the Applicant”) to carry out an Overheating Assessment for the proposed development at Campus Park East, Welwyn Garden City ("the Development").

This Overheating Assessment outlines the passive and active design measures taken by the Applicant to ensure that the risk of overheating has been minimised and that the strategy:

- Aligns with Welwyn Hatfield Borough Council (WHBC)’s current District Plan Policy SD1 – Sustainable Development of the current
- Aligns with Welwyn Hatfield Borough Council (WHBC)’s new Local Plan draft policies
- Follows the methodology set out in CIBSE TM59 and complies with the overheating criteria.
- Follows the methodology set out in the Approved Document O (AD O 2021)

This assessment has been based on a sample of 14no. representative residential dwellings, which have been selected to be assessed based on a worst-case scenario.

The Applicant incorporates the following passive and active design measures to address and successfully mitigate the risk of overheating:

- Improved Building Fabrics
- Natural Ventilation through Fully Openable Windows (subject to occupants preferences)
- The Nilan Compact P system which combines heating, ventilation and hot water and can also temper external air by up to 10^{0}C in summer months, in all habitable rooms
- Balconies and overhangs which can create shading

The Applicant takes full account of a requirement to adapt to, and mitigate for, the impact of climate change and has taken steps to ensure this is considered within the design of the proposed scheme.

Due to noise restrictions on the majority of the proposed site, the development has been assessed against criterion 3 of the CIBSE TM59 methodology.

The results show that all assessed plots fully comply with the criteria of the CIBSE TM59 and AD O methodologies. A summary of the results is provided below in Table 1.

Table 1 – Summary of the CIBSE TM59 Overheating Assessment results

Reference	Type	Block	Storey	CIBSE TM59 Results
A2-5	1B2P	A2	Ground Floor	PASS
B2-4	2B4P	B2	First Floor	PASS
E-11	2B4P	E	First Floor	PASS
A3-17	2B4P	A3	Second Floor	PASS
B4-10	1B2P	B4	Second Floor	PASS
C-8	2B4P	C	Second Floor	PASS
F-8	2B4P	F	Second Floor	PASS
H-14	1B2P	H	Second Floor	PASS
B2-11	2B4P	B2	Third Floor	PASS
H-19	1B2P	H	Third Floor	PASS
A4-24	1B2P	A4	Fourth Floor	PASS
B4-17	1B2P	B4	Fourth Floor	PASS
E-32	1B2P	E	Fourth Floor	PASS
H-28	3B5P	H	Fourth Floor	PASS

A table illustrating the maximum internal temperatures, achieved when windows are closed and the air tempering is in operation, compared to the external temperature at the time of internal maximums is provided in Appendix 7.

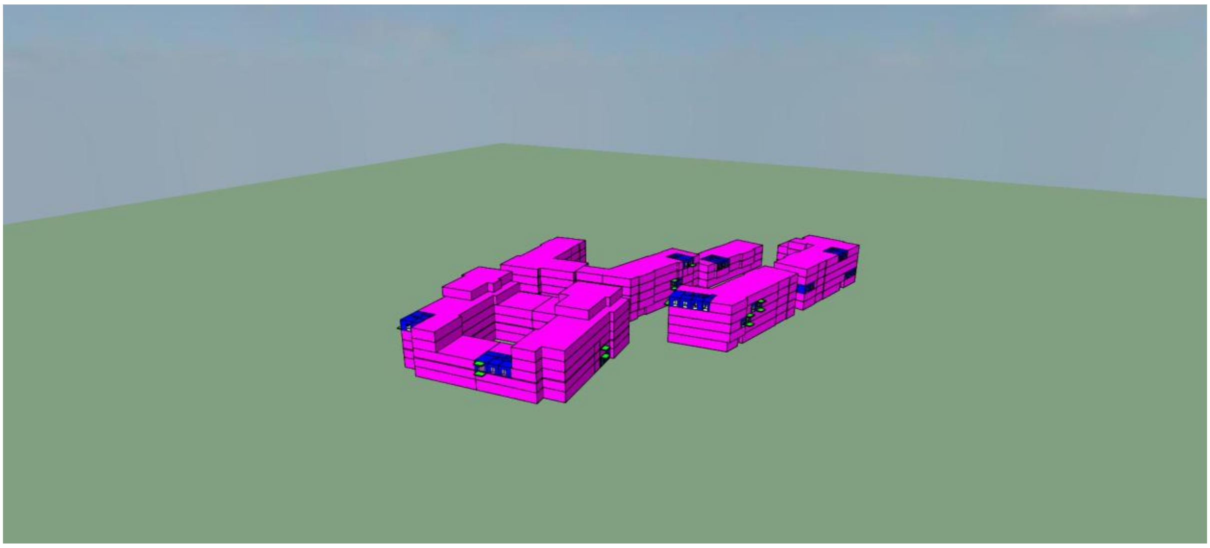
1. INTRODUCTION

Overheating has become a Common Issue in recent years due to climate change and stricter national and regional policies for energy efficient buildings, improved building fabrics and airtight buildings. Furthermore, in urban centres, especially in the South and Southeast of the UK, the Urban Heat Island effect is deteriorating the consequences of the already intense and frequent hot summer events to the building industry.

Therefore, it becomes of significant importance to assess the risk of overheating at the early stages of the design process to avoid any expensive modifications to the design at later stages of the Development process. This Overheating Assessment has been prepared by Energist UK Ltd. for the domestic elements of the proposed development at Campus Park East, Welwyn Garden City (" the Development").

This report presents how the Development aligns with the requirements of national and regional planning policies related to overheating, described in Appendix 2. It follows the steps proposed by the CIBSE TM59 guidance '*Design methodology for the assessment of overheating risk in homes*' and applies the limitations introduced in the AD O 2021. For this assessment, the IES Virtual Environment software (2021) has been used. A representative number of dwellings have been modelled and the risk of overheating assessed.

Figure 1 - IES VE model view of assessed dwellings



2. DEVELOPMENT OVERVIEW

This Overheating Assessment has been produced for the proposed development at Campus Park East, Welwyn Garden City. A Full Detailed Planning Application is being submitted to Welwyn Hatfield Borough Council (WHBC).

The proposal comprises Demolition of all existing buildings and structures followed by the erection of five buildings to provide 313 residential units (Use Class C3) including 30% affordable housing, resident's car parking, cycle storage, refuse storage, hard and soft landscaping, external lighting, drainage, infrastructure and all associated works.

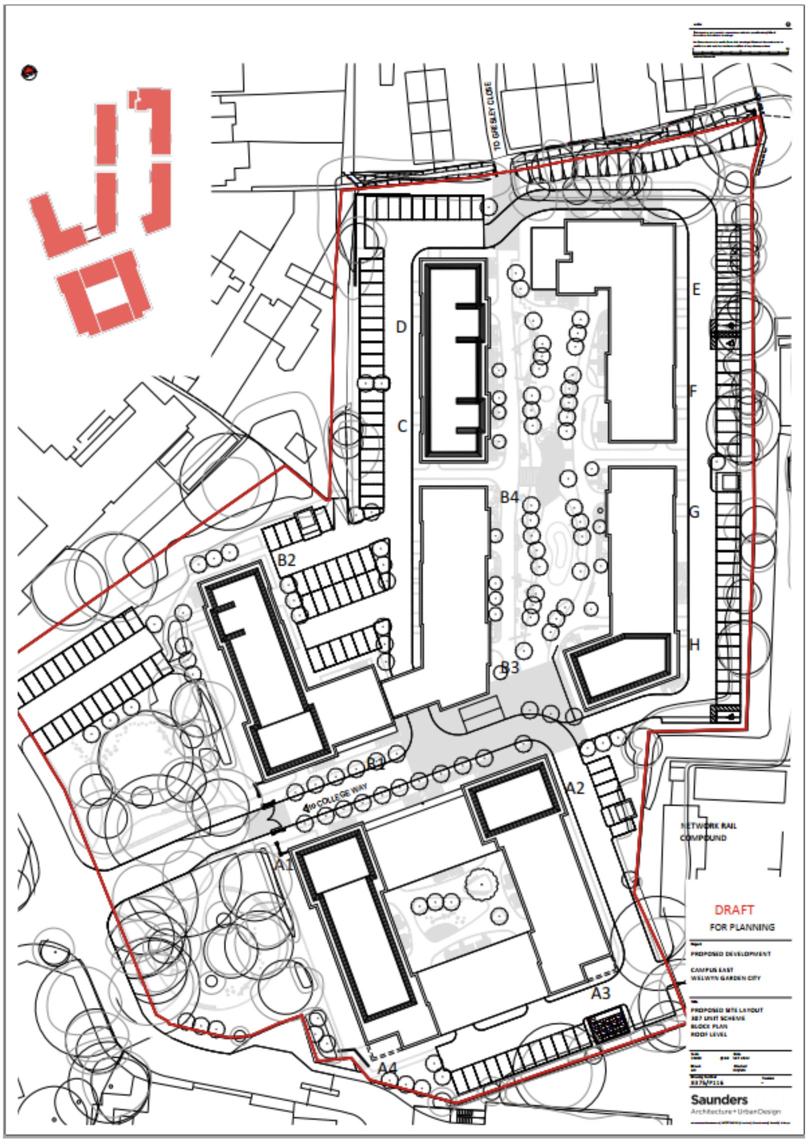


Figure 2 – Site Layout Roof Level (Saunders Architecture & Urban Design drawing 8375/P116) Sep 2022

3. ASSESSMENT METHODOLOGY AND INPUTS

CIBSE TM59 Criteria

CIBSE TM59 '*Design methodology for the assessment of overheating risk in homes (2017)*' introduces two sets of compliance criteria for assessing overheating which are based on the ventilation type of the dwelling:

For houses predominantly naturally ventilated

a) The number of hours for living rooms, kitchens, and bedrooms, for which the difference between the internal and external temperatures (ΔT) is greater than or equal to one degree (K) during the period May to September inclusive shall not be more than 3 per cent of the occupied hours (TM52 criterion 1).
b) For bedrooms only, to guarantee comfort during the sleeping hours the operative temperature from 10pm to 7am shall not exceed 26°C for more than 1 per cent of annual hours (i.e., 32 hours, so 33 or more hours above 26°C will be recorded as a fail). Criteria 2 and 3 of CIBSE TM52 may fail to be met, but both a and b above must be met.

For homes predominantly mechanically ventilated

a) (for example, because of air quality or noise issues), the CIBSE Guide A fixed temperature test must be followed, i.e., all occupied rooms should not exceed an operative temperature of 26 °C for more than 3 per cent of the annual occupied hours.

The assessed residential dwellings are considered predominantly mechanically ventilated and therefore have been assessed against Criterion 3 of the CIBSE TM59 methodology.

Approved Document O (AD O) 2021

From June 15th, 2022, an additional volume of Building Regulations will be applied to new building works in England.

Approved Document O (2021) considers the overheating risk of new dwellings, and buildings which are used in a domestic manner.

The launch of AD O ties in with rewrites for AD F (Ventilation) and AD L (Conservation of Fuel and Power). These updates are collectively referred to as phase one of the Future Homes Standard.

The Building Regulation Requirement of Approved Document O is:

> *1) Reasonable provision must be made in respect of a dwelling, institution or any other building containing one or more rooms for residential purposes, other than a room in a hotel ("residences") to–*
>
> *a. Limit unwanted solar gains in summer.*
>
> *b. Provide an adequate means to remove heat from the indoor environment*
>
> *2) In meeting the obligations in paragraph 1 –*
>
> *a. Account must be taken of the safety of any occupant, and their reasonable enjoyment of the residence, and*
>
> *b. Mechanical cooling may only be used where insufficient heat is capable of being removed from the indoor environment without it.*

More information about the local and national policies are provided in Appendix 2.

Sample Size

For the purpose of this Overheating Assessment a sample of 14no. dwellings have been selected for assessment. The selection of the dwellings has been based on the criteria set by CIBSE TM59 for dwellings being at high risk of overheating. These are likely to be dwellings:

a. on the topmost floor,
b. with large glazing areas,
c. having less shading,
d. having large, sun facing windows,
e. having a single aspect,
f. having limited opening windows.

Furthermore, the sample apartments have been selected from different buildings located across the site to represent all noise sources, i.e., road traffic, Waitrose servicing and railway noise.

Mark ups identifying the assessed apartments are provided in Appendix 6.

Simulation Weather Data

For the assessment of the risk of overheating the CIBSE Design Weather Year (DSY1) for the 2020s, high emissions, 50% percentile scenario has been used as required in the CIBSE TM59 methodology.

The site is located in a suburban area and therefore the London Heathrow DSY1 has been selected as the most appropriate location.

Building Fabric Specification

The Proposed Development incorporates sustainable and passive measures as part of the Energy Strategy.

A summary of the design specification for Campus Park East is provided below.

Table 2 - Proposed fabric specification

Element	Fabric Specification
Ground Floor U-Value (W/m^2.K)	0.13
External Wall U-Value (W/m^2.K)	0.18
Roof U-Value (W/m^2.K)	0.13
Door U-Value (W/m^2.K)	1.40
Glazing U-Value (W/m^2.K)	1.40
Glazing G-Value	0.5
Design Air Permeability	5

Internal Gains

Occupancy Gains

For residential areas occupancy maximum sensible and latent gains should be equal to 75W/person and 55W/person in all living spaces.

For communal corridors since they cannot be considered as living spaces, the occupancy gains are assumed to be equal to zero.

A summary of the occupancy gains as required by CIBSE TM59 are provided in Appendix 3.

Lighting Gains

For residential areas internal gains due to lighting for the purposes of this assessment have been assumed to be equal to 2 W/m^2 and will be operating from 6pm till 11pm.

Equipment Gains

For residential areas equipment gains should be assumed to be equal to the values provided in CIBSE TM59. Further details for equipment gain values and hours of operation for each living space can be found in Appendix 4.

Ventilation

Natural Ventilation

All assessed units at Campus Park East are provided with openable windows for natural ventilation and can be used for natural ventilation if and when future occupants prefer to.

However, in line with the noise assessment's recommendations, for the purposes of this assessment windows across the development have been assumed closed at all times. This is to ensure that the proposed overheating strategy is aligned with the noise strategy, and the proposed solutions mitigate both noise and overheating, minimising any discomfort of future occupants.

The noise assessment completed by Ardent identifies road traffic, Waitrose servicing and railway noise as the main noise sources at Campus Park East.

A noise markup illustrating the facades which require windows to be closed at all times is provided in Appendix 5.

Mechanical Ventilation

All assessed plots in Campus Park East are provided with the Nilan Compact P system which is capable of providing heating, mechanical ventilation with heat recovery and hot water. In addition, the Nilan Compact P system is equipped with a reversible cooling circuit which can temper supplied air by up to 10ºC in the summer.

The system is capable of providing flow rates of up to 300 m^3/h. To ensure that thermal comfort is achieved during summer months, a setpoint internal temperature of 20ºC has been assigned to the model for the cooling circuit to activate. Setpoint temperatures are in line with the ranges provided in Table 1.5 of the CIBSE Guide A.

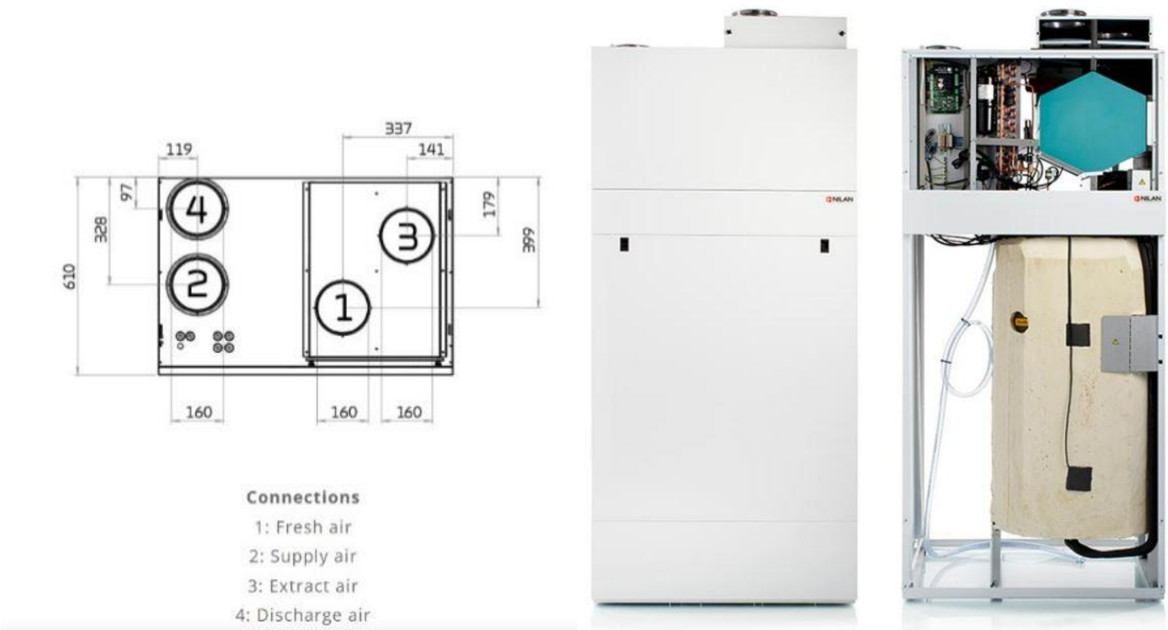


Figure 3 - Illustrative Nilan Compact P, for space heating, DHW, ventilation, and air tempering

4. SIMULATION RESULTS

The following section presents and analyses the results of the Overheating Assessment for the Proposed Development at Campus Park East.

As required by the CIBSE TM59 methodology the modelled air speed has been set at 0.1m/s.

The results below indicate that all assessed plots successfully comply with the AD O and CIBSE TM59 overheating criteria.

Table 3 - Summary of all assessed living spaces and bedrooms against CIBSE TM59 criterion c, using DSY1 weather file

Unit Reference	Total Occupied Hours	Hours Exceeding 26 deg Celsius	Criterion C	Compliance
1F_Plot B2-4_DBLBed 1	8760	39	0.45%	PASS
1F_Plot B2-4_DBLBed 2	8760	49	0.56%	PASS
1F_Plot B2-4_Kitchen	4732	12	0.25%	PASS
1F_Plot B2-4_Liv/Din	4732	14	0.30%	PASS
1F_Plot E-11_DBLBed 1	8760	210	2.40%	PASS
1F_Plot E-11_DBLBed 2	8760	179	2.04%	PASS
1F_Plot E-11_Kitchen	4732	42	0.89%	PASS
1F_Plot E-11_Liv/Din	4732	43	0.91%	PASS
2F_Plot A3-17_DBLBed 1	8760	31	0.35%	PASS
2F_Plot A3-17_DBLBed 2	8760	42	0.48%	PASS
2F_Plot A3-17_Kitchen	4732	0	0.00%	PASS
2F_Plot A3-17_Liv/Din	4732	0	0.00%	PASS
2F_Plot B4-10_ DBLBed	8760	10	0.11%	PASS
2F_Plot B4-10_ Kitchen	4732	1	0.02%	PASS
2F_Plot B4-10_ Liv/Din	4732	2	0.04%	PASS
2F_Plot C-8_DBLBed 1	8760	84	0.96%	PASS
2F_Plot C-8_DBLBed 2	8760	65	0.74%	PASS
2F_Plot C-8_Kitchen	4732	27	0.57%	PASS
2F_Plot C-8_Liv/Din	4732	48	1.01%	PASS
2F_Plot F-8_DBLBed 1	8760	75	0.86%	PASS
2F_Plot F-8_DBLBed 2	8760	129	1.47%	PASS
2F_Plot F-8_Kitchen	4732	45	0.95%	PASS

2F_Plot F-8_Liv/Din	4732	61	1.29%	PASS
2F_Plot H-14_DBLBed	8760	28	0.32%	PASS
2F_Plot H-14_Kitchen	4732	3	0.06%	PASS
2F_Plot H-14_Liv/Din	4732	3	0.06%	PASS
3F_Plot B2-11_DBLBed 1	8760	146	1.67%	PASS
3F_Plot B2-11_DBLBed 2	8760	100	1.14%	PASS
3F_Plot B2-11_Kitchen	4732	22	0.46%	PASS
3F_Plot B2-11_Liv/Din	4732	40	0.85%	PASS
3F_Plot H-19_DBLBed	8760	31	0.35%	PASS
3F_Plot H-19_Kitchen	4732	3	0.06%	PASS
3F_Plot H-19_Liv/Din	4732	3	0.06%	PASS
4F_Plot A4-24_DBLBed	8760	223	2.55%	PASS
4F_Plot A4-24_Kitchen	4732	63	1.33%	PASS
4F_Plot A4-24_Liv/Din	4732	112	2.37%	PASS
4F_Plot B4-17_DBLBed	8760	40	0.46%	PASS
4F_Plot B4-17_Kitchen	4732	0	0.00%	PASS
4F_Plot B4-17_Liv/Din	4732	0	0.00%	PASS
4F_Plot E-32_DBLBed	8760	73	0.83%	PASS
4F_Plot E-32_Kitchen	4732	24	0.51%	PASS
4F_Plot E-32_Liv/Din	4732	37	0.78%	PASS
4F_Plot H-28_DBLBed 1	8760	252	2.88%	PASS
4F_Plot H-28_DBLBed 2	8760	250	2.85%	PASS
4F_Plot H-28_Kitchen	4732	119	2.51%	PASS
4F_Plot H-28_Liv/Din	4732	130	2.75%	PASS
4F_Plot H-28_SGLBed 3	8760	411	4.69%	PASS
GF_Plot A2-5_DBLBed	8760	7	0.08%	PASS
GF_Plot A2-5_Kitchen	4732	3	0.06%	PASS
GF_Plot A2-5_Liv/Din	4732	0	0.00%	PASS

In accordance with criterion c of CIBSE TM59, to guarantee comfort in predominantly mechanically ventilated flats the operative temperature shall not exceed 26°C for more than 3 per cent of annual hours.

5. CONCLUSIONS AND RECOMMENDATIONS

This Overheating Assessment demonstrates that Campus Park East successfully complies with:

- Welwyn Hatfield Borough Council (WHBC)'s current District Plan Policy SD1 – Sustainable Development of the current
- Welwyn Hatfield Borough Council (WHBC)'s new Local Plan draft policies
- The criteria set out in CIBSE TM59
- The methodology set out in the Approved Document O (AD O 2021)

The Applicant incorporates the following passive and active design measures to address and successfully mitigate for the risk of overheating:

- Improved Building Fabric
- Natural Ventilation through Fully Openable Windows
- The Nilan Compact P system which combines heating, ventilation and hot water and can also temper external air by up to 10^0C in summer months, in all habitable rooms
- Balconies and overhangs which can create shading

The Applicant takes full account of a requirement to adapt to, and mitigate for, the impact of climate change and has taken steps to ensure this is considered within the design of the proposed scheme.

The results show that all assessed plots comply with the requirements of the CIBSE TM59 and AD O methodologies.

A table illustrating the maximum internal temperatures, achieved when windows are closed and the air tempering is in operation, compared to the external temperature at the same time is provided in Appendix 7.

APPENDICES

APPENDIX 1: LIST OF ABBREVIATIONS

CIBSE	Chartered Institute of Building Services Engineers
TM	Technical Memorandum
GLA	Greater London Authority
UHI	Urban Heat Island
IESVE	Integrated Environmental Solutions Virtual Environment
DSY	Design Summer Year
MEV	Mechanical Extract Ventilation
MVHR	Mechanical Ventilation with Heat Recovery
HIU	Heat Interface Unit
ASHP	Air Source Heat Pump
CHP	Combined Heat & Power
DHN	District Heat Network
DHW	Domestic Hot Water
GSHP	Ground Source Heat Pump
LPA	Local Planning Authority
SBEM	Simplified Building Energy Model
VRF	Variable Refrigerant Flow
AOV	Automatic Opening Vent

APPENDIX 2: PLANNING POLICY AND DESIGN GUIDANCE

CIBSE TM59

In May 2017, the Chartered Institute of Building Services Engineers (CIBSE) published the Technical Memorandum TM59.

The new methodology is based on the use of dynamic thermal modelling for assessing the overheating risk in residential developments and should be especially considered for:

- Large developments.
- Developments in urban areas, particularly in Southern England.
- Blocks of flats.
- Dwellings with high levels of insulation and air tightness.
- Single aspect flats.

Developments assessed under TM59 methodology are required to pass using the DSY1 (current design summer year) weather file most appropriate to the site location, for the 2020s, high emissions, 50% percentile scenario.

Other extreme weather files (DSY2 and DSY3) as well as future weather files for climate change adaptation should be considered in buildings of particular concern (e.g., care homes) and/or where required in the client's brief.

TM59 introduces two sets of compliance criteria for assessing overheating which are based on the ventilation type of the dwelling. That is,

1. **For houses predominantly naturally ventilated**
   a. The number of hours for living rooms, kitchens and bedrooms, which ΔT is greater than or equal to one degree (K) during the period May to September inclusive shall not be more than 3 per cent of the occupied hours (TM52 criterion 1).

   b. For bedrooms only, to guarantee comfort during the sleeping hours the operative temperature from 10pm to 7am shall not exceed 26 degrees Celsius for more than 1 per cent of annual hours.

Criteria 2 and 3 of CIBSE TM52 may fail to be met, but both a and b above must be met.

2. **For homes predominantly mechanically ventilated** (for example because of air quality or noise issues), the CIBSE Guide A fixed temperature test must be followed, i.e., all occupied rooms should not exceed an operative temperature of 26 degrees Celsius for more than 3 per cent of the annual occupied hours.

Approved Document O 2021

From June 15th, 2022, an additional volume of Building Regulations will be applied to new building works in England.

Approved Document O (2021) considers the overheating risk of new dwellings, and buildings which are used in a domestic manner.

The launch of AD O ties in with rewrites for AD F (Ventilation) and AD L (Conservation of Fuel and Power). These updates are collectively referred to as phase one of the Future Homes Standard.

Aside from measuring the overheating performance of the building fabric, AD O also sets requirements to protect the health and wellbeing of residents.

These topics will not apply in all cases; however, the Developer should action any issues where appropriate as part of the overall overheating mitigation strategy.

- Night-time noise from external sources
- Local air pollution
- Building security
- Protection from falling
- Protection from entrapment

Noise

If the construction site is in a location where the local planning authority or developer believes external noise may be an issue for occupants, the overheating strategy should be based on the assumption that all windows will remain closed during sleeping hours (11pm until 7am).

In this scenario, the Dynamic Thermal Model approach should always be used.

If there are no noise concerns with the site, this section can be ignored.

The Developer may wish to commission an in-situ noise survey to obtain a definitive answer as to whether external noise exceeds reasonable levels.

If this survey concludes the decibel readings within bedrooms does not exceed the following targets with open windows during the hours of 11pm and 7am, the assumption of closed windows overnight can be removed.

- An average result of 40 dB
- And a peak of 55 dB no more than ten times.

Pollution

If the construction site is in a location where air pollution is considered a concern, the design of the building needs to follow the guidance given in Approved Document F (2021) Section 2.

Reasons for concerns regarding air pollution include (but not limited to) construction sites near the following:

- Busy roads and car parks
- Combustion plant rooms or industrial activity

- Where carbon monoxide levels have been tested and exceed an average of 10mg/m2 over an 8-hour period.

Security

Windows of ground floor and easily accessible bedrooms are assumed to be closed at night as a good practice security measure.

This assumption has a negative impact on the free area calculation produced by the Dynamic Thermal Model.

The Developer may wish to consider the following additional measures to improve the free area of air movement overnight without increasing the risk of burglary.

- Fixing lockable, louvred shutters to all easily accessible windows
- Installing lockable window grilles or railings to all easily accessible windows

Protection from falling

Openings which may be open for long periods to reduce overheating risk may pose a higher risk of falls from height.

Where these windows can be opened wider than 100mm, the following safety measures must be included.

- Window handles that open outward are not more than 650mm from the inside face of the wall when the window is at its maximum openable angle
- Guarding with a height at least 1.1m should be installed
- Guarding should be designed so children cannot easily climb it

Approved Document K may also apply in this situation. The higher standard of the two Building Regulations should be followed.

Protection from entrapment

Where louvered shutters, window railing and ventilation grilles are installed, they should not allow body parts to become trapped.

- They should not allow the passage of a 100mm diameter sphere
- Small holes should allow for a 25mm diameter (to prevent finger entrapment)
- Looped cords must be fitted with child safety devices.

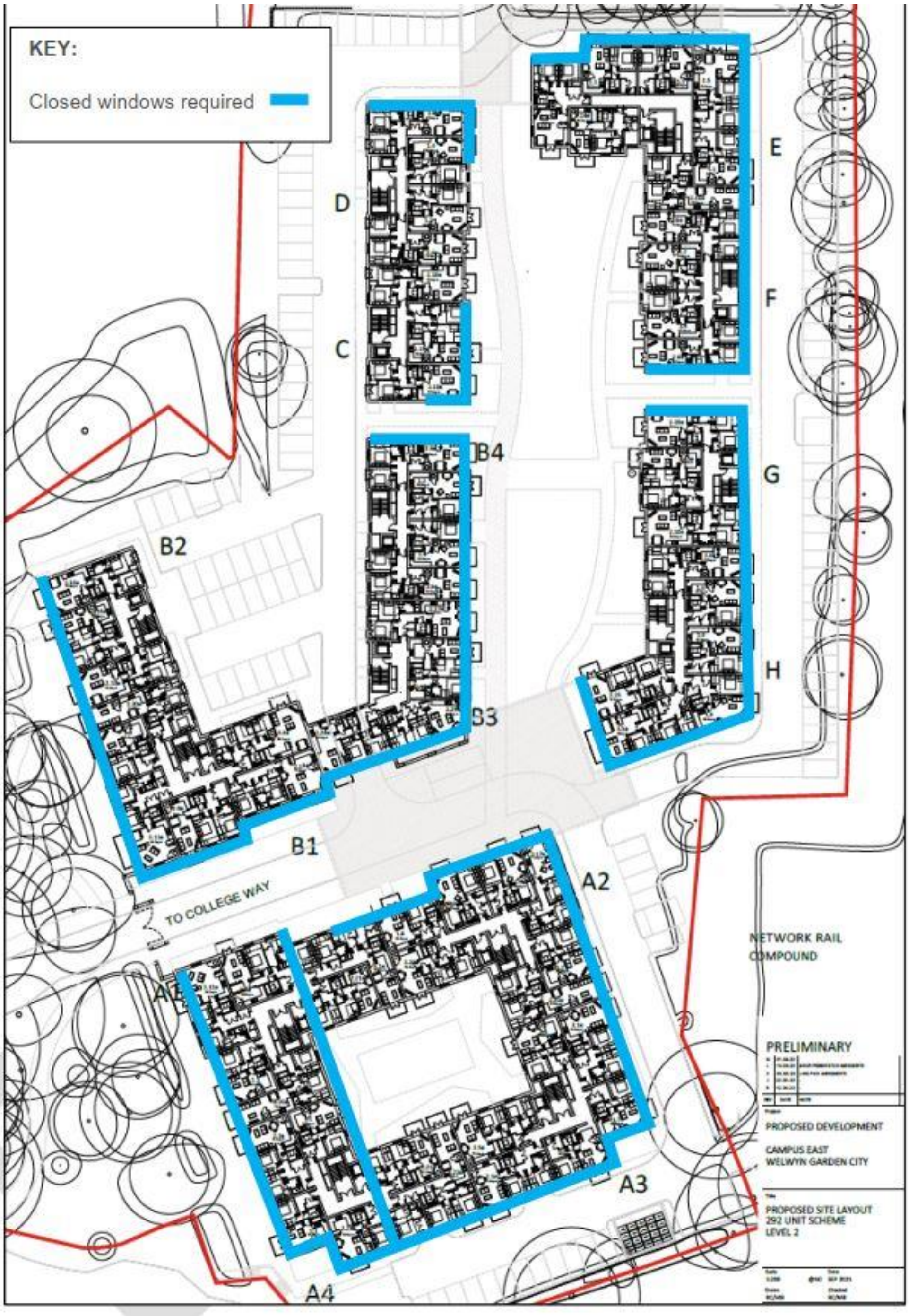
APPENDIX 3: OCCUPANCY GAINS

Number of People	Description	Peak Load (W)		Hours of Occupancy	Percentage of load
		Sensible	Latent		
1	Single Bedroom	75	55	23:00 – 08:00	0.7
				08:00 - 23:00	1
2	Double Bedroom	150	110	23:00 – 08:00	0.7
				08:00 – 09:00	1
				09:00 – 22:00	0.5
				22:00 – 23:00	1
1	1 Bed – Living Room/Kitchen	75	110	09:00 – 22:00	1
	1 Bed – Living Room			09:00 – 22:00	0.75
	1 Bed - Kitchen			09:00 – 22:00	0.25
2	2 Bed – Living Room/Kitchen	150	110	09:00 – 22:00	1
	2 Bed – Living Room			09:00 – 22:00	0.75
	2 Bed – Kitchen			09:00 – 22:00	0.25
3	3 Bed – Living/Kitchen	225	165	09:00 – 22:00	1
	3 Bed – Living Room			09:00 – 22:00	0.75
	3 Bed - Kitchen			09:00 – 22:00	0.25

APPENDIX 4: EQUIPMENT GAINS

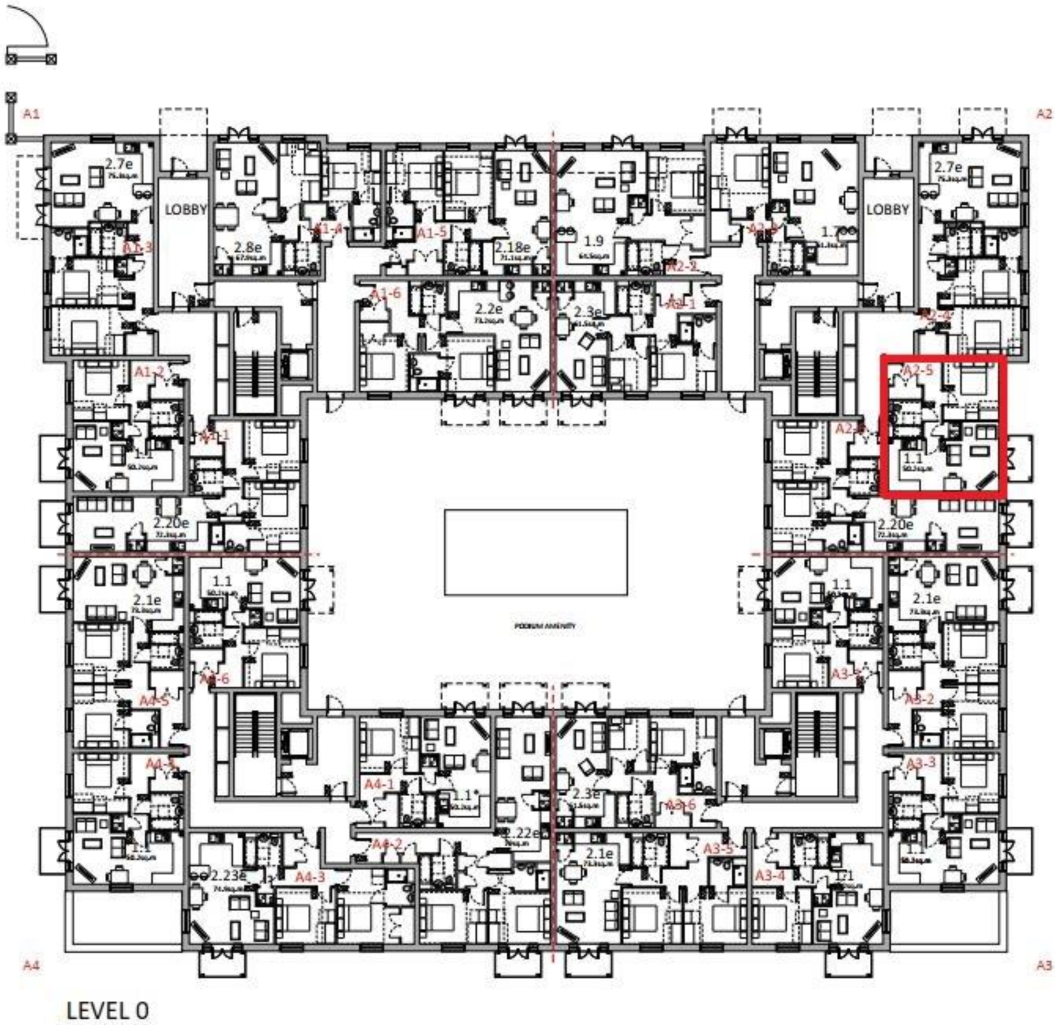
Description	Peak Load (W)	Hours of Occupancy	Percentage of load
Single Bedroom	80	23:00 – 08:00	0.13
		08:00 - 23:00	1
Double Bedroom	80	23:00 – 08:00	0.13
		08:00 – 23:00	1
Living Room/Kitchen	450	00:00 – 09:00	0.19
		09:00 – 18:00	0.24
		18:00 – 20:00	1
		20:00 – 22:00	0.44
		22:00 – 24:00	0.24
Living Room	150	00:00 - 09:00	0.23
		09:00 – 18:00	0.4
		18:00 – 22:00	1
		22:00 – 24:00	0.4
Kitchen	300	00:00 – 18:00	0.17
		18:00 – 20:00	1
		20:00 – 24:00	0.17

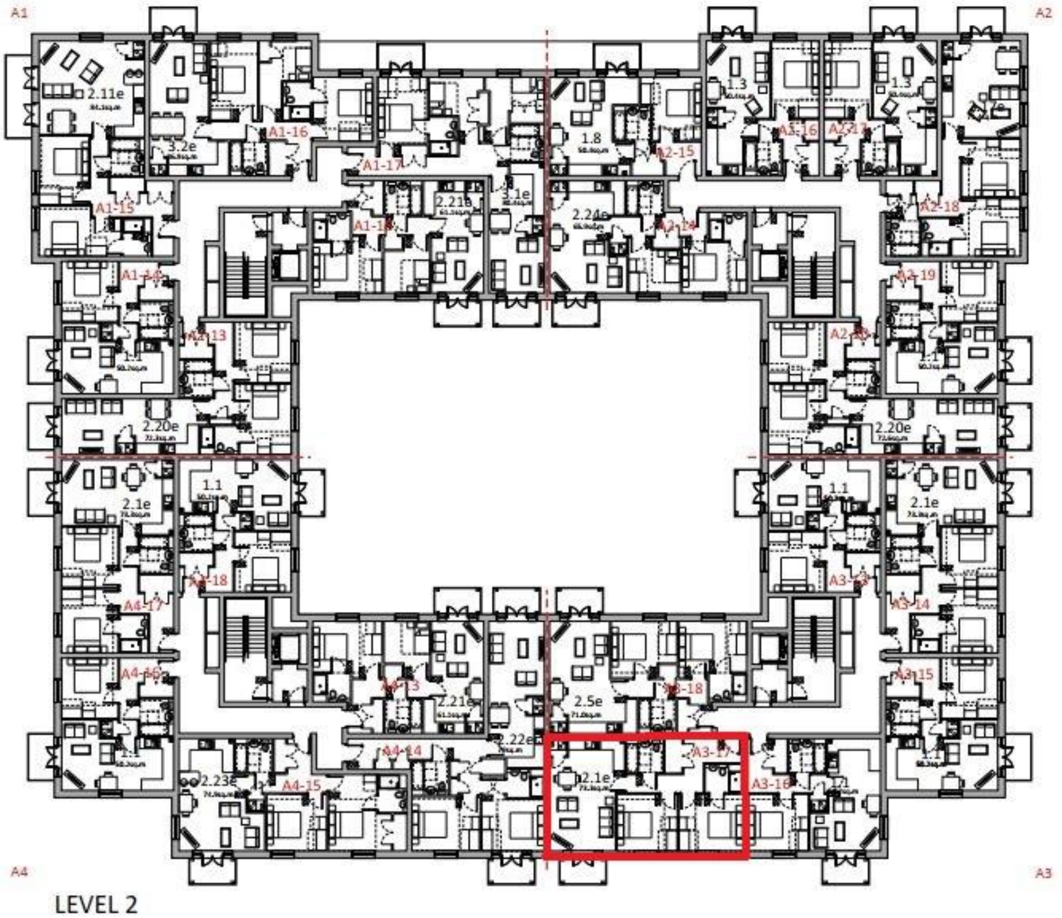
APPENDIX 5: NOISE ASSESSMENT CONTOURS

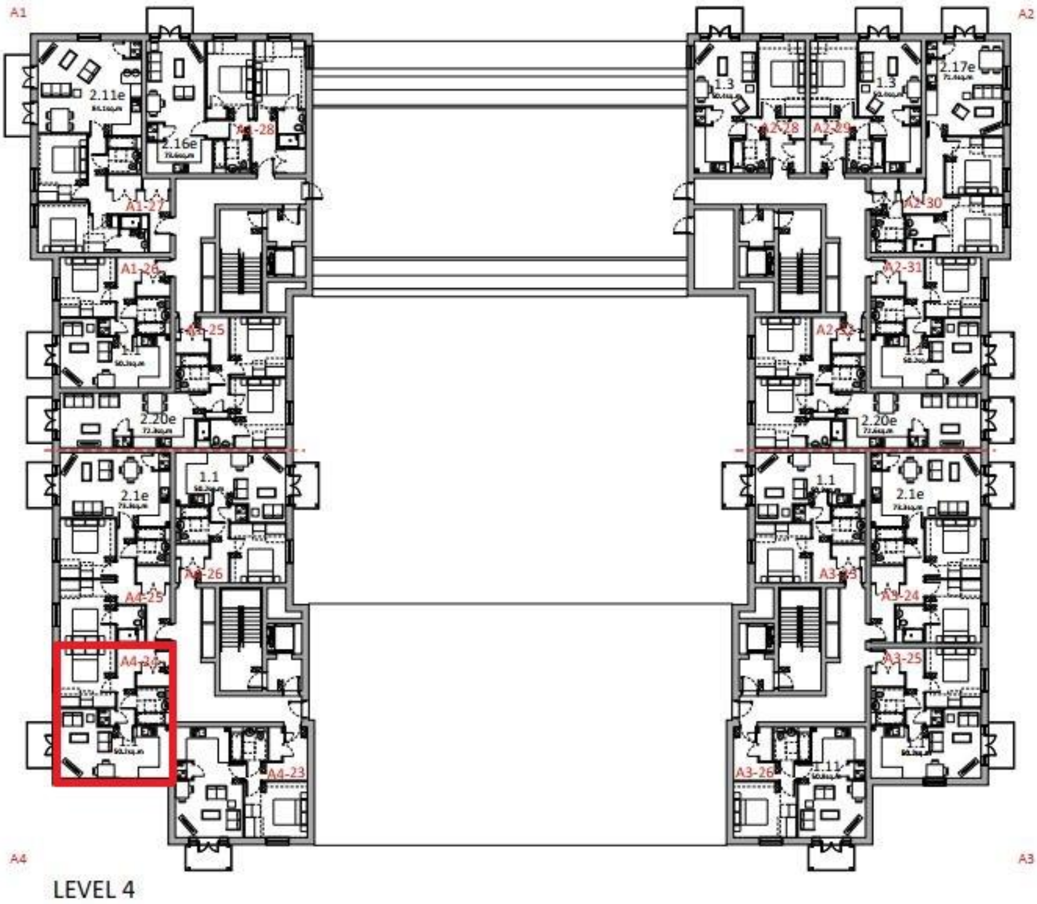


APPENDIX 6: ASSESSED PLOTS MARK UPS

Block A




A1
A2
A3
A4
LEVEL 2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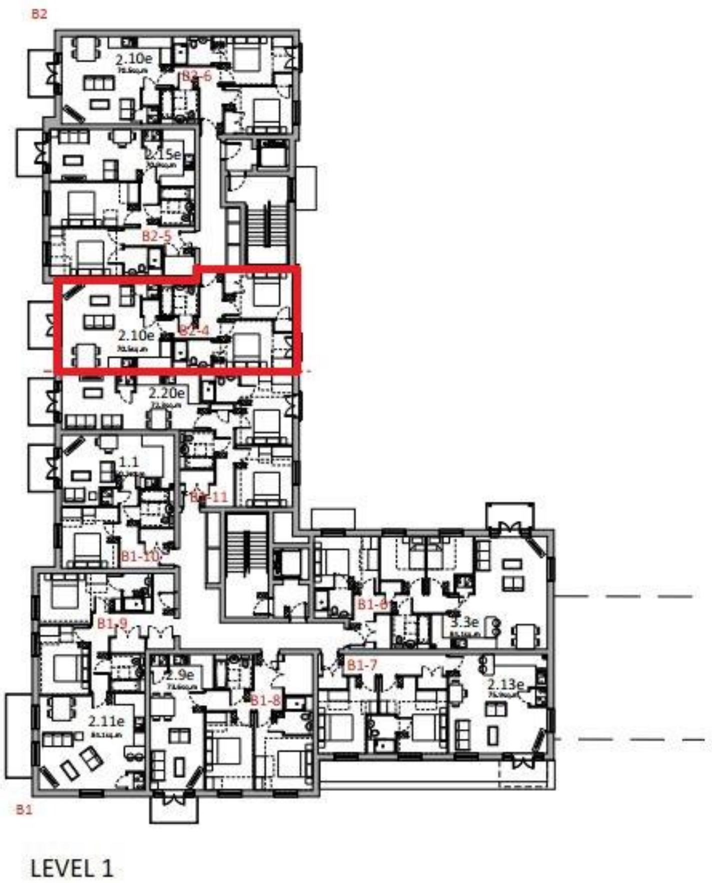
LEVEL 4

Block B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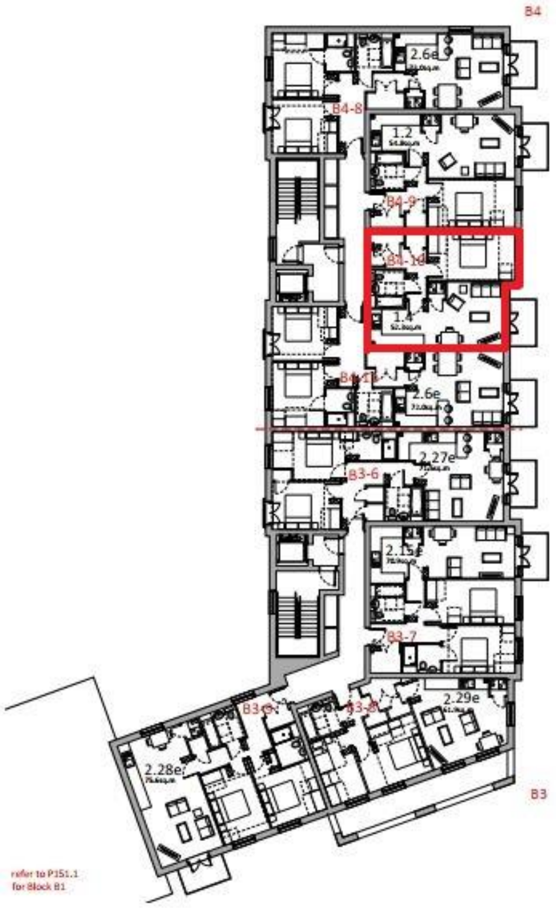
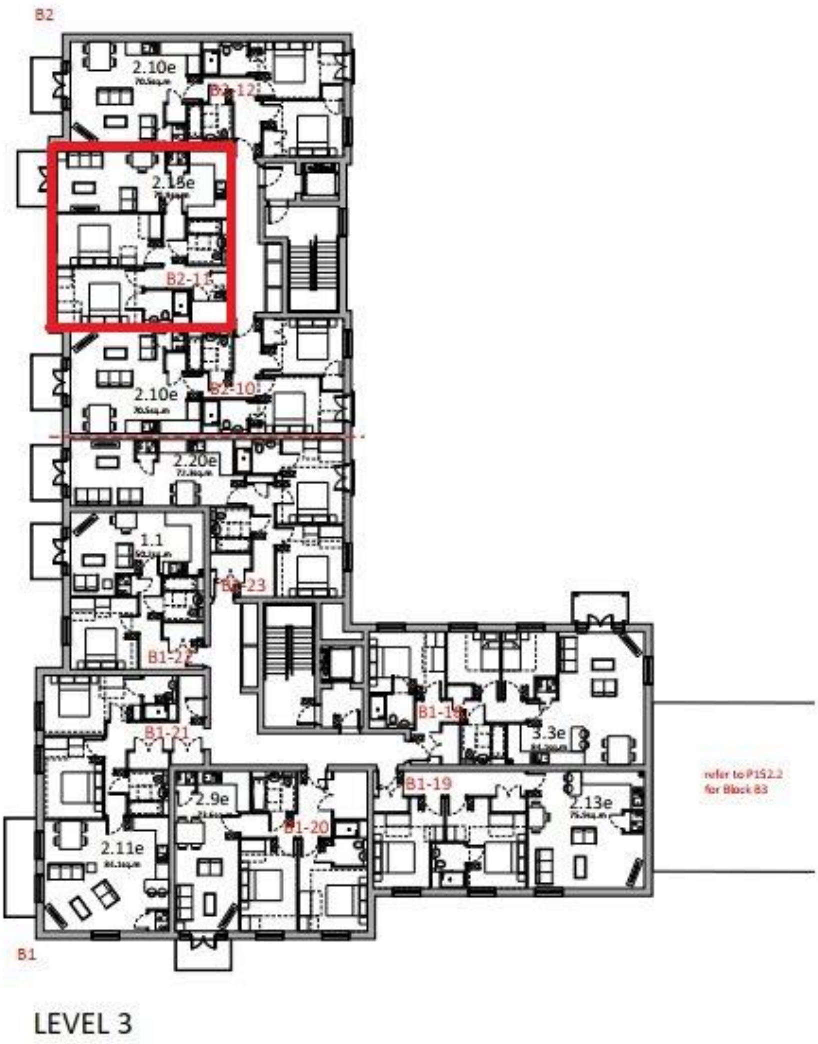
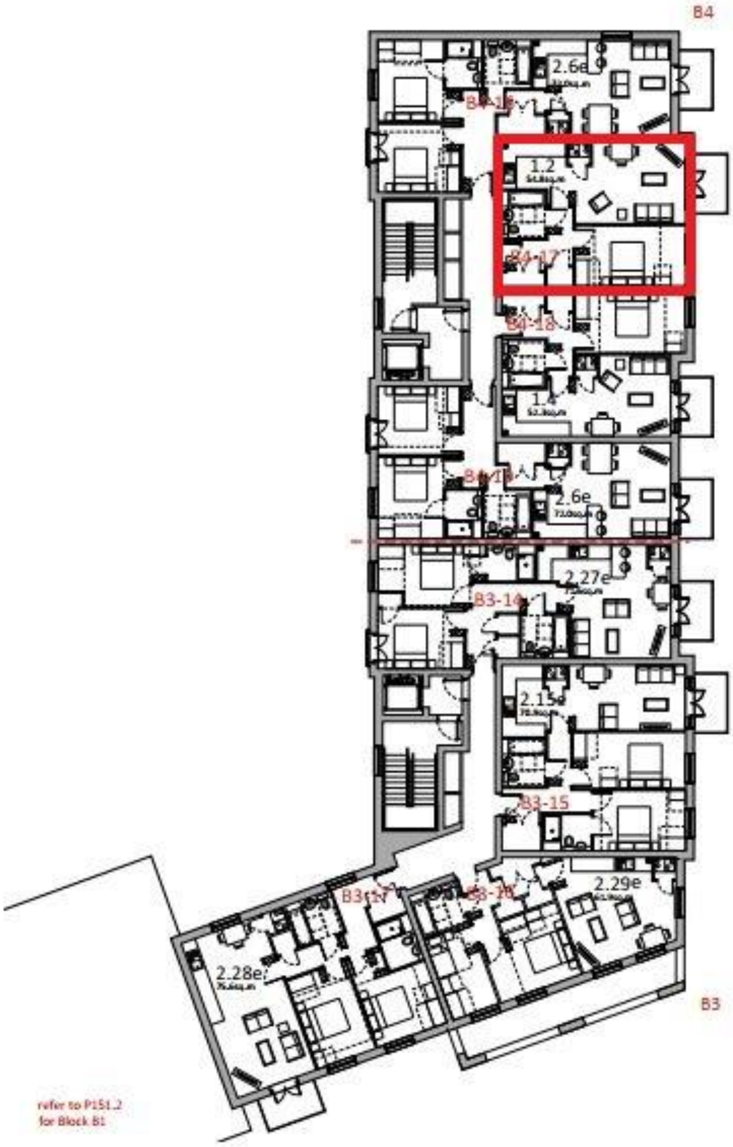
1.1
B2-11
B1-10
B1-9
B1-6
3.3e
B1-7
2.9e
B1-8
2.13e
2.11e
B1
LEVEL 1



LEVEL 2


B2
2.10e
2.15e
B2-11
2.10e
B2-10
2.20e
1.1
B1-23
B1-22
B1-21
B1-18
3.3e
B1-19
2.13e
2.9e
B1-20
2.11e
refer to P1S2.2 for Block B3
B1
LEVEL 3

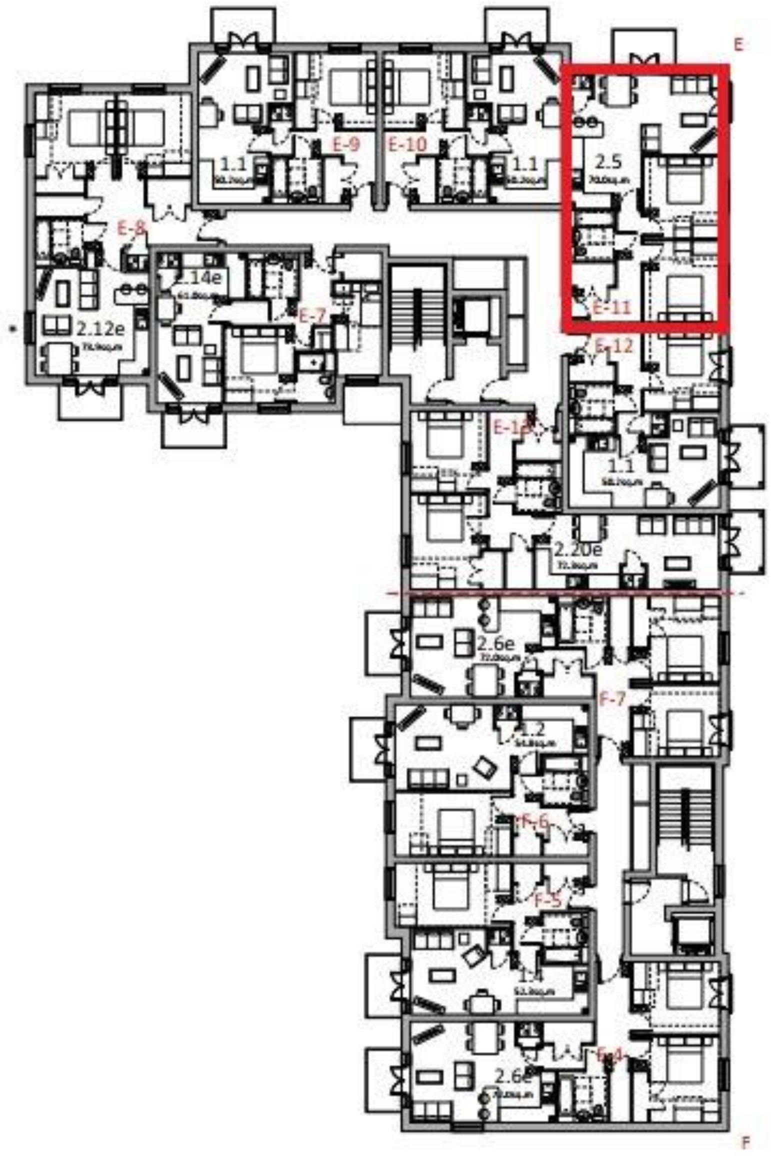

B4
2.6e
1.2
B4-17
B4-18
1.4
2.6e
2.27e
B3-14
2.15e
B3-15
2.29e
2.28e
B3
refer to P151.2
for Block B1

LEVEL 4

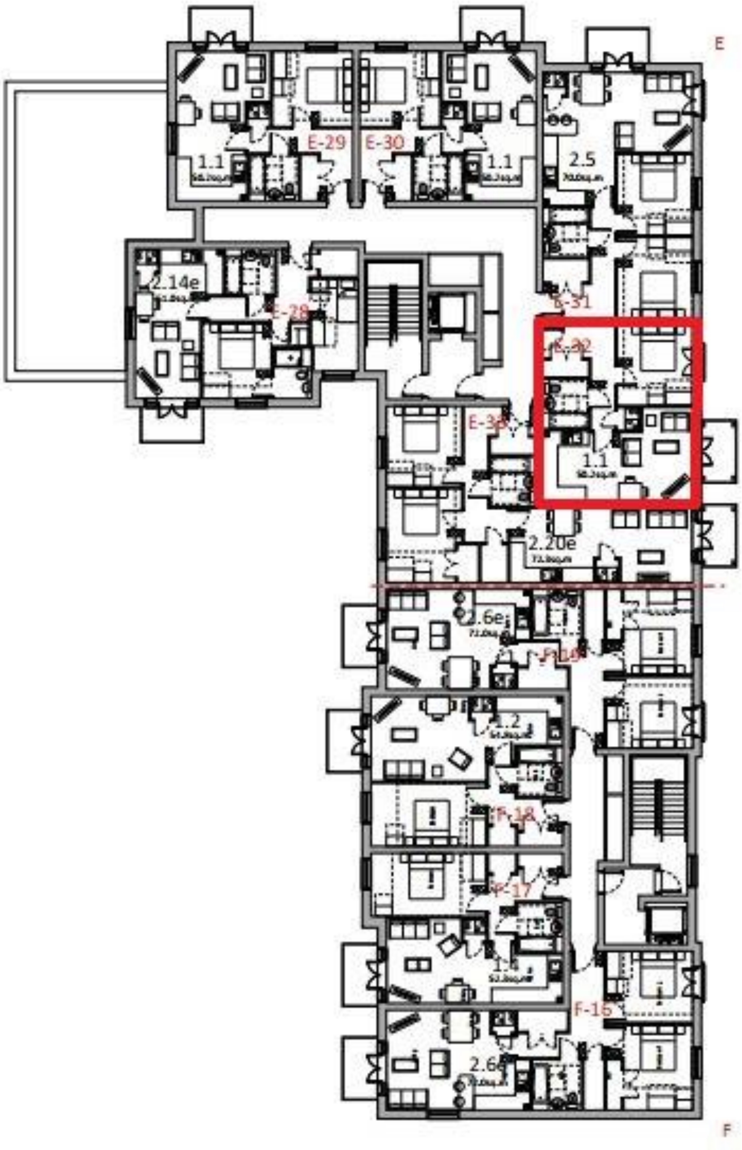
Block C

LEVEL 2

Block E

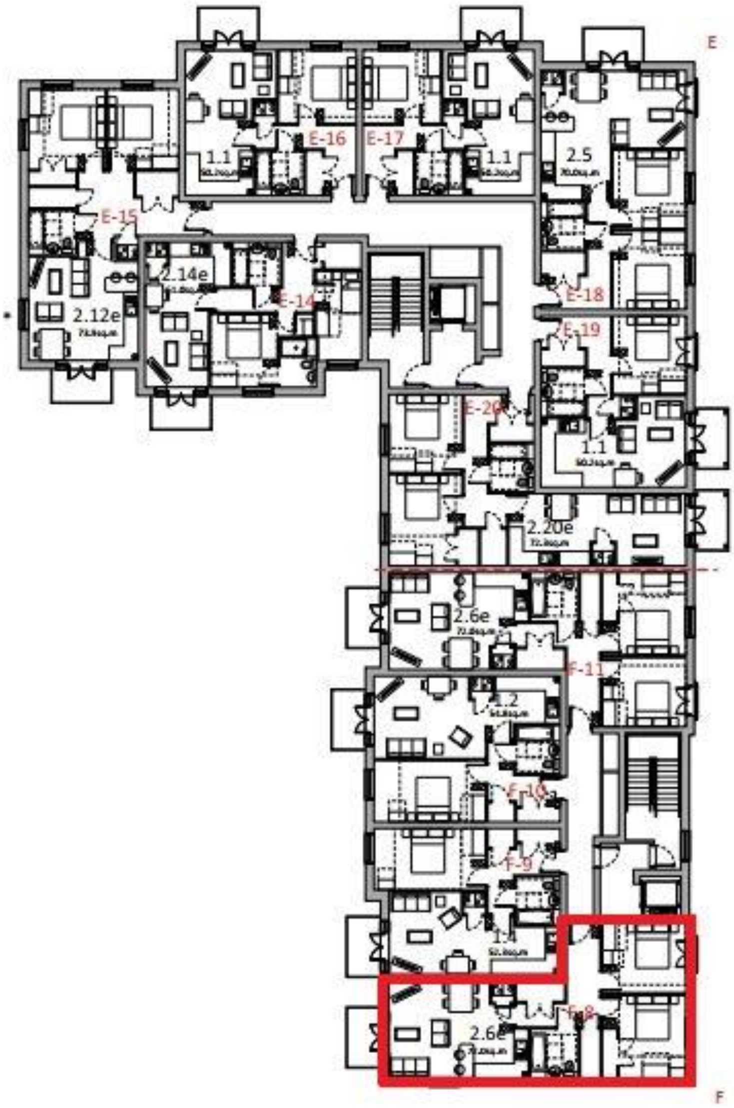


LEVEL 1


E
E-29
E-30
1.1
1.1
2.5
2.14e
E-28
E-31
E-32
E-33
1.1
2.20e
2.6e
F-19
2.2
F-18
F-17
F-16
2.6e
F

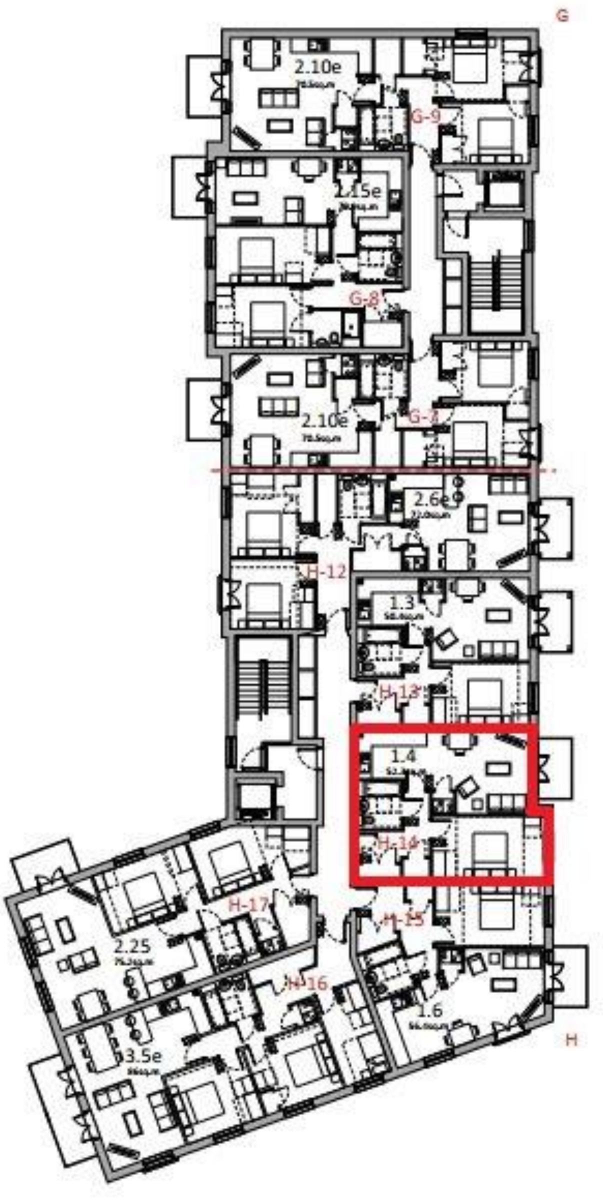
LEVEL 4

Block F

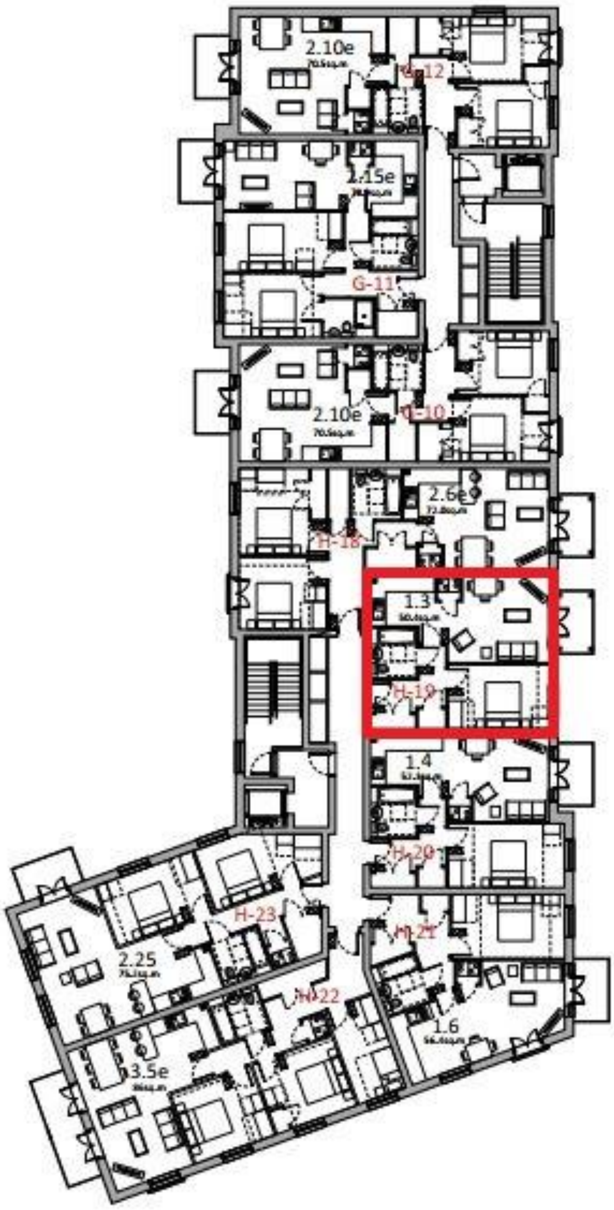


LEVEL 2

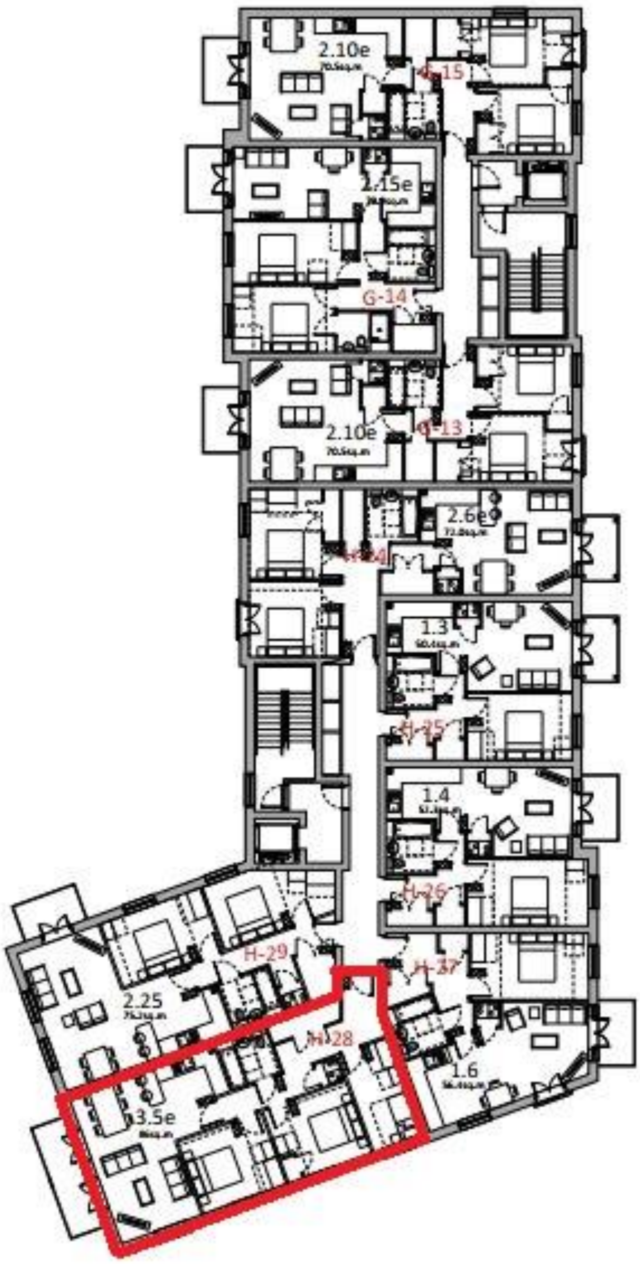
Block H



LEVEL 2


2.10e
G-12
2.15e
G-11
2.10e
G-10
2.6e
H-18
1.3
H-19
1.4
H-20
H-23
H-21
2.25
H-22
1.6
3.5e

LEVEL 3


2.10e
G-15
2.15e
G-14
2.10e
G-13
2.6e
H-24
1.3
H-25
1.4
H-26
H-29
H-27
2.25
H-28
1.6
3.5e

LEVEL 4

APPENDIX 7: MAXIMUM TEMPERATURES

Unit Reference	Maximum Internal Temperature (°C)	Occurrence	External Temperature during Max Internal (°C)
2F_Plot B4-10_ DBLBed	26.44	11:30,24/Jul	27.2
2F_Plot B4-10_ Liv/Din	26.14	19:30,22/Jul	33.7
2F_Plot B4-10_ Kitchen	26.18	19:30,22/Jul	33.7
4F_Plot B4-17_DBLBed	27.19	11:30,24/Jul	27.2
4F_Plot B4-17_Kitchen	25.71	19:30,23/Jul	32
4F_Plot B4-17_Liv/Din	25.82	19:30,23/Jul	32
2F_Plot C-8_DBLBed 2	27.84	11:30,24/Jul	27.2
2F_Plot C-8_DBLBed 1	28.41	11:30,24/Jul	27.2
2F_Plot C-8_Kitchen	27.35	19:30,22/Jul	33.7
2F_Plot C-8_Liv/Din	27.58	19:30,22/Jul	33.7
2F_Plot A3-17_DBLBed 1	26.79	13:30,24/Jul	30
2F_Plot A3-17_DBLBed 2	27.17	13:30,24/Jul	30
2F_Plot A3-17_Liv/Din	25.56	19:30,23/Jul	32
2F_Plot A3-17_Kitchen	25.61	19:30,23/Jul	32
4F_Plot A4-24_DBLBed	30.22	19:30,23/Jul	32
4F_Plot A4-24_Kitchen	29.12	19:30,23/Jul	32
4F_Plot A4-24_Liv/Din	29.65	19:30,23/Jul	32
GF_Plot A2-5_DBLBed	26.24	16:30,24/Jul	31
GF_Plot A2-5_Liv/Din	25.97	19:30,22/Jul	33.7
GF_Plot A2-5_Kitchen	26.23	19:30,22/Jul	33.7
1F_Plot B2-4_DBLBed 1	26.84	16:30,24/Jul	31

1F_Plot B2-4_DBLBed 2	27.14	16:30,24/Jul	31
1F_Plot B2-4_Kitchen	27.55	19:30,23/Jul	32
1F_Plot B2-4_Liv/Din	27.62	19:30,23/Jul	32
3F_Plot B2-11_DBLBed 1	29.63	19:30,23/Jul	32
3F_Plot B2-11_DBLBed 2	29.01	19:30,23/Jul	32
3F_Plot B2-11_Kitchen	28.06	19:30,23/Jul	32
3F_Plot B2-11_Liv/Din	28.68	19:30,23/Jul	32
1F_Plot E-11_DBLBed 2	29.15	11:30,24/Jul	27.2
1F_Plot E-11_DBLBed 1	29.31	11:30,24/Jul	27.2
1F_Plot E-11_Liv/Din	27.44	19:30,23/Jul	32
1F_Plot E-11_Kitchen	27.58	19:30,23/Jul	32
2F_Plot F-8_DBLBed 2	28.63	11:30,24/Jul	27.2
2F_Plot F-8_DBLBed 1	27.74	11:30,24/Jul	27.2
2F_Plot F-8_Kitchen	28.51	19:30,23/Jul	32
2F_Plot F-8_Liv/Din	28.72	19:30,23/Jul	32
4F_Plot E-32_DBLBed	28.01	11:30,24/Jul	27.2
4F_Plot E-32_Liv/Din	27.15	19:30,22/Jul	33.7
4F_Plot E-32_Kitchen	27.35	19:30,22/Jul	33.7
2F_Plot H-14_DBLBed	26.75	11:30,24/Jul	27.2
2F_Plot H-14_Liv/Din	26.34	19:30,22/Jul	33.7
2F_Plot H-14_Kitchen	26.37	19:30,22/Jul	33.7
3F_Plot H-19_DBLBed	26.89	11:30,24/Jul	27.2
3F_Plot H-19_Kitchen	26.32	19:30,22/Jul	33.7
3F_Plot H-19_Liv/Din	26.35	19:30,22/Jul	33.7

4F_Plot H-28_DBLBed 2	30.52	13:30,24/Jul	30
4F_Plot H-28_DBLBed 1	30.36	13:30,24/Jul	30
4F_Plot H-28_SGLBed 3	30.8	13:30,24/Jul	30
4F_Plot H-28_Liv/Din	29.83	19:30,23/Jul	32
4F_Plot H-28_Kitchen	29.6	19:30,23/Jul	32